Programmable DC Power Supply

PRP Series

PROGRAMMING MANUAL

VERSION: 1.0

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

Good Will Instrument Co., Ltd.
No. 7-1, Jhongsing Rd., Tucheng Dist., New Taipei City 236, Taiwan.

Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow during operation and storage. Read the following before any operation to insure your safety and to keep the instrument in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the PRP or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline CAUTION	• Do not place any heavy object on the PRP. • Avoid severe impact or rough handling that leads to damaging the PRP. • Do not discharge static electricity to the PRP. • Use only mating connectors, not bare wires, for the terminals. • Do not block the cooling fan opening. • Do not disassemble the PRP unless you are qualified. (Measurement categories) EN61010-1:2010 and EN61010-2-030 specify the measurement categories and their requirements as follows. The PRP falls under category II. • Measurement category IV is for measurement performed at the source of low-voltage installation. • Measurement category III is for measurement performed in the building installation. • Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation. • 0 is for measurements performed on circuits not directly connected to Mains.
Power Supply WARNING	• AC Input voltage range: 170VAC~265VAC • Frequency: 47Hz~63Hz • To avoid electrical shock connect the protective grounding conductor of the AC power cord to an earth ground.

Cleaning the PRP	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals containing harsh material such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: 20%~ 85% • Altitude: < 2000m • Temperature: 0°C to 50°C (Pollution Degree) EN61010-1:2010 and EN61010-2-030 specify the pollution degrees and their requirements as follows. The PRP falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Temperature: -25°C to 70°C • Relative Humidity: <90%
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the power supply in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

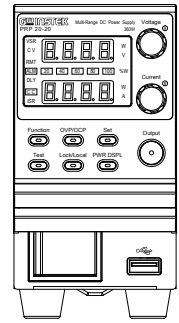
This chapter describes the power supply in a nutshell, including its main features and front / rear panel introduction, as well as an overview of the configuration settings.

PRP Series Overview

Series lineup

The PRP series consists of 2 models: 200W and 400W.

Model name	Type	Voltage Rating	Current Rating	Power
PRP 20-10	Type I	0~20V	0~10A	200W
PRP 20-20	Type I	0~20V	0~20A	400W



Main Features

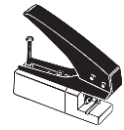
Performance	• High performance/power • Power efficient switching type power supply • Low impact on load devices • Fast transient recovery time of 1ms • Fast output response time
Features	• OVP, OCP and OTP protection • Adjustable voltage and current slew rates • User adjustable bleeder control to quickly dissipate the power after shutdown to safe levels.

	• Extensive remote monitoring and control options • Support for serial and parallel connections. • Power on configuration settings. • Supports test scripts
Interface	• RS-485 port • Analog connector for analog voltage and current monitoring • USB host port

Accessories

Please check the contents before using the PRP.

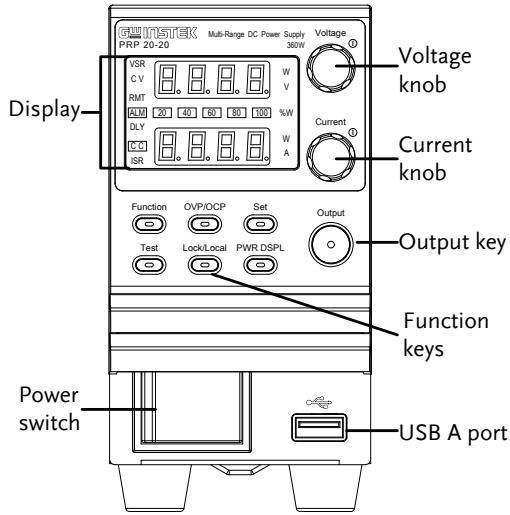
Standard Accessories	Part number	Description
	CD-ROM	User manual, programming manual
	4323-30600101	Power cord
	PSW-009	Output terminal cover
	GTL-123	Test leads: 1x red, 1x black
	PSW-004	Basic Accessory Kit: M4 terminal screws and washers x2, M8 terminal bolts, nuts and washers x2, Air filter x1, Analog control protection dummy x1, Analog control lock level x1

Optional Accessories	Part number	Description
	GET-001	Extended terminal
	PSW-001	Accessory Kit: Pin contact x10, Socket x1, Protection cover x1
	PSW-002	Simple IDC Tool 
	PSW-003	Contact Removal Tool 
	PSW-005	Series operation cable for 2 units.
	PSW-006	Parallel operation cable for 2 units.
	PSW-007	Parallel operation cable for 3 units.
	GRA-410-J	Rack mount adapter (JIS)
	GRA-410-E	Rack mount adapter (EIA)

Appearance

PRP Front Panel

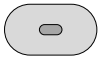
200W: PRP 20-10, 400W: PRP 20-20



Function Keys

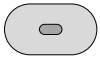
The Function keys along with the Output key will light up when a key is active.

Function



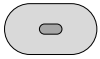
The Function key is used to configure the power supply.

OVP/OCP

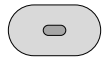
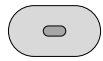
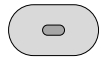
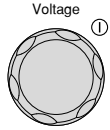
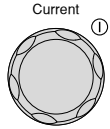


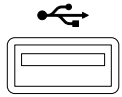
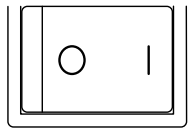
Set the over current or over voltage protection levels.

Set



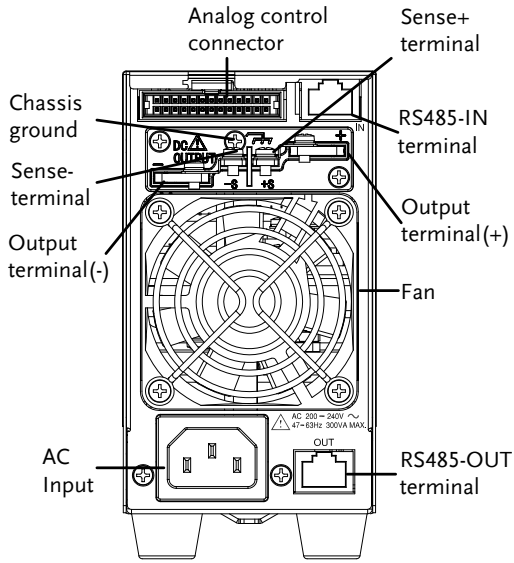
Sets the current and voltage limits.

	Test 	Used to run customized scripts for testing.
	Lock/Local 	Locks or unlocks the panel keys to prevent accidentally changing panel settings.
	PWR DSPL 	Toggles the display from viewing V/A → V/W or A/W*. *Press the Voltage knob for V/W, press the Current knob for A/W.
Display Indicators	VSR	Voltage Slew Rate
	C V	Constant Voltage Mode
	RMT	Remote Control Mode
	ALM	Alarm on
	DLY	Delay Output
	C C	Constant Current Mode
	ISR	Current Slew Rate
	20 40 60	Power bar
	80 100 % W	Indicates the current power output as a percentage.
Voltage Knob	Voltage 	Sets the voltage.
Current Knob	Current 	Sets the current.
Output	Output 	Press to turn on the output. The Output key will light up when the output is active.

USB		USB A port for data transfer, loading test scripts etc.
Power Switch		Used to turn the power on/off.

Rear Panel

200W: PRP 20-10, 400W: PRP 20-20



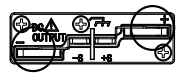
Analog Control Connector

Standard 26 pin MIL connector (OMRON XG4 IDC plug).

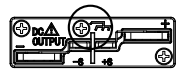
The analog control connector is used to monitor current and voltage output, machine status (OVP, OCP, OTP etc.), and for analog control of the current and voltage output.

Use an OMRON XG5 IDC socket as the mating socket.

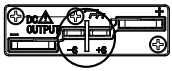
Output Terminals



Positive (+) and negative (-) output terminals.



Chassis ground

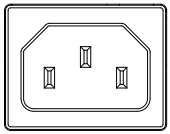


Sense (-S) and Sense (+S) terminals.

Fans

Temperature controlled fans

Line Voltage Input



200W: PRP 20-10
400W: PRP 20-20

- Voltage Input: 170~240 VAC
- Line frequency: 50Hz/60 Hz (Automatically switchable)

RS485-IN

The RS485 port is used for remote control and digital monitoring from a PC.

RS485-OUT

RJ-45 connector that is used to daisy chain power supplies with the Remote-IN port to form a communication bus.

Configuration Settings

Configuration of the PRP power supplies is divided into five different configuration settings: Normal Function, RS-485, Power ON Configuration, Calibration Settings and System Settings. Power ON Configuration differs from the other settings in that the settings used with Power ON Configuration settings can only be set during power up. The other configuration settings can be changed when the unit is already on. This prevents some important configuration parameters from being changed inadvertently. Power On Configuration settings are numbered F-90 to F-95 and the other configuration settings are numbered F-00 to F-20, F-70 to F-76 and F-88 to F-89.

Setting Normal Function Settings

The normal function settings (F-01~F-20, F-70~F76, F-88~F-89) can be easily configured with the Function key.

- Ensure the load is not connected.
- Ensure the output is off.

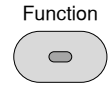
Note

Function setting F-89 (Show Version) can only be viewed, not edited.

