KIKUSUI

Communication Interface Manual

Leakage Current Tester

TOS3200
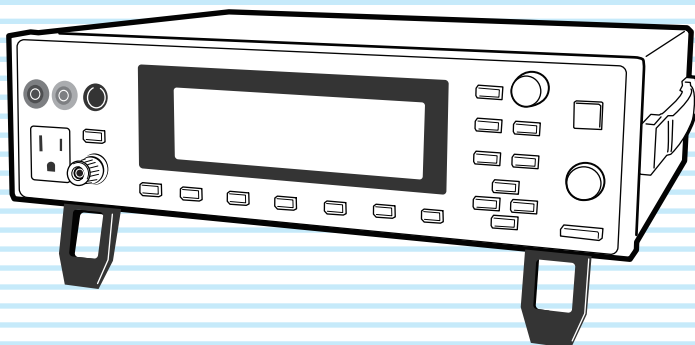
About the TOS3200 Manuals

There are five TOS5300 Series Manuals listed as follows.

- Setup Guide
  This manual is intended for first-time users of this product. It provides an overview of the product and notes on usage. It also explains how to set up the product for testing the DUT. Always read this manual before using the product.

- Quick Reference
  This manual explains Panel description and operation briefly.

- Safety Information
  This document contains general safety precautions for this product. Keep them in mind and make sure to observe them.

- User's Manual (PDF)
  This manual is intended for first-time users of this product. It provides an overview of the product and notes on usage. It also explains how to configure the product, operate the product, perform maintenance on the product, and so on.

- Communication Interface Manual (this manual)
  This manual contains details about remotely controlling the tester using SCPI commands. This manual is provided on the included CD-ROM.
  The interface manual is written for readers with sufficient basic knowledge of how to control measuring instruments using a PC.

TOS3200 Series Manuals are intended for users of the Leakage Current Tester and their instructors. Explanations are given under the presumption that the reader has knowledge about the electrical aspects of electrical safety testing.

Applicable firmware version of the TOS3200

This manual applies to TOS32000s with firmware version 4.0x.

When making an inquiry about the product, please provide us with the following information.

- Model (indicated at the top section on the front panel)
- Firmware version (See page 21.)
- Serial number (indicated at the bottom section on the rear panel)

Before reading this manual

First read the User's Manual, which includes information on the product's hardware, to avoid connecting or operating the product incorrectly.

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Notations Used in This Manual

- The TOS3200 Leakage Current Tester is also simply referred to as the TOS3200 in this manual.
- Equipment under test is also referred to as the EUT in this manual.
- The word "PC" used in this manual is a generic term for personal computers and workstations.
- Touch current is simply referred to as TC in this manual.
- Protective conductor current is simply referred to as PCC in this manual.
- The following markings are used in this manual.

NOTE

Indicates information that you should know.

DESCRIPTION

Explanation of terminology or operation principle.

See

Indicates reference to detailed information.

>

Indicates the menu level of the item to be selected. The menu item to the left of the > symbol is a higher level menu.

SHIFT+key name (marked in blue)

Indicates an operation involving pressing the named key (shown in blue) while the SHIFT key is held down.

SHIFT+Fx (F1 to F5)

Indicates an operation involving pressing a function key (F1 to F5) while the SHIFT key is held down.

Contents

1 Selecting the Interface

2 SCPI language Overview

3 Command Reference

1

Selecting the Interface

This chapter gives an overview of the remote control function and explains interface setting.

Remote Control Overview

In addition to using the front panel, the TOS3200 can be controlled remotely using the following interfaces (equipped as standard).

• RS232C interface

• GPIB interface

• USB interface

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

The remote interface complies with IEEE Std 488.2-1992 and SCPI Specification 1999.0.

Use the SCPI commands only after you have understood the SCPI command syntax for the TOS3200.

If the TOS3200 is operating under remote control, the RMT LED on the front panel will illuminate. To switch from the remote mode to the local mode (panel operation) from the panel, press the LOCAL key.

Instrument Interface Standards

The TOS3200 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

VISA Library

If you are using a VISA library (VISA COM) for the I/O library, the VISA library must be installed on the PC.

A device driver supporting USB T&M Class (USBTMC) is required to control the TOS3200 through the USB interface. The USBTMC driver is automatically installed by the VISA library.

VISA (Virtual Instrument Software Architecture) is a specification for 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. 5.1.1 or later)

- Keysight VISA by Keysight Technologies (Keysight IO Libraries Suite 16.0 or later)

- KI-VISA Ver. 5.0.4 or later

KI-VISA is Kikusui original VISA library compatible with VXIplug&play VISA Specifications 3.0. The latest version can be downloaded from Kikusui website (http://www.kikusui.co.jp/en/download/). KI-VISA is not required if NI-VISA or Keysight VISA is already installed.

Using the RS232C Interface

The RS232C port on the TOS3200 is a standard D-sub 9-pin male connector.

Check that the POWER switches of the TOS3200 and the PC are off, and connect the TOS3200 to the PC using a standard cross cable (null modem cable).

Use a D-sub 9-pin female-to-female AT type for the cross cable. Fig. 1-1shows the connector pin assignments.

The TOS3200 does not use hardware handshaking (cross cable example 2).

1: CD (carrier detect)
2: RXD (receive data)
3: TXD (transmit data)
4: DTR (data terminal ready)
5: GND (signal ground)

#4-40UNC inch screw

#4-40UNC inch screw

9: RI (ring indicator)
8: CTS (clear to send)
7: RTS (request to send)
6: DSR (data set ready)
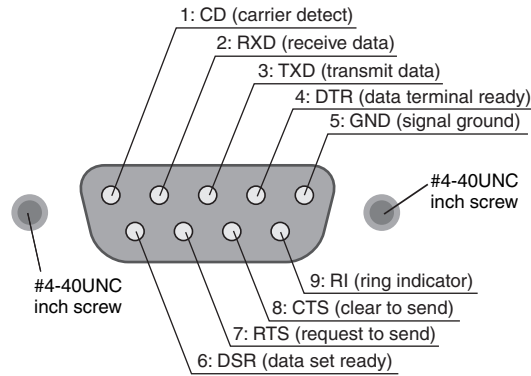
Facing the TOS3200 rear panel

D-sub 9 pin female   D-sub 9 pin female   D-sub 9 pin female   D-sub 9 pin female

Cross cable example 1   Cross cable example 2
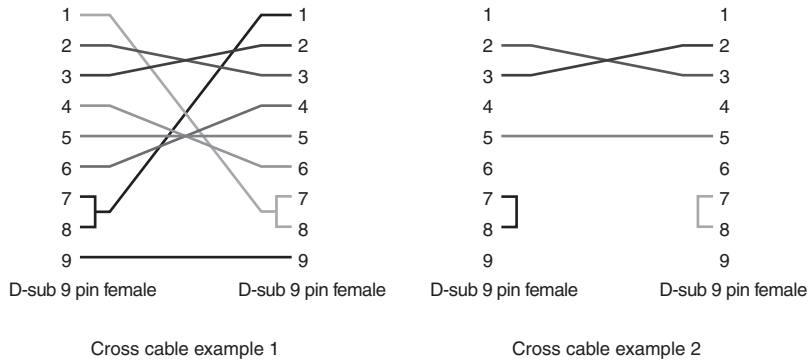
Fig. 1-1   9-pin AT type connector
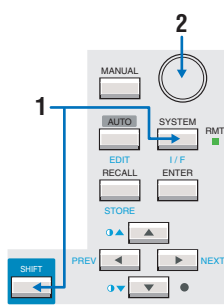
1 Press the I/F (SHIFT+SYSTEM) key to display the interface setup screen (INTERFACE).

2 Press the SHIFT+F1 key or turn the rotary knob to select RS232C.

3 Set the RS232C protocol and communication error trace function.
The settings of the communication error trace function are common to all interfaces. You cannot set it separately for each interface.

4 Turn the power off and turn it back on.
The settings are fixed. The communication error trace function is set even if you do not turn the power off.

```
┌─────────────────────────────────────────┐
│ INTERFACE                                 │
│              I/F SELECT:RS232C            │
│  BAUDRATE :19200      ERR TRACE:OFF       │
│  DATA BITS :8         X–FLOW    :ON       │
│  TALK MODE:ON         STOP BITS :1        │
│   SELECT   BAUD    DATA    X–FLOW   STOP  │
└─────────────────────────────────────────┘
```

Item	Description		Panel operation
I/F SELECT	Sets the interface that you are going to use.		F1 key
	USB	USB (see p. 12 to use the USB.)	
	RS232C	RS232C	SHIFT+F1 key
	GPIB	GPIB (see p. 11 to use the GPIB.)	
SPEED	Sets the baud rate.		F2 key
	Baud rate	38400, 19200, or 9600	Rotary knob
DATA BITS	Sets the data length.		F3 key
	Bit	8 or 7	Rotary knob
X-FLOW	Sets the flow control. （see p. 10 for details on the flow control.）		F4 key
	ON	Enable the flow control.	Rotary knob
	OFF	Disable the flow control.	
STOP BITS	Sets the stop bit.		F5 key
	Bit	2 or 1	Rotary knob
TALK MODE	Sets the talk mode. (see p. 10 for details on the talk mode.)		SHIFT+F3 key
	ON	Respond automatically	SHIFT+F3 key
	OFF	No output response	
ERR TRACE	Sets the communication error trace function. (Common to all interfaces.) Sets whether or not to display error numbers on the screen when there are errors in the error queue.		SHIFT+F4 key
	ON	Enable the error number display.	SHIFT+F4 key
	OFF	Disable the error number display.	

Flow control

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	Function	ASCII code
DC1 (Xon)	Transmission request	11H
DC3 (Xoff)	Transmission stop request	13H

The RS232C terminal must pause transmission within 10 characters after receiving DC3.
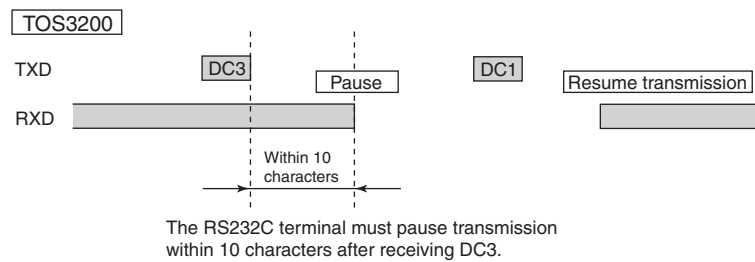
Fig. 1-2   RS232C terminal and transmission control of the TOS3200

Talk mode

Processing on the PC can be reduced by using talk mode, because commands do not need to be sent from the PC. If you connect a serial printer to the TOS3200, the test log can be printed directly.

If talk mode is turned on, the TOS3200 cannot be controlled from the PC. If you want to remotely control the TOS3200 from a PC, be sure to turn talk mode off.

• Talk mode off (default)

   Responds only to the commands from the PC.

• Talk mode on

   Responds automatically at the start and end of the test.

   Response when a test is started: START

   Response when a test ends: PROTECT, PASS, U_FAIL, L_FAIL, C_FAIL (CONTACT FAIL), or STOP

Break signal

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

Using the GPIB Interface

Use a standard IEEE488 cable to connect the TOS3200 to the PC.
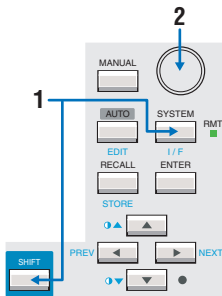
1 **Press the I/F (SHIFT+SYSTEM) key to display the interface setup screen (INTERFACE).**

2 **Press the SHIFT+F1 key or turn the rotary knob to select GPIB.**

3 **Set the GPIB address and communication error trace function.**
The settings of the communication error trace function are common to all interfaces. You cannot set it separately for each interface.

4 **Turn the power off and turn it back on.**
The settings are fixed. The communication error trace function is set even if you do not turn the power off.

```
┌─────────────────────────────────────────┐
│ INTERFACE                                 │
│                I／F  SELECT:GPIB          │
│ GPIB ADDRESS :3        ERR TRACE :OFF     │
│                                           │
│                                           │
│   SELECT   ADDRESS                        │
└─────────────────────────────────────────┘
```

Item	Description		Panel operation
I/F SELECT	Sets the interface that you are going to use.		F1 key
	USB	USB (see p. 12 to use the USB.)	
	RS232C	RS232C (see p. 8 to use the RS232C.)	SHIFT+F1 key
	GPIB	GPIB	
GPIB ADDRESS	Sets the GPIB address.		F2 key
	Address	Selectable range: 1 to 30	Rotary knob
ERR TRACE	Sets the communication error trace function. (Common to all interfaces.) If an error is present in the error queue, the error number will be displayed on the screen.		SHIFT+F4 key
	ON	Enable the error number display.	SHIFT+F4 key
	OFF	Disable the error number display.	

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

Function	Subset	Description
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.

Using the USB Interface

A device driver supporting USB T&M Class (USBTMC) is required to control the TOS3200 through the USB interface. The USBTMC driver is automatically installed by the VISA library.
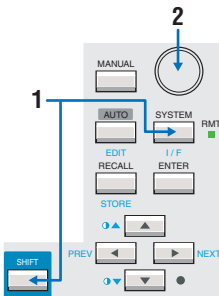
1 **Press the I/F (SHIFT+SYSTEM) key to display the interface setup screen (INTERFACE).**

2 **Press the SHIFT+F1 key or turn the rotary knob to select USB.**
You can check the vendor ID, product ID, and serial number of the TOS3200.

3 **Sets the communication error trace function.**
The settings of the communication error trace function are common to all interfaces. You cannot set it separately for each interface.

4 **Turn the power off and turn it back on.**
The settings are fixed. The communication error trace function is set even if you do not turn the power off.

```
 INTERFACE
          I/F SELECT:USB
VENDER ID :0x0B3E      ERR TRACE:OFF
PRODUCT ID:0x1010
SELIAL No.:
  SELECT
```

Item	Description		Panel operation
I/F SELECT	Sets the interface that you are going to use.		F1 key
	USB	USB	
	RS232C	RS232C (see p. 8 to use the RS232C.)	SHIFT+F1 key
	GPIB	GPIB (see p. 11 to use the GPIB.)	
ERR TRACE	Sets the communication error trace function. (Common to all interfaces.) If an error is present in the error queue, the error number will be displayed on the screen.		SHIFT+F4 key
	ON	Enable the error number display.	SHIFT+F4 key
	OFF	Disable the error number display.	

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 (vendor ID): 0x0B3E

PID (product ID): 0x1010.

Service request

Service request and serial polling functions are implemented.

2

SCPI language Overview

This chapter explains the SCPI command structure, syntax, and parameters.

