Agilent U2300A Series Multifunction USB Data Acquisition

Programming Guide

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Notices

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CAUTION

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1 Introduction to Programming

This chapter introduces the basic for remote programming of a USB DAQ device. The programming commands provide the means of remote control.

Introduction to the SCPI Language

SCPI (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 SENSe subsystem is shown below to illustrate the tree system.

```
SENSe:
    VOLTage:
       DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
       DC:RANGe? [(@<ch_list>)|MIN|MAX}]

    RESistance:
       OCOMpensated {OFF|0|ON|1}[,(@<ch_list>)]
       OCOMpensated? [(@<ch_list>)]

    TEMPerature:
       RJUNction? [(@<ch_list>)]
```

SENSe is the root keyword of the command, VOLTage and RESistance are second-level keywords, and DC and OCOMpensated are third-level keywords. A colon (:) separates a command keyword from a lower-level keyword.

Syntax Conventions

The format used to show commands is illustrated below:

```
VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
```

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, VOLT and VOLTAGE are both acceptable forms. You can use upper- or lower-case letters. Therefore, VOLTAGE, volt, and Volt are all acceptable. Other forms, such as VOL and VOLTAG, are not valid and will generate an error.

Braces (**{ }**) enclose the parameter choices for a given command string. The braces are not sent with the command string.

A vertical bar (**|**) separates multiple parameter choices for a given command string.

Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the <range> parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (e.g., "VOLT:DC:RANG 10").

Some parameters are enclosed in square brackets (**[ ]**). This indicates that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.

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:

```
"CONF:VOLT:DC 10,0.003"
```

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

```
"TRIG:SOUR EXT; COUNT 10"
```

is the same as sending the following two commands:

```
"TRIG:SOUR EXT"
"TRIG:COUNT 10"
```

Use a colon and a 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:

```
"ROUT:CHAN:DELAY 1;:TRIG:SOUR EXT"
```

Using the MIN and MAX Parameters

For many commands, you can substitute "MIN" or "MAX" in place of a parameter. For example, consider the following command:

```
VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
```

Instead of selecting a specific value for the <range> parameter, you can substitute MIN to set the range to its minimum value or MAX to set the range to its maximum value.

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 scan count to 10 sweeps:

```
"TRIG:COUNT 10"
```

You can then query the scan count value by sending:

```
"TRIG:COUNT?"
```

You can also query the minimum or maximum scan count allowed as follows:

```
"TRIG:COUNT? MIN"
"TRIG:COUNT? MAX"
```

SCPI Command Terminators

A command string sent to the instrument must terminate with a <new line> (<NL>) character. The IEEE-488 EOI (End-Or-Identify) 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 operations. 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?"
```

SCPI Parameter Types

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

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. Special values for numeric parameters such as MIN, MAX, and DEF are also accepted. You can also send engineering unit suffixes with numeric parameters (e.g., M, K, or u). If only specific numeric values are accepted, the instrument will automatically round the input numeric parameters. The following command requires a numeric parameter for the range value:

```
VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
```

Discrete Parameters

Discrete parameters are used to program settings that have a limited number of values (like 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. The following command requires a discrete parameters for the temperature units:

```
UNIT:TEMPerature {C|F|K}[,(@<ch_list>)]
```

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. For a false condition, the instrument will accept "OFF" or "0". For a true condition, the instrument will accept "ON" or "1". When you query a boolean setting, the instrument will always return "0" or "1". The following command requires a boolean parameter:

```
INPut:IMPedance:AUTO {OFF|0|ON|1}[,(@<ch_list>)]
```

ASCII String Parameters

String parameters can 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. The following command uses a string parameter:

```
DISPlay:TEXT <quoted string>
```

For example, the following command displays the message "SCANNING..." on the instrument's front panel (the quotes are not displayed).

```
DISP:TEXT "SCANNING..."
```

You can also display the same message using the following command with single quotes.

```
DISP:TEXT 'SCANNING...'
```

Channel List Parameters

Channel list parameters have the form (@sccc), where s is the mainframe slot number (1 through 8) and ccc is the channel number. You can specify a single channel, multiple channels, or a range of channels. The channel list must be preceded with the "@" symbol and must be enclosed in parentheses. The following commands use a channel list (<ch_list>) parameter:

```
ROUTe:CLOSe (@<ch_list>)

INPut:IMPedance:AUTO <mode> [,(@<ch_list>)]
```

As shown above, the <ch_list> parameter is optional for some commands (as indicated by square brackets). If you omit the <ch_list> parameter, the command will be applied to the internal DMM.

The following command closes channel 10 on the module in slot 3.

```
ROUT:CLOS (@3010)
```

The following command closes channels 10, 12, and 15 on the module in slot 2.

```
ROUT:CLOS (@2010,2012,2015)
```

The following command closes channels 5 through 10 (slot 1) and channel 15 (slot 2). When you specify a range of channels, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid.

```
ROUT:CLOS (@1005:1010,2015)
```

The Analog Bus relays (numbered s911, s912, s913, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels. For example, the following command closes all valid channels between channel 30 (slot

1) and channel 5 (slot 2). In addition, this command closes Analog Bus relay 911 on the module in slot 1 (Bank 1). Note that although the specified range of channels includes the other Analog Bus relays, they are ignored and are not closed by this command.

```
ROUT:CLOS (@1030:2005,1911)
```

The following command will generate an error since the Analog Bus relays cannot be specified as the first or last channel in a range of channels (none of the channels will be closed).

```
ROUT:CLOS (@1005:1911) !Generates an error
```

Using Device Clear

Device Clear is an IEEE-488 low-level bus message that you can use to return the instrument to a responsive state (e.g., during a lengthy query). Different programming languages and IEEE-488 interface cards provide access to this capability through their own unique commands. The status registers, the error queue, and all configuration states are left unchanged when a Device Clear message is received.

Device Clear performs the following actions:

If a scan is running, it is aborted.

The instrument returns to the trigger "idle" state.

The instrument's input and output buffers are cleared.

The instrument is prepared to accept a new command string.

An overlapped command, if any, will be terminated with no "Operation Complete" indication.

NOTE The `ABORt` command is the recommended method to terminate a measurement.

NOTE It is recommended that you allow for a two-second wait following a Device Clear to enable the instrument to process the clear operation.

2
SENSe Subsystem

This chapter explains how to use the SENSe command subsystem to acquire the properties of analog input such as range, polarity, function, signal type and etc.

[SENSe:]VOLTage:RANGe

Syntax

```
[SENS:]VOLT:RANG <range>[V], (@<ch_list>)
```

This command is used to set or inquire the analog input (AI) range of the specified channel. It selects the voltage measurement range on the specified channels.

```
[SENS:]VOLT:RANG? (@<ch_list>)
```

The query returns a discrete value representing the voltage value for current input voltage on each specified analog input channel. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Discrete	U2331A: Unipolar mode: {10|5|4|2.5|2.0|1.0|0.5|0.4|0.1} Bipolar mode: {10|5|2.5|2.0|1.25|1.0|0.5|0.25|0.2|0.05} U2351A/U2352A/U2353A/U2354A/U2355A/ U2356A: Unipolar/Bipolar mode: {10,5,2.5,1.25}	AUTO
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Query Returned Format

<range>[V]

Example

```
*RST;*CLS
ROUT:SCAN (@101)
VOLT:RANG 10,(@101)        //Bipolar with –10 V to +10 V range input
MEAS:VOLT? (@101)
```

See Also

SOURce:VOLTage:POLarity

[SENSe:]VOLTage:STYPe

[SENSe:]VOLTage:POLarity

Syntax

```
[SENS:]VOLT:POL <polarity>, (@<ch_list>)
```

This command is used to set or check the polarity of the analog input channel.

```
[SENS:]VOLT:POL? (@<ch_list>)
```

The query command returns a string value representing the mode of polarity on each specified analog input channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<polarity>	String	UNIP-Unipolar BIP-Bipolar	BIP
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remark

Mutually independent with ROUT:CHAN:POL.

Query Returned Format

```
<mode> ::={UNIP|BIP}
```

Example

```
SENS:VOLT:POL UNIP,(@101)
SENS:VOLT:STYP SING,(@101)
SENS:VOLT:RANG 10,(@101)
MEAS:VOLT:DC? (@101)
```

See Also

[SENSe:]VOLTage:STYPe

[SENSe:]VOLTage:STYPe

Syntax

```
[SENS:]VOLT:STYP <mode>, (@<ch_list>)
```

This command is used to set or inquire the reference ground of the specified analog input channel.

```
[SENS:]VOLT:POL? (@<ch_list>)
```

The query command returns a String value representing the mode of polarity on each specified analog input channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	DIFF: Differential mode SING: Referenced single-ended mode (16/64 ch common to ground system on board) NRS: Non-referenced single-ended mode (16/64 ch common to AISENSE pin)	SING
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remarks

- For U2355A/U2356A/U2331A; if Channel 101 is configured to “DIFF” mode, channel 133 will be N/A, 134 will be 102, and so on. Likewise, if channel 102 is set to “DIFF” mode, channel 134 will be N/A until channel 102 is set to back to “SING” mode again.
- For U2351A/U2352A/U2353A/U2354A; if Channel 101 is configured to “DIFF” mode, channel 109 will be N/A. Likewise, channel 102 and 110 are paired in “DIFF” mode.

Query Returned Format

```
<mode> ::={DIFF|SING|NRS}
```

Example

```
SENS:VOLT:POL UNIP,(@101)
SENS:VOLT:STYP SING,(@101)
SENS:VOLT:RANG 10,(@101)
MEAS:VOLT:DC? (@101)
```

[SENSe:]COUNter:FUNCtion

Syntax

```
[SENS:]COUN:FUNC <mode>, (@<ch_list>)
```

This command selects the present measurement function on the specified counter channels on the USB DAQ. Valid options are frequency, period, pulse width, or totalize.

