ディジタルパワーメータ
Digital Power Meter
KPM1000

Introduction

The KPM1000 Communication Interface Manual explains the settings and commands for remotely controlling the KPM1000 using the communication interface.

- RS232C interface
- GPIB interface (factory option)
- USB interface (factory option)

When the KPM1000 is operating under remote control, the RMT LED on the display on the front panel illuminates. To switch from the remote mode to the local mode (panel operation) from the panel, press the LOCAL switch.

How to read this manual

This manual is in HTML format that can be viewed with a WWW (World Wide Web) browser.

Related manuals

For the safety precautions, installation, operation, and specifications of the KPM1000, read the accompanying KPM1000 User's Manual.

Intended readers

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

Structure of the manual

This manual consists of the following sections.

- Overview
- Setup
- Overview of messages
- Command (list*1)
- Appendix
- Tutorial

*1. The list of command is provided in a PDF file.

Trademarks

Firmware version of the product to which this manual applies

This manual applies to products with firmware version 1.0x.

Copyright and publication

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Setup

A VISA library is required to use the software application. The VISA library (any one of NI-VISA, AgilentVISA, and KI-VISA) must be installed in the controller (Windows).

Installing the VISA Library

VISA (Virtual Instrument Software Architecture) is a specification for a standard software for connecting instruments that was defined by the VXIplug&play Systems Alliance.

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

•NI-VISA by National Instruments (Ver. 4.0 or later)

•Agilent VISA by Agilent Technologies (Agilent IO Libraries Suite14.2 or later)

•KI-VISA Ver. 3.1.3 or later

Installing KI-VISA

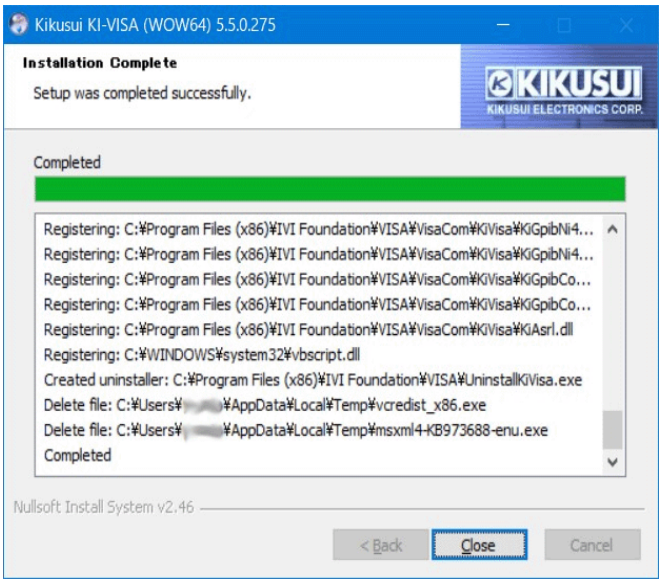
KI-VISA is Kikusui's original VISA library that supports VXIplug&play VISA Specifications. The newest version can be downloaded from Kikusui website (https://www.kikusui.co.jp/en/download/).

KI-VISA is not required if NI-VISA or Agilent VISA is already installed.

1. Open the ki-visa folder in the CD-ROM.
2. Double-click kivisa_5_5_x.exe in the folder to run it.
   For 32-bit operating systems, install kivisa_5_5_x_(x86). For 64-bit operating systems, install kivisa_5_5_x_(x64).
3. Proceed with the installation according to the instructions on the screen.

NOTE

kivisa_5_5_x(x64).exe contains two software packages, KI-VISA (x64) and KI-VISA (WOW64). When KI-VISA (x64) has been successfully installed, the installation of KI-VISA (WOW64) begins. Be sure to confirm that the installation of KI-VISA (WOW64) has finished successfully.



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Setup

The KPM1000 is equipped with RS232C as standard. If the factory option interface board is installed, you can use GPIB or USB.

Interface Setup

The GPIB, RS232C and USB interfaces cannot be used simultaneously.

RS232C
GPIB
USB

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Overview of Messages

The information that is exchanged between the controller (computer) and the device (KPM1000) is called a message.

The KPM1000 uses the SCPI language for the messages.

There are two types of messages, commands that are sent from the computer to the KPM1000 and responses that are sent from the KPM1000 to the computer.

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 sub system. A command consists of a program header, parameters, and punctuations.

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

Program header	parameter	Hierarchy of node
SENS		Root node
:CURR		Second level
:RANGE	<numeric>	Third level
:AUTO	<bool>	Fourth level
:VOLT		Second level
:RANGE	<numeric>	Third level
:AUTO	<bool>	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.

```
MEASure[:SCALar]:CURRent:AC? {<numeric>|MINimum|MAXimum}
```

SCPI commands can be issued using the short form. The short form of an 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).

```
SENSe:CURRent:SCALing:STATe ON;CTRatio 1000
```

In the second command, SENSe:CURRennt:SCALing is omitted. This is because the path is set to SENSe:CURRent:SCALing by the first command SENSe:CURRent:SCALing:STATe MINimum.

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

```
SENSe:CURRent:SCALing:STATe ON

SENSe:CURRent:SCALing:CTRatio 1000
```

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 semicolon together.

```
SENSe:CURRent:RANGe:AUTo ON;:MEASure:CURRent:AC?
```

This compound command contains two root nodes, SENSe and MEASure.

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

NOTE

When transmitting two queries in separate lines, read the response to the first query before transmitting the second line. If you send two lines of query commands at once, an incomplete response may be received.

Program terminator

All commands must be terminated using a valid terminator.

The available terminators are <new line> (ASCII 0x0A) and EOI (end-or-identify). Either one can be used as a terminator.

EOI is not available on the RS232C. Be sure to use <new line>.

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.

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Overview of messages

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 KPM1000 is indicated below.

Non-numeric parameters

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: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.

```
SENSe:FILTer {ON|OFF|1|0}
```

Numeric parameters

NR1

Represents an integer.

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

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.

If a value that cannot be assigned is entered, the device rounds the value to the closest possible value.

```
SENSe:AVERage:COUNt 150
```

The range of values for SENSe:AVERage:COUNt is 1 to 128. Thus, 128 is set even if 150 is specified.

Special form numeric parameter

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.

```
SENSe:AVERage:CYCLe MINimum
```

The minimum and maximum values can be inquired for most parameters using queries.

```
SENSe:AVERage:CYCLe? MAX
```

```
SENSe:AVERage:CYCLe? MIN
```

Measurement unit

Below are the default measurement units.

·V (voltage)	·A (current)	·AH (integrating current)
·W (power)	·WH (integrating power)	·VA (apparent power)
·VAR (reactive power)	·DEG (degree)	·HZ (frequency)

The following optional prefixes are supported.

·M (milli) ·U (micro) ·K (kilo)

NOTE

- The unit symbols in the International System of Units (SI) contain lowercase characters. The IEEE standard uses uppercase characters. SCPI commands are not case-sensitive.
- Commands are accepted even if a measurement unit is not specified.
- To enter "μ" in the data, use "U" instead.

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Overview of Messages

Default Conditions

Conditions after sending a *RST, MEAS:<meter_fn> and at power-on

The following table shows how the KPM1000 is set when the *RST and MEAS:<meter_fn> commands are executed and when the power is turned on.

Setup item	Setting			Unit	Function
	*RST	MEAS:<meter_fn>	At power-on		
SENS:CUR:RANG	20	20	20	--	Sets the current range
SENS:CUR:RANG:AUTO	1/ON	0/OFF	1/ON	--	Sets the auto current range on/off status
SENS:CURR:SCAL	0/OFF	0/OFF	0/OFF	--	Sets the on/off status of current scaling
SENS:CURR:SCAL:CTR	1	--	1	--	Sets the scaling CT ratio
SENS:VOLT:RANG	300	300	300	--	Sets the voltage range
SENS:VOLT:RANG:AUTO	1/ON	0/OFF	1/ON	--	Sets the auto voltage range on/off status
SENS:VOLT:SCAL	0/OFF	0/OFF	0/OFF	--	Sets the on/off status of voltage scaling
SENS:VOLT:SCAL:PTR	1	--	1	--	Sets the scaling PT ratio
SENS:FILT	0/OFF	0/OFF	0/OFF	--	Sets the low pass filter
SENS:FILT:FREQ	1/ON	1/ON	1/ON	--	Sets the frequency filter
SENS:AVER:COUN	1	1	1	--	Sets the average count
SENS:UPD:CYCL	0.1	0.1	0.1	S	Sets the panel display update interval
SENS:SYNC	VOLT	VOLT	VOLT	--	Sets the synchronization source
INTEG:TIM	0/OFF	0/OFF	0/OFF	--	Sets the on/off status of integration time
INTEG:TIM:COUN	0,1,0	--	0,1,0	HR,MIN,S	Sets the integration time
INIT:CONT:SEQ1/ INIT:CONT:NAME ACQ	0/OFF	--	0/OFF	--	Sets the auto continue mode
TRIG:SOUR	IMM	--	IMM	--	Sets the trigger source
SYST:KLOC	--	--	0/OFF	--	Locks panel operations
SYST:DISP:CONT 1	--	--	V	--	Sets the measured value that is shown on the display
SYST:DISP:CONT 2	--	--	VA	--	
SYST:DISP:CONT 3	--	--	A	--	
SYST:DISP:CONT 4	--	--	W	--	

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Command (Function/ Subsystem)

IEEE488.2 Common Commands

*CLS	Clears all the event registers.
*ESE	Sets the event status enable register bits.
*ESR	Queries the event status register.
*IDN	Queries the identification string (manufacturer information).
*OPC	Causes the device to generate the operation complete message in the event status register when all pending selected device operations have been finished.
*OPT	Queries the hardware interface board that is installed.
*PSC	Initializes *ESE and *SRE.
*RST	Performs a device reset.
*SRE	Sets the service request enable register bits.
*STB	Reads the status byte and master summary status bits.
*TRG	Trigger command
*TST	Executes a self-test
*WAI	Prevents the device from executing subsequent commands or queries until the No Operation Pending flag becomes true.

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Command (Function)

Basic Setting

Current settings

SENS:CURR:RANG	Sets the current range
SENS:CURR:RANG:AUTO	Sets the auto current range on/off status
SENS:CURR:SCAL	Sets the on/off status of current scaling
SENS:CURR:SCAL:CTR	Sets the scaling CT ratio

Voltage settings

SENS:VOLT:RANG	Sets the voltage range
SENS:VOLT:RANG:AUTO	Sets the auto voltage range on/off status
SENS:VOLT:SCAL	Sets the on/off status of voltage scaling
SENS:VOLT:SCAL:PTR	Sets the scaling PT ratio

Averaging settings

SENS:AVER:COUN	Sets the average count
SENS:UPD:CYCL	Sets the AC waveform cycle count

Synchronization source setting

SENS:SYNC	Sets the synchronization source

Filter settings

SENS:FILT	Sets the low pass filter
SENS:FILT:FREQ	Sets the frequency filter

Display settings

SYST:DISP:CONT	Sets the panel display update interval
SYST:DISP:HOLD	Sets the holding of displayed values

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Command (Function)

Integration Settings

Filter settings

SENS:FILT	Sets the low pass filter

Starting and stopping integration

INTEG:STAR	Starts and stops integration
INTEG:RES	Clears the integrated results

Integration time settings

INTEG:TIM	Turns the integration time on and off
INTEG:TIM:COUN	Sets the integration time

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Command (Function)

Measurement

If you use the first-level node MEASure, you can set some settings to their default values, perform measurement, and then query the measured values. If you send the MEASure query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

If you use the first-level node READ, you can perform measurement without changing the current settings and then query the measured values.

If you use the first-level node FETCh, you can query the measured values without starting a new measurement.

