Programmable High Precision DC Power Supply

PPX Series

PROGRAMMING MANUAL

Rev. A

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

The information in this manual was correct at the time of printing. However, Good Will continues to improve products and reserves the rights to change specification, equipment, and maintenance procedures at any time without notice.

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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 PPX 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 PPX.
- Avoid severe impact or rough handling that leads to damaging the PPX.
- Do not discharge static electricity to the PPX.
- Use only mating connectors, not bare wires, for the terminals.
- Do not disassemble the PPX unless you are qualified.

Power Supply

CAUTION

- AC Input Voltage: 100Vac/120Vac/220Vac/240Vac, 50Hz/60Hz, single phase
- Frequency: 47Hz to 63Hz
- Before connecting the power plug to an AC line outlet, make sure the voltage selector switches of the bottom panel in the correct position.

WARNING

- Disconnect power cord and test leads before replacing fuse.
- The fuse specification is as following:

FUSE	LINE
250V T3.15A	100V~ 120V~
250V T1.6A	220V~ 240V~

- To avoid electrical shock connect the protective grounding conductor of the AC power cord to an earth ground.

Cleaning the PPX	• 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%~ 80% (no condensation) • Altitude: < 2000m • Temperature: 0°C to 40°C (Pollution Degree) EN61010-1:2010 specifies the pollution degrees and their requirements as follows. The PPX 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: -20°C to 70°C • Relative Humidity: 20 to 85%(no condensation)
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.

GETTING STARTED

This chapter describes the power supply in a nutshell, including its main features and front / rear panel introduction. After going through the overview, please read the theory of operation to become familiar with the operating modes, protection modes and other safety considerations.

PPX Series Overview

Series lineup

The PPX series consists of 6 models, covering a number of different current, voltage and power capacities:

Model name	Operation Voltage	Operation Current	Rated Power
PPX-1005	0-10V	0-5A	50W
PPX-2002	0-20V	0-2A	40W
PPX-2005	0-20V	0-5A	100W
PPX-3601	0-36V	0-1A	36W
PPX-3603	0-36V	0-3A	108W
PPX-10H01	0-100V	0-1A	100W

Main Features

Features

- 2.4" TFT-LCD Panel.
- Preset memory function.
- Output ON/OFF delay function.
- CV, CC priority start function. (prevents overshoot with output ON)
- Adjustable voltage and current slew rates.
- Bleeder circuit ON/OFF setting. (to prevent over-discharging of batteries)
- OVP, OCP, AC Alarm and OTP protection.
- Supports test sequence.
- Web server monitoring and control. (The function is activated when connecting to LAN Interface)
- Analog monitor output.

	• Remote sensing to compensate for voltage drop in load leads. • Support K type thermocouple temperature measurement. • With 4 measuring currents and Manual / Auto shift function.
Interface	• Built-in USB, RS-232/485 and LAN interface. • External analog control function. • Optional GPIB interface.

Accessories

Before using the PPX power supply unit, check the package contents to make sure all the standard accessories are included.

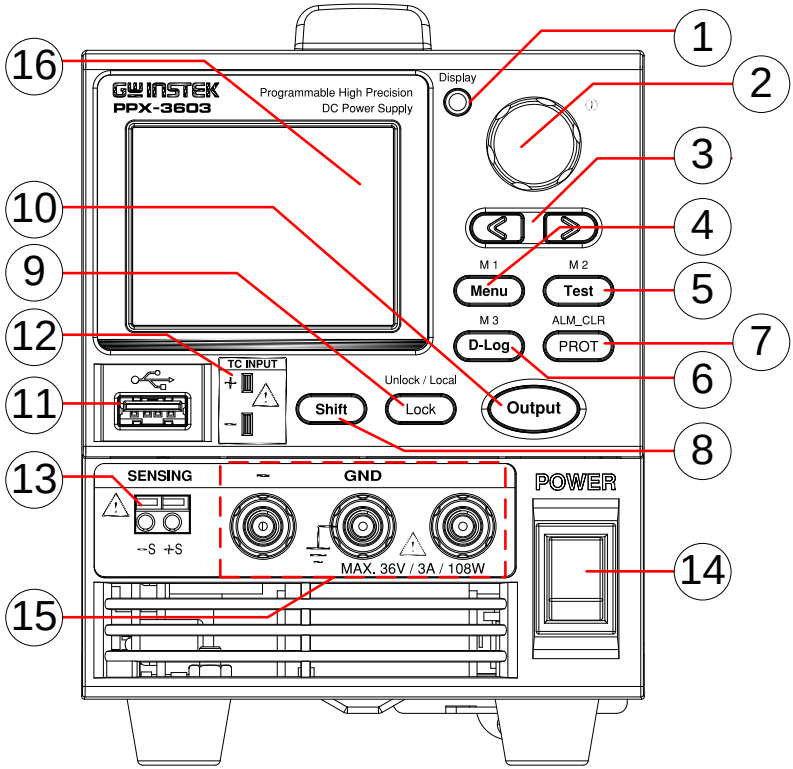
Standard Accessories	Part number	Description	Qty.
	CD-ROM	User manual, Programming manual	1
		Power Cord	1
	GTL-104A	Test leads for PPX-1005/PPX-2005/PPX-3603 (Binding Posts Terminal), 1m, 10A	1
	GTL-105A	Test leads for PPX-2002/PPX-3601, 1m, 3A	1
		Short Bar (Binding Posts Terminal)	1
	GTL-204A	Test leads for PPX-1005/PPX-2005/PPX-3603 (European Type Jack Terminal), 1m, 10A	1
	GTL-203A	Test leads for PPX-2002/PPX-3601/PPX-10H01 (European Type Jack Terminal), 1m, 3A	1
	GTL-201A	Ground lead for European Type Jack Terminal	1

Optional Accessories	Part number	Description
	GRA-441-J	Rack for PPX (JIS)
	GRA-441-E	Rack for PPX (EIA)
	GTL-205A	Temperature probe adaptor with thermocouple K type
	GTL-246	USB Cable (USB 2.0 Type A- Type B Cable, 4P)
	GTL-258	GPIB Cable, 2000mm
	GTL-259	RS232 cable with DB9 connector to RJ45
	GTL-260	RS485 cable with DB9 connector to RJ45
	GTL-262	RS485 slave cable

Factory Installed Options	Part number	Description
	Option 1	GPIB interface

Appearance

Front Panel



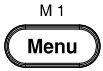
1. Display Button

Used to switch among 4 different display modes.

2. Knob Key

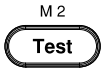
Used to navigate menu, and to configure or confirm voltage/current/time values, among others. Also, the indicator on the upper-right corner shows current state and power mode.

3. Left/Right Arrow Keys  Used to select a parameter number in the Function settings. Also the left arrow key can be used as backspace.

4. Menu Button 

Used to enter the Menu page.

M1 Button (+Shift) Used to recall the M1 setup.

5. Test Button 

Used to run customized test sequence.

M2 Button (+Shift) Used to recall the M2 setup.

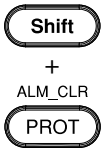
6. D-Log Button 

Used to run data log function.

M3 Button (+Shift) Used to recall the M3 setup.

7. PROT Button 

Used to set OVP, OCP and UVL protecting functions.

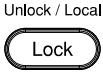
ALM_CLR Button 

(+Shift) Used to release protection functions that have been activated. The tripped protection alarms include the following: OVP Alarm, OCP Alarm, OTP Alarm, AC Alarm, Sense Alarm, WDOG Alarm, Ah CAP Alarm, Wh CAP Alarm, TEMP Short Alarm, TEMP Monitor Alarm.

8. Shift Button 

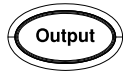
Used to enable the functions that are written in blue characters above certain buttons.

9. Lock Button Used to lock all front panel buttons other than the Output Button.



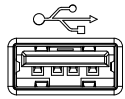
Unlock/Local Button (+Shift) Used to unlock the front panel buttons or it switches to local mode.

10. Output Button



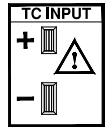
Used to turn the output on or off.

11. USB A Port



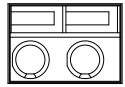
USB A port for data transfer, loading test scripts and firmware update.

12. TC Input



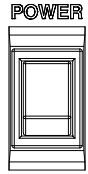
Terminal to connect the K type thermocouple cable for temperature measurement.

13. Sensing Terminal



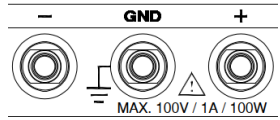
Terminal to connect the sensing cables, which compensate voltage drop occurred in load leads.

14. Power Switch



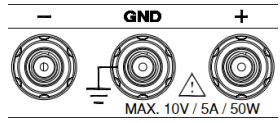
Used to turn the power on/off.

15. Output terminal



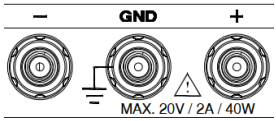
DC output terminal for PPX is European Type Jack Terminal.

PPX-10H01 the max. output is 100V/1A/100W



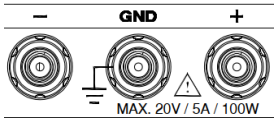
DC output terminal for PPX is Binding Posts Terminal or European Type Jack Terminal.

PPX-1005 the max. output is 10V/5A/50W



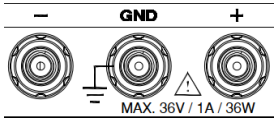
DC output terminal for PPX is Binding Posts Terminal or European Type Jack Terminal.

PPX-2002 the max. output is 20V/2A/40W



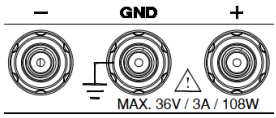
DC output terminal for PPX is Binding Posts Terminal or European Type Jack Terminal.

PPX-2005 the max. output is 20V/5A/100W



DC output terminal for PPX is Binding Posts Terminal or European Type Jack Terminal.

PPX-3601 the max. output is 36V/1A/36W

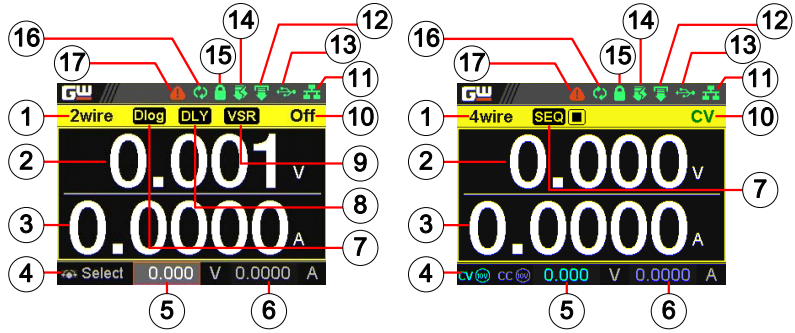


DC output terminal for PPX is Binding Posts Terminal or European Type Jack Terminal.

PPX-3603 the max. output is 36V/3A/108W

16 Display Area The display area shows set values, output values and parameter settings.

Display Area



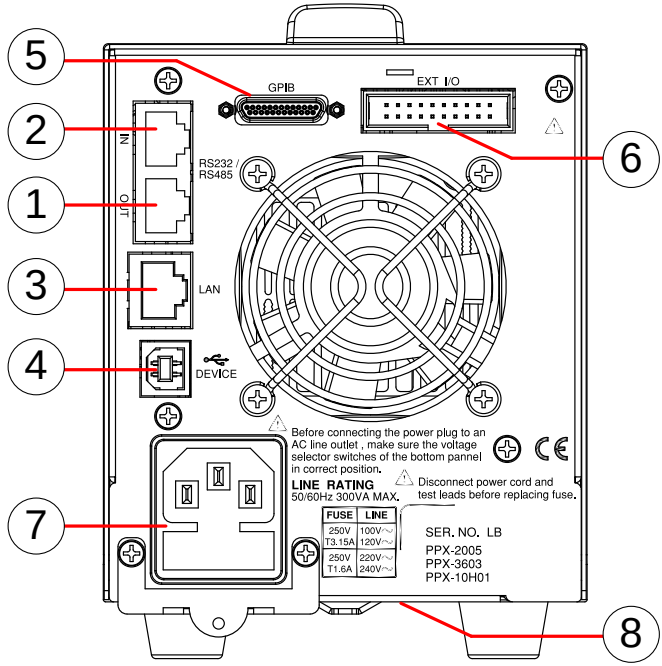
1. 2Wire/4Wire — 2-wire or 4-wire indicator.
2. Voltage Meter — Displays the voltage.
3. Current Meter — Displays the current.
4. V/A Set Guidance — The scrolling symbol indicates to select between V and A set via scrolling knob key.

   External CC & CV Control — When the external CC or CV control is activated, the indicator(s) will be shown.
5. V Set — Manually sets voltage.
6. I(A) Set — Manually sets current.
7. Dlog Icon — When Data Logger is enabled, the icon will be shown accordingly. Note that when SEQ appears, the icon will be faded out.

   SEQ — When Sequence function is turned On, the icon will be shown accordingly.

8.	DLY Icon	When Output On/Off Dly is enabled, the icon will be shown accordingly. Note that when SEQ appears, the icon will be faded out.
9.	VSR/ISR Icon	When CV/CC Slew Rate Priority (CVLS/CCLS) is activated, the icon will be shown. Note that when SEQ appears, the icon will be faded out.
10.	CC/CV/UR indicator	It shows when constant voltage or constant current mode is ongoing. However, when output is unregulated, which means neither in CV mode nor CC mode, it shows UR instead. If it is not under power output, it simply shows Off.
11.	LAN Indicator	When PPX series connects to LAN network, the icon will be shown.
12.	Remote Control Indicator	When remote control (USB/LAN/GPIB, UART) is underway, the icon will be shown.
13.	USB Indicator	When USB disk is inserted into the front panel of PPX series, the icon will be shown.
14.	External Output Indicator	When external output enable is turned On, the icon will be shown.
15.	Lock Indicator	When the lock mode is activated, the icon will be shown.
16.	Communication Monitor Indicator	When communication monitor is enabled, the icon will be shown.
17.	Error Indicator	When error occurs from command of remote control, the icon will be shown.

Rear Panel



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

2. Remote-IN Two different types of cables can be used for RS232 or RS485-based remote control.
   PSU-232: RS232 cable with DB9 connector kit.
   PSU-485: RS485 cable with DB9 connector kit.

3. LAN Ethernet port for controlling the PPX remotely

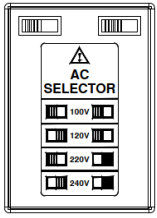
4. USB USB port for controlling the PPX remotely.

5. GPIB — GPIB connector for units equipped with IEEE programming option. (Factory Installed Options)

6. EXT I/O — External analog remote control connector.

7. Line Voltage Input — AC inlet.

8. AC Select Switch



The AC selector is located at the bottom side of the unit.

Switch Voltage to 100V, 120V, 220V or 240V.

Theory of Operation

The theory of operation chapter describes the basic principles of operation, protection modes and important considerations that must be taken into account before use.

Operating Description

Background

The PPX power supplies are regulated DC power supplies with a stable voltage and current output. These operate within a switch automatically between constant voltage and constant current according to changes in the load.

