HIOKI

INSTRUCTION MANUAL

3532-50
3522-50
LCR HiTESTER

9593-01

RS-232C INTERFACE

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing the HIOKI "9593-01 RS-232C INTERFACE" for the 3532-50 and 3522-50 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

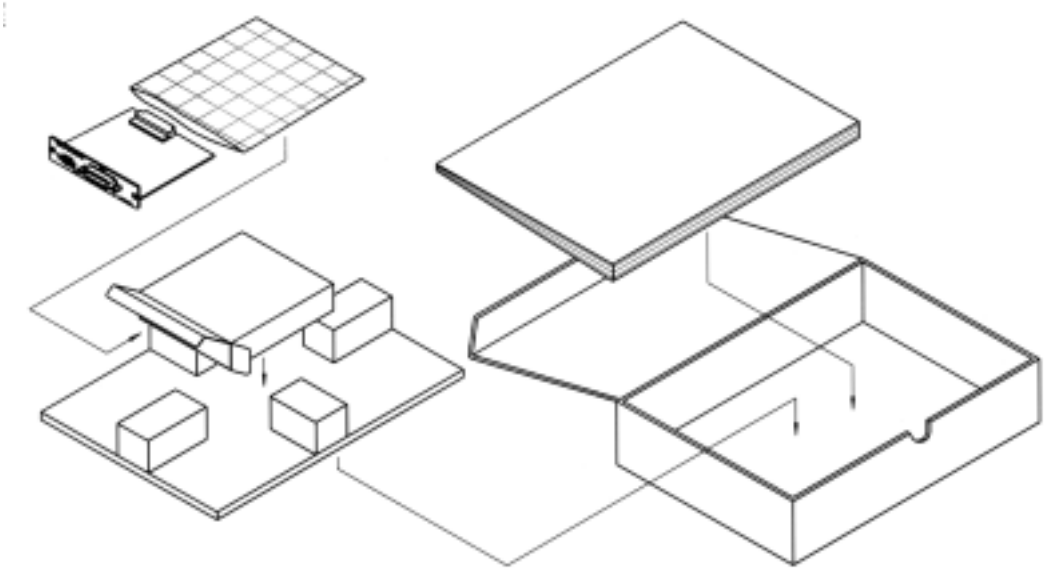
When you receive the product, inspect it carefully to ensure that no damage occurred during shipping.
In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

(1) 9593-01 RS-232C 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 communication condition of the 3532-50/3522-50 while using it, you should immediately turn the power off and on again. If you do not do so, the communication conditions will not be changed to the new one.

(2) Always be sure to secu
re the RS-232C cable to the 9593-01 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 units.

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

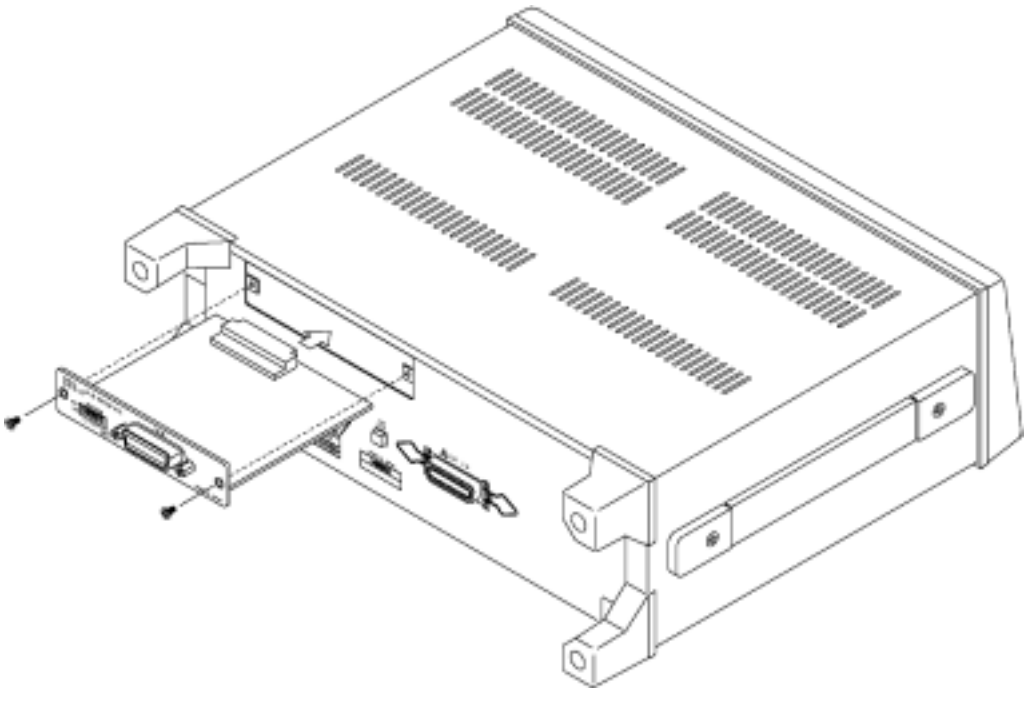
1.4 Installing the RS-232C Interface

⚠ 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.

The space for fitting the 9593-01 RS-232C INTERFACE in the rear panel of the 3532-50/3522-50 are covered with a blanking plate. Follow these three steps to install the 9593-01 interface:

1. Remove the fixing screws, and take off the blanking plate.
2. Insert the 9593-01 RS-232C INTERFACE into the exposed slot in the rear of the unit in the figure below.
3. Push the 9593-01 firmly into place, and fix with the screws removed in step 1.



