FLUKE®

MET/CAL®

Calibration Software

Reference Manual

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Contact MET/SUPPORT™ if you Need Assistance

See Appendix A for important details about the MET/SUPPORT program. Rregistered users of Fluke Metrology Software are entitled to telephone support, fax service, and an electronic bulletin board service.

Before calling, be sure to first check the manual and online help.

Have the Following Information Available:

- Product name, applicable licenses, version and serial numbers
- Manual title, part number and version
- Operating system and version
- Network information if applicable
- List of steps necessary to recreate the problem
- Contents of autoexec.bat and config.sys files if applicable
- Version of *Crystal Reports*

Dial Toll-Free in the USA: 1-800-825-7411

Refer to Appendix A for other phone numbers and additional information.

Table of Contents

Chapter	Title	Page
1	**General Rules for FSCs**	**1-1**
	Conventions	1-1
	Introduction	1-2
	What is a Function Selection Code?	1-2
	Detailed Description of a Procedure	1-3
	MET/CAL Procedure Headers	1-4
	Title Line	1-4
	Instrument	1-4
	Date	1-4
	Author	1-4
	Revision	1-4
	Adjustment Threshold	1-5
	Number of Tests	1-5
	Number of Lines	1-5
	Configuration	1-5
	Standard	1-5
	Column Headers	1-5
	Naming a Procedure	1-6
	MET/CAL Procedure Body Statements	1-7
	Test Number	1-7
	Step Number	1-7
	FSC Identifier	1-7
	Function Selection Code Types	1-7
	Instrument FSCs	1-13
	RANGE Field	1-13
	NOMINAL Field	1-14
	TOLERANCE Field	1-16
	MOD1 Field	1-17
	MOD2 Field	1-17
	MOD3 Field	1-17

MOD4 Field 1-17
CON Field 1-18
Evaluation Test 1-18
Stimulus Function 1-18
Measurement Function 1-25
Setup Test 1-26
Stimulus Function 1-27
Measurement Function 1-28
Nominal Setup Test 1-29
Stimulus Function 1-29
Measurement Function 1-30
Comparison Tests 1-31
Stimulus Function 1-31
Measurement Function 1-31
IEEE-488 Service Request (SRQ) Processing 1-31
Instrument Resets 1-32
Display Control FSCs 1-33
Evaluation FSCs 1-34
Interface Control FSCs 1-34
Memory Register Operation FSCs 1-35
Procedure Control FSCs 1-35
Miscellaneous FSCs 1-36
Use of Standard Memory Registers 1-36
Evaluation Tests 1-36
Setup Tests 1-37
Nominal Setup Tests 1-37
Comparison Tests 1-37
Adjustment Statements 1-37
Continuation Statements 1-38
Automatic Messages 1-38
Special Constructions 1-40
Delay Construction 1-42
Draw Construction 1-42
[MEM], [MEM1], [MEM2] 1-43
Numeric Literals 1-43
Variables 1-44
Function Selection Code Reference 1-44

2 FSC Reference 2-1

1271 2-2
1281 2-10
2000 2-17
2001 2-21
2002 2-27
2024 2-34

M2024 2-37
2620T 2-40
2635T 2-42
33120 2-44
M33120 2-49
34401 2-52
34420 2-56
3458 2-63
M3458 2-69
45 2-74
M45 2-82
437 2-83
M437 2-87
4000 2-90
4200 2-93
4700 2-96
4705 2-100
4707 2-104
4708 2-108
4800 2-112
4800A 2-117
4805 2-122
4808 2-127
4950 2-132
M4950 2-148
5001 2-153
MCAL 2-157
5011 2-160
M511 2-164
5030 2-167
5050 2-171
5100 2-175
5130 2-180
RESF 2-184
WIDE 2-188
5191 2-191
5192 2-195
5193 2-199
5200 2-203
5205 2-205
5220 2-208
5335 2-210
M5335 2-215
5440 2-221
5450 2-225

5500 2-229
M550 2-261
5520 2-270
M5520 2-299
5700 2-307
MMFC 2-314
5720 2-317
M5720 2-323
5790 2-326
ACMS 2-332
5800 2-335
M5800 2-347
5820 2-352
M5820 2-364
6060 2-368
M606 2-373
6666 2-376
M666 2-381
6680 2-386
M680 2-392
6681 2-398
M681 2-404
6685 2-410
M685 2-415
8505 2-418
8506 2-422
8560 2-427
M8560 2-431
8566 2-434
M8566 2-437
8568 2-440
M8568 2-443
8590 2-446
M8590 2-450
8648 2-453
M8648 2-457
8842 2-460
8901 2-464
M8901 2-468
8902 2-472
M8902 2-477
8903 2-481
M8903 2-485
8920 2-488
9000 2-492

M9000 2-499
9100 2-502
M9100 2-520
9500 2-525
M9500 2-536
HP60, HP63 2-540
ACC 2-543
ACCF 2-548
ACMS 2-552
ASK+, ASK- 2-553
CALL 2-565
CON 2-567
DISP 2-570
DOS, DOSE 2-572
DRAW 2-580
END 2-583
EVAL 2-584
HEAD 2-589
HP60, HP63 2-591
IEEE 2-592
JMP 2-602
JMPF 2-605
JMPL 2-608
JMPT 2-610
JMPZ 2-613
LABEL 2-615
M3458 2-616
M511 2-617
M550 2-618
M5720 2-619
M606 2-620
M666 2-621
M681 2-622
M685 2-623
MATH 2-624
MCAL 2-642
MEM+ (Not preferred) 2-643
MEM- (Not preferred) 2-644
MEM* (Not preferred) 2-645
MEM/ (Not preferred) 2-646
MEM2 2-647
MEMC, MEMCX 2-649
MEME 2-653
MEMI 2-654
MESS 2-656

MMFC 2-659
OPBR 2-660
P700 2-663
PIC 2-675
PICE 2-679
PORT 2-684
RESET 2-700
RNG 2-708
RPT 2-711
RSLT 2-712
SET 2-714
SMY02 2-717
MSMY02 2-721
STD 2-724
TOL 2-725

Appendices

A How to Access MET/SUPPORT™ A-1

List of Figures

Figure **Title** **Page**

1-1. Slew Dialog Box (Except Discrete Resistance) 1-20
1-2. Slew Dialog (Discrete Resistance) 1-21
1-3. Keyboard Entry Operator Prompt 1-22
1-4. Post-Test Summary of a Slew or Keyboard Entry Instrument Evaluation 1-22
1-5. Go/No-Go Evaluation Test 1-23
1-6. Post-Test Summary of a Go/No-Go Instrument Evaluation 1-24
1-7. Test Setup Prompt 1-26
1-8. UUT Setup Dialog 1-28
1-9. Stimulus Nominal Setup Dialog 1-29
1-10. Automatic Completion Message 1-30

Chapter 1
General Rules for FSCs

Conventions

The MET/CAL Reference Guide uses the following special symbols and conventions:

numeric

The following are examples of valid *numeric* entries:

123
+123
-12345

12.3
+1.234
-0.12345

1.23E+5
+123.4E-56
-12345.678E+90

integer

The following is an example of *integer* numbers with an implied decimal point.

123
+123
-12345

[ ]

Unbold square brackets indicate that data within them are optional.

[ ]

Bold square brackets indicate that data within them are literals (not optional).

filename

File names that are literal (not optional) are lowercase, bold.

blank

This indicates that a field is blank or empty.

NA

This indicates Not Applicable.

Fields of MET/CAL instrument FSC statements:

References to the fields of a MET/CAL instrument Function Selection Code (FSC) are upper-case, i.e., RANGE, NOMINAL, and TOLERANCE.

Introduction

Chapter 1 discusses the general rules of how the Function Selection Codes (FSCs) control the MET/CAL system. The topics in this chapter are the following:

- What is a Function Selection Code?
- Common FSC Properties
- Rules for FSCs
- Results Reporting
- Special Constructions

What is a Function Selection Code?

A Function Selection Code (FSC) instructs the system to perform a task that is requested in a procedure. For example, the 5700 FSC instructs the system to provide a stimulus output from the Fluke 5700A Calibrator, while the DISP FSC directs the system to display a message to the operator during the execution of a calibration procedure.

Detailed Description of a Procedure

The following example shows you what a procedure looks like. The descriptions of a procedure on the following pages relate back to this example.

```
Fluke Corporation MET/CAL Procedure
================================================================================
INSTRUMENT:                    Fluke 87: (1 year) CAL VER /5500 (Example)
DATE:                          27-Oct-95
AUTHOR:                        Fluke Corporation
REVISION:                      1.0
ADJUSTMENT THRESHOLD:          70%
NUMBER OF TESTS:               7
NUMBER OF LINES:               46
CONFIGURATION LINES:           Fluke 5500A
================================================================================
STEP    FSC     RANGE   NOMINAL         TOLERANCE   MOD1    MOD2    3   4   CON
# Source: Fluke 80 Series Service Manual (PN 834168 April 1989).
# The 90 day specifications of the 5500A are used in TUR computations.
1.001   ASK-     R       N               P                   F                   W
1.002   ASK+            K
1.003   HEAD            PRELIMINARY INSTRUCTIONS
1.004   DISP            [32]                    WARNING
1.004   DISP            HIGH VOLTAGE is used or exposed during the performance
1.004   DISP            of this calibration. DEATH ON CONTACT may result if
1.004   DISP            personnel fail to observe safety precautions.
1.005   RSLT            =DISPLAY TEST
1.006   PICE            87_dsp
2.001   DISP            No warm-up time requirement.
2.001   DISP            Ambient temperature: 18C - 28C.
2.001   DISP            Relative humidity: less than 90%.
2.002   HEAD            {ROTARY SWITCH TESTS}
2.003   DISP            Hold down the RANGE button while turning the UUT rotary
2.003   DISP            function switch from OFF to VDC. Release the RANGE
2.003   DISP            button and turn the switch to {VAC}.
2.004   EVAL    Does the UUT Indicate between -0012 and 0012?
3.001   DISP            Rotate the rotary switch to OFF.
3.002   HEAD            {AC VOLTAGE TESTS}
3.003   DISP            Rotate the UUT function switch to VAC.
3.004   PIC             55_87_2w
3.005   HEAD            AC VOLTAGE TESTS: {400mV Range}
3.006   5500    400     350.0mV         -2.9U +2.9U     60H     SI          2W
4.001   5500    400     350.0mV         7.4U            5kH     SI          2W
5.001   HEAD            {FREQUENCY TESTS}
5.002   DISP            Select the 400mV Range on the UUT.
5.002   DISP            Press the Hz button to select the Frequency Counter.
5.003   HEAD            FREQUENCY TESTS: {19.999kHz Range}
5.004   5500    20      19.000kH        0.002U          150mV   SI          2W
6.001   HEAD            {FREQUENCY SENSITIVITY AND TRIGGER LEVEL TESTS}
6.002   DISP            Press the Range button to select the 4V range.
6.003   5500            1000.0H         0.2U            300mV   SI          2W
7.001   END
```

This example procedure performs a partial calibration verification of a Fluke 87 Digital Multimeter. The Fluke 5500A is used as a calibration source.

MET/CAL Procedure Headers

The procedure is prefaced by a procedure header. The procedure header is described as follows:

Title Line

The **`Title`** line typically contains the name of your organization which is specified during the configuration of your calibration system.

Instrument

The **`Instrument`** line specifies the name of the procedure. In the example procedure, the name is **`Fluke 87: (1 year) CAL VER /5500 (Example)`**. Use names that uniquely identify the UUT for which you wrote the procedure. The name is used by an operator to select a procedure.

The name can be up to 55 characters long. Spaces are significant, but case (upper or lower) is not.

A procedure may have up to six distinct names and each name is specified on a separate Instrument line.

Date

The **`Date`** line shows the date on which the procedure was written or last edited. The system enters this information automatically. In the example procedure, the date is **`20-May-94`**.

Author

The **`Author`** line may contain the name of the person who wrote the procedure. The **`Author`** line is an optional entry. In the example procedure, the author is **`Fluke Corporation`**.

Revision

The **`Revision`** line shows the current revision of the procedure. This is incremented exclusively by the procedure writer.

Adjustment Threshold

The **`Adjustment Threshold`** line is used to specify the point above which a PASS condition is considered marginal.

Note

Percent of tolerance (% TOL) is rounded off to the nearest 1%. Therefore, you see PASS 100% (if the result is between 99.5% and 100%) and FAIL 100% (if the result is greater than 100% and less than 100.5%).

In the example procedure, the default adjustment threshold value is 70%.

Number of Tests

This line indicates how many tests the procedure contains. A test is defined as a portion of the procedure that produces a result. In a procedure, a test is identified by the integer portion of the STEP number (described later). MET/CAL automatically computes and enters this number. The example procedure contains seven tests.

Number of Lines

This line indicates how many lines the procedure contains. The procedure header is included in this count. MET/CAL automatically calculates this number.

Configuration

The **`Configuration`** line specifies the instruments required by the procedure. In the example, the Fluke 5500A is the only required instrument.

Standard

The STD FSC causes MET/CAL to perform a traceability check for a manually controlled external standard used by the procedure. The MET/CAL procedure compiler (editor) generates a "STANDARD" statement in the header of a compiled procedure for each distinct instrument specified in an STD statement.

Column Headers

The Column Headers line identifies the fields of a MET/CAL procedure statement.

Naming a Procedure

To create a name for a procedure, press Ctrl I on a blank line. The Instrument: line appears. Type in the name and press ↵Enter to compile the line.

Calibration procedures can be designed to calibrate different instruments with similar calibration or verification requirements. For example, the procedures for the Fluke 73, 75, and 77 are similar, but there are slight differences. Instead of creating a different calibration procedure for each model, it is possible to create one procedure in which the execution of the procedure is controlled by the name selected. This single procedure would have three names, shown as follows in the header of the procedure:

INSTRUMENT:	Fluke 73
INSTRUMENT:	Fluke 75
INSTRUMENT:	Fluke 77

The action of the Name Procedure command depends on the contents of the line, status of the line, and the type of line the cursor is on. The following explains what may occur in certain situations when a procedure is named:

If the line is blank, Name Procedure causes INSTRUMENT: to appear. Type in the name you want the procedure called and press ↵Enter. The procedure compiles and the procedure name appears in the instrument line.

If the line is not blank but compiled, either the procedure name appears in the title bar or the line was not an INSTRUMENT: line and the following status message displays: **Not an Instrument Line**.

If the line is not blank and not compiled, the current line may be an INSTRUMENT: line and the selected procedure name is entered into the title bar of the active window. If the line is not an Instrument line or is deleted, the previously selected procedure name is re-selected and its name remains in the title bar of the active window.

Observe the following rules for naming procedures:

- A procedure must have at least one name and may have up to six names. These names are displayed individually in the MET/CAL Procedure Directory after the procedure is stored.
- The JMPT and JMPF Function Selection Codes may be used to jump in a procedure in a manner dependent on the name selected.
- If the procedure to be edited is loaded from the Procedure Directory, the selected name of the procedure is set to the name by which it was chosen. This name is shown in the header of the Procedure Editor.
- If the procedure is created from scratch, no name is assigned until Ctrl I is used to create an instrument line. If you do not use the Name Procedure

command, the selected procedure, after compilation, is the name in the first INSTRUMENT: line. The selected name can be assigned or changed by the Name Procedure command.

MET/CAL Procedure Body Statements

The remainder of the procedure is called the procedure body. The procedure body consists of executable procedure lines that follow the header. All procedure lines in the procedure body begin with a Step Number followed by a Function Selection Code (FSC).

In the previous section, an FSC was defined as a code that informs the system of a task to be performed. All FSC statements have the following common properties:

Test Number

The **Test Number** is the integer portion of the number in the STEP field. A test is one or more statements with the same test number. Test numbers identify tests. A test is defined as a portion of a procedure that generates a test result.

Step Number

The **Step Number** is the entire number in the "STEP" field. The step number associated with each procedure test can be between <step #> .001 and <step#> .999. The step numbers are automatically assigned by the procedure compiler, although you can influence the numbering of lines in certain situations.

FSC Identifier

The **FSC** identifies the statement. It is the field following the "STEP" field. For example, DISP identifies a display statement, 5100 identifies a statement used to control the Fluke 5100B calibrator, and so on.

Function Selection Code Types

MET/CAL has seven FSC types; the FSC categories are as follows:

- Instrument
- Display Control
- Evaluation
- Interface Control
- Memory Register Operation
- Procedure Control
- Miscellaneous

Each FSC type performs a different function in the MET/CAL system. The following describes the function of each FSC type and, where appropriate, describes specific information required in the Range, Nominal, Tolerance, MOD1, MOD2, MOD3, MOD4, and CON fields. The use of these fields vary with the

type of FSC. The requirements of the remaining fields are discussed in detail in Chapter 2 of the MET/CAL Reference Manual.

The following table contains a list of all the FSCs in MET/CAL. The table shows the type of each FSC and the task each FSC performs.

Function Selection Code Types	
Display Control FSCs	
CON	Displays a connection message.
DISP	Displays messages to the operator.
DRAW	Sets up a UUT outline and image for display by EVAL, DISP,OPBR, or SET.
HEAD	Display a header message.
MESS	Stores a message to be displayed with a stimulus instrument evaluation, measurement instrument setup, or an EVAL statement
PIC	Displays a bit-mapped picture. (Also refer to PICE under Evaluation FSC.)
SET	Displays a list of settings for complex UUT setups.
RNG	Displays a range message.
Evaluation FSCs	
DOSE	Set PASS or FAIL via a DOS program.
EVAL	Set PASS or FAIL based on operator response to a YES/NO prompt
MEMC	Set PASS or FAIL based on numeric evaluation. MEM = System Actual value MEM1 = UUT Indicated value
MEMCX	Sets PASS or FAIL based on numeric evaluation. MEM1 = System Actual MEM = UUT Indicate
PICE	Set PASS or FAIL based on operator response to a YES/NO prompt displayed over bit-mapped picture.
Instrument FSCs	
Calibrators	
4000	Datro 4000 and 4000A Autocal Standards
4200	Datron 4200 Autocal AC Standards
4700	Datron 4700 Multifunction Calibrator
4705	Datron 4705 Multifunction Calibrator
4707	Datron 4707 Multifunction Calibrator
4708	Datron 4708 Multifunction Calibrator
4800	Datron 4800 Multifunction Calibrator
4800A	Datron 4800A Multifunction Calibrator
4805	Datron 4805 Multifunction Calibrator
4808	Datron 4808 Multifunction Calibrator

Function Selection Code Types	
Instrument FSCs	
Calibrators	
5001, MCAL	Tektronix CG 5001 Calibration Generator
5011, M511	Tegam/Tektronix CG 5011 Calibration Generator
5100	Fluke 5100B Calibrator, DC and AC Voltage and Current
5130	Fluke 5130A Calibrator, DC and AC Voltage and Current
RESF	Fluke 5100B or 5130A Calibrator, Resistance
WIDE	Fluke 5100B Calibrator, Wideband AC Voltage
5200	Fluke 5200A AC Calibrator
5205	Fluke 5205A and 5215A Power Amplifier controlled by a 5100B or 5130A
5220	Fluke 5220A Transconductance Amplifier controlled by a 5100B or 5130A
5440	Fluke 5440B DC Calibrator
5450	Fluke 5450A Resistance Calibrator
5500, M550	Fluke 5500A Multiproduct Calibrator
5520, M5520	Fluke 5520A Multiproduct Calibrator
5700, MMFC	Fluke 5700A Multifunction Calibrator
5720, M5720	Fluke 5720A Multifunction Calibrator
5800, M5800	Fluke 5800A Oscilloscope Calibrator
5820, M5820	Fluke 5820A Oscilloscope Calibrator
P700	Pressure Calibration using Fluke 5520A
9000, M9000	Datron 9000 Meter Calibration System
9100, M9100	Datron 9100 Calibration System
9500, M9500	Datron 9500 Oscilloscope Calibrator
Transfer Standards	
4950, M4950	Datron 4950 Multifunction Transfer Standard
5790, ACMC	Fluke 5790 AC Measurement Standard
Counters\ Timers	
5335, M5335	Hewlett-Packard 5335A Universal Counter
6666, M666	Phillips PM 6666 Timer/Counter
6680, M680	Phillips PM 6680 or Wavetek 900 Timer/Counter
6681, M681	Phillips PM 6681 or Wavetek 901 Timer/Counter
6685, M685	Phillips PM 6685 or Wavetek 905 Timer/Counter
Loads	
HP60	Hewlett-Packard 6060B DC Electronic Load
HP63	Hewlett-Packard 6063B DC Electronic Load

Function Selection Code Types	
Instrument FSCs	
Multimeters	
1271, M1271	Datron 1271 Multimeter
1281, M1281	Datron 1281 Multimeter
2000	Keithley 2000 Multimeter
2001	Keithley 2001 Multimeter
2002	Keithley 2002 Multimeter
34401	Hewlett-Packard 34401 Multimeter
34420	Hewlett-Packard 34420 Multimeter
3458,M3458	Hewlett-Packard 3458A Digital Multimeter
45, M45	Fluke 45 Dual Display Multimeter
8505	Fluke 8505A Digital Multimeter
8506	Fluke 8506A Thermal RMS Digital Multimeter
8842	Fluke 8840A and 8842A Digital Multimeters
8920	Fluke 8920A True RMS Voltmeter
Signal Generators	
2024, M2024	Marconi 2023, 2024, and IFR 2023A, 2024A AM/FM Signal Generators
5030	Tegam/Tektronix SG 5030 Leveled Sine Wave Generator
5050	Tegam SG 5050 Leveled Sine Wave Generator
Instrument FSCs	
Signal Generators	
6060, M606	Fluke 6060A, 6060B, 6061A, 6062A, 6080A, and 6082A RF Signal Generators
8648, M8648	Hewlett-Packard 8648A, 8648B, 8648C, and 8648D RF Signal Generators
SMY02, MSMY02	Rohde & Schwarz SMY01, SMY02, and SMY43 RF Signal Generators
Function Generators	
3325, M3325	Hewlett-Packard 3325A and 3325B Function Generators
5191	Phillips PM 5191 Function Generator
5192	Phillips PM 5192 Function Generator
5193	Phillips PM 5193 Function Generator
Power Meters	
437, M437	Hewlett- Packard 437B Power Meter and EPM-441A or E4418A in 437B emulation mode
RF Analyzers	
8901, M8901	Hewlett-Packard 8901A and 8901B Modulation Analyzer
8902, M8902	Hewlett-Packard 8902A Measuring Receiver and 8902S Microwave Measurement System
8903, M8903	Hewlett-Packard 8903B Audio Analyzer and 8903E Distortion Analyzer

Function Selection Code Types	
Spectrum Analyzers	
8560, M8560	Hewlett-Packard 8560A, 8561A/B, 8562A/B, 8563A and 8560 E-Series Spectrum Analyzers
8566, M8566	Hewlett-Packard 8566B Spectrum Analyzer
8568, M8568	Hewlett-Packard 8568B Spectrum Analyzer
8590, M8590	Hewlett-Packard 8590L, 8591E, 8592L, 8593E, 8594E, 8595E, and 8596E Spectrum Analyzers
Interface Control FSCs	
IEEE	Direct control of a device on an IEEE-488 interface.
PORT	Direct control of a device on a serial interface.

Function Selection Code Types	
Memory Register Operations FSCs	
MATH	Performs arithmetic & string operations using memory register.
MEM2	Manipulates the contents of the memory register MEM2.
MEME	Exchanges the values of memory registers MEM and MEM1.
MEMI	Displays a prompt for a number to be placed in memory register MEM.
MEM+	Add MEM1 or the specified value to memory register MEM.
MEM-	Subtract MEM1 or the specified value to memory register MEM.
MEM*	Multiply MEM1 or the specified value to memory register MEM.
MEM/	Divide MEM1 or the specified value to memory register MEM.
Procedure Control FSCs	
ASK+	Set system flags.
ASK-	Unset system flags.
CALL	Call one procedure from another.
DOS	Call a DOS program. Also see DOSE under Evaluation FSCs.
JMP	Branch to a specified procedure step.
JMPF	Branch to a specified procedure step if MEM1 is less than zero.
JMPL	Branch to specified LABEL.
JMPT	Branch to a specified procedure step if MEM1 is greater than zero.
JMPZ	Branch to a specified procedure step if MEM1 is equal to zero.
LABEL	Establishes target for JMPL.
OPBR	Presents a message that requests a response.
RPT	Repeats a test.
TARGET	Specifies jump destination for post test “Repeat” and “Cancel” options.
Miscellaneous FSCs	
ACC	Specifies the system accuracy for a MEMC FSC.
ACCF	Specifies an alternate accuracy file.
RESET	Specifies reset commands for user-configured or UUT instruments.
RSLT	Adds text to result files with or without an operator prompt.
STD	Includes traceability information for manual instrument.
TOL	Specifies tolerance for multiple evaluations.
VSET	Assigns values to system parameters

Instrument FSCs

Instrument FSCs control system calibration instruments. An Instrument FSC is used to apply a stimulus to, or take a measurement from, the UUT. The FSC may also generate automatic messages describing the signal connection between the calibration instrument and the UUT, and the UUT range required for the test. In addition, an instrument FSC may perform an evaluation that results in a PASS or FAIL condition.

When you enter information for a given FSC, you must enter the step number first, the FSC second. If no step number is entered, it is automatically inserted by the procedure compiler. Following the FSC code, other information for the FSC may be entered in an arbitrary order. When the statement is compiled, the compiler sorts the entries into the appropriate fields.

In some situations, the order in which entries are made is significant. For example, in the 6060 FSC, if you enter the amplitude information before the frequency information, amplitude is stored in the NOMINAL field and frequency in the MOD1 field and an evaluation, if any, is based on the amplitude.

If you enter the frequency first and then amplitude, the frequency value is stored in the NOMINAL field and the amplitude information in the MOD1 field and an evaluation, if performed, is based on the frequency. The compiler sorting routine displays error messages if it cannot sort the line. The following rules apply to all Instrument FSCs after a line is sorted.

RANGE Field

The RANGE field is a five-character field that specifies the Unit Under Test (UUT) range in units of the NOMINAL value. The format of the RANGE field is one of the following:

- number
- "A"
- *blank*

The RANGE field causes an automatic range message to be generated when the procedure statement is executed. If the RANGE field is "A", "Autorange" is specified. Refer to the section, *Automatic Messages* later in this chapter for more information. Note that the ASK "R" flag can be used to disable automatic range messages, and the ASK "D" flag can be used modify the range message. Refer to *ASK+, ASK- FSC* in Chapter 2 of this manual.

A numeric RANGE field may be used for the following:

- Calculating test tolerance. For more information, refer to the section *TOLERANCE Field Rules* later in this chapter.
- Generating automatic slew message for certain FSCs, i.e., the FSCs affected by the ASK 'D' flag.
- Calculating the compile-time T.U.R. when the procedure statement does not specify a numeric NOMINAL value.
- Controlling the formatting of certain results variables. For more information, refer to the section, *Results Formatting* later in this chapter.

Other rules:

- To be compatible with earlier versions of MET/CAL, any RANGE field specification may include an appended "R". If the appended "R" is present, the procedure compiler removes the "R" when the procedure statement is formatted. The "R" does not affect the interpretation of the RANGE field.
- No RANGE field entry is allowed in an instrument setup statement. An instrument setup statement is an instrument statement which contains an 'S' in the MOD4 field.
- No RANGE field entry is allowed in a statement which appears in an adjustment block. Statements in an adjustment block are indented so that the FSC appears in the RANGE field.

NOMINAL Field

The NOMINAL field specifies the nominal value of the stimulus for a calibration instrument source function (e.g. AC Voltage) or the anticipated measurement value of a calibration instrument measurement function (e.g. Ohms). The NOMINAL field can be up to 14 characters long. The following example shows how the nominal value is entered:

```
[numeric][prefix]units
```

The following units are recognized:

QUANTITY	UNITS	SYMBOLS
Amplitude	Decibels	D
Capacitance	Farads	F
Current, RMS or DC	Amps	A
Current peak	Amps peak	Ap
Current peak-to-peak	Amps peak-to-peak	App
Conductance	Siemens	Y
DC Offset	Volts	Voff
Duty Factor [1]	None	DF
Frequency	Hertz	H
Frequency Ratio [1]	None	H/H
Percent [1]	na	pct
Phase	Degrees	deg
Power, RMS or DC	Watts	W
Pressure	Pascals	Pa
Pressure	bars	bars
Pressure	feet or water	ftH20
Pressure	grams per sq. cm.	g/cm2
Pressure	inches of Mercury	inHg
Pressure	inches of water	inH20
Pressure	meters of Mercury	mHg
Pressure	meters of water	mH20
Pressure	pounds per sq. inch	psi
Resistance	Ohms	Z
Temperature	Degrees Celsius	degC

Temperature	Degrees Fahrenheit	degF
Temperature	Kelvins	K
Time or period	Seconds	T
Video Amplitude	IRE	IRE
Video Line Marker [1]	None	LM
Voltage, RMS or DC	Volts	V
Voltage peak	Volts peak	Vp
Volts per Amp	Volts per Amp	V/A
Voltage peak-to-peak	Volts peak-to-peak	Vpp
Voltage Ratio [1]	None	V/V

[1] MET/CAL requires a units symbol to identify the quantity, even if the quantity is dimensionless (duty factor, frequency ratio, video line marker, and voltage ratio). Similarly, even though percent is not a unit, the symbol "pct" is used to satisfy MET/CAL'S requirement for a symbol.
The actual units allowed are dependent on the FSC. Refer to Chapter 2 of this manual for the allowed units for a particular FSC.

The following prefixes are recognized:

PREFIX	SYMBOL	MULTIPLE
pico	p	1E-12
nano	n	1E-9
micro	u	1E-6
milli	m	1E-3
kilo	k	1E+3
mega	M	1E+6
giga	G	1E+9

With the exception of 'm' and 'M', case is not significant. For example, a procedure statement could specify 'NV' instead of 'nV' to indicate nanovolts. If a non-standard case is used to enter a prefix symbol (for example, 'N' for nano), the Procedure Compiler converts the symbol to the standard case.

For units of hertz or ohms, 'm' and 'M' are case significant. 'M' represents mega and 'm' represents milli.

When just units and an optional prefix (e.g., mV) are entered in the NOMINAL field, the value is taken from memory register MEM when the statement is executed.

If the NOMINAL field contains a single asterisk (*), the calibration instrument is set to a reset condition. Since this implies a Setup test, S is automatically inserted in the MOD4 field. Refer to the section about MOD4 field rules later in this chapter for more information.

When an instrument FSC is entered with all other fields blank, an asterisk is inserted automatically in the NOMINAL field and an 'S' is automatically inserted in the MOD4 field.

When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value and vice versa.

TOLERANCE Field

The TOLERANCE field specifies the tolerance to which the UUT indicated value is evaluated. This field can be up to 13 characters long including spaces. Any combination of up to three of the following entries can be used:

ENTRY	TOLERANCE SPECIFICATION
⟨% of nominal⟩ %	This tolerance is the percent of the nominal value.
⟨% of range⟩ /	This tolerance is the percent of range as entered in the RANGE field. A numeric entry (not A) in the RANGE field is required with this expression. See "Other Rules" below for information about autoranging.)
⟨ppm of nominal⟩ P%	This tolerance is in ppm of the nominal value.
⟨ppm of range⟩ P/	This tolerance is in ppm of range as entered in the RANGE field. There must be a numeric entry in the RANGE field (not A) in order to use this expression.
⟨absolute units⟩ U	Units are the same as used in the NOMINAL field; this includes the prefix.

- If the tolerance is unsigned, a ± tolerance is implied. For example, "1%" is equivalent to "+1% -1%".
- If the tolerance is prefaced by **+**, the tolerance is specified in the positive direction from the nominal value; if prefaced by **-**, the tolerance is specified as negative from the nominal value.
- A tolerance specification is not allowed with a setup (MOD4 = 'S") test or in an indented adjustment procedure step.
- % of range (/) or ppm of range (P/) are not allowed when the RANGE field is blank or autorange.
- If UUT tolerance is specified in an evaluation or comparison test, TOL is entered and the tolerance specified in the last executed TOL FSC applies. If no TOL FSC is present, the tolerance applied is zero units. Refer to the description of the TOL FSC in Chapter 2 of this manual.
- The tolerance value may be a literal numeric value or may refer to a numeric register. Valid numeric register specifications are M1, M2, ..., M255. If the value is not specified, the value is taken from MEM at runtime.

MOD1 Field

The MOD1 field specifies the frequency, period, or amplitude of a periodic signal, or the field is left blank.

If the MOD1 field contains the frequency or period, the NOMINAL field contains the amplitude and vice versa.

When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value and vice versa.

The modifier value is entered as follows:

[*numeric*] [*prefix*] *units*

As in the case of the nominal value, the *units* and allowed *numeric value* for the MOD1 field depend on the particular FSC. Refer to Chapter 2 of this manual for detailed information on specific FSCs.

Recognized prefixes are the same as discussed under the NOMINAL field rules.

MOD2 Field

One or two characters can be in the MOD2 field. Refer to Chapter 2 of this manual for detailed descriptions of each FSC.

MOD3 Field

One or two characters can be in the MOD3 field. Refer to Chapter 2 of this manual for detailed descriptions of each FSC.

MOD4 Field

The MOD4 field specifies the type of test being performed and can contain only a single character. The following four types of tests are defined in the MET/CAL procedure language:

- Evaluation Test (MOD4 field is blank).

  For a stimulus function, a calibration applies a known value to the UUT and MET/CAL checks that the UUT reading is within the specified tolerance. For a measurement function, MET/CAL checks that a UUT output is within the specified tolerance.

- Setup Test (MOD4 is S).

  For a stimulus function, a Setup Test applies the nominal value to the UUT. For a measurement function, a Setup Test continually monitors a UUT output so that it may be adjusted to the specified nominal value.

- Nominal Setup Test (MOD4 is N).

  The Nominal Setup test does not perform an evaluation. The Nominal Setup test allows the output of a stimulus calibration function to be adjusted so that the UUT reads a nominal value. For a measurement calibration function, a single reading is taken. This value may be used later in a Comparison Test.

- Comparison Test (MOD4 is C).

  The Comparison Test is used in conjunction with the Nominal Setup test. The Comparison Test operates like an evaluation test, except that the value established by the Nominal Test is used as a reference for the evaluation, instead of the value specified in the NOMINAL field.

  These tests are explained in greater detail later in this manual.

CON Field

The CON field is a two-character field. The entries depend on the particular instrument FSC. Refer to Chapter 2 of this manual for more information on individual FSCs.

Evaluation Test

An Evaluation test may perform one of two types of evaluation: a stimulus or a measurement evaluation.

For a stimulus evaluation, a calibrator applies a known value to the UUT and checks the UUT reading to determine if it is within the specified tolerance.

A measurement evaluation checks that a UUT output is within the specified tolerance.

The effects of the type of calibration instrument function, type of test, and method of UUT reading entry on UUT Indicated, System Actual, and the contents of MEM and MEM1 are described below.

Stimulus Function

An example of this type of evaluation test is as follows:

```
STEP   FSC     RANGE   NOMINAL TOLERANCE   MOD1    MOD2    3   4   CON
2.001  5500    400     350mV   0.1% 0.1/   60H     SI              2W
```

There are three ways to evaluate UUT performance when using stimulus-type calibration instruments:

- Slew the output until the UUT reads the nominal value, or slew the reading on the display to match the UUT reading. The latter method is used when the

calibration instrument supplies only discrete values of resistance. This method provides detailed performance information and is least prone to operator error. The Slew method is used when any of the defaults ASK- B, ASK- G, or ASK- K is in effect. Refer to the description of these flags in the ASK FSC description in Chapter 2 of this manual.

- Enter the UUT reading from the keyboard. The keyboard method is selected with ASK+ K. When ASK+ B is set, the operator has the option to select Keyboard entry.
- Select Yes if the UUT reading is within the range displayed on the screen; if not, select No. This method, called Go/No-Go testing, does not provide detailed performance information on the UUT but does minimize procedure execution time. The Go/No-Go method is selected when ASK+ G is in effect. When ASK+ B is set the operator has the option to select Go/No-Go.

If the UUT reading can be obtained under remote control via the IEEE-488 or RS-232C interface, a closed-loop verification is possible. Setup tests are used to apply the required stimuli. The PASS/FAIL evaluations of the readings are done with the MEMC FSC. Refer to the descriptions of the IEEE, PORT, and MEMC FSCs in Chapter 2 of this manual for detailed information. Each method is explained in more detail below:

Note

Remote control of a UUT does not guarantee the reading can be obtained remotely. This is especially true for scopes.

- Slew Evaluation (Except Discrete Resistance)

  (ASK- B, ASK- G, ASK- K or optionally with ASK+ B)

  Use the Tab key or the mouse to select the desired button, then use either the mouse or ↵ Enter key to slew the output of the calibration instrument. Refer to Figure 1-1. When the stimulus is adjusted sufficiently for the UUT to read the nominal value, select **Advance** to proceed to the next procedure step. The error is computed, and a PASS or FAIL condition is established for the test. Refer to Figure 1-4 to see the test result.

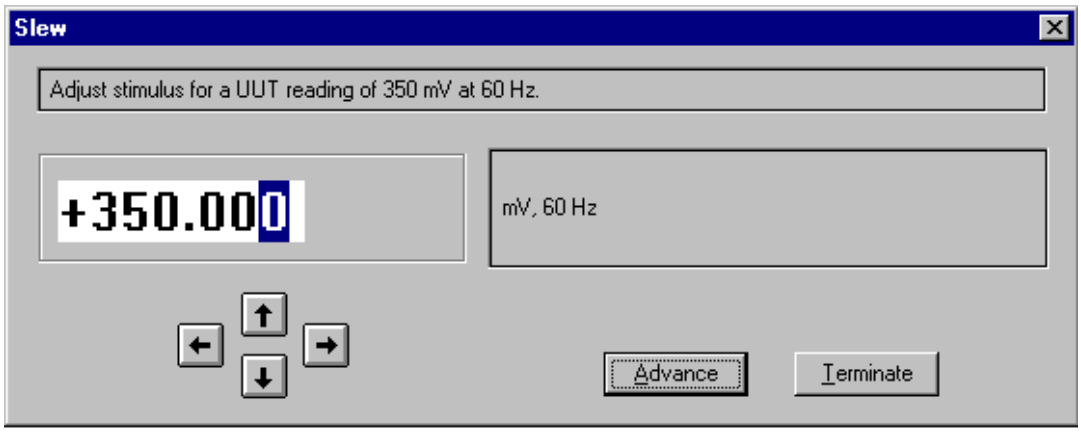

Figure 1-1. Slew Dialog Box (Except Discrete Resistance)

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.
System Actual	The calibration instrument output when **Advance** is selected.

Values of memory registers MEM and MEM1:

MEM	Not affected by the slew evaluation.
MEM1	System Actual

- Slew Evaluation (Discrete Resistance)

  (ASK- B, ASK- G, ASK- K or optionally with ASK+ B)

  When only discrete resistance values are available from calibration stimulus instruments, resistance cannot be slewed. When the slew method is used for discrete resistance, the value on the display is adjusted to exactly match the UUT. This includes the 5700, 5450, and RESF FSCs.

  An example of this type of evaluation test is as follows:

```
STEP  FSC    RANGE  NOMINAL    TOLERANCE MOD1 MOD2    3   4   CON
2.001 5700   10     10Z        0.1% 0.1/                      2W
```

Use the mouse or the ↵Enter key to slew the displayed reading as described before. When the value on the display matches the UUT reading, select **Advance** to go to the next procedure step. The error is computed and compared to the specified value in the procedure line.

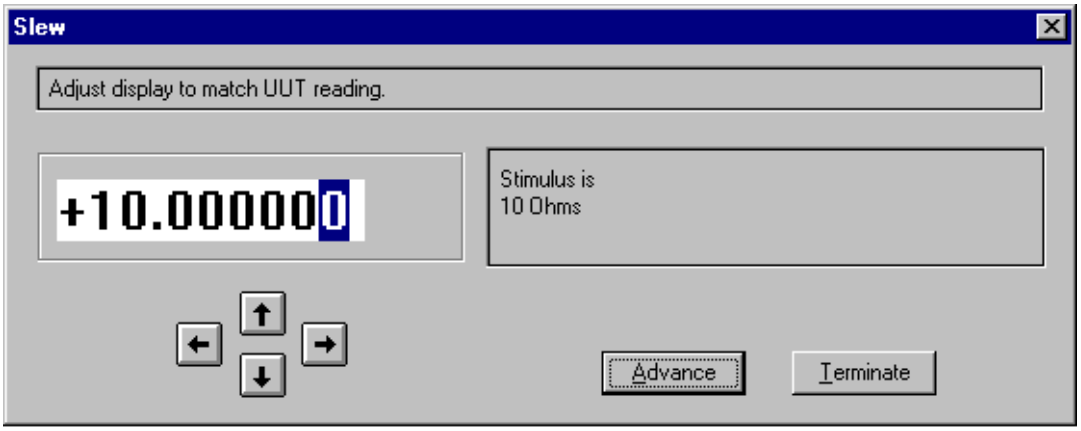

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Figure 1-2. Slew Dialog (Discrete Resistance)

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	This value on the display when **Advance** is selected.
System Actual	The actual calibration value of resistance for the 5700A and 5450A. The actual value is reported instead of the value in the NOMINAL field (e.g., 10.000012 instead of 10 Ω). The 5100B and 5130A do not support the ability to query the actual resistance; therefore, the NOMINAL value is used.

Values of memory registers MEM and MEM1:

MEM	Not affected by the slew evaluation.
MEM1	UUT Indicated.

- Keyboard Evaluation (ASK+ K or optionally with ASK+ B)
- When the keyboard method is used, you are prompted to enter the UUT reading. Refer to Figure 1-3.

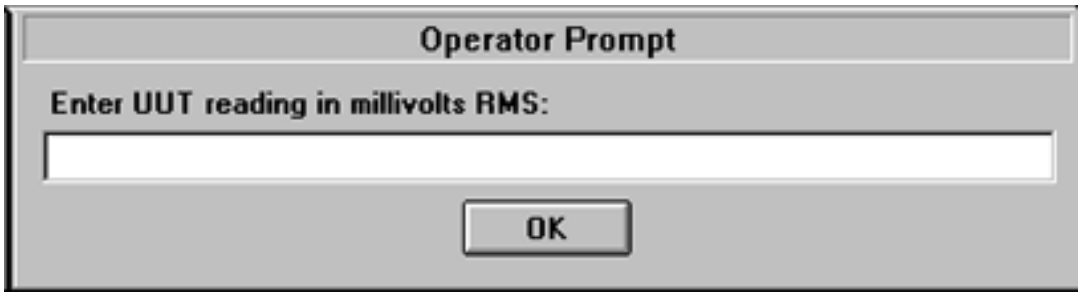


Figure 1-3. Keyboard Entry Operator Prompt

After the UUT reading is entered, the error is computed. The test result appears as shown in Figure 1-4.

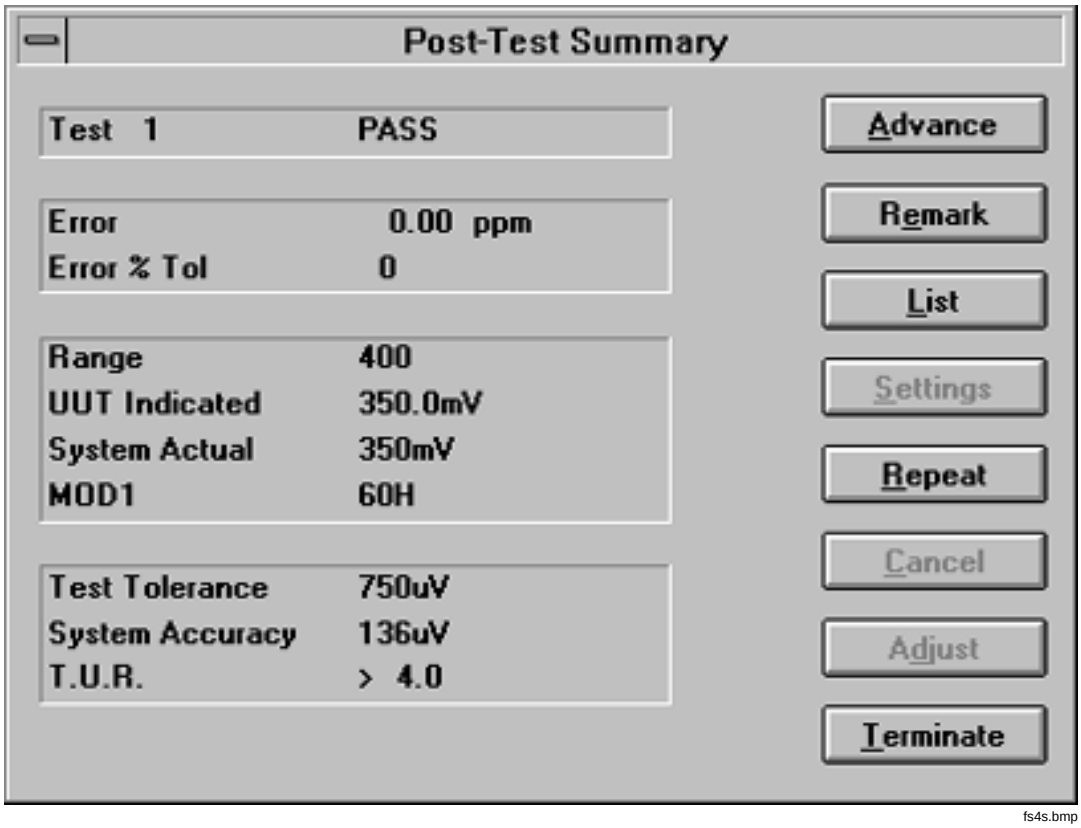


Figure 1-4. Post-Test Summary of a Slew or Keyboard Entry Instrument Evaluation

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure was executed:

UUT Indicated	The value entered from the keyboard.
System Actual	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.

Values of memory registers MEM and MEM1:

MEM	Not affected by keyboard entry evaluation.
MEM1	UUT Indicated.

- Go/No-Go Evaluation (ASK+ G or optionally with ASK+ B)

  When the Go/No-Go method is used, you are prompted to respond Yes or No based on whether the UUT reading is between the limits displayed in the dialog. Refer to Figure 1-5.

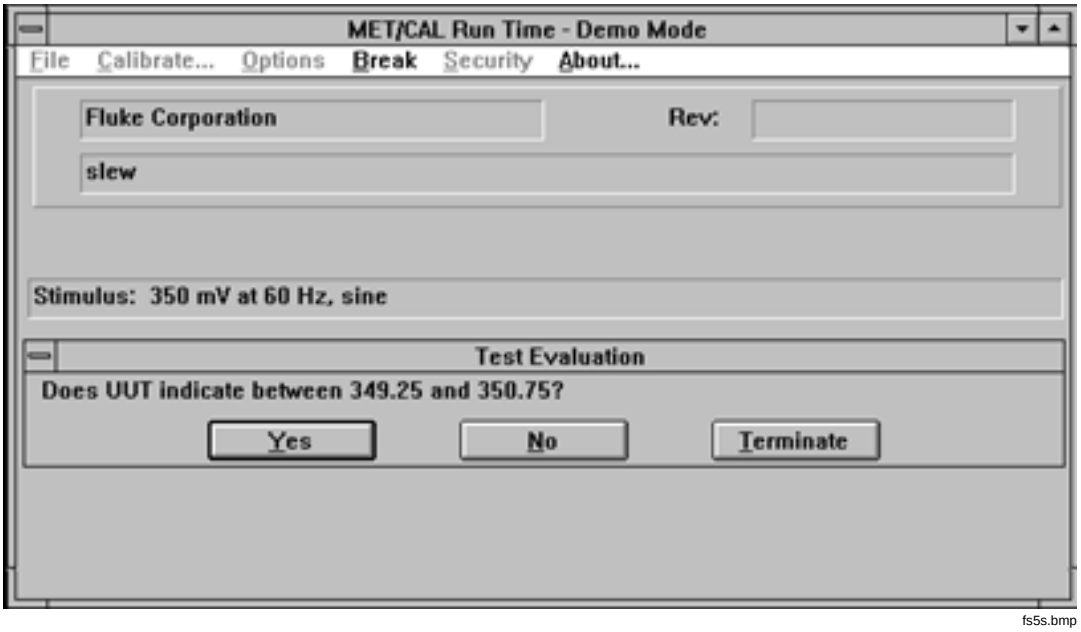


Figure 1-5. Go/No-Go Evaluation Test

These limits are determined from the tolerance information and depend on the adjustment threshold value if an adjustment procedure follows the evaluation step. For example, if no adjustment step follows, the limits are as follows:

```
349.25 mV and 350.75 mV
```

The exact UUT error cannot be computed, only a PASS/FAIL condition is determined, based on operator's response. The test result appears as shown in Figure 1-6.

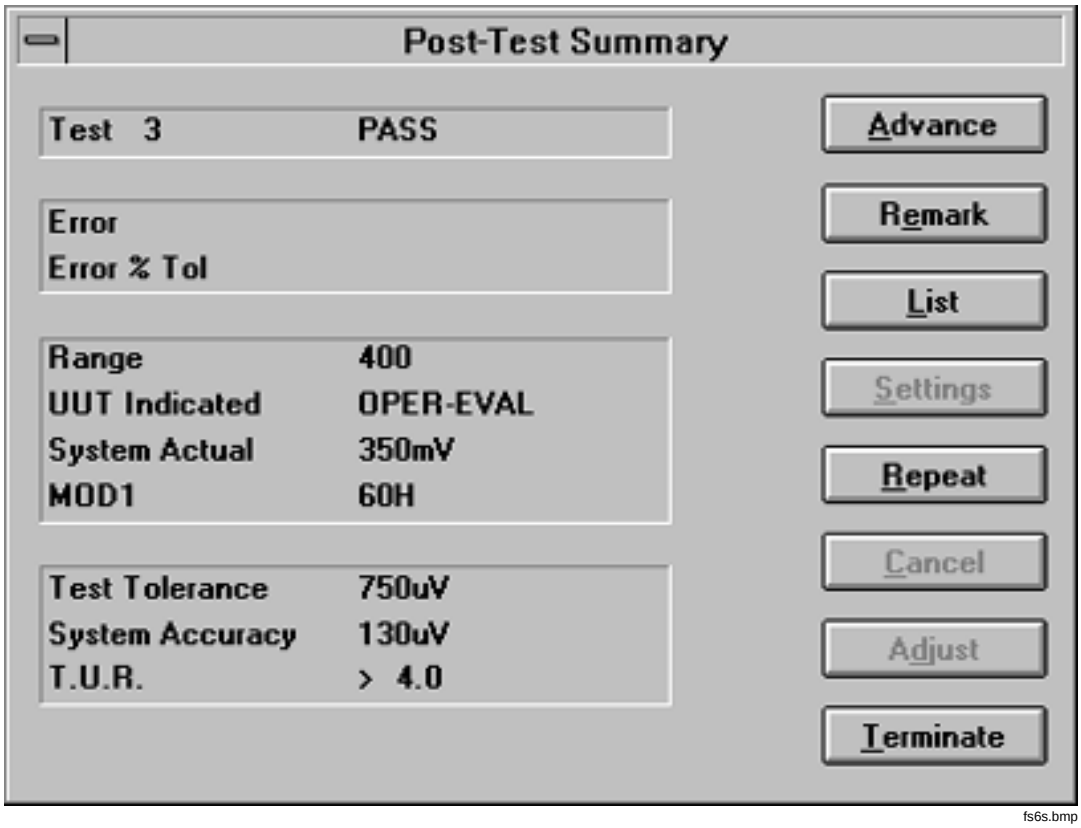


Figure 1-6. Post-Test Summary of a Go/No-Go Instrument Evaluation

The following UUT Indicated and System Actual are reported in the Post-Test summary and may be included in the results file depending on the results template used at the time the procedure was executed:

UUT Indicated	**OPER-EVAL**.
System Actual	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.

MEM and MEM1 updates:

MEM	Not affected by the Go/No-Go evaluation.
MEM1	+1 indicating a PASS condition if YES was selected. -1 indicating a FAIL condition if NO was selected.

Measurement Function

An example of this type of evaluation test is as follows:

```
STEP   FSC     RANGE   NOMINAL     TOLERANCE   MOD1    MOD2    3   4   CON
2.001  8842    10      10Z         0.1% 0.1/                           2W
```

This example programs the 8842A to measure volts.

The operator is asked to set the UUT output to the NOMINAL value and place it in operate unless this automatic message is disabled by ASK- N (Figure 1-7).

When **Advance** is selected, the measurement is made and the operator is asked to put the UUT in standby unless this automatic message is disabled by ASK- N (Figure 1-10).

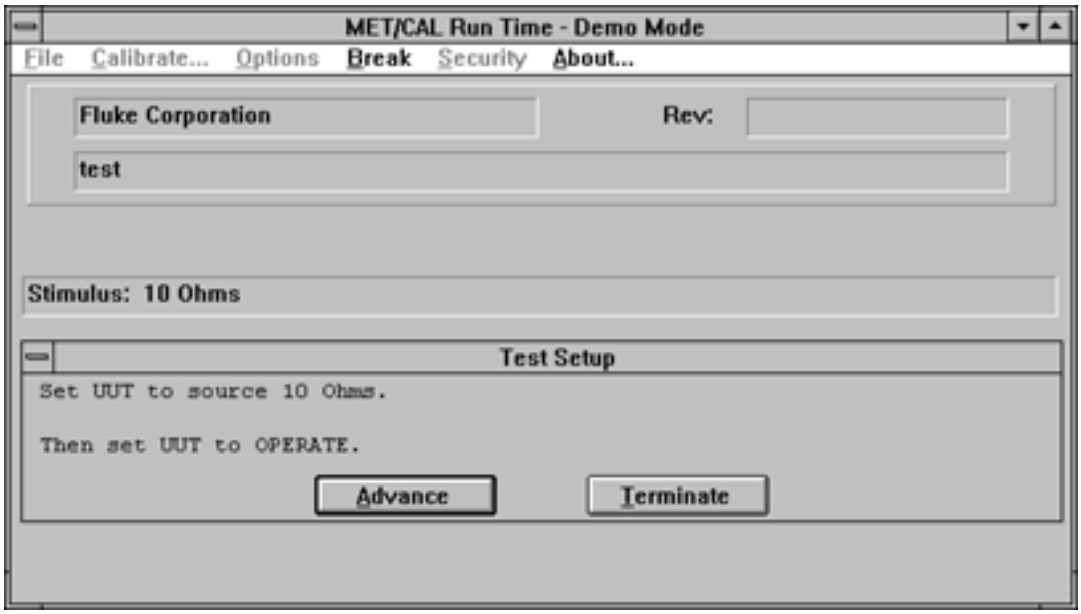


Figure 1-7. Test Setup Prompt

The error is computed and a PASS or FAIL condition is established for the test. The ASK B, G, and K-flags have no influence on this type of evaluation.

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.
System Actual	The actual UUT output as measured by the calibration instrument.

Values of memory registers MEM and MEM1:

MEM	Not affected by the evaluation.
MEM1	System Actual.

Setup Test

For a stimulus function, a Setup Test applies the nominal value to the UUT. For a measurement function, a Setup Test continually monitors a UUT output as the UUT is adjusted to the specified nominal value.

Stimulus Function

The calibration instrument is set up to output the nominal value. The upper part of the display indicates the stimulus. No evaluations or results are generated, and procedure execution continues immediately with the next procedure statement.

The stimulus is removed when a reset statement for the same FSC is executed, e.g., "*" is in the nominal field, or when an evaluation FSC is completed and the step number increments, unless ASK- D is in effect.

Values of memory registers MEM and MEM1:

MEM Not affected by the setup test.

MEM1 The applied stimulus. This is the value specified in the NOMINAL field except for resistance from the 5700A and 5450A. For these cases, MET/CAL queries the calibrator to determine the actual resistance which is then used instead of the value in the NOMINAL field (e.g., 10.000012 instead of 10Ω).

The following is an example of a stimulus Setup Test used during closed-loop verification of a UUT.

```
<example>STEP     FSC        RANGE   NOMINAL   TOLERANCE MOD1    MOD2    3
  4   CON
2.001 IEEE              F1R3
2.002 5700              10V                                S   2W
2.003 IEEE              ?[I]
2.004 MEME
2.005 MEMC              10V      0.1% 0.1/
```

Explanation:

1. The UUT is programmed to the desired function and range in step 2.001. Refer to Chapter 2 of this manual under the description of the IEEE FSC for more detailed information on its operation.
2. Step 2.002 causes the 5700A to apply 10V. After this step, MEM1 contains the value 10.
3. In step 2.003, the system acquires the reading from the UUT and stores the result in register MEM.
4. In step 2.004, the values of MEM and MEM1 are exchanged, with the result that MEM contains the value 10, and MEM1 contains the actual UUT reading.
5. In step 2.005, the values stored in MEM and MEM1 are used to determine the UUT error and a PASS or FAIL condition is established for the test. Refer to

Chapter 2 of this manual under the description of the MEMC FSC for more detailed information on its operation.

Measurement Function

The operator is prompted to adjust the UUT to the NOMINAL value, unless the message has been disabled with ASK- N (Figure 1-7).

The system displays any pending MESS lines (refer to the description of the MESS FSC in Chapter 2 for more information), and then displays the present measurement, which is continually updated. After the operator selects **Advance**, the next procedure line is executed (Figure 1-10).

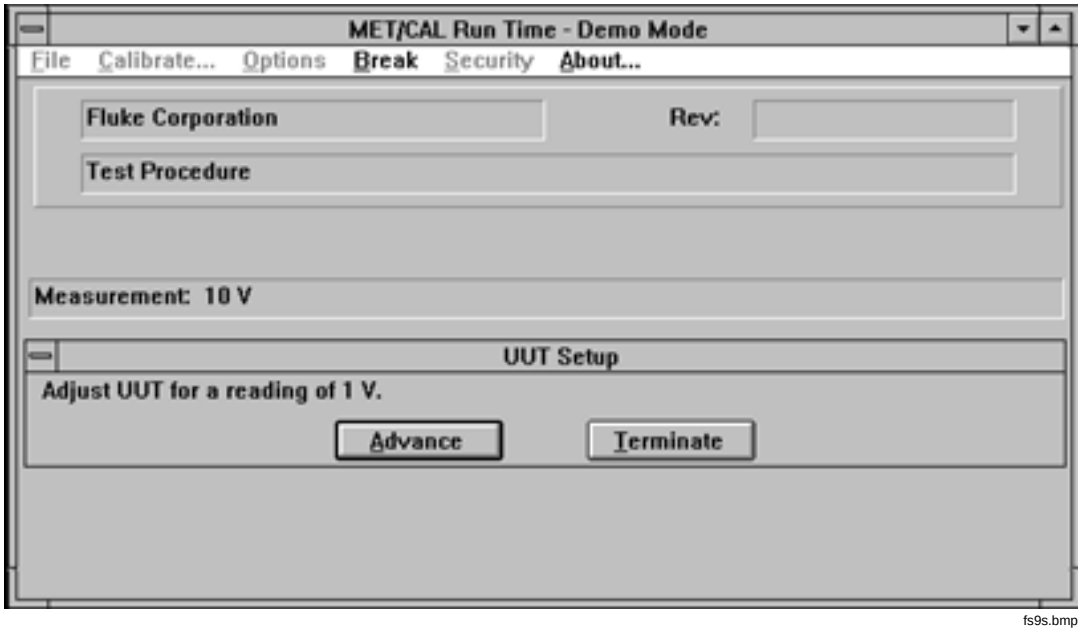


Figure 1-8. UUT Setup Dialog

Values of memory registers MEM and MEM1:

MEM	Not affected by the setup test.
MEM1	The UUT output as measured just prior to selecting **Advance**.

The operator is asked to set the UUT output to the NOMINAL value and place it in operate unless this automatic message is disabled by ASK- N (Figure 1-7).

When **Advance** is selected, the measurement is made and the operator is asked to put the UUT in standby unless this automatic message is disabled by ASK- N (Figure 1-10).

Nominal Setup Test

The Nominal Setup test allows the output of a stimulus calibration function to be adjusted until the UUT reads a nominal value; it does not perform an evaluation. For a measurement calibration function, a single reading is taken. This value may be used later in a Comparison Test.

Stimulus Function

The ASK B, G, and K flags have no influence on the NOMINAL Setup test. You slew the system stimulus until the UUT reads the nominal value, as is done for the Slew evaluation test. However, no evaluation takes place and no results are generated. The following is an example of a stimulus Nominal Setup Test.

```
STEP   FSC     RANGE   NOMINAL     TOLERANCE   MOD1    MOD2    3   4   CON
2.001  5700    10      10V                                         N   2W
```

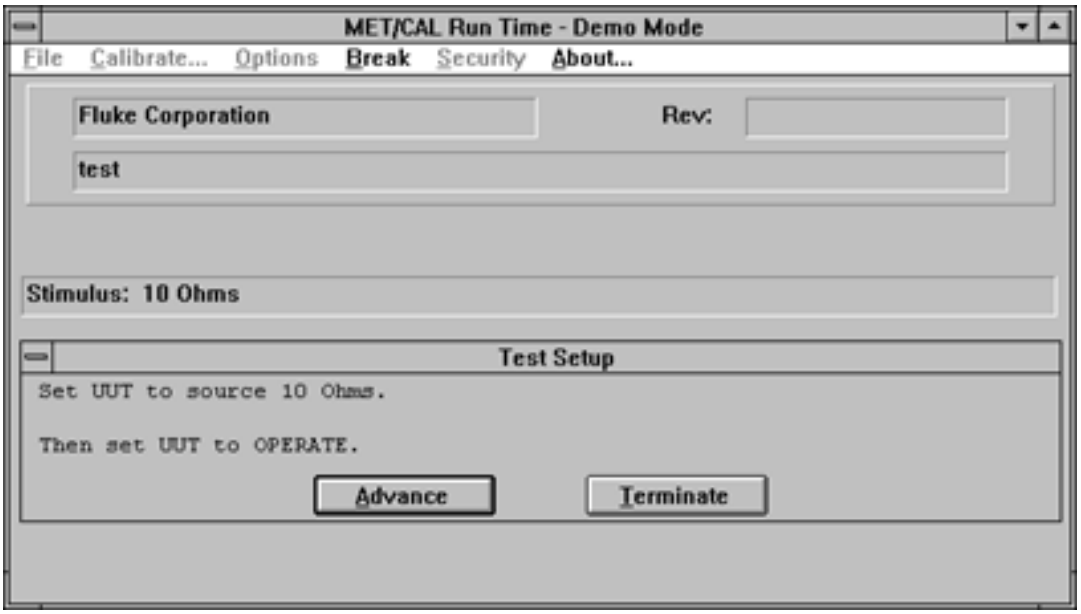


Figure 1-9. Stimulus Nominal Setup Dialog

Values of memory registers MEM and MEM1:

MEM The calibration instrument output on selecting **Advance**.

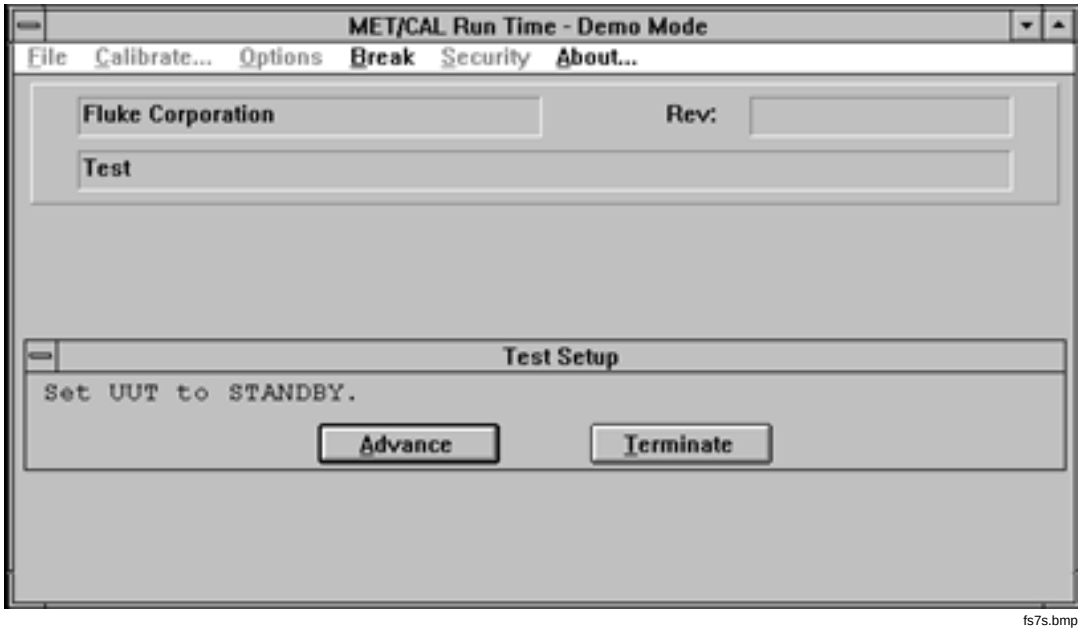
MEM1 Not affected by the test.

Measurement Function

An example of this type of test is as follows:

```
STEP   FSC     RANGE NOMINAL  TOLERANCE MOD1 MOD2 3 4    CON
3.001  8842    10      10Z                            N   2W
```

The calibration measurement instrument expects to measure the nominal value. You are asked to set the UUT output to the NOMINAL value and place it in Operate. When you select **Advance**, the measurement is taken and you are asked to put the UUT in standby. No evaluation takes place and no results are generated. The next procedure line is executed immediately afterwards.



fs7s.bmp

Figure 1-10. Automatic Completion Message

This test can be used for frequency response testing initialization in conjunction with Comparison Tests.
Values of memory registers MEM and MEM1:

MEM The measured value.

MEM1 Not affected by the test.

Comparison Tests

The Comparison Test is used in conjunction with the Nominal Setup Test. The Comparison Test operates like an evaluation test, except that the value established by the Nominal Setup Test is used as the reference for the evaluation, rather than the value specified in the NOMINAL field.

Stimulus Function

An example of this type of test is as follows:

```
STEP   FSC     RANGE   NOMINAL TOLERANCE   MOD1        MOD2    3   4   CON
1.001 5500     400     350.0mV             60H         SI          N   2W
1.002 5500     400     350.0mV 0.1% 0.1/   1kH         SI          C   2W
2.001 5500     400     350.0mV 0.1% 0.1/   100kH       SI          C   2W
```

Only the Slew method is used; ASK K, G, and B flags are ignored. See Slew Evaluation under Evaluation Tests - Stimulus Function described earlier in this section.

Measurement Function

An example of this type of test is as follows:

```
STEP   FSC     RANGE   NOMINAL TOLERANCE   MOD1    MOD2    3   4   CON
1.001 8842     2       1.900V              60H                 N   2W
1.002 8842     2       1.900V  0.1% 0.1/   1kH                 C   2W
3.001 8842     2       1.900V  0.1% 0.1/   10kH                C   2W
```

The operator is asked to set the UUT output to the NOMINAL value and place it in Operate (Figure 1-7).When **Advance** is selected, the measurement is taken and the operator is asked to put the UUT in standby (Figure 1-10). These automatic messages may be disabled using ASK- N. If ASK- R and ASK- W are in effect, the automatic connection and range messages are also disabled. The UUT error is computed using the measurement and the reference value stored in MEM. A PASS or FAIL condition is then established for the test based on the limits specified in the tolerance field.

IEEE-488 Service Request (SRQ) Processing

The calibration system maintains a list of valid instruments and their IEEE-488 addresses. IEEE-488 SRQs are processed as follows:

1. The SRQ is detected.
2. MET/CAL checks to see if the SRQ was expected as a result of the IEEE FSC. If so, the serial poll is performed and the SRQ interrupt is cleared.

If the SRQ was not expected as a result of the IEEE FSC, continue with step 3.

3. The calibration instrument whose FSC is being executed is serial polled if it is on the IEEE-488 bus. If an error is reported, the Post Test screen comes up, indicates the error and asks you to do one of the following:

   - Repeat
   - Advance
   - Terminate

If the calibration instrument whose FSC is being executed did not issue an SRQ, continue with step 4.

4. The UUT is serial polled if the UUT is on the IEEE-488 bus. If the SRQ originated from the UUT, MET/CAL reports:

Unexpected SRQ From UUT: address, SPL = *value, value*

You have the same choices: repeat or skip the test, or terminate the procedure.

If the UUT did not create the SRQ, continue with step 5.

5. Perform a serial poll of the configured calibration instruments. If the SRQ was from one of these instruments, report the error. You have the choice to repeat the test, skip it, or terminate the procedure.

   If the SRQ did not come from one of these configured instruments, test to see if the SRQ is still present. If the SRQ line is no longer asserted, continue with MET/CAL procedure execution. Otherwise, the procedure is aborted.

Instrument Resets

MET/CAL Run Time resets the calibration instruments under the following circumstances:

- When MET/CAL is started, the following sequence is carried out:

  1. An IEEE-488 Interface Clear command is sent.
  2. Each system instrument required by the procedure receives a reset command.
  3. Any error that occurs as a result of a calibration instrument not responding is reported.

  If an error occurs, the following selections are available:

  a. Correct the hardware error and retry. (Turn the power on.)

  b. Abort the calibration procedure.

  c. Ignore the error and proceed without the instrument that reported the error. MET/CAL removes this instrument from the list of configured

instruments. If the instrument is needed to perform a calibration step in the procedure, another error is reported and the operator can choose to go to the next calibration test or terminate the procedure.

- At the completion or abnormal termination of every test in the calibration procedure (an evaluation), the following occurs:
  1. Stimulus calibration instruments are placed in Standby mode.
  2. Stimulus calibration instruments are reprogrammed to a safe voltage if necessary.
- After termination of the procedure, the following occurs:
  1. An IEEE-488 Interface Clear command is sent.
  2. Each system instrument required by the procedure receives a reset command

Display Control FSCs

Display Control FSCs are used to present calibration instructions (e.g., Set Switch S1 to ON) or other information to the operator. This information is displayed on the screen of the Calibration System during execution of the calibration procedure. The following is a list of the display control FSCs for MET/CAL Calibration Software.

CON: Specify a connection from a calibration system instrument to the UUT.

DISP: Display a message.

DRAW: Define a stick figure representation of the UUT.

HEAD: Display a Header message during calibration procedure execution.

MESS: Define a message for EVAL, Measurement or Stimulus Setup test or Slew.

PIC: Display a Picture.

RNG: Specify a UUT Range message.

SET: Generate a list of UUT settings (usually used with oscilloscopes).

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps) that are discussed earlier in this section, the following general rules apply to Display Control FSCs.

- RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, MOD3, MOD4, and CON fields are not separate. Instead, the FSC-dependent information starts with the NOMINAL field column, and the rest of the line is a single undivided record.

- Messages with up to eight lines can be created for the DISP, MESS, and SET FSCs. Each line of a multiline message is assigned identical step numbers.
- The message length in any line is limited to 56 characters.
- Certain special constructions can be used in some of these display control FSCs. The description of the individual display control FSC contains information on which Special Constructions are allowed for that FSC. For general information about the special constructions, refer to *Special Constructions* discussed later in this chapter.

Evaluation FSCs

Evaluation FSCs are non-instrument procedure statements that perform evaluations. These are used when a simple instrument evaluation statement is not adequate for the test. For example, if UUT units are not directly supported by an instrument FSC.

The following is a list of evaluation FSCs:

- CMP: Sets PASS or FAIL based on numeric comparison.
- DOSE: Sets PASS or FAIL via a user program.
- EVAL: Sets PASS or FAIL based on operator response to a YES/NO prompt.
- MEMC (not prefered): Sets PASS or FAIL based on numeric comparison.
- PICE: Sets PASS or FAIL based on operator response to a YES/NO prompt displayed over a bit-mapped picture.

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps) that are discussed, the following information applies to Evaluation FSCs.

Certain special constructions can be used in some of these FSCs. The description of the individual procedure control FSC contains information on which Special Constructions are allowed with that FSC. For general information about the special constructions, refer to *Special Constructions* discussed later in this chapter.

Interface Control FSCs

The Interface Control FSCs provide direct control of a UUT using an IEEE-488 or serial interface. IEEE-488 or serial system calibration instruments may also be controlled when no FSC exists or the FSC does not support the desired instrument function.

- IEEE: Direct control of a device on an IEEE-488 interface.

- PORT: Direct control of a device on a serial interface.

In addition to the general rules applicable to all FSCs discussed earlier in this chapter, the following information applies to the Interface Control FSCs.

Certain special constructions can be used with some of these FSCs. The descriptions of individual FSCs contain information on which special constructions are allowed with that FSC. For general information, refer to *Special Constructions* discussed later in this chapter.

Memory Register Operation FSCs

The Memory Register Operation FSCs store, retrieve, and maintain data stored in the data registers. The following FSCs are used in memory register operations:

- MATH: performs arithmetic operations using memory registers.
- MEM2: Manipulates the contents of the memory register MEM2.
- MEME: Exchanges the values of memory registers MEM and MEM1.
- MEMI: Displays a prompt for a number to be placed in memory register MEM.
- MEM+: Adds MEM1 or the specified value to memory register MEM.
- MEM-: Subtracts MEM1 or the specified value from memory register MEM.
- MEM*: Multiplies MEM by a the specified value or MEM1.
- MEM/: Divides MEM by a specified value or MEM1.

Procedure Control FSCs

The Procedure Control FSCs control the flow of the procedure. These are transparent to the operator and do not perform tests or produce results. OPBR is the only exception; this FSC displays a prompt that requires a response. Refer to Chapter 2 in this manual for more information on OPBR.

The following FSCs control procedures:

- ASK+: Sets one or more of the system flags.
- ASK-: Unsets one or more of the system flags.
- CALL: Calls one procedure from another.
- DOS: Calls a user program (also see DOSE under Evaluation FSCs).
- JMP: Jumps to a specified procedure step.
- JMPF: Jumps to a specified procedure step if MEM1 is less than zero.
- JMPT: Jumps to a specified procedure step if MEM1 is greater than zero.
- JMPL: Branch to specified LABEL.

- JMPZ: Jumps to a specified procedure step if MEM1 is equal to zero.
- LABEL: Establishes target for JMPL.
- OPBR: Presents a message that requests a response.
- RPT: Repeats a test.
- TARGET: Specifies jump destinction for post test “Repeat” and “Cancel” options.

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps), the following information applies to Procedure Control FSCs.

Certain special constructions can be used in some of these FSCs. The descriptions of the individual procedure control FSCs contain information on which Special Constructions are allowed. For general information about the special constructions, refer to *Special Constructions* discussed later in this chapter.

Miscellaneous FSCs

The following list contains various FSCs that have specific functions but do not belong to any other category:

- ACC: This specifies the system accuracy for a MEMC FSC.
- RESET: Specifies reset commands for user-configured instruments.
- RSLT: Adds text to result files, with or without an operator prompt.
- STD: Includes traceability information for manual instrument.
- TOL: Specifies tolerance.

Use of Standard Memory Registers

The following tables show how the standard memory locations, MEM, MEM1, UUT Indicated, and System Actual, are used:

Evaluation Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW (Except Discrete Ohms)	No Change	Slew Value	Nominal Value	Slew Value
Stimulus, SLEW (5100B & 5130A Ohms)	No Change	Slew Value	Slew Value	Nominal Value
Stimulus, SLEW (5700A & 5450A Ohms	No Change	Slew Value	Slew Value	Actual Resistance
Stimulus, Keyboard Entry	No Change	Entered Value	Entered Value	Nominal Value
Stimulus, Go/No-Go	No Change	+1 (PASS) -1 (FAIL)	OPER-EVAL	Nominal Value
Measurement	No	Measured	Nominal	Measured

Function	MEM	MEM1	UUT Indicated	System Actual
	Change	Value	Value	Value

Setup Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus (Except 5700A & 5450A Ohms)	No Change	Nominal Value	na	na
Stimulus (5700A & 5450A Ohms)	No Change	Real Value	na	na
Measurement	No Change	Measured Value when advance is selected	na	na

Nominal Setup Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW	Slew Value	No Change	na	na
Measurement	Measured Value	No Change	na	na

Comparison Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW (Except Discrete Ohms)	No Change	Slew Value	MEM	Slew Value
Stimulus, SLEW (Discrete Ohms)	No Change	Slew Value	Slew Value	MEM
Measurement	No Change	Measured Value	Nominal Value	Measured Value

Adjustment Statements

If the instrument's actual performance is below the adjustment threshold, a normal PASS condition is recorded, and any adjustment statement immediately following are skipped. The value of the adjustment threshold (shown in the procedure header) is normally set to 70%.

If the instrument's actual performance is between the adjustment threshold and the full specified tolerance, a MARGINAL PASS condition is recorded, and any

immediately following adjustment procedure lines are executed. This condition indicates that although the UUT is within specification, it is advisable to adjust the UUT so it is well within specification.

If the instrument's performance is out of tolerance, a FAIL condition is recorded and any immediately following adjustment procedure lines are executed. The adjustment may resolve the FAIL condition, so the UUT can PASS the calibration procedure. The following example illustrates how the adjustment portion of a procedure might appear:

```
STEP   FSC     RANGE   NOMINAL TOLERANCE MOD1 MOD2    3   4   CON
2.001  5700    10      10V     0.1% 0.1/                      2W
2.001          5700    10V                                S   2W
2.003          DISP    Adjust R1 for a 10V Reading
```

Because the FSC is in the RANGE field, no UUT range information is allowed in an adjustment procedure step. To adjust a step, select Adjust while entering the line. After successfully compiling the line, the FSC is shown under the RANGE header. When you press [↵ Enter], the next line is an adjustment procedure line.

To change an adjustment procedure step back to a regular procedure step, select adjust anywhere in the line and recompile that line. The spaces are deleted in the line and the FSC is positioned in the FSC field.

Continuation Statements

Continue allows you to mark the current line as a continuation of the previous line. This is useful for certain FSCs which allow multiline statements.

To create a multiline statement, type in the first line of the statement and press [↵ Enter]. On the second line of the statement, press [F6] to link the lines together. The FSC is automatically inserted if the following conditions occur:

- The FSC field of the current line is empty.
- The previous line was successfully compiled.
- The FSC of the previous line can be part if a multiline message.

In some cases, there are FSC-specific limits on the number of continuation lines per statement. An attempt to exceed these limits causes the compiler to display an appropriate error message.

Automatic Messages

The following messages are automatically displayed by MET/CAL unless defeated using an associated ASK flag. Refer to Chapter 2, *FSC Reference* for a general description of the ASK+ and ASK- FSCs.

- Connection Message

  An automatic connection message is generated by an instrument FSC or the CON FSC. If the required connection from the UUT to the calibration system changes, the operator is asked to make the required disconnections and connections before proceeding. The automatic connection message may be disabled using ASK- V or ASK- W.

- UUT Range Message

  An automatic range message is generated by an instrument FSC for an evaluation test, nominal setup test, or comparison test (with a non-blank RANGE field) or the RNG FSC. If the UUT function or range has changed, you are asked to set the UUT to the new function and range. The automatic range message for a numeric value in the RANGE field is of the form:

  Set UUT <MEM2> to the *range* value nominal prefix + units [AC|DC] range.

  The automatic range message for autorange is of the form:

  Set UUT <MEM2> to autorange *function* (based on nominal units).

  If the D-flag is in effect the automatic range message is of the form:

  Set UUT <MEM2> to *range* value nominal prefix + units/div.

  The automatic range message may be disabled using ASK- R.

- Slew Message

  An automatic slew message is generated by an instrument FSC specifying a calibration instrument stimulus function in the following cases:

  1. An evaluation test is specified and any of the defaults ASK- B, ask- G, or ASK- K are in effect.
  2. A nominal setup test is specified.

     For discrete resistance specified using 5700, 5450, and RESF FSCs, the automatic slew message is:

     Adjust display to match UUT reading.

     For all other cases, the automatic slew message is of the form:

     Adjust stimulus for a UUT reading of *nominal* value+prefix+units.

     If the D-flag is in effect and the RANGE field specifies a numeric value, the automatic slew message is one of the following:

  3. Adjust stimulus for a UUT horizontal reading of *nominal/range* divisions (when the NOMINAL field specifies amplitude).

     Adjust stimulus for a UUT vertical reading of *nominal/range* markers/div (when the NOMINAL field specifies frequency or period).

     The automatic slew message may be disabled using ASK- N.

- UUT Setup Message

  An automatic UUT setup message is generated by an instrument FSC specifying a calibration instrument measurement function for an evaluation test, nominal setup test, or comparison test. The UUT setup message may be disabled using ASK- N.

- UUT Adjustment Message

An automatic UUT adjustment message is generated by an instrument FSC specifying a setup test for a calibration instrument measurement function. The UUT adjustment message may be disabled using ASK- N.

Special Constructions

A number of special constructions are used in Procedure Control FSCs, Display Control FSCs, PORT, IEEE, and EVAL FSCs. The following shows what the various special constructions are, how they are written, and what FSCs they are used with.

Special Constructions		
IEEE-488	address @pri addr:sec addr	IEEE only
delay	Dnumber	DISP, EVAL, HEAD, IEEE, MEMI, OPBR, PORT, RSLT, SET
draw	Drawx,y, view	DISP, EVAL, OPVR, SET
input	[I$] > file name or [I] > file name	IEEE, PORT
memory register	MEM, MEM1 or MEM2	DISP, EVAL, HEAD, IEEE, MEMI, MEM2, MESS, OPBR, PORT, RSLT
integer	positive integer	DISP, EVAL, HEAD, IEEE, MEMI, MEM2, MESS, OPBR, PORT, RSLT
port configuration	[baud],[par],[ndata], [nstop], [hndshk]	PORT only
timout	Ttimeout	IEEE, PORT
wait for srq	SRQ(delay, mask) |ON|OFF	IEEE only
serial poll	SPLmask	IEEE only
negate response	N	EVAL only
selected device clear	SDC	IEEE only
remote enable	REN	IEEE only
goto local	GTL	IEEE only
local lockout	LLO	IEEE only
group execute trigger	TRIG	IEEE only
end of information	EOI ON|OFF	IEEE only
input terminator	TERM number, TERM 'char', TERM CR or TERM LF	IEEE, PORT
output terminator	OTERM number, OTERM 'char', OTERM CR, OTERM LF, OTERM CRLF, OTERM NONE, OTERM OFF	PORT only
interface clear	IFC port number	IEEE only
inter-byte delay	S inter-byte delay	IEEE only
variable	V variable name	DISP, HEAD, IEEE, MEMI, MEM2, MESS, OPBR, PORT, RSLT, SET
output to file	O < file name	IEEE, PORT
flush receive buffer	CLR, CLR ON or CLR OFF	PORT only
serial address	@port designator	PORT only
default button	NO	OPBR only

Delay Construction

The special construct D[*n*] causes a delay of the message line by *integer* milliseconds. The available range is 0 to 32767 milliseconds. The delay occurs at the position of the construct. For example, the following procedure line first causes the word **`This`** to be displayed. Ten seconds later, the word **`message`** is added, followed five seconds later by **`is delayed`**.

Draw Construction

A drawing is defined by a "DRAW" statement together with a [DRAW*x, y, view*] construction. The drawing does not appear until a statement containing a [DRAW*x, y, view*] construction is executed.

The DRAW FSC allows you to display two rectangles, one within the other. These rectangles are intended to show the outline of the UUT and the location of an item of interest (such as an adjustment potentiometer.) For detailed information on the DRAW FSC, refer to its description in Chapter 2.

The DRAW construct positions a annunciator within a simple drawing of the UUT, as created by the DRAW FSC, to show the location of a control or an adjustment. The drawing can indicate the view (from the front, from the back, etc.)The drawing appears on the right side of the computer screen.

The DRAW construct includes three modifiers (par1, par2, and par3), and is entered as follows:

```
[DRAWpar1,par2,par3]
```

The three modifiers are optional; however, the commas must still be entered. The modifiers are used for the following purposes:

- *par1* specifies the Y coordinate of the annunciator. This modifier is specified as a percentage of the height of the UUT box, measured up from the bottom edge.

  Allowable range: 0 - 100, inclusive.

- *par2* specifies the X coordinate of the annunciator. This modifier is specified as a percentage of the width of the UUT box, measured right from the left edge.

  Allowable range: 0 - 100, inclusive.

- *par3* indicates the desired view from the UUT: front (F), back (B), left side (L), right side ®, top (T), or bottom/underside (U).

  Specifying 0 (zero) for *par1* and *par2* causes the UUT drawing to be displayed without an annunciator.

[MEM], [MEM1], [MEM2]

MET/CAL provides a number of registers that can be used to store and retrieve values. The registers that are directly accessible are:

[MEM]	MEM is a numeric memory register that stores a floating-point value. This construction causes the current value of memory register MEM to be inserted in the text in place of the construction.
[MEM1]	MEM1 is a numeric memory register that stores a floating-point value. This construction causes the current value of memory register MEM1 to be inserted in the text in place of the construction.
[MEM2]	MEM2 is a 4096-character string register. This construction causes the current value of memory register MEM2 to be inserted in the text in place of the construction.
[M1], [M2], [M3], …, [M255],	M[n] are numeric memory registers that store a floating-point value. These constructions cause the value of the respective memory register M[n] to be inserted in the text in place of the construction.
[S1], [S2], [S3], …, [S32],	S[n] are string registers (max 32767). These constructions cause the current value of memory register S[n] to be inserted in the text in place of the construction.
[SREG1], [SREG2], …, [SREG32]	Alternate form for S[1] through S[32]. This from is required when used in the IEEE and RESET FSC's.

When included in a procedure statement, the value contained in the identified memory location replaces the related special construction during procedure execution. For example:

```
STEP  FSC     RANGE   NOMINAL    TOLERANCE  MOD1    MOD2    3   4   CON
1.010 DISP            [MEM] Volts are stored
```

Assuming that memory location MEM contains the value 2, the following is displayed during program execution:

```
2 Volts are Stored
```

Numeric Literals

Numeric literals print ASCII characters during procedure execution. The syntax that provides this capability is **[***n***]**. The square brackets are included. This

construction causes the ASCII character corresponding to the numeric to be printed or used. For example:

```
STEP  FSC    RANGE  NOMINAL    TOLERANCE  MOD1   MOD2   3   4   CON
1.011 DISP          [7]Safety Notice Follows
```

This construction causes the computer to beep when the message is displayed because 7 is the ASCII character for bell (BEL).

Since braces and square brackets are reserved for special constructions, they cannot be used literally in a procedure line. The following special constructions must be used to print braces or square brackets:

Construct	Prints
[91]	[(left square bracket)
[93]	] (right square bracket)
[123]	{ (left brace)
[125]	} (right brace)

Variables

The Variable construction evaluates to the value of the named variable. The syntax for the variable construction is [V*variable name*]. The variable must, at run time, be present in the MET/CAL Variable File. The default name is VARIABLE.DAT. The following is an example:

```
DISP Current date is [V DATE$].
```

Function Selection Code Reference

Chapter 2 provides specific information about the various FSCs. The information there must be used in conjunction with material provided in this section, where the general features and restrictions of the FSCs are discussed.

The FSCs are arranged in alphanumerical order. The page header for the FSC contains:

- FSC name (e.g., 5700)
- FSC type (e.g., Instrument or Message)

The description of each FSC includes:

- A general description.
- The values each parameter field in the FSC can assume.
- Use of the standard memory registers MEM, MEM1, and MEM2.
- The generation of automatic messages by the calibration system.
- Miscellaneous information on the FSC.

One or more examples.

