HIOKI

Instruction Manual

3505
3506

C HiTESTER

HIOKI E. E. CORPORATION

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Contents

Introduction

Thank you for purchasing the HIOKI “Model 3505/ 3506 C HiTester.” To obtain maximum performance from the unit, please read this manual first, and keep it handy for future reference.

Verifying Package Contents

When you receive the unit, 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.

This unit 3505, 3506 C HiTester

Accessories

- Instruction Manual..... 1
- Power cord..... 1
- Spare fuse for power supply (according to voltage specification) 1
  100 V, 120 V setting : 250 V F 1.0 AL 20 mm x 5 mm dia
  220 V, 240 V setting : 250 V F 0.5 AL 20 mm x 5 mm dia

NOTE

Probes, fixture are not supplied with the unit as standard equipment. You should order them separately, according to requirements.

Shipping precautions

Use the original packing materials when transporting the unit, if possible.

Options

See Appendix 6 "Options" (p. A9)

Safety Information

⚠WARNING

This instrument is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the instrument. Using the instrument in a way not described in this manual may negate the provided safety features. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from instrument defects.

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

Safety Symbols

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the unit. The ⚠ symbol printed on the unit indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates AC (Alternating Current).
	Indicates a grounding terminal.
	Indicates a fuse.
	Indicates the ON side of the power switch.
	Indicates the OFF side of the power switch.

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 unit.
NOTE	Indicates advisory items related to performance or correct operation of the unit.

Other Symbols

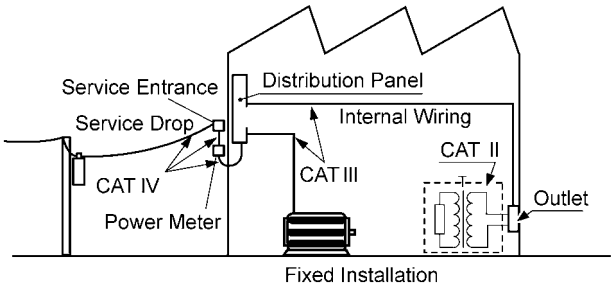
	Indicates a prohibited action.
See	Indicates the location of reference information.
	Indicates quick references for operation and remedies for troubleshooting.
*	Indicates that descriptive information is provided below.

Measurement Categories

To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories. These are defined as follows.

CAT II:	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.) CAT II covers directly measuring electrical outlet receptacles.
CAT III:	Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.
CAT IV:	The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Using a measurement product in an environment designated with a higher-numbered category than that for which the product is rated could result in a severe accident, and must be carefully avoided.
Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



Accuracy

We define measurement tolerances in terms of rdg. (reading) and dgt. (digit) values, with the following meanings:

rdg. (reading or displayed value)	The value currently being measured and indicated on the measuring instrument.
dgt. (resolution)	The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1" as the least-significant digit.

Operating Precautions

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

Preliminary Checks

- Before using the unit the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.
- Before using the unit, make sure that the insulation on the probes and cables is undamaged and that no bare conductors are improperly exposed. Using the unit in such conditions could cause an electric shock, so contact your dealer or Hioki representative for replacements.

Unit Installation

Operating Temperature and Humidity: 0 to 40°C, 80%RH or less, no condensation
Storage Temperature and Humidity: -10 to 55°C, 80%RH or less, no condensation
Accuracy-guaranteed temperature and humidity ranges: 23±5°C, 80%RH

Avoid the following locations that could cause an accident or damage to the unit.

Exposed to direct sunlight
Exposed to high temperature

In the presence of corrosive or explosive gases

Exposed to liquids
Exposed to high humidity or condensation

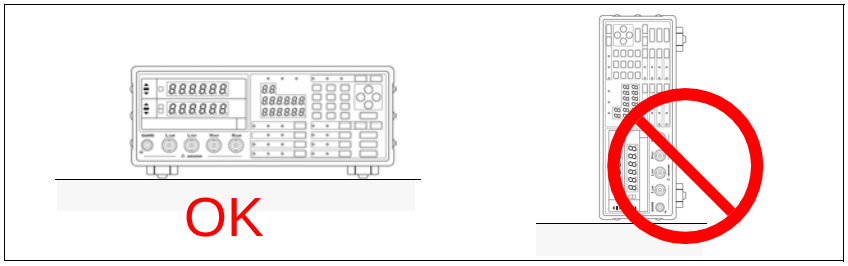
Exposed to strong electromagnetic fields
Near electromagnetic radiators

Exposed to high levels of particulate dust

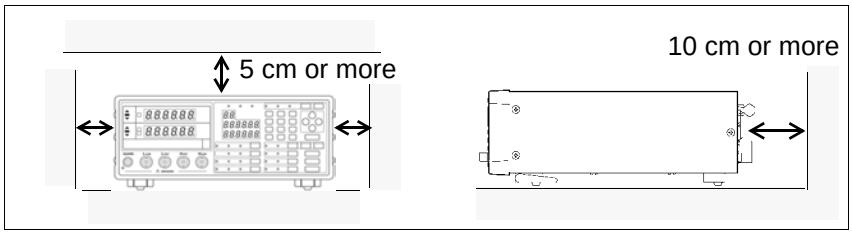
Subject to vibration

Installing

- Do not install the unit with any side except the bottom facing down.



- Vents must not be obstructed.



Handling this device

⚠WARNING

- **Do not allow the instrument to get wet, and do not take measurements with wet hands. This may cause an electric shock.**
- **Never modify the unit. Only Hioki service engineers should disassemble or repair the unit. Failure to observe these precautions may result in fire, electric shock, or injury.**

⚠CAUTION

- If anything unusual happens during operation of the unit, turn off the power switch immediately and contact any HIOKI service facility for help, advice and service.
- To avoid damage to the unit, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.

NOTE

This instrument may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Before connection and powering on

⚠WARNING

- **Before turning the unit on, make sure the supply voltage matches that indicated on the its power connector. Connection to an improper supply voltage may damage the unit and present an electrical hazard.**
- **The power supply voltage for this unit is switchable. To avoid electrical accidents, check that the voltage selector is set correctly for the supply voltage you are using.**

  See Setting Procedure for the Power Voltage : 2.2 "Checking the Power Voltage" (p. 18)
- **To avoid electrical accidents and to maintain the safety specifications of this unit, connect the power cord provided only to a 3-contact (two-conductor + ground) outlet.**

  See Connection Procedure : 2.3 "Connecting the Power Cord" (p. 19)
- **To avoid shock and short circuits, turn off all power before connecting probes.**

⚠CAUTION

Check the connections carefully in order to avoid any chance of setting up a short-circuit etc.

About the guarantee

You should be aware that HIOKI cannot accept any responsibility directly or indirectly if the unit has been incorporated in some other system, or if it is resold to a third party.

Overview Chapter 1

1.1 Product Overview

The HIOKI Model 3505, 3506 C HiTesters are capacitance meters employing 1 kHz and 100 kHz (only for 3505) and 1 MHz frequencies to measure large-value multilayer ceramic capacitors with constant voltage at high speed and high accuracy. Primary applications include pass-fail judgment and ranking of capacitors on tape machines and sorters.

1.2 Features

Capacitance-specific units

These capacitance meters use 1 kHz, 100 kHz (only for 3505) and 1 MHz measurement frequencies.

High-speed measurement

The 3505,3506 are capable of high-speed measurement: 2 ms at FAST.

Bin sorting function (p. 74)

Capacitors are easily ranked according to C (Capacitance*1) measurement values into as many as 13 classifications.

Comparator function (p. 59)

Makes pass-fail judgment of components based on C measurement value and D (dissipation factor*2), or on Q (quality factor*3) measurement value.

LED display

Provides superior visibility.

Equipped with standard data transfer interfaces (p. 129)

The 3505,3506 offers external I/O for sequencing, a standard RS-232C interface, and a standard GP-IB interface.

Measurement value memory (p. 232)

Up to 1000 measurement values can be stored in memory.

*1. Capability to store electric charge.
*2. An indicator of capacitor losses.
*3. An indicator of capacitor purity.

Trigger-synchronous measurement capability (p. 103)

The measurement signal can be input to the sample in sync with a trigger.

Frequency shift function (p. 101)

When using multiple devices, decreases measurement value fluctuation due to interference by shifting the measuring frequency of each device.

Contact check function (p. 95)

Checks for bad contacts using the Low C reject function and measurement level monitoring function.

1.3 Entire Workflow

Measurement Preparations

See Chapter 2 "Measurement Preparations" (p. 17)

1. Check the power voltage.
2. Connect the power cord.
3. Connect the probes or fixture (option) to the measurement terminals.
4. Turn the power on.
5. Connect the sample.

Pre-Operation Inspection

See 3.1 "Pre-Operation Inspection" (p. 23)

Be sure to perform pre-operation inspection prior to measurement.

Basic Measurement

See 3.2 "Measurement Example" (p. 24)

1. Prepare the unit, fixture, and sample.
2. Connect the fixture to the measurement terminals.
3. Set the measurement conditions.
4. Connect the sample to the fixture.
5. Check the measurement results.
6. Disconnect the sample and turn the power off.

End of Measurement

Application Functions

Function	Description	Reference Section
Open and Short circuit compensation	Eliminates measurement errors due to residual impedance.	(p. 37)
Load compensation	Allows interchangeability between measuring instruments by measuring a known sample.	(p. 45)
Offset compensation	Allows interchangeability between measuring instruments by subtracting the set value from the measurement value.	(p. 51)
Cable length compensation	Compensates for error caused by extending the measurement cable.	(p. 58)
Self calibration	Reduces measurement value drift.	(p. 55)
Comparator measurement function	Set the upper limit and lower limit values and judge whether samples pass or fail.	(p. 59)
BIN measurement function	Set variations of the upper limit and lower limit values and rank samples accordingly.	(p. 74)
Average function	Reduces fluctuation of the measurement value by performing an averaging process of the measurement values.	(p. 91)
Trigger delay	Provides a reliable measurement value even when taking a measurement immediately after connecting to a sample.	(p. 93)
Contact check function	Discerns whether or not the contact pin and sample are connected.	(p. 95)
Current detection circuit monitoring function	Monitors whether or not current outside the allowed range is being produced.	(p. 100)
Applied voltage monitoring function	Monitors whether or not voltage outside the allowed range is being produced.	(p. 100)
Frequency shift	Reduce the differences in measurement values caused by interference when using multiple 3505,3506 units for measurement.	(p. 101)
Display	Turns the LED display ON/ OFF.	(p. 102)
Trigger synchronous output function	Apply the measurement signal only during measurement to reduce the generation of heat in the sample and decrease electrode wear.	(p. 103)
Key lock function	Disable key operations.	(p. 104)
Communication function	Control the unit from a PC.	(p. 129)
Panel save function	Save measurement conditions.	(p. 105)
Panel load function	Load saved measurement conditions	(p. 106)
Beep tone	Turns ON/ OFF the beep tone for judgment results and key operations.	(p. 110)
System reset	Resets device settings.	(p. 114)
Printing function	Print measurement values.	(p. 115)

Application Measurement

- Countermeasures Against Incorporation of External Noise
  See Appendix 1 "Countermeasures Against Incorporation of External Noise" (p. A1)
- Measurement of high impedance components
  See Appendix 2 "Measurement of High Impedance Components" (p. A3)
- Measurement of components in circuit networks
  See Appendix 3 "Measurement of In-circuit Components" (p. A4)

1.4 Names and Functions of Parts

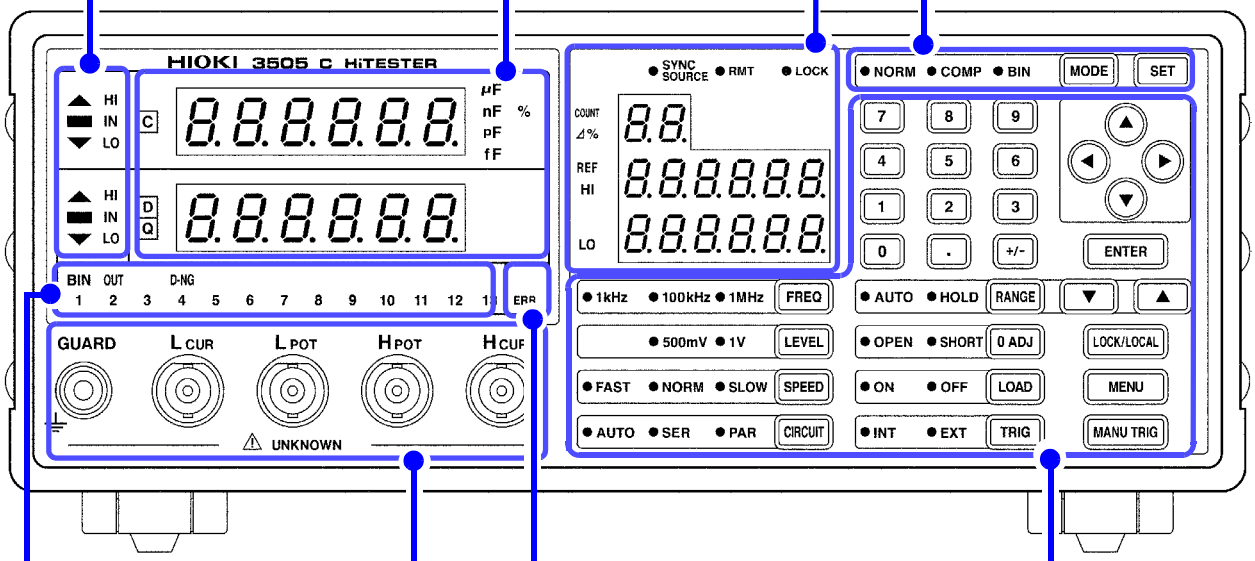
Front

SUB Display
Displays the limit values of BIN and comparator.

Comparator Evaluation Result Display
Displays evaluation results in Comparator Mode.
See 5.1 "Comparator Function" (p. 59)

MAIN Display
Displays the measurement values of C and D (or Q).
Displays the MENU items.

Setting Condition Display
Displays current measurement conditions, presettings, and other information.



BIN Judgment Result Display
Displays judgment results in BIN mode.
See 5.2 "BIN Measurement Function" (p. 74)

Error Display
Displays Low C reject and measured sine wave abnormality errors.
See 6.3.1 "Setting the Low C Reject Function" (p. 96)
See 6.3.2 "Measurement Level Monitoring Function Settings" (p. 98)

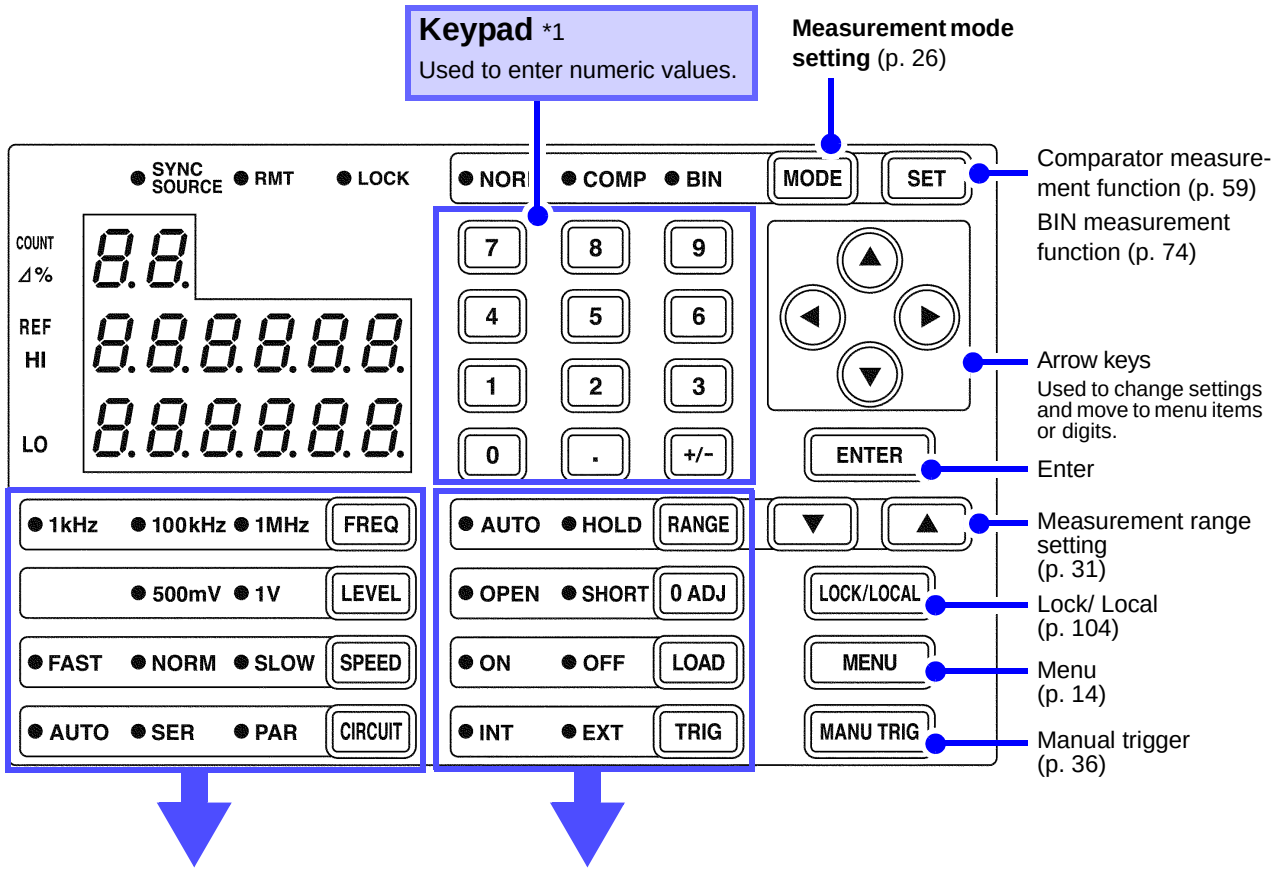
Operating Panel
Use to set measurement conditions and to make other settings.
(p. 12)

Measurement Terminals
There are five measurement terminals:

H_{CUR}	The test signal is supplied to this terminal.
H_{POT}	Detected voltage high terminal
L_{POT}	Detected voltage low terminal
L_{CUR}	Measurement current detected terminal
GUARD	Guard terminal

See 2.4 "Connecting the Probes and Fixtures" (p. 20)

Operating Panel



FREQ Measurement frequency setting *2 (p. 27)

LEVEL Measurement signal level setting (p. 28)

SPEED Measurement speed setting (p. 28)

CIRCUIT Equivalent circuit mode (p. 29)

RANGE Measurement range setting (p. 31)

0 ADJ Open short circuit compensation (p. 37)

LOAD Load compensation setting (p. 45)

TRIG Trigger signal mode setting (p. 36)

*1 : A decimal point key is only effective when measuring the C offset compensation value.
*2 : 100 kHz measurement frequency display is only valid on the 3505.

Back

EXT I/O Connector
Inputs external trigger signals and outputs comparator result signals and other signals. Supports connection to a PLC (Programmable Logic Controller).

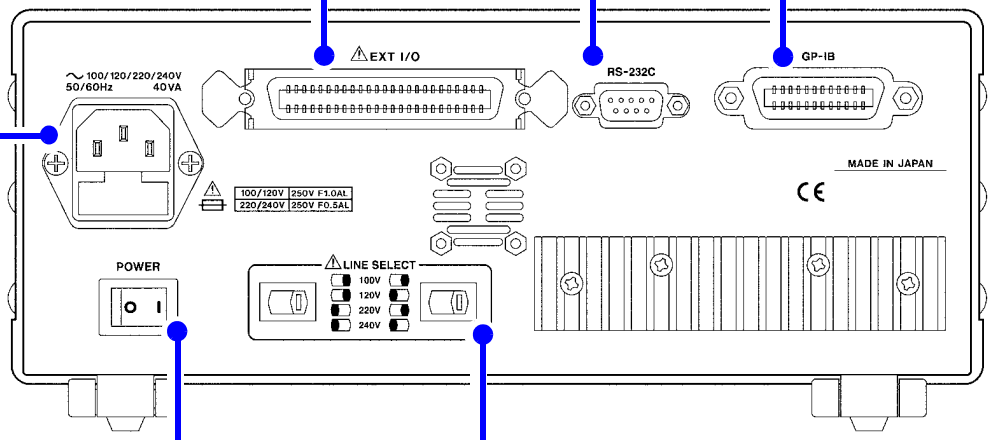
See 7.1 "About the EXT I/O Connector" (p. 121)

RS-232C Connector
Connect an RS-232C cable.

See Chapter 8 "Controlling the Unit from a PC" (p. 129)

GP-IB Connector
Connect a GP-IB cable.

See Chapter 8 "Controlling the Unit from a PC" (p. 129)



Power Inlet
Connect the supplied power cord.

See 2.3 "Connecting the Power Cord" (p. 19)

Power Switch
Turns the power on and off.

○ : Turns the power off.
| : Turns the power on.

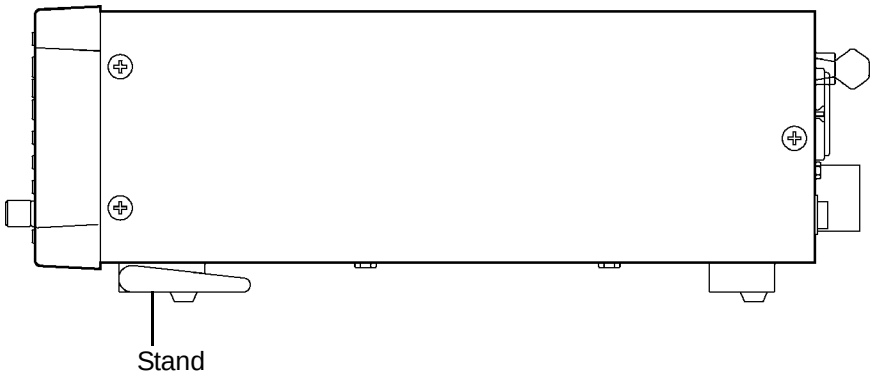
See 2.5 "Turning the Power On and Off" (p. 21)

Voltage Selectors
Changes the power voltage.

See 2.2 "Checking the Power Voltage" (p. 18)

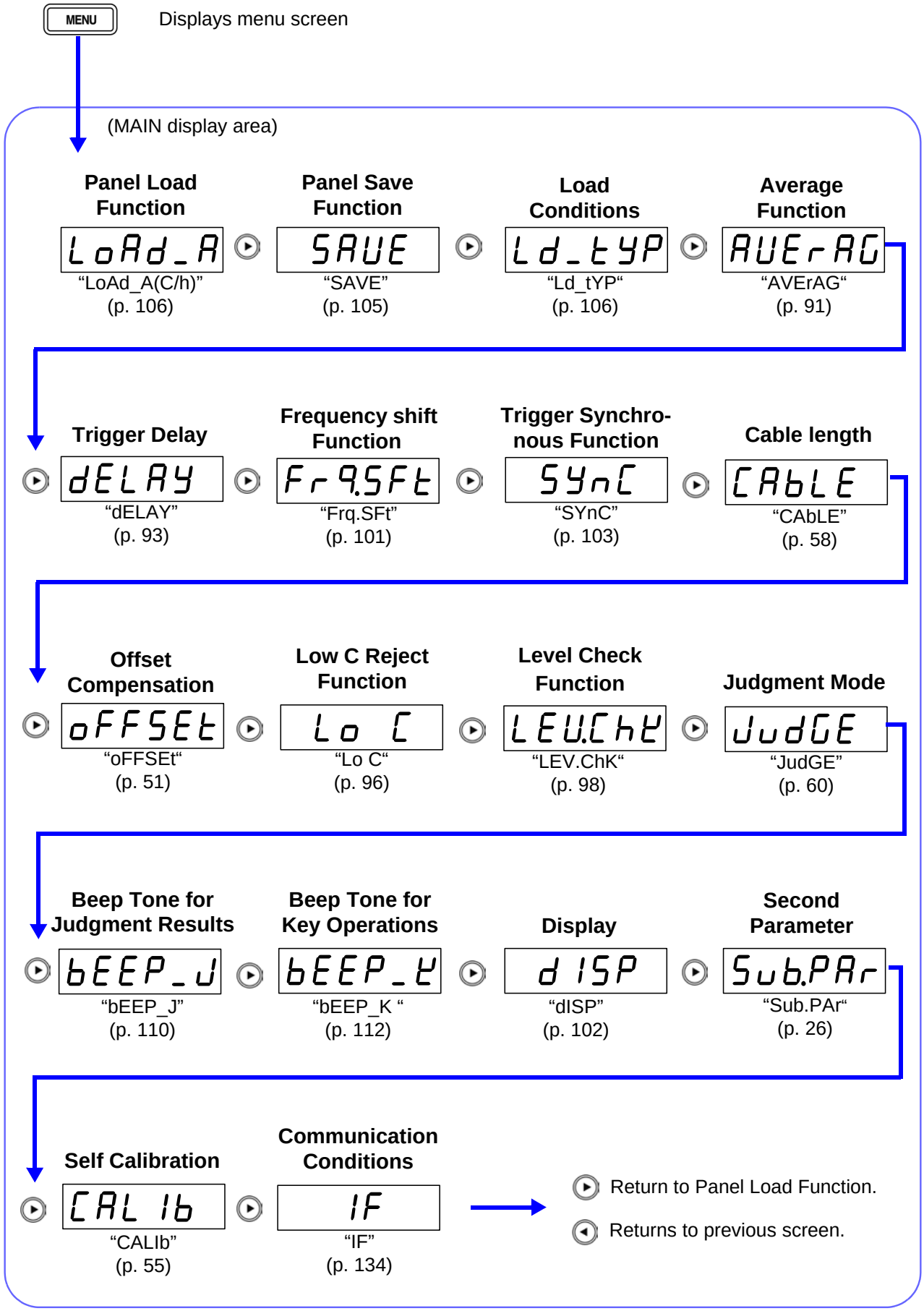
Side

Right side



⚠CAUTION Do not apply heavy downward pressure with the stand extended. The stand could be damaged.

Menu display organization



MAIN display area ERROR display

When the 3505/ 3506 detects a measurement abnormality, an error message is displayed in the MAIN display area. When a measurement error occurs, the device's condition is displayed in order of priority rank in the MAIN display area.

Priority rank	Error content	MAIN display	EXT.I/O	Solution
–	**OPEN compensation error** Displayed when the OPEN compensation value is less than 1 kΩ.	At 1 kHz _ Err At 100 kHz _ _ Err At 1 MHz _ _ _ Err	–	Put the measurement terminals in an open state. (Short circuit the H_{CUR} terminal to the H_{POT} terminal, and the L_{CUR} terminal to the L_{POT} terminal.)
				Use the shielding process as a countermeasure against external noise.
				Connect the 3505/ 3506 to ground.
				Check to see if the measurement cable is broken.
	SHORT compensation error Displayed when the SHORT compensation value is more than 1 kΩ	At 1 kHz _ Err At 100 kHz _ _ Err At 1 MHz _ _ _ Err	–	Short the measurement terminals.
				Check to see if the measurement cable is broken.
	LOAD compensation error Displayed when the LOAD compensation value is outside of range.	Error	–	Perform compensation again after setting to the appropriate range.

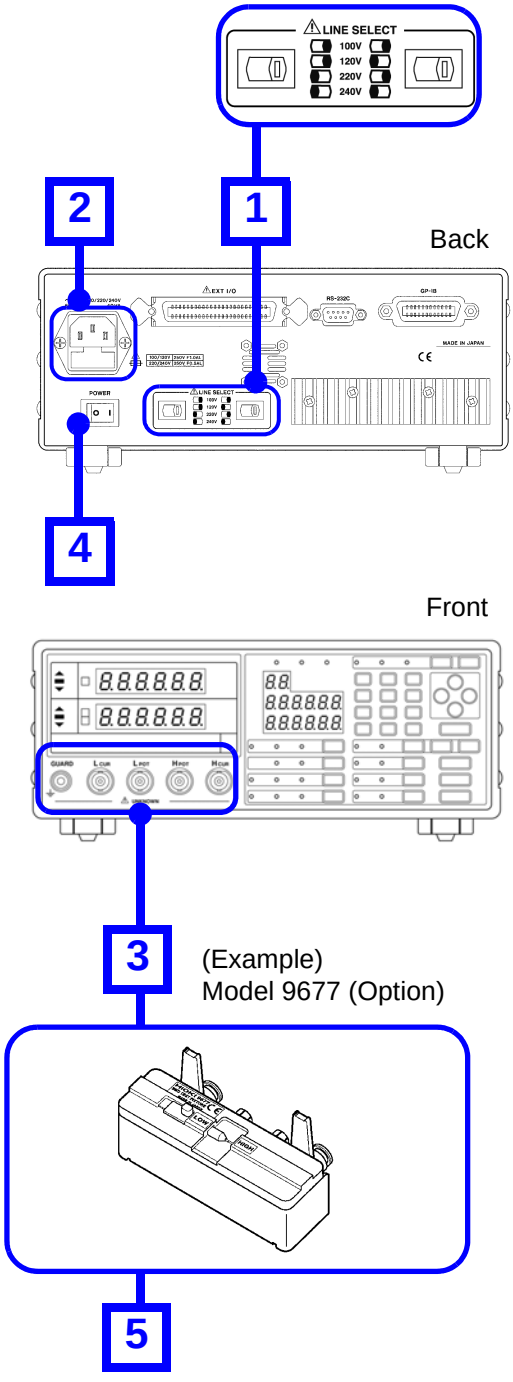
Priority rank	Error content	MAIN display	EXT.I/O	Solution
High ↓ Low	**Sampling error** Displayed when the A/D conversion is not carried out normally.	SAMP_E	ERR output, HI judgment, OUT judgment	It is possible that the device is being affected by incoming noise. The 3505/ 3506 is broken. Submit it for repairs.
	Timeout Displayed when measurement does not commence following trigger input.	t IME_E	ERR output, HI judgment, OUT judgment	It is possible that the device is being affected by incoming noise. The 3505/ 3506 is broken. Submit it for repairs.
	Current detection abnormality Displayed when the measured current is outside the present range.	I_hI	HI judgment, OUT judgment	The measurement range may be set too low. Set the range to the appropriate setting and measure again. The object being measured may have a SHORT circuit. Measure again to see if the object being measured is normal.
	Applied voltage abnormality Displayed when the voltage between the measurement terminals is lower than the measured voltage.	U_Lo	ERR output, HI judgment, OUT judgment	The H_{POT} and H_{CUR} terminals may be disconnected. Check the connection between the measurement sample and the terminals. There may be a high contact resistance between the H_{CUR} and L_{CUR} terminals and the object being measured.
	Low C Connector error Displayed when the measured value is abnormally lower than the measurement range.	Normal measurement value	ERR output, Standard judgment	The measurement terminals may not be connected to the object being measured. Check the contact between the object being measured and the measurement terminals.
	Abnormal level detected Displayed when the inspection level abnormality monitor value fluctuates.	LEU_E	ERR output, HI judgment, OUT judgment	Chattering may have occurred. Check the connection between the measurement sample and the terminals. It is possible that the device is being affected by incoming noise. Use the shielding process as a countermeasure against external noise.

NOTE When an error display occurs, the comparator and BIN measurement judgment results will be HI and OUTOF-BINS.

Measurement Preparations Chapter 2

Be sure to read "Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions." (p. 4) prior to setting up the unit.

2.1 Preparation Flowchart



1 Check the power voltage.

See 2.2 "Checking the Power Voltage" (p. 18)

2 Connect the power cord.

See 2.3 "Connecting the Power Cord" (p. 19)

3 Connect the probes or fixture (option) to the measurement terminals.

See 2.4 "Connecting the Probes and Fixtures" (p. 20)

4 Turn the power on.

See 2.5 "Turning the Power On and Off" (p. 21)

5 Connect the sample.

Unit Settings and Measurement

Chapter 3 "Setting the Measurement Conditions" (p. 23)
Chapter 6 "Application Functions" (p. 91)
Appendix 1 "Countermeasures Against Incorporation of External Noise" (p. A1)
Appendix 2 "Measurement of High Impedance Components" (p. A3)
Appendix 3 "Measurement of In-circuit Components" (p. A4)

2.2 Checking the Power Voltage

WARNING

- **Before turning the unit on, make sure the supply voltage matches that indicated on the its power connector. Connection to an improper supply voltage may damage the unit and present an electrical hazard.**
- **The power of the unit can be changed with the voltage selectors. To avoid an electric accident, use the unit with the voltage selectors set to a voltage value that matches the voltage to be used.**
- **Make sure the power is off when you change the voltage with the voltage selectors. Changing the power voltage when the power is on may result in damage to the unit or an electric accident.**
- **The maximum rated power is 40 VA.**
- **Replace the fuse only with one of the specified characteristics and voltage and current ratings. Using a non-specified fuse or shorting the fuse holder may cause a life-threatening hazard.**

  Fuse type: 100 V 120 V setting: 250 V F1.0AL ϕ20 mm x 5 mm dia
  220 V 240 V setting: 250 V F0.5AL ϕ20 mm x 5 mm dia

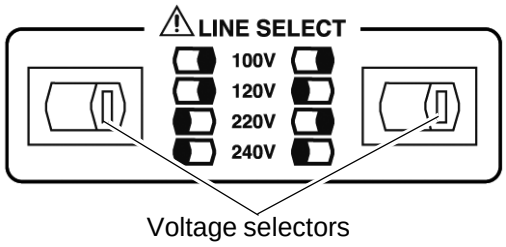
See 10.2 "Replacing the Power Fuse" (p. 269)

The power voltage specification of the unit is set as specified when the unit was ordered.
You can select from 100 V, 120 V, 220 V, and 240 V.

You can determine which voltage is set by checking the positions of the voltage selectors.
Refer to the diagram between the voltage selectors.

Voltage	Position of Left Voltage Selector	Position of Right Voltage Selector
100 V	(Right side)	(Right side)
120 V	(Right side)	(Left side)
220 V	(Left side)	(Right side)
240 V	(Left side)	(Left side)

Example:
Back



In the diagram, the voltage value is 100 V because both the left and right voltage selectors are set to the right side.

2.3 Connecting the Power Cord

⚠WARNING

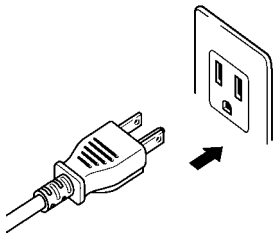
To avoid electrical accidents and to maintain the safety specifications of this unit, connect the power cord provided only to a 3-contact (two-conductor + ground) outlet.

⚠CAUTION

- To avoid damaging the power cord, grasp the plug, not the cord, when unplugging it from the power outlet.
- Turn off the power before disconnecting the power cord.

Connection Procedure

1. Make sure the power switch of the unit is off.
2. Make sure the power voltage matches and connect the power cord to the power inlet with voltage selectors on the rear of the unit.
3. Insert the plug into the power outlet.



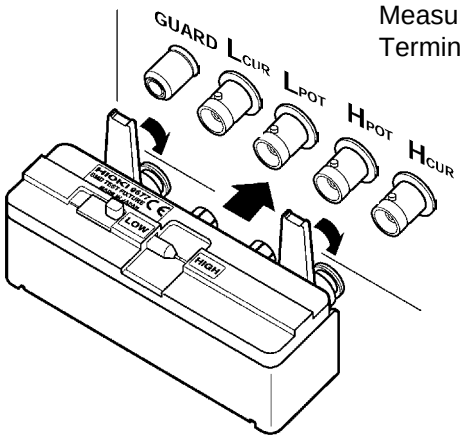
2.4 Connecting the Probes and Fixtures

⚠CAUTION

- Do not apply a voltage to the measurement terminals. Doing so may damage the unit.
- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- To avoid breaking the probes, do not bend or pull them.
- Avoid stepping on or pinching cables, which could damage the cable insulation.

Connection Procedure

Example: Connecting a Model 9677 Test Fixture (Option)



Measurement Terminal

Position upwards the side of the device with the model number imprinted on it, plug directly into the measurement terminals and use the right-left levers to lock the connections.

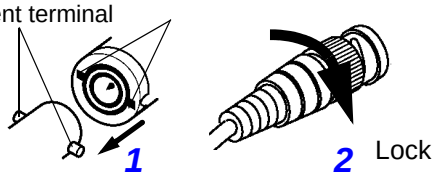
The measurement terminal for this device is the following four terminal configuration.

H_{CUR} terminal	Terminal for applying measurement signals
H_{POT} terminal	Voltage detection HIGH terminal
L_{POT} terminal	Voltage detection LOW terminal
L_{CUR} terminal	Measurement current detection terminal
GUARD terminal	Connect this terminal to the case

Example: Connecting the measurement cables

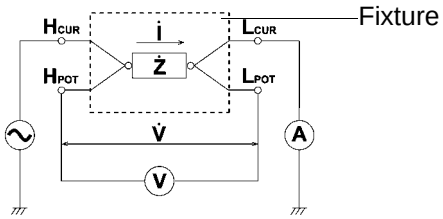
Connector guides of the Model 3505/ 3506 measurement terminal

Measurement cables BNC Connector Grooves



Align the grooves of the BNC connector with the connector guides of the connector of the unit and then insert the connector and rotate it clockwise until it locks into position.
To disconnect the connector, rotate it counterclockwise until it unlocks and then remove it.

Measurement Terminal Configuration

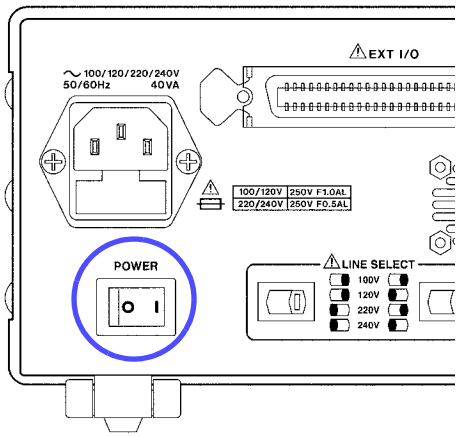


For details such as the connection procedure for a fixture, refer to the corresponding instruction manual.

NOTE

- Use Hioki fixtures (option), etc.
  See Appendix 6 "Options" (p. A9)
- This device is adjusted for 1.5D-2V coaxial cable use. Using other cable types may cause an increase in measurement errors.
- If all four terminals are disconnected, a meaningless number may be displayed on the unit.
- As this device has a four terminal configuration, always connect all 4 terminals' shields in the vicinity of the sample. If you do not make a connection to the 4 terminals' shields in the vicinity of the sample, there is the possibility of the measurement error becoming greater.

2.5 Turning the Power On and Off



Power ON |

Power OFF ○

Turning the power On

Set the power switch on the rear of the unit to ON (|).

All LEDs on the front panel light up.
The measurement conditions at startup are the same as the last time the power was turned off.

After turning the power on, wait 60 minutes for the unit to warm up before beginning measurement.

Turning the power Off

Set the power switch on the rear of the unit to OFF (○).

The measurement conditions are saved when the power is turned off.

Even if there is a power failure or other problem with the power, the unit will be in the measurement mode prior to the power failure after it recovers.

Setting the Measurement Conditions

Chapter 3

3.1 Pre-Operation Inspection

To ensure safe use of the unit, be sure to check the following inspection items prior to performing measurements.

Items	Countermeasure	Reference
Inspect the unit, probe, and fixture. (Are there any damaged parts?)	If there is damage: Unit and fixture: Submit them for repairs. Probe: Replace it with a new one.	———
Inspect the power cord and connection cord. (Is the covering cracked or is any metal exposed?)	Do not use a damaged cord because doing so may result in electric shock. (Replace the cord with a new one.)	———
Check the power supply voltage setting. (Does the setting of the voltage selector on the rear of the unit match the power supply voltage to be used?)	Use of the unit outside the specified power supply voltage range may result in the unit being damaged or an electrical fault. Set the voltage selector in accordance with the power supply voltage to be used.	Setting the Voltage Selector: 2.2 "Checking the Power Voltage" (p. 18)
When the power is turned on, does the fan spin and do the “3505/ 3506 ” and version number indications appear on the MAIN display area?	If the fan does not spin or the “3505/ 3506 ” and version number indications are not displayed, the unit may be malfunctioning. Submit it for repairs.	———
Are the measurement values indicated on the unit normal when measuring known samples such as standard capacitors?	If the measurement values are abnormal, check/perform the following. • Are the measurement conditions set appropriately? • Perform open circuit and short circuit compensation again. • Turn load compensation off. If the measurement values are still abnormal after you have checked/performed the above, the unit, probe, or fixture may be malfunctioning. Unit and fixture: Submit them for repairs. Probe: Replace it with a new one.	3.3 "Setting the Measurement Conditions" (p. 26) Chapter 4 "Compensate for errors" (p. 37)

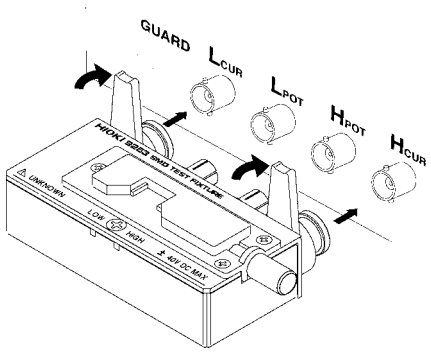
3.2 Measurement Example

Example The 9263 SMD Test Fixture is used for the measurement of multi-layer ceramic capacitors.:

Necessary tools
- Model 3505/ 3506
- Model 9263 SMD Test Fixture
- Sample to be measured: Multilayer ceramic capacitor

Measurement Conditions See 2 .

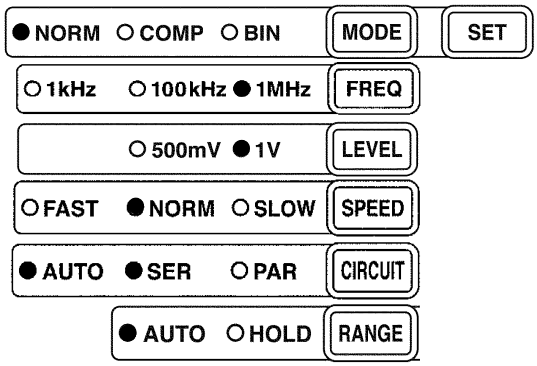
1 Connect the 9263 SMD Test Fixture (Option).



Connect the 9263 SMD Test Fixture to the measurement terminal.

For the connection method, refer to the instruction manual supplied with the fixture.

2 Set the measurement conditions.



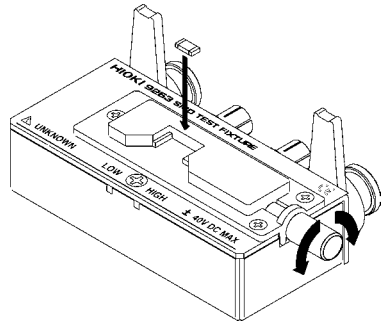
Using the keys on the operating panel, set the measurement conditions as shown at left.

Display parameter ..... D (p. 26)
MODE Measurement mode..... NORM (p. 27)
FREQ Frequency.....1 MHz (p. 27)
LEVEL Measurement signal level.....1 V (p. 28)
SPEED Measurement speed..... NORM (p. 28)
CIRCUIT Equivalent-circuit mode .. AUTO (p. 29)
RANGE Measurement range..... AUTO (p. 31)

Make other settings as necessary.
4.1 "Open Circuit Compensation and Short Circuit Compensation" (p. 37)
4.2 "Load Compensation" (p. 45)
4.3 "Offset Compensation" (p. 51)
4.4 "Self Calibration" (p. 55)
4.5 "Set the Cable Length" (p. 58)
3.3.8 "Trigger Signal" (p. 36)
6.1 "Setting the Average Function" (p. 91)
6.2 "Trigger Delay Setting" (p. 93)

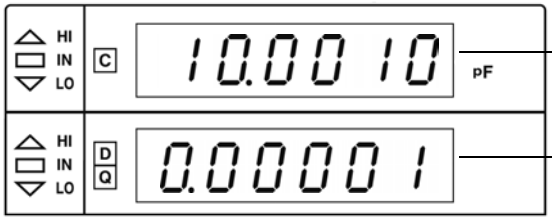
The open circuit compensation and short circuit compensation and self calibration settings improve measurement accuracy.

3 Connect the sample to be measured to the 9263 SMD Test Fixture.



For the connection method, refer to the instruction manual supplied with the fixture.

4 Check the measurement results.



Capacitance

Dissipation Factor

The voltage monitor and the current monitor can be checked on the SUB display. (p. 113)

3.3 Setting the Measurement Conditions

3.3.1 Setting the Display Parameter

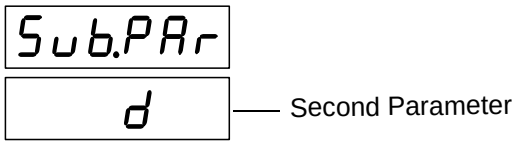
The lower parameter (second parameter) of the MAIN display can either be set to D (dissipation factor) or Q (quality factor).

1. **Press [MENU].**

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

2. **Use [◀] [▶] to select the “Sub.PAr” menu item.**

The state becomes as follows.
(MAIN display area)



(Display parameter settings screen)

3. **Press [▲] [▼] to enable or disable the second parameter.**

It toggles “d” and “q” each time [▲] [▼] is pressed.

4. **Press [ENTER] to confirm the second parameter.**

Once selected, "CALIb" (Self calibration settings screen) will be shown in the upper part of the MAIN display area.

The second parameter will not be confirmed unless [ENTER] is pressed.

5. **Press [MENU].**

The unit returns to normal measurement mode.

3.3.2 Measurement Mode

Select a measurement mode.

Press MODE **to change the mode.**

Mode: **NORM**, **COMP**, **BIN**

The selected item is indicated by the lit LED lamp.

NORM	Select this when using normal measurement mode.
COMP	Select this when using comparator measurement mode. **See** 5.1 "Comparator Function" (p. 59)
BIN	Select this when using BIN measurement mode. **See** 5.2 "BIN Measurement Function" (p. 74)

3.3.3 Measurement Frequency

Set the measurement frequency.
Set a frequency appropriate for the sample to be measured.

Press FREQ **to change the mode.**

Measurement frequency: **1 kHz**, **100 kHz (only for 3505)**, **1 MHz**

The selected item is indicated by the lit LED lamp.

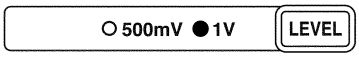
At 1 MHz the measured frequency can be shifted by ±1% or ±2% with the use of the frequency shift function.

See 6.6 "Using the Frequency Shift Function" (p. 101)

3.3.4 Measurement Signal Level

Set the measurement signal level.
Set a signal level appropriate for the sample to be measured.

Press LEVEL **to change the mode.**



Measurement signal level: **500 mV, 1 V**

The selected item is indicated by the lit LED lamp.

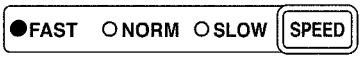
NOTE

- In some samples, the value may vary depending on the measurement-signal level.
- Because this is an open terminal voltage mode device it cannot measure constant voltage. When measuring large capacity condensers the voltage between condenser terminals will be lower than the set voltage. This is due to the voltage decrease caused by output resistance and measurement cable resistance.
  Output resistance: Approx. 1 Ω (Above 2.2 μF range at 1 kHz ; above 22 nF range at 100 kHz)
  Approx.20 Ω (Ranges other than the above-mentioned)

3.3.5 Measurement Speed

Set the measurement speed.

Press SPEED **to change the mode.**



Measurement speed: **FAST**, **NORM**, **SLOW**

The selected item is indicated by the lit LED lamp.

FAST	Measures at high speed.
NORM	Measures at normal speed.
SLOW	Measures at low speed, but provides improved measurement accuracy.

The lower the measurement speed, the higher the measurement accuracy becomes.

Measurement speed

FAST	NORM	SLOW
2.0 ms	5.0 ms	14.0 ms

(Allowance: ±5%±0.5 ms)

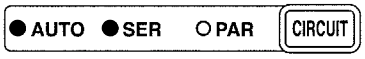
NOTE

The measurement time varies depending on such factors as the open and short and load circuit compensation ON/ OFF and the comparator/ BIN measurement function ON/ OFF.

3.3.6 Equivalent Circuit Mode

You may set an equivalent circuit mode (SER/ PAR).
Automatic selection is also possible.
See "Equivalent Circuit Mode" (p. 30)

Press CIRCUIT **to change the mode.**



Equivalent circuit mode: **AUTO**, **SER**, **PAR**

The selected item is indicated by the lit LED lamp.

AUTO The series equivalent circuit mode or parallel equivalent circuit mode is automatically selected according to the measurement range.

Measurement Frequency	Range	Automatically selected mode
1 kHz	100 pF to 100 nF	Parallel equivalent circuit
	220 nF to 10 μF	Series equivalent circuit
100 kHz (only for 3505)	1 pF to 1 nF	Parallel equivalent circuit
	2.2 nF to 100 nF	Series equivalent circuit
1 MHz	220 fF to 100 pF	Parallel equivalent circuit
	220 pF to 1 nF	Series equivalent circuit

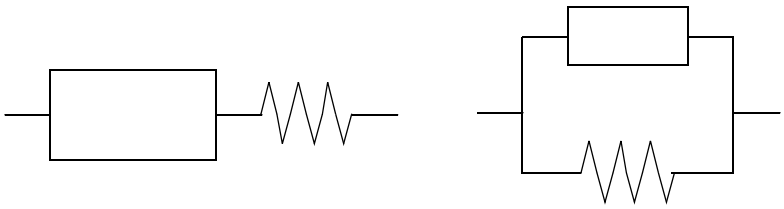
See About the Range No.(p. 33)

SER Series equivalent circuit mode

PAR Parallel equivalent circuit mode

Equivalent Circuit Mode

This unit measures a current that flows through the sample and a voltage applied between terminals of the measurement sample to calculate and obtain impedance Z and phase angle θ. Static capacitance can be obtained using Z and θ values.
A series-equivalent circuit mode calculates as though a captive component C and a resistive component were connected in series, or alternatively a parallel-equivalent circuit mode calculates as though connected in parallel. Because the operation is different between a series-equivalent circuit mode and a parallel-equivalent circuit mode, the appropriate equivalent circuit mode need be selected to reduce error margin.



Series-equivalent circuit　　Parallel-equivalent circuit

Normally, the series-equivalent circuit mode is used for a large capacitance (low-impedance components: approx. 100 Ω or less). While the parallel-equivalent circuit mode is used for a small capacitance (high-impedance components: approx. 10 kΩ or more). When you are not sure about selection of equivalent-circuit mode for the impedance such as between approx. 100 Ω to 10 kΩ), please call the parts maker.

3.3.7 Measurement Range

Select a measurement range. Automatic selection is also possible.

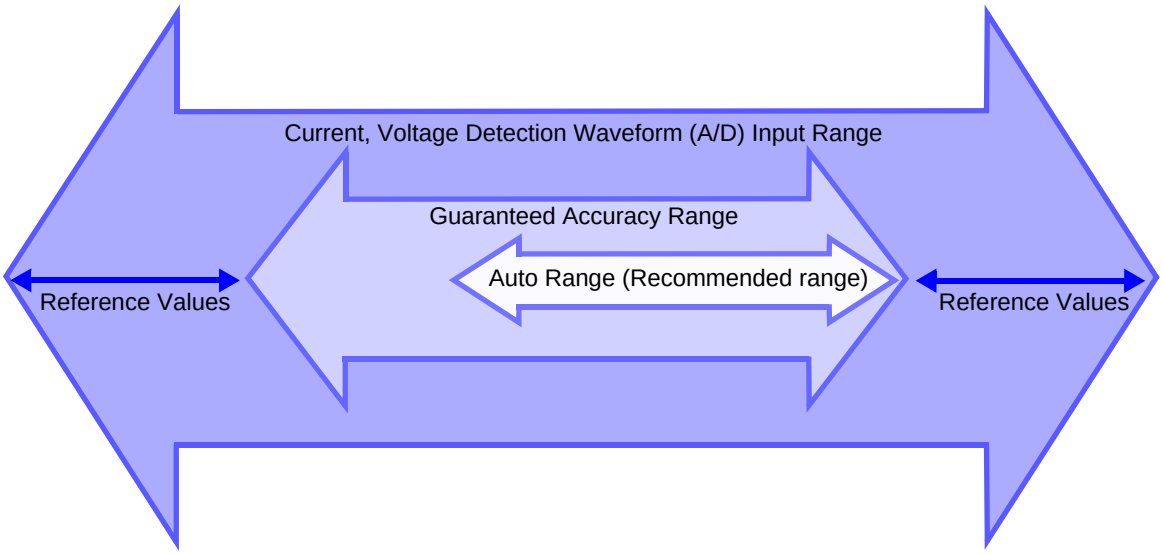
Press RANGE **to change the mode.**

Measurement Range: **AUTO**, **HOLD**

The selected item is indicated by the lit LED lamp.

