HIOKI

9518-01

Instruction Manual

GB-IB INTERFACE

For 3532-50, 3522-50, 3511-50 LCR HiTESTER

EN

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Contents

Introduction

Thank you for purchasing the HIOKI 9518-01 GP-IB INTERFACE for the 3532-50, 3522-50 and 3511-50 LCR HiTESTERs.
To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

This manual contains information and warnings essential for safe operation of the product and for maintaining it in safe operating condition. Before using the product, be sure to carefully read the following safety notes.

The following symbols in this manual indicate the relative importance of cautions and warnings.

⚠ WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
⚠ CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.
NOTE	Advisory items related to performance or correct operation of the product.

Chapter 1
Before Use

1.1 Check of External Appearance and Accessories

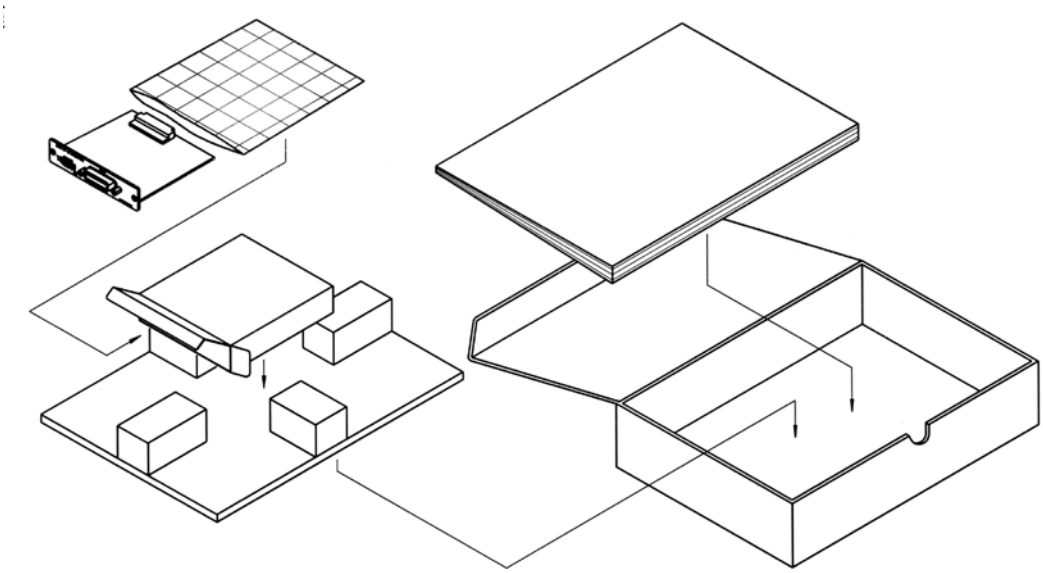
When you receive the product, inspect it carefully to ensure that no damage occurred during shipping.
In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

(1) 9518-01 GP-IB INTERFACE

(2) This instruction manual

1.2 Shipping Precautions

If reshipping the unit, preferably use the original packing.



If this is not available, use the following procedure.

1. Wrap the unit in plastic sheeting.

2. After wrapping cushioning material around the unit, pack it into a cardboard box, and then seal up the box with adhesive tape.

1.3 Points for Attention During Use

(1) If you change the device address of the 3532-50/3522-50/3511-50 while using it, you should immediately turn the power off and on again. If you do not do so, the address change will not be registered by the bus, and problems will occur.

(2) Always be sure to secure the GP-IB cable to the 9518-01 unit by tightening up the fixing screws provided.

(3) Program messages sent just after the power has been turned on are executed after the self test has terminated.

(4) It is vital that the proper data format is used when inputting commands with data values to the 3532-50/3522-50/3511-50 unit.

(5) For details of the various functions, refer to the instruction manuals for the 3532-50/3522-50/3511-50 unit.

1.4 Installing the GP-IB Interface

⚠ WARNING

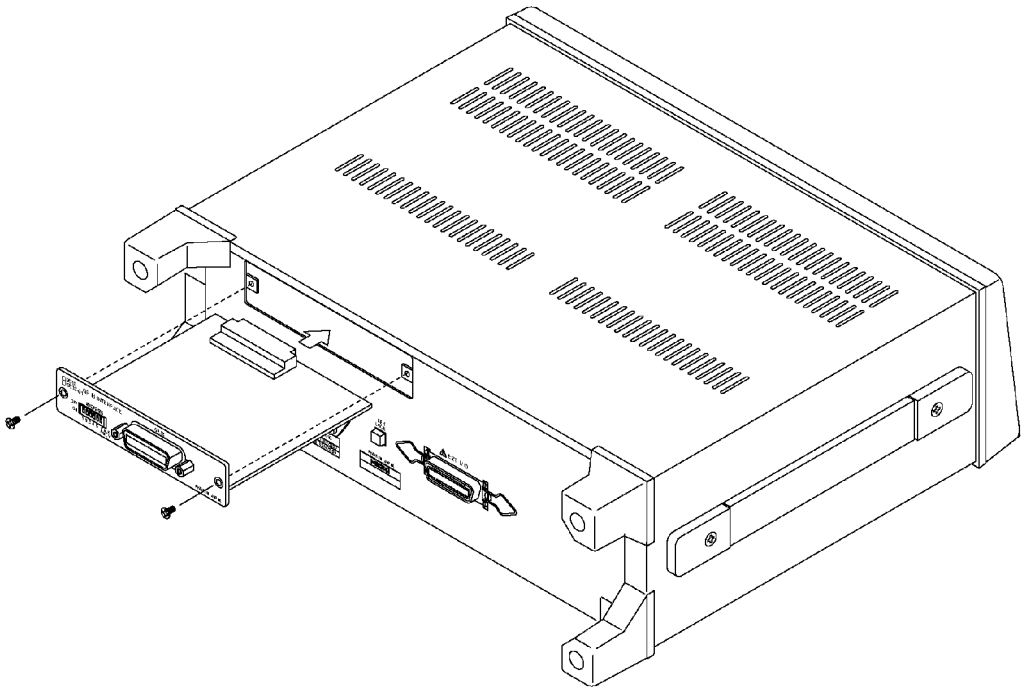
- To avoid electric shock accident, before removing or replacing an input module, confirm that the instrument is turned off and that the power cord and connection cables are disconnected.
- The mounting screws must be firmly tightened or the input unit may not perform to specifications, or may even fail.
- To avoid the danger of electric shock, never operate the product with an input module removed. To use the product after removing an input module, install a blank panel over the opening of the removed module.

⚠ CAUTION

When inserting in the interface, hold the metal plate. Directly touching the board may cause static electricity and lead to damage of the instrument. (Using the wrist strap for preventing static electricity when inserting is recommended.)

The space for fitting the 9518-01 GP-IB INTERFACE in the rear panel of the 3532-50/3522-50/3511-50 are covered with a blanking plate. Follow these three steps to install the 9518-01 interface:

1. Remove the fixing screws, and take off the blanking plate.
2. Insert the 9518-01 GP-IB INTERFACE into the exposed slot in the rear of the unit in the figure below.
3. Push the 9518-01 firmly into place, and fix with the screws removed in step 1.



Chapter 2
Overview

2.1 Introduction to the 9518-01 GP-IB INTERFACE

By connecting the 9518-01 GP-IB INTERFACE to the 3532-50/3522-50/3511-50, it is possible to control the main unit via the GP-IB bus. This unit is compliance with the following standard.

Compliance standard : IEEE 488.1-1987

Further, the 9518-01 is designed with reference to the following standard:

Reference standard : IEEE 488.2-1987

NOTE

On the 9518-01, if the output queue becomes full, it is cleared and a query error is generated. This differs from the IEEE 488.2 specification, which only stipulates the clearing of the output queue and the outputting of a query error when a deadlock state occurs, that is, when both the input buffer and the output queue have become full, and continuation of processing has become impossible.

2.2 Specifications

Interface Functions

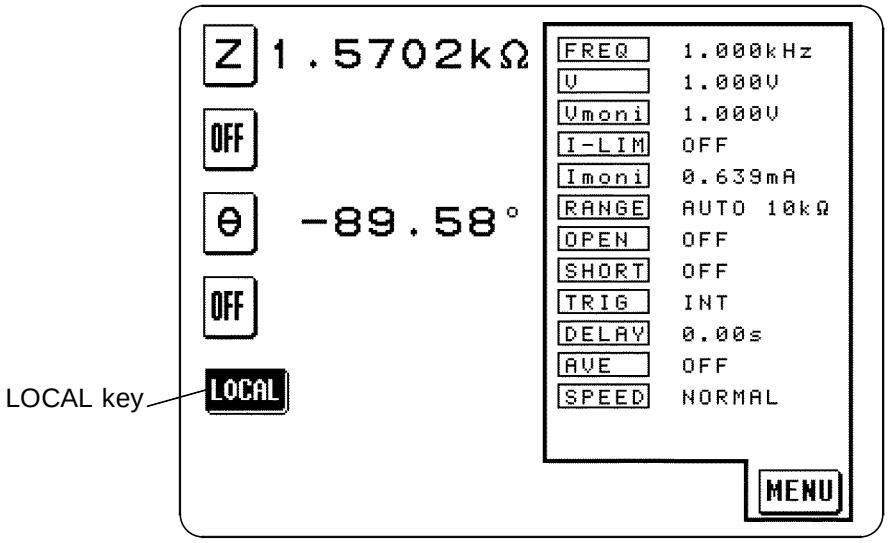
SH1	All source handshake functions
AH1	All acceptor handshake functions
T6	Basic talk functions Serial poll function No talk-only mode The talker cancellation function with MLA (My Listen Address)
L4	Basic listener functions No listen-only mode The listener cancellation function with MTA (My Talk Address) is provided.
SR1	All service request functions
RL1	All remote/local functions
PP0	No parallel polling function
DC1	All device clear functions
DT1	All device trigger functions
C0	No controller function

ASCII codes are used.

Chapter 3
Names of Parts

3.1 Controls and Connections

(1) 3532-50/3522-50 Initial Screen



LOCAL key

During communications (in the remote state), the **LOCAL** key to release the remote state is displayed on the screen. Press this key to resume the normal state (local state).

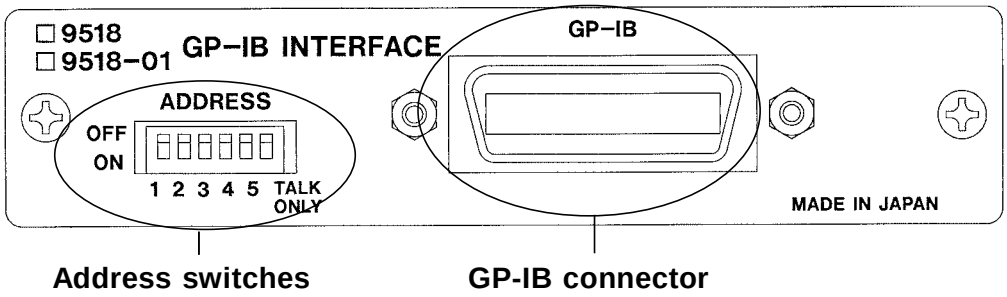
However, this key is disabled if the GP-IB controller has put the unit into the local lock out state. (Pressing the key has no effect.)

In the remote state, the initial screen is forcibly displayed excluding the following conditions.

- When executing OPEN/SHORT correction or sending the execution command (correction execution screen appears).
- When the magnification display screen appears.

(2) 9518-01 GP-IB INTERFACE outer panel

⚠ WARNING In order to prevent any danger of electric shock to the operator, check carefully that the power cable and the connectors to the 3532-50/3522-50/3511-50 have been removed first, before connecting the GP-IB cable to this connector.



Address switches
These are used to set the device address of the 3532-50/3522-50 units on the GP-IB bus. For how to set these switches, refer to Section 4.1, "Setting the GP-IB Device Address."

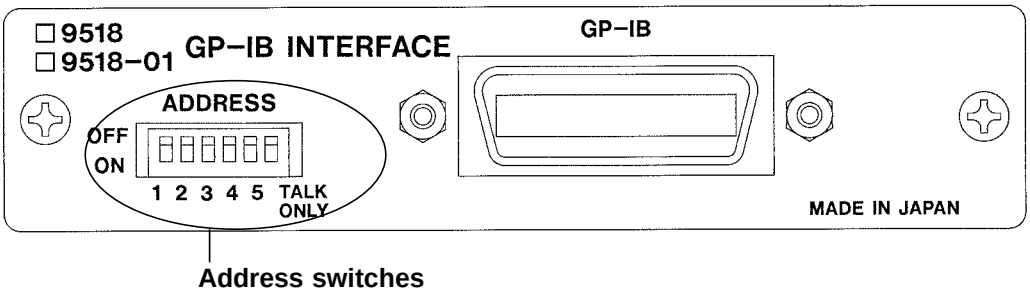
GP-IB connector
Connect the GP-IB cable to this connector.

Chapter 4
Operation

4.1 Setting the GP-IB Device Address

- The address of the 3532-50/3522-50/3511-50 units (called the device) on the GP-IB bus can be set to any number from 0 to 30.
- Use the Address switches on the GP-IB panel to set the device address.
- On dispatch from the factory, this address is initially set to 1.
- If this address is (apparently) set to 31, i.e. if all the switches are in the ON position, then the bus lines of the 3532-50/3522-50/3511-50 are disabled.
- Always the Address switch for TALK ONLY is in the OFF position, since it is not used.

NOTE If you change the bus address while the 3532-50, 3522-50 or 3511-50 is being used, then you should immediately turn the power off and on again. If this is not done, the address will not be changed to the new one.

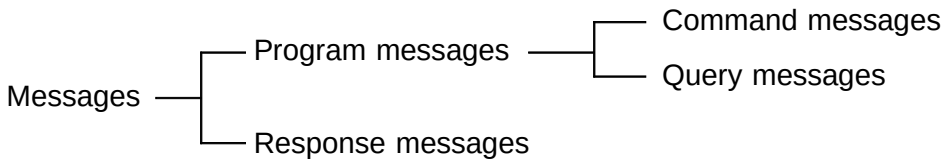


Address switches

Address	Switch settings 12345	Address	Switch settings 12345	Address	Switch settings 12345
0	00000	10	01010	20	00101
1	10000	11	11010	21	10101
2	01000	12	00110	22	01101
3	11000	13	10110	23	11101
4	00100	14	01110	24	00011
5	10100	15	11110	25	10011
6	01100	16	00001	26	01011
7	11100	17	10001	27	11011
8	00010	18	01001	28	00111
9	10010	19	11001	29	10111
0: OFF 1: ON				30	01111

4.2 Communication Methods by the GP-IB

- In order to control the 3532-50/3522-50/3511-50 by the GP-IB, there are several kinds of messages.
- Of these, program messages are those received by the 3532-50/3522-50/3511-50 from the computer, while response messages are those sent from the 3532-50/3522-50/3511-50 to the computer.



(1) Program messages

Program messages are command messages or query messages.

- Command messages are orders for controls of the 3532-50/3522-50/3511-50, such as for making measurement condition settings or for reset or the like.

  Example FREQUENCY <data>
  (Command message which sets the frequency)

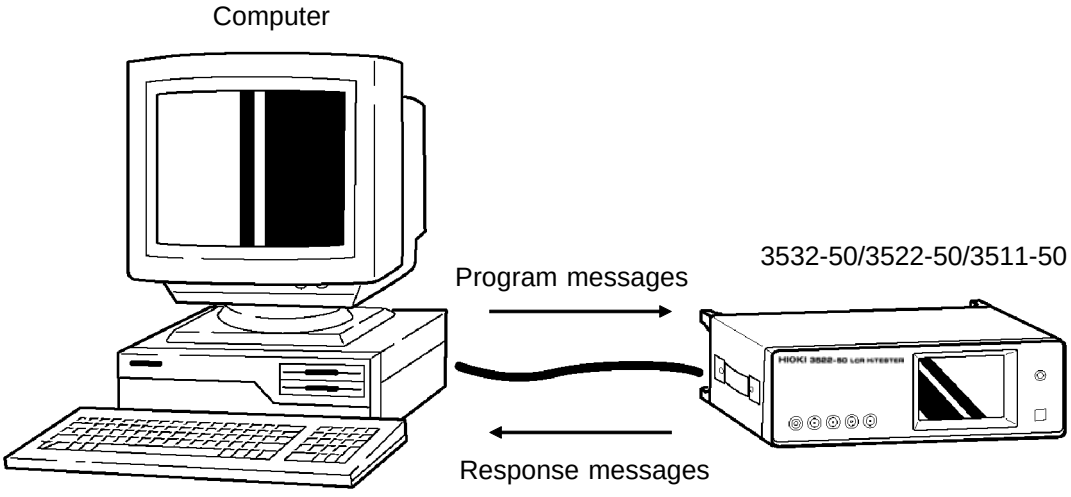
- Query messages are orders for responses relating to results of operation, results of measurement, or the state of 3532-50/3522-50/3511-50 settings. (A question mark "?" is suffixed at the end of the command.)

  Example FREQUENCY?
  (Queries the current frequency)

(2) Response messages

It represents the response data for query messages from the 3532-50/3522-50/3511-50.

Example FREQUENCY 1.000E+03
(Current frequency is 1 kHz.).



4.3 Message Format

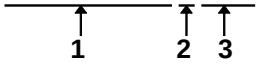
The commands for the 3532-50/3522-50/3511-50 are as far as possible mnemonic. Furthermore, all commands have a long form, and an abbreviated short form.

4.3.1 Program Message

The program message is made up from header and data portions

Example Command message to set frequency to 1 kHz

:FREQUENCY 1000



1 Header portion
2 Space separating header portion and data portion.
3 Data portion (ASCII-format text or numeric values.
Some messages have no data portions...query messages, etc.)

A command header can be abbreviated. The whole command form is referred to as the "long form" and the abbreviated form as the "short form." In this manual, the short form is written in upper case letters, and then this is continued in lower case letters so as to constitute the long form. Either of these forms will be accepted during operation, but intermediate forms will not be accepted. Further, during operation both lower case letters and upper case letters will be accepted without distinction.
For "FREQUENCY", either "FREQuency" (the long form) or "FREQ" (the short form) will be accepted. However, any one of "FREQU", or "FRE" is wrong and will generate an error.

4.3.2 Response Messages

It represents the response message for query messages from the 3532-50/3522-50/3511-50.
Response messages generated by the 3532-50/3522-50/3511-50 are in long form and in upper case letters.

Example FREQUENCY 1.000E+03
(Current frequency is 1 kHz.)

NOTE If an error occurs when the query message is received, the query does not produce response message.

4.4 Headers

(1) Program message headers

There are three types of header: simple commands, compound commands, and standard common commands.

- Simple command header
  A header consisting of a single word beginning with a letter.
  Examples :HEADer, etc.
- Compound command header
  A header consisting of a sequence of words separated by colons.
  Examples :BEEPer:KEY, RANGe:AUTO, etc.
- Standard command header
  A header begins with an asterisk (*) to indicate that it is a standard command, and continues with a standard command stipulated by IEEE 488.2.
  Examples *RST, etc.

(2) Response message

Headers in response messages can be enabled or disabled by using the "HEADer" command.

Example When frequency is set to 1 kHz:
:FREQUENCY?
(Query message asking for the current setting of the frequency.)
Response message when headers are on.
:FREQUENCY 1000
(Header portion) (Data portion)

Response message when headers are off.
1000
(Data portion only)

NOTE The headers are set to off when powering on.

4.5 Data Formats

The 3532-50/3522-50/3511-50 use character string data and decimal numeric data, and the type used varies according to the command in question.

(1) Character data

Character string data must always begin with an alphabetic character, and the characters following can be either alphabetic characters or numerals. Although in character data either upper case letters or lower case letters are accepted, response messages output by the 3532-50/3522-50/3511-50 are always in upper case letters.

Example :TRIGger INT

(2) Decimal data

The numeric data values are all represented in decimal, in three formats identified as NR1, NR2 and NR3, and each of these can appear as either a signed number or an unsigned number. Unsigned numbers are taken as positive.

Further, if the accuracy of a numerical value exceeds the limit which the 3532-50/3522-50/3511-50 can deal, it is rounded off. (5 and above is rounded up; 4 and below is rounded down).

NR1 format - integer data.

Examples +12, -23, 34

NR2 format - fixed point numbers.

Examples +1.23, -23.45, 3.456

NR3 format - floating point numbers.

Examples +1E-2, -2.3E+4

The term "NRf format" includes all these three formats.

When the 3532-50/3522-50/3511-50 is receiving it accepts NRf format, but when it is sending response messages it utilizes whichever one of the formats NR1 to NR3 is indicated in the specified command.

Examples :RANGe 6
:RANGe +6.012
:RANGe 0.0006E4

4.6 Message Terminators

The 3532-50/3522-50/3511-50 recognize either a linefeed character (LF) or the EOI signal, or both, as message terminators.
To terminate a response message, the 3532-50/3522-50/3511-50 always provide the appropriate EOI signal, and also sends a terminating character sequence. By the use of the ":TRANsmit:TERMinator" command either of the following can be selected as response message terminator sequence:

(1) LF (linefeed only)
(2) CR + LF (carriage return plus linefeed)

NOTE When powering on, the message terminators are (1).

A detailed explanation of the "TRANsmit:TERMinator" command is given in Section 5.4.

4.7 Separators

(1) Message unit separator

A semicolon (;) is used as a message unit separator when it is desired to set out several messages on a single line.

Example :RANGe:AUTO ON;:BEEP:KEY ON;*IDN?

NOTE When messages are combined in this way, if a syntax error occurs, all subsequent messages up to the next terminator will be ignored.

(2) Header separator

In a message which has a header and data, a space (represented by " " in the examples) is used as the header separator to separate the header from the data.

Example :LEVel V

(3) Data separator

If a message has several data items, commas (,) are required as data separators for separating these data items from one another.

Example :COMParator:FLIMit:ABSolute <lower limit>,<upper limit>

4.8 Abbreviation of Compound Commands

When several compound headers have a common head portion (for example, :BEEPer:KEY and :BEEPer:COMParator, etc.), then, when and only when writing them directly following on from one another, this common portion (:BEEPer: in this example) can be omitted from each command.
This common portion is called "the current path", by analogy with the general concept of the current directory in the directory structure of UNIX or MSDOS, and until it is cleared the analysis of following commands is performed by deeming them to be preceded by the current path which has been curtailed in the interests of brevity. This manner of using the current path is shown in the following example:

Normal expression

:BEEPer:KEY ON;:BEEPer:COMParator NG

Abbreviated expression

:BEEPer: KEY ON;COMParator NG

This becomes the current path, and can be curtailed from the following messages.