Chapter 2
FSC Reference

1271

Instrument FSC

Description

The 1271 FSC programs the Datron 1271 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Note

The 1271 must have firmware version 2.03 or later.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1100 V to 1100 V			
AC Voltage [1,5]	2 mV to 199.9999 mV	1 Hz to 100 kHz		
	200 mV to 199.9999 V	1 Hz to 1 MHz		
	200 V to 1100 V	1 Hz to 100 kHz		
	-40.969 dBm to -0.969 dBm	1 Hz to 100 kHz		5Z
	-0.969 dBm to +59.031 dBm	1 Hz to 1 MHz		5Z
	+59.031 dBm to +73.838 dBm	1 Hz to 100 kHz		5Z
	-42.730 dBm to -2.730 dBm	1 Hz to 100 kHz		7Z
	2.730 dBm to +57.270 dBm	1 Hz to 1 MHz		7Z
	+57.270 dBm to +72.077 dBm	1 Hz to 100 kHz		7Z
	-51.761 dBm to -11.761 dBm	1 Hz to 100 kHz		6Z
	-11.761 dBm to +48.239 dBm	1 Hz to 1 MHz		6Z
	+48.239 dBm to +63.046 dBm	1 Hz to 100 kHz		6Z
Resistance [2]				
True Ohms	0 Ω to 199.999999 kΩ		OC	
Normal Ohms	0 Ω to 1.99999999 MΩ			
Hi Ohms	2 MΩ to 1.99999999 GΩ			
DC Current [4]	-1.5 A to 1.5 A			
AC Current [5]	2 μA to 1.5 A	10 Hz to 5 kHz		

Frequency [1,5,6]	40 Hz to 100 kHz	2 mV to 1000 V		
	40 Hz to 1 MHz	200 mV to 199.9999 V		
	40 Hz to 100 kHz	2 mV to 1000 V		
	40 Hz to 1 MHz	200 mV to 199.9999 V		
	40 Hz to 5 kHz	2 μA to 1.5 A		

1.Requires Option 10 or 12.
2. Requires Option 20.
3. Requires Options 20 and 30.
4. Requires Options 10, 20, and 30 or Options 12, 20, and 30.
5. Option 10 is limited to a minimum of 10 Hz for all AC voltage.
6. Lower bound is 200 Hz when MOD3 = FE (Fast Gate)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as *numeric*[*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one of the following:

1. The load impedance that the AC voltage is referenced to, or
2. Offset compensated resistance "TRUE OHMS" function.

- 5Z 50 Ω
- 7Z 75 Ω
- 6Z 600 Ω
- OC Enable offset compensated resistance "True OHMS".
- *blank* (see below)

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL or MOD1 field specifies decibels.
- The MOD2 field may specify "OC" only when the NOMINAL field specifies a resistance less than 200 kΩ.
- The MOD2 must be blank for any of the following conditions:

  1. DC Voltage: The NOMINAL specifies voltage and the MOD1 field is blank.

2. DC Current: The NOMINAL specifies current

3. AC Current: The NOMINAL or MOD1 field specifies current

MOD3

Specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

Function	F	*blank*	E	FE
DC Volts:				
resolution	6.5 digits	6.5 digits	8.5 digits	8.5 digits
fast	on	off	off	on
reading rate	50/s	10/s	10/s	1/6s
Readings:				
thrown away[1]	1	1	1	1
averaged	5	1	1	1
AC Volts:				
resolution	5.5 digits	5.5 digits	6.5 digits	5.5 digits
TFER (Option 12)	off	on	on	on
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
gate fast	on	on	on	on
reading rate:				
Option 10:				
>= 1kHz	20/s	20/s	20/s	20/s
360 to 1 kHz	8/s	8/s	8/s	8/s
40 to 360 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Option 12:				
>= 100 Hz	2/s	2/s	2/s	2/s

40 to 100 Hz	1/2s	1/2s	1/2s	1/2s
10 to 40 Hz	1/2.5s	1/2.5s	1/2.5s	1/2.5s
1 to 10 Hz	1/25s	1/25s	1/25s	1/25s
Readings:				
thrown away[1]	1	1	1	1
averaged	1	3	3	1
DC Current:				
resolution	6.5 digits	5.5 digits	6.5 digits	5.5 digits
fast	on	off	off	On
reading rate	50/s	50/s	10/s	50/s
Readings:				
thrown away[1]	1	1	2	1
averaged	1	3	5	1
AC Current:				
resolution	5.5 digits	5.5 digits	5.5 digits	5.5 digits
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
reading rate:				
Option 10:				
>= 1 kHz	20/s	20/s	20/s	20/s
360 to 1 kHz	8/s	8/s	8/s	8/s
40 to 360 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Option 12:				
>= 100 Hz	4/s	4/s	4/s	4/s
40 to 100 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Readings:				
thrown away[1]	1	1	2	1

averaged	1	3	5	1
Resistance:				
resolution:				
True Ω (4-Wire only)				
>= 0 Ω to < 200 kΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
Normal Ω				
>= 20 Ω to < 2 MΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
HI Ω				
>= 2 MΩ	5.5 digits	5.5 digits	6.5 digits	5.5 digits
reading rate				
< 2 MΩ	50/s	10/s	1/2s	50/s
>= 2 MΩ	1000/s	50/s	10/s	1000/s
fast	on	off	off	on
<= 20 kΩ:				
Readings:				
thrown away [1]	1	2	2	1
averaged	3	4	4	1
>20 kΩ to <= 200 kΩ:				
Readings:				
thrown away [1]	1	2	5	1
averaged	3	4	4	1
>200 kΩ:				
Readings:				
thrown away [1]	1	2	7	1
averaged	3	4	5	1

1. With measurement uncertainty disabled. Use VSET to set number of readings to throw away when measurement certainty is enabled.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- The CON field must specify a 4W when the MOD2 field specifies Offset Compensated Resistance "OC" (True OHMS Function).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  1271         *                                              S
# ----- DC Voltage -----
  1.002  M1271  RNGLK 1V
  1.003  1271         10mV                                           N  2W
  1.004  M1271        *
  1.005  1271   A     -1000V         1% 0.1U                            2W
# ----- AC Voltage -----
  2.001  1271   200   100V           1% 2/         10kH                 2W
# ---- dBm, 50 Ohms ----
  3.001  1271         0.00D          0.1U          1kH           5Z     2W
# ----- DC Current -----
  4.001  1271   10    1.00A          1000P%                             2W
# ----- AC Current -----
  5.001  1271   2     mA             1%            1kH                  2W
# ----- Resistance -----
  6.001  1271   100   256kZ          1%                                 4W
# ----- Frequency  -----
  7.001  1271   1     10.0kH         1% 2/         1V                   2W
  8.001  1271   10    1.00kH         1% 2/         10mA                 2W
```

1281

Instrument FSC

Description

The 1281 FSC programs the Datron 1281 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Note

The 1281 must have firmware version 3.06 or later.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1100 V to 1100 V			
AC Voltage[1]	2 mV to 199.9999 mV	1 Hz to 100 kHz		
	200 mV to 199.9999 V	1 Hz to 1 MHz		
	200 V to 1100 V	1 Hz to 100 kHz		
	-40.969 dBm to -0.969 dBm	1 Hz to 100 kHz	5 Z	
	-0.969 dBm to +59.031 dBm	1 Hz to 1 MHz	5 Z	
	+59.031 dBm to +73.838 dBm	1 Hz to 100 kHz	5 Z	
	-42.730 dBm to -2.730 dBm	1 Hz to 100 kHz	7 Z	
	-2.730 dBm to +57.270 dBm	1 Hz to 1 MHz	7 Z	
	+57.270 dBm to +72.077 dBm	1 Hz to 100 kHz	7 Z	
	-51.761 dBm to -11.761 dBm	1 Hz to 100 kHz	6 Z	
	-11.761 dBm to +48.239 dBm	1 Hz to 1 MHz	6 Z	
	+48.239 dBm to +63.046 dBm	1 Hz to 100 kHz	6 Z	
Resistance[2]				
True Ohms	0 Ω to 199.999999 kΩ	OC		
Normal Ohms	0 Ω to 1.99999999 MΩ			
Hi Ohms	2 MΩ to 1.99999999 GΩ			
DC Current[3]	-1.5 A to 1.5 A			
AC Current[4]	2 μA to 1.5 A	10 Hz to 5 kHz		

Frequency[1,5]	40 Hz to 100 kHz[1]	2 mV to 1000 V		
	40 Hz to 1 MHz[1]	200 mV to 199.9999 V		
	40 Hz to 5 kHz[4]	2 µA to 1.5 A		

1. Requires Option 10.
2. Requires Option 20.
3. Requires Options 20 and 30.
4. Requires Options 10, 20, and 30.
5. Lower bound is 200 Hz when MOD3 = FE (Fast Gate)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]*Z.*
- Frequency entered as *numeric*[*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as *numeric*[*prefix*]H.

- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one of the following:

1. The load impedance that the AC voltage is referenced to, or

2. Offset compensated resistance "TRUE OHMS" function.

- 5Z 50 Ω
- 7Z 75 Ω
- 6Z 600 Ω
- OC Enable offset compensated resistance "True OHMS".
- *blank* (see below)

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL or MOD1 field specifies decibels.
- The MOD2 field may specify "OC" only when the NOMINAL field specifies a resistance less than 200 kΩ.
- The MOD2 must be blank for any of the following conditions:

    1. DC Voltage: The NOMINAL specifies voltage and the MOD1 field is blank.

    2. DC Current: The NOMINAL specifies current

    3. AC Current: The NOMINAL or MOD1 field specifies current

MOD3

Specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

Function	F	*blank*	E	FE
DC Volts:				
resolution	6.5 digits	6.5 digits	8.5 digits	8.5 digits
fast	on	off	off	on
reading rate	35/s	2/s	1/25s	1/6s
Readings:				
thrown away[1]	1	1	1	1
averaged	5	1	1	1
AC Volts:				
resolution	5.5 digits	5.5 digits	6.5 digits	5.5 digits
TFER	off	on	on	on
Coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
gate fast	on	on	on	on
reading rate:				
>= 100 Hz	4/s	2/s	2/s	2/s
40 to 100 Hz	1/s	1/2s	1/2s	1/2s
10 to 40 Hz	1/2.5s	1/5s	1/5s	1/5s
1 to 10 Hz	1/25s	1/50s	1/50s	1/50s
Readings:				
thrown away[1]	1	1	1	1
averaged	1	3	3	1
DC Current:				
resolution	6.5 digits	5.5 digits	6.5 digits	5.5 digits
fast	on	off	off	on

reading rate	35/s	35/s	2/s	35/s
Readings:				
thrown away[1]	1	1	2	1
averaged	1	3	5	1
AC Current:				
resolution	4.5 digits	4.5 digits	5.5 digits	4.5 digits
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
reading rate:				
>= 100 Hz	4/s	4/s	2/s	4/s
40 to 100 Hz	1/s	1/s	1/2s	1/s
10 to 40 Hz	1/2.5s	1/2.5s	1/5s	1/2.5s
Readings:				
thrown away[1]	1	1	2	1
averaged	1	3	5	1
Resistance:				
resolution				
True Ω (4-Wire only)				
>= 0 Ω to < 200 kΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
Normal Ω				
>= 20 Ω to < 20 MΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
HI Ω				
>= 20 MΩ	5.5 digits	5.5 digits	6.5 digits	5.5 digits
reading rate:				
< 20 Ω	35/s	1/6s	1/6s	1/6s
>= 20 Ω to < 20 MΩ	35/s	2/s	1/6s	2/s
>= 20 MΩ	35/s	2/s	1/2s	2/s

fast	on	off	off	on
<= 20 kΩ:				
Readings:				
thrown away[1]	1	2	2	1
averaged	3	4	4	1
20 kΩ to <= 200 kΩ:				
Readings:				
thrown away[1]	1	2	5	1
averaged	3	4	4	1
200 kΩ:				
Readings:				
thrown away[1]	1	2	7	1
averaged	3	4	5	

1. With measurement uncertainty disabled. Use VSET to set number of readings to throw away when measure uncertainty is enabled.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- The CON field must specify a 4W when the MOD2 field specifies Offset Compensated Resistance "OC" (True OHMS Function).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  1281         *                                              S
# ----- DC Voltage -----
  1.002  M1281  RNGLK 1V
  1.003  1281         10mV                                           N  2W
  1.004  M1281        *
  1.005  1281   A     -1000V         1% 0.1U                            2W
# ----- AC Voltage -----
  2.001  1281   200   100V           1% 2/         10kH                 2W
# ---- dBm, 50 Ohms ----
  3.001  1281         0.00D          0.1U          1kH           5Z     2W
# ----- DC Current -----
  4.001  1281   10    1.00A          1000P%                             2W
# ----- AC Current -----
  5.001  1281   2     mA             1%            1kH                  2W
# ----- Resistance -----
  6.001  1281   100   256kZ          1%                                 4W
# ----- Frequency  -----
  7.001  1281   1     10.0kH         1% 2/         1V                   2W
  8.001  1281   10    1.00kH         1% 2/         10mA                 2W
```

2000

Instrument FSC

Description

The 2000 FSC programs the Keithley 2000 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and period.

Note

If the 2000 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 2000. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 2000 must be set correctly before a procedure is executed. If the 2000 is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 2000 is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1]	0.1 mV to 750 V	3 Hz to 300 kHz	
DC Current	-3 A to 3 A		
AC Current	1 μA to 3 A	3 Hz to 5 kHz	
Resistance	0 Ω to 119.9999 MΩ		
Conductance	>8.4 nS		
Frequency	3 Hz to 300 kHz	100 mV to 750V	
Period	3.3 μs to 0.33s	100 mV to 750 V	
Decibels[1]	-66.98 dBm to 70.51 dBm	3 Hz to 300 kHz	5Z
Decibels[1]	-68.75 dBm to 68.75 dBm	3 Hz to 300 kHz	7Z
Decibels[1]	-74.77 dBm to 62.73 dBm	3 Hz to 300 kHz	3Z
Decibels[1]	-77.78 dBm to 59.71 dBm	3 Hz to 300 kHz	6Z
1. Volt-Hertz product not to exceed $8x10^7$.			

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

- The MOD1 field must specify voltage when the NOMINAL field specifies frequency or period.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50Ω
- 7Z 75Ω
- 3Z 300Ω
- 6Z 600Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

Not used.

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2000        *                                              S
# ----- DC Voltage -----
  1.002  2000   10    10V            1% 0.01U                          2W
# ----- AC Voltage -----
  5.001  2000   1000  650V           5%            30kH                2W
  6.001  2000   1     1V             1% 0.01U      10kH                2W
# ----- Decibels -----
  7.001  2000   A     60.0D          0.1U          1kH            5Z   2W
# ----- DC Current -----
  9.001  2000   4000  350mA          9U                                2W
# ----- AC Current -----
 10.001  2000   2     1A             3%            60H                 2W
# ----- Resistance -----
 11.001  2000   100   10MZ           1%                                2W
# ----- Conductance -----
 12.001  2000   100   100nY          5%                                2W
# ----- Setup Test -----
 13.001  2000         1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  2000   1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  2000   1     1V             1% 0.1U       20kH                C  2W
```

2001

Instrument FSC

Description

The 2001 FSC programs the Keithley 2001 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and temperature.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1]	100 nV to 775 V	1 Hz to 2 MHz	
DC Current	-2.1 A to 2.1 A		
AC Current	100 pA to 2.1 A	1 Hz to 100 kHz	
Resistance	0 Ω to 1.05 GΩ		
Conductance	>0.9524 nS		
Frequency[1]	1 Hz to 5 MHz 5 MHz to 15 MHz 1 Hz to 5 MHz	60 mV to 775 V 350 mV to 775 V 150 µA to 2.1 A	
Decibels[1]	-126.9 dBm to 70.79 dBm	1 Hz to 2 MHz	5Z
Decibels[1]	-128.7 dBm to 69.03 dBm	1 Hz to 2 MHz	7Z
Decibels[1]	-134.7 dBm to 63.01 dBm	1 Hz to 2 MHz	3Z
Decibels[1]	-137.7 dBm to 60.00 dBm	1 Hz to 2 MHz	6Z
Temperature[2]			
Pt385 RTD	-200°C to 630°C	R1	
Type J TC	-200°C to 760°C	_J	
Type K TC	-200°C to 1372°C	_K	
Type T TC	-200°C to 400°C	_T	
Type E TC	-200°C to 10000°C	_E	
Type R TC	0°C to 1768°C	_R	
Type S TC	0°C to 1768°C	_S	
Type B TC	+350°C to 1820°C	_B	

1. Volt-Hertz product not to exceed 2^7.
2. Temperature measurement using a thermocouple requires an external thermocouple card.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Conductance entered as [*numeric*][*prefix*]Y
- Frequency entered as [*numeric*][*prefix*]H
- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.
- The NOMINAL field must specify a resistance, or equivalent conductance, less than or equal to 21 kΩ when the MOD2 field specifies offset compensation override "O".

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as *numeric*[*prefix*]H
- Voltage entered as *numeric*[*prefix*]V
- Current entered as *numeric*[*prefix*]A
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance, conductance, or temperature.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.

MOD2

This field specifies the load impedance that the AC voltage is referenced to for decibels or the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for Ω
- 5Z 50Ω
- 7Z 75Ω
- 3Z 300Ω
- 6Z 600Ω
- R1 100Ω Pt 385 RTD
- _J Type J thermocouple
- _K Type K thermocouple
- _T Type T thermocouple
- _E Type E thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _B Type B thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance or conductance.
- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify a RTD or thermocouple only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

	F	***blank***	**E**
DC Volts			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	1	1
averaged	1	3	5
Autozero	On	On	On
DC Current			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	1	2
averaged	1	3	5
Autozero	On	On	On
Ohms (2-Wire and 4-Wire)			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	2	2
averaged	3	4	5
Autozero	On	On	On
Offset Compensation			
≤21 kΩ	On	On	On
>21 kΩ	Off	Off	Off

AC Volts			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution	N/A	5.5 digits	6.5 digits
Autozero	On	On	On
AC Current			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution	N/A	5.5 digits	6.5 digits
Autozero	On	On	On
Frequency			
Readings			
thrown away	N/A	1	N/A
averaged	N/A	1	N/A
Resolution	N/A	5 digits	N/A
Autozero	Off	Off	Off
Temperature			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution			
Pt385 RTD	N/A	0.001 °C	0.001 °C
Type J TC	N/A	0.1 °C	0.1 °C
Type K TC	N/A	0.1 °C	0.1 °C
Type T TC	N/A	0.1 °C	0.1 °C
Type E TC	N/A	0.1 °C	0.1 °C
Type R TC	N/A	1 °C	1 °C
Type S TC	N/A	1 °C	1 °C
Type B TC	N/A	1 °C	1 °C
Autozero	On	On	On

Rules:

- The MOD3 field may specify "E" only when the NOMINAL field specifies voltage, decibels, current, resistance, conductance, or temperature.
- The MOD3 field may specify "F" only when the MOD1 field is blank (DC) and the NOMINAL field specifies voltage, current, resistance, or conductance.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 3W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 3W only when the MOD2 field specifies a RTD type.
- The CON field may specify a 4W only when the NOMINAL field specifies resistance or the MOD2 field specifies a RTD type.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2001        *                                              S
# ----- DC Voltage -----
  1.002  2001   10    10V            1% 0.01U                          2W
# ----- AC Voltage -----
  5.001  2001   1000  650V           5%            30kH                2W
  6.001  2001   1     1V             1% 0.01U      10kH                2W
# ----- Decibels -----
  7.001  2001   A     60.0D          0.1U          1kH            5Z   2W
# ----- DC Current -----
  9.001  2001   4000  350mA          9U                                2W
# ----- AC Current -----
 10.001  2001   2     1A             3%            60H                 2W
# ----- Resistance -----
 11.001  2001   100   10MZ           1%                                2W
# ----- Conductance -----
 12.001  2001   100   100nY          5%                                2W
# ----- Setup Test -----
 13.001  2001         1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  2001   1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  2001   1     1V             1% 0.1U       20kH                C  2W
```

2002

Instrument FSC

Description

The 2002 FSC programs the Keithley 2002 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, or temperature.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1]	100 nV to 775 V	1 Hz to 2 MHz	
DC Current	-2.1 A to 2.1 A		
AC Current	100 pA to 2.1 A	1 Hz to 100 kHz	
Resistance	0 Ω to 1.05 GΩ		
Conductance	>0.9524 nS		
Frequency[1]	1 Hz to 5 MHz 5 MHz to 15 MHz 1 Hz to 5 MHz	60 mV to 775 V 350 mV to 775 V 150 µA to 2.1 A	
Decibels[1]	-126.9 dBm to 70.79 dBm	1 Hz to 2 MHz	5Z
Decibels[1]	-128.7 dBm to 69.03 dBm	1 Hz to 2 MHz	7Z
Decibels[1]	-134.7 dBm to 63.01 dBm	1 Hz to 2 MHz	3Z
Decibels[1]	-137.7 dBm to 60.00 dBm	1 Hz to 2 MHz	6Z
Temperature[2]			
Pt385 RTD	-200°C to 630°C	R1	
Type J TC	-200°C to 760°C	_J	
Type K TC	-200°C to 1372°C	_K	
Type T TC	-200°C to 400°C	_T	
Type E TC	-200°C to 10000°C	_E	
Type R TC	0°C to 1768°C	_R	
Type S TC	0°C to 1768°C	_S	
Type B TC	+350°C to 1820°C	_B	

1. Volt-Hertz product not to exceed 2^7.
2. Temperature measurement using a thermocouple requires an external thermocouple card.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Conductance entered as [*numeric*][*prefix*]Y
- Frequency entered as [*numeric*][*prefix*]H
- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.
- The NOMINAL field may specify temperature only when the MOD2 field specifies a RTD or thermocouple type.
- The NOMINAL field must specify a resistance, or equivalent conductance, less than or equal to 21 kΩ when the MOD2 field specifies offset compensation override "O".

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance, conductance, or temperature.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.

MOD2

This field specifies the load impedance that the AC voltage is referenced to for decibels or the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for Ω
- 5Z 50Ω
- 7Z 75Ω
- 3Z 300Ω
- 6Z 600Ω
- R1 100Ω Pt 385 RTD
- _J Type J thermocouple
- _K Type K thermocouple
- _T Type T thermocouple
- _E Type E thermocouple
- _R Type R thermocouple
- _S Type B thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance or conductance.
- The MOD2 field may specify a reference impedance ,only when the NOMINAL field specifies decibels.
- The MOD2 field may specify a RTD or thermocouple only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

	F	***blank***	**E**
DC Volts			
Number of powerline cycles	1	1	10
Resolution	7.5 digits	7.5 digits	8.5 digits
Readings			
thrown away	1	1	1
averaged	1	10	10
Autozero	Synchronous	Synchronous	Synchronous
DC Current			
Number of powerline cycles	1	1	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	1	1
averaged	1	10	10
Autozero	Normal	Normal	Normal
Ohms (2-Wire and 4-Wire)			
Number of powerline cycles	1	1	10
Resolution	7.5 digits	7.5 digits	8.5 digits
Readings			
thrown away	1	1	1
averaged	1	10	10
Autozero	Normal	Normal	Synchronous

	F	*blank*	E
Offset Compensation			
≤21 kΩ	On	On	On
>21 kΩ	Off	Off	Off
AC Volts			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution	N/A	5.5 digits	6.5 digits
Autozero	Normal	Normal	Normal
AC Current			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution	N/A	5.5 digits	6.5 digits
Autozero	Normal	Normal	Normal
Frequency			
Readings			
thrown away	N/A	1	N/A
averaged	N/A	1	N/A
Resolution	N/A	5 digits	N/A
Autozero	Off	Off	Off
Temperature			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution			
Pt385 RTD	N/A	0.001 °C	0.001 °C
Type J TC	N/A	0.1 °C	0.1 °C
Type K TC	N/A	0.1 °C	0.1 °C
Type T TC	N/A	0.1 °C	0.1 °C
Type E TC	N/A	0.1 °C	0.1 °C
Type R TC	N/A	1 °C	1 °C
Type S TC	N/A	1 °C	1 °C
Type B TC	N/A	1 °C	1 °C
Autozero	Normal	Normal	Normal

Rules:

- The MOD3 field may specify "E" only when the NOMINAL field specifies voltage, decibels, current, resistance, conductance, or temperature.
- The MOD3 field may specify "F" only when the MOD1 field is blank (DC) and the NOMINAL field specifies voltage, current, resistance, or conductance,

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 3W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 3W only when the MOD2 field specifies a RTD type.
- The CON field may specify a 4W only when the NOMINAL field specifies resistance or the MOD2 field specifies a RTD type.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2002        *                                                S
# ----- DC Voltage -----
  1.002  2002   10    10V            1% 0.01U                          2W
# ----- AC Voltage -----
  5.001  2002   1000  650V           5%            30kH                2W
  6.001  2002   1     1V             1% 0.01U      10kH                2W
# ----- Decibels -----
  7.001  2002   A     60.0D          0.1U          1kH            5Z   2W
# ----- DC Current -----
  9.001  2002   4000  350mA          9U                                2W
# ----- AC Current -----
 10.001  2002   2     1A             3%            60H                 2W
# ----- Resistance -----
 11.001  2002   100   10MZ           1%                                2W
# ----- Conductance -----
 12.001  2002   100   100nY          5%                                2W
# ----- Setup Test -----
 13.001  2002         1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  2002   1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  2002   1     1V             1% 0.1U       20kH                C  2W
```

2024

Instrument FSC

Desription

The 2024 FSC programs amplitude and frequency of the Marconi 2023, 2024, IFR 2023A and 2024A AM/FM Signal Generators.

Functional Capability

Model	Frequency	Amplitude
2023	9 kHz to 1.2 GHz	-137 dBm to +13 dBm (+25 dBm Option 3)
2024	9 kHz to 2.4 GHz	-137 dBm to +13 dBm (+25 dBm Option 3)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 202x RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2024         *                                                 S
  1.002  2024   A     -42.95D        1U            100kH          -D
  2.001  2024         100mV                        550MH          -D    S
  2.002  2024   0.5   28mVpp         5U            100kH          -D
  3.001  2024   A     D              1U            100kH          -D
  4.001  2024         V              1%            100kH          -D
  5.001  2024   50    10uT           1% 1/ 1U      -35D
  6.001  2024   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the 5800A to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  2024   20    120mVpp                      100kH                N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  2024         5MH            -100%         mVpp           -D       CH1
  8.001  MESS
  8.002  ASK+         N
```

M2024

Auxiliary Instrument Setup FSC

Description

The M2024 FSC provides the additional program functions for the Marconi 2023, 2024, IFR 2023A and 2024A AM/FM Signal Generators which are not addressed by the 2024 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

Parameters

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

Modulation Frequency:

When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*][*prefix*]H. Allowed values are 10 Hz to 20 kHz.

If just units are entered, the value is taken from memory register MEM at run time.

Reset:

To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the M2024 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation. The MOD1 field cannot be blank in an 2024 statement.

AM Depth:

AM depth is entered as [*numeric*] [*prefix*]pct. AM depth limits are 0 to 99.9%.

FM Deviation:

FM deviation is entered as [*numeric*] [*prefix*]H. FM deviation limits are 0 to 100 kHz.

Phase Deviation:

Phase deviation is entered as [*numeric*] [*prefix*]rad. Phase deviation limits are 0 to 10 radians.

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# AM Modulation
  1.001  M2024        *
  1.002  M2024        400H                       0pct
  1.003  2024   10    0D             1U          10MH
  2.001  M2024        1000H                      90pct
  2.002  2024   10    0D             1U          10MH
# FM Modulation
  3.001  M2024        400H                       100H
  3.002  2024   10    0D             0.11U       200kH
  4.001  M2024        1000H                      99.9kH
  4.002  2024   10    0D             0.1U        1000MH
# Phase Modulation
  5.001  M2024        400H                       2rad
  5.002  2024   10    0D             0.11U       200kH
  6.001  M2024        1000H                      10rad
  6.002  2024   10    0D             0.1U        1000MH
```

2620T

Instrument FSC

Description

The 2620T FSC programs the Fluke 2620T Recording Thermometer.

Functional Capability

-196degC to 400degC (-320.8degF to 752degF)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This is not used and must be blank.

MOD3

This is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This is not used and must be blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2620T       *                                                S
# ----- Evaluation Test -----
  7.001  2620T        23.0degC       0.1U
# ----- Setup Test -----
  9.001  2620T        100.0degC                                        S
# ----- Nominal Setup Test -----
  9.002  2620T  1     212.0degF                                        N
# ----- Comparison Test -----
  9.003  2620T  1     212.0degF      1% 0.1U                           C
```

2635T

Instrument FSC

Description

The 2635T FSC programs the Fluke 2635T Recording Thermometer.

Functional Capability

-196degC to 400degC (-320.8degF to 752degF)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This is not used and must be blank.

MOD3

This is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This is not used and must be blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2635T       *                                                S
# ----- Evaluation Test -----
  7.001  2635T        23.0degC       0.1U
# ----- Setup Test -----
  9.001  2635T        100.0degC                                        S
# ----- Nominal Setup Test -----
  9.002  2635T  1     212.0degF                                        N
# ----- Comparison Test -----
  9.003  2635T  1     212.0degF      1% 0.1U                           C
```

33120

Instrument FSC

Description

The 33120 FSC programs the Hewlett-Packard 33120A Function Generator to output sine, square, triangle, positive ramp, and negative ramp waveforms.

Note

If the 33120A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,…], to set the baud rate, parity, etc. of the port used to control the 33120A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 33120A must be set correctly before a procedure is executed. The 33120A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 33120A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. Select "Flow Control = None". Selecting "Hardware" sets RTS/CTS flow control. The 33120A uses DTR/DSR hardware flow control. The MET/CAL 33120A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 33120A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT "Pass-Through" Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 33120A.

Functional Capability

Waveform	Frequency
Sine	100 μHz to 15 MHz
Square	100 μHz to 15 MHz
Triangle	100 μHz to 100 kHz
Positive Ramp	100 μHz to 100 kHz

Negative Ramp	100 µHz to 100 kHz
Exponential Rise	100 µHz to 5 MHz
Exponential Fall	100 µHz to 5 MHz
Sync	100 µHz to 5 MHz
Cardiac	100 µHz to 5 MHz

Output Termination	Amplitude
50 Ω	+/-5V (DC), 50 mVpp to 10 Vpp (AC)
Open Circuit	+/-10V (DC), 100 mVpp to 20 Vpp (AC)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- Decibels entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R, -R, +X, -X, SY, CD, or OI (i.e MOD2 is not blank).
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field

is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- Decibels entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- *blank* DC or Noise

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field must be blank when the MOD2 field specifies OI (Noise).
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp

- -R Negative Ramp
- +X Exponential Rise
- -X Exponential Fall
- SY Sync Signal
- CD Cardiac Signal
- OI Noise

Rules:

- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank or OI when the MOD1 field is blank (i.e. DC Voltage or Noise is specified).

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Unterminated
- L 50 Ohm termination

Rules:

- When the CON field is L the output is expected to be terminated with 50 Ohms. This can be accomplished by using a 50 Ohm terminator at the UUT or setting the UUT input impedance to 50 Ohms.
- L is automatically inserted the CON field when the amplitude in the Nominal or MOD1 field is expressed in dBm.
- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  33120        *                                              S
# ----- DC Voltage -----
  1.002  33120  20    19.99mV        2% 0.04U                           L
  2.001  33120  400   350.0mV        1.9% 0.4U                          L
# ----- Sine Wave -----
  3.001  33120  400   350.0mV        -2.8U +2.9U   60H           SI       L
  4.001  33120  400   3.500V         7.4U          20kH          SI       L
  5.001  33120        -37.78D        0.01U         100H          SI       L
# ----- Square Wave w/DC offset -----
  6.001  M33120                                    0.5Voff
  6.002  33120        1Vpp                        1kH           SQ    S  L
# ----- Triangle Wave -----
  6.003  M33120       *
  6.004  33120        13mVpp                      10kH          TI    S  L
# ----- Positive Ramp -----
  6.005  33120        1.0Vpp                      100kH         +R    S  L
# ----- Negative Ramp -----
  6.005  33120        1.0Vpp                      5MH           -R    S  L
# ----- Frequency -----
  6.006  33120  1000  800.0H         0.1% 0.1U     300mV         SI    S  L
```

M33120

Auxiliary Instrument Setup FSC

Description

The M33120 FSC is used to specify modulation, modulation frequency, AM depth, FM deviation, duty cycle, and DC offset. The M33120 FSC is ignored when the 33120 FSC specifies DC voltage.

Functional Capability

Modulation Frequency	10 MHz to 20 kHz (AM), 10 kHz (FM)
AM Depth	0% to 120%
FM Deviation	10 MHz to 7.5 MHz
Duty cycle	20% to 80% <= 5 MHz, 40% to 60% > 5 MHz.
DC Offset	0 V to 5 V (50 Ω), 0 V to 10 V (open circuit) restricted by: |Voff|+ (Vpp / 2) <= Vmax and |Voff| <= 2 x Vpp

Parameters

RANGE

This field specifies one of the following:

- INT Internal modulation source
- EXT External modulation source
- *blank* no modulation

Rules:

- The Range field must "INT" or "EXT" when the Nominal field specifies modulation frequency.

NOMINAL

This field specifies one of the following:

- Modulation Frequency is entered as [*numeric*][*prefix*]H.
- DC Offset entered as: [*numeric*][*prefix*] Voff

- "*" reset to default values
- *blank* no modulation and no DC offset

Rules:

- The Nominal field must specify the modulation frequency when the Range field specifies "INT" or "EXT".
- If the Nominal field does not contain a value the value is taken from memory register MEM.

TOLERANCE

This field is not used.

MOD1

The MOD1 field specifies the following:

- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- Duty Cycle entered as: [*numeric*][*prefix*]pct.
- *blank* no modulation and 50% Duty Cycle (square wave only)

Rules:

- The MOD1 field must specify AM depth when the Range field specifies an external modulation source.
- The MOD1 field must specify AM depth or FM deviation when the Range field specifies an internal modulation source.
- When two frequency values are entered for a M33120 FSC, the first is taken to be the Modulation Frequency and the second is taken to be the FM deviation.
- When the MOD1 field specifies FM deviation, the deviation must be less than or equal to the frequency specified in the 33120 FSC Nominal or MOD1 field.
- When a frequency value and a percent value are entered for a M33120 FSC, the frequency is taken to be the Modulation Frequency and the percent is taken to be the AM depth.
- When a percent value is entered without also entering a frequency value, the percent is taken to be duty cycle.
- The M33120 MOD1 field may specify duty cycle only when the 33120 FSC MOD2 field is "SQ" (square wave).

- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 33120 FSC.

34401

Instrument FSC

Description

The 34401 FSC programs the HP 34401A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and period.

Note

If the 34401A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 34401A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 34401A must be set correctly before a procedure is executed.

The 34401A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 34401A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. Select "Flow Control = None". Selecting "Hardware" sets RTS/CTS flow control. The 34401A uses DTR/DSR hardware flow control. The MET/CAL 34401A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 34401A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT "Pass-Through" Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 34401A.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1000 V to 1000 V		
AC Voltage[1]	0.1 mV to 750 V	3 Hz to 300 kHz	
DC Current	-3. A to 3 A		
AC Current	1 μA to 3 A	3 Hz to 5 kHz	
Resistance	0 Ω to 119.9999 MΩ		
Conductance	>8.4 nS		
Frequency[1]	3 Hz to 300 kHz	100 mV to 750 V	
Period[1]	3.3 μs to 0.33 s	100 mV to 750 V	
Decibels[1]	-66.98 dBm to 70.51 dBm	3 Hz to 300 kHz	5Z
Decibels[1]	-68.75 dBm to 68.75 dBm	3 Hz to 300 kHz	7Z
Decibels[1]	-74.77 dBm to 62.73 dBm	3 Hz to 300 kHz	3Z
Decibels[1]	-77.78 dBm to 59.71 dBm	3 Hz to 300 kHz	6Z
1. Volt-Hertz product not to exceed $8x10^7$.			

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage when the NOMINAL field specifies frequency or period.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

Not used.

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Example

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  34401        *                                                S
# ----- DC Voltage -----
  1.002  34401  10    10V            1% 0.01U                          2W
# ----- AC Voltage -----
  5.001  34401  1000  650V           5%            30kH                2W
  6.001  34401  1     1V             1% 0.01U      10kH                2W
# ----- Decibels -----
  7.001  34401  A     60.0D          0.1U          1kH            5Z   2W
# ----- DC Current -----
  9.001  34401  4000  350mA          9U                                2W
# ----- AC Current -----
 10.001  34401  2     1A             3%            60H                 2W
# ----- Resistance -----
 11.001  34401  100   10MZ           1%                                2W
# ----- Conductance -----
 12.001  34401  100   100nY          5%                                2W
# ----- Setup Test -----
 13.001  34401        1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  34401  1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  34401  1     1V             1% 0.1U       20kH                C  2W
```

34420

Instrument FSC

Description

The 34420 FSC programs the Hewlett-Packard 34420A Multimeter measure DC voltage, DC voltage ratio, DC voltage difference, Resistance, and temperature. The 34420 FSC is also used to program the 34420/SPRT and 34420/PRT to measure temperature.

Note

If the 34420A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 34420A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 34420A must be set correctly before a procedure is executed.

The 34420A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 34420A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. Select "Flow Control = None". Selecting "Hardware" sets RTS/CTS flow control. The 34420A uses DTR/DSR hardware flow control. The MET/CAL 34420A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 34420A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT "Pass-Through" Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 34420A.

Functional Capability

FUNCTION	NOMINAL	MOD2
DC Voltage	-119.99999 V to 119.99999 V	
DC Voltage Ratio (Ch1/Ch2)	-11999999 to 11999999	
DC Voltage Difference (Ch1-Ch2)	-119.99999 V to 119.99999 V	VD
Resistance	0 Ω to 1.1999999 MΩ	
Low Power Resistance	0 Ω to 1.1999999 MΩ	LP
Voltage Limited Resistance	0 Ω to 119.99999 Ω	VL
Temperature		
100 Ω Pt 385 RTD	-200 °C to 630 °C	R1
200 Ω Pt 385 RTD	-200 °C to 630 °C	R4
500 Ω Pt 385 RTD	-200 °C to 630 °C	R5
1 kΩ Pt 385 RTD	-200 °C to 630 °C	R6
100 Ω Pt 3916 RTD	-200 °C to 630 °C	R7
Rosemount 162CE SPRT(1)	-200 °C to 661 °C	RR
Hart Scientific 5628 PRT(2)	-200 °C to 660 °C	RH
Type B TC	+350 °C to 1820 °C	_B
Type E TC	-200 °C to 10000 °C	_E
Type J TC	-200 °C to 760 °C	_J
Type K TC	-200 °C to 1372 °C	_K
Type N TC	-200 °C to 1300 °C	_N
Type R TC	0 °C to 1767 °C	_R
Type S TC	0 °C to 1767 °C	_S
Type T TC	-250 °C to 400 °C	_T
1. 34420/SPRT only 2. 34420/PRT only.		

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage entered as: [*numeric*][*prefix*]V
- Voltage Ratio entered as: [*numeric*][*prefix*]V/V
- Voltage Difference entered as: [*numeric*][*prefix*]V
- Resistance entered as [*numeric*][*prefix*]Z
- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

Rules:

- The NOMINAL field may specify temperature only when the MOD2 field specifies a RTD or thermocouple type.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This field is used to override offset compensation for Ohms, to select Low Power or Voltage Limited Resistance, or to specify the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for Ohms
- LP Low Power Resistance
- VL Voltage Limited Resistance
- VD Voltage Difference

- R1 100 Ohm Pt 385 RTD
- R4 200 Ohm Pt 385 RTD
- R5 500 Ohm Pt 385 RTD
- R6 1 kOhm Pt 385 RTD
- R7 100 Ohm Pt 3916 RTD
- RR Rosemount 162CE Standard Platinum Resistance Thermometer
- RH Hart Scientific 5628 Platinum Resistance Thermometer
- _B Type B thermocouple
- _E Type E thermocouple
- _J Type J thermocouple
- _K Type K thermocouple
- _N Type N thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _T Type T thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance.
- The MOD2 field may specify LP or VL only when the NOMINAL field specifies resistance.
- The MOD2 field may specify VD when the NOMINAL field specifies voltage.
- The MOD2 field may specify a RTD or thermocouple type only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement model determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

	F	blank	E	FE
DC Volts:				
number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	1	1	1
averaged	1	3	5	1
Ohms (2-Wire and 4-Wire):				
number of powerline cycles	10	100	200	100
<= 19 kΩ				
Readings:				
thrown away	1	2	2	1
averaged	3	4	4	1
>19 kΩ to <= 190 kΩ				
Readings:				
thrown away	1	2	5	1
averaged	3	4	4	1
>190 kΩ				
Readings:				
thrown away	1	2	7	1
averaged	3	4	5	1
Temperature (Thermocouples) number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	1	1	1
averaged	1	3	5	1
Temperature (RTD's, SPRT, and PRT)number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	2	2	1
averaged	3	4	4	1

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or the MOD2 field specifies a RTD type.
- The CON field must specify 4W when the MOD2 field specifies Lower Power resistance (LP), Voltage Limitedresistance (VL) or an RTD type.
- 4W is inserted automatically in the CON field when theMOD2 field specifies LP, VL, or an RTD type and no CON field code is entered.

Use of Standard Memory Locations And Results Reporting

System memory locations MEM and MEM1 are used. For moreinformation, refer to the "General Rules for InstrumentEvaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  34420       *                                              S
# ----- DC Voltage -----
  1.002  34420  10    10V            1% 0.01U                          2W
# ----- DC Voltage Ratio -----
  2.001  34420        0.1V/V         0.01U                             2W
# ----- DC Voltage Difference -----
  3.001  34420        10uV           1U                          VD    2W
# ----- Resistance -----
  4.001  34420  100   100kZ          1%                                2W
# ----- Low Power Resistance -----
  5.001  34420  10    10Z            0.1U                        LP    4W
# ----- Low Power Resistance -----
  6.001  34420  10    10Z            0.1U                        VL    4W
# ----- Temperature RTD -----
```

```
  7.001  34420        23.0degC       0.1U                        R1       4W
# ----- Temperature TC -----
  8.001  34420        23.0degC       0.1U                        _K       2W
# ----- Setup Test -----
  9.001  34420        1V                                               S  2W
# ----- Nominal Setup Test -----
  9.002  34420  1     1V                                               N  2W
# ----- Comparison Test -----
  9.003  34420  1     1V             1% 0.1U                           C  2W
```

3458

Instrument FSC

Description

The 3458 FSC programs the Hewlett-Packard 3458A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, frequency, period, or decibels.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1050 V to 1050 V			[F|E|FE]
AC Voltage	500 μV to 742 V 500 μV to 742 V 1 mV to 742 V		10 Hz to 2 MHz 20 Hz to 10 MHz 1 Hz to 2 MHz	[FE] F E
DC Current	-1.2 A to 1.2 A			[F|E|FE]
AC Current	5 μA to 1.2 A		10 Hz to 100 kHz	[F|E|FE]
Resistance	0 Ω to 1.2 GΩ		[O]	[F|E|FE]
Frequency	1 Hz to 10 mHz		1 mV to 742 V	[FE]
Period	100 ns to 1 s		1 mV to 742 V	[FE]
Decibels	-53.01 dBm to 70.41 dBm -53.01 dBm to 70.41 dBm -46.99 dBm to 70.41 dBm -54.77 dBm to 68.65 dBm -54.77 dBm to 68.65 dBm -48.75 dBm to 68.65 dBm -60.79 dBm to 62.63 dBm -60.79 dBm to 62.63 dBm -54.77 dBm to 62.63 dBm -63.80 dBm to 59.92 dBm -63.80 dBm to 59.92 dBm -57.78 dBm to 59.92 dBm	10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz	5Z 5Z 5Z 7Z 7Z 7Z 3Z 3Z 3Z 6Z 6Z 6Z	[FE] F E [FE] F E [FE] F E [FE] F E
The AC Voltage input range is extended to 1500 Vp if the kilovolt option is installed. This is shown in the CONFIG.DAT file as 3458(kV).				

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix]D*
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Voltage entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one of the following:

- The load impedance that the AC voltage is referenced to or
- A code which overrides the automatic enabling of the offset compensated Ohms function.

5Z	50 Ω
7Z	75 Ω
3Z	300 Ω
6Z	600 Ω
O	Override (disable) offset compensated Ohms
blank	field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify override only when the NOMINAL field specifies resistance.

MOD3

	F	Blank	E	FE
DC Volts				
number of powerline cycles	10	100	100	100
Readings				
thrown away	1	1	1	1
averaged	1	3	5	1
Autozero	On	On	On	On
DC Current				
number of powerline cycles	10	100	100	100
Readings				
thrown away	1	1	2	1
averaged	1	3	5	1
Autozero	On	On	On	On
Ohms (2-Wire and 4-Wire)				
Number of powerline cycles	10	100	100	100
≤19 kΩ				
Readings				
thrown away	1	2	2	1
averaged	3	4	4	1
>19 kΩ to ≤190 kΩ				
Readings				
thrown away	1	2	5	1
averaged	3	4	4	1
>190 kΩ				
Readings				
thrown away	1	2	7	1
averaged	3	4	5	1
Autozero	On	On	On	On
Offset Compensation				
10 kΩ	On	On	On	On
≥10 kΩ	Off	Off	Off	Off

	F	Blank	E	FE
AC Volts				
Conversion	Random Samp.	Analog RMS	Synchronous	Analog RMS
Bandwidth	20 Hz to 10 MHz	10 Hz to 2 MHz	1 Hz to 2 MHz	10 Hz to 2 MHz
Reading Thrown away averaged	 1 1	 1 3	 1 3	 1 1
Resolution	Default	Default	0.001	Default
Level Filter, AC Volts only	Default	Default	On < 75 kHz Off ≥ 75 kHz	Default
Sync. Source	NA	NA	Level, Hold	NA
AC Current				
number of powerline cycles	10	100	100	100
Reading Thrown away averaged	 1 1	 1 3	 2 5	 1 1
Frequency				
Reading Thrown away averaged	 NA NA	 1 3	 NA NA	 1 1
Level Filter, AC Volts only	Default	On < 75 kHZ Off ≥ 75 kHz	Default	On < 75 kHZ Off ≥ 75 kHz
Period				
Reading Thrown away averaged	 NA NA	 1 3	 NA NA	 1 1
AC Volts only Level Filter	Default	On > 13.3 µs Off ≤ 13.3 µs	Default	On > 13.3 µs Off ≤ 13.3 µs

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  3458         *                                              S
# ----- DC Voltage -----
  1.002  3458   A     -1000V         1% 0.1U                           2W
# ----- AC Voltage -----
  2.001  3458   200   100V           1% 2/         10kH                2W
# ----- Decibels -----
  3.001  3458   100   56.62D         2% 0.1U       1kH              6Z   2W
# ----- DC Current -----
  4.001  3458   10    1.00A          1000P%                            2W
# ----- AC Current -----
  5.001  3458   2     mA             1%            1kH                 2W
# ----- Resistance -----
  6.001  3458   100   256kZ          1%                                2W
# ----- Frequency -----
  7.001  3458         800.0H         0.1% 0.1U     300mV               2W
```

M3458

M3458 Auxiliary Instrument Setup FSC

Description

The M3458 FSC provides range locking for the Hewlett-Packard 3458A Multimeter.

Parameters

When a blank M3458 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* field not applicable

Rules:

- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.

NOMINAL

This field specifies one of the following:

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z
- "*" reset to default values

Rules:

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Selection Value	Locked Range
-12 mV to 12 mV	100 mV DC, 10 mV AC
-120 mV to < -12 mV	100 mV
> 12 mV to 120 mV	100 mV

Selection Value	Locked Range
-1.2 V to < -120 mV	1 V
> 120 mV to 1.2 V	1 V
-12 V to < -1.2 V	10 V
> 1.2 V to 12 V	10 V
-120 V to < -12 V	100 V
> 12 V to 120 V	100 V
-1050 V to < -120 V	1000 V
> 120 V to 1050 V	1000 V
-0.12 µA to 0.12 µA	0.1 µA DC, 100µA AC
-1.2 µA to < -0.12 µA	1 µA DC, 100µA AC
> 0.12 µA to 1.2 µA	1 uA DC, 100µA AC
-12 µA to < -1.2 µA	10 µA DC, 100µA AC
> 1.2 µA to 12 µA	10 µA DC, 100µA AC
-120 µA to < -12 µA	100 µA
>12 µA to 120 µA	100 µA
-1.2 mA to < -120 µA	1 mA
> 120 µA to 1.2 mA	1 mA
-12 mA to < -1.2 mA	10 mA
> 1.2 mA to 12 mA	10 mA
-120 mA to < -12 mA	100 mA
> 12 mA to 120 mA	100 mA
-1.2 A to < -120 mA	1 A
> 120 mA to 1.2 A	1 A
0 Ω to 12 Ω	10 Ω
> 12 Ω to 120 Ω	100 Ω
> 120 Ω to 1.2 kΩ	1 kΩ
> 1.2 kΩ to 12 kΩ	10 kΩ

Selection Value	Locked Range
> 12 kΩ to120 kΩ	100 kΩ
> 120 kΩ to 1.2 MΩ	1 MΩ
> 1.2 MΩ to 12 MΩ	10 MΩ
> 12 MΩ to 120 MΩ	100 MΩ
> 120 MΩ to 1.2 GΩ	1 GΩ

- A M3458 range lock specification only applies when a subsequent FSC specifies an applicable measurement function (see EXAMPLES below).
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
#
  1.001  M3458  RNGLK 10mV
#
#  100mV range is locked
#
  1.002  3458         100mV          1%                                 2W
#
#  10mV range is locked
#
  2.001  3458         10mV           1%            1kH                  2W
  3.001  3458         1kH            1%            10mV                 2W
#
#  Autorange is selected (M3458 FSC not applicable).
#
  4.001  3458         1uA            1%                                 2W
  5.001  3458         100uA          1%            1kH                  2W
  6.001  3458         1kH            1%            100uA                2W
  7.001  3458         10Z            1%                                 2W
#
  8.001  M3458  RNGLK 1uA
#
#  Autorange is selected (M3458 FSC not applicable).
#
  8.002  3458         100mV          1%                              N  2W
  9.001  3458         10mV           1%            1kH               N  2W
 10.001  3458         1kH            1%            10mV                 2W
#
#  1uA range is locked
#
 11.001  3458         1uA            1%                              N  2W
#
#  100uA range is locked
#
 12.001  3458         100uA          1%            1kH               N  2W
 13.001  3458         1kH            1%            100uA                2W
#
# Autorange is selected (M3458 FSC not applicable).
#
 14.001  3458         10Z            1%                              N  2W
#
 15.001  M3458  RNGLK 10Z
```

```
#
#  Autorange is selected (M3458 FSC not applicable).
#
 15.002  3458         100mV          1%                                N  2W
 16.001  3458         10mV           1%            1kH                 N  2W
 17.001  3458         1uA            1%                                N  2W
 18.001  3458         100uA          1%            1kH                 N  2W
#
#  10 Ohm range is locked.
#
 19.001  3458         10Z            1%                                N  2W
#
#  Autorange is selected for all subsequent 3458 FSCs.
#
20.001  M3458        *
```

45

Instrument FSC

Description

The 45 FSC programs the Fluke 45 Dual Display Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, frequency, audio power, or decibels.

Note

If the 45 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 45. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 45 must be set correctly before a procedure is executed. If the 45 is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 45 is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

The 45 setting "Echo Off" must be used for serial control by MET/CAL

Functional Capability

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
DC Voltage	-999.99 V to 999.99 V			
DC Voltage w/6 kV Probe	-6 kV to 6 kV		F	
DC Voltage w/40 kV Probe	+/-(1 kV to 40 kV)		G	
AC Voltage[1]	15 mV to 200 V 15 mV to 400 V 15 mV to 750 V	10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		
DC Current (100 mA Input)	-99.999 mA to 99.999 mA			
DC Current (10 A Input)	-9.9999 A to 9.9999 A		E	
AC Current (100 mA Input)	1.5 mA to 99.999 mA	20 Hz to 20 kHz		
AC Current (10 A Input)	0.5 A to 9.9999 A	20 Hz to 2 kHz	E	
Resistance	0 Ω to 98 M Ω			
Frequency	5 Hz to 20 kHz 5 Hz to 50 kHz 5 Hz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 mHz	30 mV to 750V 30 mV to 400V 30 mV to 200V 100 mV to[1] 1 V to[1]		
Audio Power	10 mW to 999.99 W 10 mΩ to 999.99 Ω	*blank* (DC), 10 Hz to 100 kHz		2,4,8, or 16
Decibels	-77.45 dBm to 86.99 dBm -9.49 dBm to 73.01 dBm -9.49 dBm to 79.03 dBm -9.49 dBm to 84.49 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		2 Ω 2 Ω 2 Ω 2 Ω
Decibels	-80.46 dBm to 83.98 dBm -12.50 dBm to 70.00 dBm -12.50 dBm to 76.02 dBm -12.50 dBm to 81.48 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		4 Ω 4 Ω 4 Ω 4 Ω

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
Decibels	-83.47 dBm to 80.97 dBm -15.51 dBm to 66.99 dBm -15.51 dBm to 73.01 dBm -15.51 dBm to 78.47 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		8 Ω 8 Ω 8 Ω 8 Ω
Decibels	-86.48 dBm to 77.96 dBm -18.52 dBm to 63.98 dBm -18.52 dBm to 70.00 dBm -18.52 dBm to 75.46 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		16 Ω 16 Ω 16 Ω 16 Ω
Decibels	-91.43 dBm to 73.01 dBm -23.47 dBm to 59.03 dBm -23.47 dBm to 65.05 dBm -23.47 dBm to 70.51 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		50 Ω 50 Ω 50 Ω 50 Ω
Decibels	-93.19 dBm to 71.25 dBm -25.23 dBm to 57.27 dBm -25.23 dBm to 63.29 dBm -25.23 dBm to 68.75 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		75 Ω 75 Ω 75 Ω 75 Ω
Decibels	-94.12 dBm to 70.32 dBm -26.16 dBm to 56.34 dBm -26.16 dBm to 62.36 dbm -26.16 dBm to 67.82 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 50 kHz		93 Ω 93 Ω 93 Ω 93 Ω
Decibels	-94.85 dBm to 69.59 dbm -26.89 dBm to 55.61 dBm -26.89 dBm to 61.63 dBm -26.89 dBm to 67.09 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		110 Ω 110 Ω 110 Ω 110 Ω
Decibels	-95.37 dBm to 69.07 dBm -27.41 dBm to 55.09 dBm -27.41 dBm to 61.11 dBm -27.41 dBm to 66.57 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		124 Ω 124 Ω 124 Ω 124 Ω
Decibels	-95.41 dBm to 69.03 dBm -27.45 dBm to 55.05 dBm -27.45 dBm to 61.07 dBm -27.45 dBm to 66.53 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		125 Ω 125 Ω 125 Ω 125 Ω
Decibels	-95.74 dBm to 68.70 dBm -27.78 dBm to 54.72 dBm -27.78 dBm to 60.74 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz		135 Ω 135 Ω 135 Ω

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
Decibels	-27.78 dBm to 66.20 dBm	10 Hz to 20 kHz		135 Ω
	-96.20 dBm to 68.24 dBm	*blank* (DC)		150 Ω
	-28.24 dBm to 54.26 dBm	10 Hz to 100 kHz		150 Ω
	-28.24 dBm to 60.28 dBm	10 Hz to 50 kHz		150 Ω
	-28.24 dBm to 65.74 dBm	10 Hz to 20 kHz		150 Ω
Decibels	-98.42 dBm to 66.02 dBm	*blank* (DC)		250 Ω
	-30.46 dBm to 52.04 dBm	10 Hz to 100 kHz		250 Ω
	-30.46 dBm to 58.06 dBm	10 Hz to 50 kHz		250 Ω
	-30.46 dBm to 63.52 dBm	10 Hz to 20 kHz		250 Ω
Decibels	-99.21 dBm to 65.23 dBm	*blank* (DC)		300 Ω
	-31.25 dBm to 51.25 dBm	10 Hz to 100 kHz		300 Ω
	-31.25 dBm to 57.27 dBm	10 Hz to 50 kHz		300 Ω
	-31.25 dBm to 62.73 dBm	10 Hz to 20 kHz		300 Ω
Decibels	-101.43 dBm to 63.01 dBm	*blank* (DC)		500 Ω
	-33.47 dBm to 49.03 dBm	10 Hz to 100 kHz		500 Ω
	-33.47 dBm to 55.05 dBm	10 Hz to 50 kHz		500 Ω
	-33.47 dBm to 60.51 dBm	10 Hz to 20 kHz		500 Ω
Decibels	-102.22 dBm to 62.22 dBm	*blank* (DC)		600 Ω
	-34.26 dBm to 48.24 dBm	10 Hz to 100 kHz		600 Ω
	-34.26 dBm to 54.26 dBm	10 Hz to 50 kHz		600 Ω
	-34.26 dBm to 59.72 dBm	10 Hz to 20 kHz		600 Ω
Decibels	-103.47 dBm to 60.97 dBm	*blank* (DC)		800 Ω
	-35.51 dBm to 46.99 dBm	10 Hz to 100 kHz		800 Ω
	-35.51 dBm to 53.01 dBm	10 Hz to 50 kHz		800 Ω
	-35.51 dBm to 58.47 dBm	10 Hz to 20 kHz		800 Ω
Decibels	-103.98 dBm to 60.46 dBm	*blank* (DC)		900 Ω
	-36.02 dBm to 46.48 dBm	10 Hz to 100 kHz		900 Ω
	-36.02 dBm to 52.50 dBm	10 Hz to 50 kHz		900 Ω
	-36.02 dBm to 57.96 dBm	10 Hz to 20 kHz		900 Ω
Decibels	-104.44 dBm to 60.00 dBm	*blank* (DC)		1 kΩ
	-36.48 dBm to 46.02 dBm	10 Hz to 100 kHz		1 kΩ
	-36.48 dBm to 52.04 dBm	10 Hz to 50 kHz		1 kΩ
	-36.48 dBm to 57.50 dBm	10 Hz to 20 kHz		1 kΩ
Decibels	-105.23 dBm to 59.21 dBm	*blank* (DC)		1.2 kΩ
	-37.27 dBm to 45.23 dBm	10 Hz to 100 kHz		1.2 kΩ
	-37.27 dBm to 51.25 dBm	10 Hz to 50 kHz		1.2 kΩ
	-37.27 dBm to 56.71 dBm	10 Hz to 20 kHz		1.2 kΩ

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
Decibels	-113.47 dBm to 50.97 dBm	*blank* (DC)		8 kΩ
	-45.51 dBm to 36.99 dBm	10 Hz to 100 kHz		8 kΩ
	-45.51 dBm to 43.01 dBm	10 Hz to 50 kHz		8 kΩ
	-45.51 dBm to 48.4 7 dBm	10 Hz to 20 kHz		8 kΩ
1. Volt-Hertz product not to exceed 1e6.				

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Audio Power entered as: [*numeric*][*prefix*]W
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify audio power only when the M45 FSC specifies the reference impedance as 2, 4, 8, or 16 Ω.
- The NOMINAL field may specify decibels only when the M45 FSC specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency measurements. See the NOMINAL field specification for allowed values and units.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as: *numeric*[*prefix*]V
- *blank* not applicable

Rules:

- The MOD1 field may specify voltage only when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or the MOD3 field specifies "F" or "G".

MOD2

This field is not used.

MOD3

This field specifies one of the following:

- E Current measurement using the 10 A input.
- F DC Voltage measurement using 6 kV probe
- G DC Voltage measurement using 40 kV probe
- *blank* field not applicable

Rules:

The MOD3 field may specify E only when the NOMINAL field specifies current.

- E is automatically inserted in the MOD3 field when current is specified in the NOMINAL field with a value greater than or equal to 100 mA.
- E may be specified for current lower than 100 mA to avoid connection changes.
- The MOD3 field may specify F or G only when the NOMINAL field specifies voltage.
- F is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 1000V and less than or equal to 6000V.
- G is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 6000V.
- F or G may be specified at lower voltages to avoid connection changes.

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

T.U.R. Calculation

Calculation of the Test Uncertainty Ratio (T.U.R.) for a "45" statement which specifies decibels ("D") in the NOMINAL fields requires that the impedance from the "M45" statement be known. Because of this requirement, the compile time T.U.R. calculation in this case is not done until the "last pass" of the compiler runs. In other words, if you enter, using the MET/CAL editor, a "45" statement in which NOMINAL units are decibels and press Enter (or F8), no T.U.R. calculation will be done at that time. When you press F9 ("Next Error" function) to compile the entire procedure, the T.U.R. calculation will be done and a warning message, if appropriate, will be displayed.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  45           *                                              S
# ----- DC Voltage -----
  1.002  45     20    19.99mV        2% 0.04U                          2W
# ----- AC Voltage -----
  2.001  45     400   350.0mV        -2.8U +2.9U   60H                 2W
# ----- Decibels -----
  3.001  M45          50Z

  3.002  45           10D                        100H                N  2W
# ----- Audio Power -----
  3.003  M45          8Z
  3.004  45           15W                        1kH                 N  2W
# ----- DC Current -----
  3.005  45     4000  3500mA         9U                           E     2W
# ----- AC Current -----
  4.001  45           35.00mA        0.37U         60H                 2W
# ----- Frequency -----
  5.001  45     1000  800.0H         0.1% 0.1U     300mV               2W
# ----- Resistance -----
  6.001  45           390.0Z                                         S  2W
```

M45

Auxiliary Instrument Setup FSC

Description

The M45 FSC allows selection of the reference impedances supported by the Fluke 45 which cannot be specified in the 45 FSC MOD3 field.

Parameters

RANGE

This field is not used.

NOMINAL

This field specifies the reference impedance entered as: *numeric*[*prefix*]Z.

Allowed values are:

2Ω, 4Ω, 8Ω, 16Ω, 93Ω, 110Ω, 124Ω, 125Ω, 135Ω, 150Ω, 250Ω, 500Ω, 800Ω, 900v, 1 kΩ, 1.2 kΩ, and 8 kΩ.

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

437

Instrument FSC

Description

The 437 FSC programs the Hewlett-Packard 437B Power Meter. The 437 FSC can also program the Hewlett-Packard E4418A (previously EPM-441A) Power Meter when it is in 437B language emulation mode. The driver automatically sets the E4418A to 437B language emulation mode.

Functional Capability

Function	437 MOD3	437 Nominal	437 MOD1	M437 Nominal
RF Power[1]	RF RF	-70 dBm to +44 dBm 100 pW to 25 W	100 kHz to 110 GHz 100 kHz to 110 GHz	
Zero Sensor	ZR	0 W	100 kHz to 110 GHz	
Zero and Cal Sensor	CP	1 µW to 1 mW	50 MHz	0 to 100%
1. NOMINAL (Power) and MOD1 (frequency) ranges depend upon the power sensor model used (see M437 MOD1 field).				

Model	Power Range	Frequency Range
25 W Sensors		
8481B	0 to +44 dBm (1 mW to 25 W)	10 MHz to 18.0 GHz
8482B	0 to +44 dBm (1 mW to 25 W)	100 kHz to 4.2 GHz
3 W Sensors		
8481H	-10 to +35 dBm (100 µW to 3 W)	10 MHz to 18.0 GHz
8482H	-10 to +35 dBm (100 µW to 3 W)	100 kHz to 4.2 GHz
100 mW Sensors		
8481A	-30 to +20 dBm (1 µW to 100 mW)	10 MHz to 18.0 GHz
8482A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 4.2 GHz
8483A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 2.0 GHz
8485A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 26.5 GHz
R8486A	-30 to +20 dBm (1 µW to 100 mW)	26.5 MHz to 40 GHz
Q8486A	-30 to +20 dBm (1 µW to 100 mW)	33 MHz to 50 GHz
W8486A	-30 to +20 dBm (1 µW to 100 mW)	75 MHz to 110 GHz
8487A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 50 GHz
Model	**Power Range**	**Frequency Range**
High Sensitivity Sensors		
8481D	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz

8484A	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8485D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 26.5 GHz
R8486D	-70 to -20 dBm (100 pW to 10 µW)	26.5 MHz to 40 GHz
Q8486D	-70 to -20 dBm (100 pW to 10 uW)	33 MHz to 50 GHz
8487D	-70 to -20 dBm (100 pW to 10 uW)	50 MHz to 50 GHz

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- RF Power entered as [*numeric*][*prefix*]W or D.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is not used.

MOD3

This field specifies the measurement type:

- RF RF Power
- ZR Zero sensor
- CP Zero and Calibrate sensor

Rules:

- See Functional Capability table.
- RF is inserted in the MOD3 field when no legal MOD3 field code is entered.
- The MOD3 field may specify ZR and CP only for a Nominal Setup Test
- (MOD4 = N). However MEM is not update when MOD3 is ZR or CP.
- When the MOD3 field specifies CP the M437 NOMINAL field must specify the reference calibration factor.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.002  M437         *
  1.002  437          *                                                 S
# ----- Specify table for Power Sensor Data -----
# ----- Assume factory default table (#5) for 8482A ----
  1.002  M437                                      HP8482A        T5
# ----- Zero and Calibrate sensor -----
  1.004  DISP         Connect the HP 8482A Power Sensor to the 437B.
  1.005  MEMI         Enter sensor's reference calibration factor in percent.
  1.006  M437         pct                          HP8482A        T5
  1.007  DISP         Connect the sensor to the 1mW/50MHz POWER REF Output.
  1.008  437          1mW                          50MH              CP N
# ----- Power Measurement (Decibels) -----
  1.010  M437                         F4           HP8482A        T5
  1.011  DISP         Connect the 437B Power Sensor to Sig. Gen. RF Output.
  1.013  437          -30.00D        3.00U         100MH             RF
  2.002  437          -20.00D        1.00U         100MH             RF
  3.002  437          -10.00D        1.00U         100MH             RF
  4.002  437          0.00D          1.00U         100MH             RF
  5.002  437          10.00D         1.00U         100MH             RF
# ----- Power Measurement (Watts) -----
  6.003  437          1.00uW         20%           100MH             RF
  7.002  437          10.00uW        5%            100MH             RF
  8.002  437          100.0uW        5%            100MH             RF
  9.002  437          1.000mW        5%            100MH             RF
 10.002  437          10.00mW        5%            100MH             RF
# ----- Low Resolution -----
 11.004  M437   LOW                   F128          HP8482A
 11.005  437          0.0D                         300MH             RF S
# ----- Mid Resolution -----
 11.009  M437   MID                   F128          HP8482A
 11.010  437          0.00D                        300MH             RF S
# ----- High Resolution -----
 11.014  M437   HIGH                  F128          HP8482A
 11.015  437          0.000D                       300MH             RF S
# ----- Filter -----
 11.018  M437                         F1            HP8482A
 11.019  437          -1.00D                       150MH             RF N
 11.022  M437   HIGH                  F512          HP8482A
 11.023  437          -2.000D                      150MH             RF N
```

M437

Auxiliary Instrument Setup FSC

Description

The M437 FSC provides the additional program functions for Hewlett-Packard 437B which are not addressed by the 437 FSC.These functions include resolution, calibration factor, filter, and calibration factor table number.

Parameters

RANGE

This field specifies the resolution.

- LOW 0.1 dB (log), 1% full scale (linear)
- MID 0.01 dB (log), 0.1% full scale (linear)
- HIGH 0.001 dB (log), 0.01% full scale (linear)
- *blank* Default

Rules:

- When the Range field is blank the power-on default resolution is used, which is "MID".

NOMINAL

This field specifies the reference calibration factor or a reset.

- Reference Calibration Factor entered as: [*numeric*][*prefix*]pct.
- "*" Reset
- *blank* Not applicable

Rules:

- Legal values for reference calibration factor are 0 to 100%.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- When the NOMINAL field specifies a reset the following default values are selected:

  Resolution: MID

Filter: Auto

Cal. Factor Table: 0

TOLERANCE

This field specifies the filter.

- Number of readings to average entered as: F *average*.
- *blank* Default

Rules:

- Legal values for *average* are: 1, 2, 4, 8,... 512.
- When the TOLERANCE field is blank auto filter mode is selected.

MOD1

This field specifies the power sensor used entered as:

[HP] *model number*. Legal entries are:

HP8481A

HP8481B

HP8481D

HP8481H

HP8482A

HP8482B

HP8482H

HP8483A

HP8484A

HP8485A

HP8485D

HP8487A

HP8487D

HPQ8486A

HPQ8486D

HPR8486A

HPR8486D

HPW8486A

Rules:

- The MOD1 field must specify the power sensor model number except when the NOMINAL field specifies a reset '*'.

MOD2

This field specifies the power sensor calibration factor table to be used.

Cal factor table entered as: T [*table number*]

blank Default

Rules:

- Legal values for table number are: 0-9
- When the MOD1 field does not specify a value, the value is taken from memory register MEM2 as an ASCII integer.
- When the MOD1 field is blank table 0 is selected.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 437 FSC.

4000

Instrument FSC

Description

The 4000 FSC controls the following functions of the Datron 4000 Autocal Standard:

- DC Voltage
- DC Current and Resistance with Option 20 installed

Note

4000 FSC can be used to control a 4000 A. In this case 4000 A accuracy will be used.

Functional Capability

Function	Nominal
DC Voltage	-1200 V to 1200 V
DC Current [1]	-1.999999 A to 1.999999 A
Resistance Conductance [1]	0 Ω (Short), 1 Ω to 10 MΩ, 1S to 100nS (in decade steps)
1. With Option 20 installed.	

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.

- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used and must be blank.

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character 'O' for this field.

The internal divider allows a user to achieve higher levels ofcalibration accuracy in most circumstances; therefore the useof the divider is always automatically selected, where it is applicable.

The following table is shows effect of the MOD2 field

Function	Nominal	MOD2	Effect
DC Volts	>= 20 V	*blank*	Low output impedance
DC Volts	< 20 V	*blank*	50 Ω output impedance
DC Volts	< 20 V	0	Locked in 10 V range, low output impedance

MOD3

This field is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance,and DC Voltage >= 200mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4000		*					S	
1.002	4000	1000	1200V	1U 1/					2W
2.001	4000	10	0V	1U					2W
3.001	4000	100	-22uA	10%					2W
4.001	4000	10	20mV					N	2W
4.002	4000	A	1Z	5%					4W

4200

Instrument FSC

Description

The 4200 FSC controls the following functions of the Datron 4200 Autocal AC Standard:

- AC Voltage
- AC Current with Option 30 installed

Functional Capability

Function	Amplitude	Frequency
AC Voltage	100 μV to 19.99999 V	10 Hz to 1 MHz
	20 V to 100 V	10 Hz to200 kHz
	100 V to 199.9999 V	10 Hz to 100 kHz[1]
	200 V to 1100 V	45 Hz to 33 kHz
AC Current[2]	100 μA to 1.999999 A	10 Hz to 5 kHz
1. V x Hz product not to exceed 20e+6 2. Requires Option 30		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following:

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.

MOD2

This field is not used and must be blank.

MOD3

This field is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for AC Voltage >= 200mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4200		*					S	
1.002	4200	200	220mV	10%	50H				2W
2.001	4200	1000	1000V	1U	1kH				4W
3.001	4200	2	1.999A	1% 1/	1kH				2W
4.001	4200	A	mV	0.1U	50H				2W
5.001	4200	A	A	5%	1kH				2W
6.001	4200		1.999A		1kH			S	2W
6.002	4200	10	20mV	0.5%	1kH			C	2W

4700

Instrument FSC

Description

The 4700 FSC controls the following functions of the Datron 4700 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current with Option 20
- AC Current with Option 20
- Resistance with Option 20
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.9999 V to 199.99999 V -1100 V to 1100 V[1]		
AC Voltage	90 μV to 19.99999 V 90 μV to 199.9999 V 90 μV to 1100 V[1]	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.999999 A to 1.999999 A[2] -11 A to 11 A[3,2]		BC
AC Current	9 μA to 1.999999 A[2] 100 mA to 11 A[3,2]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 10, 1000 V Ranges (DCV & ACV)
2. Requires Option 20, DC Current, AC Current, and Resistance Functions
3. Requires Option 60, 4600 Transconductance Amplifier

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as:
- [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.

- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4700		*					S	
1.002	4700	1000	1100V	1U 1/					2W
2.001	4700	10	0V	1U					2W
3.001	4700	200	220mV	10%	50H				2W
4.001	4700	1000	1100V	1U	1kH				4W
5.001	4700	100	-22uA	10%					2W
6.001	4700	2	1.999A	1% 1/	1kH				2W
7.001	4700	A	mV	0.1U	50H				2W
8.001	4700	A	A	5%	1kH				2W
9.001	4700		1.999A		1kH			S	2W
9.002	4700	10	20mV		500H			N	2W
9.003	4700	10	20mV	0.5%	1kH			C	2W
10.001	4700	A	10Z	5%					4W

4705

Instrument FSC

Description

The 4705 FSC controls the following functions of the Datron 4705 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current
- AC Current
- Resistance
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
AC Voltage	90 μV to 199.9999 V 90 μV to 1100 V	10 Hz to 100 kHz 45 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		BC
AC Current	9 μA to 1.99999 A 100 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
1. Requires 4600 Transconductance Amplifier.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of the this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4705		*					S	
1.002	4705	1000	1100V	1U 1/					2W
2.001	4705	10	0V	1U					2W
3.001	4705	200	220mV	10%	50H				2W
4.001	4705	1000	1100V	2U	1kH				4W
5.001	4705	100	-22uA	10%					2W
6.001	4705	2	1.999A	1% 1/	1kH				2W
7.001	4705	A	mV	0.1U	50H				2W
8.001	4705	A	A	5%	1kH				2W
9.001	4705		1.999A		1kH			S	2W
9.002	4705	10	20mV		500H			N	2W
9.003	4705	10	20mV	1%	1kH			C	2W
10.001	4705	A	10Z	5%					4W

4707

Instrument FSC

Description

The 4707 FSC controls the following functions of the Datron 4707 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current with Option 27
- AC Current with Option 27
- Resistance with Option 27
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.9999 V to 199.99999 V -1100 V to 1100 V [1]		
AC Voltage	90 μV to 19.99999 V 90 μV to 199.9999 V 90 μV to 1100 V [1]	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.999999 A to 1.999999 A [2] -11 A to 11 A [2,3]		BC
AC Current	9 μA to 1.999999 A [2] 100 mA to 11 A [2,3]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 17, 1000 V Ranges (DCV & ACV).
2. Requires Option 27, DC Current, AC Current, and Resistance Functions.
3. Requires Option 60, 4600 Transconductance Amplifier.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals:

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.

- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4700		*					S	
1.002	4700	1000	1100V	1U 1/					2W
2.001	4700	10	0V	1U					2W
3.001	4700	200	220mV	10%	50H				2W
4.001	4700	1000	1100V	2U	1kH				4W
5.001	4700	100	-22uA	10%					2W
6.001	4700	2	1.999A	1% 1/	1kH				2W
7.001	4700	A	mV	0.1U	50H				2W
8.001	4700	A	A	5%	1kH				2W
9.001	4700		1.999A		1kH			S	2W
9.002	4700	10	20mV		500H			N	2W
9.003	4700	10	20mV	1%	1kH			C	2W
10.001	4700	A	10Z	5%					4W

4708

Instrument FSC

Description

The 4708 FSC controls the following functions of the Datron 4708 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 30 and Option 10 installed
- AC Current with Option 30 and Option 20 installed
- Resistance with Option 30 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage [1]	-1100 V to 1100 V		
AC Voltage [2]	90 μV to 19.99999 V 90 μV to 100.0000 V 90 μV to 750 V 90 μV to 1100 V	10 Hz to 1 MHz 10 Hz to 200 kHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A [1,3] -11 A to 11 A [1,3,4]		 BC
AC Current	9 μA to 1.99999 A [2,3] 100 mA to 11 A [2,3,4]	10 Hz to 5 kHz 10 Hz to 20 kHz	 BC
Resistance or Conductance [3]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, Ohms and Current
4. Requires 4600 Transconductance Amplifier

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.

- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* no boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4708		*					S	
1.002	4708	1000	1100V	1U 1/					2W
2.001	4708	10	0V	1U					2W
3.001	4708	200	220mV	10%	50H				2W
4.001	4708	1000	1100V	1U	1kH				4W
5.001	4708	100	-22uA	10%					2W
6.001	4708	2	1.999A	1% 1/	1kH				2W
7.001	4708	A	mV	0.1U	50H				2W
8.001	4708	A	A	5%	1kH				2W
9.001	4708		1.999A		1kH			S	2W
9.002	4708	10	20mV		500H			N	2W
9.003	4708	10	20mV	0.5%	1kH			C	2W
10.001	4708	A	10Z	5%					4W

4800

Instrument FSC

Description

The 4800 FSC controls the following functions of the Datron 4800 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 40 and Option 10 installed
- AC Current with Option 40 and Option 20 installed
- Resistance with Option 50 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 10 installed in 4800)
- AC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 20 installed in 4800)
- Wideband AC Voltage with Option 70 installed

Note

The 4800 FSC can also be used to control a 4800 A, 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V [1] -1100 V to 1100 V [1,3]		
AC Voltage	90 μV to 19.99999 V,[2] -78.69667 dBm to 28.23908 dBm	10 Hz to 1 MHz	
	90uV to 199.9999V,[2] -78.69667dBm to 48.23908dBm	10 Hz to 100 kHz	
	100 μV to 1100 V,[2,3] -78.6966 7dBm to 63.04634 dBm	10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.*			
DC Current	-1.99999 A to 1.99999 A [1,4] -11 A to 11 A [1,4,6]		BC
AC Current	9 μA to 1.99999 A [2,4] 100 mA to 11 A[2,4,6]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [5 & 1 or 2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV [7]	300 μV to 3.5 V, -57.4 dBm to 23.9 dBm	10 Hz to 30 MHz	W

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, 1000V Range
4. Requires Option 40, Current
5. Requires Option 50, Resistance
6. Requires Option 60, 4600 Transconductance Amplifier
7. Requires Option 70, Wideband ACV

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Current
  2. AC Current
  3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations And Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON	
1.001	4800		*						S	
1.002	4800	1000	1100V	1U 1/						2W
2.001	4800	10	0V	1U						2W
3.001	4800	200	220mV	10%	50H					2W
4.001	4800	1000	1100V	1U	1kH					4W
5.001	4800	100	-22uA	10%						2W
6.001	4800	2	1.999A	1% 1/	1kH					2W
7.001	4800	A	mV	0.1U	50H					2W
8.001	4800	A	A	5%	1kH					2W
9.001	4800		1.999A		1kH				S	2W
9.002	4800	10	20mV		500H				N	2W
9.003	4800	10	20mV	0.5%	1kH				C	2W
10.001	4800	A	10Z	5%						4W

4800A

Instrument FSC

Description

The 4800A FSC controls the following functions of the Datron 4800A MultifunctionCalibrator:

DC Voltage

- AC Voltage
- DC Current
- AC Current
- Resistance
- DC Current from the 4600 Transconductance Amplifier (Option 60)
- AC Current from the 4600 Transconductance Amplifier (Option 60)
- Wideband AC Voltage with Option 70 installed

Note

The 4800A FSC can also be used to control a 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V -1100 V to 1100 V		
AC Voltage[3]	90 μV to 19.99999 V -78.69667 dBm to 28.23908 dBm 90 μV to 199.9999 V -78.69667dBm to 48.23908 dBm 100 μV to 1100 V -78.69667 dBm to 63.04634 dBm	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		 BC
AC Current	9 μA to 1.99999 A 100 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	 BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV	300 μV to 3.5 V[2] -57.4 dBm to 23.9 dBm	10 Hz to 30 MHz	W

1. Requires Option 60, 4600 Transconductance Amplifier
2. Requires Option 70, Wideband ACV
3. The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as:[*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*] V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2 W 2-wire

4 W 4-wire

Rules:

2 W is automatically entered in the CON field when no CON field code is entered.

The CON field may not specify 4 W when any of the following conditions exist:

1. DC Current
2. AC Current
3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of the MET/CAL Reference Manual.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  4800A         *                                                 S
  1.002  4800A  1000   1100V          1U 1/                                 2W
  2.001  4800A  10     0V             1U                                    2W
  3.001  4800A  200    220mV          10%            50H                    2W
  4.001  4800A  1000   1100V          1U             1kH                    4W
  5.001  4800A  100    -22uA          10%                                   2W
  6.001  4800A  2      1.999A         1% 1/          1kH                    2W
  7.001  4800A  A      mV             0.1U           50H                    2W
  8.001  4800A  A      A              5%             1kH                    2W
  9.001  4800A         1.999A                        1kH                 S  2W
  9.002  4800A  10     20mV                          500H                N  2W
  9.003  4800A  10     20mV           0.5%           1kH                 C  2W
 10.001  4800A  A      100Z           5%                                    4W

 11.001  END
```

4805

Instrument FSC

Description

The 4805 FSC controls the following functions of the Datron 4805 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current
- AC Current
- Resistance
- DC Current from the 4600 Transconductance Amplifier (Option 60)
- AC Current from the 4600 Transconductance Amplifier (Option 60)
- Wideband AC Voltage with Option 70 installed

Note

The 4805 FSC can be used to control any 4700 series or 4800 series calibrator. The accuracy file corresponding to the instrument that is actually configured is used at the time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
AC Voltage	90 μV to 199.9999 V, -78.69667 dBm to 48.23908 dBm 90 μV to 1100 V, -78.69667 dBm to 48.23908 dBm	10 Hz to 100 kHz 10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.*			
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		BC
AC Current	9 μA to 1.99999 A 900 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV [2]	300 μV to 3.5 V, -57.4 dBm to 23.9 dBm	10 Hz to 30 MHz	W
1. Requires Option 60, 4600 Transconductance Amplifier 2. Requires Option 70, Wideband ACV 3. Maximum voltage = 30 x freq - 100			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:

1. DC Current
2. AC Current
3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4805		*				S		
1.002	4805	1000	1100V	1U 1/					2W
2.001	4805	10	0V	1U					2W
3.001	4805	200	220mV	10%	50H				2W
4.001	4805	1000	1100V	3U	1kH				4W
5.001	4805	100	-22uA	10%					2W
6.001	4805	2	1.999A	1% 1/	1kH				2W
7.001	4805	A	mV	0.1U	50H				2W
8.001	4805	A	A	5%	1kH				2W
9.001	4805		1.999A		1kH		S		2W
9.002	4805	10	20mV		500H		N		2W
9.003	4805	10	20mV	1%	1kH		C		2W
10.001	4805	A	1kZ	5%					4W

4808

Instrument FSC

Description

The 4808 FSC controls the following functions of the Datron 4808 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 40 and Option 10 installed
- AC Current with Option 40 and Option 20 installed
- Resistance with Option 50 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 10 installed in 4808)
- AC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 20 installed in 4808)
- Wideband AC Voltage with Option 70 installed

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V [1] -1100 V to 1100 V [1,3]		
AC Voltage	90 µV to 19.99999 V, -77.78151 dBm to 28.23908 dBm [2]	10 Hz to 1 MHz	
	90 µV to 199.9999 V, -78.69667 dBm to 48.23908 dBm [2]	10 Hz to 100 kHz	
	90 µV to 750 V, -77.78151 dBm to 59.71971 dBm [2,3]	10 Hz to 100 kHz	
	90 uV to 1100 V, -77.78151 dBm to 63.04634 dBm[2,3]	10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz. The maximum voltage decreases linearly from 199.999 9 V at 100 kHz to 19.9999 9 V at 1 MHz.*			
DC Current	-1.99999 A to 1.99999 A [1,4] -11 A to 11 A [1,4,6]		BC
AC Current	9 µA to 1.99999 A[2,4] 100 mA to 11 A[2,4,6]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps) [5 & 1 or 2]		
Wideband ACV	300 µV to 3.5 V,[7] -57.4 dBm to 23.9 dBm	10 Hz to 30 MHz	W

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, 1000 V Range
4. Requires Option 40, Current
5. Requires Option 50, Resistance
6. Requires Option 60, 4600 Transconductance Amplifier
7. Requires Option 70, Wideband ACV

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

- Nominal

This field specifies one of the following:

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field is not used and must be blank.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.

- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Current
  2. AC Current
  3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4808		*					S	
1.002	4808	1000	1100V	1U 1/					2W
2.001	4808	10	0V	1U					2W
3.001	4808	200	220mV	10%	50H				2W
4.001	4808	1000	1100V	1U	1kH				4W
5.001	4808	100	-22uA	10%					2W
6.001	4808	2	1.999A	1% 1/	1kH				2W
7.001	4808	A	mV	0.1U	50H				2W
8.001	4808	A	A	5%	1kH				2W
9.001	4808		1.999A		1kH			S	2W
9.002	4808	10	20mV		500H			N	2W
9.003	4808	10	20mV	0.5%	1kH			C	2W
10.001	4808	A	10kZ	5%					4W

4950

Instrument FSC

Description

The 4950 FSC programs the Datron 4950 Multifunction Transfer Standard to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Functional Capability

BANDS ON (MOD2 = *blank*)

Function	Range	Band	Amplitude	Frequency
DC Voltage	100 mV	0%	-15 mV to +15 mV	
	100 mV	100%	+85 mV to +115 mV	
	100 mV	100%	-115 mV to -85 mV	
	1 V	0%	-0.1 V to +0.1 V	
	1 V	100%	+0.9 V to +1.1 V	
	1 V	100%	-1.1 V to -0.9 V	
	10 V	0%	-1 V to +1 V	
	10 V	100%	+9 V to +11 V	
	10 V	190%	-11 V to -9 V	
	100 V	0%	-10 V to +10 V	
	100 V	100%	+90 V to +110 V	
	100 V	100%	-110 V to -90 V	
	1000 V	0%	-100 V to +100 V	
	1000 V	100%	+900 V to +1100 V	
	1000 V	100%	-1100 V to -900 V	

AC Voltage	1 mV	100%	0.85 mV to 1.15 mV	9 Hz to 11 Hz
	1 mV	100%	0.85 mV to 1.15 mV	18 Hz to 22 Hz
	1 mV	100%	0.85 mV to 1.15 mV	27 Hz to 33 Hz
	1 mV	100%	0.85 mV to 1.15 mV	36 Hz to 44 Hz
	1 mV	100%	0.85 mV to 1.15 mV	46.25 Hz to 63.75 Hz
	1 mV	100%	0.85 mV to 1.15 mV	270 Hz to 440 Hz
	1 mV	100%	0.85 mV to 1.15 mV	0.9 kHz to 1.1 kHz
	1 mV	100%	0.85 mV to 1.15 mV	18 kHz to 22 kHz
	1 mV	100%	0.85 mV to 1.15 mV	27 kHz to 33 kHz
	1 mV	100%	0.85 mV to 1.15 mV	45 kHz to 55 kHz
	1 mV	100%	0.85 mV to 1.15 mV	90 kHz to 110 kHz
	1 mV	100%	0.85 mV to 1.15 mV	270 kHz to 330 kHz
	1 mV	100%	0.85 mV to 1.15 mV	450 kHz to 550 kHz
	1 mV	100%	0.85 mV to 1.15 mV	0.9 MHz to 1.1 MHz
	10 mV	100%	8.5 mV to 11.5 mV	9 Hz to 11 Hz
	10 mV	100%	8.5 mV to 11.5 mV	18 Hz to 22 Hz
	10 mV	100%	8.5 mV to 11.5 mV	27 Hz to 33 Hz
	10 mV	100%	8.5 mV to 11.5 mV	36 Hz to 44 Hz
	10 mV	100%	8.5 mV to 11.5 mV	46.25 Hz to 63.75 Hz
	10 mV	100%	8.5 mV to 11.5 mV	270 Hz to 440 Hz
	10 mV	100%	8.5 mV to 11.5 mV	0.9 kHz to 1.1 kHz
	10 mV	100%	8.5 mV to 11.5 mV	18 kHz to 22 kHz
	10 mV	100%	8.5 mV to 11.5 mV	27 kHz to 33 kHz
	10 mV	100%	8.5 mV to 11.5 mV	45 kHz to 55 kHz
	10 mV	100%	8.5 mV to 11.5 mV	90 kHz to 110 kHz
	10 mV	100%	8.5 mV to 11.5 mV	270 kHz to 330 kHz
	10 mV	100%	8.5 mV to 11.5 mV	450 kHz to 550 kHz
	10 mV	100%	8.5 mV to 11.5 mV	0.9 MHz to 1.1 MHz

	100 mV	100%	85 mV to 115 mV	9 Hz to 11 Hz
	100 mV	100%	85 mV to 115 mV	18 Hz to 22 Hz
	100 mV	100%	85 mV to 115 mV	27 Hz to 33 Hz
	100 mV	100%	85 mV to 115 mV	36 Hz to 44 Hz
	100 mV	100%	85 mV to 115 mV	46.25 Hz to 63.75 Hz
	100 mV	100%	85 mV to 115 mV	270 Hz to 440 Hz
	100 mV	100%	85 mV to 115 mV	0.9 kHz to 1.1 kHz
	100 mV	100%	85 mV to 115 mV	18 kHz to 22 kHz
	100 mV	100%	85 mV to 115 mV	27 kHz to 33 kHz
	100 mV	100%	85 mV to 115 mV	45 kHz to 55 kHz
	100 mV	100%	85 mV to 115 mV	90 kHz to 110 kHz
	100 mV	100%	85 mV to 115 mV	270 kHz to 330 kHz
	100 mV	100%	85 mV to 115 mV	450 kHz to 550 kHz
	100 mV	100%	85 mV to 115 mV	0.9 MHz to 1.1 MHz
	1 V	100%	0.9 V to 1.1 mV	9 Hz to 11 Hz
	1 V	100%	0.9 V to 1.1 mV	18 Hz to 22 Hz
	1 V	100%	0.9 V to 1.1 mV	27 Hz to 33 Hz
	1 V	100%	0.9 V to 1.1 mV	36 Hz to 44 Hz
	1 V	100%	0.9 V to 1.1 mV	46.25 Hz to 63.75 Hz
	1 V	100%	0.9 V to 1.1 mV	270 Hz to 440 Hz
	1 V	100%	0.9 V to 1.1 mV	0.9 kHz to 1.1 kHz
	1 V	100%	0.9 V to 1.1 mV	18 kHz to 22 kHz
	1 V	100%	0.9 V to 1.1 mV	27 kHz to 33 kHz
	1 V	100%	0.9 V to 1.1 mV	45 kHz to 55 kHz
	1 V	100%	0.9 V to 1.1 mV	90 kHz to 110 kHz
	1 V	100%	0.9 V to 1.1 mV	270 kHz to 330 kHz
	1 V	100%	0.9 V to 1.1 mV	450 kHz to 550 kHz
	1 V	100%	9 V to 11 V	0.9 MHz to 1.1 MHz

	10 V	100%	9 V to 11 V	9 Hz to 11 Hz
	10 V	100%	9 V to 11 V	18 Hz to 22 Hz
	10 V	100%	9 V to 11 V	27 Hz to 33 Hz
	10 V	100%	9 V to 11 V	36 Hz to 44 Hz
	10 V	100%	9 V to 11 V	46.25 Hz to 63.75 Hz
	10 V	100%	9 V to 11 V	270 Hz to 440 Hz
	10 V	100%	9 V to 11 V	0.9 kHz to 1.1 kHz
	10 V	100%	9 V to 11 V	18 kHz to 22 kHz
	10 V	100%	9 V to 11 V	27 kHz to 33 kHz
	10 V	100%	9 V to 11 V	45 kHz to 55 kHz
	10 V	100%	9 V to 11 V	90 kHz to 110 kHz
	10 V	100%	9 V to 11 V	270 kHz to 330 kHz
	10 V	100%	9 V to 11 V	450 kHz to 550 kHz
	10 V	100%	9 V to 11 V	0.9 MHz to 1.1 MHz
	10 V	190%	18 V to 19.5 V	0.9 kHz to 1.1 kHz
	100 V	100%	90 V to 110 V	9 Hz to 11 Hz
	100 V	100%	90 V to 110 V	18 Hz to 22 Hz
	100 V	100%	90 V to 110 V	27 Hz to 33 Hz
	100 V	100%	90 V to 110 V	36 Hz to 44 Hz
	100 V	100%	90 V to 110 V	46.25 Hz to 63.75 Hz
	100 V	100%	90 V to 110 V	270 Hz to 440 Hz
	100 V	100%	90 V to 110 V	0.9 kHz to 1.1 kHz
	100 V	100%	90 V to 110 V	18 kHz to 22 kHz
	100 V	100%	90 V to 110 V	27 kHz to 33 kHz
	100 V	100%	90 V to 110 V	45 kHz to 55 kHz
	100 V	100%	90 V to 110 V	90 kHz to 110 kHz
	100 V	100%	90 V to 110 V	180 kHz to 220 kHz

	1000 V	70%	600 V to 800 V	45 kHz to 55 kHz
	1000 V	70%	600 V to 800 V	90 kHz to 110 kHz
	1000 V	100%	900 V to 1100 V	9 Hz to 11 Hz
	1000 V	100%	900 V to 1100 V	18 Hz to 22 Hz
	1000 V	100%	900 V to 1100 V	27 Hz to 33 Hz
	1000 V	100%	900 V to 1100 V	36 Hz to 44 Hz
	1000 V	100%	900 V to 1100 V	46.25 Hz to 63.75 Hz
	1000 V	100%	900 V to 1100 V	270 Hz to 440 Hz
	1000 V	100%	900 V to 1100 V	0.9 kHz to 1.1 kHz
	1000 V	100%	900 V to 1100 V	18 kHz to 22 kHz
	1000 V	100%	900 V to 1100 V	27 kHz to 33 kHz
DC Current	100 µa	0%	-10.µA to +10 µA	
	100 µA	100%	+90 µA to +110 µA	
	100 µA	100%	-110 µA to -90 µA	
	1 mA	0%	-0.1 mA to +0.1 mA	
	1 mA	100%	+0.9 mA to +1.1 mA	
	1 mA	100%	-1.1 mA to -0.9 mA	
	10 mA	0%	-1 mA to +1 mA	
	10 mA	100%	+9 mA to +11 mA	
	10 mA	100%	-11 mA to -9 mA	
	100 mA	0%	-10 mA to +10 mA	
	100 mA	100%	+90 mA to +110 mA	
	100 mA	100%	-110 mA to -90 mA	
	1 A	0%	-0.1 A to +0.1 A	

	1 A	100%	+0.9 A to +1.1 A	
	1 A	100%	-1.1 A to -0.9 A	
	10 A[1]	0%	-1 A to +1 A	
	10 A[1]	100%	+9 A to +11 A	
	10 A[1]	100%	-11 A to -9 A	
AC Current	100 µA	100%	90 µA to 110 µA	9 Hz to 11 Hz
	100 µA	100%	90 µA to 110 µA	18 Hz to 22 Hz
	100 µA	100%	90 µA to 110 µA	27 Hz to 33 Hz
	100 µA	100%	90 µA to 110 µA	36 Hz to 44 Hz
	100 µA	100%	90 µA to 110 µA	46.25 Hz to 63.75 Hz
	100 µA	100%	90 µA to 110 µA	270 Hz to 440 Hz
	100 µA	100%	90 µA to 110 µA	0.9 kHz to 1.1 kHz
	100 µA	100%	90 µA to 110 µA	4.5 kHz to 5.5 kHz
	100 µA	100%	90 µA to 110 µA	9 kHz to 11 kHz
	100 µA	100%	90 µA to 110 µA	18 kHz to 22 kHz
	100 µA	100%	90 µA to 110 µA	27 kHz to 33 kHz
	1 mA	100%	0.9 mA to 1.1 mA	9 Hz to 11 Hz
	1 mA	100%	0.9 mA to 1.1 mA	18 Hz to 22 Hz
	1 mA	100%	0.9 mA to 1.1 mA	27 Hz to 33 Hz
	1 mA	100%	0.9 mA to 1.1 mA	36 Hz to 44 Hz
	1 mA	100%	0.9 mA to 1.1 mA	46.25 Hz to 63.75 Hz
	1 mA	100%	0.9 mA to 1.1 mA	270 Hz to 440 Hz
	1 mA	100%	0.9 mA to 1.1 mA	0.9 kHz to 1.1 kHz
	1 mA	100%	0.9 mA to 1.1 mA	4.5 kHz to 5.5 kHz
	1 mA	100%	0.9 mA to 1.1 mA	9 kHz to 11 kHz
	1 mA	100%	0.9 mA to 1.1 mA	18 kHz to 22 kHz
	1 mA	100%	0.9 mA to 1.1 mA	27 kHz to 33 kHz

	10 mA	100%	9 mA to 11 mA	9 Hz to 11 Hz
	10 mA	100%	9 mA to 11 mA	18 Hz to 22 Hz
	10 mA	100%	9 mA to 11 mA	27 Hz to 33 Hz
	10 mA	100%	9 mA to 11 mA	36 Hz to 44 Hz
	10 mA	100%	9 mA to 11 mA	46.25 Hz to 63.75 Hz
	10 mA	100%	9 mA to 11 mA	270 Hz to 440 Hz
	10 mA	100%	9 mA to 11 mA	0.9 kHz to 1.1 kHz
	10 mA	100%	9 mA to 11 mA	4.5 kHz to 5.5 kHz
	10 mA	100%	9 mA to 11 mA	9 kHz to 11 kHz
	10 mA	100%	9 mA to 11 mA	18 kHz to 22 kHz
	10 mA	100%	9 mA to 11 mA	27 kHz to 33 kHz
	100 mA	100%	90 mA to 110 mA	9 Hz to 11 Hz
	100 mA	100%	90 mA to 110 mA	18 Hz to 22 Hz
	100 mA	100%	90 mA to 110 mA	27 Hz to 33 Hz
	100 mA	100%	90 mA to 110 mA	36 Hz to 44 Hz
	100 mA	100%	90 mA to 110 mA	46.25 Hz to 63.75 Hz
	100 mA	100%	90 mA to 110 mA	270 Hz to 440 Hz
	100 mA	100%	90 mA to 110 mA	0.9 kHz to 1.1 kHz
	100 mA	100%	90 mA to 110 mA	4.5 kHz to 5.5 kHz
	100 mA	100%	90 mA to 110 mA	9 kHz to 11 kHz
	100 mA	100%	90 mA to 110 mA	18 kHz to 22 kHz
	100 mA	100%	90 mA to 110 mA	27 kHz to 33 kHz
	1 A	100%	0.9 A to 1.1 A	9 Hz to 11 Hz
	1 A	100%	0.9 A to 1.1 A	18 Hz to 22 Hz
	1 A	100%	0.9 A to 1.1 A	27 Hz to 33 Hz
	1 A	100%	0.9 A to 1.1 A	36 Hz to 44 Hz
	1 A	100%	0.9 A to 1.1 A	46.25 Hz to 63.75 Hz

	1 A	100%	0.9 A to 1.1 A	270 Hz to 440 Hz
	1 A	100%	0.9 A to 1.1 A	0.9 kHz to 1.1 kHz
	1 A	100%	0.9 A to 1.1 A	4.5 kHz to 5.5 kHz
	1 A	100%	0.9 A to 1.1 A	9 kHz to 11 kHz
	1 A	100%	0.9 A to 1.1 A	18 kHz to 22 kHz
	1 A	100%	0.9 A to 1.1 A	27 kHz to 33 kHz
	10 A[1]	100%	9 A to 11 A	9 Hz to 11 Hz
	10 A[1]	100%	9 A to 11 A	18 Hz to 22 Hz
	10 A[1]	100%	9 A to 11 A	27 Hz to 33 Hz
	10 A[1]	100%	9 A to 11 A	36 Hz to 44 Hz
	10 A[1]	100%	9 A to 11 A	46.25 Hz to 63.75 Hz
	10 A[1]	100%	9 A to 11 A	270 Hz to 440 Hz
	10 A[1]	100%	9 A to 11 A	0.9 kHz to 1.1 kHz
	10 A[1]	100%	9 A to 11 A	4.5 kHz to 5.5 kHz
	10 A[1]	100%	9 A to 11 A	9 kHz to 11 kHz
	10 A[1]	100%	9 A to 11 A	18 kHz to 22 kHz
Resistance	10 Ω	0%	0 Ω to 1 Ω	
	10 Ω	10%	0 Ω to 2 Ω	
	10 Ω	30%	2 Ω to 4 Ω	
	10 Ω	100%	9 Ω to 11 Ω	
	10 Ω	190%	18 Ω to 19.5 Ω	
	100 Ω	0%	0 Ω to 10 Ω	
	100 Ω	30%	20 Ω to 40 Ω	
	100 Ω	100%	90 Ω to 110 Ω	
	100 Ω	190%	180 Ω to 195 Ω	
	1 kΩ	0%	0 k Ω to 0.1 kΩ	

	1 kΩ	30%	0.2 k Ω to 0.4 k Ω
	1 kΩ	100%	0.9 kΩ to 1.1 kΩ
	1 kΩ	190%	1.8 kΩ to 1.95 kΩ
	10 kΩ	0%	0 kΩ to 1 kΩ
	10 kΩ	30%	2 kΩ to 4 kΩ
	10 kΩ	100%	9 k Ω to 11 kΩ
	10 kΩ	190%	18 kΩ to 19.5 kΩ
	100 kΩ	0%	0 kΩ to 10 kΩ
	100 kΩ	30%	20 kΩ to 40 k Ω
	100 kΩ	100%	90 kΩ to 110 kΩ
	100 kΩ	190%	180 kΩ to 195 kΩ
	1 MΩ	0%	0 MΩ to 0.1 MΩ
	1 MΩ	30%	0.2 MΩ to 0.4 MΩ
	1 MΩ	100%	0.9 MΩ to 1.1 MΩ
	1 MΩ	190%	1.8 MΩ to 1.95 MΩ
	10 MΩ	0%	0 MΩ to 1 MΩ
	10 MΩ	30%	2 MΩ to 4 MΩ
	10 MΩ	100%	9 MΩ to 11 MΩ
	10 MΩ	190%	18 MΩ to 19.5 MΩ
	100 MΩ	0%	0 MΩ to 10 MΩ
	100 MΩ	30%	20 MΩ to 40 MΩ
	100 MΩ	100%	90 MΩ to 110 MΩ

BANDS OFF (MOD2 = "O")

Function	Amplitude	Frequency
DC Voltage	-1100 V to 1100 V	
AC Voltage	0.85 mV to 19.99999 V	9 Hz to 1.1 MHz
	20 V to 199.9999 V	9 Hz to 220 kHz
	200 V to 800 V	9 Hz to 110 kHz
	>800 V to 1100 V	9 Hz to 33 kHz
Resistance	Ω to 199.999999 MΩ	
DC Current	-1.999999 A to 1.999999 A	
	-19.99999 A to 19.99999 A[1]	
AC Current	90 μA to 1.999999 A	10 Hz to 33 kHz
	2 A to 19.99999 A[1]	10 Hz to 22 kHz
Frequency	9 Hz to 1.1 MHz	0.85 mV to 19.99999 V
	9 Hz to 220 kHz	20 V to 199.9999 V
	9 Hz to 110 kHz	200 V to 800 V
	9 Hz to 33 kHz	>800 V to 1100 V
	10 Hz to 33 kHz	90 μA to 1.999999 A
	10 Hz to 22 kHz[1]	2 A to 11 A
1. Requires 4953 AC/DC Shunt		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.

- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as[*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one the band limits mode:

- *blank* Bands On
- Override (Bands Off)

MOD3

This field specifies the accuracy mode for the instrument.

- *blank* High accuracy

- F Low accuracy

Note

MOD3 does not effect the measurement accuracy of a frequency measurement. Therefore, if MOD3 is left blank for frequency, measurement execution time will be increased with no increase in accuracy.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON may specify 4W only for either for the following conditions:
  1. Resistance (i.e. the Nominal field units are ohms).
  2. AC voltage (i.e. the Nominal or MOD1 field units are volts and and the MOD1 field is not blank) and
     a) the M4950 Nominal field locks the 1 V or 10 V range and
     b) the M4950 MOD1 field is 300 kHz, 500 kHz, or 1 MHz.

Using the Datron 4950

In most respects the Datron 4950 functions like any other supported system instrument. However, since the 4950 is designed to internally take a sequence of measurements and return to the user the mean of the measurements and the standard error, MET/CAL handles the 4950 as a special case. When the number of measurements (NMEAS) is set to 1, and when the 4950 is in a mode in which the sample size is greater than 1, MET/CAL uses the standard error calculated by the 4950 as the basis for the determination of the standard deviation.

The calculation is:

Standard Deviation = Standard Error * (N ^ 0.5)

where N is the sample size.

Note that this operation is different from the normal operation when NMEAS is 1. Normally, when NMEAS is 1, no standard deviation is determined, which causes S1 to be zero, which in turn causes U2 to be based only on the UUT's resolution.

It remains possible, even with the Datron 4950, for the procedure writer to override the default calculation. For example, if the procedure includes a VSET statement which directly specifies the value of S1, MET/CAL will no longer use the Standard Error calculated by the 4950, even if NMEAS is set to 1 and the 4950 sample size is greater than 1.

Setting NMEAS to any value greater than 1 disables the built-in use of the standard error calculated by the 4950. For example, suppose NMEAS is 5 and the 4950 is in high accuracy DCI mode. The sample size is 32, and the 4950 calculates the standard error, but MET/CAL will make no use of the calculated standard error in the measurement uncertainty calculation. Rather, in this case, MET/CAL will simply calculate the standard deviation of 5 readings (each of which is really based on 32 internal readings).

If the 4950 is used in a mode in which the sample size is 1 (for example, low accuracy ACV), the procedure writer should set the number of measurements to a value greater than 1 in order to include in the measurement uncertainty calculation the standard deviation of a sequence of measurements.

For additional information refer to the "Sample Size and Resolution" table on page 6-17 of the "Wavetek Model 4950 Multifunction Transfer Standard Instrument User's Handbook" (December 1998).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001 ASK-   R   Q N              P                              F        V

# -----  Number of Measurement to average in MET/CAL is set to one because
# -----  the 4950 internal number of samples and standard error are used
# -----  for the measurement uncertainty calculation.
  1.002 VSET         NMEAS = 1

# -----  Establish reset command for UUT.
  1.003 RESET        *CLS;*RST;*OPC?[I!]

# -----  DC Voltage
  1.004 DISP         Connect the 4950 Input Cable to the 5700A as follows:
  1.004 DISP         [32] 4950 Hi Lead to 5700A OUTPUT HI
  1.004 DISP         [32] 4950 Lo Lead to 5700A OUTPUT LO
  1.004 DISP         [32] 4950 I+ Lead to 5700A SENSE HI
  1.004 DISP         [32] 4950 I- Lead to 5700A SENSE LO
  1.005 IEEE         OUT 0V;OPER;*OPC?[I!]
  1.006 M4950  RNGLK 100mV          0%
  1.007 4950   220   0.00000mV      7P% 0.00075U                          2W
  2.001 IEEE         OUT 100mV;OPER;*OPC?[I!]
  2.002 M4950  RNGLK 100mV          100%
  2.003 4950   220   100.00000mV    7P% 0.00075U                          2W
  3.001 IEEE         *CLS;*RST;*OPC?[I!]

# -----  AC Voltage
  3.002 IEEE         OUT 1V,10Hz;OPER;*OPC?[I!]
  3.003 M4950  RNGLK 1V             100%          10H
  3.004 4950   2.2   1.000000V      550P% 100e-6U 10H                     2W
  4.001 IEEE         OUT 1V,10kHz;OPER;*OPC?[I!]
  4.002 M4950  RNGLK 1V             100%          10kH
  4.003 4950   2.2   1.000000V      75P% 7e-6U    10kH                    2W
  5.001 IEEE         *CLS;*RST;*OPC?[I!]

# -----  Resistance
  5.002 IEEE         OUT 0Ohm;EXTSENSE ON;OPER;*OPC?[I!]
  5.003 M4950  RNGLK 10Z            0%
  5.004 4950   0     0.0000000Z     0.0000500U                            4W
  6.001 IEEE         OUT 10Ohm;EXTSENSE ON;OPER;*OPC?[I!]OUT?[I]
  6.002 M4950  RNGLK 10Z            100%
  6.003 4950   10    Z              0.000028U                             4W
  7.001 IEEE         OUT 19Ohm;EXTSENSE ON;OPER;*OPC?[I!]OUT?[I]
  7.002 M4950  RNGLK 10Z            190%
```

```
  7.003  4950   19    Z              0.000026U                              4W
  8.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  DC Current
  8.002  DISP         Connect the 4950 Input cable to the 5700A as follows.
  8.002  DISP         [32] 4950 I+ Lead to 5700A OUTPUT HI
  8.002  DISP         [32] 4950 I- Lead to 5700A OUTPUT LO
  8.003  M4950  RNGLK 1mA            0%
  8.004  4950         0.000mA                                      F  N  2W
  8.005  IEEE         OUT 0mA;OPER;*OPC?[I!]
  8.006  4950   2.2   0.000mA        50P% 0.010U                            2W
  9.001  M4950  RNGLK 1mA            100%
  9.002  4950         1.000mA                                      F  N  2W
  9.003  IEEE         OUT 1mA;OPER;*OPC?[I!]
  9.004  4950   2.2   1.000mA        50P% 0.010U                            2W
 10.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  AC Current
 10.002  M4950  RNGLK 100mA          100%          10H
 10.003  4950         100.000mA                    10H             F  N  2W
 10.004  IEEE         OUT 100mA,10Hz;OPER;*OPC?[I!]
 10.005  4950   220   100.000mA      700P% 5e-6U   10H                    2W
 11.001  M4950  RNGLK 100mA          100%          1kH
 11.002  4950         100.000mA                    1kH             F  N  2W
 11.003  IEEE         OUT 100mA,1kHz;OPER;*OPC?[I!]
 11.004  4950   220   100.000mA      150P% 4e-6U   1kH                    2W
 12.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  4953 10A Current Shunt
 12.002  DISP         Connect the 4950 Input cable to 4953 Shunt as follows:
 12.002  DISP         [32] 4950 Hi Lead to 4953 Hi
 12.002  DISP         [32] 4950 Lo Lead to 4953 Lo
 12.002  DISP
 12.002  DISP         Connect the 5725A to the 4953 Shunt as follows:
 12.002  DISP         [32] 5725A CURRENT OUTPUT HI to 4953 I+
 12.002  DISP         [32] 5725A CURRENT OUTPUT LO to 4953 I-
 12.003  M4950  RNGLK 10A            100%
 12.004  4950         10.00000A                                    F  N  2W
 12.005  IEEE         OUT 10A;OPER;*OPC?[I!]
 12.006  4950   11    10.00000A      340P% 480e-9U                          2W
 13.001  M4950  RNGLK 10A            100%          40H
 13.002  4950         10.0000A                     40H             F  N  2W
 13.003  IEEE         OUT 10A,40Hz;OPER;*OPC?[I!]
 13.004  4950   11    10.0000A       400P% 170e-9U 40H                    2W
 14.001  M4950  RNGLK 10A            100%          5kH
```

```
14.002  4950         10.0000A                    5kH             F  N  2W
14.003  IEEE         OUT 10A,5kHz;OPER;*OPC?[I!]
14.004  4950   11    10.0000A       850P% 380e-9U 5kH                   2W
```

M4950

Instrument FSC

Description

The M4950 FSC provides additional functions for the Datron 4950 Multimeter that are not addressed in the 4950 FSC. These functions include measurement range, percentage band, and guard.

