IMPEDANCE ANALYZER

ZA57630

INSTRUCTION MANUAL

(REMOTE CONTROL)

NF Corporation

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Introduction

This manual explains remote control of the ZA57630 impedance analyzer.

- The manuals listed below are available for the ZA57630.

  - ZA57630 Instruction Manual (basics)

    This manual covers operation of the ZA57630 from the panel, specifications, and other basic matters.

  - ZA57630 Instruction Manual (advanced)

    This manual covers more advanced operating procedures, maintenance, and other matters.

  - ZA57630 Instruction Manual (remote control)

    This manual covers remote control of the ZA57630.

Introduction

■   This Instruction Manual comprises the following chapters.

1. Preparation before Use
    This chapter explains how to set up the interface and matters that require
    particular attention.

2. Switching between Remote and Local Modes
    This chapter explains how to switch between the remote operation mode and the
    local operation mode of the instrument.

3. Responding to Interface Messages
    Mainly, responses for IEEE-488.1 messages are shown.

4. List of Commands and Command Tree
    This chapter provides an overview of all commands.

5. Commands
    This chapter explains each command in detail.

6. Status System
    This chapter explains the status system.

7. Command Execution Examples
    This chapter explains examples of executing measurement commands.

8. Error Message
    This chapter explains error messages related to remote operation

Contents

Figures and Tables

1. Preparation before Use

The ZA57630 can be controlled remotely via USB, GPIB, RS-232, or LAN interfaces. Program messages can be sent from the controller to achieve the same control of operation as when using the control panel of this instrument. Response messages received from this instrument contain measurement values and configuration status.

Connectors for the various interfaces are provided on the rear panel of the ZA57630.

1.1 Selection of the remote control interface

USB, GPIB, RS-232, or LAN can be selected as the remote control interface for the ZA57630. It is not possible to use more than one interface at the same time.

■ Displaying the current interface
First tap [MENU] on the screen and then tap [Remote] in top menu 2/3 to display the Remote menu and the interface that is currently set in [INTERFACE].
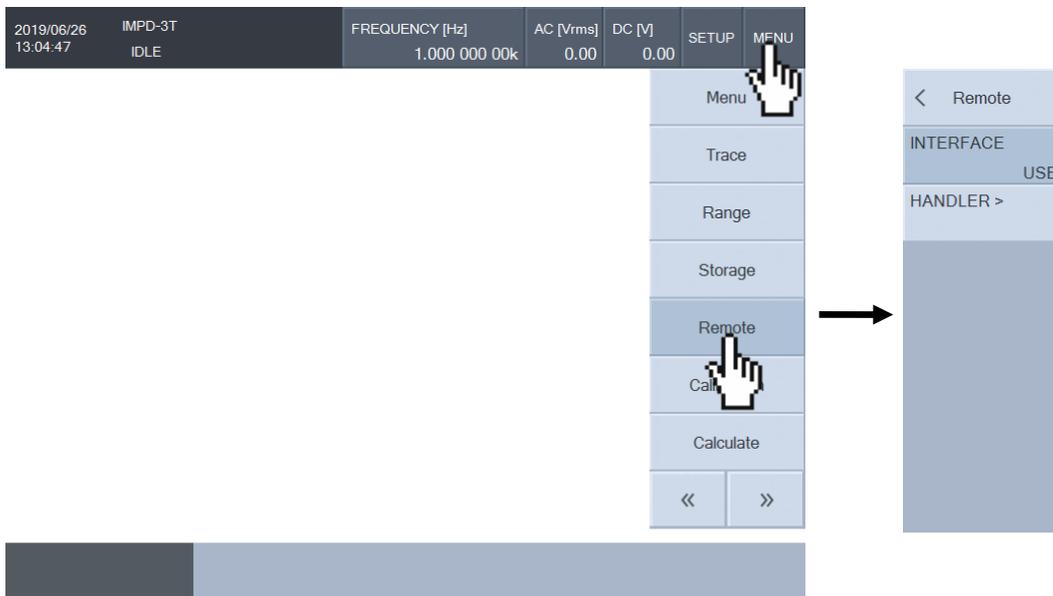
■ Setting the interface

Select the communication interface to use from [INTERFACE]－[SELECT] in the

Remote menu.
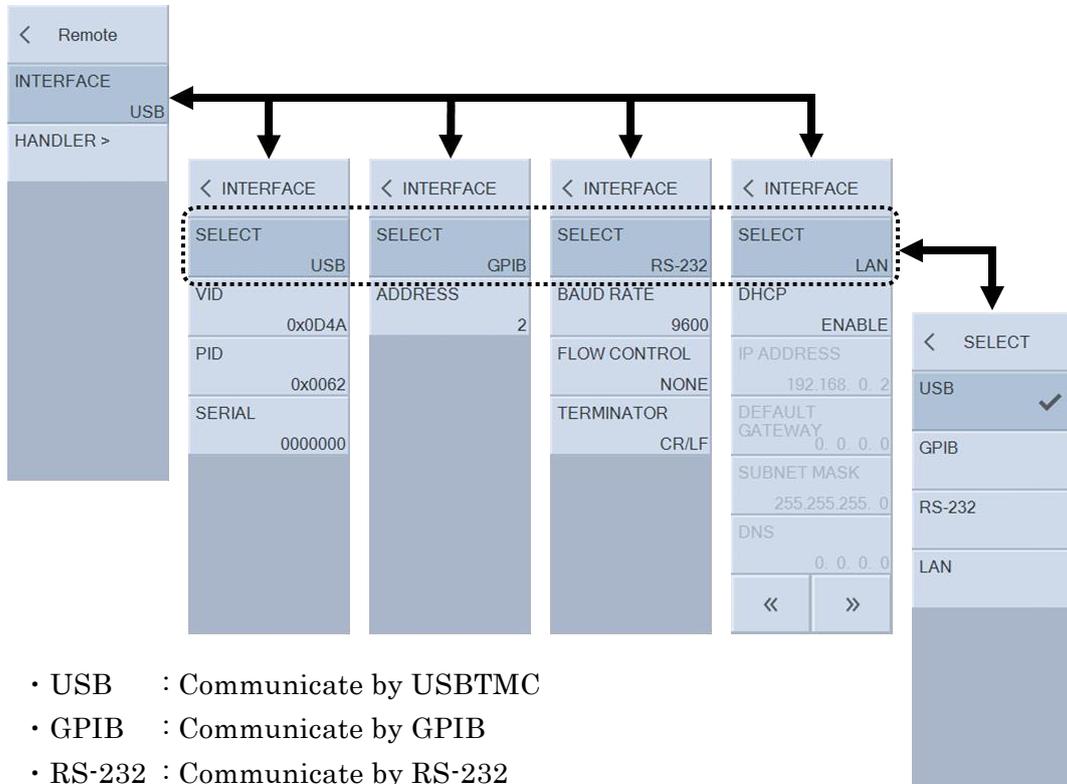
・USB　　：Communicate by USBTMC
・GPIB　　：Communicate by GPIB
・RS-232　：Communicate by RS-232
・LAN　　：Communicate by Ethernet

Just selecting the interface from [INTERFACE]－[SELECT] does not apply the interface setting. The communication interface is changed by tapping the [INTERFACE APPLY] function key.
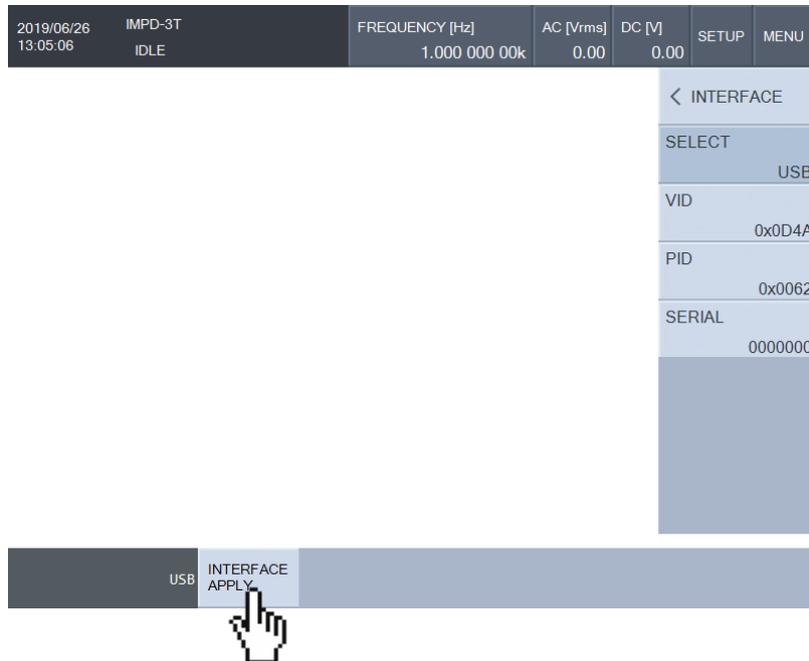
"DSBL" (disable) is displayed momentarily at the top left of the screen immediately after tapping [INTERFACE APPLY]. After it disappears, the specified remote control will be available.
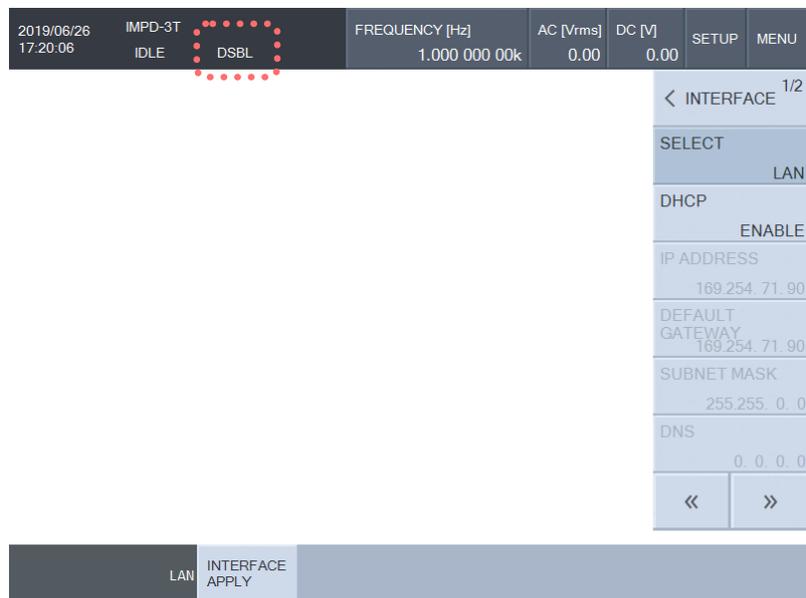
1.2 USB overview

1.2.1 Preparing the controller

To use the USB interface, prepare a controller that is equipped with a USB interface (a computer to be used for control).

Install a USBTMC driver on the controller. Usually, this driver supports the USB488 subclass and can perform control over USB that is nearly the same as GPIB.

USBTMC: Universal Serial Bus Test and Measurement Class

That driver is included in the hardware products and software products provided by various manufacturers that supply the VISA library. If you do not have a VISA library license, it is necessary to obtain one.

VISA: Virtual Instrument Software Architecture

Using the VISA library enables unified operation over any USB, GPIB, RS-232, or LAN interface, within the respective supported ranges.

This instrument has been confirmed to operate on the NI-VISA supplied by National Instruments.

1.2.2 Preparing the ZA57630

■ Remote menu [INTERFACE]

The information that is displayed when the USB interface has been selected is as shown below.

‹ INTERFACE
SELECT
USB
VID
0x0D4A
PID
0x0062
SERIAL
0000000
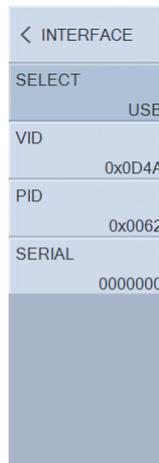
・VID　　　　　　Vendor ID = 0x0D4A (hexadecimal notation): a number that indicates the company
In decimal notation, the number is 3402.

・PID　　　　　　Product ID = 0x0062 (hexadecimal notation): the product number for the ZA57630. In decimal notation, the number is 98.

・SERIAL　　　　Serial Number = 0000000 (example): a 7-digit number that is specific to the instrument

■　Message terminator

A set of commands and responses must end with a terminator that indicates the end of the message.

The response message terminator that is sent by the ZA57630 is always LF^EOM.

The terminators used for program messages received by the ZA57630 can be any of those listed below.

  ・LF   Line Feed code

  ・LF^EOM   LF accompanying an EOM (END message)

  ・(final code)^EOM EOM (END message) added to the final code

1.2.3 Identification of USB instruments

The ZA57630 is connected to the USB connector of the computer by a commercial USB cable. This instrument may not operate correctly if the connection is made via a USB hub.

The ZA57630 is automatically recognized when connected via USB to a computer on which a USBTMC class driver has been installed. The ZA57630 instrument in a system is identified by the vendor ID, product ID, and serial number, which are displayed in the Remote menu. If the instrument is not automatically recognized, specify those items directly so that this instrument is recognized.

1.3 GPIB overview

The GPIB interface is not intended for use in an environment with electronic noise.

1.3.1 Preparing the controller

To use the GPIB interface, install a commercial GPIB interface card on the controller (computer used for control) and connect the ZA57630 to the connector on the interface card with a GPIB cable. Refer to the manual for the GPIB interface card for information on driver software.

1.3.2 Preparing the ZA57630

The instruments in GPIB systems are identified by addresses that are specific to each instrument. Set a different GPIB address for each instrument.

■ Remote menu [INTERFACE]

When GPIB is selected, the display is as shown below.
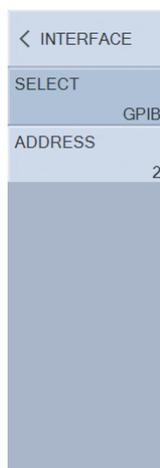
■ Message terminator

A set of commands and responses must end with a terminator that indicates the end of the message.

The response message terminator that is sent by the ZA57630 is always LF^EOI.

The terminators used for program messages received by the ZA57630 can be any of those listed below.

    ・LF   Line Feed code
    ・LF^EOI   LF accompanying an EOI (END message)
    ・(final code)^EOI   EOI (END message) added to the final code

1.3.3 Important points for using GPIB

・Turn off the power to all instruments that are connected to the bus before inserting or removing the GPIB connector cable.

・When using GPIB, turn on the power to all instruments that are connected to the bus.

・Up to 15 instruments, including the controller, can be connected to a single GPIB bus. The following limitations apply to the length of cables.

  － The total cable length cannot exceed 2 m times the number of instruments or 20 m, whichever is less.

  － The length of one cable cannot exceed 4 m.

・Set a different value for the GPIB address of each instrument. If there are instruments on the bus that have the same address, the instruments may be damaged by output collision.

1.3.4 Basic GPIB specifications

■ GPIB compliance standards

IEEE std 488.1-1987 and IEEE std 488.2-1992

■ IEEE std 488.1-1987 interface functions

SH1　All transmission flow control functions are supported.

AH1　All receiving flow control functions are supported.

T6　　The basic talker, serial poll, and listener-specified talker release functions are supported; the talk-only function is not supported.

L4　　The basic listener function and the talker-specified listener release function are supported; the listen-only function is not supported.

SR1　All service request functions are supported.

RL1　All remote/local control functions are supported.

PP0　The parallel poll function is not supported.

DC1　All device clear functions are supported.

DT0　Device trigger function is not supported.

C0　　The controller function is not supported.

E1　　Open collector drive

1.4 RS-232 overview

1.4.1 Preparing the controller

To use the RS-232 interface, prepare a controller (computer to be used for control) that is equipped with an RS-232 serial connector.

Match the parameters listed below on the ZA57630 and the controller.

- ・Baud rate　　　　　4800 to 230400 bps
- ・Data length　　　　8 bits (*1)
- ・Stop bit length　　　1 for sending and 1 for receiving (*1)
- ・Parity　　　　　　　None (*1)
- ・Flow control　　　　None/software/hardware
- ・Terminator　　　　　LF/CR LF

*1: This is fixed for the ZA57630. It cannot be changed.

1.4.2 Preparing the ZA57630

■　Remote menu [INTERFACE]

The information shown below is displayed when the RS-232 interface is selected.

```
< INTERFACE

SELECT
                RS-232
BAUD RATE
                  9600
FLOW CONTROL
                  NONE
TERMINATOR
                 CR/LF
```

■　Baud rate

This sets the communication speed. The baud rate is the same for both sending and receiving.

For communication speeds in excess of 19200 bps, higher speeds require lower cable capacitance and shorter cable length.

■ Flow control

This sets the flow control method.

NONE   No flow control (default)

SOFT   Software flow control

Communication is managed with control codes (X-ON and X-OFF). Reliable communication can be achieved using a connection cable with just TxD, RxD, and GND lines. However, binary data cannot be transmitted and the effective speed may be lower.

In hexadecimal notation, X-ON is 11 and X-OFF is 13.

HARD   Hardware flow control

Communication is managed with a hardware control line (RTS and CTS).

When flow control is enabled, communication is temporarily halted when the receive buffer is nearly full and resumed when the available buffer capacity is sufficient.

■ Terminator

A set of commands and responses must end with a terminator that indicates the end of the message.

LF   The terminator is a one-character LF (Line Feed).

CRLF   The terminator is a two-character combination of CR (Carriage Return) and LF.

In hexadecimal notation, CR is 0x0D and LF is 0x0A.

・ For ZA57630 sending

The specified terminator is added to the end of the response message.

・ For ZA57630 receiving

When the terminator that has been set for this instrument is received, the command is executed.

1.4.3 Connection

Prepare a commercially-available cable to use for the connecting cable. When connecting to the serial interface of a personal computer, the cable described below can be used.

Cable specifications：D-Sub, 9-pin, female-female, interlink, with ISO inch screws.

To prevent operating problems due to electromagnetic interference or noise, a shielded cable must be used.

The minimum cable configuration for communication is RxD, TxD, and GND.

For hardware flow control, RTS and CTS are required.

To use hardware flow control, use an interlink cable (Fig. 1-1 (b)). Another cross or reverse connection method is to connect adjacent pens 7 and 8 (Fig. 1-1 (c)). With that type of cable, communication is possible, but hardware flow control cannot be used.
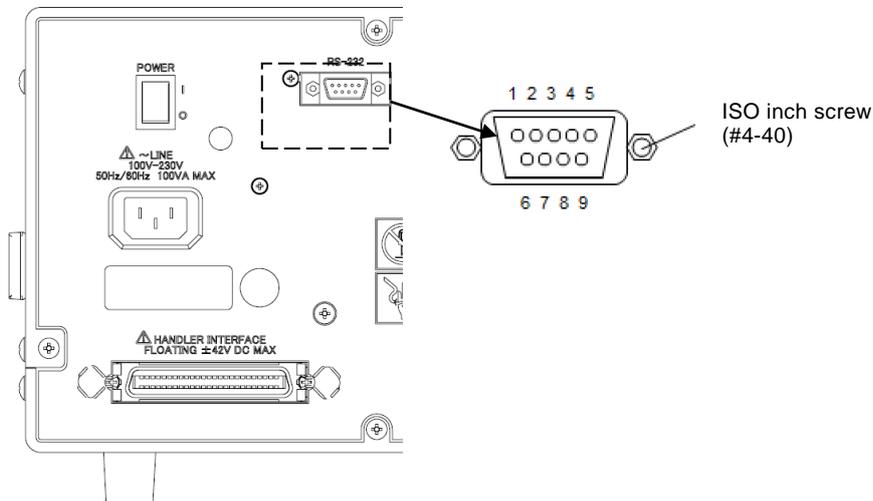
(a) Rear panel RS-232 connector

ZA57630			Personal computer (PC/AT, etc.)	
Signal	Pin		Pin	Signal
—	1		1	—
RxD	2		2	RxD
TxD	3		3	TxD
—	4		4	DTR
GND	5		5	GND
—	6		6	—
RTS	7		7	RTS
CTS	8		8	CTS
—	9		9	—
	Frame		Frame	
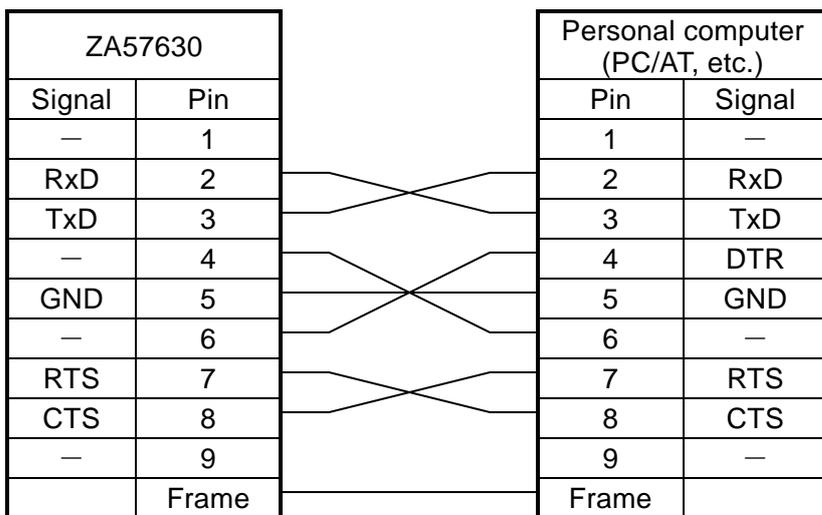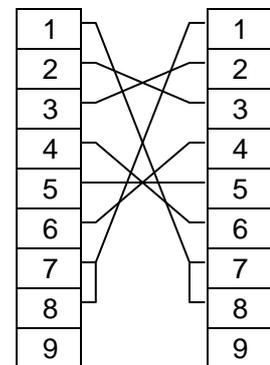
(b) Interlink wiring (c) Other cross wiring

Figure 1-1 RS-232 cable wiring diagram

1.4.4 Restrictions and cautions

- For the RS-232 interface, there is one-to-one connection between the controller and the ZA57630.
  It is not possible to connect multiple instruments to one port in parallel.

- GPIB-specific functions such as SRQ cannot be used.
  For the remote/local control function, the :SYSTem{:LOCal|:REMote|:RWLock} command can be mostly replaced.

- Clear the receive buffer before beginning communication.
  If the instrument power is turned on or off, or if the RS-232 connector is removed or inserted while the controller has an open RS-232 communication path, invalid data may be input to the receive buffer of the controller. For that reason, it is necessary to clear the receive buffer of the controller when a program on the controller opens or reopens communication (by initializing communication for example) before normal operation.
  In the same way, invalid data may remain in the receive buffer of the ZA57630.

1.5 LAN overview

1.5.1 Preparing the controller

To use the LAN interface, prepare a controller (computer used for control) that is equipped with a LAN interface. The ZA57630 can communicate by using the TCP/IP protocol.

1.5.2 Preparing the ZA57630

■   Remote menu [INTERFACE]

The information shown below is displayed when the LAN interface is selected.
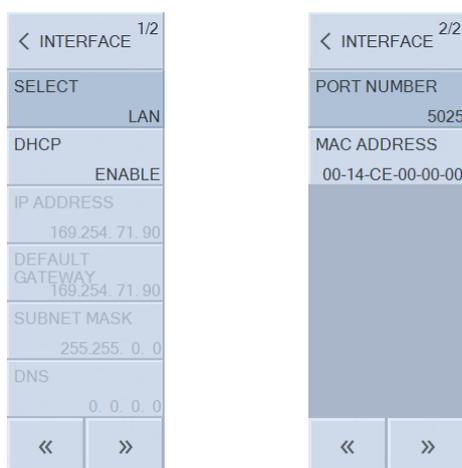
■   DHCP

This sets the DHCP. When the DHCP state is ENABLE and [INTERFACE APPLY] is executed, an IP address request is sent to the DHCP server on the network.

If the DHCP is present, the IP address request ends normally and the returned IP address can be used for communication. If no DHCP server is detected or the IP address assignment did not end normally, the APIPA (Automatic Private IP Addressing) function automatically allocates an IP address in the range of 169.254.0.0 to 169.254.255.255.

■   IP address

In the IP (Internet Protocol), an address that identifies an instrument is set (logical address). The range of addresses from 192.168.0.0 to 192.168.255.255 is for private IP addresses that can be used freely within a small-scale local network (class C).

■   Default gateway

When accessing an external network, the IP address of the gateway that is used implicitly is set.

■   Subnet mask

A subnet mask is set to separate the IP addresses of a higher-level network from the IP addresses of lower-level host.

■ DNS

The IP address of the DNS server for resolving host names to IP addresses is set.

■ Port number

This is the port number that is used when the ZA57630 communicates using the TCP protocol. It cannot be changed. It is written in decimal notation.

■ MAC address

This displays an instrument-specific address (physical address). It cannot be changed.

■ LAN reset

This resets the LAN settings for the specified instrument to the factory settings. When the cursor is over LAN related parameters in [INTERFACE] of the Remote menu, it is shown on the function key.

■ Message terminator

A set of commands and responses must end with a terminator that indicates the end of the message.

The terminator for response messages sent by the ZA57630 and the terminator for the program messages that are received by the ZA57630 are fixed as LF.

1.5.3 Connection

The ZA57630 can distinguish between a straight cable and a cross cable, so either type of cable can be used.

Use the type of cable that is compatible with the equipment to which the ZA57630 is being connected.

1.5.4 Restrictions and cautions

- GPIB-specific functions such as SRQ cannot be used.
  The remote/local control function can be replaced by the :SYSTem:{LOCal|REMote|RWLock} command.

1.6 Communication cautions

■ Input buffer
- The commands that have been sent are temporarily stored in the input buffer, from where they are interpreted and executed in sequence.
  The input buffer capacity is 100 KB (K = 1024). Even if program messages exceed that size, they are interpreted and executed in order.
- If an invalid command is encountered during interpretation and execution, an error results and none of the subsequent commands up to the program message terminator are executed.

■ Output buffer
- The output buffer capacity is 4096 KB (K = 1024).
- If the maximum capacity is exceeded, the output buffer is cleared and the query error bit of the standard event status register is set to 1. Subsequently, command interpretation and execution proceeds in the normal manner, but all generated response messages are discarded up to the program message terminator.

■ Error queue
- The queue can hold up to 16 error messages.
- If there are more than 16 error messages, the 16th message returns "Queue overflow". Subsequent error messages are discarded. The error messages up to the 15th message are retained.

■ Program message terminator
When commands are sent from the controller, be sure to append the program message terminator, which is either LF (Line Feed, 0x0A hex) or CRLF (Carriage Return, 0x0D hex + Line Feed, 0x0A hex) to the end of the message. Alternatively, place an EOI (END message) byte at the end. If commands are sent without LF, CRLF, or EOI appended, the instrument may not operate properly.
Depending on the driver software used by the computer that is used for control, the program message terminator may not be output unless the terminator is specified separately from the command itself. The line feed (LF) is sometimes written as new line (NL), but the binary code is the same in either case.
For the RS-232 and LAN interfaces, there is no END message concept, so EOI is not appended.

■ RS-232 and LAN restrictions
GPIB-specific functions cannot be used. Examples are shown below.
  Receiving GTL (Go To Local) messages
  Receiving LLO (Local Lockout) messages
  Receiving GET (Group Execute Trigger) messages
  Receiving REN (Remote Enable) messages

Sending SRQ (Service Request) messages

Serial polling (receiving SPE or SPD and sending a status byte)

Sending an END message (EOI signal to serve as a message terminator)

2. Switching between Remote and Local Modes

The ZA57630 has two operating modes relevant to remote control: remote and local.

In the local mode, all panel operations are enabled.

In the remote mode, all panel operations other than return to local mode and power-off are disabled.

