8902A MEASURING RECEIVER

08902-90026 A

GENERAL INFORMATION

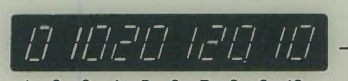
SPCL

This key is used to complete Special Function entries, to display requested Special Functions, and to display actual instrument settings.

To enter a Special Function, enter the Special Function code (prefix, decimal point, suffix) shown below, then press the Special Function Key, SPCL.

SPECIAL DISPLAY. To display the selected state of Special Functions prefixed 1 through 10, press the SPCL key once. Digit position is the prefix, displayed number is the suffix.

SPCL



- Suffixes
- Prefixes
- Special Function Codes

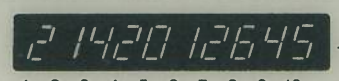
1 2 3 4 5 6 7 8 9 10 – Prefixes

1.0 2.1 3.0 4.2 5.0 6.1 7.2 8.0 9.1 10.0 – Special Function Codes

Indicates input attenuation is automatically selected.

SPECIAL SPECIAL DISPLAY. To display actual instrument settings, press SPCL key again while Special Display is still active. The Special Function prefix position and suffixes displayed represent actual instrument settings.

SPCL + SPCL



- Suffixes
- Prefixes
- Special Function Codes

1 2 3 4 5 6 7 8 9 10 – Prefixes

1.2 2.1 3.4 4.2 5.0 6.1 7.2 8.6 9.4 10.5 – Special Function Codes

Indicates 10 dB attenuation selected.

Both the Special and the Special Special Displays may be cleared using the CLEAR key. AUTOMATIC OPERATION sets Special Functions 1 through 10 to their zero suffix mode and turns off many with prefixes greater than 10. Blue key, INSTR PRESET, also sets Special functions 1 through 10 to their zero suffix mode and turns off all other Special Functions, For Special Functions prefixed 0, or 40 through 99, refer to service section of manual.

SPECIAL FUNCTIONS 11 THROUGH 39

PREVIOUS RATIO

11.2 Display previous ratio reference

CALIBRATION: FM, AM

	Display Peak FM	Display Peak AM
Computed	**12.0**	**13.0**
Residual	**12.1**	**13.1**
Measured	**12.2**	**13.2**

LIMIT

14.0 Disable

14.9 Display limit status:
Lower limit status.Upper
(0=disabled, 1=enabled)

	Lower Limit	Upper Limit
Set to Ratio Reference	**14.1**	**14.2**
Enable	**14.3**	**14.4**
Display	**14.5**	**14.6**
Display Measurement Code*	**14.7**	**14.8**

* See Operating Manual for more information.

TIME BASE CHECK

15.0 Displays Error 12 if Option 002 is installed and oven cold. Displays 0 if Option 002 is installed and oven warm, or if Option 002 is not installed.

15.1 Displays 0 if internal time base is being used. Displays 1 if external time base is being used.

CALIBRATION FACTORS: AM, FM

	AM Cal Factor	FM Cal Factor
Disable	**16.0**	**17.0**
Enable	**16.1**	**17.1**
Display	**16.2**	**17.2**

TONE-BURST RECEIVER

18.NN Configures instrument as a tone-burst receiver. A time delay of NN ms is inserted between detection of a carrier and unsquelching of the output at MODULATION OUTPUT/AUDIO INPUT. Range of NN is 1 to 99 ms. If NN is 0, delay is 99 ms.

HP-IB ADDRESS

21.0 Displays HP-IB address in form AAAAAAA.TLS.

AAAAAAA=binary address
T=1=talk only
L=1=listen only
S=1=requesting service

SERVICE REQUEST

22.NN A value of NN from 0 to 63 sums the weighted conditions below to set up a service request mask. The summed, weighted conditions are displayed when NN is 64.