TRIG:SOUR	Sets the trigger source
INIT INIT:NAME	Initiates the trigger function
TRIG	Software trigger
INIT:CONT:SEQ1 INIT:CONT:NAME	Sets the auto continue mode
ABOR	Aborts the trigger function
MEAS READ FETC	Queries the voltage, AC current, active power, integration time, and integrated power
MEAS:CURR:AC READ:CURR:AC FETC:CURR:AC	Queries the AC current
READ:CURR:AC:INTEG FETC:CURR:AC:INTEG	Queries the integrated current
MEAS:CURR:AMPL:MAX READ:CURR:AMPL:MAX FETC:CURR:AMPL:MAX	Queries the current peak
MEAS:CURR:CRES READ:CURR:CRES FETC:CURR:CRES	Queries the current crest factor
MEAS:FREQ READ:FREQ FETC:FREQ	Queries the frequency
MEAS:POW:AC READ:POW:AC FETC:POW:AC	Queries the active power
MEAS:POW:AC:APP READ:POW:AC:APP FETC:POW:AC:APP	Queries the power (the apparent power)
READ:POW:AC:INTEG FETC:POW:AC:INTEG	Queries the integrated power
MEAS:POW:AC:PFAC READ:POW:AC:PFAC FETC:POW:AC:PFAC	Queries the power factor
MEAS:POW:AC:PHAS READ:POW:AC:PHAS FETC:POW:AC:PHAS	Queries the phase angle
MEAS:POW:AC:REAC READ:POW:AC:REAC FETC:POW:AC:REAC	Queries the power (the reactive power)
READ:TIM:INTEG FETC:TIM:INTEG	Queries the integration time
MEAS:VOLT:AC READ:VOLT:AC FETC:VOLT:AC	Queries the voltage
MEAS:VOLT:AMPL:MAX READ:VOLT:AMPL:MAX FETC:VOLT:AMPL:MAX	Queries the voltage peak
MEAS:VOLT:CRES	Queries the voltage crest factor

READ:VOLT:CRES FETC:VOLT:CRES WAVE	Queries the waveform data

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Command (Function)

System

SYST:BACK	Saves the panel settings and configuration settings
SYST:COMM:TRAC	Communication error trace function
SYST:ERR	Reads the oldest error information
SYST:KLOC	Locks the KPM1000 panel operations
SYST:LOC	Sets the KPM1000 to panel operation
SYST:OPT	Queries the optional interface boards that are installed in the KPM1000
SYST:REM	Sets the KPM1000 to remote mode. Locks panels keys except the local key
SYST:RWL	Sets the KPM1000 to remote mode Locks panels keys
SYST:VERS	Queries the version of the SCPI specifications

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Command (Function)

Register

Status byte register

Event status register

OPERation status register

STAT:OPER	Event
STAT:OPER:COND	Condition of register
STAT:OPER:ENAB	Enable register
STAT:OPER:NTR	Negative transition
STAT:OPER:PTR	Positive transition

QUEStionable status register

STAT:QUES	Event
STAT:QUES:COND	Condition of register
STAT:QUES:ENAB	Enable register
STAT:QUES:NTR	Negative transition
STAT:QUES:PTR	Positive transition

Preset status

STAT:PRES	Constructs status data

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ABOR

Aborts the measurement.

The trigger status immediately after the KPM1000 is turned on is the same as the condition when the ABOR is sent. If the ABOR is sent when a measurement is already in progress, the measured data remains invalid.

If the ABOR is sent when the KPM1000 is not initiated and the measured data that is held is valid, the measured data is never discarded.

Command

```
ABORt
```

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WAVE

Queries the waveform data.

At 38400 bit/s, it would take approximately 40 seconds to retrieve 10000 points.

While the data is being retrieved, "DATA TRANSFR" is displayed (no measured values are displayed). In this situation, you cannot perform panel operations.

Because the data is being retrieved, integration continues.

-> Tutorial

Command

```
WAVE? <NRf>
```

Parameter

Value	1 to 16384	The number of data points to query
	-1	Retrieves the next block of data

Response (RS232C)

Returns the voltage and current values for the specified number of points of waveform data in the following format in response to WAVE? <NRf>. The hexadecimal numbers are 16-bit signed integers.

Voltage coefficient<NR3>_current coefficient<NR3>,voltage value (hexadecimal)_current value (hexadecimal),voltage value (hexadecimal)_current value (hexadecimal), . . .(the pattern is repeated for the specified number of points),END.

The interval between points is 10 µs.

Response (GPIB and USB)

Up to 256 characters can be returned as the response to a single query.

Returns the voltage and current values for the specified number of points of waveform data in the following format in response to WAVE? <NRf>. The hexadecimal numbers are 16-bit signed integers.

When the waveform data is 256 characters or less

Voltage coefficient<NR3>_current coefficient<NR3>,voltage value (hexadecimal)_current value (hexadecimal),voltage value (hexadecimal)_current value (hexadecimal), . . .(the pattern is repeated for the specified number of points),END.

When the waveform data is 257 characters or more

Voltage coefficient<NR3>_current coefficient<NR3>,voltage value (hexadecimal)_current value (hexadecimal),voltage value (hexadecimal)_current value (hexadecimal), . . .(the pattern is repeated until the total data length is 256 characters),CONT.

To query the next block of data, send the same query with parameter "-1." In response to "WAVE? -1," the KPM1000 returns the voltage and current values for the next block of the waveform data in the following format.

If there are more blocks of data to be retrieved:

Voltage value (hexadecimal)_current value (hexadecimal),voltage value (hexadecimal)_current value (hexadecimal), . . .(the pattern is repeated until the total data length is 256 characters),CONT.

If this is the last block of data to be retrieved:

Voltage value (hexadecimal)_current value (hexadecimal), . . . (the pattern is repeated for the remaining points),END.

The interval between points is 10 µs.

*

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Command (Subsystem)

SENSe Subsystem

During integration, only the queries are valid. If you send one of these commands to settings while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

SENS:AVER:COUN	Sets the average count
SENS:CURR:RANG	Sets the current range
SENS:CURR:RANG:AUTO	Sets the auto current range on/off status
SENS:FILT	Sets the low pass filter
SENS:FILT:FREQ	Sets the frequency filter
SENS:CURR:SCAL	Sets the on/off status of current scaling
SENS:CURR:SCAL:CTR	Sets the scaling CT ratio
SENS:SYNC	Sets the synchronization source
SENS:VOLT:RANG	Sets the voltage range
SENS:UPD:CYCL	Sets the panel display update interval
SENS:VOLT:RANG:AUTO	Sets the auto voltage range on/off status
SENS:VOLT:SCAL	Sets the on/off status of voltage scaling
SENS:VOLT:SCAL:PTR	Sets the scaling PT ratio

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Command (Subsystem)

INTEGrate subsystem

INTEG:RES	Clears the integrated results
INTEG:STAR	Starts and stops integration
INTEG:TIM	Turns the integration time on and off
INTEG:TIM:COUN	Sets the integration time

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Command (Subsystem)

MEASure, READ, and FETCh Subsystems

MEAS READ FETC	Queries the voltage, AC current, active power, integration time, and integrated power
MEAS:CURR:AC READ:CURR:AC FETC:CURR:AC	Queries the AC current
READ:CURR:AC:INTEG FETC:CURR:AC:INTEG	Queries the integrated current
MEAS:CURR:AMPL:MAX READ:CURR:AMPL:MAX FETC:CURR:AMPL:MAX	Queries the current peak
MEAS:CURR:CRES READ:CURR:CRES FETC:CURR:CRES	Queries the current crest factor
MEAS:FREQ READ:FREQ FETC:FREQ	Queries the frequency
MEAS:POW:AC READ:POW:AC FETC:POW:AC	Queries the active power
MEAS:POW:AC:APP READ:POW:AC:APP FETC:POW:AC:APP	Queries the power (the apparent power)
READ:POW:AC:INTEG FETC:POW:AC:INTEG	Queries the integrated power
MEAS:POW:AC:PFAC READ:POW:AC:PFAC FETC:POW:AC:PFAC	Queries the power factor
MEAS:POW:AC:PHAS READ:POW:AC:PHAS FETC:POW:AC:PHAS	Queries the phase angle
MEAS:POW:AC:REAC READ:POW:AC:REAC FETC:POW:AC:REAC	Queries the power (the reactive power)
READ:TIM:INTEG FETC:TIM:INTEG	Queries the integration time
MEAS:VOLT:AC READ:VOLT:AC FETC:VOLT:AC	Queries the voltage
MEAS:VOLT:AMPL:MAX READ:VOLT:AMPL:MAX FETC:VOLT:AMPL:MAX	Queries the voltage peak
MEAS:VOLT:CRES READ:VOLT:CRES FETC:VOLT:CRES	Queries the voltage crest factor

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Command (Subsystem)

TRIGger Subsystem

ABOR	Aborts the trigger function
INIT	Initiates the trigger function
INIT:CONT:NAME	Sets the auto continue mode
INIT:CONT:SEQ1	Sets the auto continue mode
INIT:NAME	Initiates the trigger function
TRIG	Software trigger
TRIG:SOUR	Sets the trigger source

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Command (Subsystem)

SYSTem Subsystem

SYST:BACK	Saves the panel settings and configuration settings
SYST:COMM:TRAC	Communication error trace function
SYST:DISP:CONT	Sets the measured value that is shown on the display
SYST:DISP:HOLD	Sets the holding of displayed values
SYST:ERR	Reads the oldest error information
SYST:KLOC	Locks the KPM1000 panel operations
SYST:LOC	Sets the KPM1000 to panel operation
SYST:OPT	Queries the optional interface boards that are installed in the KPM1000
SYST:REM	Sets the KPM1000 to remote mode Locks panels keys except the local key
SYST:RWL	Sets the KPM1000 to remote mode Locks panels keys
SYST:VERS	Queries the version of the SCPI specifications

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Command (Subsystem)

STATus Subsystem

STATus:OPERation	OPERation status register: Event
STATus:OPERation:CONDtion	OPERation status register: Condition of register
STATus:OPERation:ENABle	OPERation status register: Enable register
STATus:OPERation:PTRansition	OPERation status register: Positive transition
STATus:OPERation:NTRansition	OPERation status register: Negative transition
STATus:QUESionable	QUEStionable status register: Event
STATus:QUESionable:CONDtion	QUEStionable status register: Condition of register
STATus:QUESionable:ENABle	QUEStionable status register: Enable register
STATus:QUESionable:PTRansition	QUEStionable status register: Positive transition
STATus:QUESionable:NTRansition	QUEStionable status register: Negative transition
STATus:PRESet	Constructs status data

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List of Messages

SCPI command: Command name in the short form.

*RST: “Yes” for commands that are affected by *RST.

R/W: “R” for query commands and “W” for set commands.

FETCh | READ | MEASure subsystem

SCPI command		Value		Response	*RST	Description	R/W
Program header			Unit				
FETC[:SCAL] | READ[:SCAL] | MEAS[:SCAL]							
:CURR	:AC		A	NR3		Queries the current	R
	:AC:INTEG		AH	NR3,NR3		Queries the integrated current	R
	:AMPL:MAX		A	NR3		Queries the current peak	R
	:CRES			NR3		Queries the current crest factor	R
:VOLT	:AC		V	NR3		Queries the voltage	R
	:AMPL:MAX		V	NR3		Queries the voltage peak	R
	:CRES			NR3		Queries the voltage crest factor	R
:POW	:AC[:REAL]		W	NR3		Queries the active power	R
	:AC:INTEG		WH	NR3,NR3		Queries the integrated power	R
	:AC:APP		VA	NR3		Queries the apparent power	R
	:AC:REAC		VAR	NR3		Queries the reactive power	R
	:AC:PFAC			NR3		Queries the power factor	R
	:AC:PHAS		DEG	NR3		Queries the phase angle	R
:FREQ			HZ	NR3		Queries the frequency	R
:TIM:INTEG			HR,MIN,S,MS	NR3,NR3,NR3,NR3		Queries the integration time	R

SENSe subsystem

SCPI command			Value		Default	Response	*RST	Description	R/W
Program header		Parameter		Unit					
SENS:									
:CURR	:RANG[:UPP]	numeric	0.005 to 20		20	NR3	Yes	Sets the current range	R/W
	:RANG:AUTO	bool			ON	NR1	Yes	Sets the auto current range on/off status	R/W
	:SCAL[:STAT]	bool			OFF	NR1	Yes	Sets the current scaling on/off status	R/W
	:SCAL:CTR	numeric	1 to 2000		1	NR3	Yes	Sets the scaling CT ratio	R/W
:VOLT	:RANG[:UPP]	numeric	150, 300		300	NR3	Yes	Sets the voltage range	R/W
	:RANG:AUTO	bool			ON	NR1	Yes	Sets the auto voltage range on/off status	R/W
	:SCAL[:STAT]	bool			OFF	NR1	Yes	Sets the voltage scaling on/off status	R/W
	:SCAL:PTR	numeric	1 to 2000		1	NR3	Yes	Sets the scaling PT ratio	R/W
:FILT	[:LINE:STAT]	bool			OFF	NR1	Yes	Sets the low pass filter	R/W
	:FREQ[:STAT]	bool			ON	NR1	Yes	Sets the frequency filter	R/W
:AVER:COUN		numeric	1 to 64		1	NR3	Yes	Sets the average count	R/W
:UPD:CYCL		numeric	0.1 to 10	S	0.1	NR3	Yes	Sets the panel display update interval	R/W
:SNYC		char	VOLT | CURR | OFF		VOLT	char	Yes	Sets the synchronization source	R/W

INTEGrate subsystem

SCPI command		Value		Default	Response	*RST	Description	R/W
Program header	Parameter		Unit					
INTEG								
:STAR[:STAT]	bool				NR1		Starts and stops integration	R/W
:RES					NR1		Clears the integrated results	R/W
:TIM[:STAT]	bool			OFF	NR1	Yes	Turns the integration time on and off	R/W
:TIM:COUN	NR1,NR1,NR1	0,1,0 to 9999,59,0	HR,MIN,S	0,1,0	NR1,NR1,NR1	Yes	Sets the integration time	R/W

