

Keysight U2751A USB Modular Switch Matrix



Programmer's
Reference
Guide

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Introduction to Programming

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This chapter introduces the remote programming basics of the U2751A USB modular switch matrix. 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 ROUTe subsystem is shown below to illustrate the tree system.

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

ROUTe is the root keyword of the command, CLOSe and OPEN are second-level keywords. A colon (:) separates a command keyword from a lower-level keyword.

For example, in the above syntax statement, ROUT and ROUTE are both acceptable forms. You can use upper- or lower-case letters. Therefore, ROUTE, Rout, and rout are all acceptable. Other forms, such as ROU, 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 multiple parameter choices for a given command string.
Square brackets []	Items within square brackets are optional. 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.
Parenthesis ()	Items within parentheses are used in place of the usual parameter types to specify a channel list. The notation (@1:3) specifies a channel list that consists of channels 1, 2, and 3. The notation (@1,3) specifies a channel list that includes only channels 1 and 3.
Braces { }	Braces indicate parameters that may be repeated zero or more times. It is used especially for showing arrays. The notation <A>{ , } shows that parameter "A" must be entered, while parameter "B" may be omitted, or may be entered one or more times.

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Data programmed or queried from the instrument is ASCII. The data may be numerical or character string.

- <NR1>** Digits with an implied decimal point assumed at the right of the least-significant digit. Example: 273
- <NR2>** Digits with an explicit decimal point. Example: 27.3
- <NR3>** Digits with an explicit decimal point and an exponent. Example: 2.73E+02
- <NRf>** Extended format that includes <NR1>, <NR2>, and <NR3>.
Examples: 273 27.3 2.73E+02
- <NRf+>** Expanded decimal format that includes <NRf> and MIN, MAX.
Examples: 273 27.3 2.73E+02 MAX
- MIN and MAX are the minimum and maximum limit values that are implicit in the range specification for the parameter.
- <Bool>** Boolean Data. Can be numeric (0, 1) or named (OFF, ON).
- <SPD>** String Program Data. Programs string parameters enclosed in single or double quotes.
- <CPD>** Character Program Data. Programs discrete parameters. Accepts both the short form and long form.
- <SRD>** String Response Data. Returns string parameters enclosed in single or double quotes.
- <CRD>** Character Response Data. Returns discrete parameters. Only the short form of the parameter is returned.
- <AARD>** Arbitrary ASCII Response Data. Permits the return of undelimited 7-bit ASCII. This data type has an implied message terminator.
- <Block>** Arbitrary Block Response Data. Permits the return of definite length and indefinite length arbitrary response data. This data type has an implied message terminator.

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.

```
ROUT:CLOS (@101)
```

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

```
ROUT:OPEN (@101); CLOS (@102)
```

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

```
ROUT:OPEN (@101)
ROUT:CLOS (@102)
```

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.

```
ROUT:CLOS (@101);: DIAG:REL:CYCL:CLE (@101)
```

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 closes channel 101.

```
ROUT:CLOS (@101)
```

You can then query the current range settings by sending:

```
ROUT:CLOS? (@101)
```

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?
```

Channel List Parameters

The channel parameter is required to address one or more channels.

It has the following syntax.

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

You can also specify a range of sequential channels as follows.

```
(@<start_ch_list>:<end_ch_list>)
```

The following command closes channel 101 on the module.

```
ROUT:CLOS (@101) // For single channel selection.
```

The following command closes channels 101, 103, and 107 on the module.

```
ROUT:CLOS (@101,103,107) // By using ',' for individual channel
                        selection in the same row.
```

The following commands close channels 101, 303, and 405 on the module.

```
ROUT:CLOS (@101,303,405) // By using ',' for individual channel
                        selection in different row.
ROUT:CLOS (@101, 303, 405) // The command is still valid with or
                        without the spaces in between each
                        channel.
```

The following command closes channels 201 through 203.

```
ROUT:CLOS (@201:203) // By using ':' for multiple channel
                    selection in the same row.
```

The following command closes channels 106 through 303.