Overview of Messages

The information that is exchanged between the PC and the TOS3200 is called a message.

The TOS3200 uses the SCPI language for the messages.

There are two types of messages, commands that are sent from the PC to the TOS3200 and responses that are sent from the TOS3200 to the PC.

Commands are used to execute functions of the TOS3200, change settings, and query settings and statuses. Responses return the settings and statuses of the TOS3200.

SCPI Command Syntax

Command hierarchy

The SCPI is an ASCII-based command language 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 SYSTem subsystem as an example.

Program header	Parameter	Node hierarchy
:SYSTem		Root node
:BEEP		2nd level
:VOLume		3rd level
:FAIL	<numeric>	4th level
:PASS	<numeric>	4th level
:DATE	<nrf>,<nrf>,<nrf>	2nd level
:ERRor		2nd level
[:NEXT]	<code>, "<description>"	3rd level

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

Command syntax

This manual denotes SCPI commands using the following format.

(Example)
SYSTem:BEEP:VOLume:FAIL {<numeric>|MINimum|MAXimum}

- There are two forms of SCPI commands, the long form in which the command is written out in its entirety and the short form in which the letters written in lowercase are omitted. SCPI commands can be sent in the long form or short form.
- SCPI commands are not case sensitive. VOL, Vol, and vol are all accepted as short forms of VOLTage.
  VOLUME, Volume, volume are all accepted as long forms.
- A space is required between the program header section and the parameter section.
- Multiple parameters, when available, are concatenated using commas.
- Compound commands can be created by concatenating two commands with a semicolon.

(Example)
SYSTem:BEEP:VOLume:FAIL MINimum;PASS MINimum

This compound command is the same as entering the following two commands.
SYSTem:BEEP:VOLume:FAIL MINimum
SYSTem:BEEP:VOLume:PASS MINimum

The first command, SYSTem:BEEP:VOLume:FAIL, sets the path to SYSTem:BEEP:VOLume. Therefore, SYSTem:BEEP:VOLume, can be omitted in the second command.

An error occurs if a node that is not defined in the current path (except FAIL and PASS) is designated.

- A colon is required between program headers.
- Commands of different subsystems can be concatenated using colons and semicolons.

(Example)
SYSTem:CONFigure:PHOLd MINimum;:MEASure:CURRent?

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

If the second or subsequent command starts with a colon, the path specified by the previous command will be cleared.

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

Special symbols and characters

Special symbols and characters used in this manual to describe SCPI commands are defined as indicated in the following.

Symbols or characters	Description
< >	Characters strings inside the < and > symbols indicate program data. Do not include these symbols in the actual program.
{ }	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.
[ ]	Characters strings inside brackets indicate optional data. When option data is not sent with the program, the default value will be sent. Do not include the brackets in the actual program.

2

SCPI language Overview

Query

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.

(Example)
CURRent? MIN

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.

String termination

All commands must be terminated using a valid terminator.

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

Because EOI is not available on the RS232C, be sure to use <line feed>.

If a command string is terminated, the path will be reset to the root level.

NOTE CR (ASCII 0x0D) is not a terminator.

Common commands

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

Parameters

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

The representation system of the program data that is used on the TOS3200 is indicated below.

Non-numeric parameters

The TOS3200 uses the following three types of non-numeric parameters.

Symbols or characters	Description
Character string data (String)	Used when a series of ASCII characters are requested. Be sure to enclose a string in single quotations or double quotations. The start and end quotation marks must match. (Example) `NETWork "A"` If you want to use a quotation mark as a part of the string, enter two quotation marks consecutively (with no characters in between). ASCII codes 20H to 7EH can be used.
Character data (Character)	Used when only a limited number of values is available for the program setting. Responses are returned in the short form. (Example) `CURRent:RANGe:SELect {LOW|MEDium|HIGH}`
Boolean data (Boolean)	Expresses a 1 or 0 condition or an ON or OFF condition. Responses are returned as 1 or 0. (Example) `SYSTem:CONFigure:TRACe {ON|OFF|1|0}`

Numeric parameters

The TOS3200 uses the following five types of numeric parameters.

Symbols or characters	Description
NR1	Represents an integer.[1]
NR2	Represents a real number (floating point).[1]
NR3	Represents a real number (exponential).[1] 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	Represents a decimal point, optional sign, and measurement unit. The numeric representation syntax is the same as NRf. MINimum and MAXimum are available as substitutes for declaring certain values. Units such as V, A, and S can also be used in a numeric parameter. If a value that cannot be assigned is entered, the device will round the value to the closest possible value. (Example) `SYSTem:BEEPer:VOLume:FAIL 20` The range of values for SYST:BEEP:VOL:FAIL is 0 to 10. Thus, 10 is set even if 20 is specified.

[1]. Details are given in the *IEEE 488.2 Standard Digital Interface for Programmable Instrumentation*.

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 buzzer volume for FAIL judgments is to the minimum value.
`SYSTem:BEEPer:VOLume:FAIL MINimum`

The minimum and maximum values can be inquired for most parameters using queries.
`CURRent:LIMit:UPPer? MAX`

Measurement unit

Below are the default measurement units. Commands will be accepted even if measurement units are not specified.

- A (current)
- V (voltage)
- W (wattage)
- S (second)

The following optional prefixes are supported. To enter "μ" in the parameter, use "U" instead.

- M (milli)
- U (micro)

NOTE | The unit symbols in the International System of Units contain lowercase characters. The IEEE standard uses uppercase characters. SCPI commands are not case sensitive.

3

Command Reference

This chapter explains details of each command and registers.

Command Description in This Manual

This manual describes the commands in the following manner.

Attach the value you want to specify after the command and send the command. To set the test time to **20 s** in the touch current measurement, send **TC:TIM 20**.

Commands with these marks will be affected if *RST or *RCL is sent. The settings will be changed to the default values indicated on page 196. The test time will be changed to 10 s if *RST is sent.

TC:TIM / PCC:TIM

*RST ***RCL**

Set the test time. TC:TIM:ST This setting is valid when TC:TIM:STAT or PCC:TIM:STAT is on.

The parameters are listed. In the case of this command, the parameter is numeric. In addition to specifying the desired value, you can specify the minimum or maximum value.

Command

The commands are given in the long form. The lower-case section can be omitted. The section enclosed by braces ([]) can also be omitted.

```
[SENSe:]TC:TIMer {<numeric>|MIN|MAX}

[SENSe:]TC:TIMer? {MIN|MAX}
```

Touch current measurement command

```
[SENSe:]PCC:TIMer {<numeric>|MIN|MAX}

[SENSe:]PCC:TIMer? {MIN|MAX}
```

Protective conductor current measurement command

Parameter

Specify MAX to set the maximum value.

The selectable range is given. Optional symbols such as m and μ can also be used.

Value: 1 to 999   (The default value is 10.)

Specify MIN to set the minimum value.

Unit: S

The unit for the value. The unit can be omitted.

This command is affected if *RST is sent, and the setting changes to the value indicated in Table 7-9. The test time is changed to 10 s if *RST is sent.

Table A-4 shows the setting that is specified when *RST or *RCL is sent.

Response

Returns the test time in the <NR3> form in response to TC:TIM? or PCC:TIM?.

The representation system of the value that is returned when a query is sent.

Command items and reference pages

Item	See Page
Command syntax	14
Parameter	17
Unit	18
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Representation system	17
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List of errors	74

IEEE488.2 Common Commands

*CLS

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

Command   `*CLS`

*ESE

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

Command   `*ESE <NR1>`
                  `*ESE?`

Parameter

Parameter   Value: 0 to 255
                   An SCPI error (-222, "Data out of range") occurs if outside the range.

       (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 the <NR1> form.

*ESR

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

Command   `*ESR?`

Response   Returns the value of the event status register in the <NR1> form and clears the register.

*IDN

Queries the model name, serial number, and firmware version of the TOS3200.

Command   `*IDN?`

Response   The response to *IDN? is indicated below.

       (Example) For TOS3200 with a serial number AB123456 and firmware version 1.00
            Returns `KIKUSUI,TOS3200,AB123456,1.00.`

3

Command Reference

*OPC

Sets the OPC bit (bit 0) of the event status register when the processing of all commands standing by is complete.

Command   ***OPC**
             *OPC?

Response   Returns 1 when the processing of all commands standing by is complete.

*OPT

Queries the option (HP21-TOS only) that is installed in the TOS3200.

Command   ***OPT?**

Response   If the HP21-TOS is installed, "HP21-TOS" is returned. Returns 0 if the option is not installed.

*RCL

Aborts the measurement operation and reads the contents stored in memory. The operation is the same as MEM:RCL.

Command   ***RCL <NR1>**

Parameter   Value: 0 to 99   Memory number
                         An SCPI error (-222, "Data out of range") occurs if outside the range.

*RST

Aborts the measurement operation and initializes the TOS3200 to factory default condition.

For the commands that are affected by *RST, see "Default values.

Command   ***RST**

*SAV

Stores the present TOS3200 settings to memory. The operation is the same as MEM:SAV. The settings that are stored are the same as those recalled using the *RCL command. See "Default values.

Command   ***SAV <NR1>**

Parameter   Value: 0 to 99   Memory number
                         An SCPI error (-222, "Data out of range") occurs if outside the range.

*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 <NR1>`
`*SRE?`

Parameter Value: 0 to 255
An SCPI error (-222, "Data out of range") occurs if outside the range.

(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 the <NR1> form.

*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> form.

*TRG

See
Section 10.37 in
IEEE 488.2-1992

Trigger command.

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

If the TOS3200 is not in a condition to accept triggers, an SCPI error (-211,"Trigger ignored") will occur.

Command `*TRG`

*TST

See
Section 10.38 in
IEEE 488.2-1992

Executes a self-test. Use SYST:ERR? to query the errors that occurred.

Command `*TST?`

Response Returns 0 if there are no errors. If there are, the error code is returned.

*WAI

Prevents the TOS3200 from executing subsequent commands until all operations in standby are complete.

Command `*WAI`

Selecting the Operation Mode

FUNC

Sets the operation mode.

Command   `[SENSe:]FUNCtion[:ON] "{CURRent|PCC|TC|VOLTage|AUTO}"`
              `[SENSe:]FUNCtion[:ON]?`

Parameter "CURRent" Current measurement (Meter Mode)
              "PCC"   PCC Measurement Mode
              "TC"   TC Measurement Mode (default)
              "VOLTage" Voltage measurement (Meter Mode)
              "AUTO"   Program test

Response Returns the operation mode in the <string> form.
              If the TOS3200 is displaying the SYSTEM or INTERFACE screen, "" will be returned.

Setting the TC Measurement and PCC Measurement

The commands with "TC" in the second-level node are for TC measurement. Commands with "PCC" are for PCC measurement.

Setting the Connection Destination of the Measurement Terminal (TC measurement only)

TC:PROB

Sets the connection destination (PROBE) of measurement terminals A and B.

Command   `[SENSe:]TC:PROBe {ENCPE|ENCENC|ENCLIV|ENCNEU}`
              `[SENSe:]TC:PROBe?`

Parameter Value: ENCPE   Between the enclosure and earth (default)
                       ENCENC   Between two enclosures
                       ENCLIV   Between the enclosure and power line (live)
                       ENCNEU   Between the enclosure and power line (neutral)

Response Returns the connection destination of the measurement terminal in the <character> form.

Setting the Power Line Polarity

TC:POL / PCC:POL

`*RST` `*RCL`

Sets the polarity (POL) of the power line supplied to the EUT. If you set the connection destination of the measurement terminal to between the enclosure and power line, this command will be invalid.

Command
```
[SENSe:]TC:POLarity {NORMal|REVersed}
[SENSe:]TC:POLarity?
[SENSe:]PCC:POLarity {NORMal|REVersed}
[SENSe:]PCC:POLarity?
```

Parameter Value:

NORM	Normal phase connection (default)
REV	Reverse phase connection

Response Returns the polarity of the power line in the <character> form. If the connection destination of the measurement terminal is set to between the enclosure and power line, NA is returned.

Setting the Single Fault Mode

TC:COND / PCC:COND

`*RST` `*RCL`

Sets the single fault mode (COND). If you set the connection destination of the measurement terminal to between the enclosure and power line, this command will be invalid.

Command
```
[SENSe:]TC:CONDition {NORMal|FLTNEU|FLTPE}
[SENSe:]TC:CONDition?
[SENSe:]PCC:CONDition {NORMal|FLTNEU}
[SENSe:]PCC:CONDition?
```

Parameter Value:

NORMal	Normal condition (default)
FLTNEU	Power line (neutral) disconnected condition
FLTPE	Earth line disconnected condition (TC Measurement Mode only)

Response Returns the single fault mode in the <character> form. If the connection destination of the measurement terminal is set to between the enclosure and power line, NA is returned.

3

Command Reference

Setting the Lower Reference

TC:LIM:LOW / PCC:LIM:LOW

*RST   *RCL

Sets the lower limit of the judgment reference (lower reference). This setting is valid when TC:LIM:LOW:STAT or PCC:LIM:LOW:STAT is on.

For TC measurement, the setting varies depending on the measurement network and current measurement mode settings. For PCC measurement, the setting varies depending on the current measurement mode setting.

Command
```
[SENSe:]TC:LIMit:LOWer[:LEVel] {<numeric>|MIN|MAX}
[SENSe:]TC:LIMit:LOWer[:LEVel]? {MIN|MAX}
[SENSe:]PCC:LIMit:LOWer[:LEVel] {<numeric>|MIN|MAX}
[SENSe:]PCC:LIMit:LOWer[:LEVel]? {MIN|MAX}
```

Parameter   Value: Varies depending on the current measurement mode and the measurement network settings. (The default value is 30 µ.)

Unit: A

Response   Returns the lower reference in the <NR3> form.

■ Selectable range of LOWER

MODE	TC measurement				PCC measurement
	NTWK A, B, B1,C	NTWK D, E	NTWK F	NTWK G	
DC, RMS	30 µA to 30.0 mA	30 µA to 30.0 mA	30 µA to 20.0 mA	30 µA to 15.0 mA	30 µA to 30.0 mA
PEAK	50 µA to 90.0 mA	50 µA to 45.0 mA	50 µA to 30.0 mA	50 µA to 22.5 mA	50 µA to 90.0 mA

TC:LIM:LOW:STAT / PCC:LIM:LOW:STAT

*RST   *RCL

Sets whether to perform judgment with respect to the lower reference. Set the lower reference using TC:LIM:LOW or PCC:LIM:LOW.