STATus subsystem

SCPI command		Value	Response	Description	R/W
Program header	Parameter				
STAT					
:OPER					
[:EVEN]			NR1	Event[1]	R
:COND			NR1	Register status[1]	R
:ENAB	NRf	0 to 32767	NR1	Enable[1]	R/W
:PTR	NRf	0 to 32767	NR1	Positive transition[1]	R/W
:NTR	NRf	0 to 32767	NR1	Negative transition[1]	R/W
:PRES				Resets the enable register	W
:QUES					
[:EVEN]			NR1	Event[2]	R
:COND			NR1	Register status[2]	R
:ENAB	NRf	0 to 32767	NR1	Enable[2]	R/W
:PTR	NRf	0 to 32767	NR1	Positive transition[2]	R/W
:NTR	NRf	0 to 32767	NR1	Negative transition[2]	R/W

1 OPERation status register
2 QUEStionable status register

SYSTem subsystem

SCPI command		Value	Default	Response	*RST	Description	R/W
Program header	Parameter						
SYST							
:ERR[:NEXT]				string		Reads error information	R
:BACK						Saves panel settings and configuration settings	W
:KLOC	bool		OFF	NR1		Locks panel operations	R/W
:LOC						Switches the KPM1000 to local mode	W
:OPT				char		Queries the options	R
:REM						Switches the KPM1000 to remote mode; locks all panel keys except for the LOCAL switch	W
:RWL						Switches the KPM1000 to remote mode; locks all panel keys	W
:VERS						Queries the SCPI specification version with which the KPM1000 complies	R
:COMM:TRAC	bool			NR1		Sets the communication error display	R/W
:DISP:HOLD	bool			NR1		Sets the holding of displayed values	R/W
:DISP:CONT	NR1	1 to 4				Sets which measured values are shown on the displays	R/W
	char	V|A|AHP|AHN|W|VA|VAR|HZ|WH|WHP|WHN|TIM|AH|PA|PV|CFA|CFV|DEG|PF	1: V 2: VA 3: A 4: W	char			

TRIGger subsystem

SCPI command		Value		Default	Response	*RST	Description	R/W
Program header	Parameter		Unit					
ABOR							Aborts the operation of all sequences	W
INIT								
[:IMM]								
:NAME	char	ACQ					Starts the trigger function	W
[:SEQ1]								W
:CONT								
:NAME	char	ACQ				Yes	Sets the auto continue mode	R/W
	bool			OFF	NR1			
:SEQ1	bool			OFF	NR1	Yes		
TRIG[SEQ[1]] | TRIG[:ACQ]								
[:IMM]							Software trigger	W
:SOUR	char	IMM | BUS		IMM	char	Yes	Sets the trigger source	R/W

WAVE subsystem

SCPI command		Value	Response	*RST	Description	R/W
Program header	Parameter					
WAVE	NR3	1 to 16384	NR3_NR3,NR3_NR3, . . .		Queries the waveform data	R

IEEE 488.2 common commands

IEEE488.2 common commands	Parameter	Description	R/W
*CLS		Clears all the event registers	W
*ESE	NR1	Sets the event status enable register bits	R/W
*ESR		Queries the event status register	R
*IDN		Queries the identification string (manufacturer information)	R
*OPC		Causes the KPM1000 to generate the operation complete message in the event status register when all of its pending operations have finished	R/W
*OPT		Queries the options that are installed in the KPM1000	R
*PSC	0 | 1	Sets whether the *ESE and *SRE settings will be cleared	R/W
*RST		Performs a device reset; configures the KPM1000 to a known condition independent from the usage history of the device	W
*SRE	NR1	Sets the service request enable register bits	R/W
*STB		Reads the status byte and master summary status bits	R
*TRG		Trigger command	W
*TST		Executes a self test	R
*WAI		Prevents the KPM1000 from executing subsequent commands or queries until the flag indicating that there are no operations standing by becomes true	W

Appendix

Instrument Interface Standards

The KPM1000 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

•IEEE Std 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation

•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

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[-199,-100] | [-299,-200]
[-399,-300] | [-499,-400]
[-899,-800]

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 which 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 recieved than required for the header.
-110	Command header error	An error was detected in the header.
-120	Numeric data error	This error is generated when parsing a data element that appears to be numeric, including the nondecimal numeric types.
-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.
-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.
-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 are generated when defining a macro or executing a macro.

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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.
-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 subsequent measurement query is received.
-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.

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Device-specific errors

The occurrence of any error in this class shall cause the Device Dependent Error (bit 3) in the event status register to be set.

Error code		Error message description
-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 is used.
-362	Framing error in program message	Framing error. This error applies when the RS232C is used.
-363	Input buffer overrun	Buffer overrun error. This error applies when the RS232C is used.
-364	Time out error	Time out error. This error applies when the RS232C is used.

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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)	This is the generic query error for devices that cannot detect more specific errors.
-410	Query INTERRUPTED	Received a new command before the response was read.
-420	Query UNTERMINATED	The controller attempted to read the response after the device received an unsupported query or has not received a query. The -100 "COMMAND ERROR" error and this error are stored in the error queue. The controller will time out.
-430	Query DEADLOCKED	The error queue, input buffer, and output buffer are full when sending large binary data as a response, and the transmission timing is off.
-440	Query UNTERMINATED after indefinite response	Received a separate query in semicolon-delimited format after a query that returns a response in an indefinite form. (Example: A command such as the following. *IDN?;SYST:ERR?)

>top

Operation complete event errors

An error in the range [-899, -800] is used when the KPM1000 wishes to report an IEEE488.2 operation complete event. This event occurs when the instrument's synchronization protocol, having been enabled by an *OPC command, completes all selected pending operations.

The occurrence of any event error in this class shall cause the Operation Complete (bit 0) in the event status register to be set.

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.

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Processing Time of Commands

The command processing time is the time until the next command is accepted.
It does not include the response time of the hardware.
The processing times indicated here are typical values.
They are not warranted.

Command	GPIB processing time *1 (ms)	USB processing time (ms)	RS232C processing time *2 (ms)	Description
IDN?	16	14	12	Queries the model name
READ:POW:AC?	202	201	200	Queries the measured active power
FETC:CURR:AC?	24	21	20	Queries the measured AC current
SENS:CURR:RANG 1	11	10	9	Sets the current range
*RST	205	203	202	Performs a device reset

*1: Using GPIB-USB-B by National Instruments.
*2: Data rate setting: 38 400 bps. Flow control: On

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Measurement

The simplest measurement procedure

The KPM1000 has features for returning the measured voltage, current, and power. The simplest measurement procedure is simply to send the MEASure? query. When you send the MEAS? query, some of the measurement conditions are set to the default values, and this enables you to retrieve the measured data with the minimum amount of trouble.

Because the MEASure? query sets some of the measurement conditions to the default values, you cannot use this query to measure the integrated current, integrated voltage, or integration time. If you send the MEASure? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

The MEASure query sets some of the KPM1000 measurement conditions to the default values, and then starts a new measurement. Because this query starts a new measurement each time that it is sent, you cannot use it to synchronize the measurement of multiple items.

You can use the MEAS? query to perform measurements even if you do not possess in-depth knowledge of measuring instruments. On the other hand, because this query sets some of the measurement conditions to default values, you cannot use this query to set detailed measurement conditions. If you want to perform measurements with more detailed conditions, configure the settings, and then send the READ? query. The MEAS? query performs the same operations as the following sequence: *RST, SENS:CURR:RANG:AUTO OFF, and then the SENS:VOLT:RANG:AUTO OFF command followed by the READ? query.

Measuring voltage and current

```
MEASure:VOLTage:AC?     'Query the voltage.
MEASure:CURRent:AC?     'Query the current.
```

A slightly more flexible measurement procedure

When you use the READ? query to perform measurements, the process is broken up into two steps: (1) setting the measurement conditions and (2) starting the measurement and retrieving data.

You can set the measurement conditions, and then use the READ? query to start the measurement.

```
SENS:CURR:RANG:AUTO ON     'Turn on the current auto range.
SENS:FILT ON     'Turn on the low pass filter.
READ:CURR:CRES?     'Query the current crest factor.
```

(Reading the response)

```
FETC:VOLT:AC?;CRES?;AMPL:MAX?     'Query the voltage.
```

(Reading the response)

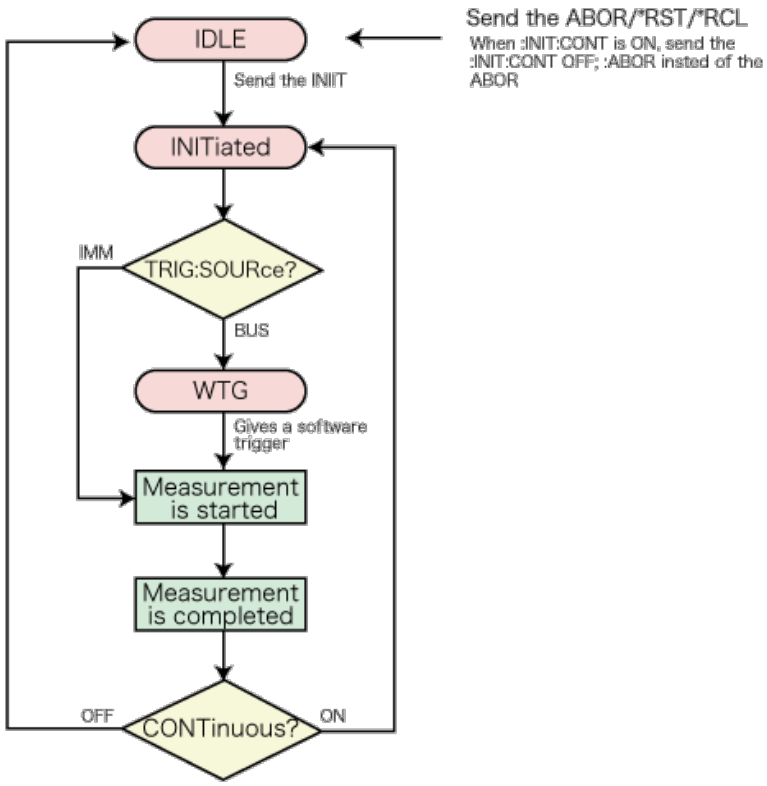
If you want to abort the measurement that you have started, send the ABORt command. You can also use this to abort *RST commands and IEEE488.1 sdc/dc. You cannot use the *CLS command to abort the measurement. After the measurement starts, you cannot change any measurement conditions or trigger settings. You can only change these settings after the measurement finishes or is aborted. Using the READ? query to perform measurements is a flexible method because it enables you to specify detailed measurement conditions. The READ? query starts a new measurement each time that it is sent, so this method is not flexible in terms of measurement timing. If you want to program detailed measurement timing, use the INIT command and the FETC? query to separate the start of the measurement from the retrieval of data. The READ? query performs the same operations as the following sequence: the INIT command followed by the FETC? query.

The most flexible measurement procedure (advanced measurement)

Using the INIT command and the FETC? query to perform advanced measurement separates the start of the measurement from the retrieval of data. This provides you with the most detailed control over measurement. The INIT command instructs the KPM1000 to start the measurement. FETC? queries the completed measurement data. If you want to use software triggers to manage the timing of the start of measurement, you have to use the INIT command and the FETC? query.

Status

A sequence has three states: IDLE, INITiated, and WTG. For details, click here.



Measuring voltage, current, or power

To start a new measurement, set the trigger source to IMMediate, and then use the INITiate command.

```
TRIGger:SOURce IMMediate     'Set the trigger source to IMM.
INITiate     ' Initiate the measurement.
```

If you are using software triggers to start the measurement, change the trigger source to BUS.

```
TRIGger:SOURce BUS     'Set the trigger source to BUS.
INITiate     ' Initiate the measurement.
TRIGger     'Apply a software trigger.
```

When the measurement finishes, you can use the FETCh query to retrieve the measured data.

```
FETCh:VOLTage:AC?     'Query the voltage.
FETCh:CURRent:AC?     'Query the current.
FETCh:POWer:AC:REAL?     'Query the active power.
FETCh:POWer:AC:APParent?     'Query the apparent power.
```

Use the TRIGger:SOURce command to set the trigger source to BUS or IMMediate. INITiate pulls the TRIGger subsystem out of the IDLE state and starts (initiates) the trigger feature.

If the trigger source is set to IMMediate, the measurement starts immediately. If the trigger source is set to BUS, the TRIGger subsystem enters the WTG (Waiting For Trigger) state. When a software trigger is received (through the TRIGger command or *TRG command), the measurement starts. When the measurement finishes, the TRIGger subsystem enters the IDLE state again. If the ABORt command or an equivalent command is received instead of a trigger, the measurement is canceled, and the TRIGger subsystem returns to the IDLE state.