```
ROUT:CLOS (@106:303) // By using ':' for multiple channel
                    selection in different row.
```

The following command closes channels 101 and 201 through 203 and 303.

```
ROUT:CLOS (@101,201:203,303) // By using ',' and ':' for multiple
                        channel selection.
```

The following command closes channels 101 through 108 and 205 through 308.

```
ROUT:CLOS (@101:108,205:308) // By using ':' and ',' for multiple
                        channel selection.
```

1 Introduction to Programming

When you specify a range of channels, the first and last channel in the range must be valid and any channel within the range that is invalid will be ignored (no error will be generated). Query results are returned in the order they are specified in the list.

NOTE

When adding a channel list parameter to a query, you must include a space character between the query indicator (?) and channel list parameter such as `ROUT:CLOS? (@<ch_list>)`. Otherwise error **-103, "Invalid separator"** will occur.

2 SCPI Status Registers

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This chapter explains the SCPI status registers that record various instrument conditions of the U2751A USB modular switch matrix.

SCPI Status Registers

The U2751A uses the Status Byte and Standard Event register groups to record a variety of instrument conditions. The figure below shows the relationship between various registers in the U2751A SCPI status system.

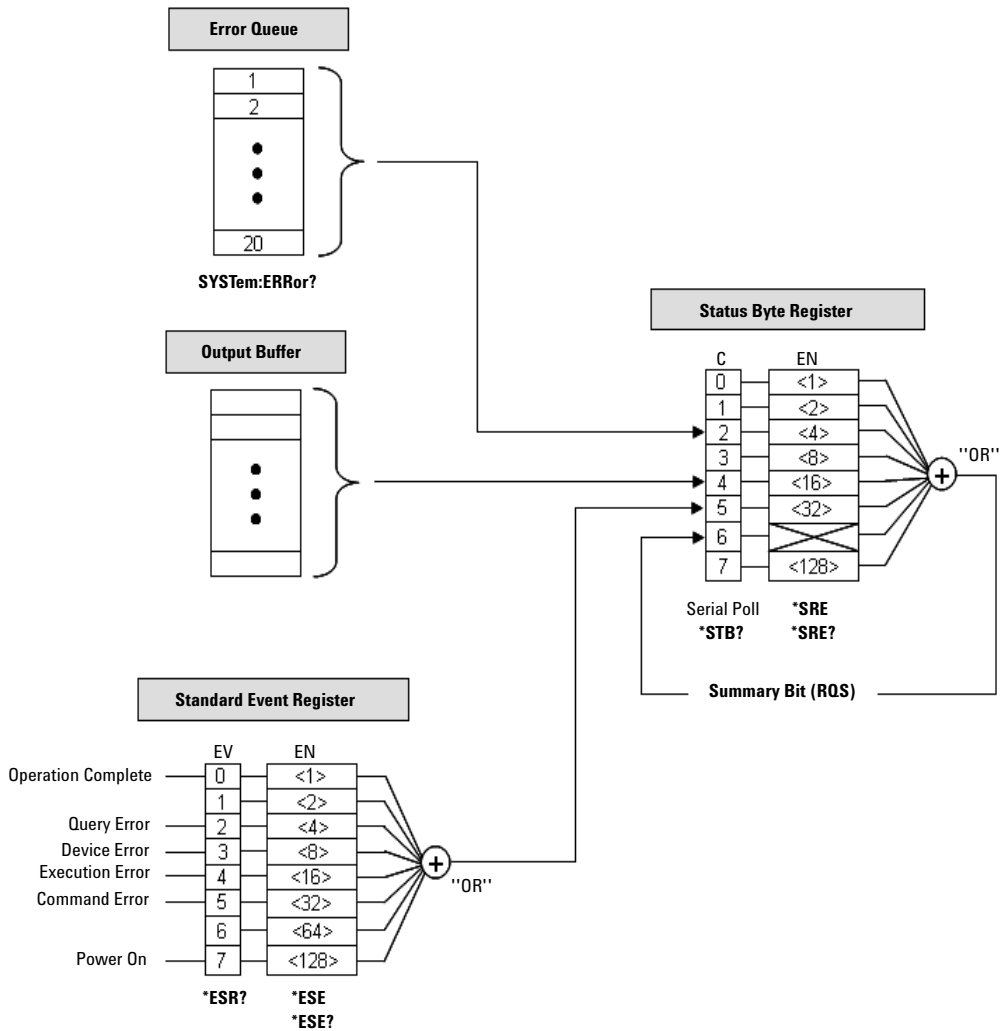


Figure 2-1 Status system diagram

Status Byte Register

The Status Byte summary register reports conditions from the other status registers. The bits are not cleared when you read the register.

Bit Definitions: Status Byte Register

Bit number	Decimal value	Definition
0 Not Used	1	Always zero.
1 Not Used	2	Always zero.
2 Error Queue	4	There is at least one error code in the error queue. Use the SYSTem:ERRor? command to read and clear the error from the queue.
3 Not Used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event	32	One or more bits are set in the Standard Event register (bits must be enabled, refer to the *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.

The Status Byte summary register will be cleared when:

- you execute the clear status (*CLS) command
- querying the Standard Event register (*ESR? command will clear only bit 5 in the summary register)

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

Standard Event Register

The Standard Event register reports the following types of instrument events: power-on detected, command syntax errors, command execution errors, self-test or calibration errors, query errors, or when an *OPC command is executed. All of these conditions can be reported in the Standard Event summary bit through 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	Always zero.
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 (an error in the –400 range has been generated).
3 Device Error	8	A self-test or device error occurred (an error in the –300 range or any positive error has been generated). For a complete listing of the error messages, refer to Chapter 7, “Error Messages” on page 47 .
4 Execution Error	16	An execution error occurred (an error in the –200 range has been generated).
5 Command Error	32	A command syntax error occurred (an error in the –100 range has been generated).
6 Not Used	64	Always zero.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

The Standard Event register 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

Please refer to [Chapter 6, “IEEE-488.2 Common Commands” on page 29](#) for more details of the common IEEE commands mentioned above.

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DIAGnostic Subsystem

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This chapter explains how the DIAGnostic command subsystem operates.

DIAGnostic:RELAy:CYCLes?

Syntax

DIAGnostic:RELAy:CYCLes? (@<ch_list>)

This query returns the cycle count of the relay at the specified channels.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Returned Query Format

<NR1> [, <NR1>]

Example

DIAG:REL:CYCL? (@101,104,103) //Queries the number of relay cycles.

Typical Response: 10000,100,10

DIAGnostic:RELAy:CYCLes:CLEAr

Syntax

DIAGnostic:RELAy:CYCLes:CLEAr (@<ch_list>)

This command sets the relay cycle counter of the specified channel(s) to zero.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Example

DIAG:REL:CYCL:CLE (@101)

NOTE

This command is used to clear the relay cycle counter when the user changes a new relay.

3 DIAGnostic Subsystem

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ROUTe Subsystem

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ROUTe:CLOSe?	19
ROUTe:OPeN	20
ROUTe:OPeN?	21

The ROUTe command subsystem is used to control the matrix relays.

ROUTe:CLOSe

Syntax

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

This command closes the specified channels in the channel list. The channel number represents the matrix cross-point of a row (one digit) and a column (two digits). For example, channel 308 represents cross-point at row 3 and column 8.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Examples

