



KIKUSUI

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Communication Interface Manual

Regulated DC Power Supply PMX-A Series

PMX18-2A

PMX18-5A

PMX35-1A

PMX35-3A

PMX70-1A

PMX110-0.6A

PMX250-0.25A

PMX350-0.2A

PMX500-0.1A

Multiple-output DC Power Supply PMX-Multi Series

PMX32-3DU

PMX32-3TR

PMX32-2QU

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Command List

***CLS**

Clears all event registers including the status byte, event status, and error queue.

***ESE**

Sets the event status enable register that is counted by the event summary bit (ESB) of the status byte.

***ESR**

Queries the event status register.

***IDN**

Queries the model name, serial number, and firmware version of the PMX.

***OPC**

Sets the OPC bit (bit 0) of the event status register when all the commands in standby have been completed.

***OPT**

Queries the option that are installed in the PMX.

***PSC (PMX-Multi only)**

Sets whether to clear the event status enable register and the service request enable register when the POWER switch is turned on (power-on status).

***RCL (PMX-A only)**

Recalls settings from the preset memory (A, B, C).

***RST**

Resets the panel settings.

***SAV (PMX-A only)**

Saves the present voltage, current, OVP, and OCP values in the preset memory.

***SRE**

Sets the service request enable register.

***STB**

Queries the contents of the status byte register and the MSS (master summary status) message.

***TRG (PMX-A only)**

Trigger command.

***TST**

Executes a self-test.

***WAI**

Prevents the PMX from executing subsequent commands until all operations in standby are complete.

ABOR (PMX-A only)

Aborts the setting change trigger function.

ABOR:DTF (PMX-Multi only)

Aborts the parallel or series operation of channels 1 and 2.

FETC:ALL (PMX-Multi only)

Queries the measured value of the current and voltage.

FETC:CURR (PMX-Multi only)

Queries the measured value of the current output.

FETC:VOLT (PMX-Multi only)

Queries the measured value of the voltage output.

INIT:TRAN (PMX-A only)

Starts the setting change (TRANSient) trigger function.

INIT:DTF:PARA (PMX-Multi only)

Starts the parallel operation of channels 1 and 2.

INIT:DTF:SER (PMX-Multi only)

Starts the series operation of channels 1 and 2.

INST/ CHAN

Specifies the channel to configure.

INST:CAT/ CHAN:CAT

Queries the list of channels that can be configured with the INST command.

INST:INFO/ CHAN:INFO

Queries the information of the channel currently being controlled.

INST:UNS/ CHAN:UNS (PMX-Multi only)

Releases the designation of the channel under control.

MEAS:ALL (PMX-Multi only)

Queries the measured value of the current and voltage.

MEAS:CURR

Queries the measured value of the current.

MEAS:VOLT

Queries the measured value of the voltage.

MEM:REC

Recalls the settings stored in the preset memory A, B, or C.

MEM:REC:CONF

Sets whether to check the contents saved in the preset memory when recalling them from the control panel.

MEM:REC:PREV

Refers to the settings stored in the preset memory A, B, or C.

MEM:SAVE

Saves to the preset memory.

OUTP

Turns the output on and off.

OUTP:ALL (PMX-Multi only)

Turns the output on or off of all channels.

OUTP:DEL (PMX-Multi only)

Enables or disables the output on/off-delay operation.

OUTP:DEL:ON (PMX-Multi only)

Sets the output-on delay.

OUTP:DEL:OFF (PMX-Multi only)

Sets the output-off delay.

OUTP:EXT

Sets whether output will be turned on and off externally.

OUTP:EXT:LOG

Sets the logic used to control the turning of output on and off using an external contact.

OUTP:PON

Sets the output state at power-on.

OUTP:PROT:CLE

Clears alarms.

OUTP:PROT:ISO (PMX-Multi only)

Sets whether to turn off the output of all channels when a OCP or OVP occurs.

OUTP:PROT:WDOG (PMX-Multi only)

Sets the Communication monitor (WATCHDOG) timer.

OUTP:RISE:TIME (PMX-Multi only)

Sets the CV rise time.

CURR

Sets the current.

CURR:EXT:SOUR (PMX-A only)

Sets whether constant current will be controlled externally.

CURR:PROT

Sets the overcurrent protection (OCP) value.

CURR:TRIG (PMX-A only)

Sets the current value that is applied when a trigger is sent.

VOLT

Sets the voltage.

VOLT:EXT:SOUR (PMX-A only)

Sets whether constant voltage will be controlled externally.

VOLT:PROT

Sets the overvoltage protection (OVP).

VOLT:TRIG (PMX-A only)

Sets the voltage that is applied when a trigger is sent.

STAT:OPER

Queries the event of the OPERation status register.

STAT:OPER:COND

Queries the condition of the OPERation status register.

STAT:OPER:ENAB

Sets the enable register of the OPERation status register.

STAT:OPER:NTR

Sets the negative transition of the OPERation status register.

STAT:OPER:PTR

Sets the positive transition of the OPERation status register.

STAT:OPER:INST (PMX-Multi only)

Queries the event of the OPERation:INSTrument subregister.

STAT:OPER:INST:COND (PMX-Multi only)

Queries the condition of the OPERation:INSTrument subregister.

STAT:OPER:INST:ENAB (PMX-Multi only)

Sets the enable register of the OPERation:INSTrument subregister.

STAT:OPER:INST:NTR (PMX-Multi only)

Sets the negative transition of the OPERation:INSTrument subregister.

STAT:OPER:INST:PTR (PMX-Multi only)

Sets the positive transition of the OPERation:INSTrument subregister.

STAT:OPER:INST:ISUM<n> (PMX-Multi only)

Queries the event of the OPERation:INSTrument:ISUMmary<n> subregister.

STAT:OPER:INST:ISUM<n>:COND (PMX-Multi only)

Queries the condition of the OPERation:INSTrument:ISUMmary<n> subregister.

STAT:OPER:INST:ISUM<n>:ENAB (PMX-Multi only)

Sets the enable register of the OPERation:INSTrument:ISUMmary<n> subregister.

STAT:OPER:INST:ISUM<n>:NTR (PMX-Multi only)

Sets the negative transition of the OPERation:INSTrument:ISUMmary<n> subregister.

STAT:OPER:INST:ISUM<n>:PTR (PMX-Multi only)

Sets the positive transition of the OPERation:INSTrument:ISUMmary<n> subregister.

STAT:QUES

Queries the event of the QUEStionable status register.

STAT:QUES:COND

Queries the condition of the QUEStionable status register.

STAT:QUES:ENAB

Sets the enable register of the QUEStionable status register.

STAT:QUES:NTR

Sets the negative transition of the QUESTIONable status register.

STAT:QUES:PTR

Sets the positive transition of the QUESTIONable status register.

STAT:QUES:INST (PMX-Multi only)

Queries the event of the QUESTIONable:INSTrument subregister.

STAT:QUES:INST:COND (PMX-Multi only)

Queries the condition of the QUESTIONable:INSTrument subregister.

STAT:QUES:INST:ENAB (PMX-Multi only)

Sets the enable register of the QUESTIONable:INSTrument subregister.

STAT:QUES:INST:NTR (PMX-Multi only)

Sets the negative transition of the QUESTIONable:INSTrument subregister.

STAT:QUES:INST:PTR (PMX-Multi only)

Sets the positive transition of the QUESTIONable:INSTrument subregister.

STAT:QUES:INST:ISUM<n> (PMX-Multi only)

Queries the event of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

STAT:QUES:INST:ISUM<n>:COND (PMX-Multi only)

Queries the condition of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

STAT:QUES:INST:ISUM<n>:ENAB (PMX-Multi only)

Sets the enable register of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

STAT:QUES:INST:ISUM<n>:NTR (PMX-Multi only)

Sets the negative transition of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

STAT:QUES:INST:ISUM<n>:PTR (PMX-Multi only)

Sets the positive transition of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

STAT:PRES

Resets the ENABLE, PTRansition, and NTRansition filter registers of all status registers (including sub registers) to their default values.

SYST:BEEP (PMX-Multi only)

Turns the buzzer on and off.

SYST:COMM:RLST (PMX-Multi only)

Sets the operation of the PMX to local or remote.

SYST:CONF:STAR:PRI

Sets the operation mode to be prioritized when the output is turned on.

SYST:DTF (PMX-Multi only)

Queries the parallel or series operation state.

SYST:ERR

Reads the oldest error information or event information from the error queue. The error queue can store up to 16 errors.

SYST:ERR:COUN (PMX-Multi only)

Returns the number of unread errors in the error queue.

SYST:ERR:TRAC

Sets whether to display communication errors by performing a debug trace.

SYST:KLOC

Sets and releases the panel operation lock (keylock).

SYST:KLOC:MODE

Sets the lock mode of the panel operations.

SYST:LOC (PMX-A only)

Sets the PMX to local mode (Remote Disable; the REMOTE LED turns off).

SYST:OPT (PMX-A only)

Queries the optional interface boards and enhanced functions that are installed in the PMX.

SYST:REM (PMX-A only)

Sets the PMX operation to remote mode.

SYST:RWL (PMX-A only)

Sets the PMX operation to remote mode.

SYST:SEC:IMM (PMX-Multi only)

Sanitizes all contents stored in memory and initializes the panel settings to their factory default conditions.

SYST:VERS

Queries the version of the SCPI specifications to which the PMX conforms.

TRAC (PMX-Multi only)

Enables or disables the tracking function.

TRAC:ABS:CURR (PMX-Multi only)

Sets the amount of change to apply to the present current using an absolute value when the tracking function is enabled.

TRAC:ABS:VOLT (PMX-Multi only)

Sets the amount of change to apply to the present voltage using an absolute value when the tracking function is enabled.

TRAC:BASE (PMX-Multi only)

Queries the reference values (voltage and current) of the tracking function.

TRAC:BASE:ANCH (PMX-Multi only)

Changes the reference value of the tracking function to the present value.

TRAC:BASE:CHAN (PMX-Multi only)

Specifies the reference channel of the tracking function.

TRAC:BASE:INST (PMX-Multi only)

Specifies the reference channel of the tracking function.

TRAC:MODE (PMX-Multi only)

Sets whether to use the tracking function based on absolute value change or percentage change.

TRAC:RAT:CURR (PMX-Multi only)

Sets the amount of change to apply to the present current using a percentage when the tracking function is enabled.

TRAC:RAT:VOLT (PMX-Multi only)

Sets the amount of change to apply to the present voltage using a percentage when the tracking function is enabled.

TRAC:SYNC (PMX-Multi only)

Enables or disables the tracking function, and sets the target channels.

TRIG:TRAN (PMX-A only)

Executes a software trigger for the TRANSient trigger subsystem.

TRIG:TRAN:SOUR (PMX-A only)

Sets the condition (trigger source) that determines when the TRANSient trigger subsystem actually changing the setting after the PMX receives the INIT:TRAN command.

Introduction

The PMX Series Communication Interface Manual explains the settings and the commands that are used to control the PMX remotely through one of the following interfaces.

- RS232C interface
- USB interface
- LAN interface

When the PMX is operating under remote control, the REMOTE on the display of the front panel lights. To switch the operating mode from remote to local (panel operation), press LOCAL key.

For the safety precautions, installation, operation, and specifications of the PMX, read the accompanying PMX series User's Manual.

■ Reading environment

This manual can be viewed by the following environment.

PDF Reader: Adobe Reader

■ Intended readers

This manual is written for readers with sufficient basic knowledge of how to control instruments using a PC.

Familiarize yourself with the syntax of the SCPI commands that are used with the product before you use them.

■ Structure of the manual

This manual consists of the following sections.

- Overview
- Setup
- Overview of messages
- Command
- Appendix
- Tutorial

■ Trademarks

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All other company names and product names used in this manual are trademarks or registered trademarks of the respective company.

■ Firmware version of the product to which this manual applies

This manual applies to products with the following IFC firmware version:

PMX-A: Ver.1.1x

PMX-Multi: Ver.1.0x

■ Instrument Interface Standards

The PMX-A conforms to the following standards.

- IEEE Std 488.2-1992 IEEE Standard Codes, Formats, Protocols, and Common Commands For Use With IEEE Std 488.1-1987
- Standard Commands for Programmable Instruments (SCPI) version 1999.0
- Universal Serial Bus Specification Rev 2.0
- Universal Serial Bus Test and Measurement Class Specification (USBTMC) Rev 1.0
- Universal Serial Bus Test and Measurement Class, Subclass USB488 Specification (USBTMC-USB488) Rev 1.0
- TCP/IP Instrument Protocol Specification VXI-11 Rev 1.0 1995
- TCP/IP-IEEE488.1 Interface Specification VXI-11.2 Draft 0.3 1995
- TCP/IP-IEEE488.2 Interface Specification VXI-11.3 Draft 0.3 1995
- LXI 1.4 Core Device Specification 2011
- IVI-6.1 IVI High-Speed LAN Instrument Protocol (HiSLIP) Rev 1.0
- VPP-4.3 The VISA Library 2010 Rev 5.0

The PMX-Multi conforms to the following standards.

- IEEE Std 488.2-1992 IEEE Standard Codes, Formats, Protocols, and Common Commands For Use With IEEE Std 488.1-1987
- Standard Commands for Programmable Instruments (SCPI) version 1999.0
- Universal Serial Bus Specification Rev 2.0
- Universal Serial Bus Test and Measurement Class Specification (USBTMC) Rev 1.0
- Universal Serial Bus Test and Measurement Class, Subclass USB488 Specification (USBTMC-USB488) Rev 1.0
- TCP/IP Instrument Protocol Specification VXI-11 Rev 1.0 1995
- TCP/IP-IEEE488.1 Interface Specification VXI-11.2 Draft 0.3 1995
- TCP/IP-IEEE488.2 Interface Specification VXI-11.3 Draft 0.3 1995
- 1.5 LXI Device Specification 2016
- LXI HiSLIP Extended Function Rev 1.0
- IVI-6.1 IVI High-Speed LAN Instrument Protocol (HiSLIP) Rev 1.0
- VPP-4.3 The VISA Library 2015 Rev 5.5

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Interface Setup

Installing the VISA Library

VISA (Virtual Instrument Software Architecture) is a specification for standard software that is used to connect instruments. VISA was defined by the IVI Foundation. A VISA library is required to use the software application. The VISA library (NI-VISA, Keysight VISA, or KI-VISA) must be installed on the controller (Windows).

One of the VISA libraries (driver software implemented in compliance with the VISA specifications) below is necessary.

- NI-VISA by National Instruments (Ver. 5.1.1 or later)
- Keysight VISA by Keysight Technologies (Keysight IO Libraries Suite 16.0 or later)
- KI-VISA Ver. 5.0.4 or later

- Note -

If your VISA library is an older version than that specified, you may not be able to use it depending on the interface.

Interface Setup

The PMX is equipped with LAN, RS232C, and USB interfaces as standard.

■ PMX-A

The LAN interface complies with LXI Device Specification 2011 Rev1.4 Class C and supports the VXI-11, HiSLIP, and SCPI-RAW protocols.

The USB interface complies with USBTMC device class.

By factory default, the remote control interface is set to the LAN interface. The LAN, RS232C, and USB interfaces cannot be used simultaneously.

■ PMX-Multi

The LAN interface complies with LXI Device Specification 2016 Rev1.5 and supports the VXI-11, HiSLIP, SCPI-RAW, and SCPI-Telnet protocols.

The USB interface complies with USBTMC device class.

There is no need to switch interfaces. All interfaces can be used simultaneously.

All Interfaces can be set to OFF in CONFIG settings.

RS232C

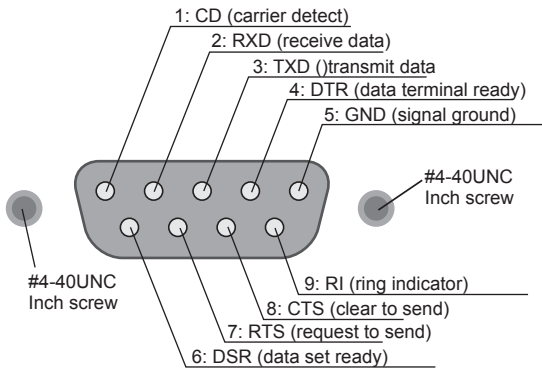
■ RS232C connection

The RS232C connector on the PMX is a D-Sub 9 pin connector. Check that the PMX and your PC are off before connecting them.

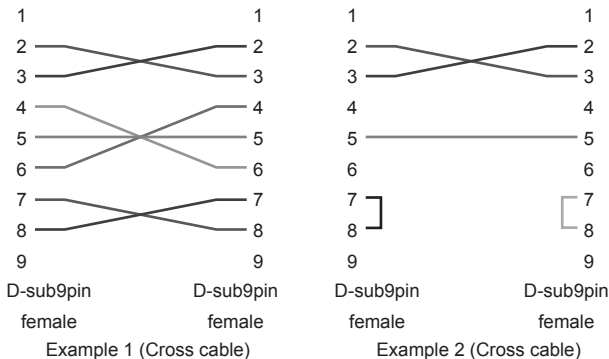
The RS232C port of this product comes with a cover. Remove the cover to use the port. Store the cover in a safe place so that you can use it to cover the RS232C port when the port is no longer in use. For safety reasons, when not using the RS232C port, be sure to attach to cover.