Suitable supply cord set for use with the equipment:

- Mains plug: shall be national approval
- Mains connector: C13 type
- Cable:
  1. Length of power supply cord: less than 3m
  2. Cross-section of conductors: at least 0.75mm^2
  3. Cord type: shall meet the requirements of IEC 60227 or IEC 60245 (e.g.: H05VV-F, H05RN-F)

Caution

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

CC and CV Mode

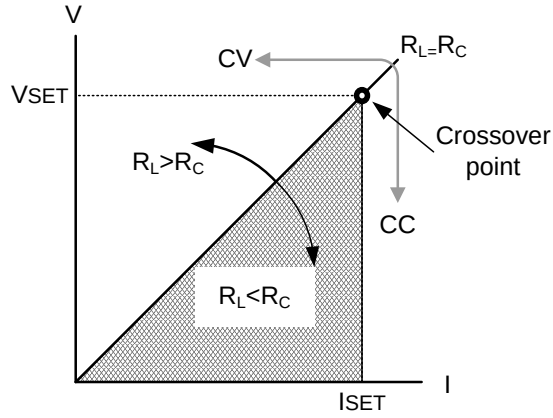
CC and CV mode Description

When the power supply is operating in constant current mode (CC) a constant current will be supplied to the load. When in constant current mode the voltage output can vary, whilst the current remains constant. When the load resistance increases to the point where the set current limit (I_{SET}) can no longer be sustained the power supply switches to CV mode. The point where the power supply switches modes is the crossover point.

When the power supply is operating in CV mode, a constant voltage will be supplied to the load, whilst the current will vary as the load varies. At the point that the load resistance is too low to maintain a constant voltage, the power supply will switch to CC mode and maintain the set current limit.

The conditions that determine whether the power supply operates in CC or CV (V_{SET}), the load resistance (R_L) and the critical resistance (R_C). The critical resistance is determined by V_{SET}/I_{SET}. The power supply will operate in CV mode when the load resistance is greater than the critical resistance. This means that the voltage output will be equal to the V_{SET} voltage but the current will be less than I_{SET}. If the load resistance is reduced to the point that the current output reaches the I_{SET} level, the power supply switches to CC mode.

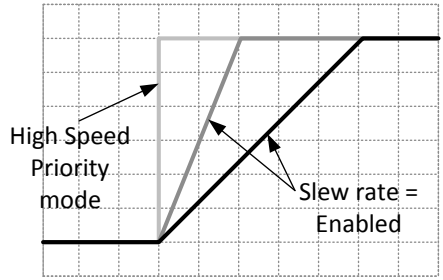
Conversely the power supply will operate in CC mode when the load resistance is less than the critical resistance. In CC mode the current output is equal to I_{SET} and the voltage output is less than V_{SET}.



Slew Rate

Theory

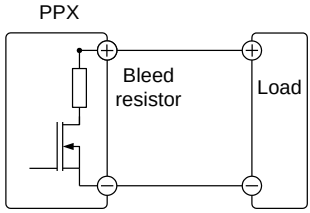
The PPX has selectable slew rates for CC and CV mode. This gives the PPX power supply the ability to limit the current/voltage draw of the power supply. Slew rate settings are divided into High Speed Priority and Slew Rate Priority. High speed priority mode will use the fastest slew rate for the instrument. Slew Rate Priority mode allows for user adjustable slew rates for CC or CV mode. The rising and falling slew rate can be set independently.



Bleeder Control

Background

The PPX DC power supplies employ a bleed resistor in parallel with the output terminals.



Bleed resistors are designed to dissipate the power from the power supply filter capacitors when power is turned off and the load is disconnected. Without a bleed resistor, power may remain charged on the filter capacitors for some time and be potentially hazardous.

In addition, bleed resistors also allow for smoother voltage regulation of the power supply as the bleed resistor acts as a minimum voltage load.

The bleed resistance can be turned on or off using the configuration settings.

⚠ Note	By default the bleed resistance is on. For battery charging applications, be sure to turn the bleed resistance off as the bleed resistor can discharge the connected battery when the unit is off.

Alarms

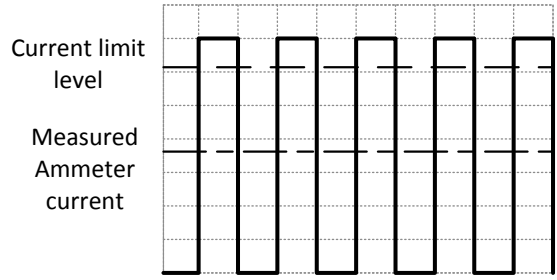
The PPX power supplies have a number of protection features. When one of the protection alarms is set, the ALM icon on the display will be lit.

OVP	Over voltage protection (OVP) prevents a high voltage from damaging the load. This alarm can be set by the user.
OCP	Over current protection prevents high current from damaging the load. This alarm can be set by the user.
UVL	Under voltage limit. This function sets a minimum voltage setting level for the output. It can be set by the user.
OTP	Over temperature protection protect the instrument from overheating
AC ALARM	When AC input voltage or frequency is abnormal or beyond the AC power range under operation, the alarm will be generated.
SENSE ALARM	This alarm function is activated when real output voltage is larger than sense output voltage.
Alarm output	Alarms are output via the analog control connector. The alarm output is an isolated open-collector photo coupler output.

Considerations

The following situations should be taken into consideration when using the power supply.

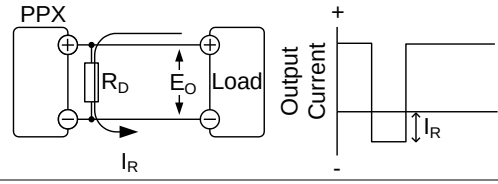
Inrush current	When the power supply switch is first turned on, an inrush current is generated. Ensure there is enough power available for the power supply when first turned on, especially if a number of units are turned on at the same time.
⚠ Caution	Cycling the power on and off quickly can cause the inrush current limiting circuit to fail as well as reduce the working life of the input fuse and power switch.
Pulsed or Peaked loads	When the load has current peaks or is pulsed, it is possible for the maximum current to exceed the mean current value. The PPX power supply ammeter only indicates mean current values, which means for pulsed current loads, the actual current can exceed the indicated value. For pulsed loads, the current limit must be increased, or a power supply with a greater capacity must be chosen. As shown below, a pulsed load may exceed the current limit and the indicated current on the power supply ammeter.



Reverse Current: Regenerative load

When the power supply is connected to a regenerative load such as a transformer or inverter, reverse current will feed back to the power supply. The PPX power supply cannot absorb reverse current. For loads that create reverse current, connect a resistor in parallel (dummy load) to the power supply to bypass the reverse current. To calculate the resistance for the dummy resistor, R_D, first determine the maximum reverse current, I_R, and determine what the output voltage, E_O, will be.

$R_D(\Omega) \leq E_O(V) \div I_R(A)$



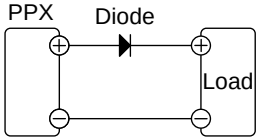
Note

The current output will decrease by the amount of current absorbed by the resistor.

Ensure the resistor used can withstand the power capacity of the power supply/load.

Reverse Current: Accumulative energy.

When the power supply is connected to a load such as a battery, reverse current may flow back to the power supply. To prevent damage to the power supply, use a reverse-current-protection diode in series between the power supply and load.



CAUTION

Ensure the reverse withstand voltage of the diode is able to withstand 2 times the rated output voltage of the power supply and the forward current capacity can withstand 3 to 10 times the rated output current of the power supply.

Ensure the diode is able to withstand the heat generated in the following scenarios.

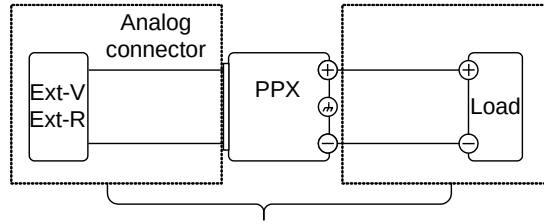
When the diode is used to limit reverse voltage, remote sensing cannot be used.

Grounding

The output terminals of the PPX power supplies are isolated with respect to the protective grounding terminal. The insulation capacity of the load, the load cables and other connected devices must be taken into consideration when connected to the protective ground or when floating.

Floating

As the output terminals are floating, the load and all load cables must have an insulation capacity that is greater than the isolation voltage of the power supply.



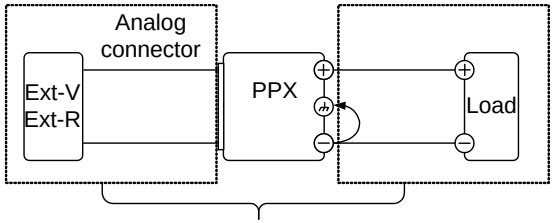
(·····) Insulation capacity ≥ isolation voltage of power supply

WARNING

If the insulation capacity of the load and load cables are not greater than the isolation voltage of the power supply, electric shock may occur.

Grounded output terminal

If the positive or negative terminal is connected to the protective ground terminal, the insulation capacity needed for the load and load cables is greatly reduced. The insulation capacity only needs to be greater than the maximum output voltage of the power supply with respect to ground.



CAUTION

If using external voltage control, do not ground the external voltage terminal as this will create a short circuit.

REMOTE CONTROL

This chapter describes basic configuration of IEEE488.2 based remote control.

Interface Configuration

USB Remote Interface

Configuration

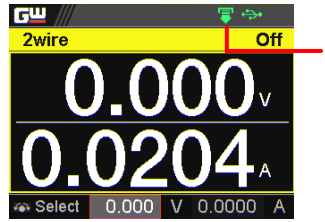
USB Configuration	PC side connector	Type A, host
	PPX side connector	Rear panel Type B, slave
	Speed	1.1 (full speed)
	USB Class	CDC (communications device class)

Steps

1. Connect the USB cable to the rear panel USB B port.

2. Set the USB setting as Auto or Full.

3. The indicator will be shown when a remote connection has been established.

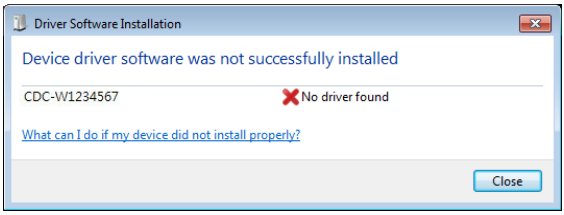


USB CDC Function Check

Background	To test the USB CDC functionality, National Instruments Measurement and Automation Explorer can be used. This program is available on the NI website, www.ni.com., via a search for the VISA Run-time Engine page, or "downloads" at the following URL, http://www.ni.com/visa/
Requirements	Operating System: Windows XP, 7, 8,10

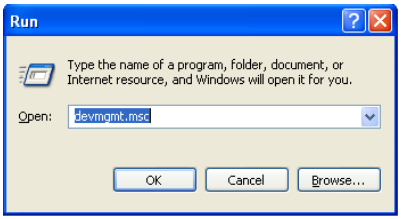
Functionality check

1. In case of Window 7 64 bits, once the USB Cable was connected to PC correctly for a while (around 1 min). It may show below message at the lower right area of display.

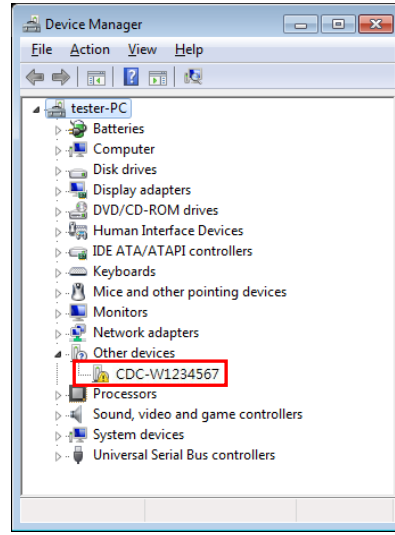


2. Open the "Run" dialog box by pressing and holding the Windows key and then press the R key ("Run").

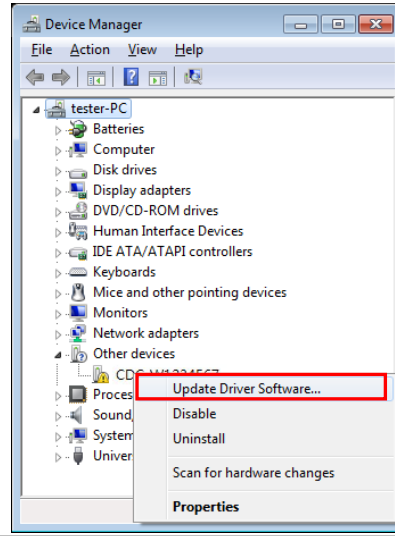
3. Type devmgmt.msc and click "OK".



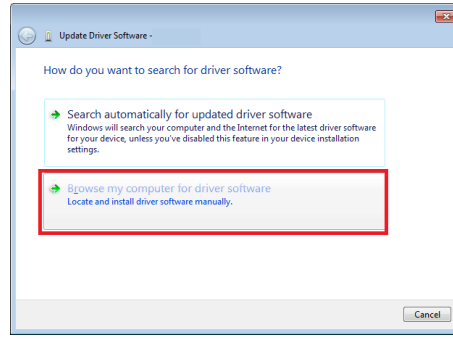
4. The Device Manager will show up CDC-WXXXXXX on “Other Devices”.



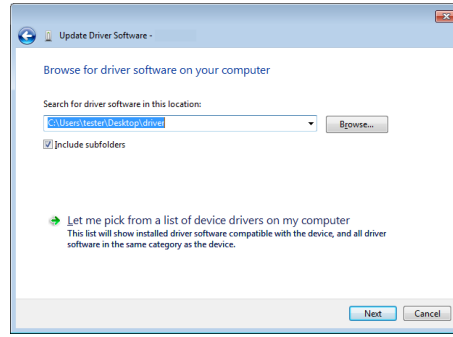
5. Select the CDC-WXXXXXX and click the right button of mouse to "Update Driver Software".



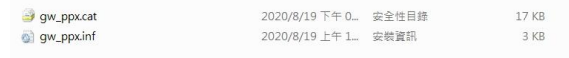
6. Select "Locate and install driver software manually."



7. Indicate the driver folder to the system and then press "Next".



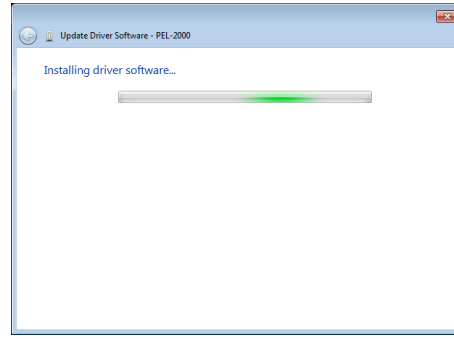
And this folder should consist of below 2 files.



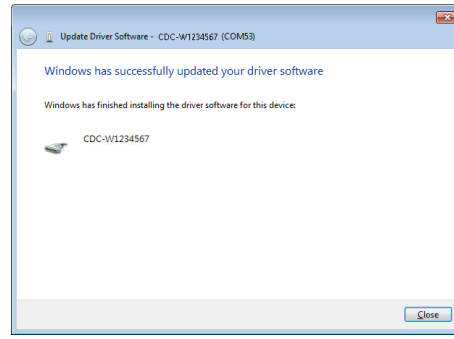
Note

The USB driver of PPX can be downloaded from download area of PPX on the GW Instek website http://www.gwinstek.com/en-global/Support/download

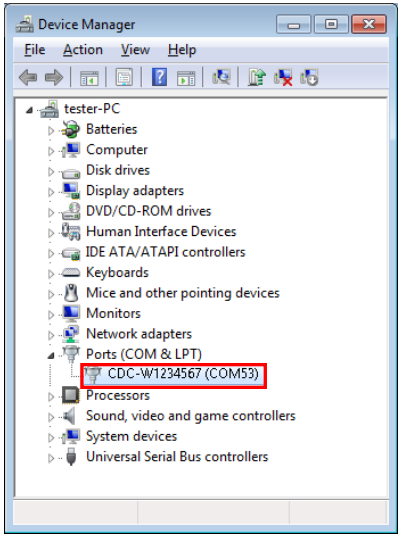
8. Windows 7 will install the driver for a while.