Parameters

RANGE

This field must be "RNGLK".

Rules:

- "RNGLK" is inserted automatically if no range field code is entered.

NOMINAL

This field specifies the locked range.

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z

Rules:

Function	M4950 Nominal	Locked Range
DC Voltage	10 mV to 100 mV	100 mV
	100 mV to 1 V	1 V
	1 V to 10 V	10 V
	10 V to 100 V	100 V
	100 V to 1000 V	1000 V
AC Voltage	0 mV to 1 mV	1 mV
	1 mV to 10 mV	10 mV
	10 mV to 100 mV	100 mV
	100 mV to 1V	1 V

	1 V to 10 V	10 V
	10 V to 100 V	100 V
	100 to 1000 V	1000 V
DC Current	0 µA to 100 µA	100 µA
	100 µA to 1 mA	1 mA
	1 mA to 10 mA	10 mA
	10 mA to 100 mA	100 mA
	100 mA to 1 A	1 A
	1 A to 10 A	10 A
AC Current	0 µA to 100 µA	100 µA
	100 µA to 1 mA	1 mA
	1 mA to 10 mA	10 mA
	10 mA to 100 mA	100 mA
	100 mA to 1 A	1 A
	1 A to 10 A	10 A
Resistance	0 Ω to 10 Ω	10 Ω
	10 Ω to 100 Ω	100 Ω
	100 Ω to 1 kΩ	1 kΩ
	1 kΩ to 10 kΩ	10 kΩ
	10 kΩ to 100 kΩ	100 kΩ
	100 kΩ to 1 MΩ	1 MΩ
	1 MΩ to 10 MΩ	10 MΩ
	10 MΩ to 100 MΩ	100 MΩ

Tolerance

This field specifies the band selection value:

Band selection value entered as: 0%, 10%, 30%, 70%, 100%, or 190%.

Rules:

See MOD1 field.

MOD1

This field specifies the frequency band center:

- Band selection value entered as: *numeric* [*prefix*]H

Rules:

Function	Locked Range	M4950 Tolerance	M4950 MOD1
DC Voltage	100 mV	0%, 100%	
	1 V	0%, 100%	
	10 V	0%, 100%, 190%	
	100 V	0%, 100%	
	1000 V	0%, 100%	
AC Voltage	1 mV	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	10 mV	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	100 mV	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	1 V	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	10 V	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 300, 500 kHz 1 MHz
	10 V	190%	1 kHz
	100 V	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 200 kHz
	1000 V	70%	50, 100 kHz
	1000 V	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30 kHz
DC Current	100 µA	0%, 100%	
	1 mA	0%, 100%	
	10 mA	0%, 100%	

	100 mA	0%, 100%	
	1 A	0%, 100%	
	10 A	0%, 100%	
AC Current	100 µA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	1 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	10 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	100 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	1 A	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	10 A	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20 kHz
Resistance	10 Ω	0%, 10%, 30%, 100%, 190%	
	100 Ω	0%, 30%, 100%, 190%	
	1 kΩ	0%, 30%, 100%, 190%	
	10 kΩ	0%, 30%, 100%, 190%	
	100 kΩ	0%, 30%, 100%, 190%	
	1 MΩ	0%, 30%, 100%, 190%	
	10 MΩ	0%, 30%, 100%, 190%	
	100 MΩ	0%, 30%, 100%	

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is used to specify the guard connection:

"G" remote guard

blank local guard

CON

This field is not used.

Examples

See 4950 FSC.

5001

Instrument FSC

Description

The 5001 FSC programs the Tektronix CG 5001 or CG 551AP Calibration Generator, respectively, to provide the following:

Voltage to check vertical and horizontal gain.

Current to check current probes and amplifiers.

Edges to check the transient response of amplifiers and attenuator networks.

Markers & Slewed Edge to check the timing accuracy of horizontal sweep rates.

Comparator Test to check the accuracy of calibrator outputs.

Functional Capability

Function	Nominal	MOD1
Amplitude Mode: Voltage	40 mVpp to 80 mVpp [3] 100 mVpp to 5 Vpp [3] 6 Vpp to 10 Vpp [2] 12 Vpp to 200 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz
Amplitude Mode: Current	1 mApp to 100 mApp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Amplitude Mode: Edge	20 mVpp to 1 Vpp [1] 1.2 Vpp to 100 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Fast Edge	1.1 Vpp [1]	100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Comparator	100 mVpp to 100 Vpp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Timing Mode: Slewed Edge	0.4 ns & 0.5 ns - 10 ns, 2.5 GHz to 100 MHz [1]	
Timing Mode: Markers	10 ns to 5 s, 100 MHz to 0.2 Hz [1]	

1. 50 Ω Load
2. ≥1 MΩ Load
3. 50 Ω or ≥1 MΩ Load

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage or current for Amplitude Mode or the period or frequency for Timing Mode.

Voltage entered as: [numeric][prefix]Vpp

Current entered as [numeric][prefix]A.

Period entered as [numeric][prefix]T.

Frequency entered as [numeric][prefix]H.

Reset entered as *.

Rules:

Amplitude Mode cardinal values are within the specified range and a decade value of one of the following factors: 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 7, or 8.

The Timing Mode cardinal values are within the specified range and a decade value of one of 1, 2, or 5.

The NOMINAL field entries must be within 9.9% of these cardinal values.

For Edge (MOD3 = E) and Fast Edge (MOD3 = FE) modes, the edge polarity is selected as follows:

NOMINAL > 0 Positive Edge

NOMINAL < 0 Negative Edge

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for Amplitude Mode.

Frequency entered as numeric[prefix]H.

blank not applicable

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies the function when Amplitude Mode is specified and the NOMINAL field units are volts:

blank Voltage or not applicable

E Edge

FE Fast Edge

CO Comparator

Rules:

The MOD2 field must be blank when the NOMINAL field units are not volts.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the input impedance that should be present at the Unit Under Test (UUT).

blank 1 MΩ or greater

L 50 Ω

Rules:

The CON field must be blank for:

Voltage > 5 Vpp

Current

Edge > 1.1 Vpp

Slewed Edge (5001 only)

Markers

The CON field may be either L or blank for comparator tests with voltage < 5 Vpp.

When the CON field is L, the procedure writer must instruct the operator to select the 50 Ω input impedance on the UUT or instruct the operator to use a 50 Ω termination at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5001         *                                              S
  1.002  5001         *                                              S
# ----- Amplitude Mode: Current -----
  1.003  5001         100mA          0.1%          100kH          -D
# ----- Amplitude Mode: Voltage -----
  2.001  5001   5     40uVpp         1%            10H            -D
# ----- Amplitude: Edge -----
  3.001  5001   100   20mVpp         1%            1kH            -D E     L
# ----- Amplitude Mode: Fast Edge -----
  4.001  5001         1.1Vpp                       10kH           -D FE S  L
# ----- Timing Mode: Slewed Edge -----
  4.002  5001    5    2.5GH          1%
# ----- Timing Mode: Markers -----
  5.001  5001   10    10 nT          1%
# ----- Amplitude Mode: Comparator Function -----
  6.001  5001   10    100mVpp        1%            1kH               CO
```

MCAL

Instrument FSC

Description

The MCAL FSC provides additional program functions for the Tektronix CG 5001 and CG 551AP Calibration Generator, not addressed in the 5001 FSC.

The special functions specified by the MCAL FSC will become effective in the first 5001 FSC that follows the MCAL FSC and remain in effect until they are disabled or changed by another MCAL FSC.

To return back to the original settings, use:

```
STEP  FSC RANGE NOMINAL TOLERANCE  MOD1 MOD2  3  4  CON
2.001 MCAL      10P               15,0E             1T
```

Parameters

RANGE

Not used.

NOMINAL

The Nominal field specifies the minimum repetition rate that the CG5001 is allowed to use for the Markers mode before switching to the Slewed Edge mode.

This value is entered by: *repetition rate*P

The allowed values are expressed in nanoseconds and must be one of 10, 20, 50, 100, or 200.

If no value is entered, the default value of 10P (for 10 ns) is automatically entered.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the number of edges and how far the first edge is shifted from the trigger pulse for the Slewed Edge mode. These values are entered in the following format:

The allowed values for the number of edges are integers ranging from 1 to 15.

The allowed values for the number shifts are integers ranging from -99 to +99.

If no value is entered for the first parameter (no comma is entered), then a default value of 15, *number of shifts* E is entered.

If no value is entered for the second parameter, than a default value of *number of edges* ,0E is entered.

If no value is entered at all, then a default value of 15,0E is entered.

MOD2

The MOD2 specifies that every tenth pulse of the Marker mode is to be accentuated.

This function is entered by entering the character 'M' in the MOD2 field.

If nothing is entered then the Magnifier is disabled.

M may be used with 5001 nominal values greater than 1 µs or less than 1 MHz.

MOD3

The MOD3 field specifies whether narrow markers should be used for slow marker repetition rates.

The narrow markers functions are selected by entering the character 'N' in this field.

If nothing is entered, the markers are returned to their normal widths.

N may be used with nominal values between 10 µs to 5 s.

MOD4

The MOD4 field specifies a 100 ns delay between the trigger and the fast-edge pulse. This delay is useful for oscilloscopes that have no internal delay between the trigger and vertical amplifier inputs.

This delay is programmed by entering a 'D' in this field.

If nothing is entered, the 100 ns delay is disabled.

CON

The CON field specifies the Trigger Rate for all functions except the Slewed Edge function. Allowed entries are:

CON entry	Effect
0T	Turn off the trigger
1T	Turn on trigger in Normal Mode
2T	Turn on trigger at x .1 of output rate
3T	Turn on trigger at x .01 of output rate

The default value entered is '1T'.

Miscellaneous

The interrelationships between the MCAL and 5001 FSCs are not verified when the procedure is compiled. Errors reported during procedure execution may occur as a result of improper parameter combinations.

Use of Standard Memory Locations

The content of standard memory registers is not affected by the MCAL FSC.

Automatic Messages

There are no automatic messages created with the MCAL FSC.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.001   MCAL         10P                          15,0E                  1T
3.002   MCAL         10P                          15,0E          M  N  D  1T
```

5011

Instrument FSC

Description

The 5011 FSC programs the Tegam and Tektronix CG 5011 Calibration Generator, respectively, to provide the following:

Voltage to check vertical and horizontal gain.

Current to check current probes and amplifiers.

Edges to check the transient response of amplifiers and attenuator networks.

Markers to check the timing accuracy of horizontal sweep rates.

Comparator Test to check the accuracy of calibrator outputs.

Functional Capability

Function	Nominal	MOD1
Amplitude Mode: Voltage	 40 mVpp to 80 mVpp [3] 100 mVpp to 5 Vpp [3] 6 Vpp to 10 Vpp [2] 12 Vpp to 200 Vpp [2]	 10 Hz, 100 Hz, 1 kHz, 10 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz
Amplitude Mode: Current	1 mApp to 100 mApp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Amplitude Mode: Edge	20 mVpp to 1 Vpp [1] 1.2 Vpp to 100 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Fast Edge	1.1 Vpp [1]	100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Comparator: Timing Mode: Markers	 100 mVpp to 100 Vpp 0.5 ns to 5 s, 2 GHz to 0. 2 Hz [1]	 DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
1. 50 Ω Load 2. ≥1 MΩ Load 3. 50 Ω or ≥1 MΩ Load		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage or current for Amplitude Mode or the period or frequency for Timing

MODE

This field specifies the UUT range as described in the section “General Rules for Instrument Evaluation FSCs”.

Voltage entered as: [numeric][prefix]Vpp

Current entered as [numeric][prefix]A.

Period entered as [numeric][prefix]T.

Frequency entered as [numeric][prefix]H.

Reset entered as *.

Rules:

Amplitude Mode cardinal values are within the specified range and a decade value of one of the following factors: 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 7, or 8.

The Timing Mode cardinal values are within the specified range and a decade value of one of 1, 2, or 5.

The NOMINAL field entries must be within 9.9% of these cardinal values.

For Edge (MOD3 = E) and Fast Edge (MOD3 = FE) modes, the edge polarity is selected as follows:

NOMINAL >0 Positive Edge

NOMINAL < 0 Negative Edge

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for Amplitude Mode.

Frequency entered as numeric[prefix]H.

blank not applicable

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies the function when Amplitude Mode is specified and the NOMINAL field units are volts:

blank	Voltage or not applicable
E	Edge
FE	Fast Edge
CO	Comparator

Rules:

The MOD2 field must be blank when the NOMINAL field units are not volts.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the input impedance that should be present at the Unit Under Test (UUT).

blank 1 MΩ or greater

L 50 Ω

Rules:

The CON field must be blank for:

Voltage > 5 V pp

Current

Edge > 1.1 V pp

Markers

The CON field may be either L or blank for comparator tests with voltage < 5 V pp.

When the CON field is L, the procedure writer must instruct the operator to select the 50 Ω input impedance on the UUT or instruct the operator to use a 50 Ω termination at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5011         *                                              S
  1.002  5011         *                                              S
# ----- Amplitude Mode: Current -----
  1.003  5001         100mA          0.1%          100kH          -D
# ----- Amplitude Mode: Voltage -----
  2.001  5011   5     40uVpp         1%            10H            -D
# ----- Amplitude: Edge -----
  3.001  5011   100   20mVpp         1%            1kH            -D E     L
# ----- Amplitude Mode: Fast Edge -----
  4.001  5011         1.1Vpp                       10kH           -D FE S  L
# ----- Timing Mode: Markers -----
  5.001  5011   10    0.5nT          1%
# ----- Amplitude Mode: Comparator Function -----
  6.001  5011   10    100mVpp        1%            1kH               CO
```

M511

Auxiliary Instrument Setup FSC

Description

The M511 FSC provides additional program functions for the Tegam and Tektronix CG5011 Programmable Calibration Generator, not addressed in the 5011 FSC.

The special functions specified by the M511 FSC will become effective in the first 5011 FSC that follows the M511 FSC and remain in effect until they are disabled or changed by another M511 FSC.

To return back to the original settings, use:

```
STEP  FSC RANGE NOMINAL TOLERANCE  MOD1 MOD2  3  4  CON
2.001 M511                                          1T
```

Parameters

RANGE

Not used.

NOMINAL

Not used.

TOLERANCE

Not used.

MOD1

Not used.

MOD2

The MOD2 specifies that every tenth pulse of the Marker mode is to be accentuated.

This function is entered by entering the character 'M' in the MOD2 field.

If nothing is entered then the Magnifier is disabled.

M may be used with 5011 nominal values greater than 1 us or less than 1 MHz.

MOD3

The MOD3 field specifies whether narrow markers should be used for

slow marker repetition rates.

The narrow markers functions are selected by entering the character 'N' in this field.

If nothing is entered, the markers are returned to their normal widths.

N may be used with nominal values between 10 µs to 5s.

MOD4

The MOD4 field specifies a 100 ns delay between the trigger and the fast-edge pulse. This delay is useful for oscilloscopes that have no internal delay between the trigger and vertical amplifier inputs.

This delay is programmed by entering a 'D' in this field.

If nothing is entered, the 100 ns delay is disabled.

CON

The CON field specifies the Trigger Rate for all functions. Allowed entries are:

CON entry	Effect
0T	Turn off the trigger
1T	Turn on trigger in Normal Mode
2T	Turn on trigger at x .1 of output rate
3T	Turn on trigger at x .01 of output rate

The default value entered is '1T'.

Miscellaneous

The interrelationships between the M511 and 5011 FSCs are not verified when the procedure is compiled. Errors reported during procedure execution may occur as a result of improper parameter combinations.

Use of Standard Memory Locations

The content of standard memory registers is not affected by the M511 FSC.

Automatic Messages

There are no automatic messages created with the M511 FSC.

Examples

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.001  M511                                                        1T
3.002  M511                                                  M  N  D  1T
```

5030

Instrument FSC

Description

The 5030 FSC programs the Tegam and Tektronix SG 5030 Leveled Sine Wave Generators.

Functional Capability

Amplitude values of 1.59 V to 1.94 V, 4.5 mVpp to 5.5 Vpp, -49.95 dBm to +18.75 dBm.

Frequency or Period 0.1 Hz to 550 MHz, 1.8182 ns to 10 s.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Voltage (into 50 Ω, dBm) entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Reset entered as *.

Rules:

When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.

When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Voltage (into 50 Ω, dBm) entered as: [numeric][prefix]D

Rules:

When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.

When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 5030 Leveling Head

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58XXA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58XXA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5030         *                                                 S
  1.003  5030   A     -42.95D        1U            100kH          -D
  2.001  5030   1     100mV                        550MH          -D    S
  2.002  5030   0.5   28mVpp         5U            100kH          -D
  3.001  5030   A     D              1U            100kH          -D
  4.001  5030         V              1%            100kH          -D
  5.001  5030   50    10uT           1% 1/ 1U      -35D
  6.001  5030   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the SG 5030 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  5030   20    120mVpp                      100kH                N
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  5030         5MH            -100%         mVpp           -D
  8.001  MESS
  8.002  ASK+         N
  8.003  END
```

5050

Instrument FSC

Description

The 5050 FSC programs the Tegam SG 5050 Leveled Sine Wave Generator.

Functional Capability

Amplitude

1.59 V to 1.94 V, 4.5 mVpp to 5.5 Vpp, -49.95 dBm to +18.75 dBm

Frequency or Period

0.1 Hz to 2.5 GHz, 0.4 ns to 10 s

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Voltage (into 50 Ω, dBm) entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Reset entered as *.

Rules:

When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.

When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Voltage (into 50 •, dBm) entered as: [numeric][prefix]D

Rules:

When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.

When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank"/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 5050 Leveling Head

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5050         *                                                 S
  1.003  5050   A     -42.95D        1U            100kH          -D
  2.001  5050   1     100mV                        550MH          -D    S
  2.002  5050   0.5   28mVpp         5U            100kH          -D
  3.001  5050   A     D              1U            100kH          -D
  4.001  5050         V              1%            100kH          -D
  5.001  5050   50    10uT           1% 1/ 1U      -35D
  6.001  5050   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                    F        W
  7.002  ASK+     D
  7.003  DISP         Connect the SG 5050 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  5050   20    120mVpp                      100kH                N
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  5050         5MH            -100%         mVpp           -D
  8.001  MESS
  8.002  ASK+         N
  8.003  END
```

5100

Instrument FSC

Description

The 5100 FSC programs the Fluke 5100B Calibrator to output DC voltage, AC voltage, DC current, and AC current. 5100B resistance is programmed using the RESF FSC. 5100B wideband AC voltage is programmed using the WIDE FSC.

Functional Capability

Function	Nominal	MOD1
DC Voltage	-1100 V to 1100 V	
AC Voltage	1 μV to 19.9999 V (-117 dBm to 28.239 dBm)[2] 1 μV to 110 V (-117 dBm to 43.046 dBm)[2] 1 μV to 1100 V (-117 dBm to 63.046 dBm)[2]	50 Hz to 50 kHz[1] 50 Hz to 20 kHz[1] 50 Hz to 1 kHz[1]
DC Current	±(9 μA to 1.99999 A)	
AC Current	9 μA to 1.99999 A (accuracy specification up to 1 kHz only)	50 Hz to 5 kHz[1]

1. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not.

2. All dBm values are into 600 Ω.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

Voltage (DC or RMS) entered as: [numeric][prefix]V

Decibels entered as: [numeric][prefix]D

Current entered as [numeric][prefix]A.

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current.

Frequency entered as numeric[prefix]H.

blank DC

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character 'O' for this field.

The use of internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances; therefore the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

The high burden property of the UUT requires divider override to maintain calibration accuracy.

Fewer operator interactions will be necessary and the feature of the (external) divider is not necessary, resulting in shorter calibration times.

The following table shows effect of the MOD2 field

Function	Nominal	MOD2	Effect
DC Volts	≥ 20 V		Low output impedance
DC Volts	< 20 V		50 Ω output impedance
DC Volts	< 20 V	O	Locked in 20 V range, low output impedance
AC Volts	≥ 2 V		Low output impedance
AC Volts	≥ 20 mV & < 200 mV		50 Ω output impedance
AC Volts	< 20 mV		External 1000:1 50 Ω divider. Reduced system noise levels.
AC Volts	< 20 mV	O	Internal divider

An external 1000:1 divider is supplied with every calibration system, which uses the 5100B as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is typically

not necessary, however to calibrate wideband voltmeters, this external divider should be used.

MOD3

This field is used to specify accuracy enhancement. Accuracy enhancement in this case means that the output of the 5100B is measured by the typically higher accuracy voltmeter in the calibration system.

The value measured by the voltmeter is then used as a further reference to execute the procedure step. The exact operation depends on the type of test; refer to the information under MOD4 for more information on the type of tests. A regular and fast mode of accuracy enhancement can be selected.

In the DC Voltage function, accuracy enhancement applies to almost the full range of allowed values (exception: 128V to 200V).

In the AC Voltage mode, accuracy enhancement can only be used between 12.5 mV and 600V, assuming the external divider is not used. If the external divider is used for nominal values below 20 mV, accuracy enhancement can be selected to improve the accuracy at the input of the external divider.

During Setup procedure steps only, another mode of accuracy enhancement is possible with the 8506A DMM. The output of the 5100B can be changed depending on the reading of the 8506A. Refer to the following accuracy enhancement information.

MOD3	MOD4	Effect
(blank)	(any)	No accuracy enhancement specified
-E	(any)	Prevent automatic accuracy enhancement
E or EF	(blank)	Apply stimulus from 5100B, nominal value. Adjust manually the stimulus so that the UUT reads nominal. Read adjusted output with the voltmeter, compare the result to the UUT nominal value, and generate the result.
E	S	Apply the stimulus Adjust the stimulus to the nominal based on a reading by the voltmeter.
EF	S	Apply the stimulus The voltmeter measures the stimulus of the 5100B, and stores the reading in MEM1.

Automatic Selection of Accuracy Enhancement

Accuracy enhancement is specified automatically where the accuracy of the UUT requires the highest accuracy from the calibration system. Automatic accuracy enhancement selection is dependent on the mode (DC or AC Voltage), the Nominal Voltage (in NOMINAL field), and the specified Tolerance (in TOLERANCE field). The following information shows the conditions for automatic accuracy enhancement selection:

Function	Nominal	UUT Tolerance
Volts DC	≥0.02 V	< 0.02 %
Volts AC	≥0.2 V	< 0.2 %

Prevention of Automatic Accuracy Enhancement Selection

Automatic insertion of accuracy enhancement is prevented by entering -E during entry of the calibration step. This entry remains and is shown in the procedure listing.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

4W 4-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5100         *                                              S
# ----- DC Voltage -----
  1.002  5100   1000  1000mV         0.05% 1U                              2W
  2.001  5100   2     -1.999V        1000P/                  O             2W
  3.001  5100   20    20mV           6%                      O  -E         2W
  4.001  5100   200   -20mV          0.019%                     E          2W
# ----- AC Voltage -----
  5.001  5100   10    1mV            +1U -2U       50H                     2W
  6.001  5100   1000  1100V          +2U -4U       1kH                     2W
  7.001  5100   A     mV             100P%         50H                     2W
  8.001  5100   20    12.6mV         2%            1kH             O  E    2W
# ----- Decibels -----
  9.001  5100   10    10D            0.1U          50kH                    2W
# ----- DC Current -----
 10.001  5100   2     1.999A         1%                                    2W
# ----- AC Current -----
 11.001  5100         100uA          1% 1/         1kH                     2W
 12.001  5100         10uA                         50H                  S  2W
 12.002  5100   A     1.999A         -1U +0.1%     1kH                     2W
```

5130

Instrument FSC

Description

The 5130 FSC instructs the system to request a voltage or current stimulus from the Fluke 5130A Calibrator. Ω stimulus from the 5130A is obtained using the RESF FSC.

RANGE

Specifies the UUT range in units of the Nominal Value or Autorange.

Allowed entries: numeric, numericR A, AR.

NOMINAL

Starting Nominal value of the 5130A output or reset: ('*').

Allowed values:

Volts, DC		
-1100 V to +1100 V		(V)
Volts, AC		
1 μV to 19.9999 V	50 Hz to 50 kHz	(V)
20 V to 110 V	50 Hz to 20 kHz	(V)
110 V to 1100 V	50 Hz to 1 kHz	(V)
(All values of dBm are into 600 Ω)		
-117 dBm to 28.239 dBm	50 Hz to 50 kHz	(D)
-117 dBm to 43.046 dBm	50 Hz to 20 kHz	(D)
-117 dBm to 63.046 dBm	50 Hz to 1 kHz	(D)
Amps, DC		
9 μA to 1.99999 A		(A)
-1.99999 A to -9 μA		(A)
Amps, AC		
9 μA to 1.99999 A	50 Hz to 5 kHz	(A)
Note: Accuracy specification up to 1 kHz only		

TOLERANCE

Specifies the tolerances that UUT results are evaluated against. The tolerances should reflect the instrument specifications of the UUT at the Nominal value. Entries (3 max) used:

numeric% (% of reading)	numeric/ (% of range)
numericP% (PPM of reading)	numericP/ (PPM of range)
numericU (Units of nominal) TOL	(from last TOL FSC)

MOD1

Frequency of the Nominal value for AC Volts and Current. See also under Nominal. Allowed values and units:

MOD1 Values	MOD1 Units	Nominal Values
50 Hz to 1 kHz	(H)	1 µV to 1100 V
50 Hz to 20 kHz	(H)	1 µV to 110 V
50 Hz to 50 kHz	(H)	1 µV to 19.9999 V
50 Hz to 5 kHz	(H)	9 µA to 1.99999 A

Additional Note

The value of frequency must have single-digit resolution. For example 50H or 60H are allowed, but 55H is not.

MOD2

The MOD2 field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character 'O' for this field.

The use of internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances; therefore the use of the divider is always automatically selected, where it is applicable.

There are two sets of reasons to override the use of the divider.

The high burden property of the UUT requires divider override to maintain calibration accuracy.

Fewer operator interactions will be necessary and the feature of the (external) divider is not necessary, resulting in shorter calibration times.

In the following table is shown the entry in the MOD2 field, the mode of the 5130A, the Nominal value and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 20 V	50 Ω output impedance from 5130A
(blank)	Volts DC	≥20 V	Low output impedance from 5130A
(blank)	Volts AC	<20 mV	External 1000:1 50 Ω divider used reduced system noise levels
(blank)	Volts AC	≥20 mV	50 Ω output <200 mV impedance from 5130A
(blank)	Volts AC	≥2 V	Low output impedance from 5130A
O	Volts DC	< 20 V	5130A fixed in 20 V range
O	Volts DC	≥20 V	Not applicable
O	Volts AC	<20 mV	5130A fixed in 2 V range, external divider not used
O	Volts AC	≥20 mV	Not applicable

An external 1000:1 divider is supplied with every calibration system, which uses the 5130A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is typically not necessary, however to calibrate wideband voltmeters, this external divider should be used.

MOD3

Not used.

MOD4

Specifies the type of test being performed:

blank	Evaluation test
S	Setup test
N	Nominal Set test
C	Comparison test

CON

The CON field specifies the UUT connection. Possible entries are:

2W for a 2-wire connection to the UUT.

4W for a 4-wire connection to the UUT.

If nothing is entered, the system will automatically insert 2W.

In case of the Volts AC mode and the external 1000:1 divider is specified and:

Nominal value is less than 20 mV,

divider override (0) is not specified in the MOD2 field

The calibration system will solicit a connection to the terminals using the external AC Divider.

Four-wire (4W) stimulus is not applicable in some situations:

Volts DC, Nominal < 2V unless MOD2 is O

Volts AC, Nominal < 200 mV

Current DC and AC

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.003 5130       *                              S
1.005 5130 1000  1000mV  0.05% 1U                    2W
9.002 5130 10    1mV     +1U -2U   50H               2W
4.001 5130 1000  1100V   +2U -4U   1kH               2W
6.001 5130 10    10D     0.1U      50kH              2W
2.003 5130 2     1.999A  1%                          2W
4.002 5130 20    10uA    1% 1/     50H               2W
4.003      5130  10uA              50H           S   2W
6.003 5130 A     mV      100P%     50H               2W
3.002 5130 A     1.999A  -1U +0.1% 1kH               2W
3.001 5130 2     -1.999V 1000P/           O          2W
```

RESF

Instrument FSC

Description

The RESF FSC provides fixed resistance or conductance from the Fluke 5100B Calibrator.

Functional Capability

1 Ω to 10 MΩ (1 s to 100 ns) in decade steps

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the resistance, conductance, or specifies a reset.

Resistance entered as: [numeric][prefix]V

Current entered as: [numeric][prefix]A

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This selection is used to compensate for lead resistance in the two-wire ohms mode. If the character 0 (for Offset) is entered in this field, the contents of

memory location MEM are used instead of the value in the NOMINAL field for comparison against the expected nominal value.

To take advantage of this feature, use another DMM, e.g., 8506A, to measure the total of the lead resistance and the value of resistance being measured. Then store this measurement in MEM, and evaluate the UUT with the nominal value of resistance (with the 0 selection specified.)

The following example tests the accuracy of a UUT at 100 Ω in two-wire mode:

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
1.004  ASK-   R
1.005  HEAD         LOW RESISTANCE/HIGH CONDUCTANCE TEST
1.006  RESF         100.0Z                                          S   2W
1.007  DISP         Configure the 8506A as follows:
1.007  DISP         8506A: Input-Hi to 8506A: Source-Hi
1.007  DISP         8506A: Input-Lo to 8506A: SOurce-Lo
1.007  DISP         Press the 4T  Ω button in to enable 4-wire ohms.
1.008  IEEE         [@8506]G3?[I]
1.009  MEME
1.010  JMPT         1.013
1.011  DISP         Press the FRONT/REAR select switch.
1.012  JMP          1.008
1.013  DISP         Connect the 5100B and the 8506A as follows:
1.013  DISP         5100B: Output-Hi to 8506A: Input-Hi
1.013  DISP         5100B: Output-Lo to 8506A: Input-Lo
1.014  8506         100Z                                            N   4W
1.015  MEME
1.016  DISP         Disconnect the 8506A from the 5100B.
1.016  DISP         Connect the 5100B and the UUT as follows:
1.016  DISP         5100B: Output-Hi to UUT V/ Ω
1.016  DISP         5100B: Output-Lo to UUT COMMON
1.017  RESF         100Z            0.7% 0.2U                  O         2W
```

The explanation is as follows:

Step 1.004 disables the regular range and function messages.

Step 1.006 applies 100 Ω from the 5100B in the two-wire mode.

Step 1.007 wires the 8506A up in the four-wire mode, directly on its front panel input terminals.

Step 1.008 checks that the FRONT/REAR selection switch of the 8506A is in the FRONT position. If it is not, the operator is prompted as defined in step 1.011.

The output of the 5100B is now connected and then measured with the leads up to the front panel of the 8506A in steps 1.013 and 1.014. The result is stored in MEM1, then it is moved over to MEM in step 1.015.

The test leads are now moved over from the 8506A input to the UUT input in step 1.016.

The performance of the UUT is now evaluated against the value in MEM in step 1.017 (note the 0 selection).

MOD3

This field specifies the guard connection.

G	External guard connection is active
blank	Guard is internally shorted to low.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W	2-wire
4W	4-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

4W does not apply for 5100B resistance values over 10 kΩ.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
   STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
   1.001  RESF          *                                            S
   1.002  RESF   100    100kZ          5.0%                             2W
   2.001  RESF   10     10Z            500P%                            4W
   3.001  RESF   10     10MZ           10000P/                          2W
   4.001  RESF   200    100Z           5.0%                             4W
   5.001  RESF   10     Z              5.0U                             4W
   6.001  RESF   10     1mY            4000P/                           4W
   6.002  RESF   1      0.1Y           5.0%                             4W
   7.001  RESF   1      1Z             5%                               4W
   8.001  RESF          1Z                                           S  4W
```

WIDE

Instrument FSC

Description

The WIDE FSC provides voltage from the 5100B-03 Wideband AC option installed in a 5100B Calibrator.

Functional Capability

Nominal	MOD1
270 μV to 3.1623 V, -58.362 dBm to +23 dBm	10 Hz to 10 MHz

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

Voltage (RMS) entered as: [numeric][prefix]V

Decibels entered as: [numeric][prefix]D

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency entered as [numeric][prefix]H.

Rules:

The value of frequency must have single-digit resolution. For example, 50H or 60H are allowed, but 55H is not.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection. A 50 Ω load is required. If the UUT does not have an internal 50 Ω input impedance or termination, the procedure must inform the operator to connect such a device to the end of the BNC cable near the input of the UUT. The procedure writer can use the DISP FSC to create such a message.

2W 2-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  WIDE         *                                                S
  1.003  WIDE   10    3.1623V        1% 0.1U       10MH                   2W
  2.001  WIDE   A      -57.5D        2%            10H                    2W
  3.001  WIDE   A     V              1%            10kH                   2W
  4.001  WIDE   A     D              0.1U          20kH                   2W
  5.001  WIDE   1     1V             5%            10kH                   2W
# ----- Setup Test ----
  6.001  WIDE         1V                           10kH                S  2W
  6.002  WIDE   1     1V                           10kH                N  2W
  6.003  WIDE   1     1V             5%            20kH                C  2W
```

5191

Instrument FSC

Description

The 5191 FSC programs the Fluke/Philips PM 5191 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 30 Vpp 0 V to 10.6 V -45 dBm to +27 dBm	0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz	SI SI SI
Square	0 Vpp to 30 Vpp 0 V to 15 V -45 dBm to +30 dBm	0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz	SQ SQ SQ
Triangle	0 Vpp to 30 Vpp 0 V to 8.6 V -45 dBm to +25 dBm	0.1 mHz to 200 kHz 0.1 mHz to 200 kHz 0.1 mHz to 200 kHz	TI TI TI
Positive Sawtooth	0 Vpp to 15 Vpp 0 V to 4.3 V -45 dBm to +19 dBm	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST
Negative Sawtooth	<0 Vpp to –15 Vpp <0 V to -4.3 V dBm not available	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

Voltage (DC or RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Decibels entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Reset entered as *.

Rules:

A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be blank. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.

When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Decibels entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

blank DC

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.

The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

blank	DC Volts
SI	Sine
SQ	Square
TI	Triangle
ST	Sawtooth

Rules:

The MOD3 field must be blank when the MOD1 field is blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

blank Open circuit

L 50 Ω

Rules:

If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5191         *                                              S
# ----- DC Voltage -----
  1.002  5191         1V                                             S
# ----- Sine w/1V DC offset -----
  2.001  5191   A     5V             1U            100kH          -D SI
# ----- Square -----
  3.001  5191   1     10Vpp          10%           10kH           -D SQ
# ----- Triangle -----
  4.001  5191   0.5   0.28Vpp        8/            100kH          -D TI
# ----- Sine (decibels) -----
  5.001  5191   A     D              1U            100kH          -D SI    L
# ----- Period -----
  6.001  5191   0.2   1T             1% 1/ 1U      1Vpp           -D SI
```

5192

Instrument FSC

Description

The 5192 FSC programs the Fluke/Philips PM 5192 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 20 Vpp 0 V to 7 V -45 dBm to +24 dBm	0.1 mHz to 20 MHz 0.1 mHz to 20 MHz 0.1 mHz to 20 MHz	SI SI SI
Square	0 Vpp to 20 Vpp 0 V to 10 V -13 dBm to +27 dBm	0.1 mHz to 20 MHz 0.1 mHz to 20 MHz 0.1 mHz to 20 MHz	SQ SQ SQ
Triangle	0 Vpp to 20 Vpp 0 V to 5.7 V -45 dBm to +22 dBm	0.1 mHz to 200 kHz 0.1 mHz to 200 kHz 0.1 mHz to 200 kHz	TI TI TI
Positive Sawtooth	0 Vpp to 10 Vpp 0 V to 2.8 V -48 dBm to +16 dBm	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST
Negative Sawtooth	<0 Vpp to -10 Vpp <0 V to -2.8 V dBm not available	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

Voltage (DC or RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Decibels entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

Reset entered as *.

Rules:

A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be blank. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.

When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Decibels entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

blank DC

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.

The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- ST Sawtooth

Rules:

The MOD3 field must be blank when the MOD1 field is blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Open circuit

L 50 Ω

Rules:

If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5192         *                                                S
# ----- DC Voltage -----
  1.002  5192         1V                                               S
# ----- Sine w/1V DC offset -----
  2.001  5192   A     5V             1U            100kH          -D SI
# ----- Square -----
  3.001  5192   1     10Vpp          10%           10kH           -D SQ
# ----- Triangle -----
  4.001  5192   0.5   0.28Vpp        8/            100kH          -D TI
# ----- Sine (decibels) -----
  5.001  5192   A     D              1U            100kH          -D SI    L
# ----- Period -----
  6.001  5192   0.2   1T             1% 1/ 1U      1Vpp           -D SI
```

5193

Instrument FSC

Description

The 5193 FSC programs the Fluke/Philips PM 5193 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 20 Vpp, 0 V to 7 V, -45 dBm to +24 dBm	0.1 mHz to 50 MHz	SI
Square	0 Vpp to 20 Vpp, 0 V to 10 V, -13 dBm to +27 dBm	0.1 mHz to 20 MHz	SQ
Triangle	0 Vpp to 20 Vpp, 0V to 5.7 V, -45 dBm to +22 dBm	0.1 mHz to 200 kHz	TI
Positive Sawtooth	0 Vpp to 10 Vpp, 0 V to 2.8 V, -48 dBm to +16 dBm	0.1 mHz to 20 kHz	ST
Negative Sawtooth	<0 Vpp to -10 Vpp, <0 V to -2.8 V, dBm not available	0.1 mHz to 20 kHz	ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Decibels entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.

Reset entered as *.

Rules:

A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be blank. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.

When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

Voltage (RMS) entered as: [numeric][prefix]V

Voltage (peak-to-peak) entered as: [numeric][prefix]Vpp

Decibels entered as: [numeric][prefix]D

Frequency entered as [numeric][prefix]H.

Period entered as [numeric][prefix]T.

blank DC

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.

The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

-D "/div" is not included

blank "/div" is included if ASK+ D is in effect

Rules:

The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

blank	DC Volts
SI	Sine
SQ	Square
TI	Triangle
ST	Sawtooth

Rules:

The MOD3 field must be blank when the MOD1 field is blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

blank	Open circuit
L	50 Ω

Rules:

If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5193         *                                              S
# ----- DC Voltage -----
  1.002  5193         1V                                             S
# ----- Sine w/1V DC offset -----
  2.001  5193   A     5V            1U            100kH          -D SI
# ----- Square -----
  3.001  5193   1     10Vpp         10%           10kH           -D SQ
# ----- Triangle -----
  4.001  5193   0.5   0.28Vpp       8/            100kH          -D TI
# ----- Sine (decibels) -----
  5.001  5193   A     D             1U            100kH          -D SI    L
# ----- Period -----
  6.001  5193   0.2   1T            1% 1/ 1U      1Vpp           -D SI
```

5200

Instrument FSC

Description

The 5200 FSC programs the Fluke 5200A AC Calibrator.

Functional Capability

Nominal	MOD1
100 mV to 119.9999 V, -77.78 dBm to +43.8 dBm[1]	10 Hz to 1.199 MHz
120 V to 1100 V, 43.803 dBm to 63 dBm[2]	10 Hz to 100 kHz
1. Product of voltage and frequency not to exceed 10^7 when frequency > 100 kHz. 2. With 5205A or 5215A Power Amplifier.	

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

Voltage (RMS) entered as: [numeric][prefix]V

Decibels entered as: [numeric][prefix]D

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency entered as [numeric][prefix]H.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

4W 4-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

The CON field may specify 4W only when the amplitude is 0.12 V to 119.9999 V (-16.19 dBm to +43.8 dBm).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
   STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
   1.001  5200         *                                                S
   1.003  5200   1     0.1mV          1U 1%         10H                    2W
   2.001  5200   100   10V            0.05U 1%      1MH                    2W
   2.002  5200   1000  1000V          1U 1% 1/      100kH                  2W
   3.001  5200   50    -77.78D        5U            10H                    2W
   4.001  5200   50    43.9D          0.1U          100H                   2W
   5.001  5200   50    D              1U            100kH                  2W
   6.001  5200   1     0.12V          +0.1U         10H                    2W
```

5205

Instrument FSC

Description

The 5205 FSC programs the Fluke 5205A or 5215A Power Amplifier via the 5100B or 5130A Calibrator. To use the 5205A with Fluke 5200A AC Calibrator, use the 5200 FSC. To use the 5205A with the Fluke 5700A Multi-function Calibrator, use the 5700 FSC.

Functional Capability

Function	Nominal	MOD1
DC Voltage	-1100 V to 1100 V[1]	
AC Voltage	20 V to 1100 V, 28.24 dBm to +63.046 dBm[2]	50 Hz to 50 kHz[3]

1. 5205A only.
2. All values in dBm are into 600 Ω.
3. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

Voltage (DC or RMS) entered as: [numeric][prefix]V

Decibels entered as: [numeric][prefix]D

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for AC Voltage.

Frequency entered as [numeric][prefix]H.

blank DC

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
# ----- Reset -----									
1.001	5205		*					S	
1.002	5205	1000	1100V	-5% 5000P/					2W
2.001	5205	60	63.046D	0.1U	50kH				2W
3.001	5205	A	1100V	5%	50kH				2W
4.001	5205	1000	1100V	5%	50kH				2W
5.001	5205		1100V		50kH			S	2W

5220

Instrument FSC

Description

The 5220 FSC programs the Fluke 5220A Transconductance Amplifier via the 5100B or 5130A Calibrator. To use the 5220A with Fluke 5440B DC Calibrator, use the 5440 FSC. To use the 5220A with the Fluke 5700A Multi-function Calibrator, use the 5700 FSC.

Functional Capability

Function	Nominal	MOD1
DC Current	-19.9999 A to 19.9999 A	
AC Current	1 A to 19.9999 A	50 Hz to 5 kHz[1]
1. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not.		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the current or reset.

Current (DC or RMS) entered as: [numeric][prefix]A

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for AC Current.

Frequency entered as [numeric][prefix]H.

blank DC

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
    STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5220          *                                                S
  1.002  5220   20     -19A           -5% 4000P%                           2W
  2.001  5220   A      19A            5000P%        50H                    2W
  3.001  5220   10     2A             -5%           1kH                    2W
  4.001  5220   20     10A            5%            1kH                    2W
  5.001  5220          10A                          1kH                 S  2W
  6.001  5220          10A            5%            500H                N  2W
  7.001  5220          10A            5%            1kH                 C  2W
```

5335

Instrument FSC

Description

The 5335 FSC programs the Hewlett-Packard 5335A Universal Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, and DC voltage. Not all 5335A capabilities are supported. To program unsupported functions, use the IEEE FSC.

Parameters

The following table shows the relationship between the supported 5335A measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	0 Hz to 200 MHz	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Frequency C[1]	FC	150 MHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm
Ratio A|B	FR	10^{-8} to 10^{16}	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Period A	PA	10 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Time Interval A-B	TI	0 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Phase A-B	PR	-180 ° to + 360 °	0.01 Hz to 160 MHz
Pulse Width A	WA	5 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Duty Cycle A	DA	1% to 99%	0 Hz to 100 MHz
Rise|Fall Time A	RF	20 ns to 10 ms	500 mVpp to 50 Vpp 177 mV rms to 17.7 V rms
DC Voltmeter [2]		-1000 V to 1000 V	*blank*

1. Requires Option 030:1.3 GHz C Channel.
2. Requires Option 020:DC Digital Voltmeter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *numeric* [*prefix*] H.
- Frequency Ratio entered as *numeric* [*prefix*] H/H.
- Period entered as *numeric* [*prefix*] T.
- Time Interval entered as *numeric* [*prefix*] T.
- Phase entered as *numeric* [*prefix*] deg.
- Pulse Width entered as *numeric* [*prefix*] T.
- Duty Cycle entered as *numeric* [*prefix*] pct.
- Rise or Fall Time entered as *numeric* [*prefix*] T.
- Voltage entered as *numeric* [*prefix*] V.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *numeric* [*prefix*] V
- Voltage (Peak) entered as: *numeric* [*prefix*] Vp

- Voltage (Peak-to-Peak) entered as: *numeric* [*prefix*] Vpp
- Voltage (into 50 •, dBm) entered as: *numeric* [*prefix*] D
- Frequency entered as *numeric* [*prefix*] H.
- *blank*

Rules:

- For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field is not used.

MOD3

This field specifies the measurement function:

- FA Frequency A
- FC Frequency C
- PA Period A
- FR Ratio A/B
- TI Time Interval A to B
- WA Pulse Width A
- RF Rise or Fall Time A
- PR Phase A Relative to B
- DA Duty Cycle A
- *blank* DC Voltage

Rules:

- The MOD3 field may specify Frequency C (FC) only when the Option 030: 1.3 GHz C Channel C is installed.
- FA is automatically inserted in the MOD3 field when the nominal field units are Hertz and no legal MOD3 code is entered.
- FR is automatically inserted in the MOD3 field when the nominal field units are Hertz/Hertz and no legal MOD3 code is entered.
- PA is automatically inserted in the MOD3 field when the nominal field units are seconds and no legal MOD3 code is entered.

- PR is automatically inserted in the MOD3 field when the nominal field units are degrees and no legal MOD3 code is entered.
- DA is automatically inserted in the MOD3 field when the nominal field units are percent and no legal MOD3 code is entered.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

MOD3	CON
blank	2W
not blank	L or *blank*

- The CON field may specify L for MOD3 = FA, PA, FR, TI, WA, RF, PR, or DA, only when Option 040 "Programmable Input Amplifiers"is not installed.
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC) and no legal CON field code is entered.
- 2W is inserted automatically in the CON field when the MOD3 field is blank and no legal CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3   4 CON
# ----- Reset -----
  1.001  M5335        *
  1.002  5335         *
# ----- Frequency A -----
  1.003  M5335  ChA                                100kH
  1.004  5335         10.000kH       1%            1Vpp              FA
# ----- Frequency C -----
  2.001  5335         100MH          0.1%          -1D               FC    L
# ----- Period A -----
  3.001  M5335        *
  3.002  5335         1.000mT        0.003U        5V                PA
# ----- Ratio A/B -----
  4.001  M5335  ChA                                                  AC
  4.002  M5335  ChB                                                  DC
  4.003  5335         10H/H          1%            1Vpp                 FR
# ----- Time Interval A to B -----
  5.001  M5335  COM   20T            0.2V          0.8V              DC ++    X1
  5.002  5335         10.00T         0.02U         1Vpp                 TI
# ----- Pulse Width A -----
  6.001  M5335        *
  6.002  5335         300uT          5%            5Vp               WA
# ----- Rise Time A -----
  7.002  5335         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M5335        *
  8.002  5335         30deg          1U            10kH              PR    L
# ----- Duty Cycle A -----
  9.001  5335         30.0pct        2%            100H              DA
```

M5335

Auxiliary Instrument Setup FSC

Description

The M5335 FSC provides the additional program functions for Channel A and Channel B of the Hewlett-Packard 5335A Universal Counter which are not addressed by the 5335 FSC. These functions include Common B via A, gate time, and trigger slope. Input coupling, attenuation, and impedance along with the trigger level and channel A low-pass filter may also be specified if Option 040 "Programmable Input Amplifiers" is installed in the counter.

Parameters

Option 040 not installed

Range	Nominal	TOL	MOD1	MOD2	MOD3	CON
ChA	[gate time]				[slope]	
ChA	[gate time]				[slope]	
COM	[gate time]				[slope]	
	*|gate time					

Option 040 installed

Range	Nominal	TOL	MOD1	MOD2	MOD3	CON
ChA	[gate time]	[level]	[LP filter]	[coupling]	[slope]	[attn]
ChA	[gate time]	[level]		[coupling]	[slope]	[attn]
COM	[gate time]	[level]	[level]	[coupling]	[slope]	[attn]
	*|gate time					

Note

Blank entries in the above table are significant and must be blank. [] denotes optionality and | denotes "or". FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Channel specific parameters are not "sticky". For example, if a M5335 FSC specifies channel A trigger level and then a subsequent M5335 FSC specifies channel slope and attenuation, the trigger level field will be viewed and *blank* and auto level will be selected.

```
STEP    FSC    RANGE NOMINAL    TOLERANCE     MOD1    MOD2  3  4 CON
1.001  M5335  ChA              1.0V
1.002  M5335  ChA                                      +        X10

1.003  M5335  ChA              1.0V                    +        X10
```

Statements 1.001 and 1.002 should be combined as statement 1.003 to preserve the trigger level specification.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- M5335 FSC parameters, other than gate time are ignored under the following conditions:

1. The RANGE field specifies Channel B and the 5335 FSC specifies Frequency A, Period A, Pulse Width A, or DC Voltmeter (5335 MOD3 field is FA, PA, WA, or blank respectively).
2. The RANGE field specifies Common B via A and the 5335 FSC specifies a measurement function other than Time Interval A-B (5335 MOD3 field is not TI).
3. The 5335 FSC specifies Frequency C (MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Gate Time entered as: *numeric* [*prefix*]T.
- Allowed values are: 100 ns to 10^7 s.
- "*" Reset to defaults
- *blank*

Rules:

- This field is ignored and GATE MODE MIN is selected when the 5335 MOD3 field is any of the following:

TI	Time Interval A to B
WA	Pulse Width A
RF	Rise or Fall Time A
PR	Phase A Relative to B

- This field is ignored when the 5335 MOD3 field is blank.
- Gate Time is not channel specific. It may be specified in a separate M5335 statement or in conjunction with a channel A or channel B specification. Either way, the last Gate Time specification prior to a 5335 statement is used.

Gate Time	Gate Mode
100 µs to 20 ms	Fast
20 ms to 30 s	Normal

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

- Allowed values for trigger level are –5 V to +5 V.
- The TOLERANCE field specifies the channel A trigger level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank or Option 040, "Programmable Input Amplifiers", is not installed.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric* [*prefix*] H.
- The Channel B Trigger Level entered as *numeric* [*prefix*] V.
- *blank* Auto Level (default) or not applicable.

Rules:

- Allowed values for trigger level are –5 V to +5 V.
- Allowed value for channel A low-pass filter is 150 kHz.
- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 150 kHz.
- The MOD1 field may specify the channel B trigger level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank or Option 040, "Programmable Input Amplifiers" is not installed.

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank* Default

5335 MOD3	Description	Default Coupling
FA	Frequency A	AC
FC	Frequency C	na
PA	Period A	AC
FR	Ratio A|B	AC
WA	Pulse Width A	DC
TI	Time Interval A-B	AC
PR	Phase A-B	AC
DA	Duty Cycle A	DC
RF	Rise Time A	DC
blank	DC Volts	na

Rules:

- The MOD2 field must be blank if Option 040 "Programmable Input Amplifiers" is not installed.
- Default values are used when one of the following conditions exists:

1. No M3535 statement has been executed.
2. The last M3535 statement executed was a M3535 Reset.
3. The M3535 MOD2 field is blank and the M3535 RANGE field specifies Channel A, Channel B, or Common B via A.

- The MOD2 field must be blank when the RANGE field is blank.

MOD3

This field specifies the trigger slope:

- \+ Positive, Channel A or B
- \- Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- When the MOD3 field is blank and the RANGE is ChA, ChB, or COM,

the trigger level is the last programmed value or the front panel setting.

MOD4

This field is not used.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The CON field must be blank when Option 040 "Programmable Input Amplifiers" is not installed.
- The CON field must be blank when the RANGE is blank.
- When the CON field is blank and the RANGE is ChA, ChB, or COM, the attenuation is the last programmed value or the front panel setting.

Examples

Refer to 5335 FSC.

5440

Instrument FSC

Description

The 5440 FSC programs the Fluke 5440B or 5442A DC Calibrator to output DC Voltage or DC Current from a Fluke 5220A Transconductance Amplifier controlled by a 5440B or 5442A.

Functional Capability

Function	Nominal
DC Voltage	-1100 V to 1100 V
DC Current	+/-(0.1 mA to 20 A) with 5220A

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage, current, or reset.

Voltage entered as: [numeric][prefix]V

Current entered as: [numeric][prefix]A

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This field allows you to specify the divider override feature of the calibration system. This selection is specified by entering the character "O". This selection is only available when the divider output can be active (between -2.2 V and +2.2 V.)

The internal divider allows the user to achieve higher levels of calibration accuracy in most circumstances; therefore, the use of the divider is always automatically selected, where it is applicable. Reasons to override the use of the divider is the following:

The high burden property of the UUT requires divider override to maintain calibration accuracy. The output impedance of the 5440B is 50Ω for programmed voltages below 2.2V. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

The resolution and accuracy of the 2.2V range is adequate for the requirement. Operator time may be saved by not having to change connections from the normal output of the calibrator to the divided output (and back again at some later time).

MOD3

This field specifies the guard connection.

G External guard connection is active

blank Guard is internally shorted to low.

The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

4W 4-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

4W is not applicable in the following situations:

-2.2 V to 2.2 V unless divider override is specified (MOD2 is O).

Current output from the 5220A.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
   STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5440          *                                              S
  1.002  5440   1000   1100V          +500P/ 4/                          2W
  2.001  5440          10mV           0.05U                              2W
  3.001  5440   10     -2.2V          1%                          O      2W
  4.001  5440   10     10V            5%                             G   2W
  5.001  5440   10     10V            5%                                 2W
  6.001  5440          10V                                            S  2W
  6.002  5440          10V            5%                              N  2W
  7.001  5440   10     10A            0.1U                               2W
  8.001  5440   A      A              0.01U                              2W
```

5450

Instrument FSC

Description

The 5450 FSC programs the Fluke 5450A Resistance Calibrator.

Functional Capability

0 Ω (short)

1 Ω to 100 M Ω, 1 S to 10 nS in decade steps

1.9 Ω to 19 M Ω, 0.52631 S to 52.631 nS in decade steps

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the resistance, conductance, or reset.

Resistance entered as: [numeric][prefix]Z

Conductance entered as: [numeric][prefix]Y

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This selection is used to compensate for lead resistance in the two-wire ohms mode. If the character "O" (for Offset) is entered in this field, the contents of memory location MEM are used (instead of the value in the NOMINAL field) for comparison against the expected nominal value.

To take advantage of this feature, you need to measure the total of the lead resistance and the value of resistance, using another DMM, for example an 8506A. Then you store the measured value in MEM and evaluate the UUT with the nominal value of resistance ("O" selected.)

Example

Test the accuracy of a UUT at 100 Ω, two-wire mode.

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
1.004  ASK-   R
1.005  HEAD         LOW RESISTANCE/HIGH CONDUCTANCE TEST
1.006  5450         100.0Z                                          S  2W
1.007  DISP         Configure the 8506A as follows:
1.007  DISP         8506A: Input-Hi to 8506A: Source-Hi
1.007  DISP         8506A: Input-Lo to 8506A: SOurce-Lo
1.007  DISP         Press the 4T  Ω button in to enable 4-wire ohms.
1.008  IEEE         [@8506]G3?[I]
1.009  MEME
1.010  JMPT         1.013
1.011  DISP         Press the FRONT/REAR select switch.
1.012  JMP          1.008
1.013  DISP         Connect the 5450A and the 8506A as follows:
1.013  DISP         5450A: Output-Hi to 8506A: Input-Hi
1.013  DISP         5450A: Output-Lo to 8506A: Input-Lo
1.014  8506         100Z                                            N  4W
1.015  MEME
1.016  DISP         Disconnect the 8506A from the 5450A.
1.016  DISP         Connect the 5450A and the UUT as follows:
1.016  DISP         5450A: Output-Hi to UUT V/ Ω
1.016  DISP         5450A: Output-Lo to UUT COMMON
1.017  5450         100Z           0.7% 0.2U                   O        2W
```

Step 1.004 disables the regular range and function messages.

Step 1.006 applies 100 Ω from the 5450A in the two-wire mode.

Step 1.007 wires the 8506A up in the two-wire mode, directly on its front panel input terminals.

Step 1.008 checks if the FRONT/REAR selection switch of the 8506A is in the FRONT position. Otherwise, the operator is prompted as defined in step 1.011.

The output of the 5450A is now connected and then measured with the leads up to the front panel of the 8506A in steps 1.013 and 1.014. The result is stored in MEM1 and then moved over to MEM in step 1.015.

The test leads are now moved over from the 8506A input to the UUT input in step 1.016. The performance of the UUT is now evaluated against the value in MEM in step 1.017 (note the O selection).

MOD3

This field specifies the guard connection.

G External guard connection is active

blank Guard is internally shorted to low.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

4W 4-wire

RW 2-wire with 2-wire compensation turned on

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
   STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5450          *                                              S
  1.002  5450   100    100kZ          5.0%                               2W
  2.001  5450   10     10Z            500P%                              4W
  3.001  5450   100    100MZ          1000P/                             2W
  4.001  5450   200    190Z           5.0%                               RW
  5.001  5450   10     Z              5.0U                               RW
  6.001  5450   10     1mY            4000P/                             4W
  6.002  5450   1      .52631Y        5.0%                               4W
  7.001  5450   1      1Z             5%                                 4W
  8.001  5450          1Z                                             S  4W
```

5500

Instrument FSC

Description

The 5500 FSC provides the means to control the following functions of the Fluke 5500A Calibrator:

- DC Voltage and DC Current
- AC Voltage and AC Current (Sine, Square, Triangle, and Truncated Sine waveforms)
- Synthesized Resistance and Capacitance
- RTD and Thermocouple Calibration stimulus
- Thermocouple measurement
- Boosted AC Voltage using the 5725A Boost Amplifier.
- Boosted DC and AC Current using the 5725A Boost Amplifier.

The 5725A must be connected to the 5500A in order to be controlled through the 5500 FSC.

When the M550 FSC is used in conjunction with the 5500 FSC the following additional 5500A functions may be controlled:

- Dual DC and Dual AC Voltage
- DC and AC Power stimulus (simultaneous voltage and current output)
- DC Voltage and DC Current range locking
- DC Offset for AC Voltage
- Duty Cycle for square waves
- Phase for Dual Voltage and Power stimulus
- Displacement Power Factor for Power stimulus
- External Reference Temperature for Thermocouple Calibration and Measurement

The following functions are available with 5500A-SC300 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Scope Square, Edge, Time Mark, and ScopeMeter waveforms)
- Trigger Signal

The following functions are available with 5500A-SC600 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- Trigger Signal

Note

If the 5500A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5500A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 5500A must be set correctly before a procedure is executed. If the 5500A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 5500A is connected to the 5520A or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Amplitude	Frequency/Period	Misc.
DC Voltage:			
Normal Output	-1000 V to 1000 V		
TC Output	-329.9999 mV to 329.9999		
AC Voltage:			
Normal Output			
Sine			
Boost Off	1 mV to 33 mV	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 80 mVp
	34 mV to 330 mV	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 800 mVp
	0.4 V to 3.3 V	0.01 Hz to 9.99 Hz	Vp + |Vof f≤ 8 Vp
	4 V to 33 V	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 50 Vp
	1 mV to 32.999 mV	10 Hz to 500 kHz	Vp + |Voff ≤ 80 mVp

Function	Amplitude	Frequency/Period	Misc.
	33 mV to 329.999 mV	10 Hz to 500 kHz	Vp + |Voff ≤ 800 mVp
	0.33 V to 3.29999 V	10 Hz to 500 kHz	Vp + |Voff ≤ 8 Vp
	3.3 V to 32.9999 V	10 Hz to 100 kHz	Vp + |Voff ≤ 55 Vp
	33 V to 329.999 V	45 Hz to 20 kHz	
	330 V to 1000 V	45 Hz to 10 kHz	
	0.3 V to 3.3 V	1 MHz, 2 MHz	
Boost Off	-63.80 dBm to -7.29 dBm	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 80 mVp
	-27.28 dBm to -7.40 dBm	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 800 mVp
	-7.3 dBm to 12.7 dBm	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 8 Vp
	13 dBm to 32 dBm	0.01 Hz to 9.99 Hz	+ |Voff ≤ 50 Vp
	-57.78 dBm to -27.41 dBm	10 Hz to 500 kHz	Vp + |Voff ≤ 80 mVp
	-27.41 dBm to -7.41 dBm	10 Hz to 500 kHz	Vp + |Voff ≤ 800 mVp
	-7.41 dBm to 12.58 dBm	10 Hz to 500 kHz	Vp + |Voff ≤ 8 Vp
	12.59 dBm to 32.58 dBm	10 Hz to 100 kHz	Vp + |Voff ≤ 55 Vp
	32.59 dBm to 52.58 dBm	45 Hz to 20 kHz	
	52.59 dBm to 62.21 dBm	45 Hz to 10 kHz	
	-8 dBm to 12.7 dBm	1 MHz, 2 MHz	
Boost On	100 V to 750 V	45 Hz to 100 kHz	
	750 V to 1000 V	45 Hz to 30 kHz	
Boost On	42.22 dBm to 59.71 dBm	45 Hz to 100 kHz	
	59.72 dBm to 62.21 dBm	45 Hz to 30 kHz	
Square[1]	3 mVpp to 66 mVpp	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 80 mVp
	67 mVpp to 660 mVpp	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 800 mVp
	0.7 Vpp to 6.6 Vpp	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 8 V
	7 Vpp to 66 Vpp	0.01 Hz to 9.99 Hz	Vp + |Voff ≤ 55 Vp
	2.9 mVpp to 65.999 mVpp	10 Hz to 100 kHz	Vp + |Voff≤80 mVp
	66 mVpp to 659.999 mVpp	10 Hz to 100 kHz	Vp + |Voff ≤ 800 mVp
	0.66 Vpp to 6.59999 Vpp	10 Hz to 100 kHz	Vp + |Voff ≤ 8 Vp
	6.6 Vpp to 66 Vpp	10 Hz to 100 kHz	Vp + |Voff ≤ 55 Vp
Triangle &	2.9 mVpp to 92.999	10 Hz to 100 kHz	Vp + |Voff ≤ 80 mVp
Truncated Sine	93 mVpp to 929.999 mVpp	10 Hz to 100 kHz	Vp + |Voff ≤ 800 mVp
	0.93 Vpp to 9.29999 Vpp	10 Hz to 100 kHz	Vp + |Voff ≤ 8 Vp
	9.3 Vpp to 93 Vpp	10 Hz to 100 kHz	Vp + |Voff ≤ 55 Vp
DC Current:			
Aux. Output	-11 A to 11 A		
5725A Output			
Boost Off	-2.19999 A to 2.19999 A		
Boost On	-11 A to 11 A		
AC Current: Aux Output, Sine			

Function	Amplitude	Frequency/Period	Misc.
no toroid	29 µA to 330 mA 29 µA to 329.999 mA 0.33 A to 2.19999 A 2.2 A to 11 A	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz	
10-turn toroid	0.29 mA to 3.29999 A 3.3 A to 21.9999 A 22 A to 110 A	10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
30-turn toroid	0.87 mA to 8.9997 A 9.9 A to 65.9997 A 66 A to 330 A	10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
50-turn toroid	1.45 mA to 16.49995 A 16.5 A to 109.9995 A 110 A to 550 A	10 Hz to 10 kHz 10 Hz to 5 45 Hz to 1 kHz	
Square	47 µApp to 660 mApp 47 µApp to 659.999 mApp 0.66 App to 4.39999 App 4.4 App to 22 App	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
Triangle & Truncated Sine	47 µApp to 930 mApp 47 µApp to 929.999 mApp 0.93 App to 6.19999 mApp 6.2 App to 31 App	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
AC Current: 5725A Output Sine no toroid			
Boost Off	0.33 mA to 329.999 mA 0.33 A to 2.19999 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On 10-turn toroid	1.5 A to 11 A	45 Hz to 10 kHz	
Boost Off	3.3 mA to 3.29999 A 3.3 A to 21.9999 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On 30-turn toroid	15 A to 110 A	45 Hz to 10 kHz	
Boost Off	9.9 mA to 8.9997 A 9.9 A to 65.9997 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On	45 A to 330 A	45 Hz to 10 kHz	

Function	Amplitude	Frequency/Period	Misc.
50-turn toroid			
Boost Off	16.5 mA to 16.49995 A	10 Hz to 10 kHz	
	16.5 A to 109.9995 A	10 Hz to 5 k	
Boost On	75 A to 550 A	45 Hz to 10 kHz	
Square			
Boost Off	0.47 mApp to 659.999 mApp	10 Hz to 10 kHz	
	0.66 App to 4.39999 App	10 Hz to 5 kHz	
Boost On	4.4 App to 22 App	45 Hz to 10 kHz	
Triangle & Truncated Sine			
Boost Off	0.47 mApp to 929.999 mApp	10 Hz to 10 kHz	
	0.93 App to 6.19999 App	10 Hz to 5 kHz	
Boost On	6.2 App to 31 App	45 Hz to 10 kHz	
Synthesized Res.			
4-wire & 2-wire comp.	0Ω to 109.999 kΩ		
2-wire	110 kΩ to 330 MΩ		
Synthesized Cap.			
2-wire	330 pF to 109.99 nF		
4-wire & 2-wire comp.	110 nF to 1 mF		
RTD Calibration			
100Ω Pt 385	-200 °C to 800 °C, -328 °F to 1472 °F		
200Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
500Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
1 kΩ Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3916	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3926	-200 °C to 630 °C, -328 °F to 1166 °F		
120Ω Ni 391	-80 °C to 260 °C, -112 °F to 500 °F		
10Ω Cu	-100 °C to 260 °C, -148 °F to 500 °F		
Thermocouple Calibration & Measurement			
Type B	600 °C to 1820 °C, 32 °F to 3308 °F		
Type C	0 °C to 2316°C, 32 °F to 4201 °F		
Type E	-250 °C to 1000 °C, -418 °F to 1832 °F		

Function	Amplitude	Frequency/Period	Misc.
Type J	-210 °C to 1200 °C, -410 °F to 2192 °F		
Type K	-200 °C to 1372 °C, -328 °F to 2502 °F		
Type L	-200 °C to 900 °C, -328 °F to 2502 °F		
Type N	-200 °C to 1300 °C, -328 °F to 2372 °F		
Type R	0 °C to 1767 °C, 32 °F to 3213 °F		
Type S	0 °C to 1767 °C, 32 °F to 3213 °F		
Type T	-250 °C to 400 °C, -418 °F to 752 °F		
Type U	-200 °C to 600 °C, -328 °F to 1103 °F		
Dual DC Voltage:			
Normal Output	-1100 V to 1100 V		
Aux Output	-3.3 V to 3.3 V		
Dual AC Voltage:			Phase:
Normal Output [4]			-180 ° to +180 °
Sine [2]			
Boost Off	1 mV to 1000 V	10 Hz to 10 kHz	
Boost Off	-57.78 dBm to 62.21 dBm	10 Hz to 10 kHz	
Boost On	150 V to 1000 V	40 Hz to 10 kHz	
Boost On	45.74 dBm to 62.21 dBm	40 Hz to 10 kHz	
Square	2.9 mVpp to 66 Vpp	10 Hz to 10 kHz	
Triangle &	2.9 mVpp to 93 Vpp	10 Hz to 10 kHz	
Truncated Sine			
Aux Output			
Sine[2]	10 mV to 330 mV	0.01 Hz to 9.99 Hz	
	-27.28 dBm to -7.40 dBm	0.01 Hz to 9.99 Hz	
	0.4 V to 3.3 V	0.01 Hz to 9.99 Hz	
	-7.3 dBm to 12.7 dBm	0.01 Hz to 9.99 Hz	
	10 mV to 3.3V	10 Hz to 10 kHz	
	-37.78 dBm to 12.58 dBm	10 Hz to 10 kHz	
Square	29 mVpp to 6.6 Vpp	0.01 Hz to 10 kHz	
Triangle &			
Truncated Sine	29 mVpp to 9.3 Vpp	0.01 Hz to 10 kHz	
DC Power:			
Normal Output	-1100 V to 1100 V		
Aux Output	-11 A to 11 A		
5725A Output			
Boost Off	-2.19999 A to 2.19999 A		

Function	Amplitude	Frequency/Period	Misc.
Boost On	-11 A to 11 A		
AC Power: Normal Output [4] Sine[2]			Phase: -180° to + 180°
Boost Off	1 mV to 1000 V	[3]	
Boost Off	-57.78 dBm to 62.21 dBm	[3]	
Boost On	150 V to 1000 V	[3]	
Boost On	45.74 dBm to 62.21 dBm	[3]	
Square	2.9 mVpp to 65.9999 Vpp	[3]	
Triangle & Truncated Sine[2]	2.9 mVpp to 93 Vpp	[3]	
Aux Output [2]			
no toroid	0.33 mA to 330 mA	0.01 Hz to 9.99 Hz	
	0.33 mA to 329.999 mA	10 Hz to 10 kHz	
	0.33 A to 2.19999 A	10 Hz to 5 kHz	
	2.2 A to 11 A	45 Hz to 1 kHz	
10-turn toroid	0.29 mA to 3.29999 A	10 Hz to 10 kHz	
	3.3 A to 21.9999 A	10 Hz to 5 kHz	
	22 A to 110 A	45 Hz to 1 kHz	
30-turn toroid	0.87 mA to 9.89997 A	10 Hz to 10 kHz	
	9.9 A to 65.9997 A	10 Hz to 5 kHz	
	66 A to 330 A	45 Hz to 1 kHz	
50-turn toroid	1.45 mA to 16.49995 A	10 Hz to 10 kHz	
	16.5 A to 109.9995 A	10 Hz to 5 kHz	
	110 A to 550 A	45 Hz to 1 kHz	
Square	47 mApp to 659.999 mApp	10 Hz to 10 kHz	
	0.66 App to 4.39999 App	10 Hz to 5 kHz	
	4.4 App to 22 App	45 Hz to 1 kHz	
Triangle & Truncated Sine	47 mApp to 929.999 mApp	10 Hz to 10 kHz	
	0.93 App to 6.19999 mApp	10 Hz to 5 kHz	
	6.2 App to 31 App	45 Hz to 1 kHz	
AC Power: 5725A Output[4] Sine[2]			Phase: -180 ° to +180 °
Boost Off	0.33 mA to 329.999 mA	10 Hz to 10 kHz	
	0.33 A to 2.19999 A	10 Hz to 5 kHz	

Function	Amplitude	Frequency/Period	Misc.
Boost On Square	1.5 A to 11 A	45 Hz to 10 kHz	
Boost Off	0.47 mA to 659.999 mApp	10 Hz to 10 kHz	
	0.66 App to 4.39999 App	10 Hz to 5 kHz	
Boost On Triangle & Truncated Sine	4.4 App to 22 App	45 Hz to 10 kHz	
Boost Off	0.47 mA to 929.999 mApp	10 Hz to 10 kHz	
	0.93 App to 6.19999 App	10 Hz to 5 kHz	
Boost On	6.2 App to 31 App	45 Hz to 10 kHz	

1. A duty cycle of 1% to 99% may be specified for square waves. The default is 50%.
2. When both waveforms are sine, either the Normal or Aux output may be specified to be a harmonic from 1 to 31.
3. The frequency is the same for the voltage and the current, therefore the limits of the AC Voltage frequency are the same as those specified for the AC Current range selected.
4. The phase between the two output signals may be specified from -180 degrees to +180 degrees.

Functional Capability (5500A SCOPE Output with Option 5500A-SC300 Installed)

Function	Amplitude	Frequency	Misc.
DC voltage			
50 Ω term.	-2.2 V to 2.2 V		
1 MΩ term.	-33 V to 33 V		
AC Voltage Scope Square Wave (zero based)			
50 Ω term.	1.8 mVpp to 2.2 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.8 mVpp to 55 Vpp	10 Hz to 10 kHz	
Scopemeter Square Wave			
1 MΩ term.	95 Vpp to 105 Vpp	10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10%	1 kHz to 1 MHz	
Leveled Sine			
50 Ω term.	5m Vpp to 5.5 Vpp	50 kHz to 350 MHz	
Time Markers			Period
50 Ω term.			1.8 ns to 2.2 ns 4.5 ns to 11 ns 18 ns to 22 ns 45 ns to 110 ns 180 ns to 1.1 µs 1.8 µs to 60 µs 90 µs to 12 ms 18 ms to 5.5 s

Functional Capability (5500A SCOPE Output with Option 5500A-SC300 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			
50 Ω term.	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp
1 MΩ term.	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=50 Vp

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage			
50 Ω term.	-6.599 V to 6.599 V		
1 MΩ term.	-130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative)			
50 Ω term. 1 MΩ term.	1.0 mVpp to 6.599 Vpp 1.0 mVpp to 130 Vpp	10 Hz to 10 kHz 10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10%	900 Hz to 11 MHz	
w/ Tunnel Diode Pulser Drive Signal	11 Vpp to 2.5 Vpp	900 Hz to 11 MHz	
Leveled Sine			
50 Ω term.	5 mVpp to 5.5 Vpp	50 kHz to 600 MHz	
Time Markers			
50 Ω term			Period
Spike Square 20 % Duty Square sine			18 ns to 5.5 s 7.5 ns to 5.5 s 75 ns to 34.99 ms 1.8 ns to 17.9 ns

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			Max AC + DC Offset
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp
1 MΩ term	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz Video	Vp + |Voff|<=50 Vp
Video			Line Marker
NTSC	-150% to 150%		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140 IRE to 140 IRE		1 to 262 Odd or Even
PAL	-150% to 150%		1 to 622
	-1.5 Vp to 1.5 Vp		1 to 622
PAL-M	-150% to 150%		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140 IRE to 140 IRE		1 to 262 Odd or Even
SECAM			
	-150% to 150%		1 to 262
	-1.5 Vp to 1.5 Vp		1 to 262
Pulse		Period	Pulse Width
50 Ω term	10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp	200 ns to 22 ms	2 ns to 500 ns
UUT Input Impedance Measurement (MEAS Z):			

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
50 Ω			40 Ω to 60 Ω
1 MΩ Capacitance UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	500 kΩ to 1.5 MΩ 5 pF to 50 pF

Parameters

The following table describes the basic operating modes of the 5500A Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5500 FSC.

5500A Operating Modes

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD3[1]	M550 Range	M550 Nominal	M550 MOD1
DC Voltage	voltage		**[TC|SC|S6|E]**	**[RNGLK**	voltage]	
AC Voltage	voltage	freq|period	**[BV|SC|S6|E]**			[DC offset]
AC Voltage	freq|period	voltage	**[BV]**			[DC offset]
AC Voltage (pulse)	p-width period[2]	voltage voltage	**S6** **S6**	**Per Pulse**	period p-width[2]	
AC Voltage	duty cycle	freq|period			voltage	[DC offset]
AC Voltage (time marks)	freq|period		**SC|S6**			
DC Current	current		**[BC|BP|E]**	**[RNGLK**	current]	
AC Current	current	freq|period	**[BC|BP|E]**			
AC Current Resistance	freq|period resistance	current	**[BC|BP]** **[E]**			

5500A Operating Modes (cont)

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD3[1]	M550 Range	M550 Nominal	M550 MOD1
Resistance	conductance		**[E]**			
Capacitance	capacitance					
RTD Cal	temperature					
TC Cal	temperature		**TC**	**[TCREF**	temp.]	
TC Meas	temperature		**TM|TN**	**[TCREF**	temp.]	
Dual DC Voltage	voltage		**[AX]**		voltage	
Dual AC Voltage	voltage	freq|period	**[BV|AX]**	[**H***n*|**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage	**[BV]**	[**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	**[BV|AX]**	[**H***n*|**H**X*n*]	voltage	voltage
DC Power	power		**[BC|BP]**		voltage	
DC Power	power				current	
DC Power	voltage				current	
DC Power	current		**[BC|BP]**		voltage	
AC Power	power	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	
AC Power	power	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	
AC Power	current	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG**]	voltage	
AC Power	voltage	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	

5500A Operating Modes (cont)

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD3[1]	M550 Range	M550 Nominal	M550 MOD1
AC Power	freq|period	current	**[BC|BP]**	[**H***n*| **LEAD|LAG]**	voltage	
AC Power	freq|period	voltage	**[BV]**	[**H**x*n*| **LEAD|LAG]**	current	
AC Power	phase	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	current
AC Power	phase	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	ODD|EVEN		
Impedance Meas.	resistance| capacitance		**ZM**			
Overload Meas.	voltage	[freq]	**OM**	Limit	time	

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period or pulse width
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle or video amplitude

5500 FSC Nominal, MOD 1, MOD2 and MOD3 Rules

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD2 [1]	5500 MOD3 [2]
DC Voltage	V			[TC|E]
AC Voltage	V|Vpp|D V|Vpp Vp H|T H|T pct	H|T H|T H|T V|Vpp|D V|Vpp H|T	SI SQ|TI|TS SI SI SQ|TI|TS SI|SQ|TI|TS	[BV|E] [BV] [BV] [BV] [BV]
DC Current	A			[BC|BP|E]
AC Current	A|App A|App Ap H|T	H|T H|T H|T A|App	SI SI|SQ|TI|TS SI|SQ|TI|TS SI|SQ|TI|TS	[BC|BP|E] [BC|BP] [BC|BP] [BC|BP]
Resistance	Z|Y			[E]
Capacitance	F			
RTD Cal	°C|°F		R1|R2|R3|R4|R5|R6| R7|R8	
TC Cal	°C|°F		_B|_C|_E|_J|_K|_L|_ N|_R|_S|_T|_U	TC
TC Meas	°C|°F		_B|_C|_E|_J|_K|_L|_ N|_R|_S|_T|_U	TM/TN
Dual DC Voltage	V			[AX]
Dual AC Voltage	V|Vp|Vpp|D V|Vp|Vpp H|T H|T	H|T H|T V|Vpp|D V|Vpp	SI SQ|TI|TS SI SQ|TI|TS	[AX|BV] [AX] [AX|BV] [AX]
DC Power	W|A V			[BC|BP]
AC Power	W V|Vp|Vpp|D V|Vp|Vpp A|Ap|App H|T H|T H|T	H|T H|T H|T H|T V|Vpp|D V|Vpp A|App	SI SI SQ|TI|TS SI|SQ|TI|TS SI SQ|TI|TS SI|SQ|TI|TS	[BV|BC|BP] [BV] [BC|BP] [BV] [BC|BP]

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC Nominal, MOD1, MOD2, and MOD3 Rules for 5500A-SC300

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD2 [1]	5500 MOD3 [2]
DC Voltage (VOLT)	V			SC
AC Voltage (VOLT)	V|Vp|Vpp H|T	H|T V|Vpp	ZQ|SM ZQ|SM	SC SC
AC Voltage (Edge)	V|Vp|Vpp	H|T	MK	SC
AC Voltage (LEVSINE)	V|Vp|Vpp H|T	H|T V|Vp|Vpp	LS LS	SC SC
AC Voltage (MARKER)	H|T		MK	SC
AC Voltage (WAVEGEN)	V|VP|VPP H|T	H|T V|VP|VPP	SI|SQ|TI SI|SQ|TI	SC

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC Nominal, MOD1, MOD2, and MOD3 Rules for 5500A-SC600

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD2[1]	5500 MOD3[2]
DC Voltage (VOLT)	V			S6
AC Voltage (VOLT)	V|Vp|Vpp H|T	H|T V|Vpp	ZQ|SN ZQ|SN	S6 S6
AC Voltage (EDGE)	V|Vp|Vpp H|T	H|T V|Vpp	ED ED	S6
AC Voltage (LEVSINE)	V|Vp|Vpp H|T	H|T V|Vpp	LS LS	S6 S6
AC Voltage (MARKER)	H|T		M1|M2|M3|M4	S6
AC Voltage (WAVEGEN)	V|VP|VPP H|T	H|T V|VP|VPP	SI|SQ|TI SI|SQ|TI	S6
AC Voltage (PULSE)	H|T	VPP	PU	S6
Video (VIDEO)	pct|Vp|IRE pct|Vp	LM LM	F1|F3 F2|F4	S6 S6
Impedance Meas (MEAS Z)	Z F			ZM ZM
Overload Meas (OVERLD)	V Vpp	 H		OM OM

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- The NOMINAL field may not specify frequency or period when any of the following sets of conditions exist:

  1. Dual AC Voltage is specified and either

     a. the M550 RANGE field specifies H and the M550 MOD3 field specifies AX or

     b. the M550 RANGE field specifies HX and the 5500 MOD3 field specifies AX.

  2. AC Power is specified and either

     a. the M550 RANGE field specifies H and the M550 NOMINAL field specifies current or

     b. the M550 RANGE field specifies HX and the M550 NOMINAL field specifies voltage.

  3. The MOD3 field specifies E.

- When the NOMINAL field specifies frequency or period and the M550 RANGE field specifies a harmonic (H or HX), the Keyboard Entry (ASK+ K) or Go/No-Go (ASK+ G) evaluation mode must be specified, Slew is not allowed.

A duty cycle other than 50% may only be specified for square waveforms (MOD2 is SQ). Therefore keyboard entry and go-nogo evaluations may be performed at 50% duty cycle for non-square waveforms, but slew mode is not allowed. In addition the duty cycle is restricted to 50%, regardless of the type of waveform, when the DC offset is not zero.

- When the NOMINAL field specifies power and the value is slewed, if the M550 NOMINAL field specifies voltage, the voltage is held constant and a new value of current is computed by the 5500A.
- If the M550 NOMINAL field specifies current, the current is held constant and a new value of voltage is computed by the 5500A.
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.

- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

- The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage or AC Current.
- The waveform type for the voltage or current not specified in the M550 FSC NOMINAL field for AC Power or Dual AC Voltage.
- The thermocouple or RTD type for TC Measurement, TC Calibration, or RTD Calibration.

blank	DC or not applicable
SI	Sine wave (WaveGen)
SQ	Square wave (WaveGen)
TI	Triangle wave (WaveGen)
TS	Truncated sine wave
LS	Leveled sine wave
ZQ	Scope square wave (DC offset is 1/2 peak-to-peak voltage)
SM	ScopeMeter wave (See 5500A manual for description)
ED	Edge signal
MK	Marker signal

_B	Type B thermocouple
_C	Type C thermocouple
_E	Type E thermocouple
_J	Type J thermocouple
_K	Type K thermocouple
_L	Type L thermocouple
_N	Type N thermocouple
_R	Type R thermocouple
_S	Type S thermocouple
_T	Type T thermocouple
_U	Type U thermocouple
R1	100 Ω Pt 385 RTD
R2	100 Ω Pt 3926 RTD
R3	120 Ω Ni RTD
R4	200 Ω Pt 385 RTD
R5	500 Ω Pt 385 RTD
R6	1 kΩ Pt 385 RTD
R7	100 Ω Pt 3916 RTD
R8	10 Ω Cu RTD
ZQ	Positive square wave (5500A-SC300 and 5500A-SC600 AC Voltage)
ZN	Negative square wave (5500A-SC600 AC Voltage)
SM	ScopeMeter wave (5500A-SC300 AC Voltage)
ED	Edge signal (5500A-SC300 and 5500A-SC600)
LS	Leveled sine wave (5500A-SC300 and 5500A-SC600)
MK	Marker signal (5500A-SC300)
M1	Spike Marker signal (5500A-SC600)
M2	Square Marker signal (5500A-SC600)
M3	20% Duty Cycle Square Marker signal (5500A-SC600)
M4	Sinusoid Marker signal (5500A-SC600)

PU	Pulse wave (5500A-SC600)
F1	NTSC video signal (5500A-SC600)
F2	PAL video signal (5500A-SC600)
F3	PAL-M video signal (5500A-SC600)
F4	SECAM video signal (5500A-SC600)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, Dual AC Voltage, or AC Power (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Measurement or TC Calibration if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Calibration if no MOD2 code is entered.
- The M550 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M550 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M550 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

blank	Default for mode specified
AX	Auxiliary Voltage
BV	Boost Voltage
BC	Boost Current
BP	Boost Port (Use Boost Amplifier port for non-boosted current)
SC	Scope
TM	Thermocouple Measurement (open TC detection on)
TN	Thermocouple Measurement (open TC detection off)
TC	Thermocouple Cal

E Extended Performance

SC 5500A-SC300 Scope Option

S6 5500A-SC600 Scope Option

ZM 5500A-SC600 UUT Input Impedance Measurement

OM 5500A-SC600 UUT 50 Input Overload Protection Measurement

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage is specified and the M550 FSC MOD3 field does not specify AX.
- The MOD3 field may specify BV only when the following conditions exist:
  1. AC Voltage, Dual AC Voltage, or AC Power is specified.
  2. The MOD2 field specifies SI.
  3. Voltage is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and current is specified in the M550 NOMINAL field.
  4. The voltage specified in the NOMINAL or MOD1 field or the M550 MOD1 field or computed from the power specified in the NOMINAL field, the current specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier.
  5. The M550 FSC MOD3 field does not specify BV, BC, or BP.
- The MOD3 field may specify BC only when the following conditions exist:
  1. DC Current, AC Current, DC Power, or AC Power is specified.
  2. Current is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and voltage is specified in the M550 NOMINAL field.
  3. The current specified or computed from the power specified in the NOMINAL field, the voltage specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier with boost on.
  4. The M550 FSC MOD3 field does not specify BC, BV, or BP.
- The MOD3 field may specify BP only when the following conditions exist:
  1. DC Current, AC Current, DC Power, or AC Power is specified.

2. Current is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and voltage is specified in the M550 NOMINAL field.
3. The current specified or computed from the power specified in the NOMINAL field, the voltage specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier with boost off.
4. The M550 FSC MOD3 field does not specify BC, BV, or BP.

- The MOD3 field may specify SC only when the 5500A-SC300 Scope option is configured.
- SC is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, SM, MK, ED, LS or MK, and the 5500A-SC300 Scope option is configured, and no MOD3 code is entered.
- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and the 5500A-SC600 Scope Option is configured, and no MOD3 code is entered.
- The MOD3 field may specify E only when the 5500A/EP option is configured. For a full description of the 5500A/EP, see the on-line help for the 5500A when "Edit Configuration" (F12) is selected from within the MET/CAL Editor.
- The M550 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 3W 3-wire
- 4W 4-wire
- CW 2-wire ohms compensated at the UUT terminals
- DV 2-wire using the external AC Divider
- TD Tunnel Diode Pulser Drive signal enabled
- T1 10-turn Toroid Coil
- T3 30-turn Toroid Coil
- T5 50-turn Toroid Coil
- L 50 Ω Termination
- *blank* 1 MΩ Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify 3W only when the RTD Cal mode is specified.
- The CON field may specify CW or 4W only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify DV only when AC Voltage mode is specified, the MOD2 field specifies SI, the MOD3 field specifies a voltage of 22 mV or less.
- The CON field may specify T1, T3, or T5 only when the MOD3 field does not specify E and DC Current or DC Power mode is specified or AC Current mode is specified and the MOD2 field specifies SI or AC Power mode is specified and either:
  1. The M550 NOMINAL field specifies voltage and the 5500 MOD2 field specifies SI or
  2. The M550 NOMINAL field specifies current and the M550 MOD2 fields specifies SI. Refer to the Fluke 31/33 Instruction Manual for directions for constructing a suitable toroid coil.
- The CON field may specify L only when the MOD3 field specifies SC or S6 and the MOD3 field specifies SC.

- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4 and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or MK, the MOD3 field specifies SC and no CON field code is entered.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, the MOD3 field specifies S6 and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M550         *
  1.002  5500         *                                                S
# ----- DC Voltage -----
  1.003  M550                                                           FL
  1.004  5500   20    19.99mV        2% 0.04U                           2W
# ----- DC Voltage w/Range Lock -----
  2.001  M550   RNGLK 3V
  2.002  5500   400   350.0mV        1.9% 0.4U                          2W
  3.001  M550         *
# ----- DC Voltage, TC Terminals -----
  3.002  5500         35mV                                        TC S  2W
# ----- AC Voltage -----
  3.003  5500   400   350.0mV        -2.8U +2.9U   60H           SI       2W
# ----- AC Voltage w/5725A Boost -----
  4.001  5500   400   350.0V         7.4U          20kH          SI BV    2W
# ----- AC Voltage w/External AC Divider -----
  5.001  5500         -37.78D        0.1U          100H          SI       DV
# ----- AC Voltage (Frequency Test) -----
  6.001  5500   1000  800.0H         0.1% 0.1U     300mV         SI       2W
# ----- Square Wave w/DC Offset -----
  7.001  M550                                     0.5Voff
  7.002  5500         1Vpp                        1kH           SQ    S  2W
# ----- Square Wave w/Duty Cycle Specified -----
  7.003  M550                       35pct
  7.004  5500         1Vpp                        1kH           SQ    S  2W
# ----- Square Wave (Duty Cycle Test) ------
  7.005  M550         1Vpp
  7.006  5500         30pct          2U           500H          SQ       2W
  8.001  M550         *
# ----- Triangle Wave -----
  8.002  5500         13mVpp                      10kH          TI    S  2W
# ----- Truncated Sine Wave -----
  8.003  5500         2.5mApp                     5kH           TS    S  2W
# ----- DC Current -----
  8.004  5500   4000  3500mA         9U                                 2W
# ----- AC Current at 5725A Output, Boost Off -----
  9.001  5500         35.00mA        0.37U         60H           SI BP    2W
# ----- AC Current at 5725A Output, Boost On -----
 10.001  5500   10    10A            0.12U         1kH           SI BC    2W
# ----- Dual DC Voltage -----
 11.001  M550         10mV
```

```
 11.002  5500         100mV          3%                              AX    2W
# ----- Dual AC Voltage w/5725A Boost -----
 12.001  M550         1V                                        SI AX
 12.002  5500         350Vp                       10kH          SI BV S  2W
# ----- Dual AC Voltage (Phase Test) ------
 12.003  M550         1Vpp                        1Vpp          SQ AX
 12.004  5500         30deg          1U           60H           SQ       2W
# ----- Dual AC Voltage (Harmonics) ------
 13.001  M550   H2    100V                                      SI BV
 13.002  5500         0D             1U           60H           SI AX    2W
 14.001  M550   HX3   1Vpp                                      SI AX
 14.002  5500         1Vpp           1U           60H           SI       2W
 15.001  M550         *
# ----- DC Power (Volts and Amps) -----
 15.002  M550         1mV                                             O  FL
 15.003  5500         1mA            1%                                  2W
# ----- AC Power (Volts and Amps) -----
 16.001  M550         1mA            60deg                       SI
 16.002  5500         1V                          400H          SI    S  2W
# ----- AC Power (Watts and Volts) w/Displacement Power Factor -----
 16.003  M550   LEAD  1V             0.998                       SI
 16.004  5500   20    19mW           1%           60H           SI       2W
# ----- AC Power (Watts and Vpp) w/Phase Specified -----
 17.001  M550         1Vpp           -45deg                      SI
 17.002  5500   20    1mW            1U           400H          SI       2W
# ----- AC Power (Harmonics) ------
 18.001  M550   H2    45D                                       SI BV
 18.002  5500         100W           1U           60H           SI       2W
 19.001  M550   HX3   1mApp                                     SI
 19.002  5500         1Vpp           1U           60H           SI       2W
 20.001  M550         *
# ----- Resistance -----
 20.002  5500   400   390.0Z         0.4% 0.1U                           CW
 21.001  5500   4     3.900MZ        0.05U                               2W
# ----- Capacitance ----
 22.001  5500   10    1.100uF        2% 0.002U                           2W
# ----- Temperature Measurement -----
 23.001  5500         1200.0degF                                _J TM N  2W
# ----- Temperature Stimulus -----
 23.002  M550   TCREF 0degC
 23.003  5500         50degC         1%                          _K TC    2W
 24.001  M550         *
 24.002  5500         45degC                                    R1    S  3W
```

5500A-SC300 Scope Option

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
# ----- DC Voltage -----									
1.001	5500	20	19.99mV	4%			SC		
# ----- AC Voltage (Scope Square Wave) -----									
2.001	5500	400	350.0mV	50U	60H	ZQ	SC		
# ----- AC Voltage (ScopeMeter Wave) -----									
3.001	5500		100Vpp		1kH	SM	SC	S	
# ----- AC Voltage (Frequency Test) -----									
3.002	5500	1000	800.0H	0.1% 0.1U	300mV	ZQ	SC		
# ----- Edge Signal (Scope Output) -----									
4.001	5500		0.5Vpp		1MH	ED	SC	S	L
# ----- Leveled Sine Wave -----									
4.002	5500		200mVpp		50kH	LS	SC	S	L
# ----- Marker Signal -----									
4.003	M550								2T
4.004	5500		1uT			MK	SC	S	L
# ----- Wavegen -----									
4.005	5500		5V		1kH	SI	SC	S	
# ----- Wavegen w/DC Offset -----									
4.006	M550				0.5Voff				
4.007	5500		1Vpp		1kH	TI	SC	S	
# ----- Wavegen w/Duty Cycle Specified -----									
4.008	M550			35pct					
4.009	5500		1Vpp		1kH	SQ	SC	S	
4.010	M550		*						

5500A-SC600 Scope Option

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5500   20    19.99mV        4%                            S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5500   400   350.0mV        50U           60H           ZQ S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  3.001  5500         100Vpp                      1kH           ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5500   1000  800.0H         0.1% 0.1U     300mV         ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5500         0.5Vpp                      1MH           ED S6 S  L
# ----- Leveled Sine Wave -----

g4.002  5500         200mVpp                     50kH          LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M550                                                           2T
  4.004  5500         1uT                                      M1 S6 S  L
  4.005  M550         *
# ----- Square Marker Signal -----
  4.006  5500         1mT                                      M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5500         5uT                                      M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5500         2nT                                      M4 S6 S  L
# ----- Wavegen -----
  4.009  5500         5V                          1kH           SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M550                                     0.5Voff
  4.011  5500         1Vpp                        1kH           TI S6 S
# ----- NTSC Video -----
  4.012  M550   ODD
  4.013  5500         1Vp                         262LM         F1 S6 S  L
  4.014  M550         *
# ----- PAL Video -----
  4.015  5500         50pct                       400LM         F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M550   EVEN
  4.017  5500         -140IRE                     1LM           F3 S6 S  L
  4.018  M550         *
# ----- SECAM Video -----
  4.019  5500         -100pct                     622LM         F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
```

```
  4.020  M550   PER   200nT
  4.021  5500         5.0nT                        2.5Vpp         PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M550   PULSE 10nT
  4.023  5500         1.00kH                       2.5Vpp         PU S6 N  L
  4.024  M550         *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5500         50Z            1U                             ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5500         1.000MZ        1U                             ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5500         10pF                                          ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M550   LIMIT 10T
  6.003  5500         5V                                            OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M550   LIMIT 10T
  7.002  5500         7V                                            OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M550

Auxiliary Instrument Setup FSC

Description

The M550 FSC provides the additional program functions for the Fluke 5500A Calibrator which are not addressed by the 5500 FSC. These functions include Range Locking, DC Offset, Thermocouple External Temperature Reference, Phase, Power Factor, Duty Cycle, voltage and/or current for power stimulus, and voltage of the second signal for dual voltage output.

The following functions are available with 5500A-SC600 Scope Option:

- Time limit for UUT 50 Ohm input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Trigger output

Parameters

For a description of the 5500A Calibrator operating modes referenced in this section, see Table 1 in the 5500 Instrument FSC description.

When a blank M550 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
H	Hertz	frequency
T	Time	period, pulse width, or time limit
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Voff	Volts offset	DC offset
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle or video amplitude

M550 FSC RANGE, NOMINAL, MOD1, MOD2, and MOD3 Rules

5500A Mode	M550 Range	M550 Nominal	M550 TOL.	M550 MOD1	M550 MOD2 [1]	M550 MOD3 [2]
DC Voltage	[RNGLK	V]				
AC Voltage		[V/Vp/Vpp] [V/Vpp]	[pct]	Voff [Voff]		
DC Current	[RNGLK	A]				
Dual DC Voltage	V					[AX]
Dual AC Voltage	[H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp V/Vp/Vpp	[deg] [deg] [deg]	 [V/Vp/Vpp/D] V/Vp/Vpp/D] V/Vp/Vpp	SI SI SI SI SQ/TI/TS SQ/TI/TS	[AX/BV [AX/BV] [AX/BV] [AX/BV] [AX] [AX]
DC Power	V A					[BC/BP]
AC Power	[LEAD/LAG] [LEAD/LAG] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D	[*dpf*] [*dpf*] [deg] [deg] [deg] [deg] [deg]	 A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App	SI SI SI SI SI SI SI SI SI SI SQ/TI/TS SQ/TI/TS	[BV] [BC/BP] [BV] [BV] [BC/BP] [BC/BP] [BV] [BV] [BC/BP] [BC/BP] [BC/BP]

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules for SC600

M550 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for 5500A-SC300.

5500 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules for 5500A-SC600

5500A Mode	M550 Range	M550 Nominal	M550 Tolerance	M550 MOD1	M550 MOD2 [1]	M550 MOD3 [2]
AC Voltage (WAVEGEN)				[OFFSET]		
AC Voltage (PULSE)	PER/PULSE	H/T				
Video (VIDEO)	[ODD/EVEN]					
Overload Meas (OVERLD)	LIMIT	T				

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter m550 Range, nominal, tolerance, MOD1, MOD2, and MOD3 fields are not used for 5500A-SC600 operating modes listed.

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- TCREF Thermocouple Reference
- LEAD Leading
- LAG Lagging
- H*n* Primary output is a harmonic, 1 to 51
- HX*n* Secondary output is a harmonic, 1 to 51
- PULSE Pulse Width
- PER Pulse Period

- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- When the RANGE field specifies LEAD or LAG, the TOLERANCE field must specify the Displacement Power Factor.
- The primary output is always the Normal output. The secondary output is typically the Aux output, but may be the 5725A current output is the case of AC Power with boosted current.
- The RANGE field may specify PULSE or PER only when the 5500 FSC MOD2 field specifies PU.
- The RANGE field must specify PULSE or PER when the 5500 FSC MOD2 field specifies PU.
- The RANGE field may specify ODD or EVEN only when the 5500 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5500 FSC MOD2 field specifies F1 or F3.
- The RANGE field may not specify RNGLK when the 5500 MOD3 field specifies TC, SC, or S6.

NOMINAL

This field specifies one of the following:

- Range lock selection value when RANGE field is RNGLK
- Thermocouple Reference when RANGE field is TCREF
- Pulse Period or Pulse Repetition Frequency when RANGE field is PER
- Pulse Width when RANGE field is PULSE
- Signal amplitude for AC Voltage, Dual DC Voltage, Dual AC Voltage, DC Power, or AC Power
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field may specify a Voltage or Current range selection value only when the RANGE field specifies RNGLK.

Voltage Range Selection Value	Locked Range
0 mV to 33 mV	33 mV DC
> 33 mV to 330 mV	330 mV DC
> 330 mV to 3.3 V	3.3 V DC
> 3.3 V to 33 V	33 V DC
> 33 V to 330 V	330 V DC
> 330 V to 1020 V	1000 V DC
Current Range Selection Value	**Locked Range**
0 mA to 3.3 mA	3.3 mA DC
> 3.3 mA to 33 mA	33 mA DC
> 33 mA to 330 mA	330 mA DC
> 330 mA to 2.2 A	2.2 A DC
> 2.2 A to 11 A	11 A DC[1]
1. The 11 A range may be locked only when the 5500 FSC MOD3 field does not specify BP (Boost Port).	

- When the NOMINAL field specifies voltage and Dual DC Voltage or Dual AC Voltage mode is specified, either the MOD3 field must specify AX or the 5500 FSC MOD3 field must specify AX.
- The NOMINAL field may specify Thermocouple Reference only when the RANGE field specifies TCREF. In this case, the UUT is compensating for its thermocouple junction temperature and Thermocouple Reference should be set to the temperature of the UUT's junction. Thermocouple Reference must be in the same units as the temperature specified in the 5500 FSC NOMINAL field.
- When the NOMINAL field does not specify Thermocouple Reference, the 550A internal reference is used and the UUT is not compensating for it's thermocouple junction temperature.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field specifies phase or duty cycle entered as [*numeric*] [*prefix*] *units symbol* or displacement power factor entered as *numeric*.

Rules:

- The TOLERANCE field may specify Displacement Power Factor only when the RANGE field specifies LEAD or LAG.
- The TOLERANCE field may specify Duty Cycle only when AC Voltage mode is specified and the 5500FSC MOD2 field specifies SQ.

MOD1

This field specifies DC offset for AC Voltage or one amplitude for AC Power or Dual AC Voltage entered as:

[*numeric*] [*prefix*] *units symbol*

Rules:

- The MOD1 field may specify voltage or current only when the 5500 NOMINAL field specifies phase.
- When the MOD1 field specifies voltage with units of "D", the 5500 FSC MOD2 field must specify SI.
- When the MOD1 field specifies voltage with units of "Vp" or "Vpp" or current with units of "Ap" or "App", the 5500 FSC MOD2 field must specify SI, SQ, TI, or TS.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified, the 5500 FSC MOD3 field does not specify E, the 5500 NOMINAL field units are not decibels.
- When the MOD1 field specifies DC Offset, either the voltage specified in the 5500 NOMINAL or MOD1 field must be less than 33 V or the DC Offset value must be zero.
- When the MOD1 field specified DC Offset and the 5500 FSC NOMINAL field specifies duty cycle, the specified DC Offset must be zero.
- When the MOD1 field specifies DC Offset other than 0 V, and the TOLERANCE field specifies duty cycle, the duty must be 50%.
- When the MOD1 field specifies DC Offset and the 5500 FSC NOMINAL field specifies duty cycle, the specified DC Offset must be zero.

MOD2

This field specifies the waveform for the output specified in the NOMINAL field.

- SI Sine wave
- SQ Square wave
- TI Triangle wave
- TS Truncated sine wave
- *blank* DC or field not applicable

MOD3

This field specifies the calibrator output mode:

- AX Auxiliary Voltage
- BV Boost Voltage
- BC Boost Current
- BP Boost Port (Use Boost Amplifier port for non- boosted current)
- *blank* no boost, default port, or field not applicable

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage mode is specified and the 5500 FSC MOD3 field does not specify AX.
- The MOD3 field may specify BV only when the following conditions exist:
  1. AC Power or Dual AC Voltage mode is specified.
  2. The MOD2 field specifies "SI".
  3. Voltage is specified in the NOMINAL field.
  4. The voltage specified in the NOMINAL field is within the range of the 5725A Boost Amplifier.
  5. The 5500 FSC MOD3 field does not specify BV, BC, or BP.
- The MOD3 field may specify BC only when the following conditions exist:
  1. DC Power or AC Power mode is specified.
  2. The current is specified in the NOMINAL field.
  3. The specified current is within the range of the 5725A Boost Amplifier with boost on (see Table 1).
  4. The 5500 FSC MOD3 field does not specify BC, BV, or BP.
- The MOD3 field may specify BP only when the following conditions exist:

1. DC Power or AC Power mode is specified.
2. The current is specified in the NOMINAL field.
3. The specified current is with the range of the 5725A Boost Amplifier with boost off (see Table 1).
4. The 5500 FSC MOD3 field does not specify BC, BV, or BP.

MOD4

This field controls whether or not the NORMAL and AUX "LO" terminals are tied together for DC Power, AC Power, Dual DC Voltage, and Dual AC Voltage modes.

- *blank* Lows Shorted or field not applicable
- O Lows Open

Rules:

- The MOD4 field may specify “0” only when the mode is DC Power, AC Power, Dual DC Voltage, or Dual DC Voltage, and the M550 CON specifies “EL” or “FL”.

CON

This field controls whether or not the NORMAL and AUX "LO" terminals are tied to Earth and the trigger output.

- *blank* default or field not applicable
- EL Low tied to Earth
- FL Floating Low

1T Trigger Output on, Normal mode
2T Trigger Output on, 1/10 of output rate
3T Trigger Output on, 1/100 of output rate

Rules:

- The CON field specification is ignored, and a floating low is used, when any of the following conditions exist:
  1. Resistance, Capacitance, RTD Calibration, or Thermocouple Measurement mode is specified.
  2. AC Current or AC Power mode is specified with a current less than 330 µA.

- A CON field specification of 1T, 2T, or 3T is only applicable (is ignored otherwise) when the 5500 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.
- When the CON field is blank, a floating low is used.

Examples

See 5500 FSC.

5520

Instrument FSC

Description

The 5520 FSC provides the means to control the following functions of the Fluke 5520A Calibrator:

- DC Voltage and DC Current
- AC Voltage and AC Current (Sine, Square, Triangle, and Truncated Sine waveforms)
- Synthesized Resistance and Capacitance
- RTD and Thermocouple Calibration stimulus
- Thermocouple measurement
- Humidity measurement

When the M5520 FSC is used in conjunction with the 5520 FSC the following additional 5520A functions may be controlled:

- Dual DC and Dual AC Voltage
- DC and AC Power stimulus (simultaneous voltage and current output)
- DC Voltage and DC Current range locking
- DC Offset for AC Voltage
- Duty Cycle for square waves
- Phase for Dual Voltage and Power stimulus
- Displacement Power Factor for Power stimulus
- External Reference Temperature for Thermocouple Calibration and Measurement

The following functions are available with SC300 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Scope Square, Edge, Time Mark, and ScopeMeter waveforms)
- Trigger Signal

The following functions are available with SC600 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- Trigger Signal

Note

If the 5520A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5520A .MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 5520A must be set correctly before a procedure is executed. If the 5520A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 5520A is connected to the 5500A or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Functional Capability (5520A NORMAL, AUX, and 20A Outputs)

Function	Amplitude	Frequency/Period	Misc.
DC Voltage: Normal Output TC Output	 -1020 V to 1020 V -329.9999 mV to 329.9999 mV		
AC Voltage: Normal Output Sine	 1 mV to 33 mV 34 mV to 330 mV 0.4 V to 3.3 V 4 V to 33 V	 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz	 Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff≤ 8 Vp Vp + |Voff ≤ 50 Vp

Function	Amplitude	Frequency/Period	Misc.
	1 mV to 32.999 mV 33 mV to 329.999 mV 0.33 V to 3.29999 V 3.3 V to 32.9999 V 33 V to 329.999 V 330 V to 1020 V 0.3 V to 3.3 V	10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 100 kHz 45 Hz to 100 kHz 45 Hz to 10 kHz 1 MHz, 2 MHz	Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 Vp Vp + |Voff ≤ 55 Vp
	-63.80 dBm to -7.29 dBm -27.28 dBm to -7.40 dBm -7.3 dBm to 12.7 dBm 13 dBm to 32 dBm -57.78 dBm to -27.41 dBm -27.41 dBm to -7.41 dBm -7.41 dBm to 12.58 dBm 12.59 dBm to 32.58 dBm 32.59 dBm to 52.58 dBm 52.59 dBm to 62.39 dBm -8 dBm to 12.7 dBm	0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 100 kHz 45 Hz to 20 kHz 45 Hz to 10 kHz 1 MHz, 2 MHz	Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 Vp + |Voff ≤ 50 Vp Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 Vp Vp + |Voff ≤ 55 Vp
Square[1]	3 mVpp to 66 mVpp 67 mVpp to 660 mVpp 0.7 Vpp to 6.6 Vpp 7 Vpp to 66 Vpp 2.9 mVpp to 65.999 mVpp 66 mVpp to 659.999 mVpp 0.66 Vpp to 6.59999 Vpp 6.6 Vpp to 66 Vpp	0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 0.01 Hz to 9.99 Hz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz	Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 V Vp + |Voff ≤ 55 Vp Vp + |Voff≤80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 Vp Vp + |Voff ≤ 55 Vp
Triangle & Truncated Sine	2.9 mVpp to 92.999 93 mVpp to 929.999 mVpp 0.93 Vpp to 9.29999Vpp 9.3 Vpp to 93Vpp	10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz	Vp + |Voff ≤ 80 mVp Vp + |Voff ≤ 800 mVp Vp + |Voff ≤ 8 Vp Vp + |Voff ≤ 55 Vp
DC Current: Aux. Output 20 A Output w/range lock	 -2.99999 A to 2.99999 A -20.5 A to -3 A, 3 A to 20.5 A -20.5 A to 20.5 A		

Function	Amplitude	Frequency/Period	Misc.
AC Current: Aux Output LCOMP OFF Sine			
no toroid	29 uA to 330 mA	0.01 Hz to 9.99 Hz	
	29 uA to 329.999 mA	10 Hz to 30 kHz	
	0.33 A to 2.99999 A	10 Hz to 10 kHz	
10-turn toroid	0.29 mA to 3.29999 A	10 Hz to 30 kHz	
	3.3 A to 29.9999 A	10 Hz to 10 kHz	
30-turn toroid	0.87 mA to 8.9997 A	10 Hz to 30 kHz	
	9.9 A to 65.9997A	10 Hz to 10 kHz	
50-turn toroid	1.45 mA to 16.49995 A	10 Hz to 30 kHz	
	16.5 A to 109.9995 A	10 Hz to 10kHz	
Square	47 uApp to 660 mApp	0.01 Hz to 9.99 Hz	
	47 uApp to 5.99999 mApp	10 Hz to 10 kHz	
Triangle &	47 uApp to 930 mApp	0.01 Hz to 9.99 Hz	
Truncated Sine	47 uApp to 8.49999 mApp	10 Hz to 10 kHz	
20 A Output Sine			
no toroid	3 A to 20.5 A	45 Hz to 5 kHz	
10-turn toroid	30 A to 205 A	45 Hz to 5 kHz	
30-turn toroid	90 A to 615 A	45 Hz to 5 kHz	
50-turn toroid	150 A to 1025 A	45 Hz to 5 kHz	
Square	6 App to 41 App	45 Hz to 1 kHz	
Triangle & Truncated Sine	8.5 App to 57 App	45 Hz to 1 kHz	
LCOMP ON			
Sine	29 uA to 329.999 mA	10 Hz to 1 kHz	
no toroid	0.33 A to 2.99999 A	10 Hz to 440 Hz	
	0.29 mA to 3.29999 A	10 Hz to 1 kHz	
10- turn toroid	3.3 A to 29.9999 A	10 Hz to 440 Hz	
	0.87 mA to 8.9997 A	10 Hz to 1 kHz	
30-turn toroid	9.9 A to 65.9997 A	10 Hz to 440 Hz	
	1.45 mA to 16.49995 A	10 Hz to 1 kHz	
50- turn toroid	16.5 A to 109.9995 A	10 Hz to 440 Hz	
Square	47 uApp to 659.999 mApp	10 Hz to 1 kHz	
	0.66 App to 5.99999 App	10 Hz to 440 Hz	
Triangle & Truncated SIne	47 uA pp to 929.999 mApp	10 Hz to 1 kHz	
	0.93 App to 8.49999 App	10 Hz to 440 Hz	

Function	Amplitude	Frequency/Period	Misc.
20A Output			
Sine			
No toroid	3 A to 20.5 A	45 Hz to 440 Hz	
10-turn toroid	30 A to 205 A	45 Hz to 440 Hz	
30- turn toroid	90 A to 615 A	45 Hz to 440 Hz	
50 turn toroid	150 A to 1025 A	45 Hz to 440 Hz	
Square	6 App to 41 App	45 Hz to 440 Hz	
Triangle & Truncated Sine	8.5 App to 57 App	45 Hz to 440 Hz	
Synthesized Resistance:	0 Ω to 109.999 kΩ		
4-wire & 2-wire comp.			
2-wire	110 kΩ to 1100 MΩ		
Synthesized Capacitance			
2-wire	330 pF to 109.99 nF		
4-wire & 2-wire comp.	110 nF to 1 mF		
RTD Calibration			
100Ω Pt 385	-200 °C to 800 °C, -328 °F to 1472 °F		
200Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
500Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
1 kΩ Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3916	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3926	-200 °C to 630 °C, -328 °F to 1166 °F		
120Ω Ni 391	-80 °C to 260 °C, -112 °F to 500 °F		
10Ω Cu	-100 °C to 260 °C, -148 °F to 500 °F		
Thermocouple Calibration & Measurement			
Type B	600 °C to 1820 °C, 32 °F to 3308 °F		
Type C	0 °C to 2316 °C, 32 °F to 4201 °F		
Type E	-250 °C to 1000 °C, -418 °F to 1832 °F		
Type J	-210 °C to 1200 °C, -410 °F to 2192 °F		
Type K	-200 °C to 1372 °C, -328 °F to 2502 °F		
Type L	-200 °C to 900 °C, -328 °F to 2502 °F		
Type N	-200 °C to 1300 °C, -328 °F to 2372 °F		
Type R	0 °C to 1767 °C, 32 °F to 3213 °F		
Type S	0 °C to 1767 °C, 32 °F to 3213 °F		
Type T	-250 °C to 400 °C, -418 °F to 752 °F		
Type U	-200 °C to 600°C, -328 °F to 1103 °F		

Function	Amplitude	Frequency/Period	Misc.
Dual DC Voltage:			
Normal Output	-1020 V to 1020V		
Aux Output	-7 V to 7 V		
Dual AC Voltage:			
Normal Output[4],			
Sine[2]	1 mV to 1020 V	10 Hz to 10 kHz	
Square	2.9 mVpp to 66 Vpp	10 Hz to 10 kHz	
Triangle &	2.9 mVpp to 93 Vpp	10 Hz to 10 kHz	
Truncated Sine			
Aux Output			
Sine[2]	10 mV to 330 mV	0.01 Hz to 9.99 Hz	
	0.4 V to 3.3V	0.01 Hz to 9.99 Hz	
	10 mV to 3.29999 V	10 Hz to 30 kHz	
	3.3 V to 5 V	10 Hz to 10 kHz	
Square	29 mVpp to 6. 59999 Vpp	0.01 Hz to 10 kHz	
Triangle &	29 mVpp to 9.29999 Vpp	0.01 Hz to 10 kHz	
Truncated Sine	9.3 Vpp to 14 Vpp	0.01Hz to 1kHz	
DC Power:			
Normal Output	-1020 V to 1020 V		
Aux Output	-2.99999 A to 2.99999 A		
20A Output	-20.5 A to 20.5 A		
AC Power:			
Normal Output[4]			
Sine[2]	1 mV to 1020 V	[3]	
	-57.78 dBm to 62.39 dBm	[3]	
Square	2.9 mVpp to 65.9999 Vpp	[3]	
Triangle &	2.9 mVpp to 93 Vpp	[3]	
Truncated Sine			
Aux Output:			
LCOMP OFF			
Sine			
no toroid			
Sine	29 µA to 330 mA	0.01 Hz to 9.99 Hz	
	29 µA to 329.999 mA	10 Hz to 30 kHz	
10-turn toroid	0.33 A to 2.99999 A	10 Hz to 10 kHz	
	0.29 mA to 3.29999 A	10 Hz to 30 kHz	
30-turn toroid	3.3 A to 29.999 A	10 Hz to 10 kHz	
	0.87 mA to 8.9997 A	10 Hz to 30 kHz	
50-turn toroid	9.9 A to 65.9997 A	10 Hz to 10 kHz	
	1.45 mA to 16.49995 A	10 Hz to 30 kHz	
Square	16.5 A to 109.9995 A	10 Hz to 10 kHz	
	47 µApp to 660 mApp	0.01Hz to 9.99 Hz	
Triangle &	47 uApp to 5.99999 App	10 Hz to 10 kHz	
Truncated Sine	47 µApp to 930 mApp	0.01Hz to 9.99 Hz	
	47 µApp to 8.49999 App	10 Hz to 10 kHz	

Function	Amplitude	Frequency/Period	Misc.
20 A Ouput:			
Sine			
no toroid	3 A to 20.5 A	45 Hz to 5 kHz	
10-turn toroid	30 A to 205 A	45 Hz to 5 kHz	
30-turn toroid	90 A to 615 A	45 Hz to 5 kHz	
50-turn toroid	150 A to 1025 A	45 Hz to 5 kHz	
Square	6 App to 41 App	45 Hz to 1 kHz	
Triangle & Truncated Sine	8.5 A to 57 App	45 Hz to 1 kHz	
Humidity Meas.			
1. A duty cycle of 1% to 99% may be specified for square waves. The default is 50%. 2. When both waveforms are sine, either the Normal or Aux output may be specified to be a harmonic from 1 to 31. 3. The frequency is the same for the voltage and the current, therefore the limits of the AC Voltage frequency are the same as those specified for the AC Current range selected. 4. The phase between the two output signals may be specified from -180 degrees to +180 degrees.			

Functional Capability (5520A SCOPE Output with Option SC300 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage:			
50 Ω term.	-2.2 V to 2.2 V		
1 MΩ term.	-33 V to 33 V		
AC Voltage:			
Scope Square Wave (zero based)			
50 Ω term.	1.8 mVpp to 2.2 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.8 mVpp to 55 Vpp	10 Hz to 10 kHz	
ScopeMeter Square Wave			
1 MΩ term.	95 Vpp to 105 Vpp	10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/- 10%	1 kHz to 1 MHz	
Leveled Sine			
50 Ω term.	5 mVpp to 5.5 Vpp	50 kHz to 350 MHz	
Time Markers			Period
50 Ω term.			1.8 ns to 2.2 ns 4.5 ns to 11 ns 18 ns to 22 ns 45 ns to 110 ns 180 ns to 1.1 µs 1.8 µs to 60 µs 90 µs to 12 ms 18 ms to 5.5 s

Functional Capability (5520A SCOPE Output with Option SC300 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			
50 Ω term.	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp
1 MΩ term.	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=50 Vp

Functional Capability (5520 SCOPE Output with Option SC600 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage: 50 Ω term. 1 MΩ term.	 -6.599 V to 6.599 V -130 V to 130 V		
AC Voltage: Scope Square Wave (zero based positive and negative) 50 Ω term. 1 MΩ term. Edge 50 Ω term.	 1.0 mVpp to 6.599 Vpp 1.0 mVpp to 130 Vpp 5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10%	 10 Hz to 10 kHz 10 Hz to 10 kHz 900 Hz to 11 MHz	
w/ Tunnel Diode Pulser Drive Signal Leveled Sine 50 Ω term. Time Markers 50 Ω term Spike Square 20 % Duty Square Sine	11 Vpp to 2.5 Vpp 5 mVpp to 5.5 Vpp	900 Hz to 11 MHz 50 kHz to 600 MHz	 Period 18 ns to 5.5 s 7.5 ns to 5.5 s 75 ns to 34.99 ms 1.8 ns to 17.9 ns
Wavegen Sine, Square, and Triangle Waveforms (zero centered) 50 Ω term 1 MΩ term 	 1.8 mVpp to 10.9 mVpp 11 Vpp to 44.9 mVpp 45 mVpp to 109 mVpp 110 mVpp to 449 mVpp 0.45 Vpp to 1.09 Vpp 1.1 Vpp to 2.2 Vpp 1.8 mVpp to 21.9 mVpp 22 mVpp to 89.9 mVpp 90 mVpp to 219 mVpp 220 mVpp to 899 mVpp 0.9 Vpp to 6.59 Vpp 6.6 Vpp to 55 Vpp	 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz Video	Max AC + DC Offset Vp + |Voff|<=12.5 mVp Vp + |Voff|<=50.5 mVp Vp + |Voff|<=125 mVp Vp + |Voff|<=225 mVp Vp + |Voff|<=1.25 Vp Vp + |Voff|<=3.1 Vp Vp + |Voff|<=26 mVp Vp + |Voff|<=100 mVp Vp + |Voff|<=260 mVp Vp + |Voff|<=1000 mVp Vp + |Voff|<=6.6 Vp Vp + |Voff|<=50 Vp

Functional Capability (5520 SCOPE Output with Option SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Video			Line Marker
NTSC	-150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE		1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even
PAL	-150% to 150% -1.5 Vp to 1.5 Vp		1 to 622 1 to 622
PAL-M	-150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE		1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even
SECAM	 -150% to 150% -1.5 Vp to 1.5 Vp		 1 to 262 1 to 262
Pulse 50 Ω term UUT Input Impedance Measurement (MEAS Z): 50 Ω 1 MΩ Capacitance	 10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp	Period 200 ns to 22 ms	Pulse Width 2 ns to 500 ns 40 Ω to 60 Ω 500 kΩ to 1.5 MΩ 5 pF to 50 pF
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	

Parameters

The following table describes the basic operating modes of the 5520A Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5520FSC.

5520 Operating Modes

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
DC Voltage	voltage		**[TC|SC|S6]**	**[RNGLK**	voltage]	
AC Voltage	voltage	freq|period	**[SC|S6]**			[DC offset]
AC Voltage	freq|period	voltage				[DC offset]
AC Voltage (pulse)	p-width period[2]	Voltage voltage	**S6** **S6**	**Per Pulse**	period p-width[2]	
AC Voltage	duty cycle	freq|period			voltage	[DC offset]
AC Voltage (time marks)	freq|period		**SC|S6**			
DC Current	current			**[RNGLK**	current]	
AC Current	current	freq|period				
AC Current	freq|period	current				
Resistance	resistance					
Resistance	conductance					
Capacitance	capacitance					
RTD Cal	temperature					
TC Cal	temperature		**TC**	**[TCREF**	temp.]	
TC Meas	temperature		**TM|TN**	**[TCREF**	temp.]	
Dual DC Voltage	voltage		**[AX]**		voltage	
Dual AC Voltage	voltage	freq|period	**[BV|AX]**	[**H***n*|**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage	**[BV]**	[**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	**[BV|AX]**	[**H***n*|**H**X*n*]	voltage	voltage
DC Power	power		**[BC|BP]**		voltage	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
DC Power	voltage				current	
DC Power	current		**[BC|BP]**		voltage	
AC Power	power	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	
AC Power	power	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	
AC Power	current	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG**]	voltage	
AC Power	voltage	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	
AC Power	freq|period	current	**[BC|BP]**	[**H***n*| **LEAD|LAG]**	voltage	
AC Power	freq|period	voltage	**[BV]**	[**H**x*n*| **LEAD|LAG]**	current	
AC Power	phase	freq|period	**[BC|BP]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	current
AC Power	phase	freq|period	**[BV]**	[**H***n*|**H**X*n*| **LEAD|LAG]**	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	ODD|EVEN		
Impedance Meas.	resistance| capacitance		**ZM**			
Overload Meas.	voltage	[freq]	**OM**	Limit	time	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
Humidity Meas	percent		**HM**			
Impedance Meas	Resistance | Capacitance		**ZM**			
Overload Meas	voltage	[freq]	**OM**	LIMIT	time	
Dual DC Voltage	voltage		**[AX]**		voltage	
Dual AC Voltage	voltage	freq|period	**[AX]**	[**H***n*|**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage		[**H**X*n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	**[AX]**	[**H***n*|**H**X*n*]	voltage	voltage
DC Power	power				voltage	
DC Power	power				current	
DC Power	voltage				current	
DC Power	current				voltage	
AC Power	power	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	
AC Power	power	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG]**	current	
AC Power	current	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG**]	voltage	
AC Power	voltage	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG]**	current	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
AC Power	freq|period	current		[**H***n*| **LEAD|LAG]**	voltage	
AC Power	freq|period	voltage		[**H**x*n*| **LEAD|LAG]**	current	
AC Power	phase	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG]**	voltage	current
AC Power	phase	freq|period		[**H***n*|**H**X*n*| **LEAD|LAG]**	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	ODD|EVEN		

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units	Symbol Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period or pulse width
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle, video amplitude, or humidity

5520 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2 [1]	5520 MOD3 [2]
DC Voltage	V			[TC]
AC Voltage	V/Vpp/D V/Vpp Vp Vp H/T H/T pct	H/T H/T H/T H/T V/Vpp/D V/Vpp H/T	SI SQ/TI/TS SI SQ/TI/TS SI SQ/TI/TS SI/SQ/TI/TS	
DC Current	A			
AC Current	A/App A/App Ap H/T	H/T H/T H/T A/App	SI SI/SQ/TI/TS SI/SQ/TI/TS SI/SQ/TI/TS	
Resistance	Z/Y			
Capacitance	F			
RTD Cal	degC/degF		R1/R2/R3/R4/R5/R6/R7/R8	
TC Cal	degC/degF		_B/_C/_E/_J/_K/_L/_N/_R/_S/_T/_U	TC
TC Meas	degC/degF		_B/_C/_E/_J/_K/_L/_N/_R/_S/_T/_U	TM/TN
Humidity Meas	pct		PB	HM
Dual DC Voltage	V			[AX]
Dual AC Voltage	V/Vp/Vpp/D V/Vp/Vpp H/T H/T	H/T H/T V/Vpp/D V/Vpp	SI SQ/TI/TS SI SQ/TI/TS	[AX] [AX] [AX] [AX]
DC Power	W/A/V			

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules (cont)

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2 [1]	5520 MOD3 [2]
AC Power	W V/Vp/Vpp/D V/Vp/Vpp A/Ap/App H/T H/T H/T	H/T H/T H/T H/T V/Vpp/D V/Vpp A/App	SI SI SQ/TI/TS SI/SQ/TI/TS SI SQ/TI/TS SI/SQ/TI/TS	
1. See MOD2 parameter for description of these specification codes and rules. 2. See MOD3 parameter for description of these specification codes and rules.				

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC300

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2[1]	5520 MOD3[2]
DC Voltage (VOLT)	V			SC
AC Voltage (VOLT)	V/Vp/Vpp H/T	H/T V/Vpp	ZQ/SM ZQ/SM	SC SC
AC Voltage (Edge)	V/Vp/Vpp	H/T	ED	SC
AC Voltage (LEVSINE)	V/Vp/Vpp H/T	H/T V/Vp/Vpp	LS LS	SC SC
AC Voltage (MARKER)	H/T		MK	SC
AC Voltage (WAVEGEN)	V/VP/Vpp H/T	H/T V/VP/Vpp	SI/SQ/TI SI/SQ/TI	SC
1. See MOD2 parameter for description of these specification codes and rules. 2. See MOD3 parameter for description of these specification codes and rules.				

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC600

5520A Mode	5520 Nominal	5520 MOD1	5500 MOD2 [1]	5500 MOD3 [2]
DC Voltage (VOLT)	V			S6
AC Voltage (VOLT)	V/Vp/Vpp H/T	H/T V/Vpp	ZQ/SN ZQ/SN	S6 S6
AC Voltage (EDGE)	V/Vp/Vpp H/T	H/T V/Vpp	ED ED	S6
AC Voltage (LEVSINE)	V/Vp/Vpp H/T	H/T V/Vpp	LS LS	S6 S6
AC Voltage (MARKER)	H/T		M1/M2/M3/M4	S6
AC Voltage (WAVEGEN)	V/VP/VPP H/T	H/T V/VP/VPP	SI/SQ/TI SI/SQ/TI	S6
AC Voltage (PULSE)	H/T	Vpp	PU	S6
Video (VIDEO)	pct/Vp/IRE pct/Vp	LM LM	F1/F3 F2/F4	S6 S6
Impedance Meas (MEAS Z)	Z F			ZM ZM
Overload Meas (OVERLD)	V Vpp	 H		OM OM

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- The NOMINAL field may not specify frequency or period when any of the following sets of conditions exist:

1. Dual AC Voltage is specified and either
   a. the M5520 RANGE field specifies H and the M5520 MOD3 field specifies AX

      or

   b. the M5520 RANGE field specifies HX and the 5520 MOD3 field specifies AX.
2. AC Power is specified and either
   a. the M5520 RANGE field specifies H and the M5520 NOMINAL field specifies current

      or

   b. the M5520 RANGE field specifies HX and the M5520 NOMINAL field specifies voltage.
3. The MOD3 field specifies E.

- When the NOMINAL field specifies frequency or period and the M5520 RANGE field specifies a harmonic (H or HX), the Keyboard Entry (ASK+ K) or Go/No-Go (ASK+ G) evaluation mode must be specified, Slew is not allowed.

A duty cycle other than 50% may only be specified for square waveforms (MOD2 is SQ). Therefore keyboard entry and go-nogo evaluations may be performed at 50% duty cycle for non-square waveforms, but slew mode is not allowed. In addition the duty cycle is restricted to 50%, regardless of the type of waveform, when the DC offset is not zero.

- When the NOMINAL field specifies power and the value is slewed, if the M5520 NOMINAL field specifies voltage, the voltage is held constant and a new value of current is computed by the 5520A.

If the M5520 NOMINAL field specifies current, the current is held constant and a new value of voltage is computed by the 5520A.

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described In "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage or AC Current.
2. The waveform type for the voltage or current not specified in the M5520 NOMINAL field for AC Power or Dual AC Voltage.
3. The thermocouple or RTD type for TC Measurement, TC Calibration, or RTD Calibration.

- *blank* DC or not applicable
- SI Sine wave (5520A, SC300 and SC600 Wavegen)
- SQ Square wave (5520A, SC300 and SC600 Wavegen)
- TI Triangle wave (5520A, SC300 and SC600 Wavegen)
- TS Truncated sine wave
- PB Temperature/Humidity Probe
- _B Type B thermocouple
- _C Type C thermocouple
- _E Type E thermocouple
- _J Type J thermocouple
- K Type K thermocouple
- _L Type L thermocouple
- _N Type N thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _T Type T thermocouple
- _U Type U thermocouple
- R1 100 Ohm Pt 385 RTD
- R2 100 Ohm Pt 3926 RTD
- R3 120 Ohm Ni RTD
- R4 200 Ohm Pt 385 RTD
- R5 500 Ohm Pt 385 RTD
- R6 1 kOhm Pt 385 RTD
- R7 100 Ohm Pt 3916 RTD
- R8 10 Ohm Cu RTD
- ZQ Positive square wave (SC300 and SC600 AC Voltage)
- ZN Negative square wave (SC600 AC Voltage)
- SM ScopeMeter wave (SC300 AC Voltage)
- ED Edge signal (SC300 and SC600)
- LS Leveled sine wave (SC300 and SC600)
- MK Marker signal (SC300)
- M1 Spike Marker signal (SC600)
- M2 Square Marker signal (SC600)
- M3 20% Duty Cycle Square Marker signal (SC600)
- M4 Sinusoid Marker signal (SC600)
- PU Pulse wave (SC600)
- F1 NTSC video signal (SC600)
- F2 PAL video signal (SC600)
- F3 PAL-M video signal (SC600)
- F4 SECAM video signal (SC600)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, Dual AC Voltage, or AC Power (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Measurement or TC Calibration if no MOD2 code is entered.

R1 is inserted automatically in the MOD2 field for RTD Calibration if no MOD2 code is entered.

- The M5520 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5520 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M5520 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- *blank* Default for mode specified
- AX Auxiliary Voltage
- TC Thermocouple Cal
- TM Thermocouple Measurement (open to TC detection on)
- TN Thermocouple Measurement (open to TC detection off)
- HM Humidity Measurement
- SC SC300 Scope Option
- S6 SC600 Scope Option
- ZM SC600 UUT Input Impedance Measurement
- OM SC600 UUT 50 Input Overload Protection Measurement

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage is specified and the M5520 MOD3 field does not specify AX.
- The MOD3 field may specify SC only when the SC300 Scope option is configured.

- The MOD3 field may specify S6 only when the SC600 Scope option is configured.
- SC is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, SM, ED, LS, or MK, and the SC300 Scope Option is configured, and no MOD3 code is entered.
- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and the SC600 Scope Option is configured, and no MOD3 code is entered.
- The M5520 RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- L2W 2-wire w/load compensation enabled
- 3W 3-wire
- 4W 4-wire
- CW 2-wire ohms compensated at the UUT terminals
- DV 2-wire using the external AC Divider
- TD Tunnel Diode Pulser Drive signal enabled
- T1 10-turn Toroid Coil
- LT1 10-turn Toroid Coil w/load compensation enabled
- T3 30-turn Toroid Coil
- LT3 30-turn Toroid Coil w/load compensation enabled

- T5 50-turn Toroid Coil
- LT5 50-turn Toroid Coil w/load compensation enabled
- L 50 Ohm Termination
- *blank* 1 MOhm Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify 3W only when the RTD Cal mode is specified.
- The CON field may specify CW only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify 4W only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify DV only when AC Voltage mode is specified, the MOD2 field specifies SI, the MOD3 field does not specify E and the NOMINAL or MOD1 field specifies a voltage of 22 mV or less.
- The CON field may specify T1, T3, or T5 only when the MOD3 field does not specify E and DC Current or DC Power mode is specified or AC Current mode is specified and the MOD2 field specifies SI or AC Power mode is specified and either

    1. the M5520 NOMINAL field specifies voltage and the 5520 MOD2 field specifies SI

       or

    2. the M5520 NOMINAL field specifies current and the M5520 MOD2 field specifies SI.

- The CON field may specify L2W, LT1, LT3, or LT5 only when the mode is AC Current or AC Power.
- The CON field may specify L only when the MOD3 field specifies SC or S6 and the MOD2 field does not specify SM.
- The CON field must specify L when the MOD2 field specifies LS, ED, or MK, and the MOD3 field specifies SC.
- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or MK, the MOD3 field specifies SC and no CON field code is entered.

- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, the MOD3 field specifies S6 and no CON field code is entered.
- CON field must specify 2W when the MOD3 field specifies ZM, HM, or OM.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5520        *
  1.002  5520         *                                              S
# ----- DC Voltage -----
  1.003  5520   20    19.99mV        2% 0.04U                           2W
# ----- DC Voltage w/Range Lock -----
  2.001  M5520  RNGLK 3V
  2.002  5520   400   350.0mV        1.9% 0.4U                          2W
  3.001  M5520        *
# ----- DC Voltage, TC Terminals -----
  3.002  5520         35mV                                        TC S  2W
# ----- AC Voltage -----
  3.003  5520   400   350.0mV        -2.8U +2.9U   60H           SI       2W
# ----- AC Voltage w/External AC Divider -----
  4.001  5520         -37.78D        0.1U          100H          SI       DV
# ----- AC Voltage (Frequency Test) -----
  5.001  5520   1000  800.0H         0.1% 0.1U     300mV         SI       2W
# ----- Square Wave w/DC Offset -----
  6.001  M5520                                     0.5Voff
  6.002  5520         1Vpp                        1kH           SQ    S  2W
# ----- Square Wave w/Duty Cycle Specified -----
  6.003  M5520                      35pct
  6.004  5520         1Vpp                        1kH           SQ    S  2W
# ----- Square Wave (Duty Cycle Test) ------
  6.005  M5520        1Vpp
  6.006  5520         30pct          2U            500H          SQ       2W
  7.001  M5520        *
# ----- Triangle Wave -----
```

```
 7.002  5520         13mVpp                        10kH           TI    S  2W
# ----- Truncated Sine Wave -----
  7.003  5520         2.5mApp                        5kH            TS    S  2W
# ----- DC Current -----
  7.004  5520   1     1.00A          1%                                    2W
  8.001  5520   20    19.00A         0.07U                            HC    2W
# ----- Dual DC Voltage -----
  9.001  M5520        10mV
  9.002  5520         100mV          3%                               AX    2W
# ----- Dual AC Voltage -----
 10.001  M5520        1V                                          SI AX
 10.002  5520         141Vp                         10kH           SI    S  2W
# ----- Dual AC Voltage (Phase Test) ------
 10.003  M5520        1Vpp                          1Vpp           SQ AX
 10.004  5520         30deg          1U             60H            SQ       2W
# ----- Dual AC Voltage (Harmonics) ------
 11.001  M5520  H2    100V                                        SI
 11.002  5520         750mV          1U             60H            SI AX    2W
 12.001  M5520  HX3   1Vpp                                        SI AX
 12.002  5520         1Vpp           1U             60H            SI       2W
 13.001  M5520        *
# ----- DC Power (Volts and Amps) -----
 13.002  M5520        1mV                                                O  EL
 13.003  5520         1mA            1%                                    2W
# ----- AC Power (Volts and Amps) -----
 14.001  M5520        1mA            60deg                          SI
 14.002  5520         1V                            400H           SI    S  2W
# ----- AC Power (Watts and Volts) w/Displacement Power Factor -----
 14.003  M5520  LEAD  1V             0.998                          SI
 14.004  5520   20    19mW           1%             60H            SI       2W
# ----- AC Power (Watts and Vpp) w/Phase Specified -----
 15.001  M5520        1Vpp           -45deg                         SI
 15.002  5520   20    1mW            1U             400H           SI       2W
# ----- AC Power (Harmonics) ------
 16.001  M5520  H2    45V                                         SI
 16.002  5520         100W           1U             60H            SI       2W
 17.001  M5520  HX3   1mApp                                       SI
 17.002  5520         1Vpp           1U             60H            SI       2W
 18.001  M5520        *
# ----- Resistance -----
 18.002  5520   400   390.0Z         0.4% 0.1U                             CW
 19.001  5520   4     3.900MZ        0.05U                                 2W
# ----- Capacitance ----
 20.001  5520   10    1.100uF        2% 0.002U                             2W
# ----- Humidity Measurement -----
```

```
 21.001  5520         50.0pct                                  PB HM N  2W
# ----- Temperature Measurement -----
 21.002  5520         1200.0degF                               _J TM N  2W
# ----- Temperature Stimulus -----
 21.003  M5520  TCREF 0degC
 21.004  5520         50degC         1%                        _K TC    2W
 22.001  M5520        *
 22.002  5520         45degC                                   R1    S  3W

SC300 Scope Option

 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5520   20    19.99mV        4%                           SC
# ----- AC Voltage (Scope Square Wave) -----
  2.001  5520   400   350.0mV        50U           60H            ZQ SC
# ----- AC Voltage (ScopeMeter Wave) -----
  3.001  5520         100Vpp                       1kH            SM SC S
# ----- AC Voltage (Frequency Test) -----
  3.002  5520   1000  800.0H         0.1% 0.1U     300mV          ZQ SC
# ----- Edge Signal (Scope Output) -----
  4.001  5520         0.5Vpp                       1MH            ED SC S  L
# ----- Leveled Sine Wave -----
  4.002  5520         200mVpp                      50kH           LS SC S  L
# ----- Marker Signal -----
  4.003  M5520                                                             2T
  4.004  5520         1uT                                      MK SC S  L
# ----- Wavegen -----
  4.005  5520         5V                           1kH            SI SC S
# ----- Wavegen w/DC Offset -----
  4.006  M5520                                     0.5Voff
  4.007  5520         1Vpp                         1kH            TI SC S
# ----- Wavegen w/Duty Cycle Specified -----
  4.008  M5520                       35pct
  4.009  5520         1Vpp                         1kH            SQ SC S
  4.010  M5520        *

SC600 Scope Option

 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5520   20    19.99mV        4%                           S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5520   400   350.0mV        50U           60H            ZQ S6
```

```
# ----- AC Voltage (Positive Scope Square Wave) -----
  3.001  5520         100Vpp                        1kH           ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5520   1000  800.0H         0.1% 0.1U     300mV         ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5520         0.5Vpp                        1MH           ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5520         200mVpp                       50kH          LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5520                                                            2T
  4.004  5520         1uT                                         M1 S6 S  L
  4.005  M5520        *
# ----- Square Marker Signal -----
  4.006  5520         1mT                                         M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5520         5uT                                         M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5520         2nT                                         M4 S6 S  L
# ----- Wavegen -----
  4.009  5520         5V                            1kH           SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5520                                      0.5Voff
  4.011  5520         1Vpp                          1kH           TI S6 S
# ----- NTSC Video -----
  4.012  M5520  ODD
  4.013  5520         1Vp                           262LM         F1 S6 S  L
  4.014  M5520        *
# ----- PAL Video -----
  4.015  5520         50pct                         400LM         F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5520  EVEN
  4.017  5520         -140IRE                       1LM           F3 S6 S  L
  4.018  M5520        *
# ----- SECAM Video -----
  4.019  5520         -100pct                       622LM         F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5520  PER   200nT
  4.021  5520         5.0nT                         2.5Vpp        PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5520  PULSE 10nT
  4.023  5520         1.00kH                        2.5Vpp        PU S6 N  L
  4.024  M5520        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5520         50Z           1U                             ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
```

```
  5.001  5520         1.000MZ        1U                              ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5520         10pF                                           ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M5520  LIMIT 10T
  6.003  5520         5V                                             OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5520  LIMIT 10T
  7.002  5520         7V                                             OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5520

Auxiliary Instrument Setup FSC

Description

The M5520 FSC provides the additional program functions for the Fluke 5520A Calibrator which are not addressed by the 5520 FSC. These functions include Range Locking, DC Offset, Thermocouple External Temperature Reference, Phase, Power Factor, Duty Cycle, voltage and/or current for power stimulus, and voltage of the second signal for dual voltage output.

The following functions are available with SC600 Scope Option:

- Time limit for UUT 50 Ohm input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Trigger output

Parameters

For a description of the 5520A Calibrator operating modes referenced in this section, see Table 1 in the 5520 Instrument FSC description.

When a blank M5520 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

Units Symbols

Units	Symbol Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage or video amplitude
V0ff	Volts offset	DC Offset
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle

M5520 FSC Range, Nominal, MOD1, MOD2, and MOD3 Rules

5520A Mode	M5520 Range	M5520 Nominal	M5520 TOL.	M5520 MOD1	M5520 MOD2 [1]	M5520 MOD3 [2]
DC Voltage	[RNGLK	V]				
AC Voltage	[IMPED	[V/Vp/Vpp] [V/Vpp] ohms]	[pct]	Voff [Voff]		
DC Current	[RNGLK	A]				
TC Cal	[TCREF	degC/degF]				
TC Meas	[TCREF	degC/degF]				
Dual DC Voltage	V					[AX]
Dual AC Voltage	[H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp V/Vp/Vpp	[deg] [deg] [deg]	 [V/Vp/Vpp/D] V/Vp/Vpp/D] V/Vp/Vpp	SI SI SI SI SQ/TI/TS SQ/TI/TS	[AX] [AX] [AX] [AX] [AX] [AX]
DC Power	V/A					
AC Power	[LEAD/LAG] [LEAD/LAG] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp V/Vp/Vpp	[*dpf*] [*dpf*] [deg] [deg] [deg] [deg] [deg]	 A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App	SI SI SI SI SI SI SI SI SI SI SQ/TI/TS SQ/TI/TS	[HC] [HC] [HC] [HC] [HC]

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

M5520 NOMINAL, MOD1, MOD2, and MOD3 Rules for SC600

M5520 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for SC300.

M5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC600

5500A Mode	M550 Range	M550 Nominal	M550 Tolerance	M550 MOD1	M550 MOD2	M550 MOD3
AC Voltage (WAVEGEN)				[OFFSET]		
AC Voltage (PULSE)	PER/PULSE	H/T				
Video (VIDEO)	[ODD/EVEN]					
Overload Meas (OVERLD)	LIMIT	T				

Note

blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter. M5520 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for SC600 operating modes not listed.

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- IMPED Output Impedance
- TCREF Thermocouple Reference
- LEAD Leading
- LAG Lagging
- H*n* Primary output is a harmonic, 1 to 51
- HX*n* Secondary output is a harmonic, 1 to 51
- PULSE Pulse Width
- PER Pulse Period

- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may not specify RNGLK when the 5520 MOD3 field specifies TC, SC, or S6.
- The RANGE field may specify IMPED only for AC Voltage mode when the amplitude is expressed in decibels.
- When the RANGE field specifies LEAD or LAG, the TOLERANCE field must specify the Displacement Power Factor.
- The primary output is always the Normal output. The secondary output is the Aux or 20A output.
- The RANGE field may specify PULSE or PER only when the 5520 MOD2 field specifies PU.
- The RANGE field must specify PULSE or PER when the 5520 MOD2 field specifies PU.
- The RANGE field may specify ODD or EVEN only when the 5520 MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5520 MOD2 field specifies F1 or F3.

NOMINAL

This field specifies one of the following entered as:

[*numeric*][*prefix*] *units symbol*

- Range lock selection value in Volts or Amps
- Output Impedance in Ohms
- Thermocouple Reference
- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- Signal amplitude for AC Voltage, Dual DC Voltage, Dual AC Voltage, DC Power, or AC Power
- "*" reset to default values

- *blank* field not applicable

Rules:

- The NOMINAL field may specify a Voltage or Current range selection value only when the RANGE field specifies RNGLK.

Voltage Range Selection Value	Locked Range
0 mV to 33 mV	33 mV DC
> 33 mV to 330 mV	330 mV DC
> 330 mV to 3.3 V	3.3 V DC
> 3.3 V to 33 V	33 V DC
> 33 V to 330 V	330 V DC
> 330 V to 1020 V	1000 V DC
Current Range Selection Value	**Locked Range**
0 mA to 3.3 mA	3.3 mA DC
> 3.3 mA to 33 mA	33 mA DC
> 33 mA to 330 mA	330 mA DC
> 330 mA to 3 A	3 A DC
> 3 A to 20 A	20 A DC[1]

1. The 11 A range may be locked only when the 5500 FSC MOD3 field does not specify BP (Boost Port).

The NOMINAL field must specify the pulse period or pulse repetition frequency when the M5520 RANGE field is PER.

- The NOMINAL field must specify the pulse width when the M5520 RANGE field is PULSE.
- When the NOMINAL field specifies voltage and Dual DC Voltage or Dual AC Voltage mode is specified, either the MOD3 field must specify AX or the 5520 MOD3 field must specify AX.
- The NOMINAL field may specify Thermocouple Reference only when the RANGE field specifies TCREF. In this case, the UUT is compensating for its thermocouple junction temperature and Thermocouple Reference should be set to the temperature of the UUT's junction. Thermocouple Reference must be in the same units as the temperature specified in the 5520 NOMINAL field.
- When the NOMINAL field does not specify Thermocouple Reference, the 5520A internal reference is used and the UUT is not compensating for its thermocouple junction temperature.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field specifies phase or duty cycle entered as

numeric[*prefix*]*units symbol* or displacement power factor entered as *numeric*.

Rules:

- The TOLERANCE field may specify Displacement Power Factor only when the RANGE field specifies LEAD or LAG.
- The TOLERANCE field may specify Duty Cycle only when AC Voltage mode is specified and the 5520 MOD2 field specifies SQ.

MOD1

This field specifies DC offset for AC Voltage or one amplitude for AC Power or Dual AC Voltage entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- The MOD1 field may specify voltage or current only when the 5520 NOMINAL field specifies phase.
- When the MOD1 field specifies voltage with units of "D", the 5520 MOD2 field must specify SI.
- When the MOD1 field specifies voltage with units of "Vp" or "Vpp" or current with units of "Ap" or "App", the 5520 MOD2 field must specify SI, SQ, TI, or TS.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5520 NOMINAL field units are not decibels.
- When the MOD1 field specifies DC Offset, either the voltage specified in the 5520 NOMINAL or MOD1 field must be less than 33V or the DC Offset value must be zero.
- When the MOD1 field specified DC Offset and the 5520 NOMINAL field specifies duty cycle, the specified DC Offset must be zero.
- When the MOD1 field specifies DC Offset other than 0V, and the TOLERANCE field specifies duty cycle, the duty must be 50%.

- When the MOD1 field specifies DC Offset and the 5520 NOMINAL field specifies duty cycle, the specified DC Offset must be zero.

MOD2

This field specifies the waveform for the output specified in the NOMINAL field.

- SI Sine wave
- SQ Square wave
- TI Triangle wave
- TS Truncated sine wave
- *blank* DC or field not applicable

MOD3

This field specifies the calibrator output mode:

- AX Auxiliary Voltage
- HC 20 A Output
- *blank* default port, or field not applicable

Rules:

The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage mode is specified and the 5520 MOD3 field does not specify AX.

MOD4

This field controls the external guard and whether or not the NORMAL and AUX "LO" terminals are tied together for DC Power, AC Power, Dual DC Voltage, and Dual AC Voltage modes.

MOD4	Lows	External Guard
blank	Shorted	Off
O	Open	Off
G	Shorted	On
OG	Open	On

Rules:

- The MOD4 field may specify "O" or "OG" only when the CON specifies "EL" or "FL".

CON

This field controls whether or not the NORMAL and AUX "LO" terminals are tied to Earth and the trigger output.

- *blank* default or field not applicable
- EL Low tied to Earth
- FL Floating Low
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

Rules:

- The CON field specification is ignored, and a floating low is used when Resistance, Capacitance, RTD Calibration, or Thermocouple Measurement mode is specified.
- A CON field specification of 1T, 2T, or 3T is only applicable (is ignored otherwise) when the 5520 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.
- When the CON is field is blank, a floating low is used.

Examples

See 5520 FSC.

5700

Instrument FSC

Description

The 5700 FSC controls the following functions of the Fluke 5700A Multi-function Calibrator:

- Voltage, current, or resistance stimulus
- HF Voltage using the 5700A-03 Wideband AC Option
- Voltage or current from the 5725A Precision Power Amplifier
- Voltage from the 5205A or 5215A Power Amplifier
- Current from the 5220A Transconductance Amplifier The 5725A, 5205A, 5215A, or 5220A must be connected to the 5700A in order to be controlled via the 5700 FSC.

Note

The 5700 FSC may also be used to control a 5700A/EP or 5720A. This capability allows 5700A based to procedures to be executed without modificaiton when a 5700A/EP or 5720A is configured.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
DC Voltage w/5205A Boost	+/-(100 V to 1100 V)		B2
AC Voltage	220 μV to 219.9999 V, -70.99307 dBm to 49.06693 dBm 220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 1.1999 MHz 50 Hz to 1 kHz	
AC Voltage w/5725A Boost	220 V to 1100 V, 49.06694 dBm to 59.71971 dBm 220 V to 750 V, 49.06694 dBm to 63.04634 dBm	40 Hz to 100 kHz 40 Hz to 30 kHz	B1 B1
AC Voltage w/5205A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B2
AC Voltage w/5215A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B3
AC Voltage w/5700A-03 Opt	300 μV to 3.5 V, -57.44741 dBm to 23.89167 dBm	10 Hz to 30 MHz	W
DC Current	-2.199999 A to 2.199999 A		
DC Current w/5725A Boost	-11 A to 11 A	B1	
DC Current w/5220A Boost	-20 A to 20 A	B4	
AC Current	9 μA to 219.999 mA 220 mA to 2.199999 A	10 Hz to 10 kHz 40 Hz to 10 kHz	
AC Current w/5725A Boost	1 A to 11 A	40 Hz to 10 kHz	B1
AC Current w/5220A Boost	1 A to 20 A	40 Hz to 5 kHz	B4
Resistance	0 Ω,1 Ω to 100 MΩ (in decade steps) 1.9 Ω to 19 MΩ (in decade steps)		
Conductance	1 S to 10 nS (in decade steps) 0.52631 S to 52.631 nS (in decade steps)		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.

- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character "O" for this field. The use of the internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances. Therefore, the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

- The high burden property of the UUT requires divider override to maintain calibration accuracy in the DC Volts mode.
- Fewer operator interactions are necessary and the feature of the internal and external divider is not necessary, resulting in shorter calibration times.

The following information shows the entries in the MOD2 field, the mode of the 5700A, the Nominal value, and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 220 mV	50 Ω output impedance from 5700A
(blank)	Volts DC	≥220 mV	Low output impedance from 5700A
(blank)	Volts AC	<22 mV	50 Ω divider used. Reduced system noise levels, less accuracy
(blank)	Volts AC	≥22 mV	Low output impedance from 5700A
O	Volts DC	<220 mV	5700A fixed in 2.2 V range
O	Volts DC	≥220 mV	Not applicable
O	Volts AC	<22 mV	used, more wideband noise.
O	Volts AC	≥22 mV	Not applicable

Use of Divider Override in DC Voltage Mode

The output impedance of the 5700A is 50 Ω for programmed voltages below 220 mV in the DC Voltage mode. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

In the DC Voltage mode, the internal divider of the 5700A can be overridden and fixed in the 2.2V range to calibrate these high burden meters. If the input impedance of the UUT has no impact on the accuracy of calibration, the divider override in DC Voltage should not be specified, since the calibration system uncertainty is less.

Use Of Divider Override In AC Voltage Mode

The output impedance of the 5700A is low in any of the ranges. An external 1000:1 divider is supplied with every calibration system, that uses the 5700A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is generally not necessary; however, to calibrate wideband voltmeters, this external divider should be used.

If the bandwidth of the AC function of the UUT is below 1 MHz, the external divider should be disabled by using the "O" selection in the MOD2 field. The calibration system uncertainty is less in this case.

MOD3

This field specifies one of the following:

- B1 use 5725A for voltage or current boost
- B2 use 5205A for voltage boost
- B3 use 5215A for voltage boost
- B4 use 5220A for current boost
- W use 5700A-03 Wideband output for AC Voltage
- *blank* No Boost, wideband, or not applicable

Rules:

- If the amplitude and frequency combination can be created only by the Boost Amplifier, B1, B2, B3, or B4 is inserted automatically. If there are two voltage boost amplifiers (e.g., 5725A and 5205A) configured in the system and both can provide the desired voltage/current combination, the 5725A has precedence and B1 is automatically inserted in the MOD3 field. If there are two current boost amplifiers (e.g., 5725A and 5220A) configured in the system and both can provide the desired current, the 5725A again has precedence and B1 is automatically inserted in the MOD3 field.
- If the amplitude and frequency combination can be created only the 5700A-03 Wideband AC option, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- CW 2-wire Ohms compensated at the UUT terminals
- RW 2-wire Ohms compensated at the 5700A terminals

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:

  DC Voltage < 22 mV (unless MOD2 is O)

  AC Voltage < 220 mV

  DC Current

  AC Current

  100 MΩ Resistance
- The CON field may specify CW or RW only for resistance less than or equal to 19 kΩ.
- MET/CAL displays an automatic connection message to use the external 1000:1 divider when the following conditions exist:

  1. AC Voltage mode is specified and the amplitude is less than 22 mV
  2. The MOD2 does not specify divider override (O)
  3. The automatic message has not been disabled using ASK- V.

⚠ Warning

If ASK- V is in effect and conditions 1 and 2 exist it is of paramount importance that the procedure write explicitly generate a connection message for the external divider using the DISP FSC. Failure to do so could result in damage to the UUT and possible bodily injury.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	5700		*					S	
1.002	5700	1000	1100V	1U 1/					2W
2.001	5700	10	0V	1U					2W
3.001	5700	200	220mV	10%	50H				2W
4.001	5700	1000	1100V	1U	1kH				4W
5.001	5700	1	-47.12D	0.1U	50H				2W
6.001	5700	100	63.045D	0.5U	1kH				2W
7.001	5700	100	-22µA	10%					2W
8.001	5700	2	1.999A	1% 1/	1kH				2W
9.001	5700	A	mV	0.1U	50H				2W
10.001	5700	A	A	5%	1kH				2W
11.001	5700		1.999A		1kH			S	2W
11.002	5700	10	20mV	500H				N	2W
11.003	5700	10	20mV	0.5%	1kH			C	2W
12.001	5700	A	1Z	5%					CW

MMFC

Auxiliary Instrument Setup FSC

Description

The MMFC FSC programs the 5700A Multifunction Calibrator for special functions. All special functions are reset when another MMFC FSC is used. The new set-up defined by the MMFC FSC becomes effective with the next occurrence of the 5700 FSC.

Parameters

RANGE

Not used.

NOMINAL

Specifies the Phase in degrees from the Variable Phase Reference Output of the 5700A, relative to the normal output, or a reset of the MMFC FSC to the default parameters. The phase is entered as:

sign phase o

A reset of the MMFC parameters is accomplished by entering an asterisk (*).

Allowed values	Units:
-180° to +180°	(o)

- If the Nominal field is blank, the variable phase is OFF.
- The sign may be +, -, or blank.

TOLERANCE

Not used.

MOD1

Specifies the 5700A range that the nominal values will use in all succeeding 5700 FSCs using the Range Lock capability of the 5700A.

- The range used will be the one that provides the highest resolution of the value entered in the range field of the MMFC FSC. Note that the value

indicated by the range name cannot be generated by that range. For example, the maximum value in the 2.2 V range is 2.1999999 V, not 2.2 V.

- Only DC voltage and DC current can be range locked.
- FSC statements which don't specify Nominal values in DC voltage or current will ignore this field.
- DC voltage outputs may have either positive or negative polarity, so the true range of possible outputs is –1100 V to +1100 V. The same is true for current, so the range of possible outputs is -2.2 A to +2.2 A
- The range to be range locked is entered as:

  `nominal_value_in_range` *`prefix`* `units`

  The prefix can be the same as specified for the NOMINAL and MOD1 field of any instrument FSC.

- Function, allowed values for nominal_value_in_range and units:

  Volts, DC -1100 V to + 1100 V (V)
  Amps, DC -2.2 A to + 2.2 A (A)

- The following 5700A ranges allow range locking:

	MMFC MOD1 Value	Range Locked
DC Voltage	-219.99999 mV to -219.99999 mV	220 mV
	-2.1999999 V to -220.00000 mV	2.2 V
	2.1999999 V	2.2 V
	-10.999999 V to -2.2000000 V	11 V
	10.999999 V	11 V
	-21.999999 V to -11.000000 V	22 V
	21.999999 V	22 V
	-219.99999 V to -22.000000 V	220 V
	219.99999 V	220 V
	-1100.0000 V to -220.00000 V	1100 V
	1100.0000 V	1100 V
	219.99999 μA	220 μA
DC Current	-2.1999999 mA to -220.00000 μA	2.2 mA
	2.1999999 mA	2.2 mA
	-21.999999 mA to -2.200000 0 mA	22 mA
	21.999999 mA	22 mA
	-219.99999 mA to -22.000000 mA	220 mA
	219.99999 mA	220 mA
	220.00000 mA	2.2 A
	2.2000000 A	2.2 A

MOD2

Allows specification of the guard connection. If 'G' is specified, the external guard connection becomes active. If nothing is entered the guard is internally shorted to low. The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD3

Specifies Phase Lock. Enter 'PL' when AC voltage or current are to use external phase lock.

MOD4

Not used.

CON

Specifies which output terminals are to be used in the Current Mode of operation. The following entries should be used as a function of the terminals to be used:

CON entry	Output terminals
C1	Normal output terminals
C2	AUX output terminals
C3	5725A output terminals

- Current greater than 2.2A will always come out of the appropriate Boost terminals.
- If the field is left blank, the default will be the value of the CON field in the previous MMFC FSC and if there is none, the default 'C1' is assumed.

Miscellaneous

- No memory location is affected by the MMFC FSC.
- There are no automatic messages associated with the MMFC FSC.
- Certain combinations of entries in MMFC FSC and 5700 FSCs that follow, are inappropriate. The interrelationships of the 5700 and MMFC FSCs are NOT verified during backup or compilation of the procedure. Incorrect combinations may result in error messages during procedure execution.

Examples

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.001  MMFC         180o                                          PL    C1
6.002  MMFC         -180o                                         PL    C2
```

5720

Instrument FSC

Description

The 5720 FSC controls the following functions of the Fluke 5720A Multi-function Calibrator:

- Voltage, current, or resistance stimulus
- HF Voltage using the 5700A-03 Wideband AC Option
- Voltage or current from the 5725A Precision Power Amplifier
- Voltage from the 5205A or 5215A Power Amplifier
- Current from the 5220A Transconductance Amplifier

The 5725A, 5205A, 5215A, or 5220A must be connected to the 5720A in order to be controlled via the 5720 FSC.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
DC Voltage w/5205A Boost	+/-(100 V to 1100 V)		B2
AC Voltage	220 µV to 219.9999 V, -70.99307 dBm to 49.06693 dBm 220 V to 250 V, 49.06694 dBm to 50.17729 dBm 250.001 V to 1100 V, 50.17732 dBm to 63.04634 dBm	10 Hz to 1.1999 MHz 15 Hz to 1 kHz 50 Hz to 1 kHz	
AC Voltage w/5725A Boost	220 V to 1100 V, 49.06694 dBm to 59.71971 dBm 220 V to 750 V, 49.06694 dBm to 63.04634 dBm	40 Hz to 100 kHz 40 Hz to 30 kHz	B1 B1
AC Voltage w/5205A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B2

Function	Amplitude	Frequency	MOD3
AC Voltage w/5215A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B3
AC Voltage w/5700A-03 Opt	300 μV to 3.5 V, -57.44741 dBm to 23.89167 dBm	10 Hz to 30 MHz	W
DC Current	-2.199999 A to 2.199999 A		
DC Current w/5725A Boost	-11 A to 11 A		B1
DC Current w/5220A Boost	-20 A to 20 A		B4
AC Current	9 μA to 219.999 mA 220 mA to 2.199999 A	10 Hz to 10 kHz 40 Hz to 10 kHz	
AC Current w/5725A Boost	1 A to 11 A	40 Hz to 10 kHz	B1
AC Current w/5220A Boost	1 A to 20 A	40 Hz to 5 kHz	B4
Resistance or Conductance	0 Ω (short) 1 Ω to 100 MΩ, 1 S to 10 nS (in decade steps) 1.9 Ω to 19 MΩ, 0.52631 S to 52.631 nS (in decade steps)		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.

- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character "O" for this field. The use of the internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances. Therefore, the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

- The high burden property of the UUT requires divider override to maintain calibration accuracy in the DC Volts mode.
- Fewer operator interactions are necessary and the feature of the internal and external divider is not necessary, resulting in shorter calibration times.

The following information shows the entries in the MOD2 field, the mode of the 5720A, the Nominal value, and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 220 mV	50Ω output impedance from 5720A
(blank)	Volts DC	≥220 mV	Low output impedance from 5720A
(blank)	Volts AC	<22 mV	External 1000:150 Ω divider used. Reduced system noise levels, less accuracy
(blank)	Volts AC	≥22 mV	Low output impedance from 5720A
O	Volts DC	<220 mV	5700A fixed in 2.2 V range
O	Volts DC	≥220 mV	Not applicable
O	Volts AC	<22 mV	External divider not used, more wideband noise.
O	Volts AC	≥22 mV	Not applicable

Use of Divider Override in DC Voltage Mode

The output impedance of the 5720A is 50 Ω for programmed voltages below 20 mV in the DC Voltage mode. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

In the DC Voltage mode, the internal divider of the 5720A can be overridden and fixed in the 2.2V range to calibrate these high burden meters. If the input impedance of the UUT has no impact on the accuracy of calibration, the divider override in DC Voltage should not be specified, since the calibration system uncertainty is less.

Use of Divider Override in AC Voltage Mode

The output impedance of the 5720A is low in any of the ranges. An external 1000:1 divider is supplied with every calibration system, that uses the 5720A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is generally not necessary; however, to calibrate wideband voltmeters, this external divider should be used.

If the bandwidth of the AC function of the UUT is below 1 MHz, the external divider should be disabled by using the "O" selection in the MOD2 field. The calibration system uncertainty is less in this case.

MOD3

This field specifies one of the following:

- B1 use 5725A for voltage or current boost
- B2 use 5205A for voltage boost
- B3 use 5215A for voltage boost
- B4 use 5220A for current boost
- W use 5700A-03 Wideband output for AC Voltage
- *blank* No Boost, wideband, or not applicable

Rules:

- If the amplitude and frequency combination can be created only by the Boost Amplifier, B1, B2, B3, or B4 is inserted automatically. If there are two configured in the system and both can provide the desired voltage/current combination, the 5725A has precedence and B1 is automatically inserted in the MOD3 field. If there are two current boost amplifiers (e.g., 5725A and 5220A) configured in the system and both can provide the desired current, the 5725A again has precedence and B1 is automatically inserted in the MOD3 field.
- If the amplitude and frequency combination can be created only the 5700A-03 Wideband AC option, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- CW 2-wire Ω compensated at the UUT terminals
- RW 2-wire Ω compensated at the 5720A terminals

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Voltage < 22 mV (unless MOD2 is O)
  2. AC Voltage < 220 mV

3. DC Current
4. AC Current
5. MΩ Resistance

- The CON field may specify CW or RW only for resistance less than or equal to 19 kΩ.
- MET/CAL displays an automatic connection message to use the external 1000:1 divider when the following conditions exist:
  1. AC Voltage mode is specified and the amplitude is less than 22 mV
  2. The MOD2 does not specify divider override (O)
  3. The automatic message has not been disabled using ASK- V.

⚠Warning

If ASK- V is in effect and conditions 1 and 2 exist, it is of paramount importance that the procedure writer explicitly generate a connection message for the external divider using the DISP FSC. Failure to do so could result in damage to the UUT and possible bodily injury.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	5720		*					S	
1.002	5720	1000	1100V	1U 1/					2W
2.001	5720	10	0V	1U					2W
3.001	5720	200	220mV	10%	50H				2W
4.001	5720	1000	1100V	1U	1kH				4W
5.001	5720	1	-47.12D	0.1U	50H				2W
6.001	5720	100	63.045D	0.5U	1kH				2W
7.001	5720	100	-22uA	10%					2W
8.001	5720	2	1.999A	1% 1/	1kH				2W
9.001	5720	A	mV	0.1U	50H				2W
10.001	5720	A	A	5%	1kH				2W
11.001	5720		1.999A		1kH			S	2W
11.002	5720	10	20mV		500H			N	2W
11.003	5720	10	20mV	0.5%	1kH			C	2W
12.001	5720	A	1Z	5%					CW

M5720

Auxiliary Instrument Setup FSC

Description

The M5720 FSC programs the 5720A Multifunction Calibrator for special functions. All special functions are reset when another M5720 FSC is used. The new set-up defined by the M5720 FSC becomes effective with the next occurrence of the 5720 FSC.

Parameters

RANGE

Not used.

NOMINAL

Specifies the Phase in degrees from the Variable Phase Reference Output of the 5720A, relative to the normal output, or a reset of the M5720 FSC to the default parameters. The phase is entered as:

sign phase o

A reset of the M5720 parameters is accomplished by entering an asterisk ('*').

Allowed values	Units
-180 °to +180 °	(o)

- If the Nominal field is blank, the variable phase is OFF.
- The sign may be +, -, or blank.

TOLERANCE

Not used.

MOD1

Specifies the 5720A range that the nominal values will use in all succeeding 5720 FSCs using the Range Lock capability of the 5720A.

- The range used will be the one that provides the highest resolution of the value entered in the range field of the M5720 FSC. Note that the value indicated by the range name cannot be generated by that range. For example, the maximum value in the 2.2 V range is .1999999 V, not 2.2 V.

- Only DC voltage and DC current can be range locked.
- 5720 FSC statements which don't specify Nominal values in DC voltage or current will ignore this field.
- DC voltage outputs may have either positive or negative polarity, so the true range of possible outputs is –1100 V to +1100 V. The same is true for current, so the range of possible outputs is -2.2 A to +2.2 A.
- The range to be range locked is entered as:

  `nominal_value_in_range` *`prefix`* `units`

  The prefix can be the same as specified for the NOMINAL and MOD1 field of any instrument FSC.
- Function, allowed values for nominal_value_in_range and units:

Volts, DC	-1100 V to + 1100 V	(V)
Amps, DC	-2.2 A to + 2.2 A	(A)

- The following 5720A ranges allow range locking:

	M5720 MOD1 Value	Range Locked
DC Voltage	-219.99999 mV to -219.99999 mV	220 mV
	-2.1999999 V to -220.00000 mV	2.2 V
	220.00000 mV to 2.1999999 V	2.2 V
	-10.999999 V to -2.2000000 V	11 V
	2.2000000 V to 10.999999 V	11 V
	-21.999999 V to -11.000000 V	22 V
	11.000000 V to 21.999999 V	22 V
	-219.99999 V to -22.000000 V	220 V
	22.000000 V to 219.99999 V	220 V
	-1100.0000 V to -220.00000 V	1100 V
	220.00000 V to 1100.0000 V	1100 V
DC Current	-219.99999 µA to 219.99999 µA	220 µA
	-2.1999999 mA to -220.00000 µA	2.2 mA
	220.00000 µA to 2.1999999 mA	2.2 mA
	-21.999999 mA to -2.2000000 mA	22 mA
	2.2000000 mA to 21.999999 mA	22 mA
	-219.99999 mA to -22.000000 mA	220 mA
	22.000000 mA to 219.99999 mA	220 mA
	-2.2000000 A to 220.00000 mA	2.2 A
	220.00000 mA to 2.2000000 A	2.2 A

MOD2

Allows specification of the guard connection. If 'G' is specified, the external guard connection becomes active. If nothing is entered the guard is internally shorted to low. The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD3

Specifies Phase Lock. Enter 'PL' when AC voltage or current are to use external phase lock.

MOD4

Not used.

CON

Specifies which output terminals are to be used in the Current Mode of operation. The following entries should be used as a function of the terminals to be used:

CON entry	Output terminals
C1	Normal output terminals
C2	AUX output terminals
C3	5725A output terminals

- Current greater than 2.2 A will always come out of the appropriate Boost terminals.
- If the field is left blank, the default will be the value of the CON field in the previous M5720 FSC and if there is none, the default 'C1' is assumed.

Miscellaneous

- No memory location is affected by the M5720 FSC.
- There are no automatic messages associated with the M5720 FSC.
- Certain combinations of entries in M5720 FSC and 5720 FSCs that follow, are inappropriate. The interrelationships of the 5720 and M5720 FSCs are NOT verified during backup or compilation of the procedure. Incorrect combinations may result in error messages during procedure execution.

Examples

```
STEP   FSC     RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.001  M5720         180o                                          PL    C1
6.002  M5720         -180o                                         PL    C2
```

5790

Instrument FSC

Description

The 5790 FSC programs the Fluke 5790A AC Measurement Standard perform the following measurements:

- AC Voltage from Input 1 or Input 2
- AC/DC and AC/AC Voltage transfer measurement
- HF AC Voltage using the Wideband option
- AC/DC Current transfer measurement on Input 1 using one of the A40 current shunts and the 792A-7004 adapter or one of the A40A current shunts and the 792A-7004 adapter and A45-4004 adapter cable.
- AC/DC Current transfer measurements on the Shunt Input using one of the A40 current shunts, a Pomona Model 1829 banana plug splice, and a Pomona cable model 1368-A-18 or one of the A40A current shunts and a Pomona cable model 5268-C-12.

Functional Capability

Mode	Amplitude	Frequency	MOD2
DC Voltage	+|-(700 µV to 1000 V)		I1
DC Voltage	+|-(700 µV to 1000 V)		I2
AC Voltage	700 µV to 1000 V	10 Hz to 1 MHz	I1
AC Voltage	700 µV to 1000 V	10 Hz to 1 MHz	I2
AC Voltage w|5790A-03 Opt	700 µV to 1 V	10 Hz to 30 MHz	W
DC Current	-20 A to 20 A[1]		I1
AC Current	0 A to 20 A[1]	10 Hz to 100 kHz	I1
1. Actual range depends on the actual A40 or A40A current shunt used.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency, the MOD1 field must specify voltage or current.
- When the NOMINAL field specifies current, only a Setup or Nominal Setup Test is allowed. You cannot perform an Evaluation Test in this mode, only AC/DC current transfer measurements.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- *blank* DC

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency.

MOD2

The MOD2 field specifies the input to be used.

I1	Input 1
I2	Input 2
SH	Shunt
W	Wideband

Rules:

- The MOD2 field value must be explicitly entered. No default value is automatically inserted in the MOD2 field and the field may not be blank.

MOD3

The 5790A has different modes of operation, which allow higher levels of accuracy at longer measurement times. Refer to the 5790 Operator Manual for detailed information on the different types of measurements and their properties. The MOD3 field controls the digital filter of the 5790A, as follow:

MOD3	Effect
(*blank*)	Digital filter is set to MEDIUM (16 samples/reading).
F	Digital filter is set to FAST (4 samples/reading).
E	Digital filter is set to SLOW (32 samples/reading).

Readings on the 700 mV range and above have an extra digit of resolution in modes E and "blank." However, the digital filter restart does not use this extra digit when evaluating the sample window. For more information about the digital filter restart, refer to the help file for the ACMS FSC and the 5790A Operator Manual.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the type of test to be performed.

- 2W Standard measurement
- XF Transfer measurement

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The AC/DC or AC/AC transfer measurement capability (AC Voltage connected to Input 1 and DC Reference Voltage connected to Input 2) is supported in a single 5790 FSC statement when the CON field specifies XF. However, it may be desirable to implement the transfer function using multiple FSC statements.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Transfer Measurements

In the following example. A Fluke 5440A is used to supply the DC reference voltage at Input 2 and the UUT on Input 1. The AC output of the UUT is measured and verified to be within 25 ppm.

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
1.001  ASK-   R     N                                                   W
1.002  DISP         Connect the 5440B Output to the 5790A Input 2.
1.002  DISP
1.002  DISP         Connect the UUT Output to the 5790A Input 1.
1.003  DISP         Setup the UUT to 1V @ 1kHz and Operate.
1.005  5440         1.000000V                                       S  2W
1.006  5790         1.000000V                                 I2 E  N  2W
1.007  MATH         M[1] = MEM
1.008  5440         -1.000000V                                      S  2W
1.009  5790         -1.000000V                                I2 E  N  2W
1.010  MATH         M[3] = (M[1] - MEM) / 2
1.011  5790         1.000000V                 1kH             I1 E  N  2W
1.012  MATH         MEM1 = M[3]
1.013  MEME
1.014  5440         *                                               S
1.015  DISP         Set the UUT to Standby.
1.016  MEMC         V             0.000025U     1kH
```

If so desired, lines 1.001 through 1.014 could be included in a subprocedure to function as a pseudo 5790A transfer function as shown below. The main procedure now becomes:

```
STEP  FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
1.001 ASK-   R     N                                                   W
1.003 DISP         Connect the 5440B Output to the 5790A Input 2.
1.003 DISP
1.003 DISP         Connect the 5700A Output to the 5790A Input 1.
1.005 MATH         M[1] = 1
1.006 MEM2         =1kHz
1.007 CALL         Sub 5790A Voltage Transfer Measurement
1.008 MEMC         V             0.000025U     1kH
```

The subprocedure is coded as follows:

```
          .
INSTRUMENT:            Sub 5790A Voltage Transfer Measurement
          .
          .
# It is assumed that the amplitude is stored in M[1] and the frequency
# designation string is stored in MEM2 before this subprocedure is called.
# This subprocedure will overwrite any value stored in M[10] by the
# calling procedure.
# Note, the frequency value in MOD1 on line 1.011 is not a concern in this
# procedure since it is neither measured or evaluated.

  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-   R     N                                                    W
  1.002  MATH        MEM = M[1]
  1.003  DISP        Set the UUT to [MEM]V @ [MEM2] and Operate.
  1.003  5440        V                                                 S  2W
  1.004  5790        V                                           I2 E  N  2W
  1.005  MATH        M[10] = MEM
  1.006  MATH        MEM = -1 * M[1]
  1.007  5440        V                                                 S  2W
  1.008  5790        V                                           I2 E  N  2W
  1.009  MATH        M[10] = (M[10] - MEM) / 2
  1.010  MATH        MEM = M[1]
  1.011  5790        V                          1kH              I1 E  N  2W
  1.012  MATH        MEM1 = M[10]
  1.013  MEME
  1.014  5440        *                                                 S
  1.015  DISP        Set the UUT to Standby.
  1.016  END
```

The original main procedure above could be coded as follows using the built in 5790 AC/ DC transfer function:

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-   R     N                                                    W
  1.002  DISP        Connect the 5440B Output to the 5790A Input 2.
  1.002  DISP
  1.002  DISP        Connect the UUT Output to the 5790A Input 1.
  1.003  DISP        Setup the UUT to 1V @ 1kHz and Operate.
  1.005  5440        1.000000V                                         S  2W
  1.006  5790        1.000000V                  1kH              I1 E  N  XF
  1.007  MATH        M[1] = MEM
  1.008  5440        -1.000000V                                        S  2W
  1.009  5790        1.000000V                  1kH              I1 E  N  XF
  1.010  MATH        MEM = (M[1] + MEM) / 2
  1.014  5440        *                                                 S
  1.015  DISP        Set the UUT to Standby.
  1.016  MEMC        1.000000V      0.000025U     1kH
```

Current Measurements

Current measurement is accomplished using an A40 or A40A and measuring the voltage drop across the shunt. AC currents are determined through comparison with a known DC or AC current.

If automatic connection messages are enabled, MET/CAL prompts you for the appropriate A40 current shunt. The shunt value is selected based on the nominal field value. You can override this feature by using the ACMS FSC to manually select a different shunt value (See ACMS FSC).

In the following example, the AC current function of a Fluke 5700A is tested using the DC current of the same 5700A. It is assumed that the DC current is in calibration and meets the manufacturer's specification.