Use a D-sub 9-pin female-to-female AT type crossover cable for the RS232C cable. The PMX does not use hardware handshaking (See Example 2 below).

Figure shows the connector pin assignments.



Facing the PMX rear panel



■ RS232C Configuration (PMX-A)

For details of CONFIG settings, see the PMX user's manual.

- 1 Press CONFIG key several times until CF20 is displayed.**
The CONFIG key LED lights.
- 2 Use the CURRENT knob to select RS232C (CF20: 232).**
- 3 Press CONFIG key several times until the measured values are displayed on both voltmeter and ammeter, or press LOCAL key.**
The PMX exits the configuration mode.
- 4 Restart the PMX.**
The settings are applied.

■ RS232C Configuration (PMX-Multi)

For details of CONFIG settings, see the PMX user's manual. The factory default RS232C settings are RS232C enabled and 19200 bps baudrate.

- 1 Press CONFIG key several times until CF20 is displayed.**
- 2 Turn the VOLTAGE knob until CF22 (RS232C interface setting) is displayed.**
- 3 Use the CURRENT knob to select ON.**
RS232C is enabled.
- 4 Press CONFIG key several times until CF50 is displayed.**
- 5 Turn the VOLTAGE knob until CF51 (RS232C interface data rate setting) is displayed.**
- 6 Use the CURRENT knob to set the baudrate.**
For the settings, see the table under Protocol below.
- 7 Press CONFIG key several times until the measured values are displayed on both voltmeter and ammeter, or press SET key.**
The PMX exits the configuration mode.
- 8 Restart the PMX.**
The settings are applied.

■ Protocol

The following table shows the settings that correspond to the RS232C protocol. Underlined values are factory default settings.

Item	Setting	
	PMX-A	PMX-Multi
Baudrate	19 200 bps	1 200 bps/ 2 400 bps/ 4 800 bps/ 9 600 bps/ <u>19 200 bps</u> / 38 400 bps/ 57 600 bps/ 115 200 bps
Data	8 bit	
Stop	1 bit	
Parity	None	
Flow (X-flow control)	None	

■ RS232C communication

The PMX does not have flow control (this is fixed). If you send setting commands consecutively at a high speed, the PMX reception buffer may overflow. Do not send setting commands consecutively. Send query commands and read the responses at a certain interval, or reduce the command transmission frequency.

■ Break signal

The break signal functions as a substitute for the IEEE488.1 dcl / sdc (Device Clear, Selected Device Clear) message.

- Note -

The RS232C interface should be shifted remotely by the command. Use the SYST:REM (PMX-A) or SYST:COMM:RLST REM (PMX-Multi) SCPI command to set the RS232C interface to the remote state. Be sure to include this command at the start of the program when you are performing remote programming.

USB

A device driver supporting USB T&M Class (USBTMC) is required to control the PMX through the USB interface. The USBTMC driver is automatically installed by the VISA library.

■ USB connection

Use a standard USB cable to connect the PMX to the computer.

■ USB Configuration (PMX-A)

For details of CONFIG settings, see the PMX user's manual.

1

Press CONFIG key several times until CF20 is displayed.

The CONFIG key LED lights.

2

Turn the CURRENT knob to select USB (CF20: uSb).

3

Press CONFIG key several times until the measured values are displayed on both voltmeter and ammeter, or press LOCAL key.

The PMX exits the configuration mode.

4

Restart the PMX.

The settings are applied.

■ USB Configuration (PMX-Multi)

For details of CONFIG settings, see the PMX user's manual. The factory default USB setting is "USB enabled."

- 1** Press **CONFIG** key several times until **CF20** is displayed.
- 2** Turn the **VOLTAGE** knob until **CF21 (USB interface setting)** is displayed.
- 3** Turn the **CURRENT** knob to select **ON**.
USB is enabled.
- 4** Press **CONFIG** key several times until the measured values are displayed on both voltmeter and ammeter, or press **SET** key.
The PMX exits the configuration mode.
- 5** Restart the **PMX**.
The settings are applied.

■ Service request

The PMX is equipped with service request and serial polling functions.

■ USB function

Complies with USB Specification 2.0

Complies with USBTMC Specification 1.0 and USBTMC-USB488 Specification 1.0

Data rate: 12 Mbps maximum (Full speed)

VID (Vender ID)

0x0B3E

PID (Product ID)

PMX-A: 0x1029

PMX32-3DU: 0x102A

PMX32-3TR: 0x102B

PMX32-2QU: 0x102C

You can confirm both IDs by referring to CF50 (for VID and PID) of the CONFIG settings.

WARNING

If a network problem occurs, an unexpected dangerous voltage may occur that may cause electric shock, fire, physical damage to the DUT, and so on. If you are going to remotely control the PMX from a distance, install a Web camera or take other measures to monitor the status.

To use the LAN interface to control the PMX, middleware that supports the SC-PI-Telnet (PMX-Multi only) / VXI-11/ HiSLIP/ SCPI-RAW protocol must be installed on the controller. The middleware is installed automatically by the VISA library.

There is a Web browser interface to the PMX embedded in the LAN interface board. You can configure the LAN interface settings from your PC's Web browser.

For information on topics such as connecting to your corporate LAN, your IP address, your host name, and security, contact your network administrator.

If you are using a host name (a Bonjour host name), you have to install Apple Bonjour.

WARNING

- **The LAN interface can be accessed from any place on the network. If required, you can configure the security settings such as password protection or host access restriction. To restrict host access, specify the hosts that are allowed to access by registering IP addresses.**
- **Avoid running LAN interface reboot (CF34) or LAN interface reset (CF33) during the auto measurement system is working. Otherwise, an error might occur.**

- Note -

The LAN interface should be shifted remotely by the command. Use the SYS-T:REM (PMX-A) or SYST:COMM:RLST REM (PMX-Multi) SCPI command to set the RS232C interface to the remote state. Be sure to include this command at the start of the program when you are performing remote programming.

■ LAN connection

Use a standard LAN cable (category 5 and straight) to connect the PMX to a network hub or router. Use a crossover cable when making a direct connection.

LAN connector on the PMX is a RJ-45 connector.

■ LAN Configuration (PMX-A)

Normally, you should set DHCP and AUTO IP to "on" to obtain the IP address automatically. The factory default settings are DHCP: ON, AUTO IP: ON.

- 1** Press **CONFIG** key several times until **CF20** is displayed.
The CONFIG key LED lights.
- 2** Turn the **CURRENT** knob to select **LAN (CF20: LAN)**.
- 3** Press **CONFIG** key once.
The voltmeter displays "CF30."
- 4** Turn the **CURRENT** knob to set **DHCP (CF30: on)**.
- 5** Turn the **VOLTAGE** knob to select **CF31 (AUTO IP)**.
- 6** Turn the **CURRENT** knob to set **AUTO IP (CF31: on)**.
- 7** Press **CONFIG** key several times until the measured values are displayed on both voltmeter and ammeter, or press **LOCAL** key.
The PMX exits the configuration mode.
- 8** Restart the **PMX**.
The settings are applied.

When you are directly connecting the PMX to the controller, set DHCP to off and Auto-IP to on for obtaining the IP address automatically. You cannot set the IP address through the front panel. To set a fixed IP address, first obtain the IP address automatically, and then change it to a fixed address on embedded Web site via a web browser.

■ LAN Configuration (PMX-Multi)

For normal use, we recommend using the factory default settings.

Setting	Description (Factory default setting)	CONFIG setting
LAN interface setting	Use LAN	CF20: ON
IP address allocation method	DHCP: on AUTO IP: on MANUAL IP: off	CF41: 110

When connecting directly, for the IP address allocation method, set DHCP to off, Auto-IP to on, and MANUAL to off (CF41: 010) to automatically set the IP address.

To set the IP address manually, for the IP address allocation method, set DHCP to off, Auto-IP to off, MANUAL to on (CF41: 001), and set the IP address (CF42 to CF45).

If you change the interface settings (CF41 to CF46), apply the changes (CF40: APPL) or restart the power supply to make the new settings take effect.

For details of CONFIG settings, see the PMX user's manual.

- 1 Press CONFIG key several times until CF20 (LAN interface setting) is displayed.**
- 2 Turn the CURRENT knob to select on.**
LAN is enabled.
- 3 Press CONFIG key several times until CF40 is displayed.**
- 4 Turn the VOLTAGE knob until CF41 (IP address assignment method) is displayed.**
- 5 Turn the CURRENT knob to set 110.**
DHCP and AUTO IP are set to on, and MANUAL IP is set to off.
- 6 Press CONFIG key several times until the measured values are displayed on both voltmeter and ammeter, or press SET key.**
The PMX exits the configuration mode.
- 7 Restart the PMX.**
The settings are applied.

■ Service request

The PMX is equipped with service request and serial polling functions.

■ LAN function

The PMX may require an Internet connection depending on the how the PMX is accessed through a Web browser.

Complies with the LXI 1.4 Core 2011

Complies with the SCPI-Telnet (PMX-Multi only)/ VXI-11/ HiSLIP/ SCPI-RAW protocol

Communication speed: Maximum 100 Mbps (Auto negotiation)

AUTO MDIX function

Web browser access

Instrument information, network information, display of VISA resource information, checking the connected PMX, remote control from browser, changing network settings, system status information, license information, password setting

■ Restarting the LAN interface

You can use the CONFIG settings to restart the LAN interface. Even if you restart the LAN interface, the LAN settings will not change.

This operation does not affect the PMX's panel settings. If the product is in remote mode, you can switch it to local mode through panel operations.

On the PMX-A, select CF34 (restart the LAN), and press SET.

On the PMX-Multi, set CF40 (LAN setting apply) to APPL, and press SET.

■ Resetting the LAN interface

When reset, network settings are changed as follows. You can use this feature when you have forgotten the security password or the IP address.

This operation does not affect the PMX's panel settings. If the product is in remote mode, you can switch it to local mode through panel operations.

The items with an X mark are returned to their default values.

LCI	DEF	Item	Default Value
X	X	Assignment Method	DHCP:ON, Auto-IP:ON, Static:OFF
	X	DNS Server Assignment	0.0.0.0
	X	WINS Server Assignment	0.0.0.0
	X	Desired Hostname	<Model name> - <Last 5 digits of serial number>
	X	Desired Description	KIKUSUI <Model name> DC Power Supply - <Serial number>
X	X	Enable Dynamic DNS	Enable
X	X	Enable mDNS	Enable
X	X	Enable NetBIOS Over TCP/IP	Enable
X	X	Password Security	Not set

On the PMX-A, select CF33 (reset the LAN interface settings), and press SET.

On the PMX-Multi, set CF40 (LAN setting reset) to LCI or DEF, and press SET.

Accessing and Operating the PMX from a Web Browser (LAN interface)

You can use the LAN interface to configure detailed settings from a Web browser on your PC. Use latest version of browser.

The Web site's URL is defined by adding "http://" in front of the PMX's IP address.

You can enter the URL directly in the address bar of your Web browser by using the CONFIG settings (PMX-A: CF35 to CF38, PMX-Multi: CF30 to CF33) to view the IP address.

When you are using a VISA library, a function is available that enables the application program (such as National Instruments NI-MAX, Keysight Connection Expert, and Kikusui KI-VISA Instrument Explorer) to retrieve the VXI-11 measuring instrument. This function is provided by VISA vendors. You can access the PMX by clicking on the hyperlink that is provided in the retrieval results.

CONFIG		Display	Description
PMX-A	PMX-Multi		
CF35	CF30	0 to 255	Display the 1st number of the IP address
CF36	CF31	0 to 255	Display the 2nd number of the IP address
CF37	CF32	0 to 255	Display the 3rd number of the IP address
CF38	CF33	0 to 255	Display the 4th number of the IP address

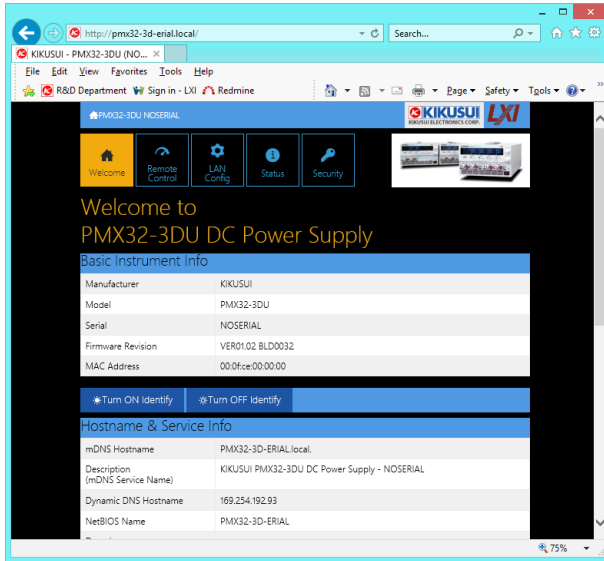
(Example) When the IP address is 169.254.7.8

<http://169.254.7.8>

■ WELCOME page

When you access the PMX from a Web browser, the WELCOME page is displayed first.

The instrument information, network information, and VISA resource (I/O resource) information appear on the display. Click items in the navigation menu to move to the other pages.

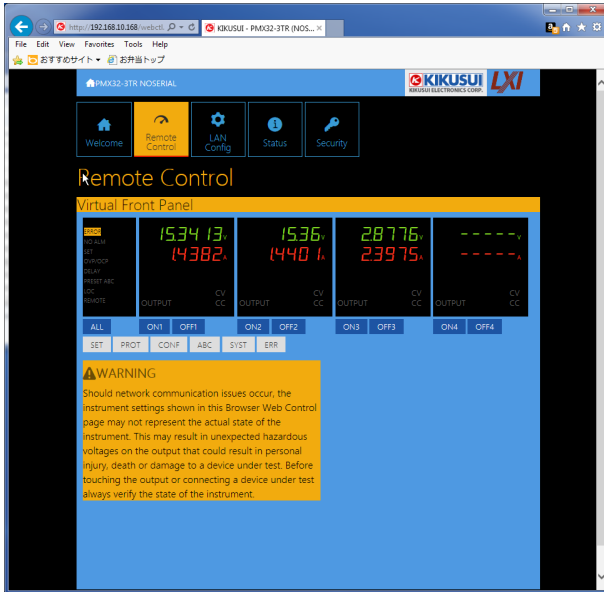


Turn ON Identify: The LAN LED on the front panel of the connected PMX blinks so that you can identify it.

Turn OFF Identify: The LAN LED blinking stops.

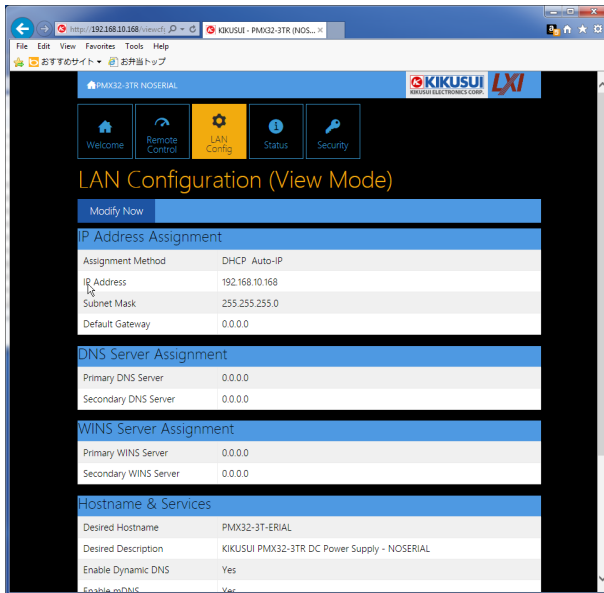
■ Remote Control page

You can remotely control the PMX from a browser. The various buttons have the same functions as those on the front panel of the PMX.



■ LAN Configuration page

You can display (View Mode) and change (Modify Mode) the network settings.



Navigation (View Mode)

Modify Now: Goes to the network setting item editing screen (Modify Mode).

Navigation (Modify Mode)

Undo: Returns the edited contents to the state before editing.

Apply: Applies the edited contents.

Reset: Resets the network settings.

Default: Returns the network settings to the factory default settings.

Back to View Mode: Goes to the network setting item viewing screen (View Mode).

IP Address Assignment

You can set the IP address. You can choose between automatic assignment and assignment of a fixed address.

In the case of automatic assignment of IP address, we recommend using the DHCP server function using a router as far as possible.

If the DHCP server function is not used, it takes about 60 seconds until determination that address assignment with DHCP has failed. Then, an address between 169.254.0.0 to 169.254.255.255 is assigned by link local address (Auto-IP).

DNS Server Assignment

Sets the address of the DNS server.

WINS Server Assignment

Sets the address of the WINS server.

Hostname & Services

You can set the host name and so on. If you set the host name, you can use it in place of the IP address to access the LAN interface. Normally, we recommend that you select “Enable Dynamic DNS”, “Enable mDNS”, and “Enable NetBIOS Over TCP/IP”.

If you leave the Hostname and Description boxes empty and click “Apply,” the host name will be created from the model name and serial number.

TCP Ports (View Mode)

The number of the TCP port in use is displayed. You cannot change the port number.