9. If everything works fine, you may get below message. And the COM53 is the USB CDC ACM port of PPX.



10. Double check the "Device Manager". The port should like below.

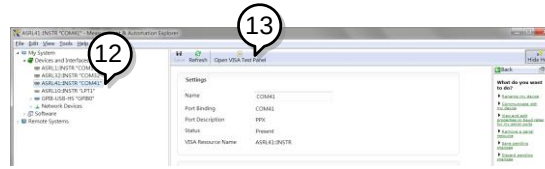


Steps 1~10 are for the USB CDC Driver installation.

11. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:
Start>All Programs>National Instruments>Measurement & Automation

12. From the Configuration panel access; *My System>Devices and Interfaces>Network Devices*

13. Click Open VISA Test Panel.

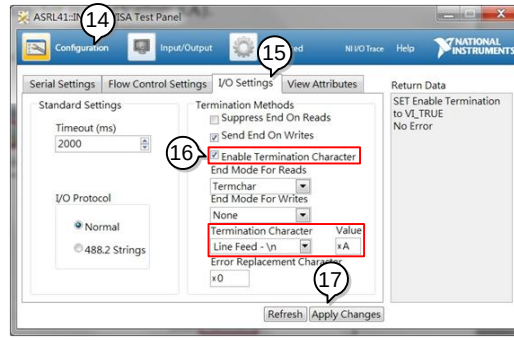


14. Click the Configuration icon,

15. Click on I/O Settings.

16. Make sure the Enable Termination Character check box is checked, and the terminal character is \n (Value: xA).

17. Click Apply Changes.



18. Click the Input/Output icon.

19. Enter *IDN? in the Select or Enter Command dialog box if it is not already.

20. Click the Query button.

21. The *IDN? query will return the Manufacturer, model name, serial number and firmware version in the dialog box.

GW-INSTEK,PPX-10H01,TW123456,V0.A4

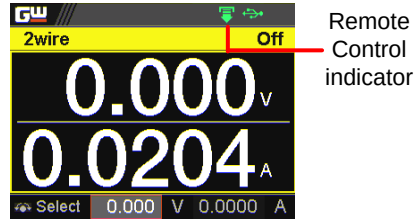
GPIB Remote Interface

Configuration

To use GPIB, the optional GPIB option (GW Instek part number: Option 1) must be installed. This is a factory installed option and cannot be installed by the end-user. Only one GPIB address can be used at a time.

Configure GPIB

1. Ensure the PPX is off before proceeding.
2. Connect the GPIB cable (GW Instek part number: GTL-258) from a GPIB controller to the GPIB port on the PPX.
3. Turn the PPX on.
4. Set the GPIB Address setting per application.
5. The indicator will be shown when a remote connection has been established.



GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

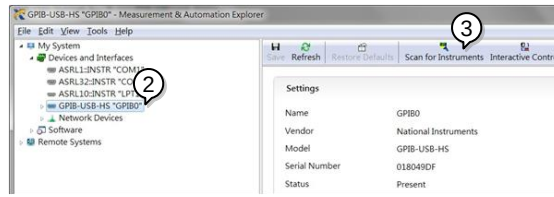
GPIB Function Check

Background	To test the GPIB functionality, National Instruments Measurement and Automation Explorer can be used. This program is available on the NI website, www.ni.com., via a search for the VISA Run-time Engine page, or "downloads" at the following URL, http://www.ni.com/visa/
Requirements	Operating System: Windows XP, 7, 8, 10
Functionality check	1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press: *Start>All Programs>National Instruments>Measurement & Automation*

2. From the Configuration panel access;

   My System>Devices and Interfaces>GPIB

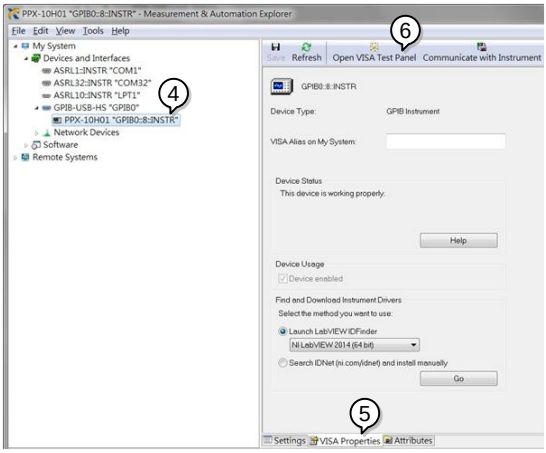
3. Press *Scan for Instruments.*



4. Select the device (GPIB address of PPX) that now appears in the *System*>*Devices and Interfaces* > *GPIB-USB-HS "GPIBX"* node.

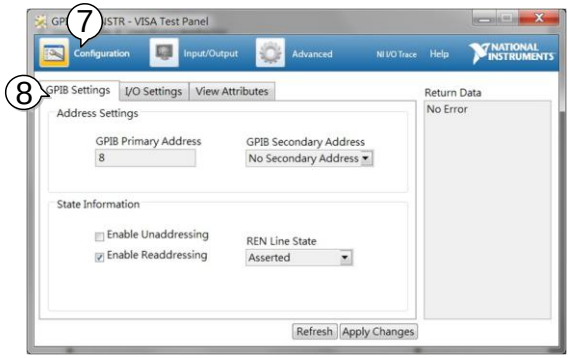
5. Click on the *VISA Properties* tab on the bottom.

6. Click *Open Visa Test Panel*.



7. Click on *Configuration*.

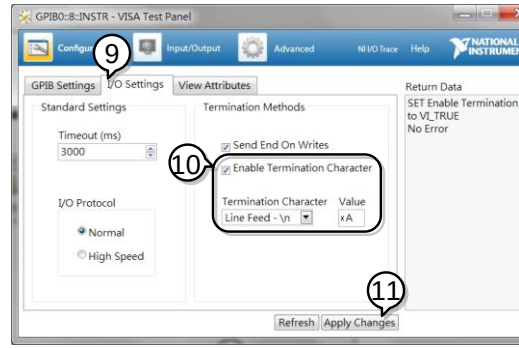
8. Click on the *GPIB Settings* tab and confirm that the GPIB settings are correct.



9. Click on the *I/O Settings* tab.

10. Make sure the *Enable Termination Character* check box is checked, and the terminal character is \n (Value: xA).

11. Click *Apply Changes*.



12. Click on *Input/Output*.

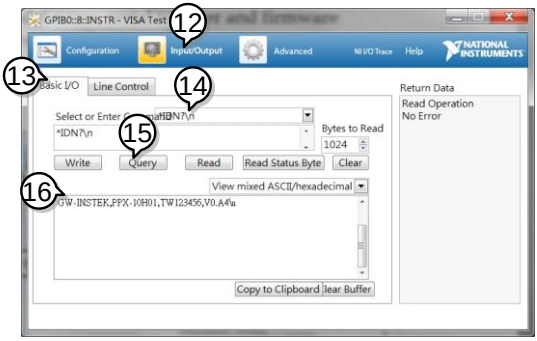
13. Click on the *Basic I/O* tab.

14. Enter *IDN? in the *Select or Enter Command* drop down box.

15. Click *Query*.

16. The *IDN? query will return the Manufacturer, model name, serial number and firmware version in the dialog box.

    GW-INSTEK,PPX-10H01,TW123456,V0.A4



Note

For further details, please see the programming manual, available on the GW Instek web site @ www.gwinstek.com.

UART Remote Interface

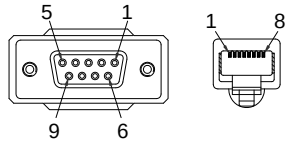
Configure UART

Overview

The PPX uses the IN & OUT ports for UART communication coupled with RS232 (GW Instek part number: GTL-259) or RS485 adapters (GW Instek part number: GTL-260).

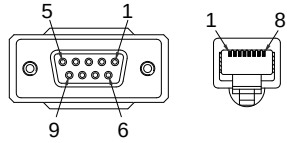
The pin outs for the adapters are shown below.

RS232 cable with DB9 & RJ-45 shielded connectors from GTL-259 connection kit	DB-9 Connector		Remote IN Port		Remarks
	Pin No.	Name	Pin No.	Name	
	Housing	Shield	Housing	Shield	
	2	RX	7	TX	Twisted pair
	3	TX	8	RX	
	5	SG	1	SG	



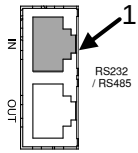
RS485 cable with DB9 & RJ-45 shielded connectors from GTL-260 connection kit

DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
9	TXD -	6	RXD -	Twisted pair
8	TXD +	3	RXD +	
1	SG	1	SG	
5	RXD -	5	TXD -	Twisted pair
4	RXD +	4	TXD +	



Steps

1. Connect the RS232 serial cable or RS485 serial cable to the Remote IN port on the real panel. Connect the other end of the cable to the PC.

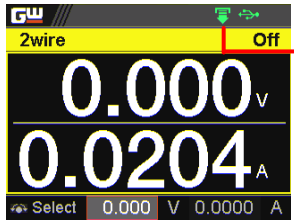


2. Select RS485 or RS232 for Mode setting. Also set UART relevant settings including Baud Rate, Data Bits, Parity, Stop Bits and Address.

Note

When RS232 Mode is selected, the Address setting is not available for assignation.

3. The indicator will be shown when a remote connection has been established.

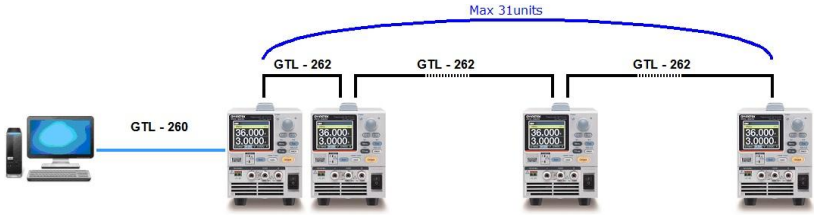


UART Function Check

Functionality check	Invoke a terminal application such as Realterm. To check the COM port No., see the Device Manager in the PC
	Run this query command via the terminal application after the instrument has been configured for UART remote control. *idn? This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format. GW-INSTEK,PPX-10H01,TW123456,V0.A4 Manufacturer: GW-INSTEK Model number : PPX-10H01 Serial number : TW1234567 Firmware version : V0.A4
⚠ Note	For further details, please see the programming manual, available on the GW Instek web site @ www.gwinstek.com.

Multiple Unit Connection

The PPX power supplies can have up to 31 units daisy-chained together using the 8 pin connectors (IN OUT ports) on the rear panel. The first unit in the chain is remotely connected to a PC using GTL-260 (RS485 cable with DB9 connector).Each subsequent unit is daisy-chained to the next using a RS485 local bus.



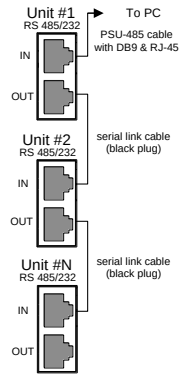
Each unit is assigned a unique address and can then be individually controlled from the host PC.

Multi Unit Connection

Operation

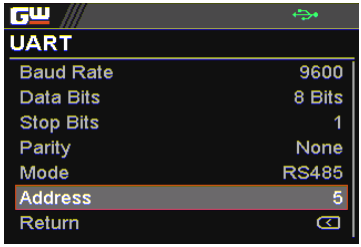
1. Connect the first unit's IN port to a PC using RS485 cable with DB9 & RJ-45.

2. Connect the OUT port on the first unit to the IN port of the second unit using the slave serial link cable (black plug) supplied in the GTL-262 connection kit.



3. Power up all units.

4. Set the addresses and mode of all units using UART menu. It must be a unique address identifier and mode select is RS485.



5. Multiple units can be operated using SCPI commands now. See the programming manual or see the function check below for usage details.

Multiple units Function Check

Functionality check	Invoke a terminal application such as Realterm. To check the COM port No, see the Device Manager in the PC. For this function check, we will assume that the one unit is assigned to address 0, while other is assigned address 5.

ADR 0

OK

*IDN?

GW-INSTEK,PPX-2005,TW123456,V0.A2

VOLT 5

OK

VOLT?

+5.000

ADR is followed by address, which can be 0 to 31 and is used to access the power supply.

Selects the unit with address 0 and returns its identity string. Also, sets its volt as 5 and returns its volt in 5.

ADR 5

OK

*IDN?

GW-INSTEK,PPX-3601,TW654321,V0.A2

VOLT 10

OK

VOLT?

+10.000

ADR is followed by address, which can be 0 to 31 and is used to access the power supply.

Selects the unit with address 5 and returns its identity string. Also, sets its volt as 10 and returns its volt in 10.

Note

All setting commands must return an “OK” response, via a following “Read” action by user, before any other commands are accepted. The power supply acknowledges received commands by returning an “OK” message. If no Read action is executed after a setting command, and user proceed to another query command, there will be something issue occurred within the returned message where an OK message will be shown prior to the returned message corresponding to the query command.

When an error is detected the power supply will return an error message. For further details, please see the programming manual, available on the GW Instek web site @ www.gwinstek.com.

Error Message

If an error is detected in command or query, the power supply will respond with an error message.

Command Errors

Overview	The command error bit in the standard Event Status Register (ESR) is set to '1' when such an error occurs.
Error Code	**Description**
E-100	Command error
E-101	Invalid character
E-102	Syntax error
E-103	Invalid separator
E-104	Data type error
E-105	GET not allowed
E-108	Parameter not allowed
E-109	Missing parameter
E-110	Command header error
E-111	Header separator error
E-112	Program mnemonic too long
E-113	Undefined header
E-114	Header suffix out of range
E-115	Unexpected number of parameters
E-120	Numeric data error
E-121	Invalid character in number
E-123	Exponent too large
E-124	Too many digits
E-128	Numeric data not allowed
E-130	Suffix error
E-131	Invalid suffix
E-134	Suffix too long
E-138	Suffix not allowed
E-140	Character data error
E-141	Invalid character data
E-144	Character data too long

E-148	Character data not allowed
E-150	String data error
E-151	Invalid string data
E-158	String data not allowed
E-160	Block data error
E-161	Invalid block data
E-168	Block data not allowed
E-170	Expression error
E-171	Invalid expression
E-178	Expression data not allowed
E-180	Macro error
E-181	Invalid outside macro definition
E-183	Invalid inside macro definition
E-184	Macro parameter error

Execution Errors

Overview	The execution error bit in the standard Event Status Register (ESR) is set to '1' when such an error occurs.
Error Code	**Description**
E-200	Execution error
E-201	Invalid while in local
E-202	Settings lost due to rtl
E-203	Command protected
E-210	Trigger error
E-211	Trigger ignored
E-212	Arm ignored
E-213	Init ignored
E-214	Trigger deadlock
E-215	Arm deadlock
E-220	Parameter error
E-221	Settings conflict
E-222	Data out of range
E-223	Too much data
E-224	Illegal parameter value
E-225	Out of memory
E-226	Lists not same length

E-230	Data corrupt or stale
E-231	Data questionable
E-232	Invalid format
E-233	Invalid version
E-240	Hardware error
E-241	Hardware missing
E-250	Mass storage error
E-251	Missing mass storage
E-252	Missing media
E-253	Corrupt media
E-254	Media full
E-255	Directory full
E-256	File name not found
E-257	File name error
E-258	Media protected
E-260	Expression error
E-261	Math error in expression
E-270	Macro error
E-271	Macro syntax error
E-272	Macro execution error
E-273	Illegal macro label
E-274	Macro parameter error
E-275	Macro definition too long
E-276	Macro recursion error
E-277	Macro redefinition not allowed
E-278	Macro header not found
E-280	Program error
E-281	Cannot create program
E-282	Illegal program name
E-283	Illegal variable name
E-284	Program currently running
E-285	Program syntax error
E-286	Program runtime error
E-290	Memory use error
E-291	Out of memory
E-292	Referenced name does not exist
E-293	Referenced name already exists
E-294	Incompatible type

Devic Specific Errors

Overview	The device dependant error bit in the standard Event Status Register (ESR) is set to '1' when such an error occurs.