```
[SENS:]COUN:FUNC? (@<ch_list>)
```

The query command returns a string value representing the present measurement function on each counter channel specified. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	FREQ: returns the measured frequency PER: returns the measured period PWID: returns the measured pulse width TOT: returns the count on the specified totalizer channels	TOT
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

```
<mode> ::={FREQ|PER|PWID|TOT}
```

Example

```
SENS:COUN:FUNC TOT (@301)

SENS:COUN:TOT:INIT

MEAS:COUN:DATA? (@301)

MEAS:COUN:TOT? (@301)

SENS:COUN:ABOR (@301)
```

[SENSe:]COUNter:ABORt

Syntax

```
[SENS:]COUN:ABOR (@<ch_list>)
```

This command aborts an initiated counter measurement in progress on the specified counter channels. This command may be useful to abort a long internally- or externally-gated measurement.

Supported Device

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	N/A

Remarks

This command does not clear or invalidate any measurement in memory.

Example

```
SENS:COUN:FUNC TOT (@301)
SENS:COUN:TOT:INIT (@301)
SENS:COUN:ABOR (@301)
```

See Also

[SENSe:]COUNter:TOTalize:CLEar

[SENSe:]COUNter:GATE:POLarity

Syntax

```
[SENS:]COUN:GATE:POL <mode>, (@<ch_list>)
```

This command sets the logic polarity of the Gate input line for counter operations. You can specify the gate polarity as "active high" or "active low". Changing the gate polarity while an initiated measurement is in progress is not allowed.

```
[SENS:]COUN:GATE:POL? (@<ch_list>)
```

The query command returns a string value that indicates the polarity type of gate configuration on each specified counter channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	AHI: Active High ALO: Active Low	AHI
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

```
<mode> ::={AHI|ALO}
```

Example

```
SENS:COUN:FUNC TOT,(@301)

SENS:COUN:TOT:INIT (@301)

SENS:COUN:GATE:POL AHI,(@301)

SENS:COUN:GATE:SOUR INT,(@301)

SENS:COUN:GATE:CONT DIS,(@301)

COUN:GATE:CONT

MEAS:COUN:TOT?

SENS:COUN:ABOR
```

[SENSe:]COUNter:GATE:SOURce

Syntax

```
[SENS:]COUN:GATE:SOUR <mode>, (@<ch_list>)
```

This command selects the gate source for counter measurements. You can select either the internal (default) source or an external gate signal. You are advised not to change the gate source when the data acquisition is in progress.

```
[SENS:]COUN:GATE:SOUR? (@<ch_list>)
```

The query command returns a string value representing the clock source setting for general purpose digital counter on each specified counter channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Gate is controlled by software EXT: Gate is controlled by COUNT301_GATE/ COUNT302_GATE pins	INT
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

```
<mode> ::={INT|EXT}
```

[SENSe:]COUNter:GATE:CONTrol

Syntax

```
[SENS:]COUN:GATE:CONT <mode>, (@<ch_list>)
```

This command is used set or check the gate status (enable/disable) of the general purpose digital counter.

```
[SENS:]COUN:GATE:CONT? (@<ch_list>)
```

The query command returns a string value representing the gate status on each specified counter channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	DIS: Start counter operation ENAB: Stop counter operation	DIS
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

```
<mode> ::={DIS|ENAB}
```

See Also

[SENSe:]COUNter:GATE:SOURce

[SENSe:]COUNter:CLocK:INTernal?

```
[SENS:]COUN:CLK:INT? (@<ch_list>)
```

The query returns a discrete value representing the internal time base frequency in kHz on each specified counter channel of the general purpose digital counter.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Discrete		12000

Remarks

Refer to the Agilent U2300A Series USB multifunction DAQ User's Guide for more information on general purpose digital counter operations.

Query Returned Format

```
<value> [KHz]
```

[SENSe:]COUNter:CLocK:EXTernal?

```
[SENS:]COUN:CLK:EXT? (@<ch_list>)
```

The query returns a float value representing the external time base frequency in kHz on each specified counter channel of the general purpose digital counter.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Float	1 to 10 MHz	N/A

Remarks

Refer to the Agilent U2300A Series USB multifunction DAQ User's Guide for more information on general purpose digital counter operations.

Query Returned Format

```
<value> [KHz]
```

[SENSe:]COUNter:CLocK:POLarity

Syntax

```
[SENS:]COUN:CLK:POL <mode>,(@<ch_list>)
```

This command is used to set or check the clock polarity settings of the general purpose counter.

```
[SENS:]COUN:CLK:POL?  (@<ch_list>)
```

The query command returns a string value that represents the clock polarity settings of specified counter channel of the general purpose digital counter. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	AHI: Active High ALO: Active Low	AHI
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

<mode> ::={AHI|ALO}

[SENSe:]COUNter:CLocK:SOURce

Syntax

```
[SENS:]COUN:CLK:SOUR <mode>, (@<ch_list>)
```

This command is used to set or check the clock source of the general purpose digital counter.

```
[SENS:]COUN:CLK:SOUR? (@<ch_list>)
```

The query command returns a string value representing the clock source settings of the general purpose digital counter. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Gate is controlled by software EXT: Gate is controlled by COUNT301_CLK/COUNT302_CLK pin	INT
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

<mode> ::={INT|EXT}

[SENSe:]COUNter:TOTalize:IVALue

Syntax

```
[SENS:]COUN:TOT:IVAL <value>, (@<ch_list>)
```

This command sets or checks the initial counter value of the general purpose digital counter.

```
[SENS:]COUN:TOT:IVAL? (@<ch_list>)
```

The query command returns a numeric value representing the initial counter value of the general purpose digital counter. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	From 0 to 2147483647 (2^{31} - 1)	0
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

<value>

[SENSe:]COUNter:TOTalize:INITiate

Syntax

```
[SENS:]COUN:TOT:INIT (@<ch_list>)
```

This command initiates a counter measurement on the USB DAQ Module. Gating begins once the counter measurement is initiated.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	N/A

Example

```
SENS:COUN:FUNC TOT, (@301)
SENS:COUN:TOT:INIT (@301)
MEAS:COUN:TOT? (@301)
SENS:COUN:ABOR
```

[SENSe:]COUNter:TOTalize:CLEar

Syntax

```
[SENS:]COUN:TOT:CLE (@<ch_list>)
```

This command clears all the operation of the general purpose digital counter.

Supported Device

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	N/A

Remarks

This command clears to zero. However, this is not the initialization value.

[SENSe:]COUNter:TOTalize:UDOWn:SOURce

Syntax

```
[SENS:]COUN:TOT:UDOW:SOUR <mode>, (@<ch_list>)
```

This command is used to set or check the clock source of the general purpose digital counter on the up/down counting process.

```
[SENS:]COUN:TOT:UDOW:SOUR? (@<ch_list>)
```

The query command returns a string value that indicates the clock source of the general purpose digital counter.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Gate is controlled by software EXT: Gate is controlled by COUNT301_UPDOWN/ COUNT302_UPDOWN pin	INT
<ch_list>	Numeric	301 through 302	N/A

Query

Query Returned Format

<mode> ::={INT|EXT}

[SENSe:]COUNter:TOTalize:UDOWn:DIRection

Syntax

```
[SENS:]COUN:TOT:UDOW:DIR <mode>, (@<ch_list>)
```

This command is used to set or check the up or down counting process.

```
[SENS:]COUN:TOT:UDOW:SOUR? (@<ch_list>)
```

The query command returns a string value that indicates the up or down direction count direction of each specified counter channel. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	UP: Up counting DOWN: Down counting	UP
<ch_list>	Numeric	301 through 302	N/A

Query Returned Format

<mode> ::={UP|DOWN}

3
SOURce Subsystem

This chapter contains information on the SOURce command subsystem. It also includes the commands on the general purpose digital counter.

SOURce:VOLTage[:LEVel]

Syntax

```
SOUR:VOLT[:LEV] <value>, (@<ch_list>)
```

This commands accepts a voltage value, scales it to the proper binary value and writes a binary value to the specified analog output channel. This command sets the output voltage level for the specified DAC channels. After setting the desired level, the command closes the corresponding output relay and enable outputs from the specified channels.

```
SOUR:VOLT[:LEVel]? (@<ch_list>)
```

The query command returns a numeric value representing the output voltage level in volts for the specified DAC channels on each analog channel specified. Use comma to separate multiple responses.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	–10 V ~ +10 V (12 bits resolution)	10
<ch_list>	Numeric	201 through 202	N/A

Remark

- This command is not allowed when “OUT ON” is set.
- Not supported for U2352A and U2354A

Query Returned Format

<value>[V]

SOURce:VOLTage:POLarity

Syntax

```
SOUR:VOLT:POL <mode>, (@<ch_list>)
```

This command sets or checks the polarity (unipolar/bipolar) of the output channel.