Command
```
[SOURce:]TC:LIMit:LOWer:STATe {ON|OFF|1|0}
[SOURce:]TC:LIMit:LOWer:STATe?
[SOURce:]PCC:LIMit:LOWer:STATe {ON|OFF|1|0}
[SOURce:]PCC:LIMit:LOWer:STATe?
```

Parameter   Value: ON (1)   Enable the judgment
OFF (0)   Disable the judgment (default)

Response   Returns the whether to perform judgment with respect to the lower reference in the <NR1> form.

Setting the Upper Reference

TC:LIM:UPP / PCC:LIM:UPP

*RST   *RCL

Sets the upper limit of the judgment reference (upper reference). This setting is valid when TC:LIM:UPP:STAT or PCC:LIM:UPP:STAT is on.

For TC measurement, the setting varies depending on the measurement network and current measurement mode settings. For PCC measurement, the setting varies depending on the current measurement mode setting.

Command
```
[SENSe:]TC:LIMit:UPPer[:LEVel] {<numeric>|MIN|MAX}
[SENSe:]TC:LIMit:UPPer[:LEVel]? {MIN|MAX}
[SENSe:]PCC:LIMit:UPPer[:LEVel] {<numeric>|MIN|MAX}
[SENSe:]PCC:LIMit:UPPer[:LEVel]? {MIN|MAX}
```

Parameter   Value: Varies depending on the current measurement mode and the measurement network settings. (The default value is 30 m.)

   Unit: A

Response   Returns the upper reference in the <NR3> form.

■ **Selectable range of UPPER**

MODE	TC measurement				PCC measurement
	NTWK A, B, B1,C	NTWK D, E	NTWK F	NTWK G	
DC, RMS	30 µA to 30.0 mA	30 µA to 30.0 mA	30 µA to 20.0 mA	30 µA to 15.0 mA	30 µA to 30.0 mA
PEAK	50 µA to 90.0 mA	50 µA to 45.0 mA	50 µA to 30.0 mA	50 µA to 22.5 mA	50 µA to 90.0 mA

TC:LIM:UPP:STAT / PCC:LIM:UPP:STAT   *RST   *RCL

Sets whether to perform judgment with respect to the upper reference. Set the upper reference using TC:LIM:UPP or PCC:LIM:UPP.

Command
```
[SENSe:]TC:LIMit:UPPer:STATe {ON|OFF|1|0}
[SENSe:]TC:LIMit:UPPer:STATe?
[SENSe:]PCC:LIMit:UPPer:STATe {ON|OFF|1|0}
[SENSe:]PCC:LIMit:UPPer:STATe?
```

Parameter   Value: ON (1)   Enable the judgment (default)
                        OFF (0)   Disable the judgment

Response   Returns the whether to perform judgment with respect to the upper reference in the <NR1> form.

Setting the Test Time and Test Wait Time

TC:TIM / PCC:TIM   *RST   *RCL

Sets the test time (TIMER). This setting is valid when TC:TIM:STAT or PCC:TIM:STAT is on.

Command
```
[SENSe:]TC:TIMer[:TIME] {<numeric>|MIN|MAX}
[SENSe:]TC:TIMer[:TIME]? {MIN|MAX}
[SENSe:]PCC:TIMer[:TIME] {<numeric>|MIN|MAX}
[SENSe:]PCC:TIMer[:TIME]? {MIN|MAX}
```

Parameter   Value: 1 to 999   (The default value is 10.)

   Unit: S

Response   Returns the test time in the <NR3> form.

3 Command Reference

Setting the Test Time and Test Wait Time (Cont'd)

TC:TIM:STAT / PCC:TIM:STAT
`*RST` `*RCL`

Sets whether to stop the test when the time specified by TC:TIM or PCC:TIM elapses. Set the test time using TC:TIM or PCC:TIM.

Command
```
[SENSe:]TC:TIMer:STATe {ON|OFF|1|0}
[SENSe:]TC:TIMer:STATe?
[SENSe:]PCC:TIMer:STATe {ON|OFF|1|0}
[SENSe:]PCC:TIMer:STATe?
```

Parameter Value: ON (1)   Stop the test after the test time elapses
             OFF (0)   Not stop the test (default)

Response Returns the whether the test is stopped after the test time elapses in the <NR1> form.

TC:WAIT / PCC:WAIT
`*RST` `*RCL`

Sets the time until the test is actually started after the test is started (test wait time). This setting is valid when TC:WAIT:STAT or PCC:WAIT:STAT is on.

Command
```
[SENSe:]TC:WAIT[:TIME] {<numeric>|MIN|MAX}
[SENSe:]TC:WAIT[:TIME]? {MIN|MAX}
[SENSe:]PCC:WAIT[:TIME] {<numeric>|MIN|MAX}
[SENSe:]PCC:WAIT[:TIME]? {MIN|MAX}
```

Parameter Value: 1 to 999   (The default value is 1.)
             Unit: S

Response Returns the test wait time in the <NR3> form.

TC:WAIT:STAT / PCC:WAIT:STAT
`*RST` `*RCL`

Sets whether to start the test immediately or after the test wait time elapses. Set the test wait time using TC:WAIT or PCC:WAIT.

Command
```
[SENSe:]TC:WAIT:STATe {ON|OFF|1|0}
[SENSe:]TC:WAIT:STATe?
[SENSe:]PCC:WAIT:STATe {ON|OFF|1|0}
[SENSe:]PCC:WAIT:STATe?
```

Parameter Value: ON (1)   Start the test after the test wait time elapses
             OFF (0)   Start the test immediately (default)

Response Returns the whether the test is started immediately in the <NR1> form.

Setting the Measurement Network (TC measurement only)

TC:NETW

`*RST` `*RCL`

Sets the measurement network (NTWK).

Command
```
[SENSe:]TC:NETWork "{A|B|B1|C|D|E|F|G}"
[SENSe:]TC:NETWork?
```

Parameter Value:

"A"	(For IEC 60990) (1.5 kΩ // 0.22 μF) + 500 Ω (default)
"B"	(For IEC 60990) (1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + 22 nF)
"B1"[*1]	(For IEC 60065) (1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + 22 nF)
"C"	(For IEC 60990)
	(1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + (20 kΩ + 6.2 nF) // 9.1 nF)
"D"	1 kΩ
"E"	1 kΩ // (10 kΩ + 11.225 nF + 579 Ω)
"F"	1.5 kΩ // 0.15 μF
"G"	2 kΩ

*1   Measures voltage U1 between the measurement network reference points.

See Specifications on the User's Manual

Response Returns the measurement network in the <string> form.

Setting the Measurement Mode

TC:MODE / PCC:MODE

`*RST` `*RCL`

Sets the current measurement mode (MODE).

Command
```
[SENSe:]TC:MODE {RMS|DC|PEAK}
[SENSe:]TC:MODE?
[SENSe:]PCC:MODE {RMS|DC|PEAK}
[SENSe:]PCC:MODE?
```

Parameter Value:

RMS	Rms measurement (default)
DC	DC measurement
PEAK	Peak measurement

Response Returns the current measurement mode in the <character> form.

3

Command Reference

Setting the Measurement Range

TC:RANG:SEL / PCC:RANG:SEL

`*RST` `*RCL`

Sets the measurement range (RANGE).

Command
```
[SENSe:]TC:RANGe:SELect {AUTO|FIXed}
[SENSe:]TC:RANGe:SELect?
[SENSe:]PCC:RANGe:SELect {AUTO|FIXed}
[SENSe:]CC:RANGe:SELect?
```

Parameter Value: AUTO Auto range switching (default)

FIX Fixed range
For TC measurement, the range is determined by the upper reference, measurement network, and current measurement mode settings.
For PCC measurement, the range is determined by the upper reference and current measurement mode settings.

Response Returns the measurement range in the <character> form.

■ Determination of the measurement range

Measure-ment range	MODE	TC measurement				PCC measurement
		Upper reference				Upper reference
		NTWK A, B, B1,C	NTWK D, E	NTWK F	NTWK G	
Range 1	DC, RMS	30 µA to 600 µA	30 µA to 300 µA	30 µA to 200 µA	30 µA to 150 µA	30 µA to 600 µA
	PEAK	50 µA to 850 µA	50 µA to 424 µA	50 µA to 282 µA	50 µA to 212 µA	50 µA to 850 µA
Range 2	DC, RMS	601 µA to 6.00 mA	301 µA to 3.00 mA	201 µA to 2.00 mA	151 µA to 1.50 mA	601 µA to 6.00 mA
	PEAK	851 µA to 8.50 mA	425 µA to 4.24 mA	283 µA to 2.82 mA	213 µA to 2.12 mA	851 µA to 8.50 mA
Range 3	DC, RMS	6.01 mA to 30.0 mA	3.01 mA to 30.0 mA	2.01 mA to 20.0 mA	1.51 mA to 15.0 mA	6.01 mA to 30.0 mA
	PEAK	8.51 mA to 90.0 mA	4.25 mA to 45.0 mA	2.83 mA to 30.0 mA	2.13 mA to 22.5 mA	8.51 mA to 90.0 mA

Querying the Settings

TC / PCC

Queries the settings.

Command
```
[SOURce:]TC?
[SOURce:]PCC?
```

Response Returns the following settings in order in the <string> form in response TC? / PCC?:
measurement mode, measurement network, measurement range, connection destination, polarity, single fault mode, lower reference, lower reference on/off, upper reference, upper reference on/off, test time, test time on/off, test wait time, test wait time on/off.
NA is always returned for the measurement network and connection destination in response to PCC?. NA may be returned for the polarity and single fault mode.

NA may be returned for the polarity and single fault mode depending on the connection setting in response to TC?.

(Example) When the settings are as follows: measurement mode: RMS, measurement network: A, measurement range: FIX, connection destination: ENCPE, polarity: REV, single fault mode: FLTNEU, lower reference: 30 µA, lower reference on/off: on, upper reference: 30 mA, upper reference on/off: on, test time: 1 s, test time on/off: on, test wait time: 1 s, and test wait time on/off: on

In response to TC?
> **Returns** "RMS,A,FIX,ENCPE,REV,FLTNEU,+3.00000E-05, 1,+3.00000E-02,1,+1.00000E+01,1,+1.00000E+01,1".

In response to PCC?
> **Returns** "RMS,NA,FIX,NA,REV,FLTNEU,+3.00000E-05, 1,+3.00000E-02,1,+1.00000E+01,1,+1.00000E+01,1".

Saving and Recalling from the Panel Memory

MEM:SAV

Saves the settings of the TC measurement or PCC measurement to the panel memory. By factory default, test conditions conforming to various safety standards are written to memory numbers 0 to 50. The operation is the same as *SAV.

Command `MEMory:SAV <NR1>`

Parameter   Value: 0 to 99   Panel memory number

MEM:RCL

Recalls the settings of the TC measurement or PCC measurement from the panel memory. The operation is the same as *RCL.

Command `MEMory:RCL <NR1>`

Parameter   Value: 0 to 99   Panel memory number

MEM:TITL

Assigns a name to the specified panel memory number. The memory name is 12 characters long. Spaces (0x20) will be automatically inserted if the name is less than 12 characters in length.

Command `MEMory:TITLe <NR1>,"<string>"`
           `MEMory:TITLe? <NR1>`

Parameter   <NR1>
           Value: 0 to 99   Panel memory number

           "<string>"

See Panel Control Basics on the User's Manual

           Value: Enter the program name. Double quotation, single quotation, comma, and "@" cannot be used.
                 Up to 12 characters.

Response   Returns the memory name in the <string> form.

Executing the Test (Trigger Function)

Executes the TC measurement, PCC measurement, or program measurement. The STOP switch on the front panel is valid even during remote control.

First, set the operation mode of the test using the FUNC command. For a program test, select the program number using the PROG:NAME command.

While the test is in progress, you can query the current, voltage, and power of the EUT as well as the measured current and maximum measured current between measurement terminals A and B.

The following three states are available in the execution of the test: IDLE, INITiated, and WTG.

IDLE state

The TOS3200 is in the IDLE state when the power is turned on. In this state, the trigger subsystems ignore all triggers. Sending ABOR, *RST, or *RCL command at any time also returns the trigger subsystems to the IDLE state.

The test is not executed in the IDLE state, even when TRG is sent.

INITiated state

If INIT is sent in the IDLE state, the trigger function will start and the TOS3200 will enter the INITiated state.

If the trigger source is set to IMMediate, the test will start immediately.
If the trigger source is set to BUS, the TOS3200 will enter the WTG (Waiting for Trigger) state.

WTG (Waiting for Trigger) state

If a trigger is sent in the WTG state, the test will start.

MANUAL TEST

AUTO TEST

```
                          Send ABOR                                      Send ABOR
      IDLE  ◄──────       *RST                    IDLE  ◄──────          *RST
       │      Send INIT   *RCL                      │      Send INIT     *RCL
       ▼                                            ▼
   INITiated                                    INITiated
       │                                            │
       ▼                                            ▼
  IMM                                                              IMM
  ◄── TRIG:SOURce?                              TRIG:SOURce? ──►
       │ BUS                                         │ BUS
       ▼                                            ▼
      WTG                                          WTG
       │  Send TRG                                  │  Send TRG
       ▼                                            ▼
  Test wait time elapsed                     Test wait time elapsed
       │                                            │
       ▼                                            ▼
   Test start                                   Test start
       │                                            │
       ▼                                            ▼
                    FAIL                                      FAIL
   PASSED? ──────────────┐                     PASSED? ──────────► FAILED
       │ PASS            │                          │ PASS              │
       ▼                 ▼                          ▼                   ▼
    PASSED            FAILED                     PASSED         FABort? ── ON ──► FAILED
       │                                            │            │ OFF
       ▼                                            ▼            │
  Pass hold time elapsed                  Interval time elapsed ◄┘
                                                    │
                                               NO   ▼
                                              ◄── Last step?
                                                    │ YES
                                                    ▼
                                          Pass hold time elapsed
```

Fig. 3-1   Flow diagram of the trigger function

TRIG:SOUR   *RST   *RCL

Send the INIT or INIT:NAME TEST command first, and then set the conditions (trigger source) for actually starting the test.

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

Parameter Value: IMM   Start the test immediately (default)
BUS   Wait for a software trigger (*TRG, TRIG, or IEEE488.1 get (Group Execute Trigger)) to start the test

Response Returns the trigger source in the <character> form.

INIT / INIT:NAME TEST

Starts the test (trigger function). The operation is the same as the INIT and INIT:NAME TEST command.

If TRIG:SOUR is set to IMM, the test will start immediately. If set to BUS, the test will start by waiting for a software trigger. If set to EXT, the test will start by waiting for an external trigger signal.

Command `INITiate[:IMMediate][:SEQuence[1]]`
`INITiate[:IMMediate]:NAME TEST`

TRIG:HREL

Releases the interval hold during the program test.