The ABORt command and IEEE488.1 sdc/dcl abort measurements that are in progress. These commands do not invalidate measured data that has already been retrieved. On the other hand, the *RST command not only aborts a measurement that is in progress, but it

also invalidates the retrieved measured data. If you send *RST;:FETC:VOLT:AC?, an error will occur because there is no measured data that the FETCh query can retrieve and there is no new measurement that is going to be performed.

The difference between the MEASure and READ commands and the FETCh command is as follows. The MEASure/READ command starts a new measurement and then queries the measured data. The FETCh command queries the measured data without first starting a new measurement.

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Measurement of the Integrated Power

First, set the voltage and current ranges.

Set the current range to match the maximum load current during the test. The auto range feature fixes the range when integration starts. Even if you use the auto range feature, there are times when the range is exceeded during integration.

```
SENSe:VOLTage:RANGe:AUTO ON  'Set the voltage range to auto range.
SENSe:CURRent:RANGe 100MA    'Set the current range to 100 mA.
```

When you are measuring a comparatively small current (100 mA or less), use the low pass filter. This limits the noise that the AC power supply generates and enables correct measurements.

If you know how long you want to integrate for, set the integration time.

```
SENSe:FILTer ON             'Turn on the low pass filter.
INTEGrate:TIMer ON          'Enable the INTEG:TIM:COUN command.
INTEGrate:TIMer:COUNt 1,0,0 'Set the integration time to 1 hour.
```

If you do not set INTEG:TIM to ON, even if you use INTEG:TIM:COUN to set the integration time, integration will continue for 9999 hours and 59 minutes.

After you have finished configuring the settings, start the integration.

```
INTEGrate:STARt ON    'Start the integration.
```

During integration, you can only send queries for the SENSe subsystem, INTEG:TIM, and INTEG:TIM:COUN commands. If you send one of these commands to configure settings while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Because the MEASure? query sets some of the measurement conditions to the default values, you cannot use this query to measure the integrated current, integrated voltage, or integration time. If you send the MEASure? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Use the READ command or the FETCh command to query the integrated values.

```
READ:CURRent:AC:INTEGrate?  'Query the integrated current.
READ:POWer:AC:INTEGrate?    'Query the integrated power.
READ:TIMe:INTEGrate?        'Query the integration time.
```

The default *RST command does not clear the integrated values.

If you have set the integration time, integration finishes when this time elapses.

If you have not set the integration time, you can stop integration by sending the INTEG:STAR command.

```
INTEGrate:STARt OFF    'Stop integration.
```

If you stop integration but you do not clear the integrated values, the SENSe subsystem, INTEG:TIM, and INTEG:TIM:COUN commands that you use to configure settings will be invalid.

Use the INTEG:RES command to clear the integrated values.

```
INTEGrate:RESet
```

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Waiting for Operation Complete

The *OPC command has a capability to wait for an operation to complete. Operation complete means that there is no pending operation that is still in progress.

When the *OPC command is sent, the KPM1000 enters the Operation Complete Command Active State (OCAS). When the measurement is completed and there is no other operation pending, the KPM1000 returns to Operation Complete Command Idle State (OCIS) and sets the OPC bit (bit 0) to TRUE (1) in the Standard Event Status Register. This information can be confirmed with the *ESR? query command by checking the OPC bit (bit 0).

The following example makes a new measurement and sends the *OPC. When the measurement is completed, an SRQ (Service Request) is generated, as the Standard Event Status Enable Register and the Service Request Enable Register are unmasked so that an SRQ can be signaled by the Operation Complete event. When using the RS232 interface, the SRQ feature cannot be used.

```
*ESE 1;*SRE 32;*CLS;:INITiate;*OPC
```

<Wait for the SRQ to be generated.>

Using the *OPC? query command instead of the *OPC command makes the KPM1000 enter the Operation Complete Query Active State (OQAS). When the measurement is completed and there is no other operation pending, the KPM1000 returns to the Operation Complete Query Idle State (OQIS) and sets the response data to "1" (in NR1 format) in the output queue.

```
INITiate;*OPC?
```

<Read the response>

At power-on or after the IEEE488 sdc/dcl, *RST command is sent, the KPM1000 is in the OCIS and OQIS state

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Status Monitoring

The KPM1000 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.

To determine whether integrated values are being measured, check bit 3 of the STATus:OPERation register.

```
:STATus:OPERation?     ' Check whether bit 3 is set.
```

STATus:QUEStionable

The STATus:QUEStionable register records events or signals that indicate abnormal operation.

To determine that an overflow has not occurred in the integrated values, check bit 0 of the STATus:QUEStionable register.

```
:STATus:QUEStionable?     ' Check whether bit 0 is set.
```

PON (Power ON) bit

The PON bit (bit 7) in the event status register is set whenever the PAT is turned on. The most common use for the PON is to generate an SRQ at power-on keeping 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 the USBTMC Interrupt-IN endpoint on the USB 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.

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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 KPM1000 can record is 255. 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, or when the KPM1000 is turned on. When the error/event queue is empty, the query returns the following:

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

Displaying communication errors

The KPM1000 has a debug trace function. The oldest item among the errors and events (if they are present) can be displayed on the KPM1000. 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:COMMunicate:TRACe command.

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

>top

ディジタルパワーメータ
Digital Power Meter
KPM1000

Tutorial

Getting the Wave Data

You can use the WAVE query command to query the waveform data.

Specify the number of points of waveform data that you want to retrieve as a parameter of the query command.

```
WAVE? 10     'Query 10 points of waveform data.
```

At 38400 bit/s, it would take approximately 40 seconds to retrieve 10000 points.

While the data is being retrieved, "DATA TRANSFR" is displayed (no measured values are displayed). In this situation, you cannot perform panel operations. Because the data is being retrieved, integration continues.

For the response, the voltage and current values for the specified number of points of waveform data are returned in the following format.

Voltage coefficient<NR3>_current coefficient<NR3>,voltage value (hexadecimal)_current value (hexadecimal),. . .(the pattern is repeated for the specified number of points),END.

The interval between points is 10 µs.

The hexadecimal numbers are 16-bit signed integers.

For GPIB and USB, up to 256 characters can be returned as the response to a single query. If the data is longer than 256 characters, it is returned in the following format.

Voltage coefficient<NR3>_current coefficient<NR3>,voltage value (hexadecimal)_current value (hexadecimal),. . .(the pattern is repeated until the total data length is 256 characters),CONT.

To query the next block of data, send the same query with parameter "-1." In response to "WAVE? -1," the KPM1000 returns the voltage and current values for the next block of the waveform data in the following format.

If there are more blocks of data to be retrieved:

Voltage value_current value,voltage value_current value . . . (the pattern is repeated until the total data length is 256 characters), CONT.

If this is the last block of data to be retrieved:

Voltage value_current value, . . . (the pattern is repeated for the remaining points),END.

Continue sending "WAVE? -1" to query the waveform data until the response ends in "END."

As an example, assume that the KPM1000 returned the following response when it received the query "WAVE? 5."

+1.50E-02_ +1.00E-04,ffda_3e8,fffd_3ea,1c_3ed,32_3e6,55_3f3,END

First, convert the hexadecimal values into decimal values. The hexadecimal numbers are 16-bit signed integers. H7FFF is 32767. H8000 is -32768.

ffda_3e8 → -37, 1000

fffd_3ea → -2, 1002

1c_3ed → 28, 1005

32_3e6 → 50, 998

55_3f3 → 85, 1011

Next, multiply the converted decimal values by the voltage or current coefficient. The coefficients are in the first line of the response. The coefficients are determined by the ranges and the CT and PT values.

ffda_3e8 → -37, 1000 → -37*+1.50E-02 = -0.555 (voltage), 1000* +1.00E-04 = 0.1 (current)

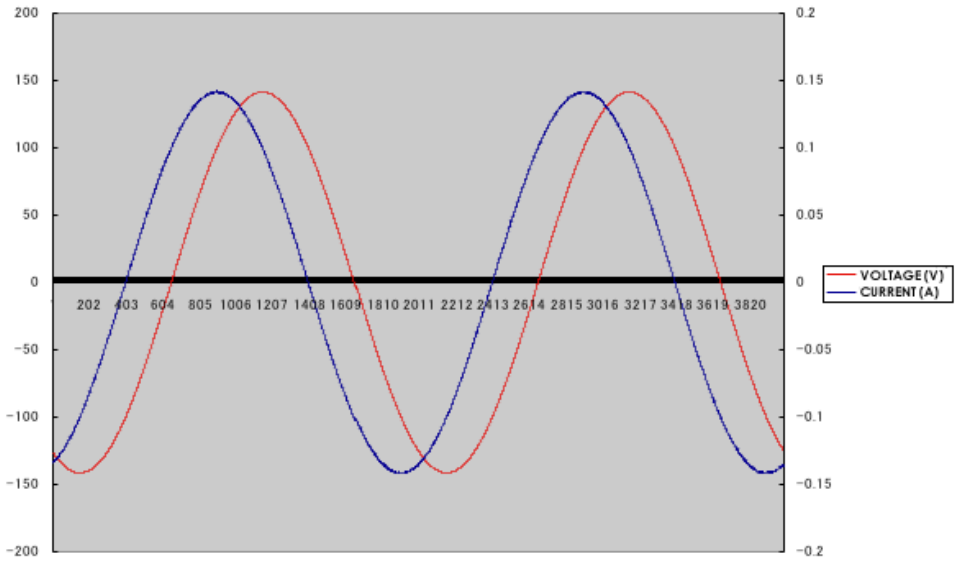
fffd_3ea → -2, 1002 → -0.03, 0.1002

1c_3ed → 28, 1005 → 0.42, 0.1005

32_3e6 → 50, 998 → 0.75, 0.0998

55_3f3 → 85, 1011 → 1.275, 0.1011

Example of a voltage graph that was constructed by using the WAVE? query

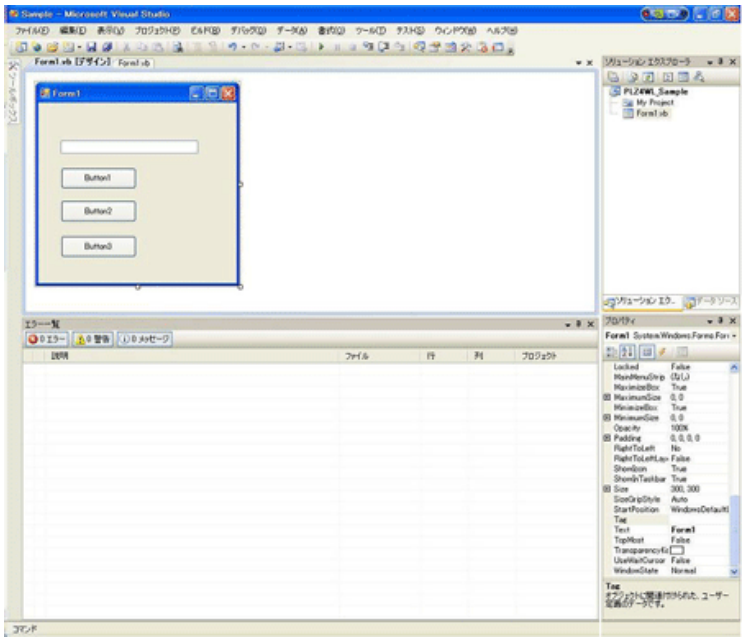


ディジタルパワーメータ
Digital Power Meter
KPM1000

Tutorial

Visual Basic 2008

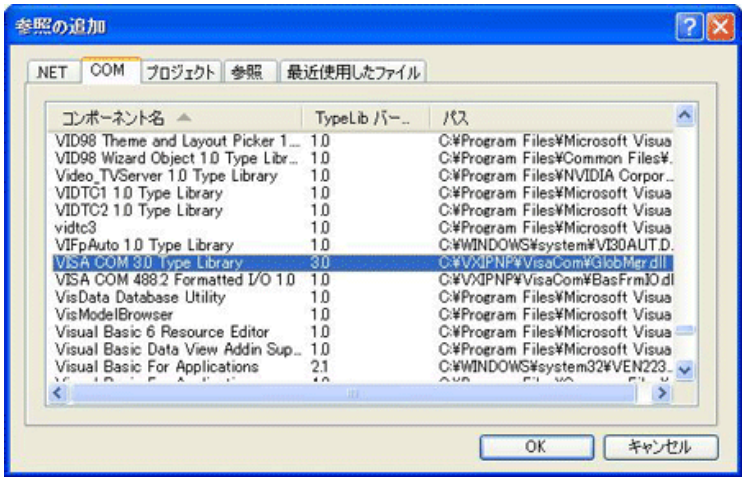
Communicate with the KPM1000 series using VISA through GPIB, RS232C, or USB.



Setting the "Project"

First, set the communication driver (VISA library) for the "Project."

Click "Project" on the menu bar, then select "Add Reference" to refer to "VISA COM 3.0 Type Library."