■ Sets the remote mode

Normally, operation from GPIB switches this instrument to the remote mode. That is a function of the driver on the controller side. According to the communication standard, asserting the REN line and specifying to a listener instrument sets the instrument to the remote mode. The operation is the same for USB (USBTMC).

■ Sets the local mode

Tapping the [LOCAL] button at the top of the screen returns from remote mode to local mode (except when local lockout is enabled).

When a GTL command is sent from the controller or the REN line returns false, local mode operation is possible. If the GPIB cable is removed, the REN becomes false, so the instrument is returned to local mode. For USB, too, removing the cable returns the instrument to local mode.
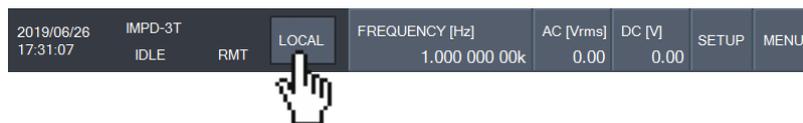
■ Disabling local panel operation

When the controller specifies local lockout, unintentional local operations are disabled. When local lockout is in effect, this instrument cannot be returned to the local mode by tapping the [LOCAL] button.

Even when local lockout is in effect, local operation can be enabled from the controller.

■ Remote and local operation with the RS-232 and LAN interfaces

If a command is sent to the ZA57630, the instrument goes into remote mode.

Tapping the [LOCAL] button returns the instrument to local mode and enables operation from the panel.

For the RS-232 and LAN interface, the commands listed below can be used.

　　:SYSTem:LOCal (change to local mode)

　　:SYSTem:REMote (change to remote mode)

　　:SYSTem:RWLock (change to remote mode with local lockout)

■ Displaying the remote control mode

It is possible to check the current status of the instrument by looking at the remote control status display in the upper part of the screen.

(Nothing is displayed)   Local mode
RMT   Remote mode
LLO   Local lockout mode
DSBL   Remote control disabled

DSBL is displayed when remote control is disabled, such as when the remote interface is being set up.

3. Responding to Interface Messages

Main interface message responses of IEEE-488.1 are described in the following table.

Table 3-1 Responses to interface messages

Message	Function
IFC	< InterFace Clear > The GPIB interface is initialized. The specified listener and talker are released.
DCL, SDC	< Device CLear >, < Selected Device Clear > The input buffer is cleared and command interpretation and execution are stopped. The output buffer is cleared and status byte register bit 4 (MAV) is cleared.
LLO	< Local LockOut > Switching from the remote mode to the local mode by tapping the [LOCAL] button is disabled.
GTL	< Go To Local > This switches to the local mode.

The method that is used for sending interface messages from the controller varies with the instrument driver. For more information, refer to the manual for each particular driver.

For RS-232 and LAN interfaces, substitute functions are available for some of them.

4. List of Commands and Command Tree

4.1 List of commands

The remote control commands for the ZA57630 are listed in the tables that follow.

The meanings of the symbols used in the tables are described below.

The descriptions here are in short-form format, which omits all optional keywords. For the long-form formats of commands and parameters, refer to the pages listed in the details column.

Supplement: Commands that read data are called queries and end with a question mark (?). In these tables, queries are omitted for functions for which setting and reading are both possible.

Furthermore, the R/W column in the tables indicates whether or not a command is a query (R) and/or setting (W), and the *RST column indicates whether or not initialization is performed by the *RST command.

[Measurement function commands]

Commands	Function	R/W	*RST	Details
:OUTP	Output status	R/W	✔	P5-46
:TRIG	Start measurement	W	—	P5-68
:TRIG:ABOR	Abort measurement	W	—	P5-67
:DATA:FORM	Data retrieval format	R/W	—	P5-35
:DATA:POIN?	Get number of sweep measurement data points	R	—	P5-36
:DATA?	Get sweep measurement data	R	—	P5-34
:DATA:SPOT?	Get spot measurement data	R	—	P5-37

[Mode commands]

Command	Function	R/W	*RST	Details
:SENS:FUNC	Measurement mode	R/W	—	P5-53

[OSC commands]

Commands	Function	R/W	*RST	Details
:SOUR:FREQ	Spot frequency	R/W	✔	P5-58
:SOUR:UNIT	Measurement signal unit	R/W	✔	P5-65
:SOUR:AMPL	Measurement signal AC amplitude	R/W	✔	P5-60
:SOUR:LIM	Measurement signal output limit	R/W	✔	P5-61
:SOUR:ALC	Automatic level control (ALC) status	R/W	✔	P5-56
:SOUR:ALC:TOL	ALC permissible error	R/W	✔	P5-56
:SOUR:ALC:COUN	Number of ALC retries	R/W	✔	P5-55
:SOUR:ALC:FAC	ALC correction factor	R/W	✔	P5-55
:SOUR:BIAS	DC bias	R/W	✔	P5-56
:SOUR:BIAS:HVOL	HV DC bias status	R/W	✔	P5-57
:ROUT:BIAS:TERM	DC bias output destination	R/W	✔	P5-46
:SOUR:MULT	DUT drive amplifier gain	R/W	✔	P5-61
:OUTP:TRIG	Trigger synchronization driving	R/W	✔	P5-46
:SOUR:SLEW:TYPE	Measurement signal ON/OFF mode	R/W	✔	P5-62
:SOUR:FREQ:TRAN	Frequency change mode	R/W	✔	P5-59
:SOUR:ROSC:EXT	10MHz REF IN status	R/W	✔	P5-62
:SOUR:ROSC:OUTP	10MHz REF OUT output	R/W	✔	P5-62

[Measure commands]

Commands	Function	R/W	*RST	Details
:CALC:FORM	Spot measurement item	R/W	✔	P5-28
:SENS:AVER:COUN	Measurement time	R/W	✔	P5-47
:TRIG:STTD	Measurement start delay	R/W	✔	P5-69
:TRIG:DEL	Measurement delay	R/W	✔	P5-68
:TRIG:SOUR	Trigger source, handler interface trigger polarity	R/W	✔	P5-69

[Sweep commands]

Commands	Function	R/W	*RST	Details
:SOUR:SEQ:LENG	Sequence sweep	R/W	✔	P5-62
:TRIG:SEQ:MODE	Sequence trigger	R/W	✔	P5-68
:SOUR:SWE:TYPE	Sweep item	R/W	✔	P5-64
:SOUR:SWE	Sweep upper and lower limits	R/W	✔	P5-63
:SOUR:SWE:RES	Number of sweep points	R/W	✔	P5-64
:SOUR:SWE:SPAC	Sweep spacing	R/W	✔	P5-64
:SOUR:FREQ:AFC:STAT	Slow sweep mode	R/W	✔	P5-57
:SOUR:FREQ:AFC:TYPE	Slow sweep monitoring parameters	R/W	✔	P5-57
:SOUR:FREQ:AFC:TOL	Slow sweep permissible quantities	R/W	✔	P5-57
:SOUR:FREQ:TRAC	Resonant frequency tracking measurement function status	R/W	✔	P5-58
:SOUR:FREQ:TRAC:SPAN	Resonant frequency tracking upper and lower limit frequencies	R/W	✔	P5-59
:SOUR:FREQ:TRAC:REF	Resonant frequency tracking target phase	R/W	✔	P5-59
:SOUR:FREQ:TRAC:TOL	Resonant frequency tracking permissible error	R/W	✔	P5-59
:SOUR:FREQ:TRAC:POL	Resonant frequency tracking polarity	R/W	✔	P5-59
:SOUR:FREQ:TRAC:FAC	Resonant frequency tracking sensitivity	R/W	✔	P5-58

[Graph commands]

Commands	Function	R/W	*RST	Details
:DISP:TEXT	Graph title	R/W	✔	P5-40
:DISP:FORM	X, Y1, and Y2 axis formats	R/W	✔	P5-38
:DISP:TRAC:X:SPAC	X-axis type	R/W	✔	P5-43
:DISP:TRAC:Y1:SPAC	Y1-axis type	R/W	✔	P5-44
:DISP:TRAC:Y2:SPAC	Y2-axis type	R/W	✔	P5-45
:DISP:TRAC:STAT	Display data	R/W	✔	P5-43
:DISP:TRAC:SCAL:AUTO	Auto scaling	R/W	✔	P5-42
:DISP:TRAC:X	X-axis upper and lower limits	R/W	✔	P5-43
:DISP:TRAC:Y1	Y1-axis upper and lower limits	R/W	✔	P5-44
:DISP:TRAC:Y2	Y2-axis upper and lower limits	R/W	✔	P5-44
:DISP:MODE	Graph display type	R/W	✔	P5-40
:DISP:TRAC:GRAT:GRID:STYL	Grid line display	R/W	✔	P5-42
:DISP:TRAC:GRAT:GRID:LINE	Grid line type	R/W	✔	P5-42
:CALC:FORM:UPH:SHIF	Executes phase shift	W	—	P5-29
:SENS:SMO:POIN	Phase moving average	R/W	✔	P5-54
:DISP:TRAC:COL	Data trace color	R/W	✔	P5-41

[Marker commands]

Commands	Function	R/W	*RST	Details
:CALC:DATA:MARK:SEAR	Executes a marker search	W	—	P5-24
:CALC:DATA:MARK:SEAR:AUTO	Automatic marker search	R/W	✔	P5-25
:CALC:DATA:MARK:VAL	Marker search value	R/W	✔	P5-27
:CALC:DATA:MARK:MODE	Marker mode	R/W	✔	P5-23
:CALC:DATA:MARK:TRAC	Marker target data	R/W	✔	P5-26
:CALC:DATA:MARK:MOVE	Moves the specified marker	W	—	P5-23
:CALC:DATA:MARK?	Queries the marker value	R	—	P5-22

[Trace commands]

Commands	Function	R/W	*RST	Details
:DATA:COPY:NAME	Executes data copy	W	—	P5-33
:DATA:CLE	Executes data deletion	W	—	P5-32
:DISP:TRAC:AUTO	Auto store	R/W	✔	P5-40

[Range commands]

Commands	Function	R/W	*RST	Details
:SENS:VOLT:RANG	PORT1, PORT2 range	R/W	✔	P5-55
:SENS:RES:RANG	Impedance measurement range	R/W	✔	P5-54
:SENS:VOLT:PROT	Overvoltage detection level	R/W	✔	P5-54
:SENS:VOLT:PROT:BEEP	Overvoltage detection beep	R/W	✔	P5-54
:SENS:VOLT:PROT:MEAS:STOP	Measurement stop for when over-level detection	R/W	✔	P5-55
:INP:GAIN	PORT1 and PORT2 input weighting factor	R/W	✔	P5-45

[Storage commands]

Commands	Function	R/W	*RST	Details
*SAV	Executes a save to the setting memory	W	—	P5-14
*RCL	Executes a read from the setting memory	W	—	P5-14
:MEM:STAT:DEL	Initializes the setting memory	W	—	P5-46
:MEM:STAT:DEF	Setting memory name	R/W	—	P5-45
:DATA:STOR	Executes a save to measurement memory	W	—	P5-37
:DATA:REC	Executes a read from measurement memory	W	—	P5-36
:DATA:DEL	Measurement memory initialization	W	—	P5-34
:DATA:STAT:DEF	Measurement memory name	R/W	—	P5-37

[Remote commands]

Commands	Function	R/W	*RST	Details
:TRIG:DIR	Handler interface sweep direction	R/W	✔	P5-68
:TEST:HANDler	Handler interface terminal state	R/W	✔	P5-70
:TEST:HANDler:MODE	Handler interface test operation state	R/W	✔	P5-71

[Calibration commands]

Commands	Function	R/W	*RST	Details
:SENS:CORR:OPEN	Open correction state	R/W	✔	P5-53
:SENS:CORR:COLL:OPEN	Executes open correction data measurement	W	−	P5-47
:SENS:CORR:SHOR	Short correction state	R/W	✔	P5-53
:SENS:CORR:COLL:SHOR	Executes short correction data measurement	W	−	P5-47
:SENS:CORR:LOAD	Load correction state	R/W	✔	P5-51
:SENS:CORR:COLL:LOAD	Executes load correction data measurement	W	−	P5-47
:SENS:CORR:LOAD:STAN:FORM	Load standard value format	R/W	✔	P5-52
:SENS:CORR:LOAD:STAN	Load standard value	R/W	✔	P5-52
:SENS:CORR:EXT	Port extension state	R/W	✔	P5-48
:SENS:CORR:EXT:IMP	Characteristic impedance	R/W	✔	P5-49
:SENS:CORR:EXT:DIST	Electrical length	R/W	✔	P5-48
:SENS:CORR:EXT:OPEN	Port extended end open correction state	R/W	✔	P5-51
:SENS:CORR:COLL:EXT:OPEN	Executes port extended end open correction data measurement	W	−	P5-47
:SENS:CORR:EXT:SHOR	Port extended end short correction state	R/W	✔	P5-51
:SENS:CORR:COLL:EXT:SHOR	Executes port extended end short correction data measurement	W	−	P5-48
:SENS:CORR:EXT:LOAD	Port extended end load correction state	R/W	✔	P5-49
:SENS:CORR:COLL:EXT:LOAD	Executes port extended end load correction data measurement	W	−	P5-47
:SENS:CORR:EXT:LOAD:STAN:FORM	Port extended end load standard value format	R/W	✔	P5-50
:SENS:CORR:EXT:LOAD:STAN	Port extended end load standard value	R/W	✔	P5-50
:SENS:CORR:SLOP:STAT	Potential slope correction state	R/W	✔	P5-53
:SENS:CORR:EQU	Equalization mode	R/W	✔	P5-48
:SENS:CORR:COLL	Calibration execution Queries the calibration code	R/W	−	P5-47

[Calculation commands]

Commands	Function	R/W	*RST	Details
:CALC:CKIT:CONS?	Queries the equivalent circuit constants	R	−	P5-15
:CALC:PZT:CKIT:CONS?	Queries the equivalent circuit constants of piezoelectric elements	R	−	P5-22
:CALC:PZT:CONS?	Queries the piezoelectric constants of piezoelectric elements	R	−	P5-31
:CALC:PZT:FAC?	Queries the characteristic frequency and mechanical quality factor of piezoelectric elements	R	−	P5-31
:CALC:PZT:SHAP?	Queries the DUT parameters of piezoelectric elements	R	−	P5-32
:CALC:PERMIT:PAR	Relative permittivity parameters	R/W	✔	P5-30
:CALC:PERMEA:PAR	Relative permeability parameters	R/W	✔	P5-29

4. List of Commands and Command Tree

[Comparator commands]

Commands	Function	R/W	*RST	Details
:CALC:COMP	Bin comparison / limit comparison function state	R/W	—	P5-19
:CALC:COMP:MODE	Bin comparison format (deviation mode)	R/W	✔	P5-17
:CALC:COMP:BIN:NOM	First parameter reference value and second parameter reference value	R/W	✔	P5-16
:CALC:COMP:BIN:BOUN	Parameter upper and lower limits of each bin	R/W	✔	P5-16
:CALC:COMP:ZONE	Zone comparison function state	R/W	✔	P5-22
:CALC:COMP:ZONE:MODE	Zone comparison format (deviation mode)	R/W	✔	P5-21
:CALC:COMP:ZONE:REF:TRAC	Reference trace to use in zone comparison	R/W	✔	P5-21
:CALC:COMP:ZONE:REF:BOUN	Comparison reference values (REF(DEV) and REF(%DEV)) of zone comparison	R/W	✔	P5-21
:CALC:COMP:ZONE:IMM:BOUN	Comparison reference value (IMMED) of zone comparison	R/W	✔	P5-20
:CALC:COMP:BEEP	Beep sound for comparison	R/W	✔	P5-15
:CALC:COMP:RES?	Queries the last bin comparison and zone comparison results	R	—	P5-18

[Other commands]

Commands	Function	R/W	*RST	Details
:SYST:BEEP	Beep sound status	R/W	—	P5-66
:SYST:DATE	Current year, month and date	R/W	—	P5-66
:SYST:TIME	Current hour, minutes, seconds	R/W	—	P5-67
*RST	Initializes the configuration settings	W	—	P5-14
:SYST:AUX:INP	Queries each input terminal level of the AUX connector	R	—	P5-66
:SYST:AUX:OUTP	Each output terminal of the AUX connector	R/W	✔	P5-66
:DISP:BRIG	LCD brightness	R/W	—	P5-37
*IDN?	Queries the instrument-specific information	R	—	P5-13

[Status system commands]

Commands	Function	R/W	*RST	Details
*CLS	Clears the status register and the error queue	W	—	P5-13
*ESE	Standard event status enable register	R/W	—	P5-13
*ESR?	Queries standard event status register	R	—	P5-13
*SRE	Service request enable register	R/W	—	P5-13
*STB?	Queries the status byte register	R	—	P5-14
:STAT:OPER:COND?	Queries the operation status condition register	R	—	P5-65
:STAT:OPER:ENAB	Operation status event enable register	R/W	—	P5-65
:STAT:OPER?	Queries the operation status event register	R	—	P5-65
:STAT:OPER:NTR	Operation status Negative transition filter	R/W	—	P5-65
:STAT:OPER:PTR	Operation status Positive transition filter	R/W	—	P5-65
:SYST:ERR?	Queries error message	R	—	P5-67

[System commands]

Commands	Function	R/W	*RST	Details
*TST?	Queries the self-diagnostic test results	R	—	P5-14
*OPC	Notification that all previous commands have ended	R/W	—	P5-13
*WAI	Waits for pending commands and queries to complete	W	—	P5-14
:SYST:LOC	Switches to local mode [†]	W	—	P5-67
:SYST:REM	Switches to remote mode [†]	W	—	P5-67
:SYST:RWL	Switches to LLO mode [†]	W	—	P5-67
:HCOP:DATA?	Gets hard copy data	R	—	P5-45

[†] Can be used only for the RS232 and LAN interfaces

4.2 Command tree

The subsystem command tree for the ZA57630 is shown below.

The brackets ([ ]) in the tree indicate optional keywords and the vertical bar (|)

separates multiple keywords from which a selection can be made.

```
<Root>                                              Command tree 1/3
  ├─ CALCulate ┬ CKIT ──────── CONStant
  │            ├ COMParator ┬ BEEPer──────── [STATe]
  │            │            ├ BIN───────┬ BOUNds
  │            │            │           ├ NOMinal
  │            │            │           └ [STATe]
  │            │            ├ MODE
  │            │            ├ RESult
  │            │            ├ [STATe]
  │            │            └ ZONE ──────┬ IMMediate ── BOUNds
  │            │                         ├ MODE
  │            │                         ├ REFerence ┬ BOUNds
  │            │                         │           └ TRACe
  │            │                         └ [STATe]
  │            ├ DATA ──────── MARKer
  │            │                     ├──────── MODE
  │            │                     ├──────── MOVE
  │            │                     │         SEARch
  │            │                     │              └──────── AUTO
  │            │                     ├──────── TRACe
  │            │                     └──────── VALue
  │            ├ FORMat
  │            │     └──────── UPHase ──────── SHIFt
  │            ├ PERMEAbility─ PARameter
  │            ├ PERMITtivity ─ PARameter
  │            └ PZT──────┬ CKIT ──────── CONStant
  │                       ├ CONStant
  │                       ├ FACtor
  │                       └ SHAPe
  └─ DATA ────┬ CLEar
              ├ COPY ──────── NAME
              ├ [DATA]
              ├ DELete
              ├ FORMat
              ├ POINts
              ├ RECall
              ├ SPOT
              ├ STATe ──────── DEFine
              └ STORe

Continued
```

Command tree 2/3

```
— DISPlay ─┬─ BRIGhtness
           └─ [WINDow] ─┬─ FORMat
                        ├─ MODE
                        ├─ TEXT ──────── [DATA]
                        └─ TRACe ─┬─ AUTO
                                  ├─ COLor
                                  ├─ GRATicule ── GRID ──┬─ LINE
                                  │                      └─ STYLe
                                  ├─ SCALe ──── AUTO
                                  ├─ STATe
                                  ├─ X
                                  │        └──────── SPACing
                                  ├─ Y1
                                  │        └──────── SPACing
                                  └─ Y2
                                           └──────── SPACing

— HCOPy ──── DATA
— INPut ──── GAIN
— MEMory ──── STATe ─┬─ DEFine
                     └─ DELete
— OUTPut ─┬─ [STATe]
          └─ TRIGger
— ROUTe ──── BIAS ──────── TERMinals
— SENSe ─┬─ AVERage ──── COUNt
         ├─ CORRection ─┬─ COLLect ─┬─ [ACQuire]
         │              │           ├─ EXTension ─┬─ LOAD ──── [ACQuire]
         │              │           │             ├─ OPEN ──── [ACQuire]
         │              │           │             └─ SHORt ──── [ACQuire]
         │              │           ├─ LOAD ──────── [ACQuire]
         │              │           ├─ OPEN ──────── [ACQuire]
         │              │           └─ SHORt ──────── [ACQuire]
         │              ├─ EQUalizing
         │              ├─ EXTension ─┬─ DISTance
         │              │             ├─ IMPedance
         │              │             ├─ LOAD
         │              │             │      └──── STANdard ──── FORMat
         │              │             ├─ OPEN
         │              │             └─ SHORt
         │              ├─ LOAD
         │              │      └──── STANdard ──── FORMat
         │              ├─ OPEN
         │              ├─ SHORt
         │              └─ SLOPe ──────── STATe
         ├─ FUNCtion
         ├─ RESistance ──── RANGe
         ├─ SMOothing ──── POINts
         └─ VOLTage ──┬─ PROTection ─┬─ BEEPer
                      │              ├─ [LEVel]
                      │              └─ MEASure ──── STOP
                      └─ RANGe
```

Continued

Command tree 3/3

```
── SOURce ─┬─ ALC ──────────┬─ COUNt
           │                ├─ FACtor
           │                ├─ [STATe]
           │                └─ TOLerance
           ├─ BIAS
           │     └──────────── HVOLtage
           ├─ FREQuency ─┬─ AFC ──────────┬─ STATe
           │             │                ├─ TOLerance
           │             │                └─ TYPE
           │             ├─ [CW | FIXed]
           │             ├─ TRACk
           │             │      ┌───────── FACtor
           │             │      ├───────── POLarity
           │             │      ├───────── REFerence
           │             │      ├───────── SPAN
           │             │      └───────── TOLerance
           │             └─ TRANsition
           ├─ {LEVel | IMMediate | AMPLitude}
           ├─ LIMit ──────── [AMPLitude]
           ├─ MULTiplier
           ├─ ROSCillator ─┬─ EXTernal
           │               └─ OUTPut
           ├─ SEQuence ──── LENGth
           ├─ SLEW ──────── TYPE
           ├─ SWEep
           │      ├───────── RESolution
           │      ├───────── SPACing
           │      └───────── TYPE
           └─ UNIT
── STATus ──── OPERation ─┬─ CONDition
                         ├─ ENABle
                         ├─ [EVENt]
                         ├─ NTRansition
                         └─ PTRansition
── SYSTem ─┬─ AUXiliary ──┬─ INPut
           │              └─ OUTPut
           ├─ BEEPer
           ├─ DATE
           ├─ ERRor
           ├─ LOCal
           ├─ REMote
           ├─ RWLock
           └─ TIME
── TRIGger ─┬─ ABORt
            ├─ DELay
            ├─ DIRection
            ├─ [IMMediate]
            ├─ SEQuence ──── MODE
            ├─ SOURce
            └─ STTDelay
── TEST ──── HANDler
               └───────── MODE
```

5. Commands

5.1 Overview

The commands of the ZA57630 are broadly classified into common commands
defined in IEEE488.2 and the subsystem commands corresponding to
instrument-specific functions.

5.1.1 Notation

For convenience in description, the following notation is used in this document.

< >   Parameters or parameter formats are enclosed in angle brackets (< >).

[ ]   Brackets are used to enclose options, which may be omitted.

{abc|xyz}

This means to use either "abc" or "xyz."

[abc|xyz]

This means to use either "abc" or "xyz" but it is optional and can be
omitted.

Uppercase and lowercase letters

Keywords that are written in uppercase and lowercase letters are
long-form expressions; keywords that are written in uppercase letters
are short-form expressions.

5.1.2 Command types

The ZA57630 program messages consist of common commands and subsystem commands. Here, the command formats, the subsystem command tree, and other items are explained.

5.1.2.1 Common commands

The common commands are for control of the general instrument functions. The command syntax is illustrated in Figure 5-1.
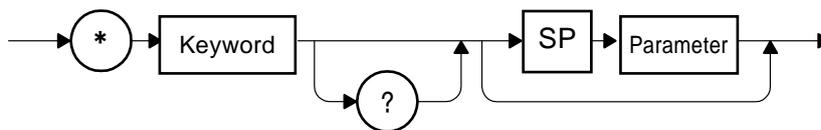
Figure 5-1 Common command syntax

The keywords in Figure 5-1 are composed of three alphabetic characters. In this example, SP represents a space (ASCII code 32).

5.1.2.2 Subsystem commands

The subsystem commands are for executing specific instrument functions. They consist of a root keyword, one or more lower-level keywords, parameters, and a suffix.
Examples of a command and a query are shown below.

```
:OUTPut:STATe ON
:OUTPut:STATe?
```

OUTPut is a root-level keyword that is concatenated with a second-level keyword. ON is a parameter.

5.1.2.3 Subsystem command syntax

The subsystem command syntax is illustrated in Figure 5-2.
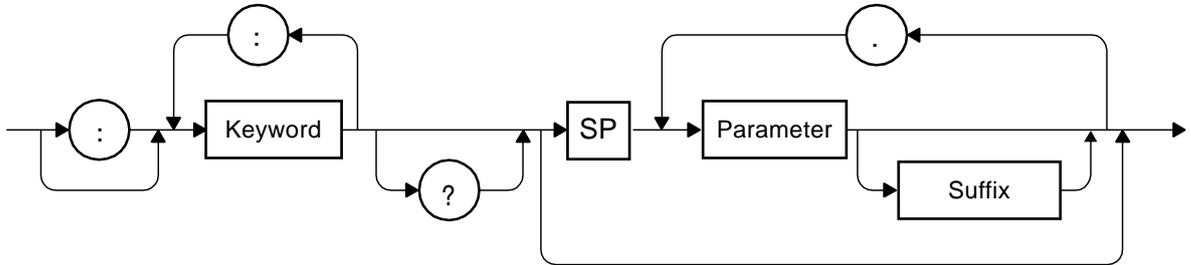
Figure 5-2 Subsystem command syntax

(A) Keyword

The keyword in Figure 5-2 is a text string of up to 12 characters that begins with a letter of the alphabet. The remaining characters can be uppercase or lowercase alphabetic characters, underscore characters, or numerals.

Most of the keywords shown in section "5.3　Command details" are composed of a mixture of uppercase and lowercase characters. Here, uppercase characters indicate short-form expressions and the mixture of uppercase and lowercase characters indicates long-form keywords. For convenience and explanation, uppercase and lowercase characters are used in keywords, but in the actual commands, there is no distinction between uppercase and lowercase. Take the keyword "OUTPut" in Table 5-1 as an example.

Table 5-1 Keywords that are accepted or not accepted by this instrument (for the case of "OUTPut")

Keyword	Explanation
OUTPUT	This can be used as the long form.
OUTP	This can be used as the short form.
OuTpUt	Uppercase and lowercase characters are not distinguished. This can be used as the long form.
oUtP	Uppercase and lowercase characters are not distinguished. This can be used as the short form.
OUTPU	This cannot be used, because it does not correspond to either the long form or the short form.
OUT	This cannot be used, because it does not correspond to either the long form or the short form.