```
ROUT:CLOS (@101)           // For single channel selection.
ROUT:CLOS (@201:203)       // By using ':' for multiple channel
                             selection in the same row.
```

NOTE

Please refer to [Chapter 1, “Channel List Parameters”](#) on page 6 for more possible combinations of this command.

See Also

[ROUTe:CLOSe?](#)

[ROUTe:OPEN](#)

ROUTE:CLOSe?

Syntax

ROUTE:CLOSe? (@<ch_list>)

This query returns the state of the specified channels. It returns "1" if the channel is closed or "0" if the channel is opened.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Returned Query Format

<NR1> [, <NR1>]

Examples

ROUT:CLOS? (@101) // Returns 1 if close, 0 if open.

Typical Response: 1

ROUT:CLOS? (@101,105,207,304) // Returns 1 if close, 0 if open.

Typical Response: 1,1,1,0

ROUT:CLOS? (@108:203,307:404) // Returns 1 if close, 0 if open.

Typical Response: 1,1,1,0,0,1,1,0,1,1

See Also

[ROUTE:CLOSe](#)

ROUTe:OPEN

Syntax

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

This command opens the specified channels in the channel list. The channel number represents the matrix cross-point of a row (one digit) and a column (two digits). For example, channel 308 represents cross-point at row 3 and column 8.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Examples