```
SOUR:VOLT[:LEV]? (@<ch_list>)
```

The query command returns a string value representing the polarity of the output channel specified. Multiple responses are separated by commas.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	UNIP: Unipolar BIP: Bipolar	BIP
<ch_list>	Integer	201 through 202	N/A

Remark

- Will force reset voltage level to zero, if the voltage output at negative voltage.
- Not supported for U2352A and U2354A.

Query Returned Format

<mode> ::= {UNIP|BIP}

SOURce:VOLTage:RSouRCe

Syntax

```
SOUR:VOLT:RSRC <mode>, (@<ch_list>)
```

This command used to set/check the reference voltage source (internal/external) for the output channel.

```
SOUR:VOLT:RSRC? (@<ch_list>)
```

The query command returns a string value representing the reference voltage source of the output channel specified. Use comma to separate multiple responses.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Internal reference EXT: External reference	INT
<ch_list>	Numeric	201 through 202	N/A

Remark

- Will force reset voltage level to zero once the reference source is changed.
- Not supported for U2352A and U2354A.

Query Returned Format

<mode> ::= {INT|EXT}

SOURce:VOLTage:RVOLtage

Syntax

```
SOUR:VOLT:RVOL <value>
```

This command used to set/check the voltage value of the reference voltage once rsrc is set to external.

```
SOUR:VOLT:RVOL?
```

The query command returns a numeric value representing voltage value of the reference voltage in units of volts of the output channels.

Supported Model

UU2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	Reference voltage value (0 to 10)	10

Remark

- Cannot reset to zero.
- Not supported for U2352A and U2354A.

Query Returned Format

<value>[V]

SOURce:DIGital:DATA

Syntax

```
SOUR:DIG:DATA <value>, (@<ch_list>)
```

This command is used to set or check digital data according to the specified digital output port. This command outputs a 4/8-bit digital pattern to the specified digital output channels. The specified channels are automatically reconfigured as output channels.

```
SOUR:DIG:DATA? (@<ch_list>)
```

The query command returns a string value representing the digital data of the digital output channel specified. Use comma to separate multiple responses.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	String	Counter channels 501 and 502: 0 through 255 Counter channels 503 and 504: 0 through 15	0
<ch_list>	Numeric	U2351A/U2353A/U2355A/U2356A/U2331A: 501 through 504 Channel 501 (8 bits) Port B: Channel 502 (8 bits) Port C High: Channel 503 (4 bits) Port D High: Channel 504 (4bits)	N/A

Query Returned Format

<value>

SOURce:DIGital:DATA:BIT

Syntax

```
SOUR:DIG:DATA:BIT <value>, <bit>, (@<ch_list>)
```

This command sets or clears individual bits on the specified digital output channels. The channels associated with the specified operation are automatically reconfigured as output channels.

```
SOUR:DIG:DATA? (@<ch_list>)
```

The query command returns a integer value representing the bit value of the digital IO channel specified. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Integer	0 or 1	0
<bit>	Integer	Counter channels 501 and 502: 0 through 7 Counter channels 503 and 504: 0 through 3	0
<ch_list>	Numeric	U2351A/U2353A/U2355A/U2356A/U2331A: 501 through 504 Port A: Channel 501 Port B: Channel 502 Port C High: Channel 503 Port D High: Channel 504	N/A

Remark

This command automatically reconfigures the channels associated with the specified operation as output channels.

Query Returned Format

<value>, <bit>

SOURce:COUNter:OUTPut:POLarity

Syntax

```
SOUR:COUN:OUTP:POL <mode>, (@<ch_list>)
```

This command sets or reads the output polarity of the general purpose digital counter.

```
SOUR:COUN:OUTP:POL? (@<ch_list>)
```

The query command returns a String value representing the output polarity for general purpose digital counter. Multiple responses are separated by commas.

Supported Device

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	AHI: Active High ALO: Active Low	AHI
<ch_list>	Numeric	301 through 302	N/A

Remark

Pulse generation for active high or active low for every event count.

Query Returned Format

<mode> ::= {AHI|ALO}

4
CONFigure Subsystem

This chapter explains all the CONFigure command subsystem.

CONFigure Subsystem Introduction

The CONFigure command provides the most flexible way to program the instrument for measurements. When you execute this command, the instrument uses default values for the requested measurement configuration (like the `MEASure?` command). However, the measurement is not automatically started and you can change some measurement attributes before actually initiating the measurement. This allows you to incrementally change the instrument's configuration from the default conditions.

The CONFigure subsystem commands are as below:

- `CONFigure:DIGital:DIRection`
- `CONFigure:TIMEbase:SOURce`
- `CONFigure:TIMEbase:ExternalCLocK`
- `CONFifure:SSI`

CONFigure:DIGital:DIRection

Syntax

```
CONFigure:DIGital:DIRection <direction>, (@<ch_list>)
```

This command is used to configure the selected digital port and the direction setting for input and output operations of the selected port.

```
CONF:DIG:DIR? (@<ch_list>)
```

The query command returns "INP" or "OUTP" for the specified channels. Multiple responses are separated by comma.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<direction>	String	{INP|OUTP}	INP
<ch_list>	Numeric	Channel 501 through 504	N/A

Query Returned Format

```
<direction> ::={INP|OUTP}
```

Example

```
CONF:DIG:DIR INP, (@501)
CONF:DIG:DIR? (@501)          //Expected returned string is INP
```

See Also

MEASure:DIGital?

MEASure:DIGital:BIT?

CONFigure:TIMEbase:SOURce

Syntax

```
CONFigure:TIMEbase:SOURce <mode>
```

This command is used to set or check the timebase/clock source for both analog inputs and outputs.

```
CONF:TIME:SOUR?
```

The query command returns a string value, which represents the timebase/clock source for both analog input and output channels.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Internal clock as the base time EXT: External clock as the base time CCG: Clock based on U2781A Modular Instrument Chassis	INT

Query Returned Format

```
<mode> ::={INT|EXT|CCG}
```

Example

```
CONF:TIME:SOUR EXT
CONF:TIME:SOUR?          //Expected returned string is EXT
```

CONFigure:TIMEbase:ECLocK

Syntax

```
CONFigure:TIMEbase:ECLK <clock>
```

This command is used to set or check if the time base/clock source is set to external.

```
CONF:TIME:ECLK?
```

The query command returns a numeric value that is set by the user of the external clock in kHz.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<clock>	Float	1 to 48 MHz	10 MHz

Query Returned Format

<clock> [kHz]

Example

```
CONF:TIME:ECLK 20000          //Set to external clock of 20 MHz
```

See Also

CONFigure:TIMEbase:SOURce

CONFigure:SSI

Syntax

```
CONFigure:SSI <mode>
```

This command sets or checks the synchronization status (master/slave) when used in the U2781A modular instrument chassis.

```
CONF:SSI?
```

The query command returns a string value, which represents the synchronization status (master/slave).

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	NONE: None MAST: To function as SSI master triggering source SLAV: To receive triggering source from master	NONE

NOTE

- This command is only operational when used in U2781A ,odular instrument chassis.
- There should only be one master assigned.

Remark

This command will force all reference clock sources to synchronous serial interface (SSI).

Query Returned Format

<mode> ::= {NONE|MAST|SLAV}

See also:

CONFigure:TIMEbase:SOURce

TRIGger:SOURce

OUTPut:TRIGger:SOURce

5 CALibration Subsystem

This chapter explains the CALibration command subsystem that is used to carry out the calibration function on the U2300A Series USB DAQ.

CALibration:BEGin

Syntax

```
CALibration:BEGin
```

This command is used to calibrate your device. When the function is executed, the device goes into a self-calibration mode. This command initiates a voltage calibration (adjustment) sequence for the specified DAC channel on the USB DAQ device. This sequence sets both zero and gain adjustment constants for each of the DAC output.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remark

Use the *OPC? command to check if the calibration is completed. The calibration is complete if the returned value is “1”. If the returned value is “0”, the calibration is still in progress

6
MEASure Subsystem

This chapter explains how the MEASure command subsystem is configured when acquiring data from the U2300A Series USB multifucntion DAQ.

MEASure[:VOLTage][:DC]?

Syntax

```
MEASure[:VOLTage][:DC]? (@<ch_list>)
```

This function performs a software triggered A/D conversion (analog input) on an analog input channel and returns the value scaled to a voltage value.

```
MEAS[:VOLT][:DC]? (@<ch_list>)
```

The query command returns a numeric value representing the scaled voltage value in volt for analog inputs. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	0

Remarks

If the returned value is 999.9, it is out of range.

Query Returned Format

<value> [V]

See Also

[SENSe:]VOLTage:STYPe

MEASure:COUNter:DATA?

Syntax

```
MEASure:COUNter:DATA?
```

This function performs a query on the current value for the specific mode, which includes the frequency, pulse width and totalizer modes. This depends on the value set in the `SENSe` command.