AUTO (Auto range)	The optimal measurement range is selected automatically. This is useful for the measurement of unknown samples. However, measurement takes longer.
HOLD (Hold range)	The measurement range is fixed, and may only be altered manually. Take measurements in the same range regardless of the value of the sample. This is useful for high-speed measurement. Changing the range: ▼ ▲ When the range is changed, the decimal point and unit in the measurement value display area change. The measurement range is displayed in the SUB display area.

Measurement range



Guaranteed Accuracy Range

No.	1 kHz		100 kHz (only for 3505)		1 MHz	
	Range	Guaranteed accuracy range	Range	Guaranteed accuracy range	Range	Guaranteed accuracy range
1					220 fF	0.000 fF to 330.000 fF
2					470 fF	68.000 fF to 680.000 fF
3			1 pF	0.00000 pF to 1.50000 pF	1 pF	0.15000 pF to 1.50000 pF
4			2.2 pF	0.33000 pF to 3.30000 pF	2.2 pF	0.33000 pF to 3.30000 pF
5			4.7 pF	0.68000 pF to 6.80000 pF	4.7 pF	0.68000 pF to 6.80000 pF
6			10 pF	1.0000 pF to 15.0000 pF	10 pF	1.0000 pF to 15.0000 pF
7			22 pF	3.3000 pF to 33.0000 pF	22 pF	3.3000 pF to 33.0000 pF
8			47 pF	6.8000 pF to 68.0000 pF	47 pF	6.8000 pF to 68.0000 pF
9	100 pF	0.000 pF to 150.000 pF	100 pF	15.000 pF to 150.000 pF	100 pF	15.000 pF to 150.000 pF
10	220 pF	33.000 pF to 330.000 pF	220 pF	33.000 pF to 330.000 pF	220 pF	33.000 pF to 330.000 pF
11	470 pF	68.000 pF to 680.000 pF	470 pF	68.000 pF to 680.000 pF	470 pF	68.000 pF to 680.000 pF
12	1 nF	0.15000 nF to 1.50000 nF	1 nF	0.15000 nF to 1.50000 nF	1 nF	0.15000 nF to 1.50000 nF
13	2.2 nF	0.33000 nF to 3.30000 nF	2.2 nF	0.33000 nF to 3.30000 nF		
14	4.7 nF	0.68000 nF to 6.80000 nF	4.7 nF	0.68000 nF to 6.80000 nF		
15	10 nF	1.5000 nF to 15.0000 nF	10 nF	1.5000 nF to 15.0000 nF		
16	22 nF	3.3000 nF to 33.0000 nF	22 nF	3.3000 nF to 33.0000 nF		
17	47 nF	6.8000 nF to 68.0000 nF	47 nF	6.8000 nF to 68.0000 nF		
18	100 nF	15.000 nF to 150.000 nF	100 nF	15.000 nF to 150.000 nF		
19	220 nF	33.000 nF to 330.000 nF				
20	470 nF	68.000 nF to 680.000 nF				
21	1 μF	0.15000 μF to 1.50000 μF				
22	2.2 μF	0.33000 μF to 3.30000 μF				
23	4.7 μF	0.68000 μF to 6.80000 μF				
24	10 μF	1.5000 μF to 15.0000 μF				

Auto Range

No.	1 kHz		100 kHz (only for 3505)		1 MHz	
	Range	Auto range	Range	Auto range	Range	Auto range
1					220 fF	0.000 fF to 330.000 fF
2					470 fF	220.000 fF to 680.000 fF
3			1 pF	0.00000 pF to 1.50000 pF	1 pF	0.47000 pF to 1.50000 pF
4			2.2 pF	1.00000 pF to 3.30000 pF	2.2 pF	1.00000 pF to 3.30000pF
5			4.7 pF	2.20000 pF to 6.80000 pF	4.7 pF	2.20000 pF to 6.80000 pF
6			10 pF	4.7000 pF to 15.0000 pF	10 pF	4.7000 pF to 15.0000 pF
7			22 pF	10.0000 pF to 33.0000 pF	22 pF	10.0000 pF to 33.0000 pF
8			47 pF	22.0000 pF to 68.0000 pF	47 pF	22.0000 pF to 68.0000 pF
9	100 pF	0.000 pF to 150.000 pF	100 pF	47.000 pF to 150.000 pF	100 pF	47.000 pF to 150.000 pF
10	220 pF	100.000 pF to 330.000 pF	220 pF	100.000 pF to 330.000 pF	220 pF	100.000 pF to 330.000 pF
11	470 pF	220.000 pF to 680.000 pF	470 pF	220.000 pF to 680.000 pF	470 pF	220.000 pF to 680.000 pF
12	1 nF	0.47000 nF to 1.50000 nF	1 nF	0.47000 nF to 1.50000 nF	1 nF	0.47000 nF to 1.50000 nF
13	2.2 nF	1.00000 nF to 3.30000 nF	2.2 nF	1.00000 nF to 3.30000 nF		
14	4.7 nF	2.20000 nF to 6.80000 nF	4.7 nF	2.20000 nF to 6.80000 nF		
15	10 nF	4.7000 nF to 15.0000 nF	10 nF	4.7000 nF to 15.0000 nF		
16	22 nF	10.0000 nF to 33.0000 nF	22 nF	10.0000 nF to 33.0000 nF		
17	47 nF	22.0000 nF to 68.0000 nF	47 nF	22.0000 nF to 68.0000 nF		
18	100 nF	47.000 nF to 150.000 nF	100 nF	47.000 nF to 150.000 nF		
19	220 nF	100.000 nF to 330.000 nF				
20	470 nF	220.000 nF to 680.000 nF				
21	1 μF	0.47000 μF to 1.50000 μF				
22	2.2 μF	1.00000 μF to 3.30000 μF				
23	4.7 μF	2.20000 μF to 6.80000 μF				
24	10 μF	4.7000 μF to 15.0000 μF				

Display range

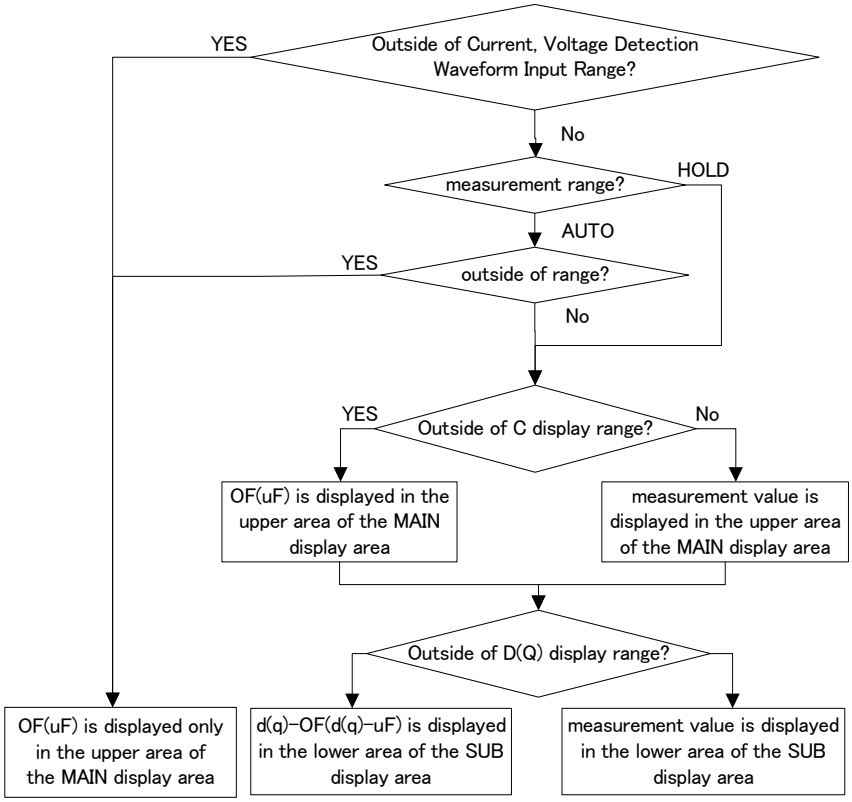
	C display range	D(Q) display range	Note
Normal measurement, comparator and BIN measurement (count setting)	-199999 to 999999	-199999 to 199999	MAIN Display shows -199999 when C measurement value falls below -199999
comparator and BIN measurement (Δsetting)			
comparator and BIN measurement (Δ%setting)	-99999 to 99999		

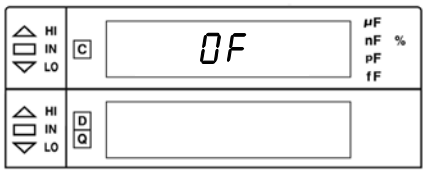
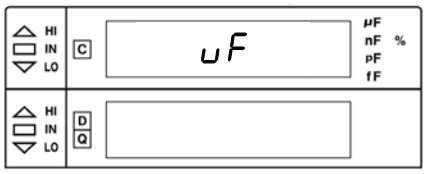
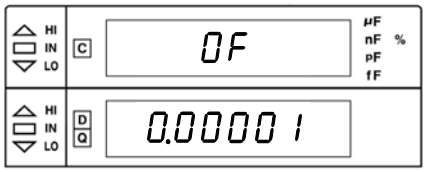
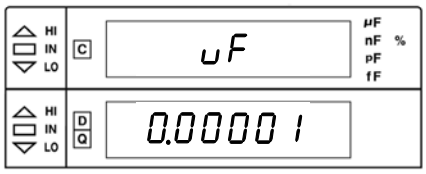
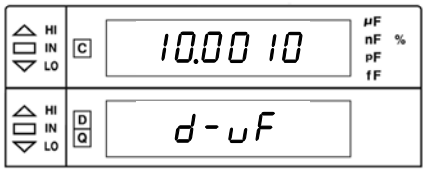
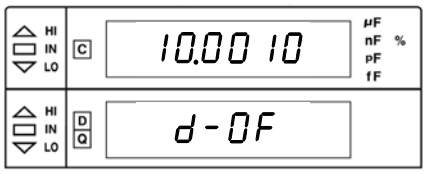
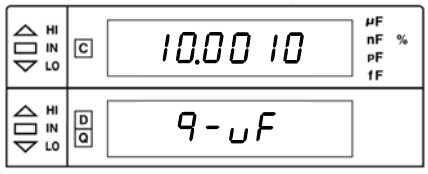
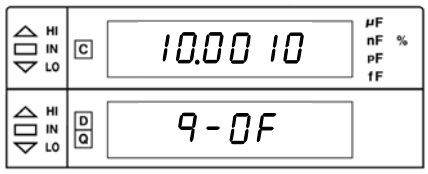
NOTE

- If the measurement values displayed on the unit are outside of the guaranteed accuracy range, the HOLD LED flashes.
- For errors other than measurement value outside of range errors, refer to "MAIN display area ERROR display" (p. 15).
- When measuring 2 test items that fall within the range of Auto Range, choosing the item with a capacity nearer the upper value will give a better repeat accuracy.
- An error message may be displayed in the MAIN display area if the value falls outside the measurement range and display range following the flow chart below.
- A negative measurement value may be displayed.
  Factors which may cause this include the following:
  - Measuring inductance that is in the opposite phase.
  - The OPEN compensation value is not accurately taken.
  - LOAD compensation enabled.
  - Offset compensation is enabled.

  The lowest display value in both the MAIN and SUB displays is "-199999". If the measurement value is lower than this, "-199999" will be shown in the MAIN display and "d-UF" will be shown in the SUB display.
- The possible measurement range setting differs depending on the frequency being measured. When the measured frequency falls outside of range, the lowest range will be used for extremely small values and the largest range for frequencies larger than the largest value.

OF, UF Judgement Flow Chart

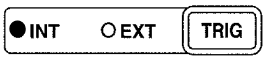


MAIN display	Cause
	HOLD Setting: When input for current detection waveform is out of the range. AUTO Setting: current detection waveform is out of the range. + When measurement value is higher than upper value of Auto Range
	HOLD Setting: When input for voltage detection waveform is out of the range. AUTO Setting: voltage detection waveform is out of the range. + When measurement value is lower than lower value of Auto Range.
 or 	When C display range is exceeded.
 or 	When D display range is exceeded.
 or 	When Q display range is exceeded.

3.3.8 Trigger Signal

The internal trigger or the external trigger can be set.

Press TRIG **to change the mode.**



Trigger signal: **INT**, **EXT**

INT (Internal trigger mode)	Continuous measurement is performed while automatically generating an internal trigger signal. The INT LED lights up.
EXT (External trigger mode)	A trigger signal is input from the outside either manually or automatically. The EXT LED lights up. Press MANU TRIG to perform measurement once. Measurement is performed with a trigger from the EXT I/O connector TRIG terminal.

When inputting the trigger signal through the interface

Measurement starts when a "∗TRG" command is received through the interface.

For details on inputting the trigger signal through the interface, refer to "Sampling Request" (p. 176) of section 8.9, "Message Reference".

When inputting the trigger signal through the EXT I/O connector

When a negative-logic pulse signal is input to $\overline{\text{TRIG}}$ (pin 1) of the EXT I/O connector on the rear panel, one measurement operation is performed.

See 7.1 "About the EXT I/O Connector" (p. 121)

Compensate for errors

Chapter 4

4.1 Open Circuit Compensation and Short Circuit Compensation

Open circuit compensation and short circuit compensation enable you to reduce the effect of impedance remaining in parts such as the probe or fixture and improve measurement accuracy.
There are two ways of performing open circuit compensation and short circuit compensation.

- **All Compensation**
  Compensates at measurement conditions set at Command: CORRection :OPEN(SHORt):POINt (Frequencies: 1 kHz, 100 kHz (3505 only), 1 MHz, Signal levels: 500 mV, 1 V's optional point).
  However, and 1 MHz it can only perform compensation on frequencies set to frequency compensation.
  This can be performed from the front panel or via a PC.
  See "Setting and Query of Open Compensation Points" (p. 204) and "Setting and Query of Short Compensation Points" (p. 208) of "8.9, "Message Reference".

  All Compensation Example
  For example, when all compensation is performed at 1% frequency shift and compensation point set to all frequencies and 1 V signal level (:CORRection :OPEN:POINt 42, :CORRection:SHORt:POINt 42), compensation is performed at the measurement conditions marked "Yes" below.

Measurement frequency / Measurement level	1 kHz	100 kHz	1 MHz				
			-2%	-1%	0%	1%	2%
500 mV	No	No	No	No	No	No	No
1 V	Yes	Yes	No	No	No	Yes	No

- **Spot Compensation**
  This performs compensation at the frequency currently set. Perform this from a PC through the interface.
  See "Setting and Query of Open Circuit Compensation Function" (p. 201) and "Setting and Query of Short Circuit Compensation Function" (p. 205) of "8.9, "Message Reference".

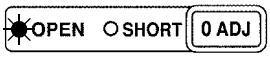
4.1 Open Circuit Compensation and Short Circuit Compensation

NOTE

- The measurement accuracy values defined in the specifications are for when open circuit compensation and short circuit compensation are performed.
- Be sure to perform compensation again after replacing the probe or fixture. You will be unable to obtain correct values if measurement is performed in the compensation state prior to replacement.
- The open circuit compensation range of impedance is 1 kΩ or more. However, if the values are not sufficiently high compared to the impedance of the sample, the measurement errors will be larger and measurement may become no longer possible.
- The short circuit compensation range of impedance is less than 1 kΩ. However, if the values are not sufficiently low compared to the impedance of the sample, the measurement errors will be larger and measurement may become no longer possible.
- The compensation value is saved at varying values depending on the measured frequency, signal level, and frequency shift settings.
  If these settings are changed and a measurement value has not been taken with the changed measurement conditions, open circuit compensation and short circuit compensation will be turned OFF.
  However, when the frequency shift or cable length setting is changed, open circuit compensation and short circuit compensation are set to OFF for all measurement conditions.
- If there is an abnormality in the compensation value, measurement value error will increase. The measurement value may be displayed as a negative number.
- When performing compensation, make sure that there is no noise source nearby. Noise may cause an error when performing compensation.
  ex. Servo Motor, switching power source, high-voltage cable and etc.

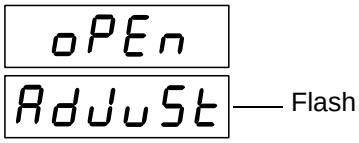
Take the open circuit compensation and short circuit compensation values

1. In normal measurement mode, press [0 ADJ].



(Flash)

(MAIN display area)

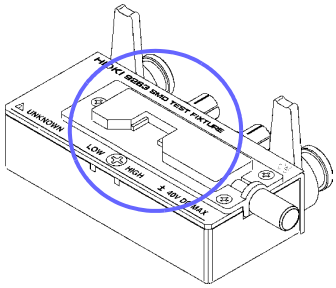


NOTE

If you do not want to perform open circuit compensation, press [0 ADJ] to proceed to configuring the short circuit compensation settings. (The SHORT LED flashes and the “Short AdJuSt” indication is displayed and the “AdJuSt” indication flashes in the MAIN display area.) Proceed to Step 5.

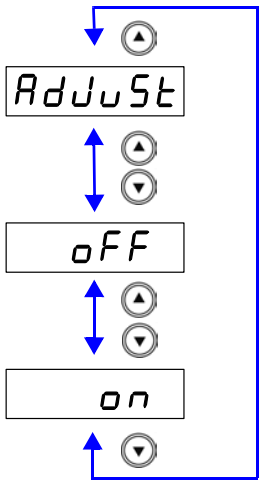
2. Open the space between the HIGH and LOW terminals of the probe or fixture connected to the measurement terminals to match the width of the object being measured.

(Example)



3. Use ◀ or ▶ to select setting the open circuit menu item.

Pressing ▲ or ▼ causes the display to change in the following manner.



“AdJuSt”
Takes the compensation values.

“oFF”
Disables the compensation values.

“on”
Enables the compensation values.

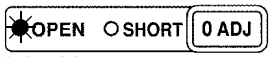
NOTE

- When performing compensation, the placement of things like the probe and the distances between terminals must be as similar as possible to the state when performing measurement.
- If compensation is being affected by external noise, use the shielding process.

See Appendix 2 "Measurement of High Impedance Components" (p. A3).

4. **Select "AdJuSt" and press ENTER.**

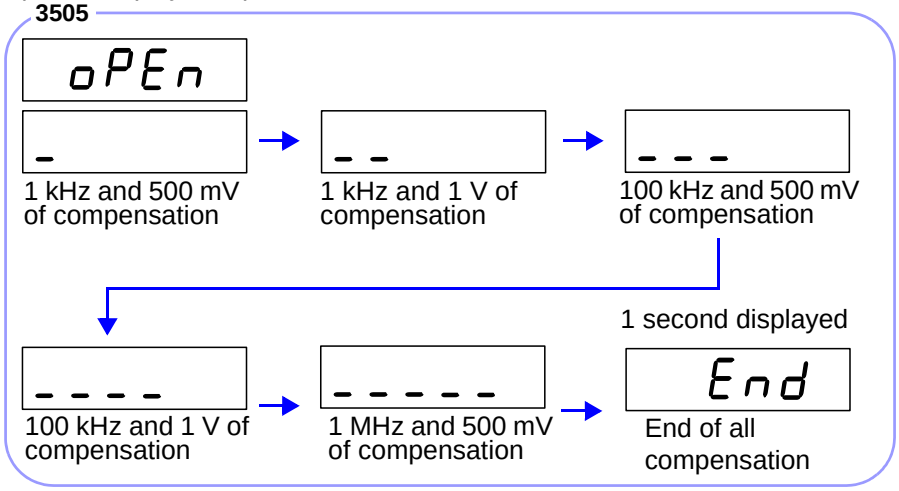
Incorporate the open circuit compensation values. (ALL Compensation)



(Flash)

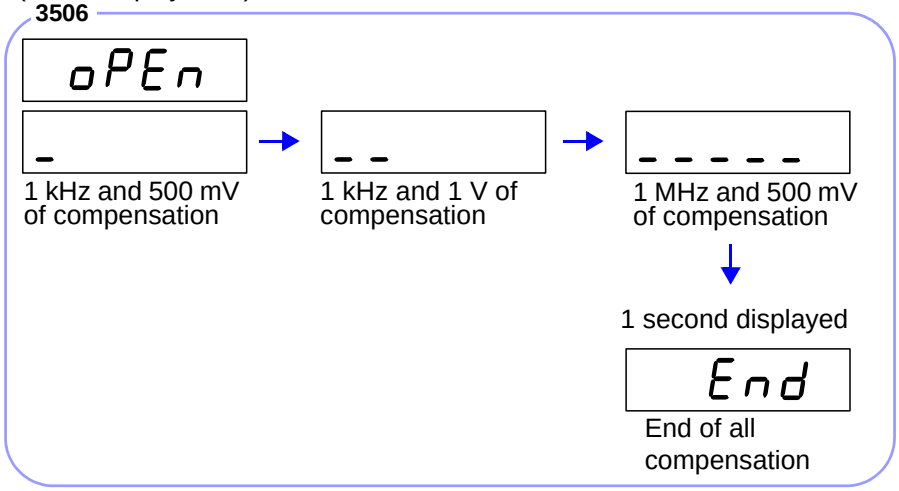
(MAIN display area)

3505



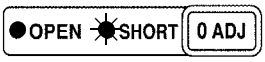
(MAIN display area)

3506



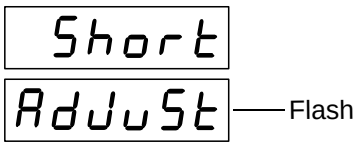
End of Compensation:

When compensation ends, the state becomes as follows.



(Light up) (Flash)

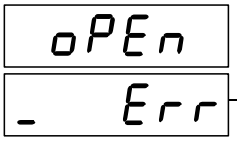
(MAIN display area)



Compensation Error:

If a compensation error occurs, a warning beep will sound and the state becomes as follows.
The measurement frequency at which the error occurred can be ascertained from the underbar display.
See "MAIN display area ERROR display" (p. 15)

(MAIN display area)



Compensation stops.

Error display	Measurement Frequency
Err	1 kHz
Err	100 kHz
Err	1 MHz

What if there is an error?

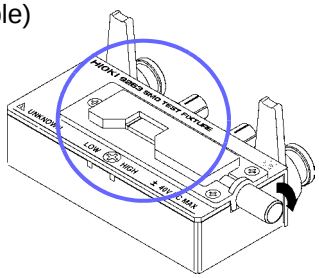
- Are the measurement terminals open? Open the measurement terminals and then perform compensation again. (To set the measurement terminals open, short the H_{CUR} terminal to the H_{POT} terminal, and the L_{CUR} terminal to the L_{POT} terminal.)
- If there is a compensation error even when the measurement terminals are open, external noise may be affecting compensation or the unit, probe, or fixture may be malfunctioning. Use the shielding process, submit the unit or fixture for repairs, or replace the probe with a new one. (The probe cannot be repaired.)
  See Appendix 2 "Measurement of High Impedance Components" (p. A3)

If 0 ADJ is pressed, the unit enters short circuit compensation incorporate mode. (Proceed to Step5) (The settings for open circuit compensation remain the same as last time.)

5. Use a shorting bar to create a short circuit state between the HIGH terminal and LOW terminal of the probe or fixture connected to the measurement terminals.

Use a shorting bar with as low an impedance as possible.

(Example)



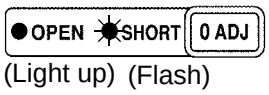
NOTE

- When performing compensation, the placement of things like the probe and fixture and the distances between terminals must be as similar as possible to the state when performing measurement.
- If you do not want to perform short circuit compensation, press 0 ADJ to return to normal measurement mode.

6. **Use ▲ or ▼ to select setting the short circuit menu item.**

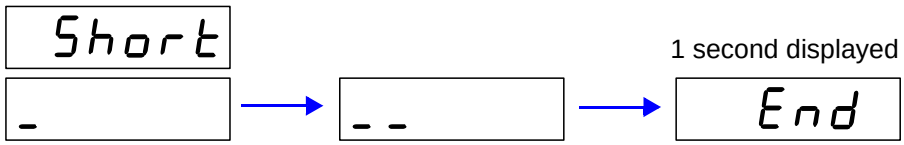
7. **Select "AdJuSt" and press ENTER.**

Incorporate the short circuit compensation values. (ALL Compensation)



(Light up) (Flash)

(MAIN display area)



1 second displayed

1 kHz end of compensation

100 kHz end of compensation (only for 3505)

End of all compensation

End of Compensation:

When compensation ends, the state becomes as follows.

(Light up) (Light up)

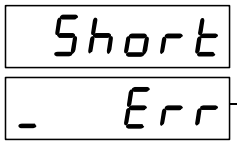
The unit returns to normal measurement mode.

Compensation Error:

If a compensation error occurs, a warning beep will sound and the state becomes as follows.
The measurement frequency at which the error occurred can be ascertained from the underbar display.

See "MAIN display area ERROR display" (p. 15)

(MAIN display area)



Light up

Compensation stops.

Error display	Measurement Frequency
_ Err	1 kHz
_ _ Err	100 kHz
_ _ _ Err	1 MHz

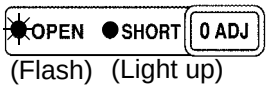
What if there is an error?

- If 0 ADJ is pressed, the unit returns to normal measurement mode. (The settings for short circuit compensation remain the same as last time.)
- Are the measurement terminals in a short circuit state? Short circuit the measurement terminals and then perform compensation again.
- If there is a compensation error even when the measurement terminals are short circuited, the unit, probe, or fixture may be malfunctioning. Use the shielding process, submit the unit or fixture for repairs, or replace the probe with a new one. (The probe cannot be repaired.)

Setting Open Circuit and Short Circuit Compensation ON/ OFF

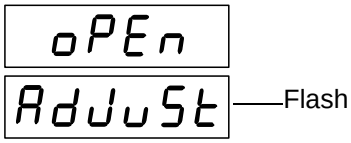
1. In normal measurement mode, press [0 ADJ].

The state becomes as follows.

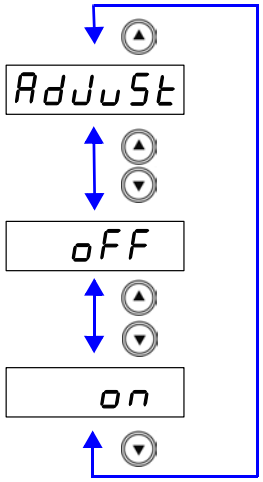


(Flash) (Light up)

(MAIN display area)



Pressing ▲ or ▼ causes the display to change in the following manner.



"AdJuSt"
Takes the compensation values.

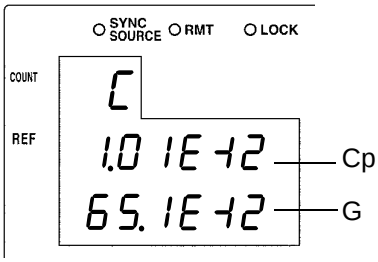
"oFF"
Disables the compensation values.

"on"
Enables the compensation values.

2. Press ▲ ▼ to set the open circuit compensation ON or OFF.

When open circuit compensation is in the ON state the open circuit compensation value will be displayed (as "Cp, G") in the SUB display area.

(SUB display area)

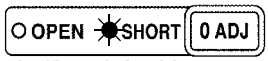


NOTE

Pressing [FREQ] and [LEVEL] on the control panel and changing measurement conditions while the open circuit compensation values are being displayed will cause the compensation value relative to the set measurement conditions to be displayed.

3. Press ENTER to confirm the open circuit compensation ON or OFF.

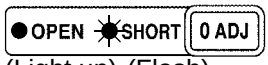
Open circuit compensation is set to OFF and the state becomes as follows.



(Off) (Flash)

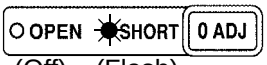
The state of the open circuit compensation LED becomes as follows and the device enters the short circuit compensation setting mode.

When select the “on”



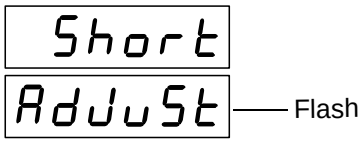
(Light up) (Flash)

When select the “oFF”



(Off) (Flash)

(MAIN display area)



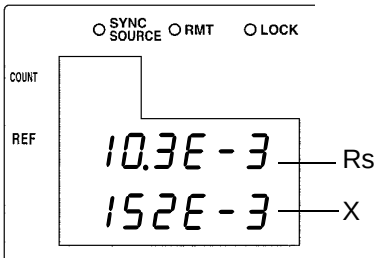
NOTE

Press 0 ADJ if not setting the open circuit compensation ON or OFF. The device enters short circuit compensation ON or OFF setting.
(Proceed to Step 4.)

4. Press ▲ ▼ to set the short circuit compensation ON or OFF.

When short circuit compensation is in the ON state the open circuit compensation value will be displayed (as "Rs, X") in the SUB display area.

(SUB display area)



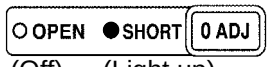
NOTE

Pressing FREQ and LEVEL on the control panel and changing measurement conditions while the open circuit compensation values are being displayed will cause the compensation value relative to the set measurement conditions to be displayed.

5. Press ENTER to confirm the short circuit compensation ON or OFF.

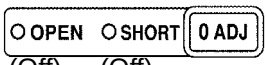
Short circuit compensation is set to OFF and the state becomes as follows.

When select the “on”



(Off) (Light up)

When select the “oFF”



(Off) (Off)

NOTE

Press 0 ADJ if not setting the short circuit compensation ON or OFF.
The unit returns to normal measurement mode.

4.2 Load Compensation

Load compensation allows for the calculation of the load compensation rate by measuring a standard sample with known measurement values and compensating the measurement values.
With this function, when using multiple 3505/ 3506 units, the measurement errors of individual 3505/ 3506 units can be reduced and a single measurement value produced. Alternately, the measurement values of the 3505/ 3506 can be matched to those of a reference device.
The compensation rate is determined by first calculating the impedance Z and phase angle θ from the reference values of the measurement conditions, C, and D (Q) and the actual measurement values and then using the following formula for the calculation.

Z compensation rate = (Z reference value)/ (Z actual value)
θ compensation rate = (θ reference value) – (θ actual value)

For the actual values of Z and θ, compensation is performed using the above load compensation rate and then C and D (Q) are calculated from Z and θ after compensation.

NOTE

- The conditions that are currently set (frequency shift, level, range, display parameter and cable length) are used as the measurement conditions for load compensation.
  However, load compensation values are separated by measurement frequencies into separate data.
  Changing the measurement conditions while load compensation in enabled results in load compensation being disabled. (When this happens, the OFF LED of LOAD flashes.)
  If, however, the measurement conditions are returned to what they were during load compensation, then load compensation is resumed.
  (The ON LED of LOAD lights up.)
  For example, in the measurement frequencies shown in “Yes” in the table below, the load compensation function is still enabled even when the measurement value is changed to 1 kHz ↔ 1 MHz after the load compensation value has been acquired. The load compensation function becomes disabled when the measurement frequency is changed to 100 kHz, or when the frequency shift, level, range, display parameter, and cable length are changed.

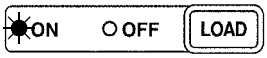
Measurement frequency	1 kHz	100 kHz	1 MHz (-2% to 2%)
Load compensation	Yes	No	Yes

- When open circuit compensation and short circuit compensation are enabled, load compensation performs compensation for Z and θ after open circuit compensation and short circuit compensation are finished.
  During settings for open circuit compensation and short circuit compensation, setting, enabling compensation value and disabling compensation value, all compensation acquisition point setting, when current measurement conditions are similar to the measurement conditions during load compensation (frequency shift, level, cable length), the load compensation value will be compensated at the latest open compensation value, short compensation value and the load compensation rate will be recalculated.

Take the load compensation rate.

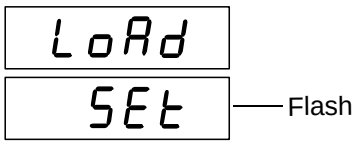
1. In normal measurement mode, press LOAD.

The state becomes as follows.



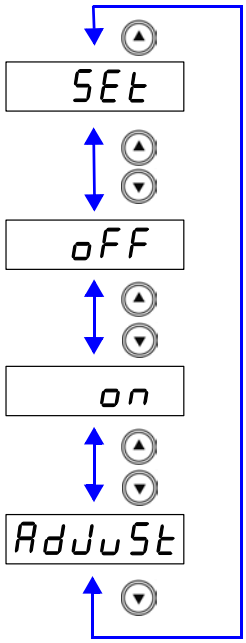
(Flash)

(MAIN display area)



2. Use ▲ or ▼ to select setting the load circuit compensation menu item.

Pressing ▲ or ▼ causes the display to change in the following manner.



"SEt"
Setting of reference value for current measurement frequency.

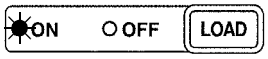
"oFF"
Disables load compensation rates for all frequencies.

"on"
Enables load compensation rates for all frequencies.

"AdJuSt"
Acquire load compensation rates at current measurement frequencies.

3. Select "AdJuSt" and press ENTER.

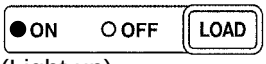
Incorporate the load compensation rate.



(Flash)

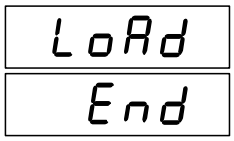
End of Compensation:

If compensation is completed normally, a beep tone sounds once and the condition becomes as follows.



(Light up)

(MAIN display area)



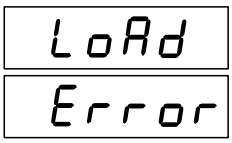
1 second light

The unit returns to normal measurement mode.

Compensation Error:

If a compensation error occurs, a warning beep will sound and the state becomes as follows.

(MAIN display area)



Compensation stops.

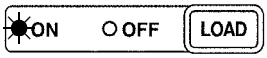
What if there is an error?

- If the value is outside the measurement range (under flow or over flow) a compensation error is generated. Set an appropriate range and then perform compensation again.
- To return to normal measurement mode, press LOAD.

Setting Reference Value

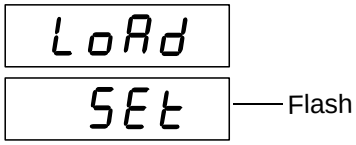
1. In normal measurement mode, press LOAD.

The state becomes as follows.



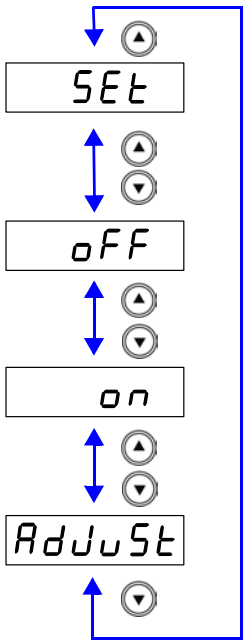
(Flash)

(MAIN display area)



2. Use ▲ or ▼ to select setting the load circuit compensation menu item.

Pressing ▲ or ▼ causes the display to change in the following manner.



"SEt"
Setting of reference value for current measurement frequency.

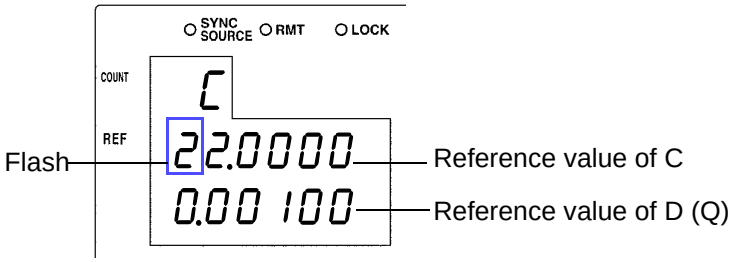
"oFF"
Disables load compensation rates for all frequencies.

"on"
Enables load compensation rates for all frequencies.

"AdJuSt"
Acquire load compensation rates at current measurement frequencies.

3. Select "SEt" and press ENTER.

(SUB display area)

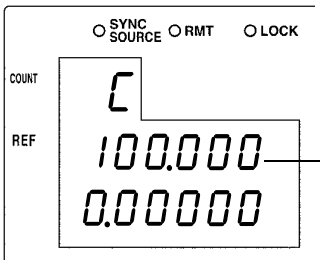


NOTE

If you want to exit the reference value input screen and return to load compensation setting screen, press LOAD.

4. Use the numeric keypad or arrow keys to enter a reference value for C and then press [ENTER].

(If you enter a number, each digit moves one place to the right.)
Settable Range: -199999 to 999999
Move to the digit..... ◀ and ▶
Change the number ... ▲ and ▼
(SUB display area)



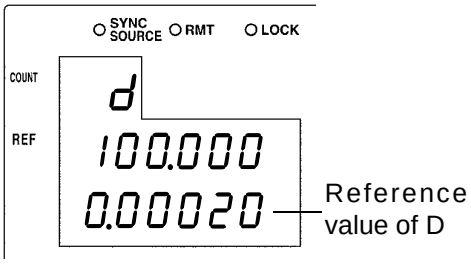
NOTE

- If you do not want to change the reference value of C, press [ENTER] without changing the number. The reference value input screen for D (Q) is displayed.
- Set count values for the reference values. The reference values at the time of shipment are 100000 for C and 0 for D.

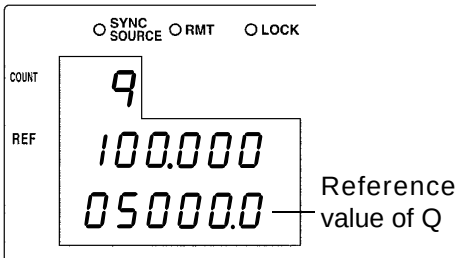
5. Use the numeric keypad or arrow keys to enter a reference value for D (Q) and then press [ENTER].

(If you enter a number, each digit moves one place to the right.)
Settable Range: -199999 to 199999
Move to the digit..... ◀ and ▶
Change the number ... ▲ and ▼

(SUB display area)



When the second parameter is D



When the second parameter is Q

The unit returns to the state of Step 2.

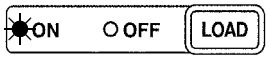
NOTE

- If there is no need to change the reference value of D (Q), press [ENTER] without changing the number.
- If you want to exit the reference value input screen and return to load compensation setting screen, press [LOAD].
- Recalculates the load compensation rate if the reference value is changed while LOAD compensation is enabled.
- Reference values are separated by measurement frequencies into separate data. The reference value is set based on the current measurement frequency.

Setting Load Circuit Compensation ON/ OFF

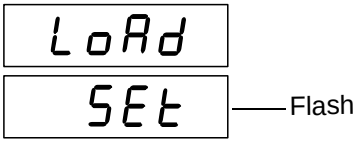
1. In normal measurement mode, press [LOAD].

The state becomes as follows.



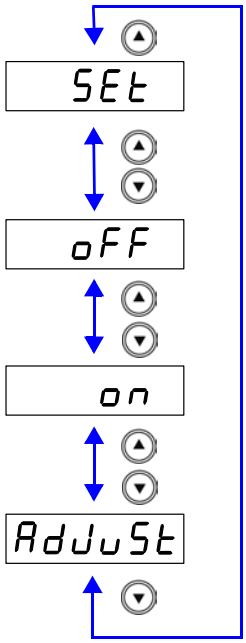
(Flash)

(MAIN display area)



2. Press ▲ ▼ to turn the load circuit compensation ON or OFF.

Pressing ▲ or ▼ causes the display to change in the following manner.



"SEt"
Setting of reference value for current measurement frequency.

"oFF"
Disables load compensation rates for all frequencies.

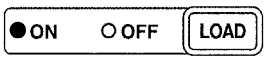
"on"
Enables load compensation rates for all frequencies.

"AdJuSt"
Acquire load compensation rates at current measurement frequencies.

3. Press [ENTER] to confirm the load circuit compensation ON or OFF.

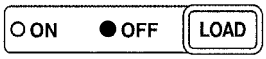
The state of the load compensation LED becomes as follows.

When select the "on"



(Light up) (Off)

When select the "oFF"



(Off) (Light up)

NOTE

Press [LOAD] if not turning load compensation ON or OFF.
The unit returns to normal measurement mode.

4.3 Offset Compensation

Compensates for discrepancy from the correct value by subtracting an optional input value from measurement results. This function can compensate for the discrepancy found when measuring a fixed sample, or enable interchangeability of measuring instruments when measuring a single sample.

Performing offset compensation

1. In normal measurement mode, press MENU.

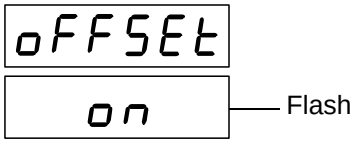
The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the “oFFSEt” menu item.

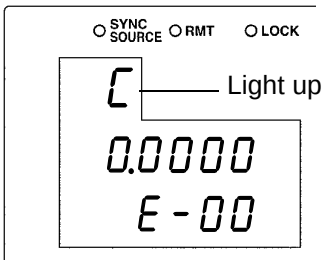
The state becomes as follows.

(MAIN display area)



(Offset compensation setting screen)

(SUB display area)



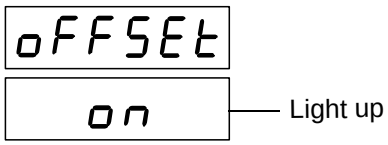
3. Press ▲ ▼ to enable or disable offset compensation.

The display switches between “on” and “oFF” each time ▲ ▼ is pressed.

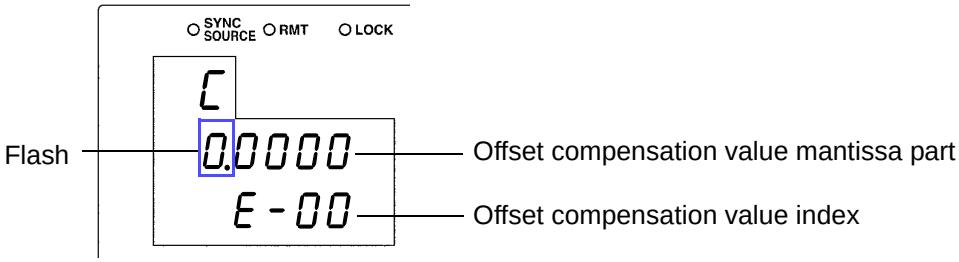
4. Press ENTER to confirm offset compensation as enabled or disabled.

When “on” is selected, the state becomes as follow.

(MAIN display area)



(SUB display area)



When “oFF” is selected, “Lo C” (Low C reject function setting screen) is shown in the upper part of the MAIN display area.

5. Input the mantissa part of the C offset compensation value using the arrow keys or the numeric keypad.
(If you enter a number, each digit moves one place to the right.)

Settable Range (Mantissa part) : ±(0.0000 to 9999.9)

Move to the digit..... ◄ and ►

Change the number .. ▲ and ▼

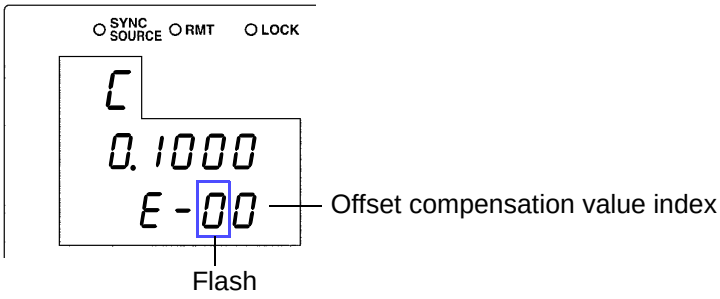
NOTE

The smallest resolution of the C offset compensation value is 1.0E-18. If you attempt to set it to a smaller value, the value will be set to "0".
Furthermore, if you attempt to make a setting lower than the lowest setting value it will be set at the lowest setting value, and if you attempt to make a setting higher than the highest setting value it will be set at the highest setting value.

6. Press ENTER to confirm the mantissa part of the C offset compensation value.

The state becomes as follows.

(SUB display area)



7. Input the C offset compensation value index with the arrow keys or the numeric keypad.

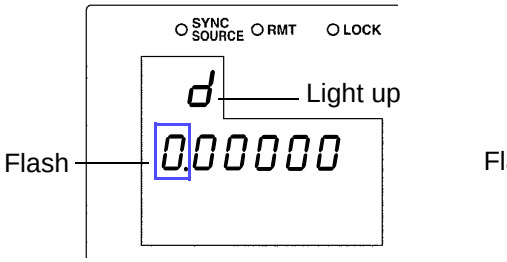
(If you enter a number, each digit moves one place to the right.)

Settable Range : -10E-6 to 10E-6 (Input the absolute value)
Smallest resolution : 1.0E-18
Move to the digit..... ◄ and ►
Change the number.... ▲ and ▼

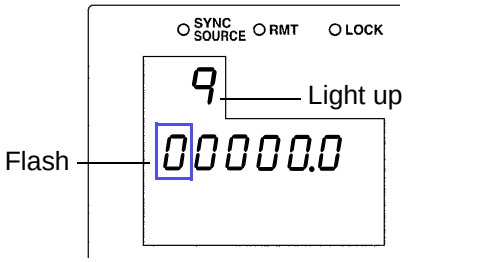
8. Press ENTER to confirm the C offset compensation value index.

The state becomes as follows.

(SUB display area)



When the second parameter is D



When the second parameter is Q

9. **Input the D (Q) offset compensation value with the arrow keys or the numeric keypad.**
(If you enter a number, each digit moves one place to the right.)

Settable Range of D : -1.99999 to 1.99999
Settable Range of Q : -19999.9 to 19999.9
Move to the digit..... and
Change the number .. and

10. **Press ENTER to confirm the D (Q) offset compensation value.**
"Lo C" is displayed in the upper part of the MAIN display area.

NOTE

- At time of shipment, the C and D (Q) offset compensation values are set to "0".
- The C and D (Q) offset compensation values are both divided into separate data depending on the measurement frequency (1 kHz, 100 kHz (only for 3505), 1 MHz).Set the offset compensation value for the presently set measurement frequency.

11. **Press MENU.**
The unit returns to normal measurement mode.

4.4 Self Calibration

On the 3505/ 3506 it is possible to reduce drift in the measurement value by carrying out self calibration. Self calibration numerically compensates for measuring circuit drift by measuring the internal standard signal to obtain a value that will compensate for any discrepancy between the current detection circuit and voltage detection circuit.

Self calibration has the following modes.

- **AUTO**
  Calculates a self calibration value upon completion of each measurement or communication and adjusts the measurement value.
- **MANUAL**
  Calculates a self calibration value if the signal to obtain the self calibration value is input via the external I/O during communication or measurement. The measurement value is adjusted according to the most recently calculated self calibration value.

During AUTO mode or when the calculate self calibration value signal is input from the external I/O, the self calibration value is obtained after one measurement. (When input via communication, the self calibration value is obtained without making a measurement.)

See "Self calibration" (p. 126)

NOTE

- The self calibration value will be the value taken after the last measurement. Therefore if the interval between taking the self calibration value and the next measurement becomes long, drift will occur between the time the self calibration value was obtained and the current circuit conditions, reducing the effectiveness of self calibration. Please make the interval after taking the self calibration value as short as possible.
  Take a new self calibration value after measuring if the ambient temperature has changed by more than 2°C.
- This device requires one hour of warm up time after it is turned on. A self calibration value is automatically taken when the device is turned on, but the circuit discrepancy after warm up will be different, so be sure to take a new self calibration value after the device warms up.
- During calculation of the self calibration value, communications are suspended until the self calibration value is obtained.

Performing Self Calibration

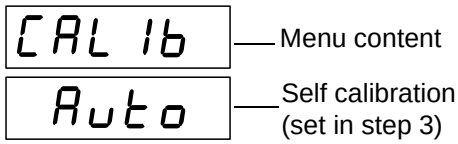
1. In normal measurement mode, press MENU.

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "CALIb" menu item.

(MAIN display area)



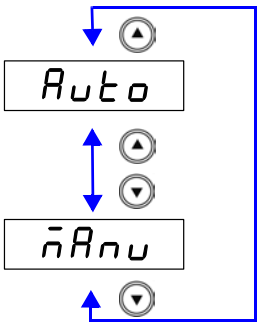
Menu content

Self calibration (set in step 3)

(Self calibration settings screen)

3. Use ▲ and ▼ to select a setting item.

Pressing ▲ or ▼ causes the display to change in the following manner.



"Auto"
Measures the basic signal and calculates the self calibration value each time a measurement is made.

"MAnu"
Immediately following trigger input calculates the self calibration value when the EXT I/O CALIB signal line is LOW or when the signal command (:CALibration:ADJust) is received.

4. Press ENTER.

The Self calibration setting is confirmed.
After confirmation, "IF" (Signal conditions setting screen) is displayed at the top of the MAIN display area.

The Self calibration setting is not confirmed unless ENTER is pressed.

5. Press MENU.

NOTE

- In the following situations the standard signal is measured only the number of times set by the :CALIbration:AVERaging command and the arithmetical average (arithmetrical mean) is taken as the self calibration value regardless of the self calibration fuction setting.
  - When turning on the power supply.
  - When changing the frequency and frequency shift initialization of the equipment.
  - When carrying out the :CALIbration:ADJust command
  - When performing panel load while the load conditions are "ALL" or "hArd".
  - When ENTER has been pressed in the standard measurement, comparator measurement, or BIN measurement screens.

  See Beginning the compensation procedure.(p. 126)

- The calculation speed of the self calibration value can be set using the :CALIbration:SPEEd command.

Calculation time of the self calibration (ms)		
FAST (Initial setting)	NORMAL	SLOW
1.7	4.7	13.0

- The measurement speed and number of times to average when calculating compensation can be set using the communication command.

  See "Setting and Query of Self Calibration Measurement Speed" (p. 192)
  See "Setting and Query of Number of Times to Average During Self Calibration" (p. 191)

4.5 Set the Cable Length

A length which matches that of the measurement cable can be set in order to compensate for error caused by extending the measurement cable.

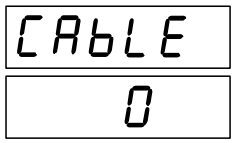
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "CAbLE" menu item.

(MAIN display area)



Menu content

Measurement cable length (set in step 3)

(Cable length settings screen)

3. Use ▲ and ▼ to select a setting measurement cable length.

Settable range : 0 to 2 (m)

4. Press [ENTER].

The cable length setting is confirmed.
After confirmation, "oFFSEt" (Offset compensation setting screen) is displayed at the top of the MAIN display area.

The Self calibration setting is not confirmed unless [ENTER] is pressed.

5. Press [MENU].

The unit returns to normal measurement mode.

NOTE

If the setting for cable length is changed, open compensation , short compensation and load compensations will be set to OFF for all measurement conditions.

Judging measurement results

Chapter 5

5.1 Comparator Function

This function enables you to set the upper limit and lower limit values for each of C and D (Q), and then indicates the judgment result with HI, IN, or LO in the comparator judgment result display area.
The judgment result enables you to determine whether the sample has passed or failed.
The corresponding signal is also output from the EXT I/O connector on the rear of the unit.

There are Three judgment modes for comparator measurement: the count value setting and deviation percent (Δ%) setting.

- **Count Value Setting** (p. 63)
  Set count values for the upper limit and lower limit values of the measurement parameters.
- **Deviation Count (Δ) Setting** (p. 66)
  Enter reference values and then set upper limit and lower limit values with count values corresponding to the reference values.
- **Deviation Percent (Δ%) Setting** (p. 66)
  Enter reference values and then set percentages corresponding to the reference values as the upper limit and lower limit values.