(B) Keyword separator

The colons that appear in Figure 5-2 are interpreted as keyword separators. The keyword separator serves to separate upper-level keywords from lower-level keywords in the command tree.

The colon that appears at the beginning of subsystem commands is interpreted as a root specifier. The root specifier sets the current path as root.

(C) Keyword omission

For the commands shown in section "5.3 Command details", the keywords enclosed in square brackets ([ ]) can be omitted. If a keyword is omitted, this instrument treats that keyword as an optional keyword when executing the command analysis.

Taking the :OUTPut[:STATe] command for example, either the following commands can be used.

  :OUTPut:STATe
  :OUTPut

(D) Parameters

The parameter formats are described below.

(1) Numerical parameters (<NRf>, <NR1>, <NR2>, and <NR3>)

The numerical parameter formats include integer (<NR1>), real number (floating-point) (<NR2>), and real number (exponent) (<NR3>). <NRf> is a generic expression that includes <NR1>, <NR2>, and <NR3>. The syntax for numerical parameters is illustrated below.
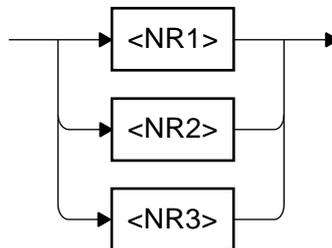
Figure 5-3 Numerical parameter syntax (<NRf>)
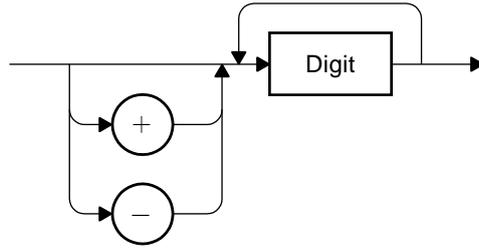
Figure 5-4 Numerical parameter syntax (< NR1>)
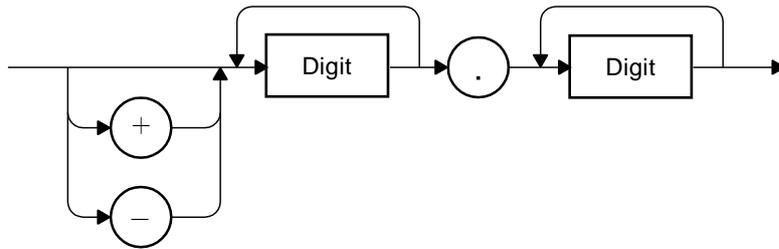
Figure 5-5 Numerical parameter syntax (< NR2>)
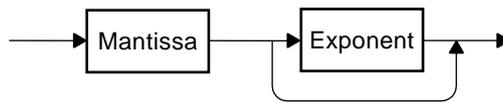
Figure 5-6 Numerical parameter syntax (< NR3>)

The syntax for the mantissa and the exponent of Figure 5-6 is illustrated below.
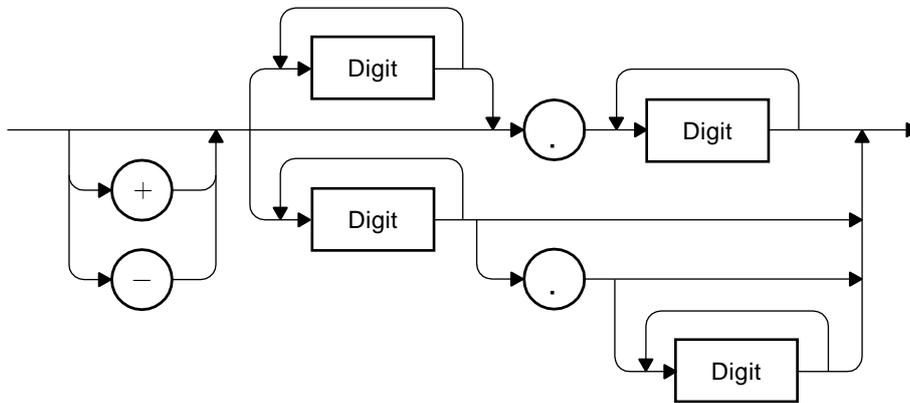
Figure 5-7 Mantissa syntax
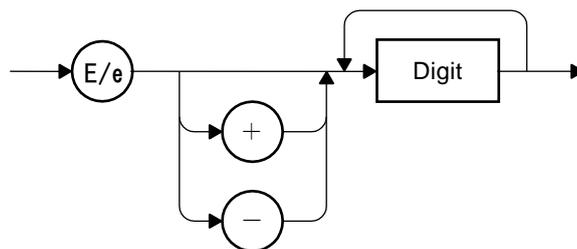
Figure 5-8 Exponent syntax

(2) Discrete parameters (<DISC>)

The syntax for discrete parameters is illustrated below.
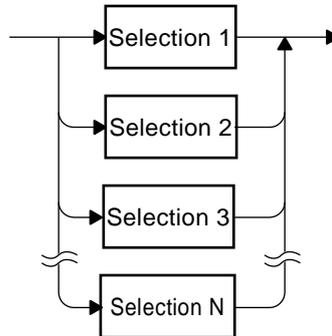
Figure 5-9 Discrete parameter syntax (<DISC>)

(3) Boolean parameters (<BOL>)

The syntax for Boolean parameters is illustrated below.

The Boolean parameter value of 0 is interpreted as "false" (OFF) and all other values are interpreted as "true" (ON).
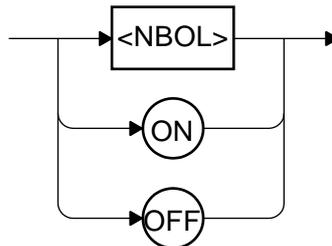
Figure 5-10 Boolean parameter syntax (<BOL>)

(4) Text string parameters (<STR>)

The syntax for text string parameters is illustrated below.
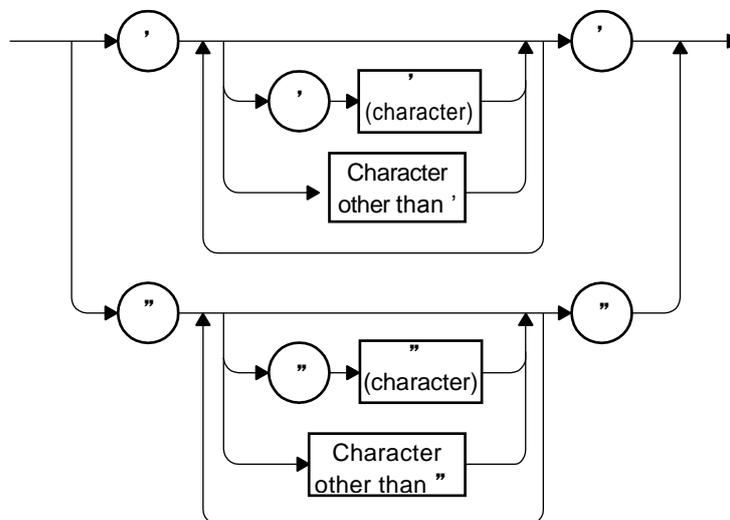
Figure 5-11 Text string parameter syntax (<STR>)

(5) Block parameters (<BLK>)

The syntax for block parameters is illustrated below.
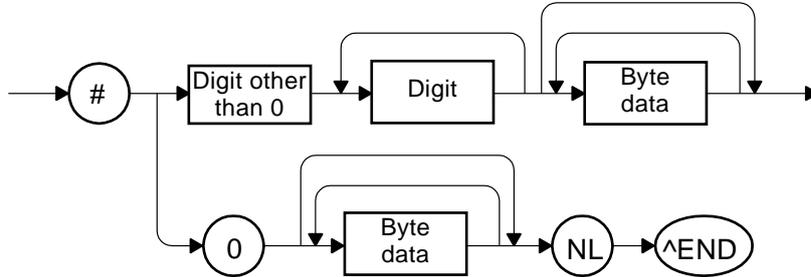
Figure 5-12 Block parameter syntax (<BLK>)

In the above diagram, NL is the new line character (ASCII code 10) and ^END is the final byte assertion (EOI).

(E) Parameter separator

The parameter separator is used between two parameters when two or more parameters are used in a command.

(F) Query parameters

Query parameters are specified after the "?" of a query.

(G) Suffixes

In some commands, it is possible to set a value by specifying an SI prefix and unit. The syntax for suffixes is illustrated below.
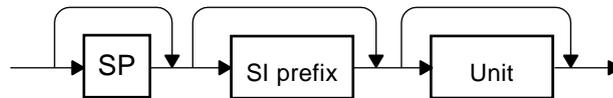
Figure 5-13 Suffix syntax

5.1.2.4 Program message syntax

The controller can send a combination of two or more common commands and subsystem commands to the instrument in a single program message. The program message syntax is illustrated below.
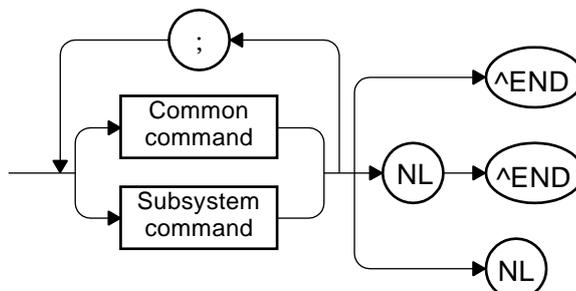
Figure 5-14 Program message syntax

Commands are separated by semicolons.

5.1.2.5 Response message syntax

Response messages are used by the instrument to send data in response to a query.

(A) Response message syntax
The syntax for response messages is illustrated in Figure 5-15.
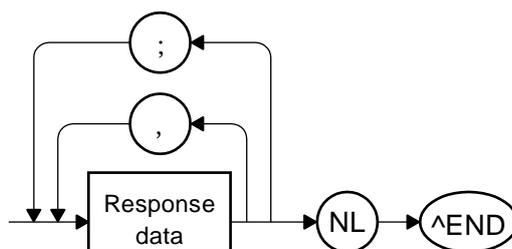
Figure 5-15 Response message syntax

In response messages, commas and semicolons are used as separators. When multiple values are returned for a single command, the data items are delineated by commas. In a response message for a single program message that contains multiple queries, on the other hand, the data that is returned for those respective queries is delineated by semicolons.

(B) Response message data
The response message data types are described below.

(1) Numerical response data (<NR1>, <NR2>, and <NR3>)

The syntax for numerical response data is illustrated below.
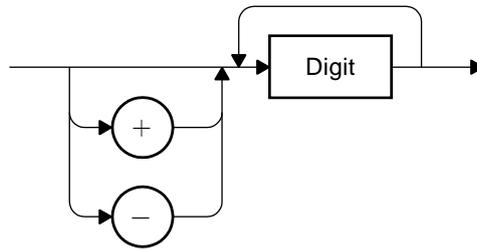
Figure 5-16 Integer response data syntax (<NR1>)
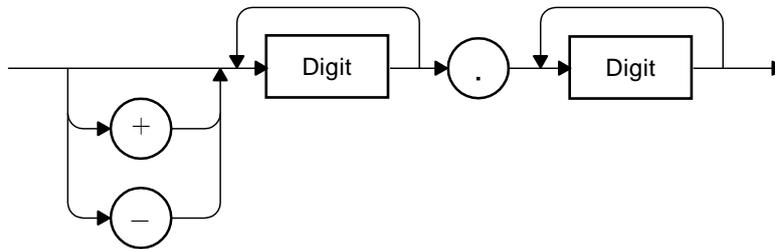
Figure 5-17 NR2 numerical response data syntax (<NR2>)
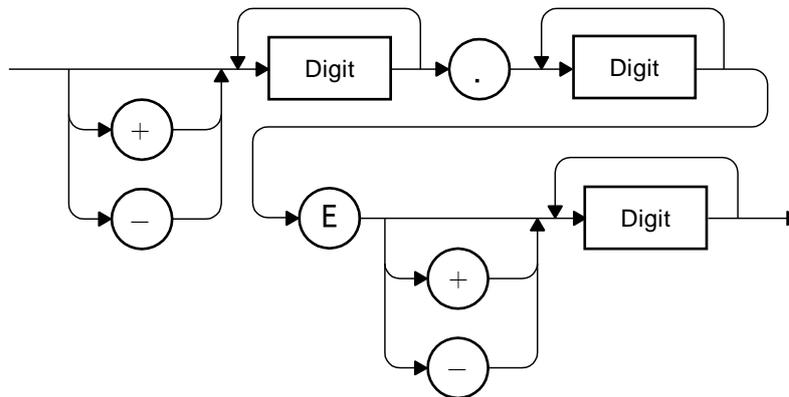
Figure 5-18 NR3 numerical response data syntax (<NR3>)

(2) Discrete response data (<DISC>)

The syntax for discrete response data is illustrated below.
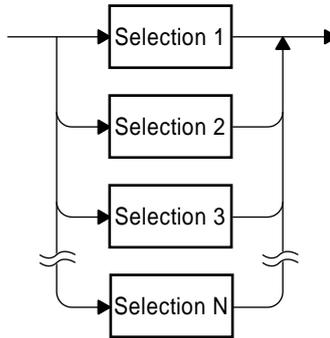
Figure 5-19 Discrete response data syntax (<DISC>)

(3) Numerical Boolean response data (<NBOL>)

The syntax for numerical Boolean response data is illustrated below.
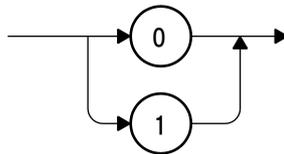
Figure 5-20 Numerical Boolean response data syntax (<NBOL>)

(4) Text string response data (<STR>)

The syntax for text string response data is illustrated below.
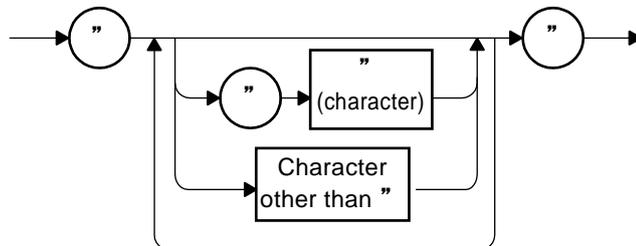
Figure 5-21 Text string response data syntax (<STR>)

(5) Defined-length arbitrary block response data (<DBLK>)

The syntax for defined-length arbitrary block response data is illustrated in Figure 5-22.
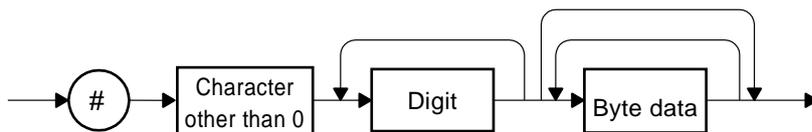
Figure 5-22 Defined-length arbitrary block response data syntax (<DBLK>)

5.2 Sequential commands

The ZA57630 commands are all sequential commands. When execution of the command is completed, the next command is executed. There are no overlapping commands.

5.3 Command details

Each command is explained in detail below.

Supplement: There is the expression "6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))" for the resolution in the tables, but this indicates that there are normally 6 significant digits and that 1 f(10^{-15})) in the case of a setting value less than 1 n(10^{-9}).

5.3.1 *CLS

Explanation	Clears the status register and error queue
Comments	Targets for the clear operation: Status byte register Standard event status register Operation status event register Error queue

5.3.2 *ESE <value>
*ESE?

Explanation	Sets and queries the standard event status enable register		
Parameters	<value>	<NR1>	Standard event status enable register
			Range : 0 to 255 Resolution : 1 Default : 0
Response format	<NR1>		
Comments	Initialized when the power is turned on. Not initialized by *RST.		

5.3.3 *ESR?

Explanation	Queries the standard event status register
Response format	<NR1>
Comments	Standard event status register is cleared when an *ESR? query or *CLS command is received.

5.3.4 *IDN?

Explanation	Queries the instrument identification information		
Response format	<corporation>,<model>,<serial>,<ver>		
	<corporation>	<STR>	Company name (NF Corporation)
	<model>	<STR>	Model name (ZA57630)
	<serial>	<STR>	Serial number
	<ver>	<STR>	Version
Comments	The response returned does not include quotation marks (""). NF Corporation,ZA57630,1234567,Ver1.00		

5.3.5 *OPC
*OPC?

Explanation	*OPC : Sets the OPC bit to 1 when all of the previous commands have completed *OPC? : Sets 1 to the output buffer when all the previous commands have completed
Response format	<NR1>
Comments	—

5.3.6 *RCL <value>

Explanation	Executes a read from the setting memory (internal memory)		
Parameters	<value>	<NR1>	Setting memory number Range : 1 to 32 Resolution: 1
Comments	—		

5.3.7 *RST

Explanation	Initializes the configuration settings
Comments	—

5.3.8 *SAV <value>

Explanation	Executes a save to the setting memory (internal memory)		
Parameters	<value>	<NR1>	Setting memory number Range : 1 to 32 Resolution: 1
Comments	—		

5.3.9 *SRE <value>
*SRE?

Explanation	Sets and queries the service request enable register		
Parameters	<value>	<NR1>	Service request enable register Range : 0 to 255 Resolution: 1 Default : 0
Response format	<NR1>		
Comments	Initialized when the power is turned on. Not initialized by *RST.		

5.3.10 *STB?

Explanation	Queries the status byte register
Response format	<NR1>
Comments	—

5.3.11 *TST?

Explanation	Queries the self-diagnostic test results
Response format	<NR1>
Comments	Always, 0 is returned.

5.3.12 *WAI

Explanation	Standby for end of overlapping command execution
Comments	There are no overlapping commands for the ZA57630.

5.3.13 :CALCulate:CKIT:CONStant?

Explanation	Queries the currently set equivalent circuit type and the equivalent circuit constants obtained by calculation.		
Response format	<type>,<const0>,<const1>,<const2>,<const3>		
	<type>	<NR1>	Equivalent circuit type (1 to 6)
	<const0>	<NR3>	Equivalent circuit constant 0
	<const1>	<NR3>	Equivalent circuit constant 1
	<const2>	<NR3>	Equivalent circuit constant 2
	<const3>	<NR3>	Equivalent circuit constant 3
Comments	The correspondence of equivalent circuit constant 0 to 3 is as follows. [When type = 1 to 4]: <const0> C, <const1> R, <const2> L, and <const3> fixed to 0 [When type = 5] : <const0> C0, <const1> C1, <const2> R, and <const3> L [When type = 6] : <const0> C, <const1> R0, <const2> R1, and <const3> fixed to 0		

5.3.14 :CALCulate:COMParator:BEEPer[:STATe] <sw>

      :CALCulate:COMParator:BEEPer[:STATe]?

Explanation	Sets and queries whether or not the beep sounds with the comparator function			
Parameters	<sw>	<BOL>	Permits/prohibits the beep	
			ON | 1	Sounds the beep when the comparison result meets the specified conditions
			OFF | 0	Never sounds the beep
			*RST value : ON	
Response format	<NBOL>			
Comments	If this is set when the measurement mode is G-PH, an error occurs.			

5.3.15 :CALCulate:COMParator:BIN:BOUNds <bin_no>,<lower1>,<upper1>,<lower2>,<upper2>
:CALCulate:COMParator:BIN:BOUNds? <bin_no>

Explanation	Sets and queries the parameter range upper and lower limits of each bin		
Parameters	<bin no>	<NR1>	Bin number that is the target for setting the parameter range upper and lower limits
			Range : 1 to 14
			Resolution : 1
	<lower1>	<NRf> | OFF	Bin comparison primary parameter lower limit value
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
	<upper1>	<NRf> | OFF	Bin comparison primary parameter upper limit value
			Range : Same as <lower1>
			Resolution : Same as <lower1>
			*RST value : 0.0
	<lower2>	<NRf> | OFF	Bin comparison secondary parameter lower limit value
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
	<upper2>	<NRf> | OFF	Bin comparison secondary parameter upper limit value
			Range : Same as <lower2>
			Resolution : Same as <lower2>
			*RST value : 0.0
Query Parameters	<bin no>	<NR1>	Bin number that is the target for setting the parameter range upper and lower limits
			Range : 1 to 14
			Resolution : 1
Response format	<lower1>,<upper1>,<lower2>,<upper2>		
	<lower1>	< NR3> | OFF	Bin comparison primary parameter lower limit value
	<upper1>	< NR3> | OFF	Bin comparison primary parameter upper limit value
	<lower2>	< NR3> | OFF	Bin comparison secondary parameter lower limit value
	<upper2>	< NR3> | OFF	Bin comparison secondary parameter upper limit value
Comments	・In this command, specify the deviation from the reference value when the comparator comparison format is DEV, and the deviation % from the reference value when it is PCNT. ・If the value of <upper> is lower than that of <lower> or the value of <lower> is higher than that of <upper>, an error occurs. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.16 :CALCulate:COMParator:BIN:NOMinal <nom1>, <nom2>
:CALCulate:COMParator:BIN:NOMinal?

Explanation	Sets and queries the reference values of the primary parameter and secondary parameter of the comparator function.		
Parameters	<nom1>	<NRf>	Primary parameter reference value
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
	<nom2>	<NRf>	Secondary parameter reference value
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
Response format	<nom1>,<nom2>		
	<nom1>	<NR3>	Primary parameter reference value
	<nom2>	<NR3>	Secondary parameter reference value
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.17 :CALCulate:COMParator:BIN[:STATe] \<bin> \<sw>

:CALCulate:COMParator:BIN[:STATe]? \<bin>

Explanation	Sets and queries enable/disable of each bin		
Parameters	\<bin>	\<NR1>	Bin target for switching enable/disable
			Range : 1 to 14
			Resolution: 1
	\<sw>	\<BOL>	Sets enable/disable
			ON | 1 — Enables the bin of the number specified in \<bin>
			OFF | 0 — Disables the bin of the number specified in \<bin>
			*RST value: 0 (BIN1 is fixed to 1)
Query Parameters	\<bin>	\<NR1>	Bin target for querying enable/disable
Response format	\<NBOL>		
Comments	· \<sw> is fixed to 1 when \<bin> is 1 · If this is set when the measurement mode is G-PH, an error occurs.		

5.3.18 :CALCulate:COMParator:MODE \<mode>

:CALCulate:COMParator:MODE?

Explanation	Sets and queries the comparison format of the comparator function		
Parameters	\<mode>	\<DISC>	Comparison format
			ABS — Comparison by absolute values (maximum value and minimum value)
			DEV — Comparison by deviation from reference value
			PCNT — Comparison by deviation percentage value
			*RST value: ABS
Response format	ABS | DEV | PCNT		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.19 :CALCulate:COMParator:RESult?

Explanation	Queries the last bin comparison or zone comparison result		
Response format	[When bin comparison or when zone comparison] : <type>,<result> [When limit comparison]　　　　　　　　　　　　　 : <type>,<result-pri>,<result_sec>		
	<type>	<DISC>	Comparison format LIMIT | BIN | ZONE | NA
			LIMIT	Limit comparison (bin comparison with only BIN1 enabled)
			BIN	Bin comparison
			ZONE	Zone comparison
			NA	No comparison
	<result>	<DISC>	Bin comparison result BIN1 | BIN2 | BIN3 | BIN4 | BIN5 | BIN6 | BIN7 | BIN8 | BIN9 | BIN10 | BIN11 | BIN12 | BIN13 | BIN14 | OUT | ERR
			BIN1	Within BIN1 comparison range
			BIN2	Within BIN2 comparison range
			BIN3	Within BIN3 comparison range
			BIN4	Within BIN4 comparison range
			BIN5	Within BIN5 comparison range
			BIN6	Within BIN6 comparison range
			BIN7	Within BIN7 comparison range
			BIN8	Within BIN8 comparison range
			BIN9	Within BIN9 comparison range
			BIN10	Within BIN10 comparison range
			BIN11	Within BIN11 comparison range
			BIN12	Within BIN12 comparison range
			BIN13	Within BIN13 comparison range
			BIN14	Within BIN14 comparison range
			OUT	Out of all BIN comparison ranges
			ERR	Measurement error or other error
			Zone comparison result IN | PRIIN | SECIN | OUT | ERR |NA	
			IN	Both primary and secondary parameters are IN
			PRIIN	Primary parameter only is IN and secondary parameter is OUT
			SECIN	Secondary parameter only is IN and primary parameter is OUT
			OUT	Both primary and secondary parameters are OUT
			ERR	Measurement error or other error
			NA	No comparison
	<result-pri>	<DISC>	Primary parameter comparison result LO | IN | HI | ERR
			LO	Less than primary parameter comparison reference value
			IN	Within comparison reference value
			HI	Exceeds primary parameter comparison reference value
			ERR	Measurement error or other error
	<result_sec>	<DISC>	Secondary parameter comparison result LO | IN | HI | ERR
			LO	Less than secondary parameter comparison reference value
			IN	Within comparison reference value
			HI	Exceeds secondary parameter comparison reference value
			ERR	Measurement error or other error
Comments	・ If comparison has not been made even once since startup, NA and NA are returned. ・ If an error occurs during limit comparison, ERR is returned for both <result-pri> and <result_sec>.		

5.3.20 :CALCulate:COMParator[:STATe] <sw>
:CALCulate:COMParator[:STATe]?

Explanation	Sets and queries enable/disable of the comparator function		
Parameters	<sw>	<BOL>	Enables/disables the comparator function
			ON | 1 Enables the comparator function
			OFF | 0 Disables the comparator function
			*RST value : 0
Response format	<NBOL>		
Comments	・ The bin comparison or limit comparison function always operate when the comparator is enabled. (Except when using the test function of the handler interface.) ・ If this is set when the measurement mode is G-PH, an error occurs.		

5.3.21 :CALCulate:COMParator:ZONE:IMMediate:BOUNds

   <sweep(1)>,<lower1(1)>,<upper1(1)>,<lower2(1)>,<upper2(1)>

   [,<sweep(2)>,<lower1(2)>,<upper1(2)>,<lower2(2)>,<upper2(2)>[, …

   [,<sweep(n)>,<lower1(n)>,<upper1(n)>,<lower2(n)>,<upper2(n)>]]]

:CALCulate:COMParator:ZONE:IMMediate:BOUNds?

Explanation	Sets and queries the zone comparison reference values of zone comparison format IMMED		
Parameters	<sweep(m)>	<NRf>	Sweep parameter value of zone comparison reference values
			Range : -1.0 T to 1.0 T(10^{12}) Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9})) *RST value : OFF (OFF means no reference data)
	<lower1(m)>	<NRf> | OFF	Zone comparison reference value Y1 lower limit
			Range : -1.0 T to 1.0 T(10^{12}) Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9})) *RST value : OFF (OFF means no reference data)
	<upper1(m)>	<NRf> | OFF	Zone comparison reference value Y1 upper limit
			Range : Same as <lower1(m)> Resolution : Same as <lower1(m)> *RST value : OFF (OFF means no reference data)
	<lower2(m)>	<NRf> | OFF	Zone comparison reference value Y2 lower limit
			Range : -1.0 T to 1.0 T(10^{12}) Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9})) *RST value : OFF (OFF means no reference data)
	<upper2(m)>	<NRf> | OFF	Zone comparison reference value Y2 upper limit
			Range : Same as <lower2(m)> Resolution : Same as <lower2(m)> *RST value : OFF (OFF means no reference data)
Response format	<sweep(1)>,<lower1(1)>,<upper1(1)>,<lower2(1)>,<upper2(1)>, <sweep(2)>,<lower1(2)>,<upper1(2)>,<lower2(2)>,<upper2(2)>, … <sweep(n)>,<lower1(n)>,<upper1(n)>,<lower2(n)>,<upper2(n)>		
	<sweep(m)>	< NR3> | OFF	Sweep parameter value of zone comparison reference values
	<lower1(m)>	< NR3> | OFF	Zone comparison reference value Y1 lower limit
	<upper1(m)>	< NR3> | OFF	Zone comparison reference value Y1 upper limit
	<lower2(m)>	< NR3> | OFF	Zone comparison reference value Y2 lower limit
	<upper2(m)>	< NR3> | OFF	Zone comparison reference value Y2 upper limit
Comments	・ If you will not set values for <lower> and <upper>, specify "OFF." ・ If this is set when the measurement mode is G-PH, an error occurs. ・ If this is set when sequence measurement is enabled, an error occurs. ・ If this is set when the X-axis is other than the sweep parameter, an error occurs. ・ If the value of <upper> is lower than that of <lower> or the value of <lower> is higher than that of <upper>, an error occurs. ・ For setting, the maximum is 20 sets. ・ If the <sweep>,<lower1>,<upper1>,<lower2>,<upper2> set is not complete, the last data set is discarded. (Unexpected number of parameters) ・ For queries, 20 sets are returned. ・ If this is not set, OFF is inserted and returned.		

