Triple Output Programmable DC Power Supply

EDU36311A

KEYSIGHT

PROGRAMMING GUIDE

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1 Remote Operation

This chapter describes the remote operation for the EDU36311A triple output programmable DC power supply.

Introduction to the SCPI Language

Standard Commands for Programmable Instruments (SCPI) is an ASCII- based instrument command language designed for test and measurement instruments.

SCPI commands are based on a hierarchical structure, also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus forming subsystems. A portion of the SOURce subsystem is shown below to illustrate the tree system.

```
[SOURce:]
        CURRent <current> | MIN | MAX
        CURRent? MIN | MAX
        CURRent:
                TRIGgered <current> | MIN | MAX
                TRIGgered? MIN | MAX
        VOLTage <voltage> | MIN | MAX
        VOLTage? MIN|MAX
        VOLTage:
                TRIGgered <voltage> | MIN | MAX
                TRIGgered? MIN | MAX
```

SOURce is the root keyword of the command, CURRent and VOLTage are second-level keywords, and TRIGgered is the third-level keyword. A colon (:) separates a command keyword from a lower-level keyword.

Command Format Used in this Manual

The format used to show commands in this manual is shown below:

```
CURRent <current> | MINimum | MAXimum
```

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

For example, in the above syntax statement, CURR and CURRENT are both acceptable forms. You can use upper- case or lower- case letters. Therefore, CURRENT, curr, and Curr are all acceptable. Other forms, such as CUR and CURREN, will generate an error.

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

Angle brackets (<>) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the current parameter enclosed in angle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (such as CURR 0.1).

Some parameters are enclosed in square brackets ([]). The brackets indicate 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 power supply chooses a default value.

A colon (:) separates 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:

```
APPLy P6V,3.5,1.5
```

Command Separators

A colon (:) separates a command keyword from a lower- level keyword as shown below:

```
SOURce:CURRent:TRIGgered
```

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

```
SOUR:VOLT MIN;CURR MAX
```

is the same as sending the following two commands:

```
SOUR:VOLT MIN
SOUR:CURR MAX
```

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 the colon and semicolon:

```
DISP:TEXT:CLE;:SOUR:CURR MIN
```

Using the MIN and MAX parameters

You can substitute MINimum or MAXimum in place of a parameter for many commands. For example, consider the following command:

```
CURRent <current> | MIN | MAX
```

Instead of selecting a specific current, you can substitute MINimum to set the current to its minimum value or MAXimum to set the current to its maximum value.

Querying Parameter Settings

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

```
CURR 5
```

You can query the value by executing:

```
CURR?
```

You can also query the maximum or minimum value allowed with the present function as follows:

```
CURR? MAX; CURR? MIN
```

CAUTION **If you send two query commands without reading the response from the first, and then attempt to read the second response, you may receive some data from the first response followed by the complete second response. To avoid this, do not send a query command without reading the response. When you cannot avoid this situation, send a device clear before sending the second query command.**

SCPI Command Terminators

A command string sent to the power supply must terminate with a <new line> character. The IEEE- 488 EOI (end-or-identify) message is interpreted as a <new line> character and can be used to terminate a command string in place of a <new line> character. A <carriage return> followed by a <new line> is also accepted. Command string termination will always reset the current SCPI command path to the root level. The <new line> character has the ASCII decimal code of 10.

IEEE-488.2 Common Commands

The IEEE- 488.2 standard defines a set of common commands that perform functions like reset, self- test, and status operations. Common commands always begin with an asterisk (*), are four to five 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 different 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 like MINimum, MAXimum, and DEFault are also accepted.

You can also send engineering unit suffixes (V, A, or SEC) with numeric parameters. If only specific numeric values are accepted, the power supply will automatically round the input numeric parameters. The following command uses a numeric parameter:

```
    CURR <current> | MIN | MAX
```

Discrete parameters

Discrete parameters are used to program settings that have a limited number of values such as BUS and IMM. Query responses will always return the short form in all upper- case letters. The following command uses discrete parameters:

```
TRIG:SOUR BUS | IMM
```

Boolean parameters

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

```
DISP OFF | ON
```

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 with 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:

```
DISP:TEXT <quoted string>
```

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. 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:

- 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.

Programming Ranges and Output Identifiers

Output setting commands require a parameter for programming ranges and an output name or an output number as the identifier of each output. Most queries will return a parameter. The programming range for a parameter varies according to the selected output of the power supply. The following table lists the programming ranges, output names, and output numbers for each output.

NOTE Refer to this table to identify parameters when programming the power supply.

		6 V output	30 V output	30 V output
Output identifier		P6V (CH1)	P30V (CH2)	N30V (CH3)
Output number		1	2	3
Voltage	Programming range	0 to 6.18 V	0 to 30.9 V	0 to 30.9 V
	MAX value	6.18 V	30.9 V	30.9 V
	MIN value	0 V	0 V	0 V
	*RST value (default value)	0 V	0 V	0 V
Current	Programming range	0 to 5.15 A	0 to 1.03 A	0 to 1.03 A
	MAX value	5.15 A	1.03 A	1.03 A
	MIN value	0.002 A	0.001 A	0.001 A
	*RST value (default value)	5 A	1 A	1 A

Channels and Channel Lists

The instrument has three output channels: P6V, P30V, and N30V. These are also referred to as CH1, CH2, and CH3, respectively.

Channel list parameter

You can also use the channel list parameter to address one or more channels. You can either list channels:

(@1)

(@1,2)

(@3,1,2)

or you can list a range of channels:

(@1:3)
(@2:3)

A channel list always starts with an @ and is enclosed in parentheses.

For example, (@2) specifies channel 2 and (@1:3) specifies channels 1 through 3. The channel list, shown as <chanlist> throughout this document, must be preceded with the @ symbol and must be enclosed in parentheses (). A maximum of three channels may be specified through a combination of single channels and ranges. Query results are channel list order-sensitive. 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 the channel list parameter. Otherwise error –103, invalid separator will occur.**

SCPI Error Messages

The instrument returns error messages in accordance with the SCPI standard.

- Up to 20 errors can be stored in the instrument's error queue, and the  annunciator turns on when one or more errors are in the error queue.
- Error retrieval is first-in-first-out (FIFO), and errors are cleared as you read them. When you have read all errors from the error queue, the **ERR** annunciator turns off.
- 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".
- Send SYSTem:ERRor? to read the most recent error. Each error is in the format: -104,"Data type error".
- To read the error queue from the front panel, press **Utilities** > **Help** > **Error**.
- The error queue is cleared by power cycles and *CLS, but not *RST.

Execution error codes

The instrument's error codes are listed below:

Code	Text
0000	No error
-100	Command error
-101	Invalid character
-102	Syntax error
-103	Invalid separator
-104	Data type error
-105	GET not allowed
-108	Parameter not allowed
-109	Missing parameter
-112	Program mnemonic too long
-113	Undefined header
-114	Header suffix out of range
-121	Invalid character in number
-123	Exponent too large
-124	Too many digits
-128	Numeric data not allowed
-131	Invalid suffix
-134	Suffix too long
-138	Suffix not allowed
-141	Invalid character data

Code	Text
-148	Character data not allowed
-150	String data error
-151	Invalid string data
-158	String data not allowed
-161	Invalid block data
-168	Block data not allowed
-170	Expression error
-171	Invalid expression
-178	Expression data not allowed
-181	Invalid outside macro definition
-183	Invalid inside macro definition
-200	Execution error
-211	Trigger ignored
-213	Init ignored
-221	Settings conflict
-222	Data out of range
-223	Too much data
-224	Illegal parameter value
-225	Out of memory
-230	Data corrupt or stale
-241	Hardware missing
-270	Macro error
-272	Macro execution error
-273	Illegal macro label
-276	Macro recursion error
-277	Macro redefinition not allowed
-310	System error
-330	Self-test failed
-350	Queue overflow
-363	Input buffer overrun
-400	Query Error
-410	Query INTERRUPTED
-420	Query UNTERMINATED
-430	Query DEADLOCKED
-440	Query UNTERMINATED after indefinite response
513	LAN invalid IP address

Code	Text
514	LAN duplicate IP address
515	LAN failed to renew DHCP lease
516	LAN failed to configure
517	LAN failed to initialize
518	LAN VXI-11 fault
519	LAN invalid subnet mask or gateway
520	LAN invalid DNS address 1
521	LAN invalid DNS address 2
550	3.3V power lost
551	5.0V power lost
552	12V power lost
553	Real time clock failed
560	Analog board firmware version mismatched
561	Analog board (CH1) does not respond
562	Analog board (CH2) does not respond
563	Analog board (CH3) does not respond
564	Analog board (CH1) over temperature
565	Analog board (CH2) over temperature
566	Analog board (CH3) over temperature
567	Analog board (CH1) command timed out
568	Analog board (CH2) command timed out
569	Analog board (CH3) command timed out
600	Analog board (CH1) failed to enter boot loader
601	Analog board (CH2) failed to enter boot loader
602	Analog board (CH3) failed to enter boot loader
610	EEPROM test failed
611	EEPROM load failed
612	EEPROM checksum failed
613	EEPROM save failed
722	Multiple channel not allowed during calibration
735	Cannot change while trigger is initiated
750	USB not connected
751	USB host access failed
752	Insufficient space in USB drive
900	Firmware update failed

Calibration error codes

The following errors indicate failures that may occur during a calibration.

Code	Text
577	Analog board (CH1) calibration failed
578	Analog board (CH2) calibration failed
579	Analog board (CH3) calibration failed
581	Invalid state. Cal secured
582	Invalid secure code
583	Secure code too long
584	Failed to calibrate voltage DAC
585	Failed to calibrate voltage ADC
586	Failed to calibrate OVP
587	Failed to calibrate current DAC
588	Failed to calibrate current ADC
590	Invalid Calibration sequence
592	This action is not allowed as calibration has not completed

Self-test error codes

The following errors indicate failures that may occur during a self-test.

Code	Text
530	(CH1) Analog bias output 12V test failed
531	(CH2) Analog bias output 12V test failed
532	(CH3) Analog bias output 12V test failed
533	(CH1) System ADC test failed
534	(CH2) System ADC test failed
535	(CH3) System ADC test failed
536	(CH1) System DAC test failed
537	(CH2) System DAC test failed
538	(CH3) System DAC test failed

Reset and Non-volatile Settings

The following tables show the reset and non-volatile settings. These parameters are set to the indicated default values at power-on or after *RST.

