Agilent U2761A USB Modular Function/Arbitrary Waveform Generator

Programmer's Reference Guide

Agilent Technologies

Notices

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Contents

1 Introduction to Programming

This chapter introduces the remote programming basics of the U2761A USB modular function/arbitrary waveform generator. The programming commands provide the means to control this instrument remotely via a PC.

Introduction to the SCPI Language

SCPI, also known as the Standard Commands for Programmable Instruments, is an ASCII-based instrument command language designed for test and measurement instruments. SCPI commands are based on a hierarchical structure, also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus forming subsystems. A portion of the SOURce subsystem is shown below to illustrate the tree system.

```
[SOURce:]
    FREQuency:
       STARt <frequency>
       STARt?

    SWEep:
       SPACing {LINear|LOGarithmic}
       SPACing?
```

`SOURce` is the root keyword of the command, `FREQuency` and `SWEep` are second-level keywords, and `STARt` and `SPACing` are third-level keywords. A colon (**:**) separates a command keyword from a lower-level keyword.

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form.

For example, in the above syntax statement, `FREQ` and `FREQuency` are both acceptable forms. You can use upper- or lower-case letters. Therefore, `FREQUENCY`, `freq`, and `Freq` are all acceptable. Other forms, such as `FRE` and `FREQUEN`, are not valid and will generate an error.

SCPI Conventions and Data Formats

The following SCPI conventions are used throughout this guide.

Angle brackets **< >**	Items within angle brackets are parameter abbreviations. For example, `<NR1>` indicates a specific form of numerical data.
Vertical bar **|**	Vertical bars separate alternative parameters. For example, `LINear|LOGarithmic` indicates that either "`LINear`" or "`LOGarithmic`" can be used as a parameter.
Square brackets **[ ]**	Items within square brackets are optional. The representation `[SOURce:]FREQuency` means that `SOURce:` may be omitted.
Parenthesis **( )**	Parameters within parentheses are used to specify an address list. The notation (@1) specifies address 1. The notation (@1,3) specifies an address list of 1 and 3.
Braces **{ }**	Braces enclose the parameter choices for a given command string. For example, `OUTPut:LOAD {<ohms>|INFinity}`. The braces are not sent with the command string.

The SCPI language defines several different data formats to be used in program messages and response messages.

Numeric Commands that require parameters to accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. You can also send engineering unit suffixes with numeric parameters (example, MHz or kHz).

Discrete Parameters used to program settings that have a limited number of values (example, BUS, IMMediate, EXTernal). They have a short form and a long form just like command keywords. You can mix upper- and lower-case letters. Query responses will always return the short form in all upper-case letters.

Boolean Parameters that represent a single binary condition that is either true or false. For a false condition, the U2761A will accept “OFF” or “0”. For a true condition, the U2761A will accept “ON” or “1”. When you query a boolean setting, the instrument will always return “0” or “1”.

String Parameters that contain virtually any set of ASCII characters. A string must begin and end with matching quotes; either with a single quote or a double quote. You can include the quote delimiter as part of the string by typing it twice without any characters in between.

Command Separators

A colon (**:**) is used to separate a command keyword from a lower-level keyword. You must insert a blank space to separate a parameter from a command keyword. If a command requires more than one parameter, you must separate adjacent parameters using a comma as shown below.

```
APPL:SIN 5 KHZ, 3.0 VPP, -2.5 V
```

A semicolon (**;**) is used to separate commands within the same subsystem, and can also minimize typing. For example, sending the following command string.

```
FREQ:START 10; STOP 1000
```

... is the same as sending the following two commands.

```
FREQ:START 10
FREQ:STOP 1000
```

Use a colon and semicolon to link commands from different subsystems. For example, in the following command string, an error is generated if you do not use both the colon and semicolon.

```
SWE:STAT ON;:TRIG:SOUR EXT
```

Querying Parameter Settings

You can query the current value of most parameters by adding a question mark (**?**) to the command. For example, the following command sets the output frequency to 5 kHz.

```
FREQ 5000
```

You can then query the current range setting by sending:

```
FREQ?
```

Typical Response: +5.0000000000000E+03

SCPI Command Terminators

A command string sent to the instrument must terminate with a <new line> (<NL>) character. The IEEE-488 End-Of-Identify (EOI) message is interpreted as a <NL> character and can be used to terminate a command string in place of a <NL> character. A <carriage return> followed by a <NL> is also accepted. Command string termination will always reset the current SCPI command path to the root level.

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines a set of common commands that perform functions such as reset, self-test, and status operation. Common commands always begin with an asterisk (*), are three characters in length, and may include one or more parameters. The command keyword is separated from the first parameter by a blank space. Use a semicolon (;) to separate multiple commands as shown below.

```
*RST; *CLS; *ESE 32; *OPC?
```

Address List Parameter

There are two ways to specify the U2761A address list parameter. To specify a single address, use the following syntax.

```
(@<address>)
```

For example, CONF:SSI SLAV, (@1), where (@1) specifies address 1.

To specify more than one address, the following syntax must be used.

```
(@<address>[,<address>])
```

NOTE The command CONFigure:SSI is the only U2761A command that uses the range of address list.

SCPI Status System

The status system records various conditions and states of the instrument in several register groups. Each of the register groups is made up of several low-level registers called Condition registers, Event registers, and Enable registers which control the action of specific bits within the register group.

A *Condition register* continuously monitors the state of the instrument. This is a read-only register and bits are not cleared when you read the register.

An *Event register* latches the various events from changes in the condition register. Once a bit is set, it remains set until cleared by query command or a clear status (*CLS) command.

An *Enable register* defines which bits in the event register will be reported to the Status Byte register group. You can write to or read from an enable register.

The relationship between various registers in the U2761A SCPI status system is shown in Figure 1-1.

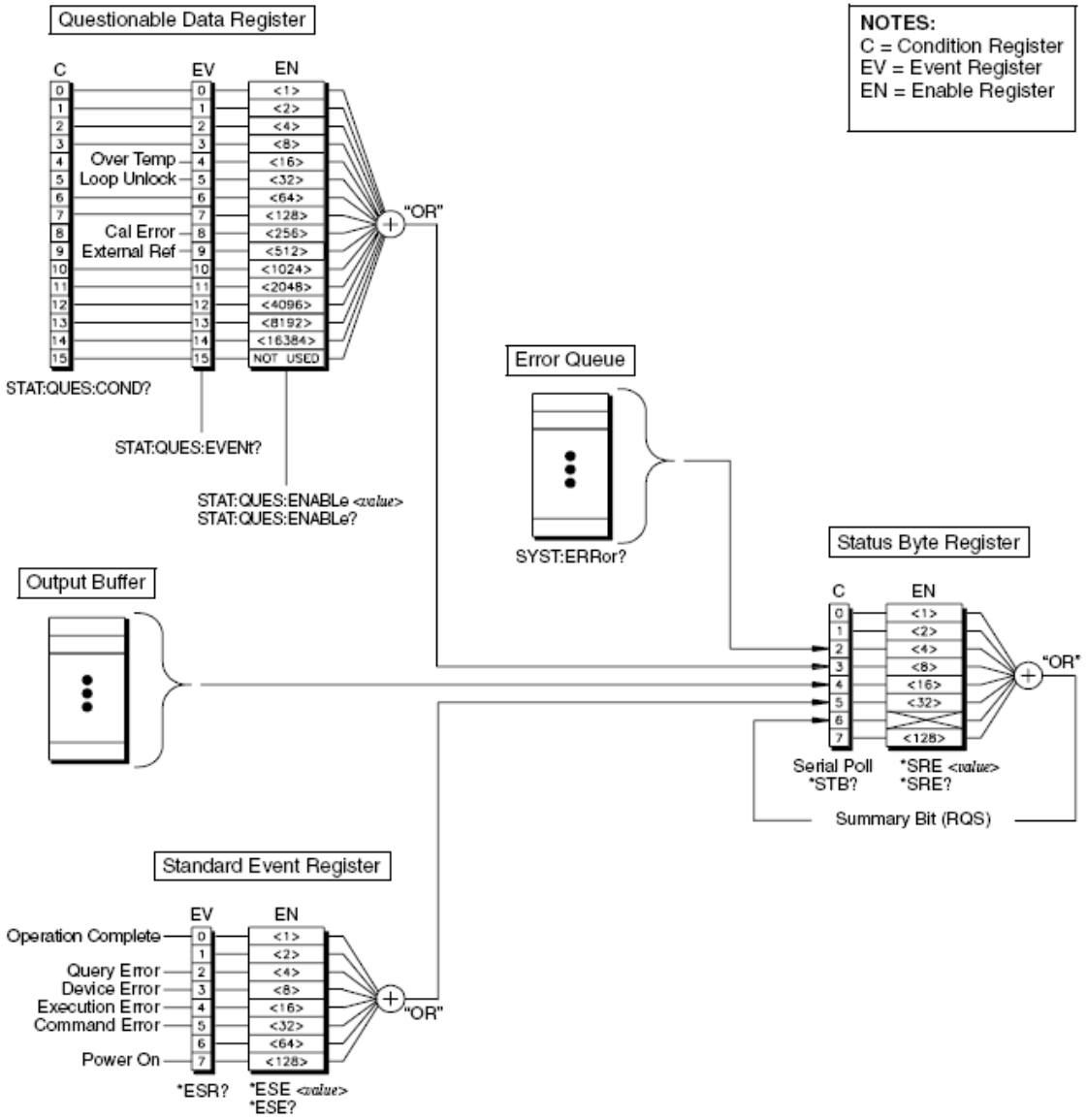


Figure 1-1 Status system diagram

Questionable Data Register

The Questionable Data register group provides the information on the quality or integrity of the U2761A. The outputs of the Questionable Data group are logically-ORed into the Questionable summary bit (3) of the Status Byte register.

Bit Definitions: Questionable Data Register

Bit number	Decimal value	Definition
0 to 3 Not Used	0	0 is returned.
4 Over Temperature	16	Internal temperature is over the limit. The U2761A is automatically reset to the default factory settings.
5 Loop Unlocked	32	The internal phase-lock loop is unlocked. Frequency accuracy will be affected.
6 to 7 Not Used	0	0 is returned.
8 Calibration Error	256	Error occurred during calibration or the calibration memory is lost.
9 External Reference	512	External phase reference is being used.
10 to 15 Not Used	0	0 is returned.

- The STATus:PRESet command will clear all bits in the enable register. This command presets the Questionable Data registers.

Standard Event Register

The Standard Event register group reports the following types of instrument events: power-on detected, command syntax errors, command execution errors, device errors (self-test or calibration), query errors, or when an `*OPC` command is executed. All of these conditions can be reported in the Standard Event summary bit through the enable register. To set the enable register mask, key in a decimal value to the register using the event status enable (`*ESE`) command.

Bit Definitions: Standard Event Register

Bit number	Decimal value	Definition
0 Operation Complete	1	All commands prior to and including `*OPC` have been executed.
1 Not Used	2	0 is returned.
2 Query Error	4	The instrument tried to read the output buffer but it was empty. Or, a new command line was received before a previous query has been read. Or, both the input and output buffers are full.
3 Device Error	8	A self-test, calibration, or other device-specific error has occurred.
4 Execution Error	16	A command execution error occurred.
5 Command Error	32	A command syntax error occurred.
6 Not Used	64	0 is returned.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

The event register in the Standard Event is cleared when:

- you execute the clear status (`*CLS`) command
- querying the event register using the event status register (`*ESR?`) command

The Standard Event enable register is cleared when you execute the `*ESE 0` command.