1 Data ready
2 HP-IB error (Cannot be Disabled.)
4 Instrument error
8 Limit exceeded
16 Frequency Offset mode state change
32 Recal or Uncal
64 Read back SRQ mask

EXTERNAL ATTENUATION (dB)

25.2 Display attenuation value

SET REFERENCE

26.0 Exit attenuator measurement

26.1 Re-enter attenuator measurement

FREQUENCY OFFSET CONTROL

Frequency Offset Mode		External LO	
Exit	Re-enter	Display	Enter/ Enable
27.0	**27.1**	**27.2**	**27.3**

OTHER MEASUREMENT MODES

29.0 SINAD

30.0 EXT AUDIO RMS LEVEL

33.0 LO FREQUENCY

34.0 IF FREQUENCY

35.0 RF LEVEL

36.0 PEAK TUNED RF LEVEL

CALIBRATION FACTORS: RF POWER

37.0 Automatic Cal Factors

37.1 Manual Cal Factors

37.2 Display Status (auto=0, held=1)

37.3 *Enter frequency, Cal factor

37.4 *Display table size

37.5 *Recall reference cal factor

37.6 *Recall next frequency, cal factor

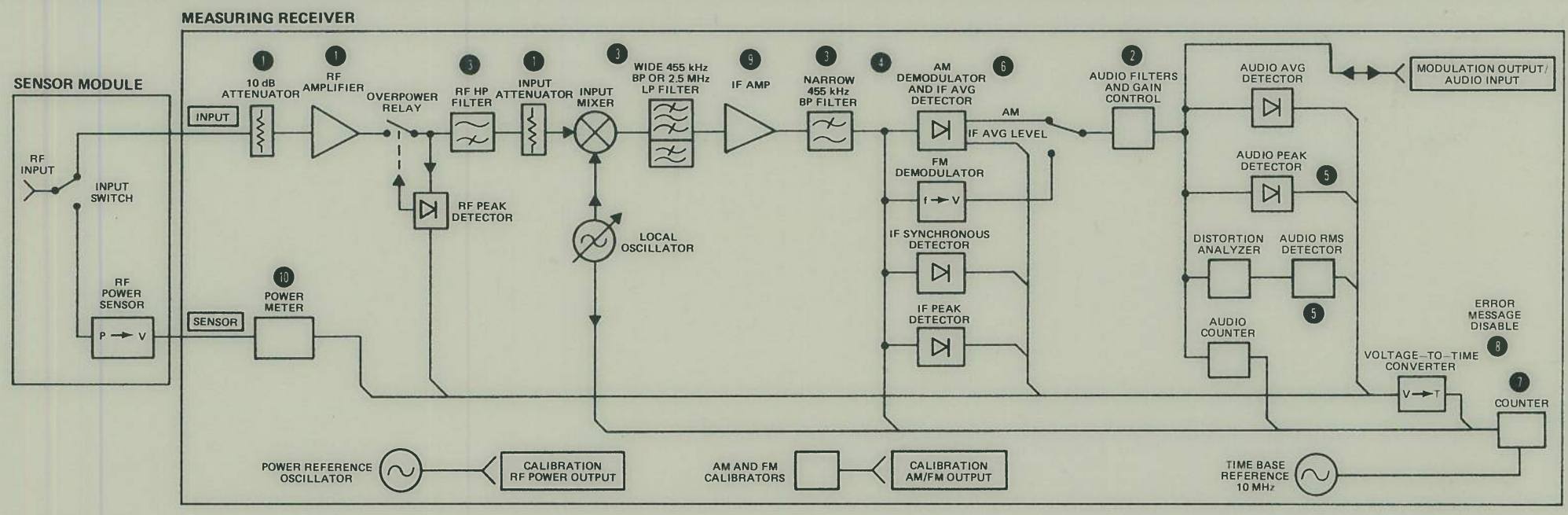
37.9 *Clear Table

* Two tables are available. The table being used is determined by the status of Frequency Offset mode (Special Function 27).

CALIBRATION FACTORS: TUNED RF LEVEL

Range	RF Power to #1	1-2	2-3	Clear all
Display	38.1	38.2	38.3	
Enter	39.1	39.2	39.3	39.9

BLOCK DIAGRAM REFERENCE FOR SPECIAL FUNCTIONS 1 THROUGH 10



SPECIAL FUNCTION CODES 1 THROUGH 10

1 RF INPUT ATTENUATION AND GAIN

AUTO	RF Attenuation (dB)						RF Gain (dB)		AUTO*
	0	10	20	30	40	50	24	14	
1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9

* Automatic selection: 10 dB attenuator always inserted. (Tuned RF Level only)

2 AUDIO RANGE

MODULATION		DETECTOR			
		RMS	Pk, Ave, RMS		
AM (%, pk)	AUTO	4.0	40	100	100
FM (kHz, pk)*		0.4	4	40	400
ϕM (rad, pk)		0.4	4	40	400
	2.0		2.1	2.2	2.3
			2.4		

*Divide by 10 with 750 μs FM DE-EMPHASIS and PRE-DISPLAY.