Reset (*RST) settings

The instrument's reset settings are listed below:

SCPI command	Default value
INSTrument:SELect	1
INSTrument:NSELect	1
OUTPut:STATe	OFF
OUTPut:STATe:DELay:FALL	0
OUTPut:STATe:DELay:RISE	0
OUTPut:TRACk:STATe	OFF
CURRent	Channel 1 = 5 A Channel 2 and 3 = 1 A
CURRent:TRIGgered	Channel 1 = 0.002 A Channel 2 and 3 = 0.001 A
CURRent:PROTection:STATe	OFF
CURRent:PROTection:DELay	50 ms
CURRent:PROTection:DELay:STARt	SCH
CURRent:MODE	FIX
VOLTage	MIN (0)
VOLTage:TRIGgered	MIN (0)
VOLTage:MODE	FIX
VOLTage:PROTection	Channel 1 = 6.6 V Channel 2 = 33 V Channel 3 = 33 V
INITiate:CONTinuous	OFF
TRIGger:DELay	0
TRIGger:SOURce	BUS
DISPlay	ON
DISPlay:VIEW	METER3
HCOPy:SDUMp:DATA:FORMat	BMP
CALibration:CURRent:LEVel	MIN
CALibration:VOLTage:LEVel	MIN

Non-volatile settings

The instrument's non-volatile settings are listed below:

SCPI command	Default value
CALibration:SECure:CODE	EDU36311A
CALibration:SECure:STATe	ON
CALibration:STRing	Empty quoted string ("")
CALibration:DATE	-
CALibration:ASAVE	OFF
SYSTem:BEEPer:STATe	ON
OUTPut:PON:STATE	RST
*PSC	1
*ESE	0
*SRE	0

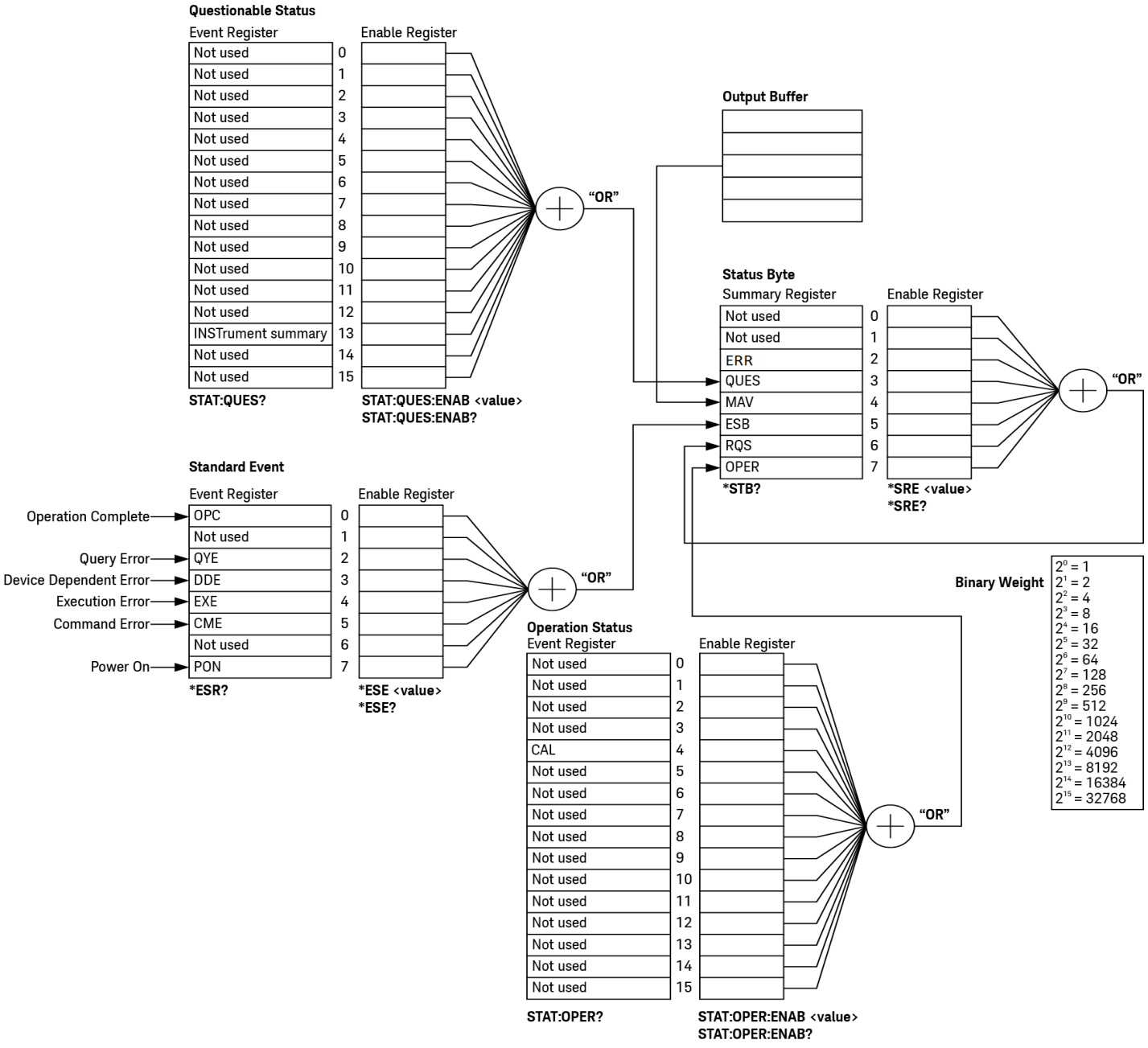
Non-volatile LAN settings

The instrument's non-volatile LAN settings are listed below:

SCPI command	Default value
DHCP	ON
LXI MDNS	ON
Static IP Address	192.168.10.1
Static Subnet Mask	255.255.255.0
Static Gateway	192.168.10.1
Static DNS	0.0.0.0
Static Host name	K-36311A-<last 5 digits of serial number>
Telnet Prompt	EDU36311A >
Telnet Welcome Message	Welcome to Keysight's EDU36311A Triple Output DC Power Supply

SCPI Status Registers

All SCPI instruments implement status registers in the same way. The status system records various instrument conditions in three register groups: the Status Byte register, the Standard Event register, and the Questionable Status register groups. The Status Byte register records high-level summary information reported in the other register groups. The figure below illustrates the SCPI status system used by the power supply.



What is an event register?

An event register is a read-only register that reports defined conditions within the instrument. Bits in an event register are latched. Once an event bit is set, subsequent state changes are ignored. Bits in an event register are automatically cleared by a query of that register (such as *ESR? or STAT:QUES:EVEN?) or by sending the *CLS (clear status) command. A reset (*RST) or device clear will not clear bits in event registers. Querying an event register returns a decimal value of the binary-weighted sum of all bits set in the register.

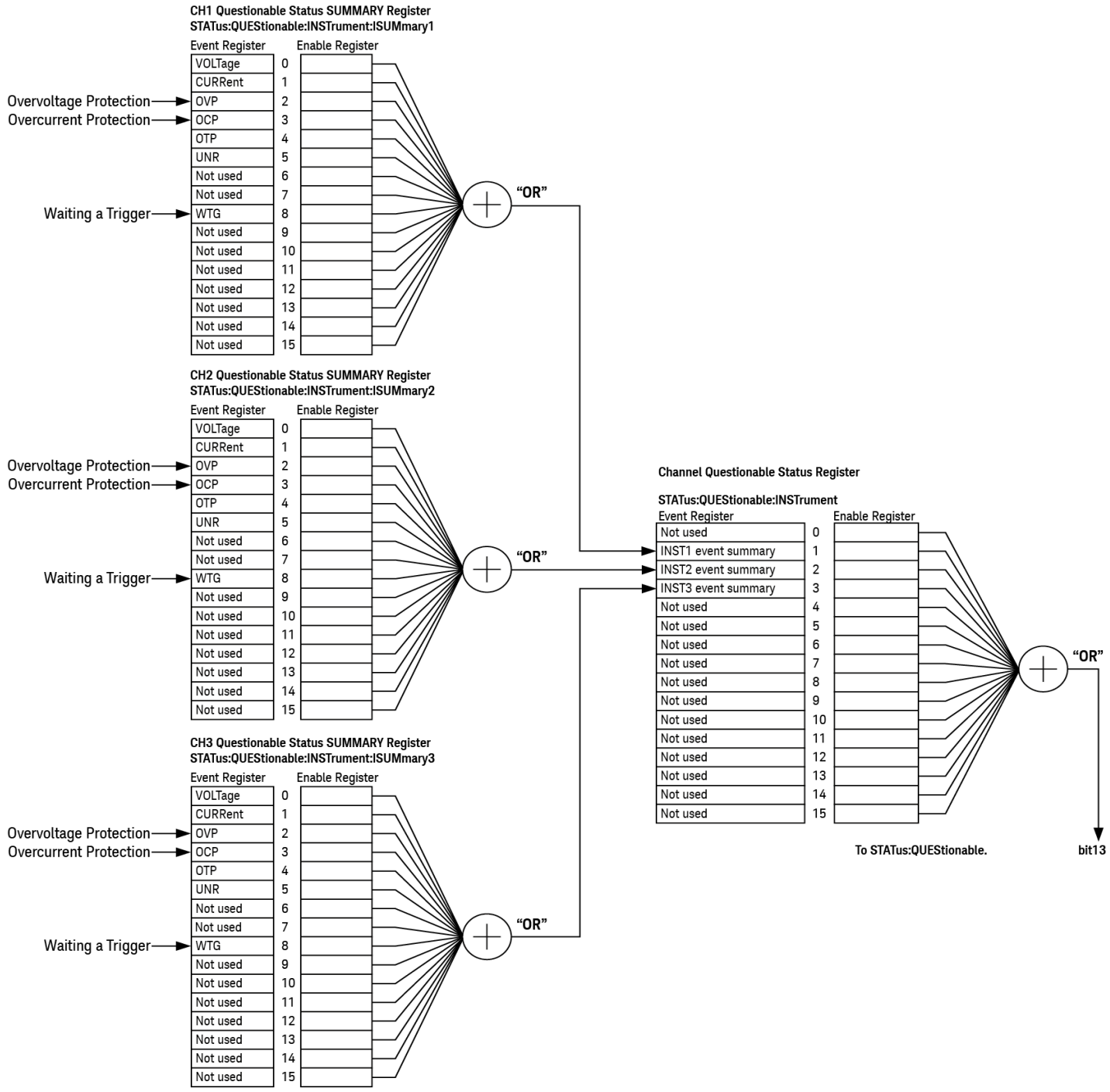
What is an enable register?

An enable register defines which bits in the corresponding event register are logically ORed together to form a single summary bit. Enable registers are both readable and writable. Querying an enable register will not clear it. The *CLS (clear status) command does not clear enable registers but it does clear the bits in the event registers. To enable bits in an enable register, you must write a decimal value which corresponds to the binary-weighted sum of the bits you wish to enable in the register.

What is a multiple logical output?

The three logical outputs of the power supply include an INSTrument summary status register and an individual instrument ISUMmary register for each logical output. The ISUMmary registers report to the INSTrument register, which in turn reports to bit 13 of the Questionable status register, as shown in the diagram below.

This status register configuration allows a status event to be cross-referenced by output and type of event. The INSTrument register indicates which output(s) have generated an event. The ISUMmary register is a pseudo-questionable status register for a particular logical output.


CH1 Questionable Status SUMMARY Register
STATus:QUEStionable:INSTrument:ISUMmary1
Event Register
Enable Register
VOLTage 0
CURRent 1
Overvoltage Protection → OVP 2
Overcurrent Protection → OCP 3
OTP 4
UNR 5
Not used 6
Not used 7
Waiting a Trigger → WTG 8
Not used 9
Not used 10
Not used 11
Not used 12
Not used 13
Not used 14
Not used 15
"OR"
CH2 Questionable Status SUMMARY Register
STATus:QUEStionable:INSTrument:ISUMmary2
Event Register
Enable Register
VOLTage 0
CURRent 1
Overvoltage Protection → OVP 2
Overcurrent Protection → OCP 3
OTP 4
UNR 5
Not used 6
Not used 7
Waiting a Trigger → WTG 8
Not used 9
Not used 10
Not used 11
Not used 12
Not used 13
Not used 14
Not used 15
"OR"
CH3 Questionable Status SUMMARY Register
STATus:QUEStionable:INSTrument:ISUMmary3
Event Register
Enable Register
VOLTage 0
CURRent 1
Overvoltage Protection → OVP 2
Overcurrent Protection → OCP 3
OTP 4
UNR 5
Not used 6
Not used 7
Waiting a Trigger → WTG 8
Not used 9
Not used 10
Not used 11
Not used 12
Not used 13
Not used 14
Not used 15
"OR"
Channel Questionable Status Register
STATus:QUEStionable:INSTrument
Event Register
Enable Register
Not used 0
INST1 event summary 1
INST2 event summary 2
INST3 event summary 3
Not used 4
Not used 5
Not used 6
Not used 7
Not used 8
Not used 9
Not used 10
Not used 11
Not used 12
Not used 13
Not used 14
Not used 15
"OR"
To STATus:QUEStionable.
bit13

The Questionable Status register

The Questionable Status register provides information about unexpected instrument operation. Bit 13 summarizes questionable outputs. For example, if one output is in constant voltage mode and loses regulation due to an overload, bit 13 is set (latched). Send the STAT:QUES? query to read the register. To make use of bit 13, you must first enable the registers you wish to summarize with bit 13. Send STAT:QUES:INST:ENAB 14 to enable the Questionable Instrument register. Then send STAT:QUES:INST:ISUM<n>:ENAB 3 for each supply to enable the Questionable Instrument Summary register, where n is 1, 2, or 3.