```
ROUT:OPEN (@106:303) // By using ':' for multiple channel
                      selection in different row.
ROUT:OPEN (@101,201:203,303) // By using ',' and ':' for multiple
                              channel selection.
```

NOTE

Please refer to [Chapter 1, “Channel List Parameters”](#) on page 6 for more possible combinations of this command.

See Also

[ROUTe:CLOSe](#)

[ROUTe:OPEN?](#)

ROUTE:OPEN?

Syntax

```
ROUTE:OPEN? (@<ch_list>)
```

This query returns the state of the specified channels. It returns "1" if the channel is opened or "0" if the channel is closed.

Parameter

Item	Type	Range of values	Default value
<ch_list>	NR1	101 through 408	N/A

Returned Query Format

```
<NR1> [ , <NR1> ]
```

Examples

```
ROUT:OPEN? (@101) // Returns 1 if open, 0 if close.
```

Typical Response: 1

```
ROUT:OPEN? (@101,205,307,404) // Returns 1 if open, 0 if close.
```

Typical Response: 1,1,1,0

```
ROUT:OPEN? (@108:203,307:404) // Returns 1 if open, 0 if close.
```

Typical Response: 1,1,1,0,0,1,1,0,1,1

See Also

[ROUTE:OPEN](#)

4 ROUTe Subsystem

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SYSTem Subsystem

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This chapter explains the functions of the SYSTem command subsystem.

SYSTem:CDEscription?

Syntax

```
SYSTem:CDEscription?
```

This query returns the slot number and chassis number (chassis ID).

Remarks

- It is only applicable when the U2751A is used in the modular instrument chassis.
- If the U2751A is used as a standalone module, the query will return a default slot number "+7" and chassis number "+0".
- Please refer to the *U2781A Modular Instrument Chassis User's Guide* for the details.

Returned Query Format

```
<NR1>, <NR1>
```

Examples

The following query returns the slot number "+2" and chassis number "+5".

```
SYST:CDES?
```

Typical Response: +2, +5

If the U2751A is used as a standalone module, the following query returns the default slot number "+7" and chassis number "+0".