The current path is cleared when the power is turned on, when a colon (:) appears at the start of a command, and when a message terminator is detected.

Messages of standard command form can be executed without relation to the current path. Further, they have no effect upon the current path.
With the 3532-50/3522-50, there are 11 possible current paths:

:APPLication:DISPlay
:BEEPer:
:COMParator:FLIMit:
:COMParator:SLIMit:
:CORRection:
:LEVel:
:LIMiter:
:MEASure:
:RANGe:
:TRIGger:
:SCALe:

With the 3511-50, there are 4 possible current paths:

:BEEPer:
:COMParator:
:CORRection:
:RANGe:

4.9 Output Queue

Response messages accumulate in the output queue and are read out as data and cleared by the controller.

The output queue is also cleared in the following circumstances:

- When a device clear is issued.
- When the power is turned off and turned on again.

The 3532-50/3522-50/3511-50 have an output queue of 300 bytes capacity. If the response messages overflow this limit of 300 bytes, a query error is generated, and the output queue is cleared. Further, if a new message is received while the output queue still contains data, the output queue is cleared, and a query error is generated.

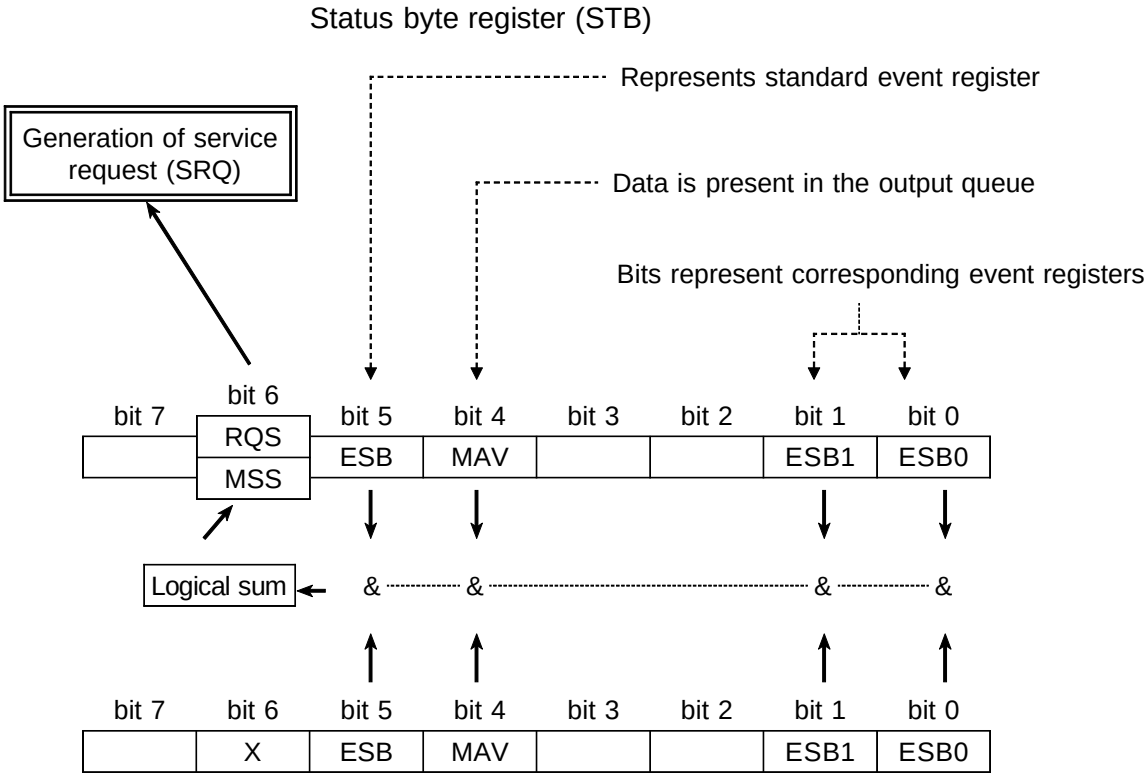
4.10 Input Buffer

The 3532-50/3522-50/3511-50 have an input buffer of 300 bytes capacity. Messages which are received are put into this buffer and executed in order. If the data accumulated in this buffer exceeds 300 bytes the buffer becomes full, and until a space again becomes available in the buffer the GP-IB interface bus goes into the waiting state.

4.11 Status Model

In its implementation of the serial polling function using service requests, the 3532-50/3522-50/3511-50 employ the status model specified by IEEE 488.2.

The term "event" refers to any phenomenon which generates a service request.



Generation of Service Requests

The status byte register holds information relating to the event registers and the output queue.

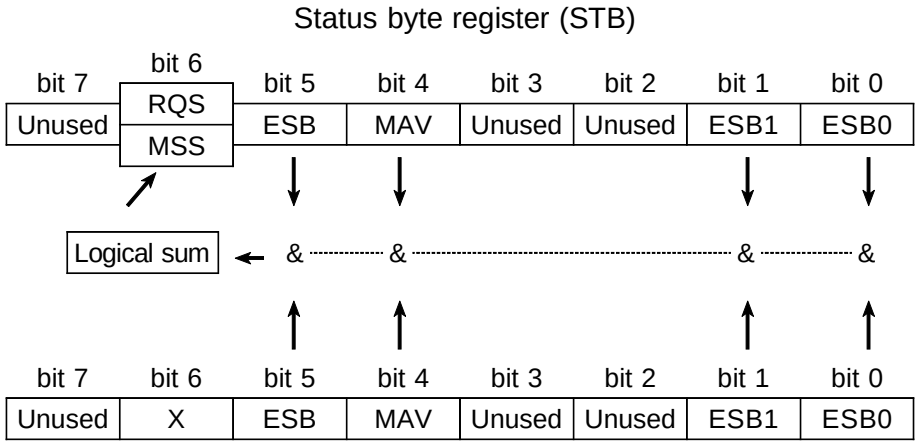
It is further possible to use the service request enable register as a mask to select the items required. If any of the bits selected by the mask becomes 1, bit 6 (the master summary status or MSS bit) is also set to 1, an RQS message is generated, and this generates a service request.

4.12 Status Byte Register

(1) Status byte register (STB)

The status byte register is an 8-bit register whose contents are output from the 3532-50/3522-50/3511-50 to the controller, when serial polling is being performed.

If any bit in the status byte register has changed from 0 to 1 (provided that it is a bit which has been set in the service request enable register as a bit which can be used), then the MSS bit is set to 1. Simultaneously with this the RQS bit is also set to 1, and a service request is generated.



The RQS bit is synchronized with service requests, and is read out and simultaneously cleared when serial polling is being performed. Although the MSS bit is only read out on an "*STB?" query, on a "*CLS" command for example it is not cleared until the event is cleared.

Status Byte Register Bit Assignments

Bit 7	Unused.
Bit 6 RQS	Set to 1 when a service request is issued.
MSS	Logical sum of the other bits of the status byte register
Bit 5 ESB	Standard event summary (logical sum) bit Shows a logical sum of the standard event status register.
Bit 4 MAV	Message available. Shows that there is at least one message in the output queue.
Bit 3	Unused.
Bit 2	Unused.
Bit 1 ESB1	Event summary bit 1 Shows a logical sum of event status register 1.
Bit 0 ESB0	Event summary bit 0 Shows a logical sum of event status register 0.

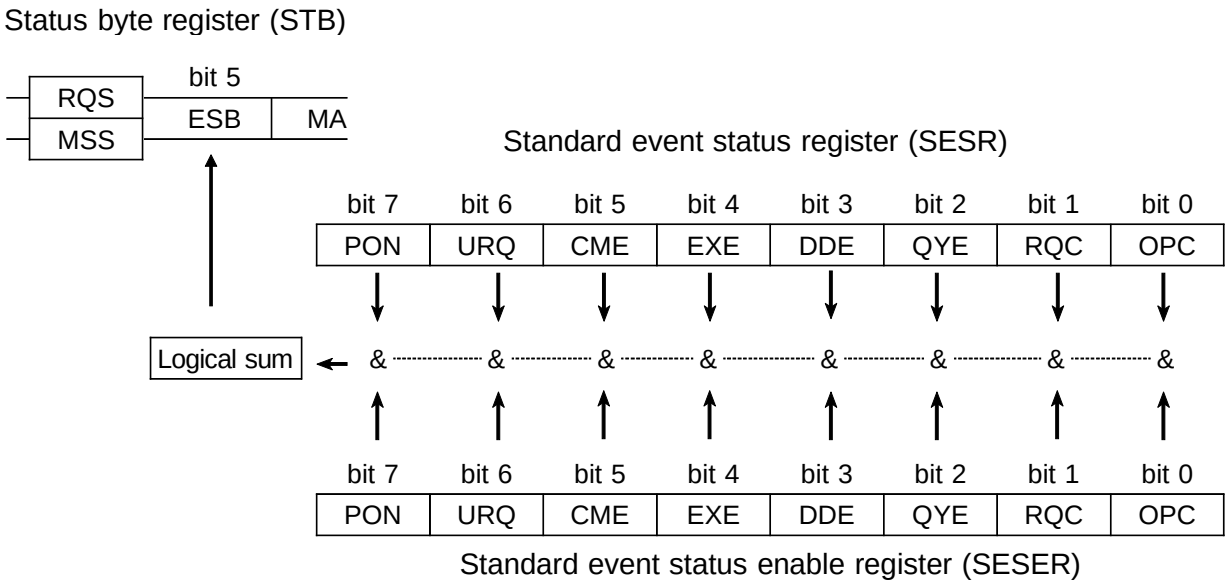
(2) Service request enable register (SRER)

This register masks the status byte register. Setting a bit of this register to 1 enables the corresponding bit of the status byte register to be used.

4.13 Event Registers

(1) Standard event status register (SESR)

The standard event status register is an 8-bit register. If any bit in the standard event status register is set to 1 (after masking by the standard event status enable register), bit 5 (ESB) of the status byte register is set to 1.



The standard event status register is cleared in the following three situations:

1. When a "*CLS" command is received.
2. When an "*ESR?" query is received.
3. When the unit is powered on.

(2) Standard event status enable register (SESER)

Setting any bit of the standard event status enable register to 1 enables the corresponding bit of the standard event status register to be accessed.

Standard Event Status Register (SESR) Bit Assignments

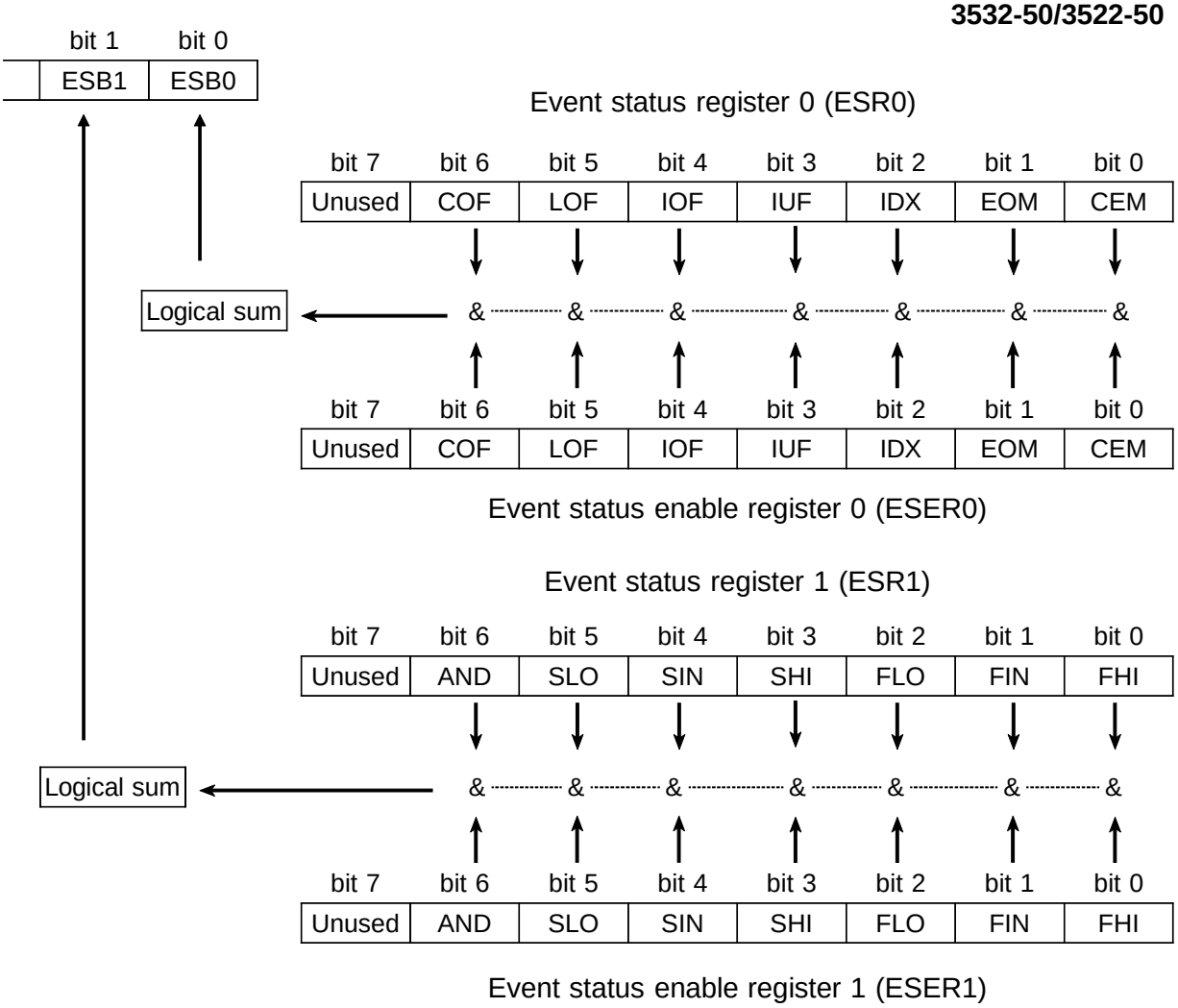
Bit 7 PON	Power on flag. When the power is turned on, or on recovery from a power cut, this bit is set to 1.
Bit 6 URQ	User request. Not used by the 3532-50/3522-50/3511-50.
Bit 5 CME	Command error. When a command which has been received contains a syntactic or semantic error, this bit is set to 1. ・ The command is not supported by the 3532-50/3522-50/3511-50. ・ There is a mistake in a program header. ・ The number of data parameters is wrong. ・ The format of the parameters is wrong.
Bit 4 EXE	Execution error. When for some reason a command which has been received cannot be executed, this bit is set to 1. ・ The designated data value is outside the set range. ・ The designated data value is not acceptable. ・ Execution is impossible because some other function is being performed.
Bit 3 DDE	Device dependent error. When a command cannot be executed due to some cause other than a command error, a query error, or an execution error, this bit is set to 1. ・ Execution is impossible due to an abnormality inside the 3532-50/3522-50/3511-50. ・ During open or short circuit compensation, valid data cannot be obtained.
Bit 2 QYE	Query error. This bit is set to 1 when a query error is detected by the output queue control. ・ When an attempt has been made to read the output queue when it is empty. ・ When the data overflows the output queue. ・ When data in the output queue has been lost.
Bit 1 RQC	Request for controller authority. Not used by the 3532-50/3522-50/3511-50.
Bit 0 OPC	Operation terminated. This bit is set to 1 when an "*OPC" command is executed, when the operation of all the messages up to the "*OPC" command has been completed.

(3) Event status registers specific to the 3532-50/3522-50/3511-50 (ESR0 and ESR1)

Two 8-bit event status registers are provided for managing events on the 3532-50/3522-50/3511-50. If any bit in one of these event status registers is set to 1 (after masking by the corresponding event status enable register), the following happens:

- For event status register 0, bit 0 of the status byte register (ESB0) is set to 1.
- For event status register 1, bit 1 of the status byte register (ESB1) is set to 1.

3532-50/3522-50



Event status register 0 and event status register 1 are cleared in the following three situations:

1. When a "*CLS" command is received.
2. When an ":ESR0?" query (for event status register 0) or ":ESR1?" query (for event status register 1) is received.
3. When the unit is powered on.

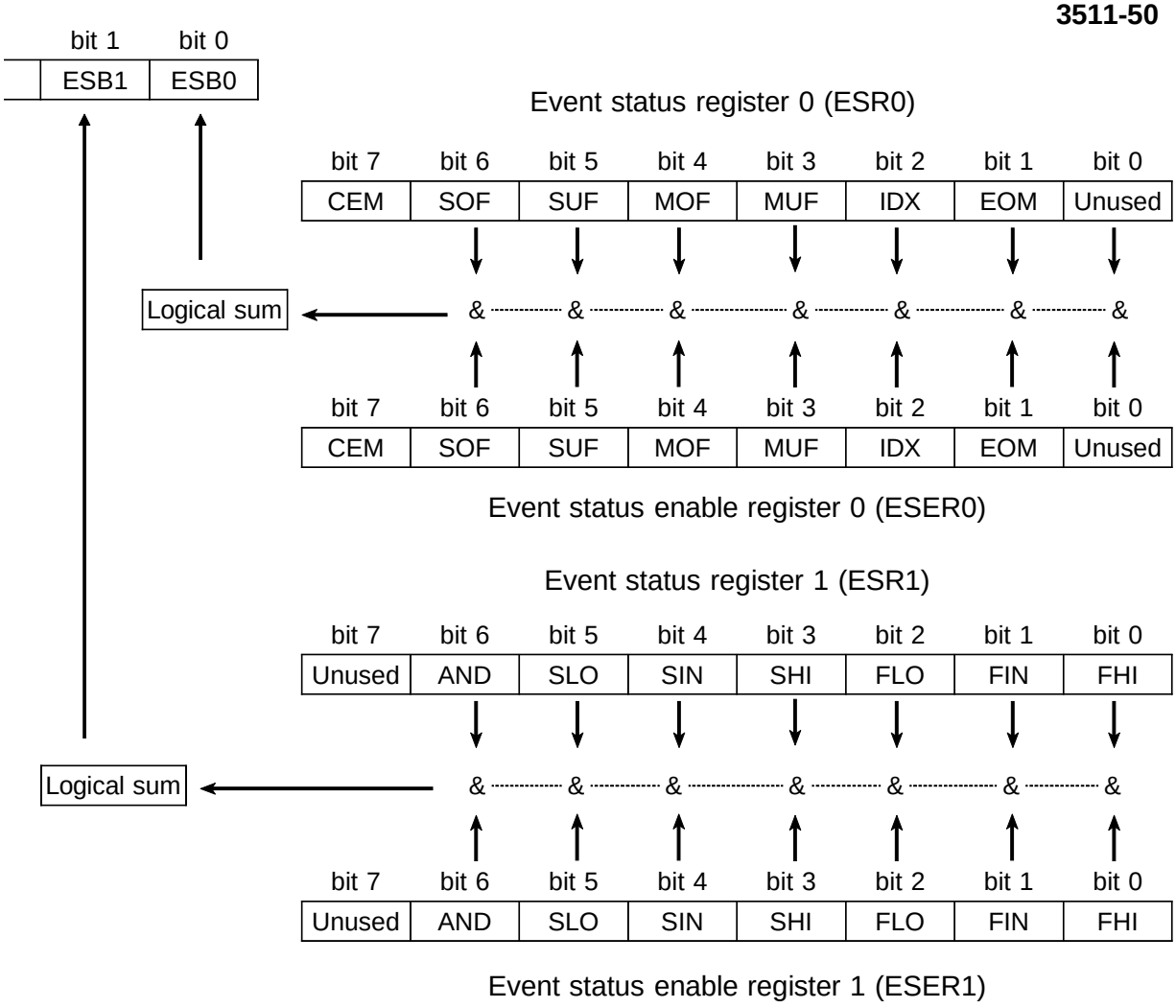
Event Status Register 0 (ESR0) Bit Assignments

Bit 7	Unused
Bit 6 COF	Constant current and constant voltage overflow
Bit 5 LOF	Limits overflow
Bit 4 IOF	Impedance overflow
Bit 3 IUF	Impedance underflow
Bit 2 IDX	Data sampling completed
Bit 1 EOM	Measurement completed
Bit 0 CEM	Compensation data measurement completed

Event Status Register 1 (ESR1) Bit Assignments

Bit 7	Unused
Bit 6 AND	Logical product (AND) of comparison results
Bit 5 SLO	Second parameter below lower limit
Bit 4 SIN	Second parameter within limits
Bit 3 SHI	Second parameter above upper limit
Bit 2 FLO	First parameter below lower limit
Bit 1 FIN	First parameter within limits
Bit 0 FHI	First parameter above upper limit

3511-50


bit 1
bit 0
ESB1
ESB0
Event status register 0 (ESR0)
bit 7
bit 6
bit 5
bit 4
bit 3
bit 2
bit 1
bit 0
CEM
SOF
SUF
MOF
MUF
IDX
EOM
Unused
Logical sum
&
Event status enable register 0 (ESER0)
Event status register 1 (ESR1)
Unused
AND
SLO
SIN
SHI
FLO
FIN
FHI
Logical sum
Event status enable register 1 (ESER1)

Event status register 0 and event status register 1 are cleared in the following three situations:

1. When a "*CLS" command is received.
2. When an ":ESR0?" query (for event status register 0) or ":ESR1?" query (for event status register 1) is received.
3. When the unit is powered on.

Event Status Register 0 (ESR0) Bit Assignments

Bit 7 CEM	Compensation data measurement completed
Bit 6 SOF	Second parameter range over bit
Bit 5 SUF	Second parameter range under bit
Bit 4 MOF	First parameter range over bit
Bit 3 MUF	First parameter range under bit
Bit 2 IDX	Data sampling completed
Bit 1 EOM	Measurement completed
Bit 0 Unused	Unused

Event Status Register 1 (ESR1) Bit Assignments

Bit 7	Unused
Bit 6 AND	Logical product (AND) of comparison results (bit 1 and bit 4)
Bit 5 SLO	Second parameter below lower limit
Bit 4 SIN	Second parameter within limits
Bit 3 SHI	Second parameter above upper limit
Bit 2 FLO	First parameter below lower limit
Bit 1 FIN	First parameter within limits
Bit 0 FHI	First parameter above upper limit

(4) Event status enable registers specific to the 3532-50/3522-50-50/3511-50 (ESER0 and ESER1)

These event status enable registers mask the corresponding event status registers.