NOTE

- When the command, execution, device, and query errors occurred, the related error messages will be generated.
- For a complete listing of the error messages, refer to Chapter 16, "Error Messages" on page 128.

Status Byte Register

The Status Byte register group reports conditions from the other status registers. Clearing an event register from one of the other register groups will clear the corresponding bits in the Status Byte condition register. Data that is waiting in the U2761A output buffer is immediately reported on the "Message Available" bit (bit 4).

Bit Definitions: Status Byte Register

Bit number	Decimal value	Definition
0 Not Used	1	0 is returned.
1 Not Used	2	0 is returned.
2 Error Queue	4	There is at least one error message in the error queue.
3 Questionable Data summary	8	One or more bits are set in the Questionable Event register (bits must be enabled in the enable register).
4 Message Available	16	Data is available in the instrument's output buffer.
5 Event Status Byte summary	32	One or more bits are set in the Standard Event register (bits must be enabled in the enable register).
6 Master Status summary (Request for Service)	64	One or more bits are set in the Status Byte register (bits must be enabled in the enable register). Also used to indicate a request for service.
7 Not Used	128	0 is returned.

The Status Byte condition register will be cleared when:

- you execute the clear status (`*CLS`) command
- you read the event register from one of the other register groups, only the corresponding bits are cleared in the condition register

The Status Byte enable register is cleared when you execute the `*SRE 0` command.

NOTE Please refer to Chapter 13, "IEEE-488.2 Common Commands" on page 103 for more details of the common IEEE commands mentioned above.

1 Introduction to Programming

2 APPLy Commands

This section describes the APPLy commands used to program the U2761A over the remote interface.

Using the APPLy Command

The APPLy command provides the most straightforward method to program the U2761A over the remote interface. You can select the function, frequency, amplitude, and offset all in one command as shown in the syntax statement below.

```
APPLy: <function> [<frequency> [,<amplitude> [,<offset>] ]]
```

Due to the use of optional parameters in the APPLy commands (enclosed in square brackets), you must specify the frequency to use the amplitude parameter, and you must specify both frequency and amplitude to use the offset parameter. You cannot specify an amplitude or offset without specifying a frequency.

The APPLy commands perform the following operation.

- Turn off any modulation or sweep mode currently enabled and place the instrument in the continuous waveform mode.
- Turn on the output connector (`OUTP ON` command) but the output termination setting (`OUTP:LOAD` command) are not changed.
- For Square waveforms, override the current duty cycle setting and automatically select 50% (`FUNC:SQU:DCYC` command).
- For Ramp waveforms, override the current symmetry setting and automatically select 100% (`FUNC:RAMP:SYMM` command).

APPLy:SINusoid

Syntax

```
APPLy:SINusoid [<frequency> [,<amplitude> [,<offset>] ]]
```

Description

This command outputs a Sine wave with the specified frequency, amplitude, and DC offset.

Parameters

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz	1 kHz
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
`offset`	Numeric	±2.48 V (Into 50 Ω load) ±4.96 V (Into open circuit)	0 V

Example

The following command sets the output frequency to 2 kHz, output amplitude to 1 Vrms, and output offset to 0 V.

```
APPL:SIN 2000, 1 VRMS, 0
```

APPLy:SQUare

Syntax

```
APPLy:SQUare [<frequency> [,<amplitude> [,<offset>] ]]
```

Description

This command outputs a Square wave with the specified frequency, amplitude, and DC offset.

Parameters

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz	1 kHz
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
`offset`	Numeric	±2.48 V (Into 50 Ω load) ±4.96 V (Into open circuit)	0 V

Remark

This command overrides the current duty cycle setting and automatically selects 50%.

Example

The following command sets the output frequency to 5 kHz, output amplitude to 5 Vpp, and output offset to 0 V.

```
APPL:SQU 5000, 5 VPP, 0
```

APPLy:RAMP

Syntax

```
APPLy:RAMP [<frequency> [,<amplitude> [,<offset>] ]]
```

Description

This command outputs a Ramp wave with the specified frequency, amplitude, and DC offset.

Parameters

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 200 kHz	1 kHz
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
`offset`	Numeric	±2.48 V (Into 50 Ω load) ±4.96 V (Into open circuit)	0 V

Remarks

This command overrides the current symmetry setting and automatically selects 100%.

Example

The following command sets the output frequency to 10 kHz, output amplitude to 1 dbm, and output offset to 0 V.

```
APPL:RAMP 10000, 1 DBM, 0
```

APPLy:PULSe

Syntax

```
APPLy:PULSe [<frequency> [,<amplitude> [,<offset>] ]]
```

Description

This command outputs a Pulse wave with the specified frequency, amplitude, and DC offset.

Parameters

Item	Type	Range of values	Default value
`frequency`	Numeric	500 μHz to 5 MHz	1 kHz
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
`offset`	Numeric	±2.48 V (Into 50 Ω load) ±4.96 V (Into open circuit)	0 V

Example

The following command sets the output frequency to 1.5 kHz, output amplitude to 3 Vpp, and output offset to 1 V.

```
APPL:PULS 1500, 3 VPP, 1
```

APPLy:DC

Syntax

```
APPLy:DC [<frequency|DEFault> [,<amplitude>|DEFault>
[,<offset>] ]]
```

Description

This command outputs a DC voltage with the level specified by the offset parameter.

Parameters

Item	Type	Range of values	Default value
frequency|DEF	Numeric	N/A	DEF
amplitude|DEF	Numeric	N/A	DEF
offset	Numeric	±2.5 V (Into 50 Ω load) ±5 V (Into open circuit)	0 V

Remark

The frequency and amplitude parameters have no effect for the DC output but you must specify a value or DEFault. If you specify a frequency and amplitude, the values are stored in memory when you change to a different function.

Example

The following command sets the output frequency and amplitude to DEFault, and output offset to –2.5 V.

```
APPL:DC DEF, DEF, -2.5
```

APPLy:USER

Syntax

```
APPLy:USER [<frequency> [,<amplitude> [,<offset>] ]]
```

Description

This command outputs an Arbitrary waveform with the specified frequency, amplitude, and DC offset.

Parameters

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 200 kHz	1 kHz
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
`offset`	Numeric	±2.48 V (Into 50 Ω load) ±4.96 V (Into open circuit)	0 V

Remark

The maximum amplitude will be limited if the waveform data points do not span the full range of the output Digital-to-Analog Converter (DAC) from –8191 to 8191.

Example

The following command sets the output frequency to 1 kHz, output amplitude to 2 Vpp, and output offset to 0 V.

```
APPL:USER 1000, 2 VPP, 0
```

APPLy?

Syntax

```
APPLy?
```

Description

This query returns the U2761A current configuration of the function, frequency, amplitude, and offset in a quoted string (the quotation marks are returned as part of the string).

Example

The following query returns the function, frequency, amplitude, and offset values.

```
APPL?
```

Typical Response:

```
"SIN +1.0000000000000E+03,+1.0000000000000E+00,+0.0000000000000E+00"
```

3 Output Configuration Commands

This section describes the low-level commands used to program the U2761A output configuration.

FUNCtion

Syntax

```
[SOURce:]FUNCtion[:SHAPe]
{SINusoid|SQUare|RAMP|PULSe|DC|USER}
```

```
[SOURce:]FUNCtion[:SHAPe]?
```

Description

```
[SOURce:]FUNCtion[:SHAPe]
{SINusoid|SQUare|RAMP|PULSe|DC|USER}
```

This command selects the output function.

```
[SOURce:]FUNCtion[:SHAPe]?
```

This query returns the selected output function as SIN, SQU, RAMP, PULS, DC, or USER.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid, SQUare, RAMP, PULSe, DC, or USER	SIN

Examples

The following command sets the output function to Square.

```
FUNC SQU
```

The query returns the output function.

```
FUNC?
```

Typical Response: `SQU`

FREQuency

Syntax

```
[SOURce:]FREQuency[:CW|:FIXed] <frequency>
[SOURce:]FREQuency[:CW|:FIXed]?
```

Description

```
[SOURce:]FREQuency[:CW|:FIXed] <frequency>
```

This command sets the output frequency.

```
[SOURce:]FREQuency[:CW|:FIXed]?
```

This query returns the frequency setting in hertz for the function currently selected.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz (for sine and square) 1 μHz to 200 kHz (for ramp and arbitrary) 500 μHz to 5 MHz (for pulse)	1 kHz

Examples

The following command sets the output frequency to 2 kHz.

```
FREQ 2000
```

The query below returns the output frequency setting.

```
FREQ?
```

Typical Response: `+2.0000000000000E+03`

VOLTage

Syntax

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]
<amplitude> [VPP|VRMS|DBM]

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]?
```

Description

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]
<amplitude> [VPP|VRMS|DBM]
```

This command sets the output amplitude with optional unit.

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]?
```

This query returns the output amplitude for the function and unit currently selected.

Parameter

Item	Type	Range of values	Default value
`amplitude`	Numeric	40 mVpp to 5 Vpp (Into 50 Ω load) 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp

Examples

The following command sets the output amplitude to 5 Vpp.

```
VOLT 5 VPP
```

The query below returns the output amplitude.

```
VOLT?
```

Typical Response: `+5.0000000000000E+00`

VOLTage:OFFSet

Syntax

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet <offset>
[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet?
```

Description

`[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet <offset>`

This command sets the offset voltage.

`[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet?`

This query returns the offset voltage for the function currently selected.

Parameter

Item	Type	Range of values	Default value
`offset`	Numeric	±2.48 V (Into 50 Ω load)* ±4.96 V (Into open circuit)*	0 V

* For DC function, the range of values is ±2.5 V (into 50 Ω load) and ±5 V (into open circuit).

Examples

The following command sets the offset voltage to 1 V.

```
VOLT:OFFS 1
```

The query returns the offset voltage.

```
VOLT:OFFS?
```

Typical Response: `+1.0000000000000E+00`

VOLTage:HIGH

Syntax

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH <voltage>
```

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH?
```

Description

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH <voltage>
```

This command sets the high voltage levels.

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH?
```

This query returns the high voltage levels for the function currently selected.

Parameter

Item	Type	Range of values	Default value
`voltage`	Numeric	–2.46 V to 2.5 V (Into 50 Ω load) –4.92 V to 5 V (Into open circuit)	0.5 V

Examples

The following command sets the high voltage to 2 V.

```
VOLT:HIGH 2
```

The query returns the high voltage level.

```
VOLT:HIGH?
```

Typical Response: `+2.0000000000000E+00`

VOLTage:LOW

Syntax

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW <voltage>
```

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW?
```

Description

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW <voltage>
```

This command sets the low voltage levels.

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW?
```

This query returns the low voltage levels for the function currently selected.

Parameter

Item	Type	Range of values	Default value
`voltage`	Numeric	–2.5 V to 2.46 V (Into 50 Ω load) –5 V to 4.92 V (Into open circuit)	–0.5 V

Examples

The following command sets the low voltage to –2 V.

```
VOLT:LOW -2
```

The query returns the low voltage level.

```
VOLT:LOW?
```

Typical Response: `-2.0000000000000E+00`

VOLTage:UNIT

Syntax

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT {VPP|VRMS|DBM}
```

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT?
```

Description

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT {VPP|VRMS|DBM}
```

This command selects the units for the output amplitude.

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT?
```

This query returns the units for the output amplitude as VPP, VRMS, or DBM.