Reset and factory default settings

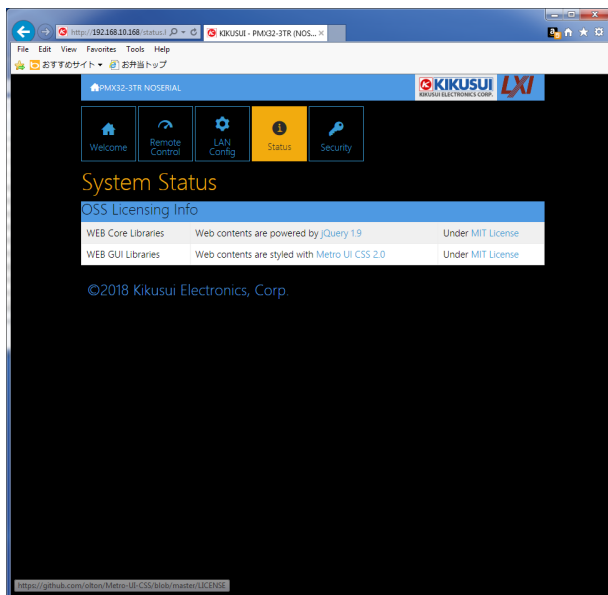
Clicking Reset and Default changes the network settings change as follows.

The items with an X mark are returned to their default values.

Reset	Default	Item	Default Value
X	X	Assignment Method	DHCP:ON, Auto-IP:ON, Static:OFF
X	X	DNS Server Assignment	0.0.0.0
X	X	WINS Server Assignment	0.0.0.0
	X	Desired Hostname	<Model name> - <Last 5 digits of serial number>
	X	Desired Description	KIKUSUI <Model name> DC Power Supply - <Serial number>
X	X	Enable Dynamic DNS	Enable
X	X	Enable mDNS	Enable
X	X	Enable NetBIOS Over TCP/IP	Enable

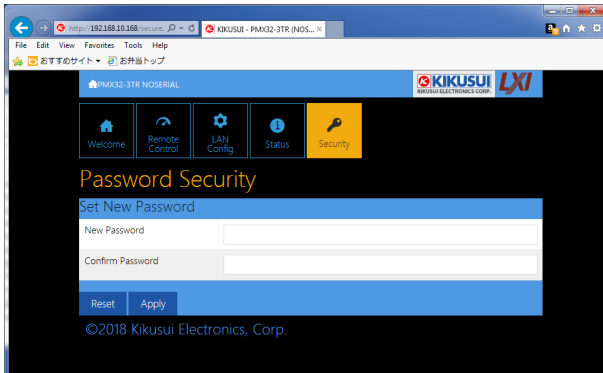
■ System Status page

Displays the license information of the open-source software.



■ Password Security page

You can set and change the password for the Web browser interface here.



When a password has been set, that password is required in order to use the following functions.

- Remote control from Remote Control page

- Editing of LAN Configuration page

- Changing/deleting the password

Set New Password

Enter the password.

You can use alphanumeric characters, hyphens, and underscores for the password. 15 characters maximum. The first character should be an alphabetical character. The maximum password length is 15 characters.

Changing/deleting the password

After the password has been set, the screen for changing the password appears when you enter the password.

To change the password, enter the present password in “Current Password”, enter the new password in “New Password” and “Confirm Password”, and then click “Apply”.

To disable password protection, enter the present password in “Current Password”, leave “New Password” and “Confirm Password” blank, and click “Apply”.

If you forget the password

If you forget the password, reset the LAN interface setting in the CONFIG settings (CF33: PMX-A, CF40: PMX-Multi) or initialize the PMX to its factory default settings.

For details of CONFIG settings, see the PMX user’s manual.

Overview of Command

The information that is exchanged between the controller (PC) and the device (PMX series) is called a message.

The PMX uses the SCPI language for the messages.

There are two types of messages, commands that are sent from the PC to the PMX and responses that are sent from the PMX to the PC.

Command Hierarchy

SCPI commands are ASCII-based commands designed for test and measurement devices. The command hierarchy is structured around the common root or node, which is the construction block of the SCPI subsystem. A command consists of a program header, parameters, and punctuation.

The hierarchy is explained using the SOURce subsystem as an example.

Program header	Parameter	Hierarchy of node
SOUR:		Root node
CURR		Second level
:EXT		Third level
:SOUR	<boolean>	Fourth level
VOLT		Second level
:PROT		Third level
[:LEV]	<character>	Fourth level

A higher node is separated from a lower node using a colon (:).

Command Syntax

This manual denotes SCPI commands using the following format.

```
[SOURce]:CURRent[:LEVel][:IMMediate][:AMPLitude] {<numeric>|MINi-  
mum|MAXimum}
```

SCPI commands can be issued using the short form. The short form of a SCPI command is the section of the command written in uppercase.

SCPI commands can be sent in the long form or short form. Since SCPI commands are not case-sensitive, CURR, Curr, and curr are all accepted as the short form of CURRent. In the long form, CURRENT, Current, and current are all acceptable.

- A space is required between the program header section and the parameter section.
- Multiple parameters, when available, are concatenated using commas.
- Commands are concatenated using semicolons (compound command).

```
SOURce:CURRent MINimum;VOLTage MINimum
```

In the second command, SOURce is omitted. This is because the path is set to SOURce: by the first command SOURce:CURRent.

This compound command is the same as entering the following commands.

```
SOURce:CURRent MINimum
```

```
SOURce:VOLTage MINimum
```

An error occurs if a node that is not defined in the current path is designated.

Commands of different subsystems can be concatenated using a colon and a semi-colon together.

```
SOURce:CURRent MINimum;:MEASure:CURRent?
```

This compound command contains two root nodes, SYSTEM and VOLTage.

When the second or subsequent command starts with a colon, the path specified by the previous command is cleared.

- The maximum number of characters that can be transmitted in a single line is 128.

■ Special symbols

Special symbols used in this manual to describe SCPI commands are defined below.

- Characters and numbers delimited by "|" in braces indicate that one of the items is to be selected.
Do not include the braces in the actual program.
- The characters <> indicate program data.
Do not write <> in the actual program.
- Brackets indicate option data.
When option data is not sent with the program, the default value is applied.
Do not write [] in the actual program.

■ Queries

The device settings or status can be queried.

To make a query, add a question mark at the end of the program header section. If a query has parameters, enter a space after the question mark followed by the parameters.

```
CURRent? MIN
```

Response

A response returned as an answer to a query. It is a message that is always sent from the device to the PC. The status of the device or measured values are transmitted to the PC.

- Note -

When transmitting two queries in separate lines, read the response to the first query before transmitting the second line.

■ Program terminator

All commands must be terminated using a valid terminator.

	RS232C	USB	LAN	
			VXI-11, HiSLIP	SCPI-RAW
reception	LF	LF or EOM	LF or END	LF
transmission	LF or CR+LF	LF+EOM	LF+END	LF

When a command string is terminated, the path is reset to the root level.

- Note -
CR (ASCII 0x0D) is not a terminator.

■ Common commands

The IEEE-488.2 and SCPI standards contain a set of common commands for reset, self-test, and other functions. These common commands always start with an asterisk. The commands may have one or multiple parameters.

Parameters

The parameter format of SCPI is derived from the program parameter format defined in IEEE 488.2.

The representation system of the program data that is used on the PMX is indicated below.

■ Non-numeric parameters

Character string data (String)

Used when a series of ASCII characters are requested.

Be sure to enclose a string in single or double quotation marks. The start and end quotation marks must match.

```
SYSTem:LANGUage "SCPI"
```

If you wish to use a quotation mark as a part of the string, enter two quotation marks consecutively (with no characters in between).

Character data

Character data is used when only a limited number of values are available for the program setting. Responses are returned in the short form.

```
TRIGger:TRANSient:SOURce {BUS|IMMEDIATE}
```

Boolean data

Boolean data expresses a 1 or 0 condition or an ON or OFF condition. Responses are returned as 1 or 0

```
OUTPut {ON|OFF|1|0}
```

■ Numeric parameters

NR1

Represents an integer.

Details are given in the IEEE 488.2 Standard Digital Interface for Programmable Instrumentation.

If a 0 is returned in the response data, it is returned as +0.

NR2

Represents a real number (floating point).

Details are given in the IEEE 488.2 Standard Digital Interface for Programmable Instrumentation.

NR3

Represents a real number (exponential).

Details are given in the IEEE 488.2 Standard Digital Interface for Programmable Instrumentation.

The value +3.80000+E02 is returned for the response data 380. The number of digits to the right of the decimal is 5.

NRf

NRf is a generic term that includes NR1, NR2, and NR3.

Numeric

A numeric parameter such as a decimal point, optional prefix, or measurement unit.

The syntax as a numeric representation is the same as NRf.

MINimum and MAXimum are available as substitutes for declaring certain values.

Units such as V, A, and W can also be used in a numeric parameter.

■ Special form numeric parameters

The special form numeric parameters MINimum and MAXimum can be used as substitutes for limit values when the parameter is numeric. In the example below, the current limit is set to the minimum value.

```
SOURce:CURRent MINimum
```

Queries can be used to inquire the minimum and maximum values for most parameters.

```
SOURce:CURRent? MAX
```

```
SOURce:CURRent? MIN
```

■ Channel designation

On this product, you can designate the channels you want to set using the syntax (@chanlist). The INSTRUMENT command settings do not apply to channel-designated commands

Response data includes the setting or measurement of the designated channels in a comma-separated format.

On the PMX-A, only (@1) is valid

In the following example, channel 2 is set to 20 V

```
VOLT 20, (@2)
```

Multiple channels can be designated at once. To designate channels 1, 3, and 4

```
CURR 5, (@1, 3, 4)
```

To designate channels 2 to 4 (@2 to @4)

```
MEAS:ALL? (@2:4)
```

■ Measurement units

The default measurement units are listed below. Commands are accepted even if measurement units are not specified.

•V (voltage) •A (current) •S (second)

The following optional prefixes are supported. If you use optional prefixes, specify the measurement unit.

•M (milli) •U (micro)

- Note -

- The unit symbols in the International System of Units contain lowercase characters. The IEEE standard uses uppercase characters. SCPI commands are not case sensitive.
- Commands are accepted whether or not measurement units are specified.
- To enter “ μ ” in the data, use “U” instead.

IEEE488.2 Common Commands

*CLS

Clears all event registers including the status byte, event status, and error queue.
Clears the operation complete standby that was created by the *OPC or *OPC?
command.

Command

*CLS

*ESE

Sets the event status enable register that is counted by the event summary bit (ESB) of the status byte.

Command

*ESE <NRf>

*ESE?

Parameter

Value: 0 to 255

Response: NR1

(Example)

When *ESE 16 is transmitted, bit 4 of the event status enable register is set.

Each time the execution error bit (bit 4) of the event status register is set, the summary bit (ESB) of the status byte is set.

***ESR**

Queries the event status register.
Registers that are read are cleared.

Command

*ESR?

Response: NR1

*IDN

Queries the model name, serial number, and firmware version of the PMX.

Command

*IDN?

Response

The response to *IDN? is indicated below.

PMX-A:

(Example) For a PMX18-5 with serial number AB123456, IFC version 1.00, IFC build number 0016, IOC version 1.00, and IOC build number 0015, this returns:

```
KIKUSUI,PMX18-5,AB123456,IFC01.00.0016 IOC01.00.0015
```

PMX-Multi:

(Example) For a PMX32-3DU with serial number AB123456, IFC version 1.00, and IFC build number 0001, this returns:

```
KIKUSUI,PMX32-3DU,AB123456,IFC01.00.0001
```


***OPC**

Sets the OPC bit (bit 0) of the event status register when all the commands in standby have been completed.

See section 12.5.3 in IEEE 488.2-1992.

Command

*OPC

*OPC?

Response

Returns 1 when all the commands in standby have been completed.

*OPT

Queries the option that are installed in the PMX.

Command

*OPT?

Response

Always returns 0.

***PSC (PMX-Multi only)**

Sets whether to clear the event status enable register and the service request enable register when the POWER switch is turned on (power-on status).

Command

```
*PSC <boolean>
```

```
*PSC?
```

Parameter <boolean>

Value:	ON(1)	The *ESE and *SRE settings are not cleared when the POWER switch is turned on.
	OFF(0)	The *ESE and *SRE settings are cleared when the POWER switch is turned on.

(Example) To enable the power-on SRQ function

```
*PSC 0;*SRE 32;*ESE 128
```

Response: NR1

*RCL (PMX-A only)

Recalls settings from the preset memory (A, B, C).

If settings are recalled from the preset memory when the output is on, the settings are applied immediately to the output.

Command

```
MEMory:RECall[:IMMEDIATE] <NRf>
```

Parameter

Value:	1	Memory A
	2	Memory B
	3	Memory C

(Example)

```
*RCL 2
```

***RST**

Resets the panel settings.

Clears alarms (if they cannot be cleared, alarms continue).

Aborts the trigger subsystem operation.

Clears the OPC bit (bit 0) of the status event register.

Setting Items	When *RST performed	Notes
OUTPut	OFF	
OUTPut:DELAy[:STATe]	OFF	PMX-Multi only
OUTPut:DELAy:ON	0.0[s]	PMX-Multi only
OUTPut:DELAy:OFF	0.0[s]	PMX-Multi only
OUTPut:EXTErnal	OFF	
OUTPut:EXTErnal:LOGic	HIGH	
[SOURce:]CURRent	MAXimum	
[SOURce:]CURRent:EXTErnal:SOURce	OFF	PMX-A only
[SOURce:]CURRent:PROTEction	MAXimum	
[SOURce:]CURRent:TRIGgerd	IMMediate	PMX-A only
[SOURce:]VOLTage	0.0[V]	
[SOURce:]VOLTage:EXTErnal:SOURce	NONE	PMX-A only
[SOURce:]VOLTage:PROTEction	MAXimum	
[SOURce:]VOLTage:TRIGgerd	IMMediate	PMX-A only
TRIGger:TRANsient:SOURce	IMMediate	PMX-A only
TRACk:MODE	ABSolute	PMX-Multi only
TRACk:ABSolute:CURRent	0	PMX-Multi only
TRACk:ABSolute:VOLTage	0	PMX-Multi only
TRACk:RATio:CURRent	0	PMX-Multi only
TRACk:RATio:VOLTage	0	PMX-Multi only
TRACk:SYNC[:STATe]	OFF	PMX-Multi only

Command

*RST

*SAV (PMX-A only)

Saves the present voltage, current, OVP, and OCP values in the preset memory.

Command

*SAV <NRf>

Parameter

Value:	1	Memory A
	2	Memory B
	3	Memory C

(Example)

*SAV 3

*SRE

Sets the service request enable register.

The service request enable register is used to select the summary messages in the status byte register that will be able to perform service requests.

To clear the service request enable register, send *SRE 0. If the register is cleared, service requests cannot be generated by status information.

Command

```
*SRE <NRf>
```

```
*SRE?
```

Parameter

Value: 0 to 255

(Example) Sending *SRE 8 sets bit 3 of the service request enable register. Each time the summary bit (bit 3) of the QUESTionable status register in the status byte is set, a service request message is generated.

Response: NR1

*STB

Queries the contents of the status byte register and the MSS (master summary status) message.

The response is the same as serial polling only with the exception that the MSS message appears in place of the RQS message in bit 6.

Command

*STB?

Response: NR1

***TRG (PMX-A only)**

Trigger command.

Executes triggers on the TRANsient trigger group and ACQuire trigger group.

This is a substitute command for the IEEE488.1 get (Group Execute Trigger) command.

If the PMX is not in a condition to accept triggers, an SCPI error (-211,"Trigger ignored") occurs.

See section 10.37 in IEEE 488.2-1992.

Command

*TRG

*TST

Executes a self-test.

Use SYST:ERR? to query the errors that occurred. See section 10.38 in IEEE 488.2-1992.

Command

*TST?

Response

Returns 0 if there are no errors. Returns the error code, if there are errors.

***WAI**

Prevents the PMX from executing subsequent commands until all operations in standby are complete.

Command

*WAI

ABORt Command

ABOR (PMX-A only)

Aborts the setting change trigger function.

The trigger status immediately after the power is turned on is the same as the trigger status when the ABOR command is received.

Command

ABORt [:ALL]

ABOR:DTF (PMX-Multi only)

Aborts the parallel or series operation of channels 1 and 2.

Command

ABORt:DTFormation

FETCh Command (PMX-Multi only)

This product does not have the INITiate or FETCh measurement function.

The measured voltage and the measured current are updated alternately at 25 ms intervals.

MEASure and FETCh are aliases and operate in the same manner. Queries the latest measured value when the command is sent.

On the PMX-A, use the MEASure command.

-> Tutorial "Settings and Measurement"

FETC:ALL (PMX-Multi only)

Queries the measured value of the current and voltage.

Command

```
FETCh[:SCALar]:ALL? [(@chanlist)]
```

Response

Returns the current <NR3> and then the voltage <NR3> in a comma-separated format.