Bit	Value	Name	Description
0-3	0	(unused)	Always set to 0.
4	16	(unused)	Always set to 0.
5-12	0	(unused)	Always set to 0.
13	8192	ISUM	Summary of QUES:INST and QUES:INST:ISUM registers.
14-15	0	(unused)	Always set to 0.

The Questionable Instrument register

The Questionable Instrument register provides information about unexpected operations for each of the three supplies. For example if the +6 V supply is in the constant voltage mode and loses regulation, then bit 1 set indicating a possible overload in the output 1 supply. The output 2 supply is reported as bit 2, and the output 3 supply as bit 3. Send the command STAT QUES:INST? to read the register. The STAT:QUES:INST:ISUM<n> registers must be enabled to make use of the Questionable Instrument register. Send STAT:QUES:INST:ISUM<n>:ENAB 3 to enable output n.

The Questionable Instrument Summary register

There are three Questionable Instrument Summary registers, one for each supply output. These registers provide information about voltage and current regulation. Bit 0 is set when the voltage becomes unregulated, and bit 1 is set if the current becomes unregulated. For example if a supply which is operating as a voltage source (constant voltage mode) momentarily goes to constant current mode, bit 0 is set to indicate that the voltage output is not regulated. To read the register for each supply, send STAT:QUES:INST:ISUM<n>?, where n is 1, 2, or 3.

To determine the operating mode (CV or CC) for the power supply send STAT:QUES:INST:ISUM<n>:COND?, where n is 1, 2, or 3 depending on the output. Bit 1 true indicates the output is in constant voltage mode, bit 0 true indicates constant current mode, both bits true indicates neither the voltage nor the current is regulated, and both bits false indicates the outputs of the power supply are off.

The Questionable Status Event register is cleared when you execute the *CLS (clear status) command or query the event register using the STATus:QUEStionable[:EVENt]? query.

The Questionable Status Enable register is cleared by the STATus:QUEStionable:ENABle 0 command.

The 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. Any or all of these conditions can be reported in the Standard Event Summary bit (ESB, bit 5) of Status Byte register through the enable register. To set the enable register mask, you write a decimal value to the register using the *ESE (Event Status Enable) command.

An error condition (Standard Event register bits 2, 3, 4, or 5) will always record one or more errors in the power supply's error queue. Read the error queue using the SYSTem:ERRor? command.

Bit	Value	Name	Description
0	1	OPC	Operation Complete. All commands prior to and including an *OPC command have been executed.
1	0	(unused)	Always set to 0.
2	4	QYE	Query Error. The power supply tried to read the output buffer but it was empty. Or, a new command line was received before a previous query had been read. Or, both the input and output buffers are full.
3	8	DDE	Device Error. A self-test or calibration error occurred.
4	16	EXE	Execution Error. An execution error occurred.
5	32	CME	Command Error. A command syntax error occurred.
6	0	(unused)	Always set to 0.
7	128	PON	Power On. 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 *CLS (clear status) command or you query the event register using the *ESR? (Event Status register) command.

The Standard Event Enable register is cleared when you execute the *ESE 0 command or you turn on the power and have previously configured the power supply using the *PSC 1 command.

For example, you must send the *ESE 24 (8 + 16) to enable DDE and EXE bits. Similarly, 24 is returned when you have queried the status of the Standard Event register and the DDE and EXE conditions have occurred.

The Status Byte summary register

The Status Byte summary register reports conditions from the other status registers. Query data waiting in the output buffer is immediately reported through the “Message Available” bit (bit 4) of Status Byte register. Bits in the summary register are not latched. Clearing an event register clears the corresponding Status Byte summary register bits. Reading all messages in the output buffer, including pending queries, clears the message available bit.

Bit	Value	Name	Description
0-1	0	(unused)	Always set to 0.
2	4	ERR	One or more errors have been stored in the Error Queue.
3	8	QUES	One or more bits are set in the questionable status register (bits must be “enabled” in the enable register).
4	16	MAV	Data is available in the power supply output buffer.
5	32	ESB	One or more bits are set in the standard event register (bits must be “enabled” in the enable register).
6	64	RQS	The power supply is requesting service (serial poll).

Bit	Value	Name	Description
7	128	OPER	One or more bits are set in the operation status register (bits must be “enabled” in the enable register).

The *CLS (clear status) command clears the Status Byte Summary Register. Querying the Standard Event register (*ESR?) clears only bit 5 in the Status Byte summary register. For example, 24 (8 + 16) is returned when you query the Status Byte register and the QUES and MAV conditions have occurred.

The Status Byte Enable register (Request Service) is cleared when you execute the *SRE 0 command or you turn on the power and have previously configured the power supply using the *PSC 1 command. For example, you must send the *SRE 96 (32 + 64) to enable ESB and RQS bits.

Using Service Request (SRQ) and serial POLL

You must configure your bus controller to respond to the IEEE-488 service request (SRQ) interrupt to use this capability. Use the Status Byte enable register (*SRE command) to select which summary bits will set the low-level IEEE-488 service request signal. When bit 6 (request service) is set in the Status Byte, an IEEE-488 service request interrupt message is automatically sent to the bus controller. The bus controller may then poll the instruments on the bus to identify which one requested service (the instrument with bit 6 set in its Status Byte).

The request service bit is cleared only by reading the Status Byte using an IEEE-488 serial poll or by reading the event register whose summary bit is causing the service request.

To read the Status Byte summary register, send the IEEE-488 serial poll message. Querying the summary register will return a decimal value which corresponds to the binary-weighted sum of the bits set in the register. Serial poll will automatically clear the “request service” bit in the Status Byte summary register. No other bits are affected. Performing a serial poll will not affect instrument throughput.

CAUTION **The IEEE-488 standard does not ensure synchronization between your bus controller program and the instrument. Use the *OPC? command to guarantee that commands previously sent to the instrument have completed. Executing a serial poll before a *RST, *CLS, or other commands have completed can cause previous conditions to be reported.**

Using *STB? to read the Status Byte

The *STB? (Status Byte) query is like a serial poll, but it is processed like any other query. The *STB? command returns the same result as a serial poll, but the “request service” bit (bit 6) is not cleared.

The*STB? query is not handled automatically by the IEEE-488 bus interface hardware and will be executed only after previous commands have completed. Polling is not possible using the *STB? query. The *STB? query does not clear the Status Byte summary register.

Using the message available bit (MAV)

You can use the Status Byte “message available” bit (bit 4) to determine when data is available to read into your bus controller. The power supply subsequently clears bit 4 only after all messages have been read from the output buffer.

To interrupt your bus controller using SRQ

1. Send a device clear message to clear the power supply's output buffer (e.g., CLEAR 705).
2. Clear the event registers with the *CLS (clear status) command.
3. Set up the enable register masks. Execute the *ESE command to set up the Standard Event register and the *SRE command for the Status Byte.
4. Send the *OPC? (operation complete query) command and enter the result to ensure synchronization.
5. Enable your bus controller's IEEE-488 SRQ interrupt.

To determine when a command sequence is completed

1. Send a device clear message to clear the power supply's output buffer (e.g., CLEAR 705).
2. Clear the event registers with the *CLS (clear status) command.
3. Enable the “operation complete” bit (bit 0) in the Standard Event register by executing the *ESE 1 command.
4. Send the *OPC? (operation complete query) command and enter the result to ensure synchronization.
5. Execute your command string to program the desired configuration, and then execute the *OPC (operation complete) command as the last command. When the command sequence is completed, the “operation complete” bit (bit 0) is set in the Standard Event register.
6. Use a serial poll to determine when bit 5 (standard event) is set in the Status Byte summary register. You could also configure the instrument for an SRQ interrupt by sending *SRE 32 (Status Byte enable register, bit 5).

Using *OPC to signal when data is in the output buffer

Generally, it is best to use the “operation complete” bit (bit 0) in the Standard Event register to signal when a command sequence finishes. This bit is set in the register by an *OPC command. If you send *OPC after a command that loads a query response in the instrument's output buffer, you can use the “operation complete” bit to determine when the message is available. However, if too many messages are generated before the *OPC command executes (sequentially), the output buffer will fill and the instrument will stop processing commands.

2 SCPI Programming

This chapter describes the subsystem commands available to the EDU36311A triple output programmable DC power supply.

ABORt [(@<chanlist>)]

The command clears any pending delayed trigger and returns the trigger system to idle. If INIT:CONT is enabled, ABORt clears any pending delayed trigger and re-initiate them. The INIT:CONT state will remain unchanged. This command also resets the WTG bit in the Questionable Instrument Summary status register.

Parameter	Typical return
(@<chanlist>)	(none)
Aborts the triggered action of channel 1: ABOR (@1)	

APPLy P6V | P30V | N30V | CH1 | CH2 | CH3[,<voltage> | DEFault | MINimum | MAXimum [,<current>| DEFault | MINimum | MAXimum]]
APPLy? [P6V | P30V | N30V | CH1 | CH2 | CH3]

The command is combination of INSTrument:SELect, [SOURce:]CURRent, and [SOURce:]VOLTage commands. The values of the voltage and current of the specified output will change as soon as the command is executed.

You can identify each output by the output name (P6V, P30V, N30V, ch1, ch2, or ch3). For the voltage and current parameters of the APPLy command, the ranges depend on the output currently selected. You can substitute “MINimum”, “MAXimum”, or “DEFault” in place of a specific value for the voltage and current parameters. If you specify only one value for the parameter, the power supply regards it as voltage setting value. If you do not specify any value for the parameter, the APPLy command only selects the output specified and acts as the INSTrument command.

The query returns the power supply's present voltage and current values for each output as a quoted string as shown in the sample string below (the quotation marks are returned as part of the string). If any output identifier is not specified, the voltage and the current of the currently selected output are returned.

"5.000000,1.000000"

Referring to the above string, the first number 5.000000 is the voltage limit value and the second number 1.000000 is the current limit value for the specified output.

Output	Range of values
<voltage>	P6V = (MAX = 6.18 V | MIN = 0 V | DEF = 0 V) P30V = (MAX = 30.9 V | MIN = 0 V | DEF = 0 V) N30V = (MAX = 30.9 V | MIN = 0 V | DEF = 0 V)
<current>	P6V = (MAX = 5.15 A | MIN = 0.002 A | DEF = 5 A) P30V = (MAX = 1.03 A | MIN = 0.001 A | DEF = 1 A) N30V = (MAX = 1.03 A | MIN = 0.001 A | DEF = 1 A)

Parameter	Typical return
<voltage>| DEF | MIN | MAX, <current> | DEF | MIN | MAX Default: <DEF in Range of values>	<voltage>, <current>
Sets the maximum voltage and current of 6 V output : APPL P6V, MAX, MAX	

NOTE The calibration can only be done one channel at a time, hence the channel list for all calibration commands will only accept one channel.

CALibration:ASAVE ON | OFF | 1 | 0
CALibration:ASAVE?