Command `TRIGger[:SEQuence[1]]:HRELease`
`TRIGger[:TEST]:HRELease`

DISP:SIZE

Switches the display mode while a test is in progress. This command is invalid while a program test is in progress.

Command `DISPlay:SIZE {NORMal|ENLarged}`
`DISPlay:SIZE?`

Parameter Value:
NORMal   Standard display (default)
ENLarged   Expanded numeric display

Response Returns the display size in the <character> form.

DISP:UXV

Sets whether or not to display the measured voltage between the reference points in expanded numeric display mode. This command is valid when the operation mode is set to current measurement or touch current measurement.

Command `CommandDISPlay:UXV {ON|OFF|1|0}`
`DISPlay:UXV?`

Parameter Value:
ON (1)   Displays the voltage
OFF (0)   Does not display the voltage

Response Returns whether or not the voltage is displayed in expanded numeric display mode. The value is returned in the <NR1> form.

TC:EXEC

Queries the execution status of the TC measurement test.

Command **[SENSe:]TC:EXECuting?**

Response Returns in order the test status, elapsed time, remaining time, program number, and step number in the comma-separated <character>, <elapsed time_NR3>, <remaining time_NR3>, <program_NR1>, and <step_NR1> form.

Returns -1 for the program number and step number. If TIMER OFF is selected, +9.9E+37 is returned for the remaining time.

Response form <character>
STOP   Test stopped
WAIT   Waiting for trigger
TEST   Test in progress

<elapsed time_NR3>elapsed time, <remaining time_NR3>remaining time

Unit: S

PCC:EXEC

Queries the execution status of the PCC measurement test.

Command **[SENSe:]PCC:EXECuting?**

Response Returns in order the test status, elapsed time, time remaining, program number, and step number in the comma-separated <character>, <elapsed time_NR3>, <remaining time_NR3>, <program_NR1>, and <step_NR1> form.

Returns -1 for the program number and step number. If TIMER OFF is selected, +9.9E+37 is returned for the time remaining.

Response form <character>
STOP   Test stopped
WAIT   Waiting for trigger
TEST   Test in progress

<elapsed time_NR3>elapsed time, <remaining time_NR3>remaining time

Unit: S

3

Command Reference

PROG:EXEC

Queries the execution status of the program test.

Command `PROGram:EXECuting?`

Response Returns in order the test status, elapsed time, remaining time, program number, and step number in the comma-separated <character>, <elapsed time_NR3>, <remaining time_NR3>, <program_NR1>, and <step_NR1> form. If TIMER OFF is selected, +9.9E+37 is returned for the time remaining.

Response form   <character>test status

STOP   Test stopped
WAIT   Waiting for trigger
TEST   Test in progress
INT   Interval time

<elapsed time_NR3>elapsed time, <remaining time_NR3>remaining time

Unit: S

ABOR

Aborts the test. The trigger status immediately after the power is turned on is the same as the condition when the ABOR command is sent.

Command `ABORt`

Saving and Querying the Test Result

Up to 50 test results can be saved separately for the TC measurement/PCC measurement (MANUAL TEST) and program test (AUTO TEST).

Commands with "MANual" in the second-level node are used to save or query the test results of the TC measurement or PCC measurement. Commands with "AUTO" are used to save or query the test results of the program test.

Querying the Judgment Result (Common to All Tests)

RES

Queries the judgment result of the last test.

Command **RESult[:IMMediate]?**

Response Returns the judgment result and measured current in the comma-separated <character>,<NR3> form. Returns +9.91E+37 for the measured current for CONTACT FAIL.

Response form <character>judgment result
PASS   Pass judgment
LFAIL   Measured a current less than or equal to the lower reference.
UFAIL   Measured a current greater than or equal to the upper reference.
CFAIL   CONTACT FAIL

<NR3>measured current

Unit: A

Saving the Result

RES:MAN:SAVE / RES:AUTO:SAVE

Saves the result of the last test by specifying the memory number.

The result can be saved until the next test is started. If you change the operation mode (Change between MANUAL TEST and AUTO TEST is not allowed. Change between TC and PCC is allowed.) or change the display to the SYSTEM or INTERFACE screen, the result can no longer be saved.

Command **RESult:MANual:SAVE <NR1>**
         RESult:AUTO:SAVE <NR1>

Parameter Value: 1 to 50   Memory number

Querying the Result

RES:MAN:HEAD / RES:AUTO:HEAD

Returns the header information of the specified memory number.

Command   `RESult:MANual:HEADer? <NR1>`
`RESult:AUTO:HEADer? <NR1>`

Parameter   Value: 1 to 50   Memory number

Response   Returns the items below in order from the top in the comma-separated form.

Item	Response form	Response for the TC measurement and PCC measurement
Memory name or program name	string	" "*1
Program number	NR1	-1
Total number of steps	NR1	0
Measurement network	character	Value saved to the memory
Measurement mode	character	Value saved to the memory
Measurement range	character	Value saved to the memory
Normal current measurement or maximum current hold.	character	Value saved to the memory
Total judgment	character	NA
Test start date/time.	YYYY/MM/DD hh:mm:ss	Value saved to the memory
Test end date/time.	YYYY/MM/DD hh:mm:ss	Value saved to the memory

*1.   For tests executed using test conditions that were recalled from the panel memory, the panel memory name is saved as header information.

(Example) The header information saved to memory 1 of the single measurement is as follows: measurement network: A, measurement mode: RMS, measurement range: FIX, maximum current hold, test start date/time: 2006/12/1 10:00:00, and test end date/time: 2006/12/1 10:00:10.

In response to RES:MAN:HEAD? 1
    `Returns "              ",-1,0,A,RMS,FIX,MAX,NA,2006/12/01`
    `10:00:00,2006/12/01 10:00:10.`

RES:MAN:DATA / RES:AUTO:DATA

For TC measurement/PCC measurement (RES:MAN:DATA), the test data information of the specified memory number is returned.

For the program test (RES:AUTO:DATA), the test data information of the specified memory number and step number is returned.

Command   `RESult:MANual:DATA? <PROGRAM_NR1>`
`RESult:AUTO:DATA? <PROGRAM_NR1>,<STEP_NR1>`

Parameter   <PROGRAM_NR1>Memory number
Value   1 to 50

<STEP_NR1>Step number (program test only)
Value   0 to 99

Response   Returns the items below in order from the top in the comma-separated form.

Item	Response form	Response for the TC measurement and PCC measurement
Step number	NR1	-1
Operation mode	character	
Connection destination of the measurement terminal	character	
Polarity	character	
Single fault mode	character	
Test time	NR3	Value saved to the memory
Measured current	NR3[1]	
Judgment for each step	character	
Test start date/time.	YYYY/MM/DD hh:mm:ss	
Test end date/time.	YYYY/MM/DD hh:mm:ss	

*1.   If the maximum current is held, the maximum current is returned. Otherwise, the last current value is returned for a PASS judgment, or the setting (upper reference for U-FAIL, lower reference for L-FAIL, or +9.91E+37 for C-FAIL) is returned for a FAIL judgment.

Deleting the Test Results

RES:MAN:DEL / RES:AUTO:DEL

Deletes the contents of the specified memory number.

Command   **RESult:MANual:DELete <NR1>**
RESult:AUTO:DELete <NR1>

Parameter   Value: 1 to 50   Memory number

RES:MAN:DEL:ALL / RES:AUTO:DEL:ALL

Deletes the contents of all memories (specified test only).

Command   **RESult:MANual:DELete:ALL**
RESult:AUTO:DELete:ALL

3

Command Reference

Setting the Program Test

To set a program, first select the program number using the PROG:NAME command. To execute the test, see " Executing the Test (Trigger Function)"".

PROG:NAME

Selects the program number.

Command   `PROGram:NAME <NR1>`
               `PROGram:NAME?`

Parameter Value: -1   Aborts the program operation (default)
                                     Set to TC Measurement Mode or PCC Measurement Mode.
                         0 to 99   Program number

Response   Returns the selected program number in the <NR1> form.

PROG:TITL

Sets the program name of the selected program.

The program name is 12 characters long. Spaces (0x20) will be automatically inserted if the name is less than 12 characters in length.

Command   `PROGram:TITLe "<string>"`
               `PROGram:TITLe?`

Parameter Value: Enter the program name. Double quotation, single quotation, comma, and "@" cannot be used. (The default name is "--UNTITLED--".)

See Panel Control
Basics on the User's
Manual

Response   Returns the selected program number in the <string> form.

(Example) If "MY TEST1" is set
               Returns `"MY TEST1    "`.

PROG:ADD

Sets the required number of steps for the selected program. The upper limit is 100 steps (500 steps total for all programs). You can query the upper limit that you can specify using PROG:COUN:FREE. The default values for the PROG:STEP:EDIT:LINE and PROG:STEP:EDIT:PAR commands are set in the added steps.

Command   `PROGram:ADD <NR1>`

Parameter Value: 1 to PROG:COUN:FREE?Required number of steps (up to 100 steps)

PROG:COUN

Queries the number of allocated steps of the selected program.

Command `PROGram:COUNt?`

Response Returns the number of allocated steps in the <NR1> form.

PROG:COUN:FREE

Queries the number of empty steps of the selected program.

Command `PROGram:COUNt:FREE?`

Response Returns the number of empty steps in the <NR1> form.

PROG:DEL

Deletes the all the allocated steps of the selected program.

Command `PROGram:DELete`

PROG:MODE

Sets the current measurement mode of the selected program.

Command `PROGram:MODE {RMS│DC│PEAK}`
`PROGram:MODE?`

Parameter Value:
RMS	Rms measurement (default)
DC	DC measurement
PEAK	Peak measurement

Response Returns the current measurement mode in the <character> form.

PROG:RANG:SEL

Sets the measurement range of the selected program.

Command `PROGram:RANGe:SELect {AUTO│FIXed}`
`PROGram:RANGe:SELect?`

Parameter Value:
AUTO   Auto range switching (default)
FIXed   Fixed range

For TC measurement, the range is determined by the upper reference, measurement network, and current measurement mode settings.
For PCC measurement, the range is determined by the upper reference and current measurement mode settings.

Response Returns the measurement range in the <character> form.

PROG:NETW

Sets the measurement network of the selected program.

Command
```
PROGram:NETWork "{A|B|B1|C|D|E|F|G}"
PROGram:NETWork?
```

Parameter Value:

"A"	(For IEC 60990) (1.5 kΩ // 0.22 μF) + 500 Ω (default)	
"B"	(For IEC 60990) (1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + 22 nF)	
"B1"[*1]	(For IEC 60065) (1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + 22 nF)	
"C"	(For IEC 60990)	
	(1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + (20 kΩ + 6.2 nF) // 9.1 nF)	
"D"	1 kΩ	
"E"	1 kΩ // (10 kΩ + 11.225 nF + 579 Ω)	
"F"	1.5 kΩ // 0.15 μF	
"G"	2 kΩ	

*1 Measures voltage U1 between the measurement network reference points.

See Specifications on the User's Manual

Response Returns the measurement network in the <string> form.

SYST:CONF:LBR

Sets whether or not to supply power to the EUT during program test interval time.

Command
```
SYSTem:CONFigure:LBReak {ON|OFF|1|0}
SYSTem:CONFigure:LBReak?
```

Parameter Value:

ON (1)	Does not supply power to the EUT during the interval time (default)
OFF (0)	Supplies power to the EUT during the interval time

Response Returns whether or not power is supplied to the EUT during the interval time. The value is returned in the <NR1> form.

PROG:FAB

Sets whether to continue the test if a FAIL judgment occurs during the program test.

Command
```
PROGram:FABort {ON|OFF|1|0}
PROGram:FABort ?
```

Parameter Value:

ON (1)	Abort the program test if a FAIL judgment occurs
OFF (0)	Continue the program test even if a FAIL judgment occurs (default)

Response Returns whether the program test continues if a FAIL judgment occurs in the <NR1> form.

PROG:STEP:EDIT:LINE

Sets the step of the selected program.

Command `PROGram:STEP:EDIT:LINE <STEP_NR1>,<FUNC_character>,`
`<PROBE_character>,<POL_character>,<COND_character>,`
`<INTERV_numeric>`
`PROGram:STEP:EDIT:LINE? <STEP_NR1>`

Parameter <STEP_NR1>Step to be set

Value:	0 to 99

<FUNC_character>Operation mode

Value:	TC	TC Measurement Mode (default)
	PCC	PCC Measurement Mode

<PROBE_character>Connection destination of the measurement terminal

Value:	ENCPE	Between the enclosure and earth (default)
	ENCENC	Between two enclosures
	ENCLIV	Between the enclosure and power line (live)
	ENCNEU	Between the enclosure and power line (neutral)
	NA	When PCC Measurement Mode is selected

<POL_character>Power line polarity

Value:	NORM	Normal phase connection (default)
	REV	Reverse phase connection
	NA	When the connection destination of the measurement terminal is set to between the enclosure and power line

<COND_character>Single fault mode

Value:	NORM	Normal condition (default)
	FLTNEU	Power line (neutral) disconnected condition
	FLTPE	Earth line disconnected condition (TC Measurement Mode only)
	NA	When the connection destination of the measurement terminal is set to between the enclosure and power line

<INTERV_numeric>Interval time

Value:	1 to 99	If 99 is exceeded, 9.9E37 will be set. The default value is 1.)
	9.9E37	HOLD
Unit:	S	

Response Returns the operation mode, connection destination of the measurement terminal, power line polarity, single fault mode, and interval time in order in the comma-separated <FUNC_character>,<PROBE_character>,<POL_character>,<COND_character>, <INTERV_NR1> form.

PROG:STEP:EDIT:PAR

Sets the step parameters of the selected program.

Command **PROGram:STEP:EDIT:PARameter <STEP_NR1>,<L_FAIL_numeric>,**
<L_FAIL_STAT_bool>,<U_FAIL_numeric>,<U_FAIL_STAT_bool>,
<TIM_numeric>,<TIM_STAT_bool>,<WAIT_numeric>,
<WAIT_STAT_bool>
PROGram:STEP:EDIT:PARameter? <STEP_NR1>

Parameter <STEP_NR1>Step to be set
Value: 0 to 99

Parameter <L_FAIL_numeric>Lower reference

See p. 26

Value: Varies depending on the current measurement mode and the measurement net-
work settings.
(The default value is 30 μ.)

Unit: A

Parameter <L_FAIL_STAT_bool>Lower reference judgment
Value: ON (1)   Enable the judgment
OFF (0)   Disable the judgment (default)

Parameter <U_FAIL_numeric>Upper reference

See p. 27

Value: Varies depending on the current measurement mode and the measurement net-
work settings.
(The default value is 15 m.)