```
SYST:CDES?
```

Typical Response: +7, +0

SYSTem:ERRor?

Syntax

SYSTem:ERRor?

This query returns the error number and its corresponding message string from the instrument's error queue. A record of up to 20 errors can be stored in the instrument's error queue. The USB remote interface I/O session has its own interface-specific error queue. Errors that appear in the error queue of the I/O session cause the error.

For a complete listing of the U2751A's error messages, refer to [Chapter 7, "Error Messages" on page 47](#).

Remarks

- This query is only used when the user is controlling the relay using own software.
- Errors are retrieved in first-in, first-out (FIFO) order where the first error returned is the first error that was stored. Once you have read all the interface-specific errors, the errors in the global error queue are retrieved.
- 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 instrument responds with **0, "No error"**.
- Error conditions are also summarized in the Status Byte Register. For more information on the SCPI Status System for the U2751A, refer to [Chapter 2, "SCPI Status Registers" on page 9](#).
- 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 is not cleared by a factory reset (***RST**) command.

5 SYSTem Subsystem

Returned Query Format

<NR1>, <SRD>

Example

SYST:ERR?

Typical Response: **-330, "Self-test failed"**

SYSTem:VERSIon?

Syntax

SYSTem:VERSIon?

This command returns the version of the Standard Commands for Programmable Instruments (SCPI) standard in which the instrument complies with.

Returned Query Format

<SRD>

Example

The command returns a string in the form of "YYYY.V", where "YYYY" represents the year of the version and "V" represents a version for that year (e.g. 1997.0).

Typical Response: 1997.0

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IEEE-488.2 Common Commands

*CLS	30
*ESE/*ESE?	31
*ESR?	34
*IDN?	36
*OPC/*OPC?	38
*RST	40
*SRE/*SRE?	41
*STB?	44
*TST?	46

This chapter contains information on the IEEE-488.2 Common (*) Commands supported by the U2751A. It also describes the universal command statements which form the nucleus of the GPIB programming understood by all instruments in the network. When combined with the programming language codes, the commands provide all management and data communication instructions for the system.

*CLS

Syntax

*CLS

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

NOTE

For more information on the system registers, refer to [Chapter 2, “SCPI Status Registers”](#) on page 9.

Example

The following command clears the event register bits.

*CLS

*ESE/*ESE?

Syntax

*ESE <enable_value>

This command enables the 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 enable register group.

NOTE

For more information on the system registers, refer to [Chapter 2, "SCPI Status Registers"](#) on page 9.

Parameter

Item	Type	Range of values	Default value
<enable_value>	NR1	A decimal value that 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 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	Always zero.
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 (an error in the –400 range has been generated).
3 Device Error	8	A self-test or device error occurred (an error in the –300 range or any positive error has been generated). For a complete listing of the error messages, refer to Chapter 7, “Error Messages” on page 47 .
4 Execution Error	16	An execution error occurred (an error in the –200 range has been generated).
5 Command Error	32	A command syntax error occurred (an error in the –100 range has been generated).
6 Not Used	64	Always zero.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

- Use the <enable_value> parameter to specify which bits will be enabled. The specified decimal value 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 4 (decimal value = 16), and bit 5 (decimal value = 32), the corresponding decimal value would be 52 (4 + 16 + 32).
- The clear status (*CLS) command will not clear the enable register but it clears all the bits in the event register.

Returned Query Format

<NR1>

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

Examples

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 to high).

```
*ESE 16
```

The following query returns the bits enabled in the register.

```
*ESE?
```

Typical Response: +16

See Also

***ESR?**

ESR?*Syntax**

*ESR?

This query returns the value of the event register of the Standard Event status group. Once it is read, it will be cleared automatically.

NOTE

For more information on the system registers, refer to [Chapter 2, “SCPI Status Registers”](#) on page 9.

Remarks

- The following table lists the bit definitions for the 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	Always zero.
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 (an error in the –400 range has been generated).
3 Device Error	8	A self-test or device error occurred (an error in the –300 range or any positive error has been generated). For a complete listing of the error messages, refer to Chapter 7, “Error Messages” on page 47.
4 Execution Error	16	An execution error occurred (an error in the –200 range has been generated).
5 Command Error	32	A command syntax error occurred (an error in the –100 range has been generated).
6 Not Used	64	Always zero.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

- For any event to be reported on the Status Byte register group, the corresponding bits in the event register must be enabled using the *ESE command.
- Once a bit is set, it will remain set until cleared by reading the event register or the clear status (*CLS) command.

Returned Query Format

<NR1>

The query command reads the event register and returns a decimal value that corresponds to the binary-weighted sum of all the 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".

Example

The following query returns the value of the event register (bit 4 is set).

*ESR?

Typical Response: +16

See Also

*ESE/*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 is the model number of the instrument, the third is the serial number, and the fourth is the firmware revision which contains three firmwares separated by dashes.

NOTE

For more information on the system registers, refer to [Chapter 2, "SCPI Status Registers"](#) on page 9.

Returned Query Format

<AARD>

The command returns a string with the following format.

KEYSIGHT TECHNOLOGIES,U2751A,<Serial Number>,Va.aa-b.bb-c.cc

a.aa = Mainframe revision number
b.bb = Matrix code revision number
c.cc = Boot code revision number

Example

The following query returns the instrument's identification string.