Chapter 2
Overview

2.1 Introduction to the 9593-01 RS-232C INTERFACE

By connecting the 9593-01 RS-232C INTERFACE to the 3532-50 or the 3522-50 LCR HiTESTER, it is possible to control all the functions of the main unit (except for powering on and off) via the RS-232C bus.

2.2 Features

(1) All of the functions of the 3532-50, 3522-50 main units, except for powering on and off, can be controlled via the RS-232C interface.

(2) The beeper sound can be turned on and off.

(3) The unit can be reset.

2.3 Specifications

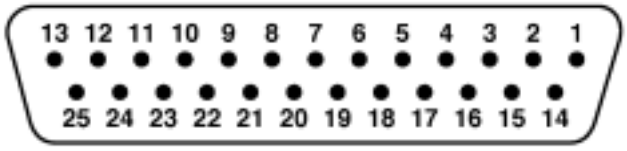
Transfer system	Start-stop synchronization
Baud rate	2400, 4800, 9600, 19200 bps
Data length	7 or 8 bits
Parity	Even, odd, or none
Stop bits	1 or 2 bits
Delimiter	CR+LF, CR
Handshake	hardware

Selected by DIP switch.

Electrical characteristic

Input voltage levels	+5 V to +15 V -15 V to -5 V	ON OFF
Output voltage levels (load impedance 3 kΩ to 7 kΩ)	+5 V to +9 V -9 V to -5 V	ON OFF

Connector



RS-232C Interface Connector Pin Assignments
(D-subminiature 25-pin female)

NOTE The connector on the 9593-01 is for terminal (DTE).

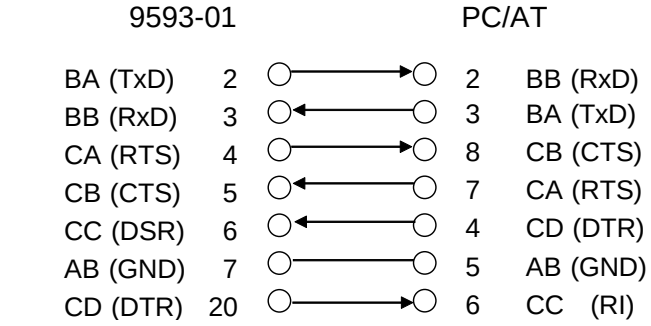
Signal Assignments and Explanation

Connector (Dsub) Pin number	Circuit		Description
	RS-232C	CCITT	
2	BA(TxD)	103	Transmitted Data
3	BB(RxD)	104	Received Data
4	CA(RTS)	105	Request to Send
5	CB(CTS)	106	Clear to Send
7	AB(GND)	102	Signal Ground
20	CD(DTR)	108/2	Data Terminal Ready
Other pins			Unused

Connecting method

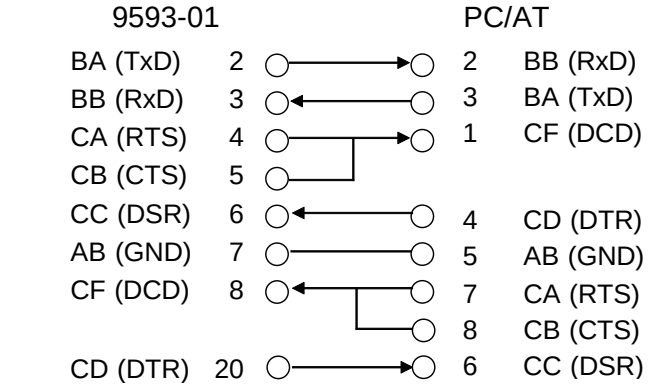
When connecting to the controller (DTE), use a cross cable which meets the connector specifications of both sides of the 9593-01 and the controller.

When connecting to the PC/AT:



D-subminiature 25-pin male

D-subminiature 9-pin female



D-subminiature 25-pin male

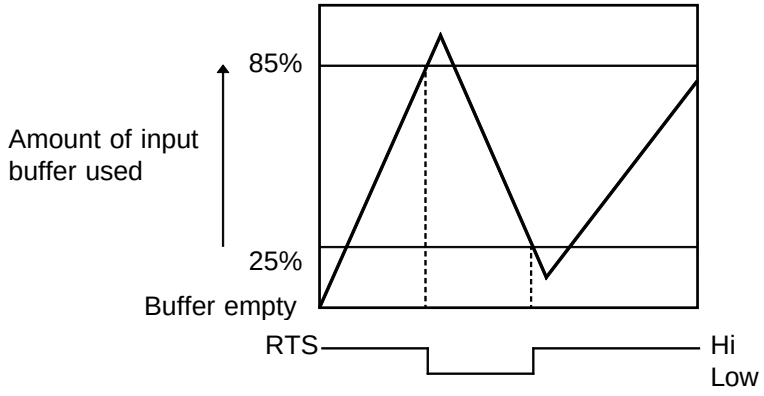
D-subminiature 9-pin female

Handshake

(1) Controls when receiving

When the receiving buffer is more than 85% full, to indicate to the controller that the empty buffer capacity is low (RTS is set to Low).

Processing of data in the buffer continues, and when the receiving buffer is less than 25 % full, to indicate to the controller that there is ample buffer capacity (RTS is set to Hi)



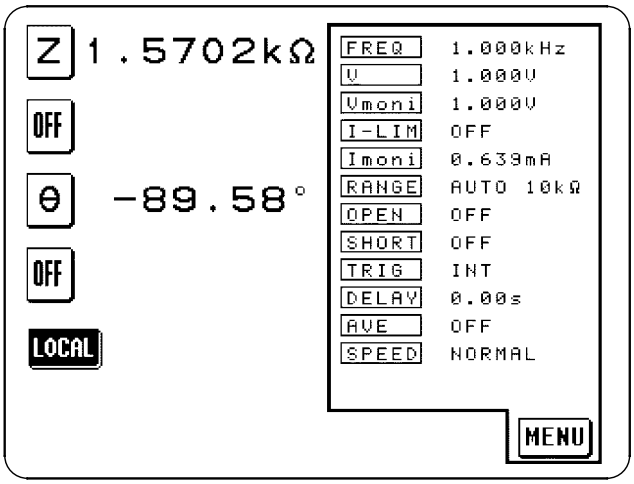
(2) Controls when transmitting

When CTS is Low, transmission is suspended; it is Hi transmission resumes.