Example

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
1.001  ASK-   R     N                                                  W
1.002  ACMS         F
1.003  HEAD         AC CURRENT: {22mA Range}
1.004  DISP         Connect the 5700A Output terminals to the 5790A
1.004  DISP         Input 1 using a Pomona cable #1368-A-18, an A40-20mA
1.004  DISP         current shunt, and a 792A-7004 current shunt adapter.
1.005  MEMI         Enter the AC-DC difference of the shunt at 100Hz.
1.006  MATH         M[20] = MEM
1.007  5790         20.00000mA                                  I1 E  N  2W
1.008  IEEE         OUT 20mA;OPER
1.009  5790         20.00000mA                                  I1 E  N  2W
1.010  MATH         M[1] = MEM + M[20]
1.011  5700         OUT -20mA;OPER
1.012  5790         -20.00000mA                                 I1 E  N  2W
1.013  MATH         M[3] = (M[1] - (MEM + M[20])) / 2
1.014  IEEE         OUT 20mA,100Hz;OPER
1.015  5790         20.00000mA                  100H            I1 E  N  2W
1.016  MATH         MEM1 = 200E-6 - (200E-6 * (1 - ((MEM + M[20])/ M[1])))
1.017  IEEE         STBY
1.018  MEMC         20.00000mA     140P% 0.0004U 100H
```

ACMS

Auxiliary Instrument Setup FSC

Description

The ACMS FSC programs the 5790A Multifunction Calibrator for special functions. All special functions are reset when another ACMS FSC is used. The new set-up defined by the ACMS FSC becomes effective with the next occurrence of the 5790 FSC.

Parameters

RANGE

Not used.

NOMINAL

Specifies the A40 current shunt that will be used for current measurements. Automatic connection messages, if enabled, will reflect the selected shunt. This feature is useful when the standard A40 shunt, for a particular measurement value, is not available.

The following Fluke current shunts are supported:

A40-10 mA	A40-20 mA	A40-30 mA	A40-50 mA
A40-100 mA	A40-200 mA	A40-300 mA	A40-500 mA
A40-1A	A40-2A	A40-3A	A40-5A
A40-10A	A40-20A		

- A reset of the ACMS parameters is accomplished by entering an asterisk (**'*'**).
- If the nominal field is blank, the appropriate A40 shunt will be selected by MET/CAL at runtime and the appropriate connection message will be issued.

TOLERANCE

Not used.

MOD1

Specifies the 5790A range that the nominal values will use in all succeeding 5790 FSCs using the Range Lock capability of the 5790A.

- The range used will be the one that provides the highest resolution of the value entered in the MOD1 field of the ACMS FSC.

- DC voltage values may have either positive or negative polarity, so the true range of possible outputs is -1000V to +1000V. (The range will be selected based on the absolute value of the entry.)
- The range to be range locked is entered as:

  nominal_value_in_range prefix units

- The prefix can be the same as specified for the nominal and MOD1 field of any instrument FSC. Function, allowed values for nominal_value_in_range and units:

  Volts -1000 V to + 1000 V (V)

- Default is no range locking.

MOD2

Allows specification of the guard connection. If 'G' is specified, the external guard connection becomes active. If nothing is entered the guard is internally shorted to low. The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test. Default is no guard connection.

MOD3

Specifies Digital Filter Reset.

Entry	DFR setting	# counts
F	FINE	10
M	MEDIUM	100 (default)
C	COARSE	1000

The digital filter specification selects the number of samples that will be averaged to produce a single 5790A reading. The digital filter reset value selects the maximum deviation, in counts, allowed between any two readings in the sample window. If the reset value is exceeded, the window is flushed and the instrument begins sampling until the window is full.

MOD4

Not used.

CON

Not used.

Miscellaneous

No memory location is affected by the ACMS FSC.

Example

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.001  ACMS         100mA                                      G  F
2.002  5790         100mA                                      SH E  N  2W
3.001  ACMS                                                    C
3.002  5790         1V             25P%          1MH          I1 F     2W
4.001  ACMS         *
```

5800

Instrument FSC

Description

The 5800 FSC provides the means to control the following functions of the Fluke 5800A Oscilloscope Calibrator:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- Trigger Signal

Note

The 5800 FSC may also be used to control a 5820A. This capability allows a 5800A based procedure to be executed without modification when a 5820A is configured.

If the 5800A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5800A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Therefore, the settings of the port used to controlling the 5800A must be set correctly before a procedure is executed. If the 5800A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 5800A is connected to the 5800A or 5520A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Function	Amplitude	Frequency	Misc.
DC Voltage			
50 Ω term.	-6.599 V to 6.599 V		
1 MΩ term.	-130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative)			
50 Ω term.	1.0 mVpp to 6.599 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.0 mVpp to 130 Vpp	10 Hz to 10 kHz	
DC Current [2]	100 µA to 100 mA		
AC Current [2]	100 µA to 100 mA	10 Hz to 100 kHz	
Edge			
50 Ω term.	5m Vpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10%	900 Hz to 11 MHz	
w/ Tunnel Diode Pulser Drive Signal	11 Vpp to 2.5 Vpp	900 Hz to 11 MHz	
Leveled Sine			
50 Ω term.	5 mVpp to 5.5 Vpp	50 kHz to 600 MHz	
	5 mVpp to 3.5 Vpp	50 kHz to 2.4 GHz [1]	
Time Markers			
50 Ω term			Period
Spike			18 ns to 5.5 s
Square			7.5 ns to 5.5 s
20 % Duty			75 ns to 34.99 ms
Square			1.8 ns to 17.9 ns
Sine			450 ps to 17.9 ns [1]
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			Max AC + DC Offset
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp

Function	Amplitude	Frequency	Misc.
1 MΩ term	1.8 mVpp to 21.9 mVpp 22 mVpp to 89.9 mVpp 90 mVpp to 219 mVpp 220 mV pp to 899 mVpp 0.9 Vpp to 6.59 Vpp 6.6 Vpp to 55 Vpp	10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz	Vp + |Voff|<=26 mVp Vp + |Voff|<=100 mVp Vp + |Voff|<=260 mVp Vp + |Voff|<=1000 mVp Vp + |Voff|<=6.6 Vp Vp + |Voff|<=50 Vp
Video NTSC PAL PAL-M SECAM 	 -150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE -150% to 150% -1.5 Vp to 1.5 Vp -150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE -150% to 150% -1.5 Vp to 1.5 Vp		Line Marker 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 622 1 to 622 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 622 1 to 622
Pulse: Old Pulse Board 50 Ω term New Pulse Board 50 Ω term	 10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp 15 mVpp, 60 mVpp, 150 mVpp, 600 mVpp, and 1.5 Vpp -10 ns to +30 ns skew variation[1]	Period 200 ns to 22 ms 200 ns to 22 ms	Pulse Width 2 ns to 500 ns 400 ps to 500 ns
UUT Input Impedance Measurement (MEAS Z): 50 Ω 1 MΩ Capacitance			 40 Ω to 60 Ω 500 kΩ to 1.5 MΩ 5 pF to 50 pF
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	
1. 5800A/BW and 5800A-GHz only 2. 5800A/BW only			

Parameters

The following table describes the basic operating modes of the 5800A Oscilloscope Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5800 FSC.

5800A Mode	5800 Nominal	5800 MOD1	5800 MOD3[1]	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
DC Voltage (volt mode)	voltage		**S6**		voltage]		
AC Voltage (volt mode)	voltage	freq|period	**S6**				
AC Voltage (pulse) [4]	p-width p-width [3] p-width [3] period period [3] period [3] skew [3] skew [3]	voltage voltage voltage voltage voltage voltage voltage voltage	**S6** **S6** **S6** **S6** **S6** **S6** **S6** **S6**	**Per** **Per** **Skew** **Pulse** **Pulse** **Skew** **Per** **Pulse**	period period skew p-width p-width skew period p-width	 [skew period [skew p-width p-width period	 SK] PR SK] PL PL PR
AC Voltage (wavegen)	voltage	freq|period	**S6**			[offset]	
AC Voltage (wavegen)	freq|period	voltage	**S6**			[offset]	
AC Voltage (time marks)	freq|period		**S6**				
DC Current [2]	current		**S6**				
AC Current [2]	current freq|per	freq|per current	**S6** **S6**				
Video	percent| voltage|IRE	line marker	**S6**	**[ODD|EVEN]**			
Impedance Meas	resistance| capacitance		**ZM**				
Overload Meas	voltage	[freq]	**OM**	**LIMIT**	time		

1. See MOD3 parameter for description of these specification codes and rules.
2. 5800A|BW only.
3. 5800A/B and 5800A-GHz only.
4. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
AP	Amps peak	current
APP	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period, pulse, width, or skew
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
pct	percent	video amplitude

5800 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5800A Mode	5800 Nominal	5800 MOD1	5800 MOD2[1]	5800 MOD3[2]
DC Voltage (VOLT)	V			S6
AC Voltage (VOLT)	V/Vp/Vpp H/T	H/T V/Vpp	ZQ/ZN ZQ/ZN	S6 S6
AC Voltage (Edge)	V/Vp/Vpp H/T	H/T V/VPP	ED ED	S6 S6
AC Voltage (LEVSINE)	V/Vp/Vpp H/T	H/T V/Vpp	LS LS	S6 S6
AC Voltage (MARKER)	H/T		M1/M2/M3/M4	S6
AC Voltage (WAVEGEN)	V/VP/VPP H/T	H/T V/VP/VPP	SI/SQ/TI SI/SQ/TI	S6
AC Voltage (PULSE)	H/T	Vpp	PU	S6
DC Current [3] (CURR)	A			S6
Video (VIDEO)	pct/Vp/IRE pct/Vp	LM LM	F1/F3 F2/F4	S6 S6
Impedance Meas (MEAS Z)	Z F			ZM ZM
Overload Meas (OVERLD)	V Vpp	 H		OM OM

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.
3. 5800A/BW only.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SI Sine wave (Wavegen)
- SQ Square wave (Wavegen)
- TI Triangle wave (Wavegen)
- ZQ Positive square wave (AC Voltage)
- ZN Negative square wave (AC Voltage)
- ED Edge signal
- LS Leveled sine wave
- M1 Spike Marker signal
- M2 Square Marker signal
- M3 20% Duty Cycle Square Marker signal
- M4 Sinusoid Marker signal
- PU Pulse wave
- F1 NTSC video signal
- F2 PAL video signal
- F3 PAL-M video signal
- F4 SECAM video signal

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- ZQ is inserted automatically in the MOD2 field for AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.

- The M5800 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5800 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M5800 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- S6 5800A-SC600 Scope Option
- ZM UUT Input Impedance Measurement
- OM UUT 50 Input Overload Protection Measurement
- *blank* NA

Rules:

- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and no MOD3 code is entered.
- The M5800 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire

- TD Tunnel Diode Pulser Drive signal enabled
- L 50 Ohm Termination
- *blank* 1 MOhm Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify S6 and no CON field code is entered.
- The CON field may specify TD only when the MOD2 field specifies ED.
- The CON field may specify L only when the MOD3 field specifies S6.
- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.
- The CON field must be blank when the NOMINAL or MOD1 field specifies current.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5800        *
  1.002  5800         *                                              S
# ----- DC Voltage -----
  1.003  5800   20    19.99mV        4%                              S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5800   400   350.0mV        50U           60H            ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5800         100Vpp                       1kH            ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5800   1000  800.0H         0.1% 0.1U     300mV          ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5800         0.5Vpp                       1MH            ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5800         200mVpp                      50kH           LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5800                                                            2T
  4.004  5800         1uT                                         M1 S6 S  L
  4.005  M5800        *
# ----- Square Marker Signal -----
  4.006  5800         1mT                                         M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5800         5uT                                         M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5800         2nT                                         M4 S6 S  L
# ----- Wavegen -----
  4.009  5800         5V                           1kH            SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5800                                     0.5Voff
  4.011  5800         1Vpp                         1kH            TI S6 S
# ----- NTSC Video -----
  4.012  M5800  ODD
  4.013  5800         1Vp                          262LM          F1 S6 S  L
  4.014  M5800        *
# ----- PAL Video -----
  4.015  5800         50pct                        400LM          F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5800  EVEN
  4.017  5800         -140IRE                      1LM            F3 S6 S  L
  4.018  M5800        *
# ----- SECAM Video -----
```

```
  4.019  5800         -100pct                      622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5800  PER   200nT
  4.021  5800         5.0nT                        1Vpp           PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5800  PULSE 10nT
  4.023  5800         1.00kH                       1Vpp           PU S6 N  L
  4.024  M5800        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5800         50Z            1U                             ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5800         1.000MZ        1U                             ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5800         10pF                                          ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M5800  LIMIT 10T
  6.003  5800         5V                                            OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5800  LIMIT 10T
  7.002  5800         7V                                            OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5800

Auxiliary Instrument Setup FSC

Description

The M5800 FSC provides the additional program functions for the Fluke 5800A Oscilloscope Calibrator which are not addressed by the 5800 FSC.

- Time limit for UUT 50 Ohm input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Channel selection for 5800A-5 Five Channel Output Option
- Trigger output and rate

Parameters

5800/M5800 Rules for 5800A Pulse Mode:

5800 Nominal	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
pulse period	PULSE	pulse width		
pulse width	PER	pulse period		

5800/M5800 Rules for 5800A/BW Pulse Mode:

5800 Nominal	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
pulse period	PULSE	pulse width	[trigger skew	SK]
pulse period	SKEW	trigger skew	pulse width	PL
pulse width	PER	pulse period	[trigger skew	SK]
pulse width	SKEW	trigger skew	pulse period	PR
trigger skew	PER	pulse period	pulse width	PL
trigger skew	PULSE	pulse width	pulse period	PR

Range

This field specifies one of the following:

- PULSE Pulse Width
- PER Pulse Period

- SKEW Trigger Skew
- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may specify ODD or EVEN only when the 5800 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5800 FSC MOD2 field specifies F1 or F3.
- See table in "PARAMETERS" section for pulse mode rules.

NOMINAL

This field specifies one of the following:

Pulse Width entered as: [*numeric*][*prefix*]T or H

Pulse Period entered as: [*numeric*][*prefix*]T

Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H

Trigger Skew entered as: [*numeric*][*prefix*]T or H

Time Limit entered as: [*numeric*][*prefix*]T

"*" reset to default values

blank field not applicable

Rules:

- The NOMINAL field must specify the time limit when the RANGE field is LIMIT.
- The NOMINAL field must be blank when the RANGE field is ODD or EVEN.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field specifies reset *, all other fields must be blank.
- See table in "PARAMETERS" section for pulse mode rules.

TOLERANCE

This field is not used.

MOD1

This field specifies one of the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- Pulse Width entered as: [*numeric*][*prefix*]T or H
- Pulse Period entered as: [*numeric*][*prefix*]T
- Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H
- Trigger Skew entered as: [*numeric*][*prefix*]T or H
- *blank* field not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5800 FSC MOD2 field specifies SI, SQ or TI.
- The MOD1 field must specify the pulse width when the MOD3 field specifies PL.
- The MOD1 field must be blank when the RANGE field specifies ODD, EVEN, or LIMIT.
- See table in "PARAMETERS" section for pulse mode rules.

MOD2

This field selects the signal output channel when the 5800A-5 Five channel output option is installed.

- C1 Channel 1
- C2 Channel 2
- C3 Channel 3
- C4 Channel 4
- C5 Channel 5
- *blank*

MOD3

This field specifies one of the following:

- PL Pulse Width
- PR Pulse Period
- SK Trigger Skew
- *blank*

Rules:

See table in "PARAMETERS" section.

MOD4

This field is not used.

CON

This field controls the trigger output.

- *blank* Trigger Output off
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

The following codes require the 5800A-5 Five Channel Output Option:

- 1T1 Trigger Output on Channel 1, Normal mode
- 2T1 Trigger Output on Channel 1, 1/10 of output rate
- 3T1 Trigger Output on Channel 1, 1/100 of output rate
- 1T5 Trigger Output on Channel 5, Normal mode
- 2T5 Trigger Output on Channel 5, 1/10 of output rate
- 3T5 Trigger Output on Channel 5, 1/100 of output rate

Rules:

M5800 FSC MOD2 and CON Field Rules

MOD2	CON
blank	*blank* | 1T | 2T | 3T
C1	*blank* | 1T5 | 2T5 | 3T5
C2 | C3 | C4	*blank* | 1T1 | 2T1 | 3T1 | 1T5 | 2T5 | 3T5
C5	*blank* | 1T1 | 2T1 | 3T1

- If MOD1 is not blank (i.e. skew is specified), the CON field must not be blank.
- A CON field specification of 1T, 2T, 3T, 1T1, 2T1, 3T1, 1T5, 2T5, and 3T5 is only applicable (is ignored otherwise) when the 5800
- MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.

EXAMPLES

See 5800 FSC.

5820

Instrument FSC

Description

The 5820 FSC provides the means to control the following functions of the Fluke 5820A Oscilloscope Calibrator:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- DC Voltage Measurement
- Trigger Signal

Note

If the 5820A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5820A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Therefore, the settings of the port used to controlling the 5820A must be set correctly before a procedure is executed. If the 5820A is connected to COM1, COM2, COM3, or COM4, select the "Ports" application in the Windows control panel to choose the proper settings. If the 5820A is connected to the 5500A or 5520A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Amplitude	Frequency	Misc.
DC Voltage 50 Ω term. 1 MΩ term.	 -6.599 V to 6.599 V -130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative) 50 Ω term. 1 MΩ term.	 1.0 mVpp to 6.599 Vpp 1.0 mVpp to 130 Vpp	 10 Hz to 10 kHz 10 Hz to 10 kHz	
DC Current	100 µA to 100 mA		
AC Current	100 µA to 100 mA	10 Hz to 100 kHz	
Edge 50 Ω term. w/ Tunnel Diode Pulser Drive Signal	 5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10% 11 Vpp to 2.5 Vpp	 900 Hz to 11 MHz 900 Hz to 11 MHz	
Leveled Sine 50 Ω term.	 5 mVpp to 5.5 Vpp 5 mVpp to 3.5 Vpp	 50 kHz to 600 MHz 50 kHz to 2.4 GHz [1]	
Fast Edge 50 Ω term	 250 mV pp fixed	 900 Hz to 11 MHz	
Leveled Sine 50 Ω term	 5 mVpp to 5.5Vpp 5 mVpp to 3.5Vpp	 50 kHz to 600 MHz 50 kHz to 2.4 GHz [1]	
Time Markers 50 Ω term Spike Square 20 % Duty Square Sine			Period 18 ns to 5.5 s 7.5 ns to 5.5 s 75 ns to 34.99 ms 1.8 ns to 17.9 ns 450 ps to 17.9 ns [1]

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			Max AC + DC Offset
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp
1 MΩ term	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=50 Vp
Video			Line Marker
NTSC	-150% to 150%		1 to 262 Odd or Even
	-1.5Vp to 1.5Vp		1 to 262 Odd or Even
	-140IRE to 140IRE		1 to 262 Odd or Even
PAL	-150% to 150%		1 to 622
	-1.5Vp to 1.5Vp		1 to 622
PAL-M	-150% to 150%		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140 IRE to 140 IRE		1 to 262 Odd or Even
SECAM	-150% to 150%		1 to 622
	-1.5 Vp to 1.5 Vp		1 to 622
Pulse 50 Ω term	15 mVpp, 60 mVpp, 150 mVpp, 600 mVpp, and 1.5 Vpp	Period 200 ns to 22 ms	Pulse Width 400 ps to 500 ns -10 ns to +30 ns skew variation [1]
UUT Input Impedance Meas. (MEAS Z) 50 Ω 1 MΩ Capacitance			 40 Ω to 60 Ω 500 kΩ to 1.5 MΩ 5 pF to 50 pF

Function	Amplitude	Frequency	Misc.
UUT Voltage Measurement (MEAS V) 1 MΩ	-10 V to +10 V DC		
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	
1. With 5800A-GHz option.			

Parameters

The following table describes the basic operating modes of the 5820A Oscilloscope Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5820 FSC.

5820A Mode	5820 Nominal	5820 MOD1	5820 MOD3[1]	M5820 Range	M5820 Nominal	M5820 MOD1	M5820 MOD3
DC Voltage (volt mode)	voltage		**S6**				
AC Voltage (volt mode)	voltage	freq|period	**S6**				
AC Voltage (pulse)	p-width p-width [2] p-width [2] period period [2] period [2] skew [2] skew [2]	voltage voltage voltage voltage voltage voltage voltage voltage	**S6** **S6** **S6** **S6** **S6** **S6** **S6** **S6**	**Per** **Per** **Skew** **Pulse** **Pulse** **Skew** **Per** **Pulse**	period period skew p-width p-width skew period p-width	 [skew period [skew p-width p-width period	 SK] PR SK] PL PL PR
AC Voltage (wavegen)	voltage freq|period	freq|period voltage	**S6** **S6**			[offset] [offset]	
AC Voltage (time marks)	freq|period		**S6**				
DC Current	current		**S6**				
AC Current	current freq|per	freq|per current	**S6** **S6**				
Video	percent| voltage|IRE	line marker	**S6**	**[ODD|EVEN]**			
Impedance Meas	resistance| capacitance		**ZM**				
Voltage Meas	voltage		**VM**				
Overload Meas	voltage	[freq]	**OM**	**LIMIT**	time		

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
AP	Amps peak	current
APP	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period, pulse, width, or skew
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
Pct	percent	video amplitude

5820 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5820A Mode	5820 Nominal	5820 MOD1	5820 MOD2[1]	5820 MOD3[2]
DC Voltage (VOLT)	V			S6
AC Voltage (VOLT)	V|Vp|Vpp H|T	H|T V|Vpp	ZQ|ZN ZQ|ZN	S6 S6
AC Voltage (EDGE)	V|Vp|Vpp H|T	H|T V|VPP	ED ED	S6 S6
AC Voltage (FAST EDGE)	V|Vp|Vpp H|T	H|T V|VPP	FE FE	S6 S6
AC Voltage (LEVSINE)	V|Vp|Vpp H|T	H|T V|Vpp	LS LS	S6 S6
AC Voltage (MARKER)	H|T		M1|M2|M3|M4	S6
AC Voltage (WAVEGEN)	V|VP|VPP H|T	H|T V|VP|VPP	SI|SQ|TI SI|SQ|TI	S6
AC Voltage (PULSE)	H|T	Vpp	PU	S6
DC Current (CURR)	A			S6
Video (VIDEO)	pct|Vp|IRE pct|Vp	LM LM	F1|F3 F2|F4	S6 S6
Impedance Meas (MEAS Z)	Z F			ZM ZM
Voltage Meas (MEAS V)	V			VM
Overload Meas (OVERLD)	V Vpp	 H		OM OM

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency, period, or voltage entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SI Sine wave (Wavegen)
- SQ Square wave (Wavegen)
- TI Triangle wave (Wavegen)
- ZQ Positive square wave (AC Voltage)
- ZN Negative square wave (AC Voltage)
- ED Edge signal
- LS Leveled sine wave
- M1 Spike Marker signal
- M2 Square Marker signal
- M3 20% Duty Cycle Square Marker signal

- M4 Sinusoid Marker signal
- PU Pulse wave
- F1 NTSC video signal
- F2 PAL video signal
- F3 PAL-M video signal
- F4 SECAM video signal

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- ZQ is inserted automatically in the MOD2 field for AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- The M5820 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5820 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M5820 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- S6 Default
- OM UUT 50 Input Overload Protection Measurement
- ZM UUT Input Impedance Measurement
- VM UUT Voltage Measurement
- *blank* NA

Rules:

- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, FE, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and no MOD3 code is entered.
- The M5820 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- TD Tunnel Diode Pulser Drive signal enabled
- L 50 Ω Termination
- *blank* 1 MΩ Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify TD only when the MOD2 field specifies ED.
- The CON field may specify L only when the MOD3 field specifies S6.
- The CON field must specify L when the MOD2 field specifies LS, M1, M2, M3, M4, F1, F2, F3, or F4.
- The CON field must specify L or TD when the MOD2 field specifies ED.
- L is inserted automatically in the CON field when the MOD2 field
- specifies LS, ED, FE, M1, M2, M3, M4, F1, F2, F3, or F4, and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.
- The CON field must be blank when the NOMINAL or MOD1 field specifies current.

Use Of Standard Memory Locations And Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5820        *
  1.002  5820         *                                              S
# ----- DC Voltage -----
  1.003  5820   20    19.99mV        4%                          S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5820   400   350.0mV        50U           60H           ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5820         100Vpp                       1kH           ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5820   1000  800.0H         0.1% 0.1U     300mV         ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5820         0.5Vpp                       1MH           ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5820         200mVpp                      50kH          LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5820                                                            2T
  4.004  5820         1uT                                       M1 S6 S  L
  4.005  M5820        *
# ----- Square Marker Signal -----
  4.006  5820         1mT                                       M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5820         5uT                                       M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5820         2nT                                       M4 S6 S  L
# ----- Wavegen -----
  4.009  5820         5V                           1kH           SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5820                                     0.5Voff
  4.011  5820         1Vpp                         1kH           TI S6 S
# ----- NTSC Video -----
  4.012  M5820  ODD
  4.013  5820         1Vp                          262LM         F1 S6 S  L
  4.014  M5820        *
# ----- PAL Video -----
```

```
  4.015  5820         50pct                        400LM          F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5820  EVEN
  4.017  5820         -140IRE                      1LM            F3 S6 S  L
  4.018  M5820        *
# ----- SECAM Video -----
  4.019  5820         -100pct                      622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5820  PER   200nT
  4.021  5820         5.0nT                        1Vpp           PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5820  PULSE 10nT
  4.023  5820         1.00kH                       1Vpp           PU S6 N  L
  4.024  M5820        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5820         50Z            1U                           ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5820         1.000MZ        1U                           ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5820         10pF                                        ZM N  2W
# ----- Voltage Measurement -----
  6.002  5820         2.5V           0.1U                         VM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.003  M5820  LIMIT 10T
  6.004  5820         5V                                          OM N  2W
  6.005  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5820  LIMIT 10T
  7.002  5820         7V                                          OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5820

Auxiliary Instrument Setup FSC

Description

The M5820 FSC provides the additional program functions for the Fluke 5820A Oscilloscope Calibrator which are not addressed by the 5820 FSC.

- Time limit for UUT 50 Ohm input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Channel selection for 5800A-5 Five Channel Output Option
- Trigger output and rate

Parameters

5820/M5820 Rules for 5820A Pulse Mode

5820 Nominal	**M5820 Range**	**M5820 Nominal**	**M5820 MOD1**	**M5820 MOD3**
pulse period	PULSE	*pulse width*	[*trigger skew*	SK]
pulse period	SKEW	*trigger skew*	*pulse width*	PL
pulse width	PER	*pulse period*	[*trigger skew*	SK]
pulse width	SKEW	*trigger skew*	*pulse period*	PR
trigger skew	PER	*pulse period*	*pulse width*	PL
trigger skew	PULSE	*pulse width*	*pulse period*	PR

RANGE

This field specifies one of the following:

- PULSE Pulse Width
- PER Pulse Period
- SKEW Trigger Skew
- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may specify ODD or EVEN only when the 5820 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5820 FSC MOD2 field specifies F1 or F3.
- See table in "PARAMETERS" section for pulse mode rules.

NOMINAL

This field specifies one of the following:

- Pulse Width entered as: [*numeric*] [*prefix*] T or H
- Pulse Period entered as: [*numeric*] [*prefix*] T
- Pulse Repetition Frequency entered as: [*numeric*] [*prefix*] H
- Trigger Skew entered as: [*numeric*] [*prefix*] T or H
- Time Limit entered as: [*numeric*] [*prefix*] T
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the time limit when the RANGE field is LIMIT.
- The NOMINAL field must be blank when the RANGE field is ODD or EVEN.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field specifies reset *, all other fields must be blank.
- See table in "PARAMETERS" section for pulse mode rules.

TOLERANCE

This field is not used.

MOD1

This field specifies one of the following:

- DC Offset entered as: [*numeric*] [*prefix*] Voff
- Pulse Width entered as: [*numeric*] [*prefix*] T or H
- Pulse Period entered as: [*numeric*] [*prefix*] T
- Pulse Repetition Frequency entered as: [*numeric*] [*prefix*] H
- Trigger Skew entered as: [*numeric*] [*prefix*] T or H
- *blank* field not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5820 FSC MOD2 field specifies SI, SQ or TI.
- The MOD1 field must specify the pulse width when the MOD3 field specifies PL.
- The MOD1 field must be blank when the RANGE field specifies ODD, EVEN, or LIMIT.
- See table in "PARAMETERS" section for pulse mode rules.

MOD2

This field selects the signal output channel when the 5800A-5 Five channel output option is installed.

- C1 Channel 1
- C2 Channel 2
- C3 Channel 3
- C4 Channel 4
- C5 Channel 5
- *blank*

MOD3

This field specifies one of the following:

- PL Pulse Width
- PR Pulse Period
- SK Trigger Skew
- *blank*

Rules:

- See table in "PARAMETERS" section.

MOD4

This field is not used.

CON

This field controls the trigger output.

- *blank* Trigger Output off
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

The following codes require the 5800A-5 Five Channel Output Option:

- 1T1 Trigger Output on Channel 1, Normal mode
- 2T1 Trigger Output on Channel 1, 1/10 of output rate
- 3T1 Trigger Output on Channel 1, 1/100 of output rate
- 1T5 Trigger Output on Channel 5, Normal mode
- 2T5 Trigger Output on Channel 5, 1/10 of output rate
- 3T5 Trigger Output on Channel 5, 1/100 of output rate

Rules:

M5820 FSC MOD2 and CON Field Rules

MOD2	CON
Blank	*blank* | 1T | 2T | 3T
C1	*blank* | 1T5 | 2T5 | 3T5
C2 | C3 | C4	*blank* | 1T1 | 2T1 | 3T1 | 1T5 | 2T5 | 3T5
C5	*blank* | 1T1 | 2T1 | 3T1

- If MOD1 is not blank (i.e. skew is specified), the CON field must not be blank.
- A CON field specification of 1T, 2T, 3T, 1T1, 2T1, 3T1, 1T5, 2T5, and 3T5 is only applicable (is ignored otherwise) when the 5820 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.

Examples

See 5820 FSC.

6060

Instrument FSC

Description

The 6060 FSC programs the frequency and amplitude of the Fluke or Gigatronics 6060A, 6060B, 6061A, 6062A, 6080A[1], or 6082A[1] RF Signal Generators. The M606 FSC may be used to program the modulation frequency and AM depth or FM deviation.

1. The 6080A and 6082A must be in 6060 emulation mode in order to be programmed using the 6060 FSC.

Functional Capability

Parameters

Note

The 6060 FSC programs the 6060A, 6060B, 6061A, 6062A, 6080A, and 6082A which all have different frequency ranges. You have to verify the capability of the instrument, which is actually in the system against the value specified. If you violate the limitations of the generator, you will get an error message while executing the procedure.

Frequency	
6060A	100 kHz to 1050 MHz, 952.3809 ps to 10 µs
6060B	10 kHz to 1050 MHz, 952.3809 ps to 100 µs
6061A	10 kHz to 1050 MHz, 952.3809 ps to 100 µs
6062A	100 kHz to 2100 MHz, 476.1905 ps to 10 µs
6080A	10 kHz to 1056 MHz, 946.9697 ps to 100 µs
6081A	100 kHz to 2100 MHz[1], 476.1905 ps[1] to 10 µs
1. Maximum frequency of the 6082A is limited to that of the 6062A.	
Amplitude	
0.1 µV to 1 V	
0.283 µVpp to 2.82 Vpp	
-127 dBm to +13 dBm	

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the frequency, period, or amplitude of the output signal, or a reset. The 6060 FSC can contain frequency or period information in the NOMINAL field and amplitude information in the MOD1 field or vice-versa. The order in which this information is provided determines which information is contained in either field.

- Frequency entered as: [*numeric*][*prefix*]H><
- Period entered as: [*numeric*][*prefix*]T

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Decibels entered as: [*numeric*][*prefix*]D
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.
- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency of period.
- When the NOMINAL field contains only units the value is taken from MEM.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Decibels entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency of period.
- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field contains only units the value is taken from MEM.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is not used. The signal generator always expects a 50Ω termination.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-                                                          W
  1.002  ASK+   D
  # ----- Reset -----
  1.003  6060         *                                              S
  1.004  6060   A     -127D          1U            100kH          -D
  2.001  6060   1     0.1uV          1%            1050MH         -D
  2.002  6060   0.5   0.28uVpp       1/            100kH
  3.001  6060   A     D              1U            100kH          -D
  4.001  6060         uV             1%            100kH          -D
  5.001  6060   50    10uT           1% 1/ 1U      -127D
  6.001  6060   0.2   1nT            1% 1/ 1U      1Vpp
  # ----- Oscilloscope Bandwidth Testing -----
#
# Line 7.001 enables the automatic range and adjustment messages with the
# "/div" modifier.
# Line 7.002 instructs the operator to perform the proper connection.
# Line 7.003 generates the following range message:
#     Set UUT to 10us/div.
# Line 7.004 sets the MEM2 string register to "Channel 1".
# Line 7.005 generates the following automatic range and adjustment messages:
#     Set UUT Channel 1 to 20mV/div.
#     Adjust stimulus for a UUT reading of 6 divisions.
# Line 7.006 disables automatic adjustment messages.
# Line 7.007 specifies a message to be displayed upon execution of line 7.008.
# Line 7.008 sets the generator to the final amplitude from line 7.005 and a
# starting frequency of 5 MHz. The message specified on line 7.007 is then
# displayed which instructs the operator to slew the frequency until the
# amplitude displayed on the UUT is 3dB (4.2 div.) down from the original
# peak-to-peak amplitude of 6 divisions. Note the tolerance is negative to
# reflect that the bandwidth should be more than the nominal value (creating
# a negative error).
#
  7.001  ASK+   R D   N
  7.002  DISP         Connect the 6060B to the UUT Channel1
  7.003  RNG          1uT
  7.004  MEM2         =Channel 1
  7.005  6060   20    120mVpp                     100kH               N
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT reading of 4.2 divisions.
  7.008  6060         5MH            -50%          mVpp
  7.009  MESS
```

M606

Auxiliary Instrument Setup FSC

Description

The M606 FSC provides the additional program functions for the Fluke 6060A, 6060B, 6061A or 6062A Synthesized Signal Generators, which are not addressed by the 6060 FSC. This functions include AM and FM modulation.

- The special functions specified by the M606 FSC will become effective in the first 6060 FSC that follows this M606 FSC.
- An asterisk (*') in the Nominal field resets all previous settings created with the M606 FSC.

RANGE

Not used.

NOMINAL

The Nominal field specifies the Modulation Frequency either AM or FM. Allowed values for the Modulation frequency in either case are 400 Hz or 1000 Hz. Units are: **H** or **T**.

- A Nominal entry of an asterisk (*') sets the 606X modulation to standby, and clears all pending M606 functions.
- If just nominal units are entered, the nominal value will be that of the content of memory register MEM plus the units specified.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies:

- In case of AM Modulation, the AM Modulation Depth; allowed values and units are:

```
0 to 90%(%)
```

- In case of FM Modulation, the FM Modulation Index; the allowed values depend on:

  The carrier frequency fo (in MHz)

  The modulation frequency fm (in kHz)

- Units can be 'H' or 'T'. Allowed values for the maximum deviation ACFM as a function of the carrier frequency are the lesser of:

Frequency range 10 kHz to 0.4 MHz: 100 Hz to 99.9 kHz and (1000*fo-100)/3

Frequency range 0.4 MHz to 245 MHz: 100 Hz to 99.9 kHz and (2*fm*(fo + 800))

Frequency range 245 MHz to 1050 MHz: 100 Hz to 99.9 kHz and 2*fm*fo

MOD2

Not used

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Miscellaneous

- The Procedure Editor cannot always check the correctness of the M606 entry with the 6060 FSC entries that follow. If the combination of parameters are not valid, an error message will occur when the procedure is executed. Procedures using the M606 FSC should be carefully tested.
- The Pulse Modulation capability of the 6062A is not supported in MET/CAL calibration software.

Example

```
  STEP   FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
# AM Modulation
  4.003  M606         *
  4.004  M606         400H                        0%
  4.005  6060   10    0D            1U            10MH
  5.001  M606         *
  5.002  M606         1000H                       90%
  5.003  6060   10    0D            1U            10MH
# FM Modulation
  6.005  M606         *
  6.006  M606         400H                        100H
  6.007  6060   10    0D            0.11U         200kH
  7.001  M606         *
  7.002  M606         1000H                       99.9kH
  7.003  6060   10    0D            0.1U          1000MH
```

6666

Instrument FSC

Description

The 6666 FSC programs the Philips PM 6666 Timer/Counter to measure frequency, frequency ratio, period, time interval and voltage max and min.

Perameters

The following table shows the relationship between the supported PM 6666 measurement functions and the FSC fields listed.

Function	MOD3	Nominal Value	MOD1 Value
Frequency A	FA	0.1 Hz to 120 MHz	[1]
Frequency C (Opt PM 9608)	FC	70 MHz to 900 MHz 70 MHz to 900 MHz 900 MHz to 1.1 GHz 900 MHz to 1.1 GHz 1.1 GHz to 1.3 GHz 1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Ratio A/B	FR	$1x10^{-7}$ to 2×10^{9}	[1]
Period A	PA	8 ns to 2×10^{8}s	[1]
Time Interval A-B	TI	100 ns to 2×10^{8}s	[1]
Voltage Max A	MX	-51 V to 51 V –51 V to 51 V	*blank* (DC) or 100 Hz to 50 MHz
Voltage Min A	MN	-51 V to 51 V –51 V to 51 V	*blank* (DC) or 100 Hz to 50 MHz

1. The allowed voltage is based upon the input frequency:

0.1 Hz to 440 Hz	20 mV rms to 350 Vp
440 Hz to 1 MHz	20 mV rms to [2]
1 MHz to 30 MHz	20 mV rms to 8 V rms
30 MHz to 120 MHz	40 mV rms to 8 V rms

2. The voltage upper bound is determined by the line defined by {(440 Hz, 350 Vp), (1 MHz, 8 Vrms)}. Range This field specifies the UUT range as described "General Rules for Instrument Evaluation FSCs".

RANGE

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *numeric*[*prefix*]H.
- Frequency Ratio entered as *numeric*[*prefix*]H/H.
- Period entered as *numeric*[*prefix*]T.
- Time Interval entered as *numeric*[*prefix*]T.
- Voltage entered as *numeric*[*prefix*]V.
- Reset entered as *.

Rules:

- The NOMINAL field may specify the units symbol "H" only when the MOD3 field specifies Frequency A (FA) or Frequency C (FC).
- The NOMINAL field may specify the units symbol "H/H" only when the MOD3 field specifies Ratio A/B (FR).
- The NOMINAL field may specify the units symbol "T" only when the MOD3 field specifies Period A (PA) or Time Interval A-B (TI).
- The NOMINAL field may specify the units symbol "V" only when the MOD3 specifies Voltage Max A (MX) or Voltage Min A (MN).
- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the expected amplitude.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric* [*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric* [*prefix*]D
- Frequency entered as *numeric* [*prefix*]H.
- *blank*

Rules:

- The MOD1 field may specify the units symbol "V" only when the MOD3 field does not specify Voltage Max A (MX) or Voltage Min A (MN).
- The input signal is assumed to be sinusoid when the MOD1 field specifies the units symbol "V".
- The MOD1 field may specify the units symbol "Vp" only when the MOD3 field specifies Frequency A (FA), Period A (PA), Frequency A/B (FR), or Time Interval A-B (TI).
- The MOD1 field may specify the units symbol "Vpp" only when the MOD3 field specifies Frequency A (FA), Period A (PA), Frequency A/B (FR), or Time Interval A-B (TI).
- The MOD1 field may specify the units symbol "D" only when the MOD3 field specifies Frequency C (FC).
- The MOD1 field may be blank or specify the units symbol "H" only when the MOD3 field specifies Voltage Max A (MX) or Voltage Min A (MN).

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless specified otherwise using the M666 FSC.
- The MOD2 field must specify +A when the MOD3 field specifies Frequency C (FC).
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA Frequency A
FC Frequency C
PA Period A
FR Ratio A/B
TI Time Interval A to B
MX Voltage Max A
MN Voltage Min A

Rules:

- The MOD3 field may specify Frequency C (FC) only when the High Frequency Input, option PM 9608 is installed. This is indicated in the CONFIG.DAT file as 6666(HF).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- The CON field may only specify "L" when the MOD3 field specifies Frequency C (FC).
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M666         *
  1.002  6666         *
# ----- Frequency A -----
  1.003  6666         10.000kH       1%            1Vpp +         +A FA
# ----- Frequency C -----
  2.001  6666         100MH          0.1%          1V             +A FC    L
# ----- Period A -----
  3.001  6666         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M666   ChA                                               AC
  4.002  M666   ChB                                               DC
  4.003  6666         10H/H          1%            1Vpp              FR
# ----- Time Interval A to B (Rise Time) -----
  5.001  M666   COM   10T            0.1V          0.9V           DC ++    X1
  5.002  6666         1.00uT         0.02U         1Vpp              TI
# ----- Time Interval A to B (Pulse Width) -----
  6.001  M666   COM   10T            100mV         100mV          DC +-    X1
  6.002  6666         1.00uT         0.02U         1Vpp              TI
```

M666

Auxiliary Instrument Setup FSC

Description

The M666 FSC provides the additional program functions for Channel A and Channel B of the Philips PM 6666 Timer/Counter which are not addressed by the 6666 FSC. These functions include Common B via A, Measuring Time, Trigger Level (DC coupling), Trigger Sensitivity (AC coupling), Input Coupling, Trigger Slope, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- The M666 statement is ignored under the following conditions:
- The RANGE field specifies Channel B and the 6666 FSC specifies Frequency A, Period A, Voltage Max A, or Voltage Min A (6666 MOD3 field is FA, PA, MX, or MN respectively).
- The RANGE field specifies Common B via A and the 6666 FSC specifies a measurement function other than Time Interval A-B (6666 MOD3 field is not TI).
- The 6666 FSC specifies Frequency C (6666 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T. Allowed values are: 0 or 10 ms to 10s with a resolution of 10 ms. 0 selects SINGLE-measuring mode.
- "*" Reset to defaults
- *blank*

Rules:

- Measuring Time is not channel specific. It may be specified in a separate M666 statement or in conjunction with a channel A, channel B, or Common B via A specification. Either way, the last Measuring Time specification prior to a 6666 statement is used.
- The PM 6666 truncates all values to the nearest 10 ms. For example specifying 7.34567T is the same as specifying 7.34T.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank*Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Allowed values TOLERANCE	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger sensitivity or level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger sensitivity or level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation, and trigger sensitivity or level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- The Channel B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

MOD2	CON	Allowed values TOLERANCE field	Allowed values MOD1	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel B trigger level or sensitivity only when the RANGE field specifies Common B via A (COM).
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified (TOLERANCE field is blank).
- The MOD1 field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Default Coupling

6666 MOD3 Field	6666 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
TI (Time Interval A-B)	NA	DC
MX (Voltage Max A)	<100 Hz ≥100 Hz	DC
MN (Voltage Min A)	<100 Hz ≥100 Hz	DC

Rules:

- Default values are used when the 6666 FSC does not specify the input coupling (6666 MOD2 field is blank) and one of the following conditions exists:
  1. No M666 statement has been executed.
  2. The last M666 statement executed was a M666 Reset.
  3. The M666 MOD2 field is blank and the M666 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC when the TOLERANCE field specifies the trigger sensitivity.
- The MOD2 field must specify DC when the TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6666 FSC specifies the input coupling (6666 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- \+ Positive, Channel A or B
- \- Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6666 FSC specifies the trigger slope (6666 MOD2 field is not blank).

MOD4

This field is not used.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank.
- The CON field must not be blank when the TOLERANCE field specifies the trigger sensitivity or level.
- The CON field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

Example

Refer to 6666 FSC.

6680

Instrument FSC

Description

The 6680 FSC programs the Philips PM 6680 Timer/Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, voltage min and max, and voltage peak-to- peak. Not all PM 6680 capabilities are supported. To program unsupported functions, use the IEEE FSC.

Parameters

The following table shows the relationship between the supported PM 6680 measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	10^{-10} Hz to 225 MHz	60 mV pp to 100 Vpp 30 mV p to 50 Vp 22 mV rms to 35 V rms
Frequency C (Opt PM 9621)	FC	70 MHz to 900 MHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (Opt PM 9624)	FC	100 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C (Opt PM 9625)	FC	150 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz >3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1 V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm 25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm

Function	MOD3	Nominal	MOD1
Ratio A/B	FR	10^{-9} to 10^{-5}	60 mVpp to 100 Vpp 30 mVp to 50 Vp 2 2 mV rms to 35 V rms
Period A	PA	6 ns to 10^{10} s	60 mV pp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Time Interval A-B	TI	0 ns to 10^{10} s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Phase A-B	PR	-180° to +360°	0.01 Hz to 160 MHz
Pulse Width A	WA	3 ns to 5 ns >5 ns to 10^{10} s	90 mVpp to 100 Vpp 45 mVp to 50 Vp 60 mV pp to 100 Vpp 30 mV p to 50 Vp
Duty Factor A	DA	0 to 1	0.01 Hz to 160 MHz
Rise/Fall Time A	RF	3 ns to 10^{10} s	500 mVpp to 100 Vpp 250 mVp to 50 Vp
Voltage Max A	MX	-51 V to 51 V -51 Vp to 51 Vp	*blank* (DC) 100 Hz to 120 MHz
Voltage Min A	MN	-51 V to 51 V -51 Vp to 51 Vp	*blank* (DC) 100 Hz to 120 MHz
Voltage Peak-to-Peak A	PP	0 Vpp to 102 Vpp	100 Hz to 120 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *numeric*[*prefix*]H.
- Frequency Ratio entered as *numeric*[*prefix*]H/H.
- Period entered as *numeric*[*prefix*]T.
- Time Interval entered as *numeric*[*prefix*]T.
- Phase entered as *numeric*[*prefix*]deg.
- Pulse Width entered as *numeric*[*prefix*]T.

- Duty Factor entered as *numeric*[*prefix*]DF.
- Rise or Fall Time entered as *numeric*[*prefix*]T.
- Voltage max or min entered as *numeric*[*prefix*]V or Vp.
- Voltage peak-to-peak entered as *numeric*[*prefix*]Vpp.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.
- *blank*

Rules:

For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless otherwise specified using the M680 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

- FA Frequency A
- FC Frequency C
- PA Period A
- FR Ratio A/B
- TI Time Interval A to B
- WA Pulse Width A
- RF Rise or Fall Time A
- PR Phase A Relative to B
- DA Duty Factor A
- MX Voltage Max A
- MN Voltage Min A
- PP Voltage Peak-to-Peak A

Rules:

- When MOD 3 is “RF” and channel A trigger slope is positive, a rise time measurement is performed. When channel A trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency C (FC) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625 is installed. This is indicated in the CONFIG.DAT file as 6680(21), 6680(24), or 6680(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M680         *
  1.002  6680         *
# ----- Frequency A -----
  1.003  M680   ChA                                100kH
  1.004  6680         10.000kH       1%            1Vpp           +A FA
# ----- Frequency C -----
  2.001  6680         100MH          0.1%          -1D            +A FC    L
# ----- Period A -----
  3.001  M680         *
  3.002  6680         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M680   ChA                                               AC
  4.002  M680   ChB                                               DC
  4.003  6680         10H/H          1%            1Vpp                FR
# ----- Time Interval A to B -----
  5.001  M680   COM   20T            0.2V          0.8V           DC ++    X1
  5.002  6680         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M680         *
  6.002  6680         300uT          5%            5Vp            -A WA
# ----- Rise Time A -----
  7.002  6680         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M680         *
  8.002  6680         30deg          1U            10kH              PR    L
# ----- Duty Factor A -----
  9.001  6680         0.30df         2%            100H              DA
```

M680

Auxiliary Instrument Setup FSC

Description

The M680 FSC provides the additional program functions for Channel A and Channel B of the Philips PM 6680 Timer/Counter which are not addressed by the 6680 FSC. These functions include Common B via A, Measuring Time, Trigger Level (DC coupling), Trigger Sensitivity (AC coupling), Input Coupling, Trigger Slope, Input Impedance, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

The M680 statement is ignored under the following conditions:

- The RANGE field specifies Channel B and the 6680 FSC specifies Frequency A, Period A, Pulse Width A, Voltage Max A, or Voltage Min A (6680 MOD3 field is FA, PA, WA, MX, or MN respectively).
- The RANGE field specifies Common B via A and the 6680 FSC specifies a measurement function other than Time Interval A-B (6680 MOD3 field is not TI).
- The 6680 FSC specifies Frequency C (6680 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T. Allowed values are: 0.8, 1.6, 3.2, 6.4, 12.8 and 50 µs to 400s.
- "*" Reset to defaults
- *blank*

Rules:

Measuring Time is not channel specific. It may be specified in a separate M680 statement or in conjunction with a channel A or channel B specification. Either way, the last Measuring Time specification prior to a 6680 statement is used.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank*Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Allowed values TOLERANCE	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger sensitivity or level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger sensitivity or level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation, and trigger sensitivity or level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric*[*prefix*]H.
- The Channel B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank*Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Allowed values TOLERANCE	Allowed values field	Resolution MOD1 field
AC	X1	20 mV, 50 mV, 100 mV	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 100 kHz.
- The MOD1 field may specify the channel B trigger sensitivity or level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank.
- The MOD1 field specification is ignored when the MOD1 field specifies the channel B trigger sensitivity or level and the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Default Coupling

6680 MOD3 Field	6680 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
WA (Pulse Width A)	NA	DC
TI (Time Interval A-B)	NA	DC
PR (Phase A-B)	NA	AC
DA (Duty Factor A)	NA	DC
RF (Rise Time A)	NA	DC
MX (Voltage Max A)	<100 Hz	DC
	≥100 Hz	AC
MN (Voltage Min A)	<100 Hz	DC
	≥100 Hz	AC

Rules:

- Default values are used when the 6680 FSC does not specify the input coupling (6680 MOD2 field is blank) and one of the following conditions exists:
  1. No M680 statement has been executed.
  2. The last M680 statement executed was a M680 Reset.
  3. The M680 MOD2 field is blank and the M680 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC when TOLERANCE field specifies the trigger sensitivity.
- The MOD2 field must specify DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6680 FSC specifies the input coupling (6680 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

+ Positive, Channel A or B

- Negative, Channel A or B

++ Positive Channel A and B

+- Positive Channel A, Negative Channel B

-+ Negative Channel A, Positive Channel B

-- Negative Channel A and B

blank

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6680 FSC specifies the trigger slope (6680 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

A M680 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank. The CON field must not be blank when the TOLERANCE field specifies the trigger sensitivity or level.
- The CON field specification is ignored when the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).

Example

Refer to 6680 FSC.

6681

Instrument FSC

Description

The 6681 FSC programs the Philips PM 6681 Timer/Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, voltage min and max, and voltage peak-to- peak. All PM 6681 capabilities are not supported. To program unsupported functions, use the IEEE FSC.

Parameters

The following table shows the relationship between the supported PM 6681 measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	10^{-10} Hz to 300 MHz 10^{-10} Hz to 300 MHz 10^{-10} Hz to 300 MHz	60 mV pp to 100 Vpp 30 mV p to 50 Vp 22 mV rms to 35 rms
Frequency C (Opt PM 9621)	FC	70 MHz to 900 MHz 70 MHz to 900 MHz >900 MHz to 1.1 GHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (Opt PM 9624)	FC	100 MHz to <300 MHz 100 MHz to <300 MHz 300 MHz to 2.5 GHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C (Opt PM 9625)	FC	150 MHz to <300 MHz 150 MHz to <300 MHz 300 MHz to 2.5 GHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz >2.5 GHz to 3.7 GHz >3.7 GHz to 4.2 GHz >3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz >4.2 GHz to 4.5 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1 V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm 25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm

Function	MOD3	Nominal	MOD1
Ratio A/B	FR	10^{-9} to 10^{-15}	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Period A	PA	6 ns to 10^{-10}s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Time Interval A-B	TI	0 ns to 10^{-10}s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Phase A-B	PR	-180° to +360°	0.01 Hz to 160 MHz
Pulse Width A	WA	3 ns to 5 ns >5 ns to 10^{-10}s	90 mVpp to 100 Vpp 45 mVp to 50 Vp- 60 mVpp to 100 Vpp 30 mVp to 50 Vp
Duty Factor A	DA	0 to 1	0.01 Hz to 160 MHz
Rise/Fall Time A	RF	3 ns to 10^{-10}s	250 mVpp to 100 Vpp 125 mVp to 50 Vp
Voltage Max A	MX	-51 V to 51 V -51 Vp to 51 Vp	*blank* (DC) 1 Hz to 120 MHz
Voltage Min A	MN	-51 V to 51 V -51 Vp to 51Vp	*blank* (DC) 1 Hz to 120 MHz
Voltage Peak-to-Peak A	PP	0 Vpp to 102 Vpp	1 Hz to 120 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *numeric*[*prefix*]H.
- Frequency Ratio entered as *numeric*[*prefix*]H/H.
- Period entered as *numeric*[*prefix*]T.
- Time Interval entered as *numeric*[*prefix*]T.
- Phase entered as *numeric*[*prefix*]deg.
- Pulse Width entered as *numeric*[*prefix*]T.
- Duty Factor entered as *numeric*[*prefix*]DF.

- Rise or Fall Time entered as *numeric*[*prefix*]T.
- Voltage max or min entered as *numeric*[*prefix*]V or Vp.
- Voltage peak-to-peak entered as *numeric*[*prefix*]Vpp.
- Reset entered as *.

Rules:

If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.
- *blank*

Rules:

- For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless otherwise specified using the M680 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA	Frequency A
FC	Frequency C
PA	Period A
FR	Ratio A/B
TI	Time Interval A to B
WA	Pulse Width A
RF	Rise or Fall Time A
PR	Phase A Relative to B
DA	Duty Factor A
MX	Voltage Max A
MN	Voltage Min A
PP	Voltage Peak-to-Peak A

Rules:

- When MOD3 is “RF” and channel A trigger slope is positive, a rise time measurement is performed. When channel A trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency C (FC) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625 is installed. This is indicated in the CONFIG.DAT file as 6681(21), 6681(24), or 6681(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M681         *
  1.002  6681         *
# ----- Frequency A -----
  1.003  M681   ChA                                100kH
  1.004  6681         10.000kH       1%            1Vpp           +A FA
# ----- Frequency C -----
  2.001  6681         100MH          0.1%          -1D            +A FC    L
# ----- Period A -----
  3.001  M681         *
  3.002  6681         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M681   ChA                                               AC
  4.002  M681   ChB                                               DC
  4.003  6681         10H/H          1%            1Vpp              FR
# ----- Time Interval A to B -----
  5.001  M681   COM   20T            0.2V          0.8V           DC ++    X1
  5.002  6681         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M681         *
  6.002  6681         300uT          5%            5Vp            -A WA
# ----- Rise Time A -----
  7.002  6681         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M681         *
  8.002  6681         30deg          1U            10kH              PR    L
# ----- Duty Factor A -----
  9.001  6681         0.30df         2%            100H              DA
```

M681

Description

The M681 FSC provides the additional program functions for Channel A and Channel B of the Philips PM 6681 Timer/Counter which are not addressed by the 6681 FSC. These functions include Common B via A, Measuring Time, Trigger Level (DC coupling), Trigger Sensitivity (AC coupling), Input Coupling, Trigger Slope, Input Impedance, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- The M681 statement is ignored under the following conditions:
  1. The RANGE field specifies Channel B and the 6681 FSC specifies Frequency A, Period A, Pulse Width A, Voltage Max A, or Voltage Min A (6681 MOD3 field is FA, PA, WA, MX, or MN respectively).
  2. The RANGE field specifies Common B via A and the 6681 FSC specifies a measurement function other than Time Interval A-B (6681 MOD3 field is not TI).
  3. The 6681 FSC specifies Frequency C (6681 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T. Allowed values are: 0.8, 1.6, 3.2, 6.4, and 12.8 µs and 50 µs to 400s.
- "*" Reset to defaults
- *blank*

Rules:

Measuring Time is not channel specific. It may be specified in a separate M681 statement or in conjunction with a channel A or channel B specification. Either way, the last Measuring Time specification prior to a 6681 statement is used.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank*Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Tolerance Allowed values	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger sensitivity or level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger sensitivity or level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation, and trigger sensitivity or level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric*[*prefix*]H.
- The Channel B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Allowed values Tolerance field	Allowed values MOD1	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 100 kHz.
- The MOD1 field may specify the channel B trigger sensitivity or level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified by the 6681 FSC
- MOD2 field is not blank). The MOD1 field specification is ignored when the MOD1 field specifies the channel B trigger sensitivity or level and the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Rules:

- Default Coupling

6681 MOD3 Field	6681 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
WA (Pulse Width A)	NA	DC
TI (Time Interval A-B)	NA	DC
PR (Phase A-B)	NA	AC
DA (Duty Factor A)	NA	DC
RF (Rise Time A)	NA	DC
MX (Voltage Max A)	<100 Hz	DC
	≥100 Hz	AC
MN (Voltage Min A)	<100 Hz	DC
	≥1 00 Hz	AC

Rules:

- Default values are used when the 6681 FSC does not specify the input coupling (6681 MOD2 field is blank) and one of the following conditions exists:
  1. No M681 statement has been executed.
  2. The last M681 statement executed was a M681 Reset.
  3. The M681 MOD2 field is blank and the M6816681 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC when TOLERANCE field specifies the trigger sensitivity.
- The MOD2 field must specify DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6681 FSC specifies the input coupling (6681 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- + Positive, Channel A or B
- - Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6681 FSC specifies the trigger slope (6681 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

- A M681 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1(default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank. The CON field must not be blank when the TOLERANCE field specifies the trigger sensitivity or level.
- The CON field specification is ignored when the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).

Example

Refer to 6681 FSC.

6685

Instrument FSC

Description

The 6685 FSC programs the Philips PM 6685 Timer/Counter to measure frequency, frequency ratio, period, pulse width, and duty factor.

Parameters

The following table shows the relationship between the supported PM 6685 measurement functions and the FSC fields listed.

Function	MOD3	Nominal Value	MOD1 Value
Frequency A (Opt PM 9621)	FA	10 Hz to 300 MHz	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 mV rms to 25 V rms
Frequency C (Opt PM 9624)	FC	70 MHz to 900 MHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (Opt PM 9625)	FC	100 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C	FC	150 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm

Function	MOD3	Nominal Value	MOD1 Value
		>3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz	25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm
Ratio C/A	FR	10^{-7} to 10^{-10}	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 mV rms to 25 V rms
Period A	PA	6 ns to 100 ms	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 V rms to 25 V rms
Pulse Width A	WA	3 ns to 10 ms	100 mVpp to 70 Vpp 50 mVp to 35 Vp
Duty Factor A	DA	0 to 1	50 Hz to 160 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *numeric*[*prefix*]H.
- Frequency Ratio entered as *numeric*[*prefix*]H/H.
- Period entered as *numeric*[*prefix*]T.
- Pulse Width entered as *numeric*[*prefix*]T.
- Duty Factor entered as *numeric*[*prefix*]df.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For all measurements except duty factor, this field specifies the expected amplitude. For measurements of duty factor, this field specifies the expected frequency.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.

Rules:

- For Ratio C/A (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel C.

MOD2

This field specifies the trigger slope as follows:

- +A Positive
- -A Negative
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope defaults to positive unless specified otherwise Pulse Width A using the M685 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA Frequency A (default)
FC Frequency C
FR Ratio C/B
PA Period A
WA Pulse Width A
DA Duty Factor A

Rules:

The MOD3 field may specify Frequency C (FC) and Ratio C/A (FR) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625 is installed. This is indicated in the CONFIG.DAT file as 6685(21), 6685(24), or 6685(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection:

- *blank* 1 MΩ Input Impedance
- L 50Ω Input Impedance
- 2W 2-Wire

Rules:

- For Ratio C/A (FR) measurements, the CON field specifies the impedance of the channel A input, not the channel C input.
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Example

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M685         *
  1.002  6685         *
# ----- Frequency A -----
  1.002  M685                      100mV         100kH
  1.003  6685         10kH         1%            1Vpp             FA
# ----- Frequency C -----
  2.001  6685         10MH         0.1%          +2D            +A FC    L
# ----- Period A -----
  3.001  M685         *
  2.002  6685         1.000mT      0.003U        5V               PA
# ----- Ratio C/A -----
  3.003  6685         10H/H        1%            1Vpp             FR
# ----- Pulse Width A -----
  5.002  6685         300uT        5%            5Vp            -S WA
# ----- Duty Factor A -----
  6.003  6685         0.30df       2%            100H             DA
```

M685

Auxiliary Instrument Setup FSC

Description

The M685 FSC provides the additional program functions for Channel A of the Philips PM 6685 Timer/Counter which are not addressed by the 6685 FSC. These functions include Measuring Time, and Channel A Trigger Sensitivity and Low-pass Filter.

RANGE

This field specifies the Channel.

- ChA Channel A
- *blank*

Rules:

- ChA is inserted automatically when the RANGE field is left blank and the TOLERANCE field specifies the channel A trigger sensitivity or the MOD1 field specifies the channel A low-pass filter.
- The M685 statement is ignored when the 6685 FSC specifies Frequency C (6685 MOD3 field is FC).

NOMINAL

This field specifies one of the following:

- Measuring Time entered as *numeric*[*prefix*]T. Allowed values are 800 ns, 1.6 µs, 3.2 µs, 6.4 µs, 12.8 µs, and 50 µs to 400s.
- "*" Reset to defaults
- *blank*

TOLERANCE

This field specifies one of the following:

- The Trigger Sensitivity entered as *numeric*[*prefix*]V. Allowed values are 27.12 mV to 75.4V.
- *blank* Auto Level (default)

Rules:

- The TOLERANCE field specification is ignored when the 6685 FSC specifies Auto Level (6685 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- Channel A low-pass filter entered as: *numeric*[*prefix*]H.
- *blank*

Rules:

- When the MOD1 field specifies the Channel A low-pass filter, the value must be 100kH.
- A M685 reset statement, NOMINAL field is an "*", must be used to disable the Channel A low-pass filter once it is enabled.

MOD2

This field is not used.

MOD3

This field specifies the trigger slope:

- \+ Positive (default)
- \- Negative
- *blank*

Rules:

- The MOD3 field specification is ignored when the 6685 FSC specifies the trigger slope (6685 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

- A M685 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field is not used.

Example

See 6685 FSC.

8505

Instrument FSC

Description

The 8505 FSC programs the Fluke 8505A or 8502A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, or conductance.

Functional Capability

Caution

Do not use the 8505 FSC when measuring current on closed loop procedures or when ASK- N is true. Using this FSC could cause damage to the Fluke 8505A. Use the IEEE FSC (as shown below) to program the 8505A setup prior to outputting any current from the UUT.

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  IEEE         [@8505]I
# The following IEEE FSC programs the UUT to source 50 mA.
  1.002  IEEE         50mA;OPER
  1.003  IEEE         [@8505]?[I]
# Convert to milliamps
  1.004  MATH         MEM = MEM * 1000
  1.005  MEMC         50mA           1%
```

Function	Nominal	MOD1	MOD2
DC Voltage	-1200 V to 1200 V		
AC Voltage	1 mV to 1000 V	10 Hz to 1 MHz	
DC Current	-1.28 A to 1.28 A		
AC Current	0 A to 1.28 A	10 Hz to 1 MHz	
Resistance	0 Ω to 265 MΩ		
Conductance	>3.8 nS		
Decibels	-46.99 dBm to 73.01 dBm	10 Hz to 1 MHz	5Z
Decibels	-48.75 dBm to 71.24 dBm	10 Hz to 1 MHz	7Z
Decibels	-54.77 dBm to 65.22 dBm	10 Hz to 1 MHz	3Z
Decibels	-57.78 dBm to 62.21 dBm	10 Hz to 1 MHz	6Z

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The product of the voltage and frequency must be less than $2x10^7$.

MOD2

This field specifies the load impedance that the AC voltage is referenced to when expressed in dBm.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is inserted automatically in the MOD2 field when the NOMINAL field specifies decibels and no MOD2 code is entered.

MOD3

This field specifies the coupling mode of the 8502A or 8505A.

- *blank* DC coupled AC mode
- F AC coupled
- FE AC coupled, 1024 samples/reading, slow filter

Note

MET/CAL was designed to use the RMS AC converter (option -09). If the Averaging AC converter (option - 01) is used, F must be selected; otherwise, and error will occur when executing the procedure.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance less than 256 kΩ.
- 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8505         *                                              S
# ----- DC Voltage -----
  1.002  8505   A     -1100V         1% 0.1U                             2W
# ----- AC Voltage -----
  2.001  8505   A     1000V          1%            10kH                  2W
# ----- Decibels -----
  3.001  8505   100   10D            2% 0.1U       1kH             6Z    2W
# ----- Conductance -----
  4.001  8505   20    10nY           -1% +5%                             2W
  5.001  8505   20    10uY           1%                                  2W
# ----- Resistance -----
  6.001  8505   100   256kZ          1%                                  2W
# ----- Setup Test -----
  7.001  8505         1V                           10kH                S  2W
# ----- Nominal Setup Test ----
  7.002  8505   2     1V                           10kH                N  2W
# ----- Comparison Test -----
  7.003  8505   2     1V             1% 0.1U       20kH                C  2W
```

8506

Instrument FSC

Description

The 8506 FSC programs the Fluke 8506A True RMS Digital Multimeter to measure DC voltage, AC voltage, DC current, resistance, or conductance.

Functional Capability

Caution

Do not use the 8506 FSC when measuring current on closed loop procedures or when ASK- N is true. Using this FSC could cause damage to the Fluke 8506A. Use the IEEE FSC (as shown below) to program the 8506A setup prior to outputting any current from the UUT.

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  IEEE         [@8506]I
# The following IEEE FSC programs the UUT to source 50 mA.
  1.002  IEEE         50mA;OPER
  1.003  IEEE         [@8506]?[I]
# Convert to milliamps
  1.004  MATH         MEM = MEM * 1000
  1.005  MEMC         50mA           1%
```

Function	Nominal	MOD1	MOD2
DC Voltage	-1200 V to 1200 V		
AC Voltage	1 mV to 600 V (1010 V)[1]	10 Hz to 1 MHz	
DC Current	-1.28 A to 1.28 A		
Resistance	0 Ω to 265		
Conductance	>3.8 nS		
Decibels	-46.99 dBm to 68.57 dBm (73.09 dBm)[1]	10 Hz to 1 MHz	5Z
Decibels	-48.75 dBm to 66.81 dBm (71.33 dBm)[1]	10 Hz to 1 MHz	7Z
Decibels	-54.77 dBm to 60.79 dBm (65.31 dBm)[1]	0 Hz to 1 MHz	3Z
Decibels	-57.78 dBm to 57.78 dBm (62.30 dBm)[1]	10 Hz to 1 MHz	6Z
1. (kV) specified in the CONFIG.DAT file.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The product of the voltage and frequency must be less than 10^7.

MOD2

This field specifies the load impedance that the AC voltage is referenced to when expressed in dBm.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is inserted automatically in the MOD2 field when the NOMINAL field specifies decibels and no MOD2 code is entered.

MOD3

This field specifies DC and AC operating modes which allow higher levels of accuracy at longer measurement times. Refer to the 8506A Instruction Manual for detailed information on the different types of measurements and their properties.

Function	MOD3	Operating	Samples/ Reading	Filter	Coupling
DC Voltage		normal	128	Fast	na
DC Voltage	E [1]	AVG	1024	Slow	na
AC Voltage		ENH'D	~2	na	DC
AC Voltage	F	ENH'D	~2	na	AC
AC Voltage	E	HI ACCUR	na	na	DC
AC Voltage	FE	HI ACCUR	na	na	AC
AC Voltage	G	NORMAL	~2	na	AC

1. This mode of operation will result in an improved noise floor and specification.

2. In this mode of operation the 8506A takes a single reading in the "HI ACCUR" mode and stores a correction factor (requires approximately 6 seconds). After the initial reading, the 8506A operates at approximately 2 readings/second applying the correction factor to each reading. In a stable environment, this results in the 8506A making measurements to the same accuracy as the "HI ACCUR" mode for a period of 5 minutes. If the input changes by more then +/-1%, the measurement process begins again with a single "HI ACCUR" measurement.

3. The advantage of this mode is that every measurement involves a correction factor, and therefore, the best possible specifications are maintained regardless of time, environment, and level. A full measurement cycle takes 6 seconds.

4. In this mode accuracy is limited to approximately 0.5%.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance less than 256 kΩ.
- 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8506         *                                              S
# ----- DC Voltage -----
  1.002  8506   A     -1100V         1% 0.1U                            2W
# ----- AC Voltage -----
  2.001  8506   A     600V           1%            10kH                 2W
  3.001  8506   1     1V             1% 0.01U      10kH                 2W
  4.001  8506   10    10V            1% 1/ 1P%     1kH              E   2W
  5.001  8506   10    10D            0.1U          1kH           6Z FE  2W
  6.001  8506   10    10V            1/ 1P%        1kH              E   2W
  7.001  8506   10    10D            0.1U          1kH           6Z F   2W
  8.001  8506   10    10D            0.2U          1kH           6Z E   2W
# ----- Decibels -----
  9.001  8506   A     0D             0.1U          1kH           5Z     2W
 10.001  8506   A     -25D           0.1U          10kH          7Z     2W
 11.001  8506   -30   -26D           0.1U          100kH         3Z     2W
 12.001  8506   A     60.791D        0.1U          10kH          3Z     2W
 13.001  8506   A     0D             0.1U          1kH           6Z     2W
# ----- Conductance -----
 14.001  8506   10    3.82nY         1%                                 2W
# ----- Resistance -----
 15.001  8506   100   256kZ          2%                                 4W
# ----- Setup Test -----
 16.001  8506         1V                           10kH                S  2W
# ----- Nominal Setup Test ----
 16.002  8506   2     1V                           10kH                N  2W
# ----- Comparison Test -----
 16.003  8506   2     1V             1% 0.1U       20kH                C  2W
```

8560

Instrument FSC

Description

The 8560 FSC programs the Hewlett-Packard 8560A, 8561A/B, 8562A/B, 8563A, and 8560 E-Series Spectrum Analyzers to return the amplitude or frequency obtained from a peak search over the specified frequency range.

Functional Capability

Function	8560 Nominal	8560 MOD1
8560A/E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 2.9 GHz
Peak Frequency	30 Hz to 2.9 GHz	-134 dBm to +30 dBm [1]
8561A/B/E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 6.5 GHz
Peak Frequency	30 Hz to 6.5 GHz	-134 dBm to +30 dBm [1]
8562E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 13.2 GHz
Peak Frequency	30 Hz to 13.2 GHz	-134 dBm to +30 dBm [1]
8562A/B, 8563E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 26.5 GHz
	-134 dBm to +30 dBm	30 Hz to 26.5 GHz [1]
Peak Frequency	9 kHz to 26.5 GHz	-134 dBm to +30 dBm
	30 Hz to 26.5 GHz	-134 dBm to +30 dBm [1]
1. Requires Option 006		

Function	8560 Nominal	8560 MOD1
8564E		
Peak Amplitude	-134 dBM to +30 dBm	9 kHz to 40 GHz
	-134 dBm to +30 dBm	30 Hz to 40 GHz [1]
Peak Frequency	9 khz to 40 GHz	-134 dBm to +30 dBm
	30 Hz to 40 GHz	-134 dBm to +30 dBm [1]
8565E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 50 GHz
	-134 dBm to +30 dBm	30 Hz to 50 GHz [1]
Peak Frequency	9 kHz to 50 GHz	-134 dBm to +30 dBm
	30 Hz to 50 GHz	-134 dBm to +30 dBm [1]
1. Requires Option 006		

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency, the value is used to set the center frequency.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8560        *
  1.002  8560         *                                                 S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8560  SPAN  1MH
  1.004  M8560  VIDBW 1kH
  1.005  8560         -30.00D        120U          50MH
  2.001  8560         -30.00D        120U          100MH
  3.001  8560         -30.00D        120U          150MH
  4.001  8560         -30.00D        120U          200MH
```

M8560

Auxiliary Instrument Setup FSC

Description

The M8560 FSC is used to specify the frequency span, reference level resolution bandwidth, and video bandwidth.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal
SPAN	Frequency Span
RESBW	Resolution Bandwidth
VIDBW	Video Bandwidth
blank	Reset "*"

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*][*prefix*]H.
- Resolution Bandwidth entered as [*numeric*][*prefix*]H.
- Video Bandwidth entered as [*numeric*][*prefix*]H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 30 Hz to 50 GHz (1).
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for video bandwidth are:

  1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

100kHz, 300kHz, 1MHz, and 3MHz.

- Legal values for sweep time are 50ms to 100ks
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8560 FSC's may be used to specify a combination of these parameters for a single 8560 measurement.
- Parameter values stay in effect until a M8560 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	Maximum
Reference Level:	0 dBm
Resolution Bandwidth:	Coupled
Video Bandwidth:	Coupled
Sweep Time:	Coupled

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*] D.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are –120 dBm to 30 dBm.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8560 FSC.

8566

Instrument FSC

Description

The 8566 FSC programs the Hewlett-Packard 8566B Spectrum Analyzer to return the amplitude or frequency obtained from a peak search over the specified frequency range.

Functional Capability

Function	Nominal	MOD1
Peak Amplitude	-134 dBm to +30 dBm	100 Hz to 1.0 MHz
	-134 dBm to +30 dBm	1.0 MHz to 2.5 GHz
	-132 dBm to +30 dBm	2.0 GHz to 5.8 GHz
	-125 dBm to +30 dBm	5.8 GHz to 12.5 GHz
	-119 dBm to +30 dBm	12.5 GHz to 18.6 GHz
	-114 dBm to +30 dBm	18.6 GHz to 22.0 GHz
Peak Frequency	100 Hz to 1.0 MHz	-134 dBm to +30 dBm
	1.0 MHz to 2.5 GHz	-134 dBm to +30 dBm
	2.0 GHz to 5.8 GHz	-132 dBm to +30 dBm
	5.8 GHz to 12.5 GHz	-125 dBm to +30 dBm
	12.5 GHz to 18.6 GHz	-119 dBm to +30 dBm
	18.6 GHz to 22.0 GHz	-114 dBm to +30 dBm

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*] [*prefix*] H.
- Amplitude entered as [*numeric*] [*prefix*] D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency, the value is used to set the center frequency.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8566        *
  1.002  8566         *                                                 S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8566  SPAN  1MH                          30D
  1.004  M8566  VIDBW 1kH
  1.005  8566         -30.00D        120U          50MH
  2.001  8566         -30.00D        120U          100MH
  3.001  8566         -30.00D        120U          150MH
  4.001  8566         -30.00D        120U          200MH
```

M8566

Auxiliary Instrument Setup FSC

Description

The M8566 FSC is used to specify the frequency span, reference level resolution bandwidth, video bandwidth, and sweep time.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal
SPAN	Frequency Span
RESBW	Resolution Bandwidth
VIDBW	Video Bandwidth
blank	Sweep Time
blank	Reset "*"

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*] [*prefix*] H.
- Resolution Bandwidth entered as [*numeric*][*prefix*] H.
- Video Bandwidth entered as [*numeric*] [*prefix*] H.
- Sweep Time entered as [*numeric*] [*prefix*] T.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 100 Hz to 22 GHz.
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.

- Legal values for video bandwidth are:

  1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for sweep time are 50ms to 1.5ks.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8566 FSC's may be used to specify a combination of these parameters for a single 8566B measurement.
- Parameter values stay in effect until a M8566 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	2.9 GHz
Reference Level:	0.0 dBm
Resolution Bandwidth:	Coupled
Video Bandwidth:	Coupled
Sweep Time:	Coupled

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*] D.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -89.9 dBm to +30.0 dBm.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8566 FSC.

8568

Instrument FSC

Description

The 8568 FSC programs the Hewlett-Packard 8568B Spectrum Analyzer to return the amplitude or frequency obtained from a peak search over the specified frequency range.

Functional Capability

Function	Nominal	MOD1
Peak Amplitude	-135 dBm to 30 dBm	100 Hz to 1.5 GHz
Peak Frequency	100 Hz to 1.5 GHz	-135 dBm to 30 dBm

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*] [*prefix*] D.
- Frequency entered as [*numeric*] [*prefix*] H.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*] [*prefix*] H.
- Amplitude entered as [*numeric*] [*prefix*] D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency, the value is used to set the center frequency.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field specifies the input to be used.

- I1 Input 1
- I2 Input 2

Rules:

- When no valid MOD1 code is entered, I2 is automatically inserted in the MOD2 field.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Rusults Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8560        *
  1.002  8560         *                                                  S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8560  SPAN  1MH
  1.004  M8560  VIDBW 1kH
  1.005  8560         -30.00D        120U          50MH
  2.001  8560         -30.00D        120U          100MH
  3.001  8560         -30.00D        120U          150MH
  4.001  8560         -30.00D        120U          200MH
```

M8568

Auxiliary Instrument Setup FSC

Description

The M8568 FSC is used to specify the frequency span, reference level resolution bandwidth, video bandwidth, and sweep time.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal
SPAN	Frequency Span
RESBW	Resolution Bandwidth
VIDBW	Video Bandwidth
blank	Sweep Time
blank	Reset "*"

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*] [*prefix*] H.
- Resolution Bandwidth entered as [*numeric*] [*prefix*] H.
- Video Bandwidth entered as [*numeric*] [*prefix*] H.
- Sweep Time entered as [*numeric*] [*prefix*] T.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 100 Hz to 1.5 GHz.
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for video bandwidth are:

1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, and 3 MHz.

- Legal values for sweep time are 20 ms to 1.5 ks.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8568 FSC's may be used to specify a combination of these parameters for a single 8568B measurement.
- Parameter values stay in effect until in effect until a M8568 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	1.5 GHz
Reference Level:	0.0 dBm
Resolution Bandwidth:	Auto
Video Bandwidth:	Auto
Sweep Time:	Coupled

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*] D.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -89.9 dBm to +30.0 dBm.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8568 FSC.

8590

Instrument FSC

Description

The 8590 FSC programs the Hewlett-Packard 8590L, 8591E, 8592L, 8593E, 8594E, 8595E, and 8596E Spectrum Analyzers to return the amplitude or frequency obtained from a peak search over the specified frequency range.

Functional Capability

Function	8590 Nominal	8590 MOD1
8590L, 8591E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 1.8 GHz
Peak Frequency	9 kHz to 1.8 GHz	-134 dBm to +30 dBm
8592L, 8593E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 22.0 GHz
	-134 dBm to +30 dBm	9 kHz to 26.5 GHz [1]
Peak Frequency	9 kHz to 22.0 GHz	-134 dBm to +30 dBm
	9 kHz to 26.5 GHz	-134 dBm to +30 dBm [1]
8594E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 2.9 GHz
Peak Frequency	9 kHz to 2.9 GHz	-134 dBm to +30 dBm
8595E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 6.5 GHz
Peak Frequency	9 kHz to 6.5 GHz	-134 dBm to +30 dBm
8596E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 6.5 GHz
Peak Frequency	9 kHz to 6.5 GHz	-134 dBm to +30 dBm
1. Requires Option 026/027		

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*] [*prefix*] D.
- Frequency entered as [*numeric*] [*prefix*] H.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the
- Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*] [*prefix*] H.
- Amplitude entered as [*numeric*] [*prefix*] D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency, the value is used to set the center frequency.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8590        *
  1.002  8590         *                                                  S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8590  SPAN  1MH
  1.004  M8590  REFLV 30D
  1.005  M8590  VIDBW 1kH
  1.006  8590         -30.00D        120U          50MH          I2
  2.001  8590         -30.00D        120U          100MH         I2
  3.001  8590         -30.00D        120U          150MH         I2
  4.001  8590         -30.00D        120U          200MH         I2
```

M8590

Auxiliary Instrument Setup FSC

Description

The M8590 FSC is used to specify the frequency span, reference level resolution bandwidth, and video bandwidth.

Parameters

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal
SPAN	Frequency Span
RESBW	Resolution Bandwidth
VIDBW	Video Bandwidth
blank	Reset "*"

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*] [*prefix*] H.
- Resolution Bandwidth entered as [*numeric*] [*prefix*] H.
- Video Bandwidth entered as [*numeric*] [*prefix*] H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 9 kHz to 26.5 GHz [1].
- Legal values for resolution bandwidth are:

  1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for video bandwidth are:

  30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz,

and 1 MHz

- Legal values for sweep time are 20 ms to 100 s
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8590 FSC's may be used to specify a combination of these parameters for a single 8590 measurement.
- Parameter values stay in effect until a M8590 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	Maximum
Reference Level:	0dBm
Resolution Bandwidth:	Coupled
Video Bandwidth:	Coupled
Sweep Time:	Coupled

1. Upper bound depends upon actual spectrum analyzer used (see 8590 FSC).

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*] D.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -134dBm to 30dBm.
- When the MOD1 field does not specify a value, the value istaken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8590 FSC.

8648

Instrument FSC

Description

The 8648 FSC programs amplitude and frequency of the Hewlett-Packard 8648A/B/C/D Signal Generators.

Functional Capability

Model	Frequency	Std	Amplitude [1]	
			Opt 1EA	Opt 1EA & 1E6
8648A	100 kHz to 1000 MHz	+10 dBm	NA	NA
8648B	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to 2000 MHz	+13 dBm	+17 dBm	+15 dBm
8648C	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to <= 2100 MHz	+13 dBm	+17 dBm	+15 dBm
	> 2100 MHz to <= 2500 MHz	+13 dBm	+15 dBm	+13 dBm
	> 2500 MHz to <= 3200 MHz	+10 dBm	+13 dBm	+11 dBm
8648D	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to <= 2100 MHz	+13 dBm	+17 dBm	+15 dBm
	> 2100 MHz to <= 2500 MHz	+13 dBm	+15 dBm	+13 dBm
	> 2500 MHz to <= 4000 MHz	+10 dBm	+13 dBm	+11 dBm

1. Minimum amplitude is -136dBm for all models and all option configurations.
2. Option 1EA - High power (HP 8648B/C/D only)
3. Option 1E6 - Pulse modulation (HP 8648B/C/D only)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*] [*prefix*] H.
- Period entered as [*numeric*] [*prefix*] T.
- Amplitude entered as: [*numeric*] [*prefix*] D, V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 8648A/B/C/D RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.002  8648         *                                                S
  1.003  8648   A     -42.95D        1U            100MH
  2.001  8648         100mV                        550MH          -D    S
  2.002  8648   0.5   28mV           5U            100MH
  3.001  8648   A     D              1U            100MH
  4.001  8648         V              1%            100MH
  5.001  8648   50    10uT           1% 1/ 1U      -35D
  6.001  8648   200   100nT          1% 1/ 1U      100mV
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                  F        W
  7.002  ASK+     D
  7.003  DISP         Connect the 8648 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  8648   20    120mVpp                      100kH               N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  8648         5MH            -100%         mVpp                   CH1
  8.001  MESS
  8.002  ASK+         N
  8.03   END
  8.04
```

M8648

Auxiliary Instrument Setup FSC

Description

The M8648 FSC provides the additional program functions for the Hewlett-Packard 8648A/B/C/D RF Signal Generators which are not addressed by the 8648 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

Modulation Frequency:

When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*] [*prefix*] H. Allowed values are 400 Hz or 1000 Hz, or 10 Hz to 20 kHz with Option 1E2.

If just units are entered, the value is taken from memory register MEM at run time.

Reset:

To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the M8648 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation The MOD1 field cannot be blank in an 8648 statement.

- AM Depth:

AM depth is entered as *numeric*%. AM depth limits are 0 to 100%; output <= 4 dBm.

- FM Deviation:

FM deviation is entered as *numeric* [*prefix*] H.

FM deviation depends upon the carrier and modulation frequencies as shown in the table below:

Modulation Frequency > 25 Hz

Carrier Frequency	FM Deviation
< 249 MHz	0 to 200 kHz
< 501 MHz	0 to 100 kHz
< 1001 MHz	0 to 200 kHz
< 2001 MHz	0 to 400 kHz
<= 4000 MHz	0 to 800 kHz

- Phase Deviation:

Phase deviation is entered as *numeric* [*prefix*] rad.

Phase deviation depends upon the carrier and modulation frequencies as shown in the table below:

Modulation Frequency > 20 Hz

Carrier Frequency	Phase Deviation
< 249 MHz	0 to 10 radians
< 501 MHz	0 to 5 radians
< 1001 MHz	0 to 10 radians
< 2001 MHz	0 to 20 radians
<= 4000 MHz	0 to 40 radians

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# AM Modulation
  1.001  M8648        *
  1.002  M8648        400H                        0pct
  1.003  8648   10    0D             1U           10MH
  2.001  M8648        *
  2.002  M8648        1000H                       90pct
  2.003  8648   10    0D             1U           10MH
# FM Modulation
  3.001  M8648        *
  3.002  M8648        400H                        100H
  3.003  8648   10    0D             0.11U        200kH
  4.001  M8648        *
  4.002  M8648        1000H                       99.9kH
  4.003  8648   10    0D             0.1U         1000MH
```

8842

Instrument FSC

Description

The 8842 FSC programs the Fluke 8842A and 8840A Digital Multimeters to measure DC voltage, AC voltage, DC current, AC current, resistance, and conductance. High voltage probes extend the DC voltage range to 40 kV.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1000 V to 1000 V			
DC Voltage w/6 kV Probe	-6 kV to 6 kV			F
DC Voltage w/40 kV Probe	±(1 kV to 40 kV)			G
AC Voltage[1]	1 mV to 700 V	20 Hz to 100 kHz		
DC Current	-1.99999 mA to 1.99999 mA			
AC Current	100 mA to 1.99999 A	20 Hz to 5 kHz		
Resistance	0 Ω to 19.9999 MΩ			
Conductance	>50 nS			
Decibels[1]	-46.99 dBm to 69.91 dBm	20 Hz to 100 kHz	5Z	
Decibels[1]	-48.75 dBm to 68.15 dBm	20 Hz to 100 kHz	7Z	
Decibels[1]	-54.77 dBm to 62.13 dBm	20 Hz to 100 kHz	3Z	
Decibels[1]	-57.78 dBm to 59.12 dBm	20 Hz to 100 kHz	6Z	
1. Volt-Hertz product not to exceed 2×10^7.				

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency measurements. See the NOMINAL field specification for allowed values and units.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

This field specifies one of the following:

- F DC Voltage measurement using 6 kV probe
- G DC Voltage measurement using 40 kV probe
- *blank* field not applicable

Rules:

- The MOD3 field may specify F or G only when the NOMINAL field specifies voltage.
- F is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 1000 V and less than or equal to 6000 V.
- G is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 6000 V.
- F or G may be specified at lower voltages to avoid connection changes.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- If 2 W is specified for a nominal value below 20 Ω, the measurement is taken on the 200 Ω range. 4W must be specified if the 20 Ω range is to be used.

Use of Standard Memory Locations and Results Reporting

- System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8842         *                                              S
# ----- DC Voltage -----
  1.002  8842   10    10V            1% 0.01U                              2W
  2.001  8842   2     1 kV            5%                                F     2W
  3.001  8842   10    6 kV            1%                                F     2W
  4.001  8842   100   40kV           20%                                G     2W
# ----- AC Voltage -----
  5.001  8842   1000  650V           5%            30kH                    2W
  6.001  8842   1     1V             1% 0.01U      10kH                    2W
# ----- Decibels -----
  7.001  8842   A     69.268D        0.1U          1kH            5Z       2W
# ----- DC Current -----
  9.001  8842   4000  350mA          9U                              E     2W
# ----- AC Current -----
 10.001  8842   2     1A             3%            60H                     2W
# ----- Resistance -----
 11.001  8842   100   10MZ           1%                                    2W
# ----- Conductance -----
 12.001  8842   100   100nY          5%                                    2W
# ----- Setup Test -----
 13.001  8842         1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  8842   1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  8842   1     1V             1% 0.1U       20kH                C  2W
```

8901

Instrument FSC

Description

The 8901 FSC programs the Hewlett-Packard 8901A and 8901B Modulation Analyzers to measure AM, FM, and Phase Modulation, Carrier Frequency, RF Level, and Tuned RF Level.

Functional Capability

Function	8901 MOD3	8901 Nominal	8901 MOD1	M8901 Nominal
AM	AM	0 to 99%	150 kHz to 10 MHz	20 Hz to 10 kHz
	AM	0 to 99%	10 MHz to 1300 MHz	20 Hz to 100 kHz
FM	FM	0 Hz to 40 kHz	150 kHz to 10 MHz	20 Hz to 10 kHz
	FM	0 Hz to 400 kHz	10 MHz to 1300 MHz	20 Hz to 200 kHz
PM[1]	PM	0 rad to 400 rad	10 MHz to 1300 MHz	200 Hz to 20 kHz
Frequency	FA	150 kHz to 650 MHz	-25 dBm to 30 dBm	(12 mV to 7 V)
	FA	>650 MHz to 1300 MHz	-20 dBm to 30 dBm	(22 mV to 7 V)
RF Level[2]	RF	1 mW to 1 W	150 kHz to 1300 MHz	
RF Power[3]	RF	10 uW to 1 W	100 kHz to 2.6 GHz	
	RF	-20 dBm to +30 dBm	100 kHz to 2.6 GHz	
Tuned RF Level[2]	TL	1 mW to 1 W	150 kHz to 1300 MHz	
Tuned RF Level[3]	TL	10 uW to 1 W	100 kHz to 1300 MHz	
	TL	-20 dBm to +30 dBm	100 kHz to 1300 MHz	
AM Calibration	CA	100.00%		
FM Calibration	CF	100.00%		

Function	8901 MOD3	8901 Nominal	8901 MOD1	M8901 Nominal
Power Zero[3]	ZR	0.0 W	100 kHz to 2.6 GHz	
Power Zero and Calibrate[3]	CP	1.00 mW	50 MHz	

1. Actual allowed Phase Modulation is dependent upon modulation frequency according to the graph in the 8901A Operating Manual.
2. 8901A
3. 8901B

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AM Depth entered as: [*numeric*] [*prefix*] pct.
- FM Deviation entered as: [*numeric*] [*prefix*] H.
- Phase Deviation entered as [*numeric*] [*prefix*] rad.
- RF Level or Tuned RF Level entered as [*numeric*] [*prefix*] W.
- RF Power entered as [*numeric*] [*prefix*] W or D.
- Frequency entered as [*numeric*] [*prefix*] H.
- Reset entered as *.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies carrier frequency or amplitude.

- Carrier Frequency entered as [*numeric*] [*prefix*] H.
- Amplitude entered as [*numeric*] [*prefix*] D or V.
- *blank* not applicable

Rules:

- See Functional Capability table.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is used to specifying tuning.

- TU Tune frequency
- *blank* Do not tune or not applicable

Rules:

- When the MOD2 field specifies TU, the MOD1 field is used as the tune frequency.
- The MOD2 field my specify TU only for modulation measurements, RF power measurements, and tuned RF level measurements (MOD3 = AM, FM, PM, RF, or TL).