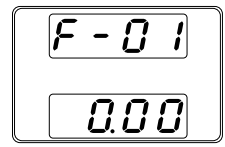
Configuration settings F-90~F-95 cannot be edited in the Normal Function Settings. Use the Power On Configuration Settings. See page 18 for details.

Steps

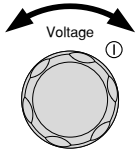
1. Press the Function key. The function key will light up.



2. The display will show F-01 on the top and the configuration setting for F-01 on the bottom.

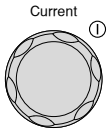


3. Rotate the voltage knob to change the F setting.

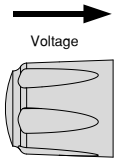


Range F-01~F-20, F-70~F76, F-88~F-89

4. Use the current knob to set the parameter for the chosen F setting.

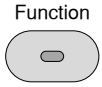


5. Press the Voltage knob to save the configuration setting. ConF will be displayed when successful.



Exit

Press the Function key again to exit the configuration settings. The function key light will turn off.



Setting Power On Configuration Settings

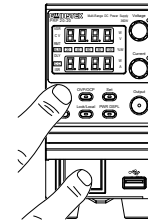
Background

The Power On configuration settings can only be changed during power up to prevent the configuration settings being inadvertently changed.

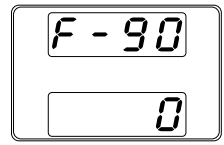
- Ensure the load is not connected.
- Ensure the power supply is off.

Steps

6. Hold the Function key whilst turning the power on.

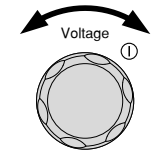


7. The display will show F-90 on the top and the configuration setting for F-90 on the bottom.

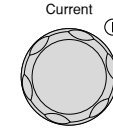


8. Rotate the voltage knob to change the F setting.

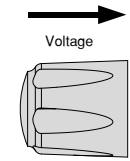
   Range F-90~ F-95

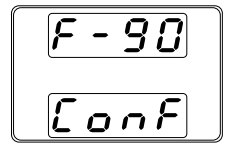


9. Use the current knob to set the parameter for the chosen F setting.



10. Press the Voltage knob to save the configuration setting. ConF will be displayed when successful.





Exit

Cycle the power to save and exit the configuration settings.

Configuration Table

Please use the configuration settings listed below when applying the configuration settings.

Normal Function Settings	Setting	Setting Range
Output ON delay time	F-01	0.00s~99.99s
Output OFF delay time	F-02	0.00s~99.99s
V-I mode slew rate select	F-03	0 = CV high speed priority 1 = CC high speed priority 2 = CV slew rate priority 3 = CC slew rate priority
Rising voltage slew rate	F-04	0.01V/s~40.00V/s (PRP 20-XX)
Falling voltage slew rate	F-05	0.01V/s~40.00V/s (PRP 20-XX)
Rising current slew rate	F-06	0.01A/s~20.00A/s (PRP 20-10) 0.01A/s~40.00A/s (PRP 20-20)
Falling current slew rate	F-07	0.01A/s~20.00A/s (PRP 20-10) 0.01A/s~40.00A/s (PRP 20-20)
Internal resistance setting	F-08	0.000Ω ~2.000Ω (PRP 20-10) 0.000Ω ~1.000Ω (PRP 20-20)
Bleeder circuit control	F-09	0 = OFF, 1 = ON, 2 = AUTO
Buzzer ON/OFF control	F-10	0 = OFF, 1 = ON
Measurement Average Setting	F-17	0 = Low, 1 = Middle, 2 = High
Lock Mode	F-19	0 = Panel lock: allow output off 1 = Panel lock: allow output on/off
USB setting		
Front panel USB State	F-20	0 = Absent, 1 = Mass Storage
RS485 Settings		
RS485 Control	F-70	0 = Disable, 1 = Half duplex (RS485-2 wire), 2 = Full duplex (RS485-4 wire)
Baud Rate	F-71	0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200
Data Bits	F-72	0 = 7 bits, 1 = 8 bits
Parity	F-73	0 = None, 1 = Odd, 2 = Even
Stop Bit	F-74	0 = 1 bit, 1 = 2 bits

Termination Character	F-75	0 = LF(Line feed, 0x0A), 1 = CR (Carriage Return, 0x0D)
Address	F-76	0~31
System Settings		
Factory Set Value	F-88	0 = No effect 1 = Return to factory settings
Show Version	F-89	0, 1 = PRP version 2, 3 = PRP build year 4, 5 = PRP build month/day 6, 7 = Keyboard CPLD version 8, 9 = Analog-Control CPLD version A, B = Reserved C, D = Kernel build year E, F = Kernel build month/day G, H = Test command version I, J = Test command build year K, L = Test command build month/day
Power On Configuration Settings*		
CV Control	F-90	0 = Panel control (local) 1 = External voltage control 2 = External resistance control (Ext-R↙ 10kΩ = Vo, max) 3 = External resistance control (Ext-R↘10kΩ = 0)
CC Control	F-91	0 = Panel control (local) 1 = External voltage control 2 = External resistance control (Ext-R↙ 10kΩ = Io,max) 3 = External resistance control (Ext-R↘10kΩ = 0)
Power-ON Output	F-92	0 = OFF at startup 1 = ON at startup T001 ~ T010 = Run test script TXX at start up

Master/Slave	F-93	0 = Master/Local 1 = Master/Parallel1 2 = Master/Parallel2 3 = Slave/Parallel 4 = Slave/Series
External Out Logic	F-94	0 = High ON, 1 = Low ON
Power Switch trip	F-95	0 = Enable , 1 = Disable
Calibration Settings*		
Calibration	F-00	0000 ~ 9999

* Note

Power On and Calibration settings can only be set during power up.

REMOTE CONTROL

This chapter describes basic configuration of IEEE488.2 based remote control. For a command list, refer to the programming manual, downloadable from GW Instek website, www.gwinstek.com

Interface Configuration

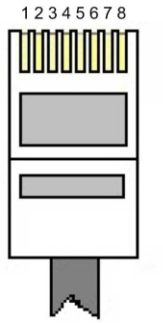
RS485 Configuration

Overview

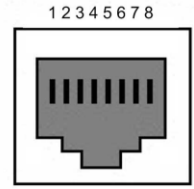
The PRP uses the IN & OUT ports for RS485 communication.

Pin assignment

Pin No.	RS485-4W	RS485-2W
1	--	--
2	RxD+	--
3	GND	GND
4	RxD-	--
5	TxD+	D+
6	TxD-	D-
7	--	--
8	--	--



RJ-45 Male plug



RJ-45 Female jack

Steps

1. Connect the RS485 serial cable to the Remote IN port on the real panel of the PRP. Connect the other end of the cable to the PC.

2. Press the Function key to enter the Normal configuration settings.

Set the following RS485 settings:

F-70 = 0 ~ 2	RS485 control: 0 = Disable, 1 = Half duplex, 2 = Full duplex
F-71 = 0 ~ 7	Set the baud rate: 0=1200, 1=2400, 2=4800, 3=9600, 4=19200, 5=38400, 6=57600, 7=115200
F-72 = 0 or 1	Data bits: 0=7 or 1=8
F-73 = 0 ~2	Parity: 0 = none, 1 = odd, 2 = even
F-74 = 0 or 1	Stop bits: 0 = 1, 1 = 2
F-75 = 0 or 1	Termination Character: 0 = LF<Line feed, 0x0A> 1 = CR<Carriage Return, 0x0D>
F-76 = 0~31	RS485 address for multi-unit remote connection.

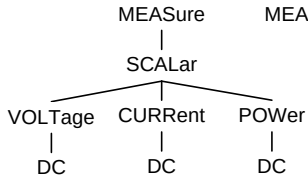
Command Syntax

Compatible Standard	IEEE488.2	Partial compatibility
	SCPI, 1999	Partial compatibility

Command Structure

SCPI commands follow a tree-like structure, organized into nodes. Each level of the command tree is a node. Each keyword in a SCPI command represents each node in the command tree. Each keyword (node) of a SCPI command is separated by a colon (:).

For example, the diagram below shows an SCPI sub-structure and a command example.



Command types

There are a number of different instrument commands and queries. A command sends instructions or data to the unit and a query receives data or status information from the unit.

Command types

Simple	A single command with/without a parameter
Example	*IDN?

Query	A query is a simple or compound command followed by a question mark (?). A parameter (data) is returned.
Example	meas:curr:dc?
Compound	Two or more commands on the same command line. Compound commands are separated with either a semi-colon (;) or a semi-colon and a colon (;:). A semi-colon is used to join two related commands, with the caveat that the last command must begin at the last node of the first command. A semi-colon and colon are used to combine two commands from different nodes.
Example	meas:volt:dc?;:meas:curr:dc?

Command Forms

Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.

The commands can be written in capitals or lower-case, just so long as the short or long forms are complete. An incomplete command will not be recognized.

Below are examples of correctly written commands.

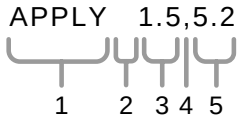
Long form	STATus:OPERation:NTRansition? STATUS:OPERATION:NTRANSITION? status:operation:ntransition?
Short form	STAT:OPER:NTR? stat:oper:ntr?