Communication through GPIB, RS232C, or USB

After setting the communication driver, you can communicate with the KPM1000 through GPIB, RS232C, or USB.

The following describes the communication procedure using VISA.

Open the VISA

To communicate with a GPIB, RS232C, or USB 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::0x102E::00000001::INSTR", NO_LOCK, 0, "")
```

"USB::0x0B3E::0x102E::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.

GPIB	GPIB[*board*]::*PrimaryAddress*[::*SecondaryAddress*][::INSTR] Example: The primary address 3 of the measuring instrument connected to GPIB0. GPIB0::3::INSTR
Serial (RS232C)	ASRL[*board*][::INSTR] Example: The measuring instrument connected to the serial port COM1. ASRL1::INSTR
USB	USB[*board*]::*VendorID*::*ProductID*::*SerialNumber*[::*InterfaceNumber*][::INSTR] Example: The USBTMC measuring instrument with vendor ID (VID) 2878, Product ID (PID) 4142 and serial number "00000001." USB0::0x0B3E::0x102E::00000001::INSTR

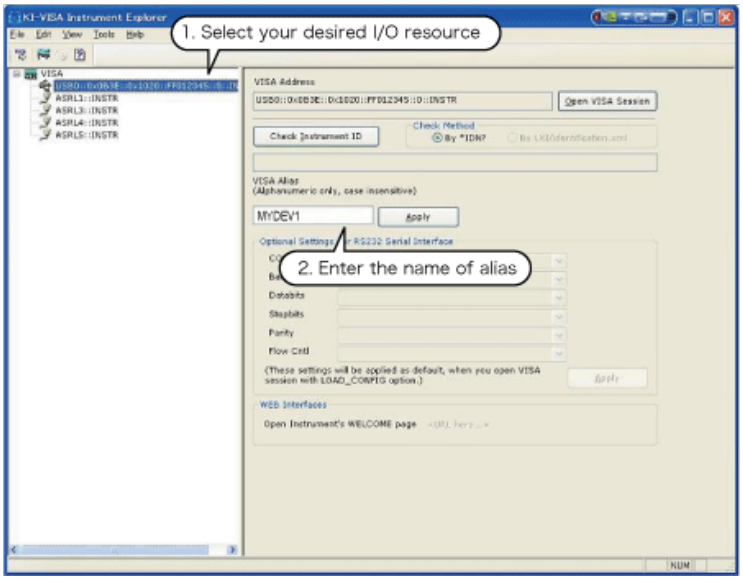
For VISA, the alias can be used for the I/O resource.

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 (example for KI-VISA):



In case of using VISA other than KI-VISA, please refer to the applicable VISA manual.

Controlling the devices

Next, use "Read" and "Write" commands to control devices.

Example:

```
msg.WriteString ("SENS:FILT ON")        'Turn the low pass filter on.
msg.WriteString ("INTEG:STAR ON")       'Start integration.
```

Closing the VISA

Close the VISA at the end.

A command for "Open" and "Close" of the VISA is required only once in the program.

```
msg.Close
```

Sample program

```
Imports Ivi.Visa.Interop

Public Class Form1

  Dim rm As ResourceManager
  Dim msg As IMessage

  Private Sub Form1_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
    rm = CreateObject("VISA.GlobalRM")
    msg = rm.Open("GPIB0::1::INSTR", AccessMode.NO_LOCK, 0, "")     'Example: GPIB
    'msg = rm.Open("MYDEV1", AccessMode.NO_LOCK, 0, "")  'Example: Using an alias
    'msg = rm.Open("USB0::0x0B3E::0x102E::00000001::INSTR", AccessMode.NO_LOCK, 0, "")  'Example: USB
  End Sub

  'Query the instrument identity
  Private Sub cmdIdn_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles cmdIdn.Click
    msg.WriteString("*IDN?")
    TextBox1.Text = msg.ReadString(256)
  End Sub

  'Set the operation mode and voltage
  Private Sub cmdCurr_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles cmdCurr.Click
    msg.WriteString("SENS:FILT ON")
    msg.WriteString("INTEG:STAR ON")
  End Sub

  'Query the instrument identity
  Private Sub cmdMeas_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles cmdMeas.Click
    msg.WriteString("MEAS:CURR:AC:INTEG?")
    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
```

>top

ディジタルパワーメータ
Digital Power Meter
KPM1000

Setup

Interface Setup

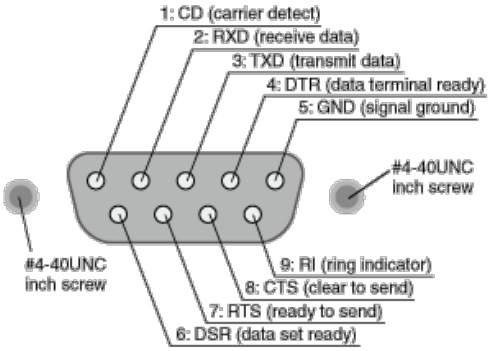
RS232C (Standard Equipped)

RS232C connection

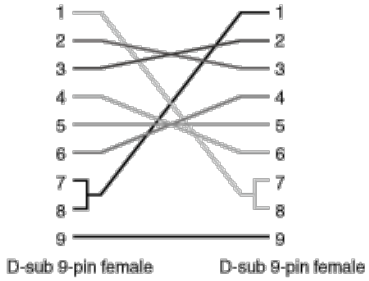
Turn off the POWER switch on the KPM1000 and the computer.

Use a D-sub 9-pin female-to-female AT type cross cable for the RS232C cable. Figure shows the connector pin assignments.

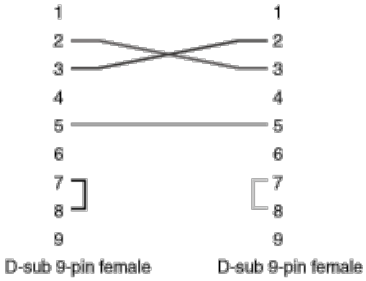
The KPM1000 does not use hardware handshaking (Cross cable example2).



Facing the KPM1000 rear panel



Cross cable example1



Cross cable example2

9-pin AT type connector

RS232C configuration

1. Press I/F.
   "SELECt" is displayed in the settings.
2. Press DISP D until "rS-232C" is displayed.
3. Press DISP C until "bit.P.SEC" is displayed.
4. Press the Δ▽ or DISP D to select the baud rate.
   You can set the baud rate to 2400, 4800, 9600, 19200, or 38400 (the unit is BPS).
5. Press DISP C until "Flo.Cont" is displayed.
6. Press the Δ▽ or DISP D to turn flow control on or off.

7. Restart the KPM1000.
The settings are applied.

Protocol

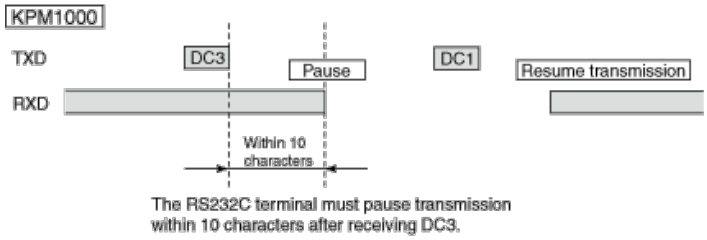
Table shows the RS232C protocol.
Underline indicates factory default condition.

Item	Setting
Connector	9-pin D-sub terminal on the rear panel
Baudrate	2400 bps/ 4800 bps/ 9600 bps/ 19200 bps/ 38400 bps
Data	Fixed to 8 bits
Stop	Fixed to 1 bit
Parity	Fixed to none
Flow (X-flow control)	XFLOW/ None (on/off)

RS232C communication

Use flow control for RS232C communication. DC (device control) codes are used as control codes.
Transmission/reception may not work correctly through unilateral transmission.

Code	Functiom	ASCII code
DC1 (Xon)	Request to send	11H
DC3 (Xoff)	Transmission stop request	13H



Break signal

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

>top

ディジタルパワーメータ
Digital Power Meter
KPM1000

Setup

Interface Setup

GPIB (Option)

This interface valid only when the factory option GPIB interface board is installed.

GPIB connection

Use a standard IEEE488 cable to connect the KPM1000 to the computer.

GPIB configuration

1. Press I/F.
   "SELECt" is displayed in the settings.
2. Press DISP D until "GPIb" is displayed.
3. Press DISP C until "AddrESS" is displayed.
4. Press the Δ▽ or DISP D to select the GPIB address (1 to 30).
5. Restart the KPM1000.
   The settings are applied.

GPIB function

Function	Subset	Description
Source handshaking	SH1	Full capability
Acceptor handshaking	AH1	Full capability
Talker	T6	Function available
Listener	L4	Function available
Service request	SR1	Full capability
Remote local	RL1	Full capability
Parallel polling	PP0	No capability
Device clear	DC1	Full capability
Device trigger	DT1	Full capability
Controller	C0	No capability
Electrical interface	E1	Open collector driver

Service request

Service request and serial polling functions are implemented.

>top

ディジタルパワーメータ
Digital Power Meter
KPM1000

Setup

Interface Setup

USB (Option)

This interface is valid only when the factory option USB interface board is installed.
A device driver supporting USB T&M Class (USBTMC) is required to control the KPM1000 through the USB interface. The USBTMC driver is automatically installed by the VISA library.

USB connection

Use a standard USB cable to connect the KPM1000 to the computer.

USB configuration

1. Press I/F.
   "SELECt" is displayed in the settings.
2. Press DISP D until "uSb" is displayed.
3. Restart the KPM1000.
   The settings are applied.

Service request

Service request and serial polling functions are implemented.

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)
  0x102E

>top

ディジタルパワーメータ
Digital Power Meter
KPM1000

*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
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

*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

(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.

Response

Returns the value of the event status enable register in NR1 format in response to *ESE?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*ESR

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

Command

```
*ESR?
```

Response

Returns the value of the event status register in NR1 format in response to *ESR? and clears the register.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*IDN

Queries the model name, serial number, and firmware version of the KPM1000.

Command

```
*IDN?
```

Response

The response to *IDN? is indicated below.

(Example) For a KPM1000 with serial number AB123456 and firmware version 1.00, this returns:

```
KIKUSUI,KPM1000,AB123456,1.00
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

*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 in response to *OPC? when all the commands in standby have been completed.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*OPT

Queries the optional interface boards that are installed in the KPM1000.

Command

```
*OPT?
```

Response

Returns 0 in response to *OPT? if there is no option installed.

If the factory option GPIB interface board (Ver.1.00) is installed, "GPIB 1.00" is returned in response to *OPT?.

If the factory option USB interface board (Ver.1.00) is installed, "USB 1.00" is returned in response to *OPT?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*PSC

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 <NRf>

*PSC?
```

Parameter

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

Returns the power-on status setting in response to *PSC?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*RST

Aborts the measurement operation and initializes the KPM1000 to its factory default condition.

->For the commands that are affected by *RST

Command

*RST

*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

Returns the value of the service request enable register in NR1 format in response to *SRE?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*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

Returns the value of the status byte register and the MSS message (bit 6) in NR1 format in response to *STB?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*TRG

Trigger command.

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

If the KPM1000 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
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

*TST

This command is used to perform the self-test, however, the KPM1000 is not equipped with this feature.

See section 10.38 in IEEE 488.2-1992.

Command

```
*TST?
```

Response

Returns 0 in response to *TST?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

*WAI

Prevents the KPM1000 from executing subsequent commands until all operations in standby are complete.

Command

```
*WAI
```

SENS:CURR:RANG

Sets the current range.

When you use this command to set the range, the auto current range feature (SENS:CURR:RANG:AUTO) is turned off.

Command

```
SENSe:CURRent:RANGe[:UPPer] {<numeric>|MINimum|MAXimum}

SENSe:CURRent:RANGe[:UPPer]? [{MINimum|MAXimum}]
```

Parameter

Value 5m, 10m, 20m, 50m, 100m, 200m, 500m, 1, 2, 5, 10, 20 (The default value is 20.)

Unit A

Table shows the setting that is specified when *RST is sent.

Response

Returns the current range in NR3 format in response to SENS:CURR:RANG?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SENS:CURR:RANG:AUTO

Sets the auto current range on/off status

Command

```
SENSe:CURRent:RANGe:AUTO[:STATe] {ON|OFF|1|0}

SENSe:CURRent:RANGe:AUTO[:STATe]?
```

Parameter

Value ON (1) The auto current range feature is turned on (this is the default value).
OFF (0) The auto current range feature is turned off.

Table shows the setting that is specified when *RST is sent.

When you send the SENS:CURR:RANG command, this setting is set to OFF.

Response

Returns the auto current range feature on/off status in NR1 format in response to SENS:CURR:RANG:AUTO?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SENS:CURR:SCAL

Sets the current scaling on/off status

Use SENS:CURR:SCAL:CTR to set the CT ratio.

Command