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit:	Current	A
	Voltage	V

Example: When the measurements of channel 2 are 10 V and 1 A and those of channel 3 are 5 V and 0.5 A, sending FETC:ALL? (@2,3) returns

```
+1.0000E+00,+1.0000E+01,+5.0000E-01,+5.0000E+00
```

FETC:CURR (PMX-Multi only)

Queries the measured value of the current output.

Command

```
FETCh[:SCALar]:CURRent[:DC]? [(@chanlist)]
```

Response: NR3

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit: A

FETC:VOLT (PMX-Multi only)

Queries the measured value of the voltage output.

Command

```
FETCh[:SCALar]:VOLTage[:DC]? [(@chanlist)]
```

Response: NR3

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit: V

INITiate Command

INIT:TRAN (PMX-A only)

Starts the setting change (TRANSient) trigger function.

If trigger source is set to IMM, the change starts immediately. If set to BUS, the change starts after waiting for a software trigger.

Command

```
INITiate[:IMMediate]:TRANsient
```

Related Command

```
TRIG:TRAN:SOUR
```

INIT:DTF:PARA (PMX-Multi only)

Starts the parallel operation of channels 1 and 2.

Command

```
INITiate[:IMMEDIATE]:DTFormation:PARAllel
```

Related Command

```
INIT:DTF:PARA
```

INIT:DTF:SER (PMX-Multi only)

Starts the series operation of channels 1 and 2.

Command

```
INITiate[:IMMEDIATE]:DTFormation:SERies
```

Related Command

```
INIT:DTF:SER
```

INSTrument/CHANnel Command

INSTrument and CHANnel are aliases and operate in the same manner.

INST/ CHAN

Specifies the channel to configure.

If parallel or series operation is in use, you cannot specify CH1.

Command

```
INSTrument[:SElect] <NRf>  
INSTrument[:SElect]?  
INSTrument[:NSElect] <NRf>  
INSTrument[:NSElect]?  
CHANnel[:SElect] <NRf>  
CHANnel[:SElect]?  
CHANnel[:NSElect] <NRf>  
CHANnel[:NSElect]?
```

Parameter

Value: 1 to 4 channel

(Example)

```
INST 4  
CHAN 4
```

Response: NR1

On the PMX-A, +1 is always returned.

INST:CAT/ CHAN:CAT

Queries the list of channels that can be configured with the INST command.

Command

```
INSTrument:CATalog?
```

```
CHANnel:CATalog?
```

Response

Returns the channels that can be configured in NR1[,NR1...] format. On the PMX-A, +1 is always returned.

Example: If parallel or series operation is being performed on a PMR-QU model, +2,+3,+4 is returned.

INST:INFO/ CHAN:INFO

Queries the information of the channel currently being controlled.

Command

```
INSTRument:INFO? [(@chanlist)]
```

```
CHANnel:INFO? [(@chanlist)]
```

Response

Returns the maximum voltage and maximum current of the channel under control in NR3 format.

Example: If the maximum voltage is 32 V and the maximum current is 2 A on the channel under control, sending INST:INFO? returns

```
+3.2000E+01, +2.0000E+00
```

INST:UNS/ CHAN:UNS (PMX-Multi only)

Releases the designation of the channel under control.

If you release the designation and send a command that requires channel designation without designating a channel, an error will occur.

Command

INSTrument:UNSelect

CHANnel:UNSelect

MEASure Command

This product does not have the INITiate or FETCh measurement function.

The measured voltage and the measured current are updated alternately at 25 ms intervals.

MEASure and FETCh are aliases and operate in the same manner. Queries the latest measured value when the command is sent.

-> Tutorial "Settings and Measurement"

MEAS:ALL (PMX-Multi only)

Queries the measured value of the current and voltage.

Command

```
MEASure[:SCALar]:ALL? [(@chanlist)]
```

Response

Returns the current <NR3> and then the voltage <NR3> in a comma-separated format.

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit:	Current	A
	Voltage	V

Example: When the measurements of channel 2 are 10 V and 1 A and those of channel 3 are 5 V and 0.5 A, sending MEAS:ALL? (@2,3) returns

```
+1.0000E+00,+1.0000E+01,+5.0000E-01,+5.0000E+00
```


MEAS:CURR

Queries the measured value of the current.

Command

```
MEASure[:SCALar]:CURRent[:DC]? [(@chanlist)]
```

Response: NR3

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit: A

MEAS:VOLT

Queries the measured value of the voltage.

Command

```
MEASure[:SCALar]:CURRent[:DC]? [(@chanlist)]
```

Response: NR3

The measured voltage and the measured current are updated alternately at 25 ms intervals.

Unit: V

MEMory Command

MEM:REC

Recalls the settings stored in the preset memory A, B, or C.

If you recall the preset memory when the output is turned on, the settings stored in the memory will be immediately applied.

You can view the settings that are stored in memory by using the [MEM:REC:PREV](#) command.

Command

```
MEMory:RECall[:IMMediate] <NRf>
```

Parameter

Value:	1	Memory A
	2	Memory B
	3	Memory C

(Example)

```
MEM:REC 2
```

MEM:REC:CONF

Sets whether to check the contents saved in the preset memory when recalling them from the control panel.

When you recall the memory by sending either MEM:REC command, however, the settings stored in the memory will be immediately recalled.

Command

```
MEMory:RECall:CONFirmation[STATe] <boolean>
```

```
MEMory:RECall:CONFirmation[STATe]?
```

Parameter

Value:	ON(1)	Confirms the settings (default)
	OFF(0)	Do not confirm the settings

(Example)

```
MEM:REC:CONF ON
```

Response: NR1

MEM:REC:PREV

Refers to the settings stored in the preset memory A, B, or C.

Command

```
MEMory:RECall:PREView? <NRf>
```

Parameter

Value:	1	Memory A
	2	Memory B
	3	Memory C

Response

PMX-A

Returns the current <NR3>, voltage <NR3>, OCP<NR3>, and OVP<NR3> that are stored in the specified preset memory in a comma-separated format in response to MEM:REC:PREV? <NRf>.

Example: When the values stored in memory A are current: 10 A, voltage: 2 V, OCP: 2 A, and OVP: 0.5 V, sending MEM:REC:PREV? 1 returns

```
+1.0000E+01,+2.0000E+00,+2.0000E+00,+5.0000E-01
```

PMX-Multi:

During normal operation

Returns the current <NR3>, voltage <NR3>, OCP<NR3>, OVP<NR3>, on-delay<NR3>, and off-delay<NR3> of channel 1 from the specified preset memory in a comma-separated format followed by the same values of channels 2 to 4 in response to MEM:REC:PREV? <NRf>.

During parallel or series operation

Returns the current <NR3>, voltage <NR3>, OCP<NR3>, OVP<NR3>, on-delay<NR3>, and off-delay<NR3> used for parallel or series operation from the specified preset memory in a comma-separated format followed by the same values of channels 3 and 4 in response to MEM:REC:PREV? <NRf>.

MEM:SAVE

Saves to the preset memory.

On the PMX-A, the current, voltage, OCP, and OVP are saved in the preset memory.

During normal operation on the PMX-Multi, the current, voltage, OCP, OVP, on-delay, and off-delay of all channels are saved in the preset memory.

During parallel or series operation on the PMX-Multi, the current, voltage, OCP, OVP, on-delay, and off-delay used for series or parallel operation are saved in the preset memory followed by the same values of channels 3 and 4.

Command

```
MEMory:SAVE[:IMMEDIATE] <NRf>
```

Parameter

Value:	1	Memory A
	2	Memory B
	3	Memory C

(Example)

```
MEM:SAVE 3
```

OUTPut Command

OUTP

Turns the output on and off.

This command is invalid when a protection function is activated.

Command

```
OUTPut[:StAtE][:IMMediate] <boolean>[, (@chanlist)]
```

```
OUTPut[:StAtE][:IMMediate]? [(@chanlist)]
```

Parameter

Value:	ON(1)	Output on
	OFF(0)	Output off (default)

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP 1
```

Response: NR1

This product's output status is updated at 50 ms intervals.

Related Command

```
OUTP:PON
```

OUTP:ALL (PMX-Multi only)

Turns the output on or off of all channels.

If there is a mixture of channels that are turned on and off, all the channels are turned off.

Command

```
OUTPut[:STATe][:IMMediate]:ALL
```


OUTP:DEL (PMX-Multi only)

Enables or disables the output on/off-delay operation.

Command

```
OUTPut:DElAy[:StATe] <boolean>
```

```
OUTPut:DElAy[:StATe]?
```

Parameter

Value: ON(1) Enables the output on/off-delay operation.
 OFF(0) Disables the output on/off-delay operation. (default)

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:DEL ON
```

Response: NR1

OUTP:DEL:ON (PMX-Multi only)

Sets the output-on delay.

Command

```
OUTPut:DElay:ON <numeric>[, (@chanlist)]
```

```
OUTPut:DElay:ON?[@chanlist]
```

Parameter

Value: 0 No delay (default)

0.1 to 99.9

Unit: S

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:DEL:ON 1.2
```

Response: NR3

OUTP:DEL:OFF (PMX-Multi only)

Sets the output-off delay.

Command

```
OUTPut:DElay:OFF <numeric>[, (@chanlist)]
```

```
OUTPut:DElay:OFF? [(@chanlist)]
```

Parameter

Value: 0 No delay (default)

 0.1 to 99.9

Unit: S

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:DEL:OFF 1.2
```

Response: NR3

OUTP:EXT

Sets whether output will be turned on and off externally.

Set the external control logic with [OUTP:EXT:LOG](#).

Command

```
OUTPut:EXTErnal[:STATe] <boolean>[, (@chanlist)]
```

```
OUTPut:EXTErnal[:STATe]? [ (@chanlist)]
```

Parameter

Value: ON(1) External control is performed.
 OFF(0) External control is not performed (default).

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:EXT ON
```

Response: NR1

OUTP:EXT:LOG

Sets the logic used to control the turning of output on and off using an external contact.

This command is invalid while a sequence is running.

Command

```
OUTPut:EXTErnal:LOGic <character>[, (@chanlist)]
```

```
OUTPut:EXTErnal:LOGic? [ (@chanlist)]
```

Parameter

Value:	LOW	The output is turned on with a low signal (default).
	HIGH	The output is turned on with a high-level signal or open circuit.

(Example)

```
OUTP:EXT:LOG HIGH
```

Response: character

OUTP:PON

Sets the output state at power-on.

Command

```
OUTPut:PON[:STATe] <character>
```

```
OUTPut:PON[:STATe]?
```

Parameter

- Value: **SAFE** When the PMX turns on, it starts in the same state as it was in the last time that it was turned off. The output is off (default).
- AUTO** When the PMX turns on, it starts in the same state—including the output on/off state—as it was in the last time that it turned off.
- FORCE** When the PMX turns on, it starts in the same state as it was in the last time that it was turned off. The output is on

(Example)

```
OUTP:PON AUTO
```

Response: character

OUTP:PROT:CLE

Clears alarms.

Command

```
OUTPut:PROTection:CLEar
```

OUTP:PROT:ISO (PMX-Multi only)

Sets whether to turn off the output of all channels when a OCP or OVP occurs.

Command

```
OUTPut:PROTection:ISOLate <character>
```

```
OUTPut:PROTection:ISOLate?
```

Parameter

Value: **SELF** The output of channels on which a OCP or OVP occurs is turned off.
 ALL The output of all channels is turned off (default).

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:PROT:ISO SELF
```

Response: character

OUTP:PROT:WDOG (PMX-Multi only)

Sets the Communication monitor (WATCHDOG) timer.

When an alarm occurs, set the value to zero first and then clear the alarm.

Command

```
OUTPut:PROTection:WDOG[:DELaY] <numeric>
```

```
OUTPut:PROTection:WDOG[:DELaY]?
```

Parameter

Value: 0 Communication monitoring function off (default)

1, 3, 10, 30, 100, 300, 1000, 3000

A SCPI error (-222, "Data out of range") occurs if outside the range.

If a value that cannot be set is specified, the next higher value is set.

(Example) If `OUTP:PROT:WDOG 31` is specified, 100 is set.

Unit: S

(Example)

```
OUTP:PROT:WDOG 30
```

Response: NR3

Related Command

```
OUTP:PROT:CLE
```

OUTP:RISE:TIME (PMX-Multi only)

Sets the CV rise time.

Command

```
OUTPut:RISE:TIME <character>[, (@chanlist)]
```

```
OUTPut:RISE:TIME? [(@chanlist)]
```

Parameter

Value: SLOW 100 ms
FAST 10 μ s (default)

Settings are reset to default when the *RST command is sent.

(Example)

```
OUTP:RISE:TIME FAST
```

Response: character

[SOURce:]CURRent Command

CURR

Sets the current.

On the PMX-A, this is invalid when the PMX is set so that constant current is controlled externally (CURR:EXT:SOUR VOLT or RES).

Command

```
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <numeric>[, (@  
chanlist)]
```

```
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [(@chanlist)]
```

Parameter

Valut: 0 % to 105 % of the rated output current (Maximum by default)

Unit: A

Settings are reset to default when the *RST command is sent.

(Example)

```
CURR 2.5
```

Response: NR3

CURR:EXT:SOUR (PMX-A only)

Sets whether constant current will be controlled externally.

Command

```
[SOURce:]CURRent:EXTernal:SOURce <character>
```

```
[SOURce:]CURRent:EXTernal:SOURce?
```

Parameter

Value: NONE External control is not performed (default).

VOLTage External voltage control is performed.

RESistance External resistance control is performed.

Settings are reset to default when the *RST command is sent.

(Example)

```
CURR:EXT:SOUR VOLT
```

Response: character

CURR:PROT

Sets the overcurrent protection (OCP) value.

Command

```
[SOURCE:]CURRENT:PROTECTION[:LEVEL] <numeric>[, (@chanlist)]
```

```
[SOURCE:]CURRENT:PROTECTION[:LEVEL]? [(@chanlist)]
```

Parameter

Value: 10 % to 110 % of the rated output current (Maximum by default)

Unit: A

Settings are reset to default when the *RST command is sent.

(Example)

```
CURR:PROT 48
```

Response: NR3

Related Command

```
OUTP:PROT:CLE
```

CURR:TRIG (PMX-A only)

Sets the current value that is applied when a trigger is sent.

This is invalid when the PMX is set so that constant current is controlled externally (CURR:EXT:SOUR VOLT or RES).

Command

```
[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude] <numeric>[, (@chan-  
list)]
```

```
[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude]? [(@chanlist)]
```

Parameter

Valut: 0 % to 105 % of the rated output current (Maximum by default)

Unit: A

Settings are reset to default when the *RST command is sent.

When you send the CURR command, this setting is set to the CURR value.

(Example)

```
CURR:TRIG 2.5
```

Response: NR3

[SOURce:]VOLTage Command

VOLT

Sets the voltage.

On the PMX-A, this is invalid when the PMX is set so that constant voltage is controlled externally (VOLT:EXT:SOUR VOLT or RES).

Command

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <numeric>[, (@  
chanlist)]
```

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [(@chanlist)]
```

Parameter

Value: 0 % to 105 % of the rated output voltage (0 by default)

Unit: V

Settings are reset to default when the *RST command is sent.

(Example)

```
VOLT 120
```

Response: NR3

VOLT:EXT:SOUR (PMX-A only)

Sets whether constant voltage will be controlled externally.

Command

```
[SOURce:]VOLTage:EXTernal:SOURce <character>
```

```
[SOURce:]VOLTage:EXTernal:SOURce?
```

Parameter

Value: NONE External control is not performed (default).

VOLTage External voltage control is performed.

RESistance External resistance control is performed.

Settings are reset to default when the *RST command is sent.

(Example)

```
VOLT:EXT:SOUR VOLT
```

Response: character

VOLT:PROT

Sets the overvoltage protection (OVP).

Command

```
[SOURce:]VOLTage:PROTection[:LEVel] <numeric>[, (@chanlist)]
```

```
[SOURce:]VOLTage:PROTection[:LEVel]? [(@chanlist)]
```

Parameter

Value: 10 % to 110 % of the rated output voltage (OVP; MAXimum by default)

Unit: V

Settings are reset to default when the *RST command is sent.

(Example)

```
VOLT:PROT 30
```

Response: NR3

Related Command

```
OUTP:PROT:CLE
```

VOLT:TRIG (PMX-A only)

Sets the voltage that is applied when a trigger is sent.

This is invalid when the PMX is set so that constant voltage is controlled externally (VOLT:EXT:SOUR VOLT or RES).

Command

```
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] <numeric>[, (@chan-  
list)]
```

```
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [(@chanlist)]
```

Parameter

Value: 0 % to 105 % of the rated output voltage (0 by default)

Unit: V

Settings are reset to default when the *RST command is sent.

When you send the VOLT command, this setting is set to the VOLT value.