5.3.22 :CALCulate:COMParator:ZONE:MODE <mode>

:CALCulate:COMParator:ZONE:MODE?

Explanation	Sets and queries the comparison format of zone comparison		
Parameters	<mode>	<DISC>	Comparison format of zone comparison
			IMMediate ZONE-IMMED comparison
			DEV ZONE-REF comparison (DEV)
			PCNT ZONE-REF comparison (DEV%)
			*RST value ：DEV
Response format	IMM | DEV | PCNT		
Comments	・ If this is set when the measurement mode is G-PH, an error occurs. ・ If this is set when sequence measurement is enabled, an error occurs. ・ If this is set when the X-axis is other than the sweep parameter, an error occurs.		

5.3.23 :CALCulate:COMParator:ZONE:REFerence:BOUNds <lower1>,<upper1>,<lower2>,<upper2>

:CALCulate:COMParator:ZONE:REFerence:BOUNds?

Explanation	Sets and queries the zone comparison deviation in zone comparison format REF (DEV) or REF (DEV%)		
Parameters	<lower1>	<NRf> | OFF	Zone comparison reference value Y1 lower limit
			Range ：-1.0 T to 1.0 T(10^{12})
			Resolution ：6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value：OFF
	<upper1>	<NRf> | OFF	Zone comparison reference value Y1 upper limit
			Range ：Same as <lower1>
			Resolution ：Same as <lower1>
			*RST value：OFF
	<lower2>	<NRf> | OFF	Zone comparison reference value Y2 lower limit
			Range ：-1.0 T to 1.0 T(10^{12})
			Resolution ：6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value：OFF
	<upper2>	<NRf> | OFF	Zone comparison reference value Y2 upper limit
			Range ：Same as <lower2>
			Resolution ：Same as <lower2>
			*RST value ：OFF
Response format	<lower1>,<upper1>,<lower2>,<upper2>		
	<lower1>	< NR3> | OFF	Zone comparison reference value Y1 lower limit
	<upper1>	< NR3> | OFF	Zone comparison reference value Y1 upper limit
	<lower2>	< NR3> | OFF	Zone comparison reference value Y2 lower limit
	<upper2>	< NR3> | OFF	Zone comparison reference value Y2 upper limit
Comments	・ If this is set when the measurement mode is G-PH, an error occurs. ・ If this is set when sequence measurement is enabled, an error occurs. ・ If this is set when the X-axis is other than the sweep parameter, an error occurs. ・ If the value of <upper> is lower than that of <lower> or the value of <lower> is higher than that of <upper>, an error occurs.		

5.3.24 :CALCulate:COMParator:ZONE:REFerence:TRACe <no>
:CALCulate:COMParator:ZONE:REFerence:TRACe?

Explanation	Sets and queries the reference trace number to use in zone comparison format REF (DEV) or REF (DEV%)		
Parameters	<no>	<NR1>	Reference trace number to use in zone comparison
			Range : 1 to 8
			Resolution : 1
			*RST value : 1
Response format	<NR1>		
Comments	・ If this is set when the measurement mode is G-PH, an error occurs. ・ If this is set when sequence measurement is enabled, an error occurs. ・ If this is set when the X-axis is other than the sweep parameter, an error occurs.		

5.3.25 :CALCulate:COMParator:ZONE[:STATe] <sw>
:CALCulate:COMParator:ZONE[:STATe]?

Explanation	Sets and queries enable/disable of zone comparison		
Parameters	<sw>	<BOL>	Enables/disables zone comparison
			ON | 1	Enables zone comparison
			OFF | 0	Disables zone comparison
			*RST value : 0
Response format	<NBOL>		
Comments	・ If this is set when the measurement mode is G-PH, an error occurs. ・ If this is set when sequence measurement is enabled, an error occurs. ・ If this is set when the X-axis is other than the sweep parameter, an error occurs.		

5.3.26 :CALCulate:DATA:MARKer? <marker>

Explanation	Reads a marker value		
Query Parameters	<marker>	<NR1>	Marker number of query target
			Range : 1 to 8
			Resolution: 1
Response format	[When the X-axis is SWEEP] : <SWEEPdata>,<Y1data>,<Y2data>,<status> [When the X-axis is not SWEEP] : <SWEEPdata>,<Xdata>,<Y1data>,<status>		
	<SWEEPdata>	<NR2>	Sweep parameter
	<Xdata>	<NR3>	X axis data
	<Y1data>	<NR3>	Y1 axis data
	<Y2data>	<NR3>	Y2 axis data
	<status>	<NR1>	Status
Comments	・ The data format is in accordance with each axis data setting of the graph settings. ・ If there is no valid measurement data, such as when measurement has not been performed, "NaN" (not a number) is returned. ・ During a sweep measurement, the current measurement value is returned. ・ After a sweep measurement, the data for the position of the specified marker is returned, regardless of the marker display status. ・ When the display mode of the specified marker is delta (DELTa) or tracking delta (TRACk), the difference from marker 1 is returned.		

5.3.27 :CALCulate:DATA:MARKer:MODE <marker>,<mode>
   :CALCulate:DATA:MARKer:MODE? <marker>

Explanation	Sets and queries the marker mode.		
Parameters	<marker>	<NR1>	Marker number of setting target
			Range : 1 to 8
			Resolution: 1
	<mode>	<DISC>	Marker mode
			OFF : Hide the marker.
			NORMal : Displays the current value
			DELTa : Displays the difference of the value from marker 1
			TRACk : Displays the difference of the value from marker 1 (moves in conjunction with marker 1)
			*RST value: Marker 1 is NORM, otherwise OFF
Query Parameters	<marker>	<NR1>	Marker number of query target
			Range : 1 to 8
			Resolution: 1
Response format	OFF | NORM | DELT | TRAC		
Comments	· If DELTa or TRACk is specified for the marker mode of marker 1, an error occurs. · If DELTa or TRACk is specified for the marker mode of markers 2 to 8 when the marker mode of marker 1 is OFF, an error occurs.		

5.3.28 :CALCulate:DATA:MARKer:MOVE <marker>,<position>

Explanation	Moves the marker of the specified number to the specified position		
Parameters	<marker>	<NR1>	Marker number of setting target
			Range : 1 to 8
			Resolution: 1
	<position>	<NRf>	Move destination of marker (specified with sweep target parameter) [When frequency sweep] : Frequency [Hz] [When amplitude sweep] : Measurement signal output voltage [Vrms] / current [Arms] [When offset sweep] : Bias output voltage [V] / current [A] [When zero-span sweep] : Time elapsed since start of sweep [s]
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
Comments	—		

5.3.29 :CALCulate:DATA:MARKer:SEARch <marker>,<param>

Explanation	Executes a marker search		
Parameters	<marker>	<NR1>	Marker number of marker search target
			Range : 1 to 8
			Resolution : 1
	<param>	<DISC>	Marker search content
			XMAX	X Max
			XMIN	X Min
			XPEAk	X Peak
			XBOTtom	X Bottom
			NXPEak	Next X Peak
			NXBOttom	Next X Bottom
			PXPEak	Previous X Peak
			PXBOttom	Previous X Bottom
			X	X
			NX	Next X
			PX	Previous X
			DX	$\triangle$X
			NDX	Next $\triangle$X
			PDX	Previous $\triangle$X
			Y1MAx	Y1 Max
			Y1MIn	Y1 Min
			Y1PEak	Y1 Peak
			Y1BOttom	Y1 Bottom
			NY1Peak	Next Y1 Peak
			NY1Bottom	Next Y1 Bottom
			PY1Peak	Previous Y1 Peak
			PY1Bottom	Previous Y1 Bottom
			Y1	Y1
			NY1	Next Y1
			PY1	Previous Y1
			DY1	$\triangle$Y1
			NDY1	Next $\triangle$Y1
			PDY1	Previous $\triangle$Y1
			Y2MAx	Y2 Max
			Y2MIn	Y2 Min
			Y2PEak	Y2 Peak
			Y2BOttom	Y2 Bottom
			NY2Peak	Next Y2 Peak
			NY2Bottom	Next Y2 Bottom
			PY2Peak	Previous Y2 Peak
			PY2Bottom	Previous Y2 Bottom
			Y2	Y2
			NY2	Next Y2
			PY2	Previous Y2
			DY2	$\triangle$Y2
			NDY2	Next $\triangle$Y2
			PDY2	Previous $\triangle$Y2
			BW1	BW1
			BW2	BW2
			BW3	BW3
Comments	—		

5.3.30 :CALCulate:DATA:MARKer:SEARch:AUTO <param>
:CALCulate:DATA:MARKer:SEARch:AUTO?

Explanation	Sets and queries automatic marker search			
Parameters	<param>	<DISC>	Marker search content	
			OFF	Turns the automatic marker search function off.
			BW1	BW1
			BW2	BW2
			BW3	BW3
			XMAX	X Max
			XMIN	X Min
			XPEAk	X Peak
			XBOTtom	X Bottom
			X	X
			DX	$\triangle$X
			Y1MAx	Y1 Max
			Y1MIn	Y1 Min
			Y1PEak	Y1 Peak
			Y1BOttom	Y1 Bottom
			Y1	Y1
			DY1	$\triangle$Y1
			Y2MAx	Y2 Max
			Y2MIn	Y2 Min
			Y2PEak	Y2 Peak
			Y2BOttom	Y2 Bottom
			Y2	Y2
			DY2	$\triangle$Y2
			*RST value　: OFF	
Response format	OFF | BW1 | BW2 | BW3 | XMAX | XMIN | XPEA | XBOT | X | DX | Y1MA | Y1MI | Y1PE | Y1BO | Y1 | DY1 | Y2MA | Y2MI | Y2PE | Y2BO | Y2 | DY2			
Comments	—			

5.3.31 :CALCulate:DATA:MARKer:TRACe <marker>,<trace>,<seq>

:CALCulate:DATA:MARKer:TRACe? <marker>

Explanation	Sets and queries the measurement data trace that will be the marker target			
Parameters	<marker>	<NR1>	Marker number	
			Range : 1 to 8	
			Resolution : 1	
	<trace>	<DISC>	Target data	
			MEAS	Measurement trace
			REF1	Reference trace 1
			REF2	Reference trace 2
			REF3	Reference trace 3
			REF4	Reference trace 4
			REF5	Reference trace 5
			REF6	Reference trace 6
			REF7	Reference trace 7
			REF8	Reference trace 8
			*RST value : MEAS	
	<seq>	<NR1>	Sequence number	
			Range : 1 to 32	
			Resolution : 1	
			*RST value : 1 (when sequence data)	
Query Parameters	<marker>	<NR1>	Marker number	
			Range : 1 to 8	
			Resolution : 1	
Response format	<trace>,<seq>			
	<trace>	<DISC>	MEAS | REF1 | REF2 | REF3 | REF4 | REF5 | REF6 | REF7 | REF8	
	<seq>	<NR1>	Sequence number	
Comments	[For setting] ・ For data that is not a sequence, <seq> is ignored. ・ If marker display is disabled or if measurement data for which display is disabled is made active, an error occurs. [For query] ・ For data that is not a sequence, 0 is returned for <seq>. ・ If marker display is disabled or if measurement data display is disabled, an error occurs.			

5.3.32 :CALCulate:DATA:MARKer:VALue <param>,<value>
:CALCulate:DATA:MARKer:VALue? <param>

Explanation	Sets and queries the marker search value		
Parameters	<param>	<DISC>	Parameters of setting target
			X	Sets the X marker search value
			Y1	Sets the Y1 marker search value
			Y2	Sets the Y2 marker search value
			DX	Sets the $\triangle$X marker search value
			DY1	Sets the $\triangle$Y1 marker search value
			DY2	Sets the $\triangle$Y2 marker search value
	<value>	<NRf>	Marker search value
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9}))
			*RST value : 0.0
Query Parameters	<param>	<DISC>	Parameters of query target
			X	Queries the X marker search value
			Y1	Queries the Y1 marker search value
			Y2	Queries the Y2 marker search value
			DX	Queries the $\triangle$X marker search value
			DY1	Queries the $\triangle$Y1 marker search value
			DY2	Queries the $\triangle$Y2 marker search value
Response format	<NR3>		
Comments	—		

5.3.33 :CALCulate:FORMat <param1>,<param2>[,…[,<param6>]]
:CALCulate:FORMat?

Explanation	Sets and queries the parameter format of the measurement results to be displayed on the screen when spot measurement			
Parameters	<param1> to <param6>	<DISC>	Specifies each parameter included in the measurement results returned by remote control.	
			FREQuency	F (frequency)	(All measurement modes)
			VOLTage	V (voltage) or V1	(All measurement modes)
			CURRent	I (current) or V2	(All measurement modes)
			MLINear	R (gain)	(G-PH)
			MLOGarithmic	dBR (gain)	(G-PH)
			REAL	a (real part)	(G-PH)
			IMAGinary	b (imaginary part)	(G-PH)
			Z	Z (impedance absolute value)	(IMPD-EXT/2T/3T)
			Y	Y (admittance absolute value)	(IMPD-EXT/2T/3T)
			R	R (resistance)	(IMPD-EXT/2T/3T)
			G	G (conductance)	(IMPD-EXT/2T/3T)
			CS	C_S (series capacitance)	(IMPD-EXT/2T/3T)
			CP	C_P (parallel capacitance)	(IMPD-EXT/2T/3T)
			LS	L_S (series inductance)	(IMPD-EXT/2T/3T)
			LP	L_P (parallel inductance)	(IMPD-EXT/2T/3T)
			X	X (reactance)	(IMPD-EXT/2T/3T)
			B	B (susceptance)	(IMPD-EXT/2T/3T)
			ES	εs (relative permittivity absolute value)	(IMPD-EXT/2T/3T)
			ES1	$\varepsilon s'$ (real part of relative permittivity)	(IMPD-EXT/2T/3T)
			ES2	$\varepsilon s''$ (imaginary part of relative permittivity)	(IMPD-EXT/2T/3T)
			US	μs (relative permeability absolute value)	(IMPD-EXT/2T/3T)
			US1	$\mu s'$ (real part of relative permeability)	(IMPD-EXT/2T/3T)
			US2	$\mu s''$ (imaginary part of relative permeability)	(IMPD-EXT/2T/3T)
			PHASe	θ (phase ±180°)	(G-PH)
			ZPHASe	θz (phase ±180°)	(IMPD-EXT/2T/3T)
			YPHASe	θy (phase ±180°)	(IMPD-EXT/2T/3T)
			RS	R_S (series resistance)	(IMPD-EXT/2T/3T)
			RP	R_P (parallel resistance)	(IMPD-EXT/2T/3T)
			D	D (loss rate)	(IMPD-EXT/2T/3T)
			DES	$D\varepsilon s$ (relative permittivity dissipation factor)	(IMPD-EXT/2T/3T)
			DUS	$D\mu s$ (relative permeability dissipation factor)	(IMPD-EXT/2T/3T)
			QC	Q_c (capacitor quality coefficient)	(IMPD-EXT/2T/3T)
			QL	Q_l (inductor quality coefficient)	(IMPD-EXT/2T/3T)
			STATus	Measurement status	(All measurement modes)
			NONE	NA (parameter not specified)	(All measurement modes)
			*RST value: [Measurement mode is IMPD-EXT] <param1> is Z, <param2> is ZPHAS, and the parameters from <param3> are NONE. [Measurement mode is IMPD-2T or IMPD-3T] <param1> is Z, <param2> is ZPHAS, and the parameters from <param3> are NONE. [Measurement mode is G-PH] <param1> is MLOG, <param2> is PHAS, and the parameters from <param3> are NONE.		

Response format	<param1>,<param2>[,<param3>[,<param4>[,<param5>[,<param6>]]]]		
	<param1> to <param6>	<DISC>	FREQ | VOLT | CURR | MLIN | MLOG | REAL | IMAG | Z | Y | R | G | CS | CP | LS | LP | X | B | ES | ES1 | ES2 | US | US1 | US2 | PHAS | ZPHAS | YPHAS | RS | RP | D | DES | DUS | QC | QL | STAT | NONE
Comments	· The items that can be set differ depending on the measurement mode. · STAT and NONE cannot be specified for <param1> and <param2>. · Parameters other than parameters 1 and 2 of the setting command can be omitted, but the settings of omitted parameters become NA (are not displayed) if other than parameter 1 is omitted. · For example, the frequency, Z, and θz are set to be displayed in the ":CALC:FORM FREQ,Z,ZPHAS" command, but the settings of param4 to param6 become NA.		

5.3.34 :CALCulate:FORMat:UPHase:SHIFt <value>

Explanation	Executes a phase shift (shift value) = 360 × <value>		
Parameters	<value>	<NR1>	Add value
			Range : -1 to 1 (-1 or 1)
Comments	The only valid settings are -1 and 1. The value is rounded to -1 or 1 if it is within the setting range.		

5.3.35 :CALCulate:PERMEAbility:PARameter <area>,<length>,<turns>,<diameter>,<loop>,<resistance>
:CALCulate:PERMEAbility:PARAameter?

Explanation	Sets and queries each parameter of the relative permeability calculation		
Parameters	<area>	<NRf>	Core effective cross-sectional area (mm^2)
			Range : 0.001 to 99990 Resolution : 4 significant digits (0.001 for <10) *RST value : 100.0
	<length>	<NRf>	Core effective magnetic path length (mm)
			Range : 0.001 to 9999 Resolution : 4 significant digits (0.001 for <10) *RST value : 100.0
	<turns>	<NR1>	Number of coil turns (turns)
			Range : 1 to 9999 Resolution : 1 *RST value : 10
	<diameter>	<NRf>	Winding wire diameter (mm)
			Range : 0.001 to 9999 Resolution : 4 significant digits (0.001 for <10) *RST value : 1.0
	<loop>	<NRf>	One coil turn length (mm)
			Range : 0.001 to 9999 Resolution : 4 significant digits (0.001 for <10) *RST value : 10.0
	<resistance>	<NRf>	Winding wire resistivity (Ωm)
			Range : 10.0 p(10^{-12}) to 1.0 Resolution : 4 significant digits (10 p(10^{-12}) for <100 n(10^{-9})) *RST value : 16.80 n(10^{-9})
Response format	<area>,<length>,<turns>,<diameter>,<loop>,<resistance>		
	<area>	<NR3>	Core effective cross-sectional area (mm^2)
	<length>	<NR3>	Core effective magnetic path length (mm)
	<turns>	<NR1>	Number of coil turns (turns)
	<diameter>	<NR3>	Winding wire diameter (mm)
	<loop>	<NR3>	One coil turn length (mm)
	<resistance>	<NR3>	Winding wire resistivity (Ωm)
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.36 :CALCulate:PERMITtivity:PARameter <area>,<distance>
:CALCulate:PERMITtivity:PARameter?

Explanation	Sets and queries the electrode surface area and distance between electrodes of the relative permittivity calculation		
Parameters	<area>	<NRf>	Electrode surface area (mm^2)
			Range : 0.001 to 99990
			Resolution : 4 significant digits (0.001 for <10)
			*RST value : 100.0
	<distance>	<NRf>	Distance between electrodes (mm)
			Range : 0.001 to 9999
			Resolution : 4 significant digits (0.001 for <10)
			*RST value : 1.0
Response format	<area>,<distance>		
	<area>	<NR3>	Electrode surface area (mm^2)
	<distance>	<NR3>	Distance between electrodes (mm)
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.37 :CALCulate:PZT:CKIT:CONStant?

Explanation	Queries the equivalent circuit constants of piezoelectric elements		
Response format	<proc>,<C0>,<C1>,<R>,<L>		
	<proc>	<DISC>	Derivation algorithm of characteristic frequency f0
			FMAX | GMAX | BAVG | RESNF
			FMAX fmax
			GMAX Gmax
			BAVG Bavg
			RESNF RESNf
	<C0>	<NR3>	Equivalent circuit constant C0[F]
	<C1>	<NR3>	Equivalent circuit constant C1[F]
	<R>	<NR3>	Equivalent circuit constant R[Ω]
	<L>	<NR3>	Equivalent circuit constant L[H]
Comments	When the measurement mode is G-PH, 0 is returned for all of them.		

5.3.38 :CALCulate:PZT:CONStant?

Explanation	Queries the piezoelectric constants of piezoelectric elements		
Response format	<A1>,<A2>,<A3>,<PD>,<PG>,<EM>		
	<A1>	<NR3>	Elasticity factor (1) 　Disc-Radial　　　　　　　　　　: S^E_{12} 　Disc-Thickness extensional : C^D_{33} 　Rod-Axial　　　　　　　　　　　: S^D_{33} 　Plate-Length extensional　: S^E_{11} 　Plate-Thickness shear　　　: C^D_{44}
	<A2>	<NR3>	Elasticity factor (2) 　Disc-Radial　　　　　　　　　　: S^E_{66} 　Disc-Thickness extensional : C^E_{33} 　Rod-Axial　　　　　　　　　　　: S^E_{33} 　Plate-Length extensional　: 0 (fixed value) 　Plate-Thickness shear　　　: C^E_{44}
	<A3>	<NR3>	Elasticity factor (3) 　Disc-Radial　　　　　　　　　　: 0 (fixed value) 　Disc-Thickness extensional : S^E_{13} 　Rod-Axial　　　　　　　　　　　: 0 (fixed value) 　Plate-Length extensional　: 0 (fixed value) 　Plate-Thickness shear　　　: S^E_{44}
	<PD>	<NR3>	Piezoelectric constant d 　Rod-Axial　　　　　　　　　　　: d_{33} 　Plate-Length extensional　: d_{31} 　Plate-Thickness shear　　　: d_{15} 　Other　　　　　　　　　　　　　: 0 (fixed value)
	<PG>	<NR3>	Piezoelectric constant g 　Rod-Axial　　　　　　　　　　　: g_{33} 　Plate-Length extensional　: g_{31} 　Plate-Thickness shear　　　: g_{15} 　Other　　　　　　　　　　　　　: 0 (fixed value)
	<EM>	<NR3>	Electromechanical coupling factor 　Disc-Radial　　　　　　　　　　: k_r 　Disc-Thickness extensional : k_t 　Rod-Axial　　　　　　　　　　　: k_{33} 　Plate-Length extensional　: k_{31} 　Plate-Thickness shear　　　: 0 (fixed value)
Comments	The meaning of the response content differs depending on the vibrator shape and vibration mode. (Refer to the explanation of each element of the response format of this command.)		

5.3.39 :CALCulate:PZT:FACtor?

Explanation	Queries the characteristic frequency and mechanical quality factor of piezoelectric elements		
Response format	<f1>,<f2>,<fs>,<fp>,<fm>,<fn>,<fr>,<fa>,<Qm>		
	<f1>	<NR2>	Maximum susceptance point f1[Hz]
	<f2>	<NR2>	Minimum susceptance point f2[Hz]
	<fs>	<NR2>	Mechanical series resonant frequency fs[Hz]
	<fp>	<NR2>	Mechanical parallel resonant frequency fp[Hz]
	<fm>	<NR2>	Maximum admittance point fm[Hz]
	<fn>	<NR2>	Minimum admittance point fn[Hz]
	<fr>	<NR2>	Resonant frequency fr[Hz]
	<fa>	<NR2>	Antiresonant frequency fa[Hz]
	<Qm>	<NR3>	Mechanical quality factor Qm
Comments	If the piezoelectric constant calculation has not been performed even once since startup, 0 is returned for all of them.		

5.3.40 :CALCulate:PZT:SHAPe?

Explanation	Queries the DUT parameters (DUT shape / vibration mode) of piezoelectric elements		
Response format	<type>,<length>,<width>,<thickness>,<diameter>,<permittivity>,<poisson>,<density>		
	<type>	<DISC>	Vibrator shape / vibration mode DR | DT | RA | PL | PT
			DR	Disc-Radial
			DT	Disc-Thickness extensional
			RA	Rod-Axial
			PL	Plate-Length extensional
			PT	Plate-Thickness shear
	<length>	<NR3>	Length [mm]
	<width>	<NR3>	Width [mm]
	<thickness>	<NR3>	Thickness [mm]
	<diameter>	<NR3>	Diameter [mm]
	<permittivity>	<NR3>	Relative permittivity
	<poisson>	<NR3>	Poisson's ratio
	<density>	<NR3>	Density [kg/m^3]
Comments	For a parameter that is invalid with the currently set vibrator shape / vibration mode, 0 is returned.		

5.3.41 :DATA:CLEar <obj>

Explanation	Executes trace data deletion		
Parameters	<obj>	<DISC>	Data to be deleted
			MEAS	Deletes the measurement trace.
			REF1	Deletes reference trace 1.
			REF2	Deletes reference trace 2.
			REF3	Deletes reference trace 3.
			REF4	Deletes reference trace 4.
			REF5	Deletes reference trace 5.
			REF6	Deletes reference trace 6.
			REF7	Deletes reference trace 7.
			REF8	Deletes reference trace 8.
Comments	—		

5.3.42 :DATA:COPY:NAME <src-no>,<dest>

Explanation	Executes measurement data copying			
Parameters	<src-no>	<NR1>	Measurement data memory number of copy source	
			Range : 1 to 20	
			Resolution : 1	
	<dest>	<DISC>	Copy destination	
			REF1	Reference trace 1
			REF2	Reference trace 2
			REF3	Reference trace 3
			REF4	Reference trace 4
			REF5	Reference trace 5
			REF6	Reference trace 6
			REF7	Reference trace 7
			REF8	Reference trace 8
			EQU	Equalizing
			OPEN	Open correction
			SHORt	Short correction
			LOAD	Load correction
			POPEN	Port extended end open correction
			PSHORt	Port extended end short correction
			PLOAD	Port extended end load correction
Comments	If the copy destination is an equalizing, open correction, or other correction system, the data is copied to the correction memory specified in <mem_no> in the following command.			
	:SENSe:CORRection:EQUalizing <sw>,<mem_no>			
	:SENSe:CORRection:OPEN <sw>,<mem_no>			
	:SENSe:CORRection:SHORt <sw>,<mem_no>			
	:SENSe:CORRection:LOAD <sw>,<mem_no>			
	:SENSe:CORRection:EXTension:OPEN <sw>,<mem_no>			
	:SENSe:CORRection:EXTension:SHORt <sw>,<mem_no>			
	:SENSe:CORRection:EXTension:LOAD <sw>,<mem_no>			

5.3.43 :DATA[:DATA]? <param>,<start>,<num>

Explanation	Queries the sweep measurement data		
Query Parameters	<param>	<DISC>	Query targets
			MEAS	Gets the measurement trace.
			REF1	Gets reference trace 1.
			REF2	Gets reference trace 2.
			REF3	Gets reference trace 3.
			REF4	Gets reference trace 4.
			REF5	Gets reference trace 5.
			REF6	Gets reference trace 6.
			REF7	Gets reference trace 7.
			REF8	Gets reference trace 8.
	<start>	<NR1>	Data retrieval starting point
			Range : 0 to 20000
			Resolution : 1
	<num>	<NR1>	Number of data points to get
			Range : 1 to 20001
			Resolution : 1
Response format (When ASCII format is specified)	<param1[start]>,<param2[start]>,<param3[start]>,<param4[start]>,<param5[start]>, <param6[start]>,<param1[start + 1]>, ... , <param4[start + num - 1]>,<param5[start + num - 1]>,<param6[start + num - 1]>		
	<param1> to <param6>	[Other than frequency data and measurement status] : <NR3> [Frequency data] : <NR2> [Measurement status] : <NR1>	
Response format (When binary format is specified)	#<bytes-digits><bytes><data>		
	<bytes-digits>	<NR1>	Number of digits (1 to 6) of <bytes>
	<bytes>	<NR1>	Number of bytes (0 to 960048) of <data>
	<data>	<BLK>	Sweep measurement data The measurement data is returned in the order of param1 to param6 for each measurement point just like with the ASCII format. However, param1 to param6 are returned in binary format (IEEE754 double precision floating point format).
Comments	· param1 to param6 are the parameters specified in the DATA:FORMat command. · If there is no valid measurement data, such as when measurement has not been performed, "NaN" (not a number) is returned. · When measurement has been performed, the measurement data is returned at the end. · If "<start> + <num>" exceeds 20001, an error occurs.		