```
SENSe:CURRent:SCALing[:STATe] {ON|OFF|1|0}

SENSe:CURRent:SCALing[:STATe]?
```

Parameter

Value ON (1) The scaling is turned on.
OFF (0) The scaling is turned off (this is the default value).

Table shows the setting that is specified when *RST is sent.

Response

Returns the current scaling on/off status in NR1 format in response to SENS:CURR:SCAL?.

SENS:CURR:SCAL:CTR

Sets the scaling CT ratio.

This command is valid when current scaling has been enabled (SENS:CURR:SCAL has been sent with parameter ON).

Command

```
SENSe:CURRent:SCALing:CTRatio {<numeric>|MINimum|MAXimum}

SENSe:CURRent:SCALing:CTRatio? [{MINimum|MAXimum}]
```

Parameter

Value 1 to 2000 (The default value is 1.)

Table shows the setting that is specified when *RST is sent.

Response

Returns the CT ratio in NR3 format in response to SENS:CURR:SCAL:CTR?.

SENS:VOLT:RANG

Sets the voltage range.

When you use this command to set the range, the auto voltage range feature (SENS:VOLT:RANG:AUTO) is turned off.

Command

```
SENSe:VOLTage:RANGe[:UPPer] {<numeric>|MINimum|MAXimum}

SENSe:VOLTage:RANGe[:UPPer]?
```

Parameter

Value	150	150 V range
	300	300 V range (This is the default value.)

Table shows the setting that is specified when *RST is sent.

Response

Returns the voltage range in NR3 format in response to SENS:VOLT:RANG?.

SENS:VOLT:RANG:AUTO

Sets the auto voltage range on/off status

Command

```
SENSe:VOLTage:RANGe:AUTO {ON|OFF|1|0}

SENSe:VOLTage:RANGe:AUTO?
```

Parameter

Value	ON (1)	The auto voltage range feature is turned on (this is the default value).
	OFF (0)	The auto voltage range feature is turned off.

Table shows the setting that is specified when *RST is sent.

When you send the SENS:VOLT:RANG command, this setting is set to OFF.

Response

Returns the auto voltage range feature on/off status in NR1 format in response to SENS:VOLT:RANG:AUTO?.

SENS:VOLT:SCAL

Sets the voltage scaling on/off status

Use SENS:VOLT:SCAL:PTR to set the PT ratio.

Command

```
SENSe:VOLTage:SCALing[:STATe] {ON|OFF|1|0}

SENSe:VOLTage:SCALing[:STATe]?
```

Parameter

Value	ON (1)	The scaling is turned on.
	OFF (0)	The scaling is turned off (this is the default value).

Table shows the setting that is specified when *RST is sent.

Response

Returns the voltage scaling on/off status in NR1 format in response to SENS:VOLT:SCAL?.

ディジタルパワーメータ
Digital Power Meter
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SENS:VOLT:SCAL:PTR

Sets the scaling PT ratio.

This command is valid when voltage scaling has been enabled (SENS:VOLT:SCAL has been sent with parameter ON).

Command

```
SENSe:VOLTage:SCALing:PTRatio {<numeric>|MINimum|MAXimum}

SENSe:VOLTage:SCALing:PTRatio? [{MINimum|MAXimum}]
```

Parameter

Value 1 to 2000 (The default value is 1.)

Table shows the setting that is specified when *RST is sent.

Response

Returns the PT ratio in NR3 format in response to SENS:VOLT:SCAL:PTR?.

SENS:AVER:COUN

Sets the averaging count.

Command

```
SENSe:AVERage:COUNt {<numeric>|MINimum|MAXimum}

SENSe:AVERage:COUNt? [{MINimum|MAXimum}]
```

Parameter

Value 1, 2, 4, 8, 16, 32, 64 (The default value is 1.)

Table shows the setting that is specified when *RST is sent.

Response

Returns the averaging count in NR3 format in response to SENS:AVER:COUN?.

ディジタルパワーメータ
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SENS:UPD:CYCL

Sets the panel display update period.

Command

```
SENSe:UPDate:CYCLe {<numeric>|MINimum|MAXimum}

SENSe:UPDate:CYCLe? [{MINimum|MAXimum}]
```

Parameter

Value	0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0	This is the time between updates (the default value is 0.1).
Unit	S	

Table shows the setting that is specified when *RST is sent.

Response

Returns the update period in NR3 format in response to SENS:UPD:CYCL?.

ディジタルパワーメータ
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SENS:SYNC

Sets the synchronization source.

Command

```
SENSe:SYNChronize {VOLTage|CURRent|OFF}

SENSe:SYNChronize?
```

Parameter

Value	VOLTage	Voltage is used as the synchronization source (this is the default value).
	CURRent	Current is used as the synchronization source.
	OFF	No synchronization source is used.

Table shows the setting that is specified when *RST is sent.

Response

Returns the synchronization source in char format in response to SENS:SYNC?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SENS:FILT

Turns the low pass filter on and off.

Command

```
SENSe:FILTer[:LINE][:STATe] {ON|OFF|1|0}

SENSe:FILTer[LINE][:STATe]?
```

Parameter

Value ON (1) The filter is turned on.
OFF (0) The filter is turned off (this is the default value).

Table shows the setting that is specified when *RST is sent.

Response

Returns the low pass filter on/off status in NR1 format in response to SENS:FILT?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SENS:FILT:FREQ

Turns the frequency filter on and off.

Command

```
SENSe:FILTer:FREQuency[:STATe] {ON|OFF|1|0}

SENSe:FILTer:FREQuency[:STATe]?
```

Parameter

Value ON (1) The filter is turned on (this is the default value).
OFF (0) The filter is turned off.

Table shows the setting that is specified when *RST is sent.

Response

Returns the frequency filter on/off status in NR1 format in response to SENS:FILT:FREQ?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:DISP:CONT

Sets the measured value that is shown on the display

Command

```
SYSTem:DISPlay:CONTents {A|B|C|D},
   {V|A|W|VA|VAR|HZ|WH|WHP|WHN|TIMe|AH|PA|PV|CFA|CFV|DEGree|PF}

SYSTem:DISPlay:CONTents? {A|B|C|D}
```

Parameter{A|B|C|D}

Value	A	Display A
	B	Display B
	C	Display C
	D	Display D

Parameter{V|A|AHP|AHN|W|VA|VAR|HZ|WH|WHP|WHN|TIMe|AH|PA|PV|CFA|CFV|DEGree|PF}

Value	Description	Assignable display
V	Voltage (This is the default value for display A.)	A, B, C, D
A	Current (This is the default value for display C.)	A, B, C, D
W	Active power (This is the default value for display D.)	A, B, C, D
WHP	Positive integrated power	B, D
WHN	Negative integrated power	B, D
VA	Apparent power (This is the default value for display B.)	B, D
VAR	Reactive power	B, D
HZ	Frequency	A, C
WH	Integrated power	B, D
TIMe	Integration time	B, D
AH	Integrated current	B, D
PA	Peak current	A, C
PV	Peak voltage	A, C
CFA	Current crest factor	B, D
CFV	Voltage crest factor	B, D
DEGree	Phase angle	B, D
PF	Power factor	A, C

Response

Returns the measured value that is shown on the specified display in char format in response to SYST:DISP:CONT? {A|B|C|D}.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:DISP:HOLD

Holds the currently displayed measured values (stops the display from updating).

Command

```
SYSTem:DISPlay:HOLD {ON|OFF|1|0}

SYSTem:DISPlay:HOLD?
```

Parameter

Value	ON (1)	The display is held.
	OFF (0)	The display is not held.

Response

Returns whether the display is held in NR1 format in response to SYST:DISP:HOLD?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

INTEG:STAR

Starts and stops integration.

Command

```
INTEGrate:STARt[:STATe] {ON|OFF|1|0}

INTEGrate:STARt[:STATe]?
```

Parameter

Value	ON (1)	The integration starts.
	OFF (0)	The integration stops.

Response

Returns whether integration is being performed in NR1 format in response to INTEG:STAR?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

INTEG:RES

Clears the integration results.

Command

```
INTEGrate:RESet

INTEGrate:RESet?
```

Response

Returns whether the integrated values have been reset in NR1 format in response to INTEG:RES?. If the values have been reset, "1" is returned.

INTEG:TIM

Enables and disables the integration time.

Use INTEG:TIM:COUN to set the integration time.

During integration, only the queries are valid. If you send one of these commands to settings while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Command

```
INTEGrate:TIMer[:STATe] {ON|OFF|1|0}

INTEGrate:TIMer[:STATe]?
```

Parameter

Value	ON (1)	The integration time is enabled.
	OFF (0)	The integration time is disabled (this is the default value).

Table shows the setting that is specified when *RST is sent.

Response

Returns whether the integration time is enabled in NR1 format in response to INTEG:TIM?.

INTEG:TIM:COUN

Sets the integration time.

This command is valid when the integration time has been enabled (INTEG:TIM has been sent with parameter ON).

During integration, only the queries are valid. If you send one of these commands to settings while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Command

```
INTEGrate:TIMer:COUNt <Hour_NR1>,<Min_NR1>,<Sec_NR1>

INTEGrate:TIMer:COUNt?
```

Parameter <Hour_NR1>,<Min_NR1>,<Sec_NR1>

Value 1 minute to 9999 hours and 59 minutes (The default value is 1 minute.)

Unit <Hour_NR1>:HR
<Min_NR1>:MIN
<Sec_NR1>:s

Table shows the setting that is specified when *RST is sent.

Response

Returns the integration time in NR1,NR1,NR1 format (a comma-separated list in which the data is in the order of hours, minutes, and seconds) in response to INTEG:TIM:COUN?.

TRIG:SOUR

Sets the condition (trigger source) for actually measuring after the sequence 1 group receives INIT or INIT:NAME ACQ.

Command

```
TRIGger[:SEQuence[1]]:SOURce {IMMediate|BUS}

TRIGger[:SEQuence[1]]:SOURce?

TRIGger[:ACQuire]:SOURce {IMMediate|BUS}

TRIGger[:ACQuire]:SOURce?
```

Parameter

Value	IMM	Starts the setting immediately (Default)
	BUS	Wait for a software trigger (*TRG, TRIG, or IEEE488.1 get (Group Execute Trigger)) to change the setting

For the setting that is applied when *RST is sent, see Table.

Response

Returns the trigger source as character data in response to TRIG:SOUR?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

INIT and INIT:NAME

These commands invalidate the current measured data and start a new measurement.

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][:SEQuence[1]]
```

```
INITiate[:IMMediate]:NAME ACQuire
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

TRIG

Executes a software trigger.

Command

```
TRIGger[:SEQuence[1]][:IMMediate]

TRIGger[:ACQuire][:IMMediate]
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

INIT:CONT:SEQ1 and INIT:CONT:NAME

These commands set the measurement conditions in sequence operation auto continue mode.

When the sequence operation auto continue mode is turned on

If the trigger source parameter is set to IMM, the measurement starts immediately. When the operation is complete, a new measurement automatically starts.

If the parameter is set to BUS, the measurement starts after receiving a software trigger. When the operation is complete, the KPM1000 waits for the next trigger.

When the sequence operation auto continue mode is turned off

The measurement currently in progress continues unless ABOR is sent. New measurements are not automatically continued.

Command

```
INITiate:CONTinuous:SEQuence1 {ON|OFF|1|0}

INITiate:CONTinuous:SEQuence1?

INITiate:CONTinuous:NAME ACQuire,{ON|OFF|1|0}

INITiate:CONTinuous:NAME?
```

Parameter

Value	ON (1)	Auto continue mode on
	OFF (0)	Auto continue mode off (default)

For the setting that is applied when *RST is sent, see Table.

Response

Returns the sequence operation auto continue mode setting in NR1 format in response to INIT:CONT:SEQ1? or INIT:CONT:NAME ACQ.

MEAS, READ, and FETC

MEAS? sets some of the settings to their default values, performs a measurement, and then queries the voltage, current, active power, integration time, and integrated power. If you send the MEAS? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

READ? performs a measurement without changing the current settings and then queries the voltage, current, active power, integration time, and integrated power.

FETC? queries the voltage, current, active power, integration time, and integrated power without starting a new measurement.

Command

```
MEASure[:SCALar]?

READ[:SCALar]?

FETCh[:SCALar]?
```

Response

Returns the voltage, current, active power, integration time, and integrated power in NR3,NR3,NR3,NR3,NR3 format in response to MEAS?, READ?, or FETC?.

Voltage unit: V

Current unit: A

Power unit: W

Integration time unit: S

Integrated power unit: WH

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:CURR:AC, READ:CURR:AC, and FETC:CURR:AC

MEAS:CURR:AC? sets some of the settings to their default values, performs a measurement, and then queries the current.

READ:CURR:AC? performs a measurement without changing the current settings and then queries the current.

FETC:CURR:AC? queries the current without starting a new measurement.