Chapter 3
Names of Parts

3.1 Controls and Connections

(1) Initial Screens



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).

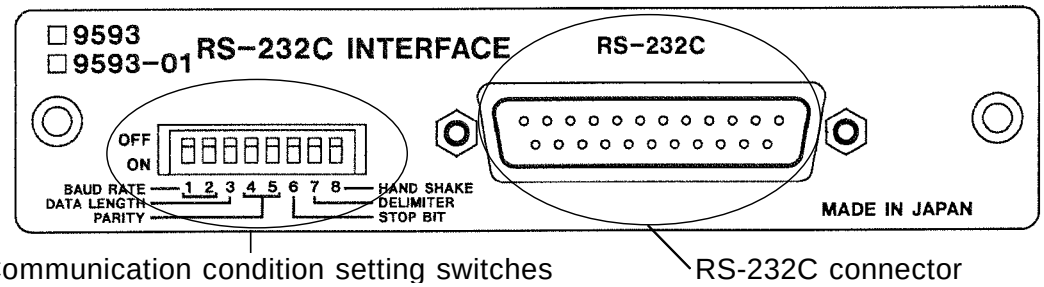
During communications, the initial screen is forcibly displayed excluding the following conditions.

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

(2) 9593-01 RS-232C INTERFACE

⚠ WARNING To avoid electrocution, turn off the power to all devices before pluggingor unplugging any of the RS-232C INTERFACE connectors.

⚠ CAUTION To avoid damage to the product, do not short-circuit the output terminal and do not input voltage to the output terminal.



Communication condition setting switches

RS-232C connector

Communication condition setting switches

These are used to set the communication condition of the 3532-50/3522-50 units on the RS-232C bus. For how to set these switches, refer to Section 4.1, "Setting the RS-232C Communication Conditions."

RS-232C connector

Connect the RS-232C cable to this connector.

Chapter 4
Operation

4.1 Setting the RS-232C Communication Conditions

- Use the communication condition setting switches on the RS-232C panel to set the communication condition.
- On dispatch from the factory, this address is initially set to 00000000.

NOTE

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

Bits	Description
1	Baud rate
2	
3	Data length
4	Parity
5	
6	Stop bits
7	Delimiter
8	Handshake

0: OFF 1: ON

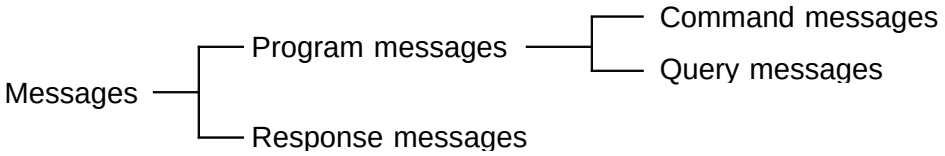
Bits	Description
1 2	Baud rate
0 0	9600
0 1	4800
1 0	2400
1 1	19200
3	Data length
0	8 bits
1	7 bits
4 5	Parity
0 0	None
0 1	None
1 0	Even
1 1	Odd

6	Stop bits
0	1 bit
1	2 bits
7	Delimiter
0	CR+LF
1	CR

When using with the personal computer, set bit 8 to 0.
When using with the optional 9442 printer, set all bits to 1.

4.2 Communication Methods by the RS-232C

- In order to control the 3532-50/3522-50 by the RS-232C, there are several kinds of messages.
- Of these, program messages are those received by the 3532-50/3522-50 from the computer, while response messages are those sent from the 3532-50/3522-50 to the computer.



(1) Program messages

Program messages are command messages or query messages.

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

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

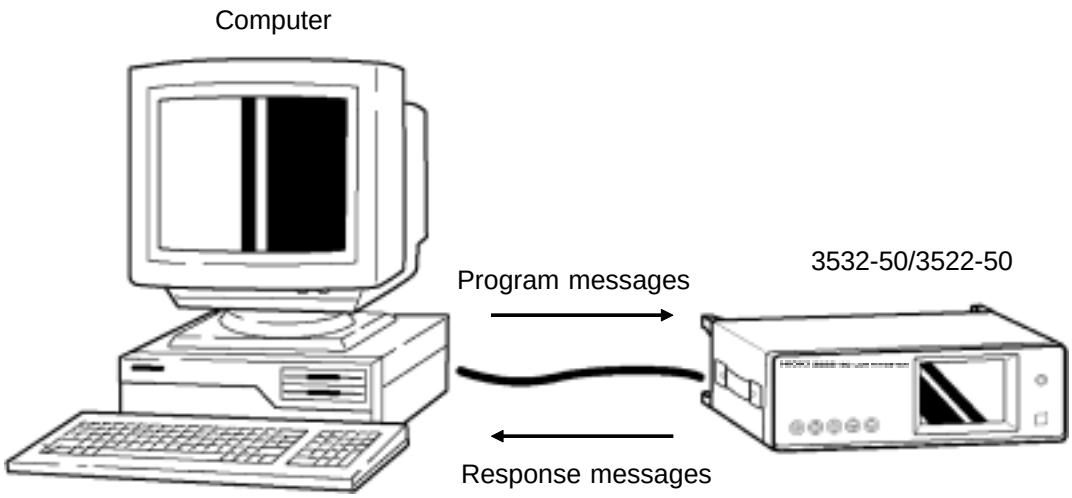
- Query messages are orders for responses relating to results of operation, results of measurement, or the state of 3532-50/3522-50 settings. (A question mark "?" is suffixed at the end of the command.)