Error Code	Description
E-300	Device-specific error.
E-310	System error.
E-311	Memory error.
E-312	PUD memory lost.
E-313	Calibration memory lost.
E-314	Save/recall memory lost.
E-315	Configuration memory lost.
E-320	Storage fault.
E-321	Out of memory.
E-330	Self-test failed.
E-340	Calibration failed.
E-350	Queue overflow.
E-360	Communication error.
E-361	Parity error in program message.
E-362	Framing error in program message.
E-363	Input buffer overrun.
E-365	Time out error.

Query Errors

Overview	The query error bit in the standard Event Status Register (ESR) is set to ‘1' when such an error occurs.

Error Code	Description
E-400	Query error.
E-410	Query INTERRUPTED.
E-420	Query UNTERMINATED.
E-430	Query DEADLOCKED.
E-440	Query UNTERMINATED after indefinite response.

Other SCPI Defined Error Values

Overview	The corresponding bit in the standard Event Status Register (ESR) is set to '1' when such an event occurs.

Error Code	Description
E-500	Power on.
E-600	User request.
E-700	Request control.
E-800	Operation complete.

Configure Ethernet Connection

The Ethernet interface can be configured for a number of different applications. Ethernet can be configured for basic remote control or monitoring using a web server or it can be configured as a socket server.

The PPX series supports both DHCP connections so the instrument can be automatically connected to an existing network or alternatively, network settings can be manually configured.

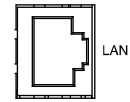
Ethernet configuration	For details on how to configure the Ethernet settings, please refer to the User Manual.	
Parameters	MAC Address (display only)	Hostname (display only)
	DHCP On/Off	IP Address
	Subnet Mask	Gateway IP
	DNS Address	Web Server On/Off

Web Server Configuration

Configuration

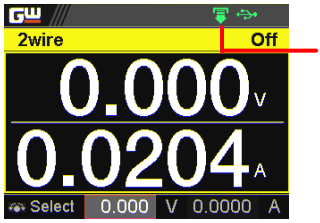
This configuration example will configure the PPX as a web server and use DHCP to automatically assign an IP address to the PPX.

1. Connect an Ethernet cable from the network to the rear panel Ethernet port.



2. Turn On DHCP and Web Server settings.

3. The indicator will be shown when a remote connection has been established.



Note

It may be necessary to cycle the power or refresh the web browser to connect to a network.

Web Server Remote Control Function Check

Functionality check

Enter the IP address of the power supply in a web browser after the instrument has been configured as a web server.

The web server allows you to monitor the function settings of the PPX.

The web browser interface appears as follows.

The web browser interface allows you to access the following:

- Network configuration settings
- Measurement setting
- Normal Function setting
- External Control setting
- Temperature Control setting
- Analog Control
- Figure of Dimension
- Sequence setting
- Datalog setting

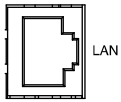
Sockets Server Configuration

Configuration

This configuration example will configure the PPX socket server.

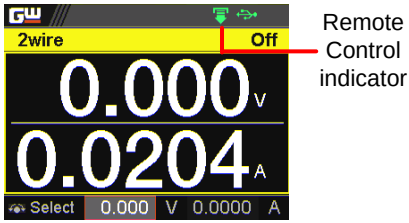
The following configuration settings will manually assign the PPX an IP address and enable the socket server. The socket server port number is fixed at 2268.

1. Connect an Ethernet cable from the network to the rear panel Ethernet port.



2. Turn Off DHCP setting followed by setting the relevant settings including IP Address, Subnet Mask, Gateway IP and DNS Address.

3. The indicator will be shown when a remote connection has been established.



Socket Server Function Check

Background	To test the socket server functionality, National Instruments Measurement and Automation Explorer can be used. This program is available on the NI website, www.ni.com., via a search for the VISA Run-time Engine page, or "downloads" at the following URL, http://www.ni.com/visa/
Requirements	Operating System: Windows XP, 7, 8, 10

Functionality check

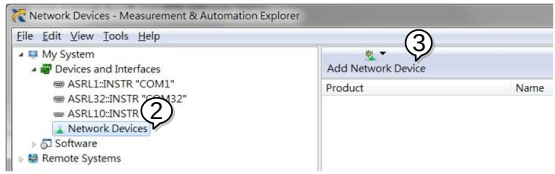
1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:

   Start>All Programs>National Instruments>Measurement & Automation

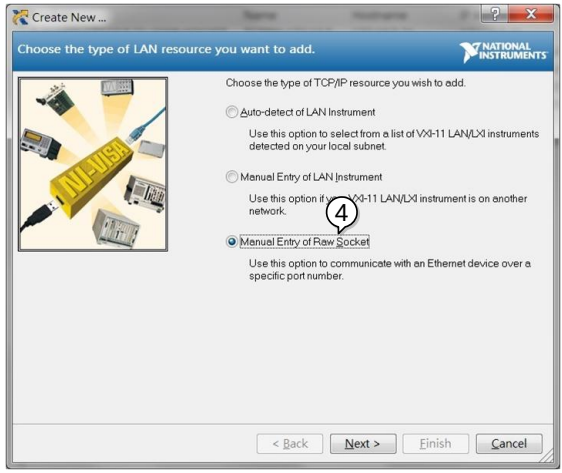
2. From the Configuration panel access;

   My System>Devices and Interfaces>Network Devices

3. Press *Add New Network Device>Visa TCP/IP Resource…*



4. Select *Manual Entry of Raw Socket* from the popup window.

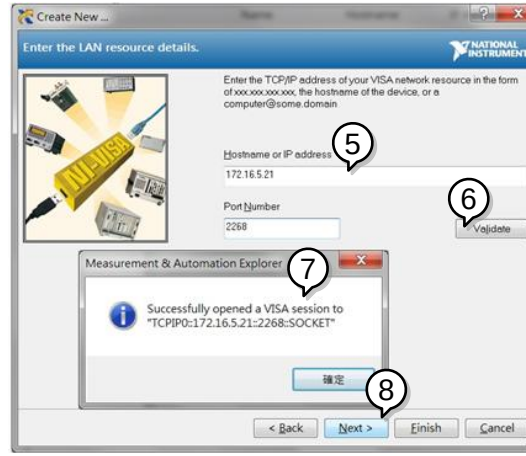


5. Enter the IP address and the port number of the PPX. The port number is fixed at 2268.

6. Click the Validate button.

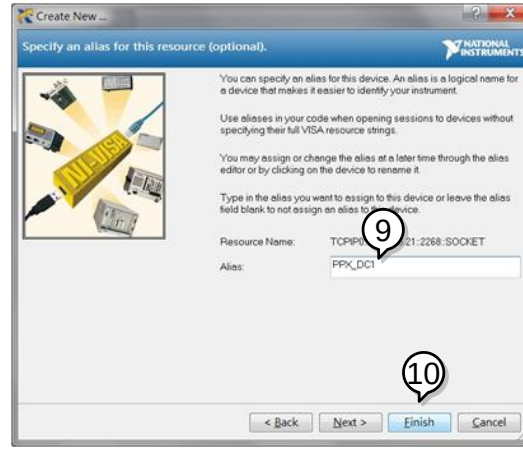
7. A popup will appear if a connection is successfully established.

8. Click Next.



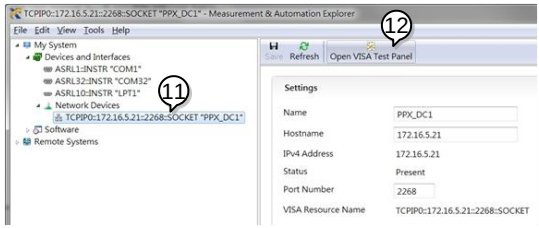
9. Next configure the Alias (name) of the PPX connection. In this example the Alias is: PPX_DC1

10. Click finish.



11. The IP address of the PPX will now appear under Network Devices in the configuration panel. Select this icon now.

12. Click *Open VISA Test Panel.*

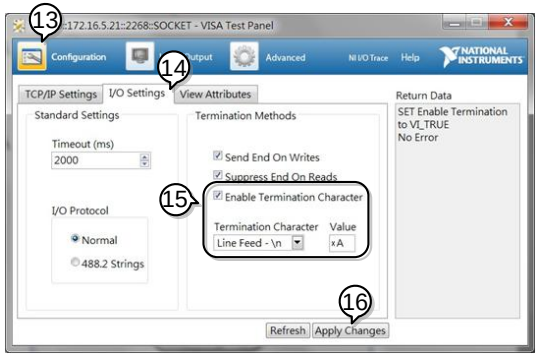


13. Click the *Configuration* icon,

14. Click on *I/O Settings*.

15. Make sure the *Enable Termination Character* check box is checked, and the terminal character is \n (Value: xA).

16. Click *Apply Changes*.



17. Click the *Input/Output* icon.

18. Enter *IDN? in the *Select or Enter Command* dialog box if it is not already.

19. Click the *Query* button.

20. The *IDN? query will return the Manufacturer, model name, serial number and firmware version in the dialog box.

GW-INSTEK,PPX-10H01,TW123456,V0.A4

Note

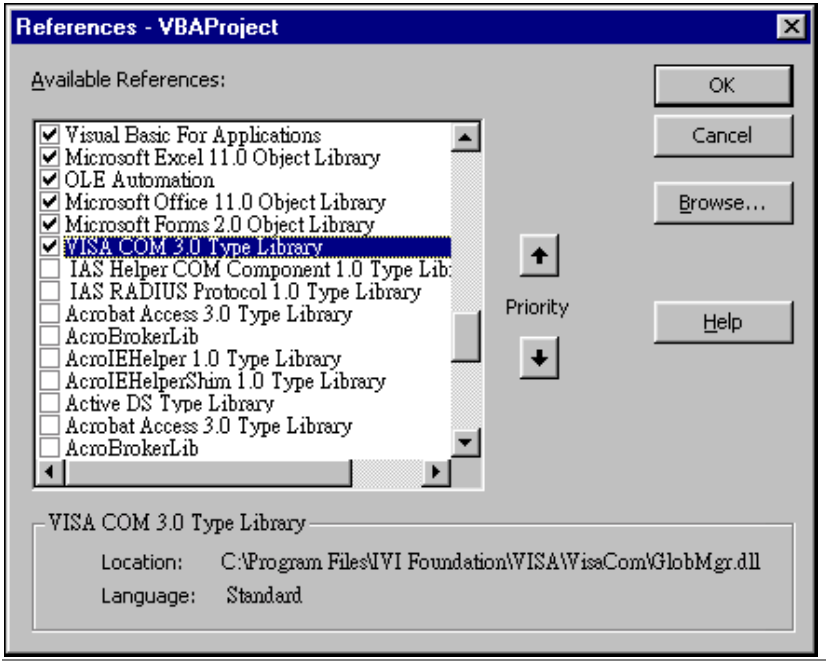
For further details, please see the programming manual, available on the GW Instek web site @ www.gwinstek.com.

Socket Server Examples

Visual Basic Example

Background

The following visual basic programming example uses the VISA COM 3.0 Type Library. The example will connect to the PPX series using the IP address of 172.15.5.133 over port 2268. The program will send the *IDN? to the PPX Series, print the return string and then close the connection.



```
'Create VISA ResourceManager object
    Dim rm As New VisaComLib.ResourceManager
    Dim accessMode As VisaComLib.accessMode
    Dim serial As String
    Dim timeOut As Integer
    Dim optionString As String
    Dim psw As VisaComLib.IMessage
    Dim pswcom As VisaComLib.FormattedIO488
    Dim pswsfc As VisaComLib.IAsyncMessage
```

```
Private Sub CommandButton1_Click()
    accessMode = VisaComLib.accessMode.NO_LOCK

    timeOut = 0

    optionString = ""

    'Connect to the PSW

    Set psw = rm.Open("TCPIP0::172.16.5.133::2268::SOCKET", _
        accessMode, _
        timeOut, _
        optionString)
    Set pswsfc = psw
    pswsfc.TerminationCharacterEnabled = True

    'Query the System Identify Name
    psw.WriteString ("*IDN?" & vbLf)

    Worksheets("Sheet1").Cells(1, 5) = psw.ReadString(256)

    'Close the communication
    psw.Close

End Sub
```

C++ Example

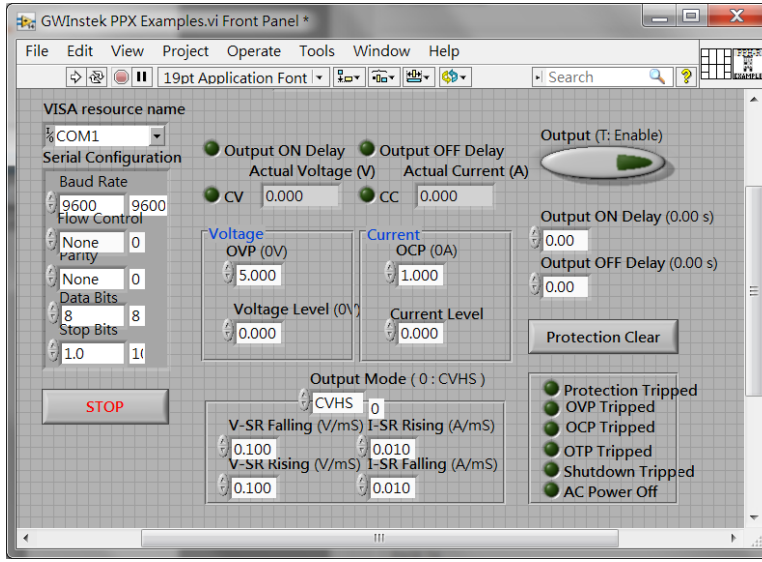
Background	The following program creates a connection to the PPX series and sets the voltage to 3.3 volts and the current 1.5 amps. The voltage and current reading is then read back and the connection is closed.
⚠ Note	Add visa32.lib to the project library when building the following sample program.

```
#include "stdio.h"
#include "string.h"
#include "visatype.h"
#include "visa.h"
#define IPaddr "172.16.20.181"
int main(int argc, char* argv[])
{
    ViSession defaultRm, instr;
    // Create VISA ResourceManager object
    ViStatus status = viOpenDefaultRM(&defaultRm);
    if (status < VI_SUCCESS)
    {
        // Initialization error
        return -1;
    }
    ViChar rsc[256];
    sprintf(rsc, "TCPIP0::%s::2268::SOCKET", IPaddr);
    ViAccessMode accessMode = VI_NO_LOCK;
    ViUInt32 timeout = 0;
    // Connect the device
    viOpen(defaultRm, rsc, accessMode, timeout, &instr);
    /* Set the timeout for message-based communication           */
    status = viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);
    status = viSetAttribute(instr, VI_ATTR_TERMCHAR, 10);
    status = viSetAttribute(instr,  VI_ATTR_TERMCHAR_EN, VI_TRUE);
    ViUInt32 count;
    // Set the Voltage to 3.3, Current to 1.5
    ViBuf buf = (ViBuf)":volt 3.3;:curr 1.5\n";
    viWrite(instr, buf, (ViUInt32)strlen((ViPChar)buf), &count);

    // Query the Voltage, and Current
    buf = (ViBuf)":apply?\n";
    status =viWrite(instr, buf, (ViUInt32)strlen((ViPChar)buf), &count);
    ViChar result[257];
    status =viRead(instr, (ViPBuf)result, 256, &count);
    if (status=VI_SUCCESS_TERM_CHAR)
    {
      result[count] = 0;
      printf("Voltage(V), Current(A)= %s\n", result);
    }else
      printf("Error\n");

    // Close the device
    viClose(instr);
    viClose(defaultRm);

    return 0;
}
```

LabVIEW Example

Background

The following picture shows a LabView programming example for the PPX Series.