Command

```
MEASure[:SCALar]:CURRent:AC?

READ[:SCALar]:CURRent:AC?

FETCh[:SCALar]:CURRent:AC?
```

Response

Returns the current in NR3 format in response to MEAS:CURR:AC?, READ:CURR:AC?, or FETC:CURR:AC?.

Unit: A

ディジタルパワーメータ
Digital Power Meter
KPM1000

READ:CURR:AC:INTEG and FETC:CURR:AC:INTEG

READ:CURR:AC:INTEG? performs a measurement without changing the current settings and then queries the integrated current.

FETC:CURR:AC:INTEG? queries the integrated current without starting a new measurement.

If you send the MEAS:CURR:AC:INTEG? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Command

```
READ[:SCALar]:CURRent:AC:INTEGrate?

FETCh[:SCALar]:CURRent:AC:INTEGrate?
```

Response

Returns the positive and negative integrated currents (in that order) in NR3,NR3 format in response to READ:CURR:AC:INTEG? or FETC:CURR:AC:INTEG?.

Unit: AH

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:CURR:AMPL:MAX, READ:CURR:AMPL:MAX, and FETC:CURR:AMPL:MAX

MEAS:CURR:AMPL:MAX? sets some of the settings to their default values, performs a measurement, and then queries the peak current.

READ:CURR:AMPL:MAX? performs a measurement without changing the current settings and then queries the peak current.

FETC:CURR:AMPL:MAX? queries the peak current without starting a new measurement.

Command

```
MEASure[:SCALar]:CURRent:AMPLitude:MAXimum?
READ[:SCALar]:CURRent:AMPLitude:MAXimum?
FETCh[:SCALar]:CURRent:AMPLitude:MAXimumv?
```

Response

Returns the peak current in NR3 format in response to MEAS:CURR:AMPL:MAX?, READ:CURR:AMPL:MAX?, or FETC:CURR:AMPL:MAX?.

Unit: A

MEAS:CURR:CRES, READ:CURR:CRES, and FETC:CURR:CRES

MEAS:CURR:CRES? sets some of the settings to their default values, performs a measurement, and then queries the current crest factor.

READ:CURR:CRES? performs a measurement without changing the current settings and then queries the current crest factor.

FETC:CURR:CRES? queries the current crest factor without starting a new measurement.

Command

```
MEASure[:SCALar]:CURRent:CREStfactor?

READ[:SCALar]:CURRent:CREStfactor?

FETCh[:SCALar]:CURRent:CREStfactor?
```

Response

Returns the current crest factor in NR3 format in response to MEAS:CURR:CRES?, READ:CURR:CRES?, or FETC:CURR:CRES?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:FREQ, READ:FREQ, and FETC:FREQ

MEAS:FREQ? sets some of the settings to their default values, performs a measurement, and then queries the frequency.

READ:FREQ? performs a measurement without changing the current settings and then queries the frequency.

FETC:FREQ? queries the frequency without starting a new measurement.

Command

```
MEASure[:SCALar]:FREQuency?

READ[:SCALar]:FREQuency?

FETCh[:SCALar]:FREQuency?
```

Response

Returns the frequency in NR3 format in response to MEAS:FREQ?, READ:FREQ?, or FETC:FREQ?.

Unit: HZ

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:POW:AC, READ:POW:AC, and FETC:POW:AC

MEAS:POW:AC? sets some of the settings to their default values, performs a measurement, and then queries the active power.

READ:POW:AC? performs a measurement without changing the current settings and then queries the active power.

FETC:POW:AC? queries the active power without starting a new measurement.

Command

```
MEASure[:SCALar]:POWer:AC[:REAL]?

READ[:SCALar]:POWer:AC[:REAL]?

FETCh[:SCALar]:POWer:AC[:REAL]?
```

Response

Returns the active power in NR3 format in response to MEAS:POW:AC?, READ:POW:AC?, or FETC:POW:AC?.

Unit: W

MEAS:POW:AC:APP, READ:POW:AC:APP, and FETC:POW:AC:APP

MEAS:POW:AC:APP? sets some of the settings to their default values, performs a measurement, and then queries the power (the apparent power).

READ:POW:AC:APP? performs a measurement without changing the current settings and then queries the power (the apparent power).

FETC:POW:AC:APP? queries the power (the apparent power) without starting a new measurement.

Command

```
MEASure[:SCALar]:POWer:AC:APParent?
```

```
READ[:SCALar]:POWer:AC:APParent?
```

```
FETCh[:SCALar]::POWer:AC:APParent?
```

Response

Returns the power (the apparent power) in NR3 format in response to MEAS:POW:AC:APP?, READ:POW:AC:APP?, or FETC:POW:AC:APP?.

Unit: W

ディジタルパワーメータ
Digital Power Meter
KPM1000

READ:POW:AC:INTEG and FETC:POW:AC:INTEG

READ:POW:AC:INTEG? performs a measurement without changing the current settings and then queries the integrated power.

FETC:POW:AC:INTEG? queries the integrated power without starting a new measurement.

If you send the MEAS:POW:AC:INTEG? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Command

```
READ[:SCALar]:POWer:AC:INTEGrate?

FETCh[:SCALar]:POWer:AC:INTEGrate?
```

Response

Returns the positive and negative integrated powers (in that order) in NR3,NR3 format in response to READ:POW:AC:INTEG? or FETC:POW:AC:INTEG?.

The integrated power is the sum of the queried positive and negative values.

Unit: WH

MEAS:POW:AC:PFAC, READ:POW:AC:PFAC, and FETC:POW:AC:PFAC

MEAS:POW:AC:PFAC? sets some of the settings to their default values, performs a measurement, and then queries the power factor.

READ:POW:AC:PFAC? performs a measurement without changing the current settings and then queries the power factor.

FETC:POW:AC:PFAC? queries the power factor without starting a new measurement.

Command

```
MEASure[:SCALar]::POWer:PFACtor?

READ[:SCALar]::POWer:PFACtor?

FETCh[:SCALar]::POWer:PFACtor?
```

Response

Returns the power factor in NR3 format in response to MEAS:POW:AC:PFAC?, READ:POW:AC:PFAC?, or FETC:POW:AC:PFAC?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:POW:AC:PHAS, READ:POW:AC:PHAS, and FETC:POW:AC:PHAS

MEAS:POW:AC:PHAS? sets some of the settings to their default values, performs a measurement, and then queries the phase angle.

READ:POW:AC:PHAS? performs a measurement without changing the current settings and then queries the phase angle.

FETC:POW:AC:PHAS? queries the phase angle without starting a new measurement.

Command

```
MEASure[:SCALar]:POWer:PHASe?
```

```
READ[:SCALar]:POWer:PHASe?
```

```
FETCh[:SCALar]:POWer:PHASe?
```

Response

Returns the phase angle in NR3 format in response to MEAS:POW:AC:PHASe?, READ:POW:AC:PHASe?, or FETC:POW:AC:PHASe?.

Unit: DEG

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:POW:AC:REAC, READ:POW:AC:REAC, and FETC:POW:AC:REAC

MEAS:POW:AC:REAC? sets some of the settings to their default values, performs a measurement, and then queries the power (the reactive power).

READ:POW:AC:REAC? performs a measurement without changing the current settings and then queries the power (the reactive power).

FETC:POW:AC:REAC? queries the power (the reactive power) without starting a new measurement.

Command

```
MEASure[:SCALar]:POWer:REACtive?
```

```
READ[:SCALar]:POWer:REACtive?
```

```
FETCh[:SCALar]:POWer:AC:REACtive?
```

Response

Returns the power (the reactive power) in NR3 format in response to MEAS:POW:AC:REAC?, READ:POW:AC:REAC?, or FETC:POW:AC:REAC?.

Unit: W

READ:TIM:INTEG and FETC:TIM:INTEG

READ:TIM:INTEG? performs a measurement without changing the current settings and then queries the integration time.

FETC:TIM:INTEG? queries the integration time without starting a new measurement.

If you send the MEAS:TIM:INTEG? query while the KPM1000 is performing integration, an error (-221, Settings conflict) will occur.

Command

```
READ[:SCALar]:TIMe:INTEGrate?

FETCh[:SCALar]:TIMe:INTEGrate?
```

Response

Returns the integration time in NR3,NR3,NR3,NR3 format (a comma-separated list in which the data is in the order of hours, minutes, seconds, and milliseconds) in response to READ:TIM:INTEG? or FETC:TIM:INTEG?.

Unit: HR, MIN, S, MS

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:VOLT:AC, READ:VOLT:AC, and FETC:VOLT:AC

MEAS:VOLT:AC? sets some of the settings to their default values, performs a measurement, and then queries the voltage.

READ:VOLT:AC? performs a measurement without changing the current settings and then queries the voltage.

FETC:VOLT:AC? queries the voltage without starting a new measurement.

Command

```
MEASure[:SCALar]:VOLTage:AC?

READ[:SCALar]:VOLTage:AC?

FETCh[:SCALar]:VOLTage:AC?
```

Response

Returns the voltage in NR3 format in response to MEAS:VOLT:AC?, READ:VOLT:AC?, or FETC:VOLT:AC?.

Unit: V

ディジタルパワーメータ
Digital Power Meter
KPM1000

MEAS:VOLT:AMPL:MAX, READ:VOLT:AMPL:MAX, and FETC:VOLT:AMPL:MAX

MEAS:VOLT:AMPL:MAX? sets some of the settings to their default values, performs a measurement, and then queries the peak voltage.

READ:VOLT:AMPL:MAX? performs a measurement without changing the current settings and then queries the peak voltage.

FETC:VOLT:AMPL:MAX? queries the peak voltage without starting a new measurement.

Command

```
MEASure[:SCALar]:VOLTage:AMPLitude:MAXimum?
```

```
READ[:SCALar]:VOLTage:AMPLitude:MAXimum?
```

```
FETCh[:SCALar]:VOLTage:AMPLitude:MAXimumv?
```

Response

Returns the peak voltage in NR3 format in response to MEAS:VOLT:AMPL:MAX?, READ:VOLT:AMPL:MAX?, or FETC:VOLT:AMPL:MAX?.

Unit: V

MEAS:VOLT:CRES, READ:VOLT:CRES, and FETC:VOLT:CRES

MEAS:VOLT:CRES? sets some of the settings to their default values, performs a measurement, and then queries the voltage crest factor.

READ:VOLT:CRES? performs a measurement without changing the current settings and then queries the voltage crest factor.

FETC:VOLT:CRES? queries the voltage crest factor without starting a new measurement.

Command

```
MEASure[:SCALar]:VOLTage:CREStfactor?

READ[:SCALar]:VOLTage:CREStfactor?

FETCh[:SCALar]:VOLTage:CREStfactor?
```

Response

Returns the voltage crest factor in NR3 format in response to MEAS:VOLT:CRES?, READ:VOLT:CRES?, or FETC:VOLT:CRES?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:BACK

Saves the panel settings and the configuration settings.

The settings you have made in remote mode are saved to the KPM1000 when you switch from remote mode to local mode.

If you turn the KPM1000 off while it is in remote mode without first saving the settings, the settings you have made will be lost, and the KPM1000 will start with the settings that were being used prior to it being switched to remote mode.

If you send the SYST:BACK command, the current panel settings and configuration settings will be saved to the KPM1000. If you then turn the KPM1000 off while it is in remote mode, the KPM1000 will start with the settings that were being used when you sent the SYST:BACK command.

Command

```
SYSTem:BACKup
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:COMM:TRAC

Sets whether to execute a debug trace and display communication errors. If you turn the debug trace feature on, error numbers, such as Err-100, are shown in the KPM1000 display area.

Command

```
SYSTem:COMMunicate:TRACe {ON|OFF|1|0}

SYSTem:COMMunicate:TRACe?
```

Parameter

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

Response

Returns whether communication errors are displayed in NR1 format in response to SYST:COMM:TRAC?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:ERR

Reads the oldest error information or event information from the error queue. The error queue can store up to 255 errors.-> Tutorial

The error queue is cleared using the *CLS command.

Command

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

Response

Returns the oldest error or event information in the error/event queue in response to SYST:ERR? as follows:

(Example) When there is no error or event

0"No error"

(Example) When a command that cannot be executed in the current operating condition is received

-221,"Settings conflict"

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:KLOC

Sets and releases the panel operation lock.

Command

```
SYSTem:KLOCk {ON|OFF|1|0}

SYSTem:KLOCk?
```

Parameter

Value	ON (1)	The panel operation lock is set.
	OFF (0)	The panel operation lock is released.

Response

Returns the panel operation lock setting in NR1 format in response to SYST:KLOCk?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:LOC (RS232C and USB only)

Sets the KPM1000 to local mode (Remote Disable; the RMT LED turns off). This is a substitute command for the IEEE488.1 REN (Remote Disable) command.

The Remote Disable state enables both panel operations and commands.

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

The panel settings and configuration settings that you have made in remote mode are saved when you switch from remote mode to local mode.

Command

```
SYSTem:LOCal
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:OPT

Queries the optional interface boards that are installed in the KPM1000.