MOD3

This field specifies the measurement type:

- AM AM Measurement
- FM FM Measurement
- PM Phase Measurement
- FA Frequency Measurement
- RF RF Level

- TL Tuned RF Level
- CA Calibrate AM (8901A Requires Opt 010)
- CF Calibrate FM (8901A Requires Opt 010)
- ZR Zero (8901B only)
- CP Zero and Calibrate RF Power (8901B only)

Rules:

- See Functional Capability table.
- The MOD3 field may specify CA, CF, ZR, and CP only for a Nominal Setup Test (MOD4 = N).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8901         *                                              S
# ----- AM -----
  1.002  M8901        400Hz
  1.003  8901         20pct          5U            750kH            AM
# ----- FM -----
  2.001  M8901        1kH                                           L2    P+
  2.002  8901         35.0H          +100%         5MH              FM
# ----- Phase -----
  3.001  8901         15.0rad        1.0U          5MH              PM
# ----- RF Level -----
  4.001  M8901        *
  4.002  8901         50.0mW         0.2U          102.5MH          RF
# ----- Frequency -----
  5.001  8901         102.5MH        0.1U          10D              FA
```

M8901

Auxiliary Instrument Setup FSC

Description

The M8901 FSC provides the additional program functions for Hewlett-Packard 8901A/B which are not addressed by the 8901 FSC. These functions include modulation frequency, special functions, FM de-emphasis, high-pass filter, low-pass filter, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies the Modulation Frequency or a reset.

- Modulation Frequency entered as: *numeric* [*prefix*] H.
- "*" Reset
- *blank*

Rules:

- When the M8901 FSC Nominal field specifies a reset thefollowing parameter values are set:
- High-Pass Filter All Off
- Low-Pass Filter All Off
- Special Functions Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special function entered as: *numeric* SP.
- *blank* not applicable

Rules:

- Special Function codes supported:

Tolerance Field	Special Function
1.0 SP to 1.6 SP	Input Attenuation
2.0 SP to 2.3 SP	Modulation Range
3.0 SP to 3.4 SP	IF Frequency and Input High-Pass Filter
4.0 SP to 4.2 SP	Tune Mode
5.0 SP to 5.1 SP	Audio Peak Detector Time Constant
6.0 SP to 6.2 SP	AM ALC Response Time
7.0 SP to 7.2 SP	Frequency Resolution
8.0 SP to 8.8 SP	Error Disable
15.0 SP	Display E12 if Oven Cold
16.0 SP to 16.1 SP	AM Calibration
17.0 SP to 17.1 SP	FM Calibration

See the 8901B Operator's Manual for a description of individual

Special Function codes.

- Multiple M8901 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a M8901 reset is executed.
- However the actual special function settings of the 8901 are only updated when a 8901 statement is executed.
- MET/CAL does not check to make sure that a special function specified is compatible with other 8901 settings specified in the 8901 and M8901 FSCs.

MOD1

This field specifies FM De-Emphasis.

- FM De-Emphasis entered as: [*numeric*] [*prefix*] T.
- *blank* Pre-Display and FM De-Emphasis off

Rules:

- Allowed values are: 25µs, 50 µs, 75 µs, and 750 µs.
- Pre-Display is turned on whenever De-Emphasis is specified.

- The M8901 MOD1 field may only specify FM De-Emphasis when the 8901 MOD3 field specifies FM.

MOD2

This field specifies the High-Pass Filter:

- H0 All Off
- H1 50 Hz
- H2 300 Hz

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 3 kHz
- L2 15 kHz
- L3 >20 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field is not used.

CON

This field specifies the Detector:

- P+ Peak +
- P- Peak -
- P+- Peak +-/2 (8901B only)
- HLD Peak Hold

- AVG Average (RMS Calibrated)
- *blank* Not applicable

Rules:

8901 MOD3	M8901 Nominal	M8901 CON
AM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
PM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FA	*blank*	*blank*
RF	*blank*	*blank*
TL	*blank*	*blank*
CA	mod-freq	*blank*
CF	mod-freq	*blank*
CP	*blank*	*blank*

Examples

Refer to 8901 FSC.

8902

Instrument FSC

Description

The 8902 FSC programs the Hewlett-Packard 8902A Measuring Receiver and 8902S Microwave Measurement System to measure AM, FM, and Phase Modulation, Carrier Frequency, RF Power, Tuned RF Level, Audio Frequency, and Audio Distortion.

The 8902S is a 8902A, with a 11792A Sensor Module, and a 11793A Microwave Converter.

Functional Capability

Function	8902 MOD3	8902 Nominal	8902 MOD1	M8902 Nominal
AM	AM	0 to 99%	150 kHz to <10 MHz	20 Hz to 10 kHz
	AM	0 to 99%	10 MHz to 1300 MHz [3]	20 Hz to 100 kHz
FM	FM	0 Hz to 40 kHz	150 kHz to <10 MHz	20 Hz to 10 kHz
	FM	0 Hz to 400 kHz	10 MHz to 1300 MHz [3]	20 Hz to 200 kHz
PM [1]	PM	0 rad to 400 rad	150 kHz to <10 MHz	200 Hz to 10 kHz
	PM	0 rad to 400 rad	10 MHz to 1300 MHz [3]	200 Hz to 20 kHz
Frequency	FA	150 kHz to 650 MHz	-25 dBm to 30 dBm	(12 mV to 7 V)
	FA	>650 MHz to 1300 MHz [3]	-20 dBm to 30 dBm	(22 mV to 7 V)
RF Power [2]	RF	10 uW to 1 W	100 kHz to 2.6 GHz [3]	
	RF	-20 dBm to +30 dBm	100 kHz to 2.6 GHz [3]	
Tuned RF Level	TL	10 uW to 1 mW	2.5 MHz to 1300 MHz [3]	
	TL	-127 dBm to 0 dBm	2.5 MHz to 1300 MHz [3]	
Audio Freq	AF	. 20 Hz to 250 kHz	-40 dBm to -10.5 dBm	(100 mV to 3 V)
Audio Dist	AD	0.01% to 100%	380 Hz to 420 Hz	
	AD	-80 dB to 0 dB	380 Hz to 420 Hz	
	AD	0.01% to 100%	0.95 kHz to 1.05 kHz	
	AD	-80 dB to 0 dB	0.95 kHz to 1.05 kHz	

Function	8902 MOD3	8902 Nominal	8902 MOD1	M8902 Nominal
AM Calibration	CA	100.00%		
FM Calibration	CF	100.00%		
Power Zero only	ZR	0.0 W	100 kHz to 2.6 GHz [3]	
Power Zero and Calibrate	CP	1.00 mW	50 MHz	

1. Actual allowed Phase Modulation is dependent upon modulation frequency according to the the graph in the 8902A Operating Manual.
2. With HP 11711A Sensor Module
3. 8902S: 1300 MHz to 26.5 GHz

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AM Depth entered as: [*numeric*] [*prefix*] pct.
- FM Deviation entered as: [*numeric*] [*prefix*] H.
- Phase Deviation entered as [*numeric*] [*prefix*] rad. Frequency entered as [*numeric*] [*prefix*] H.
- RF Power or Tuned RF Level entered as [*numeric*] [*prefix*] W or D.
- Audio Distortion entered as [*numeric*] [*prefix*] pct.
- Reset entered as *.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the carrier frequency or amplitude.

- Carrier Frequency entered as [*numeric*] [*prefix*] H.
- Amplitude entered as [*numeric*] [*prefix*] D or V.
- *blank* not applicable

Rules:

- See Functional Capability table.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is used to specifying tuning.

- TU Tune frequency
- *blank* Do not tune or not applicable

Rules:

- When the MOD2 field specifies TU, the MOD1 field is used as the tune frequency.
- The MOD2 field my specify TU only for modulation measurements, RF power measurements, and tuned RF level measurements (MOD3 = AM, FM, PM, RF, or TL).

MOD3

This field specifies the measurement type:

- AM AM Measurement
- FM FM Measurement
- PM Phase Measurement
- RF RF Power
- TL Tuned RF Level
- FA Frequency Measurement
- AF Audio Frequency Measurement
- AD Audio Distortion Measurement
- CA Calibrate AM
- CF Calibrate FM
- ZR Zero
- CP Zero and Calibrate RF Power

Rules:

- See Functional Capability table.
- The MOD3 field may specify CA, CF, ZR, and CP only for a Nominal Setup Test (MOD4 = N).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8902        *
  1.002  8902         *                                              S
# ----- AM Calibration -----
  1.003  8902         100.00pct                                      CA N
# ----- FM Calibration -----
  1.004  8902         100.00pct                                      CF N
# ----- RF Power Calibration -----
  1.005  DISP         Connect the HP 11722A Sensor Module to the HP 8902A
  1.005  DISP         CALIBRATION RF POWER OUTPUT.
  1.006  HEAD         HP 8902A ZERO/CAL in Progress, Please Wait ...
  1.007  8902         1mW                          50MH              CP N
  1.008  HEAD         HP 8902A ZERO/CAL operations completed.
  1.009  DISP         Remove the HP 11722A Sensor Module from the HP 8902A
  1.009  DISP         CALIBRATION RF POWER OUTPUT and connect it to the UUT.
# ----- Frequency Measurement -----
  1.010  8902         120MH                        11D               FA N
# ----- RF Power Measurement -----
  1.011  8902   130   11.0D          1.0U          MH             TU RF
# ----- Tuned RF Level Measurement -----
  2.001  8902         120MH                        -13D              FA N
  2.002  8902   130   -13.0D         1.0U          MH             TU TL
# ----- AM Measurement -----
  3.001  M8902        400H                                        H0 L0    P+-
  3.002  8902         30.0pct        3.2U          0.4MH             AM
  4.001  M8902        *
# ----- FM Measurement -----
  4.002  M8902        1kH                                         H1 L2    P+-
  4.003  8902         100.0kH        7U            245MH             FM
# ----- PM Measurement -----
  5.001  8902         50.0rad        10U           50MH              PM
  6.001  M8902        *
  6.002  END
```

M8902

Auxiliary Instrument Setup FSC

Description

The M8902 FSC provides the additional program functions for Hewlett-Packard 8902A which are not addressed by the 8902 FSC. These functions include modulation frequency, 8902S Local Oscillator (LO) frequency, special functions, FM de-emphasis, high-pass filter, low-pass filter, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies the Modulation Frequency or a reset.

- Modulation Frequency entered as: *numeric* [*prefix*] H.
- Local Oscillator Frequency enter as: [*numeric*] [*prefix*] H.
- "*" Reset
- *blank*

Rules:

- When a frequency is entered in the Nominal field, it is interpreted as follows: If the M8902 Tolerance field is 27.3SP the Nominal field value is assumed to be the LO frequency applied to the 11793A Microwave Converter. In all other cases, the Nominal value is assumed to be the modulation frequency.
- Allowed values for LO Frequency are 1300MHz to 26.5GHz.
- When the M8902 FSC Nominal field specifies a reset the following parameter values are set:

High-Pass Filter	All Off
Low-Pass Filter	All Off
Special Functions	Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special function entered as: *numeric* SP.
- *blank* not applicable

Rules:

Special Function codes supported:

Tolerance Field	Special Function
1.0 SP to 1.9 SP	Input Attenuation & Gain
2.0 SP to 2.4 SP	Audio Range Selection
3.0 SP to 3.8 SP	RF and IF Filters
4.0 SP to 4.7 SP	Tune RF Level Sync., Average Detector, & Display Averaging
5.0 SP to 5.1 SP	Audio Detector Response
6.0 SP to 6.2 SP	Automatic Level Control
7.0 SP to 7.4 SP	RF Frequency Resolution
8.0 SP to 8.8 SP	Error Message Disable Control
9.0 SP to 9.7 SP	IF Gain
10.0 SP to 10.5 SP	RF Power Range
15.0 SP	Display E12 if Oven Cold
16.0 SP to 16.1 SP	AM Calibration
17.0 SP to 17.1 SP	FM Calibration
23.0 SP to 23.1 SP	External LO (Option 030 only)
27.0 SP to 27.3 SP	Frequency Offset Mode (8902S only)
32.0 SP to 32.2 SP	Increased Resolution (Option 050 only)

See the 8902A Operator's Manual for a description of individual Special Function codes.

- Multiple M8902 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a M8902 reset is executed. However the actual special function settings of the 8902 are only updated when a 8902 statement is executed.

- In general, MET/CAL does not check to make sure that a special function specified is compatible with other 8902 settings specified in the 8902 and M8902 FSCs. The exception is special function 27.3, which is used to enter and enable the 8902S frequency offset mode. When the Tolerance field specifies 27.3SP, the M8902 Nominal field must specify the frequency of the local oscillator applied to the 11793A Microwave Converter.

MOD1

This field specifies FM De-Emphasis.

- FM De-Emphasis entered as: [*numeric*] [*prefix*] T.
- *blank* NA or Pre-Display and FM De-Emphasis off

Rules:

- Allowed values of FM De-Emphasis are: 25 µs, 50 µs, 75 µs, and 750 µs.
- Pre-Display is turned on whenever De-Emphasis is specified.
- The M8902 MOD1 field may only specify FM De-Emphasis when the 8902 MOD3 field specifies FM.

MOD2

This field specifies the High-Pass Filter:

- H0 All Off
- H1 50 Hz
- H2 300 Hz

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 3 kHz
- L2 15 kHz
- L3 >20 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field is not used.

CON

This field specifies the Detector:

- P+ Peak +
- Peak -
- P+- Peak +-/2
- HLD Peak Hold
- AVG Average (RMS Calibrated)
- RMS RMS
- D5 1 kHz DISTN
- D6 400 Hz DISTN
- *blank* Not applicable

Rules:

8902 MOD3	M8902 NOMINAL	M8902 CON
AM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
PM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FA	*blank*	*blank*
RF	*blank*	*bank*
TL	*blank*	*blank*
AF	*blank*	*blank*
AD	*blank*	RMS, D5, D6
CA	mod-freq	*blank*
CF	mod-freq	*blank*
CP	*blank*	*blank*

Examples

Refer to 8902 FSC.

8903

8903 Instrument FSC

Description

The 8903 FSC programs the Hewlett-Packard 8903B Audio Analyzer to measure AC Level, DC Level, Distortion, and Signal-to-Noise Ratio and the Hewlett-Packard 8903E Distortion Analyzer to measure AC Level, DC Level, and Distortion.

Functional Capability

Funtion	MOD3	Nominal	MOD1
AC Level	AL	0.0001 mV to 300 V	20 Hz to 150 kHz
	AL	-160 dBm to +30 dBm	20 Hz to 150 kHz
DC Level	DL	0 V to 300 V	
Frequency	AF	20 Hz to 150 kHz	5 mV to 300 V
	AF	20 Hz to 150 kHz	-66 dBm to +30 dBm
Distortion	AD	0% to 100%	20 Hz to 100 kHz
	AD	-99.99 dB to 0 dB	20 Hz to 100 kHz
Source [1]		0.6 mV to 6 V	20 Hz to 100 kHz
		-62.21 dBm to 17.78 dBm	20 Hz to 100 kHz

1. 8903B only. To use the source and a measurement function simultaneously, simply apply the source with a 8903 Setup statement (MOD4 = S) followed by a 8903 statement specifying the measurement function desired. The source will be turned off when an evaluation occurs except when ASK- Q is in effect.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AC Level entered as: [*numeric*] [*prefix*] V or D.
- DC Level entered as: [*numeric*] [*prefix*] V.
- Frequency entered as: [*numeric*] [*prefix*] H.
- Distortion entered as: [*numeric*] [*prefix*] pct or D.
- Source Amplitude entered as: [*numeric*] [*prefix*] V or D.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*] [*prefix*] H.
- Distortion entered as: [*numeric*] [*prefix*] pct or D.
- Source Frequency entered as: [*numeric*] [*prefix*] H.
- *blank* not applicable

Rules:

- See Functional Capability table.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is not used.

MOD3

This field specifies the measurement type:

- AD Distortion
- AF Frequency
- AL AC Level
- DL DC Level
- *blank* Source

Rules:

- See Functional Capability table.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the source output impedance.

- L 50 Ω
- *blank* 600 Ω or not applicable

Rules:

- The CON must be blank when the MOD3 field is not blank (analyzer).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8903        *
  1.002  8903         *                                                 S
  1.003  DISP         Connect 8902A MODULATION OUTPUT to the 8903B INPUT HIGH.
  1.003  DISP
  1.003  DISP         Connect 8903B OUTPUT HIGH to the UUT MOD INPUT.
  1.003  DISP
  1.003  DISP         Ensure that both the HP 8903B INPUT and OUTPUT "FLOAT"
  1.003  DISP         switches are set for 'grounded' operation.
  1.004  M8902        1kH                                          H0 L0    P+-
  1.005  M8903                                                     H0 L2    RMS
# ----- Source -----
  1.006  8903         1.4142V                    1kH                 S
  1.007  8902         30.0pct                    0.4MH            AM N
# ----- Distortion -----
  1.008  8903         0.000pct       1.5U        1kH              AD
  2.001  M8903        *
# ----- AC Level -----
  2.002  8903         10.0mV         0.2U        400H             AL
  3.001  8903         -10D                       400H             AL N
# ----- DC Level -----
  3.002  8903         35.0V          +100%                        DL
```

M8903

Auxiliary Instrument Setup FSC

Description

The M8903 FSC provides the additional program functions for Hewlett-Packard 8903B and 8903E which are not addressed by the 8903 FSC. These functions include special functions, plug-in and low-pass filters, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies a reset.

- "*" Reset
- *blank* Not applicable

Rules:

- When the M8903 FSC Nominal field specifies a reset the following parameter values are set:
- Source Off
- Plug-in Filters Off
- Low-Pass Filter All Off
- Detector RMS
- Special Functions Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special Function entered as: *numeric* SP.
- *blank* not applicable

Rules:

- Special Function codes supported:

Tolerance Field	Special Function
1.0SP to 1.19SP	Input Level Range (except DC Level)
2.0SP to 2.4SP	Input Level Range (DC Level only)
3.0SP to 3.4SP	Post Notch Gain
5.0SP to 5.7SP	Post Notch Detector Response
6.0SP to 6.1SP	Notch Tuning
8.0SP to 8.3SP	Error Disable
12.0SP to 12.9SP	Signal-to-Noise Measurements Delay
14.0SP to 14.1SP	Time Between Measurements
16.0SP to 16.1SP	Signal-to-Noise Display Resolution
19.0SP to 19.NNNSP	Display Level in Watts

- See the 8903B Operator's Manual for a description of individual Special Function codes.
- Multiple M8903 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a M8903 reset is executed. However the actual special function settings of the 8903 are only updated when a 8903 statement is executed.
- MET/CAL does not check to make sure that a special function specified is compatible with other 8903 settings specified in the 8903 and M8903 FSCs.

MOD1

This field is not used.

MOD2

This field specifies the Plug-in HP/BP Filters:

- H0 All Off
- H1 Left Plug-in Filter on
- H2 Right Plug-in Filter on

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 30 kHz
- L2 80 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field is not used.

CON

This field specifies the Detector:

- RMS RMS
- AVG Average

Rules:

- RMS is automatically inserted in the CON field if no CON field code is entered.

Examples

Refer to 8903 FSC.

8920

Instrument FSC

Description

The 8920 FSC programs the Fluke 8920A True RMS Voltmeter using the Fluke 1120A IEEE-488 translator and the -520 IEEE-488 Interface. Normally a MET/CAL instrument FSC will program the required instrument setup for a measurement. However, because the 8920A is a talk only device (cannot be programmed), a reading is taken to determine the current measurement units.

If the current units do not agree with the units in the NOMINAL field (Volts or dBm), an automatic message is generated to prompt the operator to select the correct display mode on the 8920A front panel. In addition, if the NOMINAL field units are dBm, and the current 8920A dBm reference value does not agree with the reference specified by the MOD2 field, an automatic message is also generated to prompt the operator to select the correct reference value.

Note

It is not possible for MET/CAL to determine the current 8920A range and function (AC or AC+DC and filter on or off). The DISP FSC must be used to prompt the operator to perform any changes to the function and range settings.

Functional Capability

MEAS. MODE	Nominal	MOD 1	MOD2	Function
DC Voltage	180 μV to 700 V			AC+DC
AC Voltage	180 μV to 700 V	2 Hz to 30 MHz		AC or AC+DC
Decibels	-61.88 dBm to 69.91 dBm	2 Hz to 30 MHz	5Z	AC or AC+DC
Decibels	-63.65 dBm to 68.15 dBm	2 Hz to 30 MHz	7Z	AC or AC+DC
Decibels	-69.67 dBm to 62.13 dBm	2 Hz to 30 MHz	3Z	AC or AC+DC
Decibels	-72.68 dBm to 62.13 dBm	2 Hz to 30 MHz	6Z	AC or AC+DC

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* DC

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is automatically inserted in the MOD2 field if no MOD2 field impedance code is entered.

MOD3

This field specifies the coupling for AC Voltage.

- F AC
- *blank* AC+DC

AC accuracy is better when using the AC mode (MOD3 = F).

Rules:

The MOD3 field may specify F (AC) only when the MOD1 field specifies a frequency (AC Voltage).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8920         *                                              S
# ----- DC Voltage -----
  1.002  DISP         Set the 8920A FUNCTION to AC+DC.
  1.003  8920   1000  650V           10%                                 2W
# ----- AC Voltage -----
  2.001  DISP         Set the 8920A FUNCTION to AC.
  2.002  8920   10    10V            1% 0.1U       100kH            F     2W
  3.001  8920   1     1V             1% 0.1U       10kH                   2W
# ----- Decibels -----
  4.001  8920   A     50D            1U            1kH           6Z F     2W
# ----- Setup Test -----
  5.001  8920         1V                           10kH             F  S  2W
# ----- Nominal Setup Test -----
  5.002  8920   1     1V                           10kH                N  2W
# ----- Comparison Test -----
  5.003  8920   1     1V             1% 1U         20MH                C  2W
```

9000

Instrument FSC

Description

The 9000 FSC provides the means to control the following functions of the Datron 9000 Calibrator:

- DC Voltage
- AC Voltage (sine)
- DC Current
- AC Current (sine)
- Resistance (resistance or conductance)
- Frequency
- Mark/Period (pulse)
- Capacitance
- Thermocouple Temperature
- RTD Temperature

Functional Capability

DC Voltage	-1050 V to 1050 V	
AC Voltage (Sine)	0.000 V to 105 V	10 Hz to 100 kHz
	105.001 V to 350 V	40 Hz to 30 kHz
	320.01 V to 1050 V	40Hz to 30 kHz*
DC Current	-20 A to 20 A	
AC Current (Sine)	0.00000 mA to 320 mA	10 Hz to 30 kHz
	0.32001 A to 20 A	10 Hz to 10 kHz
Resistance	0 Ω to 400 MΩ	
	2.5 nS to 2.49999 mS	
Frequency	0.5 Hz to 10 MHz	+/-(0.01 Vp to 30 Vp)
Mark/Period:		
Output Voltage	<=6 Vp	
Repetition	0.6 µs to 2000.00 ms	
Pulse Width	0.3 µs to 1999.99 ms	
Output Voltage	6 Vp< ... <= 30 Vp	
Repetition	1 ms to 2000.00 ms	
Pulse Width	10 µs to 1999.99 ms	73.15 K to 1123.15 K
Capacitance	0.5 nF to 40 mF	
RTD Temperature:		
Pt 385	-200 °C to 850 °C -328 °F to 1562 °F 7301 K to 1123.15 K	100 Ω (fixed) 100 Ω (fixed) 100 Ω (fixed)
TC Temperature:		
Type K	-250 °C to 1350 °C -418 °F to 1832 °F 23.1 K to 1273.2 K	100 Ω (fixed) 100 Ω (fixed) 100 Ω (fixed)
*ramped to 10 kHz		

Parameters

The following table describes the basic operating modes of the 9000 Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 9000 FSC.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Y	Siemens	conductance
Z	Ohms	resistance
degC	degrees Celcius	temperature
degF	degrees Fahrenheit	temperature
K	Kelvins	temperature

9000 FSC Nominal, MOD1, MOD2, and CON Rules

9000 Mode (function)	9000 Nominal	9000 MOD1	9000 MOD2[1]	9000 CON[2]
DC Voltage	V			2W
AC Voltage	V|Vpp	H|T	SI	2W
	H|T	V|Vpp	SI	2W
DC Current	A			2W
AC Current	A|App	H|T	SI	2W
	H|T	A|App	SI	2W

Resistance	Z|Y			2W|4W
Frequency	H|T	Vp	ZQ	2W
	Vp	H|T	ZQ	2W
Mark/Period	H|T	Vp	PU	2W
(pulse)	Vp	H|T	PU	2W
Capacitance	F			2W|4W
TC Temperature	degC|degF|K		_K	2W
RTD Temperature	degC|degF|K	Z	R1	2W|4W

Notes:
Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

1. See MOD2 parameter for description of these specification codes.
2. See CON parameter for description of these specification codes.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*] *units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value if it is not blank.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage or AC Current modes or the nominal resistance for RTD Temperature mode entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- For RTD Temperature, only a nominal resistance of 100 Ohms is allowed.

MOD2

This field specifies the waveform, thermocouple, or RTD type.

- *blank* not applicable
- SI AC Voltage or AC Current (Sine)
- _K TC Temperature Mode (Type K)
- R1 RTD Temperature Mode (Pt 385)
- PU Frequency Mode (Pulse)
- ZQ Frequency Mode (Hz)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, or AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Temperature if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Temperature if no MOD2 code is entered.
- The M9000 RANGE and NOMINAL field must specify the pulse period or pulse repetition frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M9000 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse period or pulse repetition frequency.

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify 4W only for resistance, capacitance, and RTD temperature modes.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M9000        *
  1.002  9000         *                                              S
# ----- DC Voltage -----
  1.003  9000   20    19.99mV        2% 0.04U                           2W
# ----- AC Voltage -----
  2.001  9000   400   350.0mV        -2.8U +2.9U   60H           SI      2W
# ----- DC Current -----
  3.001  9000   400   350mA          9U                                 2W
# ----- AC Current -----
  4.001  9000         350.0mA                      60H           SI    S  2W
# ----- Resistance -----
  4.002  9000   400   390.0Z         0.4% 0.1U                          4W
  5.001  9000   4     3.900MZ        0.05U                              2W
```

```
# ----- Conductance -----
  6.001  9000         2.50uY                                          N  2W
# ----- Capacitance ----
  6.002  9000   10    1.100uF        2% 0.002U                           2W
# ----- Frequency Function -----
  7.001  9000         1kH                          1Vp           ZQ    S  2W
  7.002  M9000                                     1Voff
  7.003  9000         -1.00Vp                      1kH           ZQ    N  2W
# ----- Marker/Period (pulse) Function -----
  7.004  M9000  PULSE 10uT
  7.005  9000         1mT                          1Vp           PU    S  2W
  7.006  M9000  PER   200mT
  7.007  9000         1mT                          1Vp           PU    S  2W
  7.008  M9000  PULSE 10uT                         -10Voff
  7.009  9000         -5.00Vp                      1kH           PU    N  2W
  7.010  M9000        *
# ----- TC Temperature -----
  7.011  9000         50degC         1U                          _K       2W
# ----- RTD Temperature -----
  8.001  9000         45degC                       100Z          R1    S  4W
```

M9000

Auxiliary Instrument Setup FSC

Description

The M9000 FSC provides the additional program functions for the Datron 9000 Calibrator which are not addressed by the 9000 FSC.

Parameters

For a description of the 9000 Calibrator operating modes referenced in this section, see Table 1 in the 9000 Instrument FSC description.

RANGE

This field specifies the pulse width, pulse period, or pulse repetition frequency for Mark/Period mode or the temperature scale for RTD or TC Temperature mode.

- PULSE Pulse Width
- PER Pulse Period
- *blank* default or field not applicable

NOMINAL

This field specifies a reset or the pulse period or pulse width entered as:

[*numeric*][*prefix*]H|T

- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the pulse period or pulse repetition frequency when the M9000 RANGE field is PER.
- The NOMIMAL field must specify the pulse width when the M9000 RANGE field is PULSE.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.
- When the NOMINAL field specifies reset "*", all other fields mustbe blank.

TOLERANCE

This field is not used.

MOD1

This field specifies DC offset for Frequency or Mark/Period (pulse) mode

[*numeric*][*prefix*]Voff

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field specifies the 9005 Work Mat connection for current or the UUT source current for Resistance and RTD Temperature modes.

Temperature modes.

- C1 9005 Work Mat yellow lead (I+20A)
- C2 9005 Work Mat white lead (I+mA)
- LO Low UUT source current
- HI High UUT source current
- *blank* Applicable default (C1 or LO)

Rules:

Mode (function)	M9100 CON	Connection
DC Current	[C1]	9005 Work Mat Yel & Blk

	C2	9005 Work Mat Wht & Blk
AC Current	[C1]	9005 Work Mat Yel & Blk
	C2	9005 Work Mat Wht & Blk
Mode	9000 Nominal	
Resistance	< 40,001 Ω	[LO]
	> = 40,001 Ω	[LO][HI]
	Siemens (all)	[LO][HI]
RTD Temperature	< -149.29 degC	[LO]
	> = -149.30 degC	[LO][HI]
	< - -236.73 degF.	[LO]
	> = -236.73 degF	[LO][HI]
	< 128.86 K	[LO]
	> = 128.86 K	[LO][HI]

Examples

9100

Instrument FSC

Description

The 9100 FSC provides the means to control the following functions of the Datron 9100 Calibrator:

- DC Voltage
- AC Voltage (sine, square, pulse, triangle, trapezoid, impulse)
- DC Current
- AC Current (sine, square, pulse, triangle, trapezoid, impulse)
- Resistance (resistance or conductance)
- Frequency
- Mark/Period (pulse)
- Capacitance
- Thermocouple Temperature
- RTD Temperature

9100 with Option 135 (High Voltage Resistance)

- Insulation
- Continuity

9100 with Option 250 or Option 600 (250 MHz or 600 MHz Scope Module):

- Square
- DC Voltage
- Leveled Sine
- Edge Signal
- Marker Signal

9100 with Option PWR (Power Module):

- DC Power (voltage & current or dual voltage)
- AC Power (voltage & current or dual voltage)
- AC Harmonics

Functional Capability

DC Voltage	-1050 V to 1050 V	
AC Voltage:		
Sine	0 V to 105 V	10 Hz to 100 kHz
	105.001 V to 320 V	40 Hz to 30 kHz
	320.01 V to 800 V	40 Hz to 30 kHz
	800.01 V to 1050 V	40 Hz to 20 kHz
Square	0 V to 147.9 V	10 Hz to 1 kHz
	147.9 V to 500 V	45 Hz to 65 Hz
Impulse	0 V to 78.05 V	10 Hz to 1 kHz
	78.05 V to 500 V	45 Hz to 65 Hz
Triangle	0 V to 85.7 V	10 Hz to 1 kHz
	85.7 V to 500 V	45 Hz to 65 Hz
Trapezoid	0 V to 131.9 V	10 Hz to 1 kHz
	131.9 V to 500 V	45 Hz to 65 Hz
DC Current	-20 A to 20 A	
	+/-(3.2001 A to 200 A) [1]	
	+/-(16.001 A to 1000 A)[2]	
AC Current:		
Sine	0 mA to 320 mA	10 Hz to 30 kHz
	0.32001 A to 20 A	10 Hz to 10 kHz
	3.2001 A to 200 A	10 Hz to 440 Hz[1]
	16.001 A to 1000 A	10 Hz to 100 Hz[2]
Square	0 mA to 450.8 mA	10 Hz to 1 kHz
	0.4508 A to 18 A	10 Hz to 100 Hz
	4.508 A to 180 A	10 Hz to 65 Hz[1]
	22.45 A to 900 A	10 Hz to 65 Hz[2]
Impulse	0 mA to 237.9 mA	10 Hz to 1 kHz
	0.2379 A to 15 A	10 Hz to 100 Hz
	2.379 A to 150 A	10 Hz to 65 Hz[1]
	11.9 A to 750 A	10 Hz to 65 Hz[2]

Triangle	0 mA to 261.2 mA	10 Hz to 1 kHz
	0.2612 A to 16.3 A	10 Hz to 100 Hz
	2.612 A to 163 A	10 Hz to 65 Hz[1]
	13.06 A to 815 A	10 Hz to 65 Hz[2]
Trapezoid	0 mA to 399.1 mA	10 Hz to 1 kHz
	0.3991 A to 19.2 A	10 Hz to 100 Hz
	3.991 A to 192 A	10 Hz to 65 Hz[1]
	19.95 A to 960 A	10 Hz to 65 Hz[2]
Resistance	0 Ω to 400 MΩ	
	2.5 nS to 2.5 mS	
Frequency	0.5 Hz to 10 MHz	+/-(0.01 Vp to 30 Vp)*
		*|Vp| + |offset| < 30 Vp
Mark/Period:	0.6 µs to 2000.00 ms	+/-(0.01 Vp to 30 Vp)*
Pulse Width	0.3 µs to 1999.99 ms	*|Vp| + |offset| < 30 Vp
Capacitance	0.5 nF to 40 mF	
RTD Temperature:		
Pt 385	-200 degC to 850 degC	10 Ω to 2 kΩ
Pt 392	-200 degC to 850 degC	10 Ω to 2 kΩ
TC Temperature:		
Type B	0 degC to 1820 degC	
Type C	0 degC to 2320 degC	
Type E	-250 degC to 1000 degC	
Type J	-210 degC to 1200 degC	
Type K	-250 degC to 1372 degC	
Type L	-200 degC to 900 degC	
Type N	-200 degC to 1300 degC	
Type R	0 degC to 1767 degC	
Type S	0 degC to 1767 degC	
Type T	-250 degC to 400 degC	

1. Requires Option 200 (10-Turn Current Coil)
2. Requires Option 200 (50-Turn Current Coil)

Option 135 (High Voltage Resistance)

Insulation:	100 kΩ to 2 GΩ
	0 V to 1350 V
	1 μA to 2.3 mA
Continuity:	0 Ω to 4 kΩ
	100 μA to 350 mA

Option PWR (Power Module)

DC Power:		
Primary Output	-1050 V to 1050 V	
Aux Output:		
Voltage	0 V to 7.5 V[1,5]	
Current	-20 A to 20 A	
	+/-(3.2001 A to 200 A)[2]	
	+/-(16.001 A to 1000 A)[3]	
AC Power:		
Primary Output:		
Sine	0 V to 105 V	10 Hz to 3 kHz[4]
	105.001 V to 1050 V	40 Hz to 3 kHz[4]
Square	0 V to 147.9 V	10 Hz to 1 kHz[4]
	147.9 V to 500 V	45 Hz to 65 H[4]
Impulse	0 V to 78.05 V	10 Hz to 1 kHz[4]
	78.05 V to 500 V	45 Hz to 65 H[4]
Triangle	0 V to 85.7 V	10 Hz to 1 kHz[4]
	85.7 V to 500 V	45 Hz to 65 Hz[4]
Trapezoid	0 V to 131.9 V	10 Hz to 1 kHz[4]
	131.9 V to 500 V	45 Hz to 65 Hz[4]
Aux Output:		
Sine		
Voltage	0.32 mV to 7.5 V	10 Hz to 3 kHz[1,4,5]
Current	0 A to 20 A	10 Hz to 3k Hz[4]

	3.2001 A to 200 A	10 Hz to 440 Hz[2,4]
	16.001 A to 1000 A	10 Hz to 100 Hz[3,4]
Square		
Voltage	0 V to 4.5 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 450.8 mA	10 Hz to 1 kHz[4]
	0.4508 A to 18 A	10 Hz to 100 Hz[4]
	4.508 A to 180 A	10 Hz to 65 Hz[2,4]
	22.45 A to 900 A	10 Hz to 65 Hz[3,4]
Impulse		
Voltage	0 V to 2.38 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 237.9 mA	10 Hz to 1 kHz[4]
	0.2379 A to 15 A	10 Hz to 100 Hz[4]
	2.379A to 150A	10 Hz to 65 Hz[2,4]
	11.9A to 750A	10 Hz to 65 Hz[3,4]
Triangle		
Voltage	0 V to 2.61 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 261.2 mA	10 Hz to 1 kHz[4]
	0.2612 A to 16.3 A	10 Hz to 100 Hz[4]
	2.612 A to 163 A	10 Hz to 65 Hz[2,4]
	13.06 A to 815 A	10 Hz to 65 Hz[3,4]
Trapezoid		
Voltage	0 V to 4.02 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 399.10 mA	10 Hz to 1 kHz[4]
	0.3991 A to 19.2 A	10 Hz to 100 Hz[4]
	3.991 A to 192 A	10 Hz to 65 Hz[2,4]
	19.95 A to 960 A	10 Hz to 65 Hz[3,4]
Phase	-180deg to 180deg	

AC Harmonic:		
Primary Output:		
Sine	0 V to 1050 V	50, 60, or 400 Hz[4]
Aux Output:		
Sine		
Voltage	0.32 mV to 7.5 V	50, 60, or 400 Hz[4]
Current	0 A to 20 A	50, 60, or 400 Hz[4]
	3.2001 A to 200 A	50, 60, or 400 Hz[2,4]
	16.001 A to 1000 A	50 or 60 Hz [3,4]
Phase	-180° to 180°	
Harmonic	1 to 40	

1. Using appropriate V/A scale factor.
2. Requires Option 200 (10-Turn Current Coil)
3. Requires Option 200 (50-Turn Current Coil)
4. Actual maximum frequency is the lower of the maximum frequency for the primary channel signal and the maximum frequency for the auxiliary channel signal.
5. Actual maximum frequency is the lower of the maximum frequency for the primary channel signal and the maximum frequency for the auxiliary channel signal.

Option 250 and Option 600 (Scope Calibrators)

Square:		
50 Ω term.	4.44 mVpp to 3.336 Vpp	1 kHz/1 ms
1 MΩ term.	4.44 mVpp to 133.44 Vpp	1 kHz/1 ms
DC Voltage:		
50 Ω term.	+/-(4.44 mV to 2.78 V)	
1 MΩ term.	+/-(4.44 mV to 133.44 V)	
Leveled Sine:		
50 Ω term.	4.44 mVpp to 5.56 Vpp	10 Hz to 250 MHz [1]
	4.44 mVpp to 5.56 Vpp	1.6666 ns to 100 ms[1]
50 Ω term.	4.44 mVpp to 5.56 Vpp	10 Hz to 600 MHz[2]
	4.44 mVpp to 5.56 Vpp	4.0000 ns to 100 ms[2]
1 MΩ term.	4.44 mVpp to 133.44 Vpp	10 Hz to 49.999 kHz

	4.44 mVpp to 133.44 Vpp	20.001 µs to 100 ms
Edge:		
50 Ω term.	88.8 mVpp to 1.112 Vpp	100 Hz to 10 MHz or
		0.1 µs to 10 ms[3]
1 MΩ term.	88.8 mVpp to 55.6 Vpp	100 Hz to 100 kHz or
		10 µs to 10 ms[3]
Marker (50 Ω only):		
	4.0000 ns to 5.5005 s[1]	0.1, 0.2, 0.5 & 1 Vpp
	0.1818 Hz to 250 MHz [1]	0.1, 0.2, 0.5 & 1 Vpp
	1.6666 ns to 5.5005 s[2]	0.1, 0.2, 0.5 & 1 Vpp
	0.1818 Hz to 600 HHz[2]	0.1, 0.2, 0.5 & 1 Vpp
1. Option 250 2. Option 600 3. In a 1-2-5 sequence.		

Parameters

The following table describes the basic operating modes of the 9100 Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 9100 FSC.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
K	Kelvins	temperature
T	Time	period or pulse width
V	Volts	voltage
VA	Volt-Amps	power
VAR	Volt-Amps reactive	power
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celcius	temperature
degF	degrees Fahrenheit	temperature
K	Kelvins	temperature
V/A	Volts per Amp	scale factor

9100 FSC Nominal, MOD1, MOD2, MOD3, and CON Rules

9100 Mode (function)	9100 Nominal	9100 MOD1	9100 MOD2 [1]	9100 MOD3[2]	9100 CON[3]
DC Voltage	V				2W
AC Voltage	V|Vpp	H|T	SI|SQ|IP|TI|TZ	2W	
	H|T	V|Vpp	SI|SQ|IP|TI|TZ	2W	
DC Current	A				2W|T1|T5
AC Current	A|App	H|T	SI|SQ|IP|TI|TZ		2W|T1|T5
	H|T	A|App	SI|SQ|IP|TI|TZ		2W|T1|T5
Resistance	Z|Y				2W|4W
Frequency	H|T	Vp	ZQ		2W
	Vp	H|T	ZQ		2W
Mark/Period (pulse)	H|T	Vp	PU		2W
	Vp	H|T	PU		2W
Capacitance	F				2W|4W
TC Temperature	degC|degF|K		_B|_C|_E|_J|_K| _L|_N|_R|_S|_T		2W
RTD Temperature	degC|degF|K	Z	R1|R9		2W|4W
DC Power	W|V			PR	2W|T1|T5
	A			AX	2W|T1|T5
AC Power	W|VA|VAR	H|T	SI	PR	2W|T1|T5
	V|Vpp	H|T	SI|SQ|IP|TI|TZ	PR	2W|T1|T5
	A|App	H|T	SI|SQ|IP|TI|TZ	AX	2W|T1|T5
	H|T	V|Vpp	SI|SQ|IP|TI|TZ	PR	2W|T1|T5
	deg	H|T	SI|SQ|IP|TI|TZ	PR	2W|T1|T5
AC Harmonic	V|Vpp	H	SI	MN|MX	2W|T1|T5
	A|App	H	SI	MX	2W|T1|T5
	H	V|Vpp	SI	MN	2W|T1|T5

	deg	H	SI	MN	2W|T1|T5
Scope (Square)	V|Vpp	H|T	ZQ	SC	[L]
	H|T	V|Vpp	ZQ	SC	[L]
Scope (DCV)	V			SC	[L]
Scope (Leveled Sine)	V|Vpp	H|T	LS	SC	[L]
	H|T	V|Vpp	LS	SC	[L]
Scope (Edge)	V|Vpp	H|T	ED	SC	[L]
	H|T	V|Vpp	ED	SC	[L]
Scope (Marker)	H|T	Vpp	MK	SC	L
Insulation	Z		[SE]	HV	2W
	V|A	Z	SE	HV	2W
Continuity	Z		[SE]	CO	4W
	A	Z	SE	CO	4W

Notes:

Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

1. See MOD2 parameter for description of these specification codes.

2. See MOD3 parameter for description of these specification codes.

3. See CON parameter for description of these specification codes.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*] units symbol

or "*" to specify a reset.

Rules:

- When the NOMINAL field units are "W" (Watts), the M9100 NOMINAL field must specify the auxiliary channel current.
- When the NOMINAL field units are "deg" (phase), the M9100 MOD1 field must specify the primary channel voltage.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*] units symbol

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field specifies the waveform, thermocouple, or RTD type or source vs. sense (read) for High Voltage Resistance mode.

- *blank* not applicable
- SI AC Voltage, Current, or Power Modes (Sine)
- SQ AC Voltage, Current, or Power Modes (Square)
- IP AC Voltage, Current, or Power Modes (Impulse)
- TI AC Voltage, Current, or Power Modes (Triangle)
- TZ AC Voltage, Current, or Power Modes (Trapezoid)
- _B TC Temperature Mode (Type B)
- _C TC Temperature Mode (Type C)
- _E TC Temperature Mode (Type E)
- _J TC Temperature Mode (Type J)

- _K TC Temperature Mode (Type K)
- _L C Temperature Mode (Type L)
- _N TC Temperature Mode (Type N)
- _R TC Temperature Mode (Type R)
- _S TC Temperature Mode (Type S)
- _T TC Temperature Mode (Type T)
- R1 RTD Temperature Mode (Pt 385)
- R9 RTD Temperature Mode (Pt 392)
- PU Frequency Mode (Pulse)
- ZQ Frequency Mode (Hz) or Scope Mode (Square)
- LS Scope Mode (Leveled Sine)
- ED Scope Mode (Edge signal)
- MK Scope Mode (Marker signal)
- SE Insulation or Continuity Mode (Sense "Read" Nominal value)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, or AC Power mode (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Temperature if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Temperature if no MOD2 code is entered.
- The M9100 RANGE and NOMINAL field must specify the pulse period or pulse repetition frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M9100 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse period or pulse repetition frequency.

MOD3

This field specifies the calibrator option required. In addition, for Power mode, the channel associated with the MOD2 field and the amplitude specified in the 9100 NOMINAL or M9100 MOD1 field.

- PR Option PWR (Power Module) Power mode Primary channel
- AX Option PWR (Power Module) Power mode Auxiliary channel
- MN Option PWR (Power Module) Harmonic mode Primary channel
- MX Option PWR (Power Module) Harmoinc mode Auxiliary channel
- SC Option 250 or Option 600 (Scope Calibrator)
- HV Option 135 (High Voltage Resistance) Insulation mode
- CO Option 135 (High Voltage Resistance) Continuity mode
- *blank* No option required

Rules:

9100 & M9100 NOMINAL, MOD1, and MOD3 Rules

	9100			M9100		
Mode (function)	NOMINAL	MOD1	MOD3	NOMINAL	MOD1	MOD3
DC Power	V		PR	A		AX
	A		AX	V		PR
AC Power	W|V|Vpp	H|T	PR	A|App	[deg]	AX
	A|App	H|T	AX	V|Vpp	[deg]	PR
	H|T	V|Vpp	PR	A|App	[deg]	AX
	deg	H|T	PR	A|App	V|Vpp	AX
AC Harmonic	V|Vpp	H|T	MN	A|App|V|Vpp	[deg]	MX
	A|App|V|Vpp	H|T	MX	V|Vpp	[deg]	MN
	H|T	V|Vpp	MN	A|App|V|Vp	[deg]	MX
	deg	H|T	MN	A|App|V|Vpp	V|Vpp	MX
Insulation	Z		HV			
	A	Z	HV			
	V	Z	HV			
Continuity	Z		CO			
	A	Z	CO			
Note: Blank entries are significant and must be blank.						

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- T1 Option 200 10-turn Toroid Coil

- T5 Option 200 50-turn Toroid Coil
- L 50-Ω Termination (scope modes only)
- *blank* 1-MΩ Termination (scope modes only)

Rules:

- The CON field may specify 4W only for Resistance, Capacitance, RTD Temperature, or High Voltage Resistance mode.
- The CON field may specify T1 or T5 only when the Nominal or MOD1 field specifies current or for DC or AC Power mode and the M9100 Tolerance field does not specify a V/A scale factor.
- The CON field may specify L or be blank only for scope modes.
- The CON field must be L for Scope Marker mode.
- L is inserted automatically in the CON field for Scope Marker mode if no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M9100        *
  1.002  9100         *                                                S
# ----- DC Voltage -----
  1.003  9100   20    19.99mV        2% 0.04U                             2W
# ----- AC Voltage (sine) -----
  2.001  9100   400   350.0mV        -2.8U +2.9U   60H           SI       2W
# ----- AC Voltage (square) -----
  3.001  9100         1V                           1kH           SQ    S  2W
# ----- AC Voltage (impulse) -----
  3.002  9100         1V                           1kH           IP    S  2W
# ----- AC Voltage (triangle) -----
  3.003  9100         13mVpp                       100H          TI    S  2W
# ----- AC Voltage (trapezoid) -----
  3.004  9100         1V                           1kH           TZ    S  2W
# ----- DC Current -----
  3.005  9100   400   350mA          9U                                   2W
# ----- AC Current (sine) -----
  4.001  9100         350.0mA                      60H           SI    S  2W
# ----- AC Current (square) -----
  4.002  9100         1mA                          1kH           SQ    S  2W
# ----- AC Current (impulse) -----
  4.003  9100         100mA                        1kH           IP    S  2W
# ----- AC Current (triangle) -----
  4.004  9100         13mApp                       440H          TI    S  2W
# ----- AC Current (trapezoid) -----
  4.005  9100         1mA                          1kH           TZ    S  2W
# ----- Resistance -----
  4.006  9100   400   390.0Z         0.4% 0.1U                            4W
  5.001  9100   4     3.900MZ        0.05U                                2W
# ----- Conductance -----
  6.001  9100         2.50uY                                           N  2W
# ----- Capacitance ----
  6.002  9100   10    1.100uF        2% 0.002U                            2W
# ----- Frequency Function -----
  7.001  9100         1kH                          1Vp           ZQ    S  2W
  7.002  M9100                                     1Voff
  7.003  9100         -1.00Vp                      1kH           ZQ    N  2W
# ----- Marker/Period (pulse) Function -----
  7.004  M9100  PULSE 10uT
  7.005  9100         1mT                          1Vp           PU    S  2W
```

```
  7.006  M9100  PER   200mT
  7.007  9100         1mT                          1Vp            PU    S  2W
  7.008  M9100  PULSE 10uT                         -10Voff
  7.009  9100         -5.00Vp                      1kH            PU    N  2W
# ----- TC Temperature -----
  7.010  M9100  TS68
  7.011  9100         50degC         1U                         _K       2W
# ----- RTD Temperature -----
  8.001  9100         45degC                       100Z           R1    S  4W

# ============================== Option 135 ================================

  8.002  DISP         Set UUT to MOhm, 250V.
  8.003  M9100                                                               HI
  8.004  9100         1.0mA                        250kZ          SE HV N  2W
  8.005  EVAL   -e MEM > 1.0 : Current [MEM]mA
  9.001  9100         250.0V         20%           250kZ          SE HV    2W
 10.001  DISP         Set UUT to MOhm, 500V
 10.002  M9100                                                              SP
 10.003  9100         1.0mA                        500kZ          SE HV N  2W
 10.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 11.001  9100         500.0V         20%           500kZ          SE HV    2W
 12.001  DISP         Set UUT to MOhm, 1000V
 12.002  M9100                                                              SP
 12.003  9100         1.0mA                        1MZ            SE HV N  2W
 12.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 13.001  9100         1000V          20%           1MZ            SE HV    2W
 14.001  DISP         Set UUT to LO Ohm.
 14.002  M9100                                                              HI
 14.003  9100         1.000mA                      1kZ            SE CO N  4W
 14.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 15.001  M9100        *

# ========================= Option 250 & 600 ===============================

# ----- DC Voltage -----
 15.002  9100   20    19.99mV        4%                            SC
# ----- Square Voltage -----
 16.001  9100   400   350.0mV        50U           1kH            ZQ SC
# ----- Edge Signal -----
 17.001  9100         0.5Vpp                       1MH            ED SC S  L
# ----- Leveled Sine Wave -----
 17.002  9100         200mVpp                      50kH           LS SC S  L
 17.003  9100         1.00MH         1%            100mVpp        LS SC    L
```

```
# ----- Marker Signal -----
 18.001  9100         1uT                          0.2Vpp         MK SC S  L

# ============================== Option PWR ================================

# ----- DC Power -----
 18.002  M9100        1V                                             PR
 18.003  9100         1.000A                                         AX S  2W
 18.004  M9100        10A            45uV/A                          AX
 18.005  9100         1W                                             PR S  2W
 18.006  M9100        10A                                            AX
 18.007  9100         1.000kW                                        PR S  2W
# ----- DC Power w/Option 200 10-turn coil -----
 18.008  M9100        100A                                           AX
 18.009  9100         10.00kW                                        PR S  T1
# ----- DC Power w/Option 200 50-turn coil -----
 18.010  M9100        500A                                           AX
 18.011  9100         -100.0kW                                       PR S  T5

# ----- AC Power (Watts) -----
 18.012  M9100        10A                          0deg           SI AX
 18.013  9100         1W                           1kH            SI PR S  2W
 18.014  M9100        10A            1mV/A                         SI AX
 18.015  9100         1W                           1kH            SI PR S  2W
# ----- AC Power (Volt-Amps) -----
 18.016  M9100        10A                          0deg           SI AX
 18.017  9100         1VA                          1kH            SI PR S  2W
# ----- AC Power (VAR) -----
 18.018  M9100        10A                          90deg          SI AX
 18.019  9100         1VAR                         1kH            SI PR S  2W
# ----- AC Power (Frequency) -----
 18.020  M9100        10A                          0deg           SI AX
 18.021  9100         60.0H          0.2U          1V             SI PR    2W
# ----- AC Power (Phase) -----
 19.001  M9100        10A                          1V             SI AX
 19.002  9100         0.0deg         0.1U          50H            SI PR    2W

# ----- AC Harmonic -----
 20.001  M9100  HX3   10A                          0deg           SI MX
 20.002  9100         1V                           60H            SI MN S  2W
 20.003  M9100  HX1   1V                           0deg           SI MN
 20.004  9100         1.000mA        0.010U        60H            SI MX    2W
 21.001  M9100  HX39  1V                           0deg           SI MN
 21.002  9100         10mV                         60H            SI MX S  2W
```

M9100

Auxiliary Instrument Setup FSC

Description

The M9100 FSC provides the additional program functions for the Datron 9100 Calibrator which are not addressed by the 9100 FSC.

Parameters

For a description of the 9100 Calibrator operating modes referenced in this section, see the 9100 Instrument FSC description.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage
Voff	Volts offset	DC offset
Vpp	Volts peak to peak	voltage
V/A	Volts per Amp	scale factor (see Tolerance field)
deg	degrees	phase

M9100 FSC Range, Nominal, Tolerance, MOD1, MOD2, and MOD3 Rules

Mode (function)	Range	Nominal	TOL	MOD1	MOD2	MOD3
Frequency				[Voff]		
Mark/Period (pulse)	PER|PULSE	T|H		[Voff]		
RTD Temperature	[TS68|TS90]					
TC Temperature	[TS68|TS90]					
DC Power		V	[V/A]			PR
		A	[V/A]			AX
AC Power		V|Vpp	[V/A]	[deg]	SI|SQ|IP|TI|TZ	PR
		A|App	[V/A]	[deg]	SI|SQ|IP|TI|TZ	AX
		A|App	[V/A]	[V|Vpp]	SI|SQ|IP|TI|TZ	AX
AC Harmonic	HX*n*	V|Vpp		[deg]	SI|SQ|IP|TI|TZ	MN
	HX*n*	A|App|V|Vpp		[deg]	SI|SQ|IP|TI|TZ	MX
	HX*n*	A|App|V|Vpp		[V|Vpp]	SI|SQ|IP|TI|TZ	MX
Scope Edge	RISE|FALL					

Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies one of the following:

- HX*n* Selects harmonic on auxiliary channel, 1 to 40
- PULSE Pulse Width
- PER Pulse Period
- RISE Polarity (Edge)
- FALL Polarity (Edge)
- TS68 TS68 temperature scale
- TS90 TS90 temperature scale
- *blank* default or field not applicable

Rules:

- For RTD and TC Temperature modes, if the RANGE field does not specify the temperature scale, the default is TS90.
- For Scope Edge mode, if the RANGE field does not specify RISE or FALL, the default is RISE.

NOMINAL

This field specifies one of the following entered as:

[*numeric*][*prefix*] units symbol

- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- Signal amplitude for the power or harmonic mode channel specified by the MOD3 field.
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the pulse period or pulse repetition frequency when the M9100 RANGE field is PER.
- The NOMIMAL field must specify the pulse width when the M9100 RANGE field is PULSE.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is used to specify the scale factor applied to the auxiliary channel, when in 'auxiliary voltage' power mode, to calculate the effective voltage on the auxiliary channel. This field is entered as:

[*numeric*][*pref*ix]V/A

Rules:

- When the TOLERANCE field contains only units, the value is obtained from memory register MEM.

MOD1

This field specifies one of the following:

1. DC offset for Frequency or Mark/Period (pulse) mode or
2. The phase for AC Power or AC Harmonic mode or
3. The primary voltage for AC Power or AC Harmonic mode when the 9100 NOMINAL field specifies phase.

Values are entered as:

[*numeric*][*prefix*] units symbol

Rules:

- The MOD1 field may specify voltage or current only when the 9100 NOMINAL field specifies phase.
- The MOD1 field may specify DC offset only for Frequency and Mark/Period (pulse) mode.
- When the MOD1 field is blank the DC offset is set to zero.
- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field specifies the waveform for the power mode channel specified by the MOD3 field.

- *blank* DC
- SI Sine
- SQ Square
- IP Impulse
- TI Triangle
- TZ Trapezoid

MOD3

This field specifies the channel associated with the Power mode parameters specified in the NOMINAL and MOD2 fields.

- PR Power mode Primary channel
- AX Power mode Auxiliary channel
- MN Harmonic mode Primary channel

- MX Harmoinc mode Auxiliary channel
- *blank* not applicable

Rules:

See 9100 MOD3 field rules.

MOD4

This field is not used.

CON

This field specifies the 9105 Work Mat connection for current or the UUT source current for Resistance, Capacitance, and RTD Temperature modes.

- C1 9105 Work Mat yellow lead (I+20A)
- C2 9105 Work Mat white lead (I+mA)
- LO Low UUT source current
- HI High UUT source current
- SP Super High UUT source current
- *blank* Applicable default (C1 or LO)

Rules:

Mode (function)	9100 CON	M9100 CON	Connection
DC Current	2W	[C1]	9105 Work Mat Yel & Blk
	2W	C2	9105 Work Mat Wht & Blk
	T1|T5	[C1]	9100 I+ & I-
AC Current	2W	[C1]	9105 Work Mat Yel & Blk
	2W	C2	9105 Work Mat Wht & Blk
	T1|T5	[C1]	9100 I+ & I-
Resistance	2W|4W	[LO|HI|SP]	9105 Work Mat Red & Blk
Capacitance	2W|4W	[LO|SP]	9105 Work Mat Red & Blk
RTD Temperature	2W|4W	[LO|HI|SP]	9105 Work Mat Red & Blk
Continuity	4W	[HI|SP]	9100 HI and LO Terminals 9100 1 + and 1 – as sense
Insulation	2W	[HI|SP]	9100 HI and LO Terminals

Examples

See 9100 FSC.

9500

Instrument FSC

Description

The 9500 FSC provides the means to control the following functions of the Datron 9500 Oscilloscope Calibrator:

- DC Voltage
- Square Voltage
- Leveled Sine
- Edge
- Fast Edge
- Time Markers
- DC Current
- Square Current
- Composite Video
- Linear Ramp
- Zero Skew
- Oscilloscope 50 Ohm Input Impedance Overload Pulse
- Oscilloscope Input Impedance Measurement
- Trigger Signal

Functional Capability

9500 Model	Maximum Frequency	Minimum Period
9500/400	400 MHz	2.5 ns
9500/600	600 MHz	1.6666 ns
9500/1100	1100 MHz	909.09 ps
9500/3200	3200 MHz	312.50 ps

Active Head	Maximum Frequency	Minimum Period
9510	1.1 GHz	909.09 ps

9520	1.1 GHz	909.09 ps
9530	3.2 Hz	312.50 ps
9550	(see Fast Edge)	

DC Voltage	Amplitude
50 Ω term.	0 V and +/-(888 µV to 5.56 V)
1 MΩ term.	0 V and +/-(888 µV to 222.4 V)

Square Voltage	Amplitude	Frequency
50 Ω term.	35.52 µVpp to 5.56 Vpp	10 Hz to 100 kHz
1 MΩ term.	35.52 µVpp to 222.4 Vpp	10 Hz to 100 kHz

Leveled Sine	Frequency	Amplitude
Single Channel:		
50 Ω & 1 MΩ	100 mHz to 550 MHz	4.44 mVpp to 5.560 Vpp
	>550 MHz to 1.1 GHz	4.44 mVpp to 3.336 Vpp
50 Ω	>1.1 GHz to 2.5 GHz	4.44 mVpp to 3.336 Vpp
	>2.5 GHz to 3.2 GHz	4.44 mVpp to 2.224 Vpp
Dual Channel:		
50 Ω & 1 MΩ	100 mHz to 550 MHz	4.44 mVpp to 2.780 Vpp
	>550 MHz to 1.1 GHz	4.44 mVpp to 1.668 Vpp

Low Edge	Amplitude	Frequency	Rise Time
50 Ω & 1 MΩ	4.44 mVpp to 3.1 Vpp	10 Hz to 2 MHz	<=500 ps

High Edge	Amplitude	Frequency	Rise Time
50 Ω	888 mVpp to 5.56 Vpp	10 Hz to 100 kHz	<=150 ns
1 MΩ	888 mVpp to <100 Vpp	10 Hz to 100 kHz	<=150 ns
1 MΩ	100 Vpp to 222.4 Vpp	10 Hz to 100 kHz	<=200 ns

Fast Edge	Amplitude	Frequency	Rise Time
9510	not supported		
9520 and 9530:			
50 Ω & 1 MΩ	4.44 mVpp to 3.1 Vpp	10 Hz to 2 MHz	<=150 ps
9550:			
50 Ω	425 mVpp to 575 mVpp	10 Hz to 1 MHz	<=25 ps

Time Markers (50 Ω & 1 MΩ)	Period	Amplitude
Triangle	901.00 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Square	9.0001 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1Vpp
Pulse	900.91 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Sine	450.46 ps to 909.09 ps	100 mVpp, 250 mVpp, 500 mVpp
Sine	909.10 ps to 9 ns	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp

Function	Amplitude
DC Current	+/-(88.8 µA to 111.2 mA)

Function	Amplitude	Frequency
Square Current	88.8 µApp to 111.2 mApp	10 Hz to 100 kHz

Video	Amplitude	Video
NTSC	0.3 Vpp	Black
	0.7 Vpp	Mid-Grey
	1.0 Vpp	White
PAL/SECAM	0.3 Vpp	Black
	0.7 Vpp	Mid-Grey
	1.0 Vpp	White

Function	Period	Amplitude
Linear Ramp	3 s, 300 ms, 30 ms, 3 ms	1 Vpp

Function	Frequency	Amplitude
Zero Skew	10 Hz to 100 MHz	1 Vpp

Function	Amplitude	Energy
Overload Pulse	+/-(5 V to 20 V)	1.6 J to 50.0 J

Function	UUT Input Impedance Measurement
Resistance	10 Ω to 150 Ω and 50 kΩ to 12 M Ω
Capacitance	1p F to 95 pF

Parameters

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
J	Joule	energy
T	Time	period
V	Volts	voltage
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance

9500 FSC Nominal, MOD1, MOD2, and MOD3 Rules

9500 Mode	9500 Nominal	9500 MOD1	9500 MOD2[1]	9500 MOD3
DC Voltage	V			
Square Voltage	V|Vp|Vpp	H|T	SQ|ZQ|ZN	
	H|T	V|Vpp	SQ|ZQ|ZN	
Low Edge	V|Vp|Vpp	H|T	ED	
	H|T	V|Vpp	ED	
High Edge	V|Vp|Vpp	H|T	HE	
	H|T	V|Vpp	HE	
Fast Edge	V|Vp|Vpp	H|T	FE	[EF]
	H|T	V|Vpp	FE	[EF]
Leveled Sine	V|Vp|Vpp	H|T	LS	
	H|T	V|Vpp	LS	
Linear Ramp	Vpp	T	LR	
	T	Vpp	LR	
Time Marker	T	Vpp	M1|M2|M3|M4	
DC Current	A			
Square Current	A|Ap|App	H|T	SQ	
	H|T	A|App	SQ	
Video	Vpp		F1|F2	
Overload Pulse	V	J	OP	
Zero Skew	H|T	Vpp	ZK	[PR]
Impedance Meas	Z|F			ZM

1. See MOD2 parameter for description of these specification codes and rules.

Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*] units symbol

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency, period, voltage, or energy entered as:

[*numeric*][*prefix*] units symbol

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SQ Squarewave (symmetrical)
- ZQ Squarewave (positive)
- ZN Squarewave (negative)
- ED Low-Edge signal
- HE High-Edge signal

- FE Fast-Edge signal
- M1 Triangle Marker signal
- M2 Square Marker signal
- M3 Pulse Marker signal
- M4 Sine Marker signal
- LS Leveled sine wave
- F1 NTSC composite video signal
- F2 PAL/SECAM composite video signal
- LR Linear Ramp
- OP Overload Pulse
- ZK Zero Skew

Rules:

- ZQ is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- SQ is inserted automatically in the MOD2 field for AC Current.(i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- The MOD2 field may specify fast edge "FE", only when a 9520, 9530, or 9550 Active Head is configured on the signal channel specified in the M9500 FSC MOD2 field.
- When the MOD2 field specifies "ZK" (Zero Skew) the M9500 Tolerance field must specify two, three, four, or five signal channels.

MOD3

This field specifies the calibrator mode:

- *blank* Not applicable
- ZM Input (UUT Impedance Measurement)
- +V Positive Video Polarity
- -V Negative Video Polarity
- EF Use 9550 Active Head for Fast Edge
- PR Use zero skew precision adjustments already performed and stored manually.

Rules:

- ZM is inserted automatically in the MOD3 field when the Nominal field units are Ohms or Farads.
- The MOD3 field must specify +V or -V when the MOD2 field is F1 or F2.
- The MOD3 field may specify EF only when the MOD2 field specifies FE.
- The MOD3 field may specify PR only when the MOD2 field specifies ZK.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify S (Setup Test) when the MOD2 field specifies OP (Overload Pulse).

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Termination
- L 50 Ω Termination
- 2W 2-Wire

Rules:

- 2W is inserted automatically in the CON field when the MOD3 is ZM.
- The CON field must specify 2W when the MOD3 field specifies ZM.
- The CON field must be L for any of the following conditions:
  1. Nominal field specifies current.
  2. MOD1 field specifies current.
  3. The MOD2 field specifies fast edge (FE).
  4. The MOD2 field specifies overload pulse (OP).
  5. The MOD2 field specifies zero skew (ZK).
- L is inserted automatically in the CON field for any of the following conditions if no CON field code is entered:
  1. Nominal field specifies current.

2. MOD1 field specifies current.
3. The MOD2 field specifies fast edge (FE).
4. The MOD2 field specifies overload pulse (OP).
5. The MOD2 field specifies zero skew (ZK).

- L is inserted automatically in the CON field for any of the following conditions if no CON field code is entered:

6. Nominal field specifies current.
7. MOD1 field specifies current.
8. The MOD2 field specifies fast edge (FE).
9. The MOD2 field specifies overload pulse (OP).
10. The MOD2 field specifies zero skew (ZK).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M9500        *              CH1
  1.002  9500         *                                                 S
# ----- DC Voltage -----
  1.003  9500   20    19.99mV        4%
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  9500   400   350.0mV        50U           60H            ZQ
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  9500         100Vpp                       1kH            ZN    S
# ----- AC Voltage (Frequency Test) -----
  3.002  9500   1000  800.0H         0.1% 0.1U     300mV          ZQ
# ----- Low-Edge Signal (Scope Output) -----
  4.001  9500         0.5Vpp                       500kH          ED    S  L
# ----- High-Edge Signal (Scope Output) -----
  4.002  9500         100Vpp                       100kH          HE    S
# ----- Fast-Edge Signal (Scope Output) -----
  4.003  9500         100Vpp                       100kH          HE    S
# ----- Leveled Sine Wave -----
  4.004  M9500                       CH12
```

```
  4.005  9500         10mVpp                        1MH            FE    S  L
# ----- Triangle Marker Signal -----
  4.006  M9500                       CH1
  4.007  9500         1uT                           1Vpp           M1    S  L
  4.008  M9500        *              CH1
# ----- Square Marker Signal -----
  4.009  9500         1mT                           1Vpp           M2    S  L
# ----- Pulse Marker Signal -----
  4.010  9500         5uT                           1Vpp           M3    S  L
# ----- Sinusoid Marker Signal -----
  4.011  9500         2nT                           1Vpp           M4    S  L
# ----- NTSC Video -----
  4.012  9500         1Vpp                                         F1 +V S  L
  4.013  M9500        *              CH1
# ----- PAL Video -----
  4.014  9500         0.7Vpp                                       F2 -V S  L
# ----- Linear Ramp Signal -----
  4.015  9500         300mT                         1Vpp           LR    S  L
# ----- Zero Skew Function -----
  4.016  M9500                       CH1234
  4.017  9500         500kH                         1Vpp           ZK    S  L
# ----- Impedance Measurement (50 Ohm) -----
  4.018  M9500        *              CH1
  4.019  9500         50Z            1U                              ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  9500         1.000MZ        1U                              ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  9500         10pF                                           ZM N  2W
# ----- Overload Pulse -----
  6.002  HEAD         {CH 1 50 Ohm OVERLOAD PROTECTION}
  6.003  DISP         Connect 9500 CH 1 Active Head to UUT CH 1.
  6.004  SET          VERTICAL MODE CH 1: ON
  6.004  SET          VERTICAL MODE CH 2: OFF
  6.004  SET          VERTICAL MODE CH 3: OFF
  6.004  SET          VERTICAL MODE CH 4: OFF
  6.004  SET          COUPLING CH 1 : 50 Ohm
  6.004  SET          VOLTS/DIV CH 1 : 1V
  6.004  SET          TRIGGER SOURCE : CH 1
  6.005  HEAD         CH 1 50 Ohm OVERLOAD PROTECTION: 5V test ~60s
# 5V at 30J = 60s duration.
  6.006  9500         5V                            30J            OP    S
  6.007  MATH         MEM2 = "No overload at 5V"
  6.008  EVAL   -s MEM2 : [N]Does the UUT display show "50 Ohm OVERLOAD"?
  7.001  SET          VOLTS/DIV CH 1 : 5V
```

```
  7.002  HEAD         CH 1 50 Ohm OVERLOAD PROTECTION: 20V test ~12.5s
# 20V at 50J = 6.25s. Spec is 10s so two setup statements are needed.
  7.003  9500         20V                          50J            OP    S
  7.004  9500         20V                          50J            OP    S
  7.005  MATH         MEM2 = "50 Ohm Overload at 20V"
  7.006  EVAL   -s MEM2 : Does the UUT display show "50 Ohm OVERLOAD"?
```

M9500

Instrument FSC

Description

The M9500 FSC provides the additional program functions for the Datron 9500 Oscilloscope Calibrator which are not addressed by the 9500 FSC.

Overload Pulse Time Limit

- Video Trigger
- Edge Polarity
- Signal Channel
- Trigger Output Impedance
- Trigger Channel

Parameters

RANGE

This field specifies one of the following:

- COMP Trigger Composite (Video)
- FRAME Trigger Frame (Video)
- RISE Polarity (Edge)
- FALL Polarity (Edge)
- *blank* field not applicable

Rules:

- The RANGE field may specify COMP or FRAME only when the 9500 FSC MOD2 field is F1 or F2.
- The RANGE field may specify RISE or FALL only when the 9500 FSC MOD2 field is ED, HE, or FE.

NOMINAL

This field specifies one of the following:

- "*" reset to default values
- *blank* field not applicable

TOLERANCE

This field selects the signal channel(s).

- *blank* CH 1
- CH1 CH 1
- CH2 CH 2
- CH3 CH 3
- CH4 CH 4
- CH5 CH 5
- CH12 CH 1 & CH 2
- CH13 CH 1 & CH 3
- CH14 CH 1 & CH 4
- CH15 CH 1 & CH 5
- CH23 CH 2 & CH 3
- CH24 CH 2 & CH 4
- CH25 CH 2 & CH 5
- CH34 CH 3 & CH 4
- CH35 CH 3 & CH 5
- CH45 CH 4 & CH 5
- CH123 CH 1, CH 2, & CH 3
- CH124 CH 1, CH 2, & CH 4
- CH125 CH 1, CH 2, & CH 5
- CH134 CH 1, CH 3, & CH 4
- CH135 CH 1, CH 3, & CH 5
- CH145 CH 1, CH 4, & CH 5
- CH234 CH 2, CH 3, & CH 4
- CH235 CH 2, CH 3, & CH 5
- CH245 CH 2, CH 4, & CH 5
- CH345 CH 3, CH 4, & CH 5
- CH1234 CH 1, CH 2, CH 3, & CH 4

- CH1235 CH 1, CH 2, CH 3, & CH 5
- CH1245 CH 1, CH 2, CH 4, & CH 5
- CH1345 CH 1, CH 3, CH 4, & CH 5
- CH2345 CH 2, CH 3, CH 4, & CH 5
- CH12345 CH 1, CH 2, CH 3, CH 4, & CH 5

Rules:

9500	M9500
MOD2	TOLERANCE

- When the 9500 MOD2 field specifies leveled-sine (LS) the M9500 Tolerance field may specify one or two signal channels.
- When the 9500 MOD2 field specifies zero skew (ZK) the M9500 Tolerance field must specify two, three, four, or five signal channels.
- For all waveforms (9500 MOD2 not "LS" or "ZK") the M9500 field may specify only one signal channel.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the trigger output impedance.

- *blank* 1 MΩ Termination
- L 50 Ω Termination

CON

This field specifies the trigger channel and rate. The following codes require Option 5, 5 Five Channel Output:

- *blank* Trigger Output off
- 1T1 Trigger Output on Channel 1, Normal mode
- 2T1 Trigger Output on Channel 1, 1/10 of output rate
- 3T1 Trigger Output on Channel 1, 1/100 of output rate
- 1T2 Trigger Output on Channel 2, Normal mode
- 2T2 Trigger Output on Channel 2, 1/10 of output rate
- 3T2 Trigger Output on Channel 2, 1/100 of output rate
- 1T3 Trigger Output on Channel 3, Normal mode
- 2T3 Trigger Output on Channel 3, 1/10 of output rate
- 3T3 Trigger Output on Channel 3, 1/100 of output rate
- 1T4 Trigger Output on Channel 4, Normal mode
- 2T4 Trigger Output on Channel 4, 1/10 of output rate
- 3T4 Trigger Output on Channel 4, 1/100 of output rate
- 1T5 Trigger Output on Channel 5, Normal mode
- 2T5 Trigger Output on Channel 5, 1/10 of output rate
- 3T5 Trigger Output on Channel 5, 1/100 of output rate

Rules:

- The CON field must be blank for any of the following conditions:
  1. The M9500 Tolerance field is blank.
  2. The M9500 Tolerance field specifies three or more output channels (zero skew).
  3. The 9500 MOD2 field specifies zero skew "ZK".
  4. The 9500 MOD3 field specifies impedance measurment "ZM".
- When a trigger output channel is specified the trigger channel number cannot be the same as a signal output channel specified in the Tolerance field.

Examples

See 9500 FSC.

HP60, HP63

Instrument FSC

Description

The HP60 and HP63 FSC's program the Hewlett-Packard 6060B and 6063B Electronic Loads, respectively, for constant current, constant voltage, and constant resistance modes of operation.

Functional Capability

FSC	Model	Current	Voltage	Resistance
HP60	6060B	0A to 60 A	3 V to 60 V	0.033 Ω to 10 kΩ
HP63	6063B	0A to 10 A	3 V to 240 V	0.20 Ω to 50 kΩ

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the reading that is expected from the measurement (or reset "*").

- Voltage entered as: *numeric*[*prefix*]V
- Current entered as: *numeric*[*prefix*]A
- * reset

Rules:

- The NOMINAL field may specify voltage only when the MOD1 field specifies Constant Current or Constant Resistance mode.
- The NOMINAL field may specify current only when the MOD1 field specifies Constant Voltage or Constant Resistance mode.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the operating mode of the device.

- Constant Current entered as: *numeric*[*prefix*]A
- Constant Voltage entered as: *numeric*[*prefix*]V
- Constant Resistance entered as: *numeric*[*prefix*]Z

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Example

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  HP60         *                                                S
# ----- Voltage verification (UUT in CV mode, 6060B in CC mode) -----
# ------- no load -------
  1.002  HP60         3V             0.23U         0A                    2W
  2.001  HP60         30V            0.34U         0A                    2W
  3.001  HP60         58V            0.45U         0A                    2W
# ------- sink current (load regulation) -------
  4.001  HP60         3V             0.23U         1A                    2W
  5.001  HP60         30V            0.34U         1A                    2W
  6.001  HP60         58V            0.45U         1A                    2W
# ----- Current verification (UUT in CC mode, 6060B in CV mode) -----
# ------- short -------
  7.001  HP60         0.2A           0.85U         3V                    2W
  8.001  HP60         1A             1.5U          3V                    2W
  9.001  HP60         1.8A           0.45U         3V                    2W
# ------- regulated shunt -------
 10.001  HP60         0.2A           0.85U         10V                   2W
 11.001  HP60         1A             1.5U          10V                   2W
 12.001  HP60         1.8A           0.45U         10V                   2W
```

ACC

Miscellaneous FSC

Description

The ACC FSC enables MET/CAL to calculate a Test Uncertainty Ratio for a user-configured system instrument by allowing the procedure writer to specify the system accuracy. The ACC FSC must be used in conjunction with an associated MEMC statement.

Format

ACC *range nominal tolerance*

Rules

RANGE

The RANGE field in the ACC FSC has two uses. First, it can be referred to by the TOLERANCE field. For example, a TOLERANCE specification of "1/" indicates 1% of the RANGE value. The second use is as a stand-in for the ACC NOMINAL value at compile time. If the ACC FSC does not directly specify a NOMINAL value, but does specify a RANGE value, the compile-time T.U.R. calculation uses the RANGE value in place of the NOMINAL value. The RANGE field is optional. For compatibility with other FSCs, the RANGE field may contain a number or an 'A' (for AUTORANGE), however an 'A' in the ACC RANGE field has no effect.

The ACC RANGE field is compatible with the RANGE field in an instrument FSC. Refer to the RANGE field rules section under "Instrument FSCs" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

NOMINAL

The NOMINAL field specifies the value at which the system accuracy is to be determined. If the ACC NOMINAL does not specify a numeric value, the NOMINAL value is taken from memory register MEM at run-time. Like MEMC, the ACC fsc allows an arbitrary units string to be specified in the NOMINAL field. When an ACC fsc is paired with a MEMC statement, the units string in the ACC NOMINAL field documents the procedure and is used when the System Actual, UUT Indicated, System Tolerance, and Test Tolerance are printed in the Post Test summary and results. As with MEMC, MET/CAL does not evaluate any units prefix specified in the ACC NOMINAL field. The NOMINAL values in the ACC and MEMC statements are presumed to be in the same units.

The general format for the NOMINAL field of the ACC FSC is:

[*value*]*string*

The following rules apply to the ACC NOMINAL field:

1. *string* need not be present if there is a numerical *value*.
2. *string* may be any text string, with two restrictions:

   (a) The string cannot contain blanks.

   (b) The last character in the string cannot be a 'R', '/', '%' or 'U'.
3. *string* does not affect the NOMINAL value used to calculate the system accuracy. The procedure writer must ensure that the NOMINAL values given in the ACC and associated MEMC statements are in commensurate units. Otherwise, the T.U.R. calculation will be incorrect.
4. A maximum of 14 characters is allowed in the NOMINAL field.
5. The *value* is specified in floating-point format (NR3). It may contain a sign, a decimal point, and may be expressed in scientific notation (E-format).

TOLERANCE

The TOLERANCE field specifies the tolerance used to calculate the system accuracy. The tolerances may be specified with respect to the ACC NOMINAL value, with respect to the ACC RANGE value, in absolute units, or in some combinations of these three ways. The tolerances should reflect the instrument specifications of the user-configured system instrument at the specified NOMINAL value.

An asymmetrical tolerance specification has no purpose when used in an ACC statement. The maximum deviation from the ACC NOMINAL will be taken to be the system accuracy when an asymmetrical specification is given. For example,

```
ACC 10V +1% -2%
```

specifies an asymmetrical tolerance in which the upper deviation is 0.1 V and the lower deviation is 0.2 V. The system accuracy is the maximum of the two deviations, which is 0.2 V.

The TOLERANCE field is limited to 14 characters and may contain up to 3 subfields. Allowed formats for the subfields are:

[*val*]%	% of NOMINAL
[*val*]/	% of RANGE
[val]*P*%	PPM of NOMINAL
[*val*]P/	PPM of RANGE
[*val*]U	Units of NOMINAL
TOL	use TOLERANCE spec in last "TOL" FSC

val, if specified, may be a literal numeric value or may specify a numeric register in the form M *i* where *i* is the register index (1 to 255). If *val* is not specified, the tolerance value is taken from numeric register MEM.

Examples:

```
ACC 10V M23%
```
In this example the tolerance is specified as a percentage of the NOMINAL (10 V) and the tolerance value is taken from numeric register M[23] at run time.

```
ACC 10V U
```
In this example the tolerance is specified in absolute units (in this case volts) and the tolerance value is taken from numeric register MEM at run time.

- Memory Registers

Execution of an ACC statement causes the ACC NOMINAL value to be copied into memory register MEM1. The ACC NOMINAL value is the numeric value specified in the ACC NOMINAL field. If no numeric value is specified in the ACC NOMINAL field, the value is taken from memory register MEM. The ACC FSC does not change the value of the other MET/CAL memory registers (MEM, MEM2, M[1], ..., M[255]).

Note than the ACC FSC functions in the same manner as an Instrument SETUP statement with regard to its effect on MEM1.

Example

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON

       # The underscore after the percent symbol is required to
       # differentiate between nominal units and tolerance.
       1.001 IEEE       [@FUNCGEN]SQR;AMPL 1VP;FREQ 100HZ
       1.002 ACC        50%_    1%
       1.003 IEEE       [@UUT]DUTY?[I]
       # Swap MEM and MEM1 so System Actual and UUT Indicated
       # are in correct registers for MEMC
       1.004 MEME
       1.005 MEMC       %_      4U
```

In this example, the system accuracy is .5 (1% of 50).

The T.U.R. is the test tolerance divided by the system accuracy, The test tolerance, specified by the MEMC statement, is 4.

The T.U.R. is therefore 4 / .5, which is 8.

Note

The linkage between an ACC statement and an associated MEMC statement is disabled when ASK- U is in effect. (This works in the same manner as the association between an instrument SETUP statement and a MEMC statement.) When ASK- U is set, ACC statements have no effect.

If an ACC FSC is paired with a MEMC statement, and an instrument SETUP statement appears in the test as well, the ACC statement has priority over the instrument SETUP statement in specifying the system accuracy.

For example,

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
2.001 ACC        8V      0.0025U
2.002 5700       8V                            S  2W
2.003 IEEE       [@UUT]?[I]
2.004 MEME
2.005 MEMC       V       0.01%
```

In this example, the system accuracy is .0025. It is not based on looking up the accuracy of the 5700A at 8V in the appropriate MET/CAL accuracy file, as it would be if the ACC statement were not there.

Results may be unpredictable if a MEMC test includes 2 or more ACC or Instrument Setup statements and the state of the ASK 'U' flag is changed between those statements.

ACCF

Miscellaneous FSC

Description

The ACCF FSC allows an alternate accuracy file to be specified for a particular instrument FSC.

Caution

Procedure writers should carefully read the NOTES section below before using the ACCF FSC. Unless procedures are written to follow the guidelines indicated below, compile time and run time test uncertainty ratio (T.U.R.) calculations may not agree.

Format

ACCF *FSC Accuracy File*

Rules

- \+ *FSC* Field

The *FSC* field specifies the name of the instrument FSC to which the alternate accuracy file applies.

- \+ *Accuracy File*

The *Accuracy File* field specifies the name of the alternate accuracy file.

If the name is a path specification, MET/CAL uses the name exactly as specified. (A path specification is one which contains one or more forward or backward slashes used to separate path components.)

If the name is not a path specification, MET/CAL expects the alternate accuracy file to be located in the MET/CAL accuracy directory. This is the directory specified as the value of the "accdir" parameter in the MET/CAL initialization file ("metcal.ini" in the Windows directory).

If the *Accuracy File* field specifies "*" it indicates that an ACCF reset for the specified FSC is to be done. Execution of an ACCF reset statement restores the use of the default accuracy file for the specified FSC.

- \+ Field Order

  The order of the fields is important. The *FSC* field must precede the *Accuracy File* field.

Notes

\+ Important Note on Compile Time Assumptions

The compile time system assumes that ACCF statements, if any, for a particular instrument FSC exist in the same procedure as the instrument FSC statement, and precede the instrument statement in the procedure.

Procedure writers are strongly encouraged to write procedures which conform to these assumptions. Otherwise, T.U.R.s calculated at compile time will not agree with T.U.R.s calculated at run time.

("Compile time" includes both compiling procedures (F8, F9), and generating T.U.R. reports.)

Specifically, procedure writers should adhere to the following rules:

1. Do not write procedures in which an ACCF statement is intended to apply to an instrument FSC in another procedure (either the calling procedure or a called subprocedure).

For example, do not write a procedure like this:

Main #1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  5700_95.90D
1.002 CALL       Sub #1
```

Sub #1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       1V .001%                          2W
```

At run time, the ACCF-specified accuracy file will be used when the T.U.R. calculation for the 5700 statement in the subprocedure is done, because the run time is based on execution order. But at compile time, when the system searches back from the 5700 statement in the subprocedure for ACCF statements, none will be found and the default accuracy file will therefore be used.

For example, do not write a procedure like this:

Main #2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
    1.001 CALL       Sub #2
    1.002 5700       1V      .001%                      2W
```

Sub #2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
    1.001 ACCF 5700  5700_95.90D
```

As in the preceding example, the run time and compile time systems will not do the same T.U.R. calculation. At compile time, when the 5700 statement in the main procedure is compiled, the system will use the default accuracy file, since it has no way of knowing that the subprocedure contains an ACCF statement. (Remember that when the main procedure is compiled the subprocedure need not exist.) But at run time the system will call the subprocedure first, execute the ACCF statement, and then, when the 5700 statement in the main procedure is executed, use the alternate accuracy file to do the T.U.R. calculation.

2. Do not write procedures in which jump statements are used to jump to an ACCF statement, which is then followed by a jump back to an instrument statement.

For example, the following procedure could produce different compile time and run time T.U.R. calculations:

```
STEP   FSC  RANGE   NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001  JMP          2.002
1.002  5700         1V       0.001%                    2W
2.001  JMP          2.004
2.002  ACCF 5700    5700_95.90D
2.003  JMP          1.002
2.004  END
```

At compile time MET/CAL will search back from the 5700 statement and, not finding any ACCF statements, use the default accuracy file. At run time MET/CAL will execute the indicated JMP statements, execute the ACCF statement before the 5700 statement, and therefore use the alternate accuracy file to do the run time T.U.R. calculation.

Examples

Example 1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  5700_95.90D
1.002 5700       1V      0.001%                     2W
```

In this example an alternate accuracy file for the Fluke 5700A is specified. The accuracy file name is "5700_95.90D". Since the name is not a path specification, MET/CAL expects to find the file in the MET/CAL accuracy directory (specified by "accdir" in "metcal.ini").

When MET/CAL calculates the test uncertainty ratio (T.U.R.) for the 5700 statement, the system uncertainty will be determined by looking in "5700_95.90D" instead of the default accuracy file ("5700.ACC").

Example 2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  C:\ACC\5700.ACC
1.002 5700       1V      0.001%                     2W
```

This is the same as the first example except that the ACCF statement specifies a full path name for the alternate accuracy file. MET/CAL will use the accuracy file name exactly as specified. It will not look in the MET/CAL accuracy directory.

Example 3

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       1V      .001%                      2W
2.001 ACCF 5700  5700_95.90D
2.002 5700       1V      .001%                      2W
3.001 ACCF 5700  *
3.002 5700       1V      .001%                      2W
```

When the first 5700 statement is executed, the default accuracy file will be used, because, at that point, no ACCF statement has been executed. When the second 5700 statement is executed, the alternate accuracy file ("5700_95.90D") specified in the ACCF statement will be used. When the third 5700 statement is executed, MET/CAL will use the default accuracy file. This is because an ACCF reset statement for the 5700 has been executed.

ACMS

Instrument FSC

Refer to ACMS earlier in this chapter

ASK+, ASK-

Procedure Control FSCs

Description

The ASK+ and ASK- FSCs enable and disable the MET/CAL system control flags. The effect of each system flag is summarized below.

⚠Warning

The procedure writer must make certain that safety is not compromised!

Automatic Messages

The following flags control the display of messages during procedure execution.

Flag	Controls display of automatic...	Default setting
W	Connection messages, excl. divider	ASK+ W
V	Connection messages	ASK+ V
R	UUT range message	ASK+ R
S	SET FSC messages	ASK+ S
N	Instructions to perform test	ASK+ N
M	MOD1 value with test instructions	ASK+ M
D	Meter or Oscilloscope message format	*

* The default value of the D-flag depends on the type of calibration system. The default is:

```
ASK- D for a meter calibration system and
ASK+ D for a scope calibration system.
```

Refer to section 6 of the Users Manual for a Description of how to configure the calibration system type.

Stimulus Evaluation Statement Options

The following flags are used to select the method by which an operator enters a UUT Indicated value during procedure execution.

Flag	Controls evaluation mode	Default setting
G	Go/No-Go	ASK- G
B	Go/No-Go with Slew and Kybd Options	ASK- B
K	Keyboard entry	ASK- K

The G, B, and K flags are mutually exclusive. When the G, B, and K flags are all disabled, slew mode is used.

Post Test Options

The following flags determine which options in the Post Test dialog are enabled.

Flag	Enable / Disable	Default setting
A,F	display of Post Test dialog	ASK+ A
L	List option	ASK+ L
P	Repeat current step option	ASK+ P
X	Cancel option	configurable
J	Adjust option	ASK+ J
T	Terminate option	ASK+ T

Miscellaneous

Flag	Enable / Disable	Default setting
C	Use correction file (if it exists)	configurable
Q	Reset after completion of test	ASK+ Q
U	TUR checking	ASK+ U

General Characteristics

- Entering a blank ASK+ statement results in the following:

  ASK+ R D Q N B P J S U M C X A L T W

- Entering a blank ASK- statement results in the following:

ASK- R D N B P J S U M C X A L T W

The Q-flag is not affected by ASK- *blank.*

- Only the state of the flags specified in an ASK+ or ASK- statement is affected unless there is a relationship between the state of a specified flag and one or more unspecified flags.

Relationships between flags are explained in detail in the paragraphs below.

- The D, R, and Q flags are not allowed in an ASK+ or ASK- FSC in an adjustment block.
- The state of the flags is preserved from procedure to subprocedure and vice versa.

A-FLAG

The A and F flags control whether or not the Post Test dialog is displayed upon completion of an evaluation step.

- ASK+ A causes the Post Test dialog to be displayed after an evaluation.
- ASK- A prevents the display of the Post Test dialog after an evaluation.

- ASK- F prevents the display of the Post Test dialog upon a PASS condition.

The Post Test dialog will be displayed if the test fails.

- The ASK+ A and ASK+ F statements have the same effect.
- The default is: ASK+ A

The table below shows the combined effect of the A, F, and J flags.

Note

In a PASS condition, the J-flag has no effect. In a FAIL condition, the J-flag has an effect only when there is an adjustment block following the evaluation statement.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

B-FLAG

The B-flag controls the Go/No-Go with Slew and Keyboard Entry options for a stimulus function instrument evaluation or comparison test.

- ASK+ B enables Go/No-Go with Slew and Keyboard Entry options.
- ASK- B disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- B

C-FLAG

The C-flag is used to enable or disable the MET/CAL correction mechanism.

- ASK+ C enables corrections
- ASK- C disables corrections
- The default state of the C-flag is configurable using the "ask_c_default" parameter in the MET/CAL initialization file ("metcal.ini"). If "ask_c_default" is set to "yes" (or "+"), the C-flag defaults to ASK+ C. If "ask_c_default" is set to "no" (or "-"), the C-flag defaults to ASK- C. For compatibility with earlier versions of MET/CAL which did not support the "ask_c_default" initialization file parameter, if "ask_c_default" is omitted from the initialization file, the C-flag defaults to ASK+ C. The "ask_c_default" parameter, if specified, should be in the "[startup]" section of the initialization file.

In order for a correction to be performed the following conditions must apply:

- The C-Flag must be enabled.
- A correction file must exist.
- The System Actual value to be corrected must match a range specified in the correction file.

Refer to Vol. 1, Chap. 7 of the MET/CAL manual for more information. During procedure execution, The Test Results dialog indicates whether a correction was performed for each test listed.

D-FLAG

The D-flag controls whether or not automatic range and slew messages use the scope "units/division" format. Refer to the section describing Automatic

Messages in the MET/CAL Procedure Language Reference Manual for more information.

- ASK+ D enables scope format for automatic range and slew messages.
- ASK- D disables scope format for automatic range and slew messages.
- The default value of the D-flag depends on the type of calibration system: ASK- D for a meter calibration system and ASK+ D for a scope calibration system.

The calibration system type is determined by the "systype" parameter in the MET/CAL initialization file ("metcal.ini").

For additional information, refer to Volume 1, Chapter 7.

F-FLAG

The A-flag and F-flag control whether or not the Post Test dialog is displayed upon completion of an evaluation step.

- ASK+ A causes the Post Test dialog to be displayed unconditionally after an evaluation.
- ASK- A prevents the Post Test dialog from being displayed after an evaluation.
- ASK- F prevents the display of the Post Test dialog upon a PASS condition. The Post Test dialog will be displayed upon a FAIL condition.
- The ASK+ A and ASK+ F commands have the same effect.
- The default is: ASK+ A

The table below shows the combined effect of the A, F, and J flags.

Notes

In a PASS condition, the J flag has no effect. In a FAIL condition, the J flag has an effect only when there is an adjustment block following the evaluation statement.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

G-FLAG

The G-flag controls the use of Go/No-Go for a stimulus function instrument evaluation or comparison test.

- ASK+ G enables Go/No-Go.
- ASK- G disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- G

J-FLAG

The J-flag controls the appearance of the Adjust option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information. Note that the J-flag has no effect unless (1) the test result is FAIL, and (2) an adjustment block follows the evaluation statement.

- ASK+ J enables the Adjust option in the Post Test dialog.
- ASK- J disables the Adjust option in the Post Test dialog.
- The default is: ASK+ J

The table below shows the combined effect of the A, F, and J flags.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

K-FLAG

The K-flag controls the use of Keyboard Entry for a stimulus function instrument evaluation or comparison test.

- ASK+ K enables Keyboard Entry.
- ASK- K disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- K

L-FLAG

The L-flag enables or disables the List option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ L enables the List option in the Post Test dialog.
- ASK- L disables the List option in the Post Test dialog.
- The default is: ASK+ L

M-FLAG

The M-flag controls the appearance of the MOD1 field information in the automatic messages which describe to the operator how to perform the test. Refer to the section describing Automatic Messages in the MET/CAL Procedure Language Reference Manual for more information.

- ASK+ M enables inclusion of MOD1 information in messages.
- ASK- N disables inclusion of MOD1 information in messages.
- The default is: ASK+ M

N-FLAG

The N-flag controls the appearance of automatic messages which describe to the operator how to perform the test. Refer to the section describing Automatic Messages in the MET/CAL Procedure Language Reference Manual for more information.

- ASK+ N enables automatic messages which instruct the operator how to perform a test.
- ASK- N disables automatic messages which instruct the operator how to perform a test.
- The default is: ASK+ N

P-FLAG

The P-flag determines the statement at which a test is re-started after the operator selects "Repeat" in the Post Test dialog.

- ASK+ P causes the procedure to be re-started at the current procedure line when the operator selects the Post Test "Repeat" option.
- ASK- P causes the procedure to be re-started at the first statement of the current test when the operator selects the Post Test "Repeat" option.

(The step number of the first statement of the test has the form XX.001.)

- The default is: ASK+ P

Q-FLAG

The Q-flag controls the reset of calibration instruments after a test.

- ASK+ Q enables the reset of calibration instruments after a test. ASK+ Q is forced if any of ASK+ R, ASK+ N, ASK+ W, or ASK+ V are active.
- ASK- Q disables the reset of calibration instruments after a test. ASK- Q takes effect only if ASK- R, ASK- N, ASK- W or ASK- R, ASK- N, and ASK- V are in effect.
- The default is: ASK+ Q

⚠Warning

The procedure writer should carefully evaluate every procedure using ASK- Q for safety, potential overload conditions and potential for damaging calibration instruments and the UUT. Problems may occur when setting up a new function or range in the UUT while the stimulus of the previous test is still applied.

R-FLAG

The R-flag controls the appearance of automatic UUT range messages generated by instrument FSCs and the RNG (Range) FSC. Refer to the section describing Automatic Messages in the MET/CAL Reference Manual for more information.

- ASK+ R enables automatic UUT range messages.
- ASK- R disables automatic UUT range messages.
- The default is: ASK+ R

S-FLAG

The S-flag controls the appearance of all automatic messages defined by the SET FSC. Refer to the SET FSC in the FSC Reference for more information.

- ASK+ S enables all automatic messages defined by the SET FSC.
- ASK- S disables all automatic messages defined by the SET FSC.
- The default is: ASK+ S

T-FLAG

The T-flag controls the appearance of the Terminate option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ T enables the Terminate option in the Post Test dialog.
- ASK- T disables the Terminate option in the Post Test dialog.
- The default is: ASK+ T

Caution

The procedure writer is advised not to specify ASK- T before a procedure has been thoroughly tested. When ASK-T is in effect, it may be difficult to terminate a procedure.

U-FLAG

The T-flag controls Test Uncertainty Ratio (TUR) checking. Refer to the description of the TUR calculation in the User's Manual for more information.

- ASK+ U enables TUR checking.
- ASK- U disables TUR checking.
- The default is: ASK+ U

In order for TUR checking to be performed the "tur_limit", specified in the MET/CAL initialization file ("metcal.ini"), must not equal zero.

V-FLAG

The V-flag controls the appearance of automatic connection messages.

- ASK+ V enables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes. ASK+ V and ASK+ W have the same effect.
- ASK- V disables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes.
- The default is: ASK+ V

⚠Warning

The automatic connection and disconnection messages for the External AC Divider and High Voltage Probes are disabled when ASK- V is active. If no alternate messages are created by the procedure writer, the operator may damage the UUT or calibration equipment.

Note

The procedure writer must make absolutely sure that no safety or fire hazard is present during the execution of the procedure; when ASK- V is active, the system will assume that a connection was made to the port that was active at the time that the signal is applied.

W-FLAG

The W-flag controls the appearance of automatic connection messages.

- ASK+ W enables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes. ASK+ W and ASK+ V have the same effect.
- ASK- W disables all automatic connection messages, except those related to the External AC Divider and High Voltage Probes.
- The default is: ASK+ W

Note

The procedure writer must make absolutely sure that no safety or fire hazard is present during the execution of the procedure; when ASK- W is active, the system will assume that a connection was made to the port that was active at the time that the signal is applied.

X-FLAG

The X-flag controls the appearance of the Cancel option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ X enables the Cancel option in the Post Test dialog.
- ASK- X disables the Cancel option in the Post Test dialog.
- The default state of the X-flag is configurable using the "ask_x_default" parameter in the MET/CAL initialization file ("metcal.ini"). If "ask_x_default" is set to "yes" (or "+"), the X-flag defaults to ASK+ X. If "ask_x_default" is set to "no" (or "-"), the X-flag defaults to ASK- X. For compatibility with earlier versions of MET/CAL which did not support the "ask_x_default" initialization file parameter, if "ask_x_default" is omitted from the initialization file, the X-flag defaults to ASK- X. The "ask_x_default" parameter, if specified, should be in the "[startup]" section of

the initialization file. If the procedure step terminates abnormally, the Post Test Cancel option is always disabled, regardless of the state of the X-flag. This applies both to termination due to an error and termination by the operator. In these cases no test result was generated, so there's nothing to be cancelled. If desired, use the Post Test Repeat option to retry the test.

Example

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ASK+ R D   N G     P J S     M    A     L  T   W
1.001 ASK+ R       G                    A
```

Additional Information

The information below may help procedure writers in interpreting the Test Run "ASK" dialog.