Square Brackets

Commands that contain square brackets indicate that the contents are optional. The function of the command is the same with or without the square bracketed items, as shown below.

Both "DISPlay:MENU[:NAME]?" and "DISPlay:MENU?" are both valid forms.

Command Format



1. Command header
2. Space
3. Parameter 1
4. Comma (no space before/after comma)
5. Parameter 2

Parameters

Type	Description	Example
<Boolean>	Boolean logic	0, 1

	<NR1>	integers	0, 1, 2, 3
	<NR2>	decimal numbers	0.1, 3.14, 8.5
	<NR3>	floating point	4.5e-1, 8.25e+1
	<NRf>	any of NR1, 2, 3	1, 1.5, 4.5e-1
	<block data>	Definitive length arbitrary block data. A single decimal digit followed by data. The decimal digit specifies how many 8-bit data bytes follow.	
Message Terminator	LF	Line feed	
	CR	Carriage return	
Communication Interface protocol	The power supply acknowledges received commands by returning an "OK" message. If an error is detected the power supply will return an error message.		

Command List

Abort Command

ABORt

Set →

Description	The ABORt command will cancel any triggered actions.
Syntax	ABORt

Address Command

ADR

Set →

Description	ADR is followed by address, which can be 0 to 31 and is used to access the power supply.
Syntax	ADR<NR1>
Parameter	<NR1> 0~31
Note	The address (ADR n) command must return an "OK" response before any other commands are accepted.

APPLy Command

APPLy

Set → Query

Description	The APPLy command is used to set both the voltage and current. The voltage and current will be output as soon as the function is executed if the programmed values are within the accepted range. An execution error will occur if the programmed values are not within accepted ranges. The Apply command will set the voltage/current values but these values will not be reflected on the display until the Output is On or if the DISPlay:MENU:NAME 3 (set menu) command is used.	
Syntax	APPLy {<voltage>|MIN|MAX}[,{<current>|MIN|MAX}]	
Query Syntax	APPLy?	
Parameter	<voltage>	<NRf> 0% ~ 105% of the rated output voltage.
	<current>	<NRf> 0% ~ 105% of the rated output current.
	MIN	0 volts/0 amps
	MAX	Maxium value for the present range.
Return parameter	<NRf>	Returns the voltage and current.
Example	APPL 5.05,1.1 Sets the voltage and current to 5.05V and 1.1A.	
Query Example	APPL? +5.050, +1.100 Returns voltage (5.05V) and current (1.1A) setting.	

Display Commands

DISPlay:MENU[:NAME]

Set → / → Query

Description	The DISPlay MENU command selects a screen menu or queries the current screen menu.
Syntax	DISPlay:MENU[:NAME] <NR1>
Query Sytax	DISPlay:MENU[:NAME]?

Parameter/ Return parameter	<NR1>	Description
	0	Measurement-Voltage / Measurement-Current
	1	Measurement-Voltage / Measurement-Power
	2	Measurement-Power / Measurement-Current
	3	Set Menu
	4	OVP / OCP Menu
	5~99	Not Used.
	100~199	F-00~99 Menu.

Example

DISP:MENU:NAME 0

Sets the display to the Voltage/Current display screen.

DISPlay[:WINDow]:TEXT:CLEar

Set →

Description	Clears the text on the main screen from the DISPlay[:WINDow]:TEXT[:DATA] command .
Syntax	DISPlay[:WINDow]:TEXT:CLEar

DISPlay[:WINDow]:TEXT[:DATA]

Set → / → Query

Description	Sets or queries the data text that will be written to the display. Writing to the display will overwrite data that is currently on the screen. Overwriting a display area with a shorter string may or may not overwrite the screen. The string must be enclosed in quotes: "STRING". Only ASCII characters 20H to 7EH can be used in the <string>.	
Syntax	DISPlay[:WINDow]:TEXT[:DATA] <string>	
Query Syntax	DISPlay[:WINDow]:TEXT[:DATA]?	
Parameter/ Return parameter	<string>	ASCII character 20H to 7EH can be used to in the string parameter. The string must be enclosed in quotes: "STRING"
Example	DISP:WIND:TEXT:DATA "STRING" Writes STRING to the display.	
Query Example	DISP:WIND:TEXT:DATA? "STRING" Returns the text data string on the screen.	

DISPlay:BLINk

Set → / → Query

Description	Turns blink on or off for the display.	
Syntax	DISPlay:BLINk { 0 | 1 | OFF | ON }	
Query Syntax	DISPlay:BLINk?	
Parameter	0	<NR1>Turns blink OFF
	OFF	Turns blink OFF
	1	<NR1> Turns blink ON
	ON	Turns blink ON
Return parameter	0	<NR1>Turns blink OFF
	1	<NR1>Turns blink ON
Example	DISP:BLIN 1 Turns blink ON.	

Initiate Command

INITiate[:IMMediate]:NAME Set

Description	The INITiate command starts the TRANsient or OUTPut trigger. See the trigger commands on page 54 for usage details.	
Syntax	INITiate[:IMMediate]:NAME {TRANsient|OUTPut}	
Parameter	TRANSient	Starts the TRANsient trigger.
	OUTPut	Starts the OUTPut trigger.
Example	INITiate:NAME TRANient Starts the TRANSient trigger.	

Measure Commands

MEASure[:SCALar]:CURRent[:DC] → Query

Description	Takes a measurement and returns the average output current
Syntax	MEASure[:SCALar]:CURRent[:DC]?
Return parameter	<NRf> Returns the current in amps.

MEASure[:SCALar]:VOLTage[:DC] → Query

Description	Takes a measurement and returns the average output voltage.
Syntax	MEASure[:SCALar]:VOLTage[:DC]?
Return	<NRf> Returns the voltage in volts.

MEASure[:SCALar]:POWer[:DC] → Query

Description	Takes a measurement and returns the average output power.
Syntax	MEASure[:SCALar]:POWer[:DC]?
Return	<NRf> Returns the power measured in watts.

Output Commands

OUTPut:DELay:ON

Set → / → Query

Description	Sets the Delay Time in seconds for turning the output on. The delay is set to 0.00 by default.	
Syntax	OUTPut:DELay:ON <NRf>	
Query Syntax	OUTPut:DELay:ON?	
Parameter	<NRf>	0.00~99.99 seconds, where 0=no delay.
Return parameter	<NRf>	Returns the delay on time in seconds until the output is turned on.

OUTPut:DELay:OFF

Set → / → Query

Description	Sets the Delay Time in seconds for turning the output off. The delay is set to 0.00 by default.	
Syntax	OUTPut:DELay:OFF <NRf>	
Return Syntax	OUTPut:DELay:OFF?	
Parameter	<NRf>	0.00~99.99 seconds, where 0=no delay.
Return parameter	<NRf>	Returns the delay off time in seconds until the output is turned off.

OUTPut:MODE

Set / Query

Description	Sets the PRP output mode. This is the equivalent to the F-03 (V-I Mode Slew Rate Select) settings.	
Syntax	OUTPut:MODE {<NR1>|CVHS|CCHS|CVLS|CCLS}	
Return Syntax	OUTPut:MODE?	
Parameter	0	CV high speed priority
	CVHS	CV high speed priority
	1	CC high speed priority
	CCHS	CC high speed priority
	2	CV slew rate priority
	CVLS	CV slew rate priority
	3	CC slew rate priority
	CCLS	CC slew rate priority
Return parameter	<NR1>	Returns the output mode.

OUTPut[:STATe][:IMMediate]

Set / Query

Description	Turns the output on or off.	
Syntax	OUTPut[:STATe][:IMMediate] { OFF | ON | 0 | 1 }	
Query Syntax	OUTPut[:STATe][:IMMediate]?	
Parameter	0	<NR1> Turns the output off.
	OFF	Turns the output off.
	1	<NR1> Turns the output on.
	ON	Turns the output on.
Return parameter	<NR1>	Returns output status of the instrument.

OUTPut[:STATe]:TRIGgered

Set / Query

Description	Turns the output on or off when a software trigger is generated.
Syntax	OUTPut[:STATe]:TRIGgered { OFF | ON | 0 | 1 }
Query Syntax	OUTPut[:STATe]:TRIGgered?

Parameter	0	<NR1>Turns the output off when a software trigger is generated.
	OFF	Turns the output off when a software trigger is generated.
	1	<NR1>Turns the output on when a software trigger is generated.
	ON	Turns the output on when a software trigger is generated.
Return parameter	<NR1>	Returns output trigger status of the instrument.

OUTPut:PROTection:CLEar

Set →

Description	Clears over-voltage, over-current and over-temperature (OVP, OCP, OTP) protection circuits. It also clears the shutdown protection circuit. The AC failure protection cannot be cleared.
Syntax	OUTPut:PROTection:CLEar

OUTPut:PROTection:TRIPped

→ Query

Description	Returns the state of the protection circuits (OVP, OCP, OTP).	
Query Syntax	OUTPut:PROTection:TRIPped?	
Return parameter	0	<NR1>Protection circuits are not tripped.
	1	<NR1>Protection circuits are tripped.