Select judgment mode and set judgment conditions.
- Judgment mode settings (p. 60)
- Judgment conditions settings (p. 62)
  Count Value Setting (p. 63)
  Deviation Count (Δ) Setting, Deviation Percent (Δ%) Setting (p. 66)

Measurement results display

Judgment mode	Measurement Results
Count (Count Value Setting)	Displays the measurement value.
d-Cou (Deviation Count (Δ) Setting)	Displays the result of the calculation: (measurement value - reference value)
d-PEr (Deviation Percent (Δ%) Setting)	The first parameter (C) displays the result of the calculation: $\frac{\text{(measurement value - reference value)}}{\lvert\text{reference value}\rvert} \times 100$ The second parameter (D or Q) displays the result of the calculation: (measurement value - reference value)

NOTE

- If the power is turned off while the unit is in comparator measurement mode, the unit will be in comparator measurement mode when the unit is turned back on again.
- Set the upper limit and lower limit values of any parameter (C,D or Q) that does not require a comparator judgment to be made to OFF so that judgment will not be performed.
- The measurement conditions for normal measurement mode are inherited as is for the measurement conditions when the comparator is executed. However, the AUTO range is automatically set to the HOLD range.

Setting Judgment Mode

First, set the judgment mode. (Select the count value setting and the deviation Count (Δ) setting and the deviation percent (Δ%) setting.)
The judgment modes are the same for both the comparator and BIN.

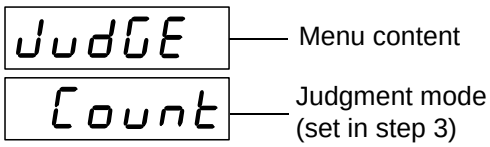
1. In normal measurement mode, press MENU.

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "JudGE" menu item.

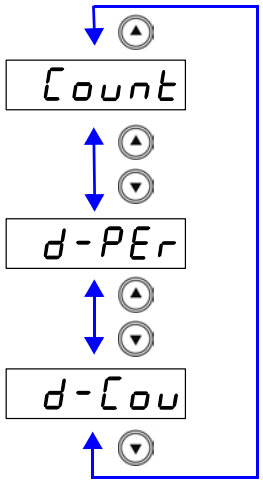
(MAIN display area)



(Judgment mode setting screen)

3. Use ▲ or ▼ to select a setting item.

Pressing ▲ or ▼ causes the display to change in the following manner.



"Count"
Count setting

"d-PEr"
Deviation percent (Δ%) setting

"d-Cou"
Deviation Count (Δ) setting

4. **Press [ENTER].**

The judgment mode is confirmed.
After confirmation, “bEEP_J” is displayed at the top of the MAIN display area. (Beep setting screen for judgment result)

The judgment mode is not confirmed unless [ENTER] is pressed.

5. **Press [MENU].**

The unit returns to normal measurement mode.

Setting the Upper Limit and Lower Limit Values for the Comparator Setting Workflow

1 Normal measurement mode

MODE — Switch to comparator measurement mode. (COMP Light up) The range is automatically set to HOLD.

2 Comparator measurement mode

SET — Switch to the setting mode for the upper limit and lower limit values.

3 C setting

ENTER — Confirm C. Move to the next setting.

4 Reference value setting for C (Only for the Δ setting and Δ% setting)

- Numeric keypad
- Arrow keys

ENTER — Set the reference value for C.

5 Upper limit and lower limit value settings for C

- Numeric keypad
- Arrow keys

Set the upper limit value for C.

ENTER — Confirm the upper limit value.

- Numeric keypad
- Arrow keys

Set the lower limit value for C.

ENTER — Confirm the lower limit value.

6 D (Q) setting

▲ ▼ — Select D (Q).

ENTER — Confirm D (Q).

7 Reference value setting for D (Q) (Only for the Δ setting and Δ% setting)

- Numeric keypad
- Arrow keys

Set the reference value for D (Q).

ENTER — Move to the next setting.

8 Upper limit and lower limit value settings for D (Q)

- Numeric keypad
- Arrow keys

Set the upper limit value for D (Q).

ENTER — Confirm the upper limit value.

- Numeric keypad
- Arrow keys

Set the lower limit value for D (Q).

ENTER — Confirm the lower limit value.

9 Comparator measurement mode

SET — Switch to comparator measurement mode.

Measurement method 1

Make settings using the upper limit and lower limit values (count setting).

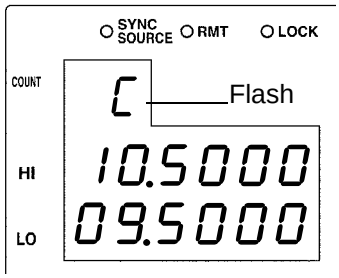
(To make settings using a reference value and the upper limit and lower limit values refer to "Measurement method 2" (p. 66))

1. Press MODE to light up COMP and enter comparator measurement mode.

(Light up)

2. Press SET.

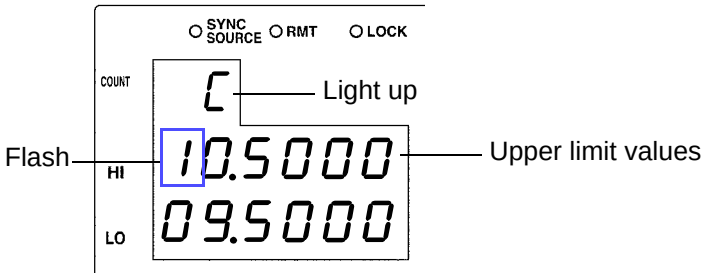
(SUB display area)



To make settings from an optional setting mode, press ▲ ▼ while "C" or "d"("q") is flashing to select the setting mode, then press ENTER.
Setting modes : C upper limit and lower limit values ←→ D (Q) reference value ←→ D (Q) upper limit and lower limit values ←→ C reference value…

3. Press ENTER to enter "C" upper limit value setting mode.

(SUB display area)



4. Input the C upper limit value using the arrow keys or the numeric keypad.

Settable Range : OFF, -199999 to 999999 (When setting to "OFF"(p.71))

Move to the digit..... ◀ and ▶

Change the number ... ▲ and ▼

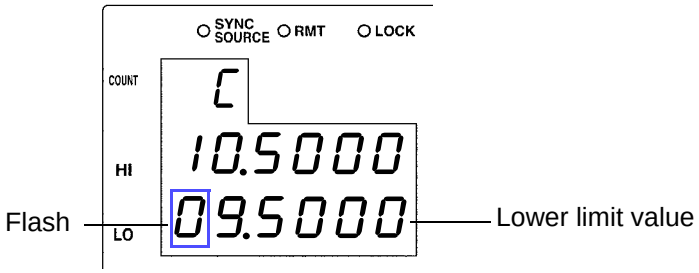
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to " - - - - - - " (OFF).

5. Press ENTER to confirm the C upper limit value.

Enter C lower limit value setting mode.

(SUB display area)



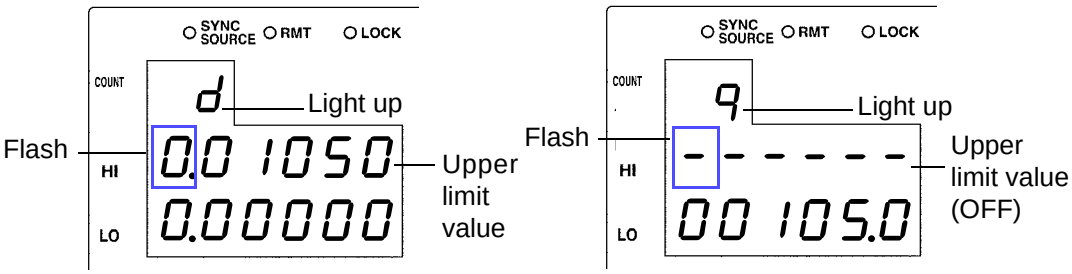
6. In the same way input the C lower limit value using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

7. Press ENTER to set the C lower limit value.

8. Press ENTER to enter the D (Q) upper limit value setting mode.

(SUB display area)



9. Input the D (Q) upper limit value using the arrow keys or the numeric keypad.

Settable Range: OFF, -199999 to 199999 (When setting to "OFF"(p. 71))

Move to the digit..... ◄ and ►

Change the number .. ▲ and ▼

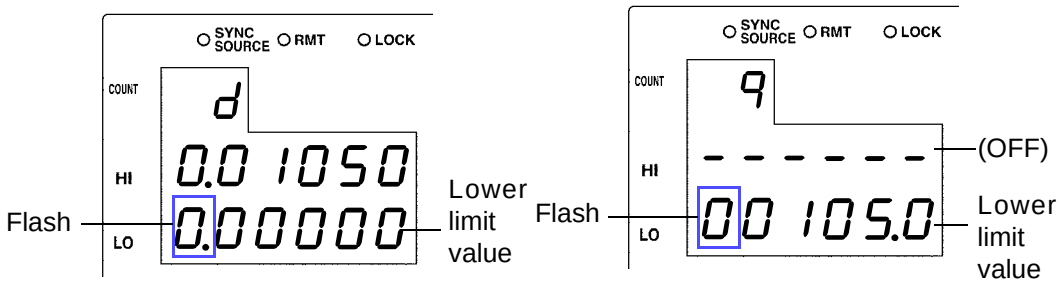
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to " - - - - - - " (OFF).

10. Press ENTER to set the D (Q) upper limit value.

Enter the D (Q) lower limit value setting mode.

(SUB display area)



11. In the same way input the D (Q) lower limit value using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

12. Press ENTER to set the D (Q) lower limit value.

13. Press SET.

The unit switches to the comparator measurement mode.

(Light up)

The comparator measurement result is displayed in the MAIN display area.

See "Comparator Measurement Results" (p. 72)

NOTE

- The upper and lower limit values set during count setting become displayed count values independent of measurement conditions. If the range settings are changed, the absolute values which define the count values are changed.
  For example, if the range is currently set at 100 pF this would mean that C count value of 50000 = 50E-12, D count value 100 = 0.00100, and Q count value 100 = 10.0.
- The upper limit value and lower limit value of D and Q both use the common count value, regardless of parameter settings.
- Set the comparator measurement mode measurement conditions while in normal measurement mode.
  See 3.3 "Setting the Measurement Conditions" (p. 26)
- The large/small judgment for the upper limit and lower limit values is not performed. An error is not generated if the upper limit and lower limit values are set in reverse, but the judgment cannot be performed properly.
- Refer to "Judgement results display" (p. 72) regarding comparator judgment results.
- After settings are complete, ▲ ▼ can be used to toggle the judgment range display to confirm the judgment range.

Measurement method 2

Make settings using a reference value and the upper limit and lower limit values (Δ setting and Δ% setting)

(To make settings using a reference value and the upper limit and lower limit values refer to "Measurement method 1" (p. 63))

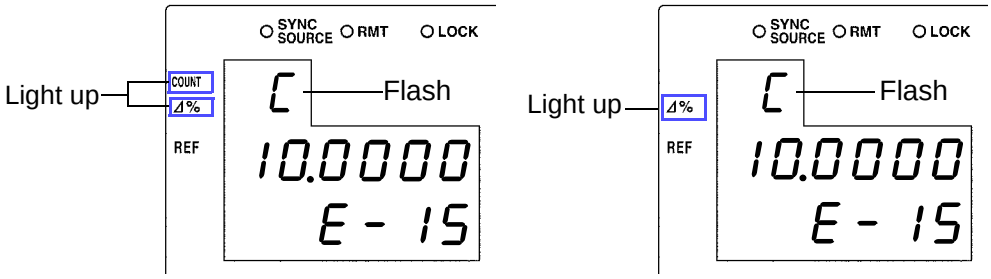
Explanation of the setting screen will now be given for the case that the SUB display area does not show a divided screen display description due to the judgment mode (Δsetting and Δ% setting).
("COUNT" lights up during Δsetting)

1. Press MODE to light up COMP and enter comparator measurement mode.

(Light up)

2. Press SET.

(SUB display area)

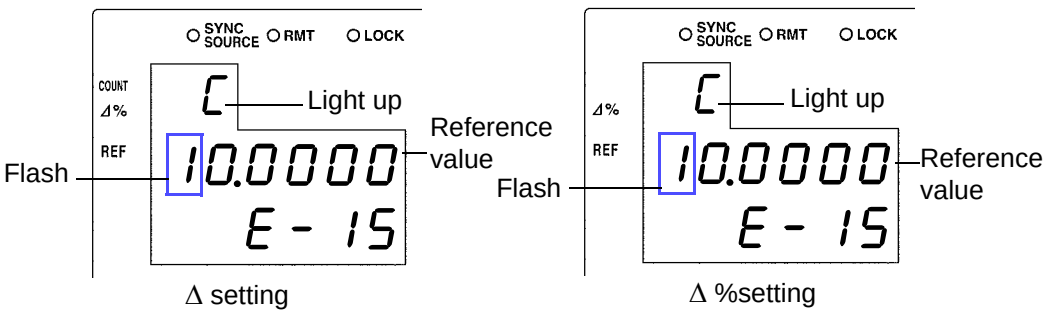


Δ setting　　Δ %setting

To make settings from an optional setting mode, press ▲ ▼ while "C" or "d"("q") is flashing to select the setting mode, then press ENTER.
Setting modes: C upper limit and lower limit values ←→ D (Q) reference value ←→D (Q) upper limit and lower limit values ←→ C reference value...

3. Press ENTER to enter "C" reference value setting mode.

(SUB display area)



Δ setting　　Δ %setting

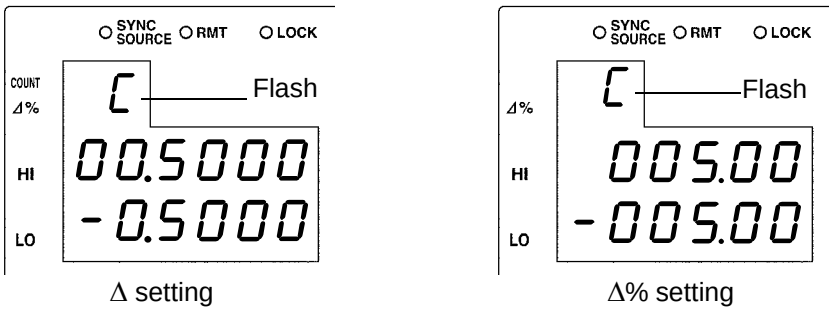
4. Enter the C reference value using the arrow keys or the numeric keypad.

(If you enter a number, each digit moves one place to the right.)
Settable Range : -199999 to 999999 (The Δ% setting cannot be set to "0")
Move to the digit..... ◄ and ►
Change the number ... ▲ and ▼
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

Set a count value for the reference value.
At time of shipment, it is set to " 100000 ".

5. Press ENTER to confirm the C reference value.

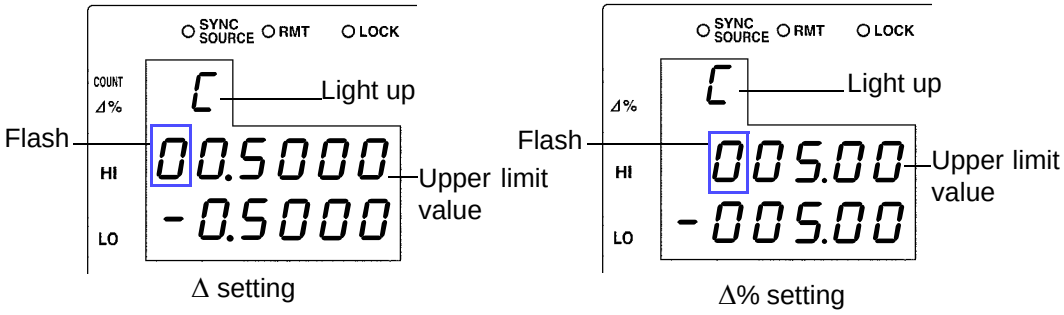
(SUB display area)



The reference value entered this time is not confirmed unless ENTER is pressed. The reference value used last time becomes valid.

6. Press ENTER to enter the C upper limit value setting mode.

(SUB display area)



7. Enter the C upper limit value using the arrow keys or the numeric keypad.

Settable Range

- For the Δ setting : OFF, -199999 to 999999
- For the Δ% setting : OFF, -999.99 to 999.99

(When setting to "OFF"(p.71))

Move to the digit..... ◄ and ►

Change the number .. ▲ and ▼

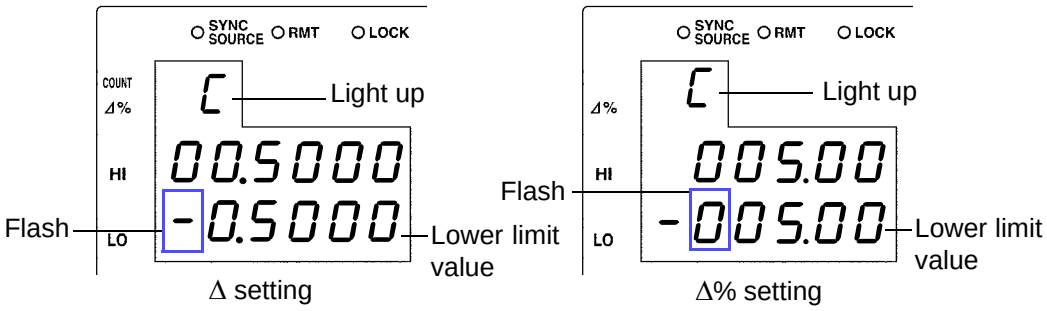
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to " - - - - - - " (OFF).

8. Press ENTER to confirm the C upper limit value.

Enter the C lower limit value setting mode.

(SUB display area)

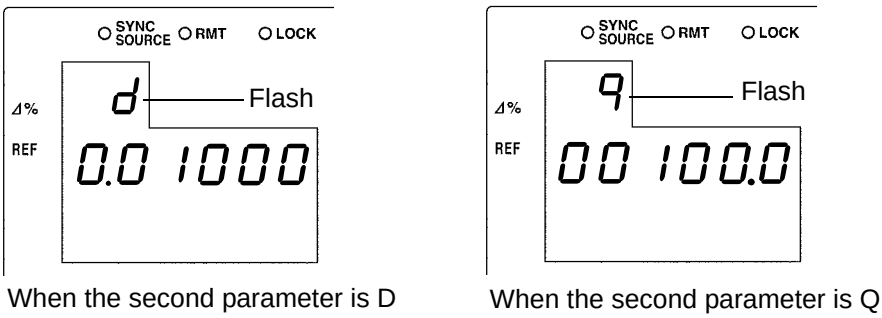


9. Enter the C lower limit value using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

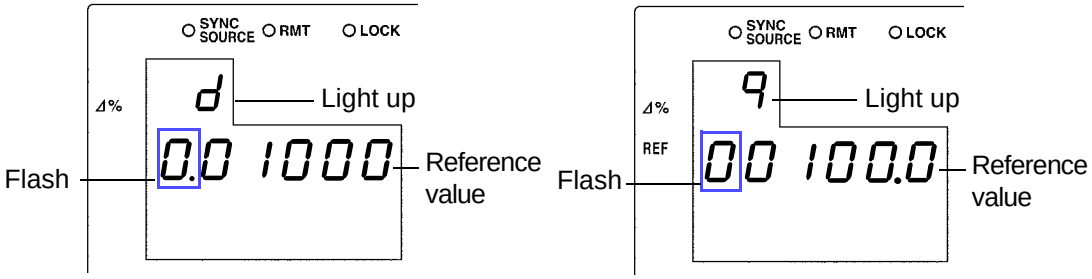
10. Press ENTER to confirm the C lower limit value.

(SUB display area / Δ% setting)



11. Press ENTER to enter the D (Q) reference value setting mode.

(SUB display area / Δ% setting)



When the second parameter is D

When the second parameter is Q

12. Enter the D (Q) reference value using the arrow keys or the numeric keypad.

Settable Range: -199999 to 199999

Move to the digit..... ◄ and ►

Change the number ... ▲ and ▼

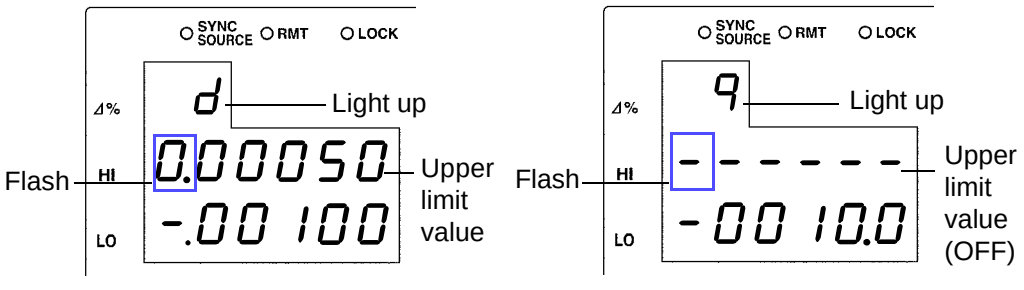
The reference value is set using the count value. At time of shipment it is set to ”0”.

13. Press ENTER to confirm the D (Q) reference value.

The reference value entered this time is not confirmed unless ENTER is pressed. The reference value used last time becomes valid.

14. Press ENTER to enter the D (Q) upper limit value setting mode.

(SUB display area / Δ% setting)



When the second parameter is D

When the second parameter is Q

15. **Enter the D (Q) upper limit value using the arrow keys or the numeric keypad.**

Settable Range: OFF, -199999 to 199999 (When setting to "OFF"(p.71))

Move to the digit..... ◄ and ►

Change the number .. ▲ and ▼

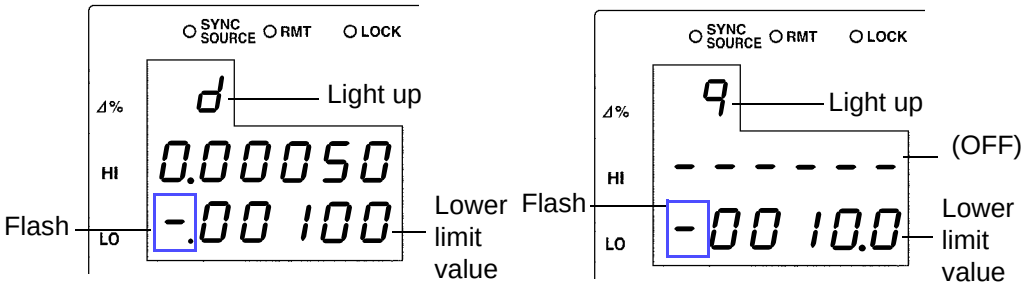
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to " - - - - - - " (OFF).

16. **Press ENTER to confirm the D (Q) upper limit value.**

Enter the D (Q) lower limit value setting mode.

(SUB display area / Δ% setting)



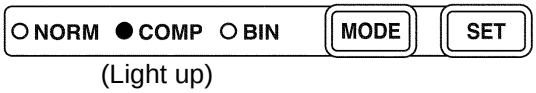
17. **In the same way, enter the D (Q) lower limit value using the arrow keys or the numeric keypad.**

At time of shipment, it is set to " - - - - - - " (OFF).

18. **Press ENTER to confirm the D (Q) lower limit value.**

19. **Press SET.**

The unit switches to the comparator measurement mode.



The comparator measurement result is displayed in the MAIN display area.

See "Comparator Measurement Results" (p. 72)

NOTE

- The upper limit and lower limit values for the count setting and the reference value for the Δ% setting become display count values that are independent of the measurement conditions. If the measurement conditions differ, the absolute values that signify the count values change.
  For example, if the range is currently set at 100 pF this would mean that C count value of 50000 = 50E-12, D count value 100 = 0.00100, and Q count value 100 = 10.0.
- The reference value of the second parameter uses the common count value, regardless of the upper limit and lower limit values.
- Set the comparator measurement mode measurement conditions while in normal measurement mode.
  See 3.3 "Setting the Measurement Conditions" (p. 26)
- The large/small judgment for the upper limit and lower limit values is not performed. An error is not generated if the upper limit and lower limit values are set in reverse, but the judgment cannot be performed properly.
- Refer to "Judgement results display" (p. 72) regarding comparator judgment results.
- After settings are complete, ▲ ▼ can be used to toggle the judgment range display to confirm the judgment range.

5

Setting the Upper Limit and Lower Limit Values to OFF

1. **When entering the upper limit and lower limit values, use ◀ to move left until the far left digit flashes and then press and hold ◀ for at least two seconds or use ▶ to move right until the far right digit flashes and then press and hold ▶ for at least two seconds.**

   The display changes to "– – – – – –" and OFF is set.

2. **Press ENTER to confirm the OFF setting.**

3. **Press SET.**

   The unit switches to comparator measurement mode.

   (Light up)

Canceling Comparator Measurement Mode

In comparator measurement mode, press MODE twice.

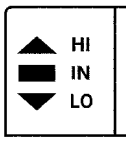
The measurement mode LEDs light in the order of COMP → BIN → NORM, and then the unit switches to normal measurement mode.

(Light up)

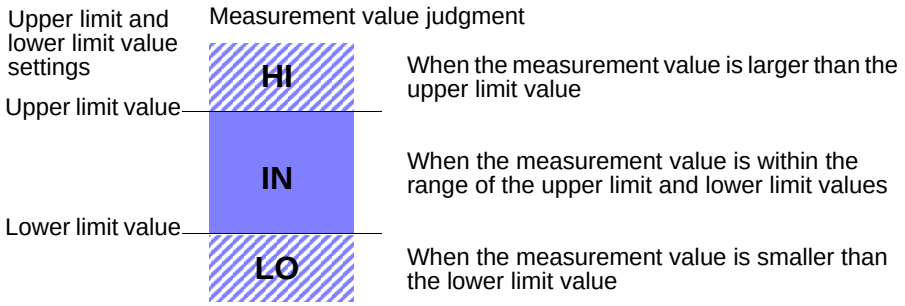
Comparator Measurement Results

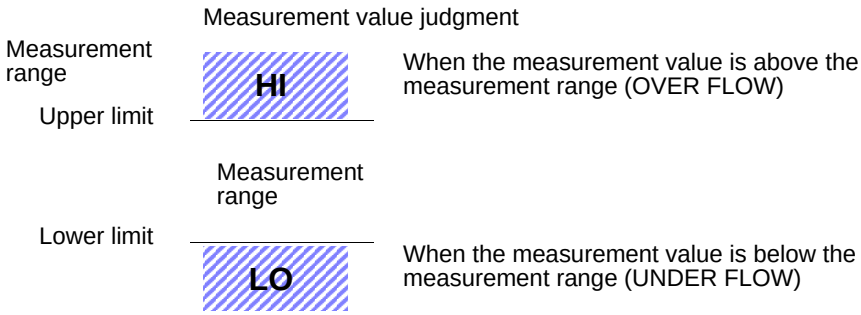
- The measurement conditions of comparator measurement mode use the measurement conditions of normal measurement. Set the comparator mode measurement conditions in normal measurement mode.
  See 3.3 "Setting the Measurement Conditions" (p. 26)
- The upper limit and lower limit value numbers are not checked for which is greater and smaller. Therefore please take care when setting them, as correct judgments cannot be made if they are set in the opposite order.

Judgement results display



Each of the judgment results for C and D (Q) is displayed in the comparator judgment result display area.
The comparator judgment is not performed for parameters with the upper limit and lower limit value set to OFF.





Judgment order	Judgement results	Meaning	Solution
1	The HI LED lights up.	Measurement error	See "MAIN display area ERROR display" (p. 15)
	The HI LED lights up.	The measurement value is above the high limit value range in the current range.	Switch to an appropriate range. See 3.3.7 "Measurement Range" (p. 31)
	The LO LED lights up.	The measurement value is below the low limit value range in the current range.	
2	The LO LED lights up.	The measurement value is lower than the lower limit value.	—
3	The HI LED lights up.	The measurement value is higher than the upper limit value.	
4	The IN LED lights up.	The measurement value is within the setting range.	

Outputting Judgment Results

- Output the judgment result for each of C and D (Q) (LO/IN/HI) and the AND results for both judgment results (only when both parameters are IN) from EXT.I/O.
  See 7.1 "About the EXT I/O Connector" (p. 121)
- The comparator judgment results (IN/NG) can be differentiated by beep tones.
  See 6.12 "Setting Beep Tones" (p. 110)

- Except for the trigger setting, the measurement conditions cannot be changed in comparator measurement mode.

  Press MODE to switch to normal measurement mode and then change the measurement conditions.

Keys Enabled for Comparator Mode

Key	Function
MODE	Switches the measurement mode.
SET	Switches to the setting modes for the upper limit and lower limit values.
TRIG	Switches the trigger setting to INT/EXT.
MANU TRIG	This key is only enabled when the trigger setting is EXT. One measurement is performed each time the key is pressed.
MENU	The following menu settings can be made. • “LoAd_A(C/h)” • “SAVE” • “Ld_tYP” • “Lo C” • “LEV.ChK” • “bEEP_K” • “dISP” • “IF” Settings other than the above listed can be made from normal measurement mode. The lower area of the MAIN display will display “– – – –” for menus that cannot be set from comparator measurement mode.
LOCK/LOCAL	Changes the keylock function and cancels the remote state.

5.2 BIN Measurement Function

This function enables you to set up to 13 categories of upper limit and lower limit values for C and one category of upper limit and lower limit values for D (Q), and indicates the judgment results in the BIN judgment result display area. The corresponding signal is also output from the EXT I/O connector on the rear of the unit.

There are Three judgment modes for BIN measurement: the count value setting and deviation count (Δ) setting and deviation percent (Δ%) setting.

- **Count Value Setting**
  Set count values for the upper limit and lower limit values of the measurement parameter.

- **Deviation Count (Δ) Setting**
  Enter reference values and then set count values corresponding to the reference values for the upper limit and lower limit values.

- **Deviation Percent (Δ%) Setting**
  Enter reference values and then set percentages corresponding to the reference values for the upper limit and lower limit values.

Select judgment mode and set judgment conditions.
- Judgment mode settings (p. 75)
- Judgment conditions settings (p. 76)
  Count Value Setting (p. 77)
  Deviation Count (Δ) Setting, Deviation Percent (Δ%) Setting (p. 81)

Measurement results display

Judgment mode	Measurement Results
Count (Count Value Setting)	Displays the measurement value.
d-Cou (Deviation Count (Δ) Setting)	Displays the result of the calculation: (measurement value - reference value)
d-PEr (Deviation Percent (Δ%) Setting)	The first parameter (C) displays the result of the calculation: $\frac{\text{(measurement value - reference value)}}{\lvert\text{reference value}\rvert} \times 100$ The second parameter (D or Q) displays the result of the calculation: (measurement value - reference value)

NOTE

- If the power is turned off while the unit is in BIN measurement mode, the unit will be in BIN measurement mode when the unit is turned back on again.
- Set the upper limit and lower limit values of any BIN number that does not require a BIN judgment to be made to OFF so that judgment will not be performed.
- The measurement conditions for normal measurement mode are inherited as is for the measurement conditions when the BIN is executed. However, the AUTO range is automatically set to the HOLD range.

Setting Judgment Mode

Set the judgment mode before setting the BIN judgment conditions.
(Select the count value setting, the deviation count (Δ) setting, the deviation percent (Δ%) setting.)

The judgment mode is common to comparator measurement and BIN measurement.

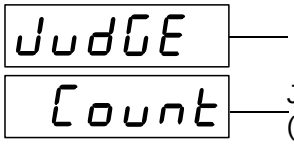
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "JudGE" menu item.

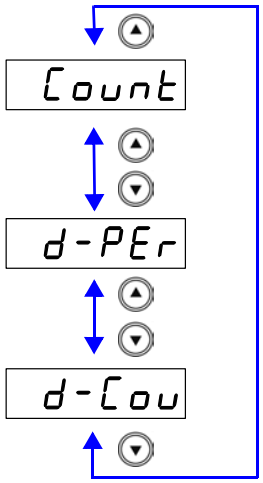
(MAIN display area)



(Judgment mode setting screen)

3. Use ▲ or ▼ to select a setting item.

Pressing ▲ or ▼ causes the display to change in the following manner.



"Count"
Count setting.

"d-PEr"
Deviation percent (Δ%) setting.

"d-Cou"
Deviation Count (Δ) setting.

4. Press [ENTER].

The judgment mode is confirmed.
After confirmation, "bEEP_J"(Beep setting screen for judgment result) is displayed at the top of the MAIN display area.

The judgment mode is not confirmed unless [ENTER] is pressed.

5. Press [MENU].

The unit returns to normal measurement mode.

Setting the Upper Limit and Lower Limit Values for the BIN Setting Workflow

1 Normal measurement mode

MODE (Twice)

Switch to comparator measurement mode. (BIN Light up)
The range is automatically set to HOLD.

2 BIN measurement mode

SET

Switch to the setting mode for the upper limit and lower limit values.

3 Reference value setting for C
(Only for the Δ setting and Δ% setting)

ENTER

Confirm C.

• Numeric keypad
• Arrow keys

Set the reference value for C.

ENTER

Confirm the setting value.

4 Upper limit and lower limit value settings for BIN1 to BIN13

ENTER

Confirm BIN1.

• Numeric keypad
• Arrow keys

Set the upper limit value for BIN1.

ENTER

Confirm the upper limit value.

• Numeric keypad
• Arrow keys

Set the lower limit value for BIN1.

ENTER

Confirm the lower limit value.
Set BIN2 to BIN13 in the same manner.

5 Reference value setting for D (Q)
(Only for the Δ setting and Δ% setting)

ENTER

Confirm D (Q).

• Numeric keypad
• Arrow keys

Set the reference value for D (Q).

ENTER

Confirm the setting value.
Move to the next setting.

6 Upper limit and lower limit value settings for D (Q).

ENTER

Confirm D (Q).

• Numeric keypad
• Arrow keys

Set the upper limit value for D (Q).

ENTER

Confirm the upper limit value.

• Numeric keypad
• Arrow keys

Set the lower limit value for D (Q).

ENTER

Confirm the lower limit values.
Move to the next setting.

7 BIN measurement mode

SET

Switch to BIN measurement mode.

Measurement method 1

Make settings using the upper limit and lower limit values (count setting).

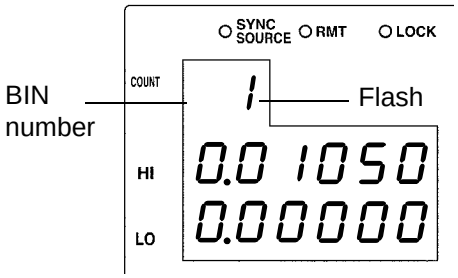
(To make settings using a reference value and the upper limit and lower limit values refer to "Measurement method 2" (p. 81))

1. Use MODE to switch to the BIN measurement mode.

(Light up)

2. Press SET.

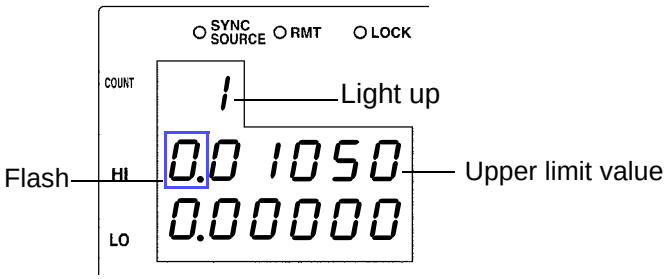
(SUB display area)



To make settings from an optional setting mode, press ▲ ▼ to select the setting mode while "1 to 13" is flashing, and then press ENTER.
Setting modes: BIN1 to 13 upper and lower limit values ←→ D(Q) reference value ←→ D (Q) upper and lower limit values ←→ BIN1 to 13 upper and lower limit values...

3. Press ENTER to enter the BIN1 upper limit value setting mode.

(SUB display area)



4. Use the numeric keypad or the arrow keys to enter an upper limit value for BIN1 and then press ENTER.

Settable Range: OFF, -199999 to 999999 (When setting to "OFF"(p. 87))

Move to the digit..... ◀ and ▶

Change the number ... ▲ and ▼

Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

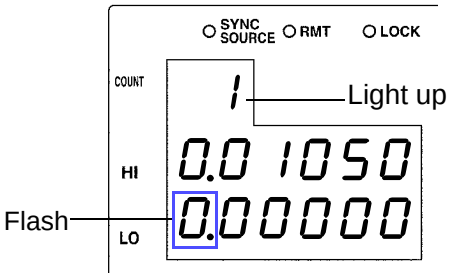
At time of shipment, it is set to " - - - - - - " (OFF).

5

5. Press ENTER to confirm the BIN1 upper limit value.

Enter the BIN1 lower limit value setting mode.

(SUB display area)



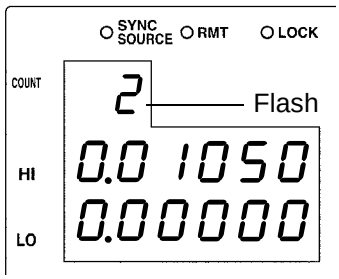
If ENTER is not pressed, the BIN upper limit and lower limit values just entered will not be set.
The previous BIN upper limit value and lower limit value will remain in effect.

6. Enter the BIN1 lower limit value using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

7. Press ENTER to confirm the BIN1 lower limit value.

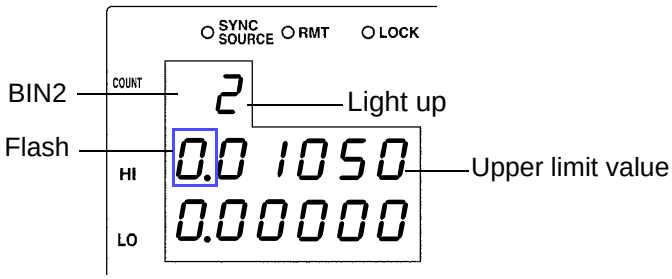
(SUB display area)



8. Press ENTER to enter the BIN2 upper limit value setting mode.

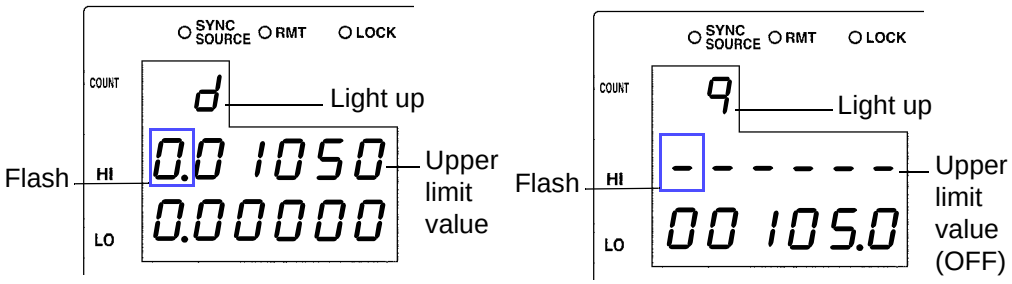
In the same way make settings for the BIN2 to 13 upper limit values and lower limit values.

(SUB display area)



9. Press ENTER to enter the D (Q) upper limit value setting mode.

(SUB display area)



10. Enter the D (Q) upper limit value using the arrow keys or the numeric keypad.

Settable Range: OFF, -199999 to 199999 (When setting to "OFF"(p. 87))

Move to the digit..... ◄ and ►

Change the number ... ▲ and ▼

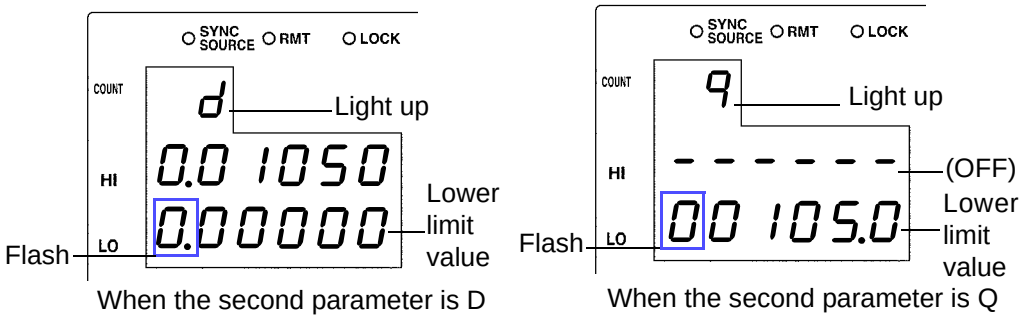
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to " - - - - - - " (OFF).

11. Press ENTER to confirm the D (Q) upper limit value.

Enter the D (Q) lower limit value setting mode.

(SUB display area)



12. Enter the D (Q) lower limit value using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

13. **Press [ENTER] to confirm the D (Q) lower limit value.**

14. **Press [SET].**

The unit switches to the BIN measurement mode.

(Light up)

See "Performing BIN Measurement" (p. 88)

NOTE

- The upper limit and lower limit values for the count setting become display count values that are independent of the measurement conditions. If the measurement conditions differ, the absolute values that signify the count values change.
  For example, if the range is currently set at 100 pF this would mean that C count value of 50000 = 50E-12, D count value 100 = 0.00100, and Q count value 100 = 10.0.
- The second parameter upper limit and lower limit values use the common count value, regardless of parameter settings.
- The measurement conditions for normal measurement mode are used for the BIN measurement mode. Set the measurement conditions to use for BIN measurement mode while the unit is in normal measurement mode.
- Check the following because judgment cannot be performed properly if the upper limit and lower limit values are set incorrectly.
  - Are the setting values within the display range of the measurement range?
  - Is the large/small relationship of the upper limit and lower limit values correct?
- After settings are complete, [▲] [▼] can be used to toggle the judgment range display to confirm the judgment range.

Measurement method 2

Make settings using the reference value upper limit and lower limit values (Δ setting and Δ% setting)

(To make settings using a reference value and the upper limit and lower limit values refer to "Measurement method 1" (p. 77))

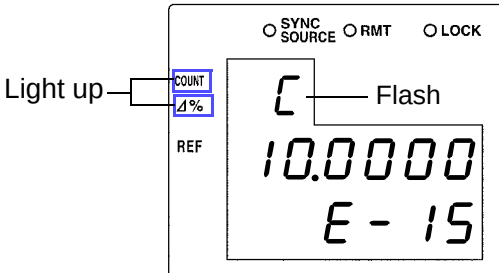
Explanation of the setting screen will now be given for the case that the SUB display area does not show a divided screen display description due to the judgment mode (Δsetting and Δ% setting).
("COUNT" lights up during Δsetting)

1. Press MODE to light up BIN and enter the BIN measurement mode.

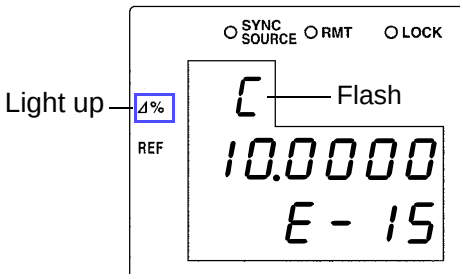
(Light up)

2. Press SET.

(SUB display area)



Δ setting

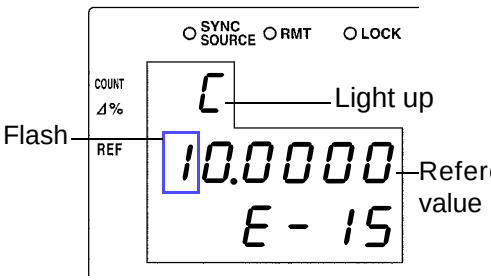


Δ% setting

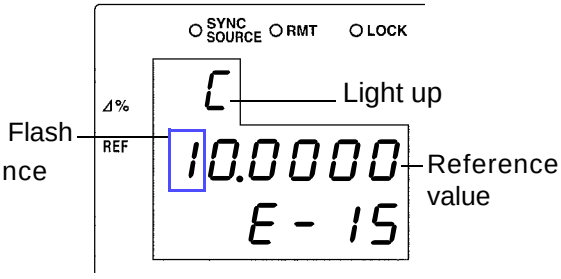
To make settings from an optional setting mode, press ▲ ▼ while "C" is flashing to select the setting mode, then press ENTER.
Setting modes: C reference value BIN1 to 13 upper limit and lower limit values ←→ D (Q) reference value ←→ D (Q) upper limit and lower limit values ←→ C reference value....

3. Press ENTER to enter the C reference value setting mode.

(SUB display area)



Δ setting



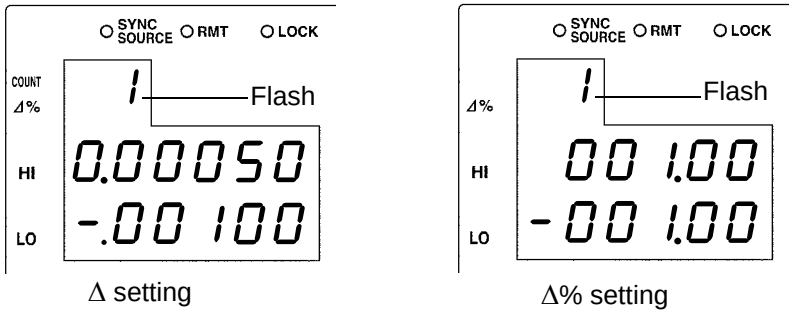
Δ% setting

4. **Enter the C reference value using the arrow keys or the numeric keypad.**
(If you enter a number, each digit moves one place to the right.)
Settable Range: -199999 to 999999 (The Δ% setting cannot be set to 0.)
Move to the digit..... ◄ and ►
Change the number .. ▲ and ▼

The reference value is set with the count value. At time of shipment it is set to ”100000”.

5. Press ENTER to confirm the C reference value.

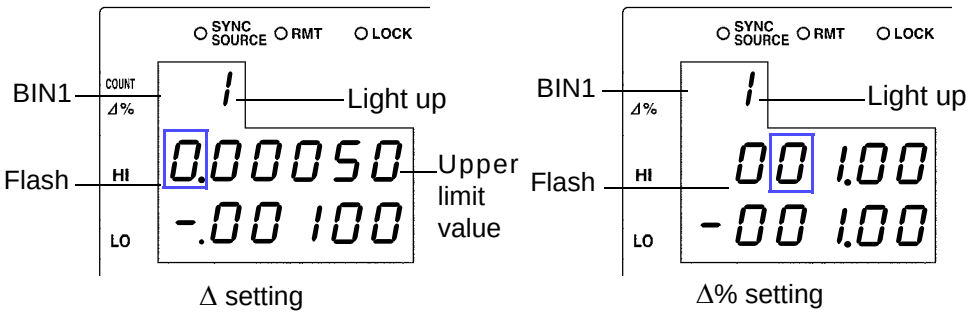
(SUB display area)



The reference value entered this time is not confirmed unless ENTER is pressed. The reference value used last time becomes valid.

6. **Press ENTER to enter the BIN1 upper limit value setting mode.**

(SUB display area)



7. Enter the BIN1 upper limit value using the arrow keys or the numeric keypad.

Settable Range

- For the Δ setting: OFF, –199999 to 999999 (When setting to "OFF"(p. 87))
- For the Δ% setting: OFF, –999.99 to 999.99

Move to the digit..... ◄ and ►

Change the number ... ▲ and ▼

Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

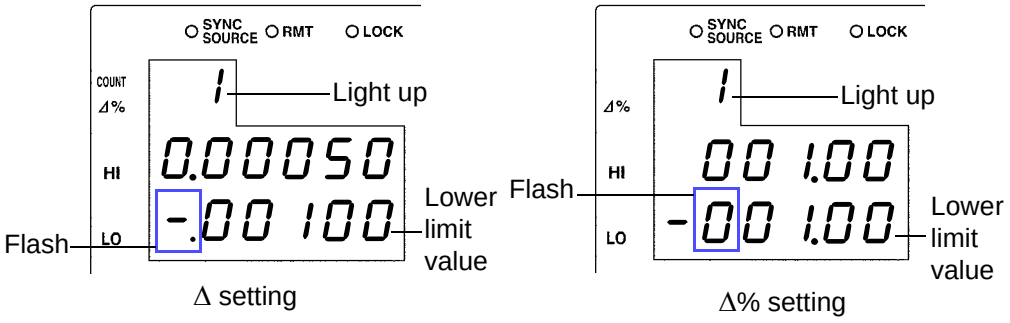
At time of shipment, it is set to " - - - - - - " (OFF).

ENTER Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

8. Press ENTER to confirm the BIN1 upper limit value.

Enter the BIN1 lower limit value setting mode.

(SUB display area)



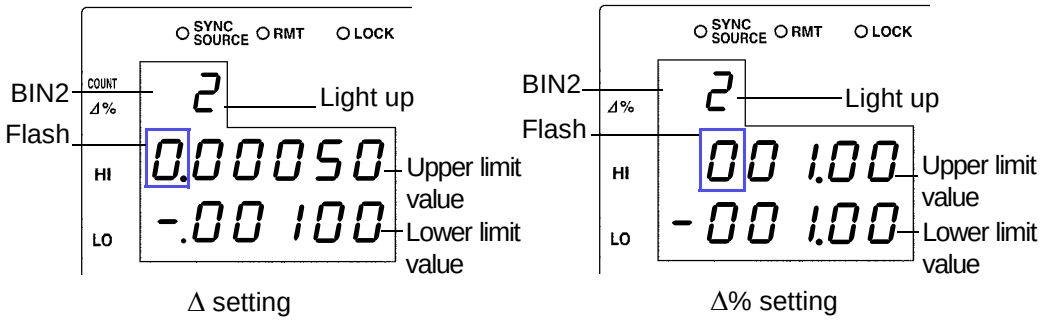
9. Enter the BIN1 lower limit value in the same way using the arrow keys or the numeric keypad.

At time of shipment, it is set to " - - - - - - " (OFF).

10. Press ENTER to confirm the BIN1 lower limit value.

11. Press ENTER to enter the BIN2 upper limit value setting mode.

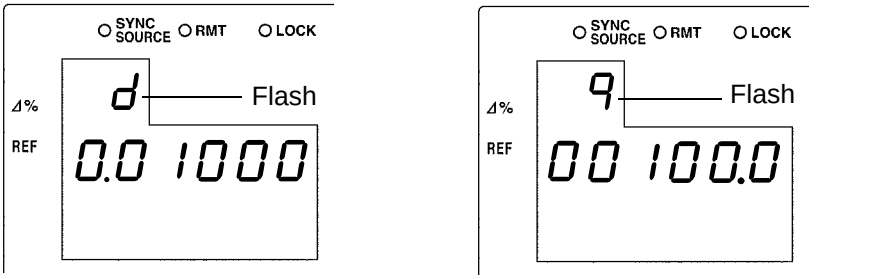
(SUB display area / Δ% setting)



In the same way set all BIN upper limit and lower limit values.

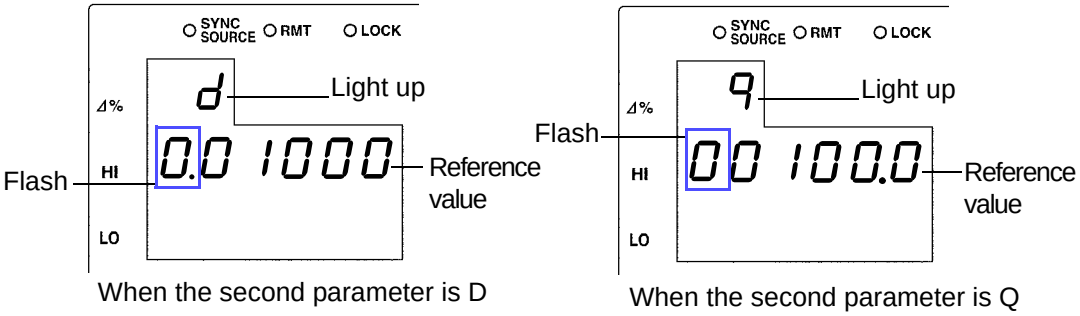
After all of the BIN upper limit and lower limit values have been set, the condition will become as follows.

(SUB display area / Δ% setting)



12. Press ENTER to enter the D (Q) reference value setting mode.

(SUB display area / Δ% setting)



13. Enter the D (Q) reference value using the arrow keys or the numeric keypad.

Settable range: -199999 to 199999

Move to the digit..... ◄ and ►

Change the number ... ▲ and ▼

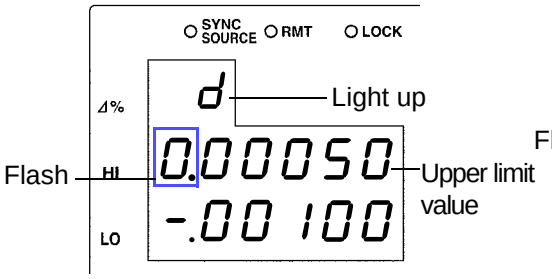
The reference value is set with the count value. At time of shipment it is set to ”0“.