Parameter

Item	Type	Range of values	Default value
unit	Discrete	VPP, VRMS, or DBM	VPP

Examples

The following command sets the unit of the output amplitude to Vpp.

```
VOLT:UNIT VPP
```

The query below returns the output amplitude unit.

```
VOLT:UNIT?
```

TYpical Response: `VPP`

FUNCtion:SQUare:DCYCle

Syntax

```
[SOURce:]FUNCtion:SQUare:DCYCle <percent>
[SOURce:]FUNCtion:SQUare:DCYCle?
```

Description

```
[SOURce:]FUNCtion:SQUare:DCYCle <percent>
```

This command sets the duty cycle percentage for Square wave.

```
[SOURce:]FUNCtion:SQUare:DCYCle?
```

This query returns the current duty cycle setting in percent.

Parameter

Item	Type	Range of values	Default value
`percent`	Numeric	20% to 80% (for frequency ≤ 10 MHz) 40% to 60% (for frequency > 10 MHz)	50%

Examples

The following command sets the duty cycle to 80%.

```
FUNC:SQU:DCYC 80
```

The query below returns the duty cycle.

```
FUNC:SQU:DCYC?
```

Typical Response: `+8.0000000000000E+01`

FUNCtion:RAMP:SYMMetry

Syntax

```
[SOURce:]FUNCtion:RAMP:SYMMetry <percent>
[SOURce:]FUNCtion:RAMP:SYMMetry?
```

Description

```
[SOURce:]FUNCtion:RAMP:SYMMetry <percent>
```

This command sets the symmetry percentage for Ramp wave.

```
[SOURce:]FUNCtion:RAMP:SYMMetry?
```

This query returns the current symmetry setting in percent.

Parameter

Item	Type	Range of values	Default value
`percent`	Numeric	0% to 100%	100%

Examples

The following command sets the symmetry to 50%.

```
FUNC:RAMP:SYMM 50
```

The query below returns the symmetry.

```
FUNC:RAMP:SYMM?
```

Typical Response: `+5.0000000000000E+01`

OUTPut

Syntax

```
OUTPut[:STATe] {OFF|ON}

OUTPut[:STATe]?
```

Description

```
OUTPut[:STATe] {OFF|ON}
```

This command disables or enables the device output.

```
OUTPut[:STATe]?
```

This query returns the status of the output as 0 if the output is OFF, or 1 if the output is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command turns on the output.

```
OUTP ON
```

The following query returns the output state.

```
OUTP?
```

Typical Response: `1`

OUTPut:LOAD

Syntax

```
OUTPut:LOAD {<ohms>|INFinity}

OUTPut:LOAD?
```

Description

```
OUTPut:LOAD {<ohms>|INFinity}
```

This command selects the desired output termination.

```
OUTPut:LOAD?
```

This query returns the current load setting in ohms or 9.9E+37 for “high impedance”.

Parameter

Item	Type	Range of values	Default value
load	Numeric	1 Ω to 10 kΩ INFinity (9.9E+37 Ω)	50 Ω

Examples

The following command sets the output load to 2 kΩ.

```
OUTP:LOAD 2000
```

The following query returns the output load.

```
OUTP:LOAD?
```

Typical Response: `+2.0000000000000E+03`

4
Pulse Configuration Commands

This section describes the low-level commands used to program the U2761A to output a Pulse waveform.

PULSe:PERiod

Syntax

```
[SOURce:]PULSe:PERiod <seconds>
```

```
[SOURce:]PULSe:PERiod?
```

Description

```
[SOURce:]PULSe:PERiod <seconds>
```

This command sets the period for Pulse wave.

```
[SOURce:]PULSe:PERiod?
```

This query returns the period of the Pulse wave in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	200 ns to 2000 s	1 ms

Examples

The following command sets the period to 1 s.

```
PULS:PER 1
```

The query below returns the pulse period.

```
PULS:PER?
```

Typical Response: `+1.0000000000000E+00`

FUNCtion:PULSe:HOLD

Syntax

```
[SOURce:]FUNCtion:PULSe:HOLD {WIDTh|DCYCle}
```

```
[SOURce:]FUNCtion:PULSe:HOLD? [WIDTh|DCYCle]
```

Description

```
[SOURce:]FUNCtion:PULSe:HOLD {WIDTh|DCYCle}
```

This command holds either the pulse width or pulse duty cycle setting constant as the period is varied.

```
[SOURce:]FUNCtion:PULSe:HOLD? [WIDTh|DCYCle]
```

The query returns the pulse hold settings as WIDT or DCYC.

Parameter

Item	Type	Range of values	Default value
hold	Discrete	WIDTh or DCYCle	WIDT

Examples

The following command sets the pulse hold to pulse width.

```
FUNC:PULS:HOLD WIDTh
```

The query below returns the pulse hold setting.

```
FUNC:PULS:HOLD?
```

Typical Response: `WIDT`

FUNCtion:PULSe:WIDTh

Syntax

```
[SOURce:]FUNCtion:PULSe:WIDTh <seconds>
```

```
[SOURce:]FUNCtion:PULSe:WIDTh?
```

Description

```
[SOURce:]FUNCtion:PULSe:WIDTh <seconds>
```

This command sets the pulse width in seconds.

```
[SOURce:]FUNCtion:PULSe:WIDTh?
```

This query returns the pulse width in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	40 ns to 1999.99998s	500 µs

Examples

The following command sets the pulse width to 2 ms.

```
FUNC:PULS:WIDT 0.002
```

The query returns the pulse width.

```
FUNC:PULS:WIDT?
```

Typical Response: `+2.0000000000000E-03`

FUNCtion:PULSe:DCYCle

Syntax

```
[SOURce:]FUNCtion:PULSe:DCYCle <percent>
[SOURce:]FUNCtion:PULSe:DCYCle?
```

Description

```
[SOURce:]FUNCtion:PULSe:DCYCle <percent>
```

This command sets the pulse duty cycle percentage.

```
[SOURce:]FUNCtion:PULSe:DCYCle?
```

This query returns the current pulse duty cycle in percent.

Parameter

Item	Type	Range of values	Default value
`percent`	Numeric	~0% to ~100%	50%

Examples

The following command sets the pulse duty cycle to 50%.

```
FUNC:PULS:DCYC 50
```

The query returns the pulse duty cycle.

```
FUNC:PULS:DCYC?
```

Typical Response: `+5.0000000000000E+01`

5 Modulation Commands

The Modulation commands are used to generate modulations of the U2761A.

AM:INTernal:FUNCtion

Syntax

```
[SOURce:]AM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}

[SOURce:]AM:INTernal:FUNCtion?
```

Description

```
[SOURce:]AM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}
```

This command selects the modulating waveform of the amplitude modulation.

```
[SOURce:]AM:INTernal:FUNCtion?
```

This query returns the selected modulating waveform as SIN, SQU, RAMP, NRAM, TRI, or USER.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid, SQUare, RAMP, NRAMp, TRI, or USER	SIN

Examples

The following command sets the modulating waveform to Sine.

```
AM:INT:FUNC SIN
```

The query below returns the Sine waveform.

```
AM:INT:FUNC?
```

Typical Response: `SIN`

AM:INTernal:FREQuency

Syntax

```
[SOURce:]AM:INTernal:FREQuency <frequency>
[SOURce:]AM:INTernal:FREQuency?
```

Description

```
[SOURce:]AM:INTernal:FREQuency <frequency>
```

This command sets the frequency of the modulating waveform.

```
[SOURce:]AM:INTernal:FREQuency?
```

This query returns the modulating waveform frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	2 mHz to 20 kHz	100 Hz

Examples

This command sets the modulating frequency to 500 Hz.

```
AM:INT:FREQ 500
```

The query below returns the modulating frequency.

```
AM:INT:FREQ?
```

Typical Response: `+5.0000000000000E+02`

AM:DEPTh

Syntax

```
[SOURce:]AM:DEPTh <depth in percent>
[SOURce:]AM:DEPTh?
```

Description

```
[SOURce:]AM:DEPTh <depth in percent>
```

This command sets the amplitude modulation depth in percent.

```
[SOURce:]AM:DEPTh?
```

This query returns the amplitude modulation depth in percent.

Parameter

Item	Type	Range of values	Default value
depth in percent	Numeric	0% to 100%	100%

Examples

The following command sets the modulation depth to 50%.

```
AM:DEPT 50
```

The query below returns the modulation depth.

```
AM:DEPT?
```

Typical Response: `+5.0000000000000E+01`

AM:STATe

Syntax

```
[SOURce:]AM:STATe {OFF|ON}

[SOURce:]AM:STATe?
```

Description

```
[SOURce:]AM:STATe {OFF|ON}
```

The command disables or enables the amplitude modulation.

```
[SOURce:]AM:STATe?
```

This query returns the status of the amplitude modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the amplitude modulation.

```
AM:STAT ON
```

The following query returns the status of the modulation.

```
AM:STAT?
```

Typical Response: `1`

FM:INTernal:FUNCtion

Syntax

```
[SOURce:]FM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}

[SOURce:]FM:INTernal:FUNCtion?
```

Description

```
[SOURce:]FM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}
```

This command selects the modulating waveform of the frequency modulation.

```
[SOURce:]FM:INTernal:FUNCtion?
```

This query returns the selected modulating waveform as SIN, SQU, RAMP, NRAM, TRI, or USER.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid, SQUare, RAMP, NRAMp, TRI, or USER	SIN

Examples

The following command sets the modulating waveform to Sine.

```
FM:INT:FUNC SIN
```

The query below returns the modulating waveform.

```
FM:INT:FUNC?
```

Typical Response: `SIN`

FM:INTernal:FREQuency

Syntax

```
[SOURce:]FM:INTernal:FREQuency <frequency>
[SOURce:]FM:INTernal:FREQuency?
```

Description

```
[SOURce:]FM:INTernal:FREQuency <frequency>
```

This command sets the frequency of the modulating waveform.

```
[SOURce:]FM:INTernal:FREQuency?
```

This query returns the modulating waveform frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	2 mHz to 20 kHz	100 Hz

Examples

This command sets the modulating frequency to 500 Hz.

```
FM:INT:FREQ 500
```

The query below returns the modulating frequency.

```
FM:INT:FREQ?
```

Typical Response: `+5.0000000000000E+02`

FM:DEViation

Syntax

```
[SOURce:]FM:DEViation <peak deviation in Hz>
[SOURce:]FM:DEViation?
```

Description

```
[SOURce:]FM:DEViation <peak deviation in Hz>
```

This command sets the peak frequency deviation.

```
[SOURce:]FM:DEViation?
```

This query returns the frequency deviation in hertz.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	1 Hz to 500 kHz	100 Hz

Examples

The following command sets the frequency deviation to 200 Hz.

```
FM:DEV 200
```

The following query returns the deviation.

```
FM:DEV?
```

Typical Response: `+2.0000000000000E+02`

FM:STATe

Syntax

```
[SOURce:]FM:STATe {OFF|ON}
```

```
[SOURce:]FM:STATe?
```

Description

```
[SOURce:]FM:STATe {OFF|ON}
```

This command disables or enables the frequency modulation.

```
[SOURce:]FM:STATe?
```

This query returns the status of the frequency modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the frequency modulation.

```
FM:STAT ON
```