5.3.44 :DATA:DELete <memory>

Explanation	Executes initialization of the measurement memory (internal memory)		
Parameters	<memory>	<NR1>	Measurement memory number to be initialized Range : 1 to 20 Resolution : 1
Comments	—		

5.3.45 :DATA:FORMat <format>,<param1>[,<param2>[,…[,<param6>]]]
:DATA:FORMat?

Explanation	Sets and queries the format of the parameters included in the measurement results returned by remote control			
Parameters	<format>	<DISC>	Specifies the format of the measurement results returned by remote control.	
			ASCii	Returns the results as a string of ASCI digits.
			BBINary	Returns the results as a binary string (IEEE754 double precision floating point format) in big-endian order.
			LBINary	Returns the results as a binary string (IEEE754 double precision floating point format) in little-endian order.
	<param1> to <param6>	<DISC>	Specifies each parameter included in the measurement results returned by remote control.	
			SWEEP	SWEEP (frequency, amplitude, DC bias, time) (All measurement modes)
			FREQuency	f (frequency) (All measurement modes)
			VOLTage	V (voltage) or V1 (All measurement modes)
			CURRent	I (current) or V2 (All measurement modes)
			MLINear	R (gain) (G-PH)
			MLOGarithmic	dBR (gain) (G-PH)
			REAL	a (real part) (G-PH)
			IMAGinary	b (imaginary part) (G-PH)
			Z	Z (impedance) (IMPD-EXT/2T/3T)
			Y	Y (admittance) (IMPD-EXT/2T/3T)
			R	R (resistance) (IMPD-EXT/2T/3T)
			G	G (conductance) (IMPD-EXT/2T/3T)
			CS	C_S (series capacitance) (IMPD-EXT/2T/3T)
			CP	C_P (parallel capacitance) (IMPD-EXT/2T/3T)
			LS	L_S (series inductance) (IMPD-EXT/2T/3T)
			LP	L_P (parallel inductance) (IMPD-EXT/2T/3T)
			X	X (reactance) (IMPD-EXT/2T/3T)
			B	B (susceptance) (IMPD-EXT/2T/3T)
			ES	εs (relative permittivity absolute value) (IMPD-EXT/2T/3T)
			ES1	$\varepsilon s'$ (real part of relative permittivity) (IMPD-EXT/2T/3T)
			ES2	$\varepsilon s''$ (imaginary part of relative permittivity) (IMPD-EXT/2T/3T)
			US	μs (relative permeability absolute value) (IMPD-EXT/2T/3T)
			US1	$\mu s'$ (real part of relative permeability) (IMPD-EXT/2T/3T)
			US2	$\mu s''$ (imaginary part of relative permeability) (IMPD-EXT/2T/3T)
			PHASe	θ (phase ±180°) (G-PH)
			PPHase	θ (phase 0° to +360°) (G-PH)
			MPHase	θ (phase -360° to 0°) (G-PH)
			UPHase	θ (phase UNWRAP) (G-PH)
			ZPHASe	θz (phase ±180°) (IMPD-EXT/2T/3T)
			ZPPHase	θz (phase 0° to +360°) (IMPD-EXT/2T/3T)
			ZMPHase	θz (phase -360° to 0°) (IMPD-EXT/2T/3T)
			ZUPHase	θz (phase UNWRAP) (IMPD-EXT/2T/3T)
			YPHASe	θy (phase ±180°) (IMPD-EXT/2T/3T)
			YPPHase	θy (phase 0° to +360°) (IMPD-EXT/2T/3T)
			YMPHase	θy (phase -360° to 0°) (IMPD-EXT/2T/3T)
			YUPHase	θy (phase UNWRAP) (IMPD-EXT/2T/3T)
			GDELay	GD (group delay) (G-PH)
			RS	R_S (series resistance) (IMPD-EXT/2T/3T)
			RP	R_P (parallel resistance) (IMPD-EXT/2T/3T)
			D	D (dissipation factor) (IMPD-EXT/2T/3T)
			DES	$D\varepsilon s$ (relative permittivity dissipation factor) (IMPD-EXT/2T/3T)
			DUS	$D\mu s$ (relative permeability dissipation factor) (IMPD-EXT/2T/3T)
			QC	QC (capacitor quality coefficient) (IMPD-EXT/2T/3T)
			QL	Ql (inductor quality coefficient) (IMPD-EXT/2T/3T)
			STATus	Measurement status (All measurement modes)

Response format	<format>, <param1>[,<param2>[,<param3>[,<param4>[,<param5>[,<param6>]]]]]		
	<format>	<DISC>	ASC｜BBIN｜LBIN
	<param1> to <param6>	<DISC>	SWEEP｜FREQ｜VOLT｜CURR｜MLIN｜MLOG｜REAL｜IMAG｜Z｜Y｜R｜G｜CS｜CP｜LS｜LP｜X｜B｜ES｜ES1｜ES2｜US｜US1｜US2｜PHAS｜PPH｜MPH｜UPH｜ZPHAS｜ZPPH｜ZMPH｜ZUPH｜YPHAS｜YPPH｜YMPH｜YUPH｜GDEL｜RS｜RP｜D｜DES｜DUS｜QC｜QL｜STAT
Comments	・ The <format> setting in this command is applied to the response for the :DATA[:DATA]? command. ・ The <param1> to <param6> settings in this command are applied to the responses for the :DATA[:DATA]? command and :DATA:SPOT? command. ・ The initial values are as follows (the initial values at power on and when the mode is changed). 　[G-PH mode]: 　　<format> = ASC, <param1> = SWEEP, <param2> = MLOG, <param3> = PHAS 　[IMPD-2T, IMPD-3T, or IMPD-EXT mode]: 　　<format> = ASC, <param1> = SWEEP, <param2> = Z, <param3> = ZPHAS		

5.3.46 :DATA:POINts? <param>

Explanation	Queries the number of sweep measurement data points		
Query Parameters	<param>	<DISC>	Query targets
			MEAS	Gets the number of measurement data points of the measurement trace.
			REF1	Gets the number of measurement data points of reference trace 1.
			REF2	Gets the number of measurement data points of reference trace 2.
			REF3	Gets the number of measurement data points of reference trace 3.
			REF4	Gets the number of measurement data points of reference trace 4.
			REF5	Gets the number of measurement data points of reference trace 5.
			REF6	Gets the number of measurement data points of reference trace 6.
			REF7	Gets the number of measurement data points of reference trace 7.
			REF8	Gets the number of measurement data points of reference trace 8.
Response format	<NR1>		
Comments	—		

5.3.47 :DATA:RECall <memory>,<dest>

Explanation	Executes a read from the measurement memory (internal memory)		
Parameters	<memory>	<NR1>	Measurement memory number to read
			Range　　　：1 to 20
			Resolution：1
	<dest>	<DISC>	Destination for the data read
			MEAS	Measurement trace
			REF1	Reference trace 1
			REF2	Reference trace 2
			REF3	Reference trace 3
			REF4	Reference trace 4
			REF5	Reference trace 5
			REF6	Reference trace 6
			REF7	Reference trace 7
			REF8	Reference trace 8
Comments	—		

5.3.48 :DATA:SPOT?

Explanation	Reads the spot measurement data	
Response format	<param1>[,<param2>[,<param3>[,<param4>[,<param5>[,<param6>]]]]]	
	<param1> to <param6>	[Other than frequency data and measurement status] ：<NR3> [Frequency data] ：<NR2> [Measurement status] ：<NR1>
Comments	NAN is returned if SWEEP or GD is specified for <param1> to <param6> in the :DATA:FORMat command.	

5.3.49 :DATA:STATe:DEFine "<name>", <memory>

:DATA:STATe:DEFine? <memory>

Explanation	Sets and queries the measurement memory name (internal memory)		
Parameters	<name>	<STR>	Memory name
			Range:　Within 20 characters
	<memory>	<NR1>	Measurement memory number
			Range ：1 to 20
			Resolution ：1
Query Parameters	<memory>	<NR1>	Measurement memory number
			Range ：1 to 20
			Resolution ：1
Response format	<STR>		
Comments	・ The response returned includes quotation marks (""). ・ The characters that can be used for a memory name are as follows. 　ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789 　!"#$%&'()-=^~¥|@`[]{};:+*,.<>/?_ (space)		

5.3.50 :DATA:STORe <memory>,<src>

Explanation	Executes a save to the measurement memory (internal memory)			
Parameters	<memory>	<NR1>	Measurement memory number that is the save destination	
			Range ：1 to 20	
			Resolution ：1	
	<src>	<DISC>	Data to be saved	
			MEAS	Measurement trace
			REF1	Reference trace 1
			REF2	Reference trace 2
			REF3	Reference trace 3
			REF4	Reference trace 4
			REF5	Reference trace 5
			REF6	Reference trace 6
			REF7	Reference trace 7
			REF8	Reference trace 8
Comments	—			

5.3.51 :DISPlay:BRIGhtness <value>

:DISPlay:BRIGhtness?

Explanation	Sets and queries the LCD brightness		
Parameters	<value>	<NR1>	LCD brightness
			Range ：0 to 100
			Resolution ：1
Response format	<NR1>		
Comments	—		

5.3.52 :DISPlay[:WINDow]:FORMat <x-axis>,<y1-axis>,<y2-axis>
:DISPlay[:WINDow]:FORMat?

Explanation	Sets and queries the X, Y1, and Y2 parameters of the graph that is displayed on the main unit screen.				
Parameters	<x-axis>	<DISC>	X axis data		
			SWEEP	SWEEP (Frequency, amplitude, DC bias, time)	(All measurement modes)
			PHASe	θ (phase ±180°)	(G-PH)
			PPHase	θ (phase 0° to +360°)	(G-PH)
			MPHase	θ (phase -360° to 0°)	(G-PH)
			UPHase	θ (phase UNWRAP)	(G-PH)
			REAL	a (real part)	(G-PH)
			R	R (resistance)	(IMPD-EXT/2T/3T)
			G	G (conductance)	(IMPD-EXT/2T/3T)
			*RST value [Measurement mode is IMPD-EXT] : SWEEP [Measurement mode is IMPD-2T or IMPD-3T] : SWEEP [Measurement mode is G-PH] : SWEEP		
	<y1-axis>	<DISC>	Y1 axis data		
			MLINear	R (gain)	(G-PH)
			MLOGarithmic	dBR (gain)	(G-PH)
			REAL	a (real part)	(G-PH)
			IMAGinary	b (imaginary part)	(G-PH)
			Z	Z (impedance)	(IMPD-EXT/2T/3T)
			Y	Y (admittance)	(IMPD-EXT/2T/3T)
			R	R (resistance)	(IMPD-EXT/2T/3T)
			G	G (conductance)	(IMPD-EXT/2T/3T)
			CS	C_S (series capacitance)	(IMPD-EXT/2T/3T)
			CP	C_P (parallel capacitance)	(IMPD-EXT/2T/3T)
			LS	L_S (series inductance)	(IMPD-EXT/2T/3T)
			LP	L_P (parallel inductance)	(IMPD-EXT/2T/3T)
			X	X (reactance)	(IMPD-EXT/2T/3T)
			MX	- X (reactance)	(IMPD-EXT/2T/3T)
			B	B (susceptance)	(IMPD-EXT/2T/3T)
			FREQuency	f (frequency)	(IMPD-EXT/2T/3T)
			VOLTage	V (voltage) or V1	(All measurement modes)
			ES	εs (relative permittivity absolute value)	(IMPD-EXT/2T/3T)
			ES1	εs' (real part of relative permittivity)	(IMPD-EXT/2T/3T)
			ES2	εs" (imaginary part of relative permittivity)	(IMPD-EXT/2T/3T)
			US	μs (relative permeability absolute value)	(IMPD-EXT/2T/3T)
			US1	μs' (real part of relative permeability)	(IMPD-EXT/2T/3T)
			US2	μs" (imaginary part of relative permeability)	(IMPD-EXT/2T/3T)
			*RST value [Measurement mode is IMPD-EXT] : Z [Measurement mode is IMPD-2T or IMPD-3T] : Z [Measurement mode is G-PH] : MLON		

	<y2-axis>	<DISC>	Y2 axis data	
			PHASe	θ (phase ±180°)	(G-PH)
			PPHase	θ (phase 0° to +360°)	(G-PH)
			MPHase	θ (phase -360° to 0°)	(G-PH)
			UPHase	θ (phase UNWRAP)	(G-PH)
			ZPHASe	θz (phase ±180°)	(IMPD-EXT/2T/3T)
			ZPPHase	θz (phase 0° to +360°)	(IMPD-EXT/2T/3T)
			ZMPHase	θz (phase -360° to 0°)	(IMPD-EXT/2T/3T)
			ZUPHase	θz (phase UNWRAP)	(IMPD-EXT/2T/3T)
			YPHASe	θy (phase ±180°)	(IMPD-EXT/2T/3T)
			YPPHase	θy (phase 0° to +360°)	(IMPD-EXT/2T/3T)
			YMPHase	θy (phase -360° to 0°)	(IMPD-EXT/2T/3T)
			YUPHase	θy (phase UNWRAP)	(IMPD-EXT/2T/3T)
			IMAGinary	b (imaginary part)	(G-PH)
			GDELay	GD (group delay)	(G-PH)
			X	X (reactance)	(IMPD-EXT/2T/3T)
			B	B (susceptance)	(IMPD-EXT/2T/3T)
			RS	R_S (series resistance)	(IMPD-EXT/2T/3T)
			RP	R_P (parallel resistance)	(IMPD-EXT/2T/3T)
			D	D (loss rate)	(IMPD-EXT/2T/3T)
			DES	Dεs (loss rate)	(IMPD-EXT/2T/3T)
			DUS	Dμs (loss rate)	(IMPD-EXT/2T/3T)
			QC	Qc (capacitor quality coefficient)	(IMPD-EXT/2T/3T)
			QL	Ql (inductor quality coefficient)	(IMPD-EXT/2T/3T)
			CURRent	I (Current) or V2	(All measurement modes)
			ES	εs (relative permittivity absolute value)	(IMPD-EXT/2T/3T)
			ES1	εs' (real part of relative permittivity)	(IMPD-EXT/2T/3T)
			ES2	εs" (imaginary part of relative permittivity)	(IMPD-EXT/2T/3T)
			US	μs (relative permeability absolute value)	(IMPD-EXT/2T/3T)
			US1	μs' (real part of relative permeability)	(IMPD-EXT/2T/3T)
			US2	μs" (imaginary part of relative permeability)	(IMPD-EXT/2T/3T)
			NONE	None	(All measurement modes)
			*RST value [Measurement mode is IMPD-EXT] : ZPHAS [Measurement mode is IMPD-2T or IMPD-3T] : ZPHAS [Measurement mode is G-PH] : PHAS		

Response format	<x-axis>,<y1-axis>,<y2-axis>		
	<x-axis>	<DISC>	SWEEP | PHAS | PPH | MPH | UPH | REAL | R | G
	<y1-axis>	<DISC>	MLIN | MLOG | REAL | IMAG | Z | Y | R | G | CS | CP | LS | LP | X | MX | B | FREQ | VOLT | ES | ES1 | ES2 | US | US1 | US2
	<y2-axis>	<DISC>	PHAS | PPH | MPH | UPH | ZPHAS | ZPPH | ZMPH | ZUPH | YPHAS | YPPH | YMPH | YUPH | IMAG | GDEL | X | B | RS | RP | D | DES | DUS | QC | Q | CURR | ES | ES1 | ES2 | US | US1 | US2 | NONE

Comments	· The display unit and phase range are also set according to the content of X-Y1-Y2. Thus, if the combinations of the graph axis types and X-Y1-Y2 are not consistent with the valid combinations for this instrument, an error occurs (for the valid combinations, refer to the display mode tables in Instruction Manual (Basics)).

5.3.53 :DISPlay[:WINDow]:MODE \<mode\>
:DISPlay[:WINDow]:MODE?

Explanation	Sets and queries the graph display type		
Parameters	\<mode\>	\<DISC\>	Graph display type
			SINGle Single display
			SPLit Split display
			*RST value : SING
Response format	SING | SPL		
Comments	—		

5.3.54 :DISPlay[:WINDow]:TEXT[:DATA] "\<title\>"
:DISPlay[:WINDow]:TEXT[:DATA]?

Explanation	Sets and queries the graph title		
Parameters	\<title\>	\<STR\>	Graph title
			Range : Within 63 characters
			*RST value : (empty)
Response format	\<STR\>		
Comments	· The response returned includes quotation marks (""). · The characters that can be used for a graph title are as follows. ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789 !"#$%&'()-=^~¥|@`[]{};:+*,.<>/?_ (space)		

5.3.55 :DISPlay[:WINDow]:TRACe:AUTO \<auto\>
:DISPlay[:WINDow]:TRACe:AUTO?

Explanation	Sets and queries the reference data automatic setting		
Parameters	\<auto\>	\<NR1\>	Reference data automatic setting
			Range : 0 to 8
			Resolution : 1
			*RST value : 0
Response format	\<NR1\>		
Comments	When 0 is specified for \<auto\>, the reference data automatic setting is set to OFF.		

5.3.56 :DISPlay[:WINDow]:TRACe:COLor <trace>,<axis>,<color-r>,<color-g>,<color-b>
:DISPlay[:WINDow]:TRACe:COLor? <trace>,<axis>

Explanation	Sets and queries the colors of the graph series to be displayed on the main unit screen.		
Parameters	<trace>	<DISC>	Specifies the traces to which the series for which to specify colors belong.
			MEAS : Measurement trace
			REF1 : Reference trace 1
			REF2 : Reference trace 2
			REF3 : Reference trace 3
			REF4 : Reference trace 4
			REF5 : Reference trace 5
			REF6 : Reference trace 6
			REF7 : Reference trace 7
			REF8 : Reference trace 8
	<axis>	<DISC>	Separately for each of Y1 and Y2 of the series for which to specify colors
			Y1 : Y1-axis trace
			Y2 : Y2-axis trace
	<color-r>	<NR1>	Red gradation of color to specify
			Range : 0 to 255
			Resolution : 1
			*RST value
			[MEAS Y1] : 162　　[MEAS Y2] : 0
			[REF1 Y1] : 217　　[REF1 Y2] : 77
			[REF2 Y1] : 238　　[REF2 Y2] : 84
			[REF3 Y1] : 255　　[REF3 Y2] : 93
			[REF4 Y1] : 255　　[REF4 Y2] : 102
			[REF5 Y1] : 255　　[REF5 Y2] : 112
			[REF6 Y1] : 255　　[REF6 Y2] : 124
			[REF7 Y1] : 255　　[REF7 Y2] : 136
			[REF8 Y1] : 255　　[REF8 Y2] : 150
	<color-g>	<NR1>	Green gradation of color to specify
			Range : 0 to 255
			Resolution : 1
			*RST value
			[MEAS Y1] : 20　　[MEAS Y2] : 114
			[REF1 Y1] : 83　　[REF1 Y2] : 190
			[REF2 Y1] : 99　　[REF2 Y2] : 228
			[REF3 Y1] : 119　　[REF3 Y2] : 255
			[REF4 Y1] : 143　　[REF4 Y2] : 255
			[REF5 Y1] : 172　　[REF5 Y2] : 255
			[REF6 Y1] : 206　　[REF6 Y2] : 255
			[REF7 Y1] : 247　　[REF7 Y2] : 255
			[REF8 Y1] : 255　　[REF8 Y2] : 255
	<color-b>	<NR1>	Blue gradation of color to specify
			Range : 0 to 255
			Resolution : 1
			*RST value
			[MEAS Y1] : 47　　[MEAS Y2] : 189
			[REF1 Y1] : 25　　[REF1 Y2] : 238
			[REF2 Y1] : 30　　[REF2 Y2] : 255
			[REF3 Y1] : 36　　[REF3 Y2] : 255
			[REF4 Y1] : 43　　[REF4 Y2] : 255
			[REF5 Y1] : 52　　[REF5 Y2] : 255
			[REF6 Y1] : 62　　[REF6 Y2] : 255
			[REF7 Y1] : 75　　[REF7 Y2] : 255
			[REF8 Y1] : 90　　[REF8 Y2] : 255

Query Parameters	<trace>	<DISC>	Specifies the traces to which the series for which to specify colors belong.		
	<axis>	<DISC>	Separately for each of Y1 and Y2 of the series for which to specify colors		
Response format	<color-r>,<color-g>,<color-b>				
	<color-r>	<NR1>	Red gradation of color to specify		
	<color-g>	<NR1>	Green gradation of color to specify		
	<color-b>	<NR1>	Blue gradation of color to specify		
Comments	—				

5.3.57 :DISPlay[:WINDow]:TRACe:GRATicule:GRID:LINE <param>
:DISPlay[:WINDow]:TRACe:GRATicule:GRID:LINE?

Explanation	Sets and queries the grid line type		
Parameters	<param>	<DISC>	Grid line type
			SOLid	Solid line
			BROKen	Broken line
			*RST value : BROK
Response format	SOL | BROK		
Comments	—		

5.3.58 :DISPlay[:WINDow]:TRACe:GRATicule:GRID:STYLe <param>
:DISPlay[:WINDow]:TRACe:GRATicule:GRID:STYLe?

Explanation	Sets and queries the grid display		
Parameters	<param>	<DISC>	Grid display
			OFF	The grid is not displayed
			X	Only X axis grid is displayed
			XY1	X and Y1 axis grids are displayed
			XY2	X and Y2 axis grids are displayed
			ALL	X, Y1, and Y2 axis grids are displayed
			*RST value : XY1
Response format	OFF | X | XY1 | XY2 | ALL		
Comments	—		

5.3.59 :DISPlay[:WINDow]:TRACe:SCALe:AUTO <sw>
:DISPlay[:WINDow]:TRACe:SCALe:AUTO?

Explanation	Sets and queries the autoscaling mode		
Parameters	<sw>	<DISC>	Autoscaling mode
			AUTOR	Enables autoscaling (aspect ratio is maintained)
			AUTO	Enables autoscaling (aspect ratio is not maintained)
			MANual	Disables autoscaling
			*RST value : AUTO
Response format	AUTOR | AUTO | MAN		
Comments	—		

5.3.60 :DISPlay[:WINDow]:TRACe:STATe <trace>,<sw>
:DISPlay[:WINDow]:TRACe:STATe? <trace>

Explanation	Sets and queries the display state of each trace		
Parameters	<trace>	<DISC>	Selects the trace for which to set the display state.
			MEAS	Measurement trace
			REF1	Reference trace 1
			REF2	Reference trace 2
			REF3	Reference trace 3
			REF4	Reference trace 4
			REF5	Reference trace 5
			REF6	Reference trace 6
			REF7	Reference trace 7
			REF8	Reference trace 8
	<sw>	<BOL>	Display state of trace
			ON | 1	Displays the trace.
			OFF | 0	Hides the trace.
			*RST value: MEAS is ON, otherwise OFF
Query Parameters	<trace>	<DISC>	Selects the trace for which to query the display state.
Response format	<NBOL>		
Comments	—		

5.3.61 :DISPlay[:WINDow]:TRACe:X <min>,<max>
:DISPlay[:WINDow]:TRACe:X?

Explanation	Sets and queries the x-axis upper and lower limits		
Parameters	<min>	<NRf>	x-axis lower limit
			Range $\quad$: -1.0 T to 1.0 T(10^{12})
			Resolution $\quad$: 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12}))
			*RST value $\quad$: 10.0
	<max>	<NRf>	x-axis upper limit
			Range $\quad$: Same as <min>
			Resolution $\quad$: Same as <min>
			*RST value $\quad$: 1 M(10^6)
Response format	<min>,<max>		
	<min>	<NR3>	x-axis lower limit
	<max>	<NR3>	x-axis upper limit
Comments	· If the value of <max> is lower than that of <min> or the value of <min> is higher than that of <max>, an error occurs. · If <min> is set to a value of 0 or lower when the X-axis type is LOG, it is forcibly set to 1 a(10^{-18}). · If <max> is set to a value of 0 or lower when the X-axis type is LOG, it is forcibly set to 2 a(10^{-18}).		

5.3.62 :DISPlay[:WINDow]:TRACe:X:SPACing <spacing>
:DISPlay[:WINDow]:TRACe:X:SPACing?

Explanation	Sets and queries the x-axis type		
Parameters	<spacing>	<DISC>	x-axis type
			LINear	Linear scale
			LOGarithmic	Log scale
			*RST value $\quad$: LOG
Response format	LIN | LOG		
Comments	If the X-axis type is set to LOG, the lower limit of the X-axis is forcibly set to 1 a(10^{-18}) if it is 0 or lower, and the upper limit of the X-axis is forcibly set to 2 a(10^{-18}) if it is 0 or lower.		

5.3.63 :DISPlay[:WINDow]:TRACe:Y1 <min>,<max>

:DISPlay[:WINDow]:8TRACe:Y1?

Explanation	Sets and queries the Y1-axis upper/lower limits and axis type		
Parameters	<min>	<NRf>	Y1-axis lower limit Range : -1.0 T to 1.0 T(10^{12}) Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12})) *RST value : 1.0
	<max>	<NRf>	Y1-axis upper limit Range : Same as <min> Resolution : Same as <min> *RST value : 100 k(10^{3})
Response format	<min>,<max>		
	<min>	<NR3>	Y1-axis lower limit
	<max>	<NR3>	Y1-axis upper limit
Comments	・ If the value of <max> is lower than that of <min> or the value of <min> is higher than that of <max>, an error occurs. ・ If <min> is set to a value of 0 or lower when the Y1-axis type is LOG, it is forcibly set to 1 a(10^{-18}). ・ If <max> is set to a value of 0 or lower when the Y1-axis type is LOG, it is forcibly set to 2 a(10^{-18}).		

5.3.64 :DISPlay[:WINDow]:TRACe:Y1:SPACing <spacing>

:DISPlay[:WINDow]:TRACe:Y1:SPACing?