(Example)

```
VOLT:TRIG 20
```

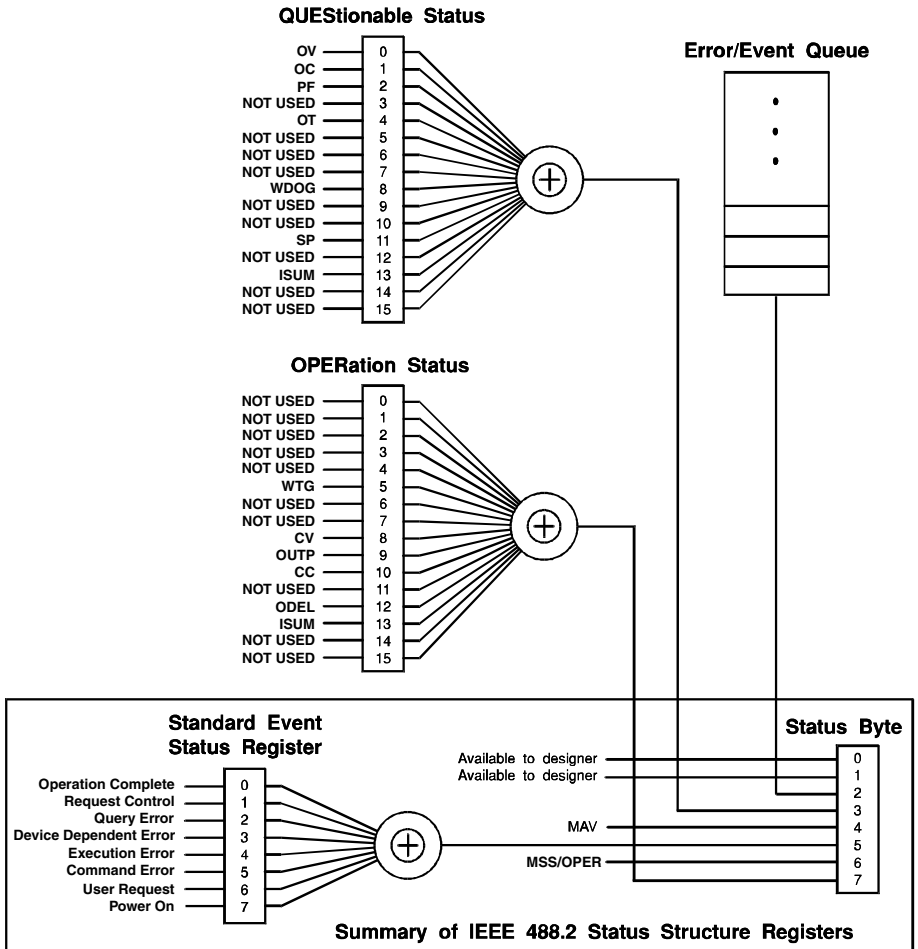
Response: NR3

STATUS Command

Register Structure

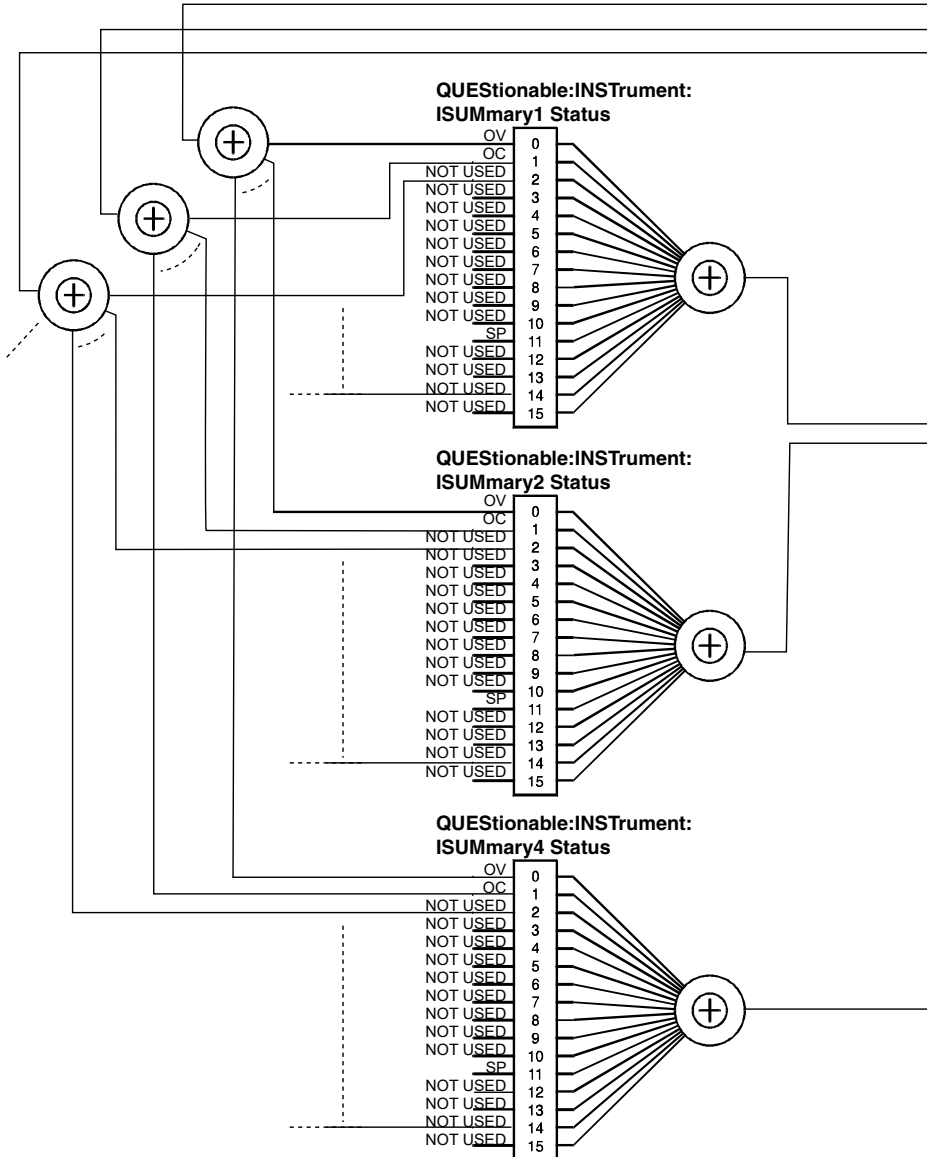
The character "+" represents the logical sum of the register bits.

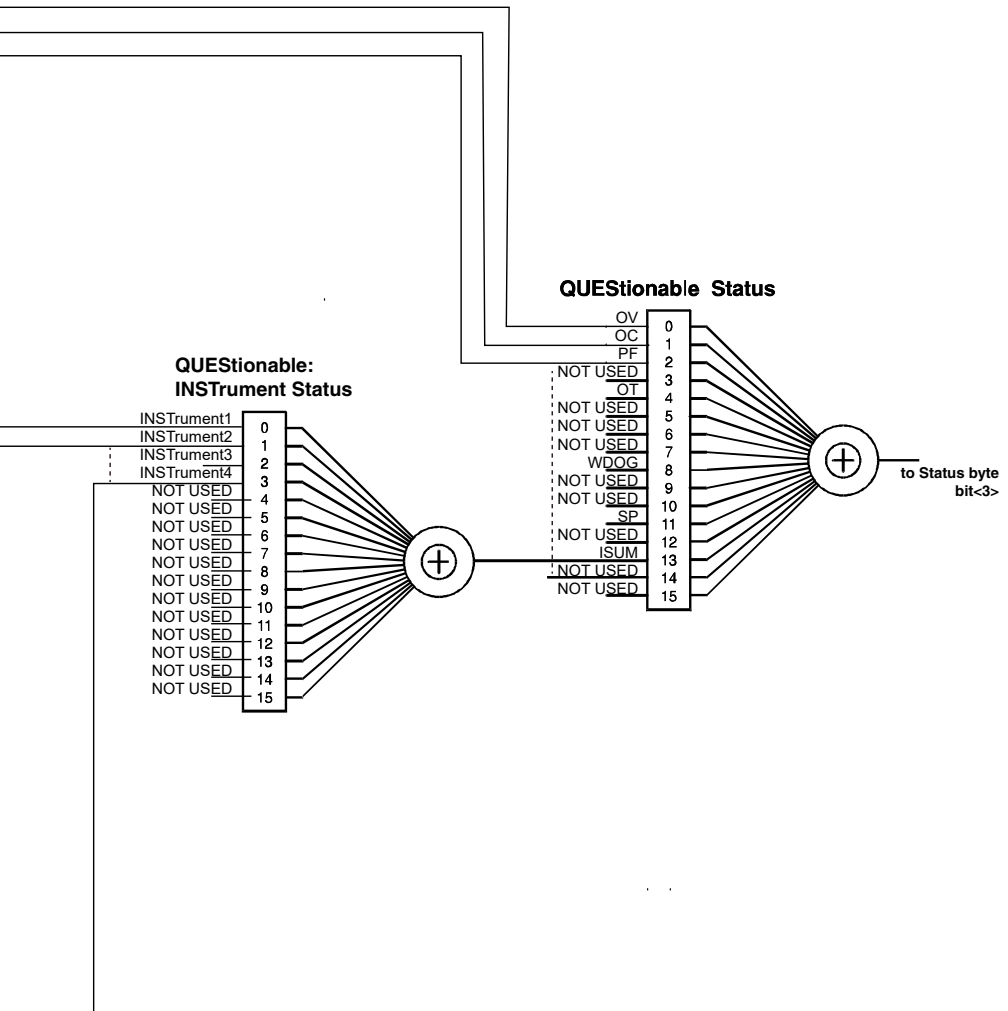
1999 SCPI Syntax & Style



■ When multichannel is in use

The character "+" represents the logical sum of the register bits. The OPERATION Status, OPERATION:INSTRument Status, and OPERATION:INSTRument:ISUMmary Status registers all operate the same way.





Architecture

IEEE488.2 and SCPI registers are used for the status reports.

In each SCPI status register, there are the following sub registers: CONDition register, EVENT register, ENABLE register, PTRansition filter, and NTRansition filter.

-> Tutorial "Status Monitoring"

CONDition register

The transition of the CONDition register is automatic and reflects the condition of the PMX in real-time. Reading this register does not affect the contents.

EVENT register

The EVENT register bits are automatically set according to the changes in the CONDition register. The rule varies depending on the positive and negative transition filters (PTRansition and NTRansition). The EVENT register is reset when it is read.

ENABLE register

The ENABLE register enables the reports to the summary bit or status bit of the event bit.

Transition filter

The PTRansition (positive transition) filter is used to report events when the condition changes from false to true.

The NTRansition (negative transition) filter is used to report events when the condition changes from true to false.

If both the positive filter and the negative filter are set to true, events can be reported each time the status changes.

If both filters are cleared, event reporting is disabled.

Status byte register

The status byte register stores STB and RQS (MSS) messages as defined by the IEEE488.1 standard. The status byte register can be read using IEEE488.1 serial polling or the IEEE488.2 common command *STB?.

When serial polling is carried out, bit 6 responds with the request service (RQS). The status byte value is not changed by serial polling.

*STB? makes the device transmit the contents of the status byte register and the master status summary (MSS) message.

*STB? does not change the status byte, MSS, or RQS.

Bit	Bit weight	Bit name	Description
0	1	Reserved	Reserved for future use by the IEEE488. The bit value is notified as zero.
1	2	Reserved	
2	4	Error/Event Queue	If data exists in the error or event queue, this bit is set to true.
3	8	Questionable Status Register (QUES)	This bit is set to true when a bit is set in the QUESTIONable event status register and the corresponding bit in the QUESTIONable status enable register is true.
4	16	Message Available (MAV)	This bit is set to true when a request is received from the digital programming interface and the PMX is ready to output the data byte.
5	32	Standard Event Status Bit Summary (ESB)	This bit is set to true when a bit is set in the event status register.
6	64	Request Service (RQS)	This bit is set to true when a bit is set in the service request enable register, and the corresponding bit exists in the status byte. The SRQ line of the GPIB is set.
		Master Status Summary (MSS)	This bit is set to true when a bit in the status byte register is set to 1 and the corresponding bit in the service request enable register is set to 1.
7	128	Operation Status Register (OPER)	This bit is set to true when a bit is set in the OPERATION event status register and the corresponding bit in the OPERATION status enable register is set.
8-15		Not Used	--

Event status register

The event status register bits are set when certain events occur during PMX operation. All bits of the event status register are set by the error event queue.

The register is defined by the IEEE488.2 standard and is controlled by the IEEE488.2 common commands *ESE, *ESE?, and *ESR?.

See SYST:ERR? for the descriptions of the errors.

Bit	Bit weight	Bit name	Description	Error code
0	1	Operation Complete(OPC)	Set when an *OPC command is received and all operations in standby are complete.	-800 to -899
1	2	Request Control (RQC)	Not used	--
2	4	Query Error(QYE)	Set when an attempt is made to read data from the output queue when there is no output or the error queue is in wait status. Indicates that there is no data in the error queue.	-400 to -499
3	8	Device Dependent Error(DDE)	Set when there is a device-specific error.	-300 to -399 100 to 999
4	16	Execution Error(EXE)	Set when the PMX evaluates that the program data following the header is outside the formal input range or does not match the performance of the PMX. This indicates that a valid SCPI command may not be executed correctly depending on the conditions of the PMX.	-200 to -299
5	32	Command Error(C-ME)	Set when an IEEE 488.2 syntax error is detected, when an unidentifiable header is received, or when a group execution trigger enters the internal IEEE 488.2 SCPI command input buffer.	-100 to -199
6	64	User Request(URQ)	Not used	--
7	128	Power On(PON)	Set when the power is turned on.	--
8-15		Reserved	Not used	--

OPERation status register

The OPERation status register is a 16-bit register that contains conditions that are part of the PMX normal operations.

Bit	Bit weight	Bit name	Description
0	1	NOT USED	--
1	2	NOT USED	--
2	4	NOT USED	--
3	8	NOT USED	--
4	16	NOT USED	--
5	32	wating for trigger(WTG)	Indicates whether the PMX is in a trigger (TRIG) wait state after an INIT is sent. (PMX-A only)
6	64	NOT USED	--
7	128	NOT USED	--
8	256	CV	CV output
9	512	OUTP	Output status (on or off)
10	1024	CC	CC output
11	2048	NOT USED	--
12	4096	ODEL	Output delay control is in progress (PMX-Multi only)
13	8192	INSTrument Summary (ISUM)	Summary bit of OPERation:INSTrument sub register (PMX-Multi only)
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:OPER

Queries the event of the OPERation status register.

A query clears the contents of the register.

Command

```
STATus:OPERation[:EVENT]?
```

Response: NR1

STAT:OPER:COND

Queries the condition of the OPERation status register.

A query does not clear the contents of the register.

Command

STATus:OPERation:CONDition?

Response: NR1

STAT:OPER:ENAB

Sets the enable register of the OPERation status register.

Command

```
STATus:OPERation:ENABle <NRf>
```

```
STATus:OPERation:ENABle?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:NTR

Sets the negative transition of the OPERation status register.

Command

```
STATus:OPERation:NTRansition <NRf>
```

```
STATus:OPERation:NTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:PTR

Sets the positive transition of the OPERation status register.

Command

```
STATus:OPERation:PTRansition <NRf>
```

```
STATus:OPERation:PTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

OPERation:INSTrument subregister (PMX-Multi only)

This is the subregister (16 bits) of bit 13 of the OPERation status register.

Bit	Bit weight	Bit name	Description
0	1	INSTrument1	Summary bit of channel 1(OPER:INST:ISUM1)
1	2	INSTrument2	Summary bit of channel 2(OPER:INST:ISUM2)
2	4	INSTrument3	Summary bit of channel 3(OPER:INST:ISUM3)
3	8	INSTrument4	Summary bit of channel 4(OPER:INST:ISUM4)
4	16	NOT USED	--
5	32	NOT USED	--
6	64	NOT USED	--
7	128	NOT USED	--
8	256	NOT USED	--
9	512	NOT USED	--
10	1024	NOT USED	--
11	2048	NOT USED	--
12	4096	NOT USED	--
13	8192	NOT USED	--
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:OPER:INST (PMX-Multi only)

Queries the event of the OPERATION:INSTRUMENT subregister.

A query clears the contents of the subregister.

Command

```
STATus:OPERation:INSTRument[:EVENT]?
```

Response: NR1

STAT:OPER:INST:COND (PMX-Multi only)

Queries the condition of the OPERation:INSTrument subregister.
A query does not clear the contents of the subregister.

Command

```
STATus:OPERation:INSTrument:CONDition?
```

Response: NR1

STAT:OPER:INST:ENAB (PMX-Multi only)

Sets the enable register of the OPERATION:INSTRUMENT subregister.

Command

```
STATus:OPERation:INSTRument:ENABle <NRf>
```

```
STATus:OPERation:INSTRument:ENABle?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:INST:NTR (PMX-Multi only)

Sets the negative transition of the OPERation:INSTrument subregister.

Command

```
STATus:OPERation:INSTrument:NTRansition <NRf>
```

```
STATus:OPERation:INSTrument:NTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:INST:PTR (PMX-Multi only)

Sets the positive transition of the OPERation:INSTrument subregister.

Command

```
STATus:OPERation:INSTrument:PTRansition <NR1>
```

```
STATus:OPERation:INSTrument:PTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

OPERation:INSTrument:ISUMmary<n> subregister (PMX-Multi only)

This is the subregister of bit <n> of the OPERation:INSTrument subregister. This is a 16-bit register that contains information about the normal operating conditions of the PMX whose channel you specified.

Use <n> to specify the channel number.