(5) Summary of commands for writing and reading each of the registers

Register	Read	Write
Status byte register	*STB?	----
Service request enable register	*SRE?	*SRE
Standard event status register	*ESR?	----
Standard event status enable register	*ESE?	*ESE
Event status register 0	:ESR0?	----
Event status enable register 0	:ESE0?	ESE0
Event status register 1	:ESR1?	----
Event status enable register 1	:ESE1?	ESE1

4.14 GP-IB Commands

The following commands are used for performing interface functions:

Command	Function
GTL	Go To Local The remote state is canceled, and the system goes into the local state.
LLO	Local Lock Out All keys, including the LOCAL key, become inoperable.
DCL	Device Clear Clears the input buffer and the output queue.
SDC	Selected Device Clear Clears the input buffer and the output queue.
GET	Group Execute Trigger The same as the "*TRG" standard command.

Chapter 5
Command Reference for the 3532-50/3522-50

5.1 Command Summary

Standard Commands

Command	Function	Ref page
*CLS	Clears event register.	35
*ESE	Sets standard event status enable register (SESER).	35
*ESE?	Queries standard event status enable register (SESER).	36
*ESR?	Queries standard event status register (SESR).	36
*IDN?	Queries device ID.	37
*OPC	Issues service request (SRQ) after execution completion.	37
*OPC?	Queries execution completion.	37
*RST	Device initialization.	38
*SRE	Sets service request enable register (SRER).	39
*SRE?	Queries service request enable register (SRER).	39
*STB?	Queries the status byte register.	40
*TRG	Performs sampling once.	40
*TST?	Queries the result of the self-test.	41
*WAI	Waits until all execution is fully completed.	41

Specific commands

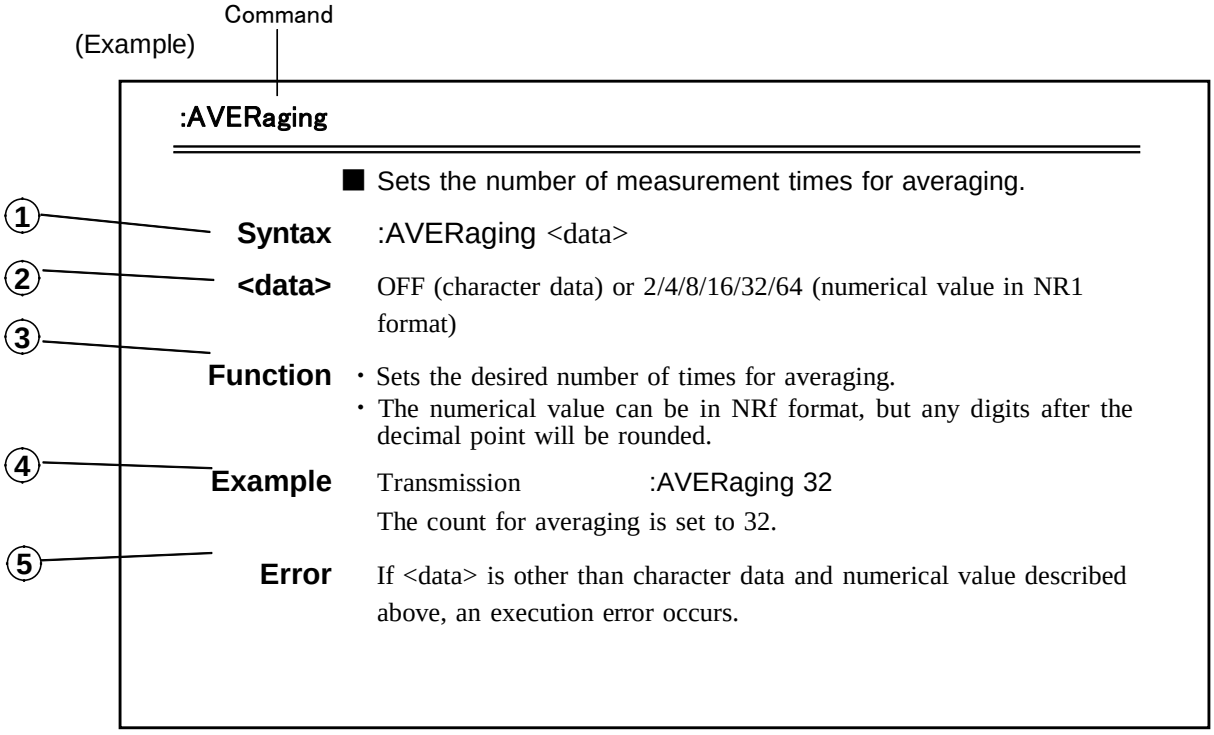
Command	Function	Ref page
■ Display function		
:APPLication:DISPlay:LIGHt	Setting for LCD display.	42
:APPLication:DISPlay:LIGHt?	Queries the setting for LCD display.	42
:APPLication:DISPlay:MONItor	Setting for voltage and current monitors.	43
:APPLication:DISPlay:MONItor?	Queries the setting for voltage and current monitors.	43
■ Averaging function		
:AVERaging	Sets the number of measurement times for averaging.	44
:AVERaging?	Queries the number of measurement times for averaging.	44
■ Beep sound function		
:BEEPer:COMParator	Sets the beep sound for the comparator.	45
:BEEPer:COMParator?	Queries the beep sound for the comparator.	45
:BEEPer:KEY	Sets the beep sound for key input.	46
:BEEPer:KEY?	Queries the beep sound for key input.	46
■ External DC bias function		
:BIAS	Enables and disables the external DC bias function.	47
:BIAS?	Queries the external DC bias function enablement	47

Command	Function	Ref page
■ Cable length setting function		
:CABLe	Sets the cable length.	47
:CABLe?	Queries the cable length.	48
■ Comparator function		
:COMParator	Enables and disables the comparator function.	48
:COMParator?	Queries the comparator function enablement.	48
:COMParator:FLIMit	(first parameter)	
:ABSolute	Sets the upper and lower limit values (absolute values).	49
:ABSolute?	Queries the upper and lower limit values (absolute values).	49
:DEViation	Sets the reference value and the upper and lower limit values (deviation percentage values).	50
:DEViation?	Queries the reference value and the upper and lower limit values (deviation percentage values).	50
:MODE	Sets the first parameter setting mode.	51
:MODE?	Queries the first parameter setting mode.	51
:PERcent	Sets the reference value and the upper and lower limit values (percentage values).	52
:PERcent?	Queries the reference value and the upper and lower limit values (percentage values).	52
:COMParator:SLIMit	(second parameter)	
:ABSolute	Sets the upper and lower limit values (absolute values).	53
:ABSolute?	Queries the upper and lower limit values (absolute values).	53
:DEViation	Sets the reference value and the upper and lower limit values (deviation percentage values).	54
:DEViation?	Queries the reference value and the upper and lower limit values (deviation percentage values).	54
:MODE	Sets the second parameter setting mode.	55
:MODE?	Queries the second parameter setting mode.	55
:PERcent	Sets the reference value and the upper and lower limit values (percentage values).	56
:PERcent?	Queries the reference value and the upper and lower limit values (percentage values).	56
■ Open and short circuit compensation function		
:CORRection:DATA?	Queries the open and short circuit compensation values.	57
:CORRection:OPEN	Enables and disables the open circuit compensation function.	58
:CORRection:OPEN?	Queries the open circuit compensation function enablement.	59
:CORRection:SHORt	Enables and disables the short circuit compensation	60
:CORRection:SHORt?	Queries the short circuit compensation function enablement.	61
■ Monitor function		
:DISPlay:MONItor?	Queries the monitored voltage and current.	61

Command	Function	Ref page
■ Event register		
:ESE0	Sets event status enable register 0.	62
:ESE0?	Queries event status enable register 0.	62
:ESE1	Sets event status enable register 1.	63
:ESE1?	Queries event status enable register 1.	63
:ESR0?	Queries event status register 0.	64
:ESR1?	Queries event status register 1.	64
■ Test frequency function		
:FREQuency	Sets the test frequency.	65
:FREQuency?	Queries the test frequency.	65
■ Headers		
:HEADer	Enables and disables headers for the response message.	66
:HEADer?	Queries headers enablement.	66
■ EXT I/O Output		
:IO:OUTPut:DELay	Sets the delay time for judgement result output ↔ $\overline{\text{EOM}}$ output period in EXT I/O	67
:IO:OUTPut:DELay?	Queries the delay time for judgement result output ↔ $\overline{\text{EOM}}$ output period in EXT I/O	67
:IO:RESult:RESet	Sets output of judgment result signal line in EXT I/O	68
:IO:RESult:RESet?	Queries output of judgment result signal line in EXT I/O	68
■ Test signal level function		
:LEVel	Sets the test signal level.	67
:LEVel?	Queries the test signal level.	67
:LEVel:CCURRent	Sets the constant current level value.	68
:LEVel:CCURRent?	Queries the constant current level value.	68
:LEVel:CVOLTage	Sets the constant voltage level value.	69
:LEVel:CVOLTage?	Queries the constant voltage level value.	69
:LEVel:VOLTage	Sets the open circuit voltage level value.	70
:LEVel:VOLTage?	Queries the open circuit voltage level value.	70
■ Limit function		
:LIMiter	Enables and disables the limit setting function.	71
:LIMiter?	Queries the limit setting function enablement.	71
:LIMiter:CURRent	Sets the current limit value.	72
:LIMiter:CURRent?	Queries the current limit value.	72
:LIMiter:VOLTage	Sets the voltage limit value.	73
:LIMiter:VOLTage?	Queries the voltage limit value.	73
■ Panel load function		
:LOAD	Transfers the specified panel number.	74

Command	Function	Ref page
■ Normal testings		
:MEASure?	Queries the data item.	75
:MEASure:ITEM	Sets test parameter.	77
:MEASure:ITEM?	Queries test parameter.	78
■ Parameter settings		
:PARAmeter*(*:1 to 4)	Sets displayed parameters.	79
:PARAmeter*?	Queries displayed parameters.	79
:PARAmeter* :DIGit	Sets the number of displayed digits.	80
:PARAmeter* :DIGit?	Queries the number of displayed digits.	80
■ Test range function		
:RANGe	Sets test range.	81
:RANGe?	Queries test range setting.	82
:RANGe:AUTO	Sets the automatic test ranging.	83
:RANGe:AUTO?	Queries the automatic test range setting.	83
■ Panel saving function		
:SAVE	Saves the test conditions in specified panel number.	84
:SAVE?	Queries the panel number in which data is saved.	84
■ Scaling function		
:SCALe	Enables and disables the scaling function.	85
:SCALe?	Queries the scaling function.	85
:SCALe:FVALue	Sets the first parameters (a and b) in the scaling function.	86
:SCALe:FVALue?	Queries the first parameters (a and b) in the scaling function.	86
:SCALe:SVALue	Sets the second parameters (a and b) in the scaling function.	87
:SCALe:SVALue?	Queries the second parameters (a and b) in the scaling function.	87
■ Test speed function		
:SPEEd	Sets the testing speed.	88
:SPEEd?	Queries the testing speed.	88
■ Terminators		
:TRANsmit:TERMinator	Sets the terminator for the response message.	89
:TRANsmit:TERMinator?	Queries the terminator for the response message.	89
■ Trigger function		
:TRIGger	Sets the type of trigger.	90
:TRIGger?	Queries the trigger setting.	90
:TRIGger:DELAy	Sets the trigger delay time.	91
:TRIGger:DELAy?	Queries the trigger delay time.	91

5.2 Format of Command Explanations



① Specifies the syntax for the command (a space is represented by " " in this syntax).

② For a command that has parameters, specifies their format.
- Numeric data values in the following formats
  NR1: integer data
  NR2: fixed point numbers
  NR3: floating point numbers
- Character data

③ Specifies the function of the command.

④ These are simple examples of the use of the command.

⑤ Specifies what types of error may occur.
For query commands, this time is the time taken when headers are on.

5.3 Particular Commands

*CLS

■ Clears the event registers.

Syntax *CLS

Function
- Clears all the event registers (SESR, ESR0, ESR1) associated with the bits of the status byte register. Accordingly, also clears the status byte register.
- This has no effect upon the output queue, the various enable registers, or bit 4 (the MAV bit) of the status byte register.

Error If the data parameters are set after this command, a command error occurs.

*ESE

■ Sets the standard event status enable register.

Syntax *ESE <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets the standard event status enable register (SESER) to a bit pattern which is used to mask the standard event status register (SESR).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard Event Status Enable Register (SESER)

Example Transmission *ESE 20

Bits 2 and 4 of SESER are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

*ESE?

■ Reads the standard event status enable register.

Syntax *ESE?

Function Returns the setting contents of SESER as a numerical value in NR1 format between 0 and 255.

Example Response

If headers are on *ESE 20

If headers are off 20

Bits 2 and 4 of SESER have been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard Event Status Enable Register (SESER)

Error If the response message is longer than 300 bytes, a query error is generated.

*ESR?

■ Reads out the contents of the standard event status register (SESR).

Syntax *ESR?

Function
- Returns the contents of the standard event status register (SESR) as a numerical value in NR1 format from 0 to 255, and then clears standard event status register.
- No header is affixed to the response message.

Example Response 32

Bit 5 of SESR has been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard Event Status Enable Register (SESER)

Error If the response message is longer than 300 bytes, a query error is generated.

*IDN?

■ Queries manufacturer's name, model name, and software version.

Syntax *IDN?

Function
- The response consists of the name of the manufacturer of the unit, the model name, and the software version.
- No header is affixed to the response message.

First field	Manufacturer's name
Second field	Model name
Third field	Fixed for fifty
Fourth field	Software version

Example Response HIOKI,3532,50,V01.01

Error If the response message is longer than 300 bytes, a query error is generated.

*OPC

■ After all action has been completed during execution, performs an SRQ request.

Syntax *OPC

Function Sets bit 0 (the OPC bit) of the standard event status register (SESR) to 1 at the instant the previous commands which is on the same line with *OPC have been completed.

Error If the data parameters are set after this command, a command error occurs.

*OPC?

■ Queries whether or not all action has been completed during execution.

Syntax *OPC?

Function
- The same as the *OPC command, except in that, at the instant that the previous commands have been completed.
- Returns the response message "1", instead of bit 0 (the OPC bit) of the standard event status register (SESR) being set to 1.
- No header is affixed to the response message.

Error If the response message is longer than 300 bytes, a query error is generated.

*RST

■ Performs device initial setting.

Syntax *RST

Function Resets the 3532-50. The items which are reset are listed below.

Test parameters	Impedance (Z), phase angle (θ)
Test frequency	1 kHz
Test signal level	Open circuit voltage mode (V mode)
V mode set value	1.00 V
CV (constant voltage) set value	1.00 V
CC (constant current) set value	10.00 mA
Limit function	OFF
Voltage limit set value	5.00 V
Current limit set value	50.00 mA
Test range	AUTO
Open circuit compensation	OFF
Short circuit compensation	OFF
Trigger setting	Internal trigger
Trigger delay time	0 s
Averaging	OFF
Test speed setting	NORMAL
Beep sound setting	ON for key input, OFF for comparator
DC bias function (3522-50 only)	OFF
Cable length (3532-50 only)	0 m
Comparator	
Comparator setting mode	Both first and second parameters set to absolute value
Absolute value set values	
First parameter	Upper and lower limit values: OFF
Second parameter	Upper and lower limit values: OFF
Percent set values	
First parameter	Reference value: 1000 Upper and lower limit values: OFF
Second parameter	Reference value: 10 Upper and lower limit values: OFF
Panel save	All contents clear
Scaling	Correction coefficient a: 1.0000, b: 0
Number of displayed digits	5 digits
EXT I/O output (3522-50, 3532-50 only)	Delay time for Judgement Result and $\overline{\text{EOM}}$ Output Period: 0.0 s Judgment Results Reset: OFF

Error If the data parameters are set after this command, a command error occurs.

*SRE

■ Sets the service request enable register.

Syntax *SRE <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets a pattern which is used to mask the status byte register (STB) to the service request enable register (SRSR).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- The setting of unused bits (bits 2,3, and 7) and bit 6 are disregarded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	×	ESB	MAV	Unused	Unused	ESE1	ESE0

Service Request Enable Register (SRER)

Example Transmission *SRE 34

Bits 1 and 5 of SRER is set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

*SRE?

■ Reads the service request enable register (SRER).

Syntax *SRE?

Function Returns the set contents of the service request enable register (SRER) as a numerical value in NR1 format between 0 and 255.

Examples Response

If headers are on *SRE 34
If headers are off 34

Bits 1 and 5 of SRER is set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	×	ESB	MAV	Unused	Unused	ESE1	ESE0

Service Request Enable Register (SRER)

Error If the response message is longer than 300 bytes, a query error is generated.

*STB?

■ Queries the status byte register.

Syntax *STB?

Function
- Returns the set contents of the status byte register (STB) as a numerical value in NR1 format between 0 and 3, 16 and 19, 32 and 35, 48 and 51, 64 and 67, 80 and 83, 96 and 99, 112 and 115.
- No header is affixed to the response message.

Example Response 16

Bit 4 of STB has been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	MSS	ESB	MAV	Unused	Unused	ESE1	ESE0

Status Byte Register (STB)

Error If the response message is longer than 300 bytes, a query error is generated.

*TRG

■ Issues external trigger.

Syntax *TRG

Function In external trigger mode, performs measurement once.

Example Transmission :TRIGger EXTernal;*TRG;:MEASure?

Error Executing this command in internal trigger mode generates an execution error. If the data parameters are set after this command, a command error occurs.

Executing this command while the open or short circuit compensation is performed generates an execution error.

*TST?

■ Requests execution of, and queries the result of, the self test.

Syntax *TST?

Function
- Performs the self test of the 3532-50/3522-50, and returns the result thereof as a numerical value in NR1 format from 0 to 15.
- No header is affixed to the response message.

bit 0	a ROM error occurred
bit 1	a RAM error occurred
bit 2	an I/O error occurred
bit 3	an interrupt error occurred
bit 4	unused
bit 5	unused
bit 6	unused
bit 7	unused

Example Response 6

A RAM error (bit 1) and an I/O error (bit 2) have occurred.

Error If the response message is longer than 300 bytes, a query error occurs.

Executing this command while the open or short circuit compensation is performed generates an execution error.

*WAI

■ Waits until all execution is fully completed.

Syntax *WAI

Function The unit goes into waiting state until the previous operation has been completed.

Note All of the specific commands are in any case sequential commands except the :MEASure? query. Therefore, using this *WAI command has an effect upon only :MEASure? query.

Example Transmission (If the frequency is set to 1 kHz)

When not using the *WAI command

```
:FREQuency 50;:MEASure?
```

The response for :MEASure? is the test value at frequency of 1 kHz.

When using the *WAI command

```
:FREQuency 50;*WAI;:MEASure?
```

The response for :MEASure? is the test value of frequency at 50 Hz.

Error If the data parameters are set after this command, a command error occurs.

5.4 Commands Specific to the 3532-50/3522-50

:APPLication:DISPlay:LIGHt <data>

■ Setting for LCD display.

Syntax :APPLication:DISPlay:LIGHt <data>

<data> ON/OFF (character data)

Function · Sets for LCD display.

ON The LCD display and backlight remain on permanently.

OFF The LCD display and backlight remain off permanently.

When OFF is selected, the LCD display and backlight go out approximately 10 seconds after the touch panel is last touched.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:APPLication:DISPlay:LIGHt?

■ Queries the setting for LCD display.

Syntax :APPLication:DISPlay:LIGHt?

Function Returns the setting for LCD display as character data.

ON The LCD display and backlight remain on permanently.

OFF The LCD display and backlight remain off permanently.

Error If the response message is longer than 300 bytes, a query error is generated.

:APPLication:DISPlay:MONItor

■ Setting for voltage and current monitors (Vmoni, Imoni).

Syntax :APPLication:DISPlay:MONItor <data>

<data> ON/OFF (character data)

Function ・Sets for voltage and current monitors (Vmoni, Imoni).

ON	The voltage and current monitors display indications.
OFF	The voltage and current monitors do not display indications.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:APPLication:DISPlay:MONItor?

■ Queries the setting for voltage and current monitors (Vmoni, Imoni).

Syntax :APPLication:DISPlay:MONItor?

Function Returns the setting for voltage and current monitors (Vmoni, Imoni) as character data.

ON	The voltage and current monitors display indications.
OFF	The voltage and current monitors do not display indications.

Error If the response message is longer than 300 bytes, a query error is generated.

:AVERaging

■ Sets the number of measurement times for averaging.

Syntax :AVERaging <data>

<data> OFF (character data) or 2/4/8/16/32/64 (numerical value in NR1 format)

Function
- Sets the desired number of times for averaging.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

Example Transmission :AVERaging 32

The count for averaging is set to 32.

Error If <data> is other than character data and numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:AVERaging?

■ Queries the number of times for averaging.

Syntax :AVERaging?

Function Returns the current setting of the number of times for averaging as character data or numerical value in NR1 format.

OFF, 2, 4, 8 ,16, 32, 64

Examples Response

If headers are on :AVERAGING 32
If headers are off 32

Error If the response message is longer than 300 bytes, a query error is generated.

:BEEPer:COMParator

■ Sets the beep sound for the comparator.

Syntax :BEEPer:COMParator <data>

<data> IN/NG/OFF (character data)

Function Sets the beep sound produced when the comparator makes decisions.

IN	When the comparator result is within limits, a beep sound is emitted.
NG	When the comparator result is out of limits, a beep sound is emitted.
OFF	No beep sound is emitted.

Example Transmission :BEEPer:COMParator NG
When the value is out of limits, a beep sound is emitted.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:BEEPer:COMParator?

■ Queries the beep sound for the comparator.

Syntax :BEEPer:COMParator?

Function Returns the beep sound setting for when the comparator makes decision as character data.

IN	When the comparator result is within limits, a beep sound is emitted.
NG	When the comparator result is out of limits, a beep sound is emitted.
OFF	No beep sound is emitted.

Example Response

If headers are on	:BEEPER:COMPARATOR NG
If headers are off	NG

Error If the response message is longer than 300 bytes, a query error is generated.