14. Press ENTER to confirm the D (Q) reference value.

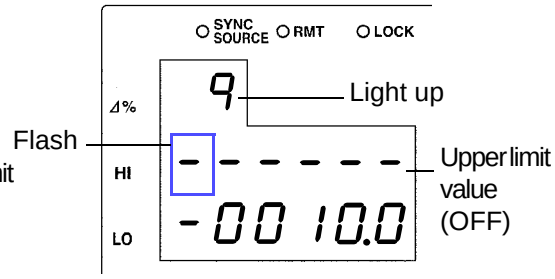
If ENTER is not pressed, the reference value just entered will not be set. The previous reference value will remain in effect.

15. Press ENTER to enter the D (Q) upper limit value setting mode.

(SUB display area / Δ% setting)



When the second parameter is D



When the second parameter is Q

16. Enter the D (Q) upper limit value using the arrow keys or the numeric keypad.

Settable range: OFF, -199999 to 199999 (When setting to "OFF"(p. 87))

Move to the digit..... ◄ and ►

Change the number ... ▲ and ▼

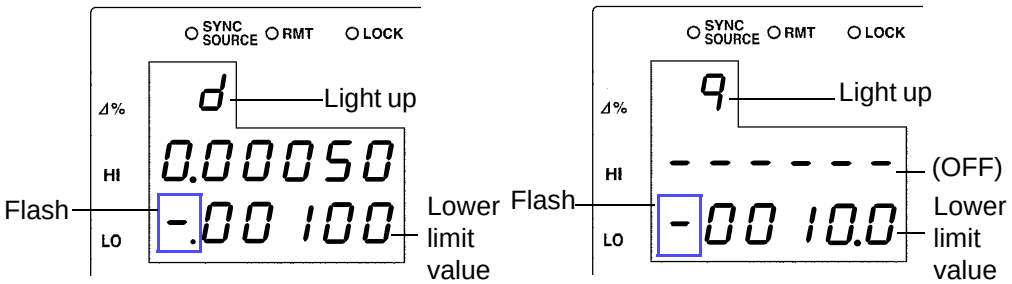
Setting a value lower than the lower limit value will not produce an error, but accurate judgment will not be possible.

At time of shipment, it is set to ” - - - - - - ” (OFF).

17. **Press ENTER to confirm the D (Q) upper limit value.**

Enter the D (Q) lower limit value setting mode.

(SUB display area / Δ% setting)



18. **In the same way enter the D (Q) lower limit value using the arrow keys or the numeric keypad.**

At time of shipment, it is set to " - - - - - - " (OFF).

19. **Press ENTER to confirm the D (Q) lower limit value.**

20. **Press SET.**

Enter the BIN measurement mode.

(Light up)

See "Performing BIN Measurement" (p. 88)

NOTE

- The reference value for the Δ setting and Δ% setting become display count values that are independent of the measurement conditions. If the measurement conditions differ, the absolute values that signify the count values change.
  For example, if the range is currently set at 100 pF this would mean that C count value of 50000 = 50E-12, D count value 100 = 0.00100, and Q count value 100 = 10.0.
- The reference value of the second parameter uses the common count value, regardless of the upper limit and lower limit values.
- The measurement conditions for normal measurement mode are used for the BIN measurement mode. Set the measurement conditions to use for BIN measurement mode while the unit is in normal measurement mode.
- When checking the upper/lower limit values, error judgment is not done.
- Check the following because judgment cannot be performed properly if the upper limit and lower limit values are set incorrectly.
  - Are the setting values within the display range of the measurement range?
  - Is the large/small relationship of the upper limit and lower limit values correct?
- After settings are complete, ▲ ▼ can be used to toggle the judgment range display to confirm the judgment range.

Setting the Upper Limit and Lower Limit Values to OFF

1. **When entering the upper limit and lower limit values, use ◀ to move left until the far left digit flashes and then press and hold ◀ for at least two seconds or use ▶ to move right until the far right digit flashes and then press and hold ▶ for at least two seconds.**

   The display changes to "– – – – – –" and OFF is set.

2. **Press ENTER to confirm the OFF setting.**

3. **Press SET.**
   Enter the BIN measurement mode.

(Light up)

Canceling BIN Measurement Mode

In BIN measurement mode, press MODE.

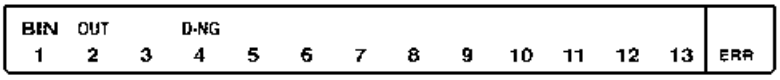
The measurement mode LEDs light in the order of BIN → NORM, and then the unit switches to normal measurement mode.

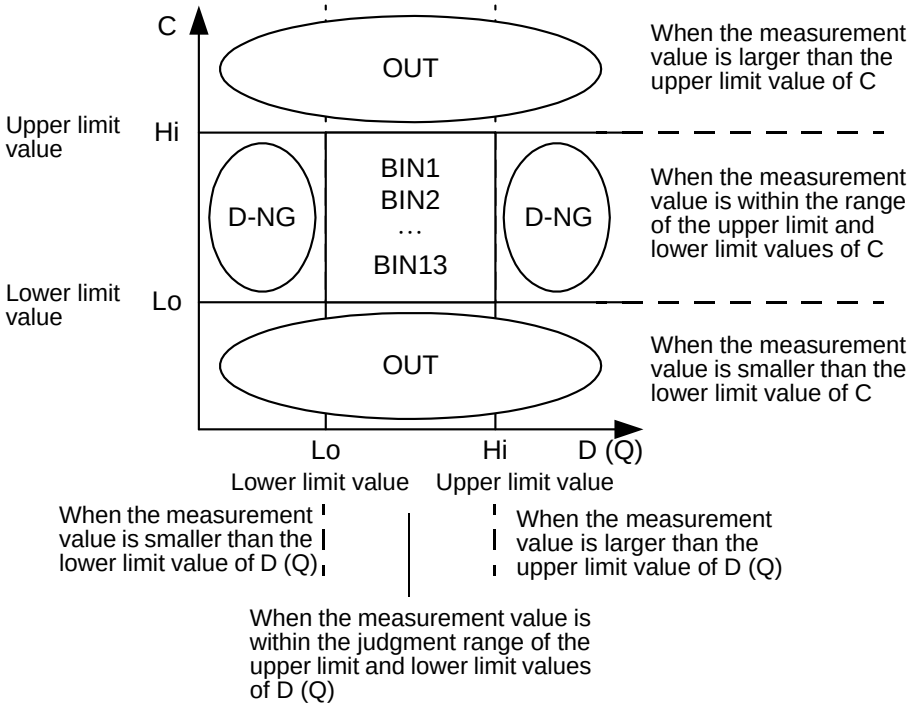
Performing BIN Measurement

- Starting with the lowest, checks to see if BIN numbers are within the set upper limit and lower limit value range and displays as a judgment result the first BIN number that is in range.
- Except for the trigger setting, the measurement conditions cannot be changed in BIN measurement mode. Press MODE to switch to normal measurement mode and then change the measurement conditions.
- Press ▲ ▼ to toggle the information shown in the SUB display area.
  C reference value (for the Δ setting and Δ% setting) ←→ BIN 1 to 13 upper limit and lower limit values ←→ D (Q) reference value (for the Δ setting and Δ % setting) ←→ D (Q) upper limit and lower limit values ←→ display OFF ←→ C reference value...
- If the upper limit and lower limit values of C and D (Q) have not been set, OUT will be displayed in the BIN judgment result display area. The measurement range will automatically become HOLD.

Judgement results display

Each of the judgment results is displayed in the BIN judgment result display area.





Outputting Judgment Results

- Output the judgment result for BIN (BIN1 to 13, OUT OF BINS, and D-NG) from EXT.I/O.
  See 7.1 "About the EXT I/O Connector" (p. 121)
- The BIN judgment results (IN/NG) can be differentiated by beep tones.
  See 6.12 "Setting Beep Tones" (p. 110)

Keys Enabled for Comparator Mode

Key	Function
MODE	Switches the measurement mode.
SET	Switches to the setting modes for the upper limit and lower limit values.
TRIG	Switches the trigger setting to INT/EXT.
MANU TRIG	This key is only enabled when the trigger setting is EXT. One measurement is performed each time the key is pressed.
MENU	The following menu settings can be made. • “LoAd_A(C/h)” • “SAVE” • “Ld_tYP” • “Lo C” • “LEV.ChK” • “bEEP_K” • “dISP” • “IF” Settings other than the above listed can be made from normal measurement mode. The lower area of the MAIN display will display “– – – –” for menus that cannot be set from BIN measurement mode.
LOCK/LOCAL	Changes the keylock function and cancels the remote state.

Application Functions Chapter 6

6.1 Setting the Average Function

The average function performs an averaging process on the measurement values. With the use of this function you can reduce measurement value fluctuations even in environments with a lot of noise.

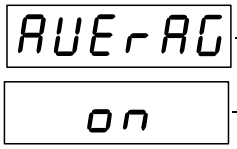
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "AVErAG" menu item.

(MAIN display area)

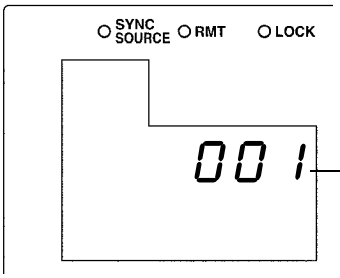


Menu content

"on" or "oFF" flashes.

(Setting screen for the number of measurements to be averaged)

(SUB display area / "on" setting)



The number of measurements to average lights up.

3. Press ◀ ▶ to enable or disable the average function.

It will toggle "on" and "oFF" each time ◀ ▶ is pressed.

4. **Press [ENTER] to enable or disable the average function.**

When “oFF” is selected, the averaging process is not performed. “dELAY” (Trigger delay setting screen) will be shown in the MAIN display area.
When “on” is selected, the number of measurements to be averaged will flash in the middle row of the SUB display area.

5. **When "on" is selected**.

Enter the number of measurements to average using ▲ ▼ or the numeric keypad.

When entering using the numeric keypad, the value is entered one digit at a time from right to left.
Settable range : 1 to 256
Move to the digit..... ◄ and ►
Change the number… ▲ and ▼

6. **Press [ENTER].**

The number of measurements to average will be set.
Once it is set, “dELAY” (Trigger delay setting screen) is shown in the MAIN display area.

If [ENTER] is not pressed, the number of measurements to average will not be set.

7. **Press [MENU].**

The unit returns to normal measurement mode.

6.2 Trigger Delay Setting

This sets the delay time between when the trigger is detected and measuring begins. With the use of this function even if measurement is commenced immediately after connecting to a sample a reliable measurement value can be attained.

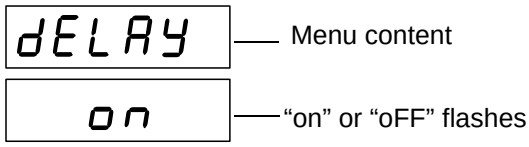
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

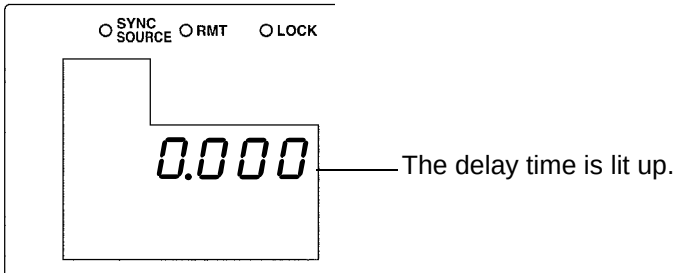
2. Use ◀ or ▶ to select the “dELAY” menu item.

(MAIN display area)



(Trigger delay setting screen)

(SUB display area / “on” setting)



3. Press ▲ ▼ to enable or disable the trigger delay.

It will toggle “on” and “oFF” each time ▲ ▼ is pressed.

4. Press [ENTER] to enable or disable trigger delay.

When “oFF” is selected, “Frq.SFt” (Frequency shift setting screen) appears in the MAIN display area.
When “on” is selected, the leftmost LED which displays the delay time will flash in the middle row of the SUB display area.

5. **When "on" is selected.**

Enter the delay time using ▲ ▼ or the numeric keypad.
(If you enter a number, each digit moves one place to the right.)
Settable range : 0.000 to 9.999(s)
Move to the digit..... ◀ and ▶
Change the number... ▲ and ▼

6. **Press ENTER to confirm the delay time setting.**

"Frq.SFt" (Frequency shift setting screen) will be shown in the MAIN display area.

If ENTER is not pressed the delay time setting will not be set.

7. **Press MENU.**

The unit returns to normal measurement mode.

6.3 Using the Contact Check Function

The contact check function contains the following two functions.

- **Exclude abnormally low measurement results. (Low C reject function)** (p. 96)
  If the C measurement value is abnormally small, it detects the measurement result as an error. It can discern whether or not the contact pin and the sample are in contact with one another. If a relative percentage the full scale of the currently selected range is set as a limit value, this function detects it as a contact error if the reading is lower than the limit value. For example, if 1% is set for a 100 pF range, measurement values lower than 1 pF will be detected as contact errors. This judgment is based on the measurement value after OPEN, SHORT and LOAD compensation.

  During a contact error the measurement value and comparator as well as BIN judgment results will be made normally. If the measurement value after offset compensation is smaller than the limit value, there will not be a contact error.

- **Exclude chattering during contact (measurement level monitoring function)** (p. 98)
  By monitoring the amount of fluctuation in the effective voltage value (Vmoni) and effective current value (Imoni), detects chattering and other waveform abnormalities resulting from the contact pin and sample in connection.
  The judgment method is as follows: During analog measurement the Vmoni and Imoni are operated several times. The first operated Vmoni and Imoni are treated as the reference values and the Δ% value is calculated relative to the subsequently operated Vmoni and Imoni using the following equation.

  $$\Delta\% = (\text{effective value} - \text{reference value}) \ / \ |\text{reference value}| \times 100$$

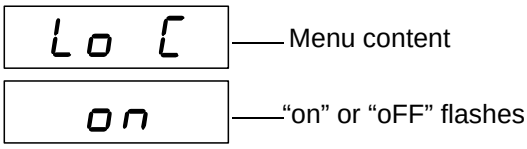
  If the Δ% value is greater than the set limit value it is detected as a contact error.

6.3.1 Setting the Low C Reject Function

1. **Press MENU.**
The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

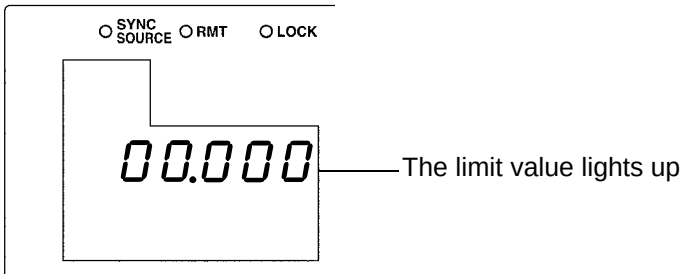
2. **Use ◀ or ▶ to select the "Lo C" menu item.**

(MAIN display area)



(Low C reject function setting screen)

(SUB display area / "on" setting)



3. **Press ▲ ▼ to enable or disable the Low C reject function.**
It will toggle "on" and "oFF" each time ▲ ▼ is pressed.

4. **Press ENTER to confirm the Low C reject function as enabled or disabled.**
When "oFF" is selected, "LEV.ChK" (Measurement level monitoring function setting screen) will be displayed in the MAIN display area.
When "on" is selected, the leftmost LED showing the limit value in the middle row of the SUB display area will flash.

5. **When "on" is selected.**

Enter the limit value using ▲ ▼ or the numeric keypad.

(If you enter a number, each digit moves one place to the right.)

Settable range : 0.000 to 10.000(%)

Move to the digit..... ◀ and ▶

Change the number... ▲ and ▼

6. **Press ENTER to confirm the limit value.**

"LEV.ChK" (Measurement level monitoring function setting screen) will be displayed in the MAIN display area.

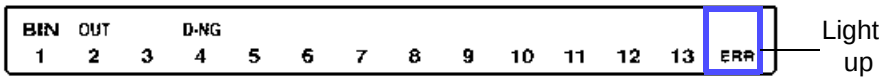
If ENTER is not pressed the Low C reject function settings will not be saved.

7. **Press MENU.**

The unit returns to the measurement mode before the menu contents were displayed.

Measurement results display

Low C contact error(ERR) is displayed in the BIN judgment results display area.



Output Measurement results

- The <measurement status> of the response data to the "MEASure?" measure value command outputs "5".
  See "Query of Measurement Data" (p. 227)
- Outputs to BIT5 of the event status register ESR3.
  See "Setting and Query of Event Status Enable Register 3 (ESER3)" (p. 217)
- Outputs Low C contact error from EXT I/O.
  See 7.1 "About the EXT I/O Connector" (p. 121)

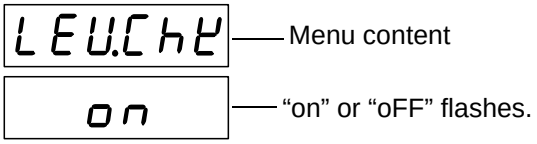
6.3.2 Measurement Level Monitoring Function Settings

1. Press MENU.

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

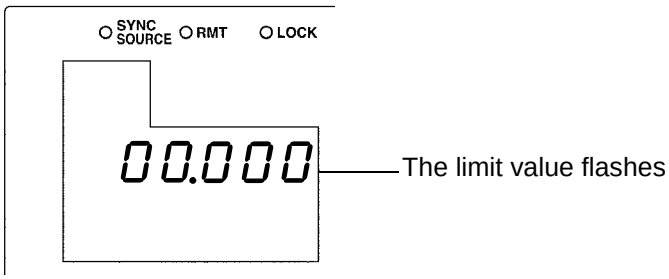
2. Use ◀ or ▶ to select the "LEV.ChK" menu item.

(MAIN display area)



(Measurement level monitoring function setting screen)

(SUB display area / "on" setting)



3. Press ▲ ▼ to enable or disable the measurement level monitoring function.

It will toggle "on" and "oFF" each time ▲ ▼ is pressed.

4. Press ENTER to confirm the measurement level monitoring function as on or off.

When "oFF" is selected, "JudGE" (Judgment mode setting screen) will be displayed in the MAIN display area.
When "on" is selected, the leftmost LED showing the limit value in the middle row of the SUB display area will flash.

5. When "on" is selected.

Enter the limit value using ▲ ▼ or the numeric keypad.

(If you enter a number, each digit moves one place to the right.)
Settable range: 0.01 to 100.00 (%)

Move to the digit..... ◀ and ▶
Change the number... ▲ and ▼

6. **Press ENTER to confirm the limit value.**

"JudGE"(Judgment mode setting screen) will be displayed in the MAIN display area.

If ENTER is not pressed, the measurement level monitoring function settings will not be saved.

7. **Press MENU.**

The unit returns to the measurement mode it was in prior to the menu items being displayed.

Measurement results display

LEU_E will be displayed in the MAIN display area.

See "MAIN display area ERROR display" (p. 15)

Output Measurement results

- The response data to the ":MEASure?" measure value command is output thusly: <measurement status> 4, <C measurement value>777777E+77, and <D (Q) measurement value>777777.
  See "Query of Measurement Data" (p. 227)
- Outputs to BIT7 of event status register ESR1.
  See "Setting and Query of Event Status Enable Register 1 (ESER1)" (p. 216)
- Outputs detected level abnormalities from EXT I/O.
  See 7.1 "About the EXT I/O Connector" (p. 121)

NOTE

Even in the case of normal contact, error output may occur due to the influence of external noise. (It is possible to judge external noise.)

6.4 Current Detection Circuit Monitoring Function

If the measurement range is set too low for the object being measured or the object being measured is in a SHORT state, a current wave outside the permissible range is generated. This can be detected as a measured current abnormality.

NOTE

- The choice to enable or disable the monitoring function can be made via communication command. The initial value is set to ON.
- If an error is detected, I_hI will be displayed in the MAIN display area.
  See "MAIN display area ERROR display" (p. 15)
- The response to the command to obtain a measurement value :MEASure? is output as below.
  <Measurement Status >8, C <Measurement Value >555555E+55,
  D (Q) <Measurement Value >555555
  See "Query of Measurement Data" (p. 227)
- Outputs to BIT5 of the event status register ESR0.
  See "Query of Event Status Register 0" (p. 218)

6.5 Applied Voltage Value Monitoring Function

The measurement signal level of this device is intended for the measurement terminals being open. Due to the influence of the device's output impedance, the voltage applied to the sample will be less than the set signal level. With this function it can be detected as an error when the applied voltage is outside the set limit value.

NOTE

- The monitoring function can be enabled or disabled, and the limit value can be set via communication commands. The device is initially set to ON, 25%. For example, if the current measurement signal level is 1 (V), the allowable range of change will be from 0.75 (V) to 1.25 (V).
  See "Setting and Query of the Applied Voltage Value Monitoring Function" (p. 243)
- If an error is detected, U_Lo will be displayed in the MAIN display area.
  See "MAIN display area ERROR display" (p. 15)
- The response to the command to obtain a measurement value :MEASure? is output as below.
  <Measurement Status >6, C <Measurement Value >666666E+66,
  D (Q) <Measurement Value >666666
  See "Query of Measurement Data" (p. 227)
- Outputs to BIT6 of the event status register ESR0.
  See "Query of Event Status Register 0" (p. 218)
- Applied voltage abnormalities are output via the EXT I/O.
  See Chapter 7 "EXT I/O" (p. 121)

6.6 Using the Frequency Shift Function

When using multiple 3505/ 3506 in a single system, measurement value fluctuations may occur due to interference with the measurement signal between 3505/ 3506 units. By shifting the measurement frequency of each 3505/ 3506, this function reduces measurement signal interference.

NOTE

- Frequency shift can be set to on when the measuring frequency is 1 MHz. The measurement frequency cannot be shifted if the measurement frequency is 1 kHz,100 kHz (only for 3505).
- Open circuit compensation and short circuit compensation perform compensation with the currently set frequency shift. When the frequency shift setting is changed, reset open circuit compensation and short circuit compensation.

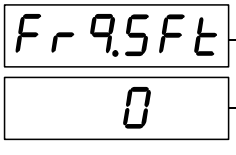
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the “Frq.SFt” menu item.

(MAIN display area)



Menu content

Frequency shift value (set in step 3)

(Frequency shift setting screen)

3. Setting the frequency shift value using ▲▼.

Settable range: -2 to 2 (%)

4. Press [ENTER].

The frequency shift setting will be set.
Once set, “SYnC” (Trigger synchronous output function setting screen) will be displayed in the upper part of the MAIN display area.

If [ENTER] is not pressed the frequency shift setting will not be saved.

5. Press [MENU].

The unit returns to normal measurement mode.

6.7 Setting the Display ON/ OFF

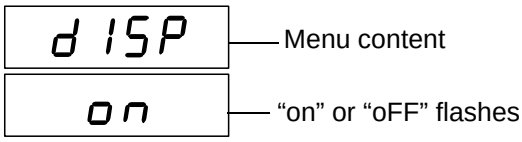
It various circumstances, such as use with a production line, EXT I/O or interfaces, displaying the measurement may be unnecessary. By using the display ON/ OFF setting, when the display is turned OFF the measurement time becomes faster and the device becomes more energy efficient.

1. **Press [MENU].**

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

2. **Use ◀ or ▶ to select the "dISP" menu item.**

(MAIN display area)



(Display setting screen)

3. **Press ▲ ▼ to turn the display ON or OFF.**

It will toggle "on" and "oFF" each time ▲ ▼ is pressed.

4. **Press [ENTER].**

The display setting is set.
Once set, "Sub.PAr" (Display parameter setting screen) will be displayed in the upper part of the MAIN display area.

If [ENTER] is not pressed the display setting will not be saved.

5. **Press [MENU].**

The unit returns to the measurement mode it was in prior to the menu items being displayed.

NOTE

- If the display is set to OFF during measurement mode, the LED display will go out approximately 10 seconds after the key was last pressed. When it is out, pressing a key will cause it to light up again.
- When the display is off, the measurement mode LED will remain lit to confirm that the unit's power is on.

6.8 Trigger Synchronous Output Function

This function enables the measurement signal to be output after measurement is triggered and ensures that the signal is applied to the sample only during measurement. Thus reducing the generation of heat in the sample and decreasing electrode wear.

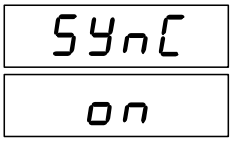
1. In normal measurement mode, press [MENU].

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. Use ◀ or ▶ to select the "SYnC" menu item.

(MAIN display area)



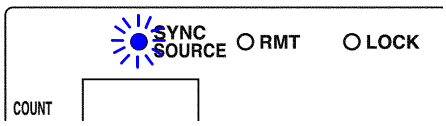
(Trigger synchronous output function setting screen)

3. Press ▲▼ to enable or disable the Trigger synchronous output function.

It will toggle "on" and "oFF" each time ▲▼ is pressed.

4. Press [ENTER].

The trigger synchronous output function setting is confirmed.
When the trigger synchronous output function is set, the SYNC SOURCE LED lights up.



After confirmation, "CAbLE" (Cable length settings screen) is displayed at the top of the MAIN display area.

The trigger synchronous output function setting is not confirmed unless [ENTER] is pressed.

5. Press [MENU].

The unit returns to normal measurement mode.

NOTE

- When the trigger synchronous output function is set to ON, there is a measurement time delay because the unit enters a wait time which spans from when the measurement signal is output to when measurement starts.
- The wait time can be set from a PC. (At the time of shipment, the wait time is 2 ms when 1 kHz and 2 ms when 100 kHz (only for 3505) and 2 ms when 1 MHz.) Set the optimal wait time for the DUT (device under test). A wait time that is too short may increase measurement errors and display differences.
  See 7.3 "About Input and Output Signals" (p. 124)

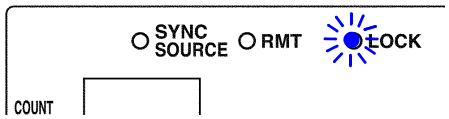
6.9 Disable Key Control (Keylock Function)

If the keylock function is set, the keys on the front panel are disabled. This function enables you to protect your setup.

Setting the Keylock

Press and hold [LOCK/LOCAL] for at least two seconds.

The LOCK LED of the SUB display area lights up.



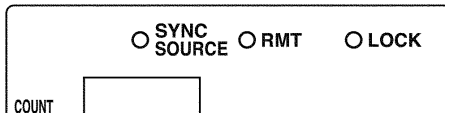
NOTE

- All the keys except [MANU TRIG] are locked.
- The following tasks can still be performed when the keylock is set.
  In the case of external triggers: Manual triggering is possible.
  In the case of internal triggers: When the interface is a printer, the measurement values can be output to the printer.
- The keylock can be set in normal measurement mode, comparator measurement mode, and BIN measurement mode.

Canceling the Keylock

Press and hold [LOCK/LOCAL] for at least two seconds.

The LOCK LED goes out and the keylock function is canceled.



NOTE

Turning off the power does not cancel the keylock function.

6.10 Save the Measurement Conditions (Panel Save Function)

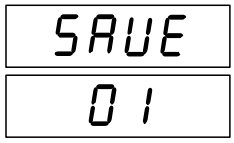
The current measurement conditions can be saved to internal memory. Up to 70 panels (70 sets) of measurement conditions can be saved.
When the panel save function is used, the measurement mode and all of the measurement conditions are saved. The saved values include comparator and BIN upper limit and lower limit values and the open circuit, short circuit, and load compensation values.
Use the panel load function to load saved measurement conditions.
See 6.11 "Load the Measurement Conditions (Panel Load Function)" (p. 106)

1. Press MENU.

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

2. Use ◀ or ▶ to select the "SAVE" menu item.

(MAIN display area)



— Menu content

— A panel number that has not been saved lights up at the bottom of the MAIN display area. (At the time of shipment: "01")
(If all panels have not been saved, the "01" indication is displayed.)

(Panel save function setting screen)

3. Use the numeric keypad or ▲ and ▼ to select the panel number to save.

The numbers 01 to 70 can be set.
Panel numbers already in use flash. To overwrite a panel number, select the panel number to overwrite.

Change the number… ▲ and ▼

4. Press ENTER to save the measurement conditions.

The unit returns to the measurement mode it was in prior to the menu items being displayed.

NOTE

- The panel is not saved unless ENTER is pressed.
- The lifespan of the backup battery for internal memory is approximately six years under normal use.
  Measurement conditions can no longer be saved after the life of the battery runs out. When this happens, submit a request for the battery to be replaced by our repair service personnel. (A fee will be charged.)

6.11 Load the Measurement Conditions (Panel Load Function)

The saved measurement values and compensation values can be loaded from internal memory.

First, set the load condition.
There are the following three load conditions.

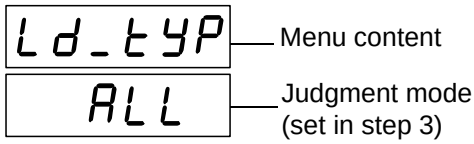
- **All**
  Loads the measurement conditions (frequency, level, range, upper limit and lower limit values, etc.) and the open circuit, short circuit, and load compensation values.
- **Measurement conditions (hArd)**
  Loads the measurement conditions (frequency, level, range, upper limit and lower limit values, etc.).
- **Compensation values (Corr)**
  Loads the open circuit, short circuit, offset compensation, and load compensation values self calibration conditions(AUTO/ MANU, number of times, speed), cable length.

1. Press MENU.

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

2. Use ◀ or ▶ to select the “Ld_tYP” menu item.

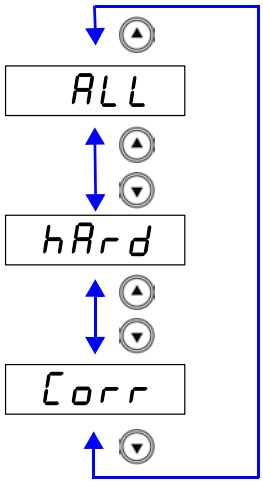
(MAIN display area)



(Load condition setting screen)

3. Use ▲ and ▼ to select a setting item.

Pressing ▲ or ▼ causes the display to change in the following manner.



“ALL”
Loads the measurement conditions (frequency, level, range, upper limit and lower limit values, etc.) and the open circuit, short circuit, and load compensation values.

“hArd”
Loads the measurement conditions (frequency, level, range, upper limit and lower limit values, etc.).

“Corr”
Loads the open circuit, short circuit, and load compensation values.

4. Press ENTER.

The load condition setting is confirmed.
The “AVErAG” (Setting screen for the number of measurements to be averaged) indication is displayed in the MAIN display area.

The load condition setting is not confirmed unless ENTER is pressed.

5. Press MENU.

The unit returns to the measurement mode it was in prior to the menu items being displayed.

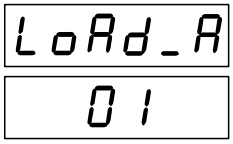
Loading Panels

1. **Press MENU.**

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

2. **Use ◀ or ▶ to select the "LoAd_A ("LoAd_C", "LoAd_h")" menu item.**

(MAIN display area)



(Panel load screen)

There are 3 types of panel load screens.

LoAd_A	Loads the measurement conditions and the open circuit, short circuit, and load compensation values.
LoAd_h	Loads the measurement conditions.
LoAd_C	Loads the open circuit, short circuit, and load compensation values.

NOTE

The panel load screen that is displayed differs depending on the load condition set in 6.11 "Load the Measurement Conditions (Panel Load Function)" (p. 106). (Refer to the following table.)

Load Condition Setting	Panel Screen Displayed
ALL	LoAd_A
hArd	LoAd_h
Corr	LoAd_C

3. Use the numeric keypad or ▲ and ▼ to select the panel number to load.

The number is entered at the bottom of the MAIN display area.

NOTE

- Only saved numbers can be set. If a number that was not saved with the numeric keypad is set, the set number flashes and then changes to the nearest saved number after one second elapses.
- At the time of shipment, when the unit has been reset, or at any other time when there are no measurement conditions saved, "– –" is displayed at the bottom of the MAIN display area.
- Each time a panel number is changed, the SUB display area for the measurement conditions of that panel number flashes.

4. Press ENTER to load the measurement conditions.

When the load condition is set to ALL (measurement conditions and compensation values) or hArd (measurement conditions), the unit switches to the saved measurement mode.
When the load condition is set to Corr (compensation values), the unit returns to the measurement mode it was in prior to the menu items being displayed.

NOTE

- The panel is not loaded unless ENTER is pressed.
- When loading a panel from EXT I/O, the wait time (the time from the trigger being input to the start of measurement) varies depending on the load condition.
  ALL: Approximately 130 ms
  Compensation values: Approximately 0.6 ms
  Measurement conditions: Approximately 130 ms
- When the load conditions in the panel load are set to "ALL" and "hArd", the device will automatically acquire a self-calibration value immediately after panel load (before measurement) regardless of the settings of the self calibration function.
  Self calibration value will not be acquired immediately after panel load (before measurement value) in "Corr".
  If the setting for self calibration after panel load is set to AUTO, the device will automatically acquire a calibration value after measurement.

6.12 Setting Beep Tones

The beep tone for judgment results and the key operations tone can be set.

Setting the Beep Tone for Judgment Results of Comparator and BIN

The following two possibilities can be chosen from.

- A beep tone plays when there is an IN judgment (AND) for both C and D during comparator measurement and a judgment corresponding to a BIN number during BIN measurement.
- A beep tone plays when there is a HI or LO judgment during comparator measurement and an OUT OF BINS or D-NG judgment during BIN measurement.

Setting the Beep Tone for Key Operations (p. 112)

6.12.1 Setting the Beep Tone for Judgment Results of Comparator and BIN

1. **In normal measurement mode, press MENU.**

The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

This setting cannot be changed in comparator mode and BIN mode.

2. **Use ◀ or ▶ to select the "bEEP_J" menu item.**

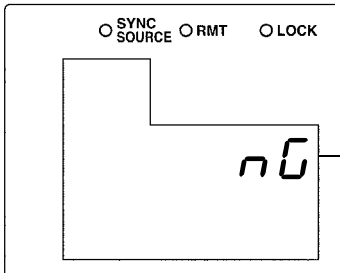
(MAIN display area)

Menu content

"on" or "oFF" flashse.

(Beep tone setting screen for judgment results)

(SUB display area)



The beep tone setting details light up.

3. **Press ▲ ▼ to enable or disable the beep tone output.**

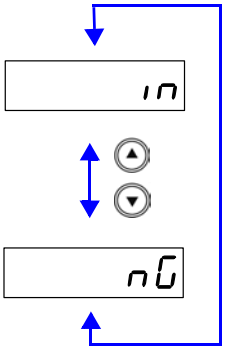
It will toggle "on" and "oFF" each time ▲ ▼ is pressed.

4. **Press [ENTER].**

If “oFF” is selected, the beep tone will not sound, regardless of the judgment result.
The "bEEP_K"(Beep tone setting screen for key operations) indication is displayed in the MAIN display area.
If “on” is selected, the leftmost LED showing the beep tone setting details function in the middle row of the SUB display area will flash.

5. **Press [▲] [▼] to enable or disable the beep tone setting details function.**

It will toggle “in” and “nG” each time [▲] [▼] is pressed.



“in”
A beep tone plays when there is an IN judgment (AND) for both C and D during comparator measurement and a judgment corresponding to a BIN number during BIN measurement.

“nG”
A beep tone plays when there is a HI or LO judgment during comparator measurement and an OUT OF BINS or D-NG judgment during BIN measurement.

6. **Press [ENTER].**

The beep tone setting for judgment results is set.
Once set, "bEEP_K" (Beep tone setting screen for key operations) will be displayed in the upper part of the MAIN display area.

The beep tone setting for judgment results is not confirmed unless [ENTER] is pressed.

7. **Press [MENU].**

The unit returns to normal measurement mode.

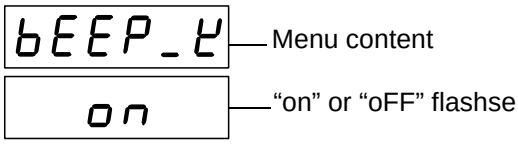
6.12.2 Setting the Beep Tone for Key Operations

1. **Press MENU.**

   The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
   (Refer to "Menu display organization" (p. 14) for menu order)

2. **Use ◀ or ▶ to select the "bEEP_K" menu item.**

   (MAIN display area)

   (Beep tone setting screen for key operations)

3. **Press ▲ ▼ to enable or disable the beep tone output.**

   It will toggle "on" and "oFF" each time ▲ ▼ is pressed.

4. **Press ENTER.**

   The beep tone setting for key operations is confirmed.
   Once set, "disp" (Display setting screen) will be displayed in the upper part of the MAIN display area.

   The beep tone setting for key operations is not confirmed unless ENTER is pressed.

5. **Press MENU.**

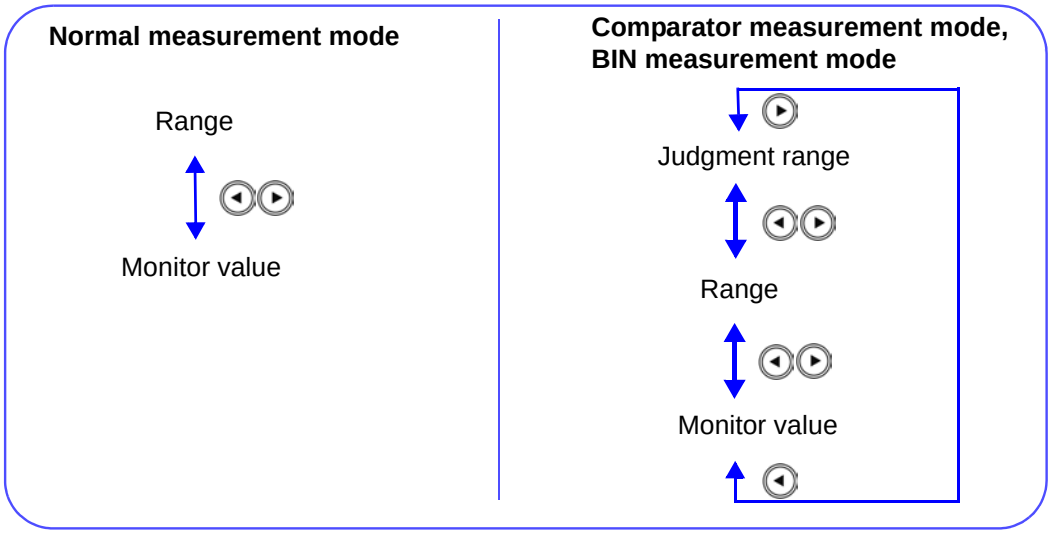
   The unit returns to the measurement mode it was in prior to the menu items being displayed.

6.13 Switching the displayed item (SUB display)

The item displayed in the SUB display area can be switched.

- Range number (for normal measurement only)
- Monitor value (Voltage between the terminals and the current flowing in the object being measured)
- Judgement range (for comparator and BIN measurement only)

Press ◀ ▶ during measurement (normal measurement, Comparator measurement or BIN measurement) to select the item displayed in the SUB display area.



NOTE

- The judgment range for comparator measurement and BIN measurement can be switched using the ▲ ▼ keys.
- The units during range display will appear as shown below.

Range display	Units
u	μ (10^{-6})
n	n (10^{-9})
P	p (10^{-12})

6.14 Performing a System Reset

System reset resets the system to the factory default state, except for the settings below.

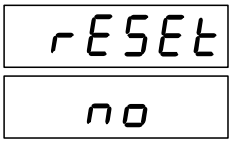
- Open, short, load, offset compensation
- Frequency shift, keylock function
- Panel save
- Status byte register, event register, enable register

1. Turn the power of the unit off.

2. Turn the power back on while holding down [ENTER], and then let go of [ENTER] when the version information is displayed.

The version information is displayed for approximately 1.5 seconds after all LEDs light up. Then, the system reset setting is displayed.

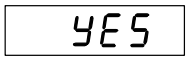
(MAIN display area)



—System reset setting item

3. Use the arrow keys to set system reset while the indication is displayed.

"no"
A system reset is not performed.



"yES"
A system reset is performed.

4. Press [ENTER] to confirm the setting.

If you execute a system reset, the measurement conditions are reset and the system is placed in the normal measurement mode.

See Appendix 7 "Initial Settings Table" (p. A11)

NOTE

The settings of the RS-232C interface in the 3505/ 3506 unit are initialized to 9600 bps for the baud rate and CR+LF for the terminator.

6.15 Printing Function

The optional 9442 Printer and 9444 Connection Cable can be used to print measurement values.

WARNING

To avoid electric shock, turn off the power to all devices before plugging or unplugging any cables or peripherals.

6.15.1 Preparation Prior to Connecting the Printer

Things to Prepare

- Model 9442 Printer
- Model 9443-01 AC adapter (for Japan)
  Model 9443-02 AC adapter (for EU)
- Model 1196 Recording Paper
- Model 9444 Connection Cable (for connecting this unit and the printer)

9442 Printer Setup

The settings of the software DIP SW need to be changed to use the 9442 Printer with this unit.

NOTE

- For details on handling the printer, be sure to careful read the instruction manual supplied with the printer.
- Use Model 1196 Recording Paper (thermal paper; 10 rolls per set) or the equivalent as the printer paper.

Procedure

1. **Turn off power of the 9442 Printer.**
2. **Turn the power back on while holding down the ON LINE switch, and then let go of the switch when printing starts.**

   The current settings are printed.
   The following is printed at the end of the printout.

```
Continue? :Push 'On-line SW'
Write?    :Push 'Paper feed SW'
```

3. **Press the ON LINE switch to change the settings.**
   “Dip SW-1” is printed and the printer enters the configuration state for the software DIP SW1.

4. Set the switches numbered 1 to 8 of DIP SW1 to either ON or OFF in accordance with the table below.

Press the **ON LINE** switch once to set a switch to ON and the **FEED** switch once to set a switch to OFF.

You can confirm the input result that is printed each time a switch is pressed. If a setting is configured incorrectly, repeat the procedure from Step 1.

is the setting to use with this unit.

Switch No.	Function	ON (Press ON LINE)	OFF (Press FEED)
1	Input method setting	Parallel	Serial
2	Print speed	Fast	Slow
3	Auto loading	Enable	Disable
4	CR function	Carriage return	Return
5	Setting command	Enable	Disable
6	Print density (set to 100%)		OFF
7		ON	
8		ON	

After you finish configuring the switch numbered 8, the following is printed again.

```
Continue? :Push 'On-line SW'
Write?    :Push 'Paper feed SW'
```

5. Press the ON LINE switch again so that the printer enters the configuration state and configure each of the settings for DIP SW2 and DIP SW3 as shown in the table below.

Switch No.	Function	ON (Press ON LINE)	OFF (Press FEED)
1	Print mode	Normal print (40 digits)	Reduced print (80 digits)
2	User-defined character backup	Enable	Disable
3	Character type	Normal characters	Special characters
4	Zero font	0	Ø
5	International characters	ON	
6		ON	
7		ON	
8		ON	

Switch No.	Function	ON (Press ON LINE)	OFF (Press FEED)
1	Data bit length	8 bits	7 bits
2	Use parity	No	Yes
3	Parity setting	Odd	Even
4	Control flow	H/W BUSY	XON/XOFF
5	Baud rate (Set to 19200 bps)		OFF
6		ON	
7		ON	
8			OFF

6. **After you finish configuring the switch numbered 8 of DIP SW3, press either the ON LINE switch or the FEED switch to complete the setup.**

The following is printed.

```
Dip SW setting complete!!
```

6.15.2 Connection Procedure

WARNING

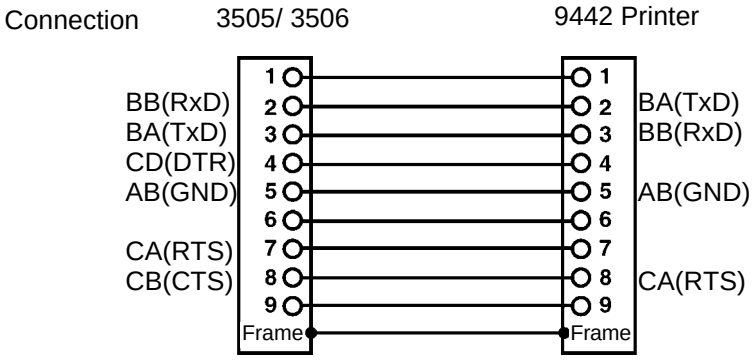
To avoid electric shock, be sure to turn off the power of the printer and unit before you connect or disconnect a cable.

Connect the 9442 Printer to the RS-232C connector of the unit.
Configure the printer and unit beforehand.
See 8.3.2 "Setting the Interface Communication Conditions" (p. 134)

Procedure

1. **Turn off the power of the 3505/ 3506 unit and the 9442 Printer.**

2. **Connect the 9444 Connection Cable to the unit and the printer.**



3. **Turn on the power of the 3505/ 3506 unit.**

4. **Turn on the power of the 9442 Printer.**

NOTE

Turn on the power of the 3505/ 3506 unit before you turn on the power of the 9442 Printer. If the 9442 Printer is on when you turn on the 3505/ 3506 unit, undefined values may be sent from the 3505/ 3506 unit because of BA(TxD) being unstable.

6.15.3 Printing

If MANU TRIG is pressed when an external trigger is set, the measurement values are output to the printer after measurement finishes.

If MANU TRIG is pressed when an internal trigger is set, the measurement values up until the time when the key is pressed are output to the printer.

1. **Example when performing normal measurement**

```
CP 100.034n F   |D  0.00041
CP 100.029n F   |D  0.00038
```

2. **Example when performing comparator measurement**

```
CP 100.052n F    HI|D  0.00050      HI
CP 100.047n F    IN|D  0.00045      IN
```

3. **Example when performing BIN measurement**

```
CP 100.016n F   |D  0.00042       BIN1
CP 100.023n F   |D  0.00036       OUTB
```

Connecting a PC instead of the 9442 Printer enables you to receive the measurement values on the PC.
Set the RS-232C communication conditions on the PC as shown below.

- Bits per second: 19200
- Data bits: 8
- Parity: None
- Stop bits: 1

NOTE

Flow control is automatically set to Hardware (RTS/CTS control) if the interface used with the 3505/ 3506 unit is a printer.

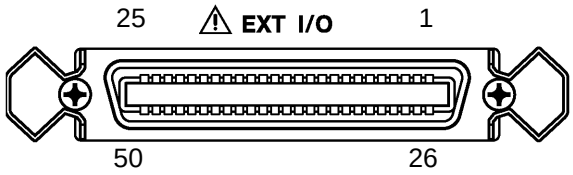
EXT I/O Chapter 7

7.1 About the EXT I/O Connector

The EXT I/O connector includes the following functions.

- Output signal for comparator result
- Output signal for BIN result
- Output end of measurement signal (EOM)
- Output analog end of measurement signal (INDEX)
- Input external trigger signal
- Select the panel number to load

Connector Used DDK 57RE-40500-730B (D29)
Applicable Connector DDK 57-30500



EXT I/O Connector Terminal

PIN No.	I/O	Signal Line Name	PIN No.	I/O	Signal Line Name
1	IN	TRIG	26	IN	LD0
2	IN	LD1	27	IN	LD2
3	IN	LD3	28	IN	LD4
4	IN	LD5	29	IN	LD6
5	IN	LD-VALID	30	OUT	BIN1, C-HI
6	OUT	BIN2, C-IN	31	OUT	BIN3, C-LO
7	OUT	BIN4, D-HI	32	OUT	BIN5, D-IN
8	OUT	BIN6, D-LO	33	OUT	BIN7, AND
9	OUT	BIN8	34	OUT	BIN9
10	OUT	BIN10	35	OUT	BIN11
11	OUT	BIN12	36	OUT	BIN13
12	-	Unused	37	OUT	OUT OF BINS
13	OUT	INDEX	38	OUT	EOM
14	OUT	ERR	39	OUT	D-NG
15	IN	CALIB	40	-	Unused
16 to 20	IN	EXT DCV	41 to 45	OUT	INT DCV
21 to 25	IN	EXT COM	46 to 50	OUT	INT COM

EXT I/O Connector Signal Lines

NOTE All input and output signals other than the power signal are negative logic.

$\overline{\text{TRIG}}$ If a negative logic signal is input in external trigger mode, a single measurement begins at the corresponding LOW level (100 μs or more).

NOTE This is not valid during analog measurement (during output of INDEX signal), even if a TRIG signal is input.

$\overline{\text{LD0}}$ to $\overline{\text{LD6}}$ Selects the number of the panel to load.
If **$\overline{\text{TRIG}}$** signal is input while the **$\overline{\text{LD-VALID}}$** signal is at LOW level, the selected panel is loaded and used for measurement (only in external trigger mode).

Panel Number	$\overline{\text{LD6}}$	$\overline{\text{LD5}}$	$\overline{\text{LD4}}$	$\overline{\text{LD3}}$	$\overline{\text{LD2}}$	$\overline{\text{LD1}}$	$\overline{\text{LD0}}$
Panel 1	0	0	0	0	0	0	1
Panel 2	0	0	0	0	0	1	0
Panel 4	0	0	0	0	1	0	0
Panel 8	0	0	0	1	0	0	0
Panel 16	0	0	1	0	0	0	0
Panel 32	0	1	0	0	0	0	0
Panel 64	1	0	0	0	0	0	0
Panel 70	1	0	0	0	1	1	0

0:(HIGH:5 to 24 V)
1:(LOW:0 to 0.9 V)

$\overline{\text{LD-VALID}}$ This is the signal to execute Panel Load function. If the **$\overline{\text{LD-VALID}}$** signal is "at LOW level" during **$\overline{\text{TRIG}}$** signal recognition, panel load will be enacted according to the **$\overline{\text{LD0}}$** through **$\overline{\text{LD6}}$** settings.

$\overline{\text{C-HI}}$, $\overline{\text{C-IN}}$, $\overline{\text{C-LO}}$ Outputs the comparator judgment result for the measurement value of the first parameter (MAIN PARAMETER).

$\overline{\text{D-HI}}$, $\overline{\text{D-IN}}$, $\overline{\text{D-LO}}$ Outputs the comparator judgment result for the measurement value of the second parameter (SUB PARAMETER).

$\overline{\text{AND}}$ Outputs a result if the judgment result AND is obtained for the measurement value of the first parameter and the measurement value of the second parameter. Outputs a result if both judgments results are IN or if one of either the first or second parameters was not judged but the judgment result of the judged parameter is IN.

$\overline{\text{BIN1}}$ to$\overline{\text{BIN13}}$
$\overline{\text{OUT OF BINS}}$
$\overline{\text{D-NG}}$ Outputs judgment results for BIN measurement.

$\overline{\text{INDEX}}$ This is the analog end of measurement signal. When this signal is at ON (after falling edge), you can change the sample.

$\overline{\text{EOM}}$ This is the end of measurement signal. When this signal is at ON (after falling edge), the judgment results of comparator and BIN are enabled.

EXT DCV, EXT COM This terminal supplies power from an external device. It enables an isolated connection to be established between the unit and an external device. The range of power voltages that can be connected is 5 to 24 V DC.

INT DCV, INT COM Outputs internal +5 V DC and internal COM of the unit.

$\overline{\text{ERR}}$ Outputs when the detected level is abnormal or during Low C detect or when the applied voltage is abnormal.

$\overline{\text{CALIB}}$ If the **$\overline{\text{CALIB}}$** signal is "at LOW level" during **$\overline{\text{TRIG}}$** signal recognition, the self calibration value will be measured after measuring the object being measured once.