Sense Commands

SENSe:AVERage:COUNt

Set → / → Query

Description	Determines the level of smoothing for the average setting. This is the equivalent to the F-17 function setting.	
Syntax	SENSe:AVERage:COUNt {<NR1>| LOW | MIDDle | HIGH}	
Query Syntax	SENSe:AVERage:COUNt?	
Parameter	0 | LOW	Low level of smoothing.
	1 | MIDDle	Middle level of smoothing.
	2 | HIGH	High level of smoothing.
Return parameter	<NR1>	Returns the level of smoothing.
	0	Low level of smoothing.
	1	Middle level of smoothing.
	2	High level of smoothing.
Example	SENSe:AVERage:COUNt 1 Sets the level of smoothing to middle.	

Status Commands

STATus:OPERation[:EVENt] → Query

Description	Queries the Operation Status Event register and clears the contents of the register.
Syntax	STATus:OPERation[:EVENt]?
Return	<NR1> Returns the bit sum of the Operation Status Event register.

STATus:OPERation:CONDition → Query

Description	Queries the Operation Status register. This query will not clear the register.
Syntax	STATus:OPERation:CONDition?
Return	<NR1> Returns the bit sum of the Operation Condition register.

STATus:OPERation:ENABle → Set / → Query

Description	Sets or queries the bit sum of the Operation Status Enable register.

Syntax	STATus:OPERation:ENABle <NRf>	
Query Syntax	STATus:OPERation:ENABle?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:OPERation:PTRansition

Set → / → Query

Description	Sets or queries the bit sum of the positive transition filter of the Operation Status register.	
Syntax	STATus:OPERation:PTRansition <NRf> STATus:OPERation:PTRansition?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:OPERation:NTRansition

Set → / → Query

Description	Sets or queries the bit sum of the negative transition filter of the Operation Status register.	
Syntax	STATus:OPERation:NTRansition <NRf>	
Query Syntax	STATus:OPERation:NTRansition?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:QUEStionable[:EVENt]

→ Query

Description	Queries the bit sum of the Questionable Status Event register. This query will also clear the contents of the register.	
Query Syntax	STATus:QUEStionable[:EVENt]?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:QUEStionable:CONDition → Query

Description	Queries the status (bit sum) of the Questionable Status register. This query will not clear the register.	
Query Syntax	STATus:QUEStionable:CONDition?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:QUEStionable:ENABle → Set / → Query

Description	Sets or queries the bit sum of the Questionable Status Enable register.	
Syntax	STATus:QUEStionable:ENABle <NRf>	
Query Syntax	STATus:QUEStionable:ENABle?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:QUEStionable:PTRansition → Set / → Query

Description	Sets or queries the bit sum of the positive transition filter of the Questionable Status register.	
Syntax	STATus:QUEStionable:PTRansition <NRf>	
Return Syntax	STATus:QUEStionable:PTRansition?	
Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:QUEStionable:NTRansition → Set / → Query

Description	Sets or queries the negative transition filter of the Questionable Status register.
Syntax	STATus:QUEStionable:NTRansition <NRf>
Query Syntax	STATus:QUEStionable:NTRansition?

Parameter	<NRf>	0~32767
Return parameter	<NR1>	0~32767

STATus:PRESet

Set

Description

This command resets the ENABle register, the PTRansistion filter and NTRansistion filter on the Operation Status and Questionable Status Registers. The registers/filters will be reset to a default value.

Default Register/Filter Values	Setting
QUEStionable Status Enable	0x0000
QUEStionable Status Positive Transition	0x7FFF
QUEStionable Status Negative Transition	0x0000
Operation Status Enable	0x0000
Operation Status Positive Transition	0x7FFF
Operation Status Negative Transition	0x0000

Summary: The Questionable Status Enable registers and the Operation Status Enable registers are both reset to 0.

The Questionable Status and Operation Status Positive Transition filters are all set high (0x7FFF) and the Negative Transition filters are all set low (0x0000). I.e., only positive transitions will be recognized for the Questionable Status and Operation Status registers.

Syntax

STATus:PRESet

Source Commands

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]

Set → / → Query

Description	Sets or queries the current level in amps. For externally set current levels (from the analog control connector) the set current level is returned.	
Syntax	[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MIN|MAX]	
Parameter/Return	<NRf>	0~105% of the rated current output level.
	MIN	Minimum current level.
	MAX	Maximum current level.
Example	SOUR:CURR:LEV:IMM:AMPL? MAX 37.800 Returns the maximum possible current level in amps.	

[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude]

Set → Query

Description	Sets or queries the current level in amps when a software trigger has been generated.	
Syntax	[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude]? [MIN|MAX]	
Parameter/Return	<NRf>	0%~105% of the rated current output in amps.
	MIN	Minimum current level.
	MAX	Maximum current level.
Example	SOUR:CURR:LEV:TRIG:AMPL? MAX 37.800 Returns the maximum possible current level in amps.	

[SOURce:]CURRent:PROTection[:LEVel]

Set → Query

Description	Sets or queries the OCP (over-current protection) level in amps.	
Syntax	[SOURce:]CURRent:PROTection[:LEVel] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]CURRent:PROTection[:LEVel]? [MIN|MAX]	
Parameter/Return	<NRf>	OCP range in Amps.
	MIN	Minimum current level.
	MAX	Maximum current level.
Example	SOUR:CURR:PROT:LEV? MIN +3.600 Returns the minimum possible current level in amps.	

[SOURce:]CURRent:PROTection:STATe

Set → / → Query

Description	Turns OCP (over-current protection) on or off.	
Syntax	[SOURce:]CURRent:PROTection:STATe {0|1|OFF|ON}	
Query Syntax	[SOURce:]CURRent:PROTection:STATe?	
Parameter/Return	0	<NR1> Turns the buzzer off.
	OFF	Turns the OCP off.
	1	<NR1> Turns the OCP on.
	ON	Turns the OCP on.
Return parameter	<Bool>	Returns the protection status (0 or 1).
Example	SOUR:CURR:PROT:STAT OFF Turns OCP off.	

[SOURce:]CURRent:SLEW:RISing

Set → / → Query

Description	Sets or queries the rising current slew rate. This is only applicable for CC slew rate priority mode.	
Syntax	[SOURce:]CURRent:SLEW:RISing {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]CURRent:SLEW:RISing? [MIN|MAX]	
Parameter/Return	<NRf>	0.01A/s~20.00A/s (PRP 20-10) 0.01A/s~40.00A/s (PRP 20-20)
	MIN	Minimum rising current slew rate.
	MAX	Maximum rising current slew rate.
Example	SOUR:CURR:SLEW:RIS 40 Sets the rising current slew rate to 40A/s.	

[SOURce:]CURRent:SLEW:FALLing

Set → / → Query

Description	Sets or queries the falling current slew rate. This is only applicable for CC slew rate priority mode.
Syntax	[SOURce:]CURRent:SLEW:FALLing {<NRf>|MIN|MAX}
Query Syntax	[SOURce:]CURRent:SLEW:FALLing? [MIN|MAX]

Parameter/Return	NRf	0.01A/s~20.00A/s (PRP 20-10) 0.01A/s~40.00A/s (PRP 20-20)
	MIN	Minimum falling current slew rate
	MAX	Maximum falling current slew rate
Example	SOUR:CURR:SLEW:FALL 1 Sets the falling current slew rate to 1A/s.	

[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude]

Set → Query

Description	Sets or queries the internal resistance in ohms.	
Syntax	[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude] {<NRf>|MIN|DEF|MAX|?}	
Query Syntax	[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude] ? [MIN|MAX]	
Parameter/Return	<NRf>	Resistance in ohms: 0.000Ω~2.000Ω (PRP 20-10) 0.000Ω~1.000Ω (PRP 20-20)
	MIN	Minimum internal resistance in ohms
	MAX	Maximum internal resistance in ohms
Example	SOUR:RES:LEV:IMM:AMPL 0.1 Sets the internal resistance to 100mΩ.	

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

Set → Query

Description	Sets or queries the voltage level in volts.	
Syntax	[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MIN|MAX]	
Parameter/Return	<NRf>	0~105% of the rated output voltage in volts.
	MIN	Minimum voltage level
	MAX	Maximum voltage level

Example	SOUR:VOLT:LEV:IMM:AMPL 10 Sets the voltage level to 10 volts.

[SOURce:]VOLTage[:LEVel]:TRIGgered [:AMPLitude]

Set → / → Query

Description	Sets or queries the voltage level in volts when a software trigger has been generated.	
Syntax	[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [MIN|MAX]	
Parameter/Return	<NRf>	0%~105% of the rated voltage output in volts.
	MIN	Minimum current level.
	MAX	Maximum current level.
Example	SOUR:VOLT:LEV:TRIG:AMPL 10 Sets the voltage level to 10 volts when a software trigger is generated.	

[SOURce:]VOLTage:PROTection[:LEVel]

Set → / → Query

Description	Sets or queries the overvoltage protection level.	
Syntax	[SOURce:]VOLTage:PROTection[:LEVel] {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]VOLTage:PROTection[:LEVel]? [MIN|MAX]	
Parameter/Return	<NRf>	OVP range in volts.
	MIN	Minimum OVP level
	MAX	Maximum OVP level
Example	SOUR:VOLT:PROT:LEV MAX Sets the OVP level to its maximum.	