The following query returns the status of the modulation.

```
FM:STAT?
```

Typical Response: `1`

PM:INTernal:FUNCtion

Syntax

```
[SOURce:]PM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}

[SOURce:]PM:INTernal:FUNCtion?
```

Description

```
[SOURce:]PM:INTernal:FUNCtion
{SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}
```

This command selects the modulating waveform of the phase modulation.

```
[SOURce:]PM:INTernal:FUNCtion?
```

This query returns the selected modulating waveform as SIN, SQU, RAMP, NRAM, TRI, or USER.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid, SQUare, RAMP, NRAMp, TRI, or USER	SIN

Examples

The following command sets the modulating waveform to Sine.

```
PM:INT:FUNC SIN
```

The query below returns the modulating waveform.

```
PM:INT:FUNC?
```

Typical Response: `SIN`

PM:INTernal:FREQuency

Syntax

```
[SOURce:]PM:INTernal:FREQuency <frequency>
[SOURce:]PM:INTernal:FREQuency?
```

Description

```
[SOURce:]PM:INTernal:FREQuency <frequency>
```

This command sets the frequency of the modulating waveform.

```
[SOURce:]PM:INTernal:FREQuency?
```

This query returns the modulating waveform frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	2 mHz to 20 kHz	10 Hz

Examples

This command sets the modulating frequency to 500 Hz.

```
PM:INT:FREQ 500
```

The query below returns the modulating frequency.

```
PM:INT:FREQ?
```

Typical Response: `+5.0000000000000E+02`

PM:DEViation

Syntax

```
[SOURce:]PM:DEViation <deviation in degrees>
[SOURce:]PM:DEViation?
```

Description

```
[SOURce:]PM:DEViation <deviation in degrees>
```

This command sets the phase deviation.

```
[SOURce:]PM:DEViation?
```

This query returns the phase deviation in degrees.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	0 ° to 360 °	180 °

Examples

The following command sets the deviation to 10 °.

```
PM:DEV 10
```

The following query returns the deviation.

```
PM:DEV?
```

Typical Response: `+1.0000000000000E+01`

PM:STATe

Syntax

```
[SOURce:]PM:STATe {OFF|ON}

[SOURce:]PM:STATe?
```

Description

```
[SOURce:]PM:STATe {OFF|ON}
```

This command disables or enables the phase modulation.

```
[SOURce:]PM:STATe?
```

This query returns the status of the phase modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the phase modulation.

```
PM:STAT ON
```

The following query returns the status of the modulation.

```
PM:STAT?
```

Typical Response: `1`

6
Shift Keying Commands

The Shift keying commands are configured to perform shift keying modulations of the U2761A.

ASKey:INTernal:RATE

Syntax

```
[SOURce:]ASKey:INTernal:RATE <rate in Hz>
```

```
[SOURce:]ASKey:INTernal:RATE?
```

Description

```
[SOURce:]ASKey:INTernal:RATE <rate in Hz>
```

This command sets the rate at which the output amplitude “shifts” between two preset amplitudes.

```
[SOURce:]ASKey:INTernal:RATE?
```

This query returns the amplitude-shift keying rate in hertz.

Parameter

Item	Type	Range of values	Default value
rate	Numeric	2 mHz to 100 kHz	10 Hz

Examples

The following commands sets the ASK rate to 10 Hz.

```
ASK:INT:RATE 10
```

The query below returns the ASK rate.

```
ASK:INT:RATE?
```

Typical Response: `+1.0000000000000E+01`

ASKey:STATe

Syntax

```
[SOURce:]ASKey:STATe {OFF|ON}

[SOURce:]ASKey:STATe?
```

Description

```
[SOURce:]ASKey:STATe {OFF|ON}
```

This command disables or enables the amplitude-shift keying modulation.

```
[SOURce:]ASKey:STATe?
```

This query returns the status of the amplitude-shift keying modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the ASK modulation.

```
ASK:STAT ON
```

The following query returns the status of the ASK modulation.

```
ASK:STAT?
```

Typical Response: `1`

FSKey:FREQuency

Syntax

```
[SOURce:]FSKey:FREQuency <frequency>
```

```
[SOURce:]FSKey:FREQuency?
```

Description

```
[SOURce:]FSKey:FREQuency <frequency>
```

This command sets the frequency-shift keying alternate (or “hop”) frequency.

```
[SOURce:]FSKey:FREQuency?
```

This query returns the “hop” frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz	100 Hz

Examples

The following commands sets the FSK frequency to 200 Hz.

```
FSK:FREQ 200
```

The query below returns the FSK frequency.

```
FSK:FREQ?
```

Typical Response: `+2.0000000000000E+02`

FSKey:INTernal:RATE

Syntax

```
[SOURce:]FSKey:INTernal:RATE <rate in Hz>
```

```
[SOURce:]FSKey:INTernal:RATE?
```

Description

```
[SOURce:]FSKey:INTernal:RATE <rate in Hz>
```

The command sets the rate at which the output frequency “shifts” between the carrier frequency and hop frequency.

```
[SOURce:]FSKey:INTernal:RATE?
```

This query returns the frequency-shift keying rate in hertz.

Parameter

Item	Type	Range of values	Default value
`rate`	Numeric	2 mHz to 100 kHz	10 Hz

Examples

The following commands sets the FSK rate to 10 Hz.

```
FSK:INT:RATE 10
```

The query below returns the FSK rate.

```
FSK:INT:RATE?
```

Typical Response: `+1.0000000000000E+01`

FSKey:STATe

Syntax

```
[SOURce:]FSKey:STATe {OFF|ON}

[SOURce:]FSKey:STATe?
```

Description

```
[SOURce:]FSKey:STATe {OFF|ON}
```

This command disables or enables the frequency-shift keying modulation.

```
[SOURce:]FSKey:STATe?
```

This query returns the status of the frequency-shift keying modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the FSK modulation.

```
FSK:STAT ON
```

The following query returns the status of the FSK modulation.

```
FSK:STAT?
```

Typical Response: `1`

PSKey:DEViation

Syntax

```
[SOURce:]PSKey:DEViation <deviation in degrees>
[SOURce:]PSKey:DEViation?
```

Description

```
[SOURce:]PSKey:DEViation <deviation in degrees>
```

This command sets the phase-shift keying deviation.

```
[SOURce:]PSKey:DEViation?
```

This query returns the deviation in degrees.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	0 ° to 360 °	180 °

Examples

The following commands sets the PSK deviation to 100 °.

```
PSK:DEV 100
```

The query below returns the PSK deviation.

```
PSK:DEV?
```

Typical Response: `+1.0000000000000E+02`

PSKey:INTernal:RATE

Syntax

```
[SOURce:]PSKey:INTernal:RATE <rate in Hz>
```

```
[SOURce:]PSKey:INTernal:RATE?
```

Description

```
[SOURce:]PSKey:INTernal:RATE <rate in Hz>
```

This command sets the rate at which the output phase “shifts” between two preset phases.

```
[SOURce:]PSKey:INTernal:RATE?
```

This query returns the phase-shift keying rate in hertz.

Parameter

Item	Type	Range of values	Default value
rate	Numeric	2 mHz to 100 kHz	10 Hz

Examples

The following commands sets the PSK rate to 100 Hz.

```
PSK:INT:RATE 100
```

The query below returns the PSK rate.

```
PSK:INT:RATE?
```

Typical Response: `+1.0000000000000E+02`

PSKey:STATe

Syntax

```
[SOURce:]PSKey:STATe {OFF|ON}

[SOURce:]PSKey:STATe?
```

Description

```
[SOURce:]PSKey:STATe {OFF|ON}
```

This command disables or enables the phase-shift keying modulation.

```
[SOURce:]PSKey:STATe?
```

This query returns the status of the phase-shift keying modulation as 0 if the modulation is OFF, and 1 if the modulation is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the PSK modulation.

```
PSK:STAT ON
```

The following query returns the status of the PSK modulation.

```
PSK:STAT?
```

Typical Response: `1`

7
Frequency Sweep Commands

This chapter lists the Frequency Sweep commands for the U2761A.

FREQuency:STARt

Syntax

```
[SOURce:]FREQuency:STARt <frequency>
```

```
[SOURce:]FREQuency:STARt?
```

Description

```
[SOURce:]FREQuency:STARt <frequency>
```

This command sets the start frequency.

```
[SOURce:]FREQuency:STARt?
```

This query returns the start frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz (for sine and square) 1 μHz to 200 kHz (for ramp and arbitrary)	100 Hz

Examples

The following command sets the start frequency to 500 Hz.

```
FREQ:STAR 500
```

The following query returns the start frequency.

```
FREQ:STAR?
```

Typical Response: `+5.0000000000000E+02`

FREQuency:STOP

Syntax

```
[SOURce:]FREQuency:STOP <frequency>
```

```
[SOURce:]FREQuency:STOP?
```

Description

```
[SOURce:]FREQuency:STOP <frequency>
```

This command sets the stop frequency.

```
[SOURce:]FREQuency:STOP?
```

This query returns the stop frequency in hertz.

Parameter

Item	Type	Range of values	Default value
`frequency`	Numeric	1 μHz to 20 MHz (for sine and square) 1 μHz to 200 kHz (for ramp and arbitrary)	1 kHz

Examples

The following command sets the stop frequency to 10 kHz.

```
FREQ:STOP 10000
```

The following query returns the stop frequency.

```
FREQ:STOP?
```

Typical Response: `+1.0000000000000E+04`

SWEep:SPACing

Syntax

```
[SOURce:]SWEep:SPACing {LINear|LOGarithmic}
[SOURce:]SWEep:SPACing?
```

Description

```
[SOURce:]SWEep:SPACing {LINear|LOGarithmic}
```

This command selects linear or logarithmic spacing for the sweep.

```
[SOURce:]SWEep:SPACing?
```

This query returns the selected spacing as LIN or LOG.

Parameter

Item	Type	Range of values	Default value
spacing	Discrete	LINear or LOGarithmic	LIN

Examples

The following command sets the spacing to linear.

```
SWE:SPAC LIN
```

The following query returns the spacing.

```
SWE:SPAC?
```

Typical Response: `LIN`

SWEep:TIME

Syntax

```
[SOURce:]SWEep:TIME <seconds>
```

```
[SOURce:]SWEep:TIME?
```

Descriptiom

```
[SOURce:]SWEep:TIME <seconds>
```

The command sets the number of seconds required to sweep from the start frequency to the stop frequency.

```
[SOURce:]SWEep:TIME?
```

This query returns the sweep time in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	1 ms to 500 s	1 s

Examples

The following command sets the sweep time to 20 s.

```
SWE:TIME 20
```

The following query returns the sweep time.

```
SWE:TIME?
```

Typical Response: `+2.0000000000000E+01`

SWEep:STATe

Syntax

```
[SOURce:]SWEep:STATe {OFF|ON}

[SOURce:]SWEep:STATe?
```

Description

```
[SOURce:]SWEep:STATe {OFF|ON}
```

This command disables or enables the sweep mode.

```
[SOURce:]SWEep:STATe?
```

This query returns the status of the sweep mode as 0 if the sweep mode is OFF, and 1 if the sweep mode is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the sweep mode.

```
SWE:STAT ON
```

The following query returns the status of the sweep mode.

```
SWE:STAT?
```

Typical Response: `1`

8 Triggering Commands

The chapter describes the triggering commands which control the triggering of the instrument.