7.2 Circuit Configuration and Connections of the EXT I/O Connector

⚠CAUTION

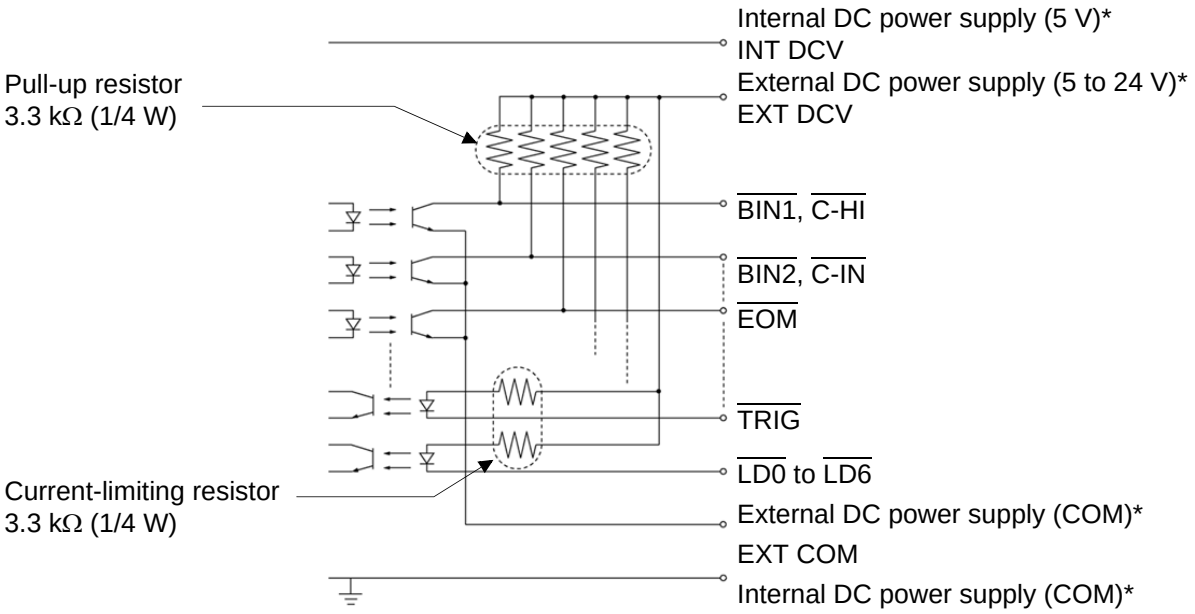
- The range of power voltages that can be connected to the external DC power supply EXT DCV and EXT COM terminals is 5 to 24 V DC. Do not apply a voltage that exceeds +24 V DC. Doing so may damage the device. Connect a device with an output capacitance of at least 200 mA in order to drive the circuit.
- Do not connect an external DC power source to the internal DC+5V (INT DVC) terminal. Doing so may damage the device.
- Signal lines are insulated to stop interference between signals. Be sure to use protective grounding for the connected device. Otherwise the insulation may be damaged.

NOTE

- +5 V DC is output between the internal DC power supply INT DCV and INT COM. The maximum current capacity is 100 mA. Do not connect a circuit that consumes 100 mA or more to an external device.
- INT COM is connected to the case.
- The maximum low level output current of the output signal is 30 mA. When a current of more than 30 mA is required, connect, for example, a transistor circuit, which is capable of current amplification and run on an external power source, to the external device.

Circuit Configuration

All input and output signal lines other than the power signal line are isolated by a photocoupler.
When using the EXT I/O, connect a 5-24 V DC power in EXT DCV-EXT COM.
When power cannot be supplied from an external device, connect INT DCV and EXT DCV, and INT COM and EXT COM.



* A connection is possible when using an internal DC power supply voltage of 5 V.

7.3 About Input and Output Signals

Electrical Characteristics of Output Signals

The output signals are photocoupler open collector output. Inside the unit, a 3.3 kΩ pull-up resistor is used to connect to the external DC power source (EXT DCV).

Relationship between External DC Power Source Voltage and Output Signal Voltage/Current (Reference Values)

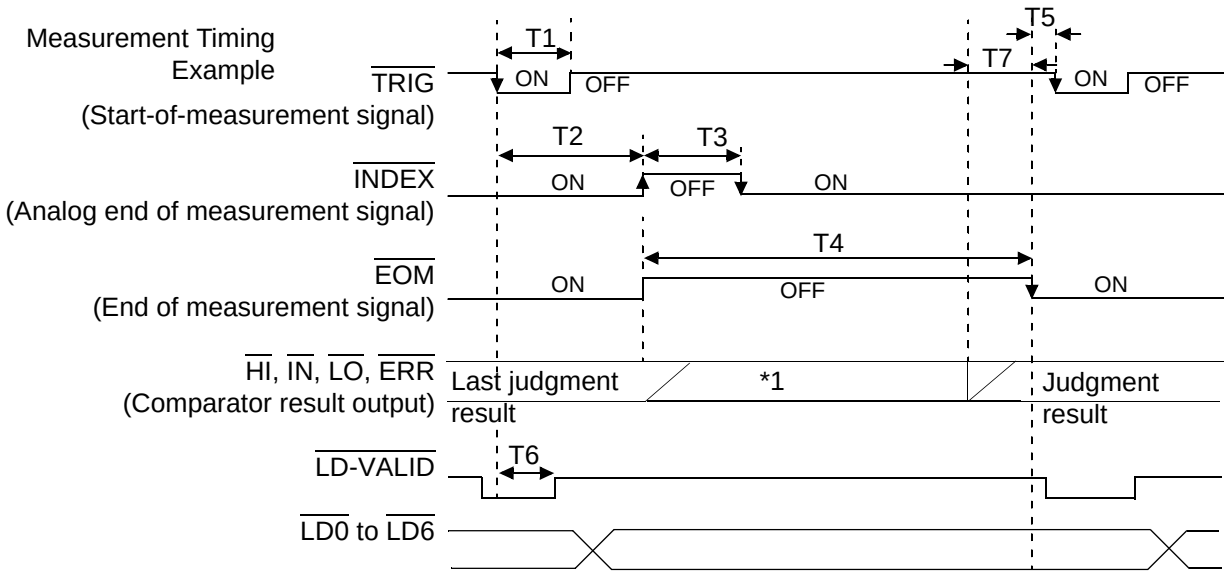
External DC Power Source	Output Signal (Internal Pull-up Resistor of 3.3 kW)		
	High Level	Low Level (Output Current)	
		(10 mA)	(30 mA)
5	5	0.9 V	1.1 V
12	12		
24	24		

The values listed above are not guaranteed.
It is not possible to directly connect a circuit that has a maximum input voltage V_{IL} of 0.8 V or more. Add a transistor and buffer circuit capable of driving so that the V_{IL} becomes less than 0.8 V.

Timing of Input Signals

Set the judgment conditions with the comparator and input a trigger signal from EXT I/O in that state. (The trigger setting is set to external trigger.)

If you press MANU TRIG, the judgment result is output from the EXT I/O comparator result output signal line.



You can use a communication command to select whether the last judgement results for comparator measurement and BIN measurement are reset when analog measurement starts or held while analog measurement is performed and updated when analog measurement ends.

NOTE

See "Setting and Query of Output of Judgment Result Signal Line in EXT I/O" (p. 223)

*1 Reset at the same time as analog measurement starts. : HIGH
Not reset at the same time as analog measurement starts. : Last judgment result remains

Symbol	Description	Approximate Time
T1	$\overline{\text{TRIG}}$ width (LOW) : Trigger signal minimum time	100 μs
T2	From $\overline{\text{TRIG}}$(LOW) to $\overline{\text{INDEX}}$ (HIGH) : Time from trigger to circuit response	350 μs *1
T3	$\overline{\text{INDEX}}$ width (HIGH) : Minimum chuck time, switching chuck with $\overline{\text{INDEX}}$ (LOW) is possible	1.1 ms *2
T4	$\overline{\text{EOM}}$ width (HIGH) : Measurement time	2.0 ms *2
T5	From $\overline{\text{EOM}}$ width (LOW) to $\overline{\text{TRIG}}$ (LOW): Minimum time from end of measurement to next trigger	2.7 ms *3
T6	From $\overline{\text{TRIG}}$ width (LOW) to $\overline{\text{LD-VALID}}$ (HIGH): Time to recognize panel number	300 μs
T7	From Comparator, BIN Judgement Result to EOM (LOW): Setting value for delay time	30 μs *4

*1: When the panel number is being loaded by the panel load function, the response times become approximately 0.6 ms (loading compensation values) and approximately 130 ms (ALL, loading measurement conditions).
When the trigger synchronous output function and trigger delay is enabled, wait times are included. (At time of shipment, the wait time is set to 2 ms trigger simultaneous output function with 0 ms trigger delay.)
*2: These reference values are when the measurement speed is FAST, and the range is HOLD. (p. 127)
*3: Self calibration setting : AUTO,
Measurement time during self calibration: the reference value for FAST (p. 128).,
When the self calibration setting is MANUAL and calibration is not performed it becomes 1 ms.
*4: There is an approximate error of 100 ms in the delay time entered for Judgement Result ↔ $\overline{\text{EOM}}$ for the setting value. When the setting value is 0.0 s, the delay time is approximately 30 μs

NOTE

- The rise time speed of signal line for comparator or BIN judgement result output (Pins 6 to 11, 30 to 37, 39) depends on the circuit structure connected to the EXT I/O. Because of this, the comparator or BIN judgement result level immediately after $\overline{\text{EOM}}$ output may cause measurement error.
  To prevent this, it is possible to set the command of delay time between comparator or BIN judgement result output and $\overline{\text{EOM}}$.
  In addition, when the Command setting for judgement result signal line in EXT I/O (:IO:RESult:RESet) is enabled (ON) and forcibly moved to HIGH level at the same time as analog measurement starts, LOW→HIGH transfer will not occur when judgement result is outputted immediately after measurement has finished. As a result, the delay time between the judgement result output and $\overline{\text{EOM}}$ can be set to the minimum level.
  As a result, the delay time between the judgement result output and $\overline{\text{EOM}}$ can be minimized. However, take note that the evaluation result confirmation range is valid until the following triggers are accepted.
- During measurement, a trigger input from EXT /IO or communicating by interface may lead to a bigger dispersion of delay time between comparator or BIN judgement result output and $\overline{\text{EOM}}$. As far as possible, try not to control from external sources when carrying out measurement.

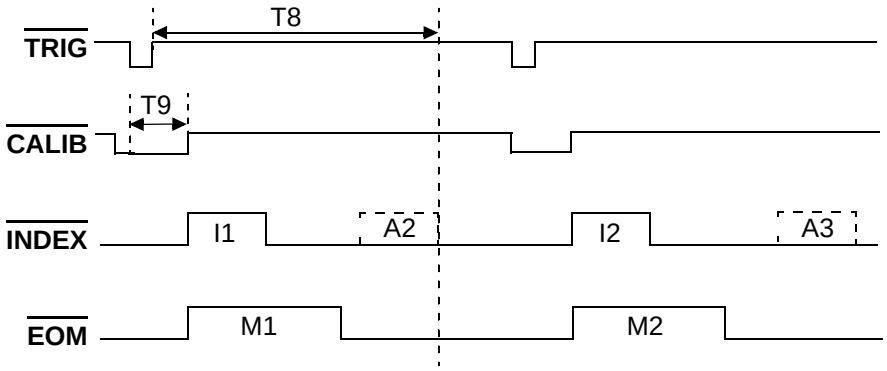
See "Setting and Query of Delay time for Judgement Result Output and EOM Output Period in EXT I/O" (p. 222)
"Setting and Query of Output of Judgment Result Signal Line in EXT I/O" (p. 223)

Self calibration

When self calibration is set to MANUAL, a self calibration value is taken after measurement of the object being measured by making CALIB to be LOW during T9 (TRIG: from LOW to 300 μs or greater). The self calibration value taken will be used for the following measurement.

NOTE

- The number of calculations to make during self calibration and the measurement time can be set by communication commands.
  See "Setting and Query of Number of Times to Average During Self Calibration" (p. 191), "Setting and Query of Self Calibration Measurement Speed" (p. 192)
- When self calibration is set to "Auto" a self calibration value will be calculated after completion of measurement even if CALIB is not set to LOW. In order to facilitate high speed measurement the self calibration value is calculated once, then a moving average calculated against the number of subsequent calculations is treated as the self calibration value.
- When displaying voltage or current monitor values, the time to measure the reference signal is about 4 ms.



T8 : Trigger input restricted range
T9 : Time from the trigger until the perform compensation signal is recognized (approximately 300 μs)
I1, I2 : Analog measuring time
M1, M2 : Measuring time
A2, A3 : Self calibration time

7.4 About Measurement Times

Measurement times differ depending on the measurement conditions. Refer to the following values.

NOTE

- All of the values are reference values. Note that they may differ depending on the conditions of use.
- A wait of 50 ms is included when the frequency, frequency shift, level, and range change.

Analog Measurement Signal

INDEX

The output time (**T3**) for an analog measurement signal (INDEX) depends on the measurement speed as shown below. (When the range is HOLD.)

Measurement Speed		
FAST	NORM	SLOW
T3 (ms)	T3 (ms)	T3 (ms)
1.1	4.1	13.3

(Allowable tolerance: ±5%±0.3 ms)

End of Measurement Signal

EOM

The output time (**T4**) for an end of measurement signal (EOM) can be obtained by the following equation.

T4 = A + B + C + D

A These measurement times are for when the unit is in normal measurement mode and not performing open circuit and short circuit compensation, and when the range is HOLD.

Measurement Speed		
FAST (ms)	NORM (ms)	SLOW (ms)
2.0	5.0	14.0

(Allowable tolerance: ±5%±0.5 ms)

B The calculation time differs depending on whether or not there is open circuit, short circuit, or load compensation

Open Circuit and Load Circuit Short Circuit Compensation	(ms)
No	0.0
Yes	Max. 0.1 Each

C The calculation time differs if comparator is executed.

Measurement Mode	(ms)
Normal measurement mode	0.0
Comparator measurement mode	MAX 0.2

D The calculation time differs if BIN is executed.

Measurement Mode	(ms)
Normal measurement mode	0.0
BIN measurement mode	MAX 0.4

Self Calibration Time

The calculation speed of each self calibration value can be set using the :CALibration:SPEEd command.

Self calculation time of one self calibration (ms)		
FAST (Initial setting)	NORMAL	SLOW
1.7	4.7	13.0

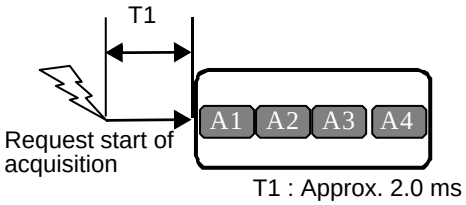
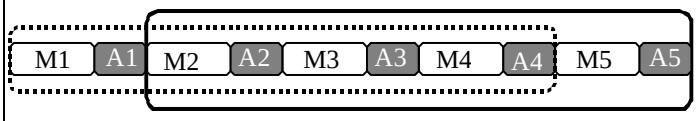
NOTE

- In the following situations the standard signal is measured only the number of times set by the :CALIbration:AVERaging command and the arithmetical average (arithmetrical mean) is taken as the self calibration value regardless of the self calibration fuction setting.
  - When turning on the power supply.
  - When changing the frequency and frequency shift, or initialization of the equipment.
  - When carrying out the :CALIbration:ADJust command
  - When performing panel load while the load conditions are "ALL" or "hArd".
  - When ENTER has been pressed in the standard measurement, comparator measurement, or BIN measurement screens.

The calculation times shown above are calculated based on the following method.

One Self calibration time × Number of times set at :CALibration:AVERaging

Example of average number of 4 times (:CALibration:AVERaging 4)

Communication command (:CALibration :ADJust) and request for self calibration using ENTER key (Self calibration value is acquired based on the arithmetic mean of the number of times set for communication command (:CALibration:AVERaging)	 T1 : Approx. 2.0 ms Self calibration value to be used in compensation for the next measurement (A1 + A2 + A3 + A4) /4
Self calibration setting: AUTO + Trigger input Self calibration setting: MANU + Trigger input + Low level **CALIB** (pin 15) Trigger Input (Self calibration value is calculated according to the moving average)	 Measurement area The acquisition area for one self calibration (self calibration area does not accept trigger input) Self calibration value used for M5 compensation (A1 + A2 + A3 + A4) /4 Self calibration value used for compensation in next measurement (M6) (A2 + A3+ A4 + A5) /4

Controlling the Unit from a PC

Chapter 8

About Marks

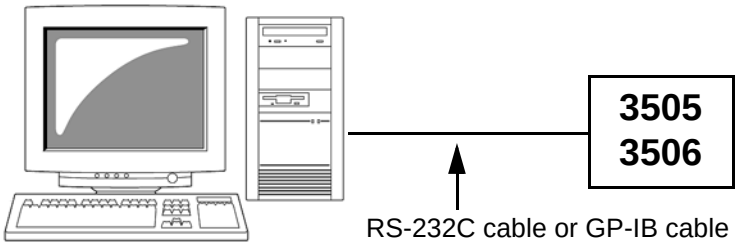
The following marks are used in this section to indicate whether a description applies to each of GP-IB and RS-232C. If no specific mark is shown, the description applies to both.

GP-IB : Only for GP-IB

RS-232C : Only for RS-232C

8.1 Outline and Features

You can connect a PC to the unit via the GP-IB interface or RS-232C interface and control the unit from the PC.



- The buzzer tone can be switched on and off.
- The system can be reset.

RS-232C

Measurement results can be printed if you connect an optional 9442 Printer to the unit.

See 6.15 "Printing Function" (p. 115)

GP-IB

- Use of the common commands of IEEE-488-2 1987 (required) is possible.
- This function is compliant with the following standard. : IEEE-488.1 1987
- This function was designed in reference to the following standard: IEEE-488.2 1987

8.2 Specifications

8.2.1 RS-232C Specifications

Transmission Method	Communication method: Full duplex Synchronous method: Start-stop synchronization
Transmission Speed	9600 bps, 19200 bps
Data Bits	8 bits
Parity	None
Stop Bits	1 bit
Message Terminator (Delimiter)	CR+LF, CR
Flow Control	Hardware (RTS/CTS control), software (XON/XOFF control) **See** "Handshake (About Buffer Flow Control)" (p. 130)
Electrical Specifications	Input voltage level 5 to 15 V ON -15 to -5 VOFF Output voltage level 5 to 9 V ON -9 to -5 V OFF

NOTE

If a PC is used to read data from the 3505/ 3506 unit immediately after the power of the 3505/ 3506 unit is turned on, undefined values may be read because of BA (TxD) being unstable. After turning the power on, wait at least six seconds before starting to read data.

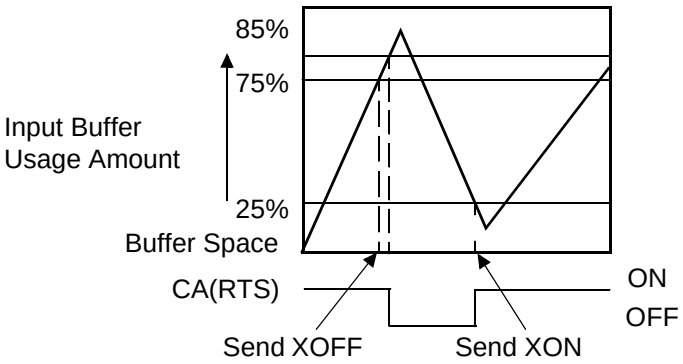
Handshake (About Buffer Flow Control)

RS-232C

Control during Receiving

When using hardware (RTS/CTS control):
When the data in the receive buffer exceeds 85% of the buffer, CA(RTS) is set to OFF and the controller is notified that there is not much space remaining in the buffer.
Processing of the data in the buffer continues, and then CA(RTS) is set to ON and the controller is notified that there is sufficient remaining space in the buffer when the amount of data becomes less than 25%.

When using software (XON/XOFF control):
When the data in the receive buffer exceeds 75% of the buffer, XOFF(13H) is sent and the controller is notified that there is not much space remaining in the buffer.
Processing of the data in the buffer continues, and then XON(11H) is sent and the controller is notified that there is sufficient remaining space in the buffer when the amount of data becomes less than 25%.



Control during Sending

When using hardware (RTS/CTS control):
When CB(CTS) is confirmed to be OFF, the sending of data is halted. When it is confirmed to be ON, the sending of data is resumed.

When using software (XON/XOFF control):
When XOFF is received, the sending of data is halted. When XON is received, the sending of data is resumed.

8.2.2 GP-IB Specifications

Interface Functions

SH1	Supports all source handshake functions.
AH1	Supports all acceptor handshake functions.
T6	Supports standard talker functions. Supports serial poll functions. Talk only mode is not supported. Supports the talker cancel function by MLA (My Listen Address).
L4	Supports standard listener functions. Listener only mode is not supported. Supports the listener cancel function by MTA (My Talk Address).
SR1	Supports all service request functions.
RL1	Supports all remote/local functions
PP0	Parallel poll functions are not supported.
DC1	Supports all device clear functions.
DT1	Supports all device trigger functions.
C0	Controller functions are not supported.

Code used: ASCII code

8.3 Connection and Setting Procedures

8.3.1 Connecting the RS-232C Cable / GP-IB Cable

WARNING

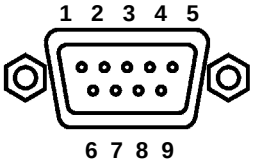
- **Always turn both devices OFF when connecting and disconnecting an interface connector. Otherwise, an electric shock accident may occur.**
- **To avoid damage to the unit, do not short-circuit the terminal and do not input voltage to the terminal.**

CAUTION

After connecting the cable, be sure to secure the connector in place by tightening the screws.

RS-232C Connector Pin Configuration

RS-232C



D-sub 9-pin male
Screws for mating locking base:
Inch screw thread #4-40

Connect the RS-232C cable.

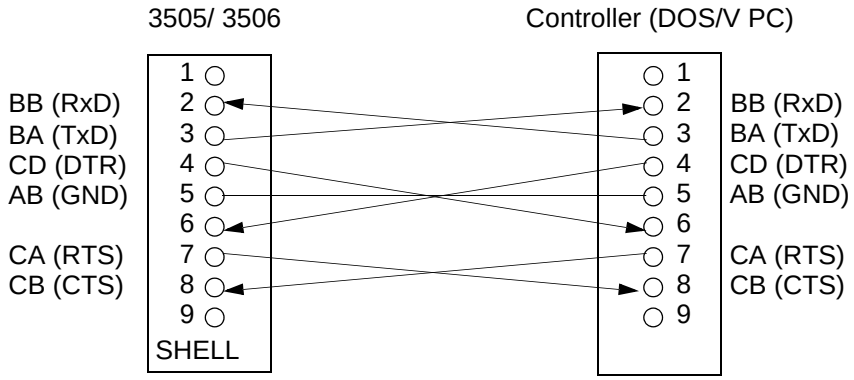
When connecting the controller (DTE), prepare a cross cable that meets the specifications of the connector of the unit and the connector of the controller

The input/output connector complies with the terminal (DTE) specifications.

Connector (D-sub) Pin No.	Interchange Circuit Name	CCITT Circuit No.	EIA Abbreviation	JIS Abbreviation	Common Abbreviation
1	Unused				
2	Received Data	104	BB	RD	RxD
3	Transmitted Data	103	BA	SD	TxD
4	Data Terminal Ready	108/2	CD	ER	DTR
5	Signal Ground	102	AB	SG	GND
6	Unused				
7	Request to Send	105	CA	RS	RTS
8	Clear to Send	106	CB	CS	CTS
9	Unused				

Example: Connecting to a DOS/V PC

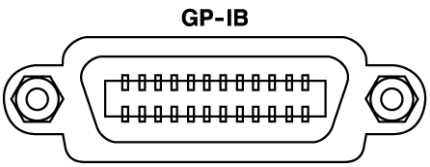
Specification: D-sub 9-pin female and female connector, reverse connection



NOTE Hardware control will not work properly if you use a cable that has CA(RTS) and CB(CTS) short-circuited.

GP-IB Connector Pin Configuration

GP-IB



Connect the GP-IB cable.

Recommended Cables
9151-02 GP-IB Connector Cable (2 m)
9151-04 GP-IB Connector Cable (4 m)

8.3.2 Setting the Interface Communication Conditions

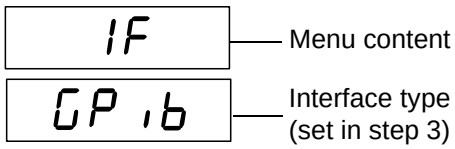
This section describes how to set the communication conditions for the interface used by the 3505/ 3506 unit.
A GP-IB interface, RS-232C interface, and 9442 Printer can be set.

Setting Procedure for Communication Conditions

1. **Press MENU.**
The upper part of the MAIN display area displays the menu contents and the lower part displays the setting information.
(Refer to "Menu display organization" (p. 14) for menu order)

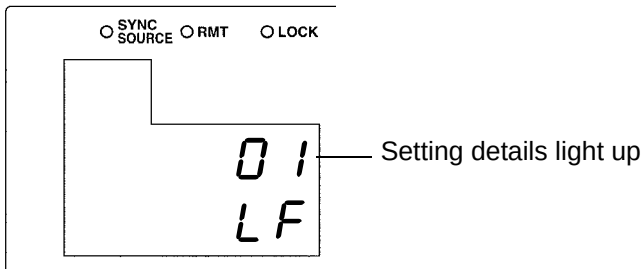
2. **Use ◀ or ▶ to select the "IF" menu item.**

(MAIN display area)



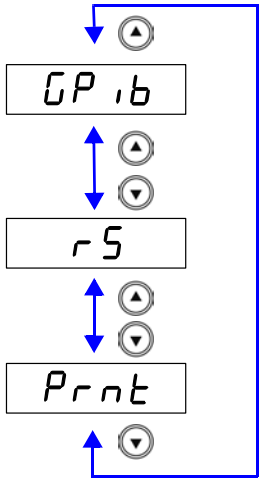
(Communication condition setting screen)

(SUB display area)



3. **Use ▲ or ▼ to select one of the above items.**

Pressing ▲ or ▼ switches the display.



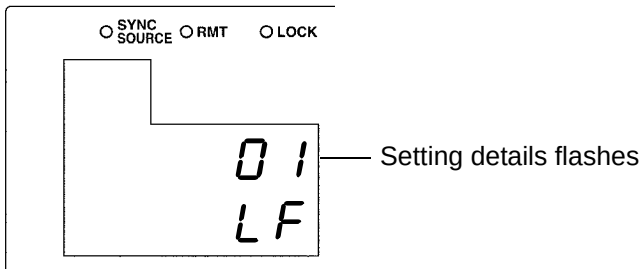
"GPib"
For using the GP-IB interface

"rS"
For using the RS-232C interface

"Prnt"
For using the 9442 Printer

4. **Press ENTER to set the interface type is confirmed.**

(SUB display area)



NOTE

Selecting "Print" completes the setup because there are no advanced setting items for this interface. After you complete the setup, "LoAd_A(C/h)"(Panel load screen) is displayed at the top of the MAIN display area.

5. Use ▲ or ▼ to select a setting item.

- **If "GPib" was selected (for using the GP-IB interface):**

1. Use the numeric keypad or ▲ and ▼ to set an address (0 to 30) and then press ENTER to confirm the address.
2. Use ▲ or ▼ to set the terminator.
   "LF":LF with EOI
   "CrLF": CR+LF with EOI
   (Pressing ▲ or ▼ switches between "LF"↔"CrLF".)

- **If "rS" was selected (for using the RS-232C interface):**

1. Use ▲ or ▼ to set a baud rate (9600, 19200) and then press ENTER to confirm the baud rate.
2. Use ▲ or ▼ to set the terminator.
   "Cr":CR
   "CrLF":CR+LF
   (Pressing ▲ or ▼ switches between "Cr"↔"CrLF".)

6. Press ENTER to confirm the terminator.

After confirmation, "LoAd_A(C/h)" (Panel load screen) is displayed at the top of the MAIN display area.

The interface communication conditions are not confirmed unless ENTER is pressed.

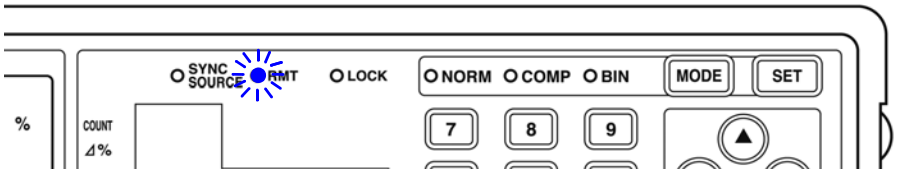
7. Press MENU.

The unit returns to the measurement mode it was in prior to the menu items being displayed.

8.4 Remote Function

When a connection is established to the interface and communication begins, the 3505/ 3506 unit enters remote mode (remote control state) and the RMT LED lights up.

See Connecting to the interface: 8.3 "Connection and Setting Procedures" (p. 132)
See Starting communication: 8.5 "Communication Procedure" (p. 137)



The keys at the top of the front panel are disabled.

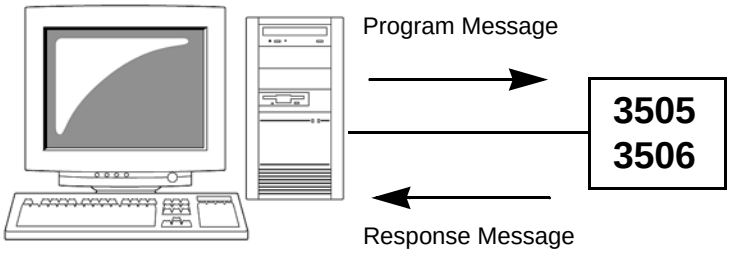
Canceling Remote Mode

Press LOCK/LOCAL **when you want to return to the normal state (local state).**
The RMT LED goes out.

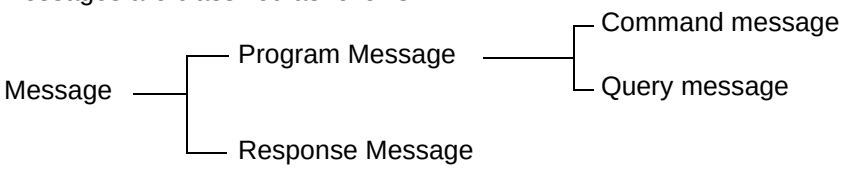
8.5 Communication Procedure

You can control the unit by sending messages from a PC to the unit via the interface.

See 8.3 "Connection and Setting Procedures" (p. 132)
See 8.5 "Communication Procedure" (p. 137)



Messages are classified as follows.



NOTE The term "command" appearing in the following explanations has the same meaning as "program message".

8.6 Things to Know before Beginning Communication

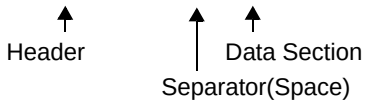
8.6.1 About Message Formats

Program Messages

Program messages can be divided into command messages and query messages.

- Command Message
  A command for controlling the unit such as an instruction to configure a setting or reset the settings of the device.

Example `:FREQUENCY 1000` (instruction for setting the frequency)



- Query Message
  A command for finding out the results of operations, results of measurements, or the current configuration state of the device.

Example `:FREQUENCY?` (instruction for finding out the set frequency)

See For details:Header (p. 139), Separator (p. 140),Data Section (p. 141)

Response Message

A response message is created after the syntax of a received query message has been checked. The "HEADer" command can be used to select whether there is a header.

Header ON `:FREQUENCY 1.00000E+3`
Header OFF ` 1.00000E+3`
(The current frequency is 1 kHz.)

The header is set to OFF when the power is turned on.
If some sort of error was generated when a query message was received, a response message is not created for the query message.

See The error explanations: (Pages 151 to 163)

Command Syntax

Command names are selected for functions to be executed in a language that is as easy as possible to understand, and command names can also be shortened. The unshortened form of a command name is known as the "long form" and the shortened form of a command name is know as the "short form". In this manual, uppercase characters are used for the short form part and lowercase characters are used for the remaining part. However, either uppercase or lowercase characters are acceptable.

FREQuency	OK (long form)
FREQ	OK (short form)
FREQu	Error
FRE	Error

For response messages returned from the unit, uppercase characters and the long form are used.

Header

The header indicates what is to be controlled. Program messages must have a header.

(1) Command Program Headers

There are three types of headers: simple command, compound command, and common command.

- Simple Command Header
  Simple command headers contain a single word beginning with an alphabetic character.
  :HEADer

- Compound Command Header
  Compound command headers contain multiple simple command headers separated by colons (**:**).
  :BEEPer:KEY

- Common Command Header
  Common command headers begin with an asterisk (*****) to indicate the commands are common commands.
- (As specified in IEEE488.2)
  ***RST**

(2) Query Program Header

This is used for finding out the results of operations performed in response to device commands, the results of measurements, or the current configuration state of the device. A program header is identified as a query if a question mark (**?**) is added at the end as shown in the example below.

:FREQuency?

Message Terminator

A message terminator indicates the end of a command.
The unit accepts the following as message terminators.

GP-IB
- LF
- CR+LF
- EOI
- LF with EOI

RS-232C
- CR
- CR+LF

NOTE The 3505/ 3506 unit analyzes a message after it has confirmed the message terminator.

Depending on the interface setting, the following can be selected as terminators of response messages.

GP-IB
- LF with EOI (initial state)
- CR and LF with EOI

RS-232C
- CR
- CR and LF (initial state)

Separator

(1) Message Unit Separator (Semicolon)

Semicolons are used as separators when executing compound messages. Linking multiple messages by semicolons (**;**) enables a single line to be used to describe a compound command.

```
:RANGe:AUTO ON;:BEEPer:KEY ON; *IDN?
```

If a command error occurs when messages are described in succession, the messages from the error to the terminator are not executed.

Example) If **:RAN:AUTO ON;:BEEPer:KEY ON;*IDN?** is executed and **:RAN:AUTO** is a command error, **:BEEPer:KEY ON;*IDN?** following the error will also not be executed
The correct input method is **:RANG:AUTO ON;:BEEPer:KEY ON;*IDN?**

Command processing is continued for an execution error or a query error

See For details on errors: 8.6.4 "About Event Registers" (p. 146), and the error explanations in 8.7"Message List"; (Pages 151 to 163)

(2) Message Unit Separator (Space)

A space is used as a separator to differentiate the header and data section. Add a space ( ) between the header and data section.

```
:LEVel 0.5
```

(3) Message Unit Separator (Comma)

When a message has multiple data sections, a comma is used as a separator to differentiate data sections. Add a comma (**,**) between data sections.

```
:COMParator:FLIMit:COUNt 112345,123456
```

Data Section

A data section indicates the content of a command. In the unit, character data and decimal numeric data are used for data sections, and use differs depending on the command.

(1) Character Data

Character data begins with an alphanumeric character and consists of alphabetic characters and numbers. Both uppercase and lowercase characters are acceptable, but uppercase characters are always used for response messages from the unit.

```
:TRIGger INTernal
```

(2) Decimal Numeric Data

There are three numeric data formats: NR1, NR2, and NR3. Both signed numeric and unsigned numeric values are acceptable for each of these formats. Unsigned numeric values are treated as positive numeric values. Furthermore, if the accuracy of numeric values exceeds that capable of being handled by the unit, the numeric values are rounded off.

- NR1 Integer data (Example: +12, -23, 34)
- NR2 Fixed-point data (Example:+1.23, -23.45, 3.456)
- NR3 Floating-point representation exponent data (Example:+1.0E-2, -2.3E+4)

The format that includes all three of the above types is referred to as the NRf format. The NRf format is accepted by the unit

For response data, the format is specified separately for each command and the data is sent in that format.

```
:RANGe 6
:LEVel 0.5
```

NOTE

For commands with data, make every effort to enter the data in the specified format.

Omitting Compound Command Headers

When compound commands contain common initial parts (example: **:BEEPer:KEY**, **:BEEPer:JUDGment**), the common initial part (example: **:BEEPer:**) can be omitted just for subsequent commands.
The common initial part is known as the "current path," and until cleared, the current paths of subsequent commands are determined to have been omitted when analysis is performed.
The following shows an example of the procedure for using current paths.

Normal expression

```
:BEEPer:KEY ON;:BEEPer:JUDGment NG
```

Expression with current path omitted

```
:BEEPer:KEY ON;JUDGment NG
```

This becomes the current path and can be omitted from subsequent commands.

The current path is cleared when the power is turned on, the interface type is changed, the device is cleared* (only for GP-IB), or upon detection of a colon (:) at the beginning of a command or a message terminator.
Common command messages can be executed regardless of the current path. Furthermore, the current path is not affected.
A colon does not need to be added to the beginning of simple and compound command headers. However, Hioki recommends adding a colon to the beginning of these headers to prevent them from being mixed up with headers that have omissions and to prevent an incorrect operation from being performed.

8.6.2 About the Output Queue and Input Buffer

Output Queue

The output queue is the area in the unit where response messages are stored. Stored response messages are cleared once they are read by the controller of the PC. The output queue is also cleared at the following times.

GP-IB

- The power is turned on
- The device is cleared*
- There is a query error

RS-232C

- The power is turned on

* The device is initialized

The output queue of the unit is 10 kB. If a response message exceeds this size, a query error is generated and the output buffer is cleared.
For GP-IB, the output queue is cleared and a query error is generated if a new message is received when there is data in the output queue.

Input Buffer

The input buffer is the area in the unit where received data is stored. The input buffer is 10 kB. If data exceeding 10 kB was sent and the input buffer becomes full, the GP-IB interface bus enters a wait state until free space becomes available. RS-232C cannot receive data that exceeds 10 kB.

NOTE

Keep the length of one command under 10 kB.

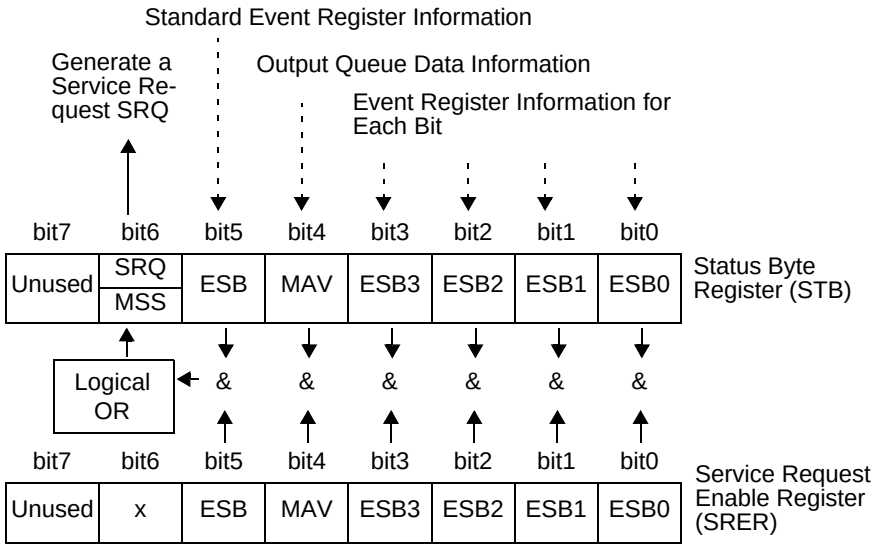
8.6.3 About the Status Byte Register

RS-232C

RS-232 reads the status bytes to find out the status of the unit.

GP-IB

The unit adopts the IEEE488.2 defined status model for parts related to the serial polling performed by the service request function. A trigger for generating a service request is called an event.



Conceptual Diagram of Generation of Service Request

The event register and output queue information is set in the status byte register. The service request enable register can be used to further select required items from this information. If the selected information is set, bit 6 (MMS master summary status bit) of the status byte register is set and an SRQ (service request) message is generated and used to generate a service request.

NOTE

For RS-232C, bit 4 (MAV message available) of the status byte register is not set.

Status Byte Register (STB)

A status byte register is an 8-bit register output from the unit to the controller during serial polling. If even one of the status byte register bits enabled by the service request enable register changes from "0" to "1" the MSS bit becomes 1. At the same time, the SRQ bit also becomes "1" and a service request is generated.

The SRQ bit is always synchronized with the service request and only read and simultaneously cleared upon being serial polled. The MSS bit is only read by an **"*STB?"** query and is not cleared until the event is cleared by a command such as a "***CLS**" command.

Bit 7	Unused
Bit 6 SRQ MSS	This becomes 1 when a service request is sent. This indicates logical OR of other bits of the status byte register.
Bit 5 ESB	Standard event summary (logical OR) bit This indicates the logical OR of a standard event status register.
Bit 4 MAV	Message available This indicates there is a message in the output queue.
Bit 3 ESB3	Event summary (logical OR) bit 3 This indicates the logical OR of event status register 3.
Bit 2 ESB2	Event summary (logical OR) bit 2 This indicates the logical OR of event status register 2.
Bit 1 ESB1	Event summary (logical OR) bit 1 This indicates the logical OR of event status register 1.
Bit 0 ESB0	Event summary (logical OR) bit 01 This indicates the logical OR of event status register 0.

Service Request Enable Register (SRER)

When the service request enable register is used to set each of the bits to "1" the corresponding bits are enabled in the status byte register.

8.6.4 About Event Registers

Standard Event Status Register (SESR)

A standard event status register is an 8-bit register.

If even one of the standard status byte register bits enabled by the standard event status enable register becomes “1,” bit 5 (ESB) of the status byte register becomes 1.
See Standard Event Status Enable Register (SESER) (p. 147)

The content of the standard event register is cleared at the following times.

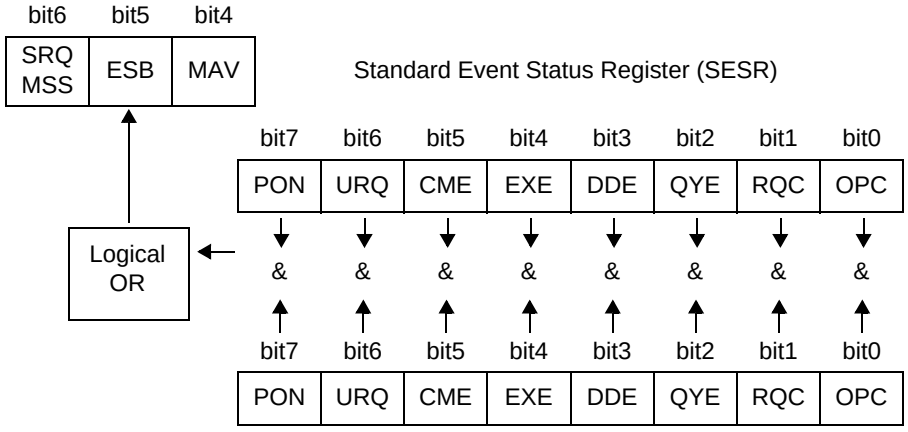
- The "***CLS"** command is executed.
- An event register query is executed (***ESR?**)
- The power is turned on again.

Standard Event Status Register (SESR)		
Bit 7	PON	Power on flag This becomes “1” when the power is turned on or the unit recovers from a power failure.
Bit 6	URQ	User request Unused
Bit 5	CME	Command error (Commands up until the message terminator are ignored.) This becomes "1" when there is an error with the syntax or meaning of a received command. • When there is an error in the program header • When the number of data items differs from that specified • When the data format differs from that specified • When a command not in the unit is received
Bit 4	EXE	Execution error This becomes "1" when a received command cannot be executed for some reason. • When the specified data is outside the setting range • When the specified data cannot be set • When the command cannot be executed because another function is being used
Bit 3	DDE	Device dependent error This becomes "1" when a command cannot be executed for a reason other than a command error, query error, or execution error. • When the command cannot be executed because there is an internal anomaly • When data valid for open circuit, short circuit, or load compensation cannot be incorporated
Bit 2	QYE	Query error (Clears the output queue.) This becomes "1" when a query error is detected by the controller of the output queue. • When an attempt was made to read the output queue while it was empty (only for GP-IB) • When there is an output queue overflow • When data in the output queue is lost
Bit 1	RQC	Request control Unused
Bit 0	OPC	End of operations This becomes "1" when the operation complete "∗OPC" command is executed. • When operations for all messages up until the "∗OPC" command have ended

Standard Event Status Enable Register (SESER)

When the standard event status enable register is used to set each of the bits to "1" the corresponding bits are enabled in the standard event status register.

Standard Event Status Register (SESR) and Standard Event Status Enable Register (SESER)



Standard Event Status Enable Register (SESER)

Unique Event Status Registers (ESR0, ESR1, ESR2, ESR3)

Four event status registers have been provided for managing events in the unit. An event status register is an 8-bit register.

If even one of the event status register bits enabled by the event status enable register becomes "1" the corresponding bit becomes as follows.

- When event status register 0: Bit 0 (ESB0) of the status byte register becomes "1"
- When event status register 1: bit 1 (ESB1) becomes "1"
- When event status register 2: bit 2 (ESB2) becomes "1"
- When event status register 3: bit 3 (ESB3) becomes "1"

The content of event status register 0, 1, 2, and 3 is cleared at the following times.

- The "***CLS**" command is executed.
- An event status register query is executed (**:ESR0?,:ESR1?,:ESR2?,:ESR3?**)
- The power is turned on again.

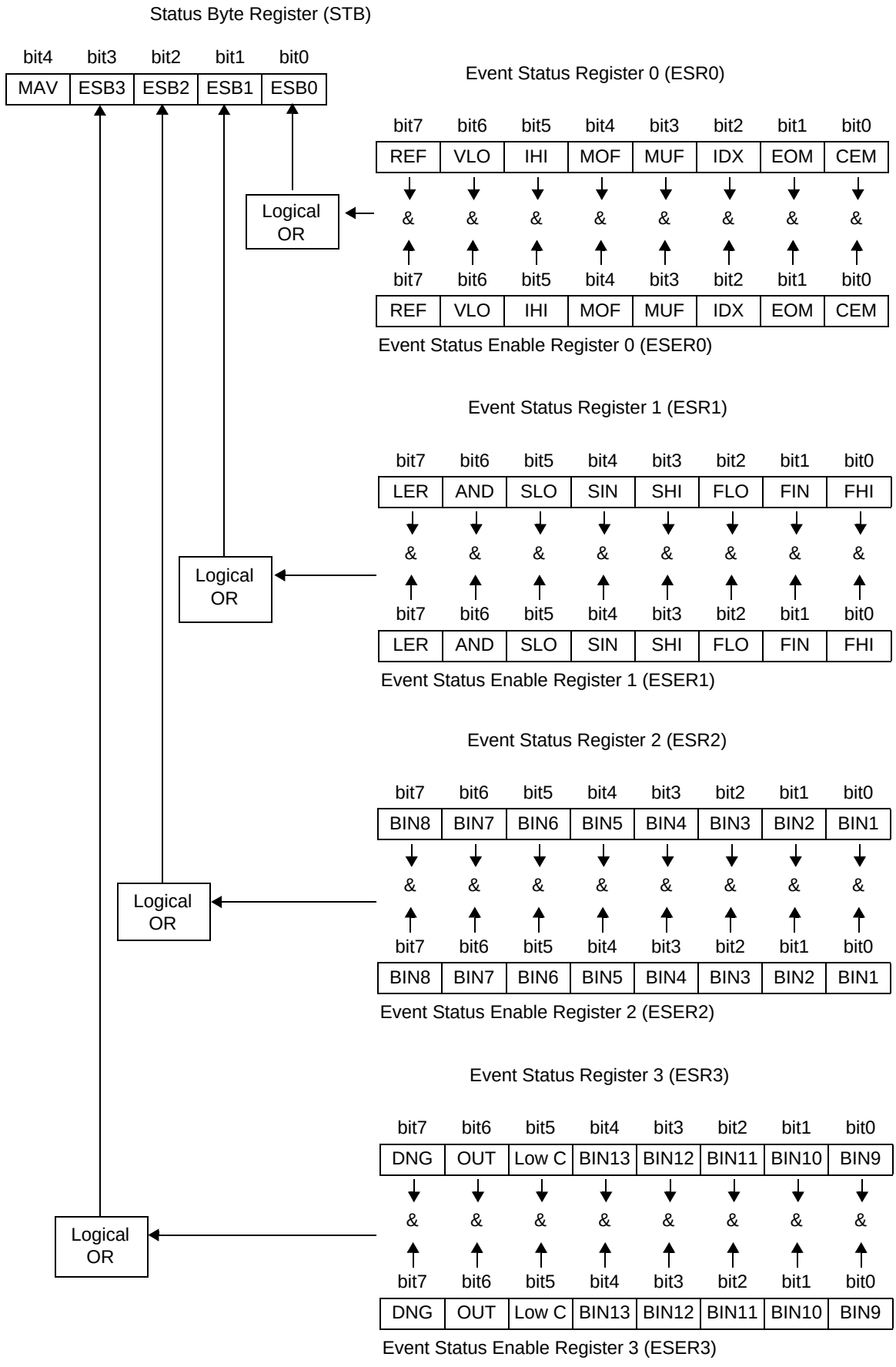
Event Status Register 0 (ESR0)		
Bit 7	REF	Non-guaranteed accuracy bit
Bit 6	VLO	Applied voltage abnormality
Bit 5	IHI	Current detection abnormality
Bit 4	MOF	First parameter over range bit
Bit 3	MUF	First parameter under range bit
Bit 2	IDX	Data incorporation end bit
Bit 1	EOM	End of measurement bit
Bit 0	CEM	End of compensation data measurement bit

Event Status Register 1 (ESR1)		
Bit 7	LER	Measurement level error bit
Bit 6	AND	Comparison result logical AND (AND of bit 1 and bit 4)
Bit 5	SLO	Below lower limit value of second parameter
Bit 4	SIN	Within range of second parameter
Bit 3	SHI	Above upper limit of second parameter
Bit 2	FLO	Below lower limit value of first parameter
Bit 1	FIN	Within range of first parameter
Bit 0	FHI	Above upper limit of first parameter

Event Status Register 2 (ESR2)		
Bit 7	BIN8	Within range of BIN 8
Bit 6	BIN7	Within range of BIN 7
Bit 5	BIN6	Within range of BIN 6
Bit 4	BIN5	Within range of BIN 5
Bit 3	BIN4	Within range of BIN 4
Bit 2	BIN3	Within range of BIN 3
Bit 1	BIN2	Within range of BIN 2
Bit 0	BIN1	Within range of BIN 1

Event Status Register 3 (ESR3)		
Bit 7	DNG	Outside range of second parameter
Bit 6	OUT	Outside range of BIN
Bit 5	Low C	Outside range of Low C reject limit
Bit 4	BIN13	Within range of BIN 13
Bit 3	BIN12	Within range of BIN 12
Bit 2	BIN11	Within range of BIN 11
Bit 1	BIN10	Within range of BIN 10
Bit 0	BIN9	Within range of BIN 9

Event Status Register 0 (ESR0), 1 (ESR1), 2 (ESR2), and 3 (ESR3) and Event Status Enable Register 0 (ESER0), 1 (ESER1), 2 (ESER2), and 3 (ESER3)



Reading and Writing of Each Register

Register	Read	Write
Status Byte Register	*STB?	–
Service Request Enable Register	*SRE?	*SRE
Standard Event Status Register	*ESR?	–
Standard Event Status Enable Register	*ESE?	*ESE
Event Status Register 0	:ESR0?	–
Event Status Enable Register 0	:ESE0?	:ESE0
Event Status Register 1	:ESR1?	–
Event Status Enable Register 1	:ESE1?	:ESE1
Event Status Register 2	:ESR2?	–
Event Status Enable Register 2	:ESE2?	:ESE2
Event Status Register 3	:ESR3?	–
Event Status Enable Register 3	:ESE3?	:ESE3

GP-IB Command

The following commands can be used by interface functions.

Command	Description	
GTL	Go To Local	Cancels the remote state and switches to the local state.
LLO	Local Lock Out	Disables all keys including LOCK/LOCAL.
DCL	Device CLear	Clears the input buffer and output queue.
SDC	Selected Device Clear	
GET	Group Execute Trigger	When there is an external trigger, performs the sampling process once.

NOTE After executing DCL and SDC, resume communication after about 100 ms.

8.7 Message List

8.7.1 Common Commands

Command	Data Section	Explanation	Error	Reference Page
∗CLS		Clearing of the event register	*1, 3	174
∗ESE	Numeric values 0 to 255 (NR1)	Setting of the standard event status enable register	*3, 5	174
∗ESE?		Query of standard event status enable register	*1, 2, 3	174
∗ESR?		Query of standard event status register	*1, 2	175
∗IDN?		Query of device ID	*1, 2, 3	172
∗OPC		SRQ request when operation ends	*1	173
∗OPC?		Query of operation end	*1, 2	173
∗RST	————————	Initialization of device	*1, 3	172
∗SRE	Numeric values 0 to 255 (NR1)	Setting of service request enable register	*3, 5	175
∗SRE?		Query of service request enable register	*1, 2, 3	175
∗STB?		Query of status byte register	*1, 2, 3	176
∗TRG	————————	Performing of sampling once	*1, 3, 4	176
∗TST?		Query of self test and results	*1, 2, 3	172
∗WAI	————————	Wait	*1	173

Error Explanations (An error is generated when a message is executed in the following cases)
*1 Command Error ___ When there is data after a command or query
*2 Query Error _____ When a response message exceeds 10 kB
*3 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*4 Execution Error ____ When this command is executed while there is an internal trigger.
*5 Execution Error ____When set to other than the specified character data or numeric data.
Note: Command errors are generated for all messages with a misspelling.