```
*IDN?
```

Typical Response:

```
KEYSIGHT TECHNOLOGIES,U2751A,MY12345678,V1.00-1.00-1.00
```

If the system is unable to recognize the model number or serial number, the *IDN? command will return the default value of the model and serial number. Please perform self-test for error check.

Typical Response:

```
KEYSIGHT TECHNOLOGIES,U2751X,MY1234567X,V1.00-1.00-1.00
```

*OPC/*OPC?

Syntax

*OPC

The command is mainly used for program synchronization. It causes the instrument to set the OPC bit (bit 0) of the Standard Event Status register when the instrument has completed all pending operation sent before the *OPC command.

*OPC?

This query returns "1" to the output buffer at the completion of all the pending operation. *OPC? command does not suspend processing of commands.

NOTE

For more information on the system registers, refer to [Chapter 2, "SCPI Status Registers"](#) on page 9.

Remarks

- Please take note of the difference between *OPC and *OPC?.
- Pending operation have completed when:
 - all commands sent before *OPC have completed. Commands are executed sequentially (the execution of a command has to be completed before the next one is being executed)
 - all triggered actions have completed
- *OPC does not prevent the processing of subsequent commands, however, the OPC bit will not be set until all pending operation have completed.

Returned Query Format

<NR1>

The command returns "1" to the output buffer.

Examples

The following command waits until the closing of channel 101 command has been executed and then sets the “Operation Complete” bit.

```
ROUT:CLOS (@101); *OPC
```

See Also

*ESE/*ESE?

*ESR?

***RST**

Syntax

*RST

This command is used to reset the relays. It will turn all relays to open state.

Example

The following command resets the instrument.

*RST

*SRE/*SRE?

Syntax

*SRE <enable_value>

This command enables the 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 register. 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 that corresponds to the binary-weighted sum of all the bits set in the register. For example, if bit 2 (decimal value = 4) and bit 6 (decimal value = 64) are enabled, the query command will return "+68".

NOTE

For more information on the system registers, refer to [Chapter 2, "SCPI Status Registers"](#) on page 9.

Parameter

Item	Type	Range of values	Default value
<enable_value>	NR1	A decimal value that 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	There is at least one error code in the error queue. Use the SYSTem:ERRor? command to read and clear the error from the queue.
3 Not Used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event	32	One or more bits are set in the Standard Event register (bits must be enabled, refer to the *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 specified decimal value 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 will be cleared when you execute the `*SRE 0` command.

Returned Query Format

<NR1>

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

Examples

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

```
*SRE 16
```

The following query returns the bits enabled in the register.