[SOURce:]VOLTage:SLEW:RISing

Set → Query

Description	Sets or queries the rising voltage slew rate. This is only applicable for CV slew rate priority mode.	
Syntax	[SOURce:]VOLTage:SLEW:RISing {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]VOLTage:SLEW:RISing? [MIN|MAX]	
Parameter/Return	<NRf>	0.01V/s~40.00V/s (PRP 20-XX)
	MIN	Minimum rising voltage slew rate.
	MAX	Maximum rising voltage slew rate.
Example	SOUR:VOLT:SLEW:RIS MAX Sets the rising voltage slew rate to its maximum.	

[SOURce:]VOLTage:SLEW:FALLing

Set → Query

Description	Sets or queries the falling voltage slew rate. This is only applicable for CV slew rate priority mode.	
Syntax	[SOURce:]VOLTage:SLEW:FALLing {<NRf>|MIN|MAX}	
Query Syntax	[SOURce:]VOLTage:SLEW:FALLing? [MIN|MAX]	
Parameter/Return	<NRf>	0.01V/s~40.00V/s (PRP 20-XX)
	MIN	Minimum voltage falling slew rate.
	MAX	Maximum voltage falling slew rate.
Example	SOUR:VOLT:SLEW:FALL MIN Sets the falling voltage slew rate to its minimum.	

Trigger Commands

The trigger commands generate and configure software triggers.

TRIGger:TRANsient[:IMMediate]

Set →

Description	Generates a software trigger for the transient trigger system. On a trigger, sets the voltage & current. Refer to the :CURR:TRIG and VOLT:TRIG commands on page 49 and 52, respectively.
Syntax	TRIGger:TRANsient[:IMMediate]
Related Commands	[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude] [SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]

TRIGger:TRANsient:SOURce

Set → / → Query

Description	Sets or queries the trigger source for the transient system.	
Syntax	TRIGger:TRANsient:SOURce {BUS | IMMediate}	
Query Syntax	TRIGger:TRANsient:SOURce?	
Parameter/Return	BUS	Internal software trigger. Waits for the *TRG (or IEEE 488.1 "get" group execute trigger) command to start the trigger.
	IMMediate	Starts the trigger immediately. (default)
Example	TRIG:TRAN:SOUR BUS Sets the trigger source as BUS.	

TRIGger:OUTPut[:IMMediate] Set

Description	Generates a software trigger for the output trigger system. On a trigger, sets the output state. Refer to the :OUTP:TRIG command on page 41.
Syntax	TRIGger:OUTPut[:IMMediate]
Related commands	OUTPut[:STATe]:TRIGgered

TRIGger:OUTPut:SOURce Set Query

Description	Sets or queries the trigger source for the output system.	
Syntax	TRIGger:OUTPut:SOURce [BUS | IMMediate]	
Query Syntax	TRIGger:OUTPut:SOURce?	
Parameter/Return	BUS	Internal software trigger. Waits for the *TRG (or IEEE 488.1 "get" group execute trigger) command to start the trigger.
	IMMediate	Starts the trigger immediately. (default)
Example	TRIG:OUTP:SOUR BUS Sets the trigger source of the output system as BUS.	

Trigger Command Examples

1. The transient system for the trigger in immediate mode.

Example 1	TRIG:TRAN:SOUR IMM	
	CURR:TRIG MAX	
	VOLT:TRIG 5	
	INIT:NAME TRAN	<==The current changes to the maximum, and the voltage changes to 5V.

2. The transient system for the trigger in BUS mode.

Example 2	TRIG:TRAN:SOUR BUS	
	CURR:TRIG MAX	
	VOLT:TRIG 5	
	INIT:NAME TRAN	
	TRIG:TRAN (or *TRG)	<==The current changes to the maximum, and the voltage changes to 5V.

3. The output system for the trigger in immediate mode.

Example 3	TRIG:OUTP:SOUR IMM	
	OUTP:TRIG 1	
	INIT:NAME OUTP	<==The output changes to ON.

4. The output system for the trigger in BUS mode.

Example 4	TRIG:OUTP:SOUR BUS	
	OUTP:TRIG 1	
	INIT:NAME OUTP	
	TRIG:OUTP (or *TRG)	<==The output changes to ON.

System Function Command

SYSTem:BEEPer[:IMMediate]

Set → / → Query

Description	This command causes an audible tone to be generated by the instrument. The duration time is specified in seconds.	
Syntax	SYSTem:BEEPer[:IMMediate] {<NR1>|MINimum|MAXimum}	
Query Syntax	SYSTem:BEEPer[:IMMediate]? [MINimum|MAXimum]	
Parameter	<NR1>	0 ~ 3600 seconds.
	MINimum	Sets the beeper time to the minimum (0 seconds)
	MAXimum	Sets the beeper time to the maximum (3600 seconds)
Return parameter	<NR1>	Returns the remaining beeper duration time in seconds or returns the maximum or minimum beeper time in seconds (for the [MINimum|MAXimum] query parameters).

Example 1	SYST:BEEP 10 **after a 2 second wait** SYST:BEEP? >8 The first command turns the beeper on for 10 seconds. After 2 seconds the SYST:BEEP? query returns the remaining beeper time (8 seconds).
Example 2	SYST:BEEP? MAX >3600 Returns the maximum settable beeper time in seconds.

SYSTem:CONFigure:BEEPer[:STATe]

Set → / → Query

Description	Sets or queries the buzzer state on/off.	
Syntax	SYSTem:CONFigure:BEEPer[:STATe] {OFF|ON|0|1}	
Query Syntax	SYSTem:CONFigure:BEEPer[:STATe]?	
Parameter	0	<NR1> Turns the buzzer off.
	OFF	Turns the buzzer off.
	1	<NR1> Turns the buzzer on.
	ON	Turns the buzzer on.
Return parameter	<Boolean>	Returns the buzzer status.

SYSTem:CONFigure:BLEeder[:STATe]

Set → / → Query

Description	Sets or queries the status of the bleeder resistor.	
Syntax	SYSTem:CONFigure:BLEeder[:STATe] {OFF|ON|AUTO|0|1|2}	
Query Syntax	SYSTem:CONFigure:BLEeder[:STATe]?	
Parameter	0	<NR1> Turns the bleeder resistor off.
	OFF	Turns the bleeder resistor off.
	1	<NR1> Turns the bleeder resistor on.
	ON	Turns the bleeder resistor on.
	2	<NR1> Turns the AUTO mode on.
	AUTO	Turns the AUTO mode on.

Return parameter	<NR1>	Returns bleeder resistor status.

SYSTem:CONFigure:BTRip[:IMMediate] Set

Description	Trips the power switch trip (circuit breaker) to turn the unit off (shut down the power).
Syntax	SYSTem:CONFigure:BTRip[:IMMediate]

SYSTem:CONFigure:BTRip:PROTection Set Query

Description	Enables/Disables the power switch trip (circuit breaker) when the OVP or OCP protection settings are tripped. This setting only applies after power has been reset.	
Syntax	SYSTem:CONFigure:BTRip:PROTection {OFF|ON|0|1}	
Query Syntax	SYSTem:CONFigure:BTRip:PROTection?	
Parameter	0	<NR1> Disables the power switch trip for OVP or OCP.
	OFF	Disables the power switch trip for OVP or OCP.
	1	<NR1> Enables the power switch trip for OVP or OCP.
	ON	Enables the power switch trip for OVP or OCP.
Return parameter	<Boolean>	Returns power switch trip setting.

SYSTem:CONFigure:CURRent:CONTrol Set Query

Description	Sets or queries the CC control mode (local control (panel), external voltage control, external resistance control). This setting is applied only after the unit is reset.	
Syntax	SYSTem:CONFigure:CURRent:CONTrol { 0 | 1 | 2 | 3 }	
Query Syntax	SYSTem:CONFigure:CURRent:CONTrol?	
Parameter/Return	<NR1>	Description
	0	Local (Panel) control

	1	External voltage control
	2	External resistance control; 10kΩ = Io max, 0kΩ = Io min.
	3	External resistance control; 10kΩ = Io min, 0kΩ = Io max.

SYSTem:CONFigure:VOLTage:CONTrol

Set → / → Query

Description	Sets or queries the CV control mode (local control, external voltage control, external resistance control). This setting is applied only after the unit is reset.
Syntax	SYSTem:CONFigure:VOLTage:CONTrol { 0 | 1 | 2 | 3 }
Query Syntax	SYSTem:CONFigure:VOLTage:CONTrol?

Parameter/Return	<NR1>	Description
	0	Local (Panel) control
	1	External voltage control
	2	External resistance control; 10kΩ = Vo max, 0kΩ = Vo min.
	3	External resistance control; 10kΩ = Vo min, 0kΩ = Vo max.

SYSTem:CONFigure:MSLave

Set → / → Query

Description	Sets or queries the unit operation mode. This setting is only applied after the unit has been reset.
Syntax	SYSTem:CONFigure:MSLave { 0 | 1 | 2 | 3 | 4 }
Query Syntax	SYSTem:CONFigure:MSLave?