  Example FREQUENCY?
  (Queries the current frequency)

(2) Response messages

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

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



4.3 Message Format

The commands for the 3532-50/3522-50 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 **2** **3**

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.
Response messages generated by the 3532-50/3522-50 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

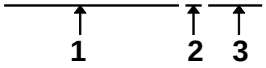
There are three types of header: simple headers, compound headers, and particular headers.

- Simple header
  A header consisting of a single word beginning with a letter.
  Examples :HEADer, etc.
- Compound header
  A header consisting of a sequence of words separated by colons.
  Examples :BEEPer:KEY, RANGe:AUTO, etc.
- Particular header
  A header beginning with an asterisk (*) to indicate that it is a particular command.
  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



1 Header portion
2 Space separating header portion and data portion.
3 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 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 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 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 or 3522-50 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 Delimiters

The term "delimiter" is used to refer to the following possibilities for separating data sequences.
The 3532-50 and 3522-50 recognizes either a carriage return (CR) or a carriage return plus linefeed (CR+LF) as delimiters.

(1) CR (carriage return only)

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

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 delimiter 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.
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 commands.

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

Messages with particular headers 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 12 possible current paths:

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

4.9 Output Queue

Response messages accumulate in the output queue and all data are received and cleared.

The output queue is also cleared when the power is turned off and turned on again.

The 3532-50/3522-50 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 buffer is cleared

4.10 Input Buffer

The 3532-50/3522-50 have an input buffer of 300 bytes capacity.
When more than 300 bytes of data are transmitted, when the buffer is full any subsequent bytes received will be ignored.
(When the controller handshake setting is not the same as the 9593-01.)

4.11 Event Registers

The 3532-50/3522-50 include three 8-bit event registers. It is possible to determine the
status of the unit by reading these registers.

The event register is cleared in the following situations:

- When a "*CLS" command is executed.
- When an event register query is executed. (*ESR?, :ESR0?, :ESR1?)
- When the unit is powered on.

(1) Standard event status register (SESR)

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	Unused.
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. • 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. • 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 the data overflows the output queue. • When data in the output queue has been lost.
Bit 1	Unused.
Bit 0	Unused.

(2) Event status registers 0 and 1 (ESR0 and ESR1)

Event Status Register 0 (ESR0) Bit Assignments

Bit 7	Unused
Bit 6 COF	Constant current or constant voltage
Bit 5 LOF	Limit overflow
Bit 4 IOF	Impedance range overflow
Bit 3 IUF	Impedance range 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 (bit1, bit4)
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

Chapter 5
Command Reference

5.1 Command Summary

Particular Commands

Command	Function	Ref page
*CLS	Clears event register.	26
*ESR?	Queries standard event status register (SESR).	26
*IDN?	Queries device ID.	27
*RST	Device initialization.	28
*TRG	Performs sampling once.	29
*TST?	Queries the result of the self-test.	29
*WAI	Waits until all execution is fully completed.	30

Commands Specific to the 3532-50, 3522-50

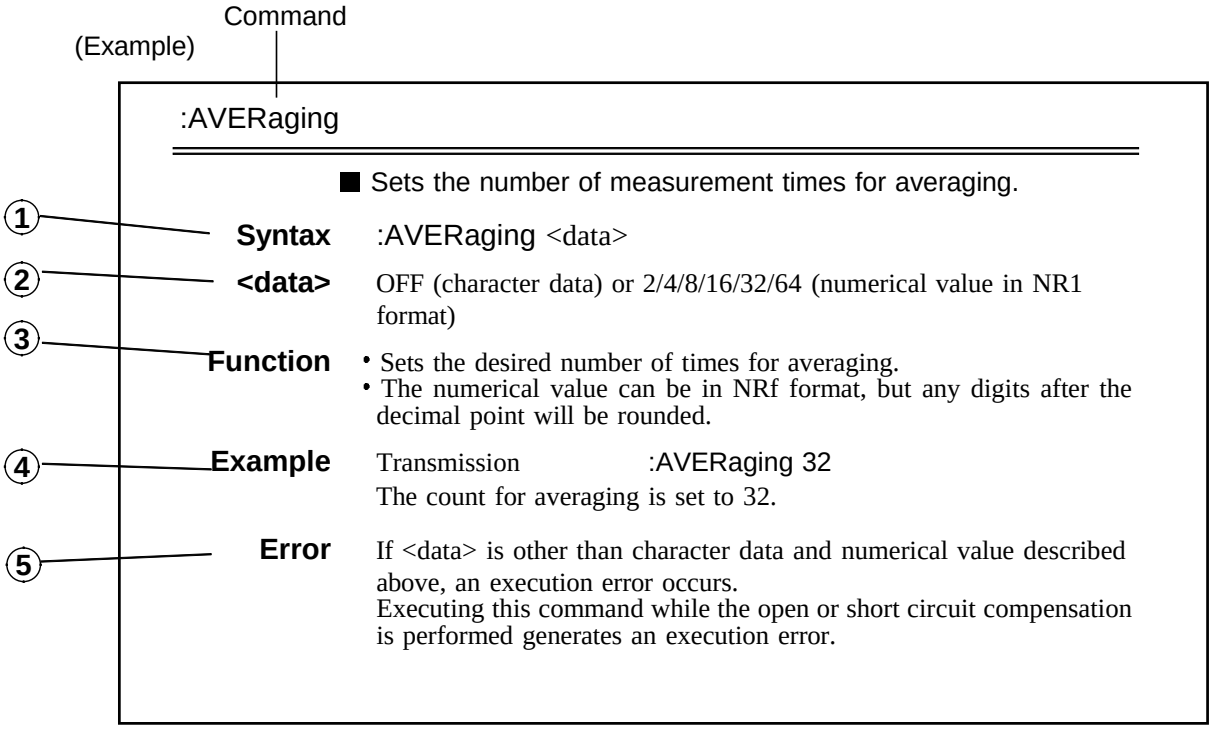
Command	Function	Ref page
■ Display function		
:APPLication:DISPlay:LIGHt	Setting for LCD display.	31
:APPLication:DISPlay:LIGHt?	Queries the setting for LCD display.	31
:APPLication:DISPlay:MONItor	Setting for voltage and current monitors.	32
:APPLication:DISPlay:MONItor?	Queries the setting for voltage and current monitors.	32
■ Averaging function		
:AVERaging	Sets the number of measurement times for averaging.	33
:AVERaging?	Queries the number of measurement times for averaging.	33
■ Beep sound function		
:BEEPer:COMParator	Sets the beep sound for the comparator.	34
:BEEPer:COMParator?	Queries the beep sound for the comparator.	34
:BEEPer:KEY	Sets the beep sound for key input.	35
:BEEPer:KEY?	Queries the beep sound for key input.	35