```
MEAS[:VOLT][:DC]? (@<ch_list>)
```

The query command returns a float value based on the `SENSe:COUNter` command. This value is the counter value for specific counting mode on specified counter channels. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	101 through 164	0

Query Returned Format

<value> [V]

Example

```
SENS:COUN:FUNC TOT,(@301)
SENS:COUN:FUNC FREQ,(@301)
MEAS:COUN:DATA? (@301)
```

See Also

[SENSe:]COUNter:FUNCtion

MEASure:COUNter:FREQuency?

Syntax

```
MEASure:COUNter:FREQuency? (@<ch_list>)
```

The query command returns a numeric value that indicates the frequency value in kHz of the specified counter channels. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	0

Query Returned Format

<value> [kHz]

Example

```
SENS:COUN:FUNC FREQ,(@301)
MEAS:COUN:FREQ? (@301)
```

See Also

[SENSe:]COUNter:FUNCtion

MEASure:COUNter:DATA?

MEASure:COUNter:PERiod?

Syntax

```
MEAS:COUN:PER? (@<ch_list>)
```

The query command returns a numeric value representing the period value in ms of the specified counter channels. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	0

Query Returned Format

<value> [ms]

Example

```
[SENS:]COUN:FUNC PER,(@301)
MEAS:COUN:PER? (@301)
```

See Also

[SENSe:]COUNter:FUNCtion

MEASure:COUNter:DATA?

MEASure:COUNter:PWIDth?

Syntax

MEAS:COUN:PWID? (@<ch_list>)

The query command returns a numeric value. This return value is the pulse width (duty cycle) in ms of the specified counter channels. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	0

Query Returned Format

<value> [ms]

Example

```
[SENS:]COUN:FUNC PWID,(@301)
MEAS:COUN:PWID? (@301)
```

See Also

[SENSe:]COUNter:FUNCtion

MEASure:COUNter:DATA?

MEASure:COUNter:TOTalize?

Syntax

```
MEAS:COUN:TOT? (@<ch_list>)
```

The query command returns a numeric value that represents the totalized value on the specified counter channels . Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	301 through 302	0

Query Returned Format

<value>

MEASure:DIGital?

Syntax

```
MEASure:DIGital? (@<ch_list>)
```

The query command returns a numeric value representing the digital data from the specified digital input port. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	Channel 501 thru 504	0
<value>	Integer	0-256 (8-bit)	0

Query Returned Format

<value>

Example

```
CONF:DIG:DIR INP,(@501)
MEAS:DIG? (@501)
```

See Also

CONFigure:DIGital:DIRection

MEASure:DIGital:BIT?

Syntax

```
MEASure:DIGital:BIT? <bit>, (@<ch_list>)
```

This query returns the digital logic state of the specified bit of the specified channel.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	Channel 501 and 502: Bit 0 to 7. Channel 503 and 504: Bit 0 to 3.	0
<ch_list>	Numeric	Channel 501 through 504	0

Remarks

- Channels 501 and 502 are 8-bit, while channels 503 and 504 are 4-bit.

Query Returned Format

<value>

Example

```
CONF:DIG:DIR INP,(@501)
CONF:DIG:BIT? 2,(@501)      //Reads bit 2 of channel 501
MEAS:DIG:BIT? 0,(@502)      //Reads bit 0 of channel 502
```

See Also

CONFigure:DIGital:DIRection

7 IEEE-488 Common Command

This chapter gives an introduction to the IEEE-488.2 common commands. It defines a set of common commands that perform functions such as reset, self-test and status operations.

*CLS

Syntax

```
*CLS
```

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

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Example

The following command clears the event register bits:

```
*CLS
```

*ESE

Syntax

```
*ESE <enable_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.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register. Refer to table below.	This is a required parameter

Returned Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 3 (decimal value = 8) and bit 7 (decimal value = 128) are enabled, the query command will return "+136".

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Decimal Value	Definition
0 Not used	1	Always zero.
1 Not used	2	Always zero.

2 Error Queue	4	One or more errors have been stored in the Error Queue. Use the `SYSTem:ERRor?` command to read and delete errors.
3 Not used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event Summary	32	One or more bits are set in the Standard Event Register (bits must be enabled, see *ESE command).
6 Master Summary	64	One or more bits are set in the Status Byte Register and may generate a Request for Service (RQS). Bits must be enabled using the `*SRE` command.
7 Not used	128	Always zero.

- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 2 (decimal value = 4), bit 3 (decimal value = 8), and bit 7 (decimal value = 128), the corresponding decimal value would be 140 (4 + 8 + 128).
- The `*CLS` (clear status) command will not clear the enable register but it does clear all bits in the event register.
- An Instrument Preset (`SYSTem:PRESet` command) does not clear the bits in the Status Byte enable register.

Example

The following command enables bit 4 (decimal value = 16) in the enable register. If an Execution Error occurs, this condition will be reported to the Status Byte Register (bit 5 will be set high).

```
*ESE 16
```

The following query returns which bits are enabled in the register.

```
*ESE?
```

Typical Response: +16

See Also

*ESR?

*ESR?

Syntax

```
*ESR?
```

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are set (and the corresponding bits are enabled), this command will return "+18".

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	NR2	1 to 48 MHz	N/A

Example

The following command reads the event register (bits 3 and 4 are set).

```
*ESR?
```

Typical Response: +24

See Also

*ESE

*IDN?

Syntax

```
*IDN?
```

This command reads the instrument's identification string which contains four comma-separated fields. The first field is the manufacturer's name, the second field is the instrument model number, the third field is the serial number, and the fourth field is a firmware revision code.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Query

The command returns a string with the following format.

Agilent Technologies,U2331A,<Serial Number>A.YYYY.MM.DD

YYYY = Year
MM = Month
DD = Date

Example

The following query returns the instrument's identification string.

```
*IDN?
```

Typical Response: Agilent Technologies,U2331A,TW12345678,A.2006.10.10

See Also

SYSTem:CDEScription?

*OPC?

Syntax

```
*OPC?
```

This query returns "1" to the output buffer at the completion of the current operation.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remarks

The purpose of this command is to synchronize your application with the instrument.

Return Format

The command returns "1" to the output buffer.

Example

The following command waits until channel 1 on the module in slot 2 is fully closed and then sends "1" to the output buffer.

```
CAL:BEGin; *OPC?
```

See Also

CALibration:BEGin

SYSTem:ERRor?

*RCL

Syntax

```
*RCL {1|2}
```

This command recalls the instrument state stored in the specified storage location. You cannot recall the instrument state from a storage location that is empty or was deleted. When shipped from the factory, storage locations 1 through 2 are empty.

Use the `*SAV` command to store the current instrument state

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remarks

- The instrument has two storage locations in non-volatile memory to store instrument states. You can only recall a state from a location that contains a previously stored state.
- Before recalling a stored state, the instrument will perform the equivalent of a Factory Reset (`*RST` command).
- A Factory Reset (`*RST` command) has no effect on the configurations stored in memory. Once a state is stored, it remains until it is overwritten or specifically deleted.

Example

The following command recalls the instrument state previously stored in location 1.

```
*RCL 1
```

See Also

*SAV

*RST

Syntax

```
*RST
```

This command resets the instrument to the default configuration. See Factory Reset State for a complete listing of the instrument's default configuration.

Remarks

- This command does not affect any previously-stored instrument states (see `*SAV` command).

Example

The following command resets the instrument.

```
*RST
```

See Also

SYSTem:ERRor?

*SAV

Syntax

```
*SAV {1|2}
```

This command stores (saves) the current instrument state in the specified storage location. Any state previously stored in the same location is overwritten (no error is generated).

Use the `*RCL` command to recall a stored instrument state.

Remarks

- The instrument has two storage locations in non-volatile memory to store instrument states. You can store the instrument state in any of the five locations, but you can only recall a state from a location that contains a previously stored state.
- A Factory Reset (`*RST` command) does not affect the configurations stored in memory. Once a state is stored, it remains until it is overwritten or specifically deleted.
- The following parameters are saved in `*SAV`:
  - `[SENS:]VOLT:RANG`
  - `[SENS:]VOLT:POL`
  - `[SENS:]VOLT:STYP`
  - `[SENS:]COUN:FUNC`
  - `[SENS:]COUN:GATE:POL`
  - `[SENS:]COUN:GATE:SOUR`
  - `[SENS:]COUN:GATE:CONT`
  - `[SENS:]COUN:CLK:EXT`
  - `[SENS:]COUN:CLK:SOUR`
  - `[SENS:]COUN:TOT:IVAL`
  - `[SENS:]COUN:TOT:UDOW:SOUR`
  - `[SENS:]COUN:TOT:UDOW:DIR`
  - `SOUR:VOLT:POL`
  - `SOUR:VOLT:RSRC`

- SOUR:VOLT:RVOL
- CONF:DIG:DIR
- CONF:TIME:SOUR
- CONF:TIME:ECLK
- CONF:SSI
- APPLy
- APPLy:SINusoid
- APPLy:SQUare
- APPLy:SAWTooth
- APPLy:NOISe
- APPLy:USER
- OUTPut:WAVeform:ITERate
- OUTPut:WAVeform:SRATe
- OUTPut:WAVeform:FREQ
- OUTPut:TRIGger:SOURce
- OUTPut:TRIGger:TYPe
- OUTPut:TRIGger:DCouNT
- OUTPut:TRIGger:ATRiGger:SOURce
- OUTPut:TRIGger:ATRiGger:HTHReshold
- OUTPut:TRIGger:ATRiGger:LTHReshold
- OUTPut:TRIGger:ATRiGger:CONDition
- OUTPut:TRiGger:DTRiGger:POLarity
- ROUTe:CHANnel:RSouRCe
- ROUTe:CHANnel:RVOLtage
- ROUTe:SCAN
- ROUTe:CHANnel:RANGe
- ROUTe:CHANnel:POLarity
- ROUTe:CHANnel:STYPe
- ACQuire:SRATe
- ACQuire:POINts
- ACQuire:BURSt

- WAVeform:POINts
- TRIGger:SOURce
- TRIGger:TYPe
- TRIGger:DCouNT
- TRIGger:ATRiGger:SOURce
- TRIGger:ATRiGger:CONDition
- TRIGger:DTRiGger:POLarity
- TRIGger:ATRiGger:HTHReshold
- TRIGger:ATRiGger:LTHReshold

Example

The following command stores the current instrument state in location 1.

```
*SAV 1
```

See Also

*RCL

*SRE

Syntax

```
*SRE <enable_value>
```

This command enables bits in the enable register for the Status Byte Register group. Once enabled, the corresponding bits may generate a Request for Service (RQS) in the Status Byte. This RQS event may generate a "call back" to your application as a type of asynchronous interrupt.

```
*SRE?
```

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 3 (decimal value = 8) and bit 7 (decimal value = 128) are enabled, the query command will return "+136".