For example, channel 2 is specified as "OPER:INST:ISUM2".

Bit	Bit weight	Bit name	Description
0	1	NOT USED	--
1	2	NOT USED	--
2	4	NOT USED	--
3	8	NOT USED	--
4	16	NOT USED	--
5	32	wating for trigger(WTG)	--
6	64	NOT USED	--
7	128	NOT USED	--
8	256	CV	CV output
9	512	OUTP	Output status (on or off)
10	1024	CC	CC output
11	2048	NOT USED	--
12	4096	ODEL	Output delay control is in progress
13	8192	INSTrument Summary (ISUM)	--
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:OPER:INST:ISUM<n> (PMX-Multi only)

Queries the event of the OPERation:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:OPER:INST:ISUM2" command.

A query clears the contents of the subregister.

Command

```
STATus:OPERation:INSTrument:ISUMmary<n>[:EVENT]?
```

Response: NR1

STAT:OPER:INST:ISUM<n>:COND (PMX-Multi only)

Queries the condition of the OPERation:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:OPER:INST:ISUM2:COND" command.

A query does not clear the contents of the subregister.

Command

```
STATus:OPERation:INSTrument:ISUMmary<n>:CONDition?
```

Response: NR1

STAT:OPER:INST:ISUM<n>:ENAB (PMX-Multi only)

Sets the enable register of the OPERation:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:OPER:INST:ISUM2:ENAB" command.

Command

```
STATus:OPERation:INSTrument:ISUMmary<n>:ENABle <NRf>
```

```
STATus:OPERation:INSTrument:ISUMmary<n>:ENABle?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:INST:ISUM<n>:NTR (PMX-Multi only)

Sets the negative transition of the OPERation:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:OPER:INST:ISUM2:NTR" command.

Command

```
STATus:OPERation:INSTrument:ISUMmary<n>:NTRansition <NRf>
```

```
STATus:OPERation:INSTrument:ISUMmary<n>:NTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:OPER:INST:ISUM<n>:PTR (PMX-Multi only)

Sets the positive transition of the OPERATION:INSTRUMENT:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:OPER:INST:ISUM2:PTR" command.

Command

```
STATus:OPERation:INSTRument:ISUMmary<n>:PTRansition <NRf>
```

```
STATus:OPERation:INSTRument:ISUMmary<n>:PTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

QUESTIONable status register

The QUESTIONable status register is a 16-bit register that stores information related to the questionable events and status during PMX operation. These register bits may indicate problems with the measured data of the PMX.

Bit	Bit weight	Bit name	Description
0	1	OVP (OV)	Overvoltage protection has been activated
1	2	OCP (OC)	Overcurrent protection has been activated
2	4	AC Power Failure or power interruption (ACPF)	AC line error or interruption
3	8	NOT USED	--
4	16	Over Temperature Protection (OT)	Overheat protection has been activated
5	32	NOT USED	--
6	64	NOT USED	--
7	128	NOT USED	--
8	256	WDOG protection (WDOG)	Communication monitor has been activated (PMX-Multi only)
9	512	NOT USED	--
10	1024	NOT USED	--
11	2048	Soliday Protection (SP)	Synchronized protection as a result of an activation of a protection function on another channel (PMX-Multi only)
12	4096	NOT USED	--
13	8192	INSTRument Summary (ISUM)	Summary bit of QUESTIONable:INSTRument sub register (PMX-Multi only)
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:QUES

Queries the event of the QUEStionable status register.

A query clears the contents of the register.

Command

```
STATus:QUEStionable[:EVENT]?
```

Response: NR1

STAT:QUES:COND

Queries the condition of the QUEStionable status register.
A query does not clear the contents of the register.

Command

```
STATus:QUEStionable:CONDition?
```

Response: NR1

STAT:QUES:ENAB

Sets the enable register of the QUEStionable status register.

Command

```
STATus:QUEStionable:ENABle <NRf>
```

```
STATus:QUEStionable:ENABle?
```

Parameter

Value:0 to 65535

Response: NR1

STAT:QUES:NTR

Sets the negative transition of the QUEStionable status register.

Command

```
STATus:QUEStionable:NTRansition <NRf>
```

```
STATus:QUEStionable:NTRansition?
```

Parameter

Value:0 to 65535

Response: NR1

STAT:QUES:PTR

Sets the positive transition of the QUEStionable status register.

Command

```
STATus:QUEStionable:PTRansition <NRf>
```

```
STATus:QUEStionable:PTRansition?
```

Parameter

Value:0 to 65535

Response: NR1

QUESTIONable:INSTrument subregister (PMX-Multi only)

This is the subregister (16 bits) of bit 13 of the QUESTIONable status register.

Bit	Bit weight	Bit name	Description
0	1	INSTrument1	Summary bit of channel 1(QUES:INST:ISUM1)
1	2	INSTrument2	Summary bit of channel 2(QUES:INST:ISUM2)
2	4	INSTrument3	Summary bit of channel 3(QUES:INST:ISUM3)
3	8	INSTrument4	Summary bit of channel 4(QUES:INST:ISUM4)
4	16	NOT USED	--
5	32	NOT USED	--
6	64	NOT USED	--
7	128	NOT USED	--
8	256	NOT USED	--
9	512	NOT USED	--
10	1024	NOT USED	--
11	2048	NOT USED	--
12	4096	NOT USED	--
13	8192	NOT USED	--
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:QUES:INST (PMX-Multi only)

Queries the event of the QUEStionable:INSTrument subregister.
A query clears the contents of the register.

Command

```
STATus:QUEStionable:INSTrument[:EVENT]?
```

Response: NR1

STAT:QUES:INST:COND (PMX-Multi only)

Queries the condition of the QUEStionable:INSTrument subregister.
A query does not clear the contents of the register.

Command

```
STATus:QUEStionable:INSTrument:CONDition?
```

Response: NR1

STAT:QUES:INST:ENAB (PMX-Multi only)

Sets the enable register of the QUEStionable:INSTrument subregister.

Command

```
STATus:QUEStionable:INSTrument:ENABle <NRf>
```

```
STATus:QUEStionable:INSTrument:ENABle?
```

Parameter

Value:0 to 65535

Response: NR1

STAT:QUES:INST:NTR (PMX-Multi only)

Sets the negative transition of the QUEStionable:INSTrument subregister.

Command

```
STATus:QUEStionable:INSTrument:NTRansition <NRf>
```

```
STATus:QUEStionable:INSTrument:NTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:QUES:INST:PTR (PMX-Multi only)

Sets the positive transition of the QUESTIONable:INSTRument subregister.

Command

```
STATus:QUEStionable:INSTRument:PTRansition <NRf>
```

```
STATus:QUEStionable:INSTRument:PTRansition?
```

Parameter

Value:0 to 65535

Response: NR1

QUESTIONable:INSTrument:ISUMmary<n> subregister (PMX-Multi only)

This is the subregister of bit <n> of the QUESTIONable:INSTrument subregister. This is a 16-bit register that stores information related to the status of and the questionable events that occur during operation of the PMX whose channel you specified.

Use <n> to specify the channel number.

For example, channel 2 is specified as "QUES:INST:ISUM2".

The QUESTIONable status register bits may indicate that there are problems with the PMX's measured data.

Bit	Bit weight	Bit name	Description
0	1	OVP (OV)	Overvoltage protection has been activated
1	2	OCP (OC)	Overcurrent protection has been activated
2	4	AC Power Failure or power interruption (PF)	--
3	8	NOT USED	--
4	16	Over Temperature Protection (OT)	--
5	32	NOT USED	--
6	64	NOT USED	--
7	128	NOT USED	--
8	256	WDOG protection (WDOG)	--
9	512	NOT USED	--
10	1024	NOT USED	--
11	2048	Soliday Protection (SP)	Synchronized protection as a result of an activation of a protection function on another channel
12	4096	NOT USED	--
13	8192	INSTrument Summary (ISUM)	--
14	16384	NOT USED	--
15	32768	NOT USED	Always zero

STAT:QUES:INST:ISUM<n> (PMX-Multi only)

Queries the event of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:QUES:INST:ISUM2" command.

A query clears the contents of the register.

Command

```
STATus:QUEStionable:INSTrument:ISUMmary<n>[:EVENT]?
```

Response: NR1

STAT:QUES:INST:ISUM<n>:COND (PMX-Multi only)

Queries the condition of the QUEStionable:INSTrument:ISUMmary<n> subregister.
Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:QUES:INST:ISUM2:COND" command.

A query does not clear the contents of the register.

Command

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

Response: NR1

STAT:QUES:INST:ISUM<n>:ENAB (PMX-Multi only)

Sets the enable register of the QUESTIONable:INSTrument:ISUMmary<n> subregister.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:QUES:INST:ISUM2:ENAB" command.

Command

```
STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle <NRf>
```

```
STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle?
```

Parameter

Value:0 to 65535

Response: NR1

STAT:QUES:INST:ISUM<n>:NTR (PMX-Multi only)

Sets the negative transition of the QUEStionable:INSTRument:ISUMmary<n> sub-register.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:QUES:INST:ISUM2:NTR" command.

Command

```
STATus:QUEStionable:INSTRument:ISUMmary<n>:NTRansition <NRf>
```

```
STATus:QUEStionable:INSTRument:ISUMmary<n>:NTRansition?
```

Parameter

Value: 0 to 65535

Response: NR1

STAT:QUES:INST:ISUM<n>:PTR (PMX-Multi only)

Sets the positive transition of the QUESTIONable:INSTrument:ISUMmary<n> sub-register.

Use <n> to specify the channel number.

For example, to specify channel 2, send the "STAT:QUES:INST:ISUM2:PTR" command.

Command

```
STATus:QUEStionable:INSTrument:ISUMmary<n>:PTRansition <NR1>
```

```
STATus:QUEStionable:INSTrument:ISUMmary<n>:PTRansition?
```

Parameter

Value:0 to 65535

Response: NR1

Preset status

STAT:PRES

Resets the ENABLE, PTRansition, and NTRansition filter registers of all status registers (including sub registers) to their default values.

Default values:

ENABLE (except INSTRument:ISUMmary<n>:ENABLE): 0x0000

INSTRument:ISUMmary<n>:ENABLE: 0x7FFF

STATus:PTRansition = 0x7FFF

STATus:NTRansition = 0x0000

Command

STATus:PRESet

SYSTEM Command

SYST:BEEP (PMX-Multi only)

Turns the buzzer on and off.

Command

```
SYSTem:BEEPer[:STATe] <boolean>
```

```
SYSTem:BEEPer[:STATe]?
```

Parameter

Value: ON(1) Buzzer on (default)
OFF(0) Buzzer off

(Example)

```
SYST:BEEP OFF
```

Response: NR1

SYST:COMM:RLST (PMX-Multi only)

Sets the operation of the PMX to local or remote.

Command

```
SYSTem:COMMunicate:RLState <character>
```

```
SYSTem:COMMunicate:RLState?
```

Parameter

Value:	LOCAL	<p>Sets the PMX to local mode (Remote Disable; the REMOTE LED turns off).</p> <p>Disable state enables both panel operations and commands. This is a substitute command for IEEE488.1 ren FALSE (Remote Disable).</p> <p>If the communication monitoring timer is set, set the timer to off (OUTP:PROT:WDOG 0) before switching to local mode.</p>
	REMOte	<p>Sets the PMX operation to remote mode.</p> <p>All panel keys except the LOCAL key are locked.</p> <p>This is a substitute command for the IEEE488.1 REN (Remote Enable) command and address designation.</p>
	RWLock	<p>Sets the PMX operation to remote mode.</p> <p>All panel keys are locked (the LOCAL key is also locked). This is a substitute command for the IEEE488.1 llo (Local Lock Out) command.</p>

(Example)

```
SYST:COMM:RLST REM
```

Response: character

SYST:CONF:STAR:PRI

Sets the operation mode to be prioritized when the output is turned on.

Command

```
SYSTem:CONFigure:STARtup:PRIority <character>[, (@chanlist)]
```

```
SYSTem:CONFigure:STARtup:PRIority? [(@chanlist)]
```

Parameter

Value:	CC	CC (constant current) is prioritized.
	CV	CV (constant voltage) is prioritized.

(Example)

```
SYST:CONF:STAR:PRI CC
```

Response: character

SYST:DTF (PMX-Multi only)

Queries the parallel or series operation state.

Command

```
SYSTem: DTFormation[:STATE]?
```

Response

Return the parallel or series operation state in character format.

Parameter

Value: **NORMal** Parallel nor series operation is in use.
 SERies Series operation is in use.
 PARAllel Parallel operation is in use.

SYST:ERR

Reads the oldest error information or event information from the error queue. The error queue can store up to 16 errors.

-> Tutorial "Error Checking"

Use the *CLS command to clear the error queue.

Command

```
SYSTem:ERRor[:NEXT]?
```

Response

Returns the oldest error or event information in the error/event queue as follows:

(Example) When there are no errors or events

```
+0,"No error"
```

(Example) When a command that cannot be executed under the current operating conditions has been received

```
-221,"Settings conflict"
```

SYST:ERR:COUN (PMX-Multi only)

Returns the number of unread errors in the error queue.

Command

SYSTem:ERRor:COUNT?

Response: NR1

SYST:ERR:TRAC

Sets whether to display communication errors by performing a debug trace.

If the communication error display is enabled, error numbers, such as Err-100, are shown in the PMX display area.

Communication errors are displayed when the PMX is set to remote mode.

Command

```
SYSTem:ERRor:TRACe <boolean>
```

```
SYSTem:ERRor:TRACe?
```

Parameter

Value: ON(1) Communication errors are displayed.
OFF(0) Communication errors are not displayed. (default)

(Example)

```
SYST:ERR:TRAC ON
```

Response: NR1

SYST:KLOC

Sets and releases the panel operation lock (keylock).

Command

```
SYSTem:KLOCk <boolean>
```

```
SYSTem:KLOCk?
```

Parameter

Value: ON(1) Key lock is set.
 OFF(0) Key lock is released.

(Example)

```
SYSTem:KLOC ON
```

Response: NR1

SYST:KLOC:MODE

Sets the lock mode of the panel operations.

Command

```
SYSTem:KLOCk:MODE {1|2|3}
```

```
SYSTem:KLOCk:MODE?
```

Parameter

Value:	1	Lock mode 1 (Loc1) Locks all panel operations with keys and rotary knobs except output on/off operation and preset memory A/B/C recall operation.
	2	Lock mode 2 (Loc2) Locks all panel operations with keys and rotary knobs except output on/off operation.
	3	Lock mode 3 (Loc3) (Default) Locks all panel operations with keys and rotary knobs.

(Example)

```
SYST:KLOC:MODE 1
```

Response: NR1

SYST:LOC (PMX-A only)

Sets the PMX to local mode (Remote Disable; the REMOTE LED turns off).

This is a substitute command for the IEEE488.1 ren FALSE (remote disable) command. The Remote Disable state enables both panel operations and commands.

Use SYST:REMO or SYST:RWL to switch to remote mode (Remote Enable; the REMOTE LED lights).

Command

```
SYSTem:LOCa1
```

SYST:OPT (PMX-A only)

Queries the optional interface boards and enhanced functions that are installed in the PMX.

This is a substitute command for *OPT.

Command

```
SYSTem:OPTion?
```

Response:

Always returns "0".

SYST:REM (PMX-A only)

Sets the PMX operation to remote mode.

All panel keys except the LOCAL key are locked. This is a substitute command for the IEEE488.1 REN (Remote Enable) command and address designation.

Use the SYST:LOC command to return the PMX to local mode.

Command

SYSTem:REMOte

SYST:RWL (PMX-A only)

Sets the PMX operation to remote mode.

All panel keys are locked (the LOCAL key is also locked). This is a substitute command for the IEEE488.1 llo (Local Lock Out) command.

Use the SYST:LOC command to return the PMX to local mode.

Command

SYSTem:RWLock

SYST:SEC:IMM (PMX-Multi only)

Sanitizes all contents stored in memory and initializes the panel settings to their factory default conditions.

Command

```
SYSTem:SECurity:IMMediate
```

SYST:VERS

Queries the version of the SCPI specifications to which the PMX conforms.

Command

SYSTem:VERSion?

Response

Returns 1999.0.

TRACK Command (PMX-Multi only)

TRAC (PMX-Multi only)

Enables or disables the tracking function.

Command

```
TRACk[:STaTe] <boolean>
```

```
TRACk[:STaTe]?
```

Parameter

Value: ON(1) The tracking function is enabled.
 OFF(0) The tracking function is disabled (default).

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC ON
```

Response: NR1

TRAC:ABS:CURR (PMX-Multi only)

Sets the amount of change to apply to the present current using an absolute value when the tracking function is enabled.

Command

```
TRACk:ABSolute:CURRent <numeric>
```

```
TRACk:ABSolute:CURRent?
```

Parameter

Value: 0 % to 105 % of the rated output current (0 by default)

Unit: A

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:ABS:CURR 5
```

Response: NR3

TRAC:ABS:VOLT (PMX-Multi only)

Sets the amount of change to apply to the present voltage using an absolute value when the tracking function is enabled.