:BEEPer:KEY

■ Enables and disables the beep sound for key input.

Syntax :BEEPer:KEY <data>

<data> ON/OFF (character data)

Function Sets the beep sound produced each time a key is pressed.

ON	A beep sound is emitted.
OFF	No beep sound is emitted.

Example Transmission :BEEPer:KEY ON
When a key is pressed, a beep sound is emitted.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:BEEPer:KEY?

■ Queries the beep sound for key input.

Syntax :BEEPer:KEY?

Function Returns the beep sound setting for when a key is pressed as character data.

ON	A beep sound is emitted.
OFF	No beep sound is emitted.

Example Response

If headers are on	:BEEPER:KEY ON
If headers are off	ON

Error If the response message is longer than 300 bytes, a query error is generated.

:BIAS (3522-50 only)

■ Enables and disables the external DC bias function.

Syntax :BIAS <data>

<data> ON/OFF (character data)

Function Turns the external DC bias function on and off.

Example Transmission :BIAS ON
The external DC bias function is turned on.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:BIAS? (3522-50 only)

■ Queries the external DC bias function enablement.

Syntax :BIAS?

Function Returns the current enablement state of the external DC bias function as character data.
ON, OFF

Example Response
If headers are on :BIAS ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:CABLe (3532-50 only)

■ Sets the cable length.

Syntax :CABLe <data>

<data> 0/1 (NR1 numerical data)
0: sets to 0 m
1: sets to 1m

Function Sets the cable length.

Example Transmission :CABLe 0
The cable length is set to 0 m.

Error If <data> is other than numerical data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:CABLe? (3532-50 only)

■ Queries the cable length.

Syntax :CABLe?

Function Returns the current cable length setting as NR1 numerical data.
0, 1

Example Response
If headers are on :CABLE 0
If headers are off 0

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator

■ Enables and disables the comparator function.

Syntax :COMParator <data>

<data> ON/OFF (character data)

Function Turns the comparator function on and off.

Example Transmission :COMParator ON
The comparator function is turned on.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator?

■ Queries the comparator function enablement.

Syntax :COMParator?

Function Returns the current enablement state of the comparator function as character data.
ON, OFF

Example Response
If headers are on :COMPARATOR ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:FLIMit:ABSolute

■ Sets the lower and upper limit values for the first comparator parameter as absolute values.

Syntax :COMParator:FLIMit:ABSolute <low>,<high>

<data>

<low>	lower limit value	OFF (character data) or numerical value in NR3 format
<high>	upper limit value	OFF (character data) or numerical value in NR3 format

Function
- Sets the lower and upper limit values for the first comparator parameter (i.e. the principal measured value) as absolute numerical values.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Note The upper and lower limit values which are set as absolute values, and which are set as percentage values are stored individually.

Example Transmission :COMParator:FLIMit:ABSolute 1.1234E-06,1.2345E-06
The lower limit value is set to 1.1234E-06 and the upper limit value is set to 1.2345E-06.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:FLIMit:ABSolute?

■ Queries the lower and upper limit values which are set as absolute values for the first comparator parameter.

Syntax :COMParator:FLIMit:ABSolute?

Function Returns the lower and upper limit values which are set as absolute values for the first comparator parameter as character data or numerical value in order.
OFF (character data) or numerical value in NR3 format

Example Response
If headers are on :COMPARATOR:FLIMIT:ABSOLUTE 1.1234E-06,1.2345E-06
If headers are off 1.1234E-06,1.2345E-06

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:FLIMit:DEViation

■ Sets the reference value and lower and upper limit values for the first comparator parameter as deviation percentage (Δ%).

Syntax :COMParator:FLIMit:DEViation <ref>,<low>,<high>

<data>

<ref>	reference value	Numerical value in NR3 format
<low>	lower limit value	OFF (character data) or numerical value in NR3 format
<high>	upper limit value	OFF (character data) or numerical value in NR3 format

Function ・Sets the reference value and the lower and upper limit values for the first comparator parameter as deviation percentage.

Note The reference value and the lower and upper limit values of the % mode and Δ% mode are common. Therefore this command and the ":COMParator:FLIMit:PERcent" command do the same action.

Example Transmission :COMParator:FLIMit:DEViation 1.2345E-6,-10.0,10.0
The reference value is set to 1.2345E-06, the lower limit value is set to -10%, and the upper limit value is set to 10%.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:FLIMit:DEViation?

■ Queries the reference value and the lower and upper limit values which are set as deviation percentage (Δ%) for the first comparator parameter.

Syntax :COMParator:FLIMit:DEViation?

Function Returns the reference value and the lower and upper limit values witch are set as deviation percentage (Δ%) for the first comparator parameter as <ref>, <low>, <hi> in order.

Note The reference value and the lower and upper limit values of the % mode and Δ% mode are common. Therefore this command and the ":COMParator:FLIMit:PERcent" command do the same action.

Example Response
If headers are on :COMPARATOR:FLIMIT:DEVIATION 1.2345E-6,-10.0,10.0
If headers are off 1.2345E-6,-10.0,10.0

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:FLIMit:MODE

■ Set the reference value and the first parameter setting mode for the comparator.

Syntax :COMParator:FLIMit:MODE <data>

<data> ABSolute/PERcent/DEViation (character data)

Function ・Sets the first parameter setting mode for the comparator function.

ABSolute	Absolute value setting mode (ABS)
PERcent	Percentage setting mode (%)
DEViation	Deviation percentage setting mode (Δ%)

Example Transmission :COMParator:FLIMit:MODE PERcent
The percentage setting mode is selected.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:FLIMit:MODE?

■ Queries the reference value and the setting mode of the first parameter for the comparator.

Syntax :COMParator:FLIMit:MODE?

Function Returns the current setting mode for the first parameter for the comparator function as character data.

ABSOLUTE	Absolute value setting mode (ABS) is selected.
PERCENT	Percentage setting mode (%) is selected.
DEVIATION	Deviation percentage setting mode (Δ%) is selected.

Example Response

If headers are on	:COMPARATOR:FLIMIT:MODE PERCENT
If headers are off	PERCENT

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:FLIMit:PERcent

■ Sets the reference value and the lower and upper limit values for the first comparator parameter as percentage.

Syntax :COMParator:FLIMit:PERcent <ref>,<low>,<high>

<data>

<ref>	reference value	numerical value in NR3 format
<low>	lower limit value	OFF (character data) or numerical value in NR1 format
<high>	upper limit value	OFF (character data) or numerical value in NR1 format

Function
- Sets the lower and upper limit values for the first comparator parameter (i.e. the principal measured value) as percentage relative to a reference value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.
- The reference value <ref> cannot be set to OFF.

Note The upper and lower limit values which are set as absolute values, and which are set as percentage values are stored individually.

Example Transmission :COMParator:FLIMit:PERcent 1.2345E-06,-20,20
The reference value is set to 1.2345E-06, the lower limit value is set to -20%, and the upper limit value is set to 20%.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:FLIMit:PERcent?

■ Queries the reference value and the lower and upper limit values which are set as percentage for the first comparator parameter.

Syntax :COMParator:FLIMit:PERcent?

Function Returns the reference value and the lower and upper limit values which are set as percentage for the first comparator parameter as <ref>,<low>,<high> in order.

<ref>	Numerical value in NR3 format
<low>, <high>	Both are OFF (character data) or numerical value in NR1 format

Example Response

If headers are on	:COMPARATOR:FLIMIT:PERCENT 1.2345E-06, -20,20
If headers are off	1.2345E-06,-20,20

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:SLIMit:ABSolute

■ Sets the lower and upper limit values for the second comparator parameter as absolute values.

Syntax :COMParator: SLIMit:ABSolute <low>,<high>

<data>

<low>	lower limit value	OFF (character data) or numerical value in NR3 format
<high>	upper limit value	OFF (character data) or numerical value in NR3 format

Function
- Sets the lower and upper limit values for the second comparator parameter as absolute numerical value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Note The upper and lower limit values which are set as absolute values, and which are set as percentage values are stored individually.

Example Transmission :COMParator:SLIMit:ABSolute 1.1234E-06,1.2345E-06
The lower limit value is set to 1.1234E-06, and the upper limit value is set to 1.2345E-06.

Error If <data> is other than character data or numerical value described above, a command error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:SLIMit:ABSolute?

■ Queries the lower and upper limit values which are set as absolute values for the second comparator parameter.

Syntax :COMParator:SLIMit:ABSolute?

Function Returns the lower and upper limit values which are set as absolute numerical values for the second comparator parameter as character data or numerical value in order.
OFF (character data) or numerical value in NR3 format

Example Response
If headers are on :COMPARATOR:SLIMIT:ABSOLUTE 1.1234E-06,1.2345E-06
If headers are off 1.1234E-06,1.2345E-06

Error If the response message is longer than 300 bytes, a query error occurs.

:COMParator:SLIMit:DEViation

■ Sets the reference value and the lower and upper limit values for the second comparator parameter as deviation percentage (Δ%).

Syntax :COMParator:SLIMit:DEViation <ref>,<low>,<high>

<data>

<ref>	reference value	Numerical value in NR3 format
<low>	lower limit value	OFF (character data) or numerical value in NR3 format
<high>	upper limit value	OFF (character data) or numerical value in NR3 format

Function · Sets the reference value and the lower and upper limit values for the second comparator parameter as deviation percentage.

Note The reference value and the lower and upper limit values of the % mode and Δ% mode are common. Therefore this command and the ":COMParator:SLIMit:PERcent" command do the same action.

Example Transmission :COMParator:SLIMit:DEViation 1.0000E-3,OFF,5
The reference value is set to 1.0000E-3, the lower limit value is set to OFF, and the upper limit value is set to 5%.

Error If <data> is other than character data or numerical value described above, a command error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:SLIMit:DEViation?

■ Queries the reference value and the lower and upper limit values for the second comparator parameter as deviation percentage (Δ%).

Syntax :COMParator:SLIMit:DEViation?

Function Returns the reference value and the lower and upper limit values witch are set as deviation percentage (Δ%) for the second comparator parameter as <ref>,<low>,<hi> in order.

Note The reference value and the lower and upper limit values of the % mode and Δ% mode are common. Therefore this command and the ":COMParator:SLIMit:PERcent" command do the same action.

Example Response
If headers are on :COMPARATOR:SLIMIT:DEVIATION 1.0000E-3,OFF,5
If headers are off 1.0000E-3,OFF,5

Error If the response message is longer than 300 bytes, a query error occurs.

:COMParator:SLIMit:MODE

■ Sets the reference value and the second parameter setting mode for the comparator.

Syntax :COMParator:SLIMit:MODE <data>

<data> ABSolute/PERcent/DEViation (character data)

Function ・Sets the second parameter setting mode for the comparator function.

ABSolute Absolute value setting mode (ABS)
PERcent Percentage value setting mode (%)
DEViation Deviation percentage setting mode (Δ%)

Example Transmission :COMParator:SLIMit:MODE PERcent
The percentage setting mode is selected.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:SLIMit:MODE?

■ Queries the reference value and the setting mode of the second parameter for the comparator.

Syntax :COMParator:SLIMit:MODE?

Function Returns the current setting mode for the second parameter for the comparator function as character data.

ABSOLUTE Absolute value setting mode (ABS) is selected.
PERCENT Percentage setting mode (%) is selected.
DEVIATION Deviation percentage setting mode (Δ%) is selected.

Example Response
If headers are on :COMPARATOR:SLIMIT:MODE PERCENT
If headers are off PERCENT

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:SLIMit:PERcent

■ Sets the reference value and the lower and upper limit values for the second comparator parameter as percentage.

Syntax :COMParator:SLIMit:PERcent <ref>,<low>,<high>

<data>

<ref>	reference value	Numerical data in NR3 format
<low>	lower limit value	OFF (character data) or numerical value in NR1 format
<high>	upper limit value	OFF (character data) or numerical value in NR1 format

Function
- Sets the lower and upper limit values for the second comparator parameter as percentage relative to a reference value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.
- The reference value <ref> cannot be set to OFF.

Note The upper and lower limit values which are set as absolute values, and which are set as percentage values are stored individually.

Example Transmission :COMParator:SLIMit:PERcent 1.2345E-06,-20,20
The reference value is set to 1.2345E-06, the lower limit value is set to -20%, and the upper limit value is set to 20%.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:SLIMit:PERcent?

■ Queries the reference value and the lower and upper percent values which are set as percentage for the second comparator parameter.

Syntax :COMParator:SLIMit:PERcent?

Function Returns the lower and upper limit values which are set as percentage for the second comparator parameter as <ref>, <low>, <high> in order.

<ref>	Numerical value in NR3 format
<low>, <high>	Both are OFF (character data) or numerical value in NR1 format

Example Response
If headers are on :COMPARATOR:SLIMIT:PERCENT 1.2345E-06,-20,20
If headers are off 1.2345E-06,-20,20

Error If the response message is longer than 300 bytes, a query error is generated.

:CORRection:DATA?

■ Queries the open circuit and short circuit compensation values.

Syntax :CORRection:DATA?

Function Returns the open and short circuits compensation values at the currently test frequency as <residual impedance of short circuit compensation>, <phase angle of short circuit compensation>, <residual impedance of open circuit compensation>, <phase angle of open circuit compensation> in order.

Residual impedance	Numerical value in NR3 format or OFF (character data)
Phase angle	Numerical value in NR2 format or OFF (character data)

When the compensation setting is OFF, or when the set test frequency of the compensation differs from the current test frequency, returns the character data "OFF."

Example Response

If headers are on :CORRECTION:DATA OFF,OFF,247.45E+06,-21.58

If headers are off OFF,OFF,247.45E+06,-21.58

The short circuit compensation for the current test frequency is set to OFF, and open circuit compensation is 247.45 MΩ, -21.58°.

Error If the response message is longer than 300 bytes, a query error is generated.

:CORRection:OPEN

■ Enables and disables the open circuit compensation function.

Syntax :CORRection:OPEN <data>

<data> OFF/ALL (character data) or numerical data in NR3 format
3532-50: 42.0E+00 to 5.000E+06
3522-50: 1E-03 to 100.0E+03

Function
- Enables and disables the open circuit compensation function.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

OFF	The open circuit compensation is not performed.
ALL	The open circuit compensation is performed at all the test frequencies.
Numerical data	The open circuit compensation is performed at the set test frequency only (spot compensation). For DC compensation, set to 0.

Note When the compensation is performed at all the test frequencies, about 3 minutes compensation (using the 3532-50) or about 2 minutes compensation (using the 3522-50) is required. Executing the command which changes test settings during compensation is performed at all the test frequencies generates an execution error. Be sure not to execute commands other than commands for checking each status registers such as *ESR? and :ESR0?.
When the SPOT compensation is performed, it takes about maximum 15 minutes (1 mHz compensation) for the 3522-50 to read the compensation data.

Example Transmission :CORRection:OPEN 1E+3
The open circuit compensation function at 1 kHz is set to ON.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the comparator function is performed generates an execution error.

:CORRection:OPEN?

■ Queries the open circuit compensation function enablement.

Syntax :CORRection:OPEN?

Function Returns the current setting of open circuit compensation function enablement as character data or a numerical value in NR3 format.

OFF	The open circuit compensation function has been set to off.
ALL	The open circuit compensation function at all the test frequencies has been set to on.
Numerical data	The open circuit compensation function at the set test frequency has been set to on (spot compensation).

Example Response

If headers are on :CORRECTION:OPEN 1.000E+03

If headers are off 1.000E+03

The open circuit compensation at 1 kHz has been enabled.

Error If the response message is longer than 300 bytes, a query error is generated.

:CORRection:SHORt

■ Enables and disables the short circuit compensation function.

Syntax :CORRection:SHORt <data>

<data> OFF/ALL (character data) or numerical data in NR3 format
3532-50: 42.0E+00 to 5.000E+06
3522-50: 0.000E+00 to 100.0E+03

Function
- Enables and disables the short circuit compensation function.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

OFF	The short circuit compensation is not performed.
ALL	The short circuit compensation is performed at all the test frequencies.
Numerical data	The short circuit compensation is performed at the set test frequency (spot compensation). 0: compensation for DC

Note When the compensation is performed at all the test frequencies, about 3 minutes compensation (using the 3532-50) or about 2 minutes compensation (using the 3522-50) is required. Executing the commands which changes test settings during compensation for all frequency generate an execution error. Be sure not to execute commands other than that of checking each status registers such as *ESR? and :ESR0?.
When the SPOT compensation is performed, it takes about maximum 15 minutes (1 mHz compensation) for the 3522-50 to read the compensation data.

Example Transmission :CORRection:SHORt 1E+3
The short circuit compensation function at 1 kHz is enabled.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the comparator function is performed generates an execution error.

:CORRection:SHORt?

■ Queries the short circuit compensation function enablement.

Syntax :CORRection:SHORt?

Function Returns the current setting of the short circuit compensation enablement as character data or a numerical value in NR3 format.

OFF	The short circuit compensation function has been set to off.
ALL	The short circuit compensation function at all the test frequencies has been set to on.
Numerical data	The short circuit compensation function at the set test frequency has been set to on (spot compensation).

Example Response

If headers are on :CORRECTION:SHORT 1.000E+03
If headers are off 1.000E+03

The open circuit compensation function at 1 kHz has been enabled.

Error If the response message is longer than 300 bytes, a query error is generated.

:DISPlay:MONItor?

■ Queries the voltage and current monitored parameters.

Syntax :DISPlay:MONItor?

Function Returns the monitored parameters as <voltage monitored value> and <current monitored value> in order.

Voltage monitored value Numerical value in NR2 format
Current monitored value Numerical value in NR3 format

Example Response

If headers are on :DISPLAY:MONITOR 1.23,0.12E-03
If headers are off 1.23,0.12E-03

Error If the response message is longer than 300 bytes, a query error occurs.

:ESE0

■ Sets event status enable register 0.

Syntax :ESE0 <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets event status enable register 0 (ESER0) to the bitmask for controlling access to events in event status register 0 (ESR0).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	COF	LOF	IOF	IUF	IDX	EOM	CEM

Event Status Enable Register 0 (ESER0)

Example Transmission :ESE0 20
Bits 2 and 4 of ESER0 are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

:ESE0?

■ Reads out event status enable register 0.

Syntax :ESE0?

Function Returns the value of event status enable register 0 (ESER0) as a numerical value in NR1 format between 0 and 255.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	COF	LOF	IOF	IUF	IDX	EOM	CEM

Event Status Enable Register 0 (ESER0)

Example Response
If headers are on :ESE0 20
If headers are off 20
Bits 2 and 4 of ESER0 have been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESE1

■ Sets event status enable register 1.

Syntax :ESE1 <data>

Function
- Sets event status enable register 1 (ESER1) to the bitmask for controlling access to events in event status register 1 (ESR1).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event Status Enable Register 1 (ESER1)

Example Transmission :ESE1 20
Bits 2 and 4 of ESER1 are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

:ESE1?

■ Reads out event status enable register 1.

Syntax :ESE1?

Function Returns the value of event status enable register 1 (ESER1) as a numerical value in NR1 format between 0 and 255.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event Status Enable Register 1 (ESER1)

Example Response
If headers are on :ESE1 20
If headers are off 20
Bits 2 and 4 of ESER1 have been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESR0?

■ Reads out event status register 0.

Syntax :ESR0?

Function
- Returns the value of event status register 0 (ESR0) as a numerical value in NR1 format from 0 to 255, and then clears event status register 0.
- No header is prefixed to the response message.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	COF	LOF	IOF	IUF	IDX	EOM	CEM

Event Status Register 0 (ESR0)

Example Response 4
Bit 2 of ESR0 has been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESR1?

■ Reads out event status register 1.

Syntax ESR1?

Function
- Returns the value of event status register 1 (ESR1) as a numerical value in NR1 format from 0 to 255, and then clears event status register 1.
- No header is prefixed to the response message.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event Status Register 1 (ESR1)

Example Response 64
Bit 6 of ESR1 has been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:FREQuency

■ Sets the test frequency.

Syntax FREQuency <data>

<data> Numerical data in NR3 format
3532-50: 42.0E+00 to 5.000E+06
3522-50: 0 to 100.0E+03

Function
- Sets the testing frequency.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.
- Specify <data> to 0 at DC measurement.

Note (for 3532-50) If the test frequency is greater than 100 kHz, the test range which can be set is limit. If it is greater than 1 MHz, the range of test signal level is limit. When the test range and the test signal level are greater than each range after changing frequencies, they are automatically change over the highest range compatible with this test frequency setting. For details, refer to the 3532-50 instruction manual.

Example Transmission :FREQuency 1.000E+03
The test frequency is set to 1 kHz.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:FREQuency?

■ Queries the test frequency.

Syntax :FREQuency?

Function Returns the currently test frequency as a numerical value in NR3 format.

Example Response
If headers are on :FREQUENCY 1.000E+03
If headers are off 1.000E+03
The test frequency has been set to 1 kHz.

Error If the response message is longer than 300 bytes, a query error is generated.

:HEADer

■ Enables and disables headers for the response message

Syntax :HEADer <data>

<data> ON/OFF (character data)

Function
- Sets whether or not the 3532-50/3522-50 will prefix headers to its response messages.
- When powering on, <data> is initially set to OFF.

Example Transmission :HEADer ON
Headers are prefixed to response messages.

Error If <data> is other than character data described above, an execution error occurs.

:HEADer?

■ Queries headers for the response messages enablement.

Syntax :HEADer?

Function Returns the setting of headers for the response messages as character data.
ON,OFF

Example Response
If headers are on :HEADER ON
If headers are off OFF

Error If the response message is longer than 300 bytes, a query error is generated.

:IO:OUTPut:DELay

■ Sets the delay time for Judgement Result Output and $\overline{\text{EOM}}$ Output Period in EXT I/O.

Syntax :IO:OUTPut:DELay <data>

<data> 0 to 0.0999 (NR1)

Function ・Sets the delay time for comparator judgement result output and $\overline{\text{EOM}}$ output period in EXT I/O.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Example Transmission :IO:OUTPut:DELay 0.0005
Sets the delay time for comparator judgement result output and $\overline{\text{EOM}}$ output period in EXT I/O to 500 µs.