The command enables or disables automatic saving of calibration constants. If auto save is enabled, the calibration data will automatically save into the non-volatile memory whenever a point is successfully calibrated.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
Enables the CAL auto save feature: `CAL:ASAVE 1`	

Remarks

- System date will be used as calibration date and automatically store into the non-volatile memory when calibration constants are stored. You can overwrite the calibration date using CAL:DATE.
- This setting is non-volatile. It will not be changed by power cycling, or after a Factory Reset (*RST command).

CALibration:COUNt?

The query returns the number of times the power supply has been calibrated. Your power supply was calibrated before it left the factory. When you receive your power supply, read the count to determine its initial value. If auto save is enabled, the value increments by one for each calibration point, a complete calibration for all points will increase the value by six counts.

If CAL:SAVE is used, the value increments by one for each channel calibration, a complete calibration for three outputs will increase the value by three counts.

Parameter	Typical return
(none)	<count>
Returns the calibration count: `CAL:COUN?`	

Remarks

- The calibration count is stored in non-volatile memory. It will not be changed by power cycling, or after a Factory Reset (*RST command).

CALibration:CURRent[:DATA][:HIGH] <current>[, (@<chanlist>)]

The command allows you to enter an output current value that you obtained by reading a digital multimeter (DMM). Select a calibration level (CAL:CURR:LEV) for the value being entered. This command can only be used when calibration is unsecured.

Parameter	Typical return
<current>	(none)
Sets the output current value obtained by reading a DMM for example 5 A: CAL:CURR 5	

Remarks

- If channel list is not specified, the output to be calibrated is based on INSTrument command.

CALibration:CURRent:LEVel[:HIGH] MINimum | MAXimum[, (@<chanlist>)]

This command can only be used after calibration is unsecured. It sets the power supply to a calibration point that is entered with CALibration:CURRent [:DATA] command. During calibration, two points must be entered and the low-end point (MIN) must be selected and entered first.

Parameter	Typical return
MINimum | MAXimum	(none)
Calibrates the output current for channel 1 to the minimum range: CAL:CURR:LEV MIN, (@1)	

Remarks

- If channel list is not specified, the output to be calibrated is based on INSTrument command.

CALibration:DATE ["<string>"]
CALibration:DATE?

The command stores the date that the power supply was last calibrated in non-volatile memory. If the input string parameter is not specified, the system date will be stored. This command can saves up to 20 characters.

The query returns the date. If no date is stored, an empty quoted string ("") is returned.

Parameter	Typical return
"<string>"	"01/01/2020"
Enters the calibration date: CAL:DATE "10/10/2020"	

Remarks

- This setting is non-volatile. It will not be changed by power cycling, or after a Factory Reset (*RST command).

CALibration:SAVE

The command saves calibration constants in non-volatile memory after the calibration procedure has been completed. When you exit (CALibration:SECure:STATe OFF) without saving, the previous constants are restored. If the Auto Save feature is not enabled, you need to send CAL:SAVE command to store the new calibration data to non-volatile memory.

Parameter	Typical return
(none)	(none)
Saves calibration constants: CAL:SAVE	

Remarks

- System date will be used as calibration date and automatically store into the non-volatile memory when calibration constants are stored. You can overwrite the calibration date using CAL:DATE.

CALibration:SECure:CODE <new code>

The command enters a new security passcode. To change the passcode, first unsecure the power supply using the old passcode. Then, enter the new passcode. The passcode can be set up to 12 characters. The first character must be a letter (A-Z), remaining may contains letters, numbers (0-9), or underscore "_". Blank spaces are not allowed.

Parameter	Typical return
<new code>	(none)
Sets the new security passcode to EDU36311A: CAL:SEC:CODE EDU36311A	

Remarks

- When you first receive your instrument, it is secured, and the default security code is set to "EDU36311A".
- This setting is non-volatile; it will not be changed by power cycling, or after a factory reset (*RST command).
- If you forget your security code, you can override the security feature. For more information, see *EDU36311A Service Guide*.

CALibration:SECure:STATe ON | OFF | 1 | 0, <code>
CALibration:SECure:STATe?

The command unsecures or secures the power supply for calibration, using the code specified by CALibration SECure:CODE.

The query returns 0 (calibration unsecured) or 1 (calibration secured).

Parameter	Typical return
ON | OFF | 1 | 0, <code>	1 or 0
Unsecures the power supply for calibration: CAL:SEC:STAT OFF, EDU36311A	

Remarks

- When you first receive your instrument, it is secured, and the default security code is set to "EDU36311A".
- This setting is non-volatile. It will not be changed by power cycling or after a Factory Reset (*RST command).

CALibration:STRing "<string>"
CALibration:STRing?

The command saves up to 40 characters of information, such as the calibration message, the next calibration due date, or the power supply's serial number. You must unsecure the instrument before saving the string, but you can read the string regardless of the security status.

The query returns a quoted string.

Parameter	Typical return
"<string>"	"<string>"
Sets the string to "4/22/17": CAL:STR "4/22/17"	

Remarks

- If no calibration message has been specified, an empty quoted string ("") is returned.
- Storing a calibration message will overwrite any message previously stored in calibration memory.
- This setting is non-volatile; it will not be changed by power cycling, or after a factory reset (*RST command).

CALibration:VOLTage[:DATA] <voltage>[, (@<chanlist>)]

The command enters a voltage value of a selected output that you obtained by reading an external meter. Before using this command, you must first unsecure calibration and select a calibration level (CAL:VOLT:LEV) for the value being entered. Two successive values (one for each end of the calibration range) must be selected and entered.

Parameter	Typical return
<voltage>	(none)
Sets the output voltage value obtained by reading a DMM for example 5 V: CAL:VOLT 5	

Remarks

- If channel list is not specified, the output to be calibrated is based on INSTrument command.

CALibration:VOLTage:LEVel MINimum | MAXimum[, (@<chanlist>)]

The command sets the power supply to a calibration point that is entered with CAL:VOLT[:DATA] command. Before using this command, you must first unsecure calibration. During calibration, the low-end point (MIN) must be selected and entered first, followed by the high-end point (MAX).

Parameter	Typical return
MINimum | MAXimum	(none)
Calibrates the minimum voltage: CAL:VOLT:LEV MIN	

Remarks

- If channel list is not specified, the output to be calibrated is based on INSTrument command.

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <current> | MINimum | MAXimum | DEFault[, (@<chanlist>)]
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chan-list>)]

The command directly programs the immediate current level of the power supply in amperes. The immediate level is the current limit value of the selected output.

The query returns a number in the form +n.nnnnnnnnE+nn for each channel specified.

Channel	CH1	CH2	CH3
MINimum	0.002 A	0.001 A	0.001 A
MAXimum	5.15 A	1.03 A	1.03 A
DEFault	5 A	1 A	1 A

Parameter	Typical return
0 - maximum | MIN | MAX | DEF (The maximum value is dependent on the current rating of the power supply)	<current level>
Default: <DEF in Default value>	
Sets the output current level to 3 A for channel 1: CURR 3, (@1)	

[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude] <current> | MINimum | MAXimum[, (@<chan-list>)]
[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command programs the triggered current level of the specified output channel. Units are in amperes. The triggered level is a stored value that is transferred to the output when an output step is triggered.

The query returns the programmed triggered level in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Channel	CH1	CH2	CH3
MINimum	0.002 A	0.001 A	0.001 A
MAXimum	5.15 A	1.03 A	1.03 A

Parameter	Typical return
0 - maximum | MIN | MAX (The maximum value is dependent on the current rating of the power supply) *Default: MIN	<current level>
Sets the triggered current to 1 A on channels 1 and 2: CURR:TRIG 1, (@1,2)	

[SOURce:]CURRent:MODE FIXed | STEP[, (@<chanlist>)]
[SOURce:]CURRent:MODE? [(<@chanlist>)]

The command determines what happens to the output current when the transient system is initiated and triggered.

The query returns the current mode for each channel specified. Multiple responses are separated by commas.

Mode	Description
FIXed	Nothing happens. The output current remains at the immediate value.
STEP	The output goes to the triggered level when a trigger occurs.

Parameter	Typical return
FIX | STEP Default: FIX	FIX or STEP
Sets the current mode of channel 3 to Step: CURR:MODE STEP, (@3)	

[SOURce:]CURRent:PROTection:CLEar [(@<chanlist>)]

The command clears the latch that disables the output due to an over current condition. You must clear the conditions that cause the over current protection tripped before executing this command. You can then restore the output to the state that existed before the over current condition occurred.

Parameter	Typical return
(none)	(none)
Clears the latch that disables channel 1 due to an over current condition: CURR:PROT:CLE (@1)	

[SOURce:]CURRent:PROTection:DELay[:TIME] <delay time> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:DELay[:TIME]? [MINimum | MAXimum,] [(@<chanlist>)]

Sets the time in milliseconds that the overcurrent protection is temporarily disabled after a current level change. Minimum value is 0 and maximum value is 3600 seconds.

The query returns the overcurrent protection delay in milliseconds in the form +n.nnnnnnnnE+nn.

Parameter	Typical return
0 – 3600.000 | MIN | MAX Default: 0.050	<delay time>
Sets the protection delay to 0.2 seconds for channel 1: CURR:PROT:DEL 0.2, (@1)	

[SOURce:]CURRent:PROTection:DELay:STARt SCHange | CCTRans[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:DELay:STARt? [(@<chanlist>)]

The command specifies the conditions under which the overcurrent protection delay timer starts:

Mode	Description
SCHange	Transitions into constant current mode are automatically ignored during a programmed settings change in voltage, current, or output state. At the end of the settings change, the delay timer starts, allowing additional protection delay time. There is no protection delay outside of these time windows.
CCTRans	The overcurrent protection delay timer is started by any transition of the output into constant current mode.

The query returns SCH or CCTR.

Parameter	Typical return
SCH | CCTR	SCH or CCTR
Default: SCH	
Sets CCTRans as the current protection delay mode for channel 1: CURR:PROT:DEL:STAR CCTR,(@1)	

[SOURce:]CURRent:PROTection:STATe ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:STATe? [(@<chanlist>)]

The command enables or disables overcurrent protection, which causes the instrument to go into a protected state when the power supply status is in constant current mode for a time longer than the over current protection (OCP) delay. Output will be OFF after OCP is tripped. An overcurrent condition can be cleared with the CURR:PROT:CLE command after the condition that caused the OCP trip is removed.

The query returns 1 (ON) or 0 (OFF) for the over current protection state.

Parameter	Typical return
ON | 1 | OFF | 0	1 or 0
Default: OFF	
Enable the current protection state for channel 1: CURR:PROT:STAT ON, (@1)	

[SOURce:]CURRent:PROTection:TRIPped? [(@<chanlist>)]

The query indicates whether an overcurrent protection occurred (1) or not (0). This is reset to 0 by CURRent:PROTection:CLEar.

Parameter	Typical return
(none)	1 or 0
Indicates whether an overcurrent protection occurred on channel 1: CURR:PROT:TRIP? (@1)	

DISPlay[:WINDow][:STATe] ON | OFF | 1 | 0
DISPlay[:WINDow][:STATe]?

The command turns the front-panel display off or on. When the display is disabled, the entire front panel display turns black. The display state is automatically turned on when any key is pressed.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON | OFF | 1 | 0 Default: ON	0 or 1
Turns the front panel display off: DISP OFF	

DISPlay[:WINDow]:VIEW METER1 | METER3
DISPlay[:WINDow]:VIEW?

The command selects 1- or 3-channel meter view. METER1 displays one big output channel with 2 small less detailed channels. METER3 displays all 3 output channels.

The query returns METER1 or METER3.

Parameter	Typical return
METER1 | METER3 Default: METER3	METER1 or METER3
Sets the front panel to display all 3 output channels: DISP:VIEW METER3	

HCOPy Subsystem

HCOPy commands return the front panel display image.

HCOPy:SDUMp:DATA?