Unit: A

Parameter <U_FAIL_STAT_bool>Upper reference judgment
Value: ON (1)   Enable the judgment (default)
OFF (0)   Disable the judgment

Parameter <TIM_numeric>Test time, <WAIT_numeric>Test wait time
Value: 1 to 999   The default value is 1.)
Unit: S

Parameter <TIM_STAT_bool>Test time on/off
Value: ON (1)   Stop the test after the test time elapses (default)
OFF (0)   Not stop the test

Parameter <WAIT_STAT_bool>Test wait time on/off
Value: ON (1)   Start the test after the test wait time elapses
OFF (0)   Start the test immediately (default)

Response Returns the lower reference, lower reference judgment, upper reference, upper reference
judgment, test time, test time on/off, test wait time, and test wait time on/off in order in the
comma-separated <L_FAIL_NR3>,<L_FAIL_STAT_NR1>,<U_FAIL_NR3>,
<U_FAIL_STAT_NR1>,<TIM_NR1>,<TIM_STAT_NR1>,<WAIT_NR1>,<WAIT_STAT_NR1>
form.

Setting the Meter Mode Measurement

This section explains the meter mode measurement commands.

The commands with "CURR" in the second-level node are for current measurement. The commands with "VOLT" are for voltage measurement.

Setting the Measurement Network (Current Measurement Only)

CURR:NETW

*RST ***RCL**

Sets the measurement network (NTWK).

Command
```
[SENSe:]CURRent:NETWork "{A|B|B1|C|D|E|F|G}"
[SENSe:]CURRent:NETWork?
```

Parameter Value:
"A"	(For IEC 60990) $(1.5\ k\Omega\ //\ 0.22\ \mu F) + 500\ \Omega$ (default)
"B"	(For IEC 60990) $(1.5\ k\Omega\ //\ 0.22\ \mu F) + 500\ \Omega\ //\ (10\ k\Omega + 22\ nF)$
"B1"[*1]	(For IEC 60065) $(1.5\ k\Omega\ //\ 0.22\ \mu F) + 500\ \Omega\ //\ (10\ k\Omega + 22\ nF)$
"C"	(For IEC 60990) $(1.5\ k\Omega\ //\ 0.22\ \mu F) + 500\ \Omega\ //\ (10\ k\Omega + (20\ k\Omega + 6.2\ nF)\ //\ 9.1\ nF)$
"D"	$1\ k\Omega$
"E"	$1\ k\Omega\ //\ (10\ k\Omega + 11.225\ nF + 579\ \Omega)$
"F"	$1.5\ k\Omega\ //\ 0.15\ \mu F$
"G"	$2\ k\Omega$

[See] Specifications on the User's Manual

[*1]   Measures voltage U1 between the measurement network reference points.

Response   Returns the measurement network in the <string> form.

Setting the Measurement Mode

CURR:MODE / VOLT:MODE

*RST ***RCL**

Sets the measurement mode (MODE).

Command
```
[SENSe:]CURRent:MODE {RMS|DC|PEAK}
[SENSe:]CURRent:MODE?
[SENSe:]VOLTage:MODE {RMS|DC|PEAK}
[SENSe:]VOLTage:MODE?
```

Parameter Value:
RMS	Rms measurement (default)
DC	DC measurement
PEAK	Peak measurement

Response   Returns the current measurement mode in the <character> form.

Setting the Measurement Range (Current Measurement Only)

CURR:RANG:SEL

`*RST` `*RCL`

Sets the measurement range (RANGE). The measurement range is determined by the measurement network and current measurement mode settings.

Command
[SOURce:]CURRent:RANGe:SELect {AUTO|LOW|MEDium|HIGH}
[SOURce:]CURRent:RANGe:SELect?

Parameter   Value: AUTO   Auto range switching (default)
                         LOW   Range 1
                         MEDium   Range 2
                         HIGH   Range 3

Response   Returns the measurement range in the <character> form.

■ Measurement range of fixed ranges

Measure-ment range setting	MODE	Measurement range			
		NTWK A, B, B1, C	NTWK D, E	NTWK F	NTWK G
Range 1	DC, RMS	30 µA to 600 µA	30 µA to 300 µA	30 µA to 200 µA	30 µA to 150 µA
	PEAK	50 µA to 850 µA	50 µA to 424 µA	50 µA to 282 µA	50 µA to 212 µA
Range 2	DC, RMS	500 µA to 6.00 mA	250 µA to 3.00 mA	166 µA to 2.00 mA	125 µA to 1.50 mA
	PEAK	700 µA to 8.50 mA	350 µA to 4.24 mA	233 µA to 2.82 mA	175 µA to 2.12 mA
Range 3	DC, RMS	5.00 mA to 30.0 mA	2.50 mA to 30.0 mA	1.66 mA to 20.0 mA	1.25 mA to 15.0 mA
	PEAK	7.00 mA to 90.0 mA	3.50 mA to 45.0 mA	2.33 mA to 30.0 mA	1.75 mA to 22.5 mA

Querying the Settings

CURR / VOLT

Queries the settings.

Command
[SENSe:]CURRent?
[SENSe:]VOLTage?

Response   Returns the measurement mode, measurement network, and measurement range in order in the <string> form in response to CURR? or VOLT?. NA is always returned for the measurement network and measurement range in response to VOLT?.

(Example) If measurement mode: RMS, measurement network: A, and measurement range: AUTO are specified

In response to CURR?
        Returns `"RMS,A,AUTO"`.
In response to VOLT?
        Returns `"RMS,NA,NA"`.

Querying the Measured Value

Queries the measured value. The READ query and MEASure query are the same. Some commands are invalid depending on the operation mode.

Querying the Measured Current Flowing through Measurement Terminals A and B

These queries are valid when the operation mode is current measurement, PCC measurement, TC measurement, and program test. These queries are valid only while the test is in progress for all modes other than current measurement.

READ:CURR:LEAK / MEAS:CURR:LEAK

Queries the measured current flowing through measurement terminals A and B.

Command   `READ[:SCALar]:CURRent:LEAKage?`
              `MEASure[:SCALar]:CURRent:LEAKage?`

Response   Returns the measured current in the NR3 form.
              Unit: A

READ:CURR:LEAK:MAX / MEAS:CURR:LEAK:MAX

Queries the maximum measured current that is being held.

Command   `READ[:SCALar]:CURRent:LEAKage:MAXimum?`
              `MEASure[:SCALar]:CURRent:LEAKage:MAXimum?`

Response   Returns the maximum measured current that is held in the <NR3> form. The same value as READ:CURR:LEAK/MEAS:CURR:LEAK is returned during the test wait time.
              Unit: A

Querying the Measured Voltage between the Measurement Network Reference Points

These queries are valid when the operation mode is set to current measurement (meter mode) and touch current measurement. In touch current measurement, these queries are valid only while a test is in progress.

READ:VOLT:UX / MEAS:VOLT:UX

See Specifications on the User's Manual

Queries the measured voltage between the measurement network reference points.

Command   `READ[:SCALar]:VOLTage:UX?`
              `MEASure[:SCALar]:VOLTage:UX?`

Response   Returns the measured voltage between reference points. The value is returned in the <NR3> form.
              Unit: V

Querying the Measured Voltage between the Measurement Network Reference Points (Cont'd)

READ:VOLT:UX :MAX / MEAS:VOLT:UX :MAX

Queries the maximum measured voltage between reference points that is retained on the TOS3200. To clear the maximum measured voltage between reference points, send the CURR:MAX:CLE command.

Command `READ[:SCALar]:VOLTage:UX:MAXimum?`
`MEASure[:SCALar]:VOLTage:UX:MAXimum?`

Response Returns the maximum measured voltage between reference points that is retained on the TOS3200. The value is returned in the <NR3> form. This query returns the same value as READ:VOLT:UX/MEAS:VOLT:UX during the test wait time.

Unit: V

Querying the Measured Voltage between Measurement Terminals A and B (Voltage Measurement Only)

READ:VOLT:AB / MEAS:VOLT:AB

Queries the measured voltage between measurement terminals A and B.

Command `READ[:SCALar]:VOLTage:AB?`
`MEASure[:SCALar]:VOLTage:AB?`

Response Returns the measured voltage in the <NR3> form.
Unit: V

READ:VOLT:AB:MAX / MEAS:VOLT:AB:MAX

Queries the maximum measured voltage that is being held.

Command `READ[:SCALar]:VOLTage:AB:MAXimum?`
`MEASure[:SCALar]:VOLTage:AB:MAXimum?`

Response Returns the maximum measured voltage that is held in the <NR3> form.
Unit: V

Clearing the Maximum Measured Value

CURR:MAX:CLE

Clears the maximum measured voltage between the reference points and the maximum measured current that are held. These values are also cleared if you send the *RST or *RCL command.

Command `[SENSe:]CURRent:MAXimum:CLEar`

VOLT:MAX:CLE

Clears the maximum measured voltage between A and B that is held. This value is also cleared if you send the *RST or *RCL command.

Command `[SENSe:]VOLTage:MAXimum:CLEar`

Voltage, current, and power of the EUT

These queries are valid in all operation modes. If the test is not in progress, make the query after sending the OUTP:LINE ON command.

READ:CURR:LINE / MEAS:CURR:LINE

Queries the current of the EUT.

Command `READ[:SCALar]:CURRent:LINE?`
`MEASure[:SCALar]:CURRent:LINE?`

Response Returns the current of the EUT in the <NR3> form.
Unit: A

READ:VOLT:LINE / MEAS:VOLT:LINE

Queries the voltage of the EUT.

Command `READ[:SCALar]:VOLTage:LINE?`
`MEASure[:SCALar]:VOLTage:LINE?`

Response Returns the voltage of the EUT in the <NR3> form.
Unit: V

READ:POW:LINE / MEAS:POW:LINE

Queries the power of the EUT.

Command `READ[:SCALar]:POWer:LINE?`
`MEASure[:SCALar]:POWer:LINE?`

Response Returns the power of the EUT in the <NR3> form.
Unit: W

3

Command Reference

Various Settings

Holding the Maximum Measured Current

SYST:CONF:MMOD

Sets whether to hold the maximum measured current (MEAS MODE).

Command `SYSTem:CONFigure:MMODe {NORMal|MAXimum}`
`SYSTem:CONFigure:MMODe?`

Parameter Value: NORMal Not hold (normal measurement) (default)
MAXimum Hold

Response Returns whether the maximum value is held in the <character> form.

Pass Judgment Hold Time

SYST:CONF:PHOL

Sets the time to hold the PASS judgment (PASS HOLD).

Command `SYSTem:CONFigure:PHOLd {<numeric>|MIN|MAX}`
`SYSTem:CONFigure:PHOLd? {MIN|MAX}`

Parameter Value: 0.2 to 10.0 If 10.0 is exceeded, 9.9E37 will be set.
(The default value is 2.)
9.9E37 HOLD
Unit: S

Response Returns the time the PASS judgment is held in the <NR3> form.

Converting Measured Current Based on the Specified Line Voltage

SYST:CONF:CONV

Sets the supply voltage used to convert to current (CONV).

Command `SYSTem:CONFigure:CONVersion {<numeric>|MIN|MAX}`
`SYSTem:CONFigure:CONVersion? {MIN|MAX}`

Parameter Value: 0 Not convert the current (default)
80.0 to 300.0
Unit: V

Response Returns the supply voltage in the <NR3> form.

Setting the Safety Extra Low Voltage (SELV)

SYST:CONF:SELV

Sets the safety extra low voltage (SELV).

Command   `SYSTem:CONFigure:SELV {<numeric>|MIN|MAX}`
               `SYSTem:CONFigure:SELV? {MIN|MAX}`

Parameter   Value: 0   Disable the SELV function (default)
                         10 to 99
             Unit: V

Response

Response   Returns the safety extra low voltage in the <NR3> form.

Setting the Buzzer Volume

SYST:BEEP:VOL:PASS

Sets the volume of the buzzer that sounds when the judgment is PASS.

Command   `SYSTem:BEEPer:VOLume:PASS {<numeric>|MIN|MAX}`
               `SYSTem:BEEPer:VOLume:PASS? {MIN|MAX}`

Parameter   Value: 0 to 10 (default: 3)

Response   Returns the buzzer volume for PASS judgments in the <NR3> form.

SYST:BEEP:VOL:FAIL

Sets the volume of the buzzer that sounds when the judgment is FAIL.

Command   `SYSTem:BEEPer:VOLume:FAIL {<numeric>|MIN|MAX}`
               `SYSTem:BEEPer:VOLume:FAIL? {MIN|MAX}`

Parameter   Value: 0 to 10 (default: 3)

Response   Returns the buzzer volume for FAIL judgments in the <NR3> form.

Setting the Screen Brightness

DISP:CONT

Sets the screen brightness.

Command   `DISPlay:CONTrast {<numeric>|MIN|MAX}`
`DISPlay:CONTrast? {MIN|MAX}`

Parameter   Value: 0 to 10 (default: 5)

Response   Returns the screen brightness in the <NR3> form.

Setting the Time

SYST:DATE

Sets the date.

Command   `SYSTem:DATE <YEAR_NR1>,<MONTH_NR1>,<DAY_NR1>`
`SYSTem:DATE?`

Parameter   `<YEAR_NR1>` Year
Value: 2000 to 2099

`<MONTH_NR1>` Month
Value: 1 to 12

`<DAY_NR1>` Day
Value: 1 to 31

Response   Returns the year, month, and day in order in the <NR1>,<NR1>,<NR1> form.

SYST:TIME

Sets the time.

Command   `SYSTem:TIME <HOUR_NR1>,<MIN_NR1>,<SEC_NR1>`
`SYSTem:TIME?`

Parameter   `<HOUR_NR1>` Hour
Value: 0 to 23

`<MIN_NR1>` Minute, `<SEC_NR1>`Second
Value: 0 to 59

Response   Returns the hour, minute, and second in order in the <NR1>,<NR1>,<NR1> form.

Turning the Power Line to the EUT On/Off

OUTP:LINE

Turns the power line to the EUT on/off. You will not be able to start the test if the power line is on.

Command   `OUTPut:LINE[:STATe] {ON|OFF|1|0}`
`OUTPut:LINE[:STATe]?`

Parameter   Value: ON (1)   Power line on
OFF (0)   Power line off (default)

Response   Returns the power line on/off setting in the <NR1> form.

Showing/Hiding Communication Errors

SYST:CONF:TRAC

Shows or hides the communication error numbers.