Parameter/Return	<NR1>	Description
	0	Master/Local
	1	Master/Parallel 1 (2 units)
	2	Master/Parallel 2 (3 units)
	3	Slave/Parallel
	4	Slave/Series

SYSTem:CONFigure:OUTPut:EXTernal[:MODE]

Set → / → Query

Description	Sets the external logic as active high or active low. This setting is only applied after the unit has been reset.	
Syntax	SYSTem:CONFigure:OUTPut:EXTernal[:MODE]	
Query Syntax	SYSTem:CONFigure:OUTPut:EXTernal[:MODE]?	
Parameter	0	Active high
	HIGH	Active high
	1	Active low
	LOW	Active low
Return Parameter	0	<boolean>Active high
	1	<boolean>Active low

SYSTem:CONFigure:OUTPut:PON[:STATe]

Set → / → Query

Description	Sets the unit to turn the output ON/OFF at power-up. This setting is only applied after the unit has been reset.	
Syntax	SYSTem:CONFigure:OUTPut:PON[:STATe] {OFF|ON|0|1}	
Query Syntax	SYSTem:CONFigure:OUTPut:PON[:STATe]?	
Parameter	0	Output off at power up
	OFF	Output off at power up
	1	Output on at power up
	ON	Output on at power up
Return Parameter	0	Output off at power up
	1	Output on at power up

SYSTem:ERRor

→ Query

Description	Queries the error queue. The last error message is returned. A maximum of 32 errors are stored in the error queue.

Query Syntax	SYSTem:ERRor?	
Paramter/Return	<NR1>,<string>	Returns an error code followed by an error message as a string. The string is returned as "string".
Example	SYSTem:ERRor? -100, "Command error"	

SYSTem:KEYLock:MODE

Set → / → Query

Description	Sets or queries the key lock mode. This setting is the equivalent of the F-19 function setting.	
Syntax	SYSTem:KEYLock:MODE {0|1}	
Query Syntax	SYSTem:KEYLock:MODE?	
Parameter / Return parameter	0	Panel lock: allow output off.
	1	Panel lock: allow output on/off.

SYSTem:KLOCk

Set → / → Query

Description	Enables or disables the front panel key lock.	
Syntax	SYSTem:KLOCk { OFF | ON | 0 | 1}	
Query Syntax	SYSTem:KLOCk?	
Parameter	0	Panel keys unlocked
	OFF	Panel keys unlocked
	1	Panel keys locked
	ON	Panel keys locked
Return parameter	0	<boolean>Panel keys unlocked
	1	<Boolean>Panel keys locked

SYSTem:INFormation

→ Query

Description	Queries the system information. Returns the machine version, build date, keyboard CPLD version and analog CPLD version.	
Query Syntax	SYSTem:INFormation?	
Return Parameter	<block data>	Definite length arbitrary block response data.

Query Example	SYST:INF? #3212MFRS GW-INSTEK,Model PRP80-13.5,SN TW0123456789,Firmware-Version 01.43.20130424, Keyboard-CPLD 0x30c,AnalogControl-CPLD 0x421,Kernel-BuiltON 2013-3-22,TEST-Version 01.00,TEST-BuiltON 2011-8-1,MAC 02-80-ad-20-31-b1 Returns the system information as a block data.

SYSTem:PRESet

Set →

Description	Performs a device reset. Configures the unit to a known configuration (default settings, exclusive of F-70~76, F-90~F95). This command functions same as command ***RST**.
Syntax	SYSTem:PRESet

SYSTem:VERSion

→ Query

Description	Returns the version of the SCPI specifications that the unit complies with.
Query Syntax	SYSTem:VERSion?
Return	<1999.0> Always returns the SCPI version: 1999.0.

IEEE 488.2 Common Commands

*CLS

Set

Description	The *CLS command clears the Standard Event Status, Operation Status and Questionable Status registers. The corresponding Enable registers in each of the above registers are not cleared. If a <NL> newline code immediately precede a *CLS command, the Error Que and the MAV bit in the Status Byte Register is also cleared.
Syntax	*CLS

*ESE

Set / Query

Description	Sets or queries the Standard Event Status Enable register.	
Syntax	*ESE <NR1>	
Query Syntax	*ESE?	
Parameter	<NR1>	0~255
Return parameter	<NR1>	Returns the bit sum of the Standard Event Status Enable register.

*ESR

→ Query

Description	Queries the Standard Event Status (Event) register. The Event Status register is cleared after it is read.	
Query Syntax	*ESR?	
Return parameter	<NR1>	Returns the bit sum of the Standard Event Status (Event) register and clears the register.

*IDN

→ Query

Description	Queries the manufacturer, model name, serial number, and firmware version of the PRP.	
Query Syntax	*IDN?	
Return parameter	<string>	Returns the instrument identification as a string in the following format: GW-INSTEK,PRP-2010,TW123456,01.00.20110101 Manufacturer: GW-INSTEK Model number : PRP-2010 Serial number : TW123456 Firmware version : 01.00.20110101

*OPC

Set →
→ Query

Description	The *OPC command sets the OPC bit (bit0) of the Standard Event Status Register when all current commands have been processed. The *OPC? Query returns 1 when all the outstanding commands have completed.	
Syntax	*OPC	
Query Syntax	*OPC?	
Return parameter	1	Returns 1 when all the outstanding commands have completed.

*RST

Set →

Description	Performs a device reset. Configures the unit to a known configuration (default settings, exclusive of F-70~76, F-90~F95). This command functions same as command **SYSTem:PRESet**. This known configuration is independent of the usage history.
Syntax	*RST

*SRE

Set →
→ Query

Description	Sets or queries the Service Request Enable register. The Service Request Enable register determines which registers of the Status Byte register are able to generate service requests.	
Syntax	*SRE <NR1>	
Query Syntax	*SRE?	
Parameter	<NR1>	0~255
Return parameter	<NR1>	Returns the bit sum of the Service Request Enable register.

*STB

→ Query

Description	Queries the bit sum of the Status Byte register with MSS (Master summary Status).	
Query Syntax	*STB?	
Return parameter	<NR1>	Returns the bit sum of the Status Byte register with the MSS bit (bit 6).

*TRG

Set →

Description	The *TRG command is able to generate a "get" (Group Execute Trigger). If the PRP cannot accept a trigger at the time of the command, an error message is generated (-211, "Trigger ignored").

Syntax	*TRG

*TST

→ Query

Description	Executes a self test.	
Query Syntax	*TST?	
Return parameter	0	Returns "0" if there are no errors.
	<NR1>	Returns an error code <NR1> if there is an error.

*WAI

Set →

Description	Prevents any other commands or queries from being executed until all outstanding commands have completed.
Syntax	*WAI

Status Register Overview

To program the PRP power supply effectively, the Status registers need to be understood. This chapter explains in detail how the Status registers are used and how to configure them.

Introduction to the Status Registers

Overview

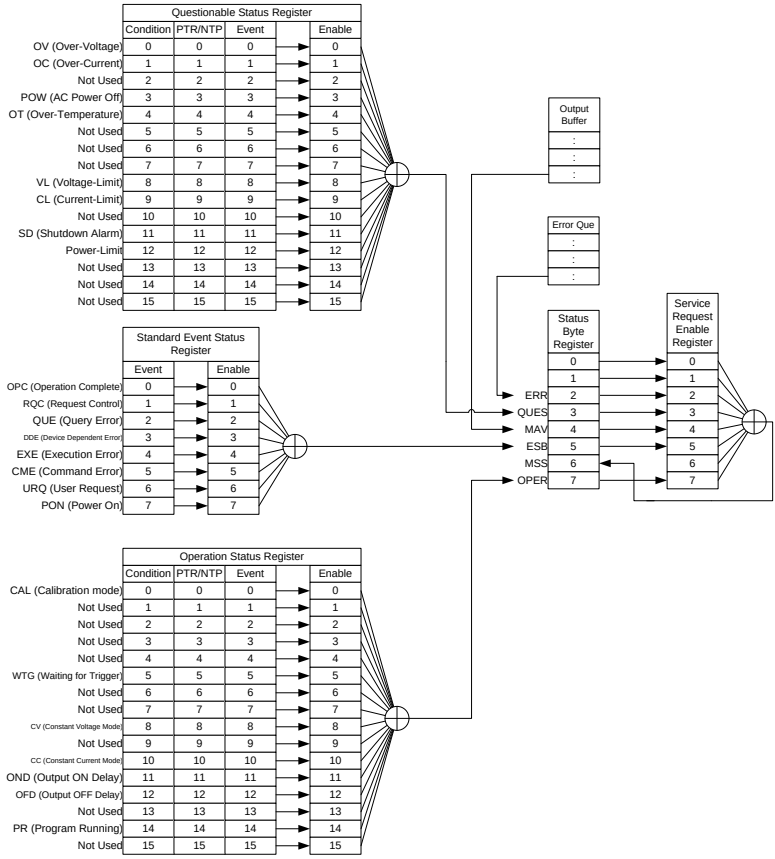
The status registers are used to determine the status of the power supply. The status registers maintain the status of the protection conditions, operation conditions and instrument errors.

The PRP Series have a number of register groups:

- Questionable Status Register Group
- Standard Event Status Register Group
- Operation Status Register Group
- Status Byte Register
- Service Request Enable Register
- Service Request Generation
- Error Queue
- Output Buffer

The next page shows the structure of the Status registers.