TRIGger:SOURce

Syntax

```
TRIGger[:SEQuence]:SOURce {IMMediate|EXTernal|BUS|STRG}

TRIGger[:SEQuence]:SOURce?
```

Description

```
TRIGger[:SEQuence]:SOURce {IMMediate|EXTernal|BUS|STRG}
```

This command selects the source from which the U2761A will accept a trigger. Star trigger (STRG) is the synchronized trigger source from the U2781A chassis.

```
TRIGger[:SEQuence]:SOURce?
```

This query returns the selected trigger source as IMM, EXT, BUS, or STRG.

Parameter

Item	Type	Range of values	Default value
source	Discrete	IMMediate, EXTernal, BUS, or STRG	IMM

Examples

The following command sets the trigger source to Immediate.

```
TRIG:SOUR IMM
```

The query below returns the trigger source.

```
TRIG:SOUR?
```

Typical Response: `IMM`

TRIGger

Syntax

```
TRIGger[:SEQuence][:IMMediate]
```

Description

This command triggers a sweep from the remote interface.

Example

The following command triggers a sweep.

```
TRIG
```

TRIGger:SLOPe

Syntax

```
TRIGger[:SEQuence]:SLOPe {POSitive|NEGative}

TRIGger[:SEQuence]:SLOPe?
```

Description

```
TRIGger[:SEQuence]:SLOPe {POSitive|NEGative}
```

This command selects whether the U2761A uses the rising edge or falling edge of the trigger signal on the device Trig In connector to start the sweep.

```
TRIGger[:SEQuence]:SLOPe?
```

This query returns the selected trigger signal as POS or NEG.

Parameter

Item	Type	Range of values	Default value
slope	Discrete	POSitive or NEGative	POS

Examples

The following command sets the trigger slope to Positive.

```
TRIG:SLOP POS
```

The query below returns the trigger slope.

```
TRIG:SLOP?
```

Typical Response: `POS`

OUTPut:TRIGger:SLOPe

Syntax

```
OUTPut:TRIGger:SLOPe {POSitive|NEGative}

OUTPut:TRIGger:SLOPe?
```

Description

```
OUTPut:TRIGger:SLOPe {POSitive|NEGative}
```

This command selects a rising or falling edge for the trigger out signal at the beginning of the sweep.

```
OUTPut:TRIGger:SLOPe?
```

This query returns the selected trigger signal as POS or NEG.

Parameter

Item	Type	Range of values	Default value
slope	Discrete	POSitive or NEGative	POS

Examples

The following command sets the trigger slope to Positive.

```
OUTP:TRIG:SLOP POS
```

The query below returns the trigger slope.

```
OUTP:TRIG:SLOP?
```

Typical Response: `POS`

OUTPut:TRIGger

Syntax

```
OUTPut:TRIGger[:STATe] {OFF|ON}

OUTPut:TRIGger[:STATe]?
```

Description

```
OUTPut:TRIGger[:STATe] {OFF|ON}
```

This command disables or enables the output trigger signal on the U2761A Trig Out connector.

```
OUTPut:TRIGger[:STATe]?
```

This query returns the status of the trigger signal as 0 if the signal is OFF, and 1 if the signal is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the trigger out.

```
OUTP:TRIG ON
```

The following query returns the trigger status.

```
OUTP:TRIG?
```

Typical Response: `1`

9 Arbitrary Waveform Commands

The Arbitrary waveform commands are used to configure the Arbitrary waveforms for the U2761A.

DATA:DAC

Syntax

```
TRACe|DATA[:DATA]:DAC VOLATILE, {<binary block>|<value>,
<value>, . . . }
```

Description

This command downloads the arbitrary data in binary block or decimal integer values into volatile memory. You can download from 1 to 65536 (64K) points per waveform.

Parameter

Item	Type	Range of values	Default value
value	Numeric	–8191 to 8191	0

Example

The following command downloads four integer points in decimal format.

```
DATA:DAC VOLATILE, -8191, 0, 8191, 0
```

FORMat:BORDer

Syntax

```
FORMat:BORDer {NORMal|SWAPped}

FORMat:BORDer?
```

Description

```
FORMat:BORDer {NORMal|SWAPped}
```

This command selects the byte order format for binary block downloads. For Normal byte order, the most significant byte (MSB) of each data point is assumed first. For Swapped byte order, the least significant byte (LSB) of each data point is assumed first.

```
FORMat:BORDer?
```

This query returns the selected byte order format for the binary block downloads as NORM or SWAP.

Parameter

Item	Type	Range of values	Default value
format	Discrete	NORMal or SWAPped	NORM

Examples

The following command sets the Normal byte order.

```
FORM:BORD NORM
```

The query below returns the Normal byte order.

```
FORM:BORD?
```

Typical Response: `NORM`

DATA:ATTRibute:AVERage?

Syntax

```
TRACe|DATA:ATTRibute:AVERage?
```

Description

This query returns the arithmetic average of all data points for the specified Arbitrary waveform.

Example

The following query returns the average of the data points.

```
DATA:ATTR:AVER?
```

Typical Response: `+0.0000000000000E+00`

DATA:ATTRibute:CFACtor?

Syntax

```
TRACe|DATA:ATTRibute:CFACtor?
```

Description

This query returns the crest factor of all data points for the specified Arbitrary waveform.

Example

The following query returns the crest factor of the data points.

```
DATA:ATTR:CFAC?
```

Typical Response: +1.4142140000000E+00

DATA:ATTRibute:POINts?

Syntax

```
TRACe|DATA:ATTRibute:POINts?
```

Description

This query returns the number of points for the specified Arbitrary waveform from 1 to 65536 points.

Example

The following query returns the points for the specified Arbitrary waveform.

```
DATA:ATTR:POIN?
```

Typical Response: `+4.0000000000000E+00`

DATA:ATTRibute:PTPeak?

Syntax

```
TRACe|DATA:ATTRibute:PTPeak?
```

Description

This query returns the peak-to-peak value of all data points for the specified Arbitrary waveform from 0 to 16382, with 16382 indicating full amplitude is available.

Example

The following query returns the peak-to-peak value of the data points.

```
DATA:ATTR:PTP?
```

Typical Response: `+1.6382000000000E+04`

10
SYSTem Subsystem

This section gives the information on topics such as error conditions and chassis identity. This information is not directly related to waveform generation but is an important part of the U2761A system.

SYSTem:CDEScription?

Syntax

```
SYSTem:CDEScription?
```

Description

This query identifies which slot and chassis that the U2761A is plugged into the U2781A, and returns the slot and chassis number respectively.

Remarks

- If the U2761A is in standalone mode, then this query would return +7,+0.
- Please refer to the *U2781A Modular Instrument Chassis User's Guide* for the details.

Example

The following shows the query when the U2761A is slotted into slot 5 of chassis #12.

```
SYST:CDES?
```

Typical Response: `+5,+12`

SYSTem:ERRor?

Syntax

```
SYSTem:ERRor?
```

Description

This query returns the next error number and its corresponding message string from the error queue. The queue is a first-in, first-out (FIFO) buffer that stores errors as they occur. As it is read, each error is removed from the queue.

Remarks

- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **–350,"Queue overflow"**.
- If no errors have occurred when you read the error queue, the U2761A responds with **+0,"No error"**.
- The error queue is cleared by the clear status (*CLS) command and when power is cycled.
- Please refer to Chapter 16, "Error Messages" on page 135 for the error messages.

Example

The following shows the query when an invalid command is specified.

```
SYST:ERR?
```

Typical Response: **–113,"Undefined header"**

SYSTem:VERSion?

Syntax

```
SYSTem:VERSion?
```

Description

This query returns the version of the SCPI (Standard Commands for Programmable Instruments) standard in which the instrument complies with. The version is in a numeric form YYYY.V, where YYYY represents the year of the version and V represents a version for that year.

Example

The following query returns the SCPI version.

```
SYST:VERS?
```

Typical Response: `1997.0`

11
Phase-Lock Commands

The Phase-lock commands for the U2761A are discussed in this chapter.

PHASe:SOURce

Syntax

```
[SOURce:]PHASe:SOURce {INTernal|EXTernal|CCG}
```

```
[SOURce:]PHASe:SOURce?
```

Description

```
[SOURce:]PHASe:SOURce {INTernal|EXTernal|CCG}
```

This command selects the phase source to synchronize the output waveform. Chassis reference clock (CCG) is the synchronized phase source from the U2781A chassis.

```
[SOURce:]PHASe:SOURce?
```

This query returns the selected phase source as INT, EXT, or CCG.

Parameter

Item	Type	Range of values	Default value
source	Discrete	INTernal, EXTernal, or CCG	INT

Examples

The following command sets the phase source to Internal.

```
PHAS:SOUR INT
```

The query below returns the phase source.

```
PHAS:SOUR?
```

Typical Response: `INT`

PHASe

Syntax

```
[SOURce:]PHASe[:ADJust] <angle>
[SOURce:]PHASe[:ADJust]?
```

Description

`[SOURce:]PHASe[:ADJust] <angle>`

This command adjusts the phase offset of the output waveform.

`[SOURce:]PHASe[:ADJust]?`

This query returns the adjusted phase offset in the specified unit.

Parameter

Item	Type	Range of values	Default value
`angle`	Numeric	–360 ° to 360 ° (for degrees) –2 π to 2 π (for radians)	0 °

Examples

The following command sets the phase offset to 180 °.

```
PHAS 180
```

The query below returns the phase offset.

```
PHAS?
```

Typical Response: `+1.8000000000000E+02`

UNIT:ANGLe

Syntax

```
UNIT:ANGLe {DEGree|RADian}
UNIT:ANGLe?
```

Description

```
UNIT:ANGLe {DEGree|RADian}
```

This command selects degrees or radians to set the phase offset value.

```
UNIT:ANGLe?
```

This query returns the selected unit as DEG or RAD.

Parameter

Item	Type	Range of values	Default value
unit	Discrete	DEGree or RADian	DEG

Examples

The following command sets the phase offset unit to degrees.

```
UNIT:ANGL DEG
```

The query below returns the phase offset unit.

```
UNIT:ANGL?
```

Typical Response: `DEG`

PHASe:REFerence

Syntax

```
[SOURce:]PHASe:REFerence
```

Description

This command immediately sets the zero-phase reference point without changing the output phase of the U2761A.

Example

The following command sets the zero-phase reference point.

```
PHAS:REF
```

PHASe:UNLock:ERRor

Syntax

```
[SOURce:]PHASe:UNLock:ERRor[:STATe] {OFF|ON}

[SOURce:]PHASe:UNLock:ERRor[:STATe]?
```

Description

```
[SOURce:]PHASe:UNLock:ERRor[:STATe] {OFF|ON}
```

This command disables or enables the U2761A to generate an error if the phase-lock is ever lost.

```
[SOURce:]PHASe:UNLock:ERRor[:STATe]?
```

This query returns the status of the phase-lock error as 0 if the status is OFF, and 1 if the status is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the phase-lock error status.

```
PHAS:UNL:ERR ON
```

The following query returns the phase-lock error status.

```
PHAS:UNL:ERR?
```

Typical Response: `1`

OUTPut:PHASe

Syntax

```
OUTPut:PHASe[:STATe] {OFF|ON}

OUTPut:PHASe[:STATe]?
```

Description

```
OUTPut:PHASe[:STATe] {OFF|ON}
```

This command disables or enables the 10 MHz reference phase output.

```
OUTPut:PHASe[:STATe]?
```

This query returns the status the phase output as 0 if the output is OFF, and 1 if the output is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 (OFF) or 1 (ON)	0

Examples

The following command enables the phase output.

```
OUTP:PHAS ON
```

The following query returns the status of the phase output.

```
OUTP:PHAS?
```

Typical Response: `1`

12
Status Reporting Commands

The Status reporting commands allow you to determine the operating condition of the U2761A at any time.