This command is the same as *OPT?.

Command

```
SYSTem:OPTion?
```

Response

Returns 0 in response to SYST:OPT? if there is no option installed.

If the factory option GPIB interface board (Ver.1.00) is installed, "GPIB 1.00" is returned in response to SYST:OPT?.

If the factory option USB interface board (Ver.1.00) is installed, "USB 1.00" is returned in response to SYST:OPT?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:REM (RS232C and USB only)

Sets the KPM1000 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.

SYST:LOC is used to return to local mode.

Command

```
SYSTem:REMote
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:RWL (RS232C and USB only)

Sets the KPM1000 operation to remote mode. All panel keys are locked (LOCAL key is also locked). This is a substitute command for the IEEE488.1 llo (Local Lock Out) command.

SYST:LOC is used to return to local mode.

Command

```
SYSTem:RWLock
```

ディジタルパワーメータ
Digital Power Meter
KPM1000

SYST:VERS

Queries the version of the SCPI specifications to which the KPM1000 conforms.

Command

```
SYSTem:VERSion?
```

Response

Returns 1999.0 in response to SYST:VERS?.

ディジタルパワーメータ
Digital Power Meter
KPM1000

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, and 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 KPM1000 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 any of the bits 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	--

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ディジタルパワーメータ
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Event status register

The event status register bits are set when certain events occur during KPM1000 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?, *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 KPM1000 evaluates that the program data following the header is outside the formal input range or does not match the performance of the KPM1000. This indicates that a valid SCPI command may not be executed correctly depending on the conditions of the KPM1000.	-200 to -299
5	32	Command Error (CME)	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	Reserved	Not used	--
7	128	Power ON (PON)	Set when the power is turned on.	--
8-15		Reserved	Not used	--

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OPERation status register

The OPERation status register is a 16-bit register that contains conditions that are part of the KPM1000 normal operations.

Bit	Bit weight	Bit name	Description
0	1	AutoRange in Progress	Range selection is being performed by the auto range feature.
1	2	Current Phase Is Leading	The current is leading the voltage.
2	4	Integ Time Up	The time specified for the integration timer has elapsed.
3	8	Integ In Progress	Integration measurement is being performed or has been paused.
4	16	MEASuring	Measurement is being performed.
5	32	Waiting for TRIGger	Waiting for triggers.
6	64	Ave Count not Reached	The average count has not yet reached the specified value.
7	128	NOT USED	Not used.
8	256	I Mute	The measured current is less than or equal to the mute level.
9	512	V Mute	The measured voltage is less than or equal to the mute level.
10	1024	NOT USED	Not used.
11	2048	NOT USED	Not used.
12	4096	NOT USED	Not used.
13	8192	NOT USED	Not used.
14	16384	NOT USED	Not used.
15	32768	NOT USED	Always 0.

>top

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STAT:OPER

Queries the event of the OPERation status register.
A query clears the contents of the register.

Command

```
STATus:OPERation[:EVENt]?
```

Response

Returns the event of the OPERation status register in NR1 format.

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STAT:OPER:COND

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

Command

```
STATus:OPERation:CONDtion?
```

Response

Returns the condition of the OPERation status register in NR1 format.

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STAT:OPER:ENAB

Sets the enable register of the OPERation status register.

Command

```
STATus:OPERation:ENABle <NR1>

STATus:OPERation:ENABle?
```

Parameter

Value: 0 to 32767

Response

Returns the enable register setting of the OPERation status register in NR1 format.

ディジタルパワーメータ
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STAT:OPER:NTR

Sets the negative transition of the OPERation status register.

Command

```
STATus:OPERation:NTRansition <NR1>

STATus:OPERation:NTRansition?
```

Parameter

Value: 0 to 32767

Response

Returns the negative transition of the OPERation status register in NR1 format.

ディジタルパワーメータ
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STAT:OPER:PTR

Sets the positive transition of the OPERation status register.

Command

```
STATus:OPERation:PTRansition <NR1>

STATus:OPERation:PTRansition?
```

Parameter

Value: 0 to 32767

Response

Returns the positive transition of the OPERation status register in NR1 format.

QUEStionable status register

The QUEStionable status register is a 16-bit register that stores information related to the questionable events and status during KPM1000 operation.These register bits may indicate problems with the measured data of the KPM1000.

Bit	Bit weight	Bit name	Description
0	1	Integ Overflow	An overflow has occurred in the integrated power, integrated current, or integration time.
1	2	Freq Out of range	The frequency is outside of the measurable range (10 Hz to 10 kHz).
2	4	Cannot Calc PF	Because the voltage or current is less than or equal to the mute level, the power factor and phase angle cannot be calculated.
3	8	Over Irms	The current rms range has been exceeded.
4	16	Over Vrms	The voltage rms range has been exceeded.
5	32	Wh Over Occurred	The voltage or current range has been exceeded during integrated measurement.
6	64	Ah Over Occurred	The current range has been exceeded during integrated measurement.
7	128	NOT USED	Not used.
8	256	NOT USED	Not used.
9	512	NOT USED	Not used.
10	1024	NOT USED	Not used.
11	2048	Internal Com Error	An internal communication error has occurred.
12	4096	Over Ipeak	A current peak over-range has occurred.
13	8192	Over Vpeak	A voltage peak over-range has occurred.
14	16384	Sync Error	A synchronization error has occurred.
15	32768	NOT USED	Always 0.

>top

STAT:QUES

Queries the event of the QUEStionable status register.
A query clears the contents of the register.

Command

```
STATus:QUEStionable[:EVENt]?
```

Response

Returns the event of the QUEStionable status register in NR1 format.

ディジタルパワーメータ
Digital Power Meter
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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

Returns the condition of the QUEStionable status register in NR1 format.

ディジタルパワーメータ
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STAT:QUES:ENAB

Sets the enable register of the QUEStionable status register.

Command

```
STATus:QUEStionable:ENABle <NR1>

STATus:QUEStionable:ENABle?
```

Parameter

Value: 0 to 32767

Response

Returns the enable register setting of the QUEStionable status register in NR1 format.

ディジタルパワーメータ
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STAT:QUES:NTR

Sets the negative transition of the QUEStionable status register.

Command

```
STATus:QUEStionable:NTRansition <NR1>

STATus:QUEStionable:NTRansition?
```

Parameter

Value: 0 to 32767

Response

Returns the negative transition of the QUEStionable status register in the NR1 form.

ディジタルパワーメータ
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STAT:QUES:PTR

Sets the positive transition of the QUEStionable status register.

Command

```
STATus:QUEStionable:PTRansition <NR1>

STATus:QUEStionable:PTRansition?
```

Parameter

Value: 0 to 32767

Response

Returns the positive transition of the QUEStionable status register in NR1 format.

ディジタルパワーメータ
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STAT:PRES

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

Default values:

STATus:ENABle = 0x0000

STATus:PTRansition = 0x7FFF

STATus:NTRansition = 0x0000

Command

```
STATus:PRESet
```

>top

State of sequence

The following three states are available in the sequence operation.

IDLE state

When the KPM1000 is turned on, all the trigger subsystems are in the IDLE state. In this state, the trigger subsystems ignore all triggers. Sending one of the following commands at any time also returns the trigger subsystems to the IDLE state.

The sequence does not start in the IDLE state, even when TRG is sent.

:ABORt (When :INIT:CONT is ON, send :INIT:CONT:SEQ1 OFF;:ABOR.)

*RST

IEEE488.1 sdc (Selected Device Clear) or dcl (Device Clear)

INITiated state

If INIT is sent in the IDLE state, the trigger function starts and the KPM1000 enters the INITiated state.

If the trigger source is set to IMMediate, measurement is started immediately.

If the trigger source is set to BUS, the KPM1000 enters the WTG (Waiting for Trigger) state.

WTG (Waiting for Trigger) state

If a trigger is sent when the KPM1000 is in the WTG state, measurement starts.

Auto continue mode

If auto continue mode is turned on, measured data is automatically refreshed without having to send the INIT command each time. In normal cases, turn auto continue mode off (default).

When the sequence operation auto continue mode is turned on

If the trigger source parameter is set to IMM, the measurement starts immediately. When the operation is complete, a new measurement automatically starts. However, if auto continue mode is on, the MEASure, READ, and FETCh queries operate in the same manner. This means that sending multiple FETCh queries results in different measurement results, and simultaneity is lost.

If the parameter is set to BUS, the measurement starts after the KPM1000 receives a software trigger. When the operation is complete, the KPM1000 waits for the next trigger.

The ABORt command to the measurement function is invalid, because the trigger subsystem automatically exits the IDLE state even if aborted.

When the sequence operation auto continue mode is turned off

The measurement currently in progress continues unless ABOR is sent. The operation does not automatically continue to the new measurement.

Status Register and Status Report Function

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.

The SCPI status register structure is shown in the figure below. The character "+" represents the logical sum of the register bits.

Architecture

CONDition register

The transition of the CONDition register is automatic and reflects the condition of the KPM1000 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.

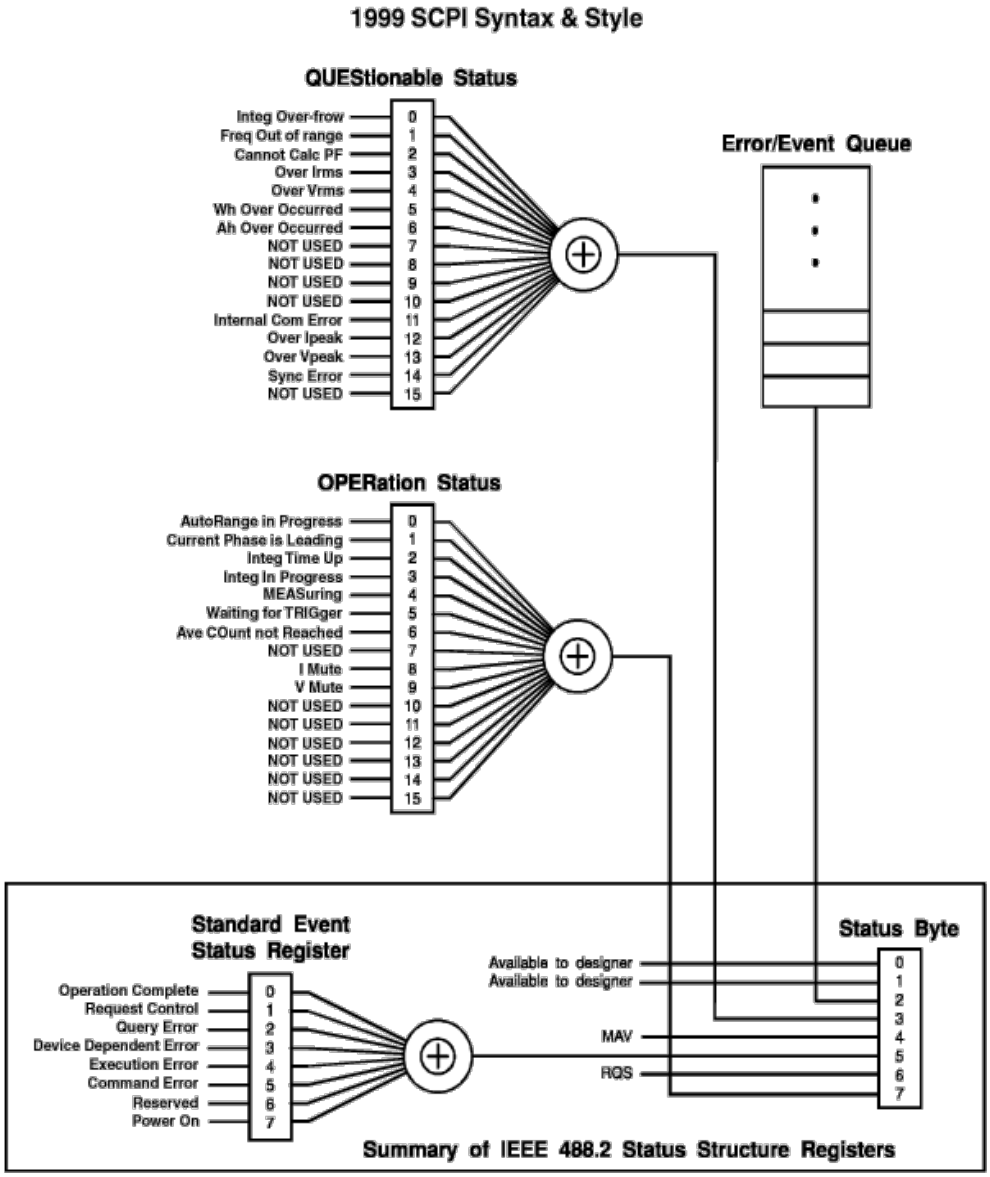
Transition filter

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

NTRansition (negative transition) filter 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.



Partially changed SCPII Standard 1999.0 Volume1 fig. 9-1.

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