The query returns the front panel display image ("screen shot").

Parameter	Typical return
(none)	(A definite-length binary block containing the image.) Definite-length block data allows any type of device-dependent data to be transmitted as a series of 8-bit binary data bytes. This is particularly useful for transferring large quantities of data or 8-bit extended ASCII codes.
Capture and return the display image: HCOP:SDUM:DATA?	

Remarks

- The image format (PNG or BMP) is specified by HCOPy:SDUMp:DATA:FORMat.

HCOPy:SDUMp:DATA:FORMat BMP
HCOPy:SDUMp:DATA:FORMat?

The command specifies the image format for images returned by HCOPy:SDUMp:DATA?.

Parameter	Typical return
BMP Default: BMP	BMP
Specify BMP as the image format: HCOP:SDUM:DATA:FORM BMP	

*CLS

The command clears the event registers in all register groups and the error queue.

Parameter	Typical return
(none)	(none)
Clears all event registers, and error queue: *CLS	

*ESE <enable value>
*ESE?

The command enables bits in the Standard Event Enable register. The selected bits are then reported to the Status Byte.

The query returns the decimal value of the binary-weighted sum of all bits in the Standard Event enable register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register. For example, to enable bit 2 (decimal value = 4), bit 3 (decimal value = 8), and bit 7 (decimal value = 128), the decimal sum would be 140 (4 + 8 + 128).	<bit value>
Default: 0	
Enable bit 3 (decimal value = 8), and bit 4 (decimal value = 16) in the enable register: *ESE 24	

Standard event status enable register

Bit	Value	Name	Description
0	1	OPC	Operation Complete. All commands prior to and including an *OPC command have been executed.
1	0	(unused)	Always set to 0.
2	4	QYE	Query Error. The power supply tried to read the output buffer but it was empty. Or, a new command line was received before a previous query had been read. Or, both the input and output buffers are full.
3	8	DDE	Device Error. A self-test or calibration error occurred.
4	16	EXE	Execution Error. An execution error occurred.
5	32	CME	Command Error. A command syntax error occurred.
6	0	(unused)	Always set to 0.
7	128	PON	Power On. Power has been turned off and on since the last time the event register was read or cleared

Remarks

- Use *PSC to control whether the Standard Event enable register is cleared at power on. For example, *PSC 0 preserves the enable register contents through power cycles.
- *CLS clears the event register, but does not clear the enable register.

- This setting is non-volatile; it does not change after a Factory Reset (*RST command), Status Preset (STATus:PRESet command) or Clear Status (*CLS command).

*ESR?

The query returns the decimal value of the binary-weighted sum of all bits in the Standard Event register.

An event register is a read-only register that latches events from the condition register. While an event bit is set, subsequent events corresponding to that bit are ignored.

Parameter	Typical return
(none)	<bit value>
Read event status register: *ESR?	

Remarks

- In order to be reported to the Status Register, the corresponding bits in the event register must be enabled using the *ESE command.
- Once a bit is set, it remains set until cleared by reading the event register or execution of the Clear Status (*CLS command).

*IDN?

The query returns the instrument's identification string. An example is shown below.

Keysight Technologies,EDU36311A,CN00000001,K-XX.XX.XX-XX.XX-XX.XX-XX.XX

The four comma-separated fields are the manufacturer's name, the model number, the serial number, and the revision code. The first "K-XX.XX.XX" in the revision code is the Keysight Pathwave revision; the second is the front panel firmware revision; the third is the controller firmware revision; and the fourth is the power board firmware revision.

Parameter	Typical return
(none)	<ASCII string with comma-separated fields>
Return the instrument's identification string: *IDN?	

*OPC
*OPC?

The command sets the “Operation Complete” bit (bit 0) of the Standard Event register after the command is executed.

The query returns 1 to the output buffer after the command is executed.

Parameter	Typical return
(none)	1
Sets the Operation Complete bit: *OPC	
Return a 1 when the command is complete: *OPC?	

*PSC 0 | 1
*PSC?

The command clears the Status Byte and the Standard Event register enable masks when power is turned on (*PSC 1). When *PSC 0 is in effect, the Status Byte and Standard Event register enable masks are not cleared when power is turned on.

The query returns a 0 (*PSC 0) or a 1 (*PSC 1).

Parameter	Typical return
0 | 1 Default: 1	0 or 1
Enables the power-on clearing of the affected registers: *PSC 1	

Remarks

- This setting is non-volatile; it does not change after a Factory Reset (*RST command), Status Preset (STATus:PRESet command) or Clear Status (*CLS command).

*RCL 0 | 1 | 2 | . . . | 8 | 9

The command recalls a previously stored state from one of ten non-volatile storage locations. To recall a stored state, you must use the same memory location used previously to store the state. If an empty memory location is recalled, power-on default states will be applied to the power supply.

Parameter	Typical return
0 - 9	(none)
Recall the state from location 1: *RCL 1	

*RST

The command resets the instrument to its power-on default state. Refer to Factory Reset State for a complete listing of the instrument's factory configuration. It does not clear any of the status registers or the error queue. It also does not affect any interface error conditions.

*RST also forces the ABORt commands. This cancels any output trigger actions presently in process and resets the WTG bits in the Status Questionable Instrument Summary Registers. This command also reset the calibration operation.

Parameter	Typical return
(none)	(none)
Reset the instrument: `*RST`	

*SAV 0 | 1 | 2 | . . . | 8 | 9

The command saves the current instrument state using one of ten non-volatile storage locations.

The instrument states includes:

- Voltage limit, mode and trigger level
- Over-voltage protection level
- Current limit, mode and trigger level
- Over-current protection state, delay and delay start
- Output selected, state, track mode, rise and fall delay
- Trigger delay, source and initiate continuous state
- Display state, meter view and image capture format

Saving a state overwrites the previous state (if any) stored in that location.

When shipped from the factory, storage locations 0 through 9 are empty.

Parameter	Typical return
0 - 9	(none)
Save the state to location 1: `*SAV 1`	

*SRE <enable value>
*SRE?

The command enables the bits in the Status Byte Enable register.

The query returns the decimal value of the binary-weighted sum of all bits set in the register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register. For example, to enable bit 2 (decimal value = 4), bit 3 (decimal value = 8), and bit 7 (decimal value = 128), the decimal sum would be 140 (4 + 8 + 128). Default: 0	<bit value>
Enable bit 3 (decimal value = 8), and bit 4 (decimal value = 16) in the enable register: *SRE 24	

Remarks

- To enable specific bits, specify the decimal value corresponding to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Master Summary" bit (bit 6) of the Status Byte Register. If any of the selected bits change from 0 to 1, the instrument generates a Service Request signal.
- *CLS command clears the event register, but does not clear the enable register. An event register is a read-only register that latches events from the condition register. While an event bit is set, subsequent events corresponding to that bit are ignored.
- Use *PSC to control whether the Status Byte enable register is cleared at power-on. For example, *PSC 0 preserves the enable register contents through power cycles.
- The <enable> setting is non-volatile; it does not change after a Factory Reset (*RST command) , Status Preset (STATus:PRESet command) or Clear Status (*CLS command).

*STB?

The query queries the Status Byte Summary register and returns the same result as a serial poll but the “Request Service” bit (bit 6) is not cleared if a serial poll has occurred.

Parameter	Typical return
(none)	<bit value>
Read the status byte: *STB?	

*TRG

The command generates an event trigger to the trigger system when the trigger system has a BUS (software) trigger as its trigger source (TRIG:SOUR BUS). If the trigger system is not initiated, the *TRG command is simply ignored.

Parameter	Typical return
(none)	(none)
Generates an immediate trigger: *TRG	

*TST?

The query returns a 0 if the self-test passes or a non-zero value if it fails. If the self-test fails, the instrument also generates an error message with additional information on why the test failed.

Parameter	Typical return
(none)	0 or 1
Performs an instrument self-test: *TST?	

*WAI

The command waits for all pending operations to complete before executing any additional remote interface commands. This command is used only in the triggered mode to wait for a pending delayed trigger.

Parameter	Typical return
(none)	(none)
Waits for all pending operations to complete: *WAI	

INITiate[:IMMediate] [(@<chanlist>)]

The command enables the output trigger system. When an output trigger is initiated, an event on a selected trigger source causes the specified triggering action to occur. If the trigger system is not initiated, all triggers are ignored.

Parameter	Typical return
(none)	(none)
Initiates the trigger system on channel 1: INIT (@1)	

INITiate:CONTinuous ON | OFF | 1 | 0[, (@<chanlist>)]
INITiate:CONTinuous? [(@<chanlist>)]

The command continuously initiates the output trigger system. This allows multiple triggers to generate multiple output transients with no intermediate commands. The enabled state is ON (1); the disabled state is OFF (0). With continuous triggering disabled, the output trigger system must be initiated for each trigger using the INIT command.

The query returns 0 if continuous transients are disabled (OFF), and 1 if continuous transients are enabled (ON).

Parameter	Typical return
ON | OFF | 1 | 0	1 or 0
Initiates the trigger system on channel 1 continuously: INIT:CONT ON, (@1)	

Remarks

- Enabling INIT:CONT will immediately initiate the output trigger when either CURR:MODE or VOLT:MODE is set to STEP.
- Disabling INIT:CONT will immediately abort the output trigger.
- If INIT:CONT is enabled, output trigger will re-initiate after abort action or Device Clear message is received.
- If INIT:CONT is enabled with both the CURR:MODE or VOLT:MODE set to FIX, either CURR:MODE or VOLT:MODE need to set to STEP and re-initiate to activate the configuration.

INSTrument[:SELect] P6V | P30V | N30V | CH1 | CH2 | CH3
INSTrument[:SELect]?

The command selects the output to be programmed. The names CH1, CH2, and CH3 are simply other names for P6V, P30V, and N30V, respectively.When one output is selected, the other outputs are unavailable for programming. All the SCPIs that accept channel list as input parameter are affected by the INSTrument command. P6V is the identifier for +6 V output (channel 1), P30V is for +30 V output (channel 2), and N30V is for +30 V output (channel 3).

The query returns the output currently selected by INSTrument [:SELect] or INSTrument:NSELect as either “P6V”, “P30V”, or “N30V”.

Parameter	Typical return
P6V | P30V | N30V | CH1 | CH2 | CH3	P6V | P30V | N30V
Selects channel 1 to be programmed: INST P6V	

INSTrument:NSELect 1 | 2 | 3
INSTrument:NSELect?

The command selects the output to be programmed by a numeric value, as opposed to the output identifier used in the INSTrument [:SELect] command. The numbers 1 through 3 refer to P6V, P30V, and N30V, respectively.

The query returns the output currently selected by INSTrument:NSELect or INSTrument[:SELect] as either 1, 2, or 3.

Parameter	Typical return
1 | 2 | 3	1 | 2 | 3
Selects channel 1 output to be programmed: INST:NSEL 1	

LXI:IDENtify[:STATe] ON | OFF | 1 | 0
LXI:IDENtify[:STATe]?

The command enables (On) or disables (Off) the LXI identify indicator on the front panel display.

The query returns the state of the LXI identity indicator.

Parameter	Typical return
ON | OFF | 1 | 0 Default: OFF	0 or 1
Disables the LXI identify indicator: LXI:IDEN 0	

LXI:MDNS:ENABle ON | OFF | 1 | 0
LXI:MDNS:ENABle?

The command enables (On) or disables (Off) the multicast Domain Name System (mDNS), which provides the capabilities of a DNS server for service discovery in a small network that without a DNS server.

The query returns the state of the mDNS service.

Parameter	Typical return
ON | OFF | 1 | 0 Default: ON	0 or 1
Enables mDNS service: LXI:MDNS:ENAB 1	

Remarks

- This setting is non-volatile; it is not changed by power cycling or a Factory Reset (*RST).
- This parameter is set to its default value when the instrument is shipped from the factory.