STATus:PRESet

Syntax

```
STATus:PRESet
```

Description

This command clears all bits in the Questionable Data enable register.

Example

The following command presets the Questionable enable register.

```
STAT:PRES
```

STATus:QUEStionable:CONDition?

Syntax

```
STATus:QUEStionable:CONDition?
```

Description

This query returns the value of the Questionable Data condition register. The condition register is a read-only register, which holds the live (unlatched) questionable status of the instrument. Reading the Questionable condition register does not clear it. This query returns the binary-weighted sum of all bits set in the register.

Remark

For more information on the Questionable condition register, refer to Chapter 1, "Status system diagram" on page 8.

Example

The following query reads the Questionable condition register.

```
STAT:QUES:COND?
```

Typical Response: `+544`

STATus:QUEStionable:ENABle

Syntax

```
STATus:QUEStionable:ENABle <value>

STATus:QUEStionable:ENABle?
```

Description

This command and its query set and read the value of the Questionable Data enable register. The enable register is a mask for enabling specific bits from the Questionable event register to set the questionable summary bit (QUES) of the Status Byte register. This bit (bit 3) is the logical OR of all the Questionable event register bits that are enabled by the Questionable enable register. This query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	0 to 65535	0

Remarks

- The STATus:PRESet command will clear all bits in the enable register.
- For more information on the Questionable enable register, refer to Chapter 1, “Status system diagram” on page 8.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
STAT:QUES:ENAB 16
```

The following query returns the bits enabled in the register.

```
STAT:QUES:ENAB?
```

Typical Response: `+16`

STATus:QUEStionable?

Syntax

```
STATus:QUEStionable[:EVENt]?
```

Description

This query returns the value of the Questionable Data event register as binary-weighted sum of all bits set in the register. Reading the Questionable Data event register clears the events in the register.

Remarks

- Once a bit is set, it remains set until cleared by reading the event register or the clear status (*CLS) command.
- For more information on the Questionable event register, refer to Chapter 1, "Status system diagram" on page 8.

Example

The following query reads the Questionable event register.

```
STAT:QUES?
```

Typical Response: `+512`

13 IEEE-488.2 Common Commands

This chapter contains information on the IEEE-488.2 Common (*) Commands supported by the U2761A.

*CLS

Syntax

```
*CLS
```

Description

This command is used to clear the event registers in all register groups and also clears the error queue.

Example

The following command clears the event register bits.

```
*CLS
```

*ESE/*ESE?

Syntax

```
*ESE <value>
```

```
*ESE?
```

Description

```
*ESE <value>
```

This command enables bits in the enable register for the Standard Event register group. The selected bits are then reported to bit 5 of the Status Byte register.

```
*ESE?
```

This will query the Standard Event register group and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	0 to 65535	0

Remark

For more information on the Standard Event registers, refer to Chapter 1, "Status system diagram" on page 8.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
*ESE 16
```

The following query returns the bits enabled in the register.

```
*ESE?
```

Typical Response: `+16`

*ESR?

Syntax

```
*ESR?
```

Description

This query returns the value of the event register of the Standard Event group as a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	0 to 65535	0

Remarks

- Once a bit is set, it will remain set until cleared by reading the event register or the clear status (*CLS) command.
- For more information on the Standard Event registers, refer to Chapter 1, “Status system diagram” on page 8.

Example

The following query returns the bits enabled in the register.

```
*ESR?
```

Typical Response: `+16`

*IDN?

Syntax

```
*IDN?
```

Description

This query reads the U2761A identification string which contains four comma-separated fields. The first field is the manufacturer's name, the second is the model number of the U2761A, the third is the serial number, and the fourth is the firmware revision number. This query returns a string with the following format.

AGILENT TECHNOLOGIES,U2761A,<Serial Number>,m.mm-f.ff-b.bb

m.mm = main firmware revision number
f.ff = I/O processor firmware revision number
b.bb = boot loader firmware revision number

Example

The following query returns the U2761A identification string.

```
*IDN?
```

Typical Response:

```
AGILENT TECHNOLOGIES,U2761A,MY12345678,1.00-1.00-1.00
```

*OPC/*OPC?

Syntax

```
*OPC

*OPC?
```

Description

```
*OPC
```

Sets the “Operation Complete” bit (bit 0) in the Standard Event register after all of the previous commands have been completed. This command is used in the triggered sweep mode to provide a way to poll (interrupt) the computer when the *TRG command is complete.

```
*OPC?
```

This query always returns 1 to the output buffer after the previous commands have been completed. Other commands cannot be executed until this command completes.

Example

The following command sets the “Operation Complete” bit (bit 0).

```
*OPC
```

The following query returns 1 after operation has completed.

```
*OPC?
```

Typical Response: `1`

*RST

Syntax

```
*RST
```

Description

This command resets the U2761A to its factory default state, which is the state when the U2761A is powered-on. This command will abort a sweep in progress, but does not affect stored Arbitrary waveforms.

NOTE Refer to Chapter 17, "Factory Default Settings" on page 143 for a complete listing of the U2761A default settings.

Example

The following command resets the U2761A.

```
*RST
```

*SRE/*SRE?

Syntax

```
*SRE <value>
```

```
*SRE?
```

Description

```
*SRE <value>
```

This command enables the bits in the Status Byte enable register. The selected enabled bits are summarized in the “Master Summary” bit (bit 6) of the Status Byte Register. If any of the selected bit condition change from 0 to 1, a Service Request is generated.

```
*SRE?
```

The query command reads the enable register and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	0 to 65535	0

Remark

For more information on the Status Byte registers, refer to Chapter 1, “Status system diagram” on page 8.

Examples

The following command enables bit 4 (decimal value = 16) in the register.

```
*SRE 16
```

The following query returns the bits enabled in the register.

```
*SRE?
```

Typical Response: `+16`

*STB?

Syntax

```
*STB?
```

Description

This query reads the summary (condition) of the Status Byte register. This command is similar to a Serial Poll but it is processed like any other instrument command. This command returns the same result as a Serial Poll but the “Master Summary” bit (bit 6) is not cleared by the `*STB?` command.

Example

The following query reads the Status Byte register (assumed that bits 3 and 4 are set).

```
*STB?
```

Typical Response: `+24`

*TRG

Syntax

```
*TRG
```

Description

This command triggers a sweep from the remote interface only if the bus (software) trigger source is currently selected.

Example

The following command triggers a sweep.

```
*TRG
```

*TST?

Syntax

```
*TST?
```

Description

This query performs a self-test on the U2761A and returns +0 (pass) or +1 (fail). If the test fails, one or more error messages will be generated to provide additional information on the failure.

Example

The following query returns the self-test status.

```
*TST?
```

Typical Response: `+0`

*WAI

Syntax

```
*WAI
```

Description

This command sets the U2761A to wait for the completion of all pending operation before executing any additional commands over the interface.

Example

The following command sets the U2761A to wait for pending operation.

```
*WAI
```

14 Calibration Commands

The Calibration commands are used to perform timebase calibration, DC offset calibration, AC amplitude calibration, 0 dB flatness calibration, –20 dB flatness calibration, +20 dB flatness calibration, and output impedance calibration on the U2761A.

CALibration:SECure:STATe

Syntax

```
CALibration:SECure:STATe {OFF|ON|RESET}, <code>

CALibration:SECure:STATe?
```

Description

```
CALibration:SECure:STATe {OFF|ON|RESET}, <code>
```

This command unsecures or secures the U2761A for calibration. If you forget your security code, you can reset the security code by specifying U2761A.

```
CALibration:SECure:STATe?
```

This query returns the security state as 0 (OFF) if the U2761A is unsecured or 1 (ON) if secured.

Parameters

Item	Type	Range of values	Default value
state	Discrete	OFF, ON, or RESET	ON
`code`	Numeric	Up to 12 alphanumeric characters	U2761A

Examples

The command below secures the U2761A for calibration.

```
CAL:SEC:STAT ON, U2761A
```

The following query returns the security state.

```
CAL:SEC:STAT?
```

Typical Response: `1`

CALibration:SECure:CODE

Syntax

```
CALibration:SECure:CODE <new code>
```

Description

This command inputs a new security code. To change the security code, you must first unsecure the U2761A using the old security code, and then enter a new code. The security code is stored in non-volatile memory.

Parameter

Item	Type	Range of values	Default value
code	String	Up to 12 alphanumeric characters	U2761A

Example

The command below renews the security code of the U2761A.

```
CAL:SEC:CODE U2761A
```

CALibration:SETup

Syntax

```
CALibration:SETup <1|2|3| . . . |115>

CALibration:SETup?
```

Description

```
CALibration:SETup <1|2|3| . . . |115>
```

This command configures the U2761A internal state for each of the calibration steps to be performed. Before any calibration step is performed for the U2761A, the default setup is 0.

```
CALibration:SETup?
```

This query reads the calibration setup number and returns a value from 1 to 115.

Parameter

Item	Type	Range of values	Default value
Setup number	Numeric	1 to 115	0

Examples

This command sets the U2761A calibration step to 5.

```
CAL:SET 5
```

The following query returns the calibration setup number.

```
CAL:SET?
```

Typical Response: `+5`

CALibration:VALue

Syntax

```
CALibration:VALue <value>
```

```
CALibration:VALue?
```

Description

```
CALibration:VALue <value>
```

This command specifies the measured value of the known calibration signal depending on the calibration steps.

```
CALibration:VALue?
```

This query returns the calibration value.

NOTE Refer to the *Agilent U2761A USB Modular Function/Arbitrary Waveform Generator Service Guide* for the range of values of each calibration step.

Examples

The following command sets the value to 1×10^{7}.

```
CAL:VAL 1E+7
```

The query below returns the calibration value.

```
CAL:VAL?
```

Typical Response: `+1.0000000000000E+07`

CALibration:COUNt?

Syntax

```
CALibration:COUNt?
```

Description

This query determines the number of times the U2761A has been calibrated, where the count number is incremented by one for each calibration step. The calibration count is stored in non-volatile memory.

NOTE Make sure that your U2761A has been calibrated before it leaves the factory. When you receive your U2761A from the factory, be sure to read the count to determine its initial value.

Example

The following query returns the calibration count for the U2761A.

```
CAL:COUN?
```

Typical Response: `+115`

CALibration:STRing

Syntax

```
CALibration:STRing <quoted string>
```

```
CALibration:STRing?
```

Description

```
CALibration:STRing <quoted string>
```

This command stores a message in non-volatile calibration memory. Storing a message will overwrite any message previously stored.

```
CALibration:STRing?
```

This query reads the calibration message and returns in a quoted string.

Parameter

Item	Type	Range of values	Default value
`string`	string	Up to 40 alphanumeric characters	N/A

Examples

The command below stores the calibration message.

```
CAL:STR '01 JAN 2008:CALIBRATED'
```

The following query returns the quoted string.

```
CAL:STR?
```

Typical Response: `"01 JAN 2008:CALIBRATED"`

15
CONFigure Subsystem

The CONFigure:SSI command from the CONFigure subsystem handles the synchronization status when the U2761A is used in the U2781A modular instrument chassis.