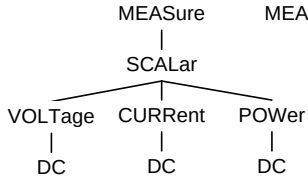
Command Syntax

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.

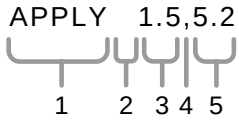
Long form	STATus:OPERation:NTRansition? STATUS:OPERATION:NTRANSITION? status:operation:ntransition?
Short form	STAT:OPER:NTR? stat:oper:ntr?

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 code	

Command List

Sense Commands

Status Commands

Source Commands

System Commands

Abort Command

:ABORt

Set →

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

Apply Commands

:APPLy

Set →
→ Query

Description	The apply command sets the voltage and current at the same time.	
Syntax	:APPLy {<NRf>(V)|MINimum|MAXimum[,<NRf>(A)|MINimum|MAXimum]}	
Query Syntax	:APPLy?	
Parameter/ Return parameter	<NRf>(V)	Voltage setting.
	MINimum	Minimum voltage level
	MAXimum	Maximum voltage level
	<NRf>(A)	Current setting.
	MINimum	Minimum voltage level
	MAXimum	Maximum voltage level
Example	APPL MIN, MIN Sets the current and voltage to the minimum settings.	

Address Commands

:ADR

Set / Query

Description	Sets or queries the RS485 interface address.	
Syntax	:ADR <NR1>	
Query Syntax	:ADR?	
Parameter/ Return parameter	<NR1>	0~30
Example	ADR 5 Sets the RS485 address 5.	

Initiate Commands

:INITiate:CONTinuous[:TRANsient]

Set / Query

Description	This command continuously initiates software triggers for the transient or output triggers.	
Syntax	:INITiate:CONTinuous[:TRANsient] {<bool>|OFF|ON}	
Query Syntax	:INITiate:CONTinuous[:TRANsient]?	
Parameter	OFF | 0 ON | 1	OFF ON
Return parameter	0 1	OFF ON
Example	INIT:TRAN 1 Turns on the continuous trigger.	

:INITiate[:IMMediate]:NAME Set

Description	The INITiate command starts the TRANsient or OUTPut trigger.
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.

:INITiate[:IMMediate][:TRANsient] Set

Description	This command controls the enabling of output triggers. When a trigger is enabled, a trigger causes the specified action to occur. If the trigger system is not enabled, all triggers are ignored.
Syntax	:INITiate[:IMMediate][:TRANsient]
Example	INIT

Memory Commands

:MEMory:TRIGgered

Set → / → Query

Description	Sets or queries which memory is loaded when a trigger input is received and the trigger input is configured to load a memory setting. This is the equivalent to the TRIG Control menu (Trigin Memory)settings.	
Related Commands	:SYSTem:CONFigure:TRIGger:INPut:MEMory {<NR1>|MINimum|MAXimum} :SYSTem:CONFigure:TRIGger:INPut:MEMory? [MINimum|MAXimum]	
Syntax	:MEMory:TRIGgered{<NR1>|MINimum|MAXimum}	
Query Syntax	:MEMory:TRIGgered? [MINimum|MAXimum]	
Parameter	<NR1>	0(M1)~9(M10).
	MINimum	
	MAXimum	
Return parameter	<NR1>	Returns the memory setting.

Measure Commands

:MEASure[:SCALar]:ALL[:DC] → Query

Description	Takes a measurement and returns the average output current and voltage	
Syntax	:MEASure[:SCALar]:ALL[:DC]?	
Return parameter	"+0.0000,+0.00000,+0.00000"	<voltage>,<current> ,<power>Returns the voltage (V),current (A),power(W) respectively.

:MEASure[:SCALar]:CURRent[:DC] → Query

Description	Takes a measurement and returns the average output current	
Syntax	:MEASure[:SCALar]:CURRent[:DC]?	
Return parameter	"+0.0000"	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	"+0.0000"	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	"+0.0000" Returns the power measured in watts.

:MEASure[:SCALar]:CURRent:RANGe → Set / → Query

Description	Sets or queries the current measurement range.	
Syntax	:MEASure[:SCALar]:CURRent:RANGe {<NR1>|AUTO|IH|IL|ILL}	
Query Syntax	:MEASure[:SCALar]:CURRent:RANGe?	
Parameter	AUTO|0	Current measurement auto range.
	IH|1	Current measurement IH range.
	IL|2	Current measurement IL range.
	ILL|3	Current measurement ILL range.
Return parameter	<NR1>	Returns the current measurement range.

:MEASure[:SCALar]:VOLTage:RANGe → Set / → Query

Description	Sets or queries the voltage measurement range.	
Syntax	:MEASure[:SCALar]:VOLTage:RANGe {<NR1>|AUTO|VH|VL }	
Query Syntax	:MEASure[:SCALar]:VOLTage:RANGe?	
Parameter	AUTO|0	Voltage measurement auto range.
	VH|1	Voltage measurement VH range.
	VL|2	Voltage measurement VL range.
Return parameter	<NR1>	Returns the voltage measurement range.

:MEASure:TEMPerature → Query

Description	Takes a measurement and returns the temperature.	
Syntax	:MEASure:TEMPerature?	
Return	"+0.0000"	Returns the temperature in celsius or fahrenheit.
Return	-32768	Returns the temperature in INVAILD.

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 {<NR2>|MINimum|MAXimum}	
Query Syntax	:OUTPut:DELay:ON?	
Parameter	<NR2>	0.00~359999.99 seconds, where 0=no delay.
Return parameter	"0.00"	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 {<NR2> |MINimum|MAXimum}	
Return Syntax	:OUTPut:DELay:OFF?	
Parameter	<NR2>	0.00~359999.99 seconds, where 0=no delay.
Return parameter	"0.00"	Returns the delay off time in seconds until the output is turned off.

:OUTPut:MODE

Set → / → Query

Description	Sets the PPX output mode. This is the equivalent to the Output menu (V-I Slew Rate Select) settings.	
Syntax	:OUTPut:MODE {<NR1>|CVHS|CCHS|CVLS|CCLS}	
Return Syntax	:OUTPut:MODE?	
Parameter	CVHS | 0	CV high speed priority
	CCHS | 1	CC high speed priority
	CVLS | 2	CV slew rate priority
	CCLS | 3	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] { <bool> | OFF | ON }	
Query Syntax	:OUTPut[:STATe][:IMMediate]?	
Parameter	OFF | 0	Turns the output off.
	ON | 1	Turns the output on.
Return parameter	<bool>	Returns output status of the instrument.

:OUTPut[:STATe]:TRIGgered

Set → / → Query

Description	Turns the output on or off when a software trigger (trigger input) is generated.	
Syntax	:OUTPut[:STATe]:TRIGgered { <bool>|OFF|ON }	
Query Syntax	:OUTPut[:STATe]:TRIGgered?	
Parameter	OFF | 0	Turns the output off when a software trigger is generated (*TRG).
	ON | 1	Turns the output on when a software trigger is generated (*TRG).
Return parameter	<bool>	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 temperature short and sense protection circuit .The other alarm(WDOG, CAP, TEMP Monitor)also clears.
Syntax	:OUTPut:PROTection:CLEar

:OUTPut:PROTection:TRIPped (Query)

Description	Queries the unit to see if a protection circuit has been tripped.	
Syntax	:OUTPut:PROTection:TRIPped?	
Return	<boolean>	0 = No protection error 1 = A protection error had occured

:OUTPut:PROTection:WDOG[:STATe] (Set / Query)

Description	Enables or disables the communication monitor setting.	
Syntax	:OUTPut:PROTection:WDOG[:STATe] { <bool> | OFF | ON }	
Query Syntax	:OUTPut:PROTection:WDOG[:STATe]?	
Parameter	OFF | 0	Disable communication monitor.
	ON | 1	Enable communication monitor.
Return parameter	<boolean>	Returns the setting in <bool> format.

:OUTPut:PROTection:WDOG:DELay (Set / Query)

Description	Sets the timer in seconds for monitor the communication.	
Syntax	:OUTPut:PROTection:WDOG:DELay {<NR1>|MINimum|MAXimum}	
Query Syntax	:OUTPut:PROTection:WDOG:DELay?	
Parameter	<NR1>	1~3600 seconds.
Return parameter	<NR1>	Returns the timer setting.

Sense Commands

:SENSe:AVERage:COUNt

Set → / → Query

Description	Sets or queries the level of smoothing for the average setting.	
Syntax	:SENSe:AVERage:COUNt {<NR1>|LOW|MIDDle|HIGH}	
Return Syntax	:SENSe:AVERage:COUNt?	
Parameter	OFF | 0	Default setting
	LOW | 0	Low setting
	MIDDle | 1	Middle setting
	HIGH | 2	High setting
Return Parameter	<NR1>	Returns the average setting.

:SENSe:DLOG:SFOL

Set → / → Query

Description	Sets or queries data logger subfolder counter.	
Syntax	:SENSe:DLOG:SFOL {<string>}	
Return Syntax	:SENSe:DLOG:SFOL?	
Parameter	<string>	ASCII characters: 30H to 39H.
Return Parameter	<string>	Returns ASCII characters: 30H to 39H.

:SENSe:DLOG:STATe

Set →
→ Query

Description	Enables or disables the data logger setting.	
Syntax	:SENSe:DLOG:STATe {<NR1>}	
Return Syntax	:SENSe:DLOG:STATe?	
Parameter	0	Disable data logger.
	1	Enable data logger.The data is stored in the USB storage when USB storage plug in.
	2	Enable data logger,The data is sent to the interface when the remote control read data.
Return Parameter	<NR1>	Returns the data logger setting.

:SENSe:DLOG:PERiod

Set →
→ Query

Description	Sets the sample period in seconds for data logger.	
Syntax	:SENSe:DLOG:PERiod {<NR2>|MINimum|MAXimum}	
Return Syntax	:SENSe:DLOG:PERiod?	
Parameter	<NR2>	0.1~999.9 seconds.
Return Parameter	<NR2>	Returns the sample period setting.

:SENSe:AHOur:RESet

Set →

Description	Sets the Ampere-hour capacity to zero. Note: Install the license first.
Syntax	:SENSe:AHOur:RESet

:SENSe:WHOur:RESet

Set →

Description	Sets the Watt-hour capacity to zero. Note: Install the license first.
Syntax	:SENSe:WHOur:RESet

Status Commands

For an overview of all the status registers, their associated register contents and the system diagram, please see the status overview on page 130

: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 <NR1>	
Query Syntax	:STATus:OPERation:ENABle?	
Parameter	<NR1>	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 <NR1>	
Query Syntax	:STATus:OPERation:PTRansition?	
Parameter	<NR1>	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 <NR1>	
Query Syntax	:STATus:OPERation:NTRansition?	
Parameter	<NR1>	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]?	
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?	
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 <NR1>	
Query Syntax	:STATus:QUEStionable:ENABle?	
Parameter	<NR1>	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 <NR1>	
Return Syntax	:STATus:QUEStionable:PTRansition?	
Parameter	<NR1>	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 <NR1>	
Query Syntax	:STATus:QUEStionable:NTRansition?	
Parameter	<NR1>	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

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] {<NR2>(A)|MINimum|MAXimum}
Query Syntax	[:SOURce]:CURRent[:LEVel][:IMMediate][:AMPLitude]?
Parameter/Return	<NR2> 0~105% of the rated current output level.

parameter	MIN	Minimum current level.
	MAX	Maximum current level.
Example	SOUR:CURR:LEV:IMM:AMPL?	
	1.0000	
	Returns the 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] {<NR2> (A)| MINimum|MAXimum}	
Query Syntax	[:SOURce]:CURRent[:LEVel]:TRIGgered[:AMPLitude]?	
Parameter	<NR2>	0%~105% of the rated current output in amps.
	MIN	Minimum current level.
	MAX	Maximum current level.
Return Parameter	<NR2>	Returns the current level.
Example	SOUR:CURR:LEV:TRIG:AMPL?	
	1.0000	
	Returns the maximum possible current level in amps.	

[:SOURce]:CURRent:LIMit:AUTO

Set → Query

Description	Enables or disables the limit on the current setting.	
Syntax	[:SOURce]:CURRent:LIMit:AUTO {<bool>|OFF|ON}	
Query Syntax	[:SOURce]:CURRent:LIMit:AUTO?	
Parameter	OFF | 0	Disable the setting current limit
	ON | 1	Enable the setting current limit
Return parameter	<bool>	Returns the setting in <bool> format.
Example	SOUR:CURR:LIM:AUTO 0	
	Disables the current limit.	

[:SOURce]:CURRent:PROTection:DELay

Set → / → Query

Description	Sets the Delay Time for OCP in seconds. The delay is set to 0.05 by default.	
Syntax	[:SOURce]:CURRent:PROTection:DELay {<NR2>|MINimum|MAXimum}	
Query Syntax	[:SOURce]:CURRent:PROTection:DELay?	
Parameter	<NR2>	0.05~2.5 seconds
	MAX	The maximum allowed delay time
	MIN	The minimum allowed delay time
Return parameter	<NR2>	Returns the delay time in seconds
Example	SOUR:CURR:PROT:DEL MAX Sets the current protection delay to the maximum.	

[:SOURce]:CURRent:PROTection[:LEVel]

Set → / → Query

Description	Sets or queries the OCP (over-current protection) level in amps.	
Syntax	[:SOURce]:CURRent:PROTection[:LEVel] {<NR2>(A) |MINimum|MAXimum}	
Query Syntax	[:SOURce]:CURRent:PROTection[:LEVel]?	
Parameter	<NR2>	Current protection level. Minimum: Irated * 0.05 Maximum: Irated * 1.1
	MIN	Minimum current level.
	MAX	Maximum current level.
Return parameter	<NR2>	Returns the current protection level.
Example	SOUR:CURR:PROT:LEV? +5.000 Returns the current level in amps.	

[:SOURce]:CURRent:PROTection:TRIPped → Query

Description	Returns the state of the current protection circuits.	
Query Syntax	[:SOURce]:CURRent:PROTection:TRIPped?	
Return parameter	<bool>	Returns protection status.
Example	SOUR:CURR:PROT:TRIP?	
	>0	
	The protection circuit has not been tripped.	