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register. Refer to the table below.	This is a required parameter

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Decimal Value	Definition
0 Not used	1	Always zero.
1 Not used	2	Always zero.
2 Error Queue	4	One or more errors have been stored in the Error Queue. Use the `SYSTem:ERRor?` command to read and delete errors.
3 Not used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.

5 Standard Event Summary	32	One or more bits are set in the Standard Event Register (bits must be enabled, see *ESEcommand).
6 Master Summary	64	One or more bits are set in the Status Byte Register and may generate a Request for Service (RQS). Bits must be enabled using the *SRE command.
7 Not used	128	Always zero.

- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 1 (decimal value = 2), bit 3 (decimal value = 8), and bit 6 (decimal value = 64), the corresponding decimal value would be 74 (2 + 8 + 64).
- The Status Byte enable register is cleared when you execute the *SRE 0 command.

Examples

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

```
*SRE 16
```

The following query returns which bits are enabled in the register.

```
*SRE?
```

Typical Response: +16

See Also

*STB?

*STB?

Syntax

```
*STB?
```

This command queries the condition register for the Status Byte Register group. This command is similar to a Serial Poll but it is processed like any other instrument command. This is a read-only register and the bits are not cleared when you read the register.

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Decimal Value	Definition
0 Not used	1	Always zero.
1 Not used	2	Always zero.
2 Error Queue	4	One or more errors have been stored in the Error Queue. Use the `SYSTem:ERRor?` command to read and delete errors.
3 Not used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event Summary	32	One or more bits are set in the Standard Event Register (bits must be enabled, see *ESE command).
6 Master Summary	64	One or more bits are set in the Status Byte Register and may generate a Request for Service (RQS). Bits must be enabled using the `*SRE` command.
7 Not used	128	Always zero.

- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 1 (decimal value = 2), bit 3 (decimal value = 8), and bit 6 (decimal value = 64), the corresponding decimal value would be 74 (2 + 8 + 64).

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

Example

The following command reads the condition register (bits 3 and 4 are set).

```
*STB?
```

Typical Response: +24

See Also

*CLS

*SRE

*TST?

Syntax

```
*TST?
```

This command performs a self-test of the instrument and returns a pass/fail indication.

Return Query Format

The command returns "+0" (all tests passed) or "+1" (one or more tests failed).

Example

The following command performs a self-test and returns a pass/fail indication.

```
*TST?
```

Typical Response: +0

*WAI

Syntax

```
*WAI
```

This command configures the instrument to wait for all pending operations to complete before executing any additional commands over the interface.

See Also

*OPC?

8 ROUTe Subsystem

This chapter contains information on the ROUTe command subsystem.

ROUTe:SCAN

Syntax

```
ROUT:SCAN (@<ch_list>)
```

This command is used to set the acquisition sequence specified in the channel list (<ch_list>). This acquisition sequence is also known as a scan list.

```
ROUT:SCAN?
```

The query command returns an integer value that indicates the specified input channel. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remark

- For multiplexing DAQ only (U2300 Series).
- The maximum channel list is 100 items.
- Repeated channel assignment is allowed, ex: 101, 102, 103, 101...
- This command is capable of changing the scan order without changing the properties on RANGE, POLARITY and SIGNAL TYPE.
- Consecutive channels can be specified using colon or comma. For example 101,102,103 or 101:103.

Query Returned Format

(@<ch_list>)

ROUTe:CHANnel:RANGe

Syntax

```
ROUT:CHAN:RANG <value>, (@<ch_list>)
```

This command is used to set the voltage range of the specified analog input channels.

```
ROUT:CHAN:RANG? (@<ch_list>)
```

The query command returns a float value that represents the range in volt of the specified analog inputs channels. Multiple responses are separated by commas.

Supported Card

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Float	U2331A: Unipolar mode: {10|5|4|2.5|2.0|1.0|0.5|0.4|0.1} Bipolar mode: {10|5|2.5|2.0|1.25|1.0|0.5|0.25|0.2|0.05} U2351A/U2352A/U2353A/U2354A/U2355A/ U2356A: Unipolar/Bipolar mode: {10,5,2.5,1.25}	10
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remark

- See also ROUTe:CHANnel:POLarity. If the polarity is UNIP, the value 10 means 0 to 10 V. Whereas, if the polarity is BIP, the value is in the range of –10 V to +10 V.
- If the reference value is out of all enumeration, it will raise error code of 224.

Query Returned Format

<value> [V]

See Also

ROUTe:CHANnel:POLarity

ROUTe:CHANnel:STYPe

ROUTe:CHANnel:POLarity

Syntax

ROUT:CHAN:POL <mode>, (@<ch_list>)

This command is used to set or read the polarity (unipolar/bipolar) on both analog input and output.

ROUT:CHAN:RANG (@<ch_list>)

The query command returns a string value. This string value is the polarity (unipolar /bipolar) of both specified analog inputs and outputs. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Integer	U2331A: Unipolar mode: {10|5|4|2.5|2.0|1.0|0.5|0.4|0.1} Bipolar mode: {10|5|2.5|2.0|1.25|1.0|0.5|0.25|0.2|0.05} U2351A/U2352A/U2353A/U2354A/U2355A/ U2356A: Unipolar/Bipolar mode: {10,5,2.5,1.25}	10
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remark

Will return error code if OUT ON.

Query Returned Format

<mode> ::= {UNIP|BIP}

See Also

ROUTe:CHANnel:POLarity

ROUTe:CHANnel:STYPe

ROUTe:CHANnel:STYPe

Syntax

```
ROUT:CHAN:STYP <mode>, (@<ch_list>)
```

This command is used to set or check the reference ground selection of the specified analog input channel.

```
ROUT:CHAN:STYP? (@<ch_list>)
```

The query command returns a string value representing the signal type of both specified analog inputs and outputs. Multiple responses are separated by commas.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	DIFF: Differential mode SING: Referenced single-ended mode (16/64 ch common to ground system on board) NRS: Non-referenced single-ended mode (16/64 ch common to AISENSE pin)	SING
<ch_list>	Numeric	Single ended mode: U2351A/U2352A/U2353A/U2354A: 101-116 U2355A/U2356A/U2331A: 101-164 Differential mode: U2351A/U2352A/U2353A/U2354A: 101-108 U2355A/U2356A/U2331A: 101-132	N/A

Remark

Some channels only support SING and NRS mode. For example, channels 108 to 116 for U2351A, U2352A, U2353A and U2354A; channels 132 to 164 for U2355A, U2356A and U2331A.

Query Returned Format

<mode> ::= {DIFF|SING|NRS}

ROUTe:CHANnel:RSouRCe

Syntax

```
ROUT:CHAN:RSRC <mode>, (@<ch_list>)
```

This command is used to set or check the reference voltage source of the analog output.

```
ROUT:CHAN:RANG (@<ch_list>)
```

The query command returns a string value, which represents the voltage source for the specified analog output. Multiple responses are separated by commas.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	INT: Internal reference EXT: External reference	INT
<ch_list>	Numeric	U2351A: 202 through 202 U2353A/U2355A/U2356A/U2331A: 201 through 202	N/A

Query Returned Format

<mode> ::= {INT|EXT}

ROUTe:CHANnel:RVOLtage

Syntax

```
ROUT:CHAN:RVOL <value>, (@<ch_list>)
```

This command is used to set or check the voltage value of the external reference voltage source of the analog outputs.

```
ROUT:CHAN:RVOL? (@<ch_list>)
```

The query command returns a numeric value, representing the external reference voltage value in volt for the analog outputs.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	From 0 to 10, if the D/A reference voltage source is the external reference.	10

Remark

- It will return an error code if OUT ON.
- Cannot be zero.

Query Returned Format

<value> [V]

See Also

ROUTe:CHANnel:RSouRCe

9 ACQuire Subsystem

This chapter ellaborates the set of commands in ACQuire command subsystem.