Command

```
TRACk:ABSolute:VOLTage <numeric>
```

```
TRACk:ABSolute:VOLTage?
```

Parameter

Value: 0 % to 105 % of the rated output voltage (0 by default)

Unit: V

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:ABS:VOLT -5
```

Response: NR3

TRAC:BASE (PMX-Multi only)

Queries the reference values (voltage and current) of the tracking function.

Command

TRACk:BASE?

Response

Returns the current <NR3> and then the voltage <NR3> in a comma-separated format.

TRAC:BASE:ANCH (PMX-Multi only)

Changes the reference value of the tracking function to the present value.

Command

TRACk:BASE:ANCHor

TRAC:BASE:CHAN (PMX-Multi only)

Specifies the reference channel of the tracking function.

TRAC:BASE:INST and TRAC:BASE:CHAN are aliases and operate in the same manner.

Command

```
TRACk:BASE:CHANnel[:[N]SElect] <NR1>
```

```
TRACk:BASE:CHANnel[:[N]SElect]?
```

Parameter

Value: 1 to 4 channel

(Example)

```
TRAC:BASE:CHAN 4
```

Response: NR1

TRAC:BASE:INST (PMX-Multi only)

Specifies the reference channel of the tracking function.

TRAC:BASE:INST and TRAC:BASE:CHAN are aliases and operate in the same manner.

Command

```
TRACk:BASE:INSTrument[:[N]SElect] <NR1>
```

```
TRACk:BASE:INSTrument[:[N]SElect]?
```

Parameter

Value: 1 to 4 channel

(Example)

```
TRAC:BASE:INST 4
```

Response: NR1

TRAC:MODE (PMX-Multi only)

Sets whether to use the tracking function based on absolute value change or percentage change.

Command

```
TRACk:MODE <character>
```

```
TRACk:MODE?
```

Parameter

Value:	RATio	Percentage change
	ABSolute	Absolute value change (default)

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:MODE RAT
```

Response: character

TRAC:RAT:CURR (PMX-Multi only)

Sets the amount of change to apply to the present current using a percentage when the tracking function is enabled.

Command

```
TRACk:RATio:CURRent <numeric>
```

```
TRACk:RATio:CURRent?
```

Parameter

Value: 0 % to 200 % (0 by default)

Unit: %(PCT)

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:RAT:CURR 90
```

Response: NR3

TRAC:RAT:VOLT (PMX-Multi only)

Sets the amount of change to apply to the present voltage using a percentage when the tracking function is enabled.

Command

```
TRACk:RATio:VOLTage <numeric>
```

```
TRACk:RATio:VOLTage?
```

Parameter

Value: 0 % ~ 200 % (100 by default)

Unit: %(PCT)

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:RAT:VOLT 112.5
```

Response: NR3

TRAC:SYNC (PMX-Multi only)

Enables or disables the tracking function, and sets the target channels.

Command

```
TRACk:SYNC[:STATe] <boolean>[, (@chanlist)]
```

```
TRACk:SYNC[:STATe]? [(@chanlist)]
```

Parameter

Value: ON(1) The tracking operation is enabled (default for channels 1 and 2).
 OFF(0) The tracking operation is disabled (default for channels 3 and 4).

Settings are reset to default when the *RST command is sent.

(Example)

```
TRAC:SYNC ON
```

Response: NR1

TRIGger Command

TRIG:TRAN (PMX-A only)

Executes a software trigger for the TRANSient trigger subsystem.

Command

```
TRIGger:TRANSient[:IMMediate]
```


TRIG:TRAN:SOUR (PMX-A only)

Sets the condition (trigger source) that determines when the TRANSient trigger subsystem actually changing the setting after the PMX receives the INIT:TRAN command.

Command

```
TRIGger:TRANSient:SOURce <character>
```

```
TRIGger:TRANSient:SOURce?
```

Parameter

Value:	IMMediate	The setting is changed immediately (default).
	BUS	The setting is changed when a software trigger is received (use the *TRG, TRIG:TRAN, or IEEE488.1 get (Group Execute Trigger) command to change the setting; default).

Settings are reset to default when the *RST command is sent.

(Example)

```
TRIG:TRAN:SOUR BUS
```

Response: character

Tutorial

Settings and Measurement

■ Voltage and current (PMX-A only)

The output voltage and output current are controlled by the VOLTage and CURRent commands. The output ON/OFF state is controlled by the OUTPut command.

```
VOLTage 10 'Set the voltage to 10 V
CURRent 5 'Set the current to 5 A
OUTPut ON 'Turn the output on
```

■ Voltage and current (PMX-Multi only)

On the PMX PMX-Multi, you must first specify the channel you want to configure. At power-on, channel 1 is selected. First specify the channel, and then configure the other settings.

Example in which channel 2 is configured:

```
INST 2 'Specify channel 2.
```

The output voltage and output current are controlled by the VOLTage and CURRent commands. The output ON/OFF state is controlled by the OUTPut command.

```
VOLTage 10 'Set the channel 2 voltage to 10 V.
CURRent 5 'Set the channel 2 current to 5 A.
OUTPut ON 'Turn on the channel 2 output.
```

In addition to using the INST command, you can also use the parameter of the CURR or VOLT command to specify the channel. If you use the parameter to specify the channel, the channel specified by the INST command is invalid.

```
INST 2 'Specify channel 2.
VOLTage 10 'Set the channel 2 voltage to 10 V.
CURRent 5 'Set the channel 2 current to 5 A.
VOLTage 5, (@3) 'Set the channel 3 voltage to 5 V.
OUTPut ON 'Turn on the channel 2 output.
```

When you use the parameter to specify the channel, you can also specify several channels at once.

```
VOLTage 5, (@1, 3) 'Set the channel 1 and 3 voltages to 5 V.
VOLTage 5, (@2:4) 'Set the channel 2 to 4 voltages to 5 V.
```

Channel designation with the parameter can also be used in query commands.

```
VOLTage? (@1) 'Query the channel 1 voltage.
```

■ Setting maximum and minimum values

To set the current to the maximum value, set the value of the CURREnt command to MAXimum.

The setting can be set to a value in the range from 0 to 105 % of the rated output current.

```
VOLTage 18 'Set the voltage to 18 V
CURREnt MAXimum 'Set the current to the maximum value
```

To set the voltage to the maximum value, set the value of the VOLTage command to MAXimum.

The setting can be set to a value in the range from the value of the VOLTage:LIM-it:LOW setting to 105 % of the rated output voltage.

```
CURREnt 5 Set the current to 5 A
VOLTage MAXimum 'Set the voltage to the maximum value
```

You can confirm the maximum allowed value that can be specified in the VOLTage and CURREnt commands by specifying the MAXimum parameter in the VOLTage? and CURREnt? queries, respectively.

```
VOLTage? MAXimum
<Read the response>
CURREnt? MAXimum
<Read the response>
```

The values that the queries above return may vary depending on the VOLTage:PROTection (OVP) and CURREnt:PROTection (OCP) settings.

■ Setting the protection functions

The PMX provides overvoltage protection (OVP) and overcurrent protection (OCP) functions that can be configured. The VOLTage:PROTection and CURREnt:PROTection commands are used to set the OVP and OCP, respectively.

```
VOLTage:PROTection 10 'Set the OVP to 10 V
CURREnt:PROTection 4.5 'Set the OCP to 4.5 A
```

If you want to set the OVP or OCP setting to the maximum or minimum value, you can specify MAXimum or MINimum for the parameter.

```
VOLTage:PROTection MAXimum 'Set the OVP to the maximum value
CURREnt:PROTection MAXimum 'Set the OCP to the maximum value
```

The output turns off if an OVP or OCP function is activated.

Eliminate the cause of the alarm, and clear the alarm.

```
OUTPut:PROTection:CLEar
```

■ Measurement

After you have set the output and protection function settings, query the measured values. The PMX can return the measured voltage and the measured current.

To measure the voltage and current, use the following queries.

MEASure:VOLTage? 'Query the voltage output

MEASure:CURRent? 'Query the current output

The measured voltage and the measured current are updated alternately at 25 ms intervals. The output status is updated alternately at 50 ms intervals. If you query the measured value or the output status at an interval shorter than 50 ms, the previous measured value will be returned.

Using Triggers to Change Settings (TRANSient) (PMX-A only)

You can use triggers to synchronize the setting of the voltage and current. This is convenient if you want to synchronize output changes with the action of other instruments such as electronic loads. To reserve triggered settings, use the `VOLTage:TRIGgered` and `CURRent:TRIGgered` commands.

```
VOLTage 12.0 'Set the voltage to 12.0 V
```

```
CURRent 1.5 'Set the current to 1.5 A
```

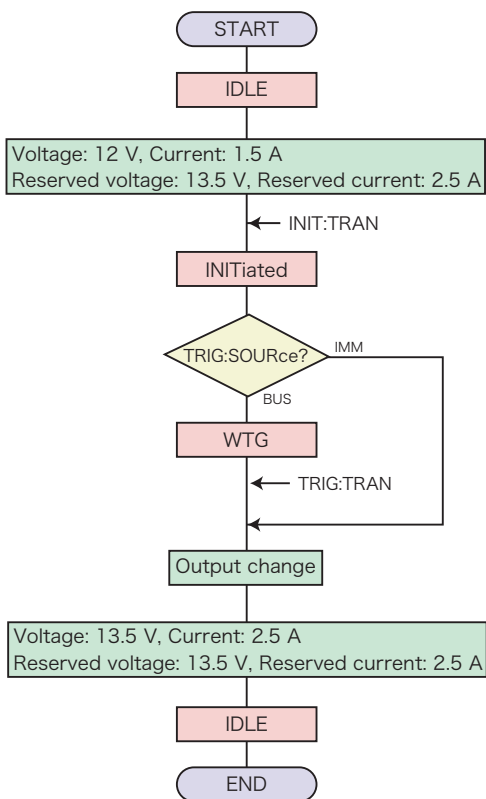
```
VOLTage:TRIGgered 13.5 'Set the PMX so that the voltage is 13.5 V when triggered
```

```
CURRent:TRIGgered 2.5 'Set the PMX so that the current is 2.5 A when triggered
```

```
TRIGger:SOURce BUS 'Set the trigger source to BUS
```

```
INITiate:TRANSient 'Initiate
```

```
TRIGger:TRANSient 'Apply a software trigger
```



The `TRIGger:TRANSient:SOURce` command sets the trigger source to `BUS`, or `IMMEDIATE`.

The INITiate:TRANSient command makes the trigger subsystem leave the IDLE state and enter the initiated state. When the Trigger Source is set to IMMEDIATE, the transient action is executed immediately, which causes the voltage or current or both to change to a new setting. When the Trigger Source is set to BUS, the trigger subsystem enters the WTG (Waiting For Trigger) state.

When the operation is completed, the TRANSient subsystem returns to the IDLE state again. When an ABORt command or an equivalent command is sent without executing the trigger, the transient action is canceled, and then the TRANSient subsystem returns to the IDLE state.

When the PMX is turned on, all the TRIGger subsystems are in the IDLE state. In this state, the TRIGger subsystem ignores all triggers. If you send one of the following commands, the TRIGger subsystem is switched to the IDLE state, regardless of its current state.

ABORt

*RST

Device clear (USB interface) or break signal (RS232 interface)

Operation using a software trigger

When ABOR is sent, INIT:TRAN is cancelled. The VOLT:TRIG setting does not change.

The following table shows the responses when the voltage is set to 20 V (VOLT 20) and when the target value to which the voltage will change when a trigger is received is set to 10 V (VOLT:TRIG 10).

	Response	
	VOLT?	VOLT:TRIG?
Immediately after the setting is made.	20 V	10 V
After a trigger is sent.	10 V	10 V
After *RST is sent.	0 V	0 V
When "VOLT 30" (to change the voltage) is sent before sending a trigger	30 V	30 V (cancel)

Using the tracking function (PMX-Multi only)

The tracking function is used to change the output of other channels by controlling a single channel. There are two change modes: absolute value change and percentage change.

- **Absolute value change**
The output of target channels change to the same values (absolute values) along with the changes in the reference channel.
- **Percentage change**
The outputs of target channels change at the same percentage along with the changes in the reference channel.

The following example shows how to change CH1 using CH2 as the reference channel. CH3 is not controlled by the tracking function. First turn off the output, and set the voltage and current

```
OUTP OFF, (@1:4) 'Turn off the output of all channels (for a QU model)
CURR 0.1, (@1:3) 'Set the CH1, CH2, and CH3 currents to 0.1 A.
VOLT 10, (@1,3) 'Set the CH1 and CH3 voltages to 10 V.
VOLT 5, (@2) 'Set the CH2 voltage to 5 V.
TRAC ON 'Enable the tracking function.
```

When using absolute value change

```
TRAC:MODE ABS 'Specify the tracking function (absolute value change).
```

When using percentage change

```
TRAC:MODE RAS 'Specify the tracking function (percentage change).
```

Specify the channels to apply the tracking function, and change the output.

```
TRAC:SYNC ON, (@1,2) 'Set CH1 and CH2 under tracking control.
TRAC:BASE:INST 2 'Specify CH2 as the reference channel.
OUTP ON, (@1,2) 'Turn on the CH1 and CH2 outputs.
```

When the tracking function is enabled, sending a VOLT or CURR command will result in error. In place of these commands, if you are using absolute value change, use TRAC:ABS:VOLT and TRAC:ABS:CURR. If you are using percentage change, use TRAC:RAT:VOLT and TRAC:RAT:CURR.

When using absolute value change

```
TRAC:ABS:VOLT -1 'CH1 will be set to 9 V and CH2 to 4 V.
```

When using percentage change

```
TRAC:RAT:VOLT 90.0 'CH1 will be set to 9 V and CH2 to 4.5 V.
TRAC:RAT:VOLT 90.0 'CH1 will be set to 8 V and CH2 to 4 V (the amount of
change is equal to values obtained by taking the percentage of the values speci-
fied before the tracking function was enabled).
```

You can query the values before the tracking function was enabled

```
TRAC:BASE? 'Query the voltage and current of the reference channel that were
```

set before the tracking function was enabled.

It is also possible to change the value as a percentage of the present value, not the value that was set before the tracking function was enabled.

TRAC:RAT:VOLT 90.0 'CH1 will be set to 9 V and CH2 to 4.5 V.

TRAC:RAT:VOLT 90.0 'CH1 will be set to 8 V and CH2 to 4 V.

TRAC:BASE:ANCH

TRAC:RAT:VOLT 90.0 'CH1 will be set to 8.2 V and CH2 to 3.6 V.

When the tracking function is enabled, use TRAC:ABS:VOLT and TRAC:ABS:CURR or TRAC:RAT:VOLT and TRAC:RAT:CURR also to change the output of channels that are not being controlled by the tracking function.

TRAC:BASE:INST 3 'Specify CH3 as the reference channel.

OUTP ON, (@3) 'Turn on the CH3 output.

TRAC:ABS:VOLT -3 'CH3 will be set to 7 V. CH1 and CH2 do not change.

Disable the tracking function.

TRAC OFF 'Disable the tracking function.

Status Monitoring

The PMX has two mandatory SCPI standard registers, STATus:OPERation and STATus:QUEStionable, in addition to the IEEE488.2 standard registers.

■ Register basics

All SCPI registers have standard event/filter architecture, employing CONDition, EVENT, ENABLE, and optionally PTRansition and NTRansition. CONDition and EVENT are read-only registers working as status indicators, and ENABLE, PTRansition and NTRansition are read-write registers working as event and summary filters.

■ STATus:OPERation

The STATus:OPERation register records events or signals that occur during normal operation.

For example, to check if the PMX is being regulated in CV state, check the CV bit (bit 8) on the STATus:OPERation register.

```
STATus:OPERation? 'Check whether the CV bit is set
```

When multichannel is in use, check the CV bit (bit 8) of the STATus:OPERation:INSTRument:ISUMmary<n> subregister.

```
STATus:OPERation:INSTRument:ISUMmary2? 'Check whether the CV bit  
of channel 2 is set.
```

■ STATUS:QUESTIONable (PMX-A only)

The STATUS:QUESTIONable register records events or signals that indicate abnormal operation.

To check if the protection function is working, check the OV bit (bit 0) on the STATUS:QUESTIONable register.

STATUS:QUESTIONable? 'Check whether the OV bit is set

■ STATUS:QUESTIONable (PMX-Multi only)

The STATUS:QUESTIONable register records events or signals that indicate abnormal operation.

To check if the protection function is working, check the OV bit (bit 0) on the STATUS:QUESTIONable register.

STATUS:QUESTIONable? 'Check whether the OV bit is set

Even if bit 0 is true, you can not tell on which channel the overvoltage protection function has been activated.

To check which channel is operating abnormally, check the STATUS:QUESTIONable:INSTRUMENT subregister.

STATUS:QUESTIONable:INSTRUMENT? 'Check which channel is operating abnormally.

All channels whose corresponding bits are true are operating abnormally. You can determine how the specified channel is operating abnormally by checking the STATUS:QUESTIONable:INSTRUMENT:ISUMmary<n> subregister of the channel.

STATUS:QUESTIONable:INSTRUMENT:ISUMmary2? 'Check whether the OV bit of channel 2 is set.

■ PON (Power ON) bit

The PON bit (bit 7) in the event status register is set whenever the PMX is turned on. The most common use for the PON bit is to generate an SRQ at power-on to keep track of unexpected loss of power or power line failure. To do this, follow the steps shown below.