8.7.2 Unique Commands

Command	Data Section	Explanation	Error	Reference Page
Average Function				
:AVERageing	1 to 256 (NR1)	Setting of the number of measurements to average	*2, 3	177
:AVERaging?		Query of the number of measurements to average	*1, 2	177
:AVERageing:STATe	ON/ OFF	Setting of average function	*2, 3	177
:AVERageing:STATe?		Query of average function	*1, 2	177
Beep Tone				
:BEEPer:JUDGment	IN/ NG/ OFF	Setting of comparator and BIN measurement beep tone	*2, 3	178
:BEEPer:JUDGment?		Query of comparator and BIN measurement beep tone	*1, 2	178
:BEEPer:KEY	ON/ OFF	Setting of key input beep tone	*2, 3	178
:BEEPer:KEY?		Query of key input beep tone	*1, 2	178
BIN Function				
:BIN	ON/ OFF	ON/ OFF setting of BIN measurement	*2, 3	179
:BIN?		ON/ OFF query of BIN measurement	*1, 2	179
:BIN:DISPlay	Numeric value from 1 to 13 (NR1)/ SECond/ CREFerence/ SRFFerence/ OFF	Setting of the SUB display area indication during BIN measurement	*2,3,7	180
:BIN:DISPlay?		Query of the SUB display area indication during BIN measurement	*1, 2	180
:BIN:FLIMit:COUNt	<BIN Number>, <Lower Limit Value>, <Upper Limit Value> <BIN Number> = Numeric Value from 1 to 13 (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)	Setting of upper limit and lower limit values of first parameter for BIN function in count value mode	*2, 3	181
:BIN:FLIMit:COUNt?	<BIN Number> = Numeric Value from 1 to 13 (NR1)	Query of upper limit and lower limit values of first parameter for BIN function in count value mode	*1,2,3	181

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____When a number that has not been saved is specified.
*5 Execution Error ____When not even one measurement value is saved to memory.
*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
:BIN:FLIMit:CDEViation	<BIN Number>, <Lower Limit Value>, <Upper Limit Value> <BIN Number> = Numeric Value from 1 to 13 (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)	Setting of upper limit and lower limit values of first parameter for BIN function in deviation count mode	*2, 3	182
:BIN:FLIMit:CDEViation?	<BIN Number> = Numeric Value from 1 to 13 (NR1)	Query of upper limit and lower limit values of first parameter for BIN function in deviation count mode	*1,2,3	182
:BIN:FLIMit:CREFerence	<Reference Value> <Reference Value> = Numeric Value from -199999 to 999999 (NR1)	Setting of reference value of first parameter for BIN function in deviation count mode	*2, 3	183
:BIN:FLIMit:CREFerence?		Query of reference value of first parameter for BIN function in deviation count mode	*1, 2	183
:BIN:FLIMit:PDEViation	<BIN Number>, <Lower Limit Value>, <Upper Limit Value> <BIN Number> = Numeric Value from 1 to 13 (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -999.99 to 999.99 (NR2)	Setting of upper limit and lower limit values of first parameter for BIN function in deviation percent mode	*2, 3	184
:BIN:FLIMit:PDEViation?	<BIN Number> = Numeric Value from 1 to 13 (NR1)	Query of upper limit and lower limit values of first parameter for BIN function in deviation percent mode	*1,2,3	184
:BIN:FLIMit:PREFerence	<Reference Value> <Reference Value> = Numeric Value from -199999 to 999999 (excluding 0) (NR1)	Setting of reference values of first parameter for BIN function in deviation percent mode	*2, 3	185
:BIN:FLIMit:PREFerence?		Query of reference values of first parameter for BIN function in deviation percent mode	*1, 2	185
:BIN:SLIMit:COUNt	<Lower Limit Value>, <Upper Limit Value> <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of upper limit and lower limit values of second parameter for BIN function in count value mode	*2, 3	186
:BIN:SLIMit:COUNt?		Query of upper limit and lower limit values of second parameter for BIN function in count value mode	*1, 2	186

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____When a number that has not been saved is specified.
*5 Execution Error ____When not even one measurement value is saved to memory.
*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
:BIN:SLIMit:CDEViation	<Lower Limit Value>, <Upper Limit Value> <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of upper limit and lower limit values of second parameter for BIN function in deviation count mode	*2, 3	187
:BIN:SLIMit:CDEViation?		Query of upper limit and lower limit values of second parameter for BIN function in deviation count mode	*1, 2	187
:BIN:SLIMit:CREFerence	<Reference Value> <Reference Value> = Numeric Value from -199999 to 199999 (NR1)	Setting of reference value of second parameter for BIN function in deviation count mode	*2, 3	187
:BIN:SLIMit:CREFerence?		Query of reference value of second parameter for BIN function in deviation count mode	*1, 2	187
:BIN:SLIMit:PDEViation	<Lower Limit Value>, <Upper Limit Value> <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of upper limit and lower limit values of second parameter for BIN function in deviation percent mode	*2, 3	188
:BIN:SLIMit:PDEViation?		Query of upper limit and lower limit values of second parameter for BIN function in deviation percent mode	*1, 2	188
:BIN:SLIMit:PREFerence	<Reference Value> <Reference Value> = Numeric Value from -199999 to 199999 (NR1)	Setting of reference values of second parameter for BIN function in deviation percent mode	*2, 3	189
:BIN:SLIMit:PREFerence?		Query of reference values of second parameter for BIN function in deviation percent mode	*1, 2	189
Self Calibraiton				
:CALibration	AUTO/ MANUal	Setting of self calibration function	*2, 3	189
:CALibration?		Query of self calibration function	*1, 2	189
:CALibration:ADJust		Calculates the self calibration value multiple times	*2	190
:CALibration:ADJust:ONCE		Single calculation of the self calibration value	*2	190
:CALibration:AVERaging	1 to 256 (NR1)	Setting of self calibration averaging number	*2, 3	191
:CALibration:AVERaging?		Query of self calibration averaging number	*1, 2	191
:CALibration:SPEEd	FAST/ NORMal/ SLOW	Setting of self calibration measurement speed	*2, 3	192
:CALibration:SPEEd?		Query of self calibration measurement speed	*1, 2	192

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____When a number that has not been saved is specified.
*5 Execution Error ____When not even one measurement value is saved to memory.
*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Cable Length				
:CALibration:CABLe	0, 1, 2 (NR1)	Setting of cable length	*2,3	191
:CALibration:CABLe?		Query of cable length	*1, 2	191
Equivalent Circuit				
:CIRCuit	SERial/ PARallel	Setting of equivalent circuit mode	*2,3	192
:CIRCuit?		Query of equivalent circuit mode	*1, 2	192
:CIRCuit:AUTO	ON/ OFF	Automatic setting of equivalent circuit mode	*2,3	193
:CIRCuit:AUTO?		Query of automatic setting of equivalent circuit mode	*1, 2	193
Comparator Function				
:COMParator	ON/ OFF	ON/ OFF setting of comparator function	*2, 3	193
:COMParator?		ON/ OFF query of comparator function	*1, 2	193
:COMParator:DISPlay	C/ SECond/ CREFerence/ SREFerence/ OFF	Setting of the SUB display area indication during comparator measurement	*2,3,7	194
:COMParator:DISPlay?		Query of the SUB display area indication during comparator measurement	*1, 2	194
:COMParator:FLIMit:COUNt	<Lower Limit Value>, <Upper Limit Value> <Lower Limit Value>, <Upper Limit Value> OFF/Numeric Value from -199999 to 999999 (NR1)	Setting of upper limit and lower limit values of first parameter for comparator function in count value mode	*2, 3	195
:COMParator:FLIMit:COUNt?		Query of upper limit and lower limit values of first parameter for comparator function in count value mode	*1, 2	195
:COMParator:FLIMit :CDEViation	<Reference Value>, <Lower Limit Value>, <Upper Limit Value> <Reference Value> = Numeric Value from -199999 to 999999(NR1),<Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)	Setting of reference value, upper limit and lower limit values of comparator function first parameter in deviation count mode.	*2, 3	196
:COMParator:FLIMit :CDEViation?		Query of reference value, upper limit and lower limit values of comparator function first parameter in deviation count mode.	*1, 2	196

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____When a number that has not been saved is specified.
*5 Execution Error ____When not even one measurement value is saved to memory.
*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
:COMParator:FLIMit :PDEViation	<Reference Value>, <Lower Limit Value>, <Upper Limit Value> <Reference Value> = Numeric Value from -199999 to 999999 (excluding 0) (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -999.99 to 999.99 (NR2)	Setting of reference value and upper limit and lower limit values of first parameter for comparator function in deviation percent mode	*2, 3	197
:COMParator:FLIMit :PDEViation?		Query of reference value and upper limit and lower limit values of first parameter for comparator function in deviation percent mode	*1, 2	197
:COMParator:SLIMit :COUNt	<Lower Limit Value>, <Upper Limit Value> <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of upper limit and lower limit values of second parameter for comparator function in count value mode	*2, 3	198
:COMParator:SLIMit :COUNt?		Query of upper limit and lower limit values of second parameter for comparator function in count value mode	*1, 2	198
:COMParator:SLIMit :CDEViation	<Reference Value>, <Lower Limit Value>, <Upper Limit Value> <Reference Value> = Numeric Value from -199999 to 199999 (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of reference value, upper limit and lower limit values of comparator function second parameter in deviation count mode.	*2, 3	199
:COMParator:SLIMit :CDEViation?		Query of reference value, upper limit and lower limit values of comparator function second parameter in deviation count mode.	*1, 2	199
:COMParator:SLIMit :PDEViation	<Reference Value>, <Lower Limit Value>, <Upper Limit Value> <Reference Value> = Numeric Value from -199999 to 199999 (NR1) <Lower Limit Value>, <Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)	Setting of reference value and upper limit and lower limit values of second parameter for comparator function in deviation percent mode	*2, 3	200
:COMParator:SLIMit :PDEViation?		Query of reference value and upper limit and lower limit values of second parameter for comparator function in deviation percent mode	*1, 2	200

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB

*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation

*3 Execution Error ____ When set to other than the specified character data or numeric data.

*4 Execution Error ____When a number that has not been saved is specified.

*5 Execution Error ____When not even one measurement value is saved to memory.

*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.

*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Open Circuit and Short Circuit Compensation				
:CORRection:OPEN	ALL/ ON/ OFF/ RETurn	Setting of open circuit compensation function	*2, 3	201
:CORRection:OPEN?		Query of open circuit compensation function	*1, 2	201
:CORRection:OPEN:DATA	<compensation values 1>,<compensation values 2> <compensation values 1>,<compensation values 2> = -99.9999E9 to 99.9999E9 (NR3)	Setting of open circuit compensation values	*1, 2	202
:CORRection:OPEN:DATA?		Query of open circuit compensation values	*1, 2	202
:CORRection:OPEN:DATA :FORMat	ZPH/ GB/ CPG	Setting of output parameter for open circuit compensation values	*2, 3	203
:CORRection:OPEN:DATA :FORMat?		Query of output parameter for open circuit compensation values	*1, 2	203
:CORRection:OPEN:POINt	1 to 255 (NR1)	Setting of open compensation points	*2, 3	204
:CORRection:OPEN:POINt?		Query of open compensation points	*1, 2	204
:CORRection:SHORt	ALL/ ON/ OFF/ RETurn	Setting of short circuit compensation function	*2, 3	205
:CORRection:SHORt?		Query of short circuit compensation function	*1, 2	205
:CORRection:SHORt:DATA	<compensation values 1>,<compensation values 2> <compensation values 1>,<compensation values 2> = -99.9999E9 to 99.9999E9 (NR3)	Setting of load compensation values	*2, 3	206
:CORRection:SHORt:DATA?		Setting of load compensation values	*1, 2	206
:CORRection:SHORt:DATA :FORMat	ZPH/ RSX/ LSRS	Setting of output parameter for short circuit compensation values	*2, 3	207
:CORRection:SHORt:DATA :FORMat?		Query of output parameter for short circuit compensation values	*1, 2	207
:CORRection:SHORt:POINt	1 to 255 (NR1)	Setting of short compensation points	*2, 3	208
:CORRection:SHORt:POINt?		Query of short compensation points	*1, 2	208
Load Compensation				
:CORRection:LOAD	ON/ OFF/ RETurn	Setting of load compensation function	*2, 3	209

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____ When a number that has not been saved is specified.
*5 Execution Error ____ When not even one measurement value is saved to memory.
*6 Execution Error ____ When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____ When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
:CORRection:LOAD?		Query of load compensation function	*1, 2	209
:CORRection:LOAD:DATA	<compensation value 1>,<compensation value 2> Differs depending on forwarding format	Setting of load compensation values	*1, 2	210
:CORRection:LOAD:DATA?		Query of load compensation values	*1, 2	210
:CORRection:LOAD:DATA :FORMat	COEFficient/ ZPH/ CD/ CQ	Setting of output format for load compensation values	*2, 3	211
:CORRection:LOAD:DATA :FORMat?		Query of output format for load compensation values	*1, 2	211
:CORRection:LOAD :REFerence	<Reference Value 1>, <Reference Value 2> <Reference Value 1> = Numeric Value from -199999 to 999999(NR1) <Reference Value 2> = Numeric Value from -199999 to 199999 (NR1)	Setting of load compensation condition reference value	*2, 3	212
:CORRection:LOAD :REFerence?		Query of load compensation condition reference value	*1, 2	212
Offset Compensation				
:CORRection:OFFSet	ON/ OFF	Setting of offset compensation function	*2, 3	213
:CORRection:OFFSet?		Query of offset compensation function	*1, 2	213
:CORRection:OFFSet:DATA	<compensation value 1>, <compensation value 2> <compensation value 1> = -10E-6 to 10E-6 (NR3), <compensation value 2> = Differs depending on display parameter settings	Setting of offset compensation values	*2, 3	213
:CORRection:OFFSet:DATA?		Query of offset compensation values	*1, 2	213
Low C Reject Function				
:CREJect	ON/ OFF	Setting of Low C reject function	*2, 3	214
:CREJect?		Query of Low C reject function ON or OFF	*1, 2	214
:CREJect:LIMit	0.000 to 10.000 (NR2)	Setting of Low C reject function limit value	*2, 3	214
:CREJect:LIMit?		Query of Low C reject function limit value	*1, 2	214

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____When a number that has not been saved is specified.
*5 Execution Error ____When not even one measurement value is saved to memory.
*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Display Function				
:DISPlay	ON/ OFF	Setting of display	*2, 3	215
:DISPlay?		Query of display	*1, 2	215
Confirmation of Communication Error				
:ERRor? RS-232C		Query of RS-232C error	*1,2,6	215
Event Registers				
:ESE0	Numeric Value from 0 to 255 (NR1)	Setting of event status enable register 0	*2, 3	216
:ESE0?		Query of event status enable register 0	*1, 2	216
:ESE1	Numeric Value from 0 to 255 (NR1)	Setting of event status enable register 1	*2, 3	216
:ESE1?		Query of event status enable register 1	*1, 2	216
:ESE2	Numeric Value from 0 to 255 (NR1)	Setting of event status enable register 2	*2, 3	217
:ESE2?		Query of event status enable register 2	*1, 2	217
:ESE3	Numeric Value from 0 to 255 (NR1)	Setting of event status enable register 3	*2, 3	217
:ESE3?		Query of event status enable register 3	*1, 2	217
:ESR0?		Query of event status register 0	*1	218
:ESR1?		Query of event status register 1	*1	218
:ESR2?		Query of event status register 2	*1	219
:ESR3?		Query of event status register 3	*1	219
Measurement Frequency				
:FREQuency	1E3/ 100E3/ 1E6 (NR3) (only for 3505)	Setting of measurement frequency	*2, 3	220
:FREQuency?		Query of measurement frequency	*1, 2	220
:FREQuency:SHIFt	-2 to 2 (NR1)	Setting of measurement frequency shift function	*2, 3	220
:FREQuency:SHIFt?		Query of measurement frequency shift function	*1, 2	220

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____ When a number that has not been saved is specified.
*5 Execution Error ____ When not even one measurement value is saved to memory.
*6 Execution Error ____ When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____ When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Communication Handshake				
:HANDshake RS-232C	OFF/ X /HARDware /BOTH	Setting of RS-232C communication handshake	*2,3,6	221
:HANDshake? RS-232C		Query of RS-232C communication handshake	*1,2,6	221
Header				
:HEADer	ON/ OFF	Setting of header for response messages	*2, 3	221
:HEADer?		Query of header for response messages	*1, 2	221
Current Detection Circuit Monitoring Function				
:ICHeck	ON/ OFF	Setting of current detection circuit monitoring function	*2, 3	222
:ICHeck?		Query of current detection circuit monitoring function	*1, 2	222
EXT I/O Output				
:IO:OUTPut:DELay	0 to 0.9999 (NR1)	Setting of delay time for judgement result output ↔ $\overline{\text{EOM}}$ output period in EXT I/O	*2, 3	222
:IO:OUTPut:DELay?		Query of delay time for judgement result Output ↔ $\overline{\text{EOM}}$ output period in EXT I/O	*1, 2	222
:IO:RESult:RESet	ON/ OFF	Setting of output of judgment result signal line in EXT I/O	*2, 3	223
:IO:RESult:RESet?		Query of output of judgment result signal line in EXT I/O	*1, 2	223
Judgment Mode				
:JUDGment:MODE	COUNt/ DEViation/ PDEViation	Setting of judgment mode of comparator and BIN functions	*2, 3	223
:JUDGment:MODE?		Query of judgment mode of comparator and BIN functions	*1, 2	223
Key Lock				
:KEYLock	ON/ OFF	Setting of key lock function	*2, 3	224
:KEYLock?		Query of key lock function	*1, 2	224

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB

*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation

*3 Execution Error ____ When set to other than the specified character data or numeric data.

*4 Execution Error ____When a number that has not been saved is specified.

*5 Execution Error ____When not even one measurement value is saved to memory.

*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.

*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Measurement Signal Level				
:LEVel	1/ 0.5 (NR2)	Setting of measurement signal level	*2, 3	224
:LEVel?		Query of measurement signal level	*1, 2	224
Detected Level Monitoring Function				
:LEVel:CHECk	ON/ OFF	Setting of detected level monitoring function	*2, 3	225
:LEVel:CHECk?		Query of detected level monitoring function	*1, 2	225
:LEVel:CHECk:LIMit	0.01 to 100.00	Setting of judging threshold for detected level abnormality	*2, 3	225
:LEVel:CHECk:LIMit?		Query of judging threshold for detected level abnormality	*1, 2	225
Panel Load				
:LOAD	1 to 70 (NR1)	Loading of specified panel number	*2,3,4	226
:LOAD:TYPE	ALL/ CORRection/ HARDware	Setting of load method	*2, 3	226
:LOAD:TYPE?		Query of load method	*1, 2	226
Normal Measurement				
:MEASure?		Query of measurement data	*1, 2	227
:MEASure:VALid	0 to 255 (NR1)	Setting of effective data for measurement value acquisition query	*2, 3	231
:MEASure:VALid?		Query of effective data for measurement value acquisition query	*1, 2	231
Measurement Value Memory Function				
:MEMory?	No Data/ ALL	Query of measurement values saved to memory by the measurement value memory function	*1,2,6	232
:MEMory:CLEar		Deleting data from memory of measurement value memory function	*2	233
:MEMory:COUNt?		Query of number of measurement values saved to memory by the measurement value memory function	*1, 2	233
:MEMory:CONTrol	ON/ OFF	ON/ OFF setting of measurement value memory function	*2, 3	233

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____ When a number that has not been saved is specified.
*5 Execution Error ____ When not even one measurement value is saved to memory.
*6 Execution Error ____ When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____ When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
:MEMory:CONTrol?		ON/ OFF query of measurement value memory function	*1, 2	233
:MEMory:POINts	1 to 1000	Setting of measurement value memory size	*2, 3	234
:MEMory:POINts?		Query of measurement value memory size	*1, 2	234
Monitor				
:MONItor?		Query of voltage and current monitor levels	*1, 2	234
:MONItor:DISPlay	ON/ OFF	Setting of voltage and current monitor value display	*2, 3	235
:MONItor:DISPlay?		Query of voltage and current monitor value display	*1, 2	235
Parameter Settings				
:PARAmeter	D/ Q	Setting of second parameter	*2, 3	235
:PARAmeter?		Query of second parameter	*1, 2	235
Initialize Device				
:PRESet		Initialize Device	*2	235
Measurement Range				
:RANGe	1 kHz : 9 to 24 100 kHz : 3 to 18 (only for 3505) 1 MHz : 1 to 12	Setting of measurement range	*2, 3	236
:RANGe?		Query of measurement range	*1, 2	236
:RANGe:AUTO	ON/ OFF	Automatic setting of measurement range	*2,3,5	237
:RANGe:AUTO?		Query of automatic setting of measurement range	*1, 2	237
Panel Save				
:SAVE	1 to 70 (NR1)	Saving of specified panel number	*2, 3	237
:SAVE?	1 to 70 (NR1)	Query of saving of specified panel number	*1,2,3	237
:SAVE:CLEar	ALL/1 to 70	Clear specified panel number		238

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB

*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation

*3 Execution Error ____ When set to other than the specified character data or numeric data.

*4 Execution Error ____When a number that has not been saved is specified.

*5 Execution Error ____When not even one measurement value is saved to memory.

*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.

*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Reference Page
Measurement Speed				
:SPEEd	FAST/ NORMal/ SLOW	Setting of measurement speed	*2, 3	238
:SPEEd?		Query of measurement speed	*1, 2	238
Trigger Synchronous Output Function				
:SSOurce	ON/ OFF	Setting of trigger synchronous output function	*2, 3	238
:SSOurce?		Query of trigger synchronous output function	*1, 2	238
:SSOurce:WAIT	<1 k, 100 k, 1M> (only for 3505) <Wait Time > <Wait Time > = Numeric Value from 0 to 9.999 (NR2)	Setting of wait time for trigger synchronous output function	*2,3,5	239
:SSOurce:WAIT?	<1 k, 100 k, 1 M> (only for 3505)	Query of wait time for trigger synchronous output function	*1, 2	239
Message Terminator				
:TRANsmit:TERMinator	Numeric Value from 0 to 255 (NR1)	Setting of the terminator of a response message	*2, 3	240
:TRANsmit:TERMinator?		Query of the terminator of a response message	*1, 2	240
Trigger				
:TRIGger	INTernal/ EXTernal	Setting of trigger	*2, 3	241
:TRIGger?		Query of trigger	*1, 2	241
:TRIGger:DELay	0 to 9.999	Setting of trigger delay time	*2, 3	241
:TRIGger:DELay?		Query of trigger delay time	*1, 2	241
:TRIGger:DELay:STATe	ON/ OFF	Query of trigger delay function	*2, 3	242
:TRIGger:DELay:STATe?		Query of trigger delay function	*1, 2	242
User ID				
:USER:IDENtity	<ID> = User ID Code	Setting of user ID	*2, 3	242
:USER:IDENtity?		Query of user ID	*1, 2	242

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB
*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation
*3 Execution Error ____ When set to other than the specified character data or numeric data.
*4 Execution Error ____ When a number that has not been saved is specified.
*5 Execution Error ____ When not even one measurement value is saved to memory.
*6 Execution Error ____ When there is an RS-232C specific command or query while the interface type is set to GP-IB.
*7 Execution Error ____ When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

Command	Data Section	Explanation	Error	Refer-ence Page
Applied Voltage Monitoring Function				
:VCHeck	ON/ OFF	Setting of applied voltage monitoring function	*2, 3	243
:VCHeck?		Query of applied voltage monitoring function	*1, 2	243
:VCHeck:LIMit	0.01 to 100.00	Setting of applied voltage monitoring function limit value	*2, 3	243
:VCHeck:LIMit?		Query of applied voltage monitoring function limit value	*1, 2	243

Error Explanations (An error is generated when a message is executed in the following cases)

*1 Query Error _____ When a response message exceeds 10 kB

*2 Execution Error ____ When a command is executed while open circuit, short circuit, or load compensation

*3 Execution Error ____ When set to other than the specified character data or numeric data.

*4 Execution Error ____When a number that has not been saved is specified.

*5 Execution Error ____When not even one measurement value is saved to memory.

*6 Execution Error ____When there is an RS-232C specific command or query while the interface type is set to GP-IB.

*7 Execution Error ____When a command to display a reference value in the SUB display area is executed while the count setting is configured.

Note: Command errors are generated for all messages with a misspelling.

8.8 Ability to Use Commands by State

The ability to use commands depends on the state of the unit; for example, whether the unit is in a measurement mode or performing compensation. Refer to the following table.

8.8.1 Common Commands

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
*CLS	Yes	Yes	Yes	No	174
*ESE	Yes	Yes	Yes	No	174
*ESE?	Yes	Yes	Yes	No	174
*ESR?	Yes	Yes	Yes	Yes	175
*IDN?	Yes	Yes	Yes	No	172
*OPC	Yes	Yes	Yes	Yes	173
*OPC?	Yes	Yes	Yes	Yes	173
*RST	Yes	Yes	Yes	No	172
*SRE	Yes	Yes	Yes	No	175
*SRE?	Yes	Yes	Yes	No	175
*STB?	Yes	Yes	Yes	No	176
*TRG	Yes	Yes	Yes	No	176
*TST?	Yes	Yes	Yes	No	172
*WAI	Yes	Yes	Yes	Yes	173

8.8.2 Unique Commands

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:AVERaging	Yes	△	△	No	177
:AVERaging?	Yes	Yes	Yes	No	177
:AVERaging:STATe	Yes	△	△	No	177
:AVERaging:STATe?	Yes	Yes	Yes	No	177
:BEEPer:JUDGment	Yes	△	△	No	178
:BEEPer:JUDGment?	Yes	Yes	Yes	No	178
:BEEPer:KEY	Yes	Yes	Yes	No	178
:BEEPer:KEY?	Yes	Yes	Yes	No	178
:BIN	Yes	Yes	Yes	No	179
:BIN?	Yes	Yes	Yes	No	179
:BIN:DISPlay	Yes	Yes	Yes	No	180
:BIN:DISPlay?	Yes	Yes	Yes	No	180

8.8 Ability to Use Commands by State

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:BIN:FLIMit:COUNt	Yes	Yes	Yes	No	181
:BIN:FLIMit:COUNt?	Yes	Yes	Yes	No	181
:BIN:FLIMit:CDEViation	Yes	Yes	Yes	No	182
:BIN:FLIMit:CDEViation?	Yes	Yes	Yes	No	182
:BIN:FLIMit:CREFerence	Yes	Yes	Yes	No	183
:BIN:FLIMit:CREFerence?	Yes	Yes	Yes	No	183
:BIN:FLIMit:PDEViation	Yes	Yes	Yes	No	184
:BIN:FLIMit:PDEViation?	Yes	Yes	Yes	No	184
:BIN:FLIMit:PREFerence	Yes	Yes	Yes	No	185
:BIN:FLIMit:PREFerence?	Yes	Yes	Yes	No	185
:BIN:SLIMit:COUNt	Yes	Yes	Yes	No	186
:BIN:SLIMit:COUNt?	Yes	Yes	Yes	No	186
:BIN:SLIMit:CDEViation	Yes	Yes	Yes	No	187
:BIN:SLIMit:CDEViation?	Yes	Yes	Yes	No	187
:BIN:SLIMit:CREFerence	Yes	Yes	Yes	No	187
:BIN:SLIMit:CREFerence?	Yes	Yes	Yes	No	187
:BIN:SLIMit:PDEViation	Yes	Yes	Yes	No	188
:BIN:SLIMit:PDEViation?	Yes	Yes	Yes	No	188
:BIN:SLIMit:PREFerence	Yes	Yes	Yes	No	189
:BIN:SLIMit:PREFerence?	Yes	Yes	Yes	No	189
:CALibration	Yes	△	△	No	189
:CALibration?	Yes	Yes	Yes	No	189
:CALibration:ADJust	Yes	Yes	Yes	No	190
:CALibration:ADJust:ONCE	Yes	Yes	Yes	No	190
:CALibration:AVERaging	Yes	Yes	Yes	No	191
:CALibration:AVERaging?	Yes	Yes	Yes	No	191
:CALibration:CABLe	Yes	△	△	No	191
:CALibration:CABLe?	Yes	Yes	Yes	No	191
:CALibration:SPEEd	Yes	Yes	Yes	No	192
:CALibration:SPEEd?	Yes	Yes	Yes	No	192
:CIRCuit	Yes	△	△	No	192
:CIRCuit?	Yes	Yes	Yes	No	192
:CIRCuit:AUTO	Yes	△	△	No	193
:CIRCuit:AUTO?	Yes	Yes	Yes	No	193
:COMParator	Yes	Yes	Yes	No	193
:COMParator?	Yes	Yes	Yes	No	193
:COMParator:DISPlay	Yes	Yes	Yes	No	194
:COMParator:DISPlay?	Yes	Yes	Yes	No	194
:COMParator:FLIMit:COUNt	Yes	Yes	Yes	No	195
:COMParator:FLIMit:COUNt?	Yes	Yes	Yes	No	195
:COMParator:FLIMit:CDEViation	Yes	Yes	Yes	No	196

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:COMParator:FLIMit:CDEViation?	Yes	Yes	Yes	No	196
:COMParator:FLIMit:PDEViation	Yes	Yes	Yes	No	197
:COMParator:FLIMit:PDEViation?	Yes	Yes	Yes	No	197
:COMParator:SLIMit:COUNt	Yes	Yes	Yes	No	198
:COMParator:SLIMit:COUNt?	Yes	Yes	Yes	No	198
:COMParator:SLIMit:CDEViation	Yes	Yes	Yes	No	199
:COMParator:SLIMit:CDEViation?	Yes	Yes	Yes	No	199
:COMParator:SLIMit:PDEViation	Yes	Yes	Yes	No	200
:COMParator:SLIMit:PDEViation?	Yes	Yes	Yes	No	200
:CORRection:OPEN	Yes	△	△	No	201
:CORRection:OPEN?	Yes	Yes	Yes	No	201
:CORRection:OPEN:DATA	Yes	△	△	No	202
:CORRection:OPEN:DATA?	Yes	Yes	Yes	No	202
:CORRection:OPEN:DATA:FORMat	Yes	Yes	Yes	No	203
:CORRection:OPEN:DATA:FORMat?	Yes	Yes	Yes	No	203
:CORRection:OPEN:POINt	Yes	Yes	Yes	No	204
:CORRection:OPEN:POINt?	Yes	Yes	Yes	No	204
:CORRection:SHORt	Yes	△	△	No	205
:CORRection:SHORt?	Yes	Yes	Yes	No	205
:CORRection:SHORt:DATA	Yes	△	△	No	206
:CORRection:SHORt:DATA?	Yes	Yes	Yes	No	206
:CORRection:SHORt:DATA:FORMat	Yes	Yes	Yes	No	207
:CORRection:SHORt:DATA:FORMat?	Yes	Yes	Yes	No	207
:CORRection:SHORt:POINt	Yes	Yes	Yes	No	208
:CORRection:SHORt:POINt?	Yes	Yes	Yes	No	208
:CORRection:LOAD	Yes	△	△	No	209
:CORRection:LOAD?	Yes	Yes	Yes	No	209
:CORRection:LOAD:DATA	Yes	△	△	No	210
:CORRection:LOAD:DATA?	Yes	Yes	Yes	No	210
:CORRection:LOAD:DATA:FORMat	Yes	Yes	Yes	No	211
:CORRection:LOAD:DATA:FORMat?	Yes	Yes	Yes	No	211
:CORRection:LOAD:REFerence	Yes	△	△	No	212
:CORRection:LOAD:REFerence?	Yes	Yes	Yes	No	212
:CORRection:OFFSet	Yes	△	△	No	213
:CORRection:OFFSet?	Yes	Yes	Yes	No	213
:CORRection:OFFSet:DATA	Yes	△	△	No	213
:CORRection:OFFSet:DATA?	Yes	Yes	Yes	No	213
:CREJect	Yes	Yes	Yes	No	214
:CREJect?	Yes	Yes	Yes	No	214
:CREJect:LIMit	Yes	Yes	Yes	No	214
:CREJect:LIMit?	Yes	Yes	Yes	No	214

8.8 Ability to Use Commands by State

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:DISPlay	Yes	Yes	Yes	No	215
:DISPlay?	Yes	Yes	Yes	No	215
:ERRor?	Yes	Yes	Yes	No	215
:ESE0	Yes	Yes	Yes	No	216
:ESE0?	Yes	Yes	Yes	No	216
:ESE1	Yes	Yes	Yes	No	216
:ESE1?	Yes	Yes	Yes	No	216
:ESE2	Yes	Yes	Yes	No	217
:ESE2?	Yes	Yes	Yes	No	217
:ESE3	Yes	Yes	Yes	No	217
:ESE3?	Yes	Yes	Yes	No	217
:ESR0?	Yes	Yes	Yes	Yes	218
:ESR1?	Yes	Yes	Yes	Yes	218
:ESR2?	Yes	Yes	Yes	Yes	219
:ESR3?	Yes	Yes	Yes	Yes	219
:FREQuency	Yes	△	△	No	220
:FREQuency?	Yes	Yes	Yes	No	220
:FREQuency:SHIFt	Yes	△	△	No	220
:FREQuency:SHIFt?	Yes	Yes	Yes	No	220
:HANDshake	Yes	Yes	Yes	No	221
:HANDshake?	Yes	Yes	Yes	No	221
:HEADer	Yes	Yes	Yes	No	221
:HEADer?	Yes	Yes	Yes	No	221
:ICHEk	Yes	Yes	Yes	No	222
:ICHEk?	Yes	Yes	Yes	No	222
:IO:OUTPut:DELay	Yes	Yes	Yes	No	222
:IO:OUTPut:DELay?	Yes	Yes	Yes	No	222
:IO:RESult:RESet	Yes	Yes	Yes	No	223
:IO:RESult:RESet?	Yes	Yes	Yes	No	223
:JUDGment:MODE	Yes	△	△	No	223
:JUDGment:MODE?	Yes	Yes	Yes	No	223
:KEYLock	Yes	Yes	Yes	No	224
:KEYLock?	Yes	Yes	Yes	No	224
:LEVel	Yes	△	△	No	224
:LEVel?	Yes	Yes	Yes	No	224
:LEVel:CHECk	Yes	Yes	Yes	No	225
:LEVel:CHECk?	Yes	Yes	Yes	No	225
:LEVel:CHECk:LIMit	Yes	Yes	Yes	No	225
:LEVel:CHECk:LIMit?	Yes	Yes	Yes	No	225
:LOAD	Yes	Yes	Yes	No	226
:LOAD:TYPE	Yes	Yes	Yes	No	226

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:LOAD:TYPE?	Yes	Yes	Yes	No	226
:MEASure?	Yes	Yes	Yes	No	227
:MEASure:VALid	Yes	Yes	Yes	No	231
:MEASure:VALid?	Yes	Yes	Yes	No	231
:MEMory?	Yes	Yes	Yes	No	232
:MEMory:CLEar	Yes	Yes	Yes	No	233
:MEMory:COUNt?	Yes	Yes	Yes	No	233
:MEMory:CONTrol	Yes	Yes	Yes	No	233
:MEMory:CONTrol?	Yes	Yes	Yes	No	233
:MEMory:POINts	Yes	Yes	Yes	No	234
:MEMory:POINts?	Yes	Yes	Yes	No	234
:MONItor?	Yes	Yes	Yes	No	234
:MONItor:DISPlay	Yes	Yes	Yes	No	235
:MONItor:DISPlay?	Yes	Yes	Yes	No	235
:PARAmeter	Yes	△	△	No	235
:PARAmeter?	Yes	Yes	Yes	No	235
:PRESet	Yes	Yes	Yes	No	235
:RANGe	Yes	△	△	No	236
:RANGe?	Yes	Yes	Yes	No	236
:RANGe:AUTO	Yes	No	No	No	237
:RANGe:AUTO?	Yes	Yes	Yes	No	237
:SAVE	Yes	Yes	Yes	No	237
:SAVE?	Yes	Yes	Yes	No	237
:SAVE:CLEar	Yes	Yes	Yes	No	238
:SPEEd	Yes	△	△	No	238
:SPEEd?	Yes	Yes	Yes	No	238
:SSOurce	Yes	△	△	No	238
:SSOurce?	Yes	Yes	Yes	No	238
:SSOurce:WAIT	Yes	Yes	Yes	No	239
:SSOurce:WAIT?	Yes	Yes	Yes	No	239
:TRANsmit:TERMinator	Yes	Yes	Yes	No	240
:TRANsmit:TERMinator?	Yes	Yes	Yes	No	240
:TRIGger	Yes	Yes	Yes	No	241
:TRIGger?	Yes	Yes	Yes	No	241
:TRIGger:DELay	Yes	△	△	No	241
:TRIGger:DELay?	Yes	Yes	Yes	No	241
:TRIGger:DELay:STATe	Yes	△	△	No	242
:TRIGger:DELay:STATe?	Yes	Yes	Yes	No	242
:USER:IDENtity	Yes	Yes	Yes	No	242
:USER:IDENtity?	Yes	Yes	Yes	No	242
:VCHeck	Yes	Yes	Yes	No	243

8.8 Ability to Use Commands by State

Yes: Available △: Only for commands available (Key unavailable) No: Unavailable

Command Name	Normal Measurement Mode	Comparator Measurement Mode	BIN Measurement Mode	Performing Compensation	Reference Page
:VCHeck?	Yes	Yes	Yes	No	243
:VCHeck:LIMit	Yes	Yes	Yes	No	243
:VCHeck:LIMit?	Yes	Yes	Yes	No	243

8.9 Message Reference

Refer to the following on how to read this section.

This indicates whether the command message format has a numeric value or character parameter.
<Numeric Value>Numeric Value Parameter
(NR1) Integer
(NR2) Fixed Point
(NR3) Floating point
(NRf) Format including all of NR1, NR2, and NR3
<Character> Character parameter
<Content to input>

Indicates the content of the command.

Setting and Query of Measurement Signal Level

Describes the syntax of the message.

Syntax
Command :LEVel <Numeric Value>
Query :LEVel ?
Response <Numeric Value>

Provides an explanation of the command data section or response data.

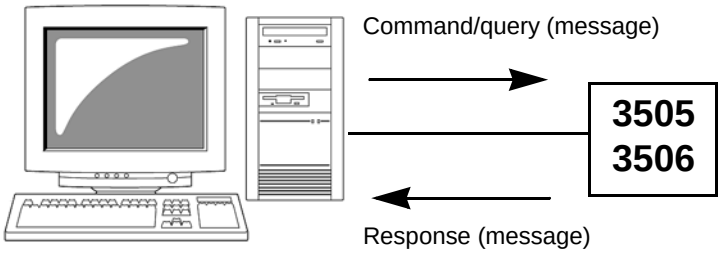
<Numeric Value> = 1/ 0.5 (NR2)
1: 1 V, 0.5: 500 mV

Provides an explanation of the message.

Explanation
Command: Sets the measurement signal level. A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
Query: Returns the setting of the measurement signal level as an NR2 numeric value.

Shows an actual example of using the command. This explanation is normally for when HEADER ON. (Except for HEADER command.)

Example
Command: **:LEVel 0.5**
Sets the measurement signal level to 500 mV
Query: **:LEVEL?**
:LEVEL 0.5 (when HEADER ON)
0.5 (when HEADER OFF)
The measurement signal level is set to 500 mV.



8.9.1 Common Commands

(1) System Data Commands

Query of Device ID (Identification Code)

Syntax
Query ***IDN?**
Response <Maker Name>,< Model Name>,0,<Software Version>

Example
HIOKI,3505,0,V1.00 (in the case of the 3505)
HIOKI,3506,0,V1.00 (in the case of the 3506)

(2) Internal Operation Commands

Initialization of Device

Syntax
Command ***RST**

Explanation
Initializes the unit.
See Appendix 7 "Initial Settings Table" (p. A11)

Query of Self Test Execution and Results

Syntax
Query ***TST?**
Response <Numeric Value>
<Numeric Value> = 0 to 15 (NR1)

Explanation
Returns the results of the self check of the unit as an NR1 numeric value.
No header is added to the response message.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	Unused	Unused	Unused	Interrupt error	I/O error	RAM error	ROM error

Example
Query ***TST?**
Response **2**
There is a RAM error (bit 1).

(3) Synchronization Commands

Setting of OPC of SESR after All Executed Operations End

Syntax Command **∗OPC**

Explanation Sets the OPC (bit 0) of SESR (standard event status register) when processing ends for sent commands prior to the ∗OPC command.

Example
```
A;B;*OPC;C
```
Sets OPC of SESR after processing ends for commands A and B.

Response of 1 of ASCII after All Executed Operations End

Syntax Query **∗OPC?**
Response 1

Explanation Responds with 1 of ASCII when processing ends for sent commands prior to the ∗OPC command.

Continuing Execution of Commands after Command Processing Ends

Syntax Command **∗WAI**

Example
```
A;B;*WAI;C
```
Executes **∗WAI** and then the C command after processing ends for commands A and B.

Current Frequency:1 kHz when in internal trigger state

- When the ∗WAI command was not used
  (Send)
  ```
  :FREQuency 1E6;:MEASure?
  ```
  In this case, it is not certain which frequency measurement value will be sent in response to the :MEASure? query.
- When the ∗WAI command was used
  (Send)
  ```
  :FREQuency 1E6;*WAI;:MEASure?
  ```
  In this case, the 1 MHz frequency measurement value is sent in response to the :MEASure? query.

Note Unique commands other than the ":MEASure?" query use sequential commands. Therefore, the ∗WAI command is only effective for the ":MEASure?" query.

(4) Status and Event Control Commands

Clearing of Status Byte Register and Related Queues (Except Output Queue)

Syntax Command ***CLS**

Explanation Clears the content of the event registers (SESR, ESR0, ESR1, ESR2, ESR3).

Note RS-232C The output queue is not affected

GP-IB The output queue and the MAV (bit 4) of each type of enable register status byte are not affected.

Reading and Writing of Standard Event Status Enable Register (SESER)

Syntax
Command ***ESE** <Numeric Value>
Query ***ESE?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation
Command: Sets the mask pattern of the SESER to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The initial value (when the power is turned on) is 0.

Query: Returns the SESER content set by the ESE command as an NR1 numeric value from 0 to 255.

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

Example
Command ***ESE 36**
Query Sets bit 5 and bit 2 of SESER
Response ***ESE?**
***ESE 36** (when HEADER ON)
36 (when HEADER OFF)
Bit 5 and bit 2 of SESER are 1.

Reading and Clearing of Standard Event Status Register (SESR)

Syntax

Query ***ESR?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Returns the SESR content as an NR1 numeric value from 0 to 255, and then clears that content.
No header is added to the response message.

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

Example

Query ***ESR?**
Response **32**
Bit 5 of SESR is 1.

Note

Bit 6 and bit 1 are not used in the unit.

Reading and Writing of Service Request Enable Register (SRER)

Syntax

Command ***SRE** <Numeric Value>
Query ***SRE?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Command

Sets the mask pattern of the SRER to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The values of bit 6 and the unused bit (bit 7) are ignored.
The value is initialized to 0 when the power is turned on.

Query

Returns the SRER content set by the *SRE command as an NR1 numeric value from 0 to 255.
The values of bit 6 and the unused bit (bit 7) are always 0.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	X	ESB	MAV	ESB3	ESB2	ESB1	ESB0

Example

Command ***SRE 34**
Sets bit 5 and bit 1 of SRER to 1.

Query ***SRE?**
Response ***SRE 34** (when HEADER ON)
34 (when HEADER OFF)
Bit 5 and bit 1 of SRER are 1.

8

Reading of Status Byte Register

Syntax

Query ***STB?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Returns the STB setting content as a NR1 numeric value from 0 to 127.
No header is added to the response message.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	MSS	ESB	MAV	ESB3	ESB2	ESB1	ESB0

Example

Query ***STB?**
Response **8**
Bit 3 of STB is 1.

Sampling Request

Syntax

Command ***TRG**

Explanation

Performs sampling once when there is an external trigger.

Example

```
:TRIGger EXTernal;*TRG;:MEASure?
```

8.9.2 Unique Commands

Setting and Query of the number of measurements to Average

Syntax

Command **:AVERaging** <Numeric Value>
Query **:AVERaging?**
Response <Numeric Value> = 1 to 256 (NR1)

Explanation

Command: Set the number of measurements to average for the average measurement value.
When the number of average measurements is set, the average function will not be automatically set to ON.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query: Returns the setting of the number of measurements to average as NR1 numeric value.

Example

Command **`:AVERaging 32`**
Set the number of measurements to average to 32.

Query **`:AVERaging?`**
Response **`:AVERaging 32`** (when HEADER ON)
`32` (when HEADER OFF)
The number of measurements to average is set at 32.

Note

The command receives 1, but the response returns OFF.

Setting and Query of Average

Syntax

Command **:AVERaging:STATe** <ON/ OFF>
Query **:AVERaging:STATe?**
Response <ON/ OFF>

Explanation

Command: Sets the ON/ OFF setting of average function.

Query: Returns ON or OFF for the setting of average function.

Example

Command **`:AVERaging:STATe ON`**
Enables the average function.

Query **`:AVERaging:STATe?`**
Response **`:AVERaging:STATE ON`** (when HEADER ON)
`ON` (when HEADER OFF)
The average function is enabled.

Setting and Query of Comparator and BIN Judgment Beep Tone Setting

Syntax

Command **:BEEPer:JUDGment** <Character>

Query **:BEEPer:JUDGment?**

Response <Character> = IN/ NG/ OFF
IN : Set so that the beep tone plays when the value is within the range
NG : Set so that the beep tone plays when the value is outside the range
OFF : Mute

Explanation

Command Sets the comparator and BIN judgment beep tone.

Query Returns the setting of the comparator and BIN judgment beep tone as characters.

Example

Command **:BEEPer:JUDGment NG**
Sets the beep tone so that it plays when the value is outside the range.

Query **:BEEPer:JUDGment?**

Response **:BEEPER:JUDGMENT NG** (when HEADER ON)
NG (when HEADER OFF)
The beep tone is set so that it plays when the value is outside the range.

Setting and Query of Key Input Beep Tone

Syntax

Command **:BEEPer:KEY** <ON/ OFF>

Query **:BEEPer:KEY?**

Response <ON/ OFF>

ON : Set so that the beep tone plays
OFF : Set so that the beep tone does not play

Explanation

Command Sets the beep tone for key input of the unit.

Query Returns the beep tone setting of key input of the unit as ON or OFF

Example

Command **:BEEPer:KEY ON**
Sets the beep tone so that it plays.

Query **:BEEPer:KEY?**

Response **:BEEPER:KEY ON** (when HEADER ON)
ON (when HEADER OFF)
The beep tone is set so that it plays.

Setting and Query of ON/ OFF Setting of BIN Measurement

Syntax

Command **:BIN** <ON/ OFF>
Query **:BIN?**
Response <ON/ OFF>

ON : Starts BIN measurement.
OFF : Ends BIN measurement.

Explanation

Command: Sets the BIN measurement function to ON/ OFF.
If the ":BIN ON" command is sent during comparator measurement, comparator measurement ends automatically and BIN measurement starts.

Query: Returns ON or OFF for the setting of the BIN measurement function.

Example

Command
```
:BIN ON
```
Sets the BIN measurement function to ON.

Query
```
:BIN?
```
Response
```
:BIN ON
```
(when HEADER ON)
```
ON
```
(when HEADER OFF)
The BIN measurement function is set to ON.

Setting and Query of SUB Display Indication During BIN Measurement

Syntax

Command **:BIN:DISPlay** <BIN Number/ Characters>

Query **:BIN:DISPlay?**

Response <BIN Number/ Characters> = 1 to 13(NR1)/ SECond/ CREFerence/ SREFerence/ OFF

BIN Number : Sets the upper limit and lower limit values of the BIN number to be displayed in the SUB display area.

SECond : Sets the second parameter (D or Q) upper limit and lower limit values to be displayed in the SUB display area.

CREFerence: Sets the reference value of C to be displayed in the SUB display area.

SREFerence: Sets the second parameter (D or Q) reference value to be displayed in the SUB display area.

OFF : Sets nothing to be displayed in the SUB display area.

Explanation

Command Sets the set upper limit and lower limit values or the reference value to be displayed in the SUB display area during BIN measurement. A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the indication setting of the SUB display area during BIN measurement as characters.

Example

Command **:BIN:DISPlay 1**

Sets the upper limit and lower limit values of BIN1 to be displayed during BIN measurement.

Query **:BIN:DISPlay?**

Response **:BIN:DISPLAY 1** (when HEADER ON)

1 (when HEADER OFF)

The upper limit and lower limit values of BIN1 are set to be displayed during BIN measurement.

Note

- If an attempt is made to set the indication setting to CREFerence or SEFerence when the judgment mode is count value mode, an execution error is generated.
- If the judgment mode setting has been changed, it will be initialized as follows.
  - Count value mode:C
  - Deviation count mode, deviation percent mode :CREFerence

Setting and Query of Upper Limit and Lower Limit Values of First Parameter for BIN Function in Count Value Mode

Syntax

Command **:BIN:FLIMit:COUNt** <BIN Number>,<Lower Limit Value>,<Upper Limit Value>

Query

Response **:BIN:FLIMit:COUNt?** <BIN Number>

<BIN Number>,<Lower Limit Value>,<Upper Limit Value>

<BIN Number> = 1 to 13(NR1)

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

Explanation

Command CommandSets the upper limit and lower limit values of the first parameter in count value mode of the specified BIN number.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query Returns the upper limit and lower limit value settings for the first parameter in count value mode of the specified BIN number in order of BIN number, lower limit value, and upper limit value.

Example

Command **`:BIN:FLIMit:COUNt 1,100000,150000`**
Sets 100000 for the lower limit value and 150000 for the upper limit value of the first parameter in count value mode of BIN1.

Query **`:BIN:FLIMit:COUNt? 1`**

Response **`:BIN:FLIMit:COUNT 1,100000,150000`** (when HEADER ON)
`1,100000,150000` (when HEADER OFF)
100000 is set for the lower limit value and 150000 is set for the upper limit value of the first parameter in count value mode of BIN1.

Setting and Query of Upper Limit and Lower Limit Values of First Parameter for BIN Function in Deviation Count Mode

Syntax

Command **:BIN:FLIMit:CDEViation** <BIN Number>,<Lower Limit Value>,<Upper Limit Value>

Query **:BIN:FLIMit:CDEViation?** <BIN Number>

Response <BIN Number>,<Lower Limit Value>,<Upper Limit Value>

<BIN Number> = 1 to 13 (NR1)

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

Explanation

Command: Sets the upper limit and lower limit values of the first parameter in deviation count mode of the specified BIN number.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query: Returns the upper limit and lower limit value settings for the first parameter in deviation count mode of the specified BIN number in order of BIN number, lower limit value, and upper limit value.

Example

Command **`:BIN:FLIMit:CDEViation 1,-10,10`**
Sets -10 for the lower limit value and 10 for the upper limit value of the first parameter in deviation count mode of BIN1.

Query **`:BIN:FLIMit:CDEViation? 1`**

Response **`:BIN:FLIMit:CDEVIATION 1,-10,10`** (when HEADER ON)
`1,-10,10` (when HEADER OFF)
-10 is set for the lower limit value and 10 is set for the upper limit value of the first parameter in deviation count mode of BIN1.

Setting and Query of Reference Value of First Parameter for BIN Function in Deviation Count Mode

Syntax

Command **:BIN:FLIMit:CREFerence** <Reference Value>
Query **:BIN:FLIMit:CREFerence?** <BIN Number>
Response <Reference Value> = Numeric Value from -199999 to 999999 (NR1)

Explanation

Command: Sets the reference value of the first parameter in deviation count mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query: Returns the reference value set for the first parameter in deviation count mode.

Example

Command
```
:BIN:FLIMit:CREFerence 100000
```
Sets 100000 for the reference value of the first parameter in deviation count mode.

Query
```
:BIN:FLIMit:CREFerence?
```
Response
```
:BIN:FLIMit:CREFERENCE 100000
```
(when HEADER ON)
```
100000
```
(when HEADER OFF)
100000 is set for the reference value of the first parameter in deviation count mode.