Command   `SYSTem:CONFigure:TRACe {ON|OFF|1|0}`
`SYSTem:CONFigure:TRACe?`

Parameter   Value: ON (1)   Communication error trace function on
OFF (0)   Communication error trace function off (default)

Response   Returns the on/off setting of the communication error trace function in the <NR1> form.

Releasing the Protection Status

SYST:PROT:CLE

Releases the protection status.

Command   `SYSTem:PROTection:CLEar`

Other Settings

••

SYST:ERR

Queries the oldest error information or event information from the error queue. The error queue can store up to 255 errors.

The error queue is cleared completely 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) If there is no error or event

Returns `0, "No error".`

(Example) If a command that cannot be executed in the present operating condition is received

Returns `-221, "Settings conflict".`

If multiple errors are present, errors are returned in order from the oldest error. The returned errors are cleared.

SYST:KLOC

Sets or releases the panel operation lock.

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

Parameter   Value: ON (1)   Lock the panel operation
OFF (0)   Release the panel operation lock (default)

Response   Returns the panel operation lock setting in the NR1 form.

SYST:LOC (RS232C and USB only)

Sets the TOS3200 operation to local mode (panel operation). This is a substitute command for the IEEE488.1 REN message (Remote Disable).
SYST:REM or SYST:RWL is used to return to remote mode.

Command   `SYSTem:LOCal`

SYST:OPT

Queries the option (HP21-TOS only) that is installed in the TOS3200. The operation is the same as *OPT?.

Command   `SYSTem:OPTion?`

Response   If the HP21-TOS is installed, "HP21-TOS" is returned. Returns 0 if the option is not installed.

SYST:REM (RS232C and USB only)

Sets the TOS3200 operation to remote mode. All panel keys except the LOCAL key and STOP switch are locked. This is a substitute command for the IEEE488.1 REN message (Remote Enable) and address designation.

SYST:LOC is used to return to local mode.

Command `SYSTem:REMote`

SYST:RWL (RS232C and USB only)

Sets the TOS3200 operation to remote mode. All panel keys except the STOP switch are locked (LOCAL key is also locked). This is a substitute command for the IEEE488.1 llo message (Local Lock Out).

SYST:LOC is used to return to local mode.

Command `SYSTem:RWLock`

SYST:VERS

Queries the version of the SCPI specifications to which the TOS3200 conforms.

Command `SYSTem:VERSion?`

Response Always returns 1999.0 in response to SYST:VERS?.

Status Register and Status Report Function

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

In each SCPI status register, there are sub registers, CONDition register, EVENt register, ENABle register, PTRansition filter, and NTRansition filter.

Fig. 3-2 shows the SCPI status register structure. The character "+" represents the the logical OR of the register bits.

CONDition register

The CONDition register transits automatically and reflects the condition of the TOS3200 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

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

Use the 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 will be disabled.

1999 SCPI Syntax & Style
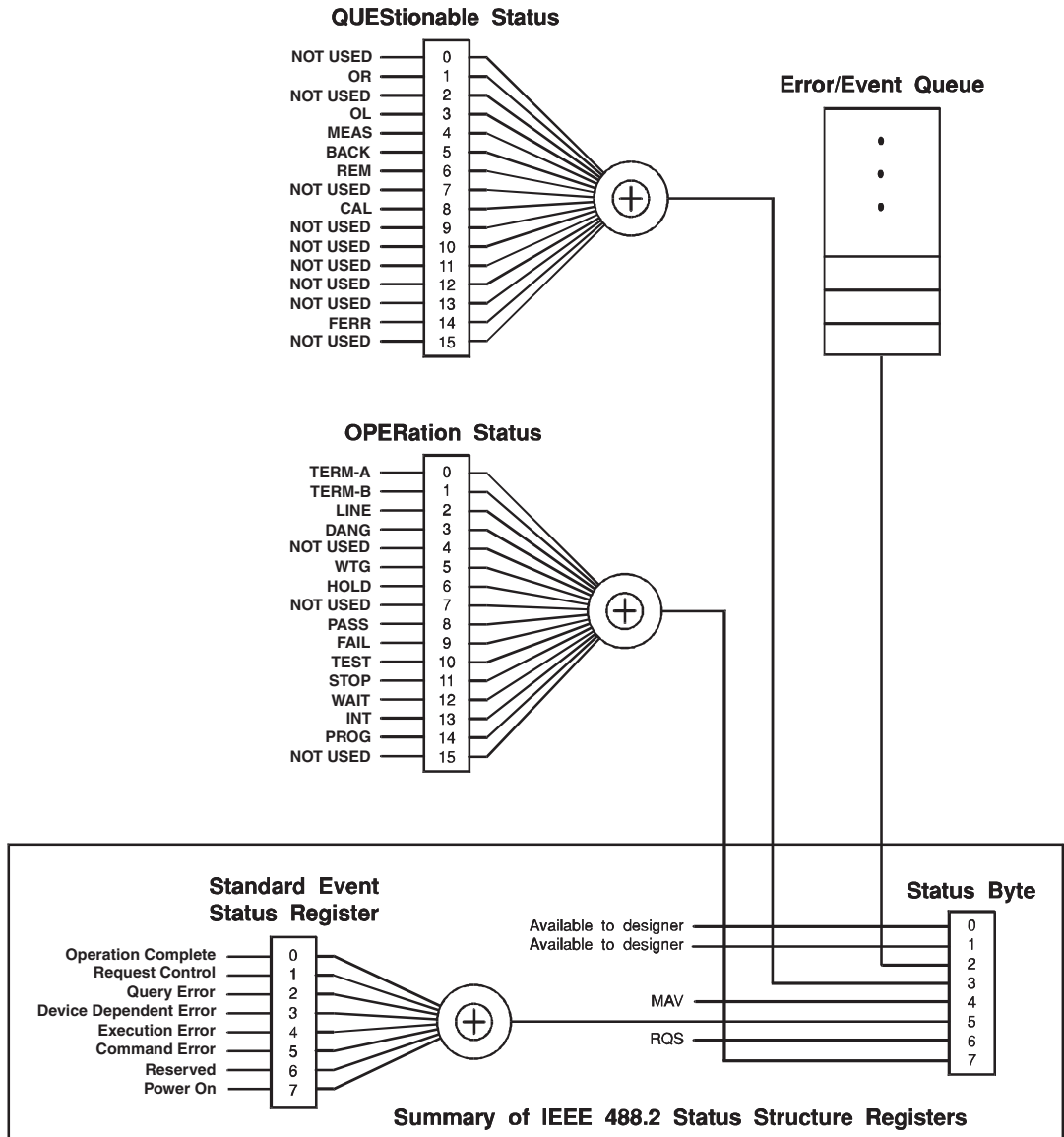
Partially changed SCPI Standard 1999.0 Volume1 fig.9-1.

Fig. 3-2   Status register

IEEE488.2 Register Model

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 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	Decimal value	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 will be 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 TOS3200 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	—

Event Status Register

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

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

Bit	Decimal value	Bit name	Description
0	1	Operation Complete (OPC)	Set when an *OPC command is received and all operations in standby are complete.
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.
3	8	Device Dependent Error (DDE)	Set when there is a device-specific error.
4	16	Execution Error (EXE)	Set when the TOS3200 evaluates the program data following the header is outside the formal input range or does not match the performance of the TOS3200. This indicates that a valid SCPI command may not be executed correctly depending on the conditions of the TOS3200.
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.
6	64	User Request (URQ)	Not used.
7	128	Power ON (PON)	Set when the power is turned on.
8-15	—	Reserved	—

3

Command Reference

SCPI Register Model

OPERation Status Register

The OPERation status register is a 16-bit register which contains information about conditions which are part of the TOS3200 normal operation.

Bit	Decimal value	Bit name	Description
0	1	Terminal [A] is active	Terminal A is active.
1	2	Terminal [B] is active	Terminal B is active.
2	4	EUT LINE is active	The power line of the EUT is active.
3	8	DANGer (AB voltage is exceeding SELV voltage)	The voltage between terminals A and B exceeds the SELV voltage while the test is in progress.
4	16	NOT USED	–
5	32	Waiting for TRIGger	The TOS3200 is waiting for a trigger.
6	64	Test is under HOLD state	Hold state
7	128	NOT USED	–
8	256	Test PASSed	Pass judgment
9	512	Test FAILed	Fail judgment
10	1024	TEST running	Test in progress
11	2048	STOP key is being pressed	The STOP switch is pressed.
12	4096	Test is under WAIT state	Test wait time status
13	8192	Test is under INTerval state	Interval state
14	16384	Auto PROGram test running	Program test is in progress.
15	32768	NOT USED	–

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 the <NR1> form.

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 the <NR1> form.

STAT:OPER:ENAB

Sets the enable register of the OPERation status register.

Command   **STATus:OPERation:ENABle <NRf>**
STATus:OPERation:ENABle?

Parameter   Value: 0 to 32767

Response   Returns the enable register of the OPERation status register in the <NR1> form.

STAT:OPER:PTR

Sets the positive transition of the OPERation status register.

Command   **STATus:OPERation:PTRansition <NRf>**
STATus:OPERation:PTRansition?

Parameter   Value: 0 to 32767

Response   Returns the positive transition of the OPERation status register in the <NR1> form.

STAT:OPER:NTR

Sets the negative transition of the OPERation status register.

Command   **STATus:OPERation:NTRansition <NRf>**
STATus:OPERation:NTRansition?

Parameter   Value: 0 to 32767

Response   Returns the negative transition of the OPERation status register in the <NR1> form.

3

Command Reference

QUEStionable Status Register

The QUEStionable status register is a 16-bit register that stores information related to the questionable events and status during TOS3200 operation.

These register bits may indicate problems with the measured data of the TOS3200.

Bit	Decimal value	Bit name	Description
0	1	NOT USED	–
1	2	Over Range	Measurement range exceeded
2	4	NOT USED	–
3	8	Overload	Overload protection
4	16	MEASure check failed	Measurement check error
5	32	BACKup data broken	Backup data error
6	64	REMote	Change in the enable signal
7	128	NOT USED	–
8	256	CALibration out-of-date	Calibration date expired
9	512	NOT USED	–
10	1024	NOT USED	–
11	2048	NOT USED	–
12	4096	NOT USED	–
13	8192	NOT USED	–
14	16384	Fatal ERRor	Send the *TST command to check[1]
15	32768	NOT USED	–

*1. If the response to the *TST command is not zero, use the SYST:ERR command to check the error details.

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 the <NR1> form.

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 the <NR1> form.

STAT:QUES:ENAB

Sets the enable register of the QUEStionable status register.

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

Parameter   Value: 0 to 32767

Response   Returns the enable register of the QUEStionable status register in the <NR1> form.

STAT:QUES:PTR

Sets the positive transition of the QUEStionable status register.

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

Parameter   Value: 0 to 32767

Response   Returns the positive transition of the QUEStionable status register in the <NR1> form.

STAT:QUES:NTR

Sets the negative transition of the QUEStionable status register.

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

Parameter   Value: 0 to 32767

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

Preset Status

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`

Tutorial

TC Measurement/PCC Measurement (MANUAL TEST)

Explanation is given using a TC measurement as an example. All commands are common with the PCC measurement except the setup commands.

First, set the TC measurement. The root node, [:SOUR], can be omitted. For a PCC measurement, replace "TC" of the second node to "PCC".

```
FUNC "TC"
TC:PROB ENCPE;POL NORM;COND FLTNEU
TC:LIM:LOW:LEV 30UA;STAT 1
TC:LIM:UPP:LEV 30M;STAT 1
TC:TIM:TIME 1;STAT 1
TC:WAIT:TIME 1;STAT 1
TC:NETW "A";MODE RMS
TC:RANG:SEL AUTO
```

The specified settings can be queried collectively.
```
TC?
```

To save the maximum measured current when saving test results
```
SYST:CONF:MMOD MAX
```

After you specify the settings, start the test (when performing the test without using the trigger).

You cannot start the test while the memory is being recalled/saved, when the power line of the EUT is on, when the TOS3200 is in the protection status, and when PASS/FAIL judgment is in progress.
```
TRIG:SOUR IMM
INIT
```

When you send INIT, the test starts. While the test is in progress, you can query the measured current, measured voltage between the reference points (only for touch current measurement), EUT current, EUT voltage, EUT power, and the test execution status.
```
MEAS:CURR:LEAK?
MEAS:CURR:LEAK:MAX?
MEAS:VOLT:UX?
MEAS:VOLT:UX:MAX?
MEAS:CURR:LINE?
MEAS:VOLT:LINE?
MEAS:POW:LINE?
TC:EXEC?
```

To switch the display during a test to expanded numeric display mode.
```
DISP:SIZE
```

To display the measured voltage between the reference points in the expanded numeric display (only for touch current measurement)
```
DISP:UXV
```

The test stops after the test time elapses, when U-FAIL judgment occurs, or when you press the STOP switch. After the test stops, query the test result.
```
RES?
```

You can save the test result.
```
RES:MAN:SAVE 1
```

Query the saved result.
RES:MAN:HEAD? 1
RES:MAN:DATA? 1

Program Test (AUTO TEST)

Set the program number and program name. If you set the program number, the operation mode will switch automatically to AUTO.
PROG:NAME 1;TITL "MY TEST1"

The current measurement mode, measurement range, measurement network, and whether to continue the test if a FAIL judgment occurs during the program test are common to the program. They cannot be set separately for each step.
PROG:MODE RMS;NETW "B";FAB 0
PROG:RANG:SEL AUTO

Set the required number of steps to the program. If a step is added, it is added to the last specified step. Default values are set to the step. The default settings are different between the MANUAL TEST and AUTO TEST.
PROG:ADD 2

You can perform various tasks such as check the number of steps or the number of steps that you can set and delete all the steps. You cannot insert a step between two steps that are already set or delete a specific step.
PROG:COUN?
PROG:COUN:FREE?
PROG:DEL

The PROG:STEP:EDIT:LINE and PROG:STEP:EDIT:PAR commands are available for setting the steps. PROG:STEP:EDIT:LINE is used to set the operation mode of the step, connection destination of the measurement terminal, power line polarity, single fault mode, and interval time.
PROG:STEP:EDIT:LINE 0,TC,ENCPE,NORM,NORM,100
PROG:STEP:EDIT:LINE 1,PCC,NA,NORM,NORM,1

Because the interval time range is 1 to 99, the interval time of step 1 is set to HOLD (+9.9E+37).
PROG:STEP:EDIT:PAR is used to set the lower reference, lower reference judgment on/off, upper reference, upper reference judgment on/off, test time, test time on/off, test wait time, and test wait time on/off.
PROG:STEP:EDIT:PAR 0,35UA,1,0.5MA,1,1S,1,1S,0
PROG:STEP:EDIT:PAR 1,40UA,0,1MA,1,1S,1,1S,0

To set the test result current to the maximum measured current
SYST:CONF:MMOD MAX

To shut off the power supply to the EUT during the interval time
SYST:CONF:LBR ON

After you specify the settings, start the test (when performing the test without using the trigger).
You cannot start the test while the memory is being recalled/saved, when the power line of the EUT is on, when the TOS3200 is in the protection status, and when PASS/FAIL judgment is in progress.
TRIG:SOUR IMM
INIT

When you send INIT, the test starts. While the test is in progress, you can query the measured current, EUT current, EUT voltage, EUT power, and the test execution status.

```
MEAS:CURR:LEAK?
MEAS:CURR:LEAK:MAX?
MEAS:CURR:LINE?
MEAS:VOLT:LINE?
MEAS:POW:LINE?
PROG:EXEC?
```

In step 1, the interval time is set to HOLD. If you send the following command during the hold status or while waiting for the interval time to elapse, the program will proceed to the next step.
TRIG:HREL

The test stops after all the steps are completed (PASS), when a FAIL judgment occurs, or when you press the STOP switch. After the test stops, query the test result (total judgment).
RES?