Command	Function	Ref page
■ External DC bias function		
:BIAS	Enables and disables the external DC bias function.	36
:BIAS?	Queries the external DC bias function enablement	36
■ Cable length setting function		
:CABLe	Sets the cable length.	36
:CABLe?	Queries the cable length.	37
■ Comparator function		
:COMParator	Enables and disables the comparator function.	37
:COMParator?	Queries the comparator function enablement.	37
:COMParator:FLIMit	(first parameter)	
:ABSolute	Sets the upper and lower limit values (absolute values).	38
:ABSolute?	Queries the upper and lower limit values (absolute values).	38
:DEViation	Sets the reference value and the upper and lower limit values (deviation percentage values).	39
:DEViation?	Queries the reference value and the upper and lower limit values (deviation percentage values).	39
:MODE	Sets the first parameter setting mode.	40
:MODE?	Queries the first parameter setting mode.	40
:PERcent	Sets the reference value and the upper and lower limit values (percentage values).	41
:PERcent?	Queries the reference value and the upper and lower limit values (percentage values).	41
:COMParator:SLIMit	(second parameter)	
:ABSolute	Sets the upper and lower limit values (absolute values).	42
:ABSolute?	Queries the upper and lower limit values (absolute values).	42
:DEViation	Sets the reference value and the upper and lower limit values (deviation percentage values).	43
:DEViation?	Queries the reference value and the upper and lower limit values (deviation percentage values).	43
:MODE	Sets the second parameter setting mode.	44
:MODE?	Queries the second parameter setting mode.	44
:PERcent	Sets the reference value and the upper and lower limit values (percentage values).	45
:PERcent?	Queries the reference value and the upper and lower limit values (percentage values).	45
■ Open and short circuit compensation function		
:CORRection:DATA?	Queries the open and short circuit compensation values.	46
:CORRection:OPEN	Enables and disables the open circuit compensation function.	47
:CORRection:OPEN?	Queries the open circuit compensation function enablement.	48
:CORRection:SHORt	Enables and disables the short circuit compensation	49
:CORRection:SHORt?	Queries the short circuit compensation function enablement.	50

Command	Function	Ref page
■ Monitor function		
:DISPlay:MONItor?	Queries the monitored voltage and current.	50
■ Communication error confirmation		
:ERRor?	Queries the RS-232C error.	51
■ Event register		
:ESR0?	Queries event status register 0.	51
:ESR1?	Queries event status register 1.	52
■ Test frequency function		
:FREQuency	Sets the test frequency.	53
:FREQuency?	Queries the test frequency.	53
■ Headers		
:HEADer	Enables and disables headers for the response message.	54
:HEADer?	Queries headers enablement.	54
■ Test signal level function		
:LEVel	Sets the test signal level.	55
:LEVel?	Queries the test signal level.	55
:LEVel:CCURRent	Sets the constant current level value.	56
:LEVel:CCURRent?	Queries the constant current level value.	56
:LEVel:CVOLTage	Sets the constant voltage level value.	57
:LEVel:CVOLTage?	Queries the constant voltage level value.	57
:LEVel:VOLTage	Sets the open circuit voltage level value.	58
:LEVel:VOLTage?	Queries the open circuit voltage level value.	58
■ Limit function		
:LIMiter	Enables and disables the limit setting function.	59
:LIMiter?	Queries the limit setting function enablement.	59
:LIMiter:CURRent	Sets the current limit value.	60
:LIMiter:CURRent?	Queries the current limit value.	60
:LIMiter:VOLTage	Sets the voltage limit value.	61
:LIMiter:VOLTage?	Queries the voltage limit value.	61
■ Panel load function		
:LOAD	Transfers the specified panel number.	62
■ Normal testings		
:MEASure?	Queries the data item.	63
:MEASure:ITEM	Sets test parameter.	65
:MEASure:ITEM?	Queries test parameter.	66