CONFigure:SSI

Syntax

```
CONFigure:SSI {NONE|MASTer|SLAVe}, (@<address>)

CONFigure:SSI?
```

Description

```
CONFigure:SSI {NONE|MASTer|SLAVe}, (@<address>)
```

This command sets the SSI state (master/slave) when used in the U2781A modular instrument chassis. This command will force all triggering sources to SSI (Synchronous Simultaneous Interface).

```
CONFigure:SSI?
```

This query command returns the SSI state as NONE, MAST, or SLAV, and the corresponding address.

Parameters

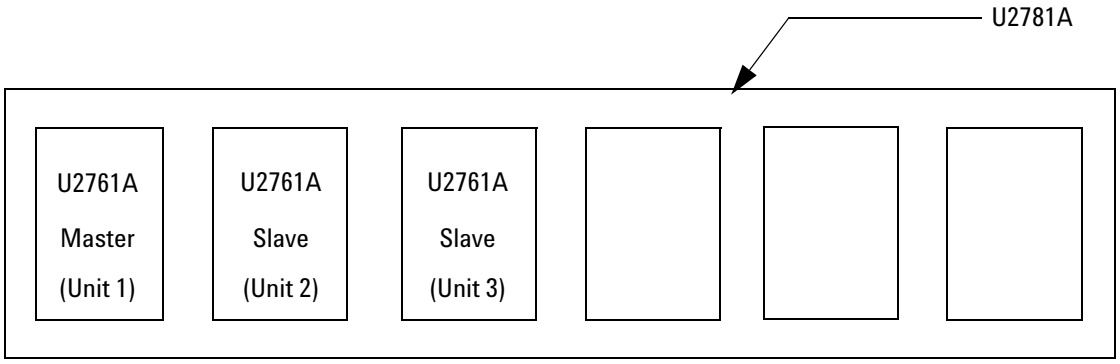
Item	Type	Range of values	Default value
SSI	Discrete	NONE, MAST, or SLAVe	NONE
address	Numeric	0 to 7	0

NOTE

- Slave can only be controlled by one master.
- Address does not need to be specified for SSI None.
- For more information on the SSI, refer to the *Agilent U2781A USB Modular Instrument Chassis User's Guide*.

Examples

The following example sets one unit of the U2761A to master and two units of the U2761A to slaves.



For Unit 1: `CONF:SSI MAST, (@0,1)`

For Unit 2: `CONF:SSI SLAV, (@0)`

For Unit 3: `CONF:SSI SLAV, (@1)`

The following queries return the string values.

For Unit 1: `CONF:SSI?`

Typical Response: `MAST,0,1`

For Unit 2: `CONF:SSI?`

Typical Response: `SLAV,0`

For Unit 3: `CONF:SSI?`

Typical Response: `SLAV,1`

16 Error Messages

The U2761A SCPI command errors are summarized in this chapter.

Error Messages

Error messages are created once an erroneous condition has been detected.

- Errors are retrieved in first-in-first-out (FIFO) order using the SYSTem:ERRor? command. The first error returned is the first error that was stored. Errors are cleared as you retrieve them.
- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **–350,"Queue overflow"**. No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the U2761A responds with **+0,"No error"**.
- The error queue is also cleared by the clear status (`*CLS`) command or when the power is cycled. The error queue is not cleared by an instrument reset (`*RST`) command.

Command Errors

The following table shows the list of command errors.

Table 16-1 Command errors

Error number	Command errors
–101	**Invalid character** An invalid character was found in the command string. You may have inserted a character such as #, $, or % in a command keyword or within a parameter.
–102	**Syntax error** Invalid syntax was found in the command string. You may have inserted a blank space before or after a colon in the command header, or before a comma.
–103	**Invalid separator** An invalid separator was found in the command string. Check for proper usage of , ; :
–105	**GET not allowed** A Group Execute Trigger (GET) is not allowed within a command string.

Table 16-1 Command errors (continued)

–108	**Parameter not allowed** More parameters were received than were expected for the command. You may have entered an extra parameter or added a parameter to a command that does not require a parameter.
–109	**Missing parameter** Fewer parameters were received than were expected for this command. You have omitted one or more parameters that are required for this command.
–112	**Program mnemonic too long** A command header was received which contained more than the maximum 12 characters allowed. This error is also reported when a character-type parameter is too long.
–113	**Undefined header** A command was received that is not valid. You may have misspelled the command or it may not be a valid command. If you are using the short form of the command, remember that it may contain up to four letters.
–121	**Invalid character in number** An invalid character was found in the number specified for a parameter value.
–123	**Exponent too large** A numeric parameter was found where its exponent was larger than 32759.
–124	**Too many digits** The mantissa of a numeric parameter contained more than 255 digits, excluding leading zeros.
–128	**Numeric data not allowed** A numeric parameter was received but a character string was expected.
–131	**Invalid suffix** A suffix was incorrectly specified for a numeric parameter.
–134	**Suffix too long** The suffix contains more than 12 characters.
–138	**Suffix not allowed** A suffix is not supported for this command.
–148	**Character data not allowed** A discrete parameter was received, but a string or numeric parameter was expected.
–151	**Invalid string data** An invalid character string was received. Check that the string is enclosed in quotation marks.

Table 16-1 Command errors (continued)

–158	**String data not allowed** A character string was received, but is not allowed for this command.
–161	**Invalid block data** The number of data bytes sent does not match the number of bytes specified in the header.
–168	**Block data not allowed** Data was sent in arbitrary block format but is not allowed for this command.
–170 to –178	**Expression errors** The U2761A does not accept mathematical expressions.

Execution Errors

The execution errors are listed in the table below.

Table 16-2 Execution errors

Error number	Execution errors
–211	**Trigger ignored** A Group Execute Trigger (GET) or *TRG was received but the trigger was ignored.
–223	**Too much data** An Arbitrary waveform was specified that contains more than 65536 waveform points.
–224	**Illegal parameter value** An exact value was expected or an invalid discrete parameter was received.
–221	**Settings conflict; frequency reduced for ramp function** When you change to the ramp function (output frequency limit is 200 kHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 200 kHz.
–221	**Settings conflict; frequency reduced for pulse function** When you change to the pulse function (output frequency limit is 5 MHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 5 MHz.

Table 16-2 Execution errors (continued)

–221	**Settings conflict; frequency reduced for user function** When you change to the Arbitrary waveform function (output frequency limit is 200 kHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 200 kHz.
–221	**Settings conflict; frequency forced duty cycle change** If the Square wave function is selected and you change to a frequency that cannot produce the current duty cycle, the duty cycle is automatically adjusted to the maximum value for the new frequency.
–221	**Settings conflict; frequency changed due to FM deviation** If the carrier frequency is lower than the minimum FM deviation plus 1 μHz, the carrier frequency will be adjusted to the minimum value allowed.
–221	**Settings conflict; amplitude changed due to offset** If the existing output amplitude is not valid, the U2761A will automatically adjust it to the maximum value allowed with the offset voltage specified.
–221	**Settings conflict; amplitude changed due to function** The amplitude limits are determined by the output units currently selected when the units are Vrms or dBm due to the differences in crest factor for the various output functions.
–221	**Settings conflict; amplitude units change to Vpp due to high-Z load** The output units cannot be set to dBm if the output termination is currently set to “high impedance”.
–221	**Settings conflict; offset changed due to amplitude** If the existing offset voltage is not valid, the U2761A will automatically adjust it to the maximum DC voltage allowed with the amplitude specified.
–221	**Settings conflict; offset changed due to arbitrary span** If the existing offset voltage is not valid, the U2761A will automatically adjust it to the maximum DC voltage allowed with the arbitrary span on differences in crest factor.
–221	**Settings conflict; offset changed on exit from dc function** When you select a different function other than DC, the U2761A will adjust the offset voltage as needed to be compatible with the current amplitude setting.
–221	**Settings conflict; low level changed due to high level** If you specify a high level that is less than the existing low level, the U2761A will automatically set the low level to the minimum value allowed lower than the high level.
–221	**Settings conflict; high level changed due to low level** If you specify a low level that is greater than the existing high level, the U2761A will automatically set the high level to the minimum value allowed greater than the low level.

Table 16-2 Execution errors (continued)

–221	**Settings conflict; pulse width increased due to large period** The U2761A has adjusted the pulse width to the new minimum determined by the current period.
–221	**Settings conflict; pulse width decreased due to period** The U2761A has decreased the pulse width to accommodate the specified period.
–221	**Settings conflict; FSK hopping frequency changed due to function** The FSK hopping frequency is greater than the maximum frequency of the switched function.
–221	**Settings conflict; not able to set amplitude level for dc function** The U2761A ia unable to generate an amplitude level for the DC function.
–221	**Settings conflict; not able to modulate pulse, modulation is turned off** The U2761A cannot generate a modulated waveform using the pulse function. The selected modulation mode has been turned off.
–221	**Settings conflict; not able to modulate dc, modulation turned off** The U2761A cannot generate a modulated waveform using the DC voltage function. The selected modulation mode has been turned off.
–221	**Settings conflict; not able to sweep pulse, sweep is turned off** The U2761A cannot generate a sweep using the pulse function. The sweep mode has been turned off.
–221	**Settings conflict; not able to sweep dc, sweep turned off** The U2761A cannot generate a sweep using the DC voltage function. The sweep mode has been turned off.
–221	**Settings conflict; AM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; FM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; PM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; ASK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; FSK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.

Table 16-2 Execution errors (continued)

–221	**Settings conflict; PSK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; sweep turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time.
–221	**Settings conflict; 10MHz reference connector used by phase output** If you have enabled the output 10 Mhz reference signal, the U2761A automatically disables the external phase source. The 10 MHz reference connector cannot be used for both operations at the same time.
–221	**Settings conflict; phase output disabled by phase external** When the external phase source is selected, the output 10 MHz reference signal cannot be enabled. The 10 MHz reference connector cannot be used for both operations at the same time.
–222	**Data out of range; sine frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Sine waveform function.
–222	**Data out of range; square frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Square waveform function.
–222	**Data out of range; user frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Arbitrary waveform function.
–222	**Data out of range; pulse frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Pulse waveform function.
–222	**Data out of range; ramp frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Ramp waveform function.
–222	**Data out of range; frequency; value clipped to lower limit** The waveform frequency has been limited to a lower boundary.
–222	**Data out of range; frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary.
–222	**Data out of range; amplitude; value clipped to lower limit** The waveform amplitude has been limited to a lower boundary.

Table 16-2 Execution errors (continued)

–222	**Data out of range; amplitude; value clipped to upper limit** The waveform amplitude has been limited to an upper boundary.
–222	**Data out of range; offset; value clipped to lower limit** The offset voltage has been limited to a lower boundary.
–222	**Data out of range; offset; value clipped to upper limit** The offset voltage has been limited to an upper boundary.
–222	**Data out of range; HIGH value; value clipped to lower limit** The high voltage has been limited to a lower boundary.
–222	**Data out of range; HIGH value; value clipped to upper limit** The high voltage has been limited to an upper boundary.
–222	**Data out of range; LOW value; value clipped to lower limit** The low voltage has been limited to a lower boundary.
–222	**Data out of range; LOW value; value clipped to upper limit** The low voltage has been limited to an upper boundary.
–222	**Data out of range; duty cycle; value clipped to lower limit** The Square wave duty cycle is limited to 20% by the U2761A hardware.
–222	**Data out of range; duty cycle; value clipped to upper limit** The Square wave duty cycle is limited to 80% by the U2761A hardware.
–222	**Data out of range; duty cycle limited by frequency; value clipped to lower limit** The Square wave duty cycle is limited to 40% when the frequency is greater than 10 MHz.
–222	**Data out of range; duty cycle limited by frequency; value clipped to upper limit** The Square wave duty cycle is limited to 60% when the frequency is greater than 10 MHz.
–222	**Data out of range; ramp symmetry; value clipped to lower limit** The ramp symmetry is limited to a lower boundary of 0.0% by the U2761A hardware.
–222	**Data out of range; ramp symmetry; value clipped to upper limit** The ramp symmetry is limited to an upper boundary of 100.0% by the U2761A hardware.
–222	**Data out of range; load; value clipped to lower limit** The output load is limited to a lower boundary of 1 Ω by the U2761A hardware.