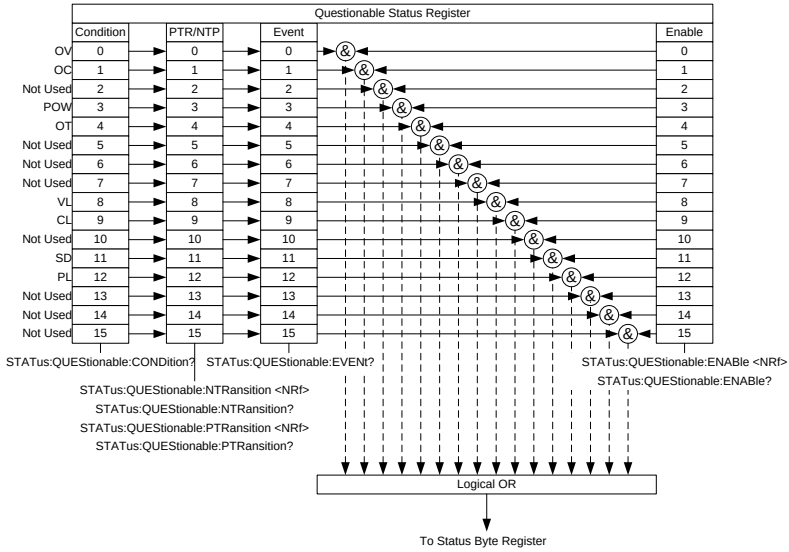
The Status Registers



Questionable Status Register Group

Overview

The Questionable Status Register Group indicates if any protection modes or limits have been tripped.



Bit Summary

Event	Bit #	Bit Weight
OV (Over-Voltage) Over voltage protection has been tripped	0	1
OC (Over-Current) Over current protection has been tripped	1	2
POW (AC Power Off) AC power switch is off	3	8

	OT (Over Temperature) Over temperature protection has been tripped	4	16
	VL (Voltage Limit) Voltage limit has been reached	8	256
	CL (Current Limit) Current limit has been reached	9	512
	SD (Shutdown Alarm)	11	2048
	PL (Power-Limit)	12	4096

Condition Register

The Questionable Status Condition Register indicates the status of the power supply. If a bit is set in the Condition register, it indicates that the event is true. Reading the condition register does not change the state of the condition register.

PTR/NTR Filters

The PTR/NTR (Positive/Negative transition) register determines the type of transition conditions that will set the corresponding bit in the Event Registers. Use the Positive transition filter to view events that change from false to positive, and use the negative transition filter to view events that change from positive to negative.

Positive Transition	0→1
Negative Transition	1→0

Event Register

The PTR/NTR Register will dictate the type of transition conditions will set the corresponding bits in the Event Register. If the Event Register is read, it will be cleared to 0.

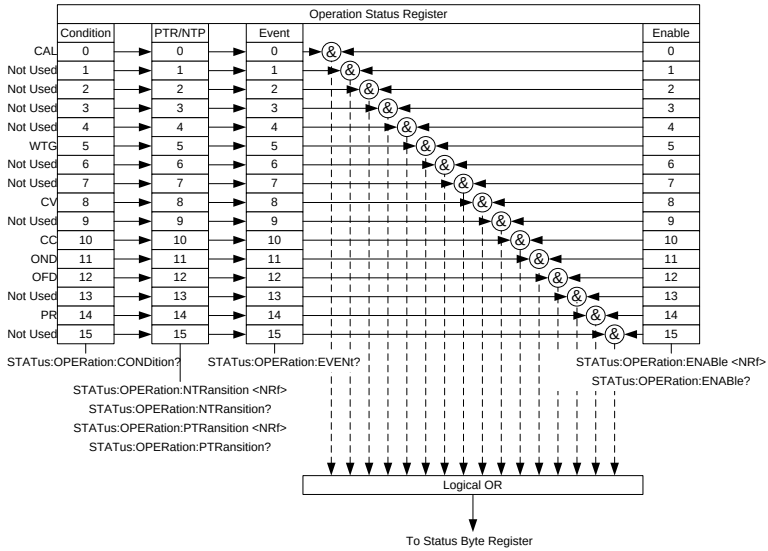
Enable Register

The Enable register determines which Events in the Event Register will be used to set the QUES bit in the Status Byte Register.

Operation Status Register Group

Overview

The Operation Status Register Group indicates the operating status of the power supply.



Bit Summary

Event	Bit #	Bit Weight
CAL (Calibration mode) Indicates if the PRP is in calibration mode.	0	1
WTG (Waiting for trigger) Indicates if the PRP is waiting for a trigger.	5	32
CV (Constant voltage mode) Indicates if the PRP is in CV mode.	8	256

	CC (Constant current mode) Indicates if the PRP is in CC mode.	10	1024
	OND (Output ON Delay) Indicates if Output ON delay time is active	11	2048
	OFD (Output OFF Delay) Indicates if Output OFF delay time is active	12	4096
	PR (Program Running) Indicates if a Test is running	13	8192

Condition Register	The Operation Status Condition Register indicates the operating status of the power supply. If a bit is set in the Condition register, it indicates that the event is true. Reading the condition register does not change the state of the condition register.
PTR/NTR Filters	The PTR/NTR (Positive/Negative transition) register determines the type of transition conditions that will set the corresponding bit in the Event Registers. Use the Positive transition filter to view events that change from false to positive, and use the negative transition filter to view events that change from positive to negative.

Positive Transition	0→1
Negative Transition	1→0

Event Register	The PTR/NTR Register will dictate the type of transition conditions will set the corresponding bits in the Event Register. If the Event Register is read, it will be cleared to 0.

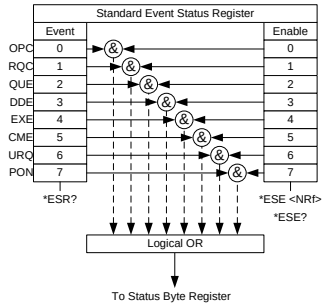
Enable Register

The Enable register determines which registered Events in the Event Register will be used to set the OPER bit in the Status Byte Register.

Standard Event Status Register Group

Overview

The Standard Event Status Register Group indicates if any errors have occurred. The bits of the Event register are set by the error event queue.



Bit Summary

Event	Bit #	Bit Weight
OPC (Operation complete) The OCP bit is set when all selected pending operations are complete. This bit is set in response to the *OPC command.	0	1
RQC (Request control)	1	2

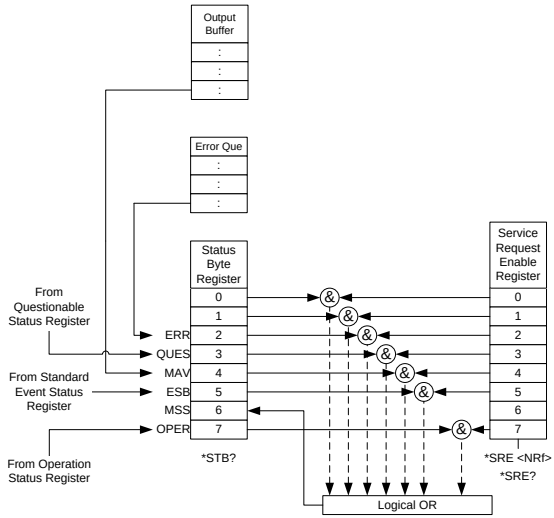
	QUE (Query Error) The Query Error bit is set in response to an error reading the Output Queue. This can be caused by trying to read the Output Queue when there is no data present.	2	4
	DDE (Device Dependent Error) Device specific error.	3	8
	EXE (Execution Error) The EXE bit indicates an execution error due to one of the following: illegal command parameter, parameter out of range, invalid parameter, the command didn't execute due to an overriding operation condition.	4	16
	CME (Command Error) The CME bit is set when a syntax error has occurred. The CME bit can also be set when a <GET> command is received within a program message.	5	32
	URQ (User Request)	6	64
	PON (Power On) Indicates the power is turned on.	7	128

Event Register	Any bits set in the event register indicate that an error has occurred. Reading the Event register will reset the register to 0.
Enable Register	The Enable register determines which Events in the Event Register will be used to set the ESB bit in the Status Byte Register.

Status Byte Register & Service Request Enable Register

Overview

The Status Byte register consolidates the status events of all the status registers. The Status Byte register can be read with the *STB? query and can be cleared with the *CLS command.



Bit Summary

Event	Bit #	Bit Weight
ERR (Error Event/Queue) If data is present in the Error queue, the ERR bit will be set.	2	4
QUES (Questionable Status Register) The summary bit for the Questionable Status Register group.	3	8
MAV (Message Available) This is set when there is data in the Output Queue waiting to be read.	4	16

	(ESB) Event Summary Bit. The ESB is the summary bit for the Standard Event Status Register group.	5	32
	MSS Bit The MSS Bit is the summary of the Status Byte Register and Service Request register (bits 1-5, 7). This will be set to 1.	6	64
	OPER (Operation Status Register) OPER bit is the summary bit for the Operation Status Register Group.	7	128

Status Byte Register	Any bits set in the Status byte register acts as a summary register for all the three other status registers and indicates if there is a service request, an error in the Error Queue or data in the Output Queue. Reading the Status Byte register will reset the register to 0.
Service Request Enable Register	The Service Request Enable Register controls which bits in the Status Byte Register are able to generate service requests.