Command	Function	Ref page
■ Parameter settings (*:1 to 4)		
:PARAmeter1 (2, 3, or 4)	Sets displayed parameters.	67
:PARAmeter1 (2, 3, or 4)?	Queries displayed parameters.	67
:PARAmeter*:DIGit	Sets the number of displayed digits.	68
:PARAmeter*:DIGit?	Queries the number of displayed digits.	68
■ Test range function		
:RANGe	Sets test range.	69
:RANGe?	Queries test range setting.	70
:RANGe:AUTO	Sets the automatic test ranging.	71
:RANGe:AUTO?	Queries the automatic test range setting.	71
■ Panel saving function		
:SAVE	Saves the test conditions in specified panel number.	72
:SAVE?	Queries the panel number in which data is saved.	72
■ Scaling function		
:SCALe	Enables and disables the scaling function.	73
:SCALe?	Queries the scaling function.	73
:SCALe:FVALue	Sets the first parameters (a and b) in the scaling function.	74
:SCALe:FVALue?	Queries the first parameters (a and b) in the scaling function.	74
:SCALe:SVALue	Sets the second parameters (a and b) in the scaling function.	75
:SCALe:SVALue?	Queries the second parameters (a and b) in the scaling function.	75
■ Test speed function		
:SPEEd	Sets the testing speed.	76
:SPEEd?	Queries the testing speed.	76
■ Trigger function		
:TRIGger	Sets the type of trigger.	77
:TRIGger?	Queries the trigger setting.	77
:TRIGger:DELAy	Sets the trigger delay time.	78
:TRIGger:DELAy?	Queries the trigger delay time.	78
■ ID function		
:USER:IDENtity	Sets the user ID.	79
:USER:IDENtity?	Queries the user ID.	79

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).
- This has no effect upon the output queue.

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

*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	Unused	CME	EXE	DDE	QYE	Unused	Unused

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,3532,50,V01.01

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

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

*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, 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

■ 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, a command 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:COMParator:FLIMit:PERcent?
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 (△%).

Syntax :COMParator:SLIMit:DEViation?

Function Returns the reference value and the lower and upper limit values witch are set as deviation percentage (△%) 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 △% 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 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 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 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.

:ERRor?

■ Reads out RS-232C communication condition errors.

Syntax :ERRor?

Function
- Returns the value of RS-232C communication condition errors as a numerical value in NR1 format from 0 to 7, and then clears RS-232C communication condition errors.
- No header is prefixed to the response message.

					4	2	1
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Unused	Unused	Unused	Unused	Unused	Overrun error	Framing error	Parity error

Example Response 4
An overrun error has occurred.

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 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.

: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 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?

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.
- When the test signal frequency is set to a value greater than 1MHz, the range which can be set is from 10 μA to 20 mA.

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.

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 displayed parameters.

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 displayed parameters.

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

Function Returns the displayed 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 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 autorange 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.

: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.

:User:IDENtity

■ Set the user ID.

Syntax :USER:IDENtity <data>

<data> For example: AB-9593

Function
- The user can set an identity code.
- The ID is backed up in the same way as the main unit settings.
- The capital and lowercase letters, digits 0 to 9, and hyphen can be used.
- If an ID of eight or more characters is entered, the first seven characters are used.
- The user ID is cleared by the system reset of the main unit.

Example Transmission :USER:IDEN AB-9593
This sets the user ID to "AB-9593"

Error If <data> is other than character data described above, a command error occurs.

:User:IDENtity?

■ Queries the user ID.

Syntax USER:IDENtity?

Function Returns a user ID as seven characters data <data>.

Example Response
If headers are on :USER:IDENTITY AB-9593
If headers are off AB-9593

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

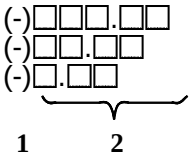
1. The response formats for |Z| (impedance),|Y| (admittance), Cs (static capacitance in series equivalent circuit mode), Cp (static capacitance in parallel equivalent circuit mode), Ls (inductance in series equivalent circuit mode), Lp (inductance in parallel equivalent circuit mode), Rs (effective resistance 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	*CLS command
RS-232C Communication conditions *1	---	---	---
Device specific functions (ranges etc.)	---	●	---
Output queue	●	---	---
Input buffer	●	---	---
Event registers	● *2	---	●
Current path	●	---	---
Headers on/off	●	●	---
Measurement resister	●	●	---

*1 When the power is turned on, item is discriminated.
*2 Except the PON bit (bit 7).

Chapter 6
Sample Programs

The following sample programs are all written for the Microsoft Quick BASIC.
For more details on the Quick BASIC, refer to the Quick BASIC documentation.
All commands in the sample programs are used in the short form, and the communication condition setting switches of the 3532-50 or 3522-50 is taken as 00000010 (baud rate: 9600bps, data length: 8 bits, parity: non, stop bit: 1 bit, delimiter: CR).

(1) Open- and short-circuit compensation

Summary

This program carries out open- and short-circuit compensation on the 3532-50or 3522-50.