[:SOURce]:CURRent:SLEWrate:RISing → Set / Query

Description	Sets or queries the rising current slew rate. This is only applicable for CC slew rate priority (CCLS) mode.	
Syntax	[:SOURce]:CURRent:SLEWrate:RISing {<NR2>(A)|MINimum|MAXimum}	
Query Syntax	[:SOURce]:CURRent:SLEWrate:RISing?	
Parameter	<NR2>	Per step is between 0.00001A/msec and depend on the unit type: 0.01 /0.02 /0.03 /0.05 A/msec.
	MIN	Minimum rising current slew rate is 0.00001A/msec.
	MAX	Maximum: Depend on the unit type: 0.01 /0.02 /0.03 /0.05 A/msec.
Return parameter	<NR2>	Returns the step current in amps.
Example	SOUR:CURR:SLEW:RIS?	
	0.02000	
	Sets the rising current slew rate to 0.02000 A/ms.	

[:SOURce]:CURRent:SLEWrate:FALLing

Set → / → Query

Description	Sets or queries the falling current slew rate. This is only applicable for CC slew rate priority (CCLS) mode.	
Syntax	[:SOURce]:CURRent:SLEWrate:FALLing {<NR2>(A)|MINimum|MAXimum}	
Query Syntax	[:SOURce]:CURRent:SLEWrate:FALLing?	
Parameter	<NR2>	Per step is between 0.00001A/msec and depend on the unit type: 0.01 /0.02 /0.03 /0.05 A/msec.
	MIN	Minimum falling current slew rate is 0.00001A/msec.
	MAX	Maximum: Depend on the unit type: 0.01 /0.02 /0.03 /0.05 A/msec.
Return Parameter	<NR2>	Returns the step current in amps.
Example	SOUR:CURR:SLEW:FALL MAX Sets the falling current slew rate to the maximum.	

[:SOURce]:MODE?

→ Query

Description	Returns the status of the output mode (CC, CV, Off) of the power supply. The interface will return "CV' if the supply is in Constant Voltage Mode, "CC" if the supply is in Constant Current Mode or "OFF" if the supply output is off.	
Query Syntax	[:SOURce]:MODE?	
Return parameter	<string>	Returns the output state as a string, "CC", "CV", "OFF"
Example	:SOUR:MODE? >CC The power supply is currently in CC mode.	

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

Set → Query

Description	Sets or queries the voltage level in volts.	
Syntax	[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude] {<NR2>(V)|MINimum|MAXimum}	
Query Syntax	[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude]?	
Parameter	<NRf>	0~105% of the rated output voltage in volts.
	MIN	Minimum voltage level
	MAX	Maximum voltage level
Return parameter	<NR2>	Returns the voltage level in volts
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 trigger in/software trigger has been generated.	
Syntax	[:SOURce]:VOLTage[:LEVel]:TRIGgered[:AMPLitude] {<NR2>(V)|MINimum|MAXimum}	
Query Syntax	[:SOURce]:VOLTage[:LEVel]:TRIGgered[:AMPLitude]?	
Parameter	<NR2>	0%~105% of the rated voltage output in volts.
	MIN	Minimum current level.
	MAX	Maximum current level.
Return parameter	<NR2>	Returns the voltage level.
Example	SOUR:VOLT:LEV:TRIG:AMPL 10 Sets the voltage level to 10 volts when a software trigger is generated.	

[:SOURce]:VOLTage:LIMit:AUTO

Set → Query

Description	Sets whether to limit the voltage setting so that it does not exceed the OVP setting or become lower than the UVL setting. If you enable the limit when the OVP setting is lower than the voltage setting, the OVP setting will be set to 105 % of the voltage setting. If you enable the limit when the UVL setting is higher than the voltage setting, the UVL setting will be set equal to the voltage setting.	
Syntax	[:SOURce]:VOLTage:LIMit:AUTO {<bool>|OFF|ON}	
Query Syntax	[:SOURce]:VOLTage:LIMit:AUTO?	
Parameter	OFF | 0	Disable the limit setting
	ON | 1	Enable the limit setting
Return parameter	<bool>	Returns the setting in <bool> format.
Example	SOUR:VOLT:LIM:AUTO 0 Disables the limit setting.	

[:SOURce]:VOLTage:LIMit:LOW

Set → Query

Description	Sets or queries the under voltage (UVL) trip point.	
Syntax	[:SOURce]:VOLTage:LIMit:LOW <NR2>(V)|MINimum|MAXimum	
Query Syntax	[:SOURce]:VOLTage:LIMit:LOW?	
Parameter/Return	<NR2>	0 ~ the present setting voltage
	MIN	Minimum allowed voltage level
	MAX	Maximum allowed voltage level
Example	SOUR:VOLT:LIM:LOW MAX Sets the UV> level to its maximum. It can't setting when voltage limit turn off.	

[:SOURce]:VOLTage:PROTection[:LEVel]

Set → / → Query

Description	Sets or queries the overvoltage protection level.
Syntax	[:SOURce]:VOLTage:PROTection[:LEVel] {<NR2>(V)|MINimum|MAXimum}
Query Syntax	[:SOURce]:VOLTage:PROTection[:LEVel]?
Parameter/Return	<NR2> Minimum: Vrated * 0.05 Maximum: Vrated * 1.1 MIN Minimum OVP level MAX Maximum OVP level
Example	SOUR:VOLT:PROT:LEV MAX Sets the OVP level to its maximum.

[:SOURce]:VOLTage:PROTection:TRIPped

→ Query

Description	Sets or queries the overvoltage protection level.
Query Syntax	[:SOURce]:VOLTage:PROTection:TRIPped?
Return parameter	<bool> 0 Protection not tripped 1 Protection tripped
Example	SOUR:VOLT:PROT:TRIP? >0 Indicates that the OVP protection has not been tripped.

[:SOURce]:VOLTage:SLEWrate:RISing

Set → / → Query

Description	Sets or queries the rising voltage slew rate. This is only applicable for CV slew rate priority (CVLS) mode.
Syntax	[:SOURce]:VOLTage:SLEWrate:RISing {<NR2>(V)|MINimum|MAXimum}
Query Syntax	[:SOURce]:VOLTage:SLEWrate:RISing?

Parameter	<NR2>	Per step is between 0.0001V/msec and depend on the unit type: 0.1 /0.2 /0.36 /1 V/msec.
	MIN	Minimum rising voltage slew rate is 0.0001V/msec.
	MAX	Maximum: Depend on the unit type: 0.1 /0.2 /0.36 /1 V/msec.
Return parameter	<NR2>	Returns the slew rate in V/msec.

Example SOUR:VOLT:SLEW:RIS MAX

Sets the rising voltage slew rate to its maximum.

[:SOURce]:VOLTage:SLEWrate:FALLing

Set → Query

Description	Sets or queries the falling voltage slew rate. This is only applicable for CV slew rate priority (CVLS) mode.
Syntax	[:SOURce]:VOLTage:SLEWrate:FALLing {<NR2>(V)|MINimum|MAXimum}
Query Syntax	[:SOURce]:VOLTage:SLEWrate:FALLing?

Parameter	<NR2>	Per step is between 0.0001V/msec and depend on the unit type: 0.1 /0.2 /0.36 /1 V/msec.
	MIN	Minimum falling voltage slew rate is 0.0001V/msec.
	MAX	Maximum: Depend on the unit type: 0.1 /0.2 /0.36 /1 V/msec.
Return parameter	<NR2>	Returns the voltage slew rate in V/msec

Example SOUR:VOLT:SLEW:FALL MIN

Sets the falling voltage slew rate to its minimum.

[:SOURce]:VOLTage:SENSe

Set → Query

Description	Sets or queries the remote sense.
Syntax	[:SOURce]:VOLTage:SENSe {<NR1>|INTernal|EXTernal}
Query Syntax	[:SOURce]:VOLTage:SENSe?
Parameter	<NR2>

	INTernal | 0	Sets remote sense 2 wire
	EXTernal | 1	Sets remote sense 4 wire
Return parameter	<NR1>	

Example SOUR:VOLT: SENS EXT

Sets remote sense 4 wire.

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]

Set → Query

Description	Sets or queries the constant power level in watts.
Syntax	[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] {<NR2>| MINimum | MAXimum }
Query Syntax	[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?

Parameter		
	<NR2>	
	MIN	Minimum constant power level.
	MAX	Maximum constant power level.
Return parameter	<NR2>	

Example :SOUR:POW:LEV:IMM:AMPL MAX

Sets the constant power to maximum.

[:SOURce]:POWer:CONTrol

Set → Query

Description	Enables or disables the constant power setting.
Syntax	[:SOURce]:POWer:CONTrol {<bool>|OFF|ON}
Query Syntax	[:SOURce]:POWer:CONTrol?

Parameter		
	OFF | 0	Disable the constant power control.
	ON | 1	Enable the constant power control.
Return parameter	<bool>	Returns the setting in <bool> format.

Example :SOUR:POW:CONT 0

Sets the constant power to disable.

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 protect buzzer state on/off.	
Syntax	:SYSTem:CONFigure:BEEPer[:STATe] {<bool>|OFF|ON}	
Query Syntax	:SYSTem:CONFigure:BEEPer[:STATe]?	
Parameter	OFF | 0	Turns the buzzer off.
	ON | 1	Turns the buzzer on.
Return parameter	<bool>	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] {<NR1>|OFF|ON}	
Query Syntax	:SYSTem:CONFigure:BLEeder[:STATe]?	
Parameter	OFF | 0	Turns the bleeder resistor off.
	ON | 1	Turns the bleeder resistor on.
Return parameter	<NR1>	Returns bleeder resistor status.

:SYSTem:CONFigure:CURRent:CONTrol

Set → / → Query

Description	Sets or queries the CC control mode (local control (panel), external voltage control, external resistance control). Note: It can not be set when output on.
Syntax	:SYSTem:CONFigure:CURRent:CONTrol { <NR1>|NONE|VOLTage|RRISing }
Query Syntax	:SYSTem:CONFigure:CURRent:CONTrol?

Parameter	<NR1>	Description
	0 | NONE	Local (Panel) control
	1 | VOLTage	External voltage control
	2 | RRISing	External resistance control; 10kΩ: maximum current setting.
Return Parameter	<NR1>	Returns the current control configuration.

:SYSTem:CONFigure:VOLTage:CONTrol

Set → / → Query

Description	Sets or queries the CV control mode (local control (panel), external voltage control, external resistance control). Note: It can not be set when output on.
Syntax	:SYSTem:CONFigure:VOLTage:CONTrol { <NR1>|NONE|VOLTage|RRISing| }
Query Syntax	:SYSTem:CONFigure:VOLTage:CONTrol?

Parameter	<NR1>	Description
	0 | NONE	Local (Panel) control
	1 | VOLTage	External voltage control
	2 | RRISing	External resistance control; 10kΩ: maximum voltage setting.

Return Parameter	<NR1>	Returns the current control configuration.

:SYSTem:CONFigure:OUTPut:PON[:STATe]

Set → / → Query

Description	Sets the output state at power-on. This is the equivalent to the PWR On Config menu(Power On Status) settings. These settings only apply after the unit has been reset.	
Syntax	:SYSTem:CONFigure:OUTPut:PON[:STATe] {<NR1>|{SAFE|OFF}|{FORCe|ON}|AUTO}	
Return Syntax	:SYSTem:CONFigure:OUTPut:PON[:STATe]?	
Parameter	SAFE | OFF | 0	The PPX turns on in the same state the unit was in prior to the previous shut down. The output is set to off (default).
	FORCe | ON | 1	The PPX turns on in the same state the unit was in prior to the previous shut down. The output is set to on.
	AUTO | 2	The PPX turns on in the same state the unit was in prior to the previous shut down, but with the same output on/off setting.
Return parameter	0	The power on output setting is "SAFE" or "OFF".
	1	The power on output setting is "FORCe" or "ON".
	2	The power on output setting is "AUTO".

Set →
:SYSTem:CONFigure:OUTPut:EXTernal:MODE → Query

Description	Sets the logic used to turn the output on or off when using an external contact. This is the equivalent to the EXT Control menu(Output Type)settings.	
Syntax	:SYSTem:CONFigure:OUTPut:EXTernal:MODE {<NR1>|LOW|HIGH}	
Return Syntax	:SYSTem:CONFigure:OUTPut:EXTernal:MODE?	
Parameter	LOW | 0	Active low
	HIGH | 1	Active high
Return Parameter	<NR1>	Returns external mode of the instrument.

Set →
:SYSTem:CONFigure:OUTPut:EXTernal[:STATe] → Query

Description	Sets the output on or off when using an external contact. This is the equivalent to the EXT Control menu(Output Enable)settings.	
Syntax	:SYSTem:CONFigure:OUTPut:EXTernal[:STATe] {<bool>|OFF|ON}	
Query Syntax	:SYSTem:CONFigure:OUTPut:EXTernal[:STATe]?	
Parameter	OFF | 0	External output control disable.
	ON | 1	External output control enable.
Return Parameter	<NR1>	Returns the output external control status.

Set →
:SYSTem:CONFigure:TRIGger:INPut:SOURce → Query

Description	Sets or queries what action will be performed on receiving a trigger.This is the equivalent to the TRIG Control menu(Trigin Action)settings.	
Syntax	:SYSTem:CONFigure:TRIGger:INPut:SOURce {<NR1>|NONE|OUTPut|SETTing|MEMory}	
Query Syntax	:SYSTem:CONFigure:TRIGger:INPut:SOURce?	
Parameter	NONE | 0	No input trigger.
	OUTPut | 1	Toggles the output on receiving a trigger.
	SETTing | 2	Sets the voltage/current on receiving a trigger.
	MEMory | 3	Loads a memory setting on receiving a trigger.
Return Parameter	<NR1>	Returns the input source.

Set →
:SYSTem:CONFigure:TRIGger:INPut:LEVel → Query

Description	Sets or queries the logic used to input trigger level. This is the equivalent to the TRIG Control menu (Trigin Level)settings.	
Syntax	:SYSTem:CONFigure:TRIGger:INPut:LEVel {<NR1>|LOW|HIGH}	
Query Syntax	:SYSTem:CONFigure:TRIGger:INPut:LEVel?	
Parameter	LOW | 0	Active high.
	High | 1	Active low.
Return Parameter	<NR1>	Returns the trigger input level.

Set →
:SYSTem:CONFigure:TRIGger:OUTPut:SOURce → Query

Description	Sets or queries the output trigger source. This is the equivalent to the TRIG Control menu (Trigout Source)settings.
Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:SOURce {<NR1>|NONE|OUTPut|SETTing|MEMory}
Query Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:SOURce?

Parameter	NONE | 0	No output trigger.
	OUTPut | 1	Output trigger is generated by a change in the output.
	SETTing | 2	Output trigger is generated when a setting is changed.
	MEMory | 3	Output trigger is generated when a memory setting is loaded.
Return Parameter	<NR1>	Returns the output source.

Set →
:SYSTem:CONFigure:TRIGger:OUTPut:WIDTh → Query

Description	Sets or queries the output trigger pulse width. This is the equivalent to the TRIG Control menu(Trigout Width)settings.
Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:WIDTh {<NR2>|MINimum|MAXimum}
Query Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:WIDTh? [MINimum|MAXimum]

Parameter	<NR2>	1.0 ~100.0 unit:ms.
	MINimum	1.0 unit:ms
	Maximum	100.0 unit:ms
Return Parameter	<NR2>	

Example :SYST:CONF:TRIG:OUTP:WIDT 20.0

Sets the output trigger pulse 20.0ms.

Set →
:SYSTem:CONFigure:TRIGger:OUTPut:LEVel → Query

Description	Sets or queries the logic used to output trigger level. This is the equivalent to the TRIG Control menu (Trigin Level)settings.
Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:LEVel {<NR1>|LOW|HIGH}
Query Syntax	:SYSTem:CONFigure:TRIGger:OUTPut:LEVel?