3 RF AND IF FILTERS

IF FREQ		455 kHz			1.5 MHz
Wide Filter	AUTO	2.5 MHz bandwidth	200 kHz bandwidth		2.5 MHz bandwidth
Narrow Filter		30 kHz bandwidth		Narrow filter out	
RF HP Filter Out	3.0	3.6	3.5	3.1	3.2
RF HP Filter In		3.8	3.7	3.3	3.4

4 TUNED RF LEVEL DETECTOR SELECTION AND DISPLAY AVERAGING

Detector	IF Synchronous				IF Average			
Measurement Averaging Time (s)	AUTO	10	1	0.1	AUTO	10	1	0.1
	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7

5 AUDIO DETECTOR RESPONSE

Audio Peak Detector Response and RMS Detector Digital Averaging Response

Fast	Slow
5.0	5.1

6 AUTOMATIC LEVEL CONTROL*

Slow AM >20 Hz	Fast AM >1 kHz	Off
6.0	6.1	6.2

* Except Tuned RF level

7 RF FREQUENCY RESOLUTION

AUTO	10 Hz	100 Hz	1 kHz
7.0	7.1	7.2	7.3

8 ERROR MESSAGE DISABLE AND ENABLE

AUTO	Disable Errors							All Errors Enabled
	01	02 03	01 02 03	04	01 04	02 03 04	01 02 03 04	
8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8

9 IF GAIN

IF Gain (dB)							
AUTO	0	10	20	30	40	50	60
9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7

10 RF POWER RANGE

Most Sensitive Range → Least Sensitive Range

AUTO	#1	#2	#3	#4	#5
10.0	10.1	10.2	10.3	10.4	10.5

8902A MEASURING RECEIVER

08902-90027 A

RF POWER

RF POWER MEASUREMENTS

RF POWER. The RF POWER key enables the Measuring Receiver to make broadband RF and microwave power measurements. If a power sensor is not connected, the instrument is automatically configured to make RF Level measurements (Special Function 35).

SENSOR MODULE. Interconnection with an external sensor module enables the Measuring Receiver to make calibrated measurements over a −20 to +30 dBm range. The sensor must be zeroed and calibrated before absolute power measurements can be made.

To zero sensor module:

RF POWER • + • ZERO → Zero Displayed

To calibrate sensor module, connect to RF POWER OUTPUT. Then:

• CALIBRATE → Measured value Displayed

• + • SAVE CAL → 1.000 mW displayed

RF POWER CALIBRATION FACTORS

CALIBRATION FACTORS. Calibration factors are listed on the power sensor. At least two calibration factors are necessary to make a calibrated RF power measurement: a reference calibration factor and a calibration factor for the current measurement frequency.

CALIBRATION FACTOR TABLES. A reference calibration factor and up to 16 frequency/calibration factor pairs can be stored in the internal calibration factor table. A second table, with an entry capability of 22 frequency/calibration factor pairs and a reference calibration factor, is accessed when in the Frequency Offset mode.

To enter a reference calibration factor:

3 7 . 3 + SPCL •

+ Key in cal factor + • + MHz CAL FACTOR

To enter a frequency/calibration factor pair:

3 7 . 3 + SPCL • + key in frequency

+ MHz INPUT FREQ + key in cal factor + • + MHz CAL FACTOR

Repeat this procedure for each table entry.