Program List

```
10 OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
20 PRINT #1, ":HEAD OFF"
30 PRINT #1, "*CLS"
40 CORR.OPEN:
50 INPUT "Prepare unit for open circuit compensation, then press Enter", A$
60 PRINT "Collecting open circuit compensation data"
70 PRINT #1, ":CORR:OPEN ALL"
80 OPEN.LOOP:
90 PRINT #1, ":ESR0?"
100 INPUT #1, A
110 IF (A AND 1) = 0 THEN GOTO OPEN.LOOP
120 PRINT #1, "*ESR?"
130 INPUT #1, A
140 IF (A AND 8) = 0 THEN GOTO CORR.SHORT
150 PRINT "Open circuit compensation failed"
160 GOTO CORR.OPEN
170 CORR.SHORT:
180 INPUT "Prepare unit for short circuit compensation, then press Enter", A$
190 PRINT "Collecting short circuit compensation data"
200 PRINT #1, ":CORR:SHOR ALL"
210 SHORT.LOOP:
220 PRINT #1, ":ESR0?"
230 INPUT #1, A
240 IF (A AND 1) = 0 THEN GOTO SHORT.LOOP
250 PRINT #1, "*ESR?"
260 INPUT #1, A
270 IF (A AND 8) = 0 THEN GOTO CORR.END
```

```
280 PRINT "Short circuit compensation failed"
290 GOTO CORR.SHORT
300 CORR.END:
310 PRINT "Compensation operations completed"
320 CLOSE
330 END
```

Program comments

Line	Comments
10	Open the RS-232C circuit file.
20	Switch off headers for the response message.
30	Clear bits of each event registers.
70	Execute open circuit compensation (at all the test frequencies).
90-110	Wait until the bit for the compensation completed is 1.
120-140	When the valid data cannot be obtained, the bit 3 of SESR is 1.
320	Close the RS-232C circuit file.

(2) Basic settings and testing

Summary

This program selects the test conditions for measurement on the 3532-50or 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 OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
20 PRINT #1,":TRIG EXT"
30 PRINT #1,":AVER 8"
40 PRINT #1,":FREQ 1.234E3"
50 PRINT #1,":RANG:AUTO ON"
60 PRINT #1,":LEV V"
70 PRINT #1,":LEV:VOLT 1.00"
80 PRINT #1,":TRIG:DELA 0.02"
90 PRINT #1,":SPEE SLOW"
100 PRINT #1,":MEAS:ITEM 5,18"
110 PRINT #1,"*TRG;:MEAS?"
120 LINE INPUT #1,A$
130 PRINT #1,":DISP:MONI?"
140 LINE INPUT #1,B$
150 PRINT A$
160 PRINT B$
170 CLOSE
180 END
```

Program comments

Line	Comments
10	Open the RS-232C circuit file.
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 1 V.
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.
170	Close the RS-232C circuit file.

(3) Saving the 3532-50 settings using the panel save function

Summary

This program makes the settings for the 3532-50 and saves the settings to the panel number 1 as "TEST1".

Program List

```
10 OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
20 PRINT #1,":FREQ 100E3"
30 PRINT #1,":LEV V"
40 PRINT #1,":LEV:VOLT 1.00;CVOLT 0.50;CCURR 5.00E-3"
50 PRINT #1,":LIM OFF"
60 PRINT #1,":LIM:CURR 15.00E-3;VOLT 3.00"
70 PRINT #1,":RANG:AUTO ON"
80 PRINT #1,":TRIG INT"
90 PRINT #1,":TRIG:DELA 0.02"
100 PRINT #1,":AVER 2"
110 PRINT #1,":SPEE SLOW"
120 PRINT #1,":BEEP:KEY ON;COMP NG"
130 PRINT #1,":PAR1 Z;:PAR2 PHAS"
140 PRINT #1,":PAR3 CP;:PAR4 D"
150 PRINT #1,":SAVE 1,TEST1"
160 CLOSE
170 END
```

Program comments

Line	Comments
10	Open the RS-232C circuit file.
20	Set the test frequency to 100 kHz.
30	Select the voltage test signal level.
40	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 mA (value setting only)
50	Set the limit value setting function to OFF
60	Set the current limit value to 15 mA (value setting only). Set the voltage limit value to 3 V (value setting only).
70	Enable auto-ranging.
80	Select internal trigger mode.
90	Set the trigger delay time to 20 ms.
100	Set the count for averaging to 2.
110	Set the testing speed to SLOW.
120	Set the beep sound.
130-140	Set displayed parameters.
150	Save the settings to the panel number 1.
160	Close the RS-232C circuit file.

(4) Carrying out comparator testing

Summary This program first makes the comparator settings.

At the end of testing, it displays the numbers of the samples which were outside the comparator limit.

Sample nos. decided HI for CP:2 5
Sample nos. decided LOW for CP:

All measured results

Sample number: 1	3.8686E-04	.34823
Sample number: 2	3.8704E-04	.34823
Sample number: 3	3.8681E-04	.34843
Sample number: 4	3.8694E-04	.34804
Sample number: 5	3.8698E-04	.34823

Program List

```
10 OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
20 PRINT #1, ":PAR1 CP;:PAR3 D"
30 PRINT #1, ":TRIG EXT"
40 PRINT #1, ":HEAD OFF"
50 PRINT #1, ":FREQ 1.234E3"
60 PRINT #1, ":RANG:AUTO ON"
70 PRINT #1, ":LEV CV;:LEV:CVOLT 1.00"
80 PRINT #1, ":COMP:FLIM:MODE ABS;ABS 386.80E-6,386.95E-6"
90 PRINT #1, ":COMP:SLIM:MODE PER;PER 1.0000,OFF,OFF"
100 NUM.SET:
110 INPUT "Number of samples to measure:"; X
120 IF X <= 0 THEN GOTO NUM.SET
130 OPTION BASE 1
140 DIM F.ALL(X), CP(X), F.CP(X), D(X), F.D(X)
150 PRINT #1, ":COMP ON"
160 INPUT "Prepare sample, then press Enter", A$
170 CLS
180 I = 1
190 MEAS.LOOP:
200 PRINT #1, "*TRG;:MEAS?"
210 INPUT #1, F.ALL(I), CP(I), F.CP(I), D(I), F.D(I)
220 I = I + 1
230 IF I > X THEN GOTO MEAS.END
240 CLS
250 PRINT "Prepare sample number ";I;
260 INPUT ", then press Enter", A$
270 GOTO MEAS.LOOP
280 MEAS.END:
290 PRINT #1, ":COMP OFF"
300 CLS
310 PRINT "Sample nos. decided HI for CP:";
320 FOR I = 1 TO X
330     IF F.CP(I) = 1 THEN PRINT I;
340 NEXT I
350 PRINT
360 PRINT "Sample nos. decided LOW for CP:";
370 FOR I = 1 TO X
380     IF F.CP(I) = -1 THEN PRINT I;
390 NEXT I
400 PRINT
```