Parameter	<NR1>	
	LOW | 0	Sets the output trigger to active low.
	High | 1	Sets the output trigger to active high.
Return Parameter	<NR1>	Returns the trigger output level.

:SYSTem:CONFigure:TEMPerature:CONTrol

Set / Query

Description	Sets or queries the temperature control (K-Type Thermocouple) on/off. This is the equivalent to the Temperature menu (Control)settings.
Syntax	:SYSTem:CONFigure:TEMPerature:CONTrol {<bool>|OFF|ON}
Query Syntax	:SYSTem:CONFigure:TEMPerature:CONTrol?

Parameter	OFF | 0	Turns the temperature control off.
	ON | 1	Turns the temperature control on.
Return Parameter	<bool>	Returns the temperature control status.

:SYSTem:CONFigure:TEMPerature:UNIT

Set / Query

Description	Sets or queries the temperature unit.This is the equivalent to the Temperature menu(Unit) settings.
Syntax	:SYSTem:CONFigure:TEMPerature:UNIT {<NR1>|CELSius|FAHRenheit }
Query Syntax	:SYSTem:CONFigure:TEMPerature:UNIT?

Parameter	CELSius |	Sets unit temperature in Celsius.
	FAHRenheit | 1	Sets unit temperature in Fahrenheit.
Return Parameter	<NR1>	Returns the unit temperature.

Set →
:SYSTem:CONFigure:TEMPerature:OUTPut:SAFE → Query

Description	Sets or queries the temperature output safe on/off. Monitor the temperature when the output is turned on and turn off the output when the monitored temperature is reached.This is the equivalent to the Temperature menu (Output safe)setting.Note:The temperature control is turned on first.	
Syntax	:SYSTem:CONFigure:TEMPerature:OUTPut:SAFE {<bool>|OFF|ON}	
Query Syntax	:SYSTem:CONFigure:TEMPerature:OUTPut:SAFE?	
Parameter	OFF | 0	Sets the temperature output safe off.
	ON | 1	Sets the temperature output safe on.
Return Parameter	<bool>	Returns the temperature output safe status.

Set →
:SYSTem:CONFigure:TEMPerature:MONitor → Query

Description	Sets or queries the monitored temperature. This is the equivalent to the Temperature menu (Monitor)settings.	
Syntax	:SYSTem:CONFigure:TEMPerature:MONitor{<NR2>|MINimum|MAXimum}	
Query Syntax	:SYSTem:CONFigure:TEMPerature:MONitor? [MINimum|MAXimum]	
Parameter	<NR2>	-200~1372(Celsius) / -328~2501.6(Fahrenheit)
	MINimum	-200(Celsius) / -328(Fahrenheit)
	MAXimum	1372(Celsius) / 2501.6(Fahrenheit)
Return Parameter	<NR2>	Returns the monitor temperature.

:SYSTem:CONFigure:TEMPerature:ADJust

Set → / → Query

Description	Sets or queries the adjust temperature. This is the equivalent to the Temperature menu (Adjust)settings.	
Syntax	:SYSTem:CONFigure:TEMPerature:ADJust {<NR2>|MINimum|MAXimum}	
Query Syntax	:SYSTem:CONFigure:TEMPerature:ADJust? [MINimum|MAXimum]	
Parameter	<NR2>	
	MINimum	-2.5(Celsius) / -4.5(Fahrenheit)
	MAXimum	2.5(Celsius) / 4.5(Fahrenheit)
Return Parameter	<NR1>	Returns the adjust temperature.

:SYSTem:COMMunicate:ENABle

Set → / → Query

Description	Enables/Disables GPIB, USB or other remote interfaces such as Sockets and the Web Server. This setting is only applied after the unit has been reset.	
Syntax	:SYSTem:COMMunicate:ENABle {<NR1> |OFF|ON|AUTO|FULL|RS232|RS485,GPIB|USBCdc |SOCKets|WEB|UART}	
Query Syntax	:SYSTem:COMMunicate:ENABle? { GPIB|USBCdc |SOCKets|WEB|UART}	
Parameter 1	OFF | 0	Disables the selected interface.
	ON | 1	Enables the selected interface.
	AUTO | 1	USB-CDC selected auto.
	FULL | 2	USB-CDC selected full.
	RS232 | 1	UART selected RS232.
	RS485 | 2	UART selected RS485.
Parameter 2	GPIB	Select GPIB
	USBCdc	Select USB-CDC
	SOCKets	Select Sockets
	WEB	Select the web server
	UART	Select the UART

Return Parameter	<bool>	Returns the status of the selected mode.
Example	SYST:COMM:ENAB 1,USBC Turns the USB-CDC interface auto.	
Query Example	SYST:COMM:ENAB? USBC 1 Queries the USB-CDC state, returns 1 (USB-CDC is auto).	

:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

Set → → Query

Description	Sets or queries the GPIB address. Note: the setting will only be valid after the power has been cycled.	
Syntax	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <NR1>	
Query Syntax	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?	
Parameter/Return	<NR1>	0~30
Example	SYST:COMM:GPIB:SELF:ADDR 15 Sets the GPIB address to 15.	

:SYSTem:COMMunicate:LAN:IPADdress

Set → → Query

Description	Sets or queries LAN IP address. Note: the setting will only be valid after the power has been cycled.	
Syntax	:SYSTem:COMMunicate:LAN:IPADdress <string>	
Query Syntax	:SYSTem:COMMunicate:LAN:IPADdress?	
Parameter/Return	<string>	LAN IP address in string format (“address”) Applicable ASCII characters: 20H to 7EH
Example	SYST:COMM:LAN:IPAD “172.16.5.111” Sets the IP address to 172.16.5.111.	

:SYSTem:COMMunicate:LAN:GATeway

Set → / → Query

Description	Sets or queries the Gateway address. Note: the setting will only be valid after the power has been cycled.
Syntax	:SYSTem:COMMunicate:LAN:GATeway <string>
Query Syntax	:SYSTem:COMMunicate:LAN:GATeway?
Parameter/Return	<string> Gateway address in string format ("address") Applicable ASCII characters: 20H to 7EH
Example	SYST:COMM:LAN:GAT "172.16.0.254" Sets the LAN gateway to 172.16.0.254.

:SYSTem:COMMunicate:LAN:SMASk

Set → / → Query

Description	Sets or queries the LAN subnet mask. Note: the setting will only be valid after the power has been cycled.
Syntax	:SYSTem:COMMunicate:LAN:SMASk <string>
Query Syntax	:SYSTem:COMMunicate:LAN:SMASk?
Parameter/Return	<string> Subnet mask in string format ("mask") Applicable ASCII characters: 20H to 7EH
Example	SYST:COMM:LAN:SMASk "255.255.0.0" Sets the LAN mask to 255.255.0.0.

:SYSTem:COMMunicate:LAN:MAC

→ Query

Description	Returns the unit MAC address as a string. The MAC address cannot be changed.
Query Syntax	:SYSTem:COMMunicate:LAN:MAC?
Return parameter	<string> Returns the MAC address in the following format "FF-FF-FF-FF-FF-FF"
Example	SYST:COMM:LAN:MAC? 02-80-AD-20-31-B1 Returns the MAC address.

:SYSTem:COMMunicate:LAN:DHCP

Set → / → Query

Description	Turns DHCP on/off. Queries the DHCP status. Note: the setting will only be valid after the power has been cycled.	
Syntax	:SYSTem:COMMunicate:LAN:DHCP {<bool>|OFF|ON}	
Query Syntax	:SYSTem:COMMunicate:LAN:DHCP?	
Parameter	OFF | 0	DHCP off
	ON | 1	DHCP on
Return parameter	<bool>	Returns the DHCP status.

:SYSTem:COMMunicate:LAN:DNS

Set → / → Query

Description	Sets or queries the DNS address. Note: the setting will only be valid after the power has been cycled.	
Syntax	:SYSTem:COMMunicate:LAN:DNS <string>	
Query Syntax	:SYSTem:COMMunicate:LAN:DNS?	
Parameter/Return	<string>	DNS in string format ("mask") Applicable ASCII characters: 20H to 7EH
Example	SYST:COMM:LAN:DNS "172.16.1.252" Sets the DNS to 172.16.1.252.	

:SYSTem:COMMunicate:RLSTate

Set → / → Query

Description	Enables or disables local/remote state of the instrument.	
Syntax	:SYSTem:COMMunicate:RLSTate {LOCal|REMote|RWLock}	
Query Syntax	:SYSTem:COMMunicate:RLSTate?	
Parameter/Return parameter	LOCal	All keys are valid. This instrument is controlled by the front panel controls.
	REMote	All keys are invalid, except for the [shift+local] key and the ability to turn the output on/off.

	RWLock	All keys are invalid. The instrument can only be controlled remotely.
Example	:SYST:COMM:RLST LOCAL Sets the operating mode to local.	

:SYSTem:COMMunicate:TCPip:CONTrol → Query

Description	Queries the socket port number.	
Query Syntax	:SYSTem:COMMunicate:TCPip:CONTrol?	
Return parameter	<NR1>	0000 ~ 9999
Example	SYST:COMM:TCP:CONT? >2268 Returns the socket port number.	

:SYSTem:COMMunicate:SERial[:RECeive] :TRANsmit:BAUD

Set → / → Query

Description	Sets or queries the UART baud rate. Note: the setting will only be valid after the power has been cycled.	
Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :BAUD <NR1>	
Query Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :BAUD?	
Parameter/Return	<NR1>	2400, 4800, 9600, 19200, 38400, 57600, 115200
Example	SYST:COMM:SER:TRAN:BAUD? >2400 Returns the baud rate settings.	

:SYSTem:COMMunicate:SERial[:RECeive] :TRANsmit:BITS

Set → / → Query

Description	Sets or queries the UART number of data bits. Note: the setting will only be valid after the power has been cycled.

Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :BITS <NR1>
Query Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :BITS?
Parameter/Return parameter	<NR1> 0 7 bits 1 8 bits
Example	SYST:COMM:SER:TRAN:BITS? >1 Indicates that 8 data bits are used for the UART connection.

:SYSTem:COMMunicate:SERial[:RECeive] :TRANsmit:PARity

Set → / → Query

Description	Sets or queries the parity of the UART connection. Note: the setting will only be valid after the power has been cycled.
Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :PARity <NR1>
Query Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :PARity?
Parameter/Return parameter	0 None 1 Odd 2 Even
Example	SYST:COMM:SER:TRAN:PARity? >1 Indicates that odd parity is used for the UART connection.

:SYSTem:COMMunicate:SERial[:RECeive] :TRANsmit:SBITs

Set → / → Query

Description	Sets or queries the number of stop bits used for the UART connection. Note: the setting will only be valid after the power has been cycled.

Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :SBITs<NR1>	
Query Syntax	:SYSTem:COMMunicate:SERial[:RECeive]:TRANsmit :SBITs?	
Parameter/Return parameter	0	1 stop bit
	1	2 stop bits
Example	SYST:COMM:SER:TRAN:SBITs? >1 Indicates that one stop bit is used for the UART connection.	

:SYSTem:COMMunicate:USB:FRONt:STATe → Query

Description	Queries the front panel USB-A port state.	
Query Syntax	:SYSTem:COMMunicate:USB:FRONt:STATe?	
Return parameter	0	<NR1>Absent
	1	<NR1>Mass Storage

:SYSTem:COMMunicate:USB:REAR:STATe → Query

Description	Queries the rear panel USB-B port state.	
Query Syntax	:SYSTem:COMMunicate:USB:REAR:STATe?	
Return parameter	0	<NR1>Absent
	1	<NR1>Connected to the PC

: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?	
Return parameter	<string>	Returns an error code followed by an error message as a single string.
Example	SYSTem:ERRor? -100, “Command error”	

:SYSTem:KLOCk

Set → / → Query

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

:SYSTem:KEYLock:MODE

Set → / → Query

Description	Sets or queries the keylock mode. This setting is the equivalent to the Keyboard menu(Lock Mode) setting.	
Syntax	:SYSTem:KEYLock {<bool>|OFF|ON}	
Query Syntax	:SYSTem:KEYLock?	
Parameter/Return parameter	0 | OFF	Panel lock: allow output off.
	1 | ON	Panel lock: allow output on/off.

:SYSTem:ERRor:ENABle

Set →

Description	Clears the Error Queue and enables all error messages to be placed in the System Error Queue.
Syntax	:SYSTem:ERRor:ENABle

:SYSTem:PRESet

Set →

Description	Loads the default settings.
Syntax	:SYSTem:PRESet

:SYSTem:VERSion

→ Query

Description	Returns the version of the PPX SCPI version.

Query Syntax	:SYSTem:VERSion?
Return	<string> Returns the SCPI version as a string.
Query Example	SYST:VERS? >1999.9

:SYSTem:KEYBoard:BEEPer

Set → / → Query

Description	Sets or queries the keyboard buzzer state on/off. This is the equivalent to the Buzzer menu (Keyboard)settings.	
Syntax	:SYSTem:KEYBoard:BEEPer {<bool>|OFF|ON}	
Query Syntax	:SYSTem:KEYBoard:BEEPer?	
Parameter	OFF | 0	Turns the keyboard buzzer off.
	ON | 1	Turns the keyboard buzzer on.
Return Parameter	<bool>	Returns the keyboard buzzer status.

:SYSTem:CAPacity:AHOur

Set → / → Query

Description	Sets or queries the Ampere-hour capacity. This is the equivalent to the Ah/Wh Meter menu (AHour) settings. Note: Install the license first.	
Syntax	:SYSTem:CAPacity:AHOur {<NR2>|MINimum|MAXimum}	
Query Syntax	:SYSTem:CAPacity:AHOur? [MINimum|MAXimum]	
Parameter	<NR2>	0.001~999999999.999
	MINimum	0.001
	MAXimum	999999999.999
Return Parameter	<NR2>	Returns the Ampere-hour capacity.

:SYSTem:CAPacity:WHOur

Set → / → Query

Description	Sets or queries the Watt-hour capacity. This is the equivalent to the Ah/Wh Meter menu (WHour) settings. Note: Install the license first.

Syntax	:SYSTem:CAPacity:WHOur {<NR2>|MINimum|MAXimum}	
Query Syntax	:SYSTem:CAPacity:WHOur? [MINimum|MAXimum]	
Parameter	<NR2>	0.001~999999999.999
	MINimum	0.001
	MAXimum	999999999.999
Return Parameter	<NR2>	Returns the Watt-hour capacity.

:SYSTem:CAPacity:MODE

Set → / → Query

Description	Sets or queries the capacity mode. This is the equivalent to the AH/WH Meter menu (Mode) settings. Note: Install the license first.	
Syntax	:SYSTem:CAPacity:MODE {<NR1>|DISable|AHOur|WHOur}	
Query Syntax	:SYSTem:CAPacity:MODE?	
Parameter	Disable | 0	Sets capacity mode in Disable.
	AHOur | 1	Sets capacity mode in AHour,The sets will turn off output when Ampere-hour capacity is reached.
	WHOur | 2	Sets capacity mode in WHour, The sets will turn off output when Watt -hour capacity is reached.
Return Parameter	<NR2>	Returns the capacity mode.

:SYSTem:CAPacity:STATe

→ Query

Description	Queries the capacity state. Monitor the capacity when the output is turned on.Turn off the output when the monitored AHour/Whour capacity is reached. Note:The capacity mode is selected Ahour/Whour first.	
Query Syntax	:SYSTem:CAPacity:STATe?	
Parameter	0	AHour/Whour capacity isn't reached.
	1	AHour/Whour capacity is reached.
Return Parameter	<NR1>	Returns the capacity state.