Explanation	Sets and queries the Y1-axis type		
Parameters	<spacing>	<DISC>	Y1-axis type	
			LINear	Linear scale
			LOGarithmic	Log scale
			*RST value : LIN	
Response format	LIN | LOG			
Comments	If the Y1-axis type is set to LOG, the lower limit of the Y1-axis is forcibly set to 1 a (10^{-18}) if it is 0 or lower, and the upper limit of the Y1-axis is forcibly set to 2 a(10^{-18}) if it is 0 or lower.			

5.3.65 :DISPlay[:WINDow]:TRACe:Y2 <min>,<max>

:DISPlay[:WINDow]:TRACe:Y2?

Explanation	Sets and queries the Y2-axis upper/lower limits and axis type		
Parameters	<min>	<NRf>	Y2-axis lower limit Range : -1.0 T to 1.0 T(10^{12}) Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12})) *RST value : -180.0
	<max>	<NRf>	Y2-axis upper limit Range : Same as <min> Resolution : Same as <min> *RST value : 180.0
Response format	<min>,<max>		
	<min>	<NR3>	Y2-axis lower limit
	<max>	<NR3>	Y2-axis upper limit
Comments	・ If the value of <max> is lower than that of <min> or the value of <min> is higher than that of <max>, an error occurs. ・ If <min> is set to a value of 0 or lower when the Y2-axis type is LOG, it is forcibly set to 1 a(10^{-18}). ・ If <max> is set to a value of 0 or lower when the Y2-axis type is LOG, it is forcibly set to 2 a(10^{-18}).		

5.3.66 :DISPlay[:WINDow]:TRACe:Y2:SPACing <spacing>

:DISPlay[:WINDow]:TRACe:Y2:SPACing?

Explanation	Sets and queries the Y2-axis type			
Parameters	<spacing>	<DISC>	Y2-axis type	
			LINear	Linear scale
			LOGarithmic	Log scale
			*RST value　: LIN	
Response format	LIN | LOG			
Comments	If the Y2-axis type is set to LOG, the lower limit of the Y2-axis is forcibly set to 1 a(10^{-18}) if it is 0 or lower, and the upper limit of the Y2-axis is forcibly set to 2 a(10^{-18}) if it is 0 or lower.			

5.3.67 :HCOPy:DATA?

Explanation	Gets the bitmap for the current screen		
Response format	#<bytes-digits><bytes><data>		
	<bytes-digits>	<NR1>	Number of digits of <bytes>
	<bytes>	<NR1>	Number of bytes of <data>
	<data>	<BLK>	Screen display content (bitmap format image)
Comments	If only the <data> part of the retrieved binary data is extracted and saved as a file in ".bmp" format, it is recognized as a bmp file.		

5.3.68 :INPut:GAIN <value1>,<value2>

:INPut:GAIN?

Explanation	Sets and queries the input weight coefficient		
Parameters	<value1>	<NRf>	PORT1 input gain Range　　　　: -999.999 G to 999.999 G(10^9) Resolution　: 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9})) *RST value　: 1.0
	<value2>	<NRf>	PORT2 input gain Range　　　　: -999.999 G to 999.999 G(10^9) Resolution　: 6 significant digits (1 f(10^{-15}) for <1 n(10^{-9})) *RST value　: 1.0
Response format	<value1>,<value2>		
	<value1>	<NR3>	PORT1 input gain
	<value2>	<NR3>	PORT2 input gain
Comments	If the absolute values of <value1> and <value2> are less than 10^{-15}, an error occurs. If they are set when the measurement mode is IMPD-2T or IMPD-3T, an error occurs.		

5.3.69 :MEMory:STATe:DEFine "<name>", <memory>

:MEMory:STATe:DEFine? <memory>

Explanation	Sets and queries the setting memory name (internal memory)		
Parameters	<name>	<STR>	Memory name Range　　　: Within 20 characters
	<memory>	<NR1>	Setting memory number Range　　　: 1 to 32 Resolution　: 1
Query Parameters	<memory>	<NR1>	Setting memory number Range　　　: 1 to 32 Resolution　: 1
Response format	<STR>		
Comments	・ The response returned includes quotation marks (""). ・ The characters that can be used for a memory name are as follows. 　ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789 　!"#$%&'()-=^~¥|@`[]{};:+*,.<>/?_ (space)		

5.3.70 :MEMory:STATe:DELete <memory>

Explanation	Executes initialization of the setting memory (internal memory)		
Parameters	<memory>	<NR1>	Setting memory number to be initialized
			Range : 1 to 32
			Resolution : 1
Comments	—		

5.3.71 :OUTPut[:STATe] <param>

:OUTPut[:STATe]?

Explanation	Sets and queries the output status		
Parameters	<param>	<DISC>	Output status
			ON	Sets the AC/DC on status
			OFF	Sets the AC/DC off status
			ACOFF	Sets the AC off status
			*RST value : OFF
Response format	ON | OFF | ACOFF		
Comments	ACOFF is ignored if the AC/DC status is not "on".		

5.3.72 :OUTPut:TRIGger <mode>

:OUTPut:TRIGger?

Explanation	Sets and queries the trigger synchronization		
Parameters	<mode>	<DISC>	On/off synchronization (trigger synchronization)
			ASYNchronous	Sets on/off synchronization to ASYNC. (disables trigger synchronization)
			SYNChronous	Sets on/off synchronization to SYNC. (enables trigger synchronization) (AC/DC on, AC/DC off)
			SYNChronous2	Sets on/off synchronization to SYNC. (enables trigger synchronization) (AC/DC on, AC off)
			*RST value : ASYN
Response format	ASYN | SYNC | SYNC2		
Comments	—		

5.3.73 :ROUTe:BIAS:TERMinals <param>

:ROUTe:BIAS:TERMinals?

Explanation	Sets and queries the DC bias output destination		
Parameters	<param>	<DISC>	Output destination
			FRONt	The DC component is output from the front panel OSC terminal.
			REAR	The DC component is output from the rear panel DC BIAS terminal.
			*RST value : FRON
Response format	FRON | REAR		
Comments	If the setting is set to REAR when the measurement mode is IMPD-2T or IMPD-3T, an error occurs.		

5.3.74 :SENSe:AVERage:COUNt <value>

:SENSe:AVERage:COUNt?

Explanation	Sets and queries the measurement time		
Parameters	<value>	<NRf>	Averaging time setting (seconds)
			Range : 0.0 to 9990.0 Resolution : 3 significant digits (100 u(10^{-6}) for <100 m(10^{-3})) *RST value : 0.0
Response format	<NR3>		
Comments	—		

5.3.75 :SENSe:CORRection:COLLect[:ACQuire]

:SENSe:CORRection:COLLect[:ACQuire]?

Explanation	Executes and queries a calibration		
Response format	<calcode>,<calcode_max>		
	<calcode>	<NR1>	Current calibration code
	<calcodemax>	<NR1>	Maximum value of calibration code
Comments	—		

5.3.76 :SENSe:CORRection:COLLect:LOAD[:ACQuire]

Explanation	Executes the correction data measurement of load correction (fixed frequency)

Comments	• The correction data is measured with predetermined frequencies
	    For details on the measurement frequencies, refer to the section on load
	    correction in "Instruction Manual (Advanced)."
	• When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.77 :SENSe:CORRection:COLLect:OPEN[:ACQuire]

Explanation	Executes the correction data measurement of open correction (fixed frequency)

Comments	• The correction data is measured with predetermined frequencies
	    For details on the measurement frequencies, refer to the section on open
	    correction in "Instruction Manual (Advanced)."
	• When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.78 :SENSe:CORRection:COLLect:SHORt[:ACQuire]

Explanation	Executes the correction data measurement of short correction (fixed frequency)

Comments	• The correction data is measured with predetermined frequencies
	    For details on the measurement frequencies, refer to the section on short
	    correction in "Instruction Manual (Advanced)."
	• When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.79 :SENSe:CORRection:COLLect:EXTension:LOAD[:ACQuire]

Explanation	Executes the correction data measurement of port extended end load correction (fixed frequency)

Comments	• The correction data is measured with predetermined frequencies
	    For details on the measurement frequencies, refer to the section on load
	    correction in "Instruction Manual (Advanced)."
	• When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.80 :SENSe:CORRection:COLLect:EXTension:OPEN[:ACQuire]

Explanation	Executes the correction data measurement of port extended end open correction (fixed frequency)
Comments	・The correction data is measured with predetermined frequencies 　For details on the measurement frequencies, refer to the section on open correction in "Instruction Manual (Advanced)." ・When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.81 :SENSe:CORRection:COLLect:EXTension:SHORt[:ACQuire]

Explanation	Executes the correction data measurement of port extended end short correction (fixed frequency)
Comments	・The correction data is measured with predetermined frequencies 　For details on the measurement frequencies, refer to the section on short correction in "Instruction Manual (Advanced)." ・When the measurement mode is G-PH, the measurement start trigger is ignored.

5.3.82 :SENSe:CORRection:EQUalizing <sw>,<mem_no>
:SENSe:CORRection:EQUalizing?

Explanation	Sets and queries the equalization mode		
Parameters	<sw>	<BOL>	Equalization mode
			ON | 1　　Enables equalization
			OFF | 0　　Disables equalization
			*RST value　: 0
	<mem_no>	<NR1>	Memory number to use for equalizing correction
			Range　　　: 1 to 32
			Resolution　: 1
Response format	<sw>,<mem_no>		
	<sw>	<NBOL>	Equalization mode
	<mem_no>	<NR1>	Memory number to use for equalizing correction
Comments	・　The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・　If this is set when the measurement mode is IMPD-EXT, IMPD-2T, or IMPD-3T, an error occurs.		

5.3.83 :SENSe:CORRection:EXTension <sw>
:SENSe:CORRection:EXTension?

Explanation	Sets and queries the port extension state		
Parameters	<sw>	<BOL>	Port extension state
			ON | 1　　Enables port extension
			OFF | 0　　Disables port extension
			*RST value　: 0
Response format	<NBOL>		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.84 :SENSe:CORRection:EXTension:DISTance <value>
:SENSe:CORRection:EXTension:DISTance?

Explanation	Sets and queries the electrical length		
Parameters	<value>	<NRf>	Electrical length [m]
			Range　　　: 0.000 to 999.999
			Resolution　: 0.001
			*RST value　: 0.0
Response format	<NR2>		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.85 :SENSe:CORRection:EXTension:IMPedance <value>
:SENSe:CORRection:EXTension:IMPedance?

Explanation	Sets and queries the characteristic impedance		
Parameters	<value>	<NRf>	Characteristic impedance[Ω]
			Range : 1.00 to 999
			Resolution : 3 significant digits
			*RST value : 50.0
Response format	<NR3>		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.86 :SENSe:CORRection:EXTension:LOAD <sw>,<mem_no>
:SENSe:CORRection:EXTension:LOAD?

Explanation	Sets and queries the port extended end load correction status		
Parameters	<sw>	<BOL>	Port extended end load correction status
			ON | 1 : Enables port extended end load correction.
			OFF | 0 : Disables port extended end load correction.
			*RST value : 0
	<mem_no>	<NR1>	Memory number to use for load correction
			Range : 1 to 32
			Resolution : 1
Response format	<sw>,<mem_no>		
	<sw>	<NBOL>	Load correction state
	<mem_no>	<NR1>	Memory number to use for load correction
Comments	・ The memory number specified will be the copy destination target of the :DATA:COPY:NAME command.		
	・ To perform port extended end load correction correctly, you need to set the port extended end load standard value data and prepare correction data in the port extended end open correction memory, port extended end short correction memory, and port extended end load correction memory.		
	・ If this is set when the measurement mode is G-PH, an error occurs.		

5.3.87 :SENSe:CORRection:EXTension:LOAD:STANdard

<freq>,<value1>,<value2>[,<freq>,<value1>,<value2> …]

:SENSe:CORRection:EXTension:LOAD:STANdard?

Explanation	Sets and queries the load standard values of port extended end load correction		
Parameters	<freq>	<NRf>	Load standard value (frequency [Hz])
			Range : 10.0 uHz to 36.0 MHz
			Resolution : 10 u (10^{-6})
			*RST value : 0.0 (Zero means no standard value data)
	<value1>	<NRf>	Load standard value (first parameter)
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12}))
			*RST value : 0.0 (Zero means no standard value data)
	<value2>	<NRf>	Load standard value (second parameter)
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12}))
			*RST value : 0.0 (Zero means no standard value data)
Response format	<freq[0]>,<value1[0]>,<value2[0]>,<freq[1]>,<value1[1]>,<value2[1]>,…, <freq[30]>,<value1[30]>,<value2[30]>		
	<freq[n]>	<NR3>	Load standard value (frequency)
	<value1[n]>	<NR3>	Load standard value (first parameter)
	<value2[n]>	<NR3>	Load standard value (second parameter)
Comments	・The first parameter and second parameter are the combination specified in the format of the load standard values. ・For setting, the maximum is 30 sets. ・If the <freq>, <value1>, and <value2> set is not complete , the last data set is discarded. (Unexpected number of parameters) ・For queries, 30 sets are returned. ・If this is not set, 0 is inserted and returned. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.88 :SENSe:CORRection:EXTension:LOAD:STANdard:FORMat <form>

:SENSe:CORRection: EXTension:LOAD:STANdard:FORMat?

Explanation	Sets and queries the load standard value format of port extended end load correction		
Parameters	<form>	<DISC>	Load standard value format
			CPD	Cp-D
			CSD	Cs-D
			RCP	Rp-Cp
			RLS	Rs-Ls
			RX	Rs-X
			ZPH	Z-θ
			*RST value : CSD
Response format	CPD | CSD | RCP | RLS | RX | ZPH		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.89 :SENSe:CORRection:EXTension:OPEN <sw>,<mem_no>
:SENSe:CORRection:EXTension:OPEN?

Explanation	Sets and queries the port extended end open correction status		
Parameters	<sw>	<BOL>	Port extended end open correction status
			ON | 1 Enables port extended end open correction.
			OFF | 0 Disables port extended end open correction.
			*RST value : 0
	<mem_no>	<NR1>	Memory number to use for open correction
			Range : 1 to 32
			Resolution : 1
Response format	<sw>,<mem_no>		
	<sw>	<NBOL>	Open correction state
	<mem_no>	<NR1>	Memory number to use for open correction
Comments	・The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.90 :SENSe:CORRection:EXTension:SHORt <sw>,<mem_no>
:SENSe:CORRection:EXTension:SHORt?

Explanation	Sets and queries the port extended end short correction status		
Parameters	<sw>	<BOL>	Port extended end short correction status
			ON | 1 Enables port extended end short correction.
			OFF | 0 Disables port extended end short correction.
			*RST value : 0
	<mem_no>	<NR1>	Memory number to use for short correction
			Range : 1 to 32
			Resolution : 1
Response format	<sw>,<mem_no>		
	<sw>	<NBOL>	Short correction state
	<mem_no>	<NR1>	Memory number to use for short correction
Comments	・The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.91 :SENSe:CORRection:LOAD <sw>,<mem_no>
:SENSe:CORRection:LOAD?

Explanation	Sets and queries the load correction state		
Parameters	<sw>	<BOL>	Load correction state
			ON | 1 Enables load correction
			OFF | 0 Disables load correction
			*RST value : 0
	<mem_no>	<NR1>	Memory number to use for load correction
			Range : 1 to 32
			Resolution : 1
Response format	<sw>,<mem_no>		
	<sw>	<NBOL>	Load correction state
	<mem_no>	<NR1>	Memory number to use for load correction
Comments	・The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・To perform load correction correctly, you need to set the load standard value data and prepare correction data in the open correction memory, short correction memory, and load correction memory. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.92 :SENSe:CORRection:LOAD:STANdard <freq>,<value1>,<value2>[,<freq>,<value1>,<value2> ...]
      :SENSe:CORRection:LOAD:STANdard?

Explanation	Sets and queries the load standard value		
Parameters	<freq>	<NRf>	Load standard value (frequency [Hz])
			Range : 10.0 uHz to 36.0 MHz
			Resolution : 10 u(10^{-6})
			*RST value : 0.0 (Zero means no standard value data)
	<value1>	<NRf>	Load standard value (first parameter)
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12}))
			*RST value : 0.0 (Zero means no standard value data)
	<value2>	<NRf>	Load standard value (second parameter)
			Range : -1.0 T to 1.0 T(10^{12})
			Resolution : 6 significant digits (1 a(10^{-18}) for <1 p(10^{-12}))
			*RST value : 0.0 (Zero means no standard value data)
Response format	<freq[0]>,<value1[0]>,<value2[0]>,<freq[1]>,<value1[1]>,<value2[1]>,..., <freq[30]>,<value1[30]>,<value2[30]>		
	<freq[n]>	<NR3>	Load standard value (frequency)
	<value1[n]>	<NR3>	Load standard value (first parameter)
	<value2[n]>	<NR3>	Load standard value (second parameter)
Comments	・The first parameter and second parameter are the combination specified in the format of the load standard values. ・For setting, the maximum is 30 sets. ・If the <freq>, <value1>, and <value2> set is not complete, the last data set is discarded. ・For queries, 30 sets are returned. ・If this is not set, 0 is inserted and returned. ・If this is set when the measurement mode is G-PH, an error occurs.		

5.3.93 :SENSe:CORRection:LOAD:STANdard:FORMat <form>
      :SENSe:CORRection:LOAD:STANdard:FORMat?

Explanation	Sets and queries the format of the load standard value		
Parameters	<form>	<DISC>	Standard value format
			CPD	Cp-D
			CSD	Cs-D
			RCP	Rp-Cp
			RLS	Rs-Ls
			RX	Rs-X
			ZPH	Z-θ
			*RST value : CSD
Response format	CPD ∣ CSD ∣ RCP ∣ RLS ∣ RX ∣ ZPH		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.94 :SENSe:CORRection:OPEN <sw>,<mem_no>
:SENSe:CORRection:OPEN?

Explanation	Sets and queries the open correction state			
Parameters	<sw>	<BOL>	Open correction state	
			ON | 1	Enables open correction
			OFF | 0	Disables open correction
			*RST value : 0	
	<mem_no>	<NR1>	Memory number to use for open correction	
			Range : 1 to 32	
			Resolution : 1	
Response format	<sw>,<mem_no>			
	<sw>	<NBOL>	Open correction state	
	<mem_no>	<NR1>	Memory number to use for open correction	
Comments	・ The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・ If this is set when the measurement mode is G-PH, an error occurs.			

5.3.95 :SENSe:CORRection:SHORt <sw>,<mem_no>
:SENSe:CORRection:SHORt?

Explanation	Sets and queries the short correction state			
Parameters	<sw>	<BOL>	Short correction state	
			ON | 1	Enables short correction
			OFF | 0	Disables short correction
			*RST value : 0	
	<mem_no>	<NR1>	Memory number to use for short correction	
			Range : 1 to 32	
			Resolution : 1	
Response format	<sw>,<mem_no>			
	<sw>	<NBOL>	Short correction state	
	<mem_no>	<NR1>	Memory number to use for short correction	
Comments	・ The memory number specified will be the copy destination target of the :DATA:COPY:NAME command. ・ If this is set when the measurement mode is G-PH, an error occurs.			

5.3.96 :SENSe:CORRection:SLOPe:STATe <sw>
:SENSe:CORRection:SLOPe:STATe?

Explanation	Sets and queries the potential slope correction state			
Parameters	<sw>	<BOL>	Potential slope correction state	
			ON | 1	Enables potential slope correction
			OFF | 0	Disables potential slope correction
			*RST value : 0	
Response format	<NBOL>			
Comments	If this is set when the measurement mode is G-PH, an error occurs.			

5.3.97 :SENSe:FUNCtion <function>
:SENSe:FUNCtion?

Explanation	Sets and queries the measurement mode (IMPD-EXT, IMPD-2T, IMPD-3T, or G-PH)			
Parameters	<function>	<DISC>	Measurement mode	
			EXTernal	IMPD-EXT mode
			RESistance	IMPD-2T mode
			FRESistance	IMPD-3T mode
			GAIN	G-PH mode
Response format	EXT | RES | FRES | GAIN			
Comments	When the measurement mode is changed, the other setting values are reset.			

5.3.98 :SENSe:RESistance:RANGe \<range\>

:SENSe:RESistance:RANGe?

Explanation	Sets and queries the impedance measurement range (IMPD-2T or IMPD-3T mode)		
Parameters	\<range\>	\<NR1\>	Impedance measurement range
			Range : 0 to 7
			(AUTO, 1Ω, 10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ)
			[Measurement mode is IMPD-2T]: 0 to 4 are valid
			[Measurement mode is IMPD-3T]: 0 and 2 to 7 are valid.
			Resolution : 1
			*RST value : 0
Response format	\<NR1\>		
Comments	· The values within parentheses are supported for range parameters.		
	· If this is set when the measurement mode is IMPD-EXT or G-PH, an error occurs.		

5.3.99 :SENSe:SMOothing:POINts \<value\>

:SENSe:SMOothing:POINts?

Explanation	Sets and queries the phase moving average		
Parameters	\<value\>	\<NR1\>	Phase moving average
			Range : 2 to 200
			Resolution : 2
			*RST value : 10
Response format	\<NR1\>		
Comments	Only an even number is valid for the parameter.		
	If this is set when the measurement mode is IMPD-EXT, IMPD-2T, or IMPD-3T, an error occurs.		

5.3.100 :SENSe:VOLTage:PROTection:BEEPer \<sw\>

:SENSe:VOLTage:PROTection:BEEPer?

Explanation	Sets and queries the over-voltage detection beep mode		
Parameters	\<sw\>	\<BOL\>	Over-voltage detection beep
			ON | 1	Beep sounds
			OFF | 0	Beep does not sound
			*RST value : 1
Response format	\<NBOL\>		
Comments	—		

5.3.101 :SENSe:VOLTage:PROTection[:LEVel] \<value1\>,\<value2\>

:SENSe:VOLTage:PROTection[:LEVel]?

Explanation	Sets and queries the over-voltage detection level		
Parameters	\<value1\>	\<NRf\>	PORT1 over-voltage detection level [Vrms]
			Range : 0.0 to 7.0
			Resolution : 3 significant digits (1 u(10^{-6}) for <1 m(10^{-3}))
			*RST value : 7.0
	\<value2\>	\<NRf\>	PORT2 over-voltage detection level [Vrms]
			Range : 0.0 to 7.0
			Resolution : 3 significant digits (1 u(10^{-6}) for <1 m(10^{-3}))
			*RST value : 7.0
Response format	\<value1\>,\<value2\>		
	\<value1\>	\<NR3\>	PORT1 over-voltage detection level
	\<value2\>	\<NR3\>	PORT2 over-voltage detection level
Comments	If they are set when the measurement mode is IMPD-2T or IMPD-3T, an error occurs.		

5.3.102 :SENSe:VOLTage:PROTection:MEASure:STOP \<sw>
:SENSe:VOLTage:PROTection:MEASure:STOP?

Explanation	Sets and queries measurement stop for over-voltage detection		
Parameters	\<sw>	\<BOL>	Measurement stop for when over-voltage detection
			ON | 1 : Stops the measurement operation upon over-voltage detection.
			OFF | 0 : Continues the measurement operation upon over-voltage detection.
			*RST value : 0
Response format	\<NBOL>		
Comments	If this is set when the measurement mode is IMPD-2T or IMPD-3T, an error occurs.		

5.3.103 :SENSe:VOLTage:RANGe \<param1>,\<param2>
:SENSe:VOLTage:RANGe?

Explanation	Sets and queries the PORT1 and PORT2 voltage range (IMPD-EXT or G-PH mode)		
Parameters	\<param1>	\<NR1>	PORT1 voltage range
			Range : 0 to 10 (AUTO, 7, 5, 2, 1, 0.5, 0.2, 0.1, 0.05, 0.02, 0.01)
			Resolution : 1
			*RST value : 0
	\<param2>	\<NR1>	PORT2 voltage range
			Range : 0 to 10 (AUTO, 7, 5, 2, 1, 0.5, 0.2, 0.1, 0.05, 0.02, 0.01)
			Resolution : 1
			*RST value : 0
Response format	\<param1>,\<param2>		
	\<param1>	\<NR1>	PORT1 voltage range
	\<param2>	\<NR1>	PORT2 voltage range
Comments	· The values within parentheses are supported for range parameters. · If this is set when the measurement mode is IMPD-2T or IMPD-3T, an error occurs.		

5.3.104 :SOURce:ALC:COUNt \<value>
:SOURce:ALC:COUNt?

Explanation	Sets and queries the number of automatic level control (ALC) retries		
Parameters	\<value>	\<NR1>	Number of ALC retries
			Range : 1 to 100
			Resolution : 1
			*RST value : 10
Response format	\<NR1>		
Comments	—		

5.3.105 :SOURce:ALC:FACtor \<value>
:SOURce:ALC:FACtor?

Explanation	Sets and queries the automatic level control (ALC) correction factor		
Parameters	\<value>	\<NR1>	ALC correction factor [%]
			Range : 1 to 100
			Resolution : 1
			*RST value : 100
Response format	\<NR1>		
Comments	—		

5.3.106 :SOURce:ALC[:STATe] <sw>

:SOURce:ALC[:STATe]?

Explanation	Sets and queries enable/disable of automatic level control (ALC)				
Parameters	<sw>	<DISC>	ALC status		
			ON	Enables ALC.	(IMPD-2T/3T)
			CV1	Enables ALC in CV1 mode.	(IMPD-EXT/G-PH)
			CV2	Enables ALC in CV2 mode.	(IMPD-EXT/G-PH)
			OFF	Disables ALC.	(All measurement modes)
			*RST value : OFF		
Response format	ON | CV1 | CV2 | OFF				
Comments	・The items that can be set differ depending on the measurement mode. ・When the ALC state is set to ON in the IMPD-2T or IMPD-3T mode, CC driving will be performed when the measurement signal unit setting is current, and CV driving will be performed when it is voltage.				

5.3.107 :SOURce:ALC:TOLerance <value>

:SOURce: ALC:TOLerance?

Explanation	Sets and queries the automatic level control (ALC) permissible error		
Parameters	<value>	<NR1>	Automatic level control permissible error [%]
			Range : 1 to 100 Resolution : 1 *RST value : 10
Response format	<NR1>		
Comments	—		

5.3.108 :SOURce:BIAS <value>[<suffix>]

:SOURce:BIAS?

Explanation	Sets and queries the DC bias value		
Parameters	<value>	<NRf>	DC bias
			Range [When measurement signal unit is current] : -0.1 to 0.1 [A] [When measurement signal unit is voltage] : -999.0 G to 999.0 G(10^9) [V] Resolution [When measurement signal unit is current] : 100 n(10^{-9}) [When measurement signal unit is voltage] : 3 significant digits or M_{DC}, whichever is the largest *RST value : 0.0
	<suffix>	<DISC>	SI prefix
			G	<value>×10^9
			MA	<value>×10^6
			K	<value>×10^3
			M	<value>×10^{-3}
			U	<value>×10^{-6}
			N	<value>×10^{-9}
			P	<value>×10^{-12}
Response format	<NR3>		
Comments	[HV DC bias is disabled]: 　A setting for which |DC bias| + (amplitude × 1.42) exceeds 5 V × |K| results in an error. K is the DUT drive amplifier gain setting. 　(When measurement mode is IMPD-2T or IMPD-3T, the amplifier gain is fixed to 1.) [HV DC bias is enabled]: 　A setting for which |DC bias| + (amplitude × 1.42) exceeds 42 V results in an error. M_{DC} = 10K'. Here, K' indicates the maximum integer that does not exceed $\log_{10}(\|K\|×10^{-2})$		

5.3.109 :SOURce:BIAS:HVOLtage <hv>
:SOURce:BIAS:HVOLtage?