Internally, each ASK flag is a single bit which is either set (1) or clear (0). The Test Run "ASK" dialog displays a vertical list of flags in which a check box is used to show the state of each flag. If a box is checked, this indicates that the corresponding ASK flag is set. If a box is not checked, this indicates that the corresponding ASK flag is clear.

In all cases except as noted in rules (1) to (7) below "ASK+ *flag*" sets *flag* and does nothing else, and "ASK- *flag*" clears *flag* and does nothing else. For example, "ASK+ X" sets the 'X' flag and has no side-effects involving other flags, and "ASK- X" clears the 'X' flag and has no side-effects involving other flags.

The following rules explain the cases in which setting or clearing an ASK flag has side-effects involving other ASK flags:

1. "ASK- A"
   This statement clears A and clears F.

   "ASK- F"
   This statement clears A and sets F.

   A and F cannot both be specified in a single ASK-statement.

2. "ASK- B"
   This statement clears B, clears G, and clears K.

   "ASK- G"
   This statement clears B, clears G, and clears K.

   "ASK- K"
   This statement clears B, clears G, and clears K.

   At most one of B, G, and K can be specified in a single ASK- statement.

3. "ASK- W"
   This statement clears W and sets V.

   "ASK- V"
   This statement clears V and clears W.

   W and V cannot both be specified in a single ASK-statement.

4. "ASK+ A"
   This statement sets A and clears F.

   "ASK+ F"
   This statement sets A and clears F.

   A and F cannot both be specified in a single ASK-statement.

5. "ASK+ B"
   This statement sets B, clears G, clears K.

   "ASK+ G"
   This statement sets G, clears B, clears K.

   "ASK+ K"
   This statement sets K, clears B, clears G.

   At most one of B, G, and K can be specified in a single ASK+ statement.

6. "ASK+ W"
   This statement sets W and sets V.

   "ASK+ V"
   This statement sets W and sets V.

   W and V cannot both be specified in a single ASK+statement.

7. "ASK+ R"
   This statement sets R and sets Q.
   "ASK+ N"
   This statement sets N and sets Q.
   "ASK+ W"
   This statement sets W and sets Q.
   "ASK+ A"
   This statement sets A and sets Q.

   In other words, setting R, N, W, or A automatically sets Q. This means that a statement like "ASK+ R" will cancel a preceding "ASK- Q" statement. It is still the case, however, that:

   ASK+ R
   ASK- Q

   leaves Q unset.

CALL

Procedure Control FSC

Description

The CALL FSC allows a procedure to call a subprocedure. The called sub procedure terminates when the end of the subprocedure is reached. At that point, execution of the calling procedure resumes at the first statement after the CALL statement.

Format

CALL *procedure name*

Rules

- A maximum of 55 characters is allowed in the *procedure name* field.
- Blank spaces preceding or following the procedure name are ignored.
- The comparison between the name of the called subprocedure and names in the MET/CAL Procedure directory is case-insensitive.
- Most internal data values maintained by MET/CAL are global. This applies to memory registers (MEM, MEM1, MEM2, M[1], M[2], ...), ASK flags, SET FSC messages, and DRAW parameters. These data values are available on entry into a called procedure, and, on exit from the subprocedure, retain their most recently assigned values, whether or not the assignment occurred in the called procedure.

Example:

```
INSTRUMENT:    main
MATH    MEM = 29
CALL    sub
DISP    MEM = [MEM]

INSTRUMENT:    sub
DISP    sub:  MEM = [MEM]
MATH    MEM = 11
```

In the example above, the main procedure sets MEM to 29. It then calls the procedure "sub". "sub" displays the value of MEM, which is still 29, and then sets MEM to 11 before it returns. When the main procedure resumes, it displays the updated value of MEM (now 11).

- Each called subprocedure must exist as a separate, compiled MET/CAL procedure file. There is no actual distinction between main procedures and subprocedures. Any procedure can call any other procedure. A procedure should not call itself, directly or indirectly, unless the procedure writer ensures that procedure termination is handled properly.
- The maximum procedure call nesting depth is 8. However, if results template files are configured to show test step numbers in formatted results, results may be unsatisfactory when the call nesting depth exceeds 2, and evaluation steps appear at level 3 and below.

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
3.007 CALL       Fluke 8050A AC Gain Adjustment
6.007 CALL       Fluke 8050A AC Zero Adjustment
```

CON

Display Control Help

Description

The CON FSC invokes a standard connection message to prompt the operator to make a change to the UUT's connections. There are two reasons why, in some cases, an automatic connection message might be used in preference to a message generated using a DISP statement:

- The message format is identical to the format of automatic connection messages generated by MET/CAL instrument drivers.
- When automatic connection messages are used, MET/CAL remembers the list of current connections. This allows the automatic generation of disconnection messages when new connections are made, and also precludes the generation of redundant connection messages.

However, because automatic connection messages are worded in a general way (that is, they are not specific to a particular UUT), most procedure writers use the DISP FSC to construct messages which refer directly to the particular UUT being calibrated.

The CON FSC refers to connection messages by number. Each connection message has a number. Connection messages (and the associated numbers) are stored in the MET/CAL Connection Message File (default name "connmesg.dat"). Refer to this file for a list of connection messages.

⚠Warning

When the CON FSC is used to generate connection and disconnection messages, MET/CAL cannot verify that instruments to which connections are to be made are in a safe state. The procedure writer must ensure that instruments are in STANDBY or are not generating unsafe voltages before prompting the operator to make connections or disconnection's.

Format

CON *connection code message list*

CON 0

Rules

- The *connection code* field may be '=', '+', or '-'. It determines the interpretation of the following *message list* as shown in the table below:

'=' - *message list* specifies connections to be made

'+' - *message list* specifies connections to be added

'-' - *message list* specifies connections to be removed

The difference between making a connection ('=') and adding a connection ('+') is that '=' first causes a disconnection message for all present connections, followed by a connection message for the new connections. '+', on the other hand, presumes that present connections are to remain, and simply generates a prompt to add the new connections.

When the *connection code* is '+' or '-', the *message list* must be non-empty. When the *connection_code* is '=', the *message list* may be empty. In this case, an empty *message list* causes a prompt to disconnect all present connections.

- The *message list* is a list of 1 or more connection message numbers, separated by commas.
- The statement "CON 0" may be used to generate a disconnection message for all connections. This statement is equivalent to "CON =".

Example:

```
CON     =47
CON     =48
CON     +49
CON     -48, 49
```

The first CON statement prompts the operator to make the connection indicated by connection message number 47. The second CON statement first causes a prompt to disconnect 47, followed by a prompt to connect 48. The third CON statement causes a prompt to connect 49. Note that, since the *connection code* is '+', it does not first trigger a disconnection message for 48. The fourth CON statement generates a disconnection message for 48 and 49.

Compatibility

For compatibility with previous versions of MET/CAL, the list of connection message numbers may be specified in binary-coded decimal format. Using this method, 53 is the maximum number which can be specified. Refer to 7411B or 7411C manuals for further information.

See Also

The ASK- W and V flags may be used to disable automatic connection messages. This applies to messages specified in CON statements, as well as to messages generated by

MET/CAL instrument drivers. Refer to the ASK+ and ASK- FSC Reference for more information.

Examples

Additional CON FSC examples are shown below.

Example 1:

```
CON       =9,10
```

Disconnect any other connection, then prompt to connect the UUT to 5100B Output and 5100B Sense (if they are not already connected).

Example 2:

```
CON       +21
```

Adds a connection from the UUT to the 5450 Sense.

Example 3:

```
CON       -21
```

Disconnect the UUT from the 5450 Sense.

Example 4:

```
CON       =
CON       0
```

Remove all connections (both forms allowed).

Example 5:

```
CON       1024
```

Connect the UUT to 5100B Wideband (old BCD format).

DISP

Display Control FSC

Description

The DISP FSC is used to display a message to the operator during procedure execution. When a DISP statement is executed, a dialog appears showing the specified message, and containing "**Advance**" and "**Terminate**" buttons.

If the operator chooses "**Advance**", execution continues with the next procedure statement.

If the operator chooses "**Terminate**", the current step is terminated, and the Post Test dialog appears.

Format

DISP *message*

Rules

- A single DISP statement may contain up to 8 lines.
- Each line of a DISP statement may contain up to 56 characters.
- The following special constructions may be used in a DISP statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [D*integer*]

  [DRAW*x,y,view*]

  [V*variable*]

  {*text*}

  [M1], [M2], ..., [M255]

  [S1], [S2], ..., [S32]

  [SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (6).

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Refer to "Special Constructions" in Chapter 1 of this manual for details.

Examples

```
1.011  DISP         Set the PM 3055 Ch.1 vertical attenuation to 1V/div.
1.011  DISP         Set the PM 3055 time base to 5ms/div.
1.011  DISP
1.011  DISP         Trigger Ch.1 on the inductive pickup waveform.
```

The example above shows a 4 line DISP statement. (The fact that all 4 lines have the same step number indicates that it is a single statement, rather than 4 separate DISP statements.)

```
1.001  DISP         [D1000] The value of MEM is [MEM].
```

This example illustrates the use of special constructions. The [D1000] construction causes a delay of 1 second (1000 milliseconds), and then displays the value of memory register MEM.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following DISP statements will cause "Ch[MEM] 20mV/div" to be stored in the results, not "Ch1 20mV/div".

12.001 MATH MEM = 1

12.002 HEAD Ch[MEM] Tests

12.003 DISP Set attenuation: {Ch[MEM] 20mV/div}

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

12.001 MATH MEM = 1

12.002 HEAD Ch[MEM] Tests

12.003 DISP Set attenuation: Ch[MEM] 20mV/div

12.004 RSLT =Ch[MEM] 20mV/div

DOS, DOSE

Procedure Control FSCs

Description

The DOS and DOSE FSCs run user-provided programs or batch files.

The programs may be MS-DOS executables, Windows executables, MS-DOS batch files, or Windows PIF files.

The difference between the DOS and DOSE FSCs is that DOSE is an evaluation FSC which generates a result.

Format

DOS [-*arg*] *program*

DOSE [-*arg*] *program*

Rules

- The *program* field, plus any arguments, may contain up to 56 characters.

  Example:

  ```
  1.001  DOS      USERPROG
  ```

- This statement will execute the user-provided program named "USERPROG.EXE".

  Example:

  ```
  2.003  DOS      USER.BAT
  ```

- This statement will execute the user-provided batch file named "USER.BAT".

The program or batch file to be executed must be in the current directory or in one of the directories listed in the "PATH" environment variable.

Arguments

1. Valid arguments are:

   -n - write all numeric registers to data file

   -a - write all registers to data file

   -x - pay attention to user program's exit status

   -i - ignore user program's exit status

2. One or more arguments may be specified for a DOS or DOSE procedure statement. Arguments, if any, must follow the FSC ("DOS" or "DOSE") and precede the user program name.

   For example:

   ```
   DOS -n myprog.exe
   ```

   is valid, but

   ```
   DOS myprog.exe -n
   ```

   is not valid (unless "-n" is an argument you wish to pass to "myprog.exe").

3. Arguments are case-sensitive.
4. No argument may be specified more than once for the same statement.
5. "-a" and "-n" may not both be specified for the same statement.
6. "-x" and "-i" may not both be specified for the same statement.
7. Each argument must be preceded and followed by one or more spaces.
8. The "-b" argument is used if you want MET/CAL to retain leading and trailing spaces on string register values read from the data file ("dosdose.dat"). For example,if you specify a MEM2 value of "x", MET/CAL will normally strip off the leading and trailing spaces and the value of MEM2 will be "x". If "-b" is specified,however, MEM2 will have the value "x" after the DOS or DOSE statement completes.

More information on the "-n" and "-a" arguments is provided in the DATA FILE section below.

More information on the "-x" and "-i" arguments is available in the EXIT CODE section below.

The *program* specifier may include optional command-line arguments and/or I/O redirection where appropriate.

These arguments are not the same as the DOS/DOSE arguments described above. Program arguments appear after the user program name, and are simply passed to the user program.

Example:

```
4.001 DOS       USER1 1.9 15.4 > TMP.DAT
```

The user-provided program "USER1.EXE" will be executed with two command-line arguments (1.9 and 15.4). Output will be directed to the file "TMP.DAT".

The following special constructions may be used to specify arguments to the user program.

(1) [MEM], [MEM1], and [MEM2]
(2) [M1], [M2], ..., [M255]
(3) [S1], [S2], ..., [S32]
(4) [SREG1], [SREG2], ..., [SREG32]
(5) [V*variable*]
(6) {*text*}

This capability is new with V6.0.

The constructions [SREG1], [SREG2], [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

There is an optional initialization file parameter which can be used to disable the evaluation of special constructions in user program arguments, if necessary. It is probably unlikely, but if a user program has command line arguments which include literal bracket or brace characters ('[', ']', '{', or '}'), it will be necessary to disable special construction parsing for DOS and DOSE procedure statements. To do this, add the line:

dos_sc_eval = no

to the "[startup]" section of the MET/CAL initialization file.Specifying "dos_sc_eval = yes", or simply omitting any "dos_sc_eval" specification, enables special construction evaluation.

Example:

```
5.001 MATH     M[3] = 2.97 ; S[5] = "-x"
5.002 DOS      USER1 [S5] [M3]
```

The user-provided program "USER1.EXE" will be executed with two command-line arguments. The first argument will be "-x", which is the value of register S[5]. The second argument will be "2.97", which is the value of register M[3].

Data File

Parameters are passed between MET/CAL and the user-written program by way of an ASCII data file named "dosdose.dat". Before executing the *program* specified in the DOS or DOSE statement, MET/CAL writes the current values of the MET/CAL memory registers into this file.

A user-written program may alter the values in this file. When MET/CAL resumes, it reads back the data file, and starts up with the values present at that time in "dosdose.dat". The file is then removed.

Optional arguments allow the procedure writer to control which memory register values are written to the data file.

The "-n" argument causes all of the numeric registers to be written, instead of just the first 20.

The "-a" argument causes all of the numeric and all of the string registers to be written.

If neither "-n" nor "-a" are specified, the data file is compatible with MET/CAL 4.0 and previous.

The following table shows the affect of the "-n" and "-a" arguments on the data file:

Argument	MEM	MEM1	MEM2	M Registers	S Registers
none	yes	yes	yes	1 - 20	none
-n	yes	yes	yes	1 - 255	none
-a	yes	yes	yes	1 - 255	1 - 32

If neither "-n" nor "-a" are specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[20]. Each memory register value is written on a separate line.

If the "-n" argument is specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[255]. Each memory register value is written on a separate line.

If the "-a" argument is specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[255], S[1], S[2], ..., S[32]. Up to M[255], each memory register value is written on a separate line. The S registers are written out using two lines for each register. The first line is an integer which specifies the length of the following string, and the second line is the string. An empty string is written as a single LINEFEED character, with the length set to 0.

Example:

Consider the procedure fragment:

```
MATH    s[1] = "abc"
MATH    S[3] = "defgh"
DOS     -a <program>
```

The beginning of the string register section of the DOS/DOSE data file will look like:

```
3
abc
0

5
defgh
.
.
.
```

The "3" indicates that the length of the following string ("abc") is 3. The 0 indicates that S[2] is empty, the 5 indicates that the length of the following string

("defgh") is 5, and so on.

When the DOSE FSC is used, the user-written program must append either 1 or 2 lines to "dosdose.dat". The first appended line is a result text string (not more than 64 characters). It is included in the Post Test Summary. The second appended line is optional. If present, it may be "PASS" to indicate a PASS condition, "FAIL" to indicate a FAIL condition, or a floating-point number to indicate the percent error for the test. This information determines the pass/fail status of the evaluation as displayed in the Post Test Summary and written to the results. If the second appended line is omitted, the evaluation is a default PASS.

Note that the DOSE mechanism described above (the requirement that the user program append 1 or 2 lines to the data file, and the fact that MET/CAL uses that information to generate a PASS/FAIL result) is the only difference between the DOS and DOSE FSCs.

Exit Code

The procedure writer may control whether MET/CAL uses the exit code of the user program to determine if the user program succeeded or failed.

Control is provided in two ways.

1. The "-i" and "-x" arguments may be used on individual DOS or DOSE statements to specify how the exit code is to be handled for that statement only. If "-i" is specified, MET/CAL ignores the exit code of the user program.

This is compatible with MET/CAL 4.0 through 4.2 and, in fact, was the only option for those versions of the software. If "-x" is specified, MET/CAL uses the user program's exit code to determine whether or not the user program succeeded. If the user program returns zero, the execution is successful. Any non-zero return value is regarded as a failure of the user program.

"Success" and "failure", as used here, do not refer to the PASS/FAIL status of the test. To control the PASS/FAIL status of an evaluation step involving a user program, you must use the DOSE FSC and write the appropriate test status into the "dosdose.dat" data file. This is discussed in more detail elsewhere in this help document.

2. The second way to control the handling of user program exit codes is to specify the optional initialization file parameter "uexit_code". If "uexit_code" is set to "yes", MET/CAL pays attention to the exit codes of all user programs invoked by DOS statements, unless overridden by "-I" arguments on individual DOS or DOSE statements. If "uexit_code" is set to "no", MET/CAL ignores the exit codes of all user programs invoked by DOS or DOSE statements, unless overridden by "-x" arguments on individual DOS or DOSE statements. If "uexit_code" is not specified in the initialization file ("metcal.ini", "STARTUP" section) it defaults to "no". Thus, the default behavior is to ignore all user program exit codes. This is compatible with versions 4.2 and previous of Windows MET/CAL. (Note, however, that DOS MET/CAL did pay attention to the user program's exit code. Compatibility with DOS MET/CAL can be achieved by setting "uexit_code" to "yes".)

If a user program fails (returns a non-zero value) and MET/CAL is configured to pay attention to the exit code (as discussed above), the behavior of the system is as follows:

1. An error message displaying the name of the user program and the non-zero exit code is displayed.
2. After the operator chooses "OK" to remove the error message, the Post Test dialog appears with a message indicating that the DOS or DOSE statement was terminated by the preceding error. At this point the operator may repeat the test, terminate the procedure, or use any of the other Post Test options.

With some versions of BASIC it may be difficult (or impossible) to control the exit code of the user program. If this problem arises, the simplest solution is to ignore the exit code. As described above, this is done either by specifying "uexit_code = no" in the initialization file and specifying neither "-i" nor "-x" on the DOS or DOSE statement, or by specifying "-i" on the DOS or DOSE statement, which overrides the initialization file setting.

If the exit code of the user program cannot be easily controlled, but there is a need to handle user program errors, this can be dealt with by ignoring the user program's exit

code (using "-i" or "uexit_code = no", as discussed above), and using an available memory register as an error indicator. That is, the user program can write a known value into a predetermined register in the "dosdose.dat" file. The procedure can then be written to jump to an error handling section if the register contains the pre-defined error indication value after return from execution of the user program.

Additional Information

The following additional information is provided for procedure writers familiar with the MS-DOS and/or Windows programming environments.

- If the *program* given in the DOS or DOSE statement specifies a batch file, or includes input/output redirection symbols (’>’, ’<’, or ’|’), MET/CAL uses the standard MS-DOS command interpreter "COMMAND.COM" to execute the batch file or executable program.
- If the *program* specifies an executable program (with extension ".EXE" or ".COM"), and no input/output redirection is specified, MET/CAL executes the program directly. The program executes either as an MS-DOS program or as a Windows program, depending on how the executable was built.
- The file name extension of the user-written program to be executed must be ".EXE", ".COM", ".BAT", or ".PIF". The extension must be explicitly specified in the DOS or DOSE statement if it is ".COM", ".BAT", or ".PIF". The extension is optional if it is ".EXE".
- The DOS or DOSE FSCs cannot be used to directly execute commands which are built into the MS-DOS command interpreter ("command.com"). For example, the statement "DOS dir" will not work. However, "command.com" may be invoked to execute built in commands. For example, "DOS command.com /c dir" will invoke the MS-DOS command interpreter to execute the built in "dir" command.

If a user-written program displays information on the PC screen, the program should pause until the operator has had time to read the display. Otherwise, when MET/CAL resumes execution, information displayed by the user program may be destroyed or overwritten. If the user program is an MS-DOS batch file, the necessary pause can be accomplished by using a "pause" statement in the batch file.

Example:

Create a batch file called "xyz.bat" which contains:

```
DIR /W
PAUSE
```

Execute the following line in a MET/CAL procedure:

```
DOS     XYZ.BAT
```

When the DOS statement is executed, an MS-DOS window will be created. A directory listing will be shown in the window (the output of the "DIR /W" command). This will be followed by the prompt:

```
Press any key to continue . . .
```

in the MS-DOS window. When the operator presses a key, the MS-DOS window will be closed, and MET/CAL will resume execution with the statement after the DOS statement.

- The procedure writer may wish to use the Windows "PIF" editor to create a ".PIF" file to control the invocation of a user-written DOS or DOSE program. This allows individual control over whether the user-written program runs full screen or in a window, the window title, and other parameters.

Example:

Suppose you have an MS-DOS batch file named "XYZ.BAT" which you wish to run in a window, with the window title "Enter Parameters". Start the Windows "PIF" editor. Set "Program Filename" to "COMMAND.COM", set "Window Title" to "Enter Parameters", set "Optional Parameters" to "/c XYZ.BAT", and under "Display Usage" choose "Windowed".

Choose "Save As..." in the "File" menu and save the file as "XYZ.PIF".

Then, in your MET/CAL procedure, enter the statement:

```
DOS     XYZ.PIF
```

Compatibility

- In general, memory limitations are less evident in Windows MET/CAL that in DOS MET/CAL. If the user's PC Windows environment is configured to use disk storage as virtual memory, then memory used by the MET/CAL program itself can become available to the user program invoked by the DOS FSC.

(In Windows 3.1, virtual memory configuration is done under "Control Panel" : "386 Enhanced" : "Virtual Memory".)

- To retain compatibility with DOS MET/CAL, only the first 20 auxiliary memory registers (M[1], M[2], ..., M[20]) are written to "dosdose.dat" before execution of a DOS FSC unless the DOS or DOSE statement specifies one of the optional arguments "-n" or "-a".

In Windows MET/CAL the file name extension of the user-program must be explicitly specified unless the extension is ".EXE". (In DOS MET/CAL ".BAT" and ".COM" files could be executed without specifying the file name extension.)

DRAW

Display Control FSC

Description

The DRAW FSC is used to set up a simple sketch of an instrument. Execution of a DRAW statement does not display the sketch, however. The sketch is displayed when a DRAW special construction in an EVAL, DISP, OPBR or SET statement is executed.

The sketch consists of an outer rectangle, an inner rectangle, and an annunciator. The outer rectangle represents the outline of an instrument (the UUT). The inner rectangle represents the UUT's front panel display. The annunciator identifies the location of an adjustment or connection.

Before the sketch can be displayed, the following information must be specified:

- The position (in the front view) of the upper right corner of the outer rectangle.
- The position (in the side view) of the upper right corner of the outer rectangle.
- The position of the upper left corner of the inner rectangle.
- The position of the lower right corner of the inner rectangle.
- The position of the annunciator.
- The view (front, back, left, right, top, and bottom).

Items 1, 2, 3, and 4 are specified in the DRAW statement, as described in the FORMAT and RULES sections below.

Items 5 and 6 are specified in the DRAW special construction. Refer to "Special Constructions" in Volume 2, Chapter 1 for details on the DRAW special construction.

The DRAW special construction allows any of 6 different views to be specified (front, back, left, right, top, and bottom). The inner rectangle and annunciator are not shown unless the front view is selected.

Format

DRAW *p1 p2 p3 p4 p5 p6 p7 p8*

where:

p1 = position of top edge of outer rectangle (front, back views)
p2 = position of right edge of outer rectangle (front, back views)
p3 = position of top edge of outer rectangle (side views)
p4 = position of right edge of outer rectangle (side views)
p5 = position of top edge of inner rectangle
p6 = position of left edge of inner rectangle
p7 = position of bottom edge of inner rectangle
p8 = position of right edge of inner rectangle

All parameters are integers.

Rules

- *p1* and *p2* specify the position of the upper-right corner of the outer rectangle, in the front and back views.

  p1 specifies the UUT front top row number. It must be between 2 and 11.
  p2 specifies the UUT front right column number. It must be between 58 and 78.
- *p3* and *p4* specify the position of the upper-right corner of the outer rectangle, in the left, right, top, and bottom views.

  p3 specifies the UUT side top row number. It must be between 2 and 11.
  p4 specifies the UUT side right column number. It must be between 58 and 78.
- *p5, p6, p7,* and *p8* specify the positions of the upper-left and lower-right corners of the inner rectangle.

  p5 specifies the position of the top edge of the inner rectangle, expressed as a percentage of the height of the outer rectangle, with respect to the bottom of the outer rectangle. *p5* must be between 0 and 100, and must be greater than *p7*.

  p6 specifies the position of the left edge of the inner rectangle, expressed as a percentage of the width of the outer rectangle, with respect to the left edge of the outer rectangle. *p6* must be between 0 and 100, and must be less than *p8*.

  p7 specifies the position of the bottom edge of the inner rectangle, expressed as a percentage of the height of the outer rectangle, with respect to the bottom of the outer rectangle. *p7* must be between 0 and 100, and must be less than *p5*.

  p8 specifies the position of the right edge of the inner rectangle, expressed as a percentage of the width of the outer rectangle, with respect to the left edge of the outer rectangle. *p8* must be between 0 and 100, and must be greater than *p6*.
- The bottom row and left column positions of the outer rectangle are fixed (in all views).

Compatibility

- The DRAW FSC is not recommended in MET/CAL 4.0. It is supported to provide compatibility with previous versions of MET/CAL.
- The display created using the DRAW FSC and DRAW special construction is very simple: two rectangles and a small circle, with no text annotation. Procedure writer's are advised to create pictures which more accurately depict the UUT. Pictures may be created using the Windows Paintbrush program. Picture may be displayed in MET/CAL using the PIC and PICE FSCs.
- Previous versions of the MET/CAL editor supported interactive entry of the parameters in a DRAW statement. The MET/CAL 4.0 editor does not support interactive parameter entry.

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 DRAW         6 78  6 77       80  5 20 60
1.002 DISP       Local/Remote switch [DRAW10,20,F]
2.001 DRAW         6100  6 78       80 25 20 60
2.002 DISP       Adjustment R1 is here [DRAW34,24,L]
```

END

Procedure Control FSC

Description

The END FSC is used to terminate procedure execution. An END statement may occur at any point in a procedure. It has a step number, and may be the destination of a jump statement. No information is allowed after the FSC in an END statement. An END statement is not required in a procedure, since simply executing the last statement in a procedure has the effect of terminating execution (unless, of course, the last statement is a jump statement).

Format

END

Example

```
1.001 DISP  This is a test.
1.002 END
```

EVAL

Evaluation FSC

Description

The EVAL FSC allows evaluations based on prompting the operator or evaluating a numeric expression.

An operator-based EVAL presents a message to the operator and waits for a YES or NO response. The operator's response determines the result of the test (PASS or FAIL), and causes the value of MEM1 to be set to 1 or -1.

An expression-based EVAL evaluates a numeric expression and, depending on whether the result is zero or not, determines the result of the test (PASS or FAIL), and causes the value of MEM1 to be set to 1 or -1.

Format

Operator-based EVAL statements have the format:

EVAL *prompt*

or

EVAL -s *string expression* : *prompt*

Expression-based EVAL statements have the format:

EVAL -e *numeric expression* : *result text*

Rules

- At most 62 characters may appear after the FSC ("EVAL").
- Operator-Based EVAL Statements

If the form of the statement is:

EVAL -s *string expression* : *prompt*

the *string expression* is evaluated as a string-valued MATH expression, and the resulting string replaces the default result string associated with the evaluation. The default result string is "Result of Operator Evaluation".

Example 1:

MEM2 ="Test #1"

EVAL -s mem2 : Did test #1 pass or fail?

or

```
MATH s[1] = "Test #1"
EVAL -s s[1] : Did test #1 pass or fail?
```

Please remember that the rules for *string expression* are defined by the MATH FSC. Thus memory register MEM2 is referred to here as "MEM2", not as "[MEM2]" (which is the syntax used in FSCs which support MET/CAL special constructions).

Example 2:

```
MATH MEM2 ="Ch2"
EVAL -s MEM2 & " Test #1" : Did [MEM2] test #1 pass or fail?
```

Example 3:

```
EVAL -s mem2 & " " & s[1] : Did test #1 pass or fail?
```

In this example, the contents of S[1] are concatenated to the contents of MEM2, with a separating space character, and the resulting string will appear in the results instead of "Result of Operator Evaluation".

The "-s" is case-insensitive, so "-S" is also ok.

- Expression-Based EVAL Statements

Expression-based EVAL statements are suitable for use in closed-loop procedures.

The *numeric expression* may be any valid MATH expression.

Here are some examples of valid expressions:

```
mem
mem < 10
m[1]
(2 * (m[3] + mem1)) > 1
```

Refer to the documentation on the MATH FSC for a full description of valid expression syntax.

Although a string-valued expression may be used, EVAL evaluates all expressions as numeric, so a string-valued expression is coerced to a numeric value.

Compound expressions are not allowed. (In the MATH FSC you can write, for example, "MATH MEM = 3 ; MEM1 = 5, where the semicolon separates the parts of a compound assignment. This syntax is not supported in the EVAL statement.)

The "-e" is case-insensitive, so "-E" is also ok.

In an expression-based EVAL statement, the colon (':') which separates the *expression* from the *result text* is required. If you leave out the colon, the statement will be interpreted as an operator-based EVAL statement.

The *expression* may not be empty.

result text is a text string to be associated with the evaluation in the formatted results. That is, where it says "Result of Operator Evaluation" for an operator-based EVAL statement, it will say *result text* for an expression-based EVAL statement.

If *result text* is not specified, the associated result text will be "Result of Expression Evaluation".

Note that when *result text* is not specified, it is still necessary to specify a colon (':') after the *expression*.

The following special constructions may be used in an EVAL statement:

1. [N]
2. [MEM], [MEM1], and [MEM2]
3. [*numeric*]
4. [D*numeric*]
5. [DRAW*x, y,view*] (operator-based EVAL only)
6. [V*variable*]
7. {*text*}
8. [M1], [M2], ..., [M255]
9. [S1], [S2], ..., [S32]
10. [SREG1], [SREG2], ..., [SREG32]

The [N] special construction is specific to the EVAL FSC, and is described in detail in the rules below. For information on special constructions (2) to (7) see "Special Constructions" in Chapter 1 of this manual.

The [DRAW *x, y, view*] is not allowed in an expression-based EVAL statement.

In an expression-based EVAL statement all special constructions (if any are used) must occur in the *result text* part of the statement.

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Note that the EVAL statement limit of 62 characters applies to the original EVAL statement and also to the evaluated text which results from replacing special constructions with the corresponding register values.

In an operator-based EVAL, if the EVAL *message* does not contain an [N] special construction the operator's response is interpreted as follows:

If the operator chooses YES:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

If the operator chooses NO:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

In an operator-based EVAL, the [N] special construction may be used to negate the interpretation of the operator's answer as follows:

If the operator chooses YES:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

If the operator chooses NO:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

Example:

The following example shows a case where the question to the operator is formulated as a negative, and the [N] construction is used to invert the normal interpretation of the response to achieve the desired test result.

```
1.011  HEAD         {DISPLAY PIXELS}
1.012  MESS         Press and hold the ON button. The
1.012  MESS         UUT displays a uniform pixel
1.012  MESS         pattern. Visually check the pixel
1.012  MESS         pattern for missing pixels. When
1.012  MESS         done, release the ON button and the
1.012  MESS         UUT will start normal operation.
1.012  MESS
1.013  EVAL         Are there any missing pixels? [N]
```

If the operator answer YES to the question "Are there any missing pixels?", the test result is FAIL and MEM1 is set to -1. If the operator answers NO, the result is PASS and MEM1 is set to 1.

In an expression-based EVAL, if the EVAL *result text* does not contain an [N] special construction the numeric result is interpreted as follows:

If the result is not zero:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

If the result is zero:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

Example:

The following example bases the evaluation result on the numeric value in register M[5].

```
If the value of M[5] is non-zero, the result is PASS.
If the value of M[5] is zero, the result is fail.
1.001  EVAL   -e M[5] : Evaluation based on M[5].
```

In an expression-based EVAL, the [N] special construction may be used to negate the interpretation of the numeric result as follows:

If the result is not zero:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

If the result is zero:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

The EVAL FSC cannot occur in an adjustment block. (Evaluation statements are not allowed in adjustment blocks.)

HEAD

Display Control FSC

Description

The HEAD FSC is used to display a one-line message during procedure execution. The message appears just below the procedure name in the main run time window, and remains displayed until it is subsequently overwritten, or until the procedure terminates. A HEAD message is not an operator prompt -- no operator action is required in response to a HEAD message.

Format

HEAD *message*

Rules

- A maximum of 56 characters may be entered in a HEAD message.
- When a HEAD statement is executed, the HEAD message displayed by a previously executed HEAD statement, if any, is overwritten.
- A HEAD statement with a blank *message* causes the displayed HEAD message to be erased.
- The following special constructions may be used in a HEAD statement:
  1. [MEM], [MEM1], and [MEM2]
  2. [*integer*]
  3. [<D*integer*]
  4. [V*variable*]
  5. {*text*}
  6. [M1], [M2], ..., [M255]
  7. [S1], [S2], ..., [S32]
  8. [SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions 1 to 5.

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Refer to "Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual for details.

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 HEAD       DC Voltage tests
5.001 HEAD       Test delay [D32767].
7.001 HEAD       Test {AC Voltage Tests}
9.001 HEAD       CH [MEM] Attenuator Tests
```

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following HEAD statements will cause "Ch[MEM] Tests" to be stored in the results, not "Ch1 Tests".

12.001 MATH MEM = 1

12.002 HEAD {Ch[MEM] Tests}

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

12.001 MATH MEM = 1

12.002 HEAD Ch[MEM] Tests

12.003 RSLT =Ch[MEM] Tests

HP60, HP63

Instrument FSC

Refer to HP60, HP63 earlier in this Chapter

IEEE

Interface Control FSC

Description

The IEEE FSC is used to control IEEE-488 instruments. Both UUTs and system calibration instruments may be controlled. The IEEE FSC may be used to control system calibration instruments which are not directly supported by MET/CAL. It may also be used to control supported instruments in cases where the built-in MET/CAL driver does not provide the required function.

Format

IEEE *message*

Rules

- An IEEE statement may include multiple lines.
- A maximum of 56 characters is allowed in a single IEEE *message*.
- A MET/CAL system may include 0, 1, or 2 IEEE-488 interfaces. In a system with two IEEE-488 interfaces, board 0 is reserved for system calibration instruments, and board 1 is reserved for the UUT.

  In a system with one IEEE-488 interface, board 0 is used for both system calibration instruments and the UUT.
- Leading and trailing blanks in a *message* are ignored.
- When an IEEE statement is executed, characters in the *message* which are not part of a special construction (enclosed by square brackets) are written to the currently addressed device on the IEEE-488 bus.
- The following special constructions may be used in an IEEE statement:

[*@address*]	select *address* as current address
[D*delay*]	delay execution for *delay* milliseconds
[EOI ON|OFF]	enable/disable assertion of EOI on a write
[GTL]	sets an instrument into local control state
[IFC *port*]	causes an Interface Clear on specified port
[	read number from current address, store in MEM
]	read string from current address, store in MEM2
[I > *file*]	read from current address, write to file
[I >> *file*]	read from current address, append to file
[LLO]	disable instrument front panel controls

[MEM]	write value of register MEM to current address
[MEM1]	write value of register MEM1 to current address
[MEM2]	write value of register MEM2 to current address
[*integer*]	write *integer* (ASCII) to current address
[O < *file*]	read from file, write to current address
[REN]	sets the Remote Enable line on the IEEE-488 bus
[SDC]	sends a Selected Device Clear to current address
[S *delay*]	sets delay between transmitted characters
[SPL*mask*]	serial polls current address
[SRQ*delay,mask*]	wait for IEEE Service Request
[SRQ ON|OFF]	enable/disable UUT Service Request processing
[TERM *integer*]	sets terminator character to *integer* (ASCII)
[TERM *'c'*]	sets terminator character to *'c'* (character)
[TERM CR]	sets terminator character to Carriage Return
[TERM LF]	sets terminator character to Line Feed
[TERM NONE]	indicates there is no terminator character
[TERM OFF]	indicates there is no terminator character
[T*integer*]	sets bus timeout to *integer* milliseconds
[TRIG]	triggers instrument at current address
[V*variable*]	write value of *variable* to current address
{*text*}	send braced text to result file as well
[M*nreg*]	write value of numeric register to current address
[SREG*nreg*]	write value of string register to current address

Constructions (2), (11-14), (30), and (31) are used by a number of FSCs and are described in "Special Constructions" in Chapter 1 of this manual. Except for (32) and (33), the rest of the constructions in the list above are either specific to the IEEE FSC, or are used only by IEEE and PORT. Detailed descriptions of these constructions, including (32) and (33), are provided in the sections below.

IEEE-488 Bus Addresses

A special IEEE construct is used to identify the IEEE-488 bus address of the instrument to receive the IEEE command; actual IEEE-488 addresses can be used or symbolic IEEE-488 addresses. IEEE-488 bus addresses are specified as follows:

[*@primary address:secondary address*]

- If only a *primary address* is specified, secondary addressing will not be used.
- If IEEE-488 port 1 is used, add 100 to the instrument address. For example, if the instrument address is 1 and the instrument is connected to IEEE port 1, it is addressed in the IEEE FSC as [@101].

- Addresses 0 and 100 cannot be used.
- There is no preset default for IEEE addresses. Once an address is specified, it becomes the default address until another address is assigned.
- A procedure line can specify a change of address within a single IEEE FSC message line.
- If no default address is established in the first IEEE FSC which requires sending out a command string to an instrument or obtain a reading from an instrument, one of two things can happen:
  1. If a second IEEE-488 port is available, MET/CAL software will attempt to find the address automatically.
  2. The operator will be prompted for the IEEE-488 bus default address to be used.

Note

If a UUT with a remote IEEE-488 interface is connected with an IEEE-488 port of the calibration system, you have to make sure that its address does NOT conflict with any of the addresses used by the calibration instruments in the system.

Where possible you should have all your calibration instruments on one IEEE-488 port and leave the other solely for the use by a UUT, so address conflicts never occur.

Refer to the instructions in the Configuration Manual for information on IEEE-488 addresses used. Generally IEEE-488 address 10 is left unused by calibration instruments.

Under the following conditions, the MET/CAL software will automatically find the IEEE-488 address of a UUT:

- The IEEE-488 address was not specified in a previous IEEE FSC.
- The searching is done on an IEEE FSC that would normally prompt for the UUT address.
- The UUT is by itself on port 1 (the secondary port).
- The first device found on the second port is assumed to be the UUT. Searching starts at IEEE-488 address 1 and ends at address 30.

Note

Address 0 cannot be searched since this address is reserved for the IEEE-488 card of the Instrument Controller.

Symbolic bus addresses are shown as [*@alias*], where the alias the name used in the Configuration file (CONFIG.DAT). Symbolic names enhance readability of the procedure.

IEEE-488 Bus Input Commands

The following special constructs are available which perform an input from the specified address.

- [I] The special construct [I] performs an input from the current address. Data strings returned by a remotely controlled instrument normally contain just a numeric value. In a few cases units are also sent. The non-numeric characters are deleted from the string.

  The numeric value is stored as the contents of memory register MEM. The current contents of MEM are overwritten.

- [I$] The special construct [I$] performs an input from the current address. The input is an alphanumeric string, and it is stored in memory register MEM2, overwriting the current contents of that memory register. The MEM2 register is 4096 characters long.

- [I>*filename*] This special construct stores the returned information in a file with the name *filename*. Any existing file is overwritten. This construct should be used, if the returned string is expected to be longer than 4096 characters. The DOS FSC is used to call a program, which processes the string and returns relevant information in the MET/CAL memory registers.

- [I>>*filename*] This special construct appends the returned information to a file with the name *filename*. If the file does not exist, then it will be created. This construct should be used, if the returned string is expected to be longer than 4096 characters. The DOS FSC is used to call a program which processes the string and returns relevant information in the MET/CAL memory registers.

The TERM special constructs is available to define the terminator character for IEEE-488 data messages for messages sent by an instrument to the controller. This construct does not affect messages written by the controller to an instrument. Valid TERM special constructs are:

- [TERM *integer integer* is a decimal integer between 0 and 255, but not 64.

- [TERM *'c'*] *'c'* is any printable character other than *'@'*. There must be exactly one character between the quotes, i.e. one cannot say: "[TERM ' x ']" and expect the blanks to be ignored. The case of the character between quotes IS case sensitive (in general special constructs are case insensitive).

- [TERM CR] Specifies that the terminator character is Carriage Return. This is equivalent to "[TERM 13]".

- [TERM LF] Specifies that the terminator character is Line Feed. This is equivalent to "[TERM 10]".
- [TERM NONE] Specifies that there is no terminator character. In this case the instrument must assert EOI to indicate the end of the message.
- [TERM OFF] Specifies that there is no terminator character. In this case the instrument must assert EOI to indicate the end of the message. This is just an alternate form for "[TERM NONE]".

IEEE-488 Bus Output Commands

- Alphanumeric characters, not part of a special construct will be sent to the addressed instrument. The strings are always terminated by an EOI (no CR or LF). Each line of a multiple line message will be terminated this way.
- Braces ('{' and '}') or square brackets ('[' and ']') can not be entered literally, since they are used to define special constructs for the IEEE FSC (see the following paragraph).

  - The EOI special construct is used to disable or enable the assertion of EOI to terminate an IEEE-488 data message written by the controller to an IEEE-488 instrument using the IEEE FSC. The EOI special construct has no affect on data messages read by the controller from an IEEE-488 instrument. Allowed EOI special constructs are:

  [EOI ON] and [EOI OFF]

- The "Slow" special construction specifies the inter-byte delay between characters sent from the controller to the instrument when the IEEE FSC is used. The format is:

  [S *inter-byte delay*]

  where *inter-byte delay* is an integer between 0 and 65536.

- The inter-byte delay is the number of milliseconds to delay between bytes when a data message consisting of 2 or more bytes is written to an IEEE-488 instrument by a MET/CAL IEEE statement.
- The default is 0. The delay, if a non-zero value is specified, affects only the current IEEE statement. It is reset to the default at the beginning of each new IEEE statement.

Note

There is no delay before the first byte, or after the last byte, of the data message. If such a delay is required, the procedure writer should use the [Ddelay] construct.

This construct is used to be able to support older non-compatible IEEE-488 interfaces (e.g. DATA PROOF scanners).

- Output from a file directly to the instrument:

  Special construct is [O<filename] ('O' for Output).

  The contents of the file "filename" is sent over the IEEE-488 bus.

- The following other special constructs may be used:

  [MEM], [MEM1], and [MEM2]

  The contents of memory register MEM, MEM1 or MEM2 will be included in the IEEE command string.

  [*integer*]

  The character with the *integer* ASCII value will be included in the IEEE command string.

Note

The [integer] construct should be used to output braces and brackets. [<Dinteger]

The [D*integer*] special construct will cause a delay of the message line by *numeric* milliseconds (*integer* is between 0 and 32767).

{*text*}

Text in braces in addition to being used in the IEEE command string, is copied literally into the results file (without numerical substitutions for [MEM] for example).

[V *variable name*] special construction

This construct evaluates to the value of the named variable. The variable must, at run time, be present in the MET/CAL variable file (default name "VARIABLE.DAT").

Example: IEEE [V DATE$]?

[M*nreg*]

The contents of the specified numeric register are included in the IEEE command string.

The constructions [M1], [M2], ..., M[255] refer to the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

[SREG*sreg*]

The contents of the specified string register are included in the IEEE command string.

The constructions [SREG1], [SREG2], ..., [SREG32] refer to the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

Note

*Other FSCs, like DISP, EVAL, OPBR, HEAD, and others, support the [S*sreg*] special construction. [S*sreg*] is identical to [SREG*sreg*], but could not be used in the IEEE FSC, because [S*n*] had already been used to specify an inter-byte delay.*

IEEE-488 Bus Timeout, SRQ and Serial Polls

A number of special constructs are available to specify IEEE-488 bus timeouts, wait for SRQs and perform a Serial Poll on the IEEE-488 bus. These constructs are unique to the IEEE FSC.

- [T*integer*]

  This construct sets the timeout of the IEEE-488 bus to *integer* milliseconds. If zero (0) timeout is specified, infinite timeout is assigned. (*integer* must be between and 32767). The default timeout is set to 15 seconds. The timeout specification only affects the current IEEE FSC line.

- [SRQ *delay integer, mask integer*]

  This construct causes the calibration system to wait for an IEEE Service Request (on either IEEE ports if both are installed and configured). The *delay integer* entry specifies the maximum time to wait in milliseconds (range 0 to 86,400,000). The *mask integer* expression is a mask, which is ANDed to the serial poll status byte and the result is stored in memory register MEM. In addition :

  1. If 0 or no delay numeric is specified, the maximum timeout is infinite.
  2. The *mask numeric* entry is optional. If no mask numeric is specified, then a mask of 255 decimal is assumed. The serial poll status byte is always ANDed with the mask and the result stored in memory register MEM.
  3. This instruction disables any other interrupts.
  4. If the timeout is exceeded, then the following error message will be displayed:

     'Timed out waiting for SRQ from device at address ##' where ## will be replaced by the current IEEE FSC default address.

5. The SRQ instruction does clear the RQS bit when doing a serial poll to verify that the SRQ came from the default address used in this IEEE FSC. If the SRQ did not come from the default address, the error message:

   "Unexpected SRQ from device at address ##" is displayed and the program will present the post-test menu as if the operator had pressed Terminate.

- [SRQ ON] and [SRQ OFF]

  This special SRQ related construct allows you to deal with a power up SRQ by a UUT, before an IEEE statement has been performed and the UUT address determined. Rules:

  1. [SRQ ON] and [SRQ OFF] are illegal unless the system is in DEMO MODE or has two (2) IEEE-488 ports. These constructs do not work if the UUT and the calibration instruments share the same IEEE-488 port.
  2. The current UUT address must not be a port 0 address. Example:

```
IEEE    abc
IEEE    [SRQ OFF]
IEEE    [@24] xyz
IEEE    [SRQ ON]
IEEE    [@115] def
```

     generates a run time error when the fourth IEEE statement is executed. At that time when the [SRQ ON] statement is evaluated, the current UUT address is 24. The solution may be to specify [@115] before the [SRQ ON] and then write "def".

3. If no UUT address is currently set at the time an [SRQ ON] occurs, it triggers an automatic search and/or prompt for the UUT address. [SRQ OFF] does not have this effect.

- [SPL *integer*]

  This special construct does a Serial Poll on the most recently addressed instrument. The *integer* expression is a mask, which is ANDed to the serial poll status byte and the result is stored in memory register MEM. In addition:

  1. The range of possible values is from 0 to 255.
  2. If no mask numeric is specified, then a mask of 255 decimal is assumed. The serial poll status byte is always ANDed with the mask and the result stored in memory register MEM.
  3. The SPL instruction may or may not clear the RQS bit. This is UUT dependent.

IEEE-488 Bus SDC, REN, GTL, LLO, TRIG and IFC Commands

The following additional IEEE-488 bus functions can be controlled through the special constructs in the IEEE FSC:

- [SDC] Selected Device Clear

  This construct sends a Selected device clear to the last instrument addressed with the IEEE FSC. It sends the bus commands UNL, UNT, MLA(address), SDC.

- [REN] Remote Enable

  This construct sets the Remote Enable line on the IEEE-488 bus. It sends the commands REN, UNL, UNT, MLA(address).

- [GTL] Go To Local

  This construct will set an instrument into the local control state. Typically this means that front panel controls are activated. It sends the commands UNL, UNT, MLA(address), GTL.

- [LLO] Local Lockout

  This construct typically disables front panel controls and any "Return To Local" function button that may be on an instrument. It sends the commands REN, LLO.

- [TRIG] Trigger

  This construct addresses and then triggers an instrument. It sends out the commands UNL, UNT, MLA(address), GET.

- [IFC *port number*]

  The IFC special construct causes an IEEE-488 Interface Clear on a specified IEEE-488 port. In MET/CAL only port 1 (the UUT port) can use IFC. The only legal option therefore is [IFC 1].

- [O< *filename*]

  The contents of the specified file are included in the IEEE command string.

Miscellaneous

During procedure execution, the MET/CAL calibration software depends heavily on the configuration table and the information about the IEEE-488 boards in the STARTUP file needs to be absolutely correct, and does no error checking on this input. If the information is wrong, unexpected errors may occur or the system may hang. This is especially important in cases where SRQs may occur.

If you are experiencing problems of this type, check first the following values in the Startup file (refer to the information on the Startup file in the Configuration Manual for appropriate values):

ib_nport =
ib_type =
ib_dmachan =
ib_ioaddr =

Also check the IEEE-488 addresses in the configuration file to make sure they are correct.

When the calibration system is in the DEMO MODE, no actual interactions on the IEEE bus will take place. The effect of the IEEE FSC in this mode is as follows:

- If an IEEE input is expected, the user will be prompted to enter the expected reading.
- The SRQ and SPL constructs are ignored.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
2.005   IEEE         [@124]VR1?[I][D500]?[I]
3.004   IEEE         {[@1][MEM][MEM1][MEM2]}
4.002   IEEE         {[@1][MEM][MEM1][MEM2]}
5.007   IEEE         {[@1][127][D32767][T32767]}
6.008   IEEE         [SRQ 32767]
7.001   IEEE         [SPL 255]
8.002   IEEE         [I] [I$]
```

JMP

Procedure Control FSC

Description

The JMP FSC is used to perform unconditional jumps in a MET/CAL procedure, or to perform conditional jumps based on the PASS/FAIL status of the most recent evaluation step.

For a conditional jump, the most recent evaluation may be an instrument evaluation, MEMC, EVAL, PICE, or DOSE statement.

Format

JMP *step number condition* where *condition* is one of:

- *blank*
- PASS
- FAIL

Rules

- If *condition* is *blank* the specified step is unconditionally executed next.

  Example:

  ```
  1.001 JMP       1.003
  1.002 DISP      This statement won't be executed.
  1.003 DISP      This statement will be executed.
  ```

  When statement 1.001 is executed, an unconditional jump to 1.003 occurs. 1.002 will not be executed.

- If *condition* is **PASS**, the specified step is executed next if the result of the most recent evaluation was PASS. If the result of the most recent evaluation was **FAIL**, execution continues with the procedure statement immediately following the JMP statement.

Example:

```
1.001 EVAL      YES or NO
2.001 JMP       2.004 PASS
2.002 DISP      Operator selected NO
2.003 JMP       2.005
2.004 DISP      Operator selected YES
2.005 END
```

In this example the first statement is an operator evaluation (EVAL statement).

If the operator chooses YES, the evaluation is a PASS. When statement 2.001 is executed, a jump to DISP statement 2.004 occurs, and a message is displayed indicating that the operator selected YES.

If the operator chooses NO, the evaluation is a FAIL. When statement 2.001 is executed, no jump occurs. Execution continues with 2.002 which displays a message indicating that that the operator selected NO. 2.003 is executed next, which causes an unconditional jump to the END statement.

- If *condition* is **FAIL**, the specified step is executed next if the result of the most recent evaluation was FAIL. If the result of the most recent evaluation was PASS, execution continues with the procedure statement immediately following the JMP statement.

  Example:

  ```
  1.001 EVAL      YES or NO
  2.001 JMP       2.004 FAIL
  2.002 DISP      Operator selected YES
  2.003 JMP       2.005
  2.004 DISP      Operator selected NO
  2.005 END
  ```

  In this example the first statement is an operator evaluation (EVAL statement).

  If the operator chooses YES, the evaluation is a PASS. When statement 2.001 is executed, no jump occurs. Execution continues with 2.002 which displays a message indicating that the operator selected YES. 2.003 is executed next, which causes an unconditional jump to the END statement.

  If the operator chooses NO, the evaluation is a FAIL. When statement 2.001 is executed, a jump to DISP statement 2.004 occurs, and a message is displayed indicating that the operator selected NO.

- If a conditional JMP statement is executed, and no preceding evaluations have been performed, the JMP statement is executed as if the most recent evaluation resulted in a PASS.

- If the jump destination (*step number*) is omitted from a JMP statement, the destination defaults to the end of the procedure. This terminates execution of the active procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

JMPF

Procedure Control FSC

Description

The JMPF FSC is used to perform a conditional jump based on the value of MEM1 or based on the selected procedure name.

The selected procedure name is the name under which the currently executing procedure is running. If the executing procedure is the main procedure, the selected name is the name which was chosen in the procedure selection dialog. If the currently executing procedure is a subprocedure, the selected name is the name by which the subprocedure was called.

Format

JMPF [*step number*] [*procedure name*]

where *procedure name* may be blank or may specify a MET/CAL procedure name.

Rules

- If *procedure name* is blank, JMPF jumps if the value of MEM1 is less than zero. If the value of MEM1 is greater than or equal to zero, execution continues with the statement immediately following the JMPF statement.

  Example:

```
1.001 OPBR      YES or NO
1.002 JMPF      1.005
1.003 DISP      Operator selected YES
1.004 JMP       1.006
1.005 DISP      Operator selected NO
1.006 END
```

  When an operator branch (OPBR) statement is executed, MEM1 is set to 1 if the operator answers YES, and is set to -1 if the operator answers NO.

  In the example above, if the operator selects YES, MEM1 is set to 1. The JMPF statement therefore does not jump to 1.005. Instead, execution continues with the statement which immediately follows the JMPF statement. This is 1.003, a DISP statement which displays a message indicating that the operator selected YES. Next, when 1.004 is executed, the procedure jumps unconditionally to 1.006.

If the operator selects NO, MEM1 is set to -1. Since MEM1 is less than zero, the JMPF statement (1.002) causes a JUMP to 1.005 to occur. 1.005 is a DISP statement which displays a message indicating that the operator selected NO.

- If *procedure name* is not blank, JMPF jumps if the name of the active procedure does not match the name specified in the JMPF statement. If the selected procedure name matches the name specified in the JMPF statement, execution continues with the statement immediately following the JMPF statement.

  Example:

  Suppose the main procedure contains the following Call statement:

```
CALLSub A
```

Suppose the called subprocedure contains:

```
INSTRUMENT:     Sub A
INSTRUMENT:     Sub B
1.001 JMPF      1.004   Sub B
1.002 DISP      Selected Procedure Name is "Sub B"
1.003 JMP       1.005
1.004 DISP      Selected Procedure Name is not "Sub B".
1.005 END
```

The subprocedure has two names: "Sub A" and "Sub B". When the "CALL Sub A" statement is executed in the main procedure, subprocedure execution begins with "Sub A" as the selected name.

When the JMPF statement executes, the name of the selected procedure name ("Sub A") is compared to the procedure name specified in the JMPF statement ("Sub B"). Since the names do not match, a jump to 1.004 occurs. 1.004 is a DISP statement which displays a message indicating that the selected procedure name is not "Sub B".

If the main procedure had called the subprocedure using the name "Sub B" instead of "Sub A", the selected name would have matched the name in the JMPF statement, and the jump to 1.004 would not have occurred.

The mechanism illustrated in this example may be useful when a single procedure is used for a family of closely related UUTs. For example, a single procedure could be written for the Fluke 73, 75, and 77 DMMs. The procedure could be given 3 names, one for each model number. The JMPF (and JMPT) FSCs can then be used to do conditional jumps based on the model number.

If a jump destination (*step number*) is not specified, a jump to the end of the active procedure occurs. This terminates execution of the active procedure.

- Jump destination step numbers must be between 1.001 and 999.999.

- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.
- The procedure name field in a JMPF statement is limited to 41 characters. If a JMPF statement specifies a 41-character procedure name, and the name of the active procedure is longer than 41 characters, MET/CAL considers the names to be the same if the first 41 characters of the active procedure name match the name specified in the JMPF statement.

Example:

```
INSTRUMENT:     This procedure name contains more than 41 characters.
STEP    FSC     RANGE   NOMINAL     TOLERANCE   MOD1    MOD2    3   3   CON
1.001   JMPF            1.004       This procedure name contains more than 41
1.002   DISP            Names match.
1.003   JMP             1.005
1.004   DISP            Names do not match.
```

When the JMPF statement is executed, the name specified in the JMPF statement matches the name of the procedure, even though the full procedure name does not fit in the JMPF statement. Since the names match, the jump to 1.004 does not occur. 1.002 DISP is therefore executed, which displays a message indicating that the test names match.

JMPL

Procedure Control FSC

Description

The JMPL FSC is used to perform conditional jumps in a MET/CAL procedure.

Each JMPL statement specifies a jump destination label and an optional MATH expression. If there is an expression, and it evaluates to a non-zero value, a jump to the specified label is done when the JMPL statement executes. If there is an expression and it evaluates to zero, procedure execution continues with the statement following the JMPL statement. If there's no expression, an unconditional jump to the specified label is done when the JMPL statement executes.

JMPL must be used in conjunction with the LABEL FSC. Only the LABEL FSC can specify the JMPL destination.

JMPL has two advantages over other MET/CAL jump-type FSCs:

1. The jump destination is specified as a label rather than a step number. This means that when the procedure compiler compiles the procedure, the literal jump destination doesn't change, as it may with JMP, JMPF, JMPT, and JMPZ. This may assist procedure writing and procedure readability.
2. The expression which defines the jump condition may be any MATH expression. This may improve readability and flexibility in specifying the jump condition.

Format

JMPL *label* [*expression*]

Rules

- The label may contain any characters except blanks and nuls (zero).
- The label and the expression, taken together are limited to 56 characters. One or more spaces must separate the label from the expression.
- When the JMPL statement executes, the jump is done only if the expression evaluates to a non-zero value, or if there's no expression.
- The expression may be any valid math expression, as defined by the MATH FSC. Note that the expression in a JMPL statement cannot be an assignment. That is, JMPL cannot be used to change the value of a register. The rule is that anything valid on the right-hand side of an assignment in a MATH statement is also valid as a JMPL expression (space permitting).

- Every JMPL statement must have exactly one jump destination. A procedure cannot be executable if the jump destination is missing, or if there are multiple jump destinations (that is, multiple LABEL statements which specify the same label).
- The expression in a JMPL statement is evaluated as a numeric expression. If the specified expression produces a string value, the string is converted to numeric form for purposes of the JMPL statement. In general, this is not recommended, because it usually makes the procedure less readable.

Examples

Example 1:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
      JMPL       abc     m[4] < 12
      .
      .
      .
      LABEL      abc
```

In this example the procedure jumps to the LABEL statement if the value in the M[4] register is less than 12.

JMPT

Procedure Control FSC

Description

The JMPT FSC is used to perform a conditional jump based on the value of MEM1 or based on the selected procedure name.

The selected procedure name is the name under which the currently executing procedure is running. If the executing procedure is the main procedure, the selected name is the name which was chosen in the procedure selection dialog. If the currently executing procedure is a subprocedure, the selected name is the name by which the subprocedure was called.

Format

JMPT [*step number*] [*procedure name*] where *procedure name* may be blank or may specify a MET/CAL procedure name.

Rules

- If *procedure name* is blank, JMPT jumps if the value of MEM1 is greater than zero. If the value of MEM1 is less than or equal to zero, execution continues with the statement immediately following the JMPT statement.

  Example:

```
1.001 OPBR      YES or NO
1.002 JMPT      1.005
1.003 DISP      Operator selected NO
1.004 JMP       1.006
1.005 DISP      Operator selected YES
1.006 END
```

  When an operator branch (OPBR) statement is executed, MEM1 is set to 1 if the operator answers YES, and is set to -1 if the operator answers NO.

  If the operator selects YES, MEM1 is set to 1. Since MEM1 is greater than zero, the JMPT statement (1.002) causes a JUMP to 1.005 to occur. 1.005 is a DISP statement which displays a message indicating that the operator selected YES.

  If the operator selects NO, MEM1 is set to -1. Since MEM1 is less than or equal to zero, the JMPT statement does not jump to 1.005. Instead, execution continues with the statement which immediately follows the JMPT statement. This is 1.003, a DISP statement which displays a message indicating that the operator selected NO. Next, when 1.004 is executed, the procedure jumps unconditionally to 1.006.

- If *procedure name* is not blank, JMPT jumps if the name of the active procedure matches the name specified in the JMPT statement. If the selected procedure name does not match the name specified in the JMPT statement, execution continues with the statement immediately following the JMPT statement.

  Example:

  Suppose the main procedure contains the following CALL statement:

  ```
  CALL       Sub B
  ```

  Suppose the called subprocedure contains:

  ```
  INSTRUMENT:    Sub A
  INSTRUMENT:    Sub B
  1.001 JMPT     1.004  Sub B
  1.002 DISP     Selected Procedure Name is not "Sub B"
  1.003 JMP      1.005
  1.004 DISP     Selected Procedure Name is "Sub B".
  1.005 END
  ```

- The subprocedure has two names: "Sub A" and "Sub B". When the "CALL Sub B" statement is executed in the main procedure, subprocedure execution begins with "Sub B" as the selected name.

  When the JMPT statement executes, the name of the selected procedure name ("Sub B") is compared to the procedure name specified in the JMPT statement ("Sub B"). Since the names match, a jump to 1.004 occurs. 1.004 is a DISP statement which displays a message indicating that the selected procedure name is "Sub B".

  If the main procedure had called the subprocedure using the name "Sub A" instead of "Sub B", the selected name would not have matched the name in the JMPT statement, and the jump to 1.004 would not have occurred.

  The mechanism illustrated in this example may be useful when a single procedure is used for a family of closely related UUTs. For example, a single procedure could be written for the Fluke 73, 75, and 77 DMMs. The procedure could be given 3 names, one for each model number. The JMPT (and JMPF) FSCs can then be used to do conditional jumps based on the model number.

- If a jump destination (*step number*) is not specified, a jump to the end of the active procedure occurs. This terminates execution of the active procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

- The procedure name field in a JMPT statement is limited to 41 characters. If a JMPT statement specifies a 41-character procedure name, and the name of the active procedure is longer than 41 characters, MET/CAL considers the names to be the same if the first 41 characters of the active procedure name match the name specified in the JMPT statement.

Example:

```
INSTRUMENT:    This procedure name contains more than 41 characters.
1.001   JMPT   1.004      This procedure name contains more than 41
1.002   DISP   Names do not match.
1.003   JMP    1.005
1.004   DISP   Names match.
```

When the JMPT statement is executed, the name specified in the JMPT statement matches the name of the procedure, even though the full procedure name does not fit in the JMPT statement. Since the names match, the jump to 1.004 occurs. 1.004 DISP is therefore executed, which displays a message indicating that the names match.

JMPZ

Procedure Control FSC

Description

The JMPZ FSC is used to perform a conditional jump based on the value of MEM1. If the value of MEM1 is zero, JMPZ causes a jump to the specified jump destination (step number). An optional tolerance for the comparison may be specified.

Format

JMPZ *step number tolerance*

where *tolerance* may be blank, or may specify a numeric expression followed by the letter 'U'.

Rules

- If *tolerance* is blank, JMPZ jumps to the specified jump destination only if the value of MEM1 is exactly zero.
- If *tolerance* is not blank, JMPZ jumps to the specified destination if the value of MEM1 is within the specified tolerance of zero.

  Example:

  ```
  JMPZ    1.002   .0001U
  ```

  When this statement is executed, the jump to 1.002 will occur if the value of MEM1 is between -0.0001 and +0.0001.

  MEM1 is stored internally as a floating-point number. When a computer compares two floating-point numbers for exact equality, the comparison may be unreliable due to small round-off errors introduced in the process of performing calculations. Whether such round-off errors are present depends on the numbers, and the sequence of operations, involved. To eliminate the possibility of unexpected results using a JMPZ statement, procedure writers are advised to always specify a small tolerance.
- When a *tolerance* is specified, only the absolute value is significant.

  Example:

  ```
  JMPZ    1.002   +1E6
  JMPZ    1.002   -1E6
  ```

  The above two statements are equivalent. In both cases, the jump will be performed if the value of MEM1 is within $1E^6$ of zero.

The *tolerance,* if specified, may be a simple number or any numeric expression compatible with the MATH FSC. Refer to the on-line help for the MATH FSC for information about expression syntax. When the *tolerance* is specified as a numeric expression, the expression may not contain spaces. The length of the expression, not counting the trailing 'U', is limited to 41 characters.

Examples:

```
JMPZ 2.001 MEMU
```

In this example, the numeric expression is "MEM". The jump will be done if, at run time, the value of MEM1 is within +/-MEM of zero.

```
JMPZ 2.001 M[1]+.001U
```

In this example, the numeric expression is "M[1]+.001". The jump will be done if, at run time, the value of MEM is within +/-(M[1]+.001) of zero.

- The ability to specify *tolerance* as a numeric expression was added in MET/CAL V5.0. Prior to V5.0, the *tolerance* could be expressed only as a simple number.
- If a jump destination (*step number*) is not specified, a jump to the end of the procedure occurs. This terminates execution of the procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

LABEL

Miscellanious FSC

Description

The LABEL FSC is used to specify a label which can serve as the jump destination for a JMPL statement.

Format

LABEL *label*

Rules

- Any string of characters, not including blanks and nuls (zero),may be used as a label.
- The LABEL FSC restricts labels to 56 characters. As a practical matter, however, the maximum label length is shorter than 56. This is because the label is only useful as a JMPL destination, and the JMPL statement usually specifies both a label and a MATH expression in 56 characters or less. Refer to the JMPL manual.
- Labels are case sensitive.

Examples

Example 1:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 JMPL       abc     mem < 10
1.002 DISP       no
1.003 END
1.004 LABEL      abc
1.005 DISP       yes
```

In this example the procedure jumps to 1.004 and then prints "yes" if MEM is less than 10. Otherwise the procedure prints "no". Note that the step number of the jump destination (1.004 in this example) makes no difference. The important point is that the body of the LABEL statement (here "abc") matches the destination specified in the JMPL statement.

M3458

Auxiliary Instrument Setup FSC

Refer to M511 earlier in this chapter.

M511

Instrument FSC

Refer to M511 earlier in this chapter.

M550

Instrument FSC

Refer to M550 earlier in this chapter.

M5720

Auxiliary Instrument Setup FSC

Refer to M5720 earlier in this chapter.

M606

Instrument Setup FSC

Refer to M606 earlier in this chapter.

M666

Instrument FSC

Refer to M666 earlier in this chapter.

M681

Instrument FSC

Refer to M681 earlier in this chapter.

M685

Instrument FSC

Refer to M685 earlier in this chapter.

MATH

Memory Register Operation FSC

Description

The MATH FSC evaluates arithmetic and string expressions and assigns the result to a specified memory register.

Format

MATH *memory register = expression*

Multiple assignments may be included in a single MATH statement, separated by semicolons.

Rules

- Registers *memory register* must be MEM, MEM1, M[1], M[2], M[255], MEM2, S[1], S[2], or S[32].

  The index of a numeric register (M[*index*]) or a string register (S[*index*]) must be a literal integer. It cannot be an expression. For example, "M[MEM + 3]" is not a legal construction in a MATH statement.

  MEM2, S[1], S[2], and S[32] are string registers. MEM2 is limited to 4096 characters. The S registers cannot exceed 32767 characters each, subject to available memory.

- Operators

  The MATH FSC supports the following binary operators:

Operation	**Symbol**
addition	+
subtraction	-
multiplication	*
division	/
exponentiation	^
string concatenation	&
less than	<
less than or equal to	≤
greater than	>
greater than or equal to	≥
not equal to	!=

The relational operators (<, <=, >, >=, = =, and !=) evaluate to 1 or 0, depending on whether the relation is true or false. For example, "MATH MEM1 = MEM < 10" sets MEM1 to 1 if the value of MEM is less than 10, and sets MEM1 to 0 if the value of MEM is greater than or equal to 10.

Procedures which make use of any of the operators "<=", ">=", "==", and "!=" should be tested carefully. There is some risk of unexpected behavior due to internal floating-point rounding in numerical calculations. For example, the statement:

MATH mem = (13.7 * 16.6 == 227.42)

will set MEM to zero, even though 13.7 * 16.6 really is equal to 227.42.

- Functions

  In addition to the operators listed above, expressions may also make use of function calls. Supported functions are listed below:

  ABS

Purpose:	Computes the absolute value of its argument.
Result Type:	Numeric
Argument Type:	Numeric

  ACOS

Purpose:	Computes the arccosine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

  ASIN

Purpose:	Computes the arcsine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

  ATAN

Purpose:	Computes the arctangent of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

  AVG

Purpose:	Computes the average of a set of numbers. The function arguments specifies the indices of a range of numeric registers the values of which are to be averaged.
Result Type:	Numeric
Argument Type:	Numeric, Numeric
Example:	

```
MATH M[5] = 25
MATH M[6] = 45
MATH M[7] = 20
MATH MEM = AVG(5, 7)
```

After the last MATH statement executes the value of MEM will be 30.

Purpose:	Computes the smallest integer greater than or equal to its argument.
Result Type:	Numeric
Argument Type:	Numeric

CMP

Purpose:	Case-sensitive string comparison. Returns 1 if strings are the same, -1 otherwise. May be used in conjunction with JMPF.
Result Type:	Numeric
Argument Type:	String, String

CMPI

Purpose:	Case-insensitive string comparison. Returns 1 if strings are the same, -1 otherwise. May be used in conjunction with JMPF.
Result Type:	Numeric
Argument Type:	String, String

COS

Purpose:	Computes the cosine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

COSH

Purpose:	Computes the hyperbolic cosine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

DATE

Purpose:	Returns the current date.

The argument is a string which controls the date format. The following format descriptors may be used:

DD - day number
MM - month number
MON - 3-letter month name
MONTH - full month name
YY - 2-digit year number(window 1970 - 2069)

No format descriptor may occur more than once in a format control string.

At most one of { MM, MON, MONTH } may occur in a format control string.
At most one of { YY, YYYY } may occur.

Characters which do not match a valid format descriptor are copied unchanged to the formatted date string.

Format descriptors are case-insensitive.

Result Type: String

Argument Type: String

Compatibility: Requires V6.0 or later.

Month names are English-only in V6.0.

Example 1:

```
MATH S[5] = date("DD/MM/YY")
```

This produces a date string like "04/20/99" and stores it in string register S[5].

Example 2:

```
MATH MEM2 = date("month dd, yyyy")
```

This produces a formatted date like "April 20, 1999" and stores it in string register MEM2.

DEGC

Purpose:	Converts from degrees F to degrees C.
Result Type:	Numeric (degrees Celsius)
Argument Type:	Numeric (degrees Fahrenheit)

DEGF

Purpose:	Converts from degrees C to degrees F.
Result Type:	Numeric (degrees Fahrenheit)
Argument Type:	Numeric (degrees Celsius)

DEFILE

Purpose: Returns the full path name of the MET/CAL DOS/DOSE datafile.

This function may be used to pass the DOS/DOSE data file name to a user program to be invoked with the DOS or DOSE FSC.

Result Type: String

Argument Type: None

Compatibility: Requires V6.0 or later.

Example:

```
MATH S[5] = DFILE() DOS  USER1 [S5]
```

In this example the full path name of the DOS/DOSE data file is stored in string register S[5], and then passed as the first (and only) argument to the user program USER1.

EXP

Purpose:	Computes the exponential function of its argument.
Result Type:	Numeric
Argument Type:	Numeric

FIND

Purpose: Finds the index of the n-th occurrence of a specified substring in a specified string. The first argument is the string to be searched. The second argument is the substring to search for. The third argument is the number of the desired occurrence. This function is case-sensitive.

Result Type: Numeric

Argument Type: String, String, Numeric

Example 1:

```
MATH S[5] = "abcxyzabcxyz"
MATH MEM  = FIND(S[5], "abc", 2)
```

After the second math statement is executed the value of MEM will be 7, since 7 is the index of the beginning of the second occurrence of "abc".

Example 2:

```
MATH MEM = FIND("abcdef", "z", 1)
```

Since "z" does not occur in "abcdef", MEM will be set to zero.

FLD

Purpose: Extracts a specified field from a string. The first argument is the string from which the field is to be extracted. The second argument specifies which field to extract. (The first field is number 1.) The third argument is a string which specifies the field separator.

Result Type: String

Argument Type: String, Numeric, String

Example 1:

```
MATH S[1]="FLUKE,5500A,6320007,NONE+1.2"
MATH MEM2=FLD(S[1], 2, ",")
```

After this statement executes the value of MEM2 will be "5500A".

Example 2:

```
# Setup RS232-communication
1.001  PORT    [P1200,N,8,1,X]
# Enable the SERVICE-mode of the
# ScopeMeter test tool.
1.002  PORT    EX110,0[13][I]
1.003  PORT    FLUKPHIL[13][I]
# Query Scopemeter Cal Fields
# returns Total Cal Fields,
# Free
1.004  PORT    QN[13][I][I$]
1.005  MATH    MEM = FLD(MEM2, 2, ",")
1.006  DISP    Fields Available [MEM]
```

FMT

Purpose: Formats a number. Format specifiers have the form: % *width.precisioncode*

width is the minimum field width.

precision is the precision of the result.

code is 'f', 'e', or 'g'.

'f' specifies fixed-point.

'e' specifies floating-format.

'g' uses 'f' or 'e', whichever is more compact. The precision specifies the maximum number of significant digits.

Result Type: String

Argument Type: Numeric, String

Example:

```
MATH MEM2 = FMT(1.234567, "%4.2f")
```

After this statement executes the value of MEM2 will be "1.23".

GETV

Purpose: Get value from MET/CAL variable file.

If the name does not exist in the variable file, or the value is empty, the return value is an empty string.

All variable names must end with '$'. However, if the '$' is omitted in a MATH statement, it is automatically added before the value is retrieved.

Variable names are case-insensitive.

The MET/CAL variable file is cached (in memory) during normal program operation. It is used by the pre-prompt and post-prompt dialogs, and accessed by the [V...] special construction.

Result Type: String

Argument Type: String

See Also: MATH function "PUTV"

Compatibility: Requires V6.0 or later.

Example:

```
MATH MEM2 = GETV("PROC_NAME$")
```

IFILE

Purpose: Returns the full path name of theMET/CAL initialization file.

This function may be used to pass the initialization file name to a user program to be invoked with the DOS or DOSE FSC.

Result Type: String

Argument Type: None

Compatibility: Requires V6.0 or later.

Example:

```
MATH S[5] = IFILE()
```

INI

Purpose: Retrieves the value of a specifiedMET/CAL initialization file parameter.

This function takes two arguments. The first argument specifies the initialization file section. The second argument specifies the initialization file parameter.

The return value is an empty string if the specified parameter does not exist in the specified section, or if the parameter exists but has no value.

The section name and parameter name arguments are case-insensitive.

One use of this function is to pass values from the initialization file to user program invoked with the DOS (or DOSE) FSC.

Result Type: String

Argument Type: String, String

Compatibility: Requires V6.0 or later.

Example:

```
MATH M[10] = INI("startup", "tur_lim")
```

In this example, the value of the "tur_lim" parameter (usually 4.0) is stored in numeric register M[10]. "tur_lim" specifies the T.U.R. limit used by MET/CAL. Note also that "INI" has a string return value, but in this example the return value is assigned to a numeric register. The MATH FSC automatically converts the string valueto a numeric value when necessary.

INT

Purpose: Computes the largest integer less than or equal to its argument.

Result Type: Numeric

Argument Type: Numeric

LEN

Purpose: Computes the length of a string.
Result Type: Numeric
Argument Type: String

LN

Purpose: Computes the natural logarithm of its argument.
Result Type: Numeric
Argument Type: Numeric

LOG

Purpose: Computes the base 10 logarithm of its argument.
Result Type: Numeric
Argument Type: Numeric

MAX

Purpose: Computes the maximum of a set of numbers. The function arguments specifies the indices of a range of numeric registers for which the maximum is to be determined.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH M[5] = 25
MATH M[6] = 45
MATH M[7] = 20
MATH MEM = MAX(5, 7)
```

After the last MATH statement executes the value of MEM will be 45.

MAX2

Purpose: Computes the maximum of two values.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH M[5] = 3.7
MATH M[6] = 4.1
MATH MEM = MAX2(M[5], M[6])
```

After the last MATH statement executesthe value of MEM will be 4.1.

MIN

Purpose: Computes the minimum of a set of numbers. The function arguments specifies the indices of a range of numeric registers for which the minimum is to be determined.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH M[5] = 25
MATH M[6] = 45
MATH M[7] = 20
MATH MEM = MIN(5, 7)
```

After the last MATH statement executes the value of MEM will be 20.

MIN2

Purpose: Computes the minimum of two values.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH M[5] = 3.7
MATH M[6] = 4.1
MATH MEM = MIN2(M[5], M[6])
```

After the last MATH statement executesthe value of MEM will be 3.7.

POW

Purpose: Raises a specified value to a specified power. (The exponentiation operator, '^', may also be used to raise a value to a power. For example, "pow(5,2) is equivalent to "5^2".)

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH MEM = POW(5, 2)
```

After this statement executes the value of MEM will be 25.

PUTV

Purpose: Store value in MET/CAL variable file.

The first argument is the variable name.

The second argument is the variable value.

The return value is the previous value, if any, of the variable.

The variable name may refer to an existing variable, or may cause the creation of a new variable.

All variable names must end with '$'. However, if the '$' is omitted in a MATH statement, it is automatically added before the value is stored.

Variable names are case-insensitive.

The MET/CAL variable file is cached (in memory) during normal program operation. It is used by the pre-prompt and post-prompt dialogs, and accessed by the [V...] special construction.

The MET/CAL variable file contains lines which have a maximum of 511 characters. This includes the terminating linefeed character, as well as the equals sign ('=') used to separate the name from the value. The MATH FSC, therefore, does not allow the combined length of the name and value strings for a variable to exceed 509 characters.

Result Type: String

Argument Type: String, String

See Also: MATH function "GETV"

Compatibility: Requires V6.0 or later.

Example:

```
MATH S[32] = PUTV("Humidity", S[30])
```

The above example assumes that string register S[30] contains the formatted relative humidity value.

Caution: Function "PUTV" must be used with caution. Modifying the value of a variable written automatically by the MET/CAL run system may cause unforeseen changes in the results.

RAD

Purpose:	Converts from degrees to radians.
Result Type:	Numeric (radians)
Argument Type:	Numeric (degrees)

RND

Purpose:	Rounds a number to the nearest integer.
Result Type:	Numeric
Argument Type:	Numeric

SDEV

Purpose:	Computes the standard deviation of a set of numbers. The function arguments specify the indices of a range of numeric registers the values of which are to be included in the calculation of the standard deviation.
Result Type:	Numeric
Argument Type:	Numeric, Numeric

Example:

```
MATH M[5] = 10
MATH M[6] = 11
MATH M[7] = 10
MATH M[8] = 11
MATH MEM = SDEV(5, 8)
```

After the last MATH statement executes the value of MEM will be .5774.

SGN

Purpose:	Determines the arithmetic sign of a number. Returns 1 for positive numbers, -1 for negative numbers, and 0 for zero.
Result Type:	Numeric
Argument Type:	Numeric

SIN

Purpose:	Computes the sine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)

SINH

Purpose:	Computes the hyperbolic sine of its argument.

Result Type: Numeric (radians)
Argument Type: Numeric (radians)

SQRT

Purpose: Computes the square root of its argument.
Result Type: Numeric
Argument Type: Numeric

SUB

Purpose: Extracts a substring of a specified length starting at a specified index. The first argument is the string from which the substring is to be extracted. The second argument is the starting index of the substring. The third argument is the length of the substring.

Result Type: String

Argument Type: String, Numeric, Numeric

Example:

```
MATH MEM2 = SUB("abcdef", 2, 3)
```

After this statement executes the value of MEM2 will be "bcd".

TAN

Purpose: Computes the tangent of its argument.
Result Type: Numeric (radians)
Argument Type: Numeric (radians)

TANH

Purpose: Computes the hyperbolic tangent of its argument.
Result Type: Numeric (radians)
Argument Type: Numeric (radians)

TIME

Purpose: Returns the current time.

The format of the time string is HH:MM:SS.

The hour number (HH) is a number in the range 00 to 23.

The minute and second numbers (MM and SS) are numbers in the range 00 to 59.

Result Type: String

Argument Type: None

Compatibility: Requires V6.0 or later.

Example:

```
MATH S[5] = time()
```

This produces a time string like "10:12:59" and stores it in string register S[5].

VERS

Purpose: Returns MET/CAL version string.

Result Type: String

Argument Type: None

Example 1:

```
MATH mem2 = vers()
```

Example 2:

```
MATH mem = vers()
```

In the second example, the version string is converted to numeric form. This allows the version number to betested in a relational expression.

ZCMP

Purpose: Case-sensitive string comparison. Returns 1 if strings are the same, 0 otherwise. (Same as CMP except returns 0 instead of -1 when strings are not the same.) May be used in conjunction with JMPZ.

Result Type: Numeric

Argument Type: String, String

ZCMPI

Purpose: Case-insensitive string comparison. Returns 1 if strings are the same, 0 otherwise. (Same as CMPI except returns 0 instead of -1 when strings are not the same.) May be used in conjunction with JMPZ.

Result Type: Numeric

Argument Type: String, String

- Literal Values

  Literal values may be numeric or string values.

  Numeric values may be integer, fixed-point or floating-point.

  Examples:

integer	23
fixed-point	3.56
floating-point	2.4E3

- String values must be enclosed in double quotes. String values may not contain embedded NUL characters (zero).
- Literal strings may include the following backslash escape sequences:

\r	carriage return
\n	linefeed
\\	backslash
\"	double quote
\ddd	decimal integer (where ddd = 001 to 255)
\xdd	hex integer (where xdd = x01 to xFF)

- Value Conversion
- Each operator has an expected type for its operands, each function has an expected type for its arguments, and each destination register has a type.

  Automatic conversions from strings to integers, and vice versa, are done as needed during expression evaluation.

  A string is converted to a numeric value by searching for the first numeric character (including '+', '-', and '.') and converting the number which begins at that point. A run time error results if the string does not contain a numeric value.

  Example:

  ```
  MATH MEM = "abc1.4xyz"
  ```

  After the statement is executed, the value of MEM will be 1.4.

- Operator Precedence

  The following table shows operator precedence from highest to lowest. Operators at the same level have the same precedence and are evaluated left to right.

Level 1	(Highest) ^
Level 2	*, /
Level 3	+, -, &
Level 4	<, <=, >, >=, ==, !=

The default precedence of an operator may be overridden by using parentheses to group sub-expressions.

Example:

```
MATHMEM = (M[1] + M[2]) * (M[3] - M[4])
```

This expression is evaluated as follows:

1. The sum of M[1] and M[2] is calculated.
2. The difference between M[3] and M[4] is calculated.
3. The result of step 1 is multiplied by the result of step 2.
4. The result of step 3 is stored in MEM.

Note

the expression in the example above would not be the same if the parentheses were removed.

5. Restrictions

   Unary sign operators may not precede non-literal values.

   For example, "MATH MEM = 1 - -MEM1" is illegal.

   Instead, write: "MATH MEM = 1 - (-1 * MEM1)".

   Unary sign operators may precede literal values, however. For example, "MATH MEM = 1 - -3" is legal.

   Array indices must be literal numeric values.

   For example, "MATH MEM = M[MEM1]" is illegal.

- Error Handling

  Division by zero is not allowed. A run time error results if division by zero occurs.

  Run time errors occur if function parameters are out of range or otherwise illegal.

  Examples

```
MATH    MEM = MEM + M[1] + M[20]
MATH    M[3]    = 7
MATH    MEM1    = M[2] / M[3]
MATH    MEM = MEM * MEM1 - 4.321

# Assign the string value "xyz" to string register 1.
MATHS[1] = "xyz"
```

```
# Assign the concatenation of the string in S[1] with "abc" to MEM2.
MATH    MEM2 = S[1] & "abc"

# Calculate the square root of 2.
MATH    MEM = sqrt(2)

# Swap MEM and MEM1, using M[1] as a temporary register.
MATH    M[1] = MEM; MEM = MEM1; MEM1 = M[1]
```

MCAL

Instrument FSC

Refer to MCAL earlier in this chapter.

MEM+ *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM+ FSC adds a specified value to MEM. If the value is omitted, the value of MEM1 is added to MEM.

Format

MEM+ *value* or MEM+

Rules

- If *value* is a numeric constant, the specified value is added to MEM.

  Example:

```
MATHMEM = 3
MEM+1
DISPMEM = [MEM]
```

  The MATH statement assigns the value 3 to MEM. The MEM+ statement adds 1 to MEM. The value of MEM is now 4. The DISP statement displays the updated value of MEM.

- If *value* is blank, the value of MEM1 is added to MEM.

  Example:

```
MATHMEM = 3.5
MATHMEM1 = 4.2
MEM+
DISPMEM = [MEM]
```

  The MATH statements set MEM to 3.5 and MEM1 to 4.2. The MEM+ statement adds the two values, storing the result in MEM. The value of MEM is now 7.7. The DISP statement displays the updated value of MEM.

- The MEM+ statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM+ Statement	Equivalent MATH Statement
MEM+ 5	MATH MEM = MEM + 5
MEM+	MATH MEM = MEM + MEM1

MEM- *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM- FSC subtracts a specified value from MEM. If the value is omitted, the value of MEM1 is subtracted from MEM.

Format

MEM- *value* or MEM-

Rules

- If *value* is a numeric constant, the specified value is subtracted from MEM.

  Example:

  ```
  MATHMEM = 3

  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 3 to MEM. The MEM- statement subtracts 1 from MEM. The value of MEM is now 2. The DISP statement displays the updated value of MEM.
- If *value* is blank, the value of MEM1 is subtracted from MEM.

  Example:

  ```
  MATHMEM = 9.5
  MATHMEM1 = 4.2
  MEM-
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 9.5 and MEM1 to 4.2. The MEM- statement subtracts MEM1 from MEM, storing the result in MEM.

  The value of MEM is now 5.3. The DISP statement displays the updated value of MEM.
- The MEM- statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM- Statement	Equivalent MATH Statement
MEM- 5	MATH MEM = MEM - 5
MEM-	MATH MEM = MEM - MEM1

MEM* *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM* FSC multiplies MEM by a specified value. If the value is omitted, MEM is multiplied by MEM1. The result of the multiplication is stored back in MEM.

Format

MEM* *value* or MEM*

Rules

- If *value* is a numeric constant, MEM is multiplied by the specified value.

  Example:

  ```
  MATHMEM = 3
  MEM*2
  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 3 to MEM. The MEM* statement multiplies MEM by 2. The value of MEM is now 6. The DISP statement displays the updated value of MEM.
- If *value* is blank, MEM is multiplied by MEM1.

  Example:

  ```
  MATHMEM = 3.5
  MATHMEM1 = 6
  MEM*
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 3.5 and MEM1 to 6. The MEM* statement multiplies the two values, storing the result in MEM. The value of MEM is now 21. The DISP statement displays the updated value of MEM.
- The MEM* statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM* Statement	Equivalent MATH Statement
MEM* 5	MATH MEM = MEM * 5
MEM*	MATH MEM = MEM * MEM1

MEM/ *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM/ FSC divides MEM by a specified value. If the value is omitted, MEM is divided by MEM1. The result of the division is stored back in MEM.

Format

MEM/ *value* or MEM/

Rules

- If *value* is a numeric constant, MEM is divvied by the specified value.

  Example:

  ```
  MATHMEM = 6
  MEM/2
  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 6 to MEM. The MEM/ statement multiplies MEM by 2. The value of MEM is now 3. The DISP statement displays the updated value of MEM.
- If *value* is blank, MEM is multiplied by MEM1.

  Example:

  ```
  MATHMEM = 8.4
  MATHMEM1 = 2
  MEM/
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 8.4 and MEM1 to 2. The MEM/ statement divides MEM by MEM1, storing the result in MEM. The value of MEM is now 4.2. The DISP statement displays the updated value of MEM.
- If the divisor is zero, a run time error occurs, terminating execution of the MEM/ statement. The value of MEM is unchanged.
- The MEM/ statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM/ Statement	Equivalent MATH Statement
MEM/ 5	MATH MEM = MEM / 5
MEM/	MATH MEM = MEM / MEM1

MEM2

Memory Register Operation FSC

Description

The MEM2 FSC assigns a value to memory register MEM2. MEM2 is a string register which may contain up to 4096 characters.

Format

MEM2 *string*

MEM2 = *string*

Rules

- If *string* is preceded by an equals sign (’=‘), the string is copied directly into MEM2.

  The string, before any special constructions are evaluated, is limited to 55 characters. The evaluated string is limited by the length of MEM2 (4096 characters).

  Example:

  ```
  MEM2 =ABC
  ```

  This statement causes the string "ABC" to be copied into MEM2.

- If *string* is not preceded by an equals sign (’=’), the string is used as a prompt to the operator.

  The response entered by the operator is copied into MEM2. The unevaluated string entered in the MEM2 statement is limited to 56 characters. The evaluated string, used as an operator prompt, is limited to 72 characters. The operator’s response is limited by the length of MEM2 (4096 characters).

  Example:

  ```
  MEM2Enter the current temperature.
  DISPCurrent temperature is [MEM2].
  ```

  Since the MEM2 string does not begin with an equals sign, the operator is prompted to "Enter the current temperature." The operator’s response is stored (as a text string) in MEM2. The DISP statement then displays the response.

- The following special constructions may be used in a MEM2 statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [V*variable*]

  {*text*}

  [M1], [M2], ..., [M255]

  [S1], [S2], ..., [S32]

  [SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Refer to "Special Constructions" in Chapter 1 of this manual for details.

MEMC, MEMCX

Evaluation FSCs

Description

The MEMC and MEMCX FSCs performs evaluations based on a comparison between the UUT Indicated value and the System Actual value.

For MEMC:

If the statement specifies a Nominal value, that value is used as the UUT Indicated value. If no value is specified in the NOMINAL field, the value of memory register MEM1 is used as theUUT Indicated value.

The value of memory register MEM is used as the System Actual

value.

For MEMCX:

If the statement specifies a Nominal value, that value is used as the System Actual value. If no value is specified in the NOMINAL field, the value of memory register MEM1 is used as the System Actual value.

The value of memory register MEM is used as the UUT Indicated value.

Execution of a MEMC or MEMCX statement does not change the values of MEM or MEM1.

MEMCX is new with MET/CAL V6.1. With MEMCX it should no longer be necessary to precede the evaluation with a MEME statement to swap the MEM and MEM1 registers. Depending on the type of test, it is now always sufficient to use either a MEMC or MEMCX evaluation, without the preceding MEME statement. See the "Historical Note" in the EXAMPLE section (below) for more information.

Format

MEMC *range nominal tolerance mod1*

MEMCX *range nominal tolerance mod1*

Rules

- RANGE Field

  The RANGE field follows the same rules as an instrument FSC. Refer to "General Rules for Instrument FSCs" in this manual.

- NOMINAL Field

The NOMINAL field is limited to 14 characters.

The format of the NOMINAL field is:

[*value*][*string*]

value is an NR3-format number.

In a MEMC statement, the value specifies the UUT Indicated value which will be compared to the value stored in MEM. If *value* is not specified, the value of MEM1 is used.

In a MEMCX statement, the value specifies the System Actual value which will be compared to the value stored in MEM. If *value* is not specified, the value of MEM1 is used.

value and *string* are both optional. However, at least one of *value* and *string* must be specified.

Note

Although the MEMC and MEMCX FSCs are similar in appearance to instrument evaluation statements, they use the registers MEM and MEM1 differently. In an instrument FSC, if no numerical quantity is specified in the NOMINAL field, the value is taken from MEM. In the MEMC and MEMCX FSCs, the value is taken from MEM1.

string cannot include blanks, and cannot end with 'R', '/', '%' or 'U'.

The *string* does not affect the numerical value used for the comparison. For example, "10mV" causes the value 10 to be used for the comparison.

In a MEMC statement, procedure writer must ensure that the original UUT reading is in the same units as specified in the NOMINAL field of the MEMC FSC.

Similarly, in a MEMCX statement, procedure writer must ensure that the original System Actual value is in the same units as specified in the NOMINAL field of the MEMCX FSC.

If the MEMC or MEMCX NOMINAL field specifies a *value*, or ASK- U is specified for the test, the specified *string* is appended to the UUT Indicated and System Actual values in the results generated for the test. In other cases, the units written to the results for the test are based on the previous instrument setup or ACC statement.

Very often the *string* consists of a prefix followed by units. However, that is not a requirement of the MEMC and MEMCX FSCs.

- TOLERANCE Field

The TOLERANCE field follows the same rules as an instrument FSC. Refer to "General Rules for Instrument FSCs" in this manual.

- MOD1 Field

  The MOD1 field is transferred directly to the results. Anything may be included in this field. Typically the frequency parameter of the test is entered here.

  The length of the field cannot exceed 14 characters.

  The field must not end with R, /, %, or U, and "TOL" is not allowed.

Example

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700        19V                            S  2W
1.002 IEEE        ?[I]
1.003 MEMCX 20    19V     1% 1/
```

Explanation:

The 5700 statement sets up the stimulus for the desired Nominal value. This value, 10, is stored in MEM1 when the 5700 statement executes.