Setting and Query of Upper Limit and Lower Limit Values of First Parameter for BIN Function in Deviation Percent Mode

Syntax

Command **:BIN:FLIMit:PDEViation** <BIN Number>,<Lower Limit Value>,<Upper Limit Value>

Query

Response **:BIN:FLIMit:PDEViation?** <BIN Number>

<BIN Number>,<Lower Limit Value>,<Upper Limit Value>

<BIN Number> = 1 to 13 (NR1)

<Lower Limit Value> = OFF/ Numeric Value from -999.99 to 999.99 (NR2)

<Upper Limit Value> = OFF/ Numeric Value from -999.99 to 999.99 (NR2)

Explanation

Command Sets the upper limit and lower limit values of the first parameter in deviation percent mode of the specified BIN number.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query Returns the upper limit and lower limit value settings for the first parameter in deviation percent mode of the specified BIN number in order of BIN number, lower limit value, and upper limit value.

Example

Command **`:BIN:FLIMit:PDEViation 1,-10.0,10.0`**
Sets -10 for the lower limit value and 10 for the upper limit value of the first parameter in deviation percent mode of BIN1.

Query **`:BIN:FLIMit:PDEViation? 1`**

Response **`:BIN:FLIMit:PDEVIATION 1,-10.000,10.000`**
(when HEADER ON)
`1,-10.000,10.000` (when HEADER OFF)
-10% is set for the lower limit value and 10% is set for the upper limit value of the first parameter in deviation percent mode of BIN1.

Setting and Query of Reference Value of First Parameter for BIN Function in Deviation Percent Mode

Syntax

Command **:BIN:FLIMit:PREFerence** <Reference Value>
Query **:BIN:FLIMit:PREFerence?**
Response <Reference Value> = Numeric Value from -199999 to 999999 (excluding 0) (NR1)

Explanation

Command: Sets the reference value of the first parameter in deviation percent mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query: Returns the reference value set for the first parameter in deviation percent mode.

Example

Command
```
:BIN:FLIMit:PREFerence 150000
```
Sets 150000 for the reference value of the first parameter in deviation percent mode.

Query
```
:BIN:FLIMit:PREFerence?
```
Response
```
:BIN:FLIMit:PREFERENCE 150000
```
(when HEADER ON)
```
150000
```
(when HEADER OFF)
150000 is set for the reference value of the first parameter in deviation percent mode.

Note

Different upper value and lower value and reference value are stored for each judgment mode.

Setting and Query of Upper Limit and Lower Limit Values of Second Parameter for BIN Function in Count Value Mode

Syntax

Command **:BIN:SLIMit:COUNt** <Lower Limit Value>,<Upper Limit Value>

Query **:BIN:SLIMit:COUNt?**

Response <Lower Limit Value>,<Upper Limit Value>

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the upper limit and lower limit values of the second parameter in count value mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query Returns the upper limit and lower limit value settings for the second parameter in count value mode in order of lower limit value and upper limit value.

Example

Command **`:BIN:SLIMit:COUNt 100000,150000`**
Sets 100000 for the lower limit value and 150000 for the upper limit value of the second parameter in count value mode.

Query **`:BIN:SLIMit:COUNt?`**

Response **`:BIN:SLIMit:COUNT 100000,150000`** (when HEADER ON)
`100000,150000` (when HEADER OFF)
100000 is set for the lower limit value and 150000 is set for the upper limit value of the second parameter in count value mode.

Setting and Query of Upper Limit and Lower Limit Value of Second Parameter for BIN Function in Deviation Count Mode

Syntax

Command **:BIN:SLIMit:CDEViation** <Lower Limit Value>,<Upper Limit Value>

:BIN:SLIMit:CDEViation?

Query <Lower Limit Value>,<Upper Limit Value>

Response <Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the upper limit and lower limit values of the second parameter in deviation count mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the upper limit and lower limit value settings for the second parameter in deviation count mode in order of lower limit value and upper limit value.

Example

Command **:BIN:SLIMit:CDEViation -10,10**
Sets -10 for the lower limit value and 10 for the upper limit value of the second parameter in deviation count mode.

Query **:BIN:SLIMit:CDEViation?**

Response **:BIN:SLIMit:CDEVIATION -10,10** (when HEADER ON)
-10,10 (when HEADER OFF)
-10 is set for the lower limit value and 10 is set for the upper limit value of the second parameter in deviation count mode.

Setting and Query of Reference Value of Second Parameter for BIN Function in Deviation Count Mode

Syntax

Command **:BIN:SLIMit:CREFerence** <Reference Value>

Query **:BIN:SLIMit:CREFerence?**

Response <Reference Value> = Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the reference value of the second parameter in deviation count mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric value can be handled.

Query Returns the reference value set for the second parameter in deviation count mode.

Example

Command **:BIN:SLIMit:CREFerence 100000**
Sets 100000 for the reference value of the second parameter in deviation count mode.

Query **:BIN:SLIMit:CREFerence?**

Response **:BIN:SLIMit:CREFERENCE 100000** (when HEADER ON)
100000 (when HEADER OFF)
100000 is set for the reference value of the second parameter in deviation count mode.

Setting and Query of Upper Limit and Lower Limit Values of Second Parameter for BIN Function in Deviation Percent Mode

Syntax

Command **:BIN:SLIMit:PDEViation** <Lower Limit Value>,<Upper Limit Value>
:BIN:SLIMit:PDEViation?

Query <Lower Limit Value>,<Upper Limit Value>

Response <Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)
<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the upper limit and lower limit values of the second parameter in deviation percent mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the upper limit and lower limit value settings for the second parameter in deviation percent mode in order of lower limit value and upper limit value.

Example

Command **:BIN:SLIMit:PDEViation -10,10**
Sets -10 for the lower limit value and 10 for the upper limit value of the second parameter in deviation percent mode.

Query **:BIN:SLIMit:PDEViation?**

Response **:BIN:SLIMit:PDEVIATION -10,10** (when HEADER ON)
-10,10 (when HEADER OFF)
-10 is set for the lower limit value and 10 is set for the upper limit value of the second parameter in deviation percent mode.

Note

The measurement value for the second parameter in deviation percent mode is the result of the calculation (measurement value - reference value).

Setting and Query of Reference Value of Second Parameter for BIN Function in Deviation Percent Mode

Syntax

Command **:BIN:SLIMit:PREFerence** <Reference Value>
Query **:BIN:SLIMit:PREFerence?**
Response <Reference Value> = Numeric Value from -199999 to 199999 (NR1)

Explanation

Command: Sets the reference value of the second parameter in deviation percent mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the reference value set for the second parameter in deviation percent mode.

Example

Command
```
:BIN:SLIMit:PREFerence 150000
```
Sets 150000 for the reference value of the second parameter in deviation percent mode.

Query
```
:BIN:SLIMit:PREFerence?
```
Response
```
:BIN:SLIMit:PREFERENCE 150000
```
(when HEADER ON)
```
150000
```
(when HEADER OFF)
150000 is set for the reference value of the second parameter in deviation percent mode.

Note

Different upper limit and lower limit values are stored for each judgment mode (count, Δ, Δ%).

Setting and Query of Self Calibration

Syntax

Command **:CALibration** <Character>
Query **:CALibration?**
Response <Character> = AUTO/ MANUal

Explanation

Command: Sets the self calibration function.
AUTO : After completion of measurement the standard signal is measured and a moving average is calculated from the number of times set by :CALibration:AVERaging to produce a self calibration value.
MANUal : If a start command is received from the EXT I/O during the start of measurement the standard signal is measured and a moving average is calculated from the number of times set by :CALibration:AVERaging to produce a self calibration value.

Query: Returns the self calibration function settings as letters.

Example

Command
```
:CALibration AUTO
```
Sets self calibration to be performed for each measurement.

Query
```
:CALibration?
```
Response
```
:CALIBRATION AUTO
```
(when HEADER ON)
```
AUTO
```
(when HEADER OFF)
Self calibration is set to be performed for each measurement.

Calculates the Self Calibration Value Multiple Times

Syntax Command **:CALibration:ADJust**

Explanation Command When moving average processing is enacted the buffer of the saved self calibration value is erased and self calibration is performed.

Example Command **:CALibration:ADJust**
Measures the standard signal and takes the arithmetic average (arithmetic mean) from the number of measurements set by :CALibration:AVERaging and produces an adjusted value, regardless of the self calibration function setting.

Note Please take a new self calibration value if the ambient temperature has changed by more than 2°C.

Single Calculation of the Self Calibration Value

Syntax Command **:CALibration:ADJust:ONCE**

Explanation Command Takes the self calibration average once.

Example Command **:CALibration:ADJust:ONCE**
Uses the self calibration value taken before the command and the self calibration value taken from the command and treats the moving averaged value as the self calibration value, regardless of the self calibration function setting.

Note Please take a new self calibration value if the ambient temperature has changed by more than 2°C.

Setting and Query of Number of Times to Average During Self Calibration

Syntax

Command **:CALibration:AVERaging** <Numeric values>
Query **:CALibration:AVERaging?**
Response <Numeric values> = 1 to 256 (NR1)

Explanation

Command Set the number of times to average during self calibration.

Query Returns the number of times to average during self calibration as a NR1 numerical value.

Example

Command **:CALibration:AVERaging 8**
Set the number of times to average during self calibration to 8 times.

Query **:CALibration:AVERaging?**
Response **:CALIBRATION:AVERAGING 8** (when HEADER ON)
8 (when HEADER OFF)
The number of times to average during self calibration is set to 8 times.

Setting and Query of Cable Length

Syntax

Command **:CALibration:CABLe** <Numeric values>
Query **:CALibration:CABLe?**
Response < Numeric values>
< Numeric values> = 0/ 1/ 2 (NR1)
0:0 m, 1:1 m, 2:2 m

Explanation

Command Set the cable length.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

Query Returns the cable length setting in NR1 format.

Example

Command **:CALibration:CABLe 1**
Sets the cable length to 1 m.

Query **:CALibration:CABLe?**
Response **:CALIBRATION:CABLE 1** (when HEADER ON)
1 (when HEADER OFF)
The cable length is set to 1 m.

Setting and Query of Self Calibration Measurement Speed

Syntax

Command **:CALibration:SPEEd** <Character>
Query **:CALibration:SPEEd?**
Response <Character> = FAST/ NORMal/ SLOW

Explanation

Command Sets the measurement speed during self calibration.

Query Returns the measurement speed during self calibration as characters.

Example

Command **:CALibration:SPEEd NORMal**
Sets the measurement speed when taking the self calibration value to the normal speed setting.

Query **:CALibration:SPEEd?**
Response **:CALIBRATION:SPEED NORMAL** (when HEADER ON)
NORMAL (when HEADER OFF)
The measurement speed when taking the self calibration value is set to the normal speed setting.

Setting and Query of Equivalent Circuit

Syntax

Command **:CIRCuit** <Character>
Query **:CIRCuit?**
Response <Character>

<Character> = SERial, PARallel
SERial : Sets the equivalent circuit mode to series-equivalent circuit.
PARallel : Sets equivalent circuit mode to parallel-equivalent circuit.

Explanation

Command Sets the equivalent circuit mode.

Query Returns the setting of the current equivalent circuit mode as characters.

Example

Command **:CIRCuit SERIAL**
Sets the equivalent circuit mode to series-equivalent circuit.

Query **:CIRCuit?**
Response **:CIRCUIT SERIAL** (when HEADER ON)
SERIAL (when HEADER OFF)
The equivalent circuit mode is set to series-equivalent circuit.

Automatic Setting and Query of Equivalent Circuit

Syntax

Command **:CIRCuit:AUTO** <ON/ OFF>
Query **:CIRCuit:AUTO?**
Response <ON/ OFF>

ON : Switching is performed automatically.
OFF : Switching is not performed automatically.

Explanation

Command: Sets equivalent circuit mode to be switched automatically.

Query: Returns ON or OFF for the automatic setting of equivalent circuit mode.

Example

Command **:CIRCuit:AUTO ON**
Sets equivalent circuit mode to be switched automatically.

Query **:CIRCuit:AUTO?**
Response **:CIRCUIT:AUTO ON** (when HEADER ON)
ON (when HEADER OFF)
Equivalent circuit mode is set to be switched automatically.

Setting and Query of ON/ OFF Setting of Comparator Function

Syntax

Command **:COMParator** <ON/ OFF>
Query **:COMParator?**
Response <ON/ OFF>

ON : Starts comparator measurement.
OFF : Ends comparator measurement.

Explanation

Command: Sets the ON/ OFF setting of the comparator function.

Query: Returns ON or OFF for the setting of the comparator function.

Example

Command **:COMParator ON**
Sets the comparator function to ON.

Query **:COMParator?**
Response **:COMPARATOR ON** (when HEADER ON)
ON (when HEADER OFF)
The comparator function is set to ON.

Setting and Query of SUB Display Indication During Comparator Measurement

Syntax

Command **:COMParator:DISPlay** <Character>

Query **:COMParator:DISPlay?**

Response <Character> = C/ SECond/ CREFerence/ SREFerence/ OFF

- C : Sets the upper limit and lower limit values of C to be displayed in the SUB display area.
- SECond : Sets the second parameter (C or Q) upper limit and lower limit values to be displayed in the SUB display area.
- CREFerence : Sets the reference value of C to be displayed in the SUB display area.
- SREFerence : Sets the second parameter (C or Q) reference value to be displayed in the SUB display area.
- OFF : Sets nothing to be displayed in the SUB display area.

Explanation

Command Sets the set upper limit and lower limit values or the reference value to be displayed in the SUB display area during comparator measurement.

Query Returns the indication setting of the SUB display area during comparator measurement as characters.

Example

Command **:COMParator:DISPlay C**

Sets the upper limit and lower limit values of C to be displayed during comparator measurement.

Query **:COMParator:DISPlay**

Response **:COMPARATOR:DISPLAY C** (when HEADER ON)

C (when HEADER OFF)

The upper limit and lower limit values of C are set to be displayed during comparator measurement.

Note

- If an attempt is made to set the indication setting to CREFerence or SREFerence when the judgment mode is count value mode, an execution error is generated.
- If the judgment mode setting has been changed, it will be initialized as follows.
  - Count value mode :C
  - Deviation count mode, deviation percent mode :CREFerence

Setting and Query of Upper Limit and Lower Limit Values of First Parameter for Comparator Function in Count Value Mode

Syntax

Command **:COMParator:FLIMit:COUNt** <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:FLIMit:COUNt?**

Response <Lower Limit Value>,<Upper Limit Value>

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

Explanation

Command Sets the upper limit and lower limit values of the first parameter for the comparator function in count value mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns data for the upper limit and lower limit value settings of the first parameter for the comparator function in order of lower limit value and upper limit value.

Example

Command **`:COMParator:FLIMit:COUNt 112345,123456`**
Sets 112345 for the lower limit value and 123456 for the upper limit value of the first parameter in count value mode.

Query **`:COMParator:FLIMit:COUNt?`**

Response **`:COMPARATOR:FLIMIT:COUNT 112345, 123456`**
(when HEADER ON)
`112345,123456` (when HEADER OFF)
112345 is set for the lower limit value and 123456 is set for the upper limit value of the first parameter in count value mode.

Setting and Query of Reference Value and Upper Limit and Lower Limit Values of First Parameter for BIN Function in Deviation Count Mode

Syntax

Command **:COMParator:FLIMit:CDEViation**
<Reference Value>, <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:FLIMit:CDEViation?**

Response <Reference Value>, <Lower Limit Value>,<Upper Limit Value>
<Reference Value> = -199999 to 999999 (NR1)
<Lower Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)
<Upper Limit Value> = OFF/ Numeric Value from -199999 to 999999 (NR1)

Explanation

Command Sets the reference value and upper limit and lower limit values of the first parameter in deviation count mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the reference value and upper limit and lower limit value settings for the first parameter in deviation count mode in order of lower limit value and upper limit value.

Example

Command
```
:COMParator:FLIMit:CDEViation
250000,-10,10
```
Sets 250000 for the reference value and -10 for the lower limit value and 10 for the upper limit value of the first parameter in deviation count mode.

Query
```
:COMParator:FLIMit:CDEViation?
```
Response
```
:COMParator:FLIMIT:CDEVIATION 250000,-10,10
```
(when HEADER ON)
```
250000,-10,10
```
(when HEADER OFF)
250000 is set for the reference value and -10 is set for the lower limit value and 10 is set for the upper limit value of the first parameter in deviation count mode.

Setting and Query of Reference Value and Upper Limit and Lower Limit Values of First Parameter for Comparator Function in Deviation Percent Mode

Syntax

Command **:COMParator:FLIMit:PDEViation** <Reference Value>, <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:FLIMit:PDEViation?**

Response <Reference Value>,<Lower Limit Value>,<Upper Limit Value>

<Reference Value> = -199999 to 999999 (excluding 0) (NR1)

<Lower Limit Value> = OFF/ Numerical Value from -999.99 to 999.99 (NR2)

<Upper Limit Value> = OFF/ Numerical Value from -999.99 to 999.99 (NR2)

Explanation

Command Sets the reference value and upper limit and lower limit values of the first parameter in deviation percent mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the reference value and upper limit and lower limit value settings for the first parameter in deviation percent mode in order of reference value, lower limit value, and upper limit value.

Example

Command **`:COMParator:FLIMit:PDEViation 250000,-5.0,5.0`**
Sets 250000 for the reference value, -5% for the lower limit value, and 5% for the upper limit value of the first parameter in deviation percent mode.

Query **`:COMParator:FLIMit:PDEViation?`**

Response **`:COMPARATOR:FLIMit:PDEVIATION 250000,-5.0000,5.0000`** (when HEADER ON)
`250000,-5.0000,5.0000` (when HEADER OFF)
250000 is set for the reference value, -5% is set for the lower limit value, and 5% is set for the upper limit value of the first parameter in deviation percent mode.

Setting and Query of Upper Limit and Lower Limit Values of Second Parameter for Comparator Function in Count Value Mode

Syntax

Command **:COMParator:SLIMit:COUNt** <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:SLIMit:COUNt?**

Response <Lower Limit Value>,<Upper Limit Value>

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the upper limit and lower limit values of the second parameter for the comparator function in count value mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns data for the upper limit and lower limit value settings of the second parameter for the comparator function in order of lower limit value and upper limit value.

Example

Command **`:COMParator:SLIMit:COUNt 112345,123456`**
Sets 112345 for the lower limit value and 123456 for the upper limit value of the second parameter in count value mode.

Query **`:COMParator:SLIMit:COUNt?`**

Response **`:COMPARATOR:SLIMIT:COUNT 112345,123456`** (when HEADER ON)

`112345,123456` (when HEADER OFF)

112345 is set for the lower limit value and 123456 is set for the upper limit value of the second parameter in count value mode.

Setting and Query of Reference Value and Upper Limit and Lower Limit Values of Second Parameter for Comparator Function in Deviation Count Mode

Syntax

Command **:COMParator:SLIMit:CDEViation**
<Reference Value>, <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:SLIMit:CDEViation?**

Response <Reference Value>, <Lower Limit Value>,<Upper Limit Value>
<Reference Value> = -199999 to 199999 (NR1)
<Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)
<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the reference value and upper limit and lower limit values of the second parameter in deviation count mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the reference value and upper limit and lower limit value settings for the second parameter in deviation count mode in order of lower limit value and upper limit value.

Example

Command **`:COMParator:SLIMit:CDEViation 1000,-10,10`**
Sets 1000 for the reference value and -10 for the lower limit value and 10 for the upper limit value of the second parameter in deviation count mode.

Query **`:COMParator:SLIMit:CDEViation?`**

Response **`:COMPARATOR:SLIMIT:CDEVIATION 1000,-10,10`** (when HEADER ON)
`1000,-10,10` (when HEADER OFF)
1000 is set for the reference value and -10 is set for the lower limit value and 10 is set for the upper limit value of the second parameter in deviation count mode.

Setting and Query of Reference Value and Upper Limit and Lower Limit Values of Second Parameter for Comparator Function in Deviation Percent Mode

Syntax

Command **:COMParator:SLIMit:PDEViation** <Reference Value>, <Lower Limit Value>,<Upper Limit Value>

Query **:COMParator:SLIMit:PDEViation?**

Response <Reference Value>,<Lower Limit Value>,<Upper Limit Value>

<Reference Value> = -199999 to 199999 (NR1)

<Lower Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

<Upper Limit Value> = OFF/ Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the reference value and upper limit and lower limit values of the second parameter in deviation percent mode.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the reference value and upper limit and lower limit value settings for the second parameter in deviation percent mode in order of reference value, lower limit value, and upper limit value.

Example

Command
```
:COMParator:SLIMit:PDEViation 2000,-5,5
```
Sets 2000 for the reference value, -5 for the lower limit value, and 5 for the upper limit value of the second parameter in deviation percent mode.

Query
```
:COMParator:SLIMit:PDEViation?
```
Response
```
:COMPARATOR:SLIMIT:PDEVIATION 2000,-5,5
```
(when HEADER ON)
```
2000,-5,5
```
(when HEADER OFF)
2000 is set for the reference value, -5 is set for the lower limit value, and 5 is set for the upper limit value of the second parameter in deviation percent mode.

Note

The measurement value for the second parameter in deviation percent mode is the result of the calculation (measurement value - reference value).

Setting and Query of Open Circuit Compensation Function

Syntax

Command **:CORRection:OPEN** <Character>
<Character> ALL/ ON/ OFF/ RETurn

Query **:CORRection:OPEN?**
<Character> = ALL/ ON/ SPOT/ OFF

Explanation

Command Sets the open circuit compensation function.

ALL : Begins taking open compensation data for all measurement conditions (frequency, level), and enables the compensation function.

ON : Begins taking open compensation data for current measurement conditions (frequency, level), and enables the compensation function.

OFF : Disables the compensation function.

RETurn: Recovers all disabled open circuit compensation values.

Query Returns the setting of the open circuit compensation function as characters.

ALL : The compensation function is enabled for all measurement conditions (frequency, level).

ON : The compensation function is enabled for the current measurement conditions (frequency, level).

SPOT: The compensation function is enabled for other than the current measurement conditions (frequency, level).

OFF : The compensation function is disabled.

Example

Command **:CORRection:OPEN ALL**
Enables the compensation function for all measurement conditions (frequency, level).

Query **:CORRection:OPEN?**
Response **:CORRECTION:OPEN ALL** (when HEADER ON)
ALL (when HEADER OFF)
The compensation function is enabled for all measurement conditions (frequency, level).

Note

The compensation value is saved as different values for frequency, level, and frequency shift settings.
When ALL compensation is executed, compensation values are loaded for all the frequencies and levels at the present frequency shift setting.
When the frequency shift or cable length setting is changed, the compensation function is disabled for all measurement conditions.

About Recovering Compensation Values
If you execute :CORRection:OPEN RETurn, the currently set compensation values are enabled for all frequencies and levels at the present frequency shift setting.

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Setting and Query of Open Compensation Values

Syntax

Command **:CORRection:OPEN:DATA** <Compensation values 1>, <Compensation values 2>

Query **:CORRection:OPEN:DATA?**

Response <Compensation values 1>,<Compensation values 2>
<Compensation values 1> = -99.9999E9 to 99.9999E9 (NR3)
<Compensation values 2> = -99.9999E9 to 99.9999E9 (NR3)

Explanation

Command Sets the open compensation value for current measurement conditions (frequency, level, frequency shift).
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns as a numeric value the open compensation value for current measurement conditions (frequency, level, frequency shift).

Note

- The forwarding format for making settings and reading data with this command follows the :CORRection:OPEN:DATA:FORMat setting.

  When the forwarding format is ZPH
  <Compensation values 1> : Z (Z < 0 an execution error)
  <Compensation values 2> : PH (PH < -180, PH > 180 an execution error)

  When the forwarding format is GB
  <Compensation values 1> : G
  <Compensation values 2> : B

  When the forwarding format is CPG
  <Compensation values 1> : Cp
  <Compensation values 2> : G

- When the compensation value is-1E-21 to 1E-21 the setting value will be 0.

Example

Command **:CORRection:OPEN:DATA:FORMat GB**
:CORRection:OPEN:DATA -1.56789E-11,8.91234E-11
When the forwarding format setting is GB, the open compensation value for the current measurement conditions will be set to **-1.56789E-11,8.91234E-11** (G,B).

Query **:CORRection:OPEN:DATA?**
:CORRECTION:OPEN:DATA -1.56789E-11,8.91234E-11
(when HEADER ON)
When the forwarding format setting is GB, the open compensation value for the current measurement conditions is set to **-1.56789E-11,8.91234E-11** (G,B).

Note

- If the value forwarded to this device when converted to G and B is outside of the -99.9999E9 to 99.9999E9 range an execution error will occur.
- You can only set a compensation value that differs according to the frequency shift setting when the frequency is 1 MHz.

Setting and Query of Output Parameter for Open Circuit Compensation Values

Syntax

Command **:CORRection:OPEN:DATA:FORMat** <Character>
Query **:CORRection:OPEN:DATA:FORMat?**
Response <Character> = ZPH/ GB/ CPG

Explanation

Command: Sets the forwarding format of open circuit compensation values.

Query: Returns the setting of the forwarding format for open circuit compensation values.

Example

Command **:CORRection:OPEN:DATA:FORMat GB**
Sets the open circuit compensation values to be the forwarding format G and B.

Query **:CORRection:OPEN:DATA:FORMat?**
Response **:CORRECTION:OPEN:DATA:FORMAT GB** (when HEADER ON)
GB (when HEADER OFF)
The open circuit compensation values are set to be the forwarding format G and B.

Setting and Query of Open Compensation Points

Syntax

Command **:CORRection:OPEN:POINt** <Numeric Value>
Query **:CORRection:OPEN:POINt?**
Response <Numeric Value> = 1 to 255 (NR1)

Explanation

Command Set measurement conditions for open compensation value acquisition during command for open compensation value (:CORRection:OPEN ALL) or acquiring open compensation value using key operation.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
Unused bit (bit6, bit 7) values will be disregarded.

Query Returns settings of measurement conditions for open compensation values.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	Unused	1 MHz, 1 V	1 MHz, 0.5 V	100 kHz, 1 V	100 kHz, 0.5 V	1 kHz, 1 V	1 kHz, 0.5 V

Example

Command **:CORRection:OPEN:POINt 42**
Set to acquire open compensation values under the measurement conditions in “Yes” below during command for open compensation value (:CORRection:OPEN ALL) or acquiring open compensation value using key operation.

Query **:CORRection:OPEN:POINt?**
Response **:CORRECTION:OPEN:POINT 42** (when HEADER ON)
42 (when HEADER OFF)
Returns the open compensation points.

Measurement frequency / Measurement signal level	1 kHz	100 kHz	1 MHz				
			-2%	-1%	0%	1%	2%
500 mV	No	No	No	No	No	No	No
1 V	Yes	Yes	No	No	Yes	No	No

Note

When any setting of the open compensation points is changed, all open compensation values prior to the change will be disabled.

Setting and Query of Short Circuit Compensation Function

Syntax

Command **:CORRection:SHORt** <Character>

<Character> = ALL/ ON/ OFF/ RETurn

Query **:CORRection:SHORt?**

<Character> = ALL/ ON/ SPOT/ OFF

Explanation

Command Sets the short circuit compensation function.

ALL : Begins taking short compensation data for all measurement conditions (frequency, level) and enables the compensation function.

ON : Begins taking short compensation data for current measurement conditions (frequency, level) and enables the compensation function.

OFF : Disables the compensation function.

RETurn: Recovers all disabled short circuit compensation values.

Query Returns the setting of the short circuit compensation function as characters.

ALL : The compensation function is enabled for all measurement conditions (frequency, level).

ON : The compensation function is enabled for the current measurement conditions (frequency, level).

SPOT : The compensation function is enabled for other than the current measurement conditions (frequency, level).

OFF : The compensation function is disabled.

Example

Command **:CORRection:SHORt ON**

Enables the compensation function for the current measurement conditions (frequency, level).

Query **:CORRection:SHORt?**

Response **:CORRECTION:SHORT ON** (when HEADER ON)

ON (when HEADER OFF)

The compensation function is enabled for the current measurement conditions (frequency, level).

Note

The compensation value is saved as different values for frequency, level, and frequency shift settings.
When ALL compensation is executed, compensation values are loaded for all the frequencies and levels at the present frequency shift setting.
When the frequency shift or cable length setting is changed, the compensation function is disabled for all measurement conditions.

About Recovering Compensation Values

If you execute :CORRection:SHORt RETurn, the currently set compensation values are enabled for all frequencies and levels at the present frequency shift setting.

Setting and Query of Short Compensation Values

Syntax

Command **:CORRection:SHORt:DATA** <Compensation values1>, <Compensation values 2>

Query **:CORRection:SHORt:DATA?**

Response <Compensation values 1>,<Compensation values 2>
<Compensation values 1> = -99.9999E9 to 99.9999E9 (NR3)
<Compensation values 2> = -99.9999E9 to 99.9999E9 (NR3)

Explanation

Command Sets the short compensation value for current measurement settings (frequency, level, frequency shift).
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns as a numerical value the short compensation value for current measurement settings (frequency, level, frequency shift).

Note

- The forwarding format for making settings and reading data with this command follows the :CORRection:SHORT:DATA:FORMat setting.

  When the forwarding format is ZPH
  <Compensation values 1> : Z (Z < 0 an execution error)
  <Compensation values 2> : PH (PH < -180, PH > 180 an execution error)

  When the forwarding format is RSX
  <Compensation values 1> : Rs
  <Compensation values 2> : X

  When the forwarding format is LSRS
  <Compensation values 1> : Ls
  <Compensation values 2> : Rs

- When the compensation value is-1E-21 to 1E-21 the setting value will be 0.

Example

Command
```
:CORRection:SHORt:DATA:FORMat RSX
:CORRection:SHORt:DATA 5.67891E-03,3.34564E-05
```
When the forwarding format setting is RSX, the open compensation value for the current measurement conditions will be set to **5.67891E-03,3.34564E-05** (Rs,X).

Query
```
:CORRection:SHORt:DATA?
:CORRection:SHORt:DATA 5.67891E-03,3.34564E-05
```
(when HEADER ON)
5.67891E-03,3.34564E-05 (when HEADER OFF)
When the forwarding format setting is RSX, the open compensation value for the current measurement conditions is set to **5.67891E-03,3.34564E-05** (Rs,X).

Note

- If the value forwarded to this device when converted to R and X is outside of the -99.9999E9 to 99.9999E9 range an execution error will occur.
- You can only set a compensation value that differs according to the frequency shift setting when the frequency is 1 MHz.

Setting and Query of Output Parameter for Short Circuit Compensation Values

Syntax

Command **:CORRection:SHORt:DATA:FORMat** <Character>
Query **:CORRection:SHORt:DATA:FORMat?**
Response <Character> = ZPH/ RSX/ LSRS

Explanation

Command :Sets the forwarding format of short circuit compensation values .

Query Returns the setting of the forwarding format for short circuit compensation values.

Example

Command **:CORRection:SHORt:DATA:FORMat RSX**
Sets the short circuit compensation values to be forwarding format Rs and X.

Query **:CORRection:SHORt:DATA:FORMat?**
Response **:CORRECTION:SHORT:DATA:FORMAT RSX** (when HEADER ON)
RSX (when HEADER OFF)
The short circuit compensation values are set to be forwarding format Rs and X.

Setting and Query of Short Compensation Points

Syntax

Command **:CORRection:SHORt:POINt** <Numeric Value>
Query **:CORRection:SHORt:POINt?**
Response <Numeric Value> = 1 to 255 (NR1)

Explanation

Command: Set measurement conditions for short compensation value acquisition during command for short compensation value (:CORRection:SHORt ALL) or acquiring short compensation value using key operation.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
Unused bit (bit6, bit 7) values will be disregarded.

Query: Returns settings of measurement conditions for short compensation values.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	Unused	1 MHz, 1 V	1 MHz, 0.5 V	100 kHz, 1 V	100 kHz, 0.5 V	1 kHz, 1 V	1 kHz, 0.5 V

Example

Command **:CORRection:SHORt:POINt 17**
Set to acquire short compensation values under the measurement conditions in “Yes” below during command for short compensation value (:CORRection:SHORt ALL) or acquiring short compensation value using key operation.

Query **:CORRection:SHORt:POINt?**
Response **:CORRECTION:SHORt:POINT 17** (when HEADER ON)
17 (when HEADER OFF)
Returns the short compensation points.

Measurement frequency / Measurement signal level	1 kHz	100 kHz	1 MHz				
			-2%	-1%	0%	1%	2%
500 mV	Yes	No	No	No	Yes	No	No
1 V	No	No	No	No	No	No	No

Note

When any setting of the short compensation points is changed, all short compensation values prior to the change will be disabled.

Setting and Query of Load Compensation Function

Syntax

Command **:CORRection:LOAD** <Character>
<Character> = ON/ OFF/ RETurn

Query **:CORRection:LOAD?**
<Character> = ON/ SPOT/ OFF

Explanation

Command Sets the load compensation function.
If ON is set, load compensation data begins to be incorporated based on the current measurement conditions (frequency, frequency shift, level, range, equivalent circuit mode, open circuit compensation, short circuit compensation, display parameter, cable length) and reference values for load compensation values.
After incorporating of the data ends properly, load compensation is enabled. If it does not end properly, the load compensation values remains the same as last time.

ON : Begins taking load compensation values for current measurement conditions and enables the load compensation function.

OFF : Disables all load compensation functions.

RETurn: Recovers all disabled load compensation values.

Query Returns the setting of the load compensation function as characters.

ON : The load compensation function is enabled for the current measurement conditions.

SPOT : The load compensation function is enabled for other than the current measurement conditions.

OFF : The load compensation function is disabled.

Example

Command **`:CORRection:LOAD ON`**
Acquires load compensation value and enables the load compensation function at the current measurement values.

Query **`:CORRection:LOAD?`**
Response **`:CORRECTION:LOAD ON`** (when HEADER ON)
`ON` (when HEADER OFF)
The load compensation function is enabled for the current measurement conditions.

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Setting and Query of Load Compensation Values

Syntax

Command **:CORRection:LOAD:DATA** <Compensation values 1>, <Compensation values 2>

Query **:CORRection:LOAD:DATA?**

Response <Compensation values 1>,<Compensation values 2>

For the load compensation value forwarding format COEFFICIENT and ZPH
<Compensation values 1> = 1E-21 to 99.9999E9 (NR3)
<Compensation values 2> = -180 to 180 (NR2)

For the load compensation value forwarding format CD,CQ
<Compensation values 1> = -19.9999E-6 to 99.9999E-6 (NR3) (excluding -1E-21 to 1E-21)
<Compensation values 2> = -19999.9 to 19999.9 (NR2)

Explanation

Command: Sets the load compensation values for the current frequency. The measurement conditions, which enable the load compensation value (frequency shift, level, range, display parameter, cable length), are the current measurement conditions, however, when the forwarding format is CD or CQ, the display parameter, which enables the load compensation value, is dependent on the forwarding format.

Query: Returns the load compensation value for the current frequency as a numerical value. When the forwarding format is CD or CQ, the internal Z and θ values will be converted and returned according to the current equivalent circuit mode.

Note

- The forwarding format for making settings and reading data with this command follows the :CORRection:LOAD:DATA:FORMat setting.
- When the forwarding format is COEFFICIENT
  <Compensation values 1> : Z_COEF
  <Compensation values 2> : PH_COEF
  When the forwarding format is ZPH
  <Compensation values 1> : Z
  <Compensation values 2> : PH
  When the forwarding format is CD
  <Compensation values 1> : C
  <Compensation values 2> : D
  When the forwarding format is CQ
  <Compensation values 1> : C
  <Compensation values 2> : Q
- When the forwarding format is CD or CQ, the setting value, Cp or Cs, which is set depending on the current equivalent mode, will be converted into the actual Z and θ measurement values.
  Z compensation rate = (Z reference value)/ (Z actual value)
  θ compensation rate = (θ reference value) - (θ actual value)
  Using the above formula and the changed actual Z and θ measurement values, the compensation rates will be calculated.
- If the forwarding format is CD or CQ but different from display parameter, LOAD compensation value is not valid.
- When the compensation value is -1E-21~1E-21 the setting value will be 0.
- If the value forwarded to this device when converted to Z is outside of the Z:IE-21 to 99.9999E9 range an execution error will occur.

Setting and Query of Load Compensation Values

Example

Command
```
:CIRCuit SERial
:CORRection:LOAD:DATA:FORMat CD
:CORRection:LOAD:DATA 100.289E-12,0.16250
```
When the current equivalent circuit is SER, the load compensation rate will be set after converting CsD to Zθ.

Query
```
:CIRCuit PARallel
:CORRection:LOAD:DATA:FORMat CD
:CORRection:LOAD:DATA?
:CORRection:LOAD:DATA 97.7089E-12,0.16250
```
(when HEADER ON)
```
97.7089E-12,0.16250
```
(when HEADER OFF)
When the current equivalent circuit is PAR, the load compensation value will be returned after converting Zθ to CpD.

Setting and Query of Output Format for Load Compensation Values

Syntax

Command **:CORRection:LOAD:DATA:FORMat** <Character>
Query **:CORRection:LOAD:DATA:FORMat?**
Response <Character> = COEFficient/ ZPH/ CD/ CQ

COEFficient : Outputs the impedance compensation coefficient and phase compensation coefficient.
ZPH : Outputs the actual measurement values for the impedance and phase.
CD : Outputs the actual measurement values for C and D.
CQ : Outputs the actual measurement values for C and Q.

Explanation

Command Sets the output format for load compensation values.

Query Returns the setting of the output format for load compensation values.

Example

Command
```
:CORRection:LOAD:DATA:FORMat COEFficient
```
Sets the impedance compensation coefficient and phase compensation coefficient to be forwarding format.

Query
```
:CORRection:LOAD:DATA:FORMat?
```
Response
```
:CORRECTION:LOAD:DATA:FORMAT COEFFICIENT
```
(when HEADER ON)
```
COEFFICIENT
```
(when HEADER OFF)
The impedance compensation coefficient and phase compensation coefficient are set to be forwarding format.

Setting and Query of Reference Values for Load Compensation Conditions

Syntax

Command **:CORRection:LOAD:REFerence** <Reference Value 1>,<Reference Value 2>

Query **:CORRection:LOAD:REFerence?**

Response <Reference Value 1> = Numeric Value from -199999 to 999999 (NR1)

<Reference Value 2> = Numeric Value from -199999 to 199999 (NR1)

Explanation

Command Sets the reference values for the load compensation conditions <Reference Value 1> indicates the reference value for C (capacitance) and <Reference Value 2> indicates the reference value for the second parameter (D or Q).
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the reference value setting in the order of <Reference Value 1> and <Reference Value 2>.

Example

Command
```
:CORRection:LOAD:REFerence 100000,1000
```
The load compensation conditions to C = 100000 pF and D (Q) = 1000.

Query
```
:CORRection:LOAD:REFerence?
```
Response
```
:CORRECTION:LOAD:REFERENCE 100000,1000
```
(when HEADER ON)
```
100000,1000
```
(when HEADER OFF)
The reference values for the load compensation conditions are set to C = 100000 pF and D (Q) = 1000.

Note

- If the reference value is changed while load compensation is enabled, the compensation factor needed to perform load compensation will be recalculated.
- The absolute value which defines the count value differs depending on the setting range and display parameter settings used when taking the load compensation value or setting the load compensation value (:CORRetion:LOAD:DATA).
- When the second parameter is Q, values from -1E-21 to 1E-21 in the setting range of <Reference Value 2> will produce execution errors.

Setting and Query of OFFSET Compensation Function

Syntax

Command **:CORRection:OFFSet** <ON/ OFF>

Query **:CORRection:OFFSet?**

Response <ON/ OFF>
ON :Enables the offset compensation function.
OFF :Disables the offset compensation function.

Explanation

Command Set the offset compensation function to ON or OFF.

Query Return the offset compensation function as ON or OFF.

Example

Command **:CORRection:OFFSet ON**
Enables the offset function.

Query **:CORRection:OFFSet?**

Response **:CORRECTION:OFFSET ON** (when HEADER ON)
ON (when HEADER OFF)
The offset compensation function is enabled.

Setting and Query of OFFSET Compensation Values

Syntax

Command **:CORRection:OFFSet :DATA** <C offset compensation value>,<The second parameter offset compensation value>

Query **:CORRection:OFFSet:DATA?**

Response <C offset compensation value>,<The second parameter offset compensation value>
<C offset compensation value> = -10.0000E -6 to 10.0000E -6 (NR3)
When the display parameter is D
<The second parameter offset compensation value> = -1.99999 to 1.99999 (NR2)
When the display parameter is Q
<The second parameter offset compensation value> = -19999.9 to 19999.9 (NR2)

Explanation

Command Sets the offset compensation value.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
(The C offset compensation value is not rounded off)

Query The offset compensation value settings are returned in the order of C offset compensation value (NR3 numerical value), and second parameter offset compensation value (NR2 numerical value).

Example

Command **:CORRection:OFFSet:DATA 1.00000E-12,0.0001**
Sets the C offset compensation value to 1.00000E-12 and the second parameter offset compensation value to 0.0001.

Query **:CORRection:OFFSet:DATA?**

Response **:CORRECTION:OFFSET:DATA 1.00000E-12,0.0001**
(when HEADER ON)
1.00000E-12,0.0001 (when HEADER OFF)
The C offset compensation value is set to 1.00000E-12, and the second parameter offset compensation value is set to 0.0001.

Setting and Query of Low C Reject Function

Syntax

Command **:CREJect** <ON/ OFF>

Query **:CREJect?**

Response <ON/ OFF>
ON :If the measurement value is abnormally low, it is detected as an error.
OFF :Even if the measurement value is abnormally low it is not considered an error.

Explanation

Command Enables or disables Low C reject function.

Query Returns the Low C reject function setting as ON or OFF.

Example

Command **:CREJect ON**
Enables the Low C reject function.

Query **:CREJect?**

Response **:CREJECT ON** (when HEADER ON)
ON (when HEADER OFF)
The Low C reject function is enabled.

Setting and Query of Low C Reject Function Limit Value

Syntax

Command **:CREJect:LIMit** <Numeric Value>

Query **:CREJect:LIMit?**

Response <Numeric Value> = 0.000 to 10.000 (NR2)

Explanation

Command Sets the Low C reject function limit value.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query Returns the Low C reject function limit value setting.

Example

Command **:CREJect:LIMit 1.000**
Set the Low C reject function limit value to 1%. If the measurement value C is lower than 1% relative to the measurement range, a Low C contact error will be detected.

Query **:CREJect:LIMit?**

Response **:CREJECT:LIMIT 1.000** (when HEADER ON)
1.000 (when HEADER OFF)
The Low C reject function limit value is set to 1%.

Setting and Query of Display

Syntax

Command **:DISPlay** <ON/ OFF>

Query **:DISPlay?**

Response <ON/ OFF>
ON :The display is always lit.
OFF :The display remains off as long as there is no key control.

Explanation

Command Turns the display ON/ OFF.

Query Returns whether the display is ON or OFF.

Example

Command **:DISPlay ON**
Makes the display always be lit up.

Query **:DISPlay?**

Response **:DISPLAY ON** (when HEADER ON)
ON (when HEADER OFF)
The display is set to always be lit up.

Query of RS-232C Communication Error

Syntax

Query **:ERRor?**

Response <Numeric Value>

<Numeric Value> = 0 to 7 (NR1)
1 Parity error (error in data)
2 Framing error (data read incorrectly)
4 Overrun error (loss of data)

Explanation

Query Returns the RS-232C communication error register content as NR1 numeric data from 0 to 7 and then clears that content.
No header is added 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

Query **:ERRor?**

Response **4**
An overrun error was generated.

Setting and Query of Event Status Enable Register 0 (ESER0)

Syntax

Command **:ESE0** <Numeric Value>
Query **:ESE0?**
Response <Numeric Value>
<Numeric Value> = 0 to 255 (NR1)

Explanation

Command Sets the mask pattern of the ESER0 to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The initial value (when the power is turned on) is 0.

Query Returns the ESER0 content as an NR1 numeric value.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
REF	VLO	IHI	MOF	MUF	IDX	EOM	CEM

Example

Command **:ESE0 20**
Sets bit 4 and bit 2 of ESER0.
Query **:ESE0?**
Response **:ESE0 20** (when HEADER ON)
20 (when HEADER OFF)
Bit 4 and bit 2 of ESER0 are set to 1.

Setting and Query of Event Status Enable Register 1 (ESER1)

Syntax

Command **:ESE1** <Numeric Value>
Query **:ESE1?**
Response <Numeric Value>
<Numeric Value> = 0 to 255 (NR1)

Explanation

Command Sets the mask pattern of the ESER1 to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The initial value (when the power is turned on) is 0.

Query Returns the ESER1 content as an NR1 numeric value.

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

Example

Command **:ESE1 64**
Sets bit 6 of ESER1.
Query **:ESE1?**
Response **:ESE1 64** (when HEADER ON)
64 (when HEADER OFF)
Bit 6 of ESER1 is set to 1.

Setting and Query of Event Status Enable Register 2 (ESER2)

Syntax

Command **:ESE2** <Numeric Value>
Query **:ESE2?**
Response <Numeric Value>
<Numeric Value> = 0 to 255 (NR1)

Explanation

Command Sets the mask pattern of the ESER2 to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The initial value (when the power is turned on) is 0.

Query Returns the ESER2 content as an NR1 numeric value.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
BIN8	BIN7	BIN6	BIN5	BIN4	BIN3	BIN2	BIN1

Example

Command **:ESE2 1**
Sets bit 0 of ESER2.
Query **:ESE2?**
Response **:ESE2 1** (when HEADER ON)
1 (when HEADER OFF)
Bit 0 of ESER2 is set to 1.

Setting and Query of Event Status Enable Register 3 (ESER3)

Syntax

Command **:ESE3** <Numeric Value>
Query **:ESE3?**
Response <Numeric Value>
<Numeric Value> = 0 to 255 (NR1)

Explanation

Command Sets the mask pattern of the ESER3 to a numeric value from 0 to 255.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.
The initial value (when the power is turned on) is 0.

Query Returns the ESER3 content as an NR1 numeric value.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
DNG	OUT	Low C	BIN13	BIN12	BIN11	BIN10	BIN9

Example

Command **:ESE3 64**
Sets bit 6 of ESER3.
Query **:ESE3?**
Response **:ESE3 64** (when HEADER ON)
64 (when HEADER OFF)
Bit 6 of ESER3 is set to 1.

Query of Event Status Register 0

Syntax

Query **:ESR0?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Query Returns the event status register 0 (ESR0) setting content as NR1 numeric data from 0 to 255 and then clears that content.
No header is added 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
REF	VLO	IHI	MOF	MUF	IDX	EOM	CEM

Example

Query **:ESR0?**
Response **4**
Bit 2 of ESR0 is 1.

Query of Event Status Register 1

Syntax

Query **:ESR1?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Query Returns the event status register 1 (ESR1) setting content as NR1 numeric data from 0 to 255 and then clears that content.
No header is added 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
LER	AND	SLO	SIN	SHI	FLO	FIN	FHI

Example

Query **:ESR1?**
Response **82**
Bit 6, bit 4, and bit 1 of ESR1 are 1.

Query of Event Status Register 2

Syntax

Query **:ESR2?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Query Returns the event status register 2 (ESR2) setting content as NR1 numeric data from 0 to 255 and then clears that content.
No header is added 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
BIN8	BIN7	BIN6	BIN5	BIN4	BIN3	BIN2	BIN1

Example

Query **:ESR2?**
Response **1**
Bit 0 of ESR2 is 1.

Query of Event Status Register 3

Syntax

Query **:ESR3?**
Response <Numeric Value>

<Numeric Value> = 0 to 255 (NR1)

Explanation

Query Returns the event status register 3 (ESR3) setting content as NR1 numeric data from 0 to 255 and then clears that content.
No header is added 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
DNG	OUT	Low C	BIN13	BIN12	BIN11	BIN10	BIN9

Example

Query **:ESR3?**
Response **64**
Bit 6 of ESR3 is 1.

Setting and Query of Measurement Frequency

Syntax

Command **:FREQuency** <Numeric Value>
Query **:FREQuency?**
Response <Numeric Value>

<Numeric Value> = 1.00000E+03/ 100.000E+03/ 1.00000E+06 (NR3)
(only for 3505)

Explanation

Command: Sets the measurement frequency.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the setting of the current measurement frequency as an NR3 numeric value.

Example

Command **:FREQuency 1.00000E+3**
Sets the measurement frequency to 1 kHz.

Query **:FREQuency?**
Response **:FREQUENCY 1.00000E+3** (when HEADER ON)
1.00000E+3 (when HEADER OFF)
The measurement frequency is set to 1 kHz.

Setting and Query of the Frequency Shift Function

Syntax

Command **:FREQuency:SHIFt** <Numeric Value>
Query **:FREQuency:SHIFt?**
Response <Numeric Value> = -2 to 2 (NR1)

Explanation

Command: Sets the measurement frequency shift ratio.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the measurement frequency shift ratio as an NR1 numerical value

Example

Command **:FREQuency:SHIFt 1**
Sets the measurement frequency shift ratio to 1%. If the measurement frequency is 1 MHz, the measurement frequency actual value is 1.01 MHz.

Query **:FREQuency:SHIFt?**
Response **:FREQUENCY:SHIFT 1** (when HEADER ON)
1 (when HEADER OFF)
The measurement frequency shift ratio is set to 1%.

Note

When the measurement frequency 1 kHz or 100 kHz (only for 3505), the measurement frequency is not shifted. The frequency shift function is only effective when the measurement frequency is 1 MHz.

Setting and Query of RS-232C Communication Handshake

Syntax

Command **:HANDshake** <Character>
Query **:HANDshake?**
Response <Character> = X/ HARDware/ BOTH/ OFF

X : Software handshake
HARDware : Hardware handshake
BOTH : Software handshake + hardware handshake
OFF : No handshake

Explanation

Command: Sets the communication handshake.

Query: Returns the setting of the communication handshake as characters.

Example

Command **:HANDshake X**
Sets the communication handshake to software handshake.

Query **:HANDshake?**
Response **:HANDshake X** (when HEADER ON)
X (when HEADER OFF)
The communication handshake is set to software handshake.

Setting and Query of Header for Response Messages

Syntax

Command **:HEADer** <ON/ OFF>
Query **:HEADer?**
Response <ON/ OFF>

ON : Sets a header to be added to response messages.
OFF : Does not set a header to be added to response messages.

Explanation

Command: Sets whether there is a header for response messages.
This is initialized to OFF when the power is turned on.

Query: Returns ON or OFF for the header setting of response messages.

Example

Command **:HEADer ON**
Sets a header to be added to response messages.

Query **:HEADer?**
Response **:HEADER ON** (when HEADER ON)
ON (when HEADER OFF)
A header is set to be added to response messages.

Setting and Query of Current Detection Circuit Monitoring Function

Syntax

Command **:ICHeck** <ON/ OFF>
Query **:ICHeck?**
Response <ON/ OFF>

ON : Starts monitoring of the current detection circuit.
OFF : Stops monitoring of the current detection circuit.

Explanation

Command: Enables or disables the current detection circuit monitoring function.

Query: Returns the current detection circuit monitoring function setting as ON or OFF.

Example

Command **:ICHeck ON**
Starts monitoring of the current detection circuit.

Query **:ICHeck?**
Response **:ICHECK ON** (when HEADER ON)
ON (when HEADER OFF)
Monitoring of current detection circuit is enabled.

Setting and Query of Delay time for Judgement Result Output and $\overline{\text{EOM}}$ Output Period in EXT I/O

Syntax

Command **:IO:OUTPut:DELay** <Numeric Value>
Query **:IO:OUTPut:DELay?**
Response <Numeric Value> = 0 to 0.9999 (NR1)

Explanation

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

Query: Returns settings EXT I/O delay time for comparator or BIN judgement result output and $\overline{\text{EOM}}$ output period.

Example

Command **:IO:OUTPut:DELay 0.0005**
Sets EXT I/O delay time for comparator or BIN judgement result output and $\overline{\text{EOM}}$ output period to 500 μs.