LXI:MDNS:HNAMe[:RESolved]?

The query returns the resolved (unique) mDNS hostname in the form "K-<model number>-<serial>-N", where <serial> is the last 5 digits of the instrument's serial number. The N is an integer appended if necessary to make the name unique.

The desired name may be truncated, if necessary, to make room for the appended integer.

Parameter	Typical return
(none)	"K-EDU36311A-yyyyy", where yyyyy is the last five digits of the serial number.
Returns the resolved mDNS hostname: LXI:MDNS:HNAMe:RESolved?	

LXI:MDNS:SNAMe:DESired "<name>"
LXI:MDNS:SNAMe:DESired?

The command sets the desired mDNS service name.

The query returns the mDNS service name.

Parameter	Typical return
<name> = Quoted string of up to 63 characters.	"Keysight EDU36311A Triple Output DC Power supply"
Sets the desired mDNS service name: LXI:MDNS:SNAM:DES "EDU36311A"	

Remarks

- This setting is non-volatile; it is not changed by power cycling or a Factory Reset (*RST).
- This parameter is set to its default value when the instrument is shipped from the factory.

LXI:MDNS:SNAMe[:RESolved]?

The resolved mDNS service name will be the desired service name (LXI:MDNS:SNAMe:DESired command), possibly with "(<N>)" appended. The N is an integer appended if necessary to make the name unique. The desired name may be truncated, if necessary, to make room for the appended integer.

Parameter	Typical return
(none)	"Keysight EDU36311A Triple Output DC Power Supply - CN00000001"
Returns the resolved mDNS service: LXI:MDNS:SNAMe:RESolved?	

LXI:MDNS[:STATe] ON | OFF | 1 | 0
LXI:MDNS[:STATe]?

The command enables (On) or disables (Off) the multicast Domain Name System (mDNS), which provides the capabilities of a DNS server for service discovery in a small network without a DNS server.

The query returns the state of the mDNS service.

Parameter	Typical return
ON | OFF | 1 | 0 Default: ON	0 or 1
Enables mDNS service: LXI:MDNS ON	

Remarks

- This setting is non-volatile; it is not changed by power cycling or a Factory Reset (*RST).
- This parameter is set to its default value when the instrument is shipped from the factory.

LXI:RESet

The command resets LAN interface to a known operating state, beginning with DHCP, and clears the Web Interface password. If DHCP fails, it uses Auto-IP.

Parameter	Typical return
(none)	(none)
Resets the LAN interface: LXI:RES	

Remarks

- Depending on your network, the LAN interface may take several seconds to restart after this command is sent.

LXI:RESTart

The command restarts the LAN interface with the current settings as specified by the SYSTem:COMMunicate:LAN commands.

Parameter	Typical return
(none)	(none)
Restarts the LAN interface: LXI:REST	

Remarks

- Depending on your network, the LAN interface may take several seconds to restart after this command is sent.

MEASure[:SCALar]:CURRent[:DC]? [P6V | P30V | N30V | CH1 | CH2 | CH3 | (@<chanlist>)]

The query returns the current measured at the specified output. If no output identifier is specified, the current of the currently selected output is returned.

Parameter	Typical return
(none)	<current>
Returns the current measured for channel 1: `MEAS:CURR? CH1`	

MEASure[:SCALar]:VOLTage[:DC]? [P6V | P30V | N30V | CH1 | CH2 | CH3 | (@<chanlist>)]

The query returns the voltage measured at the specified output. If no output identifier is specified, the voltage of the currently selected output is returned.

Parameter	Typical return
(none)	<voltage>
Returns the voltage measured for channel 1: `MEAS:VOLT? P6V`	

OUTPut[:STATe] ON | 1 | OFF | 0[, (@<chanlist>)]
OUTPut[:STATe]? [(@<chanlist>)]

The command enables or disables the specified output. The names CH1, CH2, and CH3 are simply other names for P6V, P30V, and N30V, respectively. At *RST, all outputs are off.

The query returns the output state of the power supply. The returned value is 0 (OFF) or 1 (ON).

NOTE **If output delay is enabled, the query returns the configuration state instead of the actual output state. For example, if you have a 10 s output delay and query the output state right after you turn the output on, the query will return 1 (ON) even though the actual output will be off until the delay ends.**

Parameter	Typical return
ON | 1 | OFF | 0	1 or 0
Default: 0	
Disables channel 1: OUTP 0, (@1)	

OUTPut[:STATe]:DELay:FALL <delay>[, (@<chanlist>)]
OUTPut[:STATe]:DELay:FALL? [MIN | MAX,] [(@<chanlist>)]

The command sets the delay in seconds that the power supply waits before disabling the specified output. This allows multiple output channels to turn off in sequence. Each output will not turn off until its delay time has elapsed. This command effects on-to-off transitions including changes in the OUTPut[:STATe]. The command does not affect transitions to off caused by protection functions. Delay times can be programmed from 0 to 3600 seconds with the resolution of 1 millisecond.

The query returns the parameter in the form +n.nnnnnnnnE+nn. The parameter returned is the programmed delay time.

Parameter	Typical return
0 – 3600.000 | MIN | MAX	<delay value>
Default: 0	
Sets a delay of 0.2 s for channel 1 before turning the output off: OUTP:DEL:FALL 0.2, (@1)	

OUTPut[:STATe]:DELay:RISE <delay>[, (@<chanlist>)]
OUTPut[:STATe]:DELay:RISE? [MIN | MAX,] [(@<chanlist>)]

The command sets the delay in seconds that the power supply waits before enabling the specified output. This allows multiple output channels to turn on in sequence. Each output will not turn on until its delay time has elapsed. This command affects all off-to-on transitions including changes in the OUTPut[:STATe] as well as transitions due to OUTPut:PROTection:CLEar. Delay times can be programmed from 0 to 3600 seconds with the resolution of 1 millisecond.

The query returns the parameter in the form +n.nnnnnnnnE+nn. The parameter returned is the programmed delay time.

Parameter	Typical return
0 – 3600.000 | MIN | MAX Default: 0	<delay value>
Sets a delay of 0.5 s for channel 1 before turning the output on:: OUTP:DEL:RISE 0.5, (@1)	

OUTPut:PON:STATe RST | RCL0 | RCL1 | RCL2 | . . . . | RCL8 | RCL9
OUTPut:PON:STATe?

The command specifies whether the power supply's power-on state is the *RST state (default) or the state stored in one of ten memory locations.

The query returns either RST or RCL#, where # is a digit from 0 to 9.

Parameter	Typical return
RST | RCL0 | RCL1 | RCL2 | RCL3 | RCL4 | RCL5 | RCL6 | RCL7 | RCL8 | RCL9 Default: RST	RST, RCL0, RCL1, RCL2, RCL3, RCL4, RCL5, RCL6, RCL7, RCL8, or RCL9
Sets power-on state with states stored in memory location 1: OUTP:PON:STAT RCL1	

Remarks

- This setting is non-volatile; it is not changed by power cycling or a Factory Reset (*RST).
- This parameter is set to its default value when the instrument is shipped from the factory.

OUTPut:PROTection:CLEar [(@<chanlist>)]

The command clears the latch that disables the output due to an over-voltage, over-current or over-temperature condition. You must clear the conditions that cause the fault before executing this command. You can then restore the output to the state that existed before the fault condition occurred.

Parameter	Typical return
(none)	(none)
Clears the latch that disables channel 1 due to faulty condition: OUTP:PROT:CLE (@1)	

OUTPut:TRACk[:STATe] ON | OFF | 1 | 0
OUTPut:TRACk[:STATe]?

The command enables or disables the power supply to operate in the track mode. When the track mode is first enabled, the absolute value of the N30V supply will be set to the same voltage level as the P30V supply. Once enabled, any change of the programmed voltage level in either P30V supply or N30V supply will be reflected in the other supply. The OUTPut:TRACk OFF command returns the power supply to the non-track mode. At *RST, the track mode is disabled.

The query returns the track mode state of the power supply. The returned value is 0 (OFF) or 1 (ON).

Parameter	Typical return
ON | 1 | OFF | 0	1 or 0
Default: 0	
Enables the power supply to operate in the track mode: OUTP:TRAC ON	

STATus:OPERation:[:EVENt]?

Returns the sum of the bits in the event register for the Standard Operation Register group. This is a read-destructive register and these bits are cleared when you read the register.

The query returns a decimal value which corresponds to the binary-weighted sum of all bits in the register.

Parameter	Typical return
(none)	<bit value>
Reads the event register: STAT:OPER?	

Remarks

- This register is cleared when it is read, or when you issue a *CLS command.

STATus:OPERation:CONDition?

Queries the condition register for the Standard Operation Register group. This is a read-only register and the bits are not cleared when you read the register.

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

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Reads the condition register: STAT:OPER:COND?	

STATus:OPERation:ENABle <enable value>
STATus:OPERation:ENABle?

The command enables bits in the Operation Status enable register. The selected bits are then reported to the Status Byte.

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

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Enable bit 4 in the operation enable register: STAT:OPER:ENAB 16	

STATus:PRESet

The command clears all the Operation and Questionable enable registers.

Parameter	Typical return
(none)	(none)
Clears enable register bits: STAT:PRES	

STATus:QUEStionable:[:EVENt]?

Returns the sum of the bits in the event register for the Questionable Data Register group. This is a read-destructive register and the bits are cleared when you read the register.

The query returns a decimal value which corresponds to the binary-weighted sum of all bits in the register.

Parameter	Typical return
(none)	<bit value>
Returns a decimal value which corresponds to the binary-weighted sum of all bits in the register: STAT:QUES:EVENT?	

Remarks

- This register is cleared when it is read, or when you issue a *CLS command.

STATus:QUEStionable:ENABle <enable value>
STATus:QUEStionable:ENABle?

The command enables bits in the Questionable Status enable register. The selected bits are then reported to the Status Byte.

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

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Enable bit 4 in the questionable enable register: STAT:QUES:ENAB 16	

STATus:QUEStionable:INSTrument[:EVENt]?

The query queries the Questionable Instrument event register and returns the decimal value of the binary-weighted sum of all bits in the Questionable Instrument event register. This is a read-destructive register and the bits are cleared when you read the register.

Parameter	Typical return
(none)	(none)
Returns the decimal value of the Questionable Instrument event register: STAT:QUES:INST?	

STATus:QUEStionable:INSTrument:ENABle <enable value>
STATus:QUEStionable:INSTrument:ENABle?

The command sets the value of the Questionable Instrument enable register. This register is a mask for enabling specific bits from the Questionable Instrument event register to set the Instrument Summary bit (ISUM, bit 13) of the Questionable Status register. The "ISUM" bit of the Questionable Status register is the logical OR of all the Questionable Instrument event register bits that are enabled by the Questionable Instrument enable register.

The query returns the value of the Questionable Instrument enable register.

Parameter	Typical return
A decimal value of the Questionable Instrument enable register.	<bit value>
Enable bit 4 in the questionable instrument enable register: STAT:QUES:INST:ENAB 16	

STATus:QUEStionable:INSTrument:ISUMmary<n>[:EVENt]?

The query returns the value of the Questionable Instrument Isummary event register for a specific output of the power supply. The particular output must be specified by a numeric value (<n>=1, 2, or 3). See Programming Ranges and Output Identifiers for the output number. The event register is a read-only register which holds (latches) all events. Reading the Questionable Instrument Isummary event register clears it.

Parameter	Typical return
(none)	(none)
Returns the value of the Questionable Instrument Isummary event register for output 1: STAT:QUES:INST:ISUM1?	

STATus:QUEStionable:INSTrument:ISUMmary<n>:CONDition?