```
*SRE?
```

Typical Response: +16

See Also

[*STB?](#)

STB?*Syntax**

*STB?

Queries the condition register for the Status Byte register group. 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	There is at least one error code in the error queue. Use the SYSTem:ERRor? command to read and clear the error from the queue.
3 Not Used	8	Always zero.
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event	32	One or more bits are set in the Standard Event register (bits must be enabled, refer to the *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.

- The Status Byte condition register is cleared when you execute the clear status (***CLS**) command. Clearing an event register will clear the corresponding bits in the Status Byte summary register (bit 5).
- The Status Byte Enable register is cleared when you execute the ***SRE 0** command.

Returned Query Format

<NR1>

The query command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all the bits set in the register (refer to the table under **Remarks**). 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".

Example

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

*STB?

Typical Response: +24

See Also

*CLS

*SRE/*SRE?

*TST?

Syntax

*TST?

This query command performs a self-test of the instrument and returns a pass/fail indication. This self-test is the same as the self-test conducted when the matrix is powered-on. When self-test fails, error will be reported.

Returned Query Format

<NR1>

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

7

Error Messages

Error Messages	48
Error List	48

This U2751A SCPI command errors are summarized in this chapter.

Error Messages

Error messages are created once a command error or an erroneous condition has been detected.

- Errors are retrieved in first-in, first-out (FIFO) order.
- Errors are cleared as you read them.
- If too many errors occur, the last error stored in the queue (the most recent error) will be replaced with **-350, "Queue overflow"**. No additional errors will be stored until you remove the errors from the queue. If no errors occur when you read the error queue, the instrument will respond with **0, "No error"**.
- **SYSTem:ERROr?** will read and clear one error from the queue.

Error List

The table below contains the list of command errors.

Table 7-1 Command errors

Error	Command errors (these errors set the Standard Event Status register bit #5)
-101	<p>Invalid character</p> <p>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.</p>
-102	<p>Syntax error</p> <p>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.</p>
-103	<p>Invalid separator</p> <p>An invalid separator was found in the command string. Check for proper usage of , ; :</p>
-108	<p>Parameter not allowed</p> <p>More parameters were received than expected for the command. You may have entered an extra parameter, or you have added a parameter to a command that does not accept a parameter.</p>
-109	<p>Missing parameter</p> <p>Fewer parameters were received than expected for the command. You may have omitted one or more parameters that are required for this command.</p>

Table 7-1 Command errors (continued)

Error	Command errors (these errors set the Standard Event Status register bit #5)
-112	Program mnemonic too long The header contains more than 12 characters.
-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. Example: *ESE #2
-148	Character data not allowed A discrete parameter was received, but a string or numeric parameter was expected.
-158	String data not allowed A character string was received, but is not allowed for this command.

The execution errors are listed in the table below.

Table 7-2 Execution errors

Error	Execution errors (these errors set the Standard Event Status register bit #4)
-222	Data out of range A data element could not be executed because the value was outside the valid range.
-223	Too much data A data element was received that contains more data than the instrument can handle.
-224	Illegal parameter value A discrete parameter was received which was not a valid choice for the command. You may have used an invalid parameter choice.
-224	Illegal parameter value, ranges must be positive The range entered must be in ascending order.

7 Error Messages

The following table shows the list of device-specific errors.

Table 7-3 Device-specific errors

Error	Device-specific errors (these errors set the Standard Event Status register bit #3)
-330	Self-test failed The self-test fails.
-350	Queue overflow The error queue is full and another error has occurred which could not be recorded.

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

Table 7-4 Query errors

Error	Query errors (these errors set the Standard Event Status register bit #2)
-410	Query INTERRUPTED A command was received which sends data to the output buffer but the output buffer contained data from a previous command (the previous data is not overwritten). The output buffer is cleared when power has been turned off.
-420	Query UNTERMINATED An invalid query command was received.
-440	Query UNTERMINATED after indefinite response More than one query command within a command string. The system will only return the data for the first query command. Example: *IDN?; :SYST:VERS?

The table below contains the list of instrument errors.

Table 7-5 Instrument errors

Error	Instrument errors (these errors set the Standard Event Status register bit #3)
+112	<p>Channel list: channel number out of range</p> <p>An input of less than 1 or more than 4 for the row numbers will cause this error message to appear such as 001 and 501. Also, the column numbers which are less than 1 or more than 8 will generate this error such as 100 and 109.</p>
+309	<p>Incorrectly formatted channel list</p> <p>The '@' symbol as the first character in the parameter does not exist. It contains illegal symbols other than ':', ';'. Example: ROUT:CLOS (@101;#&). It has symbol ':' again. Example: ROUT:CLOS (@101:107:).</p>

Self-test errors are displayed in the following table.

Table 7-6 Self-test errors

Error	Self-test errors (these errors set the Standard Event Status register bit #3)
+671	<p>EEPROM failed</p> <p>The communication between the controller and EEPROM fails.</p>
+672	<p>ISP failed</p> <p>The communication between the controller and USB controller fails.</p>
+673	<p>CPLD failed</p> <p>The communication between the controller and CPLD fails.</p>

7 Error Messages

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