Table 16-2 Execution errors (continued)

–222	**Data out of range; load; value clipped to upper limit** The output load is limited to an upper boundary of 10 kΩ by the U2761A hardware.
–222	**Data out of range; pulse period; value clipped to lower limit** The pulse period has been limited to a lower boundary.
–222	**Data out of range; pulse period; value clipped to upper limit** The pulse period has been limited to an upper boundary.
–222	**Data out of range; pulse width; value clipped to lower limit** The desired pulse width is limited to a lower boundary by the U2761A hardware.
–222	**Data out of range; pulse width; value clipped to upper limit** The desired pulse width is limited to an upper boundary by the U2761A hardware.
–222	**Data out of range; pulse duty cycle; value clipped to lower limit** The desired pulse duty cycle is limited to a lower boundary by the U2761A hardware.
–222	**Data out of range; pulse duty cycle; value clipped to upper limit** The desired pulse duty cycle is limited to an upper boundary by the U2761A hardware.
–222	**Data out of range; modulation frequency; value clipped to lower limit** The modulation frequency is limited to a lower boundary by the U2761A hardware.
–222	**Data out of range; modulation frequency; value clipped to upper limit** The modulation frequency is limited to an upper boundary by the U2761A hardware.
–222	**Data out of range; AM depth; value clipped to lower limit** The AM depth is limited to a lower boundary by the current function amplitude variation.
–222	**Data out of range; AM depth; value clipped to upper limit** The AM depth is limited to an upper boundary by the current function amplitude variation.
–222	**Data out of range; FM deviation; value clipped to lower limit** The desired FM deviation is limited to a lower boundary by the current function frequency.
–222	**Data out of range; FM deviation; value clipped to upper limit** The desired FM deviation is limited to an upper boundary by the current function frequency.
–222	**Data out of range; FM deviation limited by minimum frequency** The frequency deviation is limited to the lower limit.

Table 16-2 Execution errors (continued)

–222	**Data out of range; FM deviation limited by maximum frequency** The frequency deviation is limited to the upper limit.
–222	**Data out of range; PM deviation; value clipped to lower limit** The phase deviation is limited to the lower limit by the current function phase.
–222	**Data out of range; PM deviation; value clipped to upper limit** The phase deviation is limited to the upper limit by the current function phase.
–222	**Data out of range; shift keying rate; value clipped to lower limit** The shift-keying rate is limited to the lower limit by the current function frequency.
–222	**Data out of range; shift keying rate; value clipped to upper limit** The shift-keying rate is limited to the upper limit by the current function frequency.
–222	**Data out of range; FSK hopping frequency; value clipped to lower limit** The FSK hopping frequency is limited to the lower limit by the current function frequency.
–222	**Data out of range; FSK hopping frequency; value clipped to upper limit** The FSK hopping frequency is limited to the upper limit by the current function frequency.
–222	**Data out of range; sweep frequency; value clipped to lower limit** The sweep frequency is limited to the lower limit by the U2761A hardware.
–222	**Data out of range; sweep frequency; value clipped to upper limit** The sweep frequency is limited to the upper limit by the U2761A hardware.
–222	**Data out of range; sweep time; value clipped to lower limit** The sweep time is limited to the lower limit by the U2761A hardware.
–222	**Data out of range; sweep time; value clipped to upper limit** The sweep time is limited to the upper limit by the U2761A hardware.
–222	**Data out of range; arbitrary data; value(s) clipped to lower limit** The arbitrary data is limited to the lower limit by the U2761A hardware.
–222	**Data out of range; arbitrary data; value(s) clipped to upper limit** The arbitrary data is limited to the upper limit by the U2761A hardware.

Table 16-2 Execution errors (continued)

–222	**Data out of range; phase offset; value clipped to lower limit** The phase offset is limited to the lower limit by the U2761A hardware.
–222	**Data out of range; phase offset; value clipped to upper limit** The phase offset is limited to the upper limit by the U2761A hardware.

Device-Dependent Errors

The table below contains the device-dependent errors.

Table 16-3 Device-dependent errors

Error number	Device-dependent errors
–310	**System error** The U2761A operation has not completed properly, possibly due to an abnormal hardware or firmware condition.
–313	**Calibration memory lost; memory corruption detected** The non-volatile memory used to store the U2761A calibration constants has detected a checksum error which may be caused by a device failure or extreme conditions such as lightning or strong magnetic fields.
–315	**Configuration memory lost; memory corruption detected** The non-volatile memory used to store the U2761A configuration settings has detected a checksum error which may be caused by a device failure or extreme conditions such as lightning or strong magnetic fields.
–350	**Queue overflow** The error queue is full because more than 20 errors have occurred. No additional errors are stored until you remove the errors from the queue.

Query Errors

The list of query errors is shown in the following table.

Table 16-4 Query errors

Error number	Query errors
–410	**Query INTERRUPTED** A condition causing an interrupted query error occurred.
–420	**Query UNTERMINATED** A condition causing an unterminated query error occurred.
–430	**Query DEADLOCKED** A condition causing a deadlocked query error occurred.
–440	**Query UNTERMINATED after indefinite response** A query was received in the same program message after a query indicating an indefinite response was executed.

Instrument Errors

The instrument errors are listed in the following table.

Table 16-5 Instrument errors

Error number	Instrument errors
501 to 502	**501: Cross-isolation UART framing error** **502: Cross-isolation UART overrun error** Indicate an internal hardware failure. The isolation between chassis ground circuits and floating circuits is controlled by an optical isolation barrier and a serial link.
580	**Reference phase-locked loop is unlocked** The phase-lock error status has been enabled and the internal phase-locked loop that controls the frequency is currently unlocked. This error is most likely to occur when the external reference is out of lock range.

Self-Test Errors

The table below shows the self-test errors.

Table 16-6 Self-test errors

Error number	Self-test errors
604	**Self-test failed; waveform memory bank** Either the waveform RAM or the synthesis IC has failed.
605	**Self-test failed; modulation memory bank** The modulation memory bank in the synthesis IC has failed.
630	**Self-test failed; internal ADC over-range condition** Indicates a probable ADC failure which could be of the system ADC, the ADC input multiplexer, or the ADC input buffer amplifier.
631	**Self-test failed; internal ADC measurement error** Indicates a probable ADC failure which could be of the system ADC, the ADC input multiplexer, or the ADC input buffer amplifier.

Calibration Errors

The calibration errors are listed in the following table.

Table 16-7 Calibration errors

Error number	Calibration errors
702	**Calibration error; calibration memory is secured** A calibration cannot be performed when calibration memory is secured.
703	**Calibration error; secure code provided was invalid** Invalid security code specified with the `CAL:SEC:STAT ON` command.
706	**Calibration error; provided value is out of range** The calibration value specified with the `CAL:VAL` command is out of range.

Table 16-7 Calibration errors (continued)

708	**Calibration error; perform setting is not allowed** The calibration setting was predetermined by calibration setup and modification to the setting is not allowed.
755	**Calibration error; timebase calibration is not completed** The timebase calibration steps have not fully completed before exiting calibration mode.
756	**Calibration error; DC offset calibration is not completed** The DC offset calibration steps have not fully completed before exiting calibration mode.
757	**Calibration error; AC amplitude calibration is not completed** The AC amplitude calibration steps have not fully completed before exiting calibration mode.
758	**Calibration error; 0 dB flatness calibration is not completed** The 0 dB flatness calibration steps have not fully completed before exiting calibration mode.
759	**Calibration error; –20 dB flatness calibration is not completed** The –20 dB flatness calibration steps have not fully completed before exiting calibration mode.
760	**Calibration error; +20 dB flatness calibration is not completed** The +20 dB calibration steps have not fully completed before exiting calibration mode.
761	**Calibration error; output impedance calibration is not completed** The output impedance calibration steps have not fully completed before exiting calibration mode.
850	**Calibration error; setup is invalid** You have specified an invalid calibration setup number with the `CAL:SET` command.
851	**Calibration error; setup is out of order** Certain calibration setups must be performed in a specific sequence in order to be valid.
852	**Calibration error; setup timebase calibration is not in sequence** The setup timebase calibration steps are not in sequence as required.

Arbitary Waveform Errors

The table below shows the Arbitrary waveform errors.

Table 16-8 Arbitrary waveformerrors

Error number	Arbitrary waveform errors
770	**Nonvolatile arb waveform memory corruption detected** The non-volatile memory used to store the Arbitrary waveforms has detected a checksum error. The Arbitrary waveform cannot be retrieved from memory.
800	**Block length must even** The U2761A represents binary data as 16-bit integers, which are sent as two bytes (`DATA:DAC VOLATILE` command).
801	**Block length out of limit** The arbitrary data in binary block was specified which is out of range.

17
Factory Default Settings

The factory default settings are listed in this chapter.

The settings in the table below are used when the U2761A is powered-on. They are set once the *RST command is sent to the U2761A.

Table 17-1 Factory default settings

Features	Factory default setting
Output configuration	
Function	Sine wave
Frequency	1 kHz
Amplitude	1 Vpp
Offset	0 V
Voltage (High/Low)	0.5 V/–0.5 V
Output unit	Vpp
Duty cycle	50%
Symmetry	100%
Output state	Off
Output termination	50 Ω
Pulse	
Period	1 ms
Pulse hold	Pulse width
Pulse width	500 µs
Duty cycle	50%
Modulation	
Carrier waveform (AM, FM, PM)	1 kHz Sine wave
Modulating waveform (AM, FM)	100 Hz Sine wave
Modulating waveform (PM)	10 Hz Sine wave
AM depth	100%
FM deviation	100 Hz

Table 17-1 Factory default settings (continued)

Features	Factory default setting
PM deviation	180 °
Modulation state	Off
Shift keying modulation	
Carrier waveform (ASK, FSK, PSK)	1 kHz Sine wave
Rate (ASK, FSK, PSK)	10 Hz
FSK hop frequency	100 Hz
PSK deviation	180 °
Shift keying state	Off
Frequency sweep	
Start/Stop frequency	100 Hz/1 kHz
Sweep mode	Linear
Sweep time	1 s
Sweep state	Off
Trigger	
Source	Immediate
Trigger slope	Positive
Output trigger slope	Positive
Output trigger state	Off
Arbitrary	
Binary block format	Normal
Phase-lock	
Source	Internal
Phase angle	0 °
Phase-lock error state	Off
Output phase state	Off

Table 17-1 Factory default settings (continued)

Features	Factory default setting
Calibration	
Calibration secure state	On
Calibration secure code	U2761A
Calibration setup number	0
Configure	
SSI state	None

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