You can save the test result.
RES:AUTO:SAVE 1

Query the saved result.
```
RES:AUTO:HEAD? 1
RES:AUTO:DATA? 1,0
RES:AUTO:DATA? 1,1
```

Meter Mode Measurement

For a current measurement, query the measured value using the MEAS/READ command after setup.
```
FUNC "CURR"
CURR:NETW "A";MODE RMS
CURR:RANG:SEL AUTO
MEAS:CURR:LEAK?
MEAS:CURR:LEAK:MAX?
```

For a voltage measurement, query the measured value using the MEAS/READ command after setup.
```
FUNC "VOLT"
VOLT:MODE RMS
MEAS:VOLT:AB?
MEAS:VOLT:AB:MAX?
```

Appendix

A List of Messages

SCPI command: Command name in the short form.
Affected: Yes for commands that are affected by *RST and *RCL.
R/W: Query command (R)/set command (W).
*: 1, 2, and 3 indicate SCPI standard command, command in review, and KIKUSUI original command, respectively.

PROGram subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit						
PROG									3
:ADD	NR1	1 to 100[*1]					Sets the step count.	W	3
:COUN					NR1		Queries the number of steps that has been secured.	R	3
:FREE					NR1		Queries the number of steps that can be set.	R	3
:MODE	char	RMS | DC | PEAK		RMS	char		Sets the current measurement mode of the selected program.	R/W	3
:RANG:SEL	char	AUTO | FIX		AUTO	char		Sets the measurement range of the selected program.	R/W	3
:DEL							Deletes all the secured steps.	W	3
:EXEC					char		Queries the execution status of the test.	R	3
					NR3		Queries the elapsed time.		
					NR3		Queries the remaining time.		
					NR1		Queries the program number.		
					NR1		Queries the step number.		
:FAB	bool			OFF	NR1		Whether to continue the test after a failure judgment.	R/W	3
:NAME	NR1	-1 to 99		-1	NR1		Selects the program number.	R/W	3
:NETW	string	A | B | B 1|C | D | E | F |G		A	string		Sets the measurement circuit of the selected program.	R/W	3
:STEP:EDIT									
:LINE	NR1	0 to 99					Specifies the step number to be set.	W	3
	char	TC | PCC		TC	char		Sets the operation mode.[*2]		
	char	ENCPE | ENCENC | ENCLIV | ENCNEU | NA		ENCPE	char		Sets the measurement terminal destination.[*2]		
	char	NORM | REV | NA		NORM	char		Sets the power line polarity.[*2]		
	char	NORM | FLTNEU | FLTPE | NA		NORM	char		Sets the single fault mode.[*2]		
	numeric	1 to 99, 9.9E37	S	1	NR1		Sets the interval.[*2] 9.9E37 is hold.		
:PAR	NR1	0 to 99					Specifies the step number to be set.	W	3
	numeric	*3	A	30 μ	NR3		Sets the lower reference.[*4]		
	bool			OFF	NR1		Turns on/off the lower reference judgment.[*4]		
	numeric	*3	A	15 m	NR3		Sets the upper reference.[*4]		
	bool			ON	NR1		Turns on/off the upper reference judgment.[*4]		
	numeric	1 to 999	S	1	NR1		Sets the test time.[*4]		
	bool			ON	NR1		Turns on/off the test time.[*4]		
	numeric	1 to 999	S	1	NR1		Sets the test wait time.[*4]		
	bool			OFF	NR1		Turns on/off the test wait time.[*4]		
:TITL	string	12 characters		--UNTITLED--	string		Sets the program name.	R/W	3

*1. The total number of steps of all programs is 500.
*2. Sets the step details of the selected program.
*3. Varies depending on the current measurement mode and the measurement network settings.
*4. Sets the step parameters of the selected program.

READ / MEASure subsystem

SCPI Command		Setting		Defa ult	Resp onse	Affec ted	Description	R/W	*
Program header	Parameter		Unit						
READ[:SCAL]	MEAS[:SCAL]									
:CURR									
:LEAK					NR3		Queries the measured current.	R	3
:MAX					NR3		Queries the maximum measured current.	R	3
:LINE					NR3		Query the EUT current.	R	3
:VOLT									
:AB					NR3		Queries the measured voltage.	R	3
:MAX					NR3		Queries the maximum measured voltage.	R	3
:LINE					NR3		Query the EUT voltage.	R	3
:UX					NR3		Query the measured voltage between the measurement network reference points.	R	3
:MAX					NR3		Queries the maximum measured voltage between the reference points.	R	3
:POW:LINE					NR3		Query the EUT power.	R	3

RESult subsystem

SCPI Command		Setting		Defa ult	Resp onse	Affec ted	Description	R/W	*
Program header	Parameter		Unit						
RES									
[:IMM]					char		Queries the judgment result of the test.	R	3
					NR3		Queries the measured current.		3
:MAN	:AUTO [1]								
:HEAD	NR1	1 to 50					Specifies the memory number.	R	3
					string		Memory name or program name[2]		
					NR1		Program number.[2]		
					NR1		Total number of steps.[2]		
					char		Measurement network.[2]		
					char		Measurement mode.[2]		
					char		Measurement range.[2]		
					char		Normal current measurement or maximum current hold.[2]		
					char		Program judgment.[2]		
					[3]		Test start date/time.[2]		
					[3]		Test end date/time.[2]		
:DATA	NR1	1 to 50					Specifies the memory number.	R	3
	NR1[4]	0 to 99					Specifies the step number.		
					NR1		Step number.[5]		
					char		Measurement mode.[5]		
					char		Connection destination of the measurement terminal.[5]		
					char		Polarity.[5]		
					char		Single fault mode.[5]		
					NR3		Test time.[5]		
					NR3		Measured current.[5]		
					char		Judgment (step).[5]		
					[3]		Test start date/time.[5]		
					[3]		Test end date/time.[5]		
:DEL	NR1	1 to 50					Deletes the contents of the specified memory number.	W	3
:ALL							Deletes all memory contents.	W	3
:SAVE	NR1	1 to 50					Saves the test result to the specified memory number.	W	3

*1. Specify MAN to save and query the manual test. Specify AUTO to save and query that auto test.
*2. Queries the header information of the specified memory number.
*3. Response format: YYYY/MM/DD hh:mm:ss
*4. AUTO only.
*5. Queries the test data information of the specified memory number and step (auto test only).

[SENSe] subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit						
[SENS:]									
CURR					string		Queries the current setting.	R	1
:MAX:CLE							Clears the maximum measured current.	W	3
:MODE	char	RMS | DC | PEAK		RMS	char	Yes	Set the current measurement mode.	R/W	3
:NETW	string	A | B | B 1|C | D | E | F | G			string	Yes	Sets the measurement network.	R/W	3
:RANG:SEL	char	AUTO | LOW | MED | HIGH		AUTO	char		Sets the measurement range.	R/W	3
VOLT					string		Queries the voltage setting.	R	1
:MAX:CLE							Clears the maximum measured voltage.	W	3
:MODE	char	RMS | DC | PEAK		RMS	char	Yes	Set the voltage measurement mode.	R/W	3
FUNC[:ON]	string	CURR | PCC | TC | VOLT | AUTO		TC	string	Yes	Sets the operation mode.	R/W	1
TC | PCC*1					string		Queries the setting.	R	3
:COND	char	NORM | FLTNEU | FLTPE*2		NORM	char	Yes	Sets the single fault mode.	R/W	3
:EXEC					char		Queries the execution status of the test.	R	3
					NR3		Queries the elapsed time.		
					NR3		Queries the remaining time.		
					NR1		Queries the program number.		
					NR1		Queries the step number.		
:LIM									
:LOW									
[:LEV]	numeric	*3	A	30 μ	NR3	Yes	Sets the lower reference.	R/W	3
:STATE	bool			OFF	NR1	Yes	Turns on/off the lower reference judgment.	R/W	3
:UPP									
[:LEV]	numeric	*3	A	30 m	NR3	Yes	Sets the upper reference.	R/W	3
:STAT	bool			ON	NR1	Yes	Turns on/off the upper reference judgment.	R/W	3
:MODE	char	RMS | DC | PEAK		RMS	char	Yes	Set the current measurement mode.	R/W	3
:NETW (TC only)	string	A | B | B 1|C | D | E | F | G		A	string	Yes	Sets the measurement network.	R/W	3
:POL	char	NORM | REV		NORM	char	Yes	Sets the power line polarity.	R/W	3
:PROB (TC only)	char	ENCPE | ENCENC | ENCLIV | ENCNEU		ENCPE	char	Yes	Sets the connection destination of measurement terminals A and B.	R/W	3
:RANG:SEL	char	AUTO | FIX		AUTO	char		Sets the measurement range.	R/W	3
:TIM									
[:TIME]	numeric	1 to 999	S	10	NR3	Yes	Sets the test time.	R/W	3
:STAT	bool			OFF	NR1	Yes	Turns on/off the test time.	R/W	3
:WAIT									
[:TIME]	numeric	1 to 999	S	1	NR3	Yes	Sets the test wait time.	R/W	3
:STAT	bool			OFF	NR1	Yes	Turns on/off the test wait time.	R/W	3

*1. Specify TC for touch current measurement and PCC for PCC measurement.
*2. FLTPE available only for TC.
*3. Varies depending on the current measurement mode and the measurement network settings.

STATus subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit						
STAT									
:OPER									
[:EVEN]					NR1		Queries the event register.[*1]	R	1
:COND					NR1		Queries the register status.[*1]	R	1
:ENAB	NRf	0 to 32767			NR1		Enable.[*1]	R/W	1
:NTR	NRf	0 to 32767			NR1		Negative transition.[*1]	R/W	1
:PTR	NRf	0 to 32767			NR1		Positive transition.[*1]	R/W	1
:PRES							Initializes the filter register.	W	1
:QUES									
[:EVEN]					NR1		Queries the event register.[*2]	R	1
:COND					NR1		Queries the register status.[*2]	R	1
:ENAB	NRf	0 to 32767			NR1		Enable.[*2]	R/W	1
:NTR	NRf	0 to 32767			NR1		Positive transition.[*2]	R/W	1
:PTR	NRf	0 to 32767			NR1		Negative transition.[*2]	R/W	1

*1.   OPERation status register.
*2.   QUEStionable status register.

Appx

SYSTem subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit						
SYST									
:BEEP:VOL									
:FAIL	numeric	0 to 10		3	NR3		Sets the volume of the buzzer that sounds when the judgment is FAIL.	R/W	3
:PASS	numeric	0 to 10		3	NR3		Sets the volume of the buzzer that sounds when the judgment is PASS.	R/W	3
:CONF									
:CONV	numeric	0, 80.0 to 300.0	V	0	NR3		Sets the supply voltage used to convert to current. Specify zero when not converting to current.	R/W	3
:LBR	bool			ON	NR1		Sets whether or not to shut off the power supply to the EUT during the interval time.	R/W	3
:MMOD	char	NORM | MAX		NORM	char	Yes	Sets whether to hold the maximum measured current.	R/W	3
:PHOL	numeric	0.2 to 10.0, 9.9E37	S	2	NR3		Sets the time to hold the PASS setting. 9.9E37 is hold.	R/W	3
:SELV	numeric	0, 10 to 99	V	0	NR3		Sets the safety extra low voltage (SELV). Specify zero to turn the SELV function off.	R/W	3
:TRAC	bool			OFF	NR1		Turns on/off the communication error trace function.	R/W	3
:DATE	NR1	2002 to 2099			NR1		Sets the year.	R/W	1
	NR1	1 to 12			NR1		Sets the month.		
	NR1	1 to 31			NR1		Sets the day.		
:ERR[:NEXT]							Queries the error and event information.	R	1
:KLOCK	bool			OFF	NR1		Turns on/off the panel operation lock.	R/W	1
:LOC							Sets to local mode (RS232C and USB only).	W	2
:OPT					char		Queries the options.	R	3
:PROT:CLE							Releases the protection status.	W	
:REM							Enables remote mode and locks all key and switches besides the LOCAL key and STOP switch (RS232C and USB only).	W	2
:RWL							Enables remote mode and locks all key and switches besides STOP switch (RS232C and USB only).	W	2
:TIME	NR1	0 to 23			NR1		Sets the hour.	R/W	1
	NR1	0 to 59			NR1		Sets the minute.		
	NR1	0 to 59			NR1		Sets the second.		
:VERS					1999.0		Queries the SCPI specification version with which the TOS3200 complies.	R	1

TRIGger subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit						
ABOR							Aborts the test.	W	1
INIT[:IMM]									
[:SEQ[1]]							Starts the test (trigger function).	W	1
:NAME	char	TEST						W	1

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit		se	ted			
TRIG									
[:SEQ[1]] | [:TEST]1									
:SOUR	char	IMM | BUS		IMM	char	Yes	Sets the trigger source.	R/W	1
:HREL							Releases the in-progress status of the interval time.	W	3

Other subsystem

SCPI Command		Setting		Default	Response	Affected	Description	R/W	*
Program header	Parameter		Unit		se	ted			
DISP									
:CONT	numeric	0 to 10		5	NR3		Sets the screen brightness.	R/W	1
:SIZE	char	NORM | ENL		NORM	char		Switches the test-in-progress display.	R/W	3
:UXV	bool			OFF	NR1		Sets whether or not to display the voltage in expanded numeric display mode.	R/W	3
MEM									
:RCL	NR1	0 to 99					Recalls the panel memory.	W	3
:SAV	NR1	0 to 99					Saves to the panel memory.	W	3
:TITLE	NR1	0 to 99					Sets the panel memory number.	R/W	3
	string	12 characters					Sets the memory name.		
OUTP									
:LINE[:STATe]	bool			OFF	NR1	Yes	Turns on/off the EUT power line.	R/W	3

IEEE488.2 common commands

IEEE488.2 common command	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 device to generate the operation complete message in the event status register when all pending selected device operations have been finished.	R/W
*OPT		Queries the installed options.	R
*RCL	NR1	Recalls the contents saved to the memory.	W
*RST		Performs a device reset. Configures the device to a known condition independent from the usage history of the device.	W
*SAV	NR1	Saves the present settings to the memory.	W
*SRE	NR1	Sets the service request enable register.	R/W
*STB		Queries the contents of the status byte register and the master summary status message.	R
*TRG		Trigger command.	W
*TST		Executes a self-test.	R
*WAI		Prevents the device from executing subsequent commands or queries until all operations in standby are complete.	W

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B 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 (bit 5) in the event status register to be set.