ACQuire:SRATe

Syntax

```
ACQuire:SRATe <value>
```

This command is used to set or check the sampling rate of analog input.

```
ACQuire:SRATe?
```

The query command returns a numeric value, representing the sampling rate set for the instrument.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	U2351A/U2352A/U2355A: 3 Hz - 250 kHz U2353A/U2354A/U2356A: 3 Hz - 500 kHz U2331A: 3 Hz - 3 MHz	1 kHz

Remark

- <value> * <number of entries> is the maximum ADC sampling rate.
- For U2331A, the maximum sampling rate is 3 MHz if only one channel is enabled and 1 MHz/<number of entries> for multiple channels.

Query Returned Format

<value> [Hz]

See Also

DIGitize

ACQuire:POINts

Syntax

```
ACQuire:POINts <value>
```

This command is used to set or check the count of a single-shot analog input.

```
ACQ:POIN?
```

The query command returns a numeric value, representing the acquisition count for single-shot analog input. Note that the single-shot acquisition is initiated by the `DIGitize` command.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	Maximum of 8 MSa	500

Remark

<value> * <number of entries> is equivalent to 16/2 mega points.

Query Returned Format

<value>

See Also

DIGitize

ACQuire:BURSt

Syntax

```
ACQ:BURS <mode>
```

This command is used to set or check the burst mode of multiplexer DAQ device. In the burst mode, the device will use the full rate to perform data acquisition operation.

```
ACQ:BURS?
```

The query command returns a string value representing the state of the burst mode of multiplexer DAQ device for the input channels. '0' indicates OFF while '1' indicates ON.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	{0|1}	0

Remark

For multiplexing cards only (U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A).

Query Returned Format

<mode> ::={0|1}

10
TRIGger Subsystem

This chapter contains all the TRIGger subsystem commands that are used when programming the Agilent U2300A Series USB multifunction DAQ.

TRIGger:SOURce

Syntax

```
TRIG:SOUR <mode>
```

This command is used to set or check the source of the A/D trigger control.

```
TRIG:SOUR?
```

The query command returns a string value representing the source for A/D trigger control.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	NONE : Immediate EXTD: From external digital trigger source EXTA: From analog trigger pin STRG: Clock Source by Star Trigger	NONE

Remark

Only POST trigger is allowed when trigger source is in NONE mode.

Query Returned Format

<mode> ::={NONE|EXTD|EXTA|STRG}

TRIGger:TYPe

Syntax

`TRIG:TYP <mode>`

This command is used to set or check the type of the A/D source.

`TRIG:TYP?`

The query command returns a string value that indicates the setting for A/D mode selection.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	POST: Post Trigger Mode PRE: Pre-Trigger Mode MID: Middle-Trigger Mode DEL: Delay Trigger Mode	POST

Remark

- All trigger types are supported in one-shot acquisition. It is invoked by `DIG` command.
- For continuous analog input and output mode, only POST and DELAY types are supported.

Query Returned Format

<mode> ::={POST|PRE|MID|DEL}

See Also

TRIGger:SOURce

TRIGger:DCouNT

Syntax

```
TRIG:DCouNT <value>
```

This command is used to set or check the counter value of delay trigger mode.

```
TRIG:TYP?
```

The query command returns an integer value of delay trigger mode.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Integer	From 0 to 2147483647 (2^{31} - 1)	0

Query Returned Format

<value>

TRIGger:ATRiGger:SOURce

Syntax

`TRIG:ATRG:SOUR <src>`

This function sets or checks the physical pin for the analog trigger.

`TRIG:ATRG:SOUR?`

The query command returns a string value representing the trigger source selection of analog trigger control.

Supported Device

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<src>	String	EXTAP: From external analog trigger pin SONE: Source from first scanned channel for Multiplexing Device	EXTAP

Remark

- Only post and pre trigger modes can be used if trigger source is set to SONE.
- Input range should be configured well. The HTHReshold must be less than the Max input range while the LTHReshold must be larger than Min input range.
- To activate SONE trigger, users are required to run the `RUN` command before or after analog output (`"OUTP ON"`).
- The SONE trigger detection only comes into effect during the `DIG` command execution.
- The SONE parameter refers to the first entry in `ROUT:SCAN` command.

Query Returned Format

<mode> ::={EXTAP|SONE}

See Also

TRIGger:SOURce

TRIGger:TYPe

TRIGger:ATRiGger:HTHReshold

TRIGger:ATRiGger:LTHReshold

TRIGger:ATRiGger:CONDition

ROUTe:SCAN

TRIGger:ATRiGger:HTHReshold

Syntax

`TRIG:ATRG:HTHR <value>`

This command is used to set or check the high threshold for analog trigger control.

`TRIG:ATRG:HTHR?`

The query command returns a float value representing the high threshold in units of volts for analog trigger control.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Float	–10 V to +10 V	0

Remark

If SONE mode is selected by `TRIGger:ATRiGger:SOURce` command, the Threshold will be limited by the RANGE configuration of the first channel in the scan list.

Query Returned Format

<value>[V]

See Also

TRIGger:ATRiGger:LTHReshold

TRIGger:ATRiGger:LTHReshold

Syntax

```
TRIG:ATRG:LTHR <value>
```

This command is used to set or check the low threshold voltage for analog trigger control.

```
TRIG:ATRG:LTHR?
```

The query command returns a float value representing the low threshold voltage for analog trigger control.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Float	–10 V to +10 V	0

Remark

- Only post and delay trigger modes can be used if the trigger source is SONE.
- If SONE mode is selected by command TRIGger:ATRiGger:SOURce, the threshold voltage will be limited by the range configuration of the first channel of the scan list.

Query Returned Format

<value>[V]

See Also

TRIGger:ATRiGger:LTHReshold

TRIGger:ATRiGger:CONDition

Syntax

```
TRIG:ATRG:COND <mode>
```

This command is used to set or check the trigger condition of analog trigger control.

```
TRIG:ATRG:COND?
```

The query command returns a string value representing the trigger condition of analog trigger control.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	AHIG: Above-High-Level Triggering BLOW: Below-Low-Level Triggering WIND: Inside Region Triggering	BLOW

Remark

The value of HTHReshold must larger than LTHReshold

Query Returned Format

<mode> ::={AHIG|BLOW|WIND}

See Also

TRIGger:ATRiGger:SOURce

TRIGger:ATRiGger:HTHReshold

TRIGger:ATRiGger:LTHReshold

TRIGger:DTRiGger:POLarity

Syntax

```
TRIG:DTRG:POL <mode>
```

This command is used to set or check the polarity of the external digital trigger.

```
TRIG:ATRG:COND?
```

The query command returns a string value representing the polarity of external digital trigger.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	POS: Trigger positive edge active NEG: Trigger negative edge active	POS

Query Returned Format

<mode> ::={POS|NEG}

See Also

TRIGger:SOURce

11 WAVeform Subsystem

This chapter explains the CALibration command subsystem that is used to carry out the calibration function on the U2300A Series USB DAQ.

WAVeform:DATA?

Syntax

```
WAV:DATA?
```

This command is used to returns the raw data of input channels that are enabled by ROUT:SCAN command. For example, #800000200<byte 1><byte 2>...<byte 200>, indicates that there is a total of 200 bytes of returned data. Each acquisition is made up of two bytes. The first byte is the LSB and the second one is the MSB. The sample shows that there is a total of 100 acquisition points.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remark

- Maximum 8 MSa in DIGitize/4 MSa in RUN.
- The length of header is fixed at eight characters.

Example

```
*RST; *CLS
ROUT:SCAN (@101)      //Monitors only channel 101
ACQ:SRAT 30000        //Set sampling rate of 30 KHz
WAV:POIN 3000         //Set to read/fetch 3000 points at one time
RUN
WAV:STAT?             //Expect a string returned data
WAV:DATA?             //Loop until the next STOP command is issued
STOP                  //Acquisition stops
```

See Also

ROUTe:SCAN

ACQuire:SRATe

WAVeform:POINts?

RUN

STOP

WAVeform:POINts?

Syntax

```
WAVeform:POINts <value>

WAVeform:POINts?
```

This commands queries the number of acquisition points. Each acquisition point is made up of two bytes. Hence, setting the acquisition points to 100 implies that a block of 200 bytes of raw data will be transfered to the PC when the WAV:DATA command is issued.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<value>	Numeric	< 4 MSa	500

Remark

- Size of block to read
- Maximum 4 MSa
- For continuous analog input function only

Example

```
ROUT:SCAN (@101)        //Monitors only channel 101
WAV:POIN 100            //Sets acquisition points for channel 101
ROUT:SCAN (@102,103)
WAV:POIN 200            //Both channels get 100 acquisition points each.
```

See Also

ROUTe:SCAN

ACQuire:SRATe

WAVeform:POINts?

RUN

STOP

WAVeform:STATus?

Syntax

```
WAVeform:STATus?
```

This commands queries the instrument for its acquisition status.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	EPTY: Empty, no data captured FRAG: Fragment, DAQ start to measure but memory buffer block is not complete yet. DATA: At least one block is complete and ready to be read back. OVER: Buffer is full and the acquisition stops.	500

Remark

- For RUN command (continuous analog input mode) only.
- Buffer block

Query Returned Format

<mode> ::={EPTY|FRAG|DATA|OVER}

WAVeform:COMPlete?