The query returns the condition of the specified output (<n>=1, 2, or 3), as shown in the table below.

Returned value	Description
0	The output is off or unregulated.
1	The output is in CC (constant current) operating mode.
2	The output is in CV (constant voltage) operating mode.
3	The output has a hardware failure.

Parameter	Typical return
(none)	0, 1, 2, or 3
Returns the condition of the instrument for output 1: STAT:QUES:INST:ISUM1:COND?	

STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle <enable value>
STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle?

The command sets the value of the Questionable Instrument Isummary enable register for a specific output of the three-output power supply. The particular output must be specified by a numeric value (<n>=1, 2, or 3). See Programming Ranges and Output Identifiers for the output number. This register is a mask for enabling specific bits from the Questionable Instrument Isummary event register to set the Instrument Summary bit (bit 1, 2, and 3) of the Questionable Instrument register. These bits 1, 2, and bit 3 are the logical OR of all the Questionable Instrument Isummary event register bits that are enabled by the Questionable Instrument Isummary enable register.

The query returns the value of the Questionable Instrument Isummary enable register (<n>=1, 2, or 3).

Parameter	Typical return
(none)	1, 2, or 3
Returns the value of the Questionable Instrument Isummary enable register for output 1: STAT:QUES:INST:ISUM1:ENAB?	

SYSTem:BEEPer[:IMMediate]

The command issues a single beep immediately.

Parameter	Typical return
(none)	(none)
Issues a single beep immediately: SYST:BEEP	

Remarks

- You can issue a beep with this command regardless of the current beeper state (SYSTem:BEEPer:STATe command).

SYSTem:BEEPer:STATe ON | OFF | 1 | 0
SYSTem:BEEPer:STATe?

The command enables or disables the beeper.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
Turns on the beeper: SYST:BEEP:STAT ON	

Remarks

- A beep is always emitted (even with beeper state OFF) when SYSTem:BEEPer is done.
- This setting will not affect the front panel key click.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:CONTrol?

The query reads and returns the control connection port number for Socket communications. Connection is used to send and receive commands and queries. If 0 is returned, the interface does not support a Socket Control connection.

Parameter	Typical return
(none)	+5000 (0 if sockets are not suported)
Returns the control connection port number: SYST:COMM:LAN:CONT?	

Remarks

- This query is only used when programming over Sockets.
- You can use the Socket Control connection to send a Device Clear to the instrument or to detect pending Service Request (SRQ) events.

SYSTem:COMMunicate:LAN:DHCP ON | OFF | 1 | 0
SYSTem:COMMunicate:LAN:DHCP?

The command enables (On) or disables (Off) the use of the Dynamic Host Configuration Protocol (DHCP) for the instrument.

ON: The instrument will try to obtain an IP address from a DHCP server. If a DHCP server is found, it will assign a dynamic IP address, Subnet Mask, and Default Gateway to the instrument. If a DHCP server is not found, the instrument uses AutoIP to automatically configure its IP setting in the Automatic Private IP Addressing range (169.254.xxx.xxx).

OFF: The instrument will use the static IP address, Subnet Mask, and Default Gateway during power-on.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
Disables DHCP: SYST:COMM:LAN:DHCP OFF SYST:COMM:LAN:UPD	

Remarks

- Most site LANs have a DHCP server.
- If a DHCP LAN address is not assigned by a DHCP server, then an AutoIP address static IP will be assumed after approximately two minutes.
- This setting is stored in non-volatile memory, and does not change when power has been off, or after a Factory Reset (*RST).

SYSTem:COMMunicate:LAN:DNS[1 | 2] "<address>"
SYSTem:COMMunicate:LAN:DNS[1 | 2]? [CURRent | STATic]

The command assigns static IP addresses of Domain Name System (DNS) servers. A primary and a secondary server address may be assigned. If DHCP is available and enabled, DHCP will auto-assign these server addresses. These auto-assigned server addresses take precedence over the static addresses assigned with this command. Contact your LAN administrator for details.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range of 0 through 255. [CURRent | STATic] Default: CURRent	"198.105.232.4"
Set a static primary DNS address: SYST:COMM:LAN:DNS "198.105.232.4" SYST:COMM:LAN:UPD	

- CURRent - Returns address currently being used by the instrument.
- STATic - Returns address from non-volatile memory. This address is used if DHCP is disabled or unavailable.
- The assigned DNS address is used for the DNS server if DHCP is disabled. Otherwise, the DNS server address is auto-assigned by DHCP.
- This setting is stored in non-volatile memory, and does not change when power has been off, or after a Factory Reset (*RST)

SYSTem:COMMunicate:LAN:DOMain?

The query reads the current network domain name and returns an ASCII string enclosed in double quotes.

Parameter	Typical return
(none)	"example.com"
Returns the domain name being used by the instrument: SYST:COMM:LAN:DOM?	

Remarks

- If Dynamic Domain Name System (DNS) is available on your network and your instrument uses DHCP, the domain name is assigned by the Dynamic DNS service at power-on.
- If a domain name has not been assigned, a null string (" ") is returned.

SYSTem:COMMunicate:LAN:GATeway "<address>"
SYSTem:COMMunicate:LAN:GATeway? [CURRent | STATic]

The command assigns a default gateway for the instrument. The specified IP Address sets the default gateway, which allows the instrument to communicate with systems that are not on the local subnet. Thus, this is the default gateway where packets are sent that are destined for a device not on the local subnet, as determined by the Subnet Mask setting. Contact your LAN administrator for details.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range of 0 through 255. [CURRent | STATic] Default: CURRent	"198.105.232.4"
Set a default gateway address: SYST:COMM:LAN:GAT "198.105.232.4" SYST:COMM:LAN:UPD	

- CURRent - Returns address currently being used by the instrument.
- STATic - Returns address from non-volatile memory. This address is used if DHCP is disabled or unavailable.
- If DHCP is enabled (SYSTem:COMMunicate:LAN:DHCP ON command), the specified default gateway is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured default gateway is used.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).
- A gateway value of "0.0.0.0" indicates that subnetting is not being used.

SYSTem:COMMunicate:LAN:HOSTname "<name>"
SYSTem:COMMunicate:LAN:HOSTname? [CURRent | STATic]

The command assigns a hostname to the instrument. A hostname is the host portion of the domain name, which is translated into an IP address. If Dynamic Domain Name System (Dynamic DNS) is available on your network and your instrument uses DHCP, the hostname is registered with the Dynamic DNS service at power-on. If DHCP is enabled (SYSTem:COMMunicate:LAN:DHCP ON), the DHCP server can change the specified hostname.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
<name>: A string of up to 15 characters. Must start with letter (A-Z) May contain letters, numbers (0-9), or dashes ("-") Default: "K-<*instrument model number*>-nnnnn", where "nnnnn" is the last five digits of the instrument's serial number. [CURRent | STATic] Default: CURRent	"LAB1-EDU36311A"
Define a hostname: SYST:COMM:LAN:HOST "LAB1-EDU36311A" SYST:COMM:LAN:UPD	

- CURRent - Returns hostname currently being used by the instrument.
- STATic - Returns desired hostname from non-volatile memory, that may not be the actual name used by the instrument if DHCP is enabled.
- If host name has not been assigned, the query returns a null string ("").
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:IPADdress "<address>"
SYSTem:COMMunicate:LAN:IPADdress? [CURRent | STATic]

The command assigns a static Internet Protocol (IP) address for the instrument. If DHCP is enabled (SYSTem:COMMunicate:LAN:DHCP ON), the specified static IP address is not used. Contact your LAN administrator for details.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255. [CURRent | STATic] Default: CURRent	"198.105.232.4"
Sets a static IP address: SYST:COMM:LAN:IPAD "198.105.232.4" SYST:COMM:LAN:UPD	

- CURRent - Returns address currently being used by the instrument.
- STATic - Returns static address from non-volatile memory. This address is used if DHCP is disabled or unavailable.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:MAC?

The query returns the instrument's Media Access Control (MAC) address as an ASCII string of 12 hexadecimal characters (0-9 and A-F) enclosed in quotation marks.

NOTE **Your network administrator may need the instrument's MAC address in order to assign a static IP address for this device.**

Parameter	Typical return
(none)	"00:30:D3:00:10:41"
Returns the MAC address: SYST:COMM:LAN:MAC?	

- Query reads the MAC address and returns an ASCII string enclosed in double quotes.
- The instrument's MAC address is unique to the instrument. It is set at the factory and cannot be changed.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).
- MAC address also known as the link-layer address, the Ethernet (station) address, LANIC ID, or Hardware Address. This is an unchangeable 48-bit address assigned by the manufacturer to each unique Internet device.

SYSTem:COMMunicate:LAN:SMASk "<mask>"
SYSTem:COMMunicate:LAN:SMASk? [CURRent | STATic]

The command assigns a subnet mask for the instrument to use in determining whether a client IP address is on the same local subnet. When a client IP address is on a different subnet, all packets must be sent to the Default Gateway. Contact your LAN administrator for details.

NOTE **If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.**

Parameter	Typical return
<mask>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255. Default: "255.255.0.0" [CURRent | STATic] Default: CURRent	"198.105.232.4"
Sets the subnet mask: SYST:COMM:LAN:SMAS "255.255.254.0" SYST:COMM:LAN:UPDate	

- CURRent - Returns subnet mask currently being used by the instrument.
- STATic - Returns subnet mask from non-volatile memory. This address is used if DHCP is disabled or unavailable.
- A value of "0.0.0.0" or "255.255.255.255" indicates that subnetting is not being used.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:TELNet:PROMpt "<string>"
SYSTem:COMMunicate:LAN:TELNet:PROMpt?

The command sets the command prompt displayed when communicating the instrument with Telnet.

Parameter	Typical return
<string>: A string of up to 15 characters	"Command"
Defines the command prompt: SYST:COMM:LAN:TELN:PROM "Command"	

- Query returns the command prompt as ASCII strings enclosed in double quotes.
- Instrument uses LAN port 5024 for SCPI Telnet sessions, and port 5025 for SCPI Socket sessions.
- Telnet port is an alternate way to send SCPI commands to the instrument.
- Telnet session can typically be started as follows from a host computer shell:

  telnet <IP_address> <port>

  For example:

  telnet 169.254.4.10 5024

  To exit a Telnet session, press <Ctrl-D>.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:TELNet:WMESsage "<string>"
SYSTem:COMMunicate:LAN:TELNet:WMESsage?

The command sets the welcome message displayed when communicating the instrument with Telnet.

Parameter	Typical return
<string>: A string of up to 63 characters Default: "Welcome to Keysight's EDU36311A Triple Output DC Power supply"	"Welcome to the Telnet Session"
Define a welcome message: SYST:COMM:LAN:TELN:WMES "Welcome to the Telnet Session"	

- Query returns the command prompt as ASCII strings enclosed in double quotes.
- Instrument uses LAN port 5024 for SCPI Telnet sessions and port 5025 for SCPI Socket sessions.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:COMMunicate:LAN:UPDate

The command stores any changes made to the LAN settings into non-volatile memory and restarts the LAN driver with the updated settings.

Parameter	Typical return
(none)	(none)
Configures the instrument to use statically assigned LAN settings (disables DHCP): SYST:COMM:LAN:DHCP OFF SYST:COMM:LAN:DNS "198.105.232.4" SYST:COMM:LAN:DNS2 "198.105.232.5" SYST:COMM:LAN:GAT "198.105.232.1" SYST:COMM:LAN:HOST "LAB1-EDU36311A" SYST:COMM:LAN:IPAD "198.105.232.101" SYST:COMM:LAN:UPD Configures the instrument back to use DHCP (enables DHCP): SYST:COMM:LAN:DHCP ON SYST:COMM:LAN.UPD	

- Be very careful when you execute this command, because your instrument may not work on the LAN if you update the instrument with invalid LAN settings.
- If your instrument does not work after you execute this command, perform the LAN Reset through instrument's front panel softkey to restore the settings to reset values and reset the LAN, or use another I/O interface, such as USB, to correct the settings.
- This command must be sent after changing the settings for DHCP, DNS, gateway, hostname, IP address, or sub-net mask.