- 1 Set *PSC (Power-on Status Clear) to 0 (or OFF).**
Enable the backup function of the event status enable register and service request enable register (*PSC 0).
- 2 Set the PON bit (bit 7) of the event status enable register.**
Permit the transmission of a power-on event to the upper layer (*ESE 128).
- 3 Set the ESB bit (bit 5) of the status byte enable register.**
Permit the generation of an SRQ caused by a standard event (*SRE 32).

*PSC 0; *ESE 128; *SRE 32

When using the RS232C interface, the PON bit cannot be assigned to the service request, because SRQs are not generated.

Though the SRQ feature itself is provided by communication protocol on the USB interface or LAN (VXI-11/ HiSLIP) interface, a Connection Lost error in the VISA I/O session occurs immediately before the power-on event. It may be difficult to handle PON events when using the USB interface.

Error Checking

■ Error/event queue

The SCPI specifications define a standard error reporting scheme, Error/Event Queue. This is a FIFO (First In First Out) queue, which records errors and events. The maximum number of errors/events that the PMX can record is 16. Each error/event can be read with the `SYSTem:ERRor` query.

```
SYSTem:ERRor?
```

The response to this query contains a numeric part (error/event number) and a textual description, such as:

```
-222,"Data out of range"
```

The error/event queue is empty when the `*CLS` common command is sent, when the last item in the queue is read, and when the PMX is turned on. When the error/event queue is empty, the query returns the following:

```
0,"No error"
```

■ Displaying communication errors

The PMX has a debug trace function. The oldest item among the errors and events (if they are present) can be displayed on the PMX. This function is convenient when you debug your remote applications.

While an error/event item is displayed on the panel, the normal voltmeter and ammeter are disabled.

If the error/event queue is empty, the debug trace function does not display any errors. Sending the `*CLS` command clears the communication error display.

If in local mode, the debug trace function is temporarily disabled.

The communication error display can be enabled or disabled with the `SYSTem:ERRor:TRACe` command.

```
SYSTem:ERRor:TRACe {ON|OFF}
```

Visual Basic 2017

■ Setting the "Project"

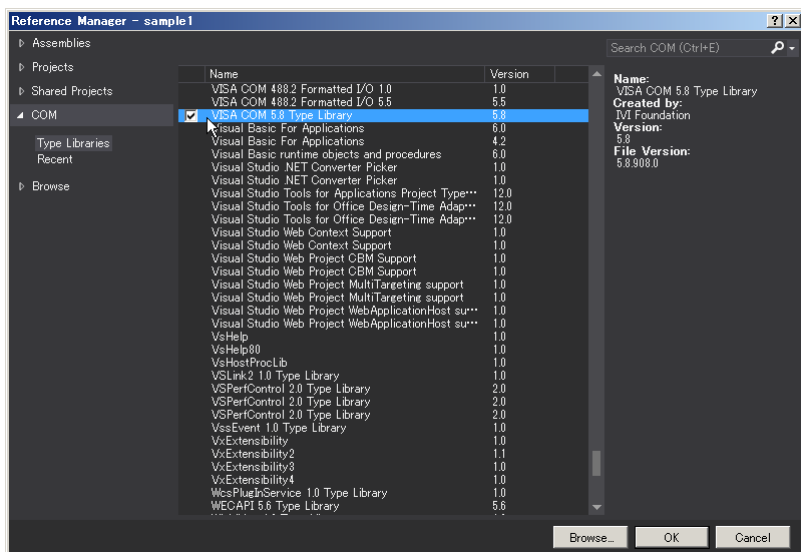
First, add the communication middleware (VISA library) to the project.

Click References on the Project menu to open the Reference Manager window.

On the navigation pane, click COM and then Type Libraries.

From the list in the center of the window, select "VISA COM *.* Type Library" (where *.* is the VISA library version number), and select the check box.

Click OK to close the dialog box.



■ Communication through RS232C, USB, or LAN

Open the VISA

To communicate with an RS232C, USB, or LAN device using VISA, you have to first open VISA. When you open VISA, specify the I/O resource.

Example : To open VISA by using USB

```
Set rm = CreateObject("VISA.GlobalRM")
Set msg = rm.Open("USB::0x0B3E::0x1029::00000001::INSTR", NO_LOCK, 0, "")
```

"USB::0x0B3E::0x1029::00000001::INSTR" is the I/O resource.

The I/O resource is specified by the following constructions. The part indicated with [] can be omitted. Enter the appropriate values in the parts specified in oblique characters.

Serial (RS232C)	ASRL[<i>board</i>][:INSTR] Example : The measuring instrument connected to the serial port COM1. ASRL1::INSTR
USB	USB[<i>board</i>]:: <i>VendorID</i> :: <i>ProductID</i> :: <i>SerialNumber</i> [: <i>InterfaceNumber</i>] Example: The USNTMC measuring instrument having vendor ID (VID) 2878, Product ID (PID) 4137 and serial number "00000001." USB0::0x0B3E::0x1029::00000001::INSTR
LAN*1	VXI-11 TCPIP[<i>board</i>]:: <i>hostname</i> [: <i>inst0</i>][:INSTR] Example :The measuring instrument whose IP address (hostname) is 169.254.7.8. TCPIP::169.254.7.8::INSTR You can also set the LAN device name using the host name.
	HiSLIP TCPIP[<i>board</i>]:: <i>hostname</i> :: <i>hislip0</i> [:INSTR] Example :The measuring instrument whose IP address (hostname) is 169.254.7.8. TCPIP::169.254.7.8::hislip0::INSTR You can also set the LAN device name using the host name.
	SCPI-RAW TCPIP[<i>board</i>]:: <i>hostname</i> :: <i>portno</i> ::SOCKET Example :The measuring instrument whose IP address (hostname) is 169.254.7.8. (The "portno" setting of the PMX is always 5025.) TCPIP::169.254.7.8::5025::SOCKET You can also set the LAN device name using the host name.

*1: The hostname must be a valid mDNS hostname (a Bonjour hostname that ends in ".local") or a DNS hostname that is managed by an external DNS server (a full-qualified domain name—FQDN). If you are using an mDNS hostname, Apple Bonjour (alternatively, iTunes or Safari) must be installed on your PC.

For VISA, the alias can be used for the I/O resource.

When using the alias for the I/O resource, even if the alias name is hard-coded

directly in the application, the alias name can be easily converted to the appropriate I/O resource name.

Example : When using the alias (MYDEV1) for the I/O resource.

```
Set msg = rm.Open("MYDEV1", NO_LOCK, 0, "")
```

When the alias is used, the actual I/O resource is specified by an external configuration table. When using USB:

Please refer to the applicable VISA manual.

Controlling the devices

Next, use "Read" and "Write" commands to control devices. You must include line-feed codes in the command strings.

Example:

```
msg.WriteString ("VOLT 10" & vbLF)      'Set the voltage to 10 V
msg.WriteString ("OUTP 1" & vbLF)      'Turn the output on
```

Closing the VISA

Close the VISA at the end.

You only need to include one "open" VISA command and one "close" VISA command in the program.

```
msg.Close
```

■ Sample program

Imports Ivi.Visa.Interop

Public Class Form1

Dim rm As ResourceManager

Dim msg As IMessage

Sub Form1_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load

rm = CreateObject("VISA.GlobalRM")

msg = rm.Open("USB0::0x0B3E::0x1029::00000001::INSTR", AccessMode.NO_LOCK, 0, "")

'Example: Using an VISA alias

'msg = rm.Open("MYDEV1", AccessMode.NO_LOCK, 0, "")

'Example: LAN(SCPI-RAW)

'msg = rm.Open("TCPIP::169.254.7.8::5025::SOCKET", AccessMode.NO_LOCK, 0, "")

msg.TerminationCharacterEnabled = True

End Sub

'Query the instrument identity

Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click

msg.WriteString("SYST:COMM:RLST?" & vbCrLf)

msg.WriteString("**IDN?" & vbCrLf)

TextBox1.Text = msg.ReadString(256)

End Sub

'Set the voltage and current

Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button2.Click

msg.WriteString("OUTP 0" & vbCrLf)

msg.WriteString("VOLT 8" & vbCrLf)

msg.WriteString("CURR 5" & vbCrLf)

msg.WriteString("OUTP 1" & vbCrLf)

End Sub

'Querys measurement voltage

Private Sub Button3_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button3.Click


```
msg.WriteString("MEAS:VOLT?" & vbCrLf)
TextBox1.Text = msg.ReadString(256)
End Sub

Private Sub Form1_Disposed(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Disposed
    msg.Close()
End Sub

End Class
```

Appendix

A List of Errors

■ Command errors

An error 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 5) in the event status register to be set.

Error code	Error message description
-100	Command error This is the generic syntax error.
-101	Invalid character A syntactic element contains a character that is invalid for that type.
-102	Syntax error An unrecognized command or data type was encountered.
-103	Invalid separator The parser was expecting a separator and encountered an illegal character.
-104	Data type error The parser recognized a data element different than one allowed.
-105	GET not allowed A Group Execute Trigger was received within a program message.
-108	Parameter not allowed More parameters were received than expected for the header.
-109	Missing parameter Fewer parameters were received than required for the header.
-110	Command header error An error was detected in the header.
-112	Program mnemonic too long The header contains more than twelve characters.
-113	Undefined header The header is undefined for this device.
-114	Header suffix out of range The value of a numeric suffix attached to a program mnemonic.
-115	Unexpected number of parameters The number of parameters received does not correspond to the number of parameters expected.
-120	Numeric data error This error is generated when parsing a data element that appears to be numeric, including the nondecimal numeric types.
-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.
-130	Suffix error This error is generated when parsing a suffix.
-131	Invalid suffix The suffix does not follow the syntax or the suffix is inappropriate for this device.
-134	Suffix too long The suffix contained more than 12 characters.
-138	Suffix not allowed A suffix was encountered after a numeric element which does not allow suffixes.

Error code		Error message description
-140	Character data error	This error is generated when parsing a character data element.
-141	Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
-144	Character data too Long	The character data element contains more than twelve characters.
-148	Character data not allowed	A legal character data element was encountered where prohibited by the device.
-150	String data error	This error is generated when parsing a string data element.
-151	Invalid string data	A string data element was expected, but was invalid for some reason.
-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 is generated when parsing a block data element.
-170	Expression error	This error is generated when parsing an expression data element.
-180	Macro error	This error is generated when defining a macro or executing a macro.

■ Execution errors

An error 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 4) in the event status register to be set.

Error code		Error message description
-200	Execution error (generic)	This is the generic syntax error for devices that cannot detect more specific errors.
-201	Invalid while in local	Indicates that a command is not executable while the device is in local due to a hard local control.
-203	Command protected	Indicates that a legal password-protected program command or query could not be executed because the command was disabled.
-210	Trigger error	Trigger error.
-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.
-213	Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
-214	Trigger deadlock	Indicates that the trigger source for the initiation of a measurement is set to GET and a subsequent measurement query was received.

Error code	Error message description
-220	Parameter error Indicates that a program data element related error occurred.
-221	Settings conflict Indicates that a legal program data element was parsed but could not be executed due to the current device state.
-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.
-223	Too much data Indicates that a legal program data element of block, expression, or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.
-224	Illegal parameter value Used where an exact value, from a list of possible values, was expected.
-230	Data corrupt or stale Possibly invalid data; new reading started but not completed since last access.
-241	Hardware missing Indicates that a legal program command or query could not be executed because of missing device hardware.

■ Device-specific errors

An error in the range [-399, -300] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error. The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the event status register to be set.

Error code	Error message description
-310	System error Indicates that some error, termed "system error" by the device, has occurred.
-311	Memory error Indicates some physical fault in the device's memory, such as parity error.
-313	Calibration memory lost Indicates that nonvolatile calibration data used by the *CAL? command has been lost.
-314	Save/recall memory lost Indicates that the nonvolatile data saved by the *SAV? command has been lost.
-315	Configuration memory lost Indicates that nonvolatile configuration data saved by the device has been lost.
-330	Self-test failed Self-test failed
-350	Queue overflow A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.
-360	Communication error Communication error when the flow control is turned off. This error applies when the RS232C interface is used.

Error code	Error message description
-362	Framing error in program message
-363	Input buffer overrun
-365	Time out error

■ Query errors

An error 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 2) in the event status register to be set.

Error code	Error message description
-400	Query error (generic)
-410	Query INTERRUPTED
-420	Query UNTERMINATED
-430	Query DEADLOCKED
-440	Query UNTERMINATED after indefinite response

■ Operation Complete Event

An error in the range [-899: -800] is used when the instrument wishes to report a 488.2 operation complete event to the error/event queue. This event occurs when instrument's synchronization protocol, having been enabled by an *OPC command, completes all selected pending operations. This protocol is described in IEEE 488.2, section 12.5.2. This event also sets the operation complete bit (bit 0) of the Standard Event Status Register.

Error code	Error message description
-800	Operation complete The instrument has completed all selected pending operations in accordance with the IEEE 488.2, 12.5.2 synchronization protocol.

■ Device-dependent errors

An error in the range [+1, +32767] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error. The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the event status register to be set.

Error code	Error message description
+101	Conflicts with PROtection state Configuration is not possible because a protection function is activated.
+102	Conflicts with OUTPut state Configuration is not possible because the output is on.
+103	Conflicts with TRACk state Configuration is not possible because the tracking function is enabled.
+155	Operation denied during ALARM condition The operation was denied because an alarm is occurring on the PMX.
+156	Operation denied during OUTPut ON The operation was denied because the output is on.
+157	Operation denied during EXTERNAL control The operation was denied because the output is being controlled through external control.
+161	Operation denied during AUTO CALibration running The operation was denied because auto calibration is being performed.
+201	Conflicts with OUTPut:DELay state Configuration is not possible because of the output delay setting.
+202	Conflicts with OUTPut:EXTERNAL state Configuration is not possible because of the setting of the output on/off control using an external contact.
+203	Conflicts with DTFormation state Configuration is not possible because of the parallel or series operation setting.
+301	Channel disabled The channel setting is invalid.
+302	Conflicts with TRANsient in progress Configuration is not possible because a TRANSient subsystem is running.

Error code		Error message description
+303	Conflicts with OUTPUT:DElay in progress	Configuration is not possible because an output delay is in effect.
+304	Conflicts with DTFormation in progress	Configuration is not possible because parallel or series operation is in progress.
+801	Conflicts with CALibration in progress	Memory content cannot be recalled because of the VOLT:PROT setting.
+802	Conflicts with CALibration:AUTO in progress	Memory content cannot be recalled because of the VOLT:LIM:LOW setting.
+901	EEPROM content error for CRITICAL data	An error has occurred in a critical area. Contact your Kikusui agent or distributor.
+902	EEPROM CAL info lost	Calibration information was lost.
+903	EEPROM content error for CONFIG data	An error has occurred in the configuration area. The PMX will be reset to its factory default settings. This error occurring multiple times indicates that the memory is damaged. Contact your Kikusui agent or distributor.
+910	IOC No response	There is no response from the IOC (firmware for controlling the instrument's internal hardware).
+911	IOC Bad sync or Cmd/Resp code mismatch	Failed to synchronize the IOC. Or, the command code does not match the response code.

Processing Time of Commands

The command processing time is the time until the next command is accepted.

The processing times indicated here are typical values. They are not guaranteed.

The processing times vary depending on the settings and the measurement conditions.

It does not include the response time of the hardware.

■ PMX-A

Command	Processing Time (ms)					Description
	USB	RS232C		LAN* ¹		
		Data rate setting: 19200 bps	VXI-11	HiSLIP	SCPI-RAW	
VOLT CURR	15.8	15.8	15.8	15.8	15.8	Sets the voltage or the current
MEAS:VOLT? MEAS:CURR?	16.5	30.0	16.0	15.9	15.9	Queries the measured value
OUTP	10.5	13.8	10.5	10.5	10.5	Output on/off
*IDN	3.0	32.0	0.45	0.27	0.25	Queries the model name

*¹: Gigabit Ethernet and 100BASE-TX L2 Switch (hub)

■ PMX-Multi

Command	Processing Time (ms)						Description
	USB	RS232C		LAN* ¹		SCPI-RAW	
		Data rate setting: 19200 bps	Data rate setting: 115200 bps	VXI-11	HiSLIP		
VOLT	1.09	4.19	0.70	2.72	0.97	0.17	Sets the voltage
CURR	1.09	3.66	0.61	2.74	2.99	0.02	Sets the current
OUTP	1.04	4.19	0.70	1.43	0.76	0.02	Output on/off
MEAS:VOLT?	2.16	19.91	6.56	46.69	4.86	4.79	Queries the measured voltage value
MEAS:CURR?	2.16	20.05	6.65	6.69	5.09	4.98	Queries the measured current value
*IDN	2.09	30.59	6.37	6.46	1.95	1.81	Queries the model name

*¹: 100BASE-TX Ethernet

KIKUSUI ELECTRONICS CORP.

1-1-3 Higashiyamata, Tsuzuki-ku, Yokohama,
224-0023, Japan

Tel: +81-45-482-6353 Fax: +81-45-482-6261



Website

<http://www.kikusui.co.jp/en>