Syntax

```
WAV:COMP?
```

This command is used to query the current acquisition status of the DIGitize command.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Parameters

Item	Type	Range of Values	Default Value
<mode>	String	NO: Capturing Data YES: One-Shot Function Completed	500

Remark

Only for DIGitize acquisition mode. The acquisition stops only if the number of points specified by the WAV:POIN command is met or when a STOP command is sent.

Query Returned Format

<mode> ::={NO|YES}

See Also

DIGitize

ACQuire:SRATe

WAVeform:POINts?

12
APPLy Subsystem

This chapter explains how the APPLy command subsystem is configured to generate different waveforms.

APPLy?

Syntax

APPL? (@<ch_list>)

The query returns a string value that indicates the application mode of analog outputs.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	201 through 202	N/A

Query Returns Format

<mode>, <amplitude>, <offset>

<mode> ::= {SIN|SQU|SWAT|TRI|NOIS|USER}

SIN: Sine wave function selected

SQU: Square wave function selected

SWAT: Sawtooth wave function selected

TRI: Sawtooth wave function selected

NOIS: Sawtooth wave function selected

USER: User defined wave pattern selected

<amplitude> ::= Vp of output function

<offset> ::= DC offset of output function

APPLy:SINusoid

Syntax

```
APPLy:SINusoid [<amplitude>,<offset>,] (@<ch_list>)
```

This command is used to configure sine waveform pattern to FIFO. It outputs a sine wave with the specified amplitude and dc offset. The waveform is generated after executing the “OUTP ON” command.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<amplitude>	Float	<amplitude>: amplitude units [V]	10
<offset>	Float	<offset>: offset voltage [V]	0.0
<ch_list>	Numeric	U2331A : 201 through 202	N/A

Remark

- Amplitude must be larger than zero
- Amplitude + Offset <= 10; Amplitude*(–1)+Offset >= –10

Query Returned Format

<mode>,<amplitude>,<offset>

APPLy:SQUare

Syntax

```
APPLy:SQUare [<amplitude>,<offset>,](@<ch_list>)
```

This command is used to configure square waveform pattern to FIFO. It outputs a square wave with the specified amplitude and dc offset. The waveform is generated after executing the “OUTP ON” command.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<amplitude>	Float	<amplitude>: amplitude units [V]	10
<offset>	Float	<offset>: offset voltage [V]	0.0
<ch_list>	Numeric	201 through 202	N/A

Remark

- Amplitude must be larger than zero
- Amplitude + Offset <= 10; Amplitude*(–1)+Offset >= –10

Query Returned Format

<mode>,<amplitude>,<offset>

APPLy:SAWTooth

Syntax

```
APPLy:SAWTooth [<amplitude>,<offset>,](@<ch_list>)
```

This command is used to configure sawtooth square waveform pattern to FIFO. It outputs a sawtooth wave with the specified amplitude and dc offset. The waveform is generated after executing the “OUTP ON” command.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<amplitude>	Float	<amplitude>: amplitude units [V]	10
<offset>	Float	<offset>: offset voltage [V]	0.0
<ch_list>	Numeric	U2331A : 201 through 202	N/A

Remark

- Amplitude must be larger than zero
- Amplitude + Offset <= 10; Amplitude*(–1)+Offset >= –10

Query Returned Format

<mode>,<amplitude>,<offset>

APPLy:TRIangle

Syntax

```
APPLy:TRIangle [<amplitude>,<offset>,](@<ch_list>)
```

This command is used to configure triangle square waveform pattern to FIFO. It outputs a triangle wave with the specified amplitude and dc offset. The waveform is generated after executing the “OUTP ON” command.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<amplitude>	Float	<amplitude>: amplitude units [V]	10
<offset>	Float	<offset>: offset voltage [V]	0.0
<ch_list>	Numeric	U2331A : 201 through 202	N/A

Remark

- Amplitude must be larger than zero
- Amplitude + Offset <= 10; Amplitude*(–1)+Offset >= –10

Query Returned Format

<mode>,<amplitude>,<offset>

APPLy:NOISe

Syntax

```
APPLy:NOISe [<amplitude>,<offset>,](@<ch_list>)
```

This command is used to configure noise waveform pattern to FIFO. It outputs a noise wave with the specified amplitude and dc offset. The waveform is generated after executing the “OUTP ON” command.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<amplitude>	Float	<amplitude>: amplitude units [V]	10
<offset>	Float	<offset>: offset voltage [V]	0.0
<ch_list>	Numeric	U2331A : 201 through 202	N/A

Remark

- Amplitude must be larger than zero
- Amplitude + Offset <= 10; Amplitude*(−1)+Offset >= −10

Query Returned Format

<mode>,<amplitude>,<offset>

APPLy:USER

Syntax

```
APPLy:USER (@<ch_list>)
```

This command is used to configure user defined pattern to FIFO. It outputs a user defined wave. The waveform is generated as soon as the command is executed.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	201 through 202	N/A

Remarks

The “OUTP” command will return error if channel 201 and 202 is configured to user defined and pre-defined waveform patterns at the same time.

13 OUTPut Subsystem

This chapter explains all the OUTPut command subsystem.

OUTPut

Syntax

`OUTP <mode>`

This command sets or checks the status (ON/OFF) of the analog output.

`OUTP?`

The query command returns a string value representing the status of the analog output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode >	String	OFF or 0: Output predefined waveform ON or 1: Terminate waveform output	OFF

Remark

- The “OUTP ON” and “OUTP OFF” commands can’t be executed repeatedly.
- Resets the voltage level by using the `SOUR:VOLT 0` command.
- Can not generate user-defined and per-defined waveforms at once

Query Returned Format

<mode> ::= {OFF|0|ON|1}

OUTPut:WAVeform:ITERate

Syntax

```
OUTP:WAV:ITER <value>
```

This command is used to set or read the number of iteration of the data in the buffer output.

```
OUTP:WAV:ITER?
```

The query command returns the integer value representing the iteration number of data in the buffer to output to the desired port.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Integer	0 to 16777215 (24 bits)	0

Remark

- 0 for infinite iteration
- Positive number for iteration count
- The iteration value must larger or equal to zero and less than 0xffffff.

Query Returns Format

<value>

OUTPut:WAVeform:SRATe

Syntax

```
OUTP:WAV:SRAT  <value>
```

This command is used to set or read the updated rate of analog outputs.

```
OUTP:WAV:SRAT?
```

The query command returns an integer value representing the update rate of analog outputs in Hz.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Float	(48/166777215) Hz to 1 MHz	0

Remark

- The range bound by 0 <= <value> <= 10^6. Must be >= $48x10^6$ / 0xffffff.
- 0 for automatic sampling configuration for SIN, SQU, SAWT, TRI, NOIS waveform generation
- Maximum 4096 points for one waveform

Query Returns Format

<value>[Hz]

OUTPut:WAVeform:FREQuency

Syntax

```
OUTP:WAV:FREQ  <value>
```

This command sets or reads the frequency of analog outputs.

```
OUTP:WAV:FREQ?
```

The query command returns a float value representing the frequency in Hz for analog outputs.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Float	10 Hz to 10000 Hz	4000.0

Remark

The range bound by 10 <= <value> <= 1000

Query Returns Format

<value>Hz

OUTPut:TRIGger:SOURce

Syntax

```
OUTP:TRIG:SOUR <mode>
```

This command is used to set or read the setting of the D/A trigger control.

```
OUTP:TRIG:SOUR?
```

The query command returns a string value representing the setting of the D/A trigger control.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode>	String	NONE: Immediate trigger EXTD: From external digital trigger pin EXTA: From external analog trigger pin STRG: Clock Source by Star Trigger	NONE

Query Returns Format

<mode> ::={SOFT|EXTD|EXTA|STRG}

OUTPut:TRIGger:TYPe

Syntax

```
OUTP:TRIG:TYP <mode>
```

This command sets or reads the trigger mode selection of the analog output.

```
OUTP:TRIG:TYP?
```

The query command returns a string value that indicates the trigger mode selection of the analog output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode>	String	POST: post-trigger DEL: delay-trigger	POST

Query Returns Format

<mode> ::= {POST|DEL}

OUTPut:TRIGger:DCouNT

Syntax

```
OUTP:TRIG:DCNT  <value>
```

This command is used to set or read the delay counter value, which is the duration of output after trigger signal is received.

```
OUTP:TRIG:DCNT?
```

The query command returns an integer value representing the delay time/count.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Integer	0 to 2147483647 (31 bits)	0

Remark

- 0 <= <value> <= 0x7fffffff (for counter)

Query Returns Format

<value> [second]

OUTPut:TRIGger:ATRiGger:SOURce

Syntax

```
OUTP:TRIG:ATRG:SOUR <mode>
```

This commands sets or reads the trigger source of the analog output.

```
OUTP:TRIG:ATRG:SOUR?
```

The query command returns a string value that indicates the trigger source of the analog output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode>	String	EXTAP: From external analog trigger pin SONE: Source from first scanned channel for multiplexing USB DAQ	EXTAP

Query Returns Format

<mode> ::= {EXTAP|SONE}

OUTPut:TRIGger:ATRiGger:HTHReshold

Syntax

```
OUTP:TRIG:ATRG:HTHR  <value>
```

This command sets or read the high threshold voltage of the analog trigger output.

```
OUTP:TRIG:ATRG:HTHR?
```