Note There is an approximate error of 40 µs in the delay time entered for comparator ↔ $\overline{\text{EOM}}$ period for the setting value. In addition, during measurement, a trigger input from EXT/IO or communicating by interface may lead to the delay time varying widely. As far as possible, try not to control from external sources when carrying out measurement.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:IO:OUTPut:DELay?

■ Queries the delay time for Judgement Result Output and $\overline{\text{EOM}}$ Output Period in EXT I/O.

Syntax :IO:OUTPut:DELay?

Function Returns settings the delay time for comparator judgement result output and $\overline{\text{EOM}}$ output period in EXT I/O.

Example Response
If headers are on :IO:OUTPUT:DELAY 0.0005
If headers are off 0.0005
The delay time for comparator judgement result output and $\overline{\text{EOM}}$ output period in EXT I/O set at 500 µs.

Error If the response message is longer than 300 bytes, a query error is generated.

:IO:RESult:RESet

■ Sets the Output of Judgment Result Signal Line in EXT I/O.

Syntax :IO:RESult:RESet <data>

<data> ON/OFF (character data)

Function
- Resets the judgment results when the start-of-measurement signal (trigger signal) is input.
- Updates the measurement results when measurement ends.

Example Transmission :IO:RESult:RESet OFF
Sets the judgment results to be updated when measurement ends.

Note The judgment result signal line indicates judgment results for M or S-HI, M or S-IN, M or S-LO and AND for comparator measurement.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:IO:RESult:RESet?

■ Queries the Output of Judgment Result Signal Line in EXT I/O.

Syntax :IO:RESult:RESet?

Function Returns the setting of whether to reset the judgment result signal line in EXT I/O.

Example Response
If headers are on :IO:RESULT:RESET OFF
If headers are off OFF
The judgment results are set to be updated when judgment ends.

Error If the response message is longer than 300 bytes, a query error is generated.

:LEVel

■ Sets the test signal level.

Syntax :LEVel <data>

<data> V/CV/CC (character data)

Function Sets the test signal level to one of the followings.

V	Open circuit voltage level
CV	Constant voltage level
CC	Constant current level

Example Transmission :LEVel CV
The test signal level is set to constant voltage.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:LEVel?

■ Queries the test signal level.

Syntax :LEVel?

Function Returns the test signal level as character data.

V	Open circuit voltage level
CV	Constant voltage level
CC	Constant current level

Example Response
If headers are on :LEVEL CV
If headers are off CV
The test signal level has been set to constant voltage.

Error If the response message is longer than 300 bytes, a query error occurs.

:LEVel:CCURRent

■ Sets the constant current value.

Syntax :LEVel:CCURRent <data>

<data> Numerical data in NR3 format
3532-50: 0.01E-03 and 99.99E-03 (frequency 42 Hz to 1 MHz)
0.01E-03 and 20.00E-03 (frequency 1.001 MHz to 5 MHz)
3522-50: 0.01E-03 and 99.99E-03

Function
- Sets the value of the constant current.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :LEVel:CCURRent 10.00E-03
The constant current value is set to 10 mA.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LEVel:CCURRent?

■ Queries the constant current value.

Syntax :LEVel:CCURRent?

Function Returns the value of the constant current as a numerical value in NR3 format.

Example Response
If headers are on :LEVEL:CCURRENT 10.00E-03
If headers are off 10.00E-03
The constant current value has been set to 10 mA.

Error If the response message is longer than 300 bytes, a query error is generated.

:LEVel:CVOLTage

■ Sets the constant voltage value.

Syntax :LEVel:CVOLTage <data>

<data> Numerical data in NR3 format
3532-50: 0.010 to 5.000 (frequency 42 Hz to 1 MHz)
0.010 to 1.000 (frequency 1.001 MHz to 5 MHz)
3522-50: 0.010 to 5.000

Function
- Sets the value of the constant voltage.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.
- When the test signal frequency is set to a value greater than 1 MHz, the range which can be set is from 0.01 to 1 V.

Example Transmission :LEVel:CVOLTage 1.234
The constant voltage value is set to 1.234 V.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LEVel:CVOLTage?

■ Queries the constant voltage values.

Syntax :LEVel:CVOLTage?

Function Returns the constant voltage value as a numerical value in NR2 format.

Example Response
If headers are on :LEVEL:CVOLTAGE 1.234
If headers are off 1.234
The constant voltage level has been set to 1.234 V.

Error If the response message is longer than 300 bytes, a query error is generated.

:LEVel:VOLTage

■ Sets the open circuit voltage value.

Syntax :LEVel:VOLTage <data>

<data> Numerical data in NR3 format
3532-50: 0.010 to 5.000 (frequency 42 Hz to 1 MHz)
0.010 to 1.000 (frequency 1.001 MHz to 5 MHz)
3522-50: 0.010 to 5.000

Function
- Sets the open circuit voltage value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :LEVel:VOLTage 1.234
The open circuit voltage value is set to 1.234 V.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LEVel:VOLTage?

■ Queries the open circuit voltage values.

Syntax :LEVel:VOLTage?

Function Returns the open circuit voltage value as a numerical value in NR2 format.

Example Response
If headers are on :LEVEL:VOLTAGE 1.234
If headers are off 1.234
The open circuit voltage level has been set to 1.234 V.

Error If the response message is longer than 300 bytes, a query error is generated.

:LIMiter

■ Enables and disables the limit value setting function.

Syntax :LIMiter <data>

<data> ON/OFF (character data)

Function Sets the limit value setting function to ON or OFF.

Example Transmission :LIMiter ON
The limit value setting function is enabled.

Error If <data> is other than character data described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LIMiter?

■ Queries the limit value setting function enablement.

Syntax :LIMiter?

Function Returns the current setting of the limit value setting function enablement as character data.
ON,OFF

Example Response
If headers are on :LIMITER ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:LIMiter:CURRent

■ Sets the current limit value.

Syntax :LIMiter:CURRent <data>

<data> Numerical data in NR3 format from 0.01E-03 to 99.99E-03

Function
- Sets the current limit value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :LIMiter:CURRent 10.00E-03
The current limit value is set to 10 mA.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LIMiter:CURRent?

■ Queries the current limit value.

Syntax :LIMiter:CURRent?

Function Returns the current limit value as a numerical value in NR3 format.

Example Response
If headers are on :LIMITER:CURRENT 10.00E-03
If headers are off 10.00E-03
The current limit value has been set to 10 mA.

Error If the response message is longer than 300 bytes, a query error is generated.

:LIMiter:VOLTage

■ Sets the voltage limit value.

Syntax :LIMiter:VOLTage <data>

<data> Numerical data in NR2 format
0.010 to 5.000

Function
- Sets the voltage limit value.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :LIMiter:VOLTage 1.234
The voltage limit value is set to 1.234 V.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LIMiter:VOLTage?

■ Queries the voltage limit value.

Syntax :LIMiter:VOLTage?

Function Returns the voltage limit value as a numerical value in NR2 format.

Example Response
If headers are on :LIMITER:VOLTAGE 1.234
If headers are off 1.234
The voltage limit value has been set to 1.234 V.

Error If the response message is longer than 300 bytes, a query error is generated.

:LOAD

■ Loads the test conditions of the specified panel number.

Syntax :LOAD <data>

<data> Numerical data in NR1 format
1 to 30

Function
- Sets the panel number which you wish to load.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

Example Transmission :LOAD 2
The test conditions which are saved in panel number 2 is loaded.

Error If <data> is other than numerical value described above, an execution error occurs.
If the panel number in which the settings have not been saved is selected, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:MEASure?

■ Queries measured data items.

Syntax :MEASure?

Function Returns the measured values of test data items as numerical values in NR2 and NR3 format.

1. During normal testing

   Returns the measured value of the parameter that bits of MR0 (measurement register 0) and MR1 (measurement register 1) have been set to 1 in the following order; impedance (Z), admittance (Y), phase angle (PHASE), series capacitance (CS), parallel capacitance (CP), loss coefficient (D), series inductance (LS), parallel inductance (LP), Q factor (Q), series resistance (RS), conductance (G), parallel resistance (RP), reactance (X), and susceptance (B).

   When powering on, the test parameters are initially set to impedance (Z) and phase angle (θ).

   The contents of MR0 and MR1 are set with the :MEASure:ITEM command.

2. During comparator testing

   Returns the measured values of the first and second parameters which have been set and the comparator result.

   The result of the comparison is as follows.

Within limits or logical product limits	0
Above the upper limit or out of logical product limits	1
Below the lower limit	-1

   The data is returned as shown below.

   <logical product of comparison result>, <test value of the first parameter>, <comparison result of first parameter>, <test value of second parameter>, <comparison result of second parameter>

   Sets the first parameter with the ":PARameter1" command, and sets the second parameter with the ":PARameter3" command. When the parameter is set to OFF, the data is not returned.

3. During scaling testing

   The data is returned as shown below.
   <test value of the first parameter>, <test value of second parameter>

   Sets the first parameter with the ":PARameter1" command, and sets the second parameter with the ":PARameter3" command. When the parameter is set to OFF, the data is not returned.

Note The results of output when using the *WAI command differs from when not using, since the :MEASure? query is not sequential command.

If the test frequency is set to 1 kHz:

When the *WAI command is not used

Transmission :FREQuency 50;:MEASure?

The response message of this :MEASure? query is the measured value of frequency at 1 kHz.

When using the *WAI command

Transmission :FREQuency 50;*WAI;:MEASure?

The response message of this :MEASure? query is the measured value of frequency at 50 Hz.

Example 1. During normal testing

When querying the measured values for impedance (Z), phase angle (θ), parallel capacitance (Cp), loss coefficient (D):

Transmission :MEASure:ITEM 53,0;:MEASure?

Response

If headers are on Z 31.981E+03,PHASE -88.05,CP 4.9736E-09,D 0.03405
If headers are off 31.981E+03,-88.05,4.9736E-9,0.03405

2. During comparator testing

When comparator testing for impedance (Z) and phase angle (θ).

Transmission :PARameter1 Z;:PARameter3 PHASe
:COMParator ON
:MEASure?

Response

If headers are on 1,Z 31.981E+03,0,PHASE -88.05,-1
If headers are off 1,31.981E+03,0,-88.05,-1

The decision result of the first parameter is within limits, and that of the second parameter is below the lower limit.

3. During scaling testing

When comparator testing for impedance (Z) and phase angle (θ).

Transmission :PARameter1 Z;:PARameter3 PHASe
:SCALe ON
:MEASure?

Response

If headers are on Z 31.981E+03,0,PHASE -88.05
If headers are off 31.981E+03,0,-88.05

Error If the response message is longer than 300 bytes, a query error is generated. During comparator testing and scaling testing, if parameters both first and second are set to OFF, an execution error occurs.

Executing this command while the open or short circuit compensation is performed generates an execution error.

:MEASure:ITEM

■ Sets the test parameter for response of the :MEASure? query during normal testing.

Syntax :MEASure:ITEM <MR0>,<MR1>

<data> Numerical data in NR1 format from 0 to 255

Function
- Specifies the test parameters for response of the :MEASure? query during normal testing with bits.
- The items of two registers (MR0 and MR1) are as follows.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Lp	Ls	D	Cp	Cs	θ	Y	Z

Measurement Register 0 (MR0)

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	Unused	B	X	Rp	G	Rs	Q

Measurement Register 1 (MR1)

- When the power is turned on, the test parameter is set to impedance (Z) and phase angle (θ) that is; <MR0> is 5 and <MR1> is 0.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

Example Transmission :MEASure:ITEM 53,18
The test parameters for response are set to impedance (Z), phase angle (θ), equivalent parallel circuit capacitance (Cp), loss coefficient (D), series resistance (Rs), reactance (X).

Error If <data> is other than numerical value described above, an execution error occurs.

:MEASure:ITEM?

■ Queries the test parameter for response of the :MEASure? query during normal testing.

Syntax :MEASure:ITEM?

Function Returns the test parameter to response the :MEASure? query during normal testing as bits <MR0> and <MR1>.
The items of two registers (MR0 and MR1) are as follows.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Lp	Ls	D	Cp	Cs	θ	Y	Z

Measurement Register 0 (MR0)

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	Unused	B	X	Rp	G	Rs	Q

Measurement Register 1 (MR1)

Example Response
If headers are on :MEASURE:ITEM 53,18
If headers are off 53,18
The test parameters to response have been set to impedance (Z), phase angle (θ), parallel capacitance (Cp), loss coefficient (D), series resistance(Rs), reactance (X).

Error If the response message is longer than 300 bytes, a query error is generated.

:PARameter1 (2, 3, or 4)

■ Sets the test parameters to be displayed.

Syntax :PARameter1 (2, 3, or 4) <data>

<data>

Z	Impedance
Y	Admittance
PHASe	Phase angle
CS	Series equivalent static capacitance
CP	Parallel equivalent static capacitance
D	Loss coefficient
LS	Series equivalent inductance
LP	Parallel equivalent inductance
Q	Q factor
RS	Series equivalent resistance
G	Conductance
RP	Parallel equivalent resistance
X	Reactance
B	Susceptance
OFF	

Function Sets the displayed parameters.

Example Transmission :PARameter1 Z;:PARameter3 PHASe
The first parameter is set to impedance, and the third parameter is set to phase angle.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:PARameter1 (2, 3, or 4)?

■ Queries the test parameters to be displayed.

Syntax :PARameter1 (2, 3, or 4)?

Function Returns the test parameters as character data.

Z, Y, PHASE, CS, CP, D, LS, LP, Q, RS, G, RP, X, B, OFF

Example Response
If headers are on :PARAMETER2 PHASE
If headers are off PHASE
The second parameter has been set to phase angle.

Error If the response message is longer than 300 bytes, a query error occurs.

:PARameter1 (2, 3, or 4):DIGit

■ Sets the number of displayed digits for the test parameters.

Syntax :PARameter 1 (2, 3, or 4):DIGit <data>

<data> Numerical data in NR1 format
3 to 5

Function Sets the number of displayed digits for the first to fourth parameters.

Example Transmission :PARameter1:DIGit 4
The number of displayed digits for the first parameter is set to 4.

Note The response message for the ":MEASure?" query is always returned in 5 digits.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:PARameter1 (2, 3, or 4):DIGit?

■ Queries the number of displayed digits for the test parameters.

Syntax :PARameter1 (2, 3, or 4):DIGit?

Function Returns the number of displayed digits for the first to fourth parameters as numerical data in NR1 format

Example Response
If headers are on :PARAMETER1:DIGIT 4
If headers are off 4
The number of displayed digits for the first parameter has been set to 4.

Error If the response message is longer than 300 bytes, a query error occurs.

:RANGe

■ Sets the test range.

Syntax :RANGe <data>

<data> Numerical data in NR1 format
1 to 10

Function
- Sets the test range.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- If this command is executed, the setting of the :RANGe:AUTO command is automatically changed to OFF.
- The numerical value corresponding to the test range and frequency which can be set is as follows.

●: settable / ---: cannot be set

Range number	Range (Ω)	to 100.0 kHz	100.1 kHz to 1.000 MHz	1.001 MHz to 5.000 MHz
1	0.1	●	●	●
2	1	●	●	●
3	10	●	●	●
4	100	●	●	●
5	1 k	●	●	●
6	10 k	●	●	●
7	100 k	●	●	●
8	1 M	●	●	---
9	10 M	●	---	---
10	100 M	●	---	---

For 3532-50 If the test frequency is greater than 100 kHz, the range number 9 (10 MΩ range) cannot be set. If the test frequency is greater than 1 MHz, the range number 8 (1 MΩ range) cannot be set.

Example Transmission :RANGe 5
The test range is set to 1 kΩ.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:RANGe?

■ Queries the test range.

Syntax :RANGe?

Function Returns the test range setting as numerical value (1 to 10) in NR1 format.
The numerical value corresponding to the test range and frequency which can be set is as follows.

Range number	Range (Ω)
1	0.1
2	1
3	10
4	100
5	1 k
6	10 k
7	100 k
8	1 M
9	10 M
10	100 M

Example Response
If headers are on :RANGE 5
If headers are off 5
The test range has been set to range 5 (1 kΩ).

Error If the response message is longer than 300 bytes, a query error is generated.

:RANGe:AUTO

■ Enables and disables the auto-range function.

Syntax :RANGe:AUTO <data>

<data> ON/OFF (character data)

Function Switches between automatic and manual setting of test range.

ON	Switches the automatic setting.
OFF	Switches the manual setting.

Example Transmission :RANGe:AUTO ON

The test range is switched to automatic selection (auto-ranging).

Error If <data> is other than character data described above, an execution error occurs.

Executing this command while the open or short circuit compensation is performed generates an execution error.

:RANGe:AUTO?

■ Queries the auto-range function enablement.

Syntax :RANGe:AUTO?

Function Returns whether the test range is automatically set as character data.

ON, OFF

Examples Response

If headers are on :RANGE:AUTO ON

If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:SAVE

■ Saves the test conditions in specified panel number.

Syntax :SAVE <number>, <name>

<data> <number> Numerical data in NR1 format between 1 and 30
<name> Character data, up to 20 characters

Function
- Saves the test conditions in specified panel number with name to be saved.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- The capital letters, numbers, and hyphen can be used.
- If 21 or more characters are entered, the first 20 characters are used.

Example Transmission :SAVE 3,TEST1
The test condition is saved as a name "TEST1" in panel number 3.

Error If <data> is other than numerical value and character data described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:SAVE?

■ Queries the panel number saved.

Syntax :SAVE? <data>

<data> Numerical data in NR1 format between 0 and 30

Function
- Returns 1 when the test conditions are saved in specified panel number, and returns 0 when not saved.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- The response message has no headers.

Example Transmission :SAVE? 3
Response 1
The test condition is saved in panel number 3.

Error If <data> is other than numerical value and character data described above, an execution error occurs.

:SCALe

■ Enables and disables the scaling function.

Syntax :SCALe <data>

<data> ON/OFF

Function Enables and disables the scaling function.

Example Transmission :SCALe ON
Enables the scaling function.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:SCALe?

■ Queries the scaling function.

Syntax :SCALe?

Function Returns the setting of scaling function enablement as character data.
ON, OFF

Example Response
If headers are on :SCALE ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error occurs.

:SCALe:FVALue

■ Sets the first parameters (a and b) in the scaling function.

Syntax :SCALe:FVALue <a>, <b>

<data> Numerical data in NR3 format

Function
- Sets the first parameters (a and b values) in the scaling function.
- For calculation equation of the scaling function, see the Instruction Manual of main unit.

Example Transmission :SCALe:FVALue 2.0000E+00,1.0000E+00
Sets a value to 2.0000, and b value to 1.0000.

Error If <data> is other than numerical data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:SCALe:FVALue?

■ Queries the first parameters (a and b) in the scaling function.

Syntax :SCALe:FVALue?

Function Returns the setting of the first parameters (a and b values) in the scaling function as a numerical value in NR3 format.

Example Response
If headers are on :SCALE:FVALUE 2.0000E+00,1.0000E+00
If headers are off 2.0000E+00,1.0000E+00

Error If the response message is longer than 300 bytes, a query error occurs.

:SCALe:SVALue

■ Sets the second parameters (a and b) in the scaling function.

Syntax :SCALe:SVALue <a>, <b>

<data> Numerical data in NR3 format

Function
- Sets the second parameters (a and b values) in the scaling function.
- For calculation equation of the scaling function, see the Instruction Manual of main unit.

Example Transmission :SCALe:SVALue 2.0000E+00,1.0000E+00
Sets a value to 2.0000, and b value to 1.0000.

Error If <data> is other than numerical data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:SCALe:SVALue?

■ Queries the second parameters (a and b) in the scaling function.

Syntax :SCALe:SVALue?

Function Returns the setting of the second parameters (a and b values) in the scaling function as a numerical value in NR3 format.

Example Response
If headers are on :SCALE:SVALUE 2.0000E+00,1.0000E+00
If headers are off 2.0000E+00,1.0000E+00

Error If the response message is longer than 300 bytes, a query error occurs.

:SPEEd

■ Sets the testing speed.

Syntax :SPEEd <data>

<data> FAST/NORMal/SLOW/SLOW2 (character data)

Function Sets the testing speed.

Example Transmission :SPEEd NORMal

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:SPEEd?

■ Queries the testing speed.

Syntax :SPEEd?

Function Returns the setting of testing speed as character data.
FAST, NORMAL, SLOW, SLOW2

Example Response
If headers are on :SPEED NORMAL
If headers are off NORMAL

Error If the response message is longer than 300 bytes, a query error is generated.

:TRANsmit:TERMinator

■ Sets the data terminator for response messages.

Syntax :TRANsmit:TERMinator <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets the data terminator for response messages.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

  If <data> = 0, the terminator is set to LF (line feed) + EOI signal.

  If <data> = 1 through 255, the terminator is set to CR (carriage return) + LF and EOI signal.
- When powering on, <data> is initially set to 0 (LF+EOI).

Example Transmission :TRANsmit:TERMinator 0
The data terminator is set to LF + EOI

Error If <data> is other than numerical value described above, an execution error occurs.

:TRANsmit:TERMinator?

■ Queries the data terminator for response messages.

Syntax :TRANsmit:TERMinator?

Function Returns the data terminator for response messages as a numerical value (0 or 1) in NR1 format.

If <data> = 0, the terminator is LF and EOI signal.

If <data> = 1, the terminator is CR + LF and EOI signal

Example Response

If headers are on :TRANSMIT:TERMINATOR 0

If headers are off 0

Error If the response message is longer than 300 bytes, a query error is generated.

:TRIGger

■ Sets the type of trigger.

Syntax :TRIGger <data>

<data> INTernal/EXTernal (character data)

Function Sets the type of trigger.
INTernal Internal trigger mode
EXTernal External trigger mode

Example Transmission :TRIGger INTernal
The trigger mode is set to internal trigger.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:TRIGger?

■ Queries the trigger setting.

Syntax :TRIGger?

Function Returns the trigger setting as character data.
INTERNAL/EXTERNAL

Example Response
If headers are on :TRIGGER INTERNAL
If headers are off INTERNAL
The trigger mode has been set to internal triggering.

Error If the response message is longer than 300 bytes, a query error is generated.

:TRIGger:DELAy

■ Sets the trigger delay time.

Syntax :TRIGger:DELAy <data>

<data> Numerical data in NR2 format from 0.00 to 9.99.

Function
- Sets the trigger delay time.
- The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :TRIGger:DELAy 0.05
The trigger delay time is set to 50 ms.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:TRIGger:DELAy?