SYSTem:COMMunicate:RLSTate LOCal | REMote | RWLock
SYSTem:COMMunicate:RLSTate?

The command sets the power supply to remote or local mode. The REMote parameter is the same as SYSTem:REMote and the RWLock parameter is the same as SYSTem:RWLock. The LOCal parameter will set the power supply to local mode and maintain in this mode for all incoming remote operations.

The query returns LOC, REM, or RWL.

Parameter	Typical return
LOC | REM | RWL	LOC, REM, or RWL
Sets the power supply to remote: SYST:COMM:RLST REM	

SYSTem:COMMunicate:TCPip:CONTrol?

The command returns the initial socket control connection port number. After the control port number is obtained, a control socket connection can be opened.

Parameter	Typical return
(none)	+5000 (0 if sockets are not supported)
Queries the Control connection port number: SYST:COMM:TCP:CONT?	

NOTE The control socket connection can only be used by a client to send a device clear to the instrument or to detect Service Request (SRQ) events.

Refer to "Using Sockets" in the *User's Guide* for more information.

SYSTem:DATE <yyyy>,<mm>,<dd>
SYSTem:DATE?

This command sets the date of the power supply's real-time clock. The range of values for the year is from 2000 – 2099.

The query returns the date in the form +2017,+7,+26.

Parameter	Typical return
<yyyy>,<mm>,<dd>	<yyyy,mm,dd>
Sets the date to April 1, 2020: SYST:DATE 2020,4,1	

Remarks

- The real-time clock is battery-backed and retains the date and time when power is off.
- The real-time clock does not adjust itself for time zone changes or daylight savings time. Be sure to set the date and time when you first receive your instrument.
- This setting is non-volatile. It will not be changed by power cycling or after a Factory Reset (*RST command).

SYSTem:ERRor[:NEXT]?

The query returns the power supply's error queue of up to 20 errors. The power supply beeps once (unless disabled by SYSTem:BEEPer:STATe OFF) and turns on the front-panel error annunciator when an error has been detected. Up to 20 errors can be stored in the error queue. See Error Messages.

NOTE Errors are retrieved in first-in-first-out (FIFO) order. The error annunciator turns off after the last error is read. The power supply beeps once (unless disabled by SYSTem:BEEPer:STATe OFF) each time an error is generated.

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, the SYST:ERR? query returns +0, “No error”.

The error queue is cleared when power has been off or after a *CLS (clear status) command has been executed. The *RST (reset) command does not clear the error queue.

Parameter	Typical return
(none)	<+0,"No error">
Reads and clears the first error in error queue: SYST:ERR?	

SYSTem:LOCal

The command places the power supply in the local mode. All front-panel keys are fully functional.

Parameter	Typical return
(none)	(none)
Sets the power supply in the local mode: SYST:LOC	

SYSTem:REMote

The command places the power supply into remote mode for remote operation. All front-panel keys are disabled except for Lock/Unlock key. You can place the power supply in local mode and unlock the front panel keys by pressing the Lock/Unlock key.

Parameter	Typical return
(none)	(none)
Sets to remote mode: SYST:REM	

SYSTem:RWLock

The command places the power supply in the remote mode. This command is the same as SYSTem:REMote except that all front-panel keys are disabled including the **Lock/Unlock** key. You can unlock the front-panel keys by using SYSTem:REMote.

Parameter	Typical return
(none)	(none)
Sets to remote mode disabling all front-panel keys: SYST:RWL	

SYSTem:SET <arbitrary_block_data>
SYSTem:SET?

The command sets the instrument state as defined by the data returned by SYSTem:SET? query.

Parameter	Typical return
<arbitrary_block_data>: The block data returned by SYSTem:SET? query.	#nN<instrument state> where the first digit after the # indicates the number of following digits. The following digits indicate the length of the data.

SYSTem:TIME <hh>,<mm>,<ss>
SYSTem:TIME?

The command sets the real time clock in hours (hh), minutes (mm), and seconds (ss). The values may range from 0,0,0 (midnight) to 23,59,59 (one second before midnight).

The query returns the real time clock in hours (hh), minutes (mm), and seconds (ss).

Parameter	Typical return
<0 - 23>,<0 - 59>,<0 - 59>	+<hh>,+<mm>,+<ss>
Sets the real time clock to 13:30:15: SYST:TIME 13,30,15	

Remarks

- The real-time clock is battery-backed and retains the date and time when power is off.
- The real-time clock does not adjust itself for time zone changes or daylight savings time. Be sure to set the date and time when you first receive your instrument.
- The setting is non-volatile, and does not change when power has been off or after a Factory Reset (*RST command).

SYSTem:VERSion?

The query returns the present SCPI version of the power supply. The returned value is a string in the form of YYYY.V where “YYYY” represent the year of the version, and the “V” represents the current version number of the SCPI.

Parameter	Typical return
(none)	1990.0
Returns the SCPI version: SYST:VERS?	

TRIGger[:SEQuence]:DELay <delay value> | MINimum | MAXimum[, (@<chanlist>)]
TRIGger[:SEQuence]:DELay? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the time delay between the detection of an event on the specified trigger source and the start of any corresponding trigger action on the power supply output. Select from 0 to 3600 seconds. Minimum value is 0 and maximum value is 3600 seconds.

The query returns the programmed trigger time delay in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
0 – 3600.000 | MIN | MAX Default: 0	<delay value>
Sets the trigger time delay to 5 seconds on channels 1 and 2: TRIG:DEL 5, (@1,2)	

TRIGger[:SEQuence]:SOURce BUS | IMMediate[, (@<chanlist>)]
TRIGger[:SEQuence]:SOURce? [(@<chanlist>)]

The command selects the trigger source for the output trigger system.

The query returns BUS or IMM.

Source	Description
BUS	Selects a remote interface trigger command. The power supply is triggered by the *TRG command received over the remote interface. The *TRG command will not be accepted unless the power supply is in the "wait-for-trigger" state (INITiate command).
IMMediate	Sets the trigger source to true. As soon as the output is INITiated, it will send the trigger immediately.

Parameter	Typical return
BUS | IMM Default: BUS	BUS or IMM
Selects BUS as the output trigger source for channel 2: TRIG:SOUR BUS, (@2)	

Program example

The program below sets the +6V supply to an output of 3 V / 1 A immediately:

```
INST P6V          Select the +6V output
VOLT:MODE STEP    Set the voltage mode to Step
VOLT:TRIG 3       Set triggered voltage to 3 V
CURR:MODE STEP    Set the current mode to Step
CURR:TRIG 1       Set triggered current to 1 A
TRIG:SOUR IMM     Select the immediate trigger source
INIT              Initiate the trigger system
```

Triggering Commands

The instrument's triggering system allows you to change voltage and current output when a trigger is received. The typical process is:

1. Select one or more outputs with the INSTrument:SELect command.
2. Configure the triggered output levels by using CURRent:TRIGgered and VOLTage:TRIGgered.
3. Configure the voltage and current mode to Step by using VOLTage:MODE and CURRent:MODE.
4. Specify the trigger source, either BUS or IMMediate.
5. If you are using the BUS trigger source, you may choose to set a time delay between the detection of the trigger and the start of any corresponding output change.
6. Send an INITiate[:IMMediate]command. If the IMMediate source is selected, the selected output is set to the triggered level immediately. If the BUS trigger source is selected, the output is set to the triggered level after the instrument receives the *TRG command.

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <voltage>| MINimum | MAXimum | DEFault[, (@<chanlist>)]
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chan-list>)]

The command programs the immediate output voltage level of the output in volts. The immediate level is the voltage limit value of the selected output.

The query returns the output voltage level of the output in volts. MAX and MIN return the highest and lowest programmable voltage levels respectively for the selected range.

Channel	CH1	CH2	CH3
MINimum	0 V	0 V	0 V
MAXimum	6.18 V	30.9 V	30.9 V
DEFault	0 V	0 V	0 V

Parameter	Typical return
0 - maximum | MIN | MAX | DEF (The maximum value is dependent on the voltage rating of the power supply) Default: DEF	<voltage level>
Sets the output voltage level to 20 V for channel 2: VOLT 20, (@2)	

[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] <voltage>| MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command programs the triggered voltage level of the specified output channel in volts. The triggered level is a stored value that is transferred to the output when an output step is triggered.

The query returns the programmed triggered level in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Channel	CH1	CH2	CH3
MINimum	0 V	0 V	0 V
MAXimum	6.18 V	30.9 V	30.9 V

Parameter	Typical return
0 - maximum | MIN | MAX (The maximum value is dependent on the voltage rating of the power supply)	<voltage level>
Default: MIN	
Sets the triggered voltage level to 5 V for channel 1: VOLT:TRIG 5, (@1)	

[SOURce:]VOLTage:MODE FIXed | STEP[, (@<chanlist>)]
[SOURce:]VOLTage:MODE? [(@<chanlist>)]

The command determines what happens to the output voltage when the transient system is initiated and triggered.

The query returns the voltage mode for each channel specified. Multiple responses are separated by commas.

Mode	Description
FIXed	Nothing happens. The output voltage remains at the immediate value.
STEP	The output goes to the triggered level when a trigger occurs.

Parameter	Typical return
FIX | STEP	FIX or STEP
Default: FIX	
Sets the voltage mode of channel 2 to Step: VOLT:MODE STEP, (@2)	

[SOURce:]VOLTage:PROTection[:LEVel][:AMPLitude] <voltage> | MINimum | MAXimum[, (@<chan-list>)]
[SOURce:]VOLTage:PROTection[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the level at which overvoltage protection trips, in volts.

The query returns +n.nnnnnnnnE+nn in volts.

Operation mode	Value
OFF Mode	CH1: (MIN = 0.5 V, MAX = 6.6 V) CH2: (MIN = 1.5 V, MAX = 33 V) CH3: (MIN = 1.5 V, MAX = 33 V)

Parameter	Typical return
CH1: 0.5 - MAX CH2 and CH3: 1.5 - MAX Default: <MAX in Maximum value>	<voltage level>
Sets the level at which overvoltage protection trips to 20 V for channel 2: VOLT:PROT 20, (@2)	

[SOURce:]VOLTage:PROTection:CLEar [(@<chanlist>)]

The command clears the latch that disables the output due to an over voltage condition. You must clear the conditions that cause the over voltage protection tripped before executing this command. You can then restore the output to the state that existed before the over voltage condition occurred.

Parameter	Typical return
(none)	(none)
Clears the latch that disables channel 1 due to an over voltage condition: VOLT:PROT:CLE (@1)	

[SOURce:]VOLTage:RANGe P6V | P30V | LOW | HIGH[, (@<chanlist>)]
[SOURce:]VOLTage:RANGe? [(@<chanlist>)]

The command sets the output voltage range on models that have multiple ranges. The power supply only support 1 range for voltage, accepting and returning a range that corresponds to the single range.

The query returns the presently selected range.

Parameter	Typical return
P6V | P30V | LOW | HIGH	<voltage range>
Queries the output voltage range for channel 1: SOUR:VOLT:RANG? (@1)	

[SOURce:]VOLTage:PROTection:TRIPped? [(@<chanlist>)]

The query indicates whether an overvoltage protection occurred (1) or not (0). This is reset to 0 by VOLTage:PROTection:CLEar.

Parameter	Typical return
(none)	1 or 0
Indicates whether an overvoltage protection occurred on channel 1: VOLT:PROT:TRIP? (@1)	

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