The query command returns a float value representing the high threshold voltage for the analog trigger output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Float	–10 V to 10 V	10.0

Query Returns Format

<value>

OUTPut:TRIGger:ATRiGger:LTHReshold

Syntax

```
OUTP:TRIG:ATRG:LTHR  <value>
```

This command is used to set or read the low threshold voltage of the analog trigger output.

```
OUTP:TRIG:ATRG:LTHR?
```

The query command returns a float value. This returned value is the low threshold voltage of the analog trigger output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<value>	Float	–10 V to 10 V	10.0

Query Returns Format

<value>

OUTPut:TRIGger:ATRiGger:CONDition

Syntax

```
OUTP:TRIG:ATRG:COND <mode>
```

This commands sets or reads the trigger condition for the analog trigger control for the analog output.

```
OUTP:TRIG:ATRG:COND?
```

The query command returns a string value representing the trigger condition for the analog trigger control for the analog output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode>	String	AHIG: Above-High-Level Triggering BLOW: Below-Low-Level Triggering WIND: Inside Region Triggering	BLOW

Query Returns Format

<mode> ::= {AHIG|BLOW|WIND|HHYT|LHYT}

OUTPut:DTRiGger:POLarity

Syntax

```
OUTP:DTRG:POL <mode>
```

This command is to set or read the polarity of the external digital trigger of the analog output.

```
OUTP:DTRG:POL?
```

The query command returns a string value representing the analog trigger condition of the analog output.

Supported Model

U2351A, U2353A, U2355A, U2356A, U2331A

Parameters

Name	Type	Range of Values	Default Value
<mode>	String	POS: Trigger positive edge active NEG: Trigger negative edge active	POS

Query Returns Format

<mode> ::= {POS|NEG}

14
Root Commands

This chapter explains how the SYSTem root commands are utilized for the U2300A Series USB DAQ.

DIGitize

Syntax

```
DIGitize
```

This command is used to start the single shot data acquisition.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remark

- Use the “STOP” command to stop a complete work flow.
- In general condition, there are four trigger conditions; post trigger, pre-trigger, middle trigger and post trigger. However, user can only select post and delay trigger modes when used in NONE trigger mode.

RUN

Syntax

```
RUN
```

This command is used to start the continuous data acquisition.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remark

- Use the “STOP” command to stop a complete work flow.
- Post and delay trigger conditions are only supported in continuous analog input mode.

STOP

Syntax

```
STOP
```

This command is used to stop the asynchronous analog input operation.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

MODel?

Syntax

```
MODel?
```

This query returns the model of the USB DAQ. The returned string can be any of the seven models in the U2300A Series DAQ.

SERial?

Syntax

```
SERial?
```

This query returns a string value indicating the serial number of the USB DAQ.

DATA[:USER]

Syntax

```
DATA[:USER]
```

```
DATA <header><binary block>
```

This command is used to set data in FIFO for analog outputs.

Supported Model

U2352A, U2354A, U2355A, U2356A, U2331A

Remark

- Binary block must use the IEEE488.2 binary block format
- Syntax cannot be executed while AO is running after executing command “OUTP ON”

Example

```
DATA #800000200<byte1><byte2>...<byte200>
```

15
SYSTem Subsystem

This chapter explains the SYSTem subsystem command for identification purpose.

SYSTem:CDEScription?

Syntax

```
SYSTem:CDEScription?
```

This query used when the USB DAQ device is slotted into the U2781A modular instrument chassis. It identifies which slot is the module plugged into.

Supported Model

U2351A, U2352A, U2353A, U2354A, U2355A, U2356A, U2331A

Remarks

- It is only applicable when the DAQ module is used in the modular instrument chasis.
- It works in conjunction with the SYSTem:IDentity command (with the modular instrument chassis).
- For detail explaination, refer to the U2781A modular instrument chassis User's Guide.

SYSTem:ERRor?

Syntax

```
SYSTem:ERRor?
```

This command reads and clears one error from the instrument's error queue.

Remarks

- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. Once you have read all of the interface-specific errors, the errors in the global error queue are retrieved.
- Errors are cleared as you read them.
- If more errors occur then the error queue is capable of storing, the last error stored in the queue (the most recent error) will be replaced with -350,"Error 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 instrument responds with +0,"No error".
- Error conditions are also summarized in the Status Byte Register.
- The interface-specific and global error queues are cleared by the clear status (*CLS) command and when power is cycled. The errors are also cleared when you read the error queue. The error queue will not be cleared by a factory reset (*RST) command or an instrument preset (SYSTem:PRESet) command.

Return Format

The command reads and clears one error string from the error queue. The error string consists of an error number and an error string enclosed in double quotes.

For example:

-113,"Undefined header"

Example

The following query reads and clears one error.

```
SYST:ERR?
```

Typical Response:

-101,"Invalid character"

See Also

*SRE

16
Error Messages

This chapter lists down the SCPI error messages.

Remarks

- Errors are retrieved in first-in-first-out (FIFO) order.
- Errors are cleared as you read them.
- If to many errors occured, the last error stored in the queue (the most recent error) is replaced with -350,"Error 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 instrument responds with +0,"No error".
- SYSTem:ERRor? will read and clear one error from the queue.
- Below are the SCPI error messages:
  - 0000, "No error",
  - -100, "Command error",
  - -101, "Invalid character",
  - -102, "Syntax error",
  - -103, "Invalid separator",
  - -104, "Data type error",
  - -108, "Parameter not allowed",
  - -109, "Missing parameter",
  - -110, "Command header error",
  - -111, "Header separator error",
  - -112, "Program mnemonic too long",
  - -113, "Undefined header",
  - -114, "Header suffix out of range",
  - -120, "Numeric data error",
  - -121, "Invalid character in number",
  - -123, "Exponent too large",
  - -124, "Too many digits",
  - -128, "Numeric data not allowed",
  - -130, "Suffix error",
  - -131, "Invalid suffix",
  - -134, "Suffix too long",
  - -138, "Suffix not allowed",

- -140, "Character data error",
- -141, "Invalid character data",
- -144, "Character data too long",
- -148, "Character data not allowed",
- -150, "String data error",
- -151, "Invalid string data",
- -158, "String data not allowed",
- -160, "Block data error",
- -161, "Invalid block data",
- -168, "Block data not allowed",
- -200, "Execution error",
- -220, "Parameter error",
- -221, "Settings conflict",
- -221, "Settings conflict; amplitude and offset out of reference voltage range",
- -221, "Settings conflict; high threshold is lower than low threshold",
- -221, "Settings conflict; analog trigger level beyond range because of analog trigger source",
- -221, "Settings conflict; sampling rate beyond range because of number of channel",
- -221, "Settings conflict; acquisition points beyond range because of number of channel",
- -221, "Settings conflict; waveform points beyond range because of number of channel",
- -221, "Settings conflict; unsupported trigger mode",
- -221, "Settings conflict; unsupported trigger mode because of analog trigger source",
- -222: Data out of range; external clock is set above instrument's capability
- -223, "Too much data",
- -224, "Illegal parameter value",
- -300, "Device specific error",
- -310, "System error",

- -311, "Memory error",
- -313, "Calibration memory lost",
- -314, "Save/recall memory lost",
- -315, "Configuration memory lost",
- -321, "Out of memory",
- -330, "Self-test failed",
- -350, "Queue overflow",
- -400, "Query error",
- -410, "Query INTERRUPTED",
- -420, "Query UNTERMINATED",
- -430, "Query DEADLOCKED",
- -440, "Query UNTERMINATED after indefinite response",
- 112, "Channel list: channel number out of range.",
- 113, "Channel list: empty scan list",
- 222, "Settings conflict: module type does not match state",
- 223, "Settings conflict: trig source changed to IMM",
- 261, "Not able to execute while scan initiated",
- 262, "Not able to abort scan",
- 263, "Not able to execute while instrument is measuring",
- 264, "Not a scannable channel",
- 281, "Not able to perform on more than one channel",
- 301, "Module currently committed to scan",
- 303, "Module is not able to perform requested operation",
- 304, "Does not exist",
- 305, "Not able to perform requested operation",
- 305, "Not able to perform requested operation; cannot generate user-defined and pre-defined waveforms at once",
- 305, "Not able to perform requested operation; output is running",
- 305, "Not able to perform requested operation; output has stopped",
- 305, "Not able to perform requested operation; function must be enabled first",

- 305, "Not able to perform requested operation; user-defined waveform not set",
- 305, "Not able to perform requested operation; sampling rate cannot be 0 with user-defined output",
- 307, "Incorrectly configured ref channel",
- 308, "Channel not able to perform requested operation",
- 308, "Channel not able to perform requested operation: currently in differential mode",
- 309, "Incorrectly formatted channel list",
- 311, "Not able to specify resolution with Auto range",
- 521, "Input buffer overflow",
- 522, "Output buffer overflow",
- 531, "Insufficient memory",
- 532, "Not able to achieve requested resolution",
- 602, "Self-test failed; RAM read/write",
- 626, "I/O processor failed self-test",
- 705, "Cal: aborted",
- 706, "Cal: value out of range",
- 747, "Calibration failed",
- 748, "Cal checksum failed, internal data",
- 748, "Cal: invalid while cal in progress",
- 748, "Firmware and FPGA revision mismatch"