■ Queries the trigger delay time.

Syntax :TRIGger:DELAy?

Function Returns the current setting of trigger delay time as a numerical value in NR2 format from 0.00 to 9.99.

Example Response
If headers are on :TRIGGER:DELAY 0.05
If headers are off 0.05
The trigger delay time has been set to 50 ms.

Error If the response message is longer than 300 bytes, a query error is generated.

5.5 Response Format for Queries as Numerical Value

(1) Test value

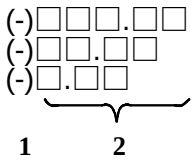
1. The response formats for |Z| (impedance),|Y| (admittance), Cs (static capacitance in series equivalent circuit mode), Cp (static capacitance in parallel equivalent circuit mode), Ls (inductance in series equivalent circuit mode), Lp (inductance in parallel equivalent circuit mode), Rs (effective resistance in series equivalent circuit mode), G (conductance), Rp (effective resistance in parallel equivalent circuit mode), X (reactance), B (susceptance) are as follows. (in NR3 format)

1 Mantissa	Five digits and decimal point
2 Exponent	Two digits

When the value is overflow or underflow, the following value is displayed.

Overflow	99999E+99
Underflow	-99999E+99

2. The response formats (in NR2 format) for θ (phase angle).



1 Sign	Only when the value is negative, minus (-) is prefixed.
2 Numerical	Up to the second decimal point

When the value is overflow or underflow, the following value is displayed.

Overflow	999.9
Underflow	-999.9

3. The response formats (in NR2 format) for D (loss coefficient)

□.□□□□□ Up to the fifth decimal point

When the value is overflow or underflow, the following value is displayed.

Overflow	999999
Underflow	-999999

4. The response formats (in NR2 format) for Q (Q factor)

□.□□ Up to the second decimal point
□□.□□
□□□.□□

When the value is overflow or underflow, the following value is displayed.

Overflow	9999
Underflow	-9999

(2) Frequency response format (in NR3 format)

□.□□□E±□□
□□.□□E±□□
□□□.□E±□□

1 **2**

1 Mantissa	Three or four digits and decimal point
2 Exponent	Two digits

(3) Voltage response format (in NR2 format)

□.□□□

Four digits and decimal point

(4) Current response format (in NR3 format)

□.□□□E±□□

1 **2**

1 Mantissa	Four digits and decimal point
2 Exponent	Two digits

(5) Trigger delay response format (in NR2 format)

□.□□

Mantissa	Three digits and decimal point

(6) Reference value (percentage value), upper and lower limit values (absolute value), scaling correction coefficient for comparator (in NR3 format)

(-)□.□□□□E±□□
(-)□□.□□□E±□□
(-)□□□.□□E±□□
(-)□□□□.□E±□□

1 **2** **3**

1 Sign	When the value is negative, minus (-) is prefixed.
2 Mantissa	Five digits and decimal point
3 Exponent	two digits

5.6 Initialization Items

The following table shows which items are initialized and which not, under various conditions.

Item \ Initialization method	Power on	*RST command	Device clear	*CLS command
GP-IB device address	---	---	---	---
Device specific functions (ranges etc.)	---	●	---	---
Output queue	●	---	●	---
Input buffer	●	---	●	---
Status byte register	●	---	● *1	● *2
Event registers	● *3	---	---	●
Enable registers	●	---	---	---
Current path	●	---	●	---
Headers on/off	●	●	---	---
Terminator for response messages	●	---	---	---
Measurement resister	●	●	---	---

*1 Only the MAV bit (bit 4) is cleared.
*2 All bits except the MAV bit are cleared.
*3 Except the PON bit (bit 7).

Chapter 6
Command Reference for 3511-50

6.1 Command Summary

Standard commands

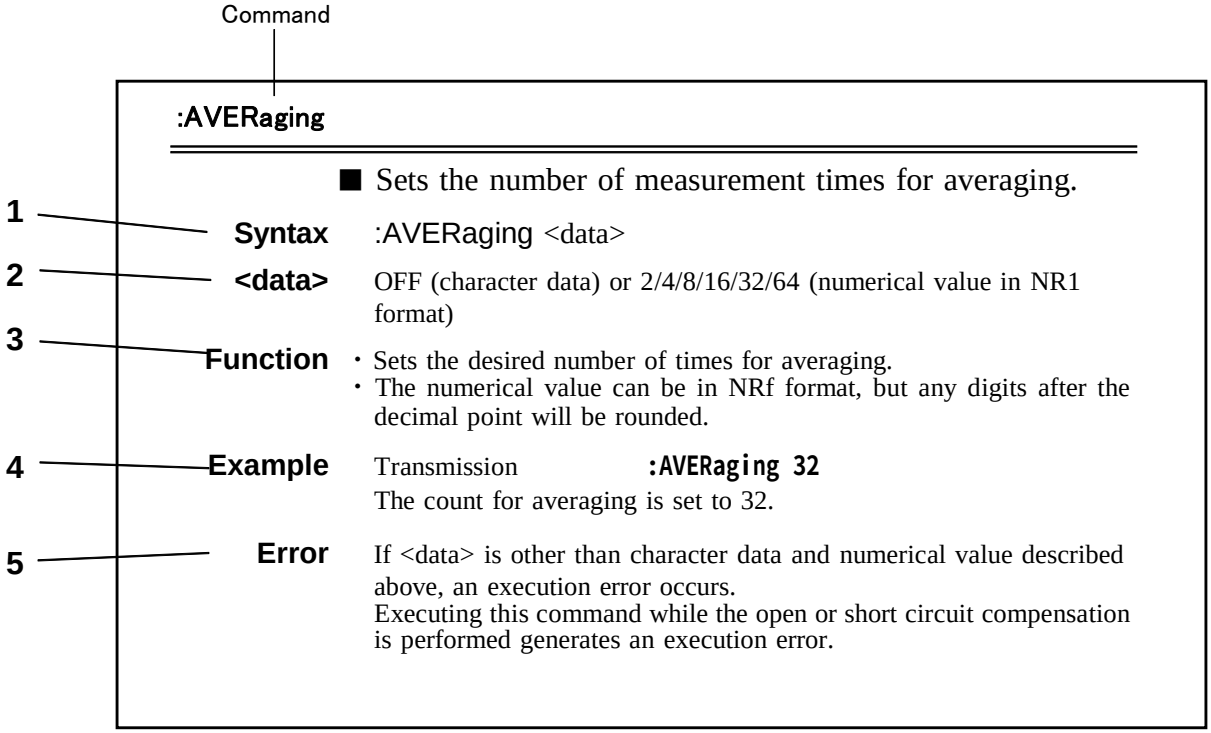
Command	Explanation	Ref page
*CLS	Clers event register.	99
*ESE	Sets standard event status enable register (SESER).	99
*ESE?	Queries standard event status enable register (SESER).	100
*ESR?	Queries standard event status register (SESR).	100
*IDN?	Queries device ID.	101
*OPC	Issues service request (SRQ) after execution completion.	101
*OPC?	Queries execution completion.	101
*RST	Device initialization.	102
*SRE	Sets service request enable register (SRER).	103
*SRE?	Queries service request enable register (SRER).	103
*STB?	Queries status byte register (STB).	104
*TRG	Performs sampling once.	104
*TST?	Queries the result of the self-test.	105
*WAI	Waits until all execution is fully completed.	105

Specific commands

Command	Function	Ref page
■ Beep sound function		
:BEEPer:COMParator	Sets the beep sound for the comparator.	106
:BEEPer:COMParator?	Queries the beep sound for the comparator.	106
:BEEPer:KEY	Sets the beep sound for key input.	107
:BEEPer:KEY?	Queries the beep sound for key input.	107
■ Equivalent circuit function		
:CIRCuit	Sets the equivalent circuit mode.	108
:CIRCuit?	Queries the equivalent circuit mode.	108
:CIRCuit:AUTO	Sets the automatic equivalent circuit mode.	109
:CIRCuit:AUTO?	Queries the automatic equivalent circuit mode.	109
■ Comparator function		
:COMParator	Enables and disables the comparator function.	109
:COMParator?	Queries the comparator function enablement.	110
:COMParator:FLIMit	Sets the lower and upper limit values for the first parameter.	110
:COMParator:FLIMit?	Queries the lower and upper limit values for the first parameter.	111
:COMParator:SLIMit	Sets the lower and upper limit values for the second parameter.	111
:COMParator:SLIMit?	Queries the lower and upper limit values for the second parameter.	112
■ Open and short circuit compensation function		
:CORRection:DATA?	Queries the open and short circuit compensation values.	112
:CORRection:OPEN	Enables and disables the open circuit compensation function.	113
:CORRection:OPEN?	Queries the open circuit compensation function enablement.	113
:CORRection:SHORt	Enables and disables the short circuit compensation function.	114
:CORRection:SHORt?	Queries the short circuit compensation function enablement.	114
■ Event register		
:ESE0	Sets event status enable register 0.	115
:ESE0?	Queries event status enable register 0.	115
:ESE1	Sets event status enable register 1.	116
:ESE1?	Queries event status enable register 1.	116
:ESR0?	Queries event status register 0.	117
:ESR1?	Queries event status register 1.	117
■ Test frequency function		
:FREQuency	Sets the test frequency.	118
:FREQuency?	Queries the test frequency.	118
■ Headers		
:HEADer	Enables and disables headers for the response message.	118
:HEADer?	Queries headers enablement.	119
■ Test signal level function		
:LEVel	Sets the test signal level.	119
:LEVel?	Queries the test signal level.	119

Command	Function	Ref page
■ Panel load function		
:LOAD	Transfers the specified panel number.	120
■ Normal testings		
:MEASure?	Queries the data item.	121
■ Parameter settings		
:PARAmeter	Sets displayed parameters.	122
:PARAmeter?	Queries displayed parameters.	122
■ Test range function		
:RANGe	Sets test range.	123
:RANGe?	Queries test range setting.	124
:RANGe:AUTO	Sets the automatic test ranging.	125
:RANGe:AUTO?	Queries the automatic test range setting.	125
■ Panel saving function		
:SAVE	Saves the test conditions in specified panel number.	126
:SAVE?	Queries the panel number in which data is saved.	126
■ Test speed function		
:SPEEd	Sets the testing speed.	127
:SPEEd?	Queries the testing speed.	127
■ Terminators		
:TRANsmit:TERMinator	Sets the terminator for the response message.	128
:TRANsmit:TERMinator?	Queries the terminator for the response message.	128
■ Trigger function		
:TRIGger	Sets the type of trigger.	129
:TRIGger?	Queries the trigger setting.	129

6.2 Format of Command Explanations



1 Specifies the syntax for the command (a space is represented by " " in this syntax).

2 For a command that has parameters, specifies their format.
- Numeric data values in the following formats
  NR1: integer data
  NR2: fixed point numbers
  NR3: floating point numbers
- Character data

3 Specifies the function of the command.

4 These are simple examples of the use of the command.

5 Specifies what types of error may occur.

For query commands, this time is the time taken when headers are on.

NOTE With the 3511-50, factors related to internal processing can delay the start of message analysis for anywhere from 20 ms to a maximum of 500 ms.

6.3 Particular Commands

*CLS

■ Clears the status byte register and the event registers.

Syntax *CLS

Function Clears all the event registers (SESR, ESR0, ESR1) associated with the bits of the status byte register. Accordingly, also clears the status byte register.
This has no effect upon the output queue, the various enable registers, or bit 4 (the MAV bit) of the status byte register.

Error If the data parameters are set after this command, a command error occurs.

*ESE

■ Sets the standard event status enable register.

Syntax *ESE <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets the standard event status enable register (SESER) to a bit pattern which is used to mask the standard event status register (SESR).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard Event Status Enable Register (SESER)

Example Transmission *ESE 20
Bits 2 and 4 of SESER are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

*ESE?

■ Reads the standard event status enable register.

Syntax *ESE?

Function Returns the setting contents of SESER as a numerical value in NR1 format between 0 and 255.

Example Response
If headers are on *ESE 20
If headers are off 20
Bits 2 and 4 of SESER have been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard event status enable register (SESER)

Error If the response message is longer than 300 bytes, a query error is generated.

*ESR?

■ Queries the contents of the standard event status register (SESR).

Syntax *ESR?

Function Returns the contents of the standard event status register (SESR) as a numerical value in NR1 format between 0 and 255, and then clears standard event status register.
No header is affixed to the response message.

Example Response 32
Bit 5 of SESR has been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Standard event status register (SESR)

Error If the response message is longer than 300 bytes, a query error is generated.

*IDN?

■ Queries manufacturer's name, model name, and software version.

Syntax *IDN?

Function The response consists of the name of the manufacturer of the unit, the model name, and the software version.
No header is affixed to the response message.

First field	Manufacturer's name
Second field	Model name
Third field	Fixed for fifty
Fourth field	Software version

Example Response HIOKI,3511,50,V01.00

Error If the response message is longer than 300 bytes, a query error is generated.

*OPC

■ After all action has been completed during execution, performs an SRQ request.

Syntax *OPC

Function Sets bit 0 (the OPC bit) of the standard event status register (SESR) to 1 at the instant the previous commands which is on the same line with *OPC have been completed.

Error If the data parameters are set after this command, a command error occurs.

*OPC?

■ Queries whether or not all action has been completed during execution.

Syntax *OPC?

Function
- The same as the *OPC command, except in that, at the instant that the previous commands have been completed.
- Returns the response message "1", instead of bit 0 (the OPC bit) of the standard event status register (SESR) being set to 1.
- No header is affixed to the response message.

Error If the response message is longer than 300 bytes, a query error is generated.

*RST

■ Performs device initial setting.

Syntax *RST

Function Resets the 3511-50. The items which are reset are listed below.

Test parameters	Impedance (Z), phase angle (θ)
Test frequency	1 kHz
Test signal level	1 V
Test range	AUTO
Equivalent circuit mode	AUTO
Open circuit compensation	OFF
Short circuit compensation	OFF
Trigger setting	Internal trigger
Test speed setting	NORMAL
Beep sound setting	ON for key input, OFF for comparator
Comparator	Both first and second parameters Upper and lower limit values: OFF
Panel save	All contents clear

Error If the data parameters are set after this command, a command error occurs.

*SRE

■ Sets the service request enable register.

Syntax *SRE <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets a pattern which is used to mask the status byte register (STB) to the service request enable register (SRSR).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- The setting of unused bits (bits 2,3, and 7) and bit 6 are disregarded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	×	ESB	MAV	Unused	Unused	ESE1	ESE0

Service Request Enable Register (SRER)

Example Transmission *SRE 34
Bits 1 and 5 of SRER is set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

*SRE?

■ Reads the service request enable register (SRER).

Syntax *SRE?

Function Returns the set contents of the service request enable register (SRER) as a numerical value in NR1 format between 0 and 255.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	×	ESB	MAV	Unused	Unused	ESE1	ESE0

Service Request Enable Register (SRER)

Example Response
If headers are on *SRE 34
If headers are off 34
Bits 1 and 5 of SRER have been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

*STB?

■ Queries the status byte register.

Syntax *STB?

Function
- Returns the set contents of the status byte register (STB) as a numerical value in NR1 format between 0 and 3, 16 and 19, 32 and 35, 48 and 51, 64 and 67, 80 and 83, 96 and 99, 112 and 115.
- No header is affixed to the response message.

Example Response 16

Bit 4 of STB has been set to 1.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	MSS	ESB	MAV	Unused	Unused	ESE1	ESE0

Status Byte Register (STB)

Error If the response message is longer than 300 bytes, a query error is generated.

*TRG

■ Issues external trigger.

Syntax *TRG

Function In external trigger mode, performs measurement once.

Example Transmission :TRIGger EXTernal;*TRG;:MEASure?

Error Executing this command in internal trigger mode generates an execution error. If the data parameters are set after this command, a command error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

*TST?

■ Requests execution of, and queries the result of, the self test.

Syntax *TST?

Function Performs the self test of the 3511-50, and returns the result thereof as a numerical value in NR1 format between 0 and 3.
No header is affixed to the response message.
Bit 0: A ROM error occurred.
Bit 1: A RAM error occurred.
Bit 2: An I/O error occurred.
Bit 3: An interrupt error occurred.
Bits 4 to 7: Unused

Example Response 6
A RAM error (bit 1) and an I/O error (bit 2) have occurred.

Error If the response message is longer than 300 bytes, a query error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

*WAI

■ Waits until all execution is fully completed.

Syntax *WAI

Function The unit goes into waiting state until the previous operation has been completed.

Note All of the specific commands are in any case sequential commands except the :MEASure? query. Therefore, using this *WAI command has an effect upon only :MEASure? query.

Example Transmission (If the frequency is set to 1 kHz)

When using the *WAI command

```
:FREQuency 120;*WAI;:MEASure?
```

The response for :MEASure? is the test value at frequency of 120 Hz.

When not using the *WAI command

```
:FREQuency 120;:MEASure?
```

The response for :MEASure? is the test value at frequency of 1 kHz.

Error If the data parameters are set after this command, a command error occurs.

6.4 Commands Specific to the 3511-50

:BEEPer:COMParator

■ Sets the beep sound for the comparator.

Syntax :BEEPer:COMParator <data>

<data> IN/NG/OFF (character data)

Function Sets the beep sound produced when the comparator makes decisions.
IN : When the comparator result is within limits, a beep sound is emitted.
NG : When the comparator result is out of limits, a beep sound is emitted.
OFF : No beep sound is emitted.

Example Transmission :BEEPer:COMParator NG
When the value is out of limits, a beep sound is emitted.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:BEEPer:COMParator?

■ Queries the beep sound for the comparator.

Syntax :BEEPer:COMParator?

<data> IN/NG/OFF (character data)

Function Returns the beep sound setting for when the comparator makes decision as character data.
IN : When the comparator result is within limits, a beep sound is emitted.
NG : When the comparator result is out of limits, a beep sound is emitted.
OFF : No beep sound is emitted.

Example Response
If headers are on :BEEPER:COMPARATOR NG
If headers are off NG

Error If the response message is longer than 300 bytes, a query error is generated.

:BEEPer:KEY

■ Enables and disables the beep sound for key input.

Syntax :BEEPer:KEY <data>

<data> ON/OFF (character data)

Function Sets the beep sound produced each time a key is pressed.
ON : A beep sound is emitted.
OFF : No beep sound is emitted.

Example Transmission :BEEPer:KEY ON
When a key is pressed, a beep sound is emitted.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:BEEPer:KEY?

■ Queries the beep sound for key input.

Syntax :BEEPer:KEY?

<data> ON/OFF (character data)

Function Returns the beep sound setting for when a key is pressed as character data.
ON : A beep sound is emitted.
OFF : No beep sound is emitted.

Example Response
If headers are on :BEEPER:KEY ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:CIRCuit

■ Sets the equivalent circuit mode.

Syntax :CIRCuit <data>

<data> SER/PAR (character data)

Function Sets the equivalent circuit mode.
SER : Series equivalent circuit mode
PAR : Parallel equivalent circuit mode

Example Transmission :CIRCuit SER
The series equivalent circuit mode is set.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:CIRCuit?

■ Queries the equivalent circuit mode.

Syntax :BEEPer:KEY?

<data> SER/PAR (character data)

Function Returns the current equivalent circuit mode setting as character data.
SER : Series equivalent circuit mode
PAR : Parallel equivalent circuit mode

Example Response
If headers are on :CIRCUIT SER
If headers are off SER

Error If the response message is longer than 300 bytes, a query error is generated.

:CIRCuit:Auto

■ Sets the automatic equivalent circuit mode.

Syntax :CIRCuit:AUTO <data>

<data> ON/OFF (character data)

Function Switches between automatic and manual setting of equivalent circuit mode.
ON : Switches the automatic setting.
OFF : Switches the manual setting.

Example Transmission ":CIRCuit:AUTO ON"
The equivalent circuit mode is switched to automatic selection (auto-ranging).

Error If <data> is other than character data described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:CIRCuit:Auto?

■ Queries the automatic equivalent circuit mode.

Syntax :CIRCuit:AUTO?

<data> ON/OFF

Function Returns whether the equivalent circuit mode is automatically set as character data.

Example Response
If headers are on ":CIRCuit:AUTO ON"
If headers are off "ON"

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator

■ Enables and disables the comparator function.

Syntax :COMParator <data>

<data> ON/OFF (character data)

Function Turns the comparator function on and off.

Example Transmission :COMParator ON
The comparator function is turned on.

Error If <data> is other than character data described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator?

■ Queries the comparator function enablement.

Syntax COMParator?

<data> ON/OFF (character data)

Function Returns the current enablement state of the comparator function as character data.

Example Response
If headers are on :COMPARATOR ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:FLIMit

■ Sets the lower and upper limit values for the first comparator parameter.

Syntax :COMParator:FLIMit <low>,<high>

<data> <low> (lower limit value) : OFF (character data) or numerical value in NR1 format
<high> (upper limit value): OFF (character data) or numerical value in NR1 format

Function Sets the lower and upper limit values for the first comparator parameter (i.e. the principal measured value) as counts that are displayed on the screen.
The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :COMParator:FLIMit 11234,12345
The lower limit value is set to 11234, and the upper limit value is set to 12345.

Error If <data> is other than character data or numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:FLIMit?

■ Queries the lower and upper limit values for the first comparator parameter.

Syntax :COMParator:FLIMit?

<data> OFF (character data) or numerical value in NR1 format

Function Returns the lower and upper limit values for the first comparator parameter as character data or numerical value in order.

Example Response
If headers are on :COMPARATOR:FLIMIT 11234,12345
If headers are off 11234,12345

Error If the response message is longer than 300 bytes, a query error is generated.

:COMParator:SLIMit

■ Sets the lower and upper limit values for the second comparator parameter.

Syntax COMParator: SLIMit:ABSolute <low>,<high>

<data> <low> (lower limit value) : OFF (character data) or numerical value in NR1 format
<high> (upper limit value): OFF (character data) or numerical value in NR1 format

Function Sets the lower and upper limit values for the second comparator parameter.
The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :COMParator:SLIMit 11234,12345
The lower limit value is set to 11234, and the upper limit value is set to 12345.

Error If <data> is other than character data or numerical value described above, a command error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:COMParator:SLIMit?

■ Queries the lower and upper limit values for the second comparator parameter.

Syntax COMParator:SLIMit?