To display the reference calibration factor, press RF POWER. Then:

3 7 . 5 + SPCL •

+ • + MHz CAL FACTOR → Cal factor displayed

To display the frequency/cal factor pairs:

3 7 . 6 + SPCL •

+ • + kHz DISPLAY FREQ → Frequency displayed

+ • + MHz CAL FACTOR → Cal factor displayed

TUNED RF LEVEL

TUNED RF LEVEL MEASUREMENTS (TRFL)

TUNED RF LEVEL. An RF Power measurement plus three internal ranges of RF attenuation and gain enable the Measuring Receiver to reach its lowest measurement levels. A calibration factor for each pair of ranges is determined during TRFL measurements. If the input frequency is changed, re-tune the Measuring Receiver and perform the calibration procedure at the new input frequency. (TRFL calibration is possible only after the RF Power procedures shown above have performed.)

IF SYNCHRONOUS DETECTOR. The Measuring Receiver automatically selects the narrow-band IF filter and the IF Synchronous Detector to make low-level measurements.

IF AVERAGE DETECTOR. To reduce the Measuring Receiver's residual FM sensitivity when making low-level measurements, select the wide-band IF filter and the IF Average Detector. This is a wide-band detector and can be used to measure drifting or modulated signals. (Special Function 4.4)

TUNED RF LEVEL CALIBRATION

CALIBRATION. Press the CALIBRATE key each time the RECAL annunciator is displayed to create an individual cal factor for each pair of TRFL ranges.

To calibrate a TRFL range:

• S + • TUNED RF LEVEL → Measured reference value displayed + • CALIBRATE

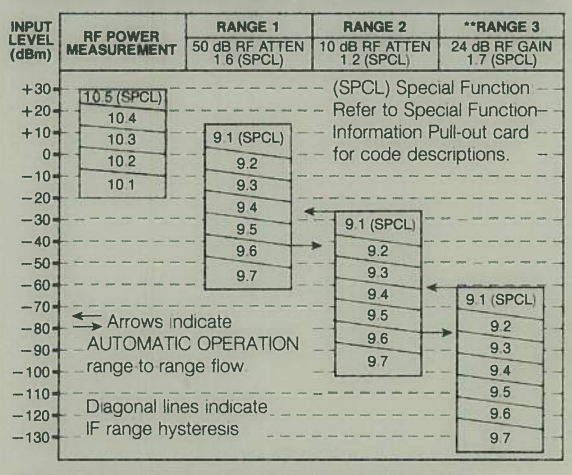
CAL FACTORS. The three calibration factors are stored and remain valid as long as the input frequency remains within ±5% of the tuned frequency. Calibration factors can also be entered from the front panel or via HP-IB.

ATTENUATOR MEASUREMENTS (SET REF). To make relative measurements, connect the input signal directly to the RF INPUT of the Measuring Receiver. Use either the Synchronous or Average Detector when making attenuator measurements.

To establish the input signal as the power reference:

• + • SET REF

TUNED RF LEVEL RANGES (IF Synchronous Detector)*



*Selecting the IF Average Detector raises the limits of all TRFL ranges by 23 dB.

**Special Function 1.9 raises the limits of Range 3 by 10 dB.

HP-IB OPERATION

Remotely program the 8902A by substituting HP-IB codes for keystrokes. HP-IB code errors will cause a service request to be issued. Refer also to Special Functions 21 and 22.

MEASUREMENT	CODE
AM	M1
FM	M2
ϕM	M3
RF POWER	M4
FREQ	M5
AUDIO FREQ	S1
AUDIO DISTN	S2
IF LEVEL	S3
TUNED RF LEVEL	S4
FREQ ERROR	S5

DETECTOR	CODE
PEAK+	D1
PEAK−	D2
PEAK HOLD	D3
AVG	D4
1 kHz DISTN	D5
400 Hz DISTN	D6
RMS	D8
PEAK±/2	D9

DISPLAY	CODE
Display LOG Result	LG
Display LIN Result	LN
dB EXT ATTEN Off	N0
dB EXT ATTEN On	N1
RATIO Off	R0
RATIO On	R1
PREVIOUS RATIO	R2

FILTERS	CODE
HP FILTERs Off	H0
50 Hz HIGH-PASS On	H1
300 Hz HIGH-PASS On	H2
LP FILTERs Off	L0
3 kHz LOW-PASS On	L1
15 kHz LOW-PASS On	L2
>20 kHz On	L3