The IEEE statement takes a reading from an IEEE-488 controlled UUT. The numeric result of the reading is stored in MEM. It is presumed in this example that the UUT reading is reported in volts.

The MEMCX FSC compares the System Actual value specified in the MEMCX NOMINAL field (which is the same as the value of the 5700 stimulus specified in the 5700 setup) with the value in MEM (which is the UUT Indicated value).

Historical Note:

Prior to MET/CAL V6.1 the test in the above example would have been coded as follows:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
    1.001 5700       19V                          S  2W
    1.002 IEEE       ?[I]
    1.003 MEME
    1.004 MEMC 20    V        1% 1/
```

The reason for the difference is that the MEMCX statement did not exist in V6.01 and earlier.

One problem with the old way is that it required the presence of a MEME statement before the MEMC statement. By interchanging the values of MEM and MEM1, the MEME stored the values to be compared in the appropriate places before the MEMC statement was evaluated. Specifically, since the 5700 setup statement stores the System Actual value in MEM1, this value must be moved into

MEM, which is where MEMC looks for the System Actual. And since the [I] construct in the IEEE statement stores the UUT Indicated value in MEM, this value must be moved into MEM1, which is where MEMC looks for the UUT Indicated value. The old method generally works, but is potentially incompatible with the measurement uncertainty calculation. The fundamental issue is that using MEME to swap the MEM and MEM1 registers also makes it absolutely necessary to repeat the 5700 setup each time through the measurement uncertainty loop. (When the number of measurements for the measurement uncertainty calculation is greater than 1 MET/CAL automatically repeats the steps of each test the specified number of times.)

Thus, if the procedure writer were to re-code the old-style test as:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       19V                           S  2W
1.002 TARGET     -M
1.003 IEEE       ?[I]
1.004 MEME
1.005 MEMC 20    V        1% 1/
```

the test would now be incompatible with the measurement uncertainty calculation. The "optimization" of not repeating the 5700 setup each time through the uncertainty loop prevents the MET/CAL 5700 driver from re-establishing the System Actual value in MEM1, which leads to invalid values in MEM and MEM1 after the MEME. This in turn causes the calculated measurement uncertainty to be incorrect.

This potential problem with the measurement uncertainty calculation in MEMC-based tests provided the primary impetus for the creation of the MEMCX FSC. Since, for a test like the above example, it’s no longer necessary to swap MEM and MEM1 before the MEMCX, the procedure writer is now free to skip the 5700 setup on the second and subsequent measurements:

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700        19V                           S  2W
1.002 TARGET      -M
1.003 IEEE        ?[I]
1.004 MEMCX 20    19V     1% 1/
```

MEME

Memory Register Operation FSC

Description

The MEME FSC is used to exchange memory registers MEM and MEM1.

Format

MEME

Examples

```
MATHMEM = 7
MATHMEM1 = 9
MEME
DISPMEM = [MEM], MEM1 = [MEM1]
```

The MATH statements initialize MEM to 7 and MEM1 to 9. The MEME statement exchanges the values. MEM is now 9, and MEM1 is 7. The DISP statements displays the updated values of MEM and MEM1.

Non-Preferred Functionality

The MEME FSC may also be used to perform the following functions for compatibility only, the MATH FSC should be used instead.

+ Load a constant value into memory register MEM.

+ Copy MEM into one of the M[*index*] memory registers.

+ Copy an M[*index*] memory register into MEM.

Format	Action
MEME *numeric*	Assigns specified value to MEM.
MEME <*index*	Copies register M [*index*] into MEM.
MEME >*index*	Copies MEM into register M [*index*].

See Also

"Memory Registers" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

"Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

MEMI

Memory Register Operation FSC

Description

The MEMI FSC prompts the operator for a number. The number entered by the operator is stored in memory register MEM.

Format

MEMI *message*

Rules

- The MEMI *message* is displayed as a prompt to the operator.
- The *message* may be up to 56 characters.
- The operator must enter a numeric value in response to the MEMI prompt. If the operator's response is blank or includes non-numeric characters, the prompt dialog is redisplayed.
- After a valid response has been entered by the operator, the entered value is stored in memory register MEM.
- The following special constructions may be used in a MEMI statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [<D *integer*]

  {*text*}

  [M1], [M2], ..., [M255]

  [S1], [S2], ..., [S32]

  [SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Example

```
3.015   MEMIUse keyboard to enter actual UUT reading in Ohms:
```

MESS

Display Control FSC

Description

The MESS FSC is used to store messages for later display. There are 3 situations in which the stored messages are displayed:

- When a stimulus instrument Evaluation Test, Nominal Setup test, or Comparison test is performed in slew mode.
- When a measurement function Setup Test is performed.
- When an EVAL statement is executed.

The primary use of the MESS FSC is to supplement or replace the messages shown during slewing.

Format

MESS *message*

Rules

- A MESS *message* may contain a maximum of 56 characters.
- A MESS statement may contain up to 8 lines.
- The regular automatic message shown during slewing or in a measurement Setup Test can be disabled using the ASK- N FSC command. In that case only the MESS messages are shown.

  Example:

  ```
  ASK-   N
  MESS   Replacement for slew message.
  5700   1v 1%
  ```

  When the 5700 statement is executed, the slew dialog will appear to allow the operator to slew the output of the 5700 calibrator. Since the ASK 'N' flag is disabled, the normal slew message ("Adjust stimulus for a UUT reading of 1 V.") will not appear. The specified MESS message will appear as a replacement (though not in the same place on the screen).
- A 1-line MESS statement with a blank *message* clears the existing MESS messages (if any) from internal storage.

- A blank MESS line which is part of a multi-line MESS statement does not clear MESS messages. It causes a blank line to appear when the MESS messages are displayed.
- Each MESS statement causes previous MESS messages to be overwritten.

  Example:

```
1.001 MESS abc
1.001 MESS def
1.002 EVAL yes or no
2.001 MESS xyz
2.002 EVAL x or y
```

  The second MESS statement (2.001) overwrites the 2 MESS messages which were stored by the first MESS statement (1.001). Thus, when the second EVAL statement is executed, the displayed MESS messages will consist of the single line "xyz".
- The following special constructions may be used in a MESS statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [V *integer*]

  {*text*}

  [M1], [M2], ..., [M255]

  [S1], [S2], ..., [S32]

  [SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following MESS statement will cause "Ch[MEM] trigger slope positive" to be stored in the results, not "Ch1 trigger slope positive".

```
12.001 MATH      MEM = 1
12.002 HEAD      Ch[MEM] Tests
12.003 MESS      Set {Ch[MEM] trigger slope positive}
12.004 EVAL      Is Ch[MEM] triggered?
```

The RSLT FSC should be used to store text with embeded [] special constructions in the results as shown below:

```
12.001 MATH      MEM = 1
12.002 HEAD      Ch[MEM] Tests
12.003 RSLT      =Ch[MEM] trigger slope positive
12.004 MESS      Set Ch[MEM] trigger slope positive
12.005 EVAL      Is Ch[MEM] triggered?
```

MMFC

Instrument FSC

Refer to MMFC earlier in this chapter.

OPBR

Procedure Control FSC

Description

The OPBR FSC presents a message to the operator. The operator must respond by choosing YES or NO. MEM1 is set to 1 if the operator chooses YES, and set to -1 if the operator chooses NO. The OPBR FSC is typically used in conjunction with a JMPF or JMPT statement to perform a jump based on the value of MEM1.

Format

OPBR *message*

Rules

- An OPBR *message* may contain up to 56 characters.
- An OPBR statement may contain up to 8 lines.
- The operator's response to the OPBR message determines the value of MEM1 as follows:

Operator Response	MEM1 Value
YES	+1
NO	-1

- If the operator responds to the displayed OPBR message by choosing NO, MEM1 is set to -1.
- The following special constructions may be used in an OPBR statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [D *integer*]

  [DRAW *x,y,view*]

  [V *variable*]

  {*text*}

  [M1], [M2], ..., [M255]

  [NO]

  [S1], [S2], ..., [S32]

[SREG1], [SREG2], ..., [SREG32]

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (6).

The constructions [M1], [M2], ..., M[255] access the numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The [NO] construction changes the default button in the OPBR prompt dialog from "Yes" to "No". This can be useful when the expected response is "No" rather than "Yes", because it allows the operator to simply press the "Enter" button in order to choose "No". The [NO] construction affects only the OPBR statement in which it appears. The default button is "Yes" for any OPBR statement which does not contain a [NO] construction.(The [NO] construction is new with V6.0.)

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers. The constructions [SREG1], [SREG2], ..., [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Example

```
47.003    OPBR       This test requires the following equipment:
47.003    OPBR       Function Generator: Philips PM 5133/5134 or
                     equiv.
47.003    OPBR       Oscilloscope: Philips PM 3055 or equivalent
47.003    OPBR
47.003    OPBR       Do you wish to perform the test?
47.004    JMPT       47.007
47.005    RSLT       = ****** NOT TESTED ******
47.006    JMP        47.008
47.007    CALL       Sub Fluke 86,88 Inductive Pickup (1 year) CAL
                     VER
47.008    END
```

The example above illustrates a typical use of OPBR. The operator is presented with a list of required equipment for a test. If the equipment is available, the operator chooses YES, which causes MEM1 to be set to 1. The JMPT statement then causes a jump to 47.007 which calls a subprocedure to perform the desired test.

If the equipment is not available, the operator chooses NO, which causes MEM1 to be set to -1. The JMPT statement does not then jump to 47.007. Execution proceeds to 47.005, which writes "****** NOT TESTED ******" in the results, and then 47.006 which jumps around the CALL statement.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following OPBR statement will cause "Ch[MEM] triggered" to be stored in the results, not "Ch1 triggered".

```
12.001 MATH     MEM = 1
12.002 HEAD     Ch[MEM] Tests
12.003 OPBR     Is {Ch[MEM] triggered}?
```

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

```
12.001 MATH     MEM = 1
12.002 HEAD     Ch[MEM] Tests
12.003 RSLT     =Ch[MEM] triggered
12.004 OPBR     Is Ch[MEM] triggered?
```

P700

Instrument FSC

Description

The P700 FSC programs the Fluke 5520A Multi-Product Calibratormeasure pressure using a Fluke 700 Series Pressure Module.

Functional Capability

Model	Minimum	Maximum
700P01	0.0 psi	0.3613 psi
	0.0 inHg	0.7356 inHg
	0.0 mmHg	18.680 mmHg
	0.0 inH_2O	10.000 in @ 4°C
	0.0 ftH_2O	0.8334 ftH_2O @ 4°C
	0.0 mmH_2O	254.00 mmH_2O @ 4°C
	0.0 mbar	24.910 mbar
	0.0 kPa	2.4910 kPa
	0.0 g/cm2	25.400 g/cm2
	0.0 inH_2O	10.010 inH_2O @ 60°F
700P02/	0.0 psi	1.0000 psi
700P22	0.0 mmHg	51.715 mmHg
	0.0 inHg	1.0360 inHg
	0.0 inH_2O	27.680 inH_2O @ 4°C
	0.0 ftH_2O	2.3067 ftH_2O @ 4°C
	0.0 mmH_2O	703.07 mmH_2O @ 4°C
	0.0 mbar	68.948 mbar
	0.0 kPa	6.8948 kPa
	0.0 g/cm2	70.307 g/cm2
	0.0 inH_2O	27.707 inH_2O @ 60°F
700P03/	0.0 psi	5.0000 psi

Model	Minimum	Maximum
700P23/	0.0 mmHg	258.58 mmHg
700PA3	0.0 inHg	10.180 inHg
	0.0 inH_2O	138.40 inH_2O @ 4°C
	0.0 ftH_2O	11.533 ftH_2O @ 4°C
	0.0 mH_2O	3.5153 mH_2O @ 4°C
	0.0 mbar	344.74 mbar
	0.0 kPa	34.474 kPa
	0.0 g/cm2	351.53 g/cm2
	0.0 inH_2O	138.54 inH_2O @ 60°F
700P04/	0.0 psi	15.000 psi
700P24/	0.0 mmHg	775.73 mmHg
700PA4	0.0 inHg	30.540 inHg
	0.0 inH_2O	415.20 inH_2O @ 4°C
	0.0 ftH_2O	34.600 ftH_2O @ 4°C
	0.0 mH_2O	1.0546 mH_2O @ 4°C
	0.0 bar	1.0342 bar
	0.0 kPa	103.42 kPa
	0.0 kg/cm2	1.0546 kg/cm2
	0.0 inH_2O	415.61 inH_2O @ 60°F
700P05/	0.0 psi	30.000 psi
700PA5	0.0 mHg	1.5515 mHg
	0.0 inHg	61.081 inHg
	0.0 inH_2O	830.40 inH_2O @ 4°C
	0.0 ftH_2O	69.200 ftH_2O @ 4°C
	0.0 mH_2O	21.092 mH_2O @ 4°C
	0.0 bar	2.0684 bar
	0.0 kPa	206.84 kPa
	0.0 kg/cm2	2.1092 kg/cm2

Model	Minimum	Maximum
	0.0 inH_2O	831.21 inH_2O @ 60°F
700P06/	0.0 psi	100.00 psi
700PA6	0.0 mHg	5.1715 mHg
	0.0 inHg	203.60 inHg
	0.0 inH_2O	2768.0 inH_2O @ 4°C
	0.0 ftH_2O	230.67 ftH_2O @ 4°C
	0.0 mH_2O	70.307 mH_2O @ 4°C
	0.0 bar	6.8948 bar
	0.0 kPa	689.48 kPa
	0.0 kg/cm2	7.0307 kg/cm2
	0.0 inH_2O	2770.7 inH_2O @ 60°F
700P07	0.0 psi	500.00 psi
	0.0 mHg	25.858 mHg
	0.0 inHg	1018.0 inHg
	0.0 inH_2O	13840 inH_2O @ 4°C
	0.0 ftH_2O	1153.3 ftH_2O @ 4°C
	0.0 mH_2O	351.53 mH_2O @ 4°C
	0.0 bar	34.474 bar
	0.0 MPa	3.4474 MPa
	0.0 kg/cm2	35.153 kg/cm2
	0.0 inH_2O	13854 inH_2O @ 60°F
700P08	0.0 psi	1000.0 psi
	0.0 mHg	51.715 mHg
	0.0 inHg	2036.0 inHg
	0.0 inH_2O	27680 inH_2O @ 4°C
	0.0 ftH_2O	2306.7 ftH_2O @ 4°C
	0.0 mH_2O	703.07 mH_2O @ 4°C
	0.0 bar	68.948 bar

Model	Minimum	Maximum
	0.0 MPa	6.8948 MPa
	0.0 kg/cm2	70.307 kg/cm2
	0.0 inH_2O	27707 inH_2O @ 60°F
700P09	0.0 psi	1500.0 psi
	0.0 mHg	77.573 mHg
	0.0 inHg	3054.0 inHg
	0.0 inH_2OO	41520 inH_2O @ 4°C
	0.0 ftH_2O	3460.0 ftH_2O @ 4°C
	0.0 kmH_2O	1.0546 kmH_2O @ 4°C
	0.0 bar	103.42 bar
	0.0 MPa	10.342 MPa
	0.0 kg/cm2	105.46 kg/cm2
	0.0 inH_2O	41561 inH_2O @ 60°F
700PV3 -	5.0000 psi	0.0psi
	-258.58 mmHg	0.0 mmHg @ 4°C
	-10.180 inHg	0.0 inHg @ 4°C
	-138.40 inH_2O	0.0 inH_2O @ 4°C
	-11.533 ftH_2O	0.0 ftH_2O @ 4°C
	-3.5153 mH_2O	0.0 mH_2O @ 4°C
	-344.74 mbar	0.0 mbar
	-34.474 kPa	0.0 kPa
	-351.53 g/cm2	0.0g/ cm2
	-138.54 inH_2O	0.0 inH_2O @ 60°F
700PV4	-15.000 psi	0.0 psi
	-775.73 mmHg	0.0 mmHg @ 4°C
	-30.540 inHg	0.0 inHg @ 4°C
	-415.20 inH_2O	0.0 inH_2O @ 4°C
	-34.600 ftH_2O	0.0 ftH_2O @ 4°C

Model	Minimum	Maximum
	-1.0546 mH_2O	0.0 mH_2O @ 4°C
	-1.0342 bar	0.0 bar
	-103.42 kPa	0.0 kPa
	-1.0546 kg/cm2	0.0 kg/cm2
	-415.61 inH_2O	0.0 inH_2O @ 60°F
700PD2	-1.0000 psi	1.0000 psi
	-51.715 mmHg	51.715 mmHg
	-1.0360 inHg	1.0360 inHg
	-27.680 inH_2O	27.680 inH_2O @ 4°C
	-2.3067 ftH_2O	2.3067 ftH_2O @ 4°C
	-703.07mmH_2O	703.07mmH_2O @ 4°C
	-6.8948 kPa	6.8948 kPa
	-68.948 mbar	68.948 mbar
	-70.307 g/cm2	70.307 g/cm2
	-27.707 inH_2O	27.707 inH_2O @ 60°F
700PD3 -	5.0000 psi	5.0000 psi
	-258.58 mmHg	258.58 mmHg
	-10.180 inHg	10.180 inHg
	-138.40 inH_2O	138.40 inH_2O @ 4°C
	-11.533 ftH_2O	11.533 ftH_2O @ 4°C
	-3.5153 mH_2O	3.5153 mH_2O @ 4°C
	-344.74 mbar	344.74 mbar
	-34.474 kPa	34.474 kPa
	-351.53 g/cm2	351.53 g/cm2
	-138.54 inH_2O	138.54 inH_2O @ 60°F
700PD4	-15.000 psi	15.000 psi
	-775.73 mmHg	775.73 mmHg
	-30.540 inHg	30.540 inHg

Model	Minimum	Maximum
	-415.20 inH_2O	415.20 inH_2O @ 4°C
	-34.600 ftH_2O	34.600 ftH_2O @ 4°C
	-1.0546 mH_2O	1.0546 mH_2O @ 4°C
	-1.0342 bar	1.0342 bar
	-103.42 kPa	103.42 kPa
	-1.0546 kg/cm2	1.0546 kg/cm2
	-415.61 inH_2O	415.61 inH_2O @ 60°F
700PD5	-30.000 psi	30.000 psi
	-1.5515 mHg	1.5515 mHg
	-61.081 inHg	61.081 inHg
	-830.40 inH_2O	830.40 inH_2O @ 4°C
	-69.200 ftH_2OO	69.200 ftH_2O @ 4°C
	-21.092 mH_2O	21.092 mH_2O @ 4°C
	-2.0684 bar	2.0684 bar
	-206.84 kPa	206.84 kPa
	-2.1092 kg/cm2	2.1092 kg/cm2
	-831.21 inH_2O	831.21 inH_2O @ 60°F
700PD6	-100.00 psi	100.00 psi
	-5.1715 mHg	5.1715 mHg
	-203.60 inHg	203.60 inHg
	-2768.0 inH_2O	2768.0 inH_2O @ 4°C
	-230.67 ftH_2O	230.67 ftH_2O @ 4°C
	-70.307 mH_2O	70.307 mH_2O @ 4°C
	-6.8948 bar	6.8948 bar
	-689.48 kPa	689.48 kPa
	-7.0307 kg/cm2	7.0307 kg/cm2
	-2770.7 inH_2O	2770.7 inH_2O @ 60°F
700PD7	-500.00 psi	500.00 psi

Model	Minimum	Maximum
	-25.858 mHg	25.858 mHg
	-1018.0 inHg	1018.0 inHg
	-13840 inH_2O	13840 inH_2O @ 4°C
	-1153.3 ftH_2O	1153.3 ftH_2O @ 4°C
	-351.53 mH_2O	351.53 mH_2O @ 4°C
	-34.474 bar	34.474 bar
	-3.4474 MPa	3.4474 MPa
	-35.153 kg/cm2	35.153 kg/cm2
	-13854 inH_2O	13854 inH_2O @ 60°F
700P29	0.0 psi	3000.0 psi
	0.0 mHg	155.15 mHg
	0.0 inHg	6108.1 inHg
	0.0 inH_2O	83040 inH_2O @ 4°C
	0.0 ftH_2O	6920.0 ftH_2O @ 4°C
	0.0 kmH_2O	2.1092 kmH_2O @ 4°C
	0.0 bar	206.84 bar
	0.0 MPa	20.684MPa
	0.0 kg/cm2	210.92 kg/cm2
	0.0 inH_2O	83121 inH_2O @ 60°F
700P30	0.0 psi	5000.0 psi
	0.0 mHg	258.58 mHg
	0.0 inHg	10180 inHg
	0.0k inH_2O	138.40 kinH_2O @ 4°C
	0.0 ftH_2O	11533 ftH_2O @ 4°C
	0.0 kmH_2O	3.5153 kmH_2O @ 4°C
	0.0 bar	344.74 bar
	0.0 MPa	34.474 MPa
	0.0 kg/cm2	351.53 kg/cm2

Model	Minimum	Maximum
	0.0 kinH_2O	138.54 kinH_2O @ 60°F
700P31	0.0 psi	10000 psi
	0.0 mHg	517.15 mHg
	0.0 inHg	20360 inHg
	0.0 kinH_2O	276.80 kinH_2O @ 4°C
	0.0 ftH_2O	23067 ftH_2O @ 4°C
	0.0 kmH_2O	7.0307 kmH_2O @ 4°C
	0.0 bar	689.48 bar
	0.0 MPa	68.948 MPa
	0.0 kg/cm2	703.07 kg/cm2
	0.0 kinH_2O	277.07 kinH_2O @ 60°F

Units Symbols

Units	Symbol Name
bar	bar
ftH2O	feet of water
g/cm2	grams per square centimeter
inH2O	inches of water
inHg	inches of mercury
mH2O	meters of water
mHg	meters of mercury
Pa	Pascal
Psi	pounds per square inch

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Pressure entered as: [*numeric*] [*prefix*] *units symbol*
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the temperature of the water.

- Temperature entered as *numeric*[*prefix*]degC or degF

Rules:

- The MOD1 field may specify temperature only when the NOMINAL field units are "inH2O", "ftH2O", or "mH2O".
- Allowed values are 4degC and 60degF.

MOD2

This field is enables and disables the filter.

- "FL" enable filter
- *blank* disable filter

MOD3

This field is used to zero a pressure module.

- "ZR" zero pressure module
- "RL" relative measurement to one taken with "ZR"
- *blank* not applicable

Rules:

- When the MOD3 field is "ZR" the Nominal field value must be zero.
- When the MOD3 field is "ZR" the MOD4 field must specify a Nominal
- When the MOD3 field is blank the outcome of executing the statement is determined by the type of test specified in the MOD4 field.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the model number of the 700 Series Pressure Module used.

CON	Model Number
P01	FLUKE-700P01
P02	FLUKE-700P02
P03	FLUKE-700P03
P04	FLUKE-700P04
P05	FLUKE-700P05
P06	FLUKE-700P06
P07	FLUKE-700P07
P08	FLUKE-700P08
P09	FLUKE-700P09
P22	FLUKE-700P22
P23	FLUKE-700P23
P24	FLUKE-700P24
P29	FLUKE-700P29
P30	FLUKE-700P30
P31	FLUKE-700P31
PA3	FLUKE-700PA3
PA4	FLUKE-700PA4
PA5	FLUKE-700PA5
PA6	FLUKE-700PA6
PD2	FLUKE-700PD2
PD3	FLUKE-700PD3
PD4	FLUKE-700PD4
PD5	FLUKE-700PD5
PD6	FLUKE-700PD6
PD7	FLUKE-700PD7

PV3	FLUKE-700PV3
PV4	FLUKE-700PV4

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON# --
--- Reset -----
  1.001  P700         *                                              S
# ----- Zero -----
  1.002  P700         0.00inH2O                    4degC             ZR N  P01
# ----- Evaluation (Relative to zero measurement) -----
  1.003  P700   10    5.00inH2O      0.15U         4degC             RL    P01
  2.001  P700         0.0inH2O                     60degF            ZR N  P23
  2.002  P700         35.0inH2O      1.0U          60degF            RL    P23
  3.001  P700         0.000psi                                    FL ZR N  P02
  3.002  P700         0.300psi       4%                           FL RL    P02
  4.001  MEMI         Enter zero value for 700PA5 absolute pressure module.
  4.002  P700         mmHg                                        FL ZR N  PA5
  4.003  P700   1000  754mmHg        2/                           FL RL    PA5
  5.001  P700         0kg/cm2                                        ZR N  PV4
# ----- Setup Test -----
  5.002  P700         -1.0kg/cm2                                     RL S  PV
```

PIC

Display Control FSC

Description

The PIC FSC displays a picture during procedure execution. Pictures, which may include text, are used to provide instructions to the operator. Pictures are used instead of text-only instructions to the operator in cases where a detailed description of a required connection, or adjustment is difficult to present in text-only form.

Pictures displayed by MET/CAL are ".BMP" files. The Windows "Paintbrush" application may be used to create pictures.

Format

PIC [*picture file*] [*position/color*] [*text*]

Rules

- Text can be superimposed on the picture. Superimposed text can be located anywhere on the screen, with a number of foreground and background colors.
- A PIC statement consists of one or more PIC lines. The first PIC line must contain the name of the picture file. Subsequent lines, if any, are used to specify text to be overlaid on the picture.
- Each PIC line may specify at most 1 text string.
- A PIC line has the format:

PIC [*picture file*] [*position/color*] [*text*] (Square brackets indicate optional subfields.)

1. The *picture file*, *position/color*, and *text* subfields may be entered in any order.
2. Rules for the *picture file* subfield:

   This subfield is a single word, which specifies the base file name (no .BMP or any other extension) of the picture file to be displayed. The length cannot exceed 8 characters. The name cannot contain parentheses, double quotes, or blanks. The file name must be specified if the line is the first line of the PIC statement, and cannot be specified, if the line is not the first line.
3. Rules for the *position/color* subfield:

This subfield specifies the row and column at which to position the first character of the text string, as well as the foreground and background colors in which to display the text string.

The subfield has the format:

([*row*],[*col*],[*color*])

The enclosing parentheses must be included in the subfield.

row specifies the row on which to display the text string. It is an integer between 0 and 23, or a '+' sign.

col specifies the column at which to start the text string. It is an integer between 0 and 79, or a '+' sign.

In MET/CAL 4.0, the row and column positions are scaled to fit the size of the displayed picture. Even if the picture is very small, it is still considered to consist of 24 rows X 80 columns for purposes of positioning text overlays. However, since the font used to display the text is not scaled with the picture, care must be taken to ensure that adjacent rows of text do not overlap.

color has the format *fg*/*bg* where:

fg has the format: ['L']|['l'] *color base*

bg has the format: ['L']|['l'] *color base.*

color base is one of the following:

B - blue
BL - black
BR - brown
C - cyan
G - green
M - magenta
R - red
W - white

These codes indicate a high intensity color. To specify a low intensity, precede the color code with 'L' or 'l'.

The entire subfield may be omitted, but, if it is not, the parentheses and all commas are required.

The default: *row* = 0, *col* = 0, *color* is BL/W. The default is used when a specification is not included on the first line of a multiline PIC statement. On a line other than the first line, a missing specification causes the current value for that statement to be used.

If *row* is '+', the current row for the PIC statement is incremented by 1. If the current row is already 23, *row* is set to 0. If *column* is '+', the current column for the PIC statement is set to the column following the end of the previously displayed text string. If this is 79, the current column is set to 0.

4. Rules for the *Text* subfield:

   The format is "*text*"

   Note that the double quotes must be included in the PIC statement. The length of the text string cannot exceed 54 (not counting the double quotes). In many cases however, the length is further limited by the fact that the PIC FSC is a display control-type FSC and the length of the body of a PIC line is limited to 56 characters.

   The text string can contain double quote "'" characters. The last double quote on the line terminates the text string.

   Example:

   ```
   PIC (5,5,B/G) "Select "Volts""
   ```

   The text which will appear on the picture is: Select "Volts".

5. Interfield Dependencies

   It is illegal to specify a text string, which, when displayed at the specified position, goes beyond column 79. In some cases this error is not detected until run time.

- Execution of a PIC Statement Execution of a multiline PIC statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

  1. The extension '.BMP' is added to the filename of the picture, and the path specified in the initialization file by the line 'picdir = ' is prepended to the filename. The specified picture file is read and displayed.
  2. All specified text strings are displayed. Execution of an empty PIC line has no effect.
  3. "Advance" and "Terminate" buttons are shown in the window in which the picture is displayed.

- If the picture file is not found, or is corrupted, an error occurs and the user is presented with the Post Test dialog. If a picture file is not present, the procedure will not start.

Compatibility

MET/CAL 4.0 does not support interactive entry of text data to be overlaid on a displayed picture. Procedure writers are encouraged to include text as an integral part of the picture itself. In other words, when a picture is created (using, for example, Windows Paintbrush) any needed text should be created as part of the picture, not subsequently overlaid on the picture by adding text to the PIC statement in a MET/CAL procedure. This approach allows flexible text positioning, color selection, and font selection.

For compatibility with previous versions of MET/CAL, overlaid text is supported when it is entered directly in a PIC statement. However, it may be difficult to determine the proper row and column position for the text overlay.

The procedure writer should be aware that the relative position of overlaid text in a picture changes when the picture is scaled down or up.

If an existing picture is reduced in size, space available for each row of overlaid text is correspondingly reduced. This can result in a situation in which a displayed text row is partially overwritten by the next row.

Examples

```
2.005 PIC     OnePict
3.005 PIC     psm-45 (1,47,LR/G) "Adjust R227 for a"
3.005 PIC     (2,47,LR/G) "UUT reading of 190.0mV."
12.005 PIC    psm-45 (3,6,LR/LG) "Adjust R 206 for a"
12.005 PIC    (4,6,LR/LG) "UUT reading of 0.00mV."
```

PICE

Evaluation FSC

Description

The PICE FSC displays a picture during procedure execution. The PICE FSC is similar to the PIC FSC. The difference is that PICE is an evaluation FSC. When a PICE statement is executed, the operator is presented with the choices: YES, NO, and TERMINATE.

The operator may choose YES to indicate PASS, NO to indicate FAIL, or TERMINATE to abort the PICE statement.

Pictures, which may include text, are used to provide instructions to the operator. Pictures are used instead of text-only instructions to the operator in cases where a detailed description of a required connection, or adjustment is difficult to present in text-only form.

Pictures displayed by MET/CAL are ".BMP" files. The Windows "Paintbrush" application may be used to create pictures.

Format

PICE [*picture file*] [*position/color*] [*text*]

Rules

- Text can be superimposed on the picture. Superimposed text can be located anywhere on the screen, with a number of foreground and background colors.
- A PICE statement consists of one or more PICE lines. The first PICE line must contain the name of the picture file. Subsequent lines, if any, are used to specify text to be overlaid on the picture.
- Each PICE line may specify at most 1 text string.
- A PICE line has the format:

  PICE [*picture file*] [*position/color*] [*text*]

  (Square brackets indicate optional subfields.)

  1. The *picture file*, *position/color*, and *text* subfields may be entered in any order.
  2. Rules for the *picture file* subfield: This subfield is a single word, which specifies the base file name (no .BMP or any other extension) of the picture file to be displayed. The length cannot exceed 8 characters. The

name cannot contain parentheses, double quotes, or blanks. The file name must be specified if the line is the first line of the PICE statement, and cannot be specified, if the line is not the first line.

3. Rules for the *position/color* subfield:

   This subfield specifies the row and column at which to position the first character of the text string, as well as the foreground and background colors in which to display the text string.

   The subfield has the format:

   ([*row*],[*col*],[*color*])

   The enclosing parentheses must be included in the subfield.

   row specifies the row on which to display the text string. It is an integer between 0 and 23, or a '+' sign.

   col specifies the column at which to start the text string. It is an integer between 0 and 79, or a '+' sign.

   In MET/CAL 4.0, the row and column positions are scaled to fit the size of the displayed picture. Even if the picture is very small, it is still considered to consist of 24 rows X 80 columns for purposes of positioning text overlays. However, since the font used to display the text is not scaled with the picture, care must be taken to ensure that adjacent rows of text do not overlap.

   color has the format *fg*/*bg* where:

   fg has the format: ['L']|['l'] *color base bg* has the format: ['L']|['l'] *color base*

   color base is one of:

   B - blue
   BL - black
   BR - brown
   C - cyan
   G - green
   M - magenta
   R - red
   W - white

   These codes indicate a high intensity color. To specify a low intensity, precede the color code with 'L' or 'l'.

   The entire subfield may be omitted, but, if it is not, the parentheses and all commas are required.

The default: *row* = 0, *col* = 0, *color* is BL/W. The default is used when a specification is not included on the first line of a multiline PICE statement. On a line other than the first line, a missing specification causes the current value for that statement to be used.

If *row* is '+', the current row for the PICE statement is incremented by 1. If the current row is already 23, *row* is set to 0. If *column* is '+', the current column for the PICE statement is set to the column following the end of the previously displayed text string. If this is 79, the current column is set to 0.

4. Rules for the *Text* subfield:

   The format is "*text*"

   Note that the double quotes must be included in the PIC statement. The length of the text string cannot exceed 54 (not counting the double quotes). In many cases however, the length is further limited by the fact that the PICE FSC is a display control-type FSC and the length of the body of a PICE line is limited to 56 characters.

   The text string can contain double quote "'' characters. The last double quote on the line terminates the text string.

   Example:

   ```
   PICE (5,5,B/G) "Select "Volts""
   ```

   The text which will appear on the picture is: Select "Volts".

5. Interfield Dependencies

   It is illegal to specify a text string, which, when displayed at the specified position, goes beyond column 79. In some cases this error is not detected until run time.

- Execution of a PICE Statement

  Execution of a multiline PICE statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

  1. The extension '.BMP' is added to the filename of the picture, and the path specified in the initialization file by the line 'picdir = ' is prepended to the filename. The specified picture file is read and displayed.
  2. All specified text strings are displayed. Execution of an empty PICE line has no effect.
  3. "Yes", "No", and "Terminate" buttons are shown in the window in which the picture is displayed.

If the operator chooses "Yes":

the test is a PASS MEM1 is set to 1

If the operator chooses "No":

the test is a FAIL MEM1 is set to -1

If the operator chooses "Terminate":

the PICE statement is aborted the Post Test dialog appears

Execution of a multiline PICE statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

Unlike the EVAL FSC, PICE does not support the [N] special construction. With PICE there is no way to invert the sense of the YES/NO question. YES always indicates PASS and NO always indicates FAIL.

Note that since PICE sets MEM1 to +1 or -1, a subsequent JMPT of JMPF statement may be used to jump to a desired procedure location based on whether the test was a PASS or a FAIL.

- If the picture file is not found, or is corrupted, an error occurs and the user is presented with the Post Test dialog. If a picture file is not present, the procedure will not start.

Compatibility

MET/CAL 4.0 does not support interactive entry of text data to be overlaid on a displayed picture. Procedure writers are encouraged to include text as an integral part of the picture itself. In other words, when a picture is created (using, for example, Windows Paintbrush) any needed text should be created as part of the picture, not subsequently overlaid on the picture by adding text to the PICE statement in a MET/CAL procedure. This approach allows flexible text positioning, color selection, and font selection.

For compatibility with previous versions of MET/CAL, overlaid text is supported when it is entered directly in a PICE statement. However, it may be difficult to determine the proper row and column position for the text overlay.

The procedure writer should be aware that the relative position of overlaid text in a picture changes when the picture is scaled down or up.

If an existing picture is reduced in size, space available for each row of overlaid text is correspondingly reduced. This can result in a situation in which a displayed text row is partially overwritten by the next row.

Examples

```
2.005     PICE    OnePict
3.005     PICE    psm-45 (1,47,LR/G) "Adjust R227 for a"
3.005     PICE    (2,47,LR/G) "UUT reading of 190.0mV."
12.005    PICE    psm-45 (3,6,LR/LG) "Adjust R 206 for a"
12.005    PICE    (4,6,LR/LG) "UUT reading of 0.00mV."
```

PORT

Interface Control FSC

Description

The PORT FSC is used to transfer data through serial (RS232-C) ports.

Serial ports which may be used are COM1, COM2, COM3, COM4, COM5500, COM5520, COM5800, and COM5820. "COM5500" designates the 5500A UUT port, and is available only if the system includes a Fluke 5500A. "COM5520" designates the 5520A UUT port, and is available only if the system includes a Fluke 5520A. "COM5800" designates the 5800A UUT port, and is available only if the system includes a Fluke 5800A. "COM5820" designates the 5820A UUT port, and is available only if the system includes a Fluke 5820A.

Availability of the other serial ports depends on the PC. Most PCs have COM1 and COM2, although many systems use COM1 for a mouse.

Format

PORT *message*

Rules

- Default Port

  The "port" parameter in the MET/CAL initialization file "metcal.ini") is used to designate a default serial port. This may be COM1, COM2, COM3, COM4, COM5500, COM5520, COM5800, COM5820, or NONE. The port designated in the initialization file is used by PORT statements in procedures which do not otherwise specify a serial port.

- Default Configuration

  Default configuration for all serial ports except COM5500, COM5520, COM5800, and COM5820 is maintained by Windows. This information may be accessed or modified by selecting "Ports" in the Windows "Control Panel".

  If the default serial port is COM5500, COM5520, COM5800, or COM5820, there is no provision for specifying a default configuration. In other words, the default is the setting
  maintained by the corresponding Fluke calibrator (5500A, 5520A, 5800A, or 5820A).

  When a MET/CAL procedure executes, each serial port required by the procedure is initially set to the specified default configuration.

- PORT Statement

The *message* of each PORT statement specifies one or both of the following:

1. Data to be written to the currently addressed serial port.
2. Special constructions which control read from, configuring or addressing a serial port, or provide functions not related to the serial port. Special constructions are delimited by square brackets ('[' ... ']').

- The body of each PORT line may contain up to 56 characters. A PORT statement may consist of multiple PORT lines.

  There are two ways to indicate that a line is a continuation line. The first way is to assign the same step number to consecutive PORT lines. The second way is to mark the line as a continuation line by using the Edit : Continue function (F7) in the MET/CAL editor. (The procedure compiler will then automatically assign identical step numbers to continuation lines.)

- Output Messages: Alphanumeric characters which are not part of a special construction are written directly to the serial port. Example: "PORT abc[13]" causes the string "abc", followed by a Carriage Return terminator, to be written to the UUT.

- Message Termination

  1. Termination of Input Messages:

     By default, MET/CAL considers any character which precedes the space character (HEX 20) in the ASCII sequence to be a message terminator. The termination character is usually a CR (Carriage Return) or LF (Linefeed).

     By using the TERM special construction, described below, the procedure writer can specify a single character terminator. A terminator specified using the TERM special construction remains in effect until it is changed or reset, and affects all serial I/O controlled by PORT statements in the procedure, even if more than one serial port is used. It does not affect serial I/O done by MET/CAL's built-in device drivers, nor does it affect serial I/O specified in RESET statements.

  2. Termination of Output Messages:

     Message termination depends on the requirements of the serial device. In general, the message must be terminated by a CR or LF, or both. This may be accomplished by including the necessary terminators in the output message using the special constructs:

     ```
     [13] for CR
     [10] for LF
     ```

     Another way to specify the output terminator is to use the "OTERM" "special construction". A terminator specified using the OTERM

construction applies to all subsequent serial output using PORT statements with the executing procedure (including any called subprocedures), until the output terminator is changed or reset.

3. Braces and Brackets

   Braces ('{' and '}') and square brackets ('[' and ']') cannot be entered literally, since they are used to define special constructions for the PORT FSC (see below). Use the [*numeric*] special construction (described below) include braces and brackets in the output message.

4. Including Brace Data in Results

   Text in a PORT statement enclosed in braces is copied literally to the results file. Special constructions embedded in the brace data are not evaluated before the enclosed text is transferred to the results file.

   Example:

   ```
   PORT {abc[MEM]xyz}
   ```
   The literal string "abc[MEM]xyz" is written to the results file. [MEM] is not replaced with the value of MEM.

- Special Constructions

  The PORT FSC supports the following special constructions:

  1. [@ port] select port as current port
  2. [CLR] flush receive queue of current port
  3. [CLR ON|OFF] enable/disable auto flush of receive queue
  4. [D *delay*] delay execution for *delay* milliseconds
  5. [I] read number from current port, store in MEM
  6. [I$] read string from current port, store in MEM2
  7. [I > file] read from current port, write to file
  8. [I >> file] read from current port, append to file
  9. [I!] read from current port, discard data
  10. [MEM] write value of register MEM to current port
  11. [MEM1] write value of register MEM1 to current port
  12. [MEM2] write value of register MEM2 to current port
  13. [*numeric*] write number (ASCII) to current port
  14. [O <file] read from file, write to current port

15. [P *params*] configure port
16. [T *timeout*] set timeout for current port
17. [V *variable*] write value of *variable* to current port
18. [REOPEN] close and re-open current port
19. [M *nreg*] write value of numeric register *nreg* to current port
20. [S *sreg*] write value of string register *sreg* to current port
21. [SREG *sreg*] write value of string register *sreg* to current port
22. [TERM *n*|*'c'*|CR|LF|NONE|OFF] set input terminator
23. [OTERM *n*] set output terminator
    [OTERM *'c'*]
    [OTERM CR]
    [OTERM LF]
    [OTERM CRLF]
    [OTERM NONE]
    [OTERM OFF]

Each special construction is described in detail below.

1. Port Addressing

   The [*@ port*] special construction is used to select the current port.

   For example, the statement "PORT [@COM1]abc[@COM2]xyz" first writes "abc" to COM1, then write "xyz" to COM2.

   port may be COM1, COM2, COM3, COM4, COM5500, COM5520, COM5800, COM5820, or a valid device alias. Device aliases are specified in the System Configuration File (usually named "config.dat"). (Type F12 in the MET/CAL Editor to modify the system configuration.)

   Like the IEEE FSC, the PORT FSC distinguishes between the UUT port and the system port. If the [*@ port*] construction specifies a literal COM port name (e.g., COM1), the specified port becomes the UUT port and the system port. All subsequent serial I/O performed by PORT statements in the current procedure will use the specified port (until changed using a subsequent [*@ port*] special construction). On the other hand, if the [*@ port*] specifies a port by way of an alias, only the system port is changed. This address remains in effect only for the current PORT statement (which may be a multi-line statement). The following example clarifies the distinction:

```
1.001  PORT  [@COM1]aaa
1.002  PORT  [@45]bbb
```

```
1.002  PORT  ccc
1.003  PORT  ddd
```

The procedure above causes the following sequence of events to occur:

a. When the first line executes, "aaa" is written to COM1.

b. When the second line executes, "bbb" is written to the device whose alias is "45".

c. When the third line executes, "ccc" is written to the device whose alias is "45". Note that this line is a continuation line.

d. When the last line executes, "ddd" is written to COM1. Since line 1.003 begins a new PORT statement, and does not specify a serial port address, the current address returns to the UUT port specified in 1.001.

When a procedure begins execution, the UUT port is the port designated by the "port" parameter in the initialization file. All serial I/O controlled by PORT statements refers to this default port, unless the procedure specifies otherwise.

Example:

```
1.001  PORT aaa
1.002  PORT [@45]bbb
1.003  PORT ccc
1.004  PORT [@COM1]ddd
1.005  PORT eee
```

Suppose the initialization file contains the line: port = COM2 The procedure above causes the following sequence of events to occur:

e. When 1.001 executes, "aaa" is written to COM2 (the default port).

f. When 1.002 executes, "bbb" is written to the device whose alias is "45".

g. When 1.003 executes, "ccc" is written to COM2 (the default port).

h. When 1.004 executes, "ddd" is written to COM1. COM1 becomes the current UUT port.

When 1.005 executes, "eee" is written to COM1, which is now the current UUT port (as a result of 1.004).

2. Clearing the Input Buffer

The [CLR] special construction causes the serial port input buffer for the current port to be immediately cleared. Any unread characters in the input buffer are simply discarded.

Note

Some UUTs may use a protocol designed for communication with a terminal, rather than under program control. Such UUTs may generate a "ready-for-command" prompt string. In such cases the [CLR] special construction can be used to flush the input buffer. An alternative to the [CLR] construction is to use [I$] to simply read (and discard) the prompt string. This method may be better than [CLR] in cases where timing is uncertain and it is necessary to wait for the prompt string to become available.

3. Enabling / Disabling Automatic Input Buffer Clearing

   The [CLR OFF] special construction is used to disable automatic clearing of the input buffer after each terminated message is read. [CLR OFF] is the default. That is, each procedure begins execution with automatic clearing disabled. The [CLR ON] special construction is used to enable automatic clearing of the serial port input buffer after each terminated message is read. A [CLR ON] or [CLR OFF] special construction remains in effect until procedure execution terminates, or a subsequent [CLR ON] or [CLR OFF] special construction is executed.

   [CLR ON] is supported for compatibility with previous versions of MET/CAL. Procedure writers using the PORT FSC should be aware that it may be difficult to obtain reliable results when automatic buffer clearing is enabled. The difficulty is due to a lack of synchronization between clearing the input buffer and reading characters sent by the serial instrument. In other words, at the time the buffer is cleared, some or all of the characters may not yet have been read. Timing depends on the baud rate, the speed of the PC, and other hardware and software parameters.

   The best way to deal with a serial instrument which sends messages containing embedded terminators is to leave automatic buffer clearing disabled ([CLR OFF]) and explicitly read each terminated data message.

   Example:

   Suppose the UUT response is:

   ```
   90E-2<CR><LF>=><CR><LF>
   ```

   The Fluke 45 is an example of an instrument which sends such a response. From the Fluke 45's point of view the response contains two terminated

messages. The terminator is CR LF. Notice, however, that the response is seen by MET/CAL as 4 distinct messages:

a. 90E-2 CR

b. LF

c. CR

d. LF

A MET/CAL procedure fragment which illustrates how to deal with this response:

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3
4 CON
     4.001  HEAD         {DIRECT VOLTAGE PERFORMANCE VERIFICATION}
     4.002  PORT         TRIGGER 3;VDC;RATE S;RANGE 1[10]
     4.003  DISP         [32] Connect 5500A and UUT as follows.
     4.003  DISP         [32]    5500A NORMAL HI to 45 V Ohm
     4.003  DISP         [32]    5500A NORMAL LO to 45 COM
     4.004  5500         0.000mV
   S  2W
     4.005  PORT         *TRG;VAL1?[10][I]
     4.006  MATH         MEM = MEM * 1000
     4.007  MEME
     4.008  MEMC   100   mV             0.006U
     5.001  5500         90.000mV
   S  2W
     5.002  PORT         [CLR]*TRG;VAL1?[10][I]
     5.003  MATH         MEM = MEM * 1000
     5.004  MEME
     5.005  MEMC   100   mV             0.024U
```

In this example the UUT is a Fluke 45. The first PORT statement sets up the UUT. The seconds PORT statement (4.005) triggers a reading and reads the response. The second 5500 setup statement (5.001) provides a sufficient delay so that when the third PORT statement (5.002) executes the remaining characters sent by the Fluke 45 (LF=CR LF) are already in the input buffer. The third PORT statement then clears the input buffer (using the [CLR] construction), thus discarding the characters in the input buffer. At that point the third PORT statement triggers and reads a second reading.

In some procedures it may be necessary to use the delay construction in a procedure to ensure that sufficient time elapses before the [CLR] construction is executed. This depends on the baud rate, the length of the message being read from the serial instrument, and the inherent delay

caused by the procedure statements between the reading of the response up to the first terminator and triggering the next response.

4. Delay

   The special construction [D *numeric*] is used to specify a delay in milliseconds. The specified number of milliseconds must be between 0 and 32767. When MET/CAL evaluates a [D *numeric*] special construction it simply pauses for the specified number of milliseconds before proceeding with any subsequent input or output specified in the PORT statement.

   Example:

   ```
   PORT CMD1[13][D1000][I]
   ```

   In this example the string "CMD1", followed by a CR, is written to the current port. A one second delay then occurs, after which a value is read from the device attached to the current port.

5. Numeric Input

   The [I] special construction is used to perform numeric input from the current serial port. When an [I] special construction is encountered in a PORT statement, MET/CAL reads a string from the serial device, strips leading non-numeric characters from the string, converts the numeric part of the string to a floating-point value, and stores the result in the memory register MEM. The prior value in MEM is overwritten. Non-numeric characters, if any, which follow the numeric portion of the string are ignored.

   See also the section on message termination.

6. String Input

   The [I$] special construction is used to perform string input from the current serial port. When an [I$] special construction is encountered in a PORT statement, MET/CAL reads a string (up to 4096 characters) from the serial device, and stores the string in the memory register MEM2. The prior contents of MEM2 are overwritten. If the input string is too long for MEM2, an error message is generated.

   See also the section on message termination.

7. Reading from a UUT and Writing to a File

   The [I > *filename*] special construction causes MET/CAL to read from the device connected to the current serial port, and write the characters read to the specified file. If the specified file already exists, it is overwritten. MET/CAL does

not restrict the length of the input message when the [I > *filename*] special construction is used. For complex messages which exceed the length of MEM2, this special construction can be used in conjunction with a user-written program, called by a DOS or DOSE FSC, to parse and evaluate the input string.

See also the section on message termination.

8. Reading from a UUT and Appending to a File

   The [I >> *filename*] special construction causes MET/CAL to read from the device connected to the current serial port, and append the characters read to the specified file. If the specified file does not exist, it is created. MET/CAL does not restrict the length of the input message when the [I >> *filename*] special construction is used. For complex messages which exceed the length of MEM2, this special construction can be used in conjunction with a user-written program, called by a DOS or DOSE FSC, to parse and evaluate the input string.

   See also the section on message termination.

9. Reading from a Serial Instrument and Discarding the Data

   This construction is the same as [I$], except that the data message read from the instrument is not stored in MEM2, or any other MET/CAL register. [I!] is appropriate only when it is necessary to read and discard a data message.

   Example:

   ```
   PORT [@DMM]REMS;FUNC1?[10][I$][I!]
   ```

   In this example, the serial instrument (a DMM with the address alias "DMM") requires a linefeed terminator. This is why the command "REMS;FUNC1?" is followed by "[10]" -- 10 is the decimal representation of the ASCII linefeed character.

   The first part of the response is read into MEM2 using the [I$] construction. However, supposing the instrument terminates its message with CR (carriage return) and LF (linefeed), the LF is read and discarded using the [I!] construction.

10. Including Memory Register MEM in Output Messages

    The special construction [MEM] causes the contents of the MEM register to be included in the output message. (The value of MEM is converted to ASCII form before being written to the serial device.)

11. Including Memory Register MEM1 in Output Messages

The special construction [MEM1] causes the contents of the MEM1 register to be included in the output message. (The value of MEM1 is converted to ASCII form before being written to the serial device.)

12. Including Memory Register MEM2 in Output Messages

    The special construction [MEM2] causes the contents of the MEM2 string register to be included in the output message.

13. Including Special or Non-Printable Characters in Output Messages

    The [*numeric*] special construction may be used to specify the decimal value of any ASCII character. This is useful for characters which have special significance to the PORT FSC (e.g., '{', '}', '[', ']'), as well as for non-printable characters (e.g., CR, LF).

    Examples:

    ```
    PORT [13]  - write Carriage Return (CR)
    PORT [10]  - write Linefeed (LF)
    PORT [91]  - write Left Bracket ('[')
    PORT [93]  - write Right Bracket (']')
    PORT [123] - write Left Brace ('{')
    PORT [125] - write Right Brace ('}')
    ```

14. Transferring Data from a File to the UUT

    The [O < *filename*] special construction causes MET/CAL to read data from the specified file, and write it to the current serial port. This special construction may be useful when the message to be sent to the UUT is too long for MEM2 (which has a maximum string length of 4096). *filename* in the above special construction is to be replaced with the actual name of an MS-DOS file containing the data to be written to the UUT.

15. Port Configuration

    The special construction [P[*port*,] *baud rate, parity, data bits, stop b*its, *handshake*] is used to configure a serial port. When MET/CAL evaluates a Port Configuration special construction, it overrides the default configuration parameters specified in the Windows Control Panel or, for COM5500, COM5520, COM5800, or COM5820, in the corresponding Fluke calibrator (5500A, 5520A, 5800A, or 5820A). The new configuration remains in effect until procedure termination, or until a subsequent Port Configuration special construction is executed.

    For COM5500 the new configuration remains in effect until changed using the front panel of the Fluke 5500A or until a subsequent Port Configuration special construction for COM5500 is executed.

For COM5520 the new configuration remains in effect until subsequent Port Configuration special construction for COM5520 is executed.

For COM5800 the new configuration remains in effect until changed using the front panel of the Fluke 5800A or until a subsequent Port Configuration special construction for COM5800 is executed. For COM5820 the new configuration remains in effect until changed using the front panel of the Fluke 5820A or until a subsequent Port Configuration special construction for COM5820 is executed.

The following table shows the allowed values for the 6 parameters:

PARAMETER	VALUES
port	COM1, COM2, COM3, COM4, COM5500, COM5520, COM5800, COM5820, or blank This parameter is optional. If omitted, the currently addressed port is configured. Specifying the port in this special construction does not select it as the current port. If *port* is not specified, the following comma must be omitted.
baud rate	50, 75, 110, 134, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600,4800, 7200, 9600, 19200, 38400, 56000,128000, 256000 The procedure writer must ensure that the specified baud rate is compatible with the serial instrument and the PC serial interface. If the serial port being configured is COM5500, COM5520, COM5800, or COM5820 the baud rate is further restricted to 300, 600, 1200, 2400, 4800 or 9600. Specifying a baud rate which would be legal for COM1, COM2, COM3, or COM4, but is illegal for COM5500, COM5520, COM5800, or COM5820 results in a run time error when the PORT statement is executed.

parity	'N' (none), 'E' (even), 'O' (odd), 'M' (mark), 'S' (space)
data bits	5, 6, 7, 8
stop bits	1, 2
handshake	'X' (X-ON/X-OFF) 'H' (hardware - using RTS & CTS) 'D' (hardware - using DTR & DSR) 'N' (none)

Examples:

```
[P1200,N,8,1,N]
[PCOM2,9600,E,7,1,X]
```

If a parameter is omitted, the value is not changed. For example, "[P9600,,,,]" changes only the baud rate.

Except for the optional *port* designator (first parameter), the commas which separate the fields must always be specified.

16. Time-Out

    The [T *number*] special construction is used to set the time-out for the current port, in milliseconds. The *number* must be an integer between 0 and 32767. A response from the UUT is expected within the specified time.

    On output, a timeout will occur if the serial device being written to fails to accept a character within the specified time.

    Setting the time-out to zero ("PORT [T0]") disables the time-out, i.e., the PORT statement will never time-out. When a MET/CAL procedure starts, the time-out is initialized to zero (infinite). If it is then set by the procedure, it retains the new value until it is re-set or the procedure terminates.

    For hardware handshaking, an infinite timeout on output is not supported. The receiving device must accept each character within 65535 milliseconds.

Note also that when a procedure is re-started from the editor (using Control-R), the PORT time-out is not re-initialized to zero.

17. Including the Value of a MET/CAL Variable in the Output Message

    The special construction [V *variable name*] evaluates to the value of the specified variable. The variable must, at run time, be present in the MET/CAL variable file (default name "VARIABLE.DAT").

    Example:

    ```
    PORT [V DATE$]?
    ```

18. Re-Open Current Port

    The special construction [REOPEN] causes the current serial port to be closed and re-opened. It is re-opened in a way which preserves the current configuration (baud rate, etc.). If the current port is not already open, or is COM5500, COM5520, COM5800, or COM5820, the [REOPEN] construction has no effect.

    This construction is support in MET/CAL V5.0 and later.

    It may be useful as a way to clear pending error conditions on UUTs with unreliable serial interfaces.

    Example:

    ```
    PORT [REOPEN]
    ```

19. Including a Numeric Register Value in Output Messages

    The special constructions [M1], [M2], ..., [M255] cause the contents of the specified numeric register to be included in the output message. (The register value is converted to ASCII before being written to the serial device.) The numeric value may include up to 12 significant digits. See the MATH FSC on-line help for more information on the numeric registers.

    Example:

    ```
    PORT [M5]
    ```

20. Including a String Register Value in Output Messages

    The special constructions [S1], [S2], ..., [S255] cause the contents of the specified string register to be included in the output message. See the MATH FSC on-line help for more information on the string registers.

    Example:

    ```
    PORT [S12]
    ```

21. Including a String Register Value in Output Messages (SREG Form)

    The special constructions [SREG1], [SREG2], ..., [SREG255] cause the contents of the specified string register to be included in the output message. See the MATH FSC on-line help for more information on the string registers.

    The constructions [SREG1], [SREG2], ..., [SREG255] are identical to [S1], [S2], ..., [S255], and are included in the PORT FSC only for compatibility with the IEEE FSC.

    Example:

    ```
    PORT [SREG23]
    ```

22. Specifying the Input Terminator

    The TERM special construction has a number of different forms:

[TERM *n*]	sets input terminator to number *n* (ASCII)
[TERM *'c'*]	sets input terminator to *c* (character)
[TERM CR]	sets input terminator to Carriage Return
[TERM LF]	sets input terminator to Linefeed
[TERM NONE]	sets default input terminator (< HEX 20)
[TERM OFF]	sets default input terminator (< HEX 20)

    A procedure which does not specify the input terminator uses default input termination. The default is that any character less than 20 (hex) is considered an input message terminator. Thus, if a serial instrument always terminates its message with CR+LF, two input operations are required to fully read the response. The first input operation reads the response up to and including the CR (carriage return), and the second input operation reads the LF (linefeed).

    A procedure which specifies an input terminator in a PORT statement does not affect serial input done by MET/CAL's built-in device drivers.

    A specified input terminator does affect, however, all subsequent read operations initiated by PORT statements.

    The input terminator is not specific to a particular serial port.

    For example:

    ```
    PORT [TERM LF]
    PORT [@COM1][I$]
    PORT [@COM2][I$]
    ```

In the example above, the [TERM LF] applies to input from both COM1 and COM2.

There is no interaction between the input terminator specified in a PORT statement and the input terminator for read operations set up by RESET statements. A procedure writer who wishes to use the RESET FSC to reset a user-configured serial instrument should specify the input terminator in the RESET statement for the instrument, or rely on default input termination when the RESET command is executed.

The '@' character cannot be used as an input terminator.

23. Specifying the Output Terminator

    The OTERM special construction has a number of different forms:

[OTERM *n*]	sets output terminator to number *n* (ASCII)
[OTERM *'c'*]	sets output terminator to *c* (character)
[OTERM CR]	sets output terminator to Carriage Return
[OTERM LF]	sets output terminator to Linefeed
[OTERM CRLF]	sets output terminator to CR + LF
[OTERM NONE]	disables the output terminator
[OTERM OFF]	disables the output terminator

    A procedure which does not specify the output terminator must append the necessary terminator to each data message written to the serial device.

    A procedure which specifies an output terminator in a PORT statement does not affect serial output done by MET/CAL's built-in device drivers, nor does it affect serial output done using the RESET FSC.

    A specified terminator does affect, however, all subsequent write operations initiated by PORT statements.

    The terminator is not specific to a particular serial port.

    Example:

```
PORT [OTERM LF]
PORT [@COM1]ABC
PORT [@COM2]DEF
```

    In the example above, the [OTERM LF] applies to output to both COM1 and COM2.

    There is no interaction between the output terminator specified in a PORT statement and the output terminator set up by RESET statements. A procedure writer who wishes to use the RESET FSC to reset a user-configured serial instrument should specify the output terminator in the RESET statement for the instrument. This can be done by using the

OTERM special construction, or by simply appending the required termination characters to the reset command.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2
3  4 CON
  2.005  PORT         [P1200,N,8,1,N][T3000]V?[I]
  2.006  PORT         [D1000]Get[I]
```

RESET

Interface Control FSC

Description

The RESET FSC is used to specify reset commands for user-configured instruments or for a UUT.

The RESET FSC may be used with both IEEE-488 and serial instruments.

The execution of a RESET statement saves the specified command in internal memory. The command is executed in the following situations:

1. After each evaluation step, unless system instrument reset is disabled using ASK- Q.
2. After an error during procedure execution.
3. After procedure termination.

Format

RESET [*address*] [*command*]

Rules

- Allowed Number of Lines Per Statement

  Each RESET statement is limited to a single line.

- Allowed Number of Commands Per Address

  For each address, at most one RESET command is active at a particular time.

- Allowed Number of Addresses Per Statement

  Unless the RESET statement applies to the UUT, each RESET statement must specify a single address, and the address must precede the RESET command.

  If the RESET statement applies to the UUT, the address may be omitted. MET/CAL will automatically send the specified reset command to the UUT when system instruments are reset.

- Resetting UUTs

  The RESET statement is designed to be used with user-configured instruments or with UUTs.

  One way to reset a UUT is to specify the UUT address in the RESET statement. This works, but makes the procedure less portable.

A better way, not available until V6.1, is to omit the address from the RESET statement altogether. Omitting the address indicates that the reset command applies to the UUT, which may be either IEEE-488 or serial.

There's an implicit assumption here that for a particular execution of a particular calibration procedure, there will not be multiple UUTs. MET/CAL does not enforce this assumption, however. If a procedure contains both PORT and IEEE statements which communicate with devices other than by way of an address alias, there will be, in effect, two UUTs. In this case the reset command will be sent to the serial device only.

If there's no remotely-controlled UUT at all, a RESET statement in which the address is omitted is ignored. (However, the reset command may become active later in the procedure if a UUT has been established at that time.)

- Resetting System Instruments

  If a RESET command is specified for a system instrument (i.e., an instrument for which MET/CAL has a built-in driver), the command will be executed in addition to the built-in reset function. Thus, the built-in reset for a system instrument cannot be replaced by specifying a new reset command with the RESET FSC.

  As a general rule, the RESET FSC should be used only with user-configured instruments, not with system instruments.

- Address Syntax

  The address syntax is the same as it is in IEEE and PORT statements. The format is [*@address*], where *address* is an IEEE-488 address, serial address, or alias string which refers to a configured instrument.

  Examples:

[@10]	specifies IEEE-488 address 10
[@COM1]	specifies the serial port COM1
[@xyz]	an alias for a configured IEEE-488 or serial instrument
[@10:5]	specifies primary IEEE-488 address 10, secondary address 5

- Clearing a Reset Command

  The command is optional. A reset statement which specifies an address, but no command, clears the previously specified RESET command, if any.

  It is important to be aware that clearing a reset command using a statement like:

  RESET [@10]

is not the same as specifying "*" as the reset command:

RESET [@10] *

The second statement sends a "*" to the instrument at IEEE-488 address 10 after each evaluation. It does not remove the reset command from internal memory, as the first statement does.

Note also that an empty RESET statement can be used to clear the UUT reset command.

- Maximum Command Length

  A maximum of 56 characters is allowed in a RESET statement for the *address* and *command*, taken together.

  If a reset command is too long for the space available, the procedure writer can use the MATH FSC and the built-in string registers (MEM2, S[1], S[2], ..., S[32]) to construct a longer reset command, and then use the appropriate special construction in the RESET statement.

- Handling of Spaces

  Leading and trailing blanks are ignored. Spaces between the *address* and the *command* are also ignored.

  Spaces embedded in the *command* are not ignored, however. For example:

  RESET [@10] a b

  When the RESET command is executed, "a b" will be sent to the IEEE-488 device at address 10.

- Command Syntax

  A RESET command consists of literal text and embedded special constructions. Special constructions are always delimited with brackets ('[' and ']'). When a RESET command is executed, characters in the command which are not part of a special construction are written to the specified device.

  In general, special constructions are evaluated as they are encountered. However, unlike IEEE and PORT statements, some special constructions are evaluated when the RESET statement is executed, while others are evaluated when the RESET command is executed.

  The special constructions which are evaluated when the RESET statement is executed are those constructions which refer to memory registers, plus the [V*variable*] construction.

  This is an important distinction which must be understood by procedure writers who make use of the RESET statements with embedded special constructions.

Example:

```
MATH MEM2 = "*RST"
RESET [@10] [MEM2][SDC]
MATH MEM2 = "ABC"
5700 1V 1%
```

The value of register MEM2 is inserted in the command when the RESET statement is executed. This value is "*RST". The RESET command is therefore "*RST[SDC]". This command will be sent to the device at IEEE-488 address 10 after each evaluation. When MEM2 is changed from "*RST" to "ABC", after the RESET statement, this change does not affect the RESET command, which will be executed after the 5700 statement. The [SDC] construction (selected device clear) is evaluated each time the RESET command is executed.

- Command Termination

  In general, the same rules apply as for the IEEE and PORT FSCs.

  For IEEE-488 instruments, EOI termination is the default, and is sufficient for most instruments.

  For serial instruments there are two approaches.

  The first approach is to explicitly specify the terminator after the data message. Typically, serial instruments expect a linefeed ([10]), carriage return ([13]), or both as a terminator.

  The second approach is to use the "OTERM" special construction to specify the terminator. Note that if this approach is used, a separate OTERM construction must be specified in each RESET statement.

- Error Handling

  As with the built-in reset commands which MET/CAL automatically uses for system instruments (like the Fluke 5700A), reset commands specified using the RESET FSC cause the procedure to be aborted if an error occurs in executing the RESET command.

  Procedure writers who use the RESET FSC must therefore carefully test procedures to make sure that the RESET command is reliable.

- Special Constructions

  The RESET FSC supports most of the special constructions allowed by the IEEE and PORT FSCs.

  Constructions which are legal only for IEEE-488 instruments cannot be used with serial instruments.

Constructions which are legal only for serial instruments cannot be used with IEEE-488 instruments.

If the address is specified as a literal IEEE-488 or serial address (i.e., not as an alias), compile time checks prevent incorrect special construction specifications.

If the address is an alias, some of the special construction error checks are deferred until run time.

The following special constructions may be used in the command portion of a RESET statement:

1. Constructions Evaluated on RESET Statement Execution

[MEM]	write value of register MEM to specified address
[MEM1]	write value of register MEM1 to specified address
[MEM2]	write value of register MEM2 to specified address
[M*nreg*]	write value of numeric register to specified address
[SREG*nreg*]	write value of string register to specified address
[V*variable*]	write value of *variable* to specified address
{*text*}	send text enclosed in braces to result file

2. Constructions Evaluated on RESET Command Execution

   2.1 Constructions Used with IEEE-488 and Serial Instruments

[D*delay*]	delay execution for *delay* milliseconds
[I!]	read number from specified address, discarding the data read
[*numeric*]	write number (ASCII) to specified address
[O < *file*]	read from file, write to specified address
[T*numeric*]	set timeout to *numeric* milliseconds
[TERM *number*]	set terminator character to number (ASCII)

[TERM *'c'*]	set terminator character to *c* (character)
[TERM CR]	set terminator character to Carriage Return
[TERM LF]	set terminator character to Line Feed
[TERM NONE]	no terminator (IEEE-488) default termination (serial)
[TERM OFF]	same as [TERM NONE]
[OTERM *number*]	set output terminator character to number (ASCII)
[OTERM *'c'*]	set output terminator character to *c* (character)
[OTERM CR]	set output terminator character to Carriage Return
[OTERM LF]	set output terminator character to Linefeed
[OTERM CRLF]	set output terminator character to Carriage Return + Linefeed
[OTERM NONE]	no output terminator
[OTERM OFF]	no output terminator

The [I!] construction was added for use with the RESET statement, because [I] and [I$] modify the memory registers (MEM and MEM2, respectively), and this side-effect is, in general, not acceptable in the context of a reset command which executes after each evaluation. The [I!] construction is also available for use in IEEE and PORT statements.

2.2 Constructions Used Only with IEEE-488 Instruments

[EOI ON|OFF]	enable/disable assertion of EOI on write
[GTL]	put instrument in local control state
[IFC *port*]	interface clear on specified port
[LLO]	disable instrument front panel controls
[REN]	assert Remote Enable line on the IEEE-488 bus
[SDC]	sends Selected Device Clear to specified address

[S *delay*]	set delay between transmitted characters
[SPL*mask*]	serial poll specified address
[SRQ*delay*,*mask*]	wait for IEEE Service Request
[SRQ ON|OFF]	enable/disable UUT Service Request processing
[TRIG]	trigger instrument at specified address

The SPL and SRQ constructions are allowed, but are not recommended for use in RESET statements, because they cause the value of memory register MEM to be modified when the RESET command is executed.

The timeout and terminator specifications, if any, are maintained independently of corresponding specifications in IEEE statements, if any.

2.3 Constructions Used Only with Serial Instruments

[CLR]	flush receive queue of specified port
[P*params*]	configure port
[REOPEN]	close and re-open the specified port

The "P" construction (port configuration) must be used with caution, because it interacts with the PORT statements in the procedure. In general, it's best to configure the port using either the Windows Control Panel, or a PORT statement at the beginning of the procedure.

The timeout specification, if any, is maintained independently of the corresponding specification in PORt statements, if any.

Refer to the IEEE FSC on-line help for additional details on special constructions used with IEEE-488 instruments.

Refer to the PORT FSC on-line help for additional details on special constructions used with serial instruments.

Examples

```
# Specify reset command for MFC.
  1.002  RESET        [@MFC]*RST;*OPC?[I!]

# Specify reset command for DMM.
  1.003  RESET        [@DMM]REMS;*RST[10][I!][I!][D1000]

# Clear reset commands for MFC and DMM.
  4.001  RESET        [@MFC]
  4.002  RESET        [@DMM]

# Re-establish reset commands for MFC and DMM.
  7.001  MATH         S[1] = "*RST;*OPC?[I!]"
  7.002  MATH         S[2] = "REMS;*RST[10][I!][I!][D1000]"
  7.003  RESET        [@MFC][SREG1]
  7.004  RESET        [@DMM][SREG2]
```

RNG

Display Control FSC

Description

The RNG FSC is used to generate a message which prompts the operator to set the UUT to a specified RANGE. The RNG FSC may be used in place of a DISP FSC for two reasons:

- Messages generated by the RNG FSC have the same format as automatic range messages.
- MET/CAL remembers the specified range. If a subsequent range message (whether automatic or generated by a RNG statement) is identical to the previous range message, the display of the message is inhibited.

Refer to "Automatic Messages" in Volume 2, Chapter 1 for a description of automatic range messages.

Format

RNG *range* [AC] [-D]

Rules

- The *range* is specified as:

  [*range value*]*prefixunits*

  range value is an NR3-format number.

  If *range value* is not specified, the message defaults to Autorange.

  prefix is a MET/CAL units prefix code:

  p - pico
  n - nano
  u - micro
  m - milli
  k - kilo
  M - mega
  g - giga

- Except for 'm' and 'M', prefix codes are case-insensitive.

  units is a MET/CAL units code:

  A - amps
  Ap - amps peak

App	-	amps peak-to-peak
D	-	decibels
deg	-	degrees
degC	-	degrees Celsius
degF	-	degrees Fahrenheit
DF	-	duty factor
F	-	farads
H	-	hertz
H/H	-	hertz / hertz (frequency ratio)
pct	-	percent
T	-	seconds
V	-	volts
Voff	-	volts offset
Vp	-	volts peak
Vpp	-	volts peak-to-peak
W	-	watts
Y	-	siemens
Z	-	ohms

- AC/DC Specification

  IF "AC" is specified, the range message will indicate that the signal is an AC signal.

  It is illegal to specify "AC" unless the units are amps, amps peak, amps peak-to-peak, volts, volts peak, or volts peak-to-peak.

  Example:

```
RNG          10V                          AC
```

  The RNG statement above will cause the following automatic range message to be constructed:

  "Set UUT to the 10V AC range."

  If "AC" is not specified, DC is assumed.

- Per Division Specification

  "-D" may be specified in a RNG statement to prevent inclusion of the 'per division' indicator in the range message.

  Normally, when an automatic range message is constructed, the ASK 'D' flag determines whether a 'per division' indicator is added to the message. The 'per division' indicator is used in scope calibration. It is included in the range message when ASK+ D is specified. Adding "-D" to a RNG statement has no effect of the ASK 'D' flag is not set (i.e., if ASK- D is specified). Refer to the ASK FSC Reference for more information on the ASK 'D' flag.

Example:

```
ASK+     D
RNG          10V
RNG          5V
                                        -D
```

The first RNG statement generates the message:

"Set UUT to 10V/div."

"/div" is included in the messages because ASK+ D is in effect, and "-D" is not specified in the RNG statement.

The second RNG statement generates the message:

"Set UUT to the 5V DC range."

Although ASK+ D is still in effect, inclusion of "/div" in the message has been suppressed because "-D" is specified in the RNG statement.

- Inclusion of MEM2

  If the MEM2 string register is non-empty, MEM2 is included in the range message. (This applies to automatic range messages as well as messages generated by the RNG FSC.)

  Example:

```
ASK-     D
MEM2         = Fluke 77
RNG          20V
```

  The RNG statement generates the range message:

  "Set UUT Fluke 77 to the 20V DC range."

  Notice that the value of MEM2 has been added to the message (after the word "UUT").

RPT

Procedure Control FSC

Description

The RPT FSC causes an unconditional jump to the first step of the current test.

Format

RPT

Rules

- RPT should be used only in an adjustment block.
- The RPT FSC causes the entire test to be repeated. Frequently, special set-up instructions are given using, for example, the DISP FSC. These set-up instructions precede the evaluation step. Since RPT jumps to the first step of the test (i.e., the statement with minor step number 001), the set-up instructions are also repeated. If this is undesirable, a JMP statement which jumps directly to the evaluation step may be used instead of a RPT statement.

RSLT

Miscellaneous FSC

Description

The RSLT FSC is used to enter information in the MET/CAL results file. The RSLT FSC has two modes of operation, depending on the first character of the text entry being the equals ('=') sign.

- In the first mode of operation with the first character NOT being the equals ('=') sign, the RSLT FSC displays the indicated message and then prompts the operator for a response. This allows the operator to make a detailed response to the RSLT message. The entire operator response is then placed in the results file.
- If the first character is the equals ('=') sign, the RSLT information can be used to directly enter information into the results file. This mode is transparent to the operator.

Format

RSLT *prompt* or RSLT = *message*

Rules

- If the body of the RSLT statement begins with an equals sign ('='), the text which follows the equals sign is entered in the results file.

  Example:

  ```
  1.012  RSLT   = Waveform Test <2V
  1.013  EVAL   Is the waveform less than 2V?
  ```

  When the RSLT statement is executed, the text string "Waveform test <2V" is written to the results file.
- If the body of the RSLT statement does not begin with an equals sign ('='), the body of the result statement is used as a prompt to the operator. The operator's response is entered into the results file.
- A maximum of 56 characters is allowed in the body of the RSLT statement.
- The following special constructions may be used in a RSLT statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

[D *delay*]

[V *variable*]

{*text*}

Refer to "Special Constructions" in Chapter 1 of this manual for details.

- Special constructions which appear in a RSLT statement are evaluated before being written to the results file.

Examples

Example 1:

```
STEP  FSC RANGE NOMINAL   TOLERANCE     MOD1 MOD2  3  4 CON
1.001 ACMS                               3mV
1.002 5790      3.00000mV                1kH     W  F  N  2W
1.003 RSLT      = 3mV @ 1kHz Reference reading = [MEM]mV
```

The result of the 5790 Nominal Setup test is stored in MEM. The RSLT statement then substitutes the value of MEM for the special construction [MEM], and writes the resulting text to the result file. If the value of MEM is 3.00002, the results file will contain: 3mV @ 1kHz Reference reading = 3.00002 mV

Example 2:

```
MATH  MEM = 4
RSLT  Enter {Reason Code for ERROR [MEM]:}
```

When the RSLT statement is executed, the operator will be prompted with:

```
Enter Reason Code for ERROR 4:
```

Suppose the operator responds by entering "Short R2". The results file will then contain:

```
Reason Code for Error 4: Short R2
```

SET

Display Control FSC

Description

The SET FSC generates a list of settings for complex UUT set-ups. When a SET statement is executed, a specified message is displayed, and also stored internally. Stored settings are recalled when the "Settings" option is chosen in the Post Test Summary.

The SET FSC may be used to specify a heading, a setting, or an automatic setting. These are described in detail below.

Format

SET *name*: *setting*

SET *name*:

SET *name*

SET

Rules

- The body of the SET statement is limited to 56 characters.
- If a SET statement has the form:

  SET *name*: *setting*

  The specified *name* and *setting* are stored in the internal settings table, according to the following rules:

  1. If the *name* matches a name already in the table, and the *settings* are different, the old *setting* in the table associated with that *name* is replaced by the new *setting*, and no new entry is created.

     After the table has been updated, the *name* and the new *setting* are displayed to the operator.

  2. If the *name* matches an existing name in the table, and the new setting is the same as the existing setting, no change is made to the table, and the setting is not displayed to the operator.

     The *setting* is limited to 32 characters (after embedded special constructions, if any, are evaluated.

Leading spaces in the specified *setting* are preserved. This allows settings to be lined up in the Post Test Summary "Setting" table.

Note that the space which immediately follows the colon is required. If a space is not present immediately after the colon, the colon is taken to be part of the *name*.

If the specified *setting* is '*', the setting is an automatic setting. In this case the following rules apply:

a. The current range is entered as the *setting* for that *name* in the settings table. (The current range is determined by the most-recently executed instrument FSC with a non-empty RANGE field, or the last-executed RNG statement.)

b. The *setting* is displayed to the operator only if the range is known. This applies both to the execution of the SET statement and to the Post Test Summary "Settings" display.

c. Whenever the current range changes, the value of the *setting* in the settings table is updated to match the current range.

- If a SET statement has the form:

  SET *name*:

  The entry for the specified *name* is deleted from the internal settings table.

  If the specified *name* does not match a name in the table, the statement is ignored.

- If the SET statement has the form:

  SET *name*

  In this case the *name* is considered to be a heading. Each time a SET statement specifies a heading, a new entry is made to the internal table.

  It is possible to have duplicate headings in the table. Headings cannot be deleted from the table, except by clearing the entire settings table, or when more than 18 entries are added to the table, causing early entries to be discarded. Headings are useful way to group related settings.

  Examples:

```
SET   Vertical Mode Controls
SET   Triggering Controls
```

- If the SET statement has the form:

  SET

An empty SET statement (or one which contains special constructions only) causes the internal settings table to be cleared. All existing entries are discarded.

- The internal settings table is large enough for 18 entries. If a new entry is added to a full table, the first (oldest) entry is deleted, and the new entry is added at the bottom of the table (it becomes the newest entry).
- The following special constructions may be used in a SET statement:

  [D *delay*]

  [DRAW *x, y, view*]

  [V*variable*]

  {*text*}

  Refer to "Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual for details.

  Example:

```
SET   Setting: [V VAR$].
```

- If the ASK- S command is in effect, SET FSC messages are not displayed. However, the settings table is updated. The operator may view the settings table by choosing "Settings" in the Post Test Summary.

Examples

```
2.005 SET        Ch1 Volts/Div: 5mV[DRAW60,15,F]
3.007 SET        Vertical Deflection Tests [D10000]
4.008 SET        Sensitivity Volts/Div: *
```

SMY02

SMY02 Instrument FSC

Description

The SMY02 FSC programs amplitude and frequency of the Rohde & Schwarz SMY01, SMY02, SMY43 Signal Generators.

Functional Capability

Model	Frequency	Amplitude [1]
SMY01	9 kHz to 1040 MHz	-140 dBm to +13 dBm
SMY02	9 kHz to 2080 GHz	-140 dBm to +13 dBm
SMY43	9 kHz to 2080 GHz	-140 dBm to +13 dBm
1. +19 dBm with Option B43		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*] [*prefix*] D, V, or Vpp.
- Frequency entered as [*numeric*] [*prefix*] H.
- Period entered as [*numeric*] [*prefix*] T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*] [*prefix*] H.
- Period entered as [*numeric*] [*prefix*] T .
- Amplitude entered as: [*numeric*] [*prefix*] D, V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* SMYxx RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  SMY02        *                                                S
  1.002  SMY02  A     -42.95D        1U            100kH          -D
  2.001  SMY02        100mV                        550MH          -D    S
  2.002  SMY02  0.5   28mVpp         5U            100kH          -D
  3.001  SMY02  A     D              1U            100kH          -D
  4.001  SMY02        V              1%            100kH          -D
  5.001  SMY02  50    10uT           1% 1/ 1U      -35D
  6.001  SMY02  200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the 5800A channel 1 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  SMY02  20    120mVpp                      100kH               N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  SMY02        5MH            -100%         mVpp           -D       CH1
  8.001  MESS
  8.002  ASK+         N
```

MSMY02

Auxiliary Instrument Setup FSC

Description

The MSMY02 FSC provides the additional program functions for the Rohde & Schwarz SMY01, SMY02, and SMY34 Signal Generators which are not addressed by the SMY02 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

Modulation Frequency:

When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*] [*prefix*] H. Allowed values are 1Hz to 500kHz.

If just units are entered, the value is taken from memoryregister MEM at run time.

Reset:

To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the MSMY02 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation. The MOD1 field cannot be blank in an SMY02 statement.

AM Depth:

AM depth is entered as *numeric* [*prefix*] pct. AM depth limits are 0 to 100%.

FM Deviation:

FM deviation is entered as *numeric* [*prefix*] H

FM deviation depends upon the carrier frequency s shown in the table below:

Carrier Frequency	FM Deviation
< 65 MHz	0 to 10.0 MHz
< 130 MHz	0 to 1.25 MHz
< 260 MHz	0 to 2.50 MHz
< 520 MHz	0 to 5.00 MHz
< 1040 MHz	0 to 10.0 MHz
< 2080 MHz	0 to 20.0 MHz

Phase Deviation:

Phase deviation is entered as *numeric* [*prefix*] rad.

Phase deviation depends upon the carrier frequency as shown in the table below:

Carrier Frequency	Phase Deviation
< 65 MHz	0 to 200 rad
< 130 MHz	0 to 25 rad
< 260 MHz	0 to 50 rad
< 520 MHz	0 to 100 rad
< 1040 MHz	0 to 200 rad
< 2080 MHz	0 to 400 rad

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3
4 CON
# AM Modulation
  1.001  MSMY02       *
  1.002  MSMY02       400H                        0pct
  1.003  SMY02  10     0D             1U           10MH
  2.001  MSMY02       1000H                       90pct
  2.002  SMY02  10     0D             1U           10MH
# FM Modulation
  3.001  MSMY02       400H                        100H
  3.002  SMY02  10     0D             0.11U        200kH
  4.001  MSMY02       1000H                       99.9kH
  4.002  SMY02  10     0D             0.1U         1000MH
# Phase Modulation
  5.001  MSMY02       400H                        2rad
  5.002  SMY02  10     0D             0.11U        200kH
  6.001  MSMY02       1000H                       10rad
  6.002  SMY02  10     0D             0.1U         1000MH
```

STD

Miscellaneous FSC

Description

The STD FSC causes traceability information for a manually controlled external standard to be included in the MET/CAL results.

Format

STD *standard*

Rules

- *standard* is the name of an instrument used as an external standard. A maximum of 29 characters is allowed.
- Leading and trailing spaces are ignored.
- When MET/CAL searches for a standard in the Traceability File, the comparison is case-insensitive.
- Execution of an STD statement has no visible effect during procedure execution. However, execution of the statement is taken to indicate that the standard has, in fact, been used.
- Before starting execution of a procedure, MET/CAL checks the Traceability File (default name "trace.dat") to see if the standard is in cal or out of cal. If the standard is out of cal when the procedure starts, and the operator chooses not to abort the procedure, execution of the STD statement prevents successful completion (PASS) of the procedure. If traceability information for the standard is not specified in the Traceability File, the procedure cannot be executed.
- The MET/CAL procedure compiler (editor) generates a "STANDARD" statement in the header of a compiled procedure for each distinct instrument specified in an STD statement.

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
3.007 STD        Fluke 792A
6.007 STD        Fluke 80K6 High Voltage Probe
```

TOL

Miscellaneous FSC

Description

The TOL FSC is used to specify a test tolerance which will be used in subsequent instrument, MEMC, or ACC statements.

When an instrument, MEMC, or ACC statement which contains "TOL" it its TOLERANCE field is executed, the tolerance specified in the most recently executed TOL statement is used.

The specified tolerance should conform to the specifications of the UUT at the reference value. Tolerance specifications in a TOL statement follow the same conventions used in the TOLERANCE field of an instrument FSC.

The TOL FSC is useful when the instrument FSC TOLERANCE field is too narrow to hold the desired tolerance specification. The TOL FSC may also be used in cases where a single tolerance specification applies to more than one test.

Format

TOL *tol spec tol spec tol spec ...*

Rules

- A TOL statement may contain 0 or more *tol spec* subfields. Subfields are separated by 1 or more blanks. A maximum of 56 characters is allowed in the body of the TOL statement (including spaces used to separate subfields).
- Each *tol spec* subfield must adhere to the format conventions which apply to the TOLERANCE field of an instrument FSC. Formats are shown in the following table:

Format	Meaning
[*val*]%	% of Nominal value
[*val*]/	% of Range value
[*val*]P%	PPM of Nominal value
[*val*]P/	PPM of Range value
[*val*]U	Units of Nominal

val, if specified, may be a literal numeric value (NR3) or may specify a numeric register in the form M *i* where *i* is the register index (1 to 255). If *val* is not specified, the tolerance value is taken from numeric register MEM. (There is no way to use numeric register MEM1 to specify the tolerance value.)

Examples:

```
TOL M23%
```

In this example the tolerance is specified as a percentage of the NOMINAL and the tolerance value is taken from numeric register M[23] at run time.

```
TOL U
```

In this example the tolerance is specified in absolute units and the tolerance value is taken from numeric register MEM at run time.

Refer to Volume 2, Chapter 1 for more information on the TOLERANCE field and the tolerance computations.

Examples

Example 1:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
2.005 TOL        0.001% 0.002/ 0.000001U
2.006 5700 10    10V     TOL                        2W
```

In this example, the desired tolerance specification is toolong to fit in the TOLERANCE field of the 5700 statement. A TOL FSC is therefore used before the 5700 statement to specify the tolerance. In the 5700 statement, "TOL" is entered in the TOLERANCE field. This indicates that the tolerance specified in the most recently executed TOL statement is to be used to calculate the test tolerance when the 5700 statement executes.

Example 2:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 TOL        3%
1.002 5700 1     1V      TOL                        2W
2.001 5700 10    10V     TOL                        2W
3.001 5700 100   100V    TOL                        2W
```

This example illustrates a case in which a single tolerance specification applies to multiple tests. The 3 5700 statements all use the same tolerance specification (3%).

Appendices

Appendix	Title	Page
A	How to Access MET/SUPPORT™	A-1

Appendix A
How to Access MET/SUPPORT™

About the MET/SUPPORT Program

Fluke Metrology Software is supported by a highly skilled and conscientious team of professionals who are available to answer questions, help solve unique problems, and assist in troubleshooting in the event you run into difficulties.

In addition, the MET/SUPPORT staff maintains a bulletin board service where you can download product updates, application notes, and utility programs.

Telephone Support

Free telephone support is available, but only to registered users of Fluke software. Be sure to register your software as soon as possible so you can make use of this service should the need arise.

Within the United States, toll free telephone support is available from 8:00 AM to 4:30 PM, Pacific Standard Time.

Phone: 1-800-825-7411

Mail, FAX, Electronic Bulletin Board and World Wide Web

You may also contact us by mail, FAX, through our electronic bulletin board service,
which is available 24 hour a day, or visit the FLUKE World Wide Web site.

FLUKE Corporation	**Phone**	1-425-356-5870
PO Box 9090	**FAX**	1-425-356-5992
Everett, WA 98206-9090	**EBB**	1-425-356-5309
Attention: MET/SUPPORT, M/S 275G	**WWW**	***http://www.fluke.com***

Before Calling Technical Support

You may be able to discover the answer for yourself., so take the following steps before calling for support:

- Check the manual
- Check the on-line help
- Check our Electronic Bulletin Board
- Check the FLUKE World Wide Web site

Please Have the Following Information Available

If you do find it necessary to call for assistance, take a few moments to jot down some information. If this information is readily available, the support person can more quickly get to the exact details of the difficulty you are having, and will be able to resolve the issue more efficiently.

- Product name, applicable licenses, version and serial numbers
- Manual title, part number and version
- Operating system and version
- Network information if applicable
- List of steps necessary to recreate the problem
- Contents of autoexec.bat and config.sys files if applicable
- Version of *Crystal Reports*

International Support

For more information on international MET/SUPPORT™, please contact the Fluke office nearest you or your local representative.

	TELEPHONE	**FAX**
Fluke Canada	905-890-7600	905-890-6866
Fluke China	86-10-6 512-3435	86-10 6 516-3437
Fluke Europe Headquarters (NL)	31-40-2678200	31-40-2678222
Fluke France	33-1-48-96 6300	33-1-48-96 6350
Fluke Germany	49-561-95940	49-561-9594-119
Fluke Japan	81-3-3434-0181	81-3-3434-0170
Fluke Singapore	65-276-5161	65-276-5759
Fluke UK	44-923-240511	44-923-225067

Index

—A—

Address
  Fluke Corporation, A-1
Adjustment
  statements, 1-37
  threshold, 1-5
Author, 1-4
Automatic message
  connection, 1-39
  slew message, 1-39
  uut adjustment message, 1-40
  uut range message, 1-39
  uut setup message, 1-40

—B—

Bulletin Board
  MET/SUPPORT, A-1

—C—

Column headers, 1-5
Common FSC properties
  FSC identifier, 1-7
Comparison test, 1-31, 1-37
CON field, 1-18
Configuration, 1-5
Continuation statements, 1-38
Conventions, 1-1

—D—

Date, 1-4
Display control FSCs, 1-33

—E—

Electronic Bulletin Board, A-1
Evaluation
  Go/no-go, 1-23
  keyboard, 1-21
  measurement function, 1-25
  Slew, 1-19
  stimulus function, 1-18
Evaluation FSCs, 1-34
Evaluation test, 1-18, 1-36

—F—

FAX, A-1
  MET/SUPPORT, A-1
Field
  CON, 1-18
  MOD1, 1-17
  MOD2, 1-17
  MOD3, 1-17
  MOD4, 1-17
  NOMINAL, 1-14
  RANGE, 1-13
  TOLERANCE, 1-16
FSC. *See* Function Selection Code
FSC identifier, 1-7
FSCs

list of, 1-8
Miscellaneous, 1-36
Function Selection Code, 1-7
definition of, 1-2
reference, 1-44

—G—

Go/no-go
evaluation, 1-23

—I—

Instrument FSCs, 1-13
Instrument line, 1-4
Instrument resets, 1-32
Interface control FSCs, 1-34

—K—

Keyboard
evaluation, 1-21

—M—

Mail, A-1
Measurement function
Comparison test, 1-31
evaluation test, 1-25
nominal setup test, 1-30
setup test, 1-28
Memory register operation FSCs, 1-35
MET/SUPPORT
about, A-1
how to access, A-1
information to have available when you call, A-2
international telephone numbers, A-2
toll-free phone number in US, A-1
Miscellaneous FSCs, 1-36
MOD1 field, 1-17
MOD2 field, 1-17
MOD3 field, 1-17
MOD4 field, 1-17
comparison test, 1-18
evaluation test, 1-17
nominal test, 1-18
setup test, 1-17

—N—

NOMINAL field, 1-14
Nominal setup test, 1-29, 1-37
Number of lines, 1-5
Number of tests, 1-5

—P—

Phone numbers
Fluke Corporation, A-1
Problems, A-1
Procedure
body statement, 1-7
control FSCs, 1-35
detailed description, 1-3
header, 1-4
Naming, 1-6

—R—

Range
rules of, 1-13
RANGE field, 1-13
Revision, 1-4

—S—

Service request processing, 1-31
Setup test, 1-26, 1-37
measurement function, 1-28
nominal
measurement function, 1-30
stimulus function, 1-29
Nominal, 1-29
Stimulus function, 1-27
Slew
evaluation, 1-20
evaluation, 1-19
Special construction
[MEM], [MEM1], [MEM2, 1-43
delay construction, 1-42
draw construction, 1-42
numeric literals, 1-43
variables, 1-44

Special constructions, 1-40
SRQ see Service Request Processing, 1-31
Standard, 1-5
Standard memory registers
  use of, 1-36
Step number, 1-7
Stimulus function
  comparison test, 1-31
  evaluation test, 1-18
  nominal setup test, 1-29
  setup test, 1-27

—T—

Technical Support, A-1
Telephone Support, A-1
Test number, 1-7
Title line, 1-4
TOLERANCE field, 1-16
Troubleshooting, A-1

—W—

World Wide Web
  address, A-1