<data> OFF (character data) or numerical value in NR1 format

Function Returns the lower and upper limit values for the second comparator parameter as character data or numerical value in order.

Example Response
If headers are on :COMPARATOR:SLIMIT 11234,12345
If headers are off 11234,12345

Error If the response message is longer than 300 bytes, a query error occurs.

:CORRection:DATA?

■ Queries the open circuit and short circuit compensation values.

Syntax :CORRection:DATA?

<data> Residual impedance : Numerical value in NR3 format or OFF (character data)
Phase angle : Numerical value in NR2 format or OFF (character data)

Function Returns the open and short circuits compensation values in the current test frequency in the following order.
<Residual impedance of short circuit compensation>
<Phase angle of short circuit compensation>
<Residual impedance of open circuit compensation>
<Phase angle of open circuit compensation>
When the compensation setting is OFF, returns the character data "OFF."

Example Response
If headers are on :CORRECTION:DATA OFF,OFF,247.45E+06,-21.58
If headers are off OFF,OFF,247.45E+06,-21.58
The short circuit compensation for the current test frequency is set to OFF, and open circuit compensation is 247.45 MΩ, -21.58°.

Error If the response message is longer than 300 bytes, a query error is generated.

:CORRection:OPEN

■ Enables and disables the open circuit compensation function.

Syntax :CORRection:OPEN <data>

<data> ON/OFF (character data)

Function Enables and disables the open circuit compensation function.
Specifying "ON" for <data> starts the reading of open circuit compensation data. Upon completion of data reading, the open circuit compensation function is set to ON.

Example Transmission :CORRection:OPEN ON
The open circuit compensation function is set to ON.

Error If <data> is other than character data described above, an execution error occurs.
Executing this command while the comparator function is performed generates an execution error.

:CORRection:OPEN?

■ Queries the open circuit compensation function enablement.

Syntax :CORRection:OPEN?

<data> ON/OFF (character data)

Function Returns the current enablement state of the open circuit compensation function as character data.
ON : The open circuit compensation function has been set to on.
OFF : The open circuit compensation function has been set to off.

Example Response
If headers are on :CORRECTION:OPEN ON
If headers are off ON
The open circuit compensation has been enabled.

Error If the response message is longer than 300 bytes, a query error is generated.

:CORRection:SHORt

■ Enables and disables the short circuit compensation function.

Syntax :CORRection:SHORt <data>

<data> ON/OFF (character data)

Function Enables and disables the short circuit compensation function.

Example Transmission :CORRection:SHORt ON
The short circuit compensation function is enabled.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the comparator function is performed generates an execution error.

:CORRection:SHORt?

■ Queries the short circuit compensation function enablement.

Syntax :CORRection:SHORt?

<data> ON/OFF (character data)

Function Returns the current enablement state of the short circuit compensation function as character data.
ON : The short circuit compensation function has been set to on.
OFF : The short circuit compensation function has been set to off.

Example Response
If headers are on :CORRECTION:SHORT ON
If headers are off ON
The open circuit compensation function has been enabled.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESE0

■ Sets event status enable register 0.

Syntax :ESE0 <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets event status enable register 0 (ESER0) to the bitmask for controlling access to events in event status register 0 (ESR0).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
CEM	SOF	SUF	MOF	MUF	IDX	EOM	Unused

Event Status Enable Register 0 (ESER0)

Example Transmission :ESE0 20
Bits 2 and 4 of ESER0 are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

:ESE0?

■ Reads out event status enable register 0.

Syntax :ESE0?

Function Returns the value of event status enable register 0 (ESER0) as a numerical value in NR1 format between 0 and 255.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
CEM	SOF	SUF	MOF	MUF	IDX	EOM	Unused

Event Status Enable Register 0 (ESER0)

Example Response
If headers are on :ESE0 20
If headers are off 20
Bits 2 and 4 of ESER0 have been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESE1

■ Sets event status enable register 1.

Syntax :ESE1 <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets event status enable register 1 (ESER1) to the bitmask for controlling access to events in event status register 1 (ESR1).
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
- When the power is turned on, the data is reinitialized to zero.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event Status Enable Register 1 (ESER1)

Example Transmission :ESE1 20
Bits 2 and 4 of ESER1 are set to 1.

Error If <data> is other than numerical value described above, an execution error occurs.

:ESE1?

■ Reads out event status enable register 1.

Syntax ESE1?

Function Returns the value of event status enable register 1 (ESER1) as a numerical value in NR1 format between 0 and 255.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event Status Enable Register 1 (ESER1)

Example Response
If headers are on :ESE1 20
If headers are off 20
Bits 2 and 4 of ESER1 have been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESR0?

■ Queries event status register 0.

Syntax ESR0?

Function Returns the value of event status register 0 (ESR0) as a numerical value in NR1 format between 0 and 255, and then clears event status register 0.
No header is prefixed to the response message.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
CEM	SOF	SUF	MOF	MUF	IDX	EOM	Unused

Event status register 0 (ESR0)

Example Response 4
Bit 2 of ESR0 has been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:ESR1?

■ Queries event status register 1.

Syntax ESR1?

Function Returns the value of event status register 1 (ESR1) as a numerical value in NR1 format between 0 and 255, and then clears event status register 1.
No header is prefixed to the response message.

128	64	32	16	8	4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	AND	SLO	SIN	SHI	FLO	FIN	FHI

Event status register 1 (ESR1)

Example Response 64
Bit 6 of ESR1 has been set to 1.

Error If the response message is longer than 300 bytes, a query error is generated.

:FREQuency

■ Sets the test frequency.

Syntax FREQuency <data>

<data> 120/1000 (numerical data in NR1 format)

Function Sets the test frequency.
The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :FREQuency 1000
The test frequency is set to 1 kHz.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:FREQuency?

■ Queries the test frequency.

Syntax :FREQuency?

<data> 120/1000 (numerical data in NR1 format)

Function Returns the current test frequency setting as a numerical value in NR1 format.

Example Response
If headers are on :FREQUENCY 1000
If headers are off 1000
The test frequency has been set to 1 kHz.

Error If the response message is longer than 300 bytes, a query error is generated.

:HEADer

■ Enables and disables headers for the response messages.

Syntax :HEADer <data>

<data> ON/OFF (character data)

Function Sets whether or not the 3511-50 will prefix headers to its response messages.
When powering on, <data> is initially set to ON.

Example Transmission :HEADer ON
Headers are prefixed to response messages.

Error If <data> is other than character data described above, an execution error occurs.

:HEADer?

■ Queries whether or not headers on response messages are enabled.

Syntax :HEADer?

<data> ON/OFF (character data)

Function Returns whether or not headers on response messages are enabled as character data.

Example Response
If headers are on :HEADER ON
If headers are off OFF

Error If the response message is longer than 300 bytes, a query error is generated.

:LEVel

■ Sets the test signal level.

Syntax :LEVel <data>

<data> 1/0.5/0.05 (numerical data in NR2 format)

Function Sets the test signal level.
The numerical value can be in NRf format, but rounding is performed for figures beyond the last valid decimal place.

Example Transmission :LEVel 0.5
The test signal level is set to 500 mV.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:LEVel?

■ Queries the test signal level.

Syntax :LEVel?

<data> 1/0.5/0.05 (numerical data in NR2 format)

Function Returns the current test signal level setting as a numerical value in NR2 format.

Example Response
If headers are on :LEVEL 0.5
If headers are off 0.5
The test signal level has been set to 500 mV.

Error If the response message is longer than 300 bytes, a query error occurs.

:LOAD

■ Loads the test conditions of the specified panel number.

Syntax :LOAD <data>

<data> Numerical data in NR1 format between 1 and 99

Function Sets the panel number which you wish to load.
The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

Example Transmission :LOAD 2
The test conditions which are saved in panel number 2 are loaded.

Error If <data> is other than numerical value described above, an execution error occurs.
If the panel number in which the settings have not been saved is selected, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:MEASure?

■ Queries measured data items.

Syntax MEASure?

Function

- Returns the measured values of test data items as numerical values in NR2 and NR3 format.
- With comparator measurement, the comparator decision results are also returned.
- The first numerical value is the ANDed comparator decision result. If decision results for both the first and second parameters are IN, this value is 1. If either result is LO or HI, the value is 0.
- The numerical values that follow the measured value are the decision results for each parameter. For each decision result, the following numerical values are returned.

Results	Numerical data
LO	-1
IN	0
HI	1

Example 1. During normal testing

When querying the measured values for impedance (Z) and phase angle (θ):

Transmission :PARameter 1;:MEASure?

Response

If headers are on 1,Z 1.2345E+03,0,PHASE 0.28,-1

If headers are off 1,1.2345E+03,0,0.28,-1

2. During comparator testing

Transmission :PARameter1 Z;:PARameter3 PHASe
:COMParator ON
:MEASure?

Response

If headers are on 0,Z 31.981E+03,0,PHASE -88.05,-1

If headers are off 0,31.981E+03,0,-88.05,-1

The decision result of the first parameter is IN, and that of the second parameter is LO.

Error If the response message is longer than 300 bytes, a query error is generated. Executing this command while the open or short circuit compensation is performed generates an execution error.

:PARameter

■ Sets the displayed parameters.

Syntax :PARameter <data>

<data> Numerical data in NR1 format between 1 and 5

Function Sets the displayed parameters.
The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
The numerical value corresponding to the displayed parameters is as follows.

	First parameter	Second parameter
1	Z	θ
2	C	D
3	L	D
4	L	Q
5	R	---

Example Transmission :PARameter 1
The first parameter is set to impedance, and the second parameter is set to phase angle.

Error If <data> is other than numerical value described above, an execution error occurs.

:PARameter?

■ Queries the displayed parameters.

Syntax :PARameter?

<data> Numerical data in NR1 format between 1 and 5

Function Returns the displayed parameters as character data.
The numerical value corresponding to the displayed parameters is as follows.

Example Response
If headers are on :PARAMETER 1
If headers are off 1
The first parameter has been set to impedance, and the second parameter has been set to phase angle.

Error If the response message is longer than 300 bytes, a query error occurs.

:RANGe

■ Sets the test range.

Syntax :RANGe <data>

<data> Numerical data in NR1 format between 1 and 10

Function Sets the test range.
The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
If this command is executed, the setting of the :RANGe:AUTO command is automatically changed to OFF.
If this command is executed when the equivalent circuit mode is set to AUTO, the setting of the equivalent circuit mode (SER/PAR) is automatically changed to the most suitable setting.
The numerical value corresponding to the test range is as follows.

	First parameter				
	Z, R	C		L	
Test frequency / Range number	120 Hz, 1 kHz	120 Hz	1 kHz	120 Hz	1 kHz
1	100 mΩ	145 pF	17 pF	130 μH	15.5 μH
2	1 Ω	1.45 nF	170 pF	1.3 mH	155 μH
3	10 Ω	14.5 nF	1.7 nF	13 mH	1.55 mH
4	100 Ω	145 nF	17 nF	130 mH	15.5 mH
5	1 kΩ	1.45 μF	170 nF	1.3 H	155 mH
6	10 kΩ	14.5 μF	1.7 μF	13 H	1.55 H
7	100 kΩ	145 μF	17 μF	130 H	15.5 H
8	1 MΩ	1.45 mF	170 μF	1.3 kH	155 H
9	10 MΩ	14.5 mF	1.7 mF	13 kH	1.55 kH
10	200 MΩ	1 F	100 mF	200 kH	20 kH

Example Transmission :PARameter 1;:RANGe 5
The test range is set to 1 kΩ.

Error If <data> is other than numerical value described above, an execution error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error.

:RANGe?

■ Queries the test range.

Syntax :RANGe?

<data> Numerical data in NR1 format between 1 and 5

Function Returns the test range setting as numerical value in NR1 format.
The numerical value corresponding to the test range is as follows.

	First parameter				
	Z, R	C		L	
Test frequency / Range number	120 Hz, 1 kHz	120 Hz	1 kHz	120 Hz	1 kHz
1	100 mΩ	145 pF	17 pF	130 μH	15.5 μH
2	1 Ω	1.45 nF	170 pF	1.3 mH	155 μH
3	10 Ω	14.5 nF	1.7 nF	13 mH	1.55 mH
4	100 Ω	145 nF	17 nF	130 mH	15.5 mH
5	1 kΩ	1.45 μF	170 nF	1.3 H	155 mH
6	10 kΩ	14.5 μF	1.7 μF	13 H	1.55 H
7	100 kΩ	145 μF	17 μF	130 H	15.5 H
8	1 MΩ	1.45 mF	170 μF	1.3 kH	155 H
9	10 MΩ	14.5 mF	1.7 mF	13 kH	1.55 kH
10	200 MΩ	1 F	100 mF	200 kH	20 kH

Example Response
If headers are on :RANGE 5
If headers are off 5
The test range has been set to range 5 (1 kΩ when the first parameter is impedance).

Error If the response message is longer than 300 bytes, a query error is generated.

:RANGe:AUTO

■ Enables and disables the auto-range function.

Syntax :RANGe:AUTO <data>

<data> ON/OFF (character data)

Function Switches between automatic and manual setting of test range.
ON : Switches the automatic setting.
OFF : Switches the manual setting.

Example Transmission :RANGe:AUTO ON
The test range is switched to automatic selection (auto-ranging).

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error**.**

:RANGe:AUTO?

■ Queries the autorange function enablement.

Syntax :RANGe:AUTO?

<data> ON/OFF (character data)

Function Returns whether the test range is automatically set as character data.

Example Response
If headers are on :RANGE:AUTO ON
If headers are off ON

Error If the response message is longer than 300 bytes, a query error is generated.

:SAVE

■ Saves the test conditions in specified panel number.

Syntax :SAVE <data>

<data> Numerical data in NR1 format between 1 and 99

Function Saves the test conditions in specified panel number.
The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

Example Transmission :SAVE 3
The test condition is saved in panel number 3.

Error If <data> is other than numerical value described above, a command error occurs.
Executing this command while the open or short circuit compensation is performed generates an execution error**.**

:SAVE?

■ Queries the panel number saved.

Syntax :SAVE? <data>

<data> Numerical data in NR1 format between 0 and 99

Function Returns 1 when the test conditions are saved in specified panel number, and returns 0 when not saved.
The numerical value can be in NRf format, but any digits after the decimal point will be rounded.
The response message has no headers.

Example Transmission :SAVE? 3
Response 1
The test condition is saved in panel number 3.

Error If <data> is other than numerical value described above, an execution error occurs.

:SPEEd

■ Sets the testing speed.

Syntax :SPEEd <data>

<data> FAST/NORMal/SLOW (character data)

Function Sets the testing speed.

Example Transmission :SPEEd NORMal

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:SPEEd?

■ Queries the testing speed.

Syntax :SPEEd?

<data> FAST/NORMAL/SLOW (character data)

Function Returns the setting of testing speed as character data.

Example Response
If headers are on :SPEED NORMAL
If headers are off NORMAL

Error If the response message is longer than 300 bytes, a query error is generated.

:TRANsmit:TERMinator

■ Sets the data terminator for response messages.

Syntax :TRANsmit:TERMinator <data>

<data> Numerical data in NR1 format between 0 and 255

Function
- Sets the data terminator for response messages.
- The numerical value can be in NRf format, but any digits after the decimal point will be rounded.

  If <data> = 0, the terminator is set to LF (line feed) + EOI signal.

  If <data> = 1 through 255, the terminator is set to CR (carriage return) + LF and EOI signal.
- When powering on, <data> is initially set to 0 (LF+EOI).

Example Transmission :TRANsmit:TERMinator 0
The data terminator is set to LF + EOI

Error If <data> is other than numerical value described above, an execution error occurs.

:TRANsmit:TERMinator?

■ Queries the data terminator for response messages.

Syntax :TRANsmit:TERMinator?

Function Returns the data terminator for response messages as a numerical value (0 or 1) in NR1 format.

If <data> = 0, the terminator is LF and EOI signal.

If <data> = 1, the terminator is CR + LF and EOI signal

Example Response

If headers are on :TRANSMIT:TERMINATOR 0

If headers are off 0

Error If the response message is longer than 300 bytes, a query error is generated.

:TRIGger

■ Sets the type of trigger.

Syntax :TRIGger <data>

<data> INTernal/EXTernal (character data)

Function Sets the type of trigger.
INTernal : Internal trigger mode
EXTernal : External trigger mode

Example Transmission :TRIGger INTernal
The trigger mode is set to internal trigger.

Error If <data> is other than character data described above, an execution error occurs. Executing this command while the open or short circuit compensation is performed generates an execution error.

:TRIGger?

■ Queries the trigger setting.

Syntax TRIGger?

<data> INTERNAL/EXTERNAL (character data)

Function Returns the trigger setting as character data.

Example Response
If headers are on :TRIGGER INTERNAL
If headers are off INTERNAL
The trigger mode has been set to internal triggering.

Error If the response message is longer than 300 bytes, a query error is generated.

Chapter 7
Sample Programs

The following sample programs are all written for the Hewlett-Packard HP9000 Series 300, using BASIC 4.0.
All commands in the sample programs are used in the short form.

(1) Open- and short-circuit compensation

Summary This program carries out open- and short-circuit compensation on the 3532-50/3522-50.

Program List

```
10    DIM A$[40]
20    OUTPUT 701;":HEAD OFF"
30    OUTPUT 701;"*CLS"
40    Open1:      !
50   INPUT "Prepare unit for open circuit compensation, then press Enter",A$
60   Open2:      !
70    PRINT "Collecting open circuit compensation data"
80    OUTPUT 701;":CORR:OPEN ALL"
90    OUTPUT 701;":ESR0?"
100   ENTER 701;A
110   IF BINAND(A,1) THEN
120     GOTO 150
130     ELSE
140     GOTO 90
150     END IF
160   OUTPUT 701;"*ESR?"
170   ENTER 701;A
180   IF BINAND(A,8) THEN
190     PRINT "Open circuit compensation failed"
200     GOTO Open1
210     ELSE
220     GOTO Short1
230     END IF
240  Short1: !
250   INPUT "Prepare unit for short circuit compensation, then press Enter",A$
260  Short2: !
270   PRINT "Collecting short circuit compensation data"
280   OUTPUT 701;":CORR:SHOR ALL"
290   OUTPUT 701;":ESR0?"
300   ENTER 701;A
310   IF BINAND(A,1) THEN
320     GOTO 350
330     ELSE
340     GOTO 290
350     END IF
360   OUTPUT 701;"*ESR?"
370   ENTER 701;A
380   IF BINAND(A,8) THEN
390     PRINT "Short circuit compensation failed"
400     GOTO Short1
410     ELSE
420     GOTO Last
430     END IF
440  Last: !
450   PRINT "Compensation operations completed"
460   END
```

Program comments

Line	Comments
30	Clear bits of each event registers.
80	Execute open circuit compensation (at all the test frequencies).
90-150	Wait until the bit for the compensation completed is 1.
160-230	When the valid data cannot be obtained, the bit 3 of SESR is 1.
280	Execute short circuit compensation (at all the test frequencies).

Summary

This program carries out open- and short-circuit compensation on the 3511-50.

Program List

```
10   DIM A$[40]
20    OUTPUT 701;":HEAD OFF"
30    OUTPUT 701;"*CLS"
40   Open1:      !
50    INPUT "Prepare unit for open circuit compensation, then press Exter",A$
60   Open2:      !
70    PRINT "Collecting open circuit compensation data"
80    OUTPUT 701;":CORR:OPEN ON"
90    OUTPUT 701;":ESR0?"
100  ENTER 701;A
110  IF BINAND(A,128) THEN
120     GOTO 150
130     ELSE
140       OTO 90
150  END IF
160  OUTPUT 701;"*ESR?"
170  ENTER 701;A
180  IF BINAND(A,8) THEN
190     PRINT "Open circuit compensation faled"
200   OTO Open1
210   ELSE
220     GOTO Short1
230     END IF
240  Short1:    !
250   INPUT "Prepare unit for short circuit compensation, then press Exter",A$
260  Short2:    !
270   PRINT "Collecting short circuit compensation data"
280   OUTPUT 701;":CORR:SHOR ON"
290   OUTPUT 701;":ESR0?"
300   ENTER 701;A
310   IF BINAND(A,128) THEN
320      GOTO 350
330      ELSE
340      GOTO 290
350   END IF
360   OUTPUT 701;"*ESR?"
370   ENTER 701;A
380   IF BINAND(A,8) THEN
390      PRINT "Open circuit compensation faled"
400      GOTO Short1
410      ELSE
420      GOTO Last
430      END IF
440  Last:   !
450   PRINT "Compensation operation completed"
460   END
```

Program comments

Line	Comments
30	Clear bits of each event registers.
80	Execute open circuit compensation (at all the test frequencies).
90-150	Wait until the bit for the compensation completed is 1.
160-230	When the valid data cannot be obtained, the bit 3 of SESR is 1.
280	Execute short circuit compensation (at all the test frequencies).

(2) Basic settings and testing

Summary

This program selects the test conditions for measurement on the 3532-50/3522-50.

- It carries out a single test measurement, and displays the result on the screen.
- It also displays the monitored voltage and current values on the screen.

Program List

```
10  DIM A$[200],B$[40]
20  OUTPUT 701;":TRIG EXT"
30  OUTPUT 701;":AVER 8"
40  OUTPUT 701;":FREQ 1.234E3"
50  OUTPUT 701;":RANG:AUTO ON"
60  OUTPUT 701;":LEV V"
70  OUTPUT 701;":LEV:VOLT 1.00"
80  OUTPUT 701;":TRIG:DELA 0.02"
90  OUTPUT 701;":SPEE SLOW"
100 OUTPUT 701;":MEAS:ITEM 5,18"
110 OUTPUT 701;"*TRG;:MEAS?"
120 ENTER 701;A$
130 OUTPUT 701;":DISP:MONI?"
140 ENTER 701;B$
150 PRINT A$
160 PRINT B$
170 END
```

Sample output

```
Z 61.798E+00;PHASE -6.43;RS 61.411E+00;X 6.8997E+00
:DISPLAY:MONITOR 0.90,14.59E-03
```

Program comments

Line	Comments
20	Select external trigger mode.
30	Set the count for averaging to 8.
40	Set the test frequency to 1.234 kHz.
50	Enable auto-ranging.
60	Select voltage measurement.
70	Set the test voltage to 1V.
80	Set the trigger delay time to 20 ms.
90	Set the testing speed to SLOW.
100	Make a setting for Z (impedance), θ (phase angle), Rs (series equivalent resistance), X (reactance) to return.
110	Query the sampling data and measurement value.
130	Query the monitored value for the test signal.
150-160	Display the test results.