Explanation	Sets enable/disable of HV DC bias		
Parameters	<hv>	<BOL>	Enables/disables HV DC bias.
			ON | 1 Enables HV DC bias.
			OFF | 0 Disables HV DC bias.
			*RST value : 0
Response format	<NBOL>		
Comments	・If the setting is set to ON when the measurement signal unit is current or when the measurement mode is IMPD-EXT or G-PH, an error occurs. ・If HV DC bias is enabled when the DC bias output destination setting is REAR, an error occurs.		

5.3.110 :SOURce:FREQuency:AFC:STATe <sw>
:SOURce:FREQuency:AFC:STATe?

Explanation	Sets and queries the slow sweep mode		
Parameters	<sw>	<BOL>	Slow sweep mode
			ON | 1 Enables the slow sweep function.
			OFF | 0 Disables the slow sweep function.
			*RST value : 0
Response format	<NBOL>		
Comments	・If this is set when the sweep parameter type is other than FREQ, an error occurs. ・If this is set when sequence sweep is enabled, an error occurs.		

5.3.111 :SOURce:FREQuency:AFC:TOLerance <value>
:SOURce:FREQuency:AFC:TOLerance?

Explanation	Sets and queries the slow sweep permissible quantities		
Parameters	<value>	<NRf>	Slow sweep permissible quantities

			Range
			  [Monitoring parameter is dBR] : 0.001 to 999.999 [dB]
			  [Monitoring parameter is R/Z/Y] : 1.0 a(10^{-18}) to 999.0 G(10^9)
			  [Monitoring parameter is θ] : 0.001 to 179.999 [°]
			Resolution
			  [Monitoring parameter is dBR] : 0.001
			  [Monitoring parameter is R/Z/Y] : 3 significant digits
			                       (1 a(10^{-18}) for <1 f(10^{-15}))
			  [Monitoring parameter is θ] : 0.001
			*RST value
			  [Monitoring parameter is dBR] : 10.0
			  [Monitoring parameter is R] : 0.1
			  [Monitoring parameter is Z] : 1000.0
			  [Monitoring parameter is Y] : 0.001
			  [Monitoring parameter is θ] : 10.0

Response format	[Monitoring parameter is dBR/θ] : <NR2> [Monitoring parameter is R/Z/Y] : <NR3>		
Comments	The range for slow sweep permissible quantity setting varies with the slow sweep monitoring parameters that are set.		

5.3.112 :SOURce:FREQuency:AFC:TYPE <param>

:SOURce:FREQuency:AFC:TYPE?

Explanation	Sets and queries the slow sweep monitoring parameters			
Parameters	<param>	<DISC>	Slow sweep monitoring parameters	
			MLOGarithmic	dBR	(G-PH)
			MLINear	R	(G-PH)
			Z	Z	(IMPD-EXT/2T/3T)
			Y	Y	(IMPD-EXT/2T/3T)
			PHASe	θ	(All measurement modes)
			*RST value : PHAS	
Response format	MLOG | MLIN | Z | Y | PHAS			
Comments	The items that can be set differ depending on the measurement mode.			

5.3.113 :SOURce:FREQuency[:CW|:FIXed] <value>[<suffix>]

:SOURce:FREQuency[:CW|:FIXed]?

Explanation	Sets and queries the spot measurement frequency			
Parameters	<value>	<NRf>	Spot measurement frequency [Hz]	
			Range	
			[HV DC bias OFF] : 10.0 uHz to 36.0 MHz	
			[HV DC bias ON] : 1.0 kHz to 36.0 MHz	
			Resolution : 10 u (10^{-6})	
			*RST value : 1000.0	
	<suffix>	<DISC>	SI prefix	
			MA	$<value>\times10^{6}$
			K	$<value>\times10^{3}$
			M	$<value>\times10^{-3}$
			U	$<value>\times10^{-6}$
			MAHZ	$<value>\times10^{6}$
			KHZ	$<value>\times10^{3}$
			MHZ	$<value>\times10^{-3}$
			UHZ	$<value>\times10^{-6}$
			HZ	<value>
Response format	<NR2>			
Comments	—			

5.3.114 :SOURce:FREQuency:TRACk <track>

:SOURce:FREQuency:TRACk?

Explanation	Sets and queries enable or disable of the resonant frequency tracking function		
Parameters	<track>	<BOL>	Resonant frequency tracking function
			ON | 1 Enables the resonant frequency tracking function.
			OFF | 0 Disables the resonant frequency tracking function.
			*RST value : 0
Response format	<NBOL>		
Comments	—		

5.3.115 :SOURce:FREQuency:TRACk:FACtor <factor>

:SOURce:FREQuency:TRACk:FACtor?

Explanation	Sets and queries the tracking sensitivity of the resonant frequency tracking function		
Parameters	<factor>	<NR1>	Tracking sensitivity [%] of resonant frequency tracking
			Range : 1 to 100
			Resolution : 1
			*RST value : 100
Response format	<NR1>		
Comments	—		

5.3.116 :SOURce:FREQuency:TRACk:POLarity \<pol>

:SOURce:FREQuency:TRACk:POLarity?

Explanation	Sets and queries the tracking polarity of the resonant frequency tracking function		
Parameters	\<pol>	\<DISC>	Tracking polarity of resonant frequency tracking
		POSitive	Tracking to target phase of series resonant frequency
		NEGative	Tracking to target phase of parallel resonant frequency
		*RST value : POS	
Response format	POS | NEG		
Comments	—		

5.3.117 :SOURce:FREQuency:TRACk:REFerence \<ref>

:SOURce:FREQuency:TRACk:REFerence?

Explanation	Sets and queries the target phase of the resonant frequency tracking function		
Parameters	\<ref>	\<NRf>	Target phase [°] of resonant frequency tracking
		Range	: -999.999 G to 999.999 G(10^9)
		Resolution	: 6 significant digits (0.001 for <1000)
		*RST value	: 0.0
Response format	\<NR2>		
Comments	This can be set within the range of -999.999 G to 999.999 G (10^9), but will be set rounded to the range of -179.999° to 180.000° on the ZA57630 main unit.		

5.3.118 :SOURce:FREQuency:TRACk:SPAN \<lower>,\<upper>

:SOURce:FREQuency:TRACk:SPAN?

Explanation	Sets and queries the tracking frequency upper and lower limits of the resonant frequency tracking function		
Parameters	\<lower>	\<NRf>	Tracking frequency lower limit [Hz]
		Range	: 10.0 uHz to 36.0MHz
		Resolution	: 10u (10^{-6})
		*RST value	: 10.0
	\<upper>	\<NRf>	Tracking frequency upper limit [Hz]
		Range	: Same as \<lower>
		Resolution	: Same as \<lower>
		*RST value	: 100 000.0
Response format	\<lower>,\<upper>		
	\<lower>	\<NR2>	Tracking frequency lower limit
	\<upper>	\<NR2>	Tracking frequency upper limit
Comments	If the value of \<upper> is lower than that of \<lower> or the value of \<lower> is higher than that of \<upper>, an error occurs.		

5.3.119 :SOURce:FREQuency:TRACk:TOLerance \<tol>

:SOURce:FREQuency:TRACk:TOLerance?

Explanation	Sets and queries the permissible error of the resonant frequency tracking function		
Parameters	\<tol>	\<NRf>	Permissible error [°] of resonant frequency tracking
		Range	: 0.001 to 179.999
		Resolution	: 0.001
		*RST value	: 10.0
Response format	\<NR2>		
Comments	—		

5.3.120 :SOURce:FREQuency:TRANsition <mode>
:SOURce:FREQuency:TRANsition?

Explanation	Sets and queries the frequency change mode			
Parameters	<mode>	<DISC>	Frequency change mode	
			SYNChronous	0° phase synchronization
			ASYNchronous	Asynchronization
			*RST value ：ASYN	
Response format	SYNC | ASYN			
Comments	—			

5.3.121 :SOURce:{LEVel\|IMMediate\|AMPLitude} <value>[<suffix>]
:SOURce:{LEVel\|IMMediate\|AMPLitude}?

Explanation	Sets and queries the measurement signal amplitude			
Parameters	<value>	<NRf>	Measurement signal amplitude	
			Range 　[When measurement signal unit is current]：0.0 to 0.060 [Arms] 　[When measurement signal unit is voltage]：0.0 to 999.0 $G(10^9)$ [Vrms] Resolution 　[When measurement signal unit is current]：3 significant digits 　　　　　　　　　　　　　　　　　　　$(100\ n(10^{-9})$ for $<100\ u(10^{-6}))$ 　[When measurement signal unit is voltage]：3 significant digits or M_{AC}, 　　　　　　　　　　　　　　　　　　whichever is the largest *RST value 　[When measurement signal unit is current] ：0.02 　[When measurement signal unit is voltage] ：1.0	
	<suffix>	<DISC>	SI prefix	
			G	$<value>\times10^9$
			MA	$<value>\times10^6$
			K	$<value>\times10^3$
			M	$<value>\times10^{-3}$
			U	$<value>\times10^{-6}$
			N	$<value>\times10^{-9}$
			P	$<value>\times10^{-12}$
Response format	<NR3>			
Comments	・A setting for which the output limit is exceeded results in an error. ・A setting for which $3.0\times|K|$ Vrms is exceeded due to the DUT drive amplifier gain setting K results in an error. ・A setting for which $|DC\ bias|+(amplitude\times1.42)$ exceeds $5V\times|K|$ results in an error. (When measurement mode is IMPD-2T or IMPD-3T, this is fixed to amplifier gain 1.) ・$M_{AC}=10K'$. Here, K' indicates the maximum integer that does not exceed $\log_{10}(|K|\times10^{-5})$			

5.3.122 :SOURce:LIMit[:AMPLitude] <value>[<suffix>]

:SOURce:LIMit[:AMPLitude]?

Explanation	Sets and queries the output limit		
Parameters	<value>	<NRf>	Output limit value
			Range
			[When measurement signal unit is current] : 100.0 n(10^{-9}) to 0.06 [Arms]
			[Voltage and IMPD-EXT or G-PH] : 1.0 a(10^{-18}) to 999.0 G(10^9) [Vrms]
			[Voltage and IMPD-2T or IMPD-3T] : 10.0 u(10^{-6}) to 3.00 [Vrms]
			Resolution
			[When measurement signal unit is current] : 3 significant digits
			(100 n(10^{-9}) for <100 u(10^{-6}))
			[Voltage and IMPD-EXT or G-PH] : 3 significant digits
			(1 a(10^{-18}) for <1 f(10^{-15}))
			[Voltage and IMPD-2T or IMPD-3T] : 3 significant digits
			(10 u(10^{-6}) for <10 m(10^{-3}))
			*RST value
			[When measurement signal unit is current] : 0.06
			[When measurement signal unit is voltage] : 3.00
	<suffix>	<DISC>	SI prefix
			G	<value>×10^9
			MA	<value>×10^6
			K	<value>×10^3
			M	<value>×10^{-3}
			U	<value>×10^{-6}
			N	<value>×10^{-9}
			P	<value>×10^{-12}
Response format	<NR3>		
Comments	A setting below the measurement signal amplitude results in an error.		

5.3.123 :SOURce:MULTiplier <value>[<suffix>]

:SOURce:MULTiplier?

Explanation	Sets and queries the DUT drive amplifier gain		
Parameters	<value>	<NRf>	DUT drive amplifier gain
			Range
			[Measurement mode is IMPD−EXT or G-PH] : -1.0T to 1.0T(10^{12})
			[Measurement mode is IMPD-2T or IMPD-3T] : Fixed to 1
			Resolution : 3 significant digits (1 p(10^{-12}) for <1 n(10^{-9}))
			*RST value : 1.0
	<suffix>	<DISC>	SI prefix
			G	<value>×10^9
			MA	<value>×10^6
			K	<value>×10^3
			M	<value>×10^{-3}
			U	<value>×10^{-6}
			N	<value>×10^{-9}
			P	<value>×10^{-12}
Response format	<NR3>		
Comments	・If the absolute value of <value> is less than 10^{-12}, an error occurs. ・A setting which exceeds 3.0×|K| Vrms results in an error. K is the DUT drive amplifier gain setting. ・A setting for which |DC bias| + (amplitude × 1.42) exceeds 5V × |K| results in an error.		

5.3.124 :SOURce:ROSCillator:EXTernal <sw>
:SOURce:ROSCillator:EXTernal?

Explanation	Sets and queries the external frequency reference (10MHz REF IN)		
Parameters	<sw>	<BOL>	Reference clock source (10MHz REF IN)
			ON | 1 : The external reference clock is enabled.
			OFF | 0 : The external reference clock is disabled.
			*RST value : 0
Response format	<NBOL>		
Comments	—		

5.3.125 :SOURce:ROSCillator:OUTPut[:STATe] <sw>
:SOURce:ROSCillator:OUTPut[:STATe]?

Explanation	Sets and queries the 10MHz REF OUT output status		
Parameters	<sw>	<BOL>	10MHz REF OUT status
			ON | 1 : 10MHz REF OUT is output.
			OFF | 0 : 10MHz REF OUT is not output.
			*RST value : 0
Response format	<NBOL>		
Comments	—		

5.3.126 :SOURce:SEQuence:LENGth <value>
:SOURce:SEQuence:LENGth?

Explanation	Sets and queries the sequence sweep		
Parameters	<value>	<NR1>	Setting memory number
			Range : 0 to 32
			Resolution : 1
			*RST value : 0
Response format	<NR1>		
Comments	· 0 indicates OFF. If this is not OFF, the measurement conditions stored in setting memories 1 to <value> are executed in order at the time of measurement. · If this is set when the trigger input source setting is other than manual operation, an error occurs. · If this is set when zone comparison is enabled, an error occurs. · If this is set when the sweep parameter type is TIME, an error occurs.		

5.3.127 :SOURce:SLEW:TYPE <param>
:SOURce:SLEW:TYPE?

Explanation	Sets and queries the on/off mode		
Parameters	<param>	<DISC>	On/off mode type
			QUICk : Sets the on/off mode to QUICK.
			SLOW : Sets the on/off mode to SLOW.
			SYNC : Sets the on/off mode to 0° SYNC.
			*RST value : QUIC
Response format	QUIC | SLOW | SYNC		
Comments	—		

5.3.128 :SOURce:SWEep <lower>,<upper>
:SOURce:SWEep?

Explanation	Sets and queries the upper and lower limits of sweep parameters		
Parameters	<lower>	<NRf>	lower limit of sweep parameters
			Range
			[Frequency sweep] : 10.0 u(10^{-6}) to 36.0 M(10^6) [Hz]
			[Voltage amplitude sweep, IMPD-EXT/G-PH]
			: 0.0 to 999.0 G(10^9) [Vrms]
			[Voltage amplitude sweep, IMPD-2T/IMPD-3T]
			: 0.0 to 3.0 [Vrms]
			[Current amplitude sweep] : 0.0 to 0.060 [Arms]
			[Voltage DC bias sweep, IMPD-EXT/G-PH] : -999.0 G to 999.0 G(10^9) [V]
			[Voltage DC bias sweep, IMPD-2T/IMPD-3T] : -5.0 to 5.0 [V]
			[HVDC bias sweep] : -40.0 to 40.0 [V]
			[Current DC bias sweep] : -0.100 to 0.100 [A]
			Resolution
			[Frequency sweep] : 10 u(10^{-6})
			[Voltage amplitude sweep, IMPD-EXT/G-PH]
			: 3 significant digits (10 a(10^{-18}) for <10 f(10^{-15}))
			[Voltage amplitude sweep, IMPD-2T/IMPD-3T]
			: 3 significant digits (10 u(10^{-6}) for <10 m(10^{-3}))
			[Current amplitude sweep]
			: 3 significant digits (100 n(10^{-9}) for <100 u(10^{-6}))
			[Voltage DC bias sweep, IMPD-EXT/G-PH]
			: 3 significant digits (10 a(10^{-18}) for <10 f(10^{-15}))
			[Voltage DC bias sweep, IMPD-2T/IMPD-3T] : 10 m(10^{-3})
			[HVDC bias sweep] : 10 m(10^{-3})
			[Current DC bias sweep] : 100 n(10^{-9})
			*RST value
			[Frequency sweep] : 10.0 [Hz]
			[Voltage amplitude sweep, IMPD-EXT/G-PH] : 0.001 [Vrms]
			[Voltage amplitude sweep, IMPD-2T/IMPD-3T] : 0.001 [Vrms]
			[Current amplitude sweep] : 20 u(10^{-6}) [Arms]
			[Voltage DC bias sweep, IMPD-EXT/G-PH] : 0.0 [V]
			[Voltage DC bias sweep, IMPD-2T/IMPD-3T] : 0.0 [V]
			[HVDC bias sweep] : 0.0 [V]
			[Current DC bias sweep] : 0.0 [A]
	<upper>	<NRf>	Upper limit of sweep parameters
			Range: Same as <lower>
			Resolution: Same as <lower>
			*RST value
			[Frequency sweep] : 100.0 k(10^3) [Hz]
			[Voltage amplitude sweep, IMPD-EXT/G-PH] : 1.0 [Vrms]
			[Voltage amplitude sweep, IMPD-2T/IMPD-3T] : 1.0 [Vrms]
			[Current amplitude sweep] : 0.02 [Arms]
			[Voltage DC bias sweep, IMPD-EXT/G-PH] : 1.0 [V]
			[Voltage DC bias sweep, IMPD-2T/IMPD-3T] : 10 m(10^{-3})
			[HVDC bias sweep] : 1.0 [V]
			[Current DC bias sweep] : 0.02 [A]
Response format	<lower>,<upper>		
	<lower>	[When frequency sweep] : <NR2>	lower limit of sweep parameters
		[When other than frequency sweep] : <NR3>	
	<upper>	[When frequency sweep] : <NR2>	Upper limit of sweep parameters
		[When other than frequency sweep] : <NR3>	

Comments	· The text in the parameter items refers to the following settings.
	Voltage amplitude sweep : Measurement signal unit is voltage and sweep type is amplitude
	Current amplitude sweep : Measurement signal unit is current and sweep type is amplitude
	Voltage DC bias sweep : Measurement signal unit is voltage and sweep type is DC bias
	HVDC bias sweep : Measurement signal unit is voltage, sweep type is DC bias, and
	HV DC bias is enabled
	Current DC bias sweep : Measurement signal unit is current and sweep type is DC bias
	· If the value of <upper> is lower than that of <lower> or the value of <lower> is higher
	than that of <upper>, an error occurs.
	· If this is set when the sweep parameter type is TIME, an error occurs.

5.3.129 :SOURce:SWEep:RESolution <value>

       :SOURce:SWEep:RESolution?

Explanation	Sets and queries the sweep density		
Parameters	<value>	<NR1>	Number of sweep points
			Range : 3 to 2000
			Resolution : 1
			*RST value : 100
Response format	<NR1>		
Comments	—		

5.3.130 :SOURce:SWEep:SPACing <param>

       :SOURce:SWEep:SPACing?

Explanation	Sets and queries the sweep resolution (linear or log)		
Parameters	<param>	<DISC>	Sweep spacing
			LINear	Linear
			LOGarithmic	Log
			*RST value : LOG
Response format	LIN | LOG		
Comments	If this is set when the sweep parameter type is BIAS or TIME, an error occurs.		

5.3.131 :SOURce:SWEep:TYPE <type>

       :SOURce:SWEep:TYPE?

Explanation	Sets and queries the sweep parameter type		
Parameters	<type>	<DISC>	Sweep parameter type
			FREQuency	Frequency
			AMPLitude	Amplitude
			BIAS	DC bias
			TIME	Time (zero-span sweep)
			*RST value : FREQ
Response format	FREQ | AMPL | BIAS | TIME		
Comments	· If the setting is set to BIAS or TIME when the sweep resolution is LOG, an error occurs.		
	· If the setting is set to other than FREQ when slow sweep is enabled, slow sweep is		
	forcibly disabled.		
	· If the setting is set to TIME when sequence sweep is enabled, sequence sweep is		
	forcibly disabled.		

5.3.132 :SOURce:UNIT <unit>

:SOURce:UNIT?

Explanation	Sets and queries the unit (voltage or current) of measurement signals (amplitude and DC bias) output from the OSC connector		
Parameters	<unit>	<DISC>	Unit of amplitude and DC bias
			VOLTage Voltage
			CURRent Current
			*RST value : VOLT
Response format	VOLT | CURR		
Comments	If the setting is set to CURR when the measurement mode is other than IMPD-2T or IMPD-3T, an error occurs.		

5.3.133 :STATus:OPERation:CONDition?

Explanation	Queries the operation status condition register
Response format	<NR1>
Comments	—

5.3.134 :STATus:OPERation:ENABle <value>

:STATus:OPERation:ENABle?

Explanation	Sets and queries the operation status event enable register		
Parameters	<value>	<NR1>	Operation status event enable register
			Range : 0 to 65535
			Resolution : 1
			Default : 0
Response format	<NR1>		
Comments	Initialized when the power is turned on. Not initialized by *RST.		

5.3.135 :STATus:OPERation[:EVENt]?

Explanation	Queries the operation status event register
Response format	<NR1>
Comments	The operation status event register is cleared when an event register query or *CLS command is received.

5.3.136 :STATus:OPERation:NTRansition <value>

:STATus:OPERation:NTRansition?

Explanation	Sets and queries the negative operation status transition filter		
Parameters	<value>	<NR1>	Negative operation status transition filter
			Range : 0 to 65535
			Resolution : 1
			Default : 0
Response format	<NR1>		
Comments	Initialized when the power is turned on. Not initialized by *RST.		

5.3.137 :STATus:OPERation:PTRansition <value>

:STATus:OPERation:PTRansition?

Explanation	Sets and queries the positive operation status transition filter		
Parameters	<value>	<NR1>	Positive operation status transition filter
			Range : 0 to 65535
			Resolution : 1
			Default : 0
Response format	<NR1>		
Comments	Initialized when the power is turned on. Not initialized by *RST.		

5.3.138 :SYSTem:AUXiliary:INPut?

Explanation	Queries each input terminal (PIN0 to PIN2) level of the AUX connector
Response format	\<NR1\>
Comments	The response is the total value of the numerical values of (1) to (3) below. (1) 4 if the input of the PIN2 terminal is the Hi level, and 0 if it is the Lo level (2) 2 if the input of the PIN1 terminal is the Hi level, and 0 if it is the Lo level (3) 1 if the input of the PIN0 terminal is the Hi level, and 0 if it is the Lo level

5.3.139 :SYSTem:AUXiliary:OUTPut \<output\>
:SYSTem:AUXiliary:OUTPut?

Explanation	Sets and queries each output terminal (POUT0 to POUT3) level of the AUX connector		
Parameters	\<output\>	\<NR1\>	POUT0 to POUT3 outputs
			Range : 0 to 15 Resolution : 1 *RST value : 0
Response format	\<NR1\>		
Comments	The setting command parameter and query response are the total value of the numerical values of (1) to (4) below. (1) 8 if the output of the POUT3 terminal is the Hi level, and 0 if it is the Lo level (2) 4 if the output of the POUT2 terminal is the Hi level, and 0 if it is the Lo level (3) 2 if the output of the POUT1 terminal is the Hi level, and 0 if it is the Lo level (4) 1 if the output of the POUT0 terminal is the Hi level, and 0 if it is the Lo level		

5.3.140 :SYSTem:BEEPer \<sw\>
:SYSTem:BEEPer?

Explanation	Sets and queries the beep sound status		
Parameters	\<sw\>	\<BOL\>	Beep sound status
			ON | 1	Enables the beep sound.
			OFF | 0	Disables the beep sound.
Response format	\<NBOL\>		
Comments	—		

5.3.141 :SYSTem:DATE \<year\>,\<month\>,\<day\>
:SYSTem:DATE?

Explanation	Sets and queries the current year, month, and day		
Parameters	\<year\>	\<NR1\>	Year
			Range : 1998 to 2099 Resolution : 1
	\<month\>	\<NR1\>	Month
			Range : 1 to 12 Resolution : 1
	\<day\>	\<NR1\>	Day
			Range : 1 to 31 Resolution : 1
Response format	\<year\>,\<month\>,\<day\>		
	\<year\>	\<NR1\>	Year
	\<month\>	\<NR1\>	Month
	\<day\>	\<NR1\>	Day
Comments	—		

5.3.142 :SYSTem:ERRor?

Explanation	Queries the remote error		
Response format	<code>,<message>		
	<code>	<NR1>	Error code
	<message>	<STR>	Error message
Comments	・<message> includes quotation marks (""). ・The error queue can hold 16 error messages, and the error messages can be read one at a time in order from the oldest. ・If 16 errors are exceeded, the last error in the error queue is replaced by "Queue overflow" and a new error cannot be added until free space becomes available in the error queue. ・If the *CLS command is received, the error queue is cleared.		

5.3.143 :SYSTem:LOCal

Explanation	Sets the remote operation state of the ZA57630 main unit to the local state.
Comments	This can be used only when RS232 or LAN is used for the remote communication interface.

5.3.144 :SYSTem:REMote

Explanation	Sets the remote operation state of the ZA57630 main unit to the remote state.
Comments	This can be used only when RS232 or LAN is used for the remote communication interface.

5.3.145 :SYSTem:RWLock

Explanation	Sets the remote operation state of the ZA57630 main unit to the LLO state.
Comments	This can be used only when RS232 or LAN is used for the remote communication interface.

5.3.146 :SYSTem:TIME <hour>,<minute>,<second>

:SYSTem:TIME?

Explanation	Sets and queries the current time (hour, minute, second)		
Parameters	<hour>	<NR1>	Hour
			Range : 0 to 23 Resolution : 1
	<minute>	<NR1>	Minute
			Range : 0 to 59 Resolution : 1
	<second>	<NR1>	Second
			Range : 0 to 59 Resolution : 1
Response format	<hour>,<monute>,<second>		
	<hour>	<NR1>	Hour
	<minute>	<NR1>	Minute
	<second>	<NR1>	Second
Comments	—		

5.3.147 :TRIGger:ABORt

Explanation	Aborts the measurement operation
Comments	—

5.3.148 :TRIGger:DELay <value>

:TRIGger:DELay?

Explanation	Sets and queries the measurement delay		
Parameters	<value>	<NRf>	Measurement delay (seconds)
			Range : 0.0 to 9990
			Resolution : 3 significant digits (100 u(10^{-6}) for <100 m(10^{-3}))
			*RST value : 0.0
Response format	<NR3>		
Comments	—		

5.3.149 :TRIGger:DIRection <direction>

:TRIGger:DIRection?

Explanation	Sets and queries the measurement operation when TRIG input of the handler interface		
Parameters	<direction>	<DISC>	Sweep direction
			UP	Up sweep
			DOWN	Down sweep
			SPOT	Spot measurement (not sweep)
			*RST value : SPOT
Response format	UP | DOWN | SPOT		
Comments	If this is set when the measurement mode is G-PH, an error occurs.		

5.3.150 :TRIGger[:IMMediate] <trig>

Explanation	Executes a trigger (starts measurement)		
Parameters	<trig>	<DISC>	Trigger type
			UP	Starts up-sweep measurement.
			DOWN	Starts down-sweep measurement.
			SPOT	Starts spot measurement.
Comments	When zero-span sweep is set, up-sweep measurement is started also when "DOWN" is specified for the parameter and this command is sent.		

5.3.151 :TRIGger:SEQuence:MODE <mode>

:TRIGger:SEQuence:MODE?

Explanation	Sets and queries the sequence trigger		
Parameters	<value>	<DISC>	Sequence trigger
			AUTO	Performs the measurement of all sequences with one trigger.
			STEP	A trigger is required for each sequence.
			*RST value : AUTO
Response format	AUTO | STEP		
Comments	—		

5.3.152 :TRIGger:SOURce <param>
:TRIGger:SOURce?