```
410 PRINT
420 PRINT "All measured results"
430 FOR I = 1 TO X
440     PRINT "Sample number"; I, CP(I), D(I)
450 NEXT I
460 CLOSE
470 END
```

Program comments

Line	Comments
10	Open the RS-232C circuit file.
20	Set the first parameter to Cp,and the second parameter to D.
30	Select external trigger mode.
40	Switch off headers for the response message.
50	Set the test frequency to 1.234 kHz.
60	Enable auto-ranging.
70	Set the constant voltage to 1 V.
80	Set the first parameter for the comparator function as absolute value (the current path is used in this settings).
90	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).
130-140	Initialize variables.
150	Switch on the comparator function.
190-280	Measurement loop Returns data as total result, measurement value of CP, CP decision, measurement value of D, D decision in order.
290	Switch off the comparator function.
310-340	Check HI decision for CP.
360-390	Check LOW decision for CP.
460	Close the RS-232C circuit file.

(5) Frequency characteristics measurement for impedance

Summary

This program measures the impedance frequency characteristics at various frequencies.

It outputs the test result to a file.

The number of test point: 34
50/ 60/ 80 Hz
100/ 120/ 150/ 200/ 250/ 300/ 400/ 500/ 600/ 800 Hz
1/ 1.2/ 1.5/ 2/ 2.5/ 3/ 4/ 5/ 6/ 8 kHz
10/ 12/ 15/ 20/ 25/ 30/ 40/ 50/ 60/ 80/ 100 kHz

Program List

```
10 OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
20 PRINT #1, ":COMP OFF;:TRIG EXT"
30 PRINT #1, ":LEV V;:LEV:VOLT 1.00"
40 PRINT #1, ":MEAS:ITEM 1,0"
50 PRINT #1, ":HEAD OFF"
60 OPTION BASE 1
70 PNT = 34
80 DIM TABLE(10), F(PNT), Z(PNT)
90 RESTORE F.DATA
100 F.DATA:
110 DATA 1,1.2,1.5,2,2.5,3,4,5,6,8
120 FOR I = 1 TO 10
130     READ TABLE(I)
140 NEXT I
150 EX = 10: T = 8
160 FOR I = 1 TO PNT
170     F(I) = EX * TABLE(T)
180     PRINT #1, ":FREQ " + STR$(F(I))
190     PRINT #1, "*TRG;:MEAS?"
200     INPUT #1, Z(I)
210     PRINT F(I), Z(I)
220     IF T = 10 THEN T = 1: EX = EX * 10 ELSE T = T + 1
230 NEXT I
240 GOSUB SAVE.DATA:
250 CLS
260 CLOSE
270 END
280 SAVE.DATA:
290 INPUT "Input the file name to be saved.", F.NAME$
300 OPEN F.NAME$ FOR OUTPUT AS #2
310 FOR I = 1 TO PNT
320     PRINT #2, F(I); ","; Z(I)
330 NEXT I
340 CLOSE #2
350 RETURN
```

Program comments

Line	Comments
10	Open the RS-232C circuit file.
20	Switch off the comparator function, and select external trigger mode.
30	Set the measured voltage to 1V.
40	Make a settings to response the parameter for Z by using the :MEAS? query.
90-140	Set frequency mantissa table.
150	Measure from EX*TABLE(T=8) = 50 (Hz)
160-230	Measurement loop
170-180	Transmit character data by transforming the numerical values.
190	Query the sampling data and measurement value.
220	Change the frequency value to the new one.
240	Save the test frequency and test results to the file.
280-350	Routines to save the measurement value to the file.

Chapter 7
Troubleshooting

If the RS-232C appears to be malfunctioning, refer to the information below before calling for servicing.

Symptom	Cause / Treatment
The RS-232C has stopped working completely.	Are the cables properly connected?
	Are all the devices powered on?
	Has the communication condition been correctly set?
Transmission on the RS-232C is not taking place properly.	Is the controller delimiter set correctly? (Refer to Section 4.5, "Delimiter".)
When attempting to read data using a BASIC INPUT statement, the RS-232C bus hangs.	Be sure to transmit one query before each INPUT statement.
	Have any of these transmitted queries resulted in as 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.
	Using the "ERRor?" query, and check whether transmission error occurred on the RS-232C.
The amount of data read in is insufficient.	If the data includes one or more commas, then try using a LINE INPUT statement.
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.

Symptom	Cause / Treatment
Although a response has been read in, the data does not appear.	Have the response messages from 3532-50, 3522-50 exceeded the buffer capacity of the computer?
	Try dividing up their reading in, by increasing the number of variables of the INPUT statement.
The response message to a query differs from the display on the front panel of the 3532-50, 3522-50.	Due to the response message being produced at the instant that the 3532-50, 3522-50 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.

Service

If damage is suspected, check the "Troubleshooting" section before contacting your dealer or Hioki representative.

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Technical Support Section

All inquiries to Sales and Marketing International Department
81 Koizumi, Ueda, Nagano, 386-1192, Japan
TEL: +81-268-28-0562 / FAX: +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.co.jp/

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HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 / FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 / FAX +1-609-409-9108

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