FM DE-EMPHASIS	CODE
FM DE-EMPHASIS Off and PRE-DISPLAY Off	P0
PRE-DISPLAY On	P1
25 μs DE-EMPHASIS	P2
50 μs DE-EMPHASIS	P3
75 μs DE-EMPHASIS	P4
750 μs DE-EMPHASIS	P5

CALIBRATION	CODE
CALIBRATE Off	C0
CALIBRATE On	C1
% CAL FACTOR	CF
SET REF	RF
SAVE CAL	SC

HP-IB OUTPUT FORMATS

Errors: ±900000DD00E+01 CR LF (DD = Error Code)

Data (Fundamental Units): ±DDDDDDDDDDE±NN CR LF (DDDDDDDDDD = Mantissa; NN = Exponent)

MANUAL OPERATION	CODE
AUTO TUNING	AT
ENABLE ERRORS	B0
DISABLE ERROR	B1
CLEAR	CL
DISPLAY FREQ	FR
DISPLAY INCREMENT	FN
Step Up (Hz)	HU
Step Down (Hz)	HD
INPUT FREQUENCY(Hz)	HZ
TRACK Mode Off	K0
TRACK Mode On	K1
Step Up (kHz)	KU
Step Down (kHz)	KD
mV Units	MV
MHz (INPUT FREQ)	MZ
RECALL	RC
SPECIAL FUNCTION	SP
SPECIAL, SPECIAL	SS
STORE	TR
μV Units	UV
V Units	VL
W Units	WT

MISCELLANEOUS	CODE
MODULATION OUTPUT	A0
AUDIO INPUT	A1
AUTOMATIC OPERATION	AU
Automatic Ranging	G0
RANGE HOLD	G1
Identify Instrument	ID
INSTR PRESET	IP
Trigger Off	T0
Hold	T1
Trigger Immediate	T2
Trigger with Settling	T3
Hexadecimal A	X0
Hexadecimal B	X1
Hexadecimal C	X2
Hexadecimal D	X3
Hexadecimal E	X4
Hexadecimal F	X5
ZERO	ZR

DISPLAY

- \- - No input signal sensed by the instrument.
- \- - - - Input signal sensed; measurement not ready or signal unstable.
- \- - - - - - Instrument in signal search routine. (Synchronous Tuned RF Level measurements only.)

TUNED RF LEVEL MEASUREMENTS

RECAL and UNCAL Current range uncalibrated, an attempt can be made to calibrate.
If neither annunciator is displayed, measurement is calibrated.

RECAL (only) Current range calibrated, attempt may be made to calibrate next range.

UNCAL (only) Current measurement uncalibrated and the current range cannot be calibrated.

ERROR CODES (AUTOMATIC OPERATION key clears many of these errors.)

OPERATING ERRORS

Error Code	Meaning
01	IF Frequency error.
02	Input level too high.
03	Input level too low.
04	Audio circuits overdriven.
05	FM squelched.
06	RF Input overload.
07	Voltmeter and Display overrange.
08	Calibrator error.
09	Option not installed.
10	Input frequency out of range.
11	Calculated value out of range.
12	Time Base Oven cold (Opt. 002 only).
13	Power Sensor not connected.
14	Cannot zero Power Sensor.
15	Calibration Factor error.
16	Audio level too low.
18	Unable to calibrate RF Power.
19	Signal too low for current Tuned RF Level Range.
96	(HP-IB only.) Indicates "−−" display (no signal at input).

ENTRY ERRORS

Error Code	Meaning
20	Entered value out of range.
21	Invalid key sequence.
22	Invalid Special Function prefix.
23	Invalid Special Function suffix.
24	Invalid HP-IB code.
25	Invalid hardware configuration for Synchronous and Average Tuned RF Level.
26	Attempt to read/store beyond end of RF Power Cal Factor tables.

TUNED RF LEVEL CALIBRATION ERRORS

30	Manual attenuation or gain selection.
31	Require new power reference.
32	Current IF gain does not allow calibration.
33	RF Power Sensor reference error.
34	Signal lost during calibration.
35	Level error during calibration.

SERVICE ERRORS

40-89 Refer to service section of HP 8902A instrument manual.