Summary

This program selects the test conditions for measurement on the 3511-50.

- It carries out a single test measurement, and displays the result on the screen.

Program List

```
10   DIM A$[200]
20   OUTPUT 701;":TRIG EXT"
30   OUTPUT 701;":PAR 1"
40   OUTPUT 701;":FREQ 120"
50   OUTPUT 701;":RANG:AUTO ON"
60   OUTPUT 701;":LEV 1"
70   OUTPUT 701;":SPEE SLOW"
80   OUTPUT 701;"*TRG;:MEAS?"
90   ENTER 701;A$
120  PRINT A$
140  END
```

Sample output

```
Z 1.000E+03,PHASE 0.26
```

Program comments

Line	Comments
20	Select external trigger mode.
30	Set the display parameter to Z-θ.
40	Set the test frequency to 120Hz.
50	Set to AUTO range.
60	Set the test voltage to 1 V.
70	Set the test speed to SLOW.
80	Query the sampling data and measurement value.
120	Display the test results.

(3) Saving the test settings using the panel save function

Summary This program makes the settings for the 3532-50/3522-50 and saves the settings to the panel number 1 as "TEST1".

Program List

```
10  OUTPUT 701;":FREQ 100E3"
20  OUTPUT 701;":LEV V"
30  OUTPUT 701;":LEV:VOLT 1.00;CVOLT 0.50;CCURR 5.00E-3"
40  OUTPUT 701;":LIM OFF"
50  OUTPUT 701;"LIM:CURR 15.00E-3;VOLT 3.00"
60  OUTPUT 701;":RANG:AUTO ON"
70  OUTPUT 701;":TRIG INT"
80  OUTPUT 701;":TRIG:DELA 0.02"
90  OUTPUT 701;":AVER 2"
100 OUTPUT 701;":SPEE SLOW"
110 OUTPUT 701;":BEEP:KEY ON;COMP NG"
120 OUTPUT 701;":PAR1 Z;:PAR2 PHAS"
130 OUTPUT 701;":PAR3 CP;:PAR4 D"
140 OUTPUT 701;":SAVE 1,TEST1"
150 END
```

If you want to measure with this settings from next time, execute with the following data:

```
OUTPUT 701;":LOAD 1"
```

Program comments

Line	Comments
20	Select the voltage test signal level.
30	Make the following settings using the current path. V (open circuit voltage) 1 V CV (constant voltage) 0.5 V (value setting only) CC (constant current) 5 mV (value setting only)
50, 110	Make a setting using the current path.
120-130	Set displayed parameters.
140	Save the settings to the panel number 1.

Summary This program makes the settings for the 3511-50 and saves the settings to the panel number.

Program List

```
10 OUTPUT 701;":PAR 1"
20   OUTPUT 701;":FREQ 120"
30   OUTPUT 701;":LEV 1"
40   OUTPUT 701;":RANG:AUTO ON"
50   OUTPUT 701;":TRIG INT"
60   OUTPUT 701;":SPEE SLOW"
70   OUTPUT 701;":BEEP:KEY ON;COMP NG"
80   OUTPUT 701;":SAVE 1"
90   END
```

Program comments

Line	Comments
10	Set the display parameter to Z-θ.
20	Set the test frequency to 120Hz.
30	Set the test voltage to 1 V.
40	Set to AUTO range.
50	Set the trigger to INT.
60	Set the test speed to SLOW.
70	Enables the beep sound by key input. The beep sounds when the comparator result is NG.
80	Save the settings to the panel number 1.

(4) Carrying out comparator testing

Summary

This program first makes the comparator settings for the 3532-50/3522-50.

- Its uses as SRQ interrupt handling routine to count the occurrences of samples outside the comparator limits (either "Hi" or "Lo").
- At the end of testing, it displays the numbers of the samples which were outside the comparator limits.

Program List

```
10  OUTPUT 701;":PAR1 CP;:PAR3 D"
20  OUTPUT 701;":TRIG EXT"
30  OUTPUT 701;":LEV CV;:LEV:CVOLT 1.00"
40  OUTPUT 701;":FREQ 1E3"
50  OUTPUT 701;":RANG:AUTO ON"
60  OUTPUT 701;":COMP:FLIM:MODE ABS;ABS 4.5560E-9,4.5565E-9"
70  OUTPUT 701;":COMP:SLIM:MODE PER;PER 1.0000,OFF,OFF"
80  OUTPUT 701;":HEAD ON"
90  OUTPUT 701;":ESE1 5;*SRE 2"
100 ON INTR 7 GOSUB Interrupt
110 C=1
120 H=0
130 L=0
140 INPUT "Number of samples to measure:",X
150 OPTION BASE 1
160 DIM A$(100)[40]
170 DIM Bh(100)
180 DIM Bl(100)
190 DIM F$[40]
200 OUTPUT 701;":COMP ON"
210 OUTPUT 701;"*CLS"
220 ENABLE INTR 7;2
230 IF C>=X+1 THEN
240 GOTO 330
250 ELSE
260 GOTO 270
270 END IF
280 OUTPUT 701;"*TRG;:MEAS?"
290 ENTER 701;F$
300 A$(C)=F$
310 C=C+1
320 GOTO 220
330 PRINT "Number of samples high:";H;"- sample nos.:";"Sample ";
340 FOR Ih=1 TO H
350 PRINT Bh(Ih);
360 NEXT Ih
370 PRINT ""
380 PRINT "Number of samples low:";L;"- sample nos.:";"Sample ";
390 FOR Il=1 TO L
400 PRINT Bl(Il);
410 NEXT Il
420 PRINT ""
430 FOR K=1 TO X
440 PRINT "Sample ";K;A$(K)
450 NEXT K
460 OUTPUT 701;":ESE1 0;*SRE 0"
470 OUTPUT 701;":COMP OFF"
480 GOTO Meas_end
490 Interrupt:  !
500 P=SPOLL(701)
510 OUTPUT 701;":ESR1?"
```

```
520  ENTER 701;G
530  IF BINAND(G,1) THEN
540  H=H+1
550  Bh(H)=C
560  GOTO 620
570  ELSE
580  L=L+1
590  Bl(L)=C
600  GOTO 620
610  END IF
620  DISABLE INTR 7
630  OUTPUT 701;"*CLS"
640  RETURN
650  Meas_end:  !
660  END
```

Sample output

```
Number of samples to measure: 5 (key input)
Number of samples high: 2 - sample nos.: 2 5
Number of samples high: 0 - sample nos.:
Sample 1  0;CP 3.8686E-04;0;D 0.34823;0
Sample 2  1;CP 3.8704E-04;1;D 0.34823;0
Sample 3  0;CP 3.8681E-04;0;D 0.34843;0
Sample 4  0;CP 3.8694E-04;0;D 0.34804;0
Sample 5  1;CP 3.8698E-04;1;D 0.34823;0
```

Program comments

Line	Comments
10	Set the first parameter to CP, and the second parameter to D.
60	Set the first parameter for the comparator function as absolute value. (the current path is used in this settings)
70	Set the second parameter for the comparator function as percentage value. Since both settings of lower and upper limits are OFF, the comparator result is always IN (within limits). Input appropriate reference value. (the current path is also used in this settings)
90	Set SRQ generation conditions (an SRQ interrupt is produced whether comparator result is "HI" or "LO").
100	Attach interrupt handler to SRQ interrupt.
110-190	Initialize variables
200	Switch on comparator function
210	Clear each event registers
220-320	Measurement loop
330-450	Display comparator results
490-640	SRQ interrupt
490-640	When value is high, ESR1 bit 0 is set to 1,and when value is low, ESR1 bit 2 is set to 1.

Summary

This program first makes the comparator settings for the 3511-50.

- At the end of testing, it displays the numbers of the samples which were outside the comparator limits.

Program List

```
10    OUTPUT 701;":PAR 2"
20    OUTPUT 701;":TRIG EXT"
30    OUTPUT 701;":LEV 1"
40    OUTPUT 701;":FREQ 120"
50    OUTPUT 701;":RANG 5"
60    OUTPUT 701;":COMP:FLIM 9000,11000"
70    OUTPUT 701;":COMP:SLIM OFF,OFF"
80    OUTPUT 701;":HEAD ON"
90    OUTPUT 701;":ESE1 5;*SRE 2"
100   ON INTR 7 GOSUB Interrupt
110   C=1
120   H=0
130   L=0
140   INPUT "Number of samples to measure:",X
150   OPTION BASE 1
160   DIM A$(100)[40]
170   DIM Bh(100)
180   DIM Bl(100)
190   DIM F$[40]
200   OUTPUT 701;":COMP ON"
210   OUTPUT 701;"*CLS"
220   ENABLE INTR 7;2
230   IF C>=X+1 THEN
240      GOTO 330
250      ELSE
260      GOTO 270
270   END IF
280   OUTPUT 701;"*TRG;:MEAS?"
290   ENTER 701;F$
300   A$(C)=F$
310   C=C+1
320   GOTO 220
330   PRINT "Number of samples high:";H;"- sample nos.:";"Sample ";
340   FOR Ih=1 TO H
350      PRINT Bh(Ih);
360   NEXT Ih
370   PRINT ""
380   PRINT "Number of samples low:";L;"- sample nos.:";"Sample";
390   FOR Il=1 TO L
400     PRINT Bl(Il);
410   NEXT Il
420   PRINT ""
430   FOR K=1 TO X
440      PRINT "No";K;A$(K)
450   NEXT K
460   OUTPUT 701;":ESE1 0;*SRE 0"
470   OUTPUT 701;":COMP OFF"
480   GOTO Meas_end
490 Interrupt:  !
500   P=SPOLL(701)
510   OUTPUT 701;":ESR1?"
520   ENTER 701;G
530   IF BINAND(G,1) THEN
540      H=H+1
550      Bh(H)=C
```

```
560       GOTO 620
570       ELSE
580       L=L+1
590       Bl(L)=C
600       GOTO 620
610     END IF
620     DISABLE INTR 7
630     OUTPUT 701;"*CLS"
640     RETURN
650   Meas_end:  !
660     END
```

Sample output

```
Number of samples to measure: 5 (key input)
Number of samples high: 2 - sample nos.: 2 5
Number of samples low: 0 -sample nos.:
Sample 1   0;C 3.8686E-04;0;D 0.34823;0
Sample 2   1;C 3.8704E-04;1;D 0.34823;0
Sample 3   0;C 3.8681E-04;0;D 0.34843;0
Sample 4   0;C 3.8694E-04;0;D 0.34804;0
Sample 5   1;C 3.8698E-04;1;D 0.34823;0
```

Program comments

Line	Comments
10	Set the display parameter to C-D.
20	Set the trigger to EXT.
30	Set the test voltage to 1 V.
40	Set the test frequency to 120Hz.
50	Set the test range to range 5(1.45 μF).
60	Set the lower limit value for C to 0.9000 μF and upper limit value to 1.1000 μF.
70	Set both limits of lower and upper for D to OFF.
90	Set SRQ generation conditions (an SRQ interrupt is produced whether comparator result is "HI" or LO").
100	Attach interrupt handler to SRQ interrupt.
110-190	initialize variables
200	Enable the comparator function.
220-320	Measurement loop
330-450	Display comparator results
490-640	SRQ interrupt when value is high, ESR1 bit 0 is set to 1,and when value is low,ESR1 bit 2 is set to 1.

(5) Frequency characteristics measurement for impedance for the 3532-50/3522-50

Summary

This program measures the impedance frequency characteristics at various frequencies.

- It outputs the test result to a file.
- The number of test point : 66
- 45 to 95 Hz: 11 points 5 Hz steps, 100 to 950 Hz: 18 points 50 Hz steps
- 1 to 9.5 kHz: 18 points 500 Hz steps, 10 to 95 kHz: 18 points 5 kHz steps
- 100 kHz

Program List

```
10  OPTION BASE 1
20  DIM Mv$(66)[15],Fv$(66)[15]
30  Freq=45
40  Ex=1
50  I=1
60  OUTPUT 701;":TRIG EXT"
70  OUTPUT 701;":LEV V;:LEV:VOLT 1.00"
80  OUTPUT 701;":MEAS:ITEM 1,0"
90  OUTPUT 701;":HEAD OFF"
100 Meas: !
110 Fv$(I)=VAL$(Freq*Ex)
120 OUTPUT 701;":FREQ "&Fv$(I)
130 FOR J=1 TO 5000
140 NEXT J
150 OUTPUT 701;"*TRG;:MEAS?"
160 ENTER 701;Mv$(I)
170 I=I+1
180 IF I>66 THEN GOTO Meas_end
190 Freq=Freq+5
200 IF Freq=100 THEN
210 Freq=10
220 Ex=Ex*10
230 END IF
240 GOTO Meas
250 Meas_end: !
260 CREATE ASCII "FILE1",100
270 ASSIGN @Path TO "FILE1"
280 FOR I=1 TO 66
290 OUTPUT @Path;Fv$(I)&","&Mv$(I)
300 NEXT I
310 ASSIGN @Path TO *
320 END
```

Program comments

Line	Comments
10-50	Initialize variables
70	Set the measured voltage to 1V.
80	Make a setting to response the parameter for Z by using the :MEAS? query.
110-120	Transmit character data by transforming the numerical values.
130-140	Wait for a certain stabilization time period.
150	Query the sampling data and measurement value.
190-230	Increase the frequency.
260-310	Save the test frequency and test results to the file "FILE1"

Chapter 8
Device Compliance Statement

The following information relates to compliance with the IEEE 488.2 standard.

(1) IEEE 488.1 interface functions

These are detailed in Section 2.2, "Specifications."

(2) Operation with a device address other than 0 through 30

The bus is disabled.

(3) Timing of changed device address recognition

A change of address is recognized immediately after powering on.

(4) Device settings at power on, including all commands which further restrict the initial setting.

The status information is cleared, and all other items are preserved. However, the header on/off setting, and response message separator and terminator are all reinitialized.

(5) List of message exchange options

(a) Input buffer capacity and operation:
These are detailed in Section 4.10, "Input Buffer."

(b) Queries to which multiple response message units are returned:

:COMParator:FLIMit:ABSolute?	2
:COMParator:FLIMit:PERcent?	3
:COMParator:SLIMit:ABSolute?	2
:COMParator:SLIMit:PERcent?	3
:CORRection:data?	4
:DISPlay:MONItor?	2
:MEASure:ITEM?	2
:MEASure?	1 to 14
:SCALe:FVALue?	2
:SCALe:SVALue?	2

(c) Queries producing responses as syntax checking is performed:
All queries produce responses when syntax checking is performed.

(d) Whether any queries produce responses when read:
There are no queries which produce response messages at the instant they are read in by the controller.

(e) Whether any commands are coupled:
There are no relevant commands.

(6) Summary of functional elements for use when constructing device specific commands, and whether compound commands or program headers can be used:

Program message, program message terminator, program message unit, program message unit separator, command message unit, query message unit, command program header, query program header, program data, character program data, and decimal program data.
Compound commands and program headers can be used.

(7) Buffer capacity limitations for block data

Block data is not used.

(8) Summary of program data elements used in expressions, and deepest nesting level allowable in sub-expressions, including syntax restrictions imposed by the device.

Sub-expressions are not used. Character data and decimal data are the only program data elements used.

(9) Response syntax for queries

Response syntax is detailed in Chapter 5, "Command Reference for 3532/3522" and Chapter 6, "Command Reference for 3511."

(10) Transmission congestion relating to device-to-device messages which do not conform to the general principles for basic response messages

There are no device to device messages.

(11) Response capacity for block data

Block data does not appear in responses.

(12) Summary of standard commands and queries used

This appears in Chapter 5, "Command Reference for 3532/3522" and Chapter 6, "Command Reference for 3511."

(13) Device state after a calibration query has been completed without any problem

The "*CAL?" query is not used.

(14) When using the "*DDT" command, the maximum length of block used in a trigger macro definition

The "*DDT" command is not used.

(15) When a macro command is being executed, the maximum length of macro label, the maximum length of block for defining a macro, and how echoing is managed when expanding a macro

Macros are not used.

(16) For queries related to identification, explanation of the response to the "*IDN?" query

This is detailed in Sections 5.3 and 6.3, "Standard Commands."

(17) Capacity of the user data storage area reserved for when the "*PUD" command and the "*PUD?" query are being executed

The "*PUD" command and the "*PUD?" query are not used. Further, there is no user data storage area.

(18) Resources when the "*RDT" command and the "*RDT?" query are being used

The "*RDT" command and the "*RDT?" query are not used.

(19) Conditions which are influenced when "*RST", "*LRN?", "*RCL?", and "*SAV" are used

"*LRN?", "*RCL?", and "*SAV" are not used. The"*RST" command returns the unit to its initial state. (Refer to Sections 5.3 and 6.3, "Standard Commands", and Section 5.6, "Initialization Items".)

(20) Scope of the self-testing executed as a result of the "*TST?" query

This is detailed in Sections 5.3 and 6.3, "Standard Commands."

(21) Additional organization of the status data used in a device status report

This is detailed in Section 4.13, "Event Registers."

(22) Whether commands are overlap or sequential type

All the commands except :MEASure? command are sequential commands.

(23) Criterion relating to the functions required at the instant that the termination message is produced, as a response to each command

Termination occurs when the command has been parsed.

Chapter 9
Troubleshooting

If the GP-IB appears to be malfunctioning, refer to the information below before calling for servicing.

Symptom	Cause / Treatment
The GP-IB has stopped working completely.	Are the cables properly connected?
	Is the device address for the 3532-50/3522-50/3511-50 set correctly?
	Does some other device have the same device address?
	Are all the devices powered on?
After transmission on the GP-IB bus, the keys on the 3532-50/3522-50/3511-50 freeze up and have no effect.	Press the LOCAL key on the front panel of the 3532-50/3522-50/3511-50 to release the remote state.
	Has a LLO (Local Lock-Out) command been transmitted? Transmit a GTL command to put the 3532-50/3522-50/3511-50 into the local state.
When attempting to read data using a HP-Basic ENTER statement, the GP-IB bus hangs.	Be sure to transmit one query before each ENTER statement.
	Have any of these transmitted queries resulted in an error?
Although a command has been transmitted, nothing has happened.	Using the "∗ESR?" query, inspect the standard event status register, and check what type of error has occurred.
Sending several queries, produces only one response.	Has an error occurred?
	Send the queries one at a time, and read the responses individually. When you want to read them in all at once, try doing so by putting them all on one line separated by the message separator character.
	Have you used the "∗IDN?" query?

Symptom	Cause / Treatment
Sometimes service requests are not generated.	Have the service request enable register and the various event status enable registers been correctly set?
	Clear all the event registers at the end of SRQ processing subroutines by using the "∗CLS" command. If an event bit is not cleared, no service request will be generated for that event.
The response message to a query differs from the display on the front panel of the 3532-50/3522-50/3511-50.	Due to the response message being produced at the instant that the 3532-50/3522-50/3511-50 receives the query, there is a possibility that it may not agree with the display at the instant that the controller reads it in.
Beeper sounds when *TRG command is transferred.	Is the trigger is set to internal trigger?
	∗TRG command can be used for the external trigger setting. For the internal trigger setting, an execution error occurs.

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Warranty Certificate

HIOKI

Model	Serial number	Warranty period Three (3) years from date of purchase (___ / ___)

Customer name: _____

Customer address: _____

Important

- Please retain this warranty certificate. Duplicates cannot be reissued.
- Complete the certificate with the model number, serial number, and date of purchase, along with your name and address. The personal information you provide on this form will only be used to provide repair service and information about Hioki products and services.

This document certifies that the product has been inspected and verified to conform to Hioki's standards.
Please contact the place of purchase in the event of a malfunction and provide this document, in which case Hioki will repair or replace the product subject to the warranty terms described below.

Warranty terms

1. The product is guaranteed to operate properly during the warranty period (three [3] years from the date of purchase). If the date of purchase is unknown, the warranty period is defined as three (3) years from the date (month and year) of manufacture (as indicated by the first four digits of the serial number in YYMM format).
2. If the product came with an AC adapter, the adapter is warrantied for one (1) year from the date of purchase.
3. The accuracy of measured values and other data generated by the product is guaranteed as described in the product specifications.
4. In the event that the product or AC adapter malfunctions during its respective warranty period due to a defect of workmanship or materials, Hioki will repair or replace the product or AC adapter free of charge.
5. The following malfunctions and issues are not covered by the warranty and as such are not subject to free repair or replacement:
   -1. Malfunctions or damage of consumables, parts with a defined service life, etc.
   -2. Malfunctions or damage of connectors, cables, etc.
   -3. Malfunctions or damage caused by shipment, dropping, relocation, etc., after purchase of the product
   -4. Malfunctions or damage caused by inappropriate handling that violates information found in the instruction manual or on precautionary labeling on the product itself
   -5. Malfunctions or damage caused by a failure to perform maintenance or inspections as required by law or recommended in the instruction manual
   -6. Malfunctions or damage caused by fire, storms or flooding, earthquakes, lightning, power anomalies (involving voltage, frequency, etc.), war or unrest, contamination with radiation, or other acts of God
   -7. Damage that is limited to the product's appearance (cosmetic blemishes, deformation of enclosure shape, fading of color, etc.)
   -8. Other malfunctions or damage for which Hioki is not responsible
6. The warranty will be considered invalidated in the following circumstances, in which case Hioki will be unable to perform service such as repair or calibration:
   -1. If the product has been repaired or modified by a company, entity, or individual other than Hioki
   -2. If the product has been embedded in another piece of equipment for use in a special application (aerospace, nuclear power, medical use, vehicle control, etc.) without Hioki's having received prior notice
7. If you experience a loss caused by use of the product and Hioki determines that it is responsible for the underlying issue, Hioki will provide compensation in an amount not to exceed the purchase price, with the following exceptions:
   -1. Secondary damage arising from damage to a measured device or component that was caused by use of the product
   -2. Damage arising from measurement results provided by the product
   -3. Damage to a device other than the product that was sustained when connecting the device to the product (including via network connections)
8. Hioki reserves the right to decline to perform repair, calibration, or other service for products for which a certain amount of time has passed since their manufacture, products whose parts have been discontinued, and products that cannot be repaired due to unforeseen circumstances.

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HIOKI

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