Error code		Error message description
-100	Command error	Command error. A generic syntax error.
-101	Invalid character	Invalid character is present. A data element different from those that are allowed was encountered.
-102	Syntax error	Syntax error. An unrecognized syntax was encountered in the command string.
-103	Invalid separator	An invalid separator exists in the command string.
-104	Data type error	The parser recognized a data element different than one allowed.
-105	GET not allowed	A Group Execute Trigger was received within a program message.
-108	Parameter not allowed	More parameters were received than expected for the header.
-109	Missing parameter	Fewer parameters were received than required for the header.
-110	Command header error	An error was detected in the header.
-120	Numeric data error	Generated when parsing a data element which appears to be numeric, including the nondecimal numeric types.
-130	Suffix error	Generated when parsing a suffix.
-131	Invalid suffix	The suffix does not follow the syntax, or the suffix is inappropriate for the TOS3200.
-134	Suffix too long	The suffix of the numeric element is too long.
-138	Suffix not allowed	A suffix was encountered after a numeric element which does not allow suffixes.
-140	Character data error	Generated when parsing a character data element.
-141	Invalid character data	–
-144	Character data too Long	Characters in the character data element are too long.
-148	Character data not allowed	–
-150	String data error	Generated when parsing a string data element.
-160	Block data error	Generated when parsing a block data element.
-170	Expression error	Generated when parsing an expression data element.
-180	Macro error	–

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 (bit 4) in the event status register to be set.

Error code		Error message description
-200	Execution error (generic)	A generic error for the TOS3200.
-203	Command protected	Password protected program or query command cannot be executed.
-210	Trigger error	–
-211	Trigger ignored	A trigger was received but discarded.
-213	Init ignored	Measurement initiate operation was ignored because measurement is in progress.
-214	Trigger deadlock	Dead lock occurred because a query was received before the software trigger.
-220	Parameter error	Invalid parameter.
-221	Settings conflict	Received a command that cannot be executed in the present condition of the TOS3200.
-222	Data out of range	Parameter out of range.
-223	Too much data	Too many parameters.
-224	Illegal parameter value	Received an invalid parameter data.
-230	Data corrupt or stale	Received a data query before the measurement was completed.
-241	Hardware missing	Cannot be executed because the optional hardware is not installed.

Device-specific errors

Error code		Error message description
-330	Self-test failed	–
-360	Communication error	–
-361	Parity error in program message	The parity bit is not correct.
-362	Framing error in program message	The stop bit cannot be detected.
-363	Input buffer overrun	–
-365	Time out error	–

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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 (bit 2) in the event status register to be set.

Error code		Error message description
-400	Query error (generic)	A generic error for the TOS3200.
-410	Query INTERRUPTED	Received a new command before the response to the previous query was read.
-420	Query UNTERMINATED	The controller attempted to read the response after the TOS3200 received an unsupported query or has not received a query. The -100 "Command error" and this error is 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) `*IDN?;SYST:ERR?`

Operation complete event errors

An error in the range [-899, -800] is used when the TOS wants 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.

This event also sets the operation complete bit (bit 0) of the standard event status register.

Error code		Error message description
-800	Operation complete	–

Errors specific to the TOS3200

Error code		Error message description
201	Operation denied while TEST is running	Operation denied because the test is in progress.
202	Operation denied due to Empty PROGram	Operation denied because the program is not set.
203	Operation denied due to PROTected state	Operation is denied because the protection status is activated.
901	Relay malfunctioning	Relay operation error.
902	Calibration data broken	Calibration data error.

C Processing Time of Main Commands

The time until the next command is accepted.

The processing times indicated here are typical values. They are not warranted.
The processing time varies depending on the setup and measurement conditions.
It does not include the response time of the hardware.

Command	GPIB[*1] processing time (ms)	USB processing time (ms)	RS232C processing time (ms)		Description
			19200	38400	
*CLS	12	11	14	13	Clears the register.
TC:NETW "B"	17	15	81	69	Sets the measurement network.
MEAS:CURR:LEAK?	17	41	33	32	Queries the measured current.
STAT:OPER:COND?	36	37	69	57	Queries the register status.
RES?	17	14	33	32	Queries the test judgment result.

*1.   Using USB-GPIB by National Instruments.

D A List of Default Settings

Initializing the TOS3200

While holding down the SHIFT key, turn on the POWER switch. The TOS3200 displays the firmware version followed by "INITIALIZING!" and starts to initialize.

If you initialize the TOS3200, various settings such as the test conditions and the saved data will be set to the default values indicated below.

> **INITIALIZING!**

Default values

Item		Command	Setting after initialization	Setting after sending the command	
				*RST	*RCL
Operation mode		FUNC	TC	←	Depends on the memory contents.
TC measurement conditions (TC)	PROBE	TC:PROB	ENCPE	←	Depends on the memory contents.
	POL	TC:POL	NORM		
	COND	TC:COND	NORM		
	LOWER	TC:LIM:LOW	30 µA		
	LOWER ON/OFF	TC:LIM:LOW:STAT	OFF		
	UPPER	TC:LIM:UPP	30 mA		
	UPPER ON/OFF	TC:LIM:UPP:STAT	ON		
	TIMER	TC:TIM	10 s		
	TIMER ON/OFF	TC:TIM:STAT	OFF		
	WAIT	TC:WAIT	1 s		
	WAIT ON/OFF	TC:WAIT:STAT	OFF		
	NTWK	TC:NETW	A		
	MODE	TC:MODE	RMS		
	RANGE	TC:RANG:SEL	AUTO		
PCC measurement conditions (PCC)	POL	PCC:POL	NORM	←	Depends on the memory contents.
	COND	PCC:COND	NORM		
	LOWER	PCC:LIM:LOW	30 µA		
	LOWER ON/OFF	PCC:LIM:LOW:STAT	OFF		
	UPPER	PCC:LIM:UPP	30 mA		
	UPPER ON/OFF	PCC:LIM:UPP:STAT	ON		
	TIMER	PCC:TIM	10 s		
	TIMER ON/OFF	PCC:TIM:STAT	OFF		
	WAIT	PCC:WAIT	1 s		
	WAIT ON/OFF	PCC:WAIT:STAT	OFF		
	MODE	PCC:MODE	RMS		
	RANGE	PCC:RANGE:SEL	AUTO		

Item		Command	Setting after initialization	Setting after sending the command	
				*RST	*RCL
Meter mode measurement conditions (METER)	NTWK	CURR:NETW	A	←	Depends on the memory contents.
	MODE	CURR:MODE	RMS		
		VOLT:MODE	RMS		
	RANGE	CURR:RANG:SEL	AUTO		
System settings (SYSTEM)	MEAS MODE	SYST:CONF:MMOD	NORM	No change	←
	PASS HOLD	SYST:CONF:PHOL	2.0 s		
	CONV	SYST:CONF:CONV	OFF		
	SELV	SYST:CONF:SELV	OFF		
	BUS VOL (PASS)	SYST:BEEP:VOL:PASS	3		
	BUS VOL(FAIL)	SYST:BEEP:VOL:FAIL	3		
	CONTRAST	DISP:CONT	5		
	LINE BRK (AUTO)	SYST:CONF:LBR	ON		
	TIME ADJUST	SYST:DATE / SYST:TIME	No change[1]		
	CAL. DATE	–			
	ALARM	–			
	CAL. PROTECT	–	ON		
Interface settings (INTERFACE)	I/F SELECT	–	GPIB	No change	←
	GPIB ADDRESS	–	3		
	BAUDRATE	–	19200		
	DATA BITS	–	8		
	X-FLOW	–	ON		
	STOP BITS	–	1		
	TALK MODE	–	OFF		
	ERR TRACE	SYST:ERR:TRAC	OFF		
Individual test data		–	No saved data	No change	←
Program test data		–	No saved data		
Panel memory		–	See .		
Sequence program		–	No registered steps		
Trigger source (during remote control)		TRIG:SOUR	IMM	←	←
Sets the program number (during remote control)		PROG:NAME	-1[2]	←	←
Power supply line		OUTP:LINE	OFF	←	←
Display during testing		DISP:SIZE	NORM	No change	←
Voltage display in expanded display mode		DISP:UXV	OFF	No change	←

*1. The factory default settings are shown below.

TIME ADJUST: Standard Japanese time at factory shipment.

CAL. DATE: Calibration date at factory shipment.

ALARM: One year after CAL. DATE.

*2. Aborts the program operation.

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Default Values of the Panel Memory

There are a total of 100 panel memories. By factory default, memory numbers 00 to 50 contain preset test conditions of TC measurement conforming to various safety standards. These memory numbers can be overwritten as with 51 to 99.

The contents of the panel memory will be reset to default values if the TOS3200 is initialized.

Default values of memory numbers 00 to 50

The default values for items other than those indicated in this table are set to the value of item B in below table.

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes

IEC 60990 Methods of measurement of TC and PCC

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
00	IEC60990(1)	B					0.5 mA	Response limit
01	IEC60990(2)	C	ENCPE	NORM	NORM	RMS	10 mA	Let-go limit
02	IEC60990(3)	A					30.0 mA	Electric burn limit

IEC 60950-1 Information technology equipment - Safety - Part 1: General requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
03	IEC60950(1)		ENCPE	NORM	NORM		0.25 mA	All equipment
04	IEC60950(2)		ENCPE	REVS				
05	IEC60950(3)		ENCNEU				0.5 mA	Class 0I equipment, hand-held equipment
06	IEC60950(4)		ENCLIV					
07	IEC60950(5)	B	ENCNEU			RMS	0.75 mA	Class I equipment, hand-held equipment
08	IEC60950(6)		ENCLIV					
09	IEC60950(7)		ENCNEU	–	–		1 mA	Class 0I equipment, other equipment
10	IEC60950(8)		ENCLIV					
11	IEC60950(9)		ENCNEU				3.5 mA	Class I equipment, other equipment
12	IEC60950(10)		ENCLIV					

IEC 60335-1 Household and similar electrical appliances - Safety - Part 1: General requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
13	IEC60335(1)		ENCLIV				0.5 mA	Class 0 and 0I equipment
14	IEC60335(2)		ENCNEU					
15	IEC60335(3)		ENCLIV				0.75 mA	Class I equipment, hand-held equipment
16	IEC60335(4)	B	ENCNEU	–	–	RMS		
17	IEC60335(5)		ENCLIV				3.5 mA	Class I equipment, motor equipment
18	IEC60335(6)		ENCNEU					
19	IEC60335(7)		ENCLIV				0.25 mA	Class II equipment
20	IEC60335(8)		ENCNEU					

IEC 60065 Audio, video and similar electronic apparatus - Safety requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
21	IEC60065(1)		EncEnc	NORM	NORM		0.7 mA	
22	IEC60065(2)	B	ENCLIV	–	–			
23	IEC60065(3)		ENCNEU			PEAK		
24	IEC60065(4)		EncEnc	NORM	NORM		70 mA	100 kHz or higher in frequency (electrical burn)
25	IEC60065(5)		ENCLIV	–	–			
26	IEC60065(6)	B1[*1]	ENCNEU					
27	IEC60065(7)		EncEnc	NORM	NORM		2 mA	
28	IEC60065(8)		ENCLIV	–	–	DC		
29	IEC60065(9)		ENCNEU					

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes

IEC 60745-1 Hand-held motor-operated electric tools - Safety - Part 1: General requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
30	IEC60745(1)	G	ENCLIV	–	–	RMS	0.5 mA	Class 0I equipment
31	IEC60745(2)		ENCNEU					
32	IEC60745(3)		ENCLIV				0.75 mA	Class I instrument
33	IEC60745(4)		ENCNEU					
34	IEC60745(5)		ENCLIV				0.25 mA	Class II equipment
35	IEC60745(6)		ENCNEU					

IEC 60598-1 Luminaries - Part 1: General requirements and tests

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
36	IEC60598(1)	B	ENCLIV	–	–	RMS	0.5 mA	Class 0 and II equipment
37	IEC60598(2)		ENCNEU					
38	IEC60598(3)	C	ENCLIV				1 mA	Class I equipment and mobile luminaire
39	IEC60598(4)		ENCNEU					

IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
40	IEC61010(1)	B	ENCPE	NORM	NORM	RMS	0.5 mA	
41	IEC61010(2)				FLTNEU		3.5 mA	
42	IEC61010(3)				FLTPE		3.5 mA	

Electrical Appliance and Material Safety Law

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
43	PSE(1)	D	ENCPE	NORM	NORM	RMS	1 mA	
44	PSE(2)	E						

IEC 61029-1 Safety of transportable motor-operated electric tools - Part 1: General requirements

No.	Memory name	NTWK	PROBE	POL	COND	MODE	UPPER	Notes
45	IEC61029(1)	F	ENCLIV	–	–	RMS	0.5 mA	Class 0I equipment
46	IEC61029(2)		ENCNEU					
47	IEC61029(3)		ENCLIV				0.75 mA	Class I instrument
48	IEC61029(4)		ENCNEU					
49	IEC61029(5)		ENCLIV				0.25 mA	Class II equipment
50	IEC61029(6)		ENCNEU					

*1.   The "A" has been contained to preset for the product equipped with the firmware version of 1.0x.

Default values of memory numbers 51 to 99

Item A	Setting
Operation mode	TC
NTWK	A
PROBE	ENCPE
POL	NORM
COND	NORM
MODE	RMS
UPPER	30 mA

Item B	Setting
UPPER ON/OFF	ON
LOWER	30 µA
LOWER ON/OFF	OFF
TIMER	10 s
TIMER ON/OFF	OFF
WAIT	1 s
WAIT ON/OFF	OFF
RANGE	AUTO

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