Fetch Commands

:FETCh:AHOur? → Query

Description	Queries the measurement of Ampere-hour capacity. Note: Install the license first.
Query Syntax	:FETCh:AHOur?
Return Parameter	<NR1> Returns the the measurement of Ampere -hour capacity.

:FETCh:WHOur? → Query

Description	Queries the measurement of Watt-hour capacity. Note: Install the license first.
Query Syntax	:FETCh:WHOur?
Return Parameter	<NR1> Returns the the measurement of Watt -hour capacity.

Trigger Commands

:TRIGger:OUTPut:SOURce

Set → Query

Description	Sets or queries the trigger source of the output trigger.	
Syntax	:TRIGger:OUTPut:SOURce {BUS|IMMediate|EXTernal}	
Query Syntax	:TRIGger:OUTPut:SOURce?	
Parameter/ Return parameter	BUS	Output trigger is generated by the bus.
	IMMediate	Output trigger is immediately generated.
	EXTernal	The output trigger is generated when an external signal triggers it.
Example	:TRIGger:OUTPut:SOURce? Sets the output trigger source to EXT.	

:TRIGger:OUTPut[:IMMediate]

Set →

Description	Generates an immediate trigger for the output trigger system.
Syntax	:TRIGger:OUTPut[:IMMediate]
Example	:TRIG:OUTP

:TRIGger[:TRANsient]:SOURce

Set → / → Query

Description	Sets or queries the source of the transient trigger.	
Syntax	:TRIGger[:TRANsient]:SOURce {BUS|IMMediate|EXTernal}	
Query Syntax	:TRIGger[:TRANsient]:SOURce?	
Parameter/ Return parameter	BUS	Transient trigger is generated by the bus.
	IMMediate	Transient trigger is immediately generated.
	EXTernal	The transient trigger is generated when an external signal triggers it.
Example	:TRIG:SOUR?	
	EXT	
	Sets the transient trigger source to EXT.	

:TRIGger[:TRANsient][:IMMediate]

Set →

Description	Generates an immediate trigger for the transient trigger system.
Syntax	:TRIGger[:TRANsient][:IMMediate]
Example	:TRIG

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.

IEEE 488.2 Common Commands

*CLS

Set

Description	The *CLS command clears all the event registers, including the status byte, event status and error queue.
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 PPX.	
Query Syntax	*IDN?	
Return parameter	<string>	Returns the instrument identification as a string in the following format: GW-INSTEK,PPX-2005,TW123456,V1.00 Manufacturer: GW-INSTEK Model number : PPX-2005 Serial number : TW123456 Firmware version : V1.00

*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.

*RCL

Set →

Description	Recalls the contents stored in memory slot M1 ~ M10.	
Syntax	*RCL {<NR1>|MAX|MIN}	
Parameter	<NR1>	0 ~ 9 (as memory M1 ~ M10)
	MIN	Recalls the M1 memory contents.
	MAX	Recalls the M10 memory contents.

*RST

Set →

Description	Performs a device reset. Configures the unit to a known configuration (default settings). This known configuration is independent of the usage history.
Syntax	*RST

*SAV

Set →

Description	Saves the settings into memory slot M1 ~ M10.	
Syntax	*SAV {<NR1>|MIN|MAX}	
Return parameter	<NR1>	0 ~ 9 (as memory M1 ~ M10)
	MIN	Saves the M1 memory contents.
	MAX	Saves the M10 memory contents.

*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) replacing the RQS bit (bit 6).	
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 PPX 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 PPX 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 PPX 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

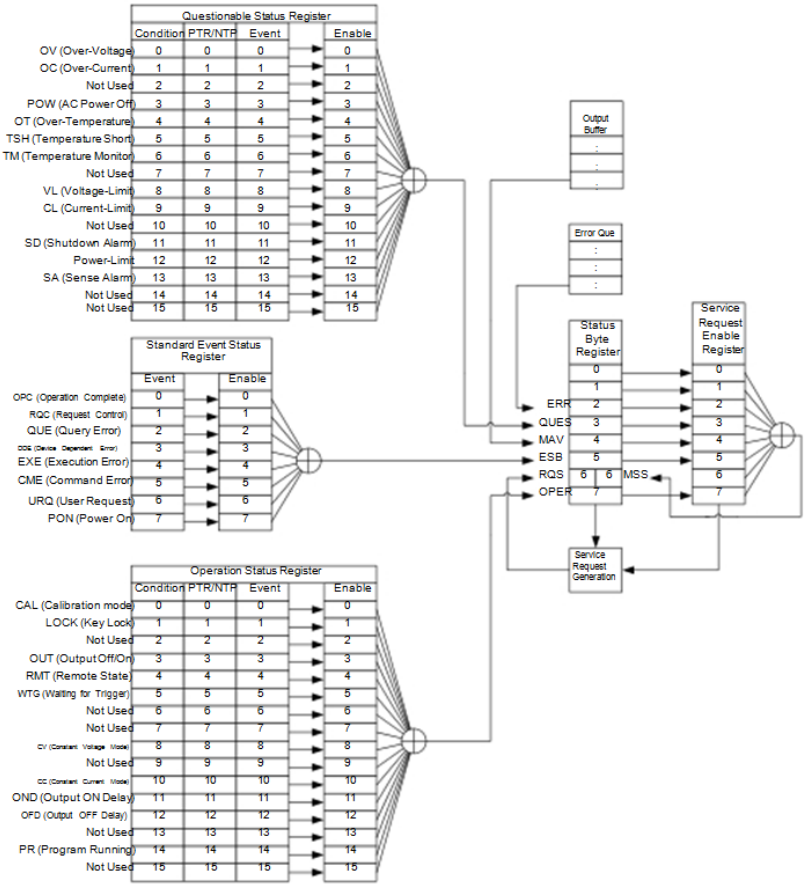
Service Request Generation

Error Queue

Output Buffer

The next page shows the structure of the Status registers.

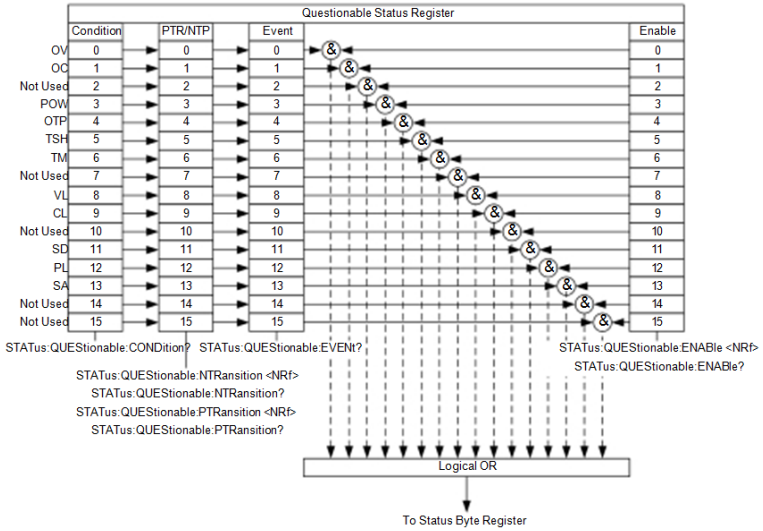
The Status Registers



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

	OTP(Over Temperature Protection) Over temperature protection has been tripped	4	16
	TSH(Temperature Short) K-Type thermocouple short.	5	32
	TM(Temperature Monitor) Temperature monitor reached.	6	64
	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
	SA (Sense Alarm)	13	8192

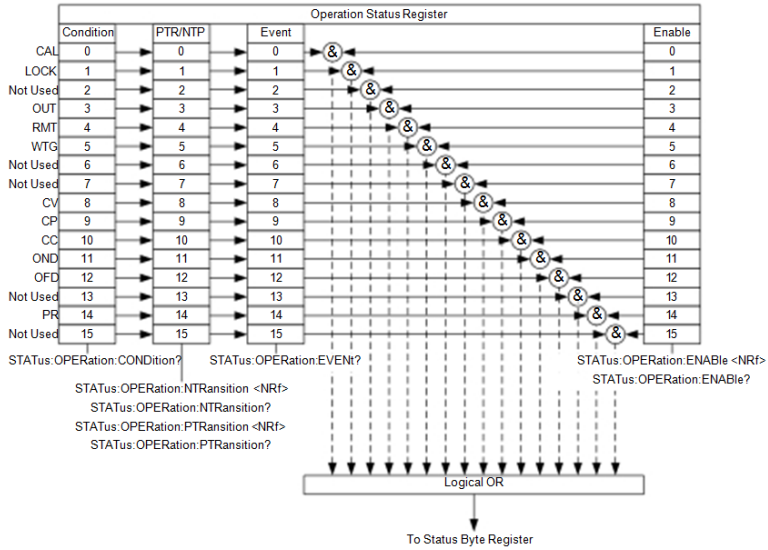
Condition Register	The Questionable Status Condition Register indicates the status of the power supply. If a bit is set in the Condition register, it indicates that the event is true. Reading the condition register does not change the state of the condition register.

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 PPX is in calibration mode.	0	1
LOCK (Key Lock) Keyboard locked.	1	2
OUT(Output off/on) Output off/on state.	3	8
RMT(Remote state) Remote state	4	16

	WTG (Waiting for trigger) Indicates if the PPX is waiting for a trigger.	5	32
	CV (Constant voltage mode) Indicates if the PPX is in CV mode.	8	256
	CP (Constant power mode) Indicates if the PPX is in CP mode.	9	512
	CC (Constant current mode) Indicates if the PPX 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	14	16384

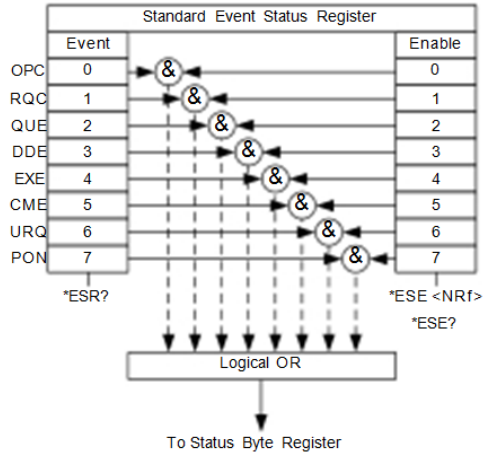
Condition Register	The Operation Status Condition Register indicates the operating status of the power supply. If a bit is set in the Condition register, it indicates that the event is true. Reading the condition register does not change the state of the condition register.

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 OPC 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

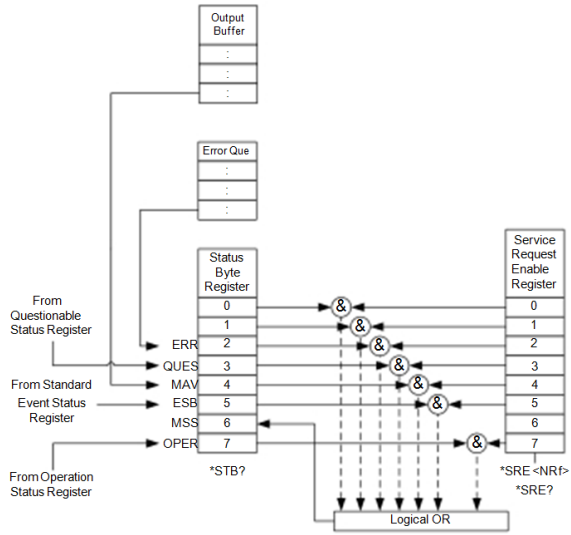
	QUE (Query Error) The Query Error bit is set in response to an error reading the Output Queue. This can be caused by trying to read the Output Queue when there is no data present.	2	4
	DDE (Device Dependent Error) Device specific error.	3	8
	EXE (Execution Error) The EXE bit indicates an execution error 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 [-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
-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.
-102 Syntax error	An unrecognized command or data type was encountered; for example, a string was received when the device does not accept strings.
-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?
-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.
-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.
-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.
-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 *SRE2 is an error.

-112 Program mnemonic too long	The header contains more that twelve characters (see IEEE 488.2, 7.6.1.4.1).
-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.
-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.
-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.
-120 Numeric data error	This error, as well as errors -121 through -129, are generated when parsing a data element which apprears to be numeric, including the nondecimal numeric types. This particular error message should be used if the device cannot detect a more specific error.
-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.
-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.
-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.

-141 Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
-148 Character data not allowed	A legal character data element was encountered where prohibited by the device.
-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.
-158 String data not allowed	A string data element was encountered but was not allowed by the device at this point in parsing.
-160 Block data error	This error, as well as errors -161 through -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.
-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.
-168 Block data not allowed	A legal block data element was encountered but was not allowed by the device at this point in parsing.
-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
-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.

-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 cannot be executed.
-203 Command protected	Indicates that a legal password-protected program command or query could not be executed because the command was disabled.
-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.
-213 Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
-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 -221 through -229.
-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.).

-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.).
-224 Illegal parameter value	Used where exact value, from a list of possibles, 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
-310 System error	Indicates that some error, termed "system error" by the device, has occurred. This code is device-dependent.
-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
-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

PPX Series Default Settings

The following default settings are the factory configuration settings for the power supply.

Initial	Default Setting
Output	Off
LOCK	Disabled
Voltage Set	0.000 V
Current Set	0.0000 A

Output	Default Setting
Output On Dly(Delay)	00(hour):00(minute):00.00(sec)
Output Off Dly(Delay)	00(hour):00(minute):00.00(sec)
Remote Sense	2 Wire
V/I Slew Rate	CVHS = CV high speed priority
R_V(Rising Voltage) Slew Rate	0.001 V/ms (PPX-10H01) 0.0001 V/ms (Other)
F_V(Falling Voltage) Slew Rate	0.001 V/ms (PPX-10H01) 0.0001 V/ms (Other)
R_C(Rising Current) Slew Rate	0.00001 A/ms (PPX all series)
F_C(Falling Current) Slew Rate	0.00001 A/ms (PPX all series)

Measurement	Default Setting
Measure Average	Off
Voltage Range	Auto
Current Range	Auto

EXT (External) Control	Default Setting
CV Control	Front Panel
CC Control	Front Panel
Output Type	High
Output Enable	Off

TRIG(Trigger Control)	Default Setting
Trigin Level	High
Trigin Action	None
Trigin Voltage	0.000 V
Trigin Current	0.0000 A
Trigin Memory	M1
Trigout Level	Low
Trigout Source	None
Trigout Width	1.0 ms

PWR(Power) On Config	Default Setting
Power On Status	Safe

Constant PWR(Power)	Default Setting
Control	Off
Power	(1.05 X Vrate) * (1.05 X Irate)

Temperature	Default Setting
Control	Off
Unit	℃
Output Safe	Off
Monitor	100.0 ℃
Adjust	0.0 ℃

Save/Recall	Default Setting
Save Mem(Memory) Set	M1
Recall Mem(Memory) Set	M1

Utility - Buzzer	Default Setting
Protect	On
Keyboard	Off

Utility - Bleeder	Default Setting
Bleeder	On

APP - AH/WH Meter (License Key)	Default Setting
Mode	Disable
AHour	999999999.999 Ah
WHour	999999999.999 Wh

Protect	Default Setting
Voltage Limit	Off
UVL	0.000 V
OVP Level	1.1 X Vrate
Current Limit	Off
OCP Level	1.1 X Irate)
OCP Delay	0.05s

INDEX