Explanation	Sets and queries the trigger input		
Parameters	<param>	<DISC>	Selects the trigger input source.
			MANual	UP/DOWN/SPOT key on the front panel (disabled for repeat measurement)
			REMote	:TRIGger remote command
			RISE	TRIG signal of the handler interface, trigger is when rising
			FALL	TRIG signal of the handler interface, trigger is when falling
			*RST value : MAN	
Response format	MAN | REM | RISE | FALL		
Comments	・When the trigger input setting is other than REMote, the measurement start trigger by the :TRIGger command is ignored. ・If the instrument enters the local state when the trigger input setting is MANual, the measurement start operation can be performed from the instrument front panel, but when the setting is other than Manual, the trigger operation of the instrument front panel will be ignored even if the instrument enters the local state. ・If the setting is set to RISE or FALL when the measurement mode is G-PH, an error occurs. ・If the setting is set to other than MAN when sequence sweep is enabled, sequence sweep is forcibly disabled.		

5.3.153 :TRIGger:STTDelay <value>
:TRIGger:STTDelay?

Explanation	Sets and queries the measurement start delay		
Parameters	<value>	<NRf>	Measurement start delay value (seconds)
			Range : 0.0 to 9990
			Resolution : 3 significant digits (100 u(10^{-6}) for <100 m(10^{-3}))
			*RST value : 0.0
Response format	<NR3>		
Comments	—		

5.3.154 :TEST:HANDler <output1>,<output2>
:TEST:HANDler?

Explanation	Sets and queries the handler interface terminal state		
Parameters	<output1>	<NR1>	Sets the handler interface output signal.
			Range : 0 to 3 221 258 176 Resolution : 1 *RST value : 4 227 891 198 (value of <state1>) A value with the bit set to 1 corresponds to the H level. The bit number matches the pin number of the handler interface. bit31 : /BIN3 bit30 : /BIN1 bit14 : /ERR bit13 : / INDEX Bit12 to 6 : /BIN14, /BIN12, /BIN10, /BIN8, /BIN6, /BIN4, /BIN2
	<output2>	<NR1>	Sets the handler interface output signal.
			Range : 0 to 127 Resolution : 1 *RST value: 127 (value of <state2>) A value with the bit set to 1 corresponds to the H level. The bit number + 32 matches the pin number of the handler interface. bit6 : /EOM bit5 : /OUT_OF_BINS bit4 to 0 : /BIN13, /BIN11, /BIN9, /BIN7, /BIN5
Response format	<state1>,<state2>		
	<state1>	<NR1>	State of each pin of the handler interface
			A value with the bit set to 1 corresponds to the H level. The bit number matches the pin number of the handler interface. bit31 : /BIN3 bit30 : /BIN1 bit29 to 26 : /RCL6, /RCL4, /RCL2, /RCL0 bit14 : /ERR bit13 : / INDEX Bit12 to 6 : /BIN14, /BIN12, /BIN10, /BIN8, /BIN6, /BIN4, /BIN2 bit5 : /RCL-VALID bit4 : /RCL5 bit3 : /RCL3 bit2 : /RCL1 bit1 : /TRIG
	<state2>	<NR1>	State of each pin of the handler interface
			A value with the bit set to 1 corresponds to the H level. The bit number + 32 matches the pin number of the handler interface. bit6 : /EOM bit5 : /OUT_OF_BINS bit4 to 0 : /BIN13, /BIN11, /BIN9, /BIN7, /BIN5
Comments	・ For details on the behavior of <state1> and <state2>, refer to handler interface section in Instruction Manual (Advanced). ・ Initialized when the power is turned on. ・ If this is set when the test operation of the handler interface is disabled, an error occurs.		

5.3.155 :TEST:HANDler:MODE <mode>
　　　　　　 :TEST:HANDler:MODE?

Explanation	Sets and queries the test operation of the handler interface		
Parameters	<mode>	<BOL>	Sets the test operation.
			ON | 1 Enables the test operation.
			OFF | 0 Disables the test operation.
			*RST value ：0
Response format	<NBOL>		
Comments	Initialized when the power is turned on.		

6.   Status System

6.1 Status system overview

The status system of the ZA57630 is illustrated in Figure 6-1.
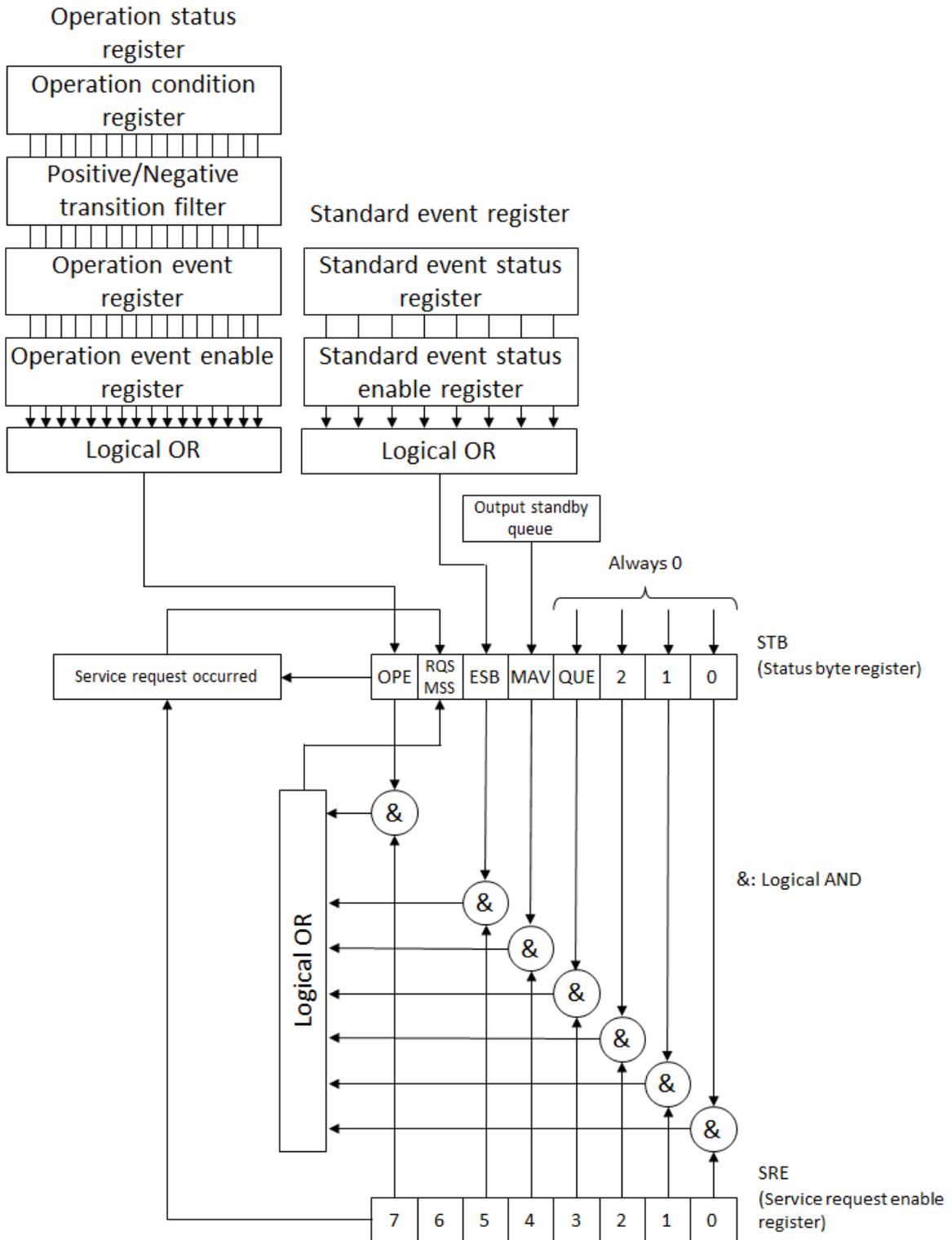
Figure 6-1 Status system

6.2 Status byte

The status byte register definitions are presented in Table 6-1. The status byte can be read by serial polling. In that case, bit 6 is RQS (Request service).

Table 6-1 Status byte register definitions

Bit		Weight	Conditions for setting to 1	Conditions for setting to 0
OPE	7	128	When any of the effective bits of the operation status event register becomes 1	・ When a device clear command is received ・ After a status byte read command has been executed
RQS/ MSS	6	64	SRQ is sent	・ When a device clear command is received ・ As for RQS, after a status byte has been read by a serial poll
ESB	5	32	When any of the effective bits of the standard event status register becomes 1	When all of the effective bits of the standard event status register become 0
MAV	4	16	When the response to the query has been prepared and can be output	When all of the responses have been output and there are no more responses to be output
—	3	8	—	Always 0 (not used)
—	2	4	—	Always 0 (not used)
—	1	2	—	Always 0 (not used)
—	0	1	—	Always 0 (not used)

■ Relevant commands and queries

*STB?

    This queries the status byte register content.

    Bit 6 is MSS (Master Summary Status).

*SRE, *SRE?

    These set and query the service request enable register.

    The register is cleared to 0 immediately after the power is turned on. To clear the register to 0, set 0. The status byte register bits become effective when the corresponding bits in the service request enable register are set to 1. The service request is issued when any one of the effective bits is set to one.

The message and response message parameters that are set in each register are the sums of all the weights of the bits that have the value of 1.

■ Checking status when making a query

Normally, a correct response message can be received after a query has been sent, and it is not necessary to check the MAV bit of the status byte. When the processing proceeds while the MAV bit is being checked, first check that the MAV bit of the status byte is 1 by serial polling after the query is sent and then read the response message. Then confirm that the MAV bit has changed to 0 and proceed to the next operation.

6.3 Standard event status

The structure of the standard event status is illustrated in Figure 6-2, and the details are presented in Table 6-2. If the bits of the standard event status enable register are set to 1, the corresponding bits of the standard event status register are enabled, and if any of the enabled bits take the value 1, the ESB bit of the status byte register is set to 1.
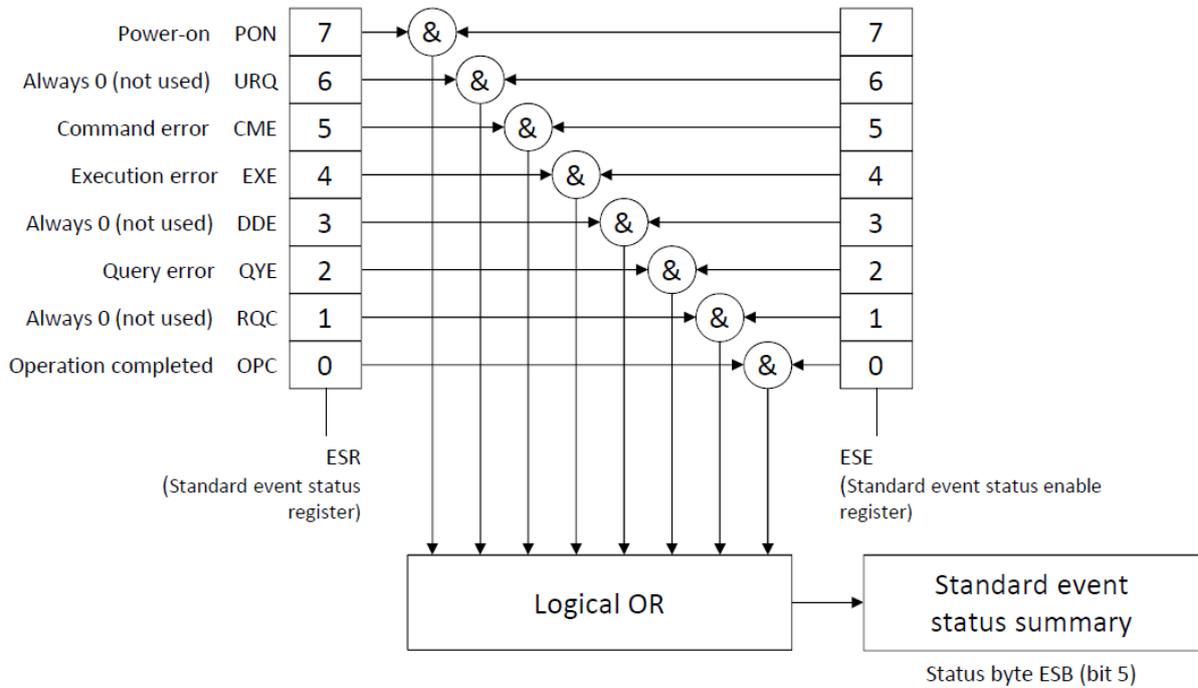
Figure 6-2 Standard event status structure

Table 6-2 Content of the standard event status register

Bit		Weight	Content
PON	7	128	Power on This bit is set to 1 when the power is turned on. It is cleared to 0 when this register is read, and the value remains 0 until the power is turned on again.
URQ	6	64	User request Always 0 (not used)
CME	5	32	Command error This bit is set to 1 when there is a syntax error in a remote command.
EXE	4	16	Execution error This bit is set to 1 when a parameter is out of range or there is a conflict in settings.
DDE	3	8	Instrument-specific error Always 0 (not used)
QYE	2	4	Query error This bit is set to 1 when a read attempt is made when there is no data in the response message output buffer or when the data in the response message output buffer has been lost.
RQC	1	2	Request control Always 0 (not used)
OPC	0	1	Operation completed This bit is set to 1 when the processing for all of the commands up to the *OPC command has been completed.

■　Relevant commands and queries

*ESR?

> This command queries the standard event status register.
>
> The query clears the register to 0. The *CLS command also clears the register.
>
> The register is cleared to 0 immediately after the power is turned on, but the PON bit is set to 1.

*ESE, *ESE?

> These commands set and query the standard event status enable register.
>
> To clear the enable register to 0, set the value 0.
>
> There are no other clear commands.
>
> The register is cleared to 0 immediately after the power is turned on.

The message and response message parameters that are set in each register are the sums of all the weights of the bits that have the value of 1.

6.4 Operation status

The operation status structure is illustrated in Figure 6-3.

The operation conditions register indicates the status of the ZA57630 as shown in Table 6-3. The transition filter detects changes in the conditions and generates events. Generating an event requires setting of the transition filter. The operation event register stores the generated events. If the operation event enable register bits are set to 1, the corresponding bits of the operation event register are enabled. If the value of any of the enabled bits is set to 1, the OPE bit of the status byte is set to 1.
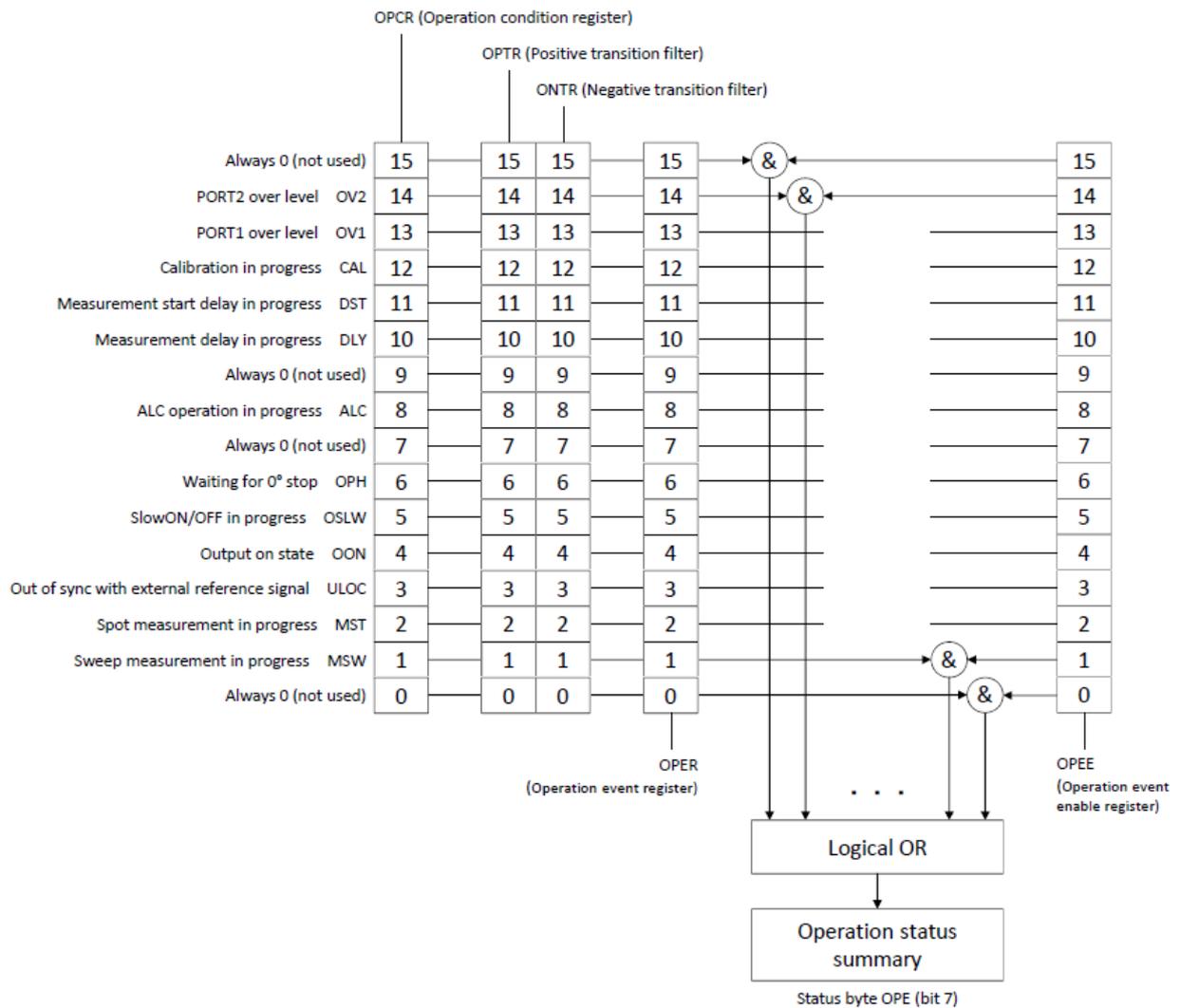
Figure 6-3 Operation status structure

Table 6-3 Contents of the operation condition register and event register

Bit		Weight	Content
—	15	32768	Always 0 (not used)
OV2	14	16384	PORT2 is at over input
OV1	13	8192	PORT1 is at over input
CAL	12	4096	Calibration in progress
DST	11	2048	Measurement start delay in progress
DLY	10	1024	Measurement delay in progress
—	9	512	Always 0 (not used)
ALC	8	256	ALC operation in progress (amplitude control in progress) (not ON/OFF setting)
—	7	128	Always 0 (not used)

OPH	6	64	Waiting for 0° phase stop
			    Waiting for 0° phase due to frequency change mode
			    Waiting for 0° phase due to on/off mode

OSLW	5	32	Slow ON/OFF in progress

OON	4	16	Output on state (also includes the following cases)
			    During output transitioning when on/off mode is SLOW
			    Waiting for 0° phase due to on/off mode

ULOC	3	8	Out of sync with external reference signal (10 MHz)
			    If a valid signal is being input to the 10MHz Ref In terminal: 0
			    If a valid signal is not being input to the 10MHz Ref In terminal: 1

MST	2	4	Spot measurement in progress (1 for delay, also)
MSW	1	2	Sweep measurement in progress (1 for delay, also)
—	0	1	Always 0 (not used)

■　Relevant commands and queries

:STATus:OPERation:CONDition?

    This command queries the operation condition register.

    Querying does not clear the register to 0.

    Always indicates the status of the instrument.

:STATus:OPERation[:EVENt]?

    This command queries the operation event register.

    The query clears the register to 0.

    The event register is also cleared by the*CLS command.

    The register is cleared to 0 immediately after the power is turned on.

:STATus:OPERation:ENABle　,　STATus:OPERation:ENABle?

    This command queries the operation event enable register.

    To clear the enable register to 0, set the value 0.

    There are no other clear commands.

    The register is cleared to 0 immediately after the power is turned on.

:STATus:OPERation:NTRansition, STATus:OPERation:NTRansition?

:STATus:OPERation:PTRansition, STATus:OPERation:PTRansition?

    These operations set and query the operation status transition filter.

    The relationships between the transition filter settings and event register

    transitions are shown in Table 6-4.

Table 6-4 Operation transition filter and event register transitions

Positive transition filter bit settings	Negative transition filter bit settings	Condition register transition for changing the event register to 1
1	0	$0 \to 1$
0	1	$1 \to 0$
1	1	$0 \to 1$ or $1 \to 0$
0	0	Event register is not changed to 1.

The message and response message parameters that are set in each register are the sums of all the weights of the bits that have the value of 1.

7. Command Execution Examples

7.1 Spot measurement

// Initialization		
(send)	*RST	Settings are initialized
(send)	*CLS	Initializes the event register
(send)	:STAT:OPER:NTR 4	Sets checking for spot measurement completion

// Mode setting		
(send)	:SENS:FUNC FRES	Sets the measurement mode to IMPD-3T

// OSC setting		
(send)	:SOUR:FREQ xxx	Sets the spot frequency to xxx
(send)	:SOUR:UNIT xxx	Sets the measurement signal unit to xxx
(send)	:SOUR:AMPL xxx	Sets the measurement signal amplitude to xxx
(send)	:SOUR:BIAS xxx	Sets the DC bias to xxx
(send)	:OUTP ON	Sets the measurement signal output to the AC/DC ON mode
(send)	:OUTP?	Checks the measurement signal output state
(receive)		

// Measure setting		
(send)	:SENS:AVER:COUN xxx	Sets the measurement time to xxx
(send)	:TRIG:SOUR REM	Sets the trigger source to the TRIG command

// Measurement data retrieval format setting		
(send)	:DATA:FORM ASC,Z,ZPHAS	Sets the retrieval format for measurement results to impedance and phase

// Measurement starting		
(send)	:TRIG SPOT	Begin spot measurement

// Spot measurement end monitoring		
(send)	:STAT:OPER?	Checks the operation event register for completion of measurement
(receive)		

Bit 2 is 0
(Spot measurement not completed)

Bit 2 is 1
(Spot measurement completed)

// Measurement data retrieval		
(send)	:DATA:SPOT?	Gets the spot measurement data
(receive)		

7.2 Sweep measurement

// Initialization		
(send)	*RST	Settings are initialized
(send)	*CLS	Initializes the event register
(send)	:STAT:OPER:NTR 2	Sets for checking sweep measurement completion

// Mode setting		
(send)	:SENS:FUNC FRES	Sets the measurement mode to IMPD-3T

// OSC setting		
(send)	:SOUR:UNIT xxx	Sets the measurement signal unit to xxx
(send)	:SOUR:AMPL xxx	Sets the measurement signal amplitude to xxx
(send)	:SOUR:BIAS xxx	Sets the DC bias to xxx
(send)	:OUTP ON	Sets the measurement signal output to the AC/DC ON mode
(send)	:OUTP?	Checks the measurement signal output state
(receive)		

// Measure setting		
(send)	:TRIG:SOUR REM	Sets the trigger source to the TRIG command

// Sweep setting		
(send)	:SOUR:SWE:TYPE FREQ	Sets the sweep parameter type to FREQ
(send)	:SOUR:SWE xxx,yyy	Sets the sweep lower limit frequency to xxx Sets the sweep upper limit frequency to yyy
(send)	:SOURce:SWE:RES xxx	Sets the number of sweep points to xxx
(send)	:SOURce:SWE:SPAC xxx	Sets the sweep resolution to xxx

// Measurement data retrieval format setting		
(send)	:DATA:FORM ASC,SWEEP,CS,D	Sets the retrieval format for measurement results to frequency, series capacitance and dissipation factor

// Measurement starting		
(send)	:TRIG UP	Begins upward sweep measurement

// Sweep measurement end monitoring		
(send)	:STAT:OPER?	Checks the operation event register for completion of measurement
(receive)		

Bit 1 is 0
(Sweep measurement not completed)

Bit 1 is 1
(Sweep measurement completed)

// Measurement data retrieval		
(send)	:DATA:POIN? MEAS	Checks the number of measurement data points
(receive)		
(send)	:DATA? MEAS,0,xxx	Gets the sweep measurement data for the number of data points that has been set
(receive)		

8. Error Message

The main errors that occur in remote control are described here.

Table 8-1 Error Message   1/2

Error Number	Error Message	Description
0	No error	No abnormalities have occurred.
-101	Invalid character	There is an abnormality in text data.
-102	Syntax error	A command or data that cannot be recognized has been received.
-103	Invalid separator	There is an abnormality in a command separator.
-104	Data type error	The parameter format is inappropriate.
-108	Parameter not allowed	There are too many parameters or there is a parameter in a place that it cannot be used.
-109	Missing parameter	There are not enough parameters.
-110	Command header error	There is an abnormality in the command header (no detailed classification).
-113	Undefined header	The command header is undefined.
-115	Unexpected number of parameters	The number of parameters is abnormal.
-120	Numeric data error	There is an abnormality in the numerical data (no detailed classification).
-123	Exponent too large	The exponent is too large (greater than 32000) (Example) SOURce:FREQuency:CW 1E50000
-124	Too many digits	A number has too many digits (more than 255).
-130	Suffix error	There is an abnormality in the suffix (multiplier or unit). (no detailed classification)
-134	Suffix too long	The SI prefix or unit is too long (more than 7 characters).
-140	Character data error	There is an abnormality in text data (no detailed classification).
-144	Character data too long	The text data is too long.
-200	Execution error	The command could do not be executed (no detailed classification). (Examples) · A setting operation command was sent during calibration. · The calibration path check failed.
-211	Trigger ignored	A trigger was received, but execution was not possible. (Examples) · A measurement start command was sent during calibration. · A measurement start command was sent during measurement.

Table 8-1 Error Message   2/2

Error Number	Error Message	Description
-221	Settings conflict	The command cannot be executed because of constraint conflicts among multiple settings. (Examples) ・ Amplitude and DC bias constraints ・ Sweep lower limit frequency and upper limit frequency constraints ・ Graph axis scale maximum and minimum constraints
-222	Data out of range	The data is outside the valid range.
-224	Illegal parameter value	The parameters are incorrect (problem other than data type error). (Example) 　SOURce:FREQuency:CW %1
-310	System error	An instrument-specific internal error has occurred (memory content lost, etc.).
-350	Queue overflow	The error queue has overflowed and can accommodate no new errors. (The error queue has more than 16 items.)
-410	Query INTERRUPTED	The next command was received before all of the requested responses were sent. The response was interrupted and the output buffer was cleared. (Does not occur with LAN or RS232 interfaces.)
-420	Query UNTERMINATED	The received query was incomplete, so the requested response could not be sent. The output buffer was cleared. (Does not occur with LAN or RS232 interfaces.)
-440	Query UNTERMINATED after indefinite response	There was a query following"*IDN?" within a text string. ("*IDN?" must be the last query in a received text string.)

Remote control errors are placed in the error queue and can be read one at a time in order of oldest first with the query ":SYSTem:ERRor?". If a read operation is executed after all of the errors have been read, 0, "No error" is returned. The error queue can be cleared with the *CLS command. If a problem occurs that results in data remaining in the input buffer or output buffer, the buffers can be cleared with a device clear interface message (DCL, SDC).

Errors other than those described above may occur in some situations. In such cases, check the error message for a summary.

For operations that can also be performed from the panel, the displayed error messages are the same as those that result from panel operation. Refer to the explanation for the panel operations that are relevant to each command and query. Errors that occur during normal measurement are also displayed in the same way under remote control operation.

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