Error List

Command Errors

Overview

An <error/event number> in the range [E-199 , -100] indicates that an IEEE 488.2 syntax error has been detected by the instrument's parser. The occurrence of any error in this class shall cause the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1) to be set. One of the following events has occurred:

- An IEEE 488.2 syntax error has been detected by the parser. That is, a controller-to-device message was received which is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates the device listening formats or whose type is unacceptable to the device.
- An unrecognized header was received. Unrecognized headers include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

Events that generate command errors shall not generate execution errors, device-specific errors, or query errors; see the other error definitions in this chapter.

Error Code	Description
E-100 Command Error	This is the generic syntax error for devices that cannot detect more specific errors. This code indicates only that a Command Error as defined in IEEE 488.2,11.5.1.1.4 has occurred.
E-102 Syntax error	An unrecognized command or data type was encountered; for example, a string was received when the device does not accept strings.
E-103 Invalid separator	The parser was expecting a separator and encountered an illegal character; for example, the semicolon was omitted after a program message unit, MEAS:VOLT:DC?:MEASCURR:DC?
E-104 Data type error	The parser recognized a data element different than one allowed; for example, numeric or string data was expected but block data was encountered.
E-108 Parameter not allowed	More parameters were received than expected for the header; for example, the KLOCk command only accepts one parameter, so receiving SYSTem:KLOCk 1,0 is not allowed.
E-109 Missing parameter	Fewer parameters were recieved than required for the header; for example, the KLOCk command requires one parameter, so receiving KLOCk is not allowed.
E-111 Header separator error	A character which is not a legal header separator was encountered while parsing the header; for example, no white space followed the header, thus APPL5,1 is an error.

E-112 Program mnemonic too long	The header contains more that twelve characters (see IEEE 488.2, 7.6.1.4.1).
E-113 Undefined header	The header is syntactically correct, but it is undefined for this specific device; for example, *XYZ is not defined for any device.
E-114 Header suffix out of range	The value of a numeric suffix attached to a program mnemonic, see Syntax and Style section 6.2.5.2, makes the header invalid.
E-115 Unexpected number of parameters	The number of parameters received does not correspond to the number of parameters expected. This is typically due an inconsistency with the number of instruments in the selected group.
E-120 Numeric data error	This error, as well as errors -121 through -129, are generated when parsing a data element which appears to be numeric, including the non-decimal numeric types. This particular error message should be used if the device cannot detect a more specific error.
E-121 Invalid character in number	An invalid character for the data type being parsed was encountered; for example, an alpha in a decimal numeric or a “9" in octal data.
E-128 Numeric data not allowed	A legal numeric data element was received, but the device does not accept one in this position for the header.
E-131 Invalid suffix	The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.

E-141 Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
E-148 Character data not allowed	A legal character data element was encountered where prohibited by the device.
E-151 Invalid string data	A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2); for example, an END message was received before the terminal quote character.
E-158 String data not allowed	A string data element was encountered but was not allowed by the device at this point in parsing.
E-160 Block data error	This error, as well as errors E-161 through E-169, are generated when parsing a block data element. This particular error message should be used if the device cannot detect a more specific error.
E-161 Invalid block data	A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2); for example, an END message was received before the length was satisfied.
E-168 Block data not allowed	A legal block data element was encountered but was not allowed by the device at this point in parsing.
E-178 Expression data not allowed	A legal expression data was encountered but was not allowed by the device at this point in parsing.

Execution Errors

Overview

An <error/event number> in the range [-299 , -200] indicates that an error has been detected by the instrument's execution control block. The occurrence of any error in this class shall cause the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1) to be set. One of the following events has occurred:

- A <PROGRAM DATA> element following a header was evaluated by the device as outside of its legal input range or is otherwise inconsistent with the device's capabilities.
- A valid program message could not be properly executed due to some device condition.

Execution errors shall be reported by the device after rounding and expression evaluation operations have taken place. Rounding a numeric data element, for example, shall not be reported as an execution error. Events that generate execution errors shall not generate Command Errors, device-specific errors, or Query Errors; see the other error definitions in this section.

Error Code	Description
E-200 Execution error	This is the generic syntax error for devices that cannot detect more specific errors. This code indicates only that an Execution Error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

E-201 Invalid while in local	Indicates that a command is not executable while the device is in local due to a hard local control (see IEEE 488.2, 5.6.1.5); for example, a device with a rotary switch receives a message which would change the switches state, but the device is in local so the message can't be executed.
E-203 Command protected	Indicates that a legal password-protected program command or query could not be executed because the command was disabled.
E-211 Trigger ignored	Indicates that a GET, *TRG, or triggering signal was received and recognized by the device but was ignored because of device timing considerations; for example, the device was not ready to respond. Note: a DT0 device always ignores GET and treats *TRG as a Command Error.
E-213 Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
E-220 Parameter error	Indicates that a program data element related error occurred. This error message should be used when the device cannot detect the more specific errors described for errors E-221 through E-229.
E-221 Settings conflict	Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2, 6.4.5.3 and 11.5.1.1.5.).

E-222 Data out of range	Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the device (see IEEE 488.2, 11.5.1.1.5.).
E-224 Illegal parameter value	Used where exact value, from a list of possible, was expected.

Device Specific Errors

Overview	An <error/event number> in the range [-399 , -300] or [1 , 32767] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error; some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set. The meaning of positive error codes is device-dependent and may be enumerated or bit mapped; the <error message>string for positive error codes is not defined by SCPI and available to the device designer. Note that the string is not optional; if the designer does not wish to implement a string for a particular error, the null string should be sent (for example, 42,""). The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set. Events that generate device-specific errors shall not generate command errors, execution errors,

	or query errors; see the other error definitions in this section.

Error Code	Description
E-310 System error	Indicates that some error, termed "system error" by the device, has occurred. This code is device-dependent.
E-320 Storage fault	Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.

Query Errors

Overview

An <error/event number> in the range [-499 , -400] indicates that the output queue control of the instrument has detected a problem with the message exchange protocol described in IEEE 488.2, chapter 6. The occurrence of any error in this class shall cause the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1) to be set. These errors correspond to message exchange protocol errors described in IEEE 488.2, section 6.5. One of the following is true:

- An attempt is being made to read data from the output queue when no output is either present or pending;
- Data in the output queue has been lost.

Events that generate query errors shall not generate command errors, execution errors, or device-specific errors; see the other error definitions in this section.

Error Code	Description
E-400 Query error	This is the generic query error for devices that cannot detect more specific errors. This code indicates only that a Query Error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

APPENDIX

PRP Default Settings

The following default settings are the factory configuration settings for the power supply (Function settings/Test settings).

Initial Settings	Default Setting	
Output	Off	
LOCK	0 (Disabled)	
Voltage	0V	
Current	0A	
OVP	Maximum	
OCP	Maximum	
Normal Function Settings	Setting	Default Setting
Output ON delay time	F-01	0.00s
Output OFF delay time	F-02	0.00s
V-I mode slew rate select	F-03	0 = CV high speed priority
Rising voltage slew rate	F-04	40V/s (PRP 20-XX))
Falling voltage slew rate	F-05	40V/s (PRP 20-XX)
Rising current slew rate	F-06	20.00A/s (PRP 20-10) 40.00A/s (PRP 20-20)
Falling current slew rate	F-07	20.00A/s (PRP 20-10) 40.00A/s (PRP 20-20)
Internal resistance setting	F-08	0.000Ω
Bleeder circuit control	F-09	1 = ON
Buzzer ON/OFF control	F-10	1 = ON
Measurement Average Setting	F-17	0 = Low
Lock Mode	F-19	0 = Panel lock: allow output off
RS485	Setting	Default Setting
RS485 Control	F-70	0 = Disable

Baud Rate	F-71	7 = 115200
Data Bits	F-72	1 = 8 bits
Parity	F-73	0 = None
Stop Bit	F-74	0 = 1 bit
Termination Character	F-75	0 = LF (Line feed, 0x0A)
Address	F-76	8
Power On Configuration	Setting	Default Setting
CV Control	F-90	0 = Panel control (local)
CC Control	F-91	0 = Panel control (local)
Power-ON Output	F-92	0 = OFF at startup
Master/Slave	F-93	0 = Master/Local
External Out Logic	F-94	0 = High ON
Power Switch trip	F-95	0 = Enable

Error Messages & Messages

The following error messages or messages may appear on the PRP screen during operation.

Error Messages	Description
Err 001	USB Mass Storage is not present
Err 002	No (such)file in USB mass storage
Err 003	Empty memory location
Err 004	File access error
Err 901	Keyboard CPLD error
Err 902	Analog CPLD error
Err 920	The ADC is over range for calibration
Err 921	The DAC is over range for calibration
Err 922	Point invalid for calibration

Messages	Description
MSG 001	External control of output. Output off (F-94=0, High=on)
MSG 002	External control of output. Output off (F-94=1, Low=on)
MSG 003	F-93 is not zero. Unable to calibrate.
LOCK F-19	F-19 is not zero. Unable to turn the output on.

LED Display Format

Use the following table to read the LED display messages.

0	1	2	3	4	5	6	7	8	9	A	B	C	D
													
E	F	G	H	I	J	K	L	M	N	O	P	Q	R
													
S	T	U	V	W	X	Y	Z	(	)	+	-	,	
													

INDEX