Query **:IO:OUTPut:DELay?**
Response **:IO:OUTPUT:DELay 0.0005** (when HEADER ON)
0.0005 (when HEADER OFF)
EXT I/O delay time for comparator or BIN judgement result output and $\overline{\text{EOM}}$ output period sets 500 μs.

Note

There is an approximate error of 100 μs in the delay time entered for comparator and the BIN judgement result ↔ $\overline{\text{EOM}}$ period for the setting value. In addition, during measurement, a trigger input from EXT/IO or communicating by interface may lead to the delay time varying widely. As far as possible, try not to control from external sources when carrying out measurement.

Setting and Query of Output of Judgment Result Signal Line in EXT I/O

Syntax

Command **:IO:RESult:RESet** <Character>

Query **:IO:RESult:RESet?**

Response <Character> = ON/ OFF

ON : Reset the judgement results at the same time as measurement starts.

OFF : Updates the measurement results when measurement ends.

Explanation

Command Sets whether to reset the judgment result signal line in EXT I/O.

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

Note

The judgment result signal line indicates judgment results for C or D-HI, C or D-IN, and C or D-LO for comparator measurement and judgment results OUT-OF-BINS, D-NG, and BIN1 to BIN13 for BIN measurement.

See 7.1 "About the EXT I/O Connector" (p. 121)

Example

Command **:IO:RESult:RESet OFF**

Sets the judgment results to be updated when measurement ends.

Query **:IO:RESult:RESet?**

Response **:IO:RESULT:RESET OFF** (when HEADER ON)

OFF (when HEADER OFF)

The judgment results are set to be updated when judgment ends.

Setting and Query of Judgment Mode for Comparator and BIN Functions

Syntax

Command **:JUDGment:MODE** <Character>

Query **:JUDGment:MODE?**

Response <Character> = COUNt/ CDEViation/ PDEViation

COUNt : Count value mode

CDEViation : Deviation count (Δ) mode

PDEViation : Deviation percent (Δ%) mode

Explanation

Command Selects the judgment mode.

Query Returns the judgment mode as characters.

Example

Command **:JUDGment:MODE COUNt**

Selects count value mode.

Query **:JUDGment:MODE?**

Response **:JUDGMENT:MODE COUNT** (when HEADER ON)

COUNT (when HEADER OFF)

The judgment mode is set to count value mode.

Setting and Query of Key Lock Function

Syntax

Command **:KEYLock** <ON/ OFF>
Query **:KEYLock?**
Response <ON/ OFF>

Explanation

Command: Sets the key lock function to ON/ OFF.

Query: Returns ON or OFF for the setting of the key lock function.

Example

Command **:KEYLock ON**
Sets the key lock function to ON.

Query **:KEYLock?**
Response **:KEYLOCK ON** (when HEADER ON)
ON (when HEADER OFF)
The key lock function is set to ON.

Setting and Query of Measurement Signal Level

Syntax

Command **:LEVel** <Numeric Value>
Query **:LEVel?**
Response <Numeric Value>

<Numeric Value> = 1/ 0.5 (NR2)
1: 1 V, 0.5: 500 mV

Explanation

Command: Sets the measurement signal level.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the setting of the measurement signal level as an NR2 numeric value.

Example

Command **:LEVel 0.5**
Sets the measurement signal level to 500 mV.

Query **:LEVel?**
Response **:LEVEL 0.5** (when HEADER ON)
0.5 (when HEADER OFF)
The measurement signal level is set to 500 mV.

Setting and Query of Measurement Level Monitoring Function

Syntax

Command **:LEVel:CHECk** <ON/ OFF>
Query **:LEVel:CHECk?**

Explanation

Command: Set whether or not to judge the amount of change of the voltage and current monitor levels

Query: Returns the measurement level monitoring function setting as ON or OFF.

Example

Command
```
:LEVel:CHECk ON
```
Enables the measurement level monitoring function.

Query
```
:LEVel:CHECk?
```
Response
```
:LEVEL:CHECK ON
```
(when HEADER ON)
ON (when HEADER OFF)
The measurement level monitoring function is set to ON.

Setting and Query of Threshold for Judging Abnormal Measurement Level

Syntax

Command **:LEVel:CHECk:LIMit** <Numeric Value>
Query **:LEVel:CHECk:LIMit?**

<Numeric Value> = 0.01 to 100.00 (NR2)

Explanation

Command: Sets the threshold for detecting abnormal measurement level.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the threshold for abnormal measurement level as an NR2 numerical value.

Example

Command
```
:LEVel:CHECk:LIMit 5.00
```
Sets the threshold for judging abnormal measurement level to 5%.
During a measurement if the amount of change of the monitor values (voltage monitor value, current monitor value) exceeds ±5% it is detected as an outside of limit range error.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query
Response
```
:LEVel:CHECk:LIMit?
:LEVEL:CHECK:LIMIT 5.00
```
(when HEADER ON)
5 (when HEADER OFF)
The threshold for judging abnormal measurement level is set to 5%.

Loading of Specified Panel Number

Syntax
Command **:LOAD** <Numeric Value>
<Numeric Value> = 1 to 70 (NR1)

Explanation
Command Loads the specified panel number.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

Example
Command **:LOAD 2**
Loads panel number 2.

Setting and Query of Load Method

Syntax
Command **:LOAD:TYPE** <Character>
Query **:LOAD:TYPE?**
<Character> = ALL/ CORRection/ HARDware
ALL : Sets the device settings and compensation values to be loaded.
CORRection: Sets the compensation values to be loaded.
HARDware : Sets the device settings to be loaded.

Explanation
Command Sets the load method.
Query Returns the setting of the load method as characters.

Example
Command **:LOAD:TYPE CORRection**
Sets only the data of the compensation values to be loaded at load time.
Query **:LOAD:TYPE?**
Response **:LOAD:TYPE CORRECTION** (when HEADER ON)
CORRECTION (when HEADER OFF)
Only the data of the compensation values are set to be loaded at load time.

Note
When the device settings are changed, there is a 300 ms wait. The load time can be shortened by setting the load method to compensation value only.

Query of Measurement Data

Syntax

Query **:MEASure?**

Response

- During normal measurement
  <Measurement Status (NR1)>,C <Measurement Value (NR3)>, D (Q) <Measurement Value (NR2)>,<Panel Load Number (NR1)>

<Measurement Status>	
0	Normal
1	No measurements are made when the power supply is turned on
2	Outside of guaranteed accuracy range
3	Outside of C display range
4	Abnormal level detected
5	Outside of Low C reject limit range
6	Applied voltage abnormality
-7	Under range
7	Over range
8	Current detection abnormality
9	Time out
10	Sampling errors

- During comparator measurement
  <Measurement Status(NR1)>,<Comparison Result Logical AND>, <Measurement Value of C (NR3)>,<Comparison Result of C>, <Measurement Value of D (Q) (NR2)>,<Comparison Result of D(Q) > ,<Panel Load Number (NR1)>

<Comparison Result Logical AND> = 0/ 1	
0	When one of C and D (Q) is LO or HI or both parameters were not judged
1	When the judgment results for both C and D (Q) are IN (within the range) or if one of the parameters was not judged but the judgment result of the judged one is IN.

<Comparison Result> = 0/ 1/ -1/ 2	
0	IN
1	HI
-1	LO
2	Not judged (when the upper limit and lower limit values are OFF)

- During BIN measurement
  <BIN Result>, <Measurement Value of C (NR3)>, <Measurement Value of D (Q) (NR2)>, <Panel Load Number (NR1)>

<BIN Result> = -1, -2, 1 to 13	
1 to 13	BIN No.
-1	OUT OF BINS
-2	DNG

However, if not even one measurement has been performed since the settings of the unit were changed, the measurement values obtained when the previous settings were configured are returned.

Query of Measurement Data

Note

- The data number returned to :MEASure? uses the :MEASure:VALid setting.
  See "Setting of Valid Data For Measurement Data Query (:MEASure)" (p. 231)
- If panel load has not been performed, or if measurement conditions have been changed after panel load has been performed, the panel load number will return 0.

Explanation

Query

- Normal measurement
  Returns the measurement status, measurement values, and panel load number.
- Comparator measurement
  Returns the measurement status, measurement values, comparison result of the comparator, and panel load number.
  However, if not even one measurement has been performed since the measurement mode was changed, 2 is returned for the comparison results of both C and D (Q).
- BIN measurement
  Returns the measurement status, the measurement values, BIN measurement result, and panel load number.
  However, if not even one measurement has been performed since the measurement mode was changed, OUT OF BINS is returned for the BIN measurement result.

Example

- During normal measurement, when the second parameter is D.

Query
```
:MEASure?
```
Response
```
0,CP 1.23456E-06,D 0.12345,0
```
(when HEADER ON)
```
0,1.23456E-06,0.12345,0
```
(when HEADER OFF)

- Comparator measurement, the second parameter is D, when panel number 5 is loaded.

Query
```
:LOAD 5
:MEASure?
```
Response
```
0,0,CP 1.23456E-06,0,D 0.12345,-1,5
```
(when HEADER ON)
```
0,0,1.23456E-06,0,0.12345,-1,5
```
(when HEADER OFF)
Indicates that the judgment result for C is IN and the judgment result for D is LO.

- During BIN measurement, when the second parameter is D.

Query
```
:BIN ON
:MEASure?
```
Response
```
0,1,CP 1.23456E-06,Q 3456.7,0
```
(when HEADER ON)
```
0,1,1.23456E-06,3456.7,0
```
(when HEADER OFF)
Indicates that the measurement value is within the set BIN1 range.

Note

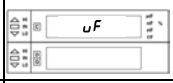
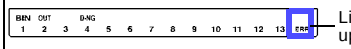
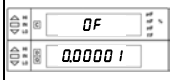
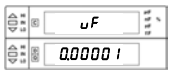
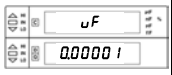
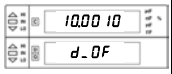
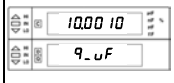
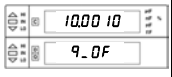
- The header of C returns CS when the equivalent circuit is a series-equivalent circuit and CP when the equivalent circuit is a parallel-equivalent circuit.

Query of Measurement Data

Note The following values are returned in the case of abnormal measurement.

Priority rank	Measurement abnormality	Measurement Status	Comparator result logical product	BIN result	C measurement value	C COMP result	D (Q) measurement value	D (Q) COMP result
High	Sampling errors	10	0	-1	333333E+33	1	333333	1
	Time out	9	0	-1	444444E+44	1	444444	1
	Current detection abnormality	8	0	-1	555555E+55	1	555555	1
	Over range	7	0	-1	999999E+99	1	999999	1
	Under range	-7	0	-1	-999999E+99	-1	-999999	-1
	Applied voltage abnormality	6	0	-1	666666E+66	1	666666	1
	Outside of Low C reject limit range	5	Standard judgment	Standard judgment	Measurement value	Standard judgment	Measurement value	Standard judgment
	Abnormal level detected	4	0	-1	777777E+77	1	777777	1
	Outside of C display range (normal measurement + comparator and BIN measurement (count setting)) *1	3	0	-1	999999E+99	1	Measurement value	Standard judgment
	Outside of C display range (comparator and BIN measurement (Δ setting))	3	0	-1	999999E+99 / -999999E+99	1 / -1	Measurement value	Standard judgment
	Outside of C display range (comparator and BIN measurement (Δ% setting))	3	0	-1	999999E+99 / -999999E+99	1 / -1	Measurement value	Standard judgment
	Outside of D display range	0	0	-1/-2	Measurement value	Standard judgment	999999/ -999999	1/-1
	Outside of Q display range	0	*2 0, Standard judgment	*3 -1/-2, Standard judgment	Measurement value	Standard judgment	999999/ -999999	*4 -1, Standard judgment
	Outside of guaranteed accuracy range	2	Standard judgment	Standard judgment	Measurement value	Standard judgment	Measurement value	Standard judgment
Low	No measurements are made when the power supply is turned on	1	0	-1	888888E+88	2	888888	2

*1: Display shows -199999 when C measurement value falls below -199999
*2: Normal evaluation carried out when value falls outside of upper limit of Q display range and returns 0 when value falls below lower limit
*3: Normal evaluation carried out when value falls outside of upper limit of Q display range and returns -1/-2 when value falls below lower limit
*4: Normal evaluation carried out when value falls outside of upper limit of Q display range and returns -1 when value falls below lower limit

EXT I/O output							
Priority rank	Measurement abnormality	$\overline{\text{ERR}}$ (pin 14)	$\overline{\text{BIN1}}$ to $\overline{\text{BIN13}}$	$\overline{\text{OUT OF BINS}}$ (pin 37)	$\overline{\text{D-NG}}$ (pin 39)	Comparator Output (Output pin)	Panel display
High	Sampling errors	LOW	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Time out	LOW	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Current detection abnormality	HI	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Over range	HI	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Under range	HI	HI	LOW	HI	$\overline{\text{C-LOW}}$ (pin 31) $\overline{\text{D-LOW}}$ (pin 8)	
	Applied voltage abnormality	LOW	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Outside of Low C reject limit range	LOW	LOW / HI	LOW / HI	LOW / HI	Standard judgment	 Light up
	Abnormal level detected	LOW	HI	LOW	HI	$\overline{\text{C-HI}}$ (pin 30) $\overline{\text{D-HI}}$ (pin 7)	
	Outside of C display range (normal measurement + comparator and BIN measurement (count setting)) *1	HI	HI	LOW	HI	C: $\overline{\text{C-HI}}$ (pin 30) D: Standard judgment	
	Outside of C display range (comparator and BIN measurement (Δ setting))	HI	HI	LOW	HI	C: $\overline{\text{C-HI}}$ (pin 30) or $\overline{\text{C-LOW}}$ (pin 31) D: Standard judgment	 or 
	Outside of C display range (comparator and BIN measurement (Δ% setting))	HI	HI	LOW	HI	C: $\overline{\text{C-HI}}$ (pin 30) or $\overline{\text{C-LOW}}$ (pin 31) D: Standard judgment	 or 
	Outside of D display range	HI	HI	LOW / HI	LOW / HI	C: Standard judgment D: $\overline{\text{D-HI}}$ (pin 7) or $\overline{\text{D-LOW}}$ (pin 8)	 or 
	Outside of Q display range	HI	LOW / HI	LOW / HI	LOW / HI	C: Standard judgment D: $\overline{\text{D-HI}}$ (pin 7) or $\overline{\text{D-LOW}}$ (pin 8)	 or 
	Outside of guaranteed accuracy range	HI	LOW / HI	LOW / HI	LOW / HI	Standard judgment	
Low	No measurements are made when the power supply is turned on	HI	HI	HI	HI	No output	

Setting of Valid Data For Measurement Data Query (:MEASure)

Syntax

Command **:MEASure:VALid** <Numeric Value>
Query **:MEASure:VALid?**
Response <Numeric Value> = 0 to 255 (NR1)

Explanation

Command Sets the measurement value result returned by measurement data query (:MEASure?).
Query Returns the measurement value result returned by measurement data query (:MEASure?) as NR1 numerical value data between 0 and 255.

128 bit 7	64 bit 6	32 bit 5	16 bit 4	8 bit 3	4 bit 2	2 bit 1	1 bit 0
Unused	Measurement Status	Comparator result logical product, or BIN result	C measurement value	C COMP result	D (Q) measurement value	D (Q) COMP result	Panel load number

Example

Command **`:MEASure:VALid 20`**
Set the unit so that when the measurement data query (:MEASure) is performed, the C measurement value and D (Q) measurement value will be returned.
Query **`:MEASure:VALid?`**
Response **`:MEASure:VALid 20`** (when HEADER ON)
`20` (when HEADER OFF)
The unit is set to return the C measurement value and D (Q) measurement value when the measurement data query (:MEASure) is performed.

Query of Measurement Values Saved to Memory by the Measurement Value Memory Function

Syntax

Query **:MEMory?** <Character>

Response <Character> = No Data/ ALL

- When there is no data section
  <First Item in Memory><Message Terminator><Second Item in Memory><Message Terminator>...<nth Item in Memory> <Message Terminator>
  n indicates a number up to 1000.
- When the characters of the data section are ALL
  <First Item in Memory><Comma(,)><Second Item in Memory><Comma(,)>...<nth Item in Memory><Message Terminator>

Explanation

Query

- Returns all of the most recent measurement values saved to memory by the measurement value memory function.
- The measurement results for a maximum of 1000 most recent measurements are saved to memory. To delete the data from memory, use the :MEMory:CLEar command.
- The format of items in memory is the same as that of the response data of the :MEASure? query. For details on the format, refer to the explanation of the :MEASure? query (p. 227).
- A memory terminator is inserted between each memory item when :MEMory? and a comma (,) is inserted between each memory item when :MEMory? ALL.
- The number of data items currently saved to memory can be confirmed with the :MEMory:COUNt? query.
- If the trigger setting is set to internal trigger, the number of data items obtained with the :MEMory:COUNt? query and the n value may differ. Set the trigger setting to external trigger before using the :MEMory:COUNt? query.

Example

During normal measurement, when the second parameter is D, and the initial measurement value is saved in memory:

Query **:MEMory?**

Response **CP 1.23456E-06, D 0.12345** (when HEADER ON)

1.23456E-06, 0.12345 (when HEADER OFF)

Note

GP-IB When :MEMory? is executed, only the first item in memory is returned with the first receive operation (specified talker). To obtain all measurement values saved to memory, perform the receive operation a number of times equal to the number of data items saved to memory or send :MEMory? ALL and then perform the receive operation once.

RS-232C The only difference between :MEMory? and :MEMory? ALL is whether data is separated by a message terminator or comma (,).
When :MEMory? is executed, there is no need to perform the receive operation a number of times equal to the number of data items saved to memory in order to obtain all measurement values.

Deleting Data from Memory of Measurement Value Memory Function

Syntax

Command **:MEMory:CLEar**

Explanation

Command Deletes all measurement values saved to memory by the measurement value memory function.
If this command is sent, subsequent measurement values are saved from the beginning of memory.

Example

Command **:MEMory:CLEar**
Deletes all measurement values saved to memory.

Query of Number of Measurement Values Saved to Memory by the Measurement Value Memory Function

Syntax

Query **:MEMory:COUNt?**
Response <Numeric Value>

<Numeric Value> = 0 to 1000 (NR1)

Explanation

Query Returns the number of data items saved to memory by the measurement value memory function as an NR1 numeric value.
No header is added to the response message.

Example

Query **:MEMory:COUNt?**
Response **1**
Indicates that one measurement value is saved to memory.

Setting and Query of Measurement Value Memory Function ON/ OFF

Syntax

Command **:MEMory:CONTrol** <ON/ OFF>
Query **:MEMory:CONTrol?**
Response <ON/ OFF>
ON :The measurement value is saved to memory.
OFF :The measurement value is not saved to memory.

Explanation

Command Sets the measurement value memory function ON/ OFF.
When the setting is changed all saved measurement values are erased.

Query Returns whether the measurement value memory function is ON or OFF.

Example

Command **:MEMory:CONTrol ON**
Sets so that the measurement value is saved each time a measurement is made.

Query **:MEMory:CONTrol?**
Response **:MEMORY:CONTROL ON** (when HEADER ON)
ON (when HEADER OFF)
The device is set to save the measurement value each time a measurement is made.

Setting and Query of Measurement Value Memory Function Memory Size

Syntax

Command **:MEMory:POINts** <Numeric Value>
Query **:MEMory:POINts?**
Response <Numeric Value> = 1 to 1000 (NR1)

Explanation

Command: Sets the memory size (the number of measurements to save).When the setting is changed all saved measurement values are erased. A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the memory size as an NR1 numerical value.

Example

Command
```
:MEMory:POINts 200
```
Sets the memory size to 200.

Query
```
:MEMory:POINts?
```
Response
```
:MEMORY:POINTS 200
```
(when HEADER ON)
```
200
```
(when HEADER OFF)
The memory size is set to 200.

Query of Voltage and Current Monitor Values

Syntax

Query **:MONItor?**
Response <Voltage Monitor Value(NR3)>,<Current Monitor Value(NR3)>

Explanation

Query: Returns the measurement signal monitor values in the order of voltage monitor value and current monitor value.

Example

Query
```
:MONItor?
```
Response
```
9.56789E-01,7.34567E-05
```
The voltage monitor value and current monitor value are set to 0.956789 V and 73.4567 μA.

Setting and Query of Voltage and Current Monitor Levels Display

Syntax

Command **:MONItor:DISPlay** <ON/ OFF>
Query **:MONItor:DISPlay?**
Response <ON/ OFF>
ON :Displays measurement signal monitor level in the SUB display area.
OFF :Does not display the measurement signal monitor level in the SUB display area.

Explanation

Command Sets the measurement signal monitor level display to ON or OFF.

Query Returns the measurement signal monitor level display as ON or OFF.

Example

Command **:MONItor:DISPlay ON**
Set the measurement signal monitor level to be displayed.
Query **:MONItor:DISPlay?**
Response **MONITOR:DISPLAY ON** (when HEADER ON)
ON (when HEADER OFF)
The measurement signal monitor level is set to be displayed.

Setting and Query of the Second Parameter

Syntax

Command **:PARAmeter** <D/ Q>
Query **:PARAmeter?**
<D/ Q>
D :Dissipation factor is the second parameter.
Q :Quality factor (the reciprocal of D) is the second parameter.

Explanation

Command Sets the second parameter.

Query Returns the second parameter as a letter.

Example

Command **:PARAmeter D**
Set the second parameter to D.
Query **:PARAmeter?**
Response **:PARAMETER D** (when HEADER ON)
D (when HEADER OFF)
The second parameter is set to D.

Initializing the Unit

Syntax

Command **:PRESet**

Explanation

Command Resets the unit to its original initialized state.
This initialized state differs from that when resetting with the ∗RST command.
See Appendix 7 "Initial Settings Table" (p. A11)

Setting and Query of Measurement Range

Syntax

Command **:RANGe** <Numeric Value>
Query **:RANGe?**
Response <Numeric Value>
<Numeric Value> = 1 kHz : 9 to 24 (NR1)
100 kHz : 3 to 18 (NR1) (only for 3505)
1 MHz : 1 to 12 (NR1)

Explanation

Command
Sets the measurement range.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.
If this command is executed, the setting of the :RANGe:AUTO command is automatically changed to OFF.
If this command is executed when the setting of the equivalent circuit is set to AUTO, the setting (SER/ PAR) of the equivalent circuit is automatically changed to the optimal setting.

Query
Returns the setting of the measurement range as an NR1 numeric value.

Example

Command **:RANGe 5**
Sets the measurement range to 5 (4.7 pF) (when 1 MHz).

Query **:RANGe?**
Response **:RANGE 5** (when HEADER ON)
5 (when HEADER OFF)
The measurement range is set to 5 (4.7 pF) (when 1 MHz).

Note

Range No.	Range		
	1 kHz	100 kHz (only for 3505)	1 MHz
1			220 fF
2			470 fF
3		1 pF	1 pF
4		2.2 pF	2.2 pF
5		4.7 pF	4.7 pF
6		10 pF	10 pF
7		22 pF	22 pF
8		47 pF	47 pF
9	100 pF	100 pF	100 pF
10	220 pF	220 pF	220 pF
11	470 pF	470 pF	470 pF
12	1 nF	1 nF	1 nF
13	2.2 nF	2.2 nF	
14	4.7 nF	4.7 nF	
15	10 nF	10 nF	
16	22 nF	22 nF	
17	47 nF	47 nF	
18	100 nF	100 nF	
19	220 nF		
20	470 nF		
21	1 μF		
22	2.2 μF		
23	4.7 μF		
24	10 μF		

Automatic Setting and Query of Measurement Range

Syntax

Command **:RANGe:AUTO** <ON/ OFF>
Query **:RANGe:AUTO?**
Response <ON/ OFF>

ON : Changes the measurement range automatically.
OFF : Does not change the measurement range automatically.

Explanation

Command: Sets the measurement range to be changed automatically.

Query: Returns ON or OFF for the automatic setting of the measurement range.

Example

Command **:RANGe:AUTO ON**
Sets the measurement range to be changed automatically.

Query **:RANGe:AUTO?**
Response **:RANGE:AUTO ON** (when HEADER ON)
ON (when HEADER OFF)
The measurement range is set to be changed automatically.

Query and Saving of Specified Panel Number

Syntax

Command **:SAVE** <No.>
Query **:SAVE?** <No.>
Response 0/ 1

<No.>1 to 70 (NR1)

Explanation

Command: Specifies the panel number and saves the measurement conditions.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

Query: Returns 1 if measurement conditions are saved for the specified number, and 0 if no measurement conditions are saved.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.
No header is added to the response message.

Example

Command **:SAVE 3**
Saves the measurement conditions to Panel No. 3.

Query **:SAVE? 3**
Response **1**
Measurement conditions are saved to Panel No. 3.

Clearing the Specified Panel Number

Syntax
Command **:SAVE:CLEar** <ALL/ Numeric Value>
<ALL/ Numeric Value> = ALL/ 1 to 70 (NR1)

Explanation
Command Erases the saved panel data.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

Example
Command **:SAVE:CLEar 5**
Erases the saved data of panel No. 5.

Setting and Query of Measurement Speed

Syntax
Command **:SPEEd** <Character>
Query **:SPEEd?**
Response <Character>
<Character> = FAST/ NORMal/ SLOW

Explanation
Command Sets the measurement speed.
Query Returns the setting of the measurement speed as characters.

Example
Command **:SPEEd NORMal**
Sets the measurement speed to normal speed.

Query **:SPEEd?**
Response **:SPEED NORMAL** (when HEADER ON)
NORMAL (when HEADER OFF)
The measurement speed is set to normal speed.

Setting and Query of Trigger Synchronous Output Function

Syntax
Command **:SSOurce** <ON/ OFF>
Query **:SSOurce?**
Response <ON/ OFF>
ON : Enables the trigger synchronous output function.
OFF : Disables the trigger synchronous output function.

Explanation
Command Enables/disables the trigger synchronous output function.
Query Returns ON or OFF for the current setting of the trigger synchronous output function.

Example
Command **:SSOurce ON**
Enables the trigger synchronous output function.

Query **:SSOurce?**
Response **:SSOURCE ON** (when HEADER ON)
ON (when HEADER OFF)
The trigger synchronous output function is enabled.

Setting and Query of Wait Time for Trigger Synchronous Output Function

Syntax

Command **:SSOurce:WAIT** <Character>, <Wait Time >

Query **:SSOurce:WAIT?** <Character>

Response <Character> = 1kHz, 100kHz (only for 3505), 1MHz

<Wait Time 1> = 0 to 9.999 (NR2)

Set the wait time for the specified measurement frequency.

Explanation

Command Sets the wait time before commencing measurement after the measurement signal has been output by the trigger.

Query Returns the trigger synchronous output function wait time as a numerical value.

Example

Command **`:SSOurce:WAIT 1k,0.250`**

Sets the wait time from after the trigger to the start of measurement to 250ms for 1kHz.

Query **`:SSOurce:WAIT?`**

Response **`:SSOURCE:WAIT 1K,0.250`** (when HEADER ON)

`1k,0.250` (when HEADER OFF)

The wait time from after the trigger to the start of measurement is set to 250ms for 1kHz.

Setting and Query of Terminator of Response Message

Syntax

Command **:TRANsmit:TERMinator** <Numeric Value>
<Numeric Value> = 0 to 255 (NR1)

Query **:TRANsmit:TERMinator?**

Response <Numeric Value> = 0/ 1 (NR1)

Explanation

Command Sets the terminator of the response message.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

- When RS-232C
  CR+LF : when 0
  CR : when 1 to 255
- When GP-IB
  LF+EOI : when 0
  CR+LF+EOI : when 1 to 255

Query Returns the setting of the terminator of the response message as NR1 numeric data of 0 and 1.

- When RS- 232C
  CR+LF : when 0
  CR : when 1
- When GP-IB
  LF+EOI : when 0
  CR+LF+EOI : when 1

Example

Command **:TRANsmit:TERMinator 0**

- RS- 232C
  Sets the terminator to CR+LF.
- GP-IB
  Sets the terminator to LF+EOI.

Query **:TRANsmit:TERMinator?**

Response **:TRANSMIT:TERMINATOR 0** (when HEADER ON)
0 (when HEADER OFF)

RS-232C : The terminator is set to CR+LF.

GP-IB : The terminator is set to LF+EOI.

Setting and Query of Trigger Mode

Syntax

Command **:TRIGger** <Character>
Query **:TRIGger?**
Response <Character>

<Character> = INTernal/ EXTernal
INTernal : Internal trigger
EXTernal : External trigger

Explanation

Command: Sets the trigger mode.

Query: Returns the setting of the trigger mode as characters.

Example

Command
:TRIGger INTernal
Sets the trigger mode to internal trigger.

Query **:TRIGger?**
Response **:TRIGGER INTERNAL** (when HEADER ON)
INTERNAL (when HEADER OFF)
The trigger mode is set to internal trigger.

Setting and Query of Trigger Delay Time

Syntax

Command **:TRIGger:DELay** <OFF/ Numeric Value>
Query **:TRIGger:DELay?**
Response <OFF/ Numeric Value> = OFF/ 0 to 9.999 (NR2)

Explanation

Command: Sets the trigger delay time.
When the trigger delay time is set, the trigger delay function will not be automatically set to ON.
A numeric value in NRf format is accepted but decimals are rounded off so the numeric value can be handled.

Query: Returns the trigger delay time as a NR2 numerical value.

Example

Command
:TRIGger:DELay 0.1
Sets so that measurement will commence 100 ms after the trigger.

Query **:TRIGger:DELay?**
Response **:TRIGGER:DELAY 0.1** (when HEADER ON)
0.1 (when HEADER OFF)
Measurement is set to commence 100 ms after the trigger.

Note

A command of OFF is accepted, but the setting will become 0, and 0 response will be returned.

Setting and Query of Trigger Delay Function

Syntax

Command **:TRIGger:DELay:STATe** <ON/ OFF>
Query **:TRIGger:DELay:STATe?**
Response <ON/ OFF>

Explanation

Command: Sets the trigger delay function ON/ OFF.

Query: Returns whether the trigger delay function is set to ON or OFF.

Example

Command
```
:TRIGger:DELay:STATe ON
```
Enables the trigger delay function

Query
```
:TRIGger:DELay:STATe?
:TRIGGER:DELAY:STATE ON
```
(when HEADER ON)
```
ON
```
(when HEADER OFF)
The trigger delay function is set to ON.

Setting and Query of User ID

Syntax

Command **:USER:IDENtity** <ID>
Query **:USER:IDENtity?**
Response <ID>

<ID> = User ID Code (Example: AB-1234)
A to Z, a to z, 0 to 9, and - (hyphen)

Explanation

Command: Allows you to set an ID code for the user.
The ID code is backed up in the same manner as the settings of the unit.
If more than 12 characters are entered, only the first 12 characters are valid.
The user ID code is cleared when the system is reset.

Query: Returns the setting of the ID as characters or numeric values.

Example

Command
```
:USER:IDENtity AB-1234
```
Stores AB-1234 as the user ID.

Query
```
:USER:IDENtity?
```
Response
```
:USER:IDENTITY AB-1234
```
(when HEADER ON)
```
AB-1234
```
(when HEADER OFF)
The user ID is set to AB-1234.

Note

If the device is initialized via the front panel, the user ID will be reset to "HIOKI".

Setting and Query of the Applied Voltage Value Monitoring Function

Syntax

Command **:VCHeck** <ON/ OFF>
Query **:VCHeck?**
Response <ON/ OFF>

ON : Starts monitoring of the applied voltage value.
OFF : Stops monitoring of the applied voltage value.

Explanation

Command: Enables or disables the applied voltage value monitoring function.

Query: Returns the applied voltage value monitoring function setting as ON or OFF.

Example

Command **:VCHeck ON**
Starts monitoring of the applied voltage value.

Query **:VCHeck?**
Response **:VCHECK ON** (when HEADER ON)
ON (when HEADER OFF)
Monitoring of applied voltage value is enabled.

Setting and Query of the Applied Voltage Value Monitoring Function Limit Value

Syntax

Command **:VCHeck:LIMit** <Numeric Value>
Query **:VCHeck:LIMit?**
Response <Numeric Value> = 0.01 to 100.00 (NR2)

Explanation

Command: Sets the applied voltage value monitoring function limit value.
A numeric value in NRf format is accepted but non significant digits are rounded off so the numeric.

Query: Returns the applied voltage value monitoring function limit value setting.

Example

Command **:VCHeck:LIMit 1.50**
An error will be detected if the absolute value of the amount of movement of the applied voltage value relative to the measurement signal is 1.50% or greater.

Query **:VCHeck:LIMit?**
Response **:VCHECK:LIMIT 1.50** (when HEADER ON)
1.50 (when HEADER OFF)
The applied voltage value monitoring limit value is set to 1.50%.

8.9.3 Response Format of Queries for Returning Values

Measurement Values

C (Capacitance) <NR3>

(-)□.□□□□□ E±□□
1 2 3

1: Sign part: The only sign added is the minus sign (-) when the value is negative
2: Mantissa part: 6 digit numeric value + decimal point
3: Exponent part: 2 digit numeric value

D (Dissipation Factor) <NR2>

(-)□.□□□□

Numeric value with 5 digits after the decimal point

Q (Quality Factor) <NR2>

(-)□.□□□□

Numeric value with 1 digits after the decimal point

Compensation Values

Compensation Values for Open Circuit and Short Circuit Compensation

- Residual Impedance (Z, G, B, Cp, Rs, X, Ls) <NR3>

(-)□.□□□□□ E±□□
1 2 3

1: Sign part: The only sign added is the minus sign (-) when the value is negative
2: Mantissa part: 6 digit numeric value + decimal point
3: Exponent part: 2 digit numeric value

- Phase Angle <NR2>

(-)□□□.□□□
(-)□□.□□□
(-)□.□□□

1: Sign part: The only sign added is the minus sign (-) when the value is negative
2: Numeric value part: Numeric value with 3 digits after the decimal point

Compensation Values for Load <NR2>

- Impedance Compensation Coefficient

  □.□□□□□
  □□.□□□□
  □□□.□□□
  □□□□.□□
  □□□□□□

  6 digit numeric value+ decimal point

- Phase Compensation Values and Phase Angle <NR2>

  (-) □□□.□□□
  (-) □□.□□□
  (-) □.□□□

  1: Sign part: The only sign added is the minus sign (-) when the value is negative
  2: Numeric value part: Numeric value with 3 digits after the decimal point

- Residual Impedance (Z, C) <NR3>

  (-)□.□□□□□ E±□□
  1 2 3

  1: Sign part: The only sign added is the minus sign (-) when the value is negative
  2: Mantissa part: 6 digit numeric value + decimal point
  3: Exponent part: 2 digit numeric value

- D (Dissipation Factor) <NR2>

  (-)□.□□□□□

  Numeric value with 5 digits after the decimal point

- Q (Quality Factor) <NR2>

  (-)□□□□□.□

  Numeric value with 1 digits after the decimal point

OFFSET For Compensation Values

- C offset compensation value

  (-)□.□□□□□ E±□□
  1 2 3

  1: Sign part: The only sign added is the minus sign (-) when the value is negative
  2: Mantissa part: 6 digit numeric value + decimal point
  3: Exponent part: 2 digit numeric value

- D (Q) offset compensation value

  (-)□□□□□.□

  1: Sign part: The only sign added is the minus sign (-) when the value is negative
  2: Mantissa part: 6 digit numeric value

Upper Limit and Lower Limit Values for BIN and COMP

COUNT Mode, Δ Mode <NR1>

(-)□□□□□□ 6 digit numeric value

Δ% Mode

(-)□□□.□□
(First parameter: C<NR2>)

1: Sign part : The only sign added is the minus sign (-) when the value is negative
2: Numeric value part: Numeric value with 2 digits after the decimal point

(-)□□□□□□
(Second parameter: D<NR1>)

1: Sign part : The only sign added is the minus sign (-) when the value is negative
2: Numeric value part: 6 digit numeric value

8.10 Initialized Items

Some items are initialized when, for example, the power is turned on. Refer to the table below.

RS-232C

●: Initialized/ ×: Not Initialized

Initialization Method Item	Upon Power On	*RST Command	*CLS Command
Device-specific functions (range, etc.)	×	●	×
Output queue	●	×	×
Input buffer	●	×	×
Status byte register	●	×	● *2
Event register	● *3	×	●
Enable register	●	×	×
Current path	●	×	×
Header ON/ OFF	●	●	×

GP-IB

●: Initialized/ ×: Not Initialized

Initialization Method Item	Upon Power On	*RST Command	Clearing of Device*	*CLS Command
GP-IB address	×	×	×	×
Device-specific functions (range, etc.)	×	●	×	×
Output queue	●	×	●	×
Input buffer	●	×	●	×
Status byte register	●	×	× *1	● *2
Event register	● *3	×	×	●
Enable register	●	×	×	×
Current path	●	×	●	×
Header ON/ OFF	●	●	×	×

*1 Only the MAV bit (bit 4) is cleared.
*2 Other than the MAV bit is cleared.
*3 Excluding the PON bit (bit 7).

* This means to initialize the unit.

8.11 Creating Programs

This section describes an example of how to use the Windows development language Visual Basic2005 Express Edition to operate the 3505/3506 unit from a PC via RS-232C, incorporate measurement values, and save measurement values to a file.

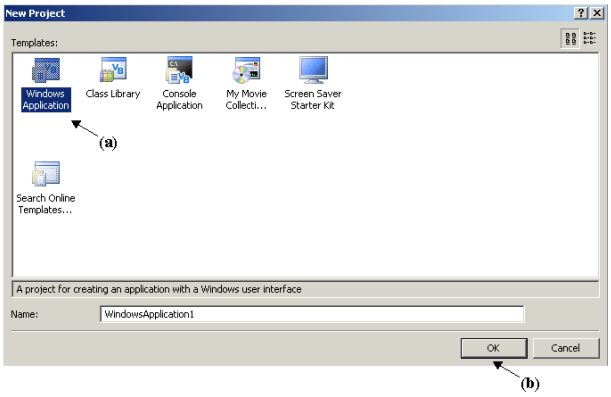
- Windows and Visual Basic2005 are registered trademarks of Microsoft Corporation.

8.11.1 Creation Procedure

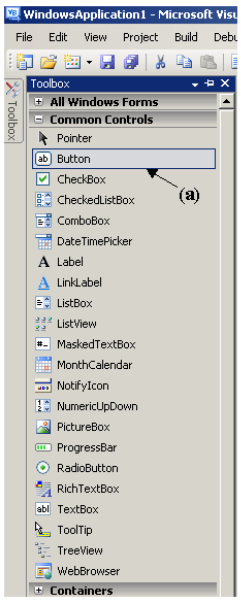
This section describes the procedure for using Visual Basic2005 to create programs. Visual Basic2005 is referred to as VB2005 hereafter.

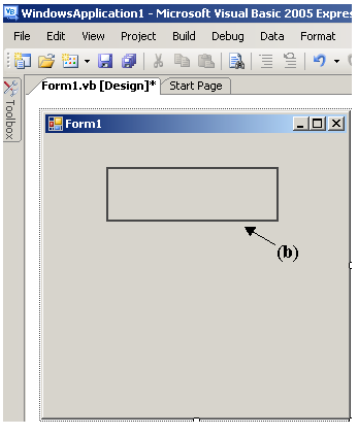
NOTE

Depending on the environment of the PC and VB2005, the procedure may differ slightly from the one described here. For a detailed explanation on how to use VB2005, refer to the instruction manual or Help of VB2005.

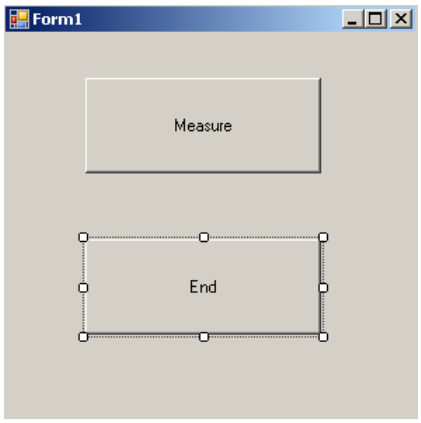


1. Startup VB2005, select [Windows Application] from [File] - [New Project] (a), and click the "OK" button (b).

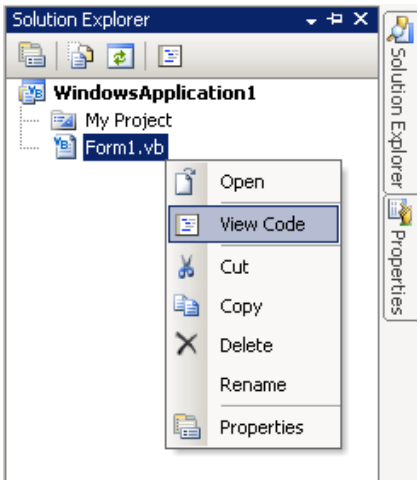




2. Click on the common control [Button] icon (a), and then drag the mouse over the form layout window (b) to insert the button.

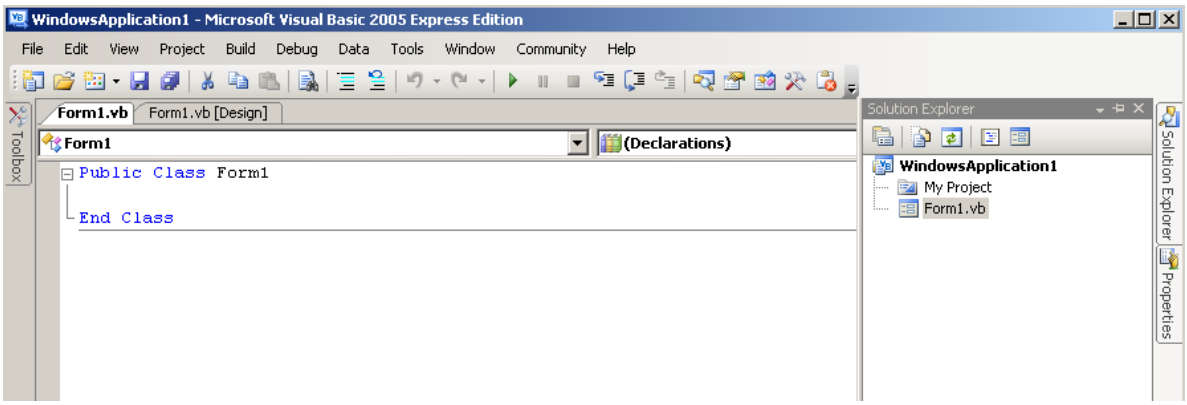


3. **Use the method in step 2 to create another button, and edit the text in the property window of each button to appear as in the diagram.**



4. **Right-click above [From1] in the solution explorer, and select [View Code].**

Follow the procedure below so that the VB2005 window becomes as shown in the diagram below. Write a program referring to 8.11.2 "Sample Programs" (p. 249), and execute the created program.



8.11.2 Sample Programs

Shown below is a sample program which uses VB2005 to enact RS-232C communication, set the 3505/ 3506 measurement conditions, read measurement results and then save them to file. The sample program will be written in the following manner.

8.11.1 "Creation Procedure" (p. 247) description.....Write using sample program
Button created to begin measuremen..... Button1
Button created to close application Button2
When the [Begin Measurement] is pressed, the 3505/ 3506 takes 10 measurements and writes the measurement values to a [data.csv] file.
When the [Quit] button is pressed the program closes.
The following program is written entirely in [Form1] code.

```
Imports System
Imports System.IO
Imports System.IO.Ports

Public Class Form1
‘Perform process when Button1 is pressed
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click
Dim recvstr As String
    Dim i As Integer

    Try
        Button1.Enabled = False                          'Disable buttons during communication ..... (a)
        Button2.Enabled = False
        Dim sp As New SerialPort("COM1", 9600, Parity.None, 8, StopBits.One) 'Communication port setting .... (b)
        sp.NewLine = vbCrLf                              'Terminator setting .....(c)
        sp.ReadTimeout = 2000                            '2 second time out ..... (d)
        sp.Open()                                        'Open port
        SendSetting(sp)                                  '3505/ 3506 settings
        FileOpen(1, "data.csv", OpenMode.Output)         'Create text file to be saved ..... (e)
        For i = 1 To 10
            sp.WriteLine("*TRG;:MEAS?")                  'Begin measurement and read measurement
                                                          results command ..... (f)
            recvstr = sp.ReadLine()                      'Read measurement results
            WriteLine(1, recvstr)                        'Write to file
        Next i
        FileClose(1)                                     'Close file
        sp.Close()                                       'Close port
        Button1.Enabled = True
        Button2.Enabled = True
    Catch ex As Exception
        MessageBox.Show(ex.Message, "Error", MessageBoxButtons.OK, MessageBoxIcon.Error)
    End Try

End Sub
'Set measurement conditions
Private Sub SendSetting(ByVal sp As SerialPort)
    Try
        sp.WriteLine(":HEAD OFF")                        'Header : OFF
        sp.WriteLine(":LEV 0.5")                         'Signal level : 500 mV
        sp.WriteLine(":FREQ 1E6")                        'Measurement frequency : 1 MHz
        sp.WriteLine(":TRIG EXT")                        'Trigger : external trigger
    Catch ex As Exception
        MessageBox.Show(ex.Message, "Error", MessageBoxButtons.OK, MessageBoxIcon.Error)
    End Try
End Sub
‘Close program when Button2 is pressed
Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button2.Click
Me.Dispose()
End Sub
End Class
```

(a) This makes it so that during communication the [Begin Measurement] and [Close] buttons cannot be pressed.
(b) Matches the 3505/ 3506 communication conditions and the computer usage conditions.
The port to be used on the computer: 1
Transmission speed: 9600 bps
Parity: none
Data length: 8 bit
Stop bit: 1bit
(c) Sets CR + LF as the terminator indicating the end of the sending and receiving character string.
(d) Sets the reading operation time to 2 seconds.
(e) Opens the “data.csv” file. However, if a file with this name already exists, the previous “data.csv” will be deleted and a new file created.
(f) Sends the command to the 3505/ 3506 to perform one measurement and return that measurement result to the computer.

8.12 Troubleshooting the Interface

If the interface is not working properly, check the following causes and solve the problem accordingly. In particular, if you are using a PC from the NEC PC-9801 series as the controller, refer to the following because there are some precautionary notes specific to that series.
* Causes and solutions without a mark are common to both RS-232C and GP-IB.

Symptom	Cause/Solution
RS-232C/GP-IB does not work at all.	• Is the cable connected properly? • Is the power of all connected devices turned on? • Is the correct cable being used? • Are the settings of the communication conditions correct? RS-232C • Is the address setting of the unit correct? GP-IB • Is the address identical to that of another device? GP-IB
Cannot perform RS-232C/GP-IB communication properly.	• Are the RS-232C settings (baud rate, data bit length, parity, and stop bits) of the 3505/ 3506 unit and PC the same? RS-232C • Configure the message terminator (delimiter) of the controller properly. GP-IB See "Message Terminator" (p. 140)
The keys do not work after using RS-232C/GP-IB for communication.	• Press the LOCAL key on the panel of the unit to cancel the remote state. • Was the LLO (local lockout) command sent? • Send the GTL command to switch to the local state. GP-IB
The program stops when attempting to read data in INPUT. RS-232C	• Be sure to send a query each time before INPUT. • Did the sent query generate an error?
The GP-IB path is stopped when attempting to read data in INPUT @ (ENTER). GP-IB	• Be sure to send a query each time before INPUT @ (ENTER). • Did the sent query generate an error?
An operation is not performed even though the command was sent.	• Use *ESR? to view the content of the standard event status register and confirm the type of error. • Use *ERR? to check whether an RS-232C communication error was generated. RS-232C
The number of read data sections was insufficient (PC-9801).	• Try using LINE INPUT for data including a comma (,).
Only one response was returned despite sending multiple queries.	• Was an error generated? • Perform one read for each query sent. When you want them to be read in one go, use message separators and place the description on a single line.
The query response message differs from the indications on the panel.	• The indications when the controller performs the read may sometimes not match because the response message is created when the unit receives the query.
Service requests are sometimes not generated. GP-IB	• Are the service request enable register and each event status enable register configured properly? • At the end of the SRQ process subroutine, use an *CLS command to clear all event registers. If the bits of an event are not cleared once, a service request will not be generated for the same event.

Symptom	Cause/Solution
Service requests do not function properly (PC-9801). GP-IB	• When using N88BASIC, add the following four lines (command to set the SRQ flag of a PC-9801 to OFF) to the SRQ process subroutine DEF SEG=SEGPTR (7) A%=PEEK(&H9F3) A%=A% AND &HBF POKE &H9F3,A%
A beep tone is played if a TRG command is sent.	• Is the trigger setting configured to internal trigger? • The *TRG command is only valid for the external trigger setting. The internal trigger setting generates an execution error.
The hardware handshake is not functioning properly. RS-232C	• Is a cable that has CA (RTS) and CB (CTS) shorted being used? Use a cross cable that does not have CA (RTS) and CB (CTS) shorted.

8.13 Device Document Requirements GP-IB

Standard implementation method related information based on the IEEE 488.2 standard

(1) Functionality of IEEE 488.1 interface function

This is included in 8.2.2 "GP-IB Specifications" (p. 131).

(2) Explanation of operation when the address is set to other than a value from 0 to 30.

Such a setting is not possible.

(3) Recognition of change to the address initially set by the user

The change to the address is recognized when the address is changed.

(4) Explanation of the device settings at power on

The status information is cleared. Other information is backed up. However, the header and response message terminator are initialized.

(5) Description of message exchange options

- Capacity and operation of input buffer
  This is included in8.6.2 "About the Output Queue and Input Buffer" (p. 143).
- Queries that return multiple response message units

:BIN:FLIMit:COUNt? 3
:BIN:FLIMit:CDEViation? 3
:BIN:FLIMit:PDEViation? 3
:BIN:SLIMit:COUNt? 2
:BIN:SLIMit:CDEViation? 2
:BIN:SLIMit:PDEViation? 2
:COMParator:FLIMit:COUNt? 2
:COMParator:FLIMit:CDEViation? 3
:COMParator:FLIMit:PDEViation? 3
:COMParator:SLIMit:COUNt? 2
:COMParator:SLIMit:CDEViation? 3
:COMParator:SLIMit:PDEViation? 3
:CORRection:LOAD:DATA? 2
:CORRection:LOAD:REFerence? 2
:CORRection:OFFSet:DATA? 2
:CORRection:OPEN:DATA?.....2
:CORRection:SHORt:DATA? 2
:MEASure?..... 0 to 7
:MEMory? .....1 to 1000

- Queries that result in the creation of a response once the syntax is checked
  All queries result in the creation of responses once the syntax is checked.
- Use/non use of queries that result in a response being created upon being read
  Queries that result in a response being created when they are read by the controller are not used.
- Use/non use of a coupling command
  There is no such command.

(6) List of the functional elements used for device-specific commands and explanation of whether to use compound command program headers

The following are used
- Program message
- Program message terminator
- Program message unit
- Program message unit separator
- Command message unit
- Query message unit
- Command program header
- Query program header
- Program data
- Character program data
- Decimal numeric program data
- Compound command program header

(7) Explanation of buffer capacity limits related to block data

Block data is not used

(8) List of program data elements used in <expression> and maximum nesting level for sub-expressions (including syntax rules assigned for <expression> by device)

Sub-expressions are not used. The program data elements used are character program data and decimal numeric program data.

(9) Explanation of response syntax for each query

The response syntax is included in 8.9 "Message Reference" (p. 171).

(10) Explanation of delay in sending messages between devices not following response message element rules

Messages are not sent between devices

(11) Explanation of block data response capacity

There is no block data response.

(12) List of the common commands and queries used

This is included in 8.7 "Message List" (p. 151).

(13) Explanation of the device state after the calibration command ends without a problem

The ∗CAL? command is not used

(14) Use/non use of the "∗DDT" command

In the case of a ∗DDT command being executed, the maximum block length used to define the trigger macro.
The ∗DDT command is not used.

(15) Use/non use of the macro command

In the case of the macro command being executed, the maximum macro label length, the maximum block length used to define the macro, and how to process reflection when extending the macro.
The macro command is not used.

(16) Explanation of queries related to the identification and response for the ∗IDN? query

These are defined in 8.9.1 "Common Commands" (p. 172).

(17) Capacity of the user data storage area protected by executing the ∗PUD command and ∗PUD? query

The ∗PUD command and ∗PUD? query are not used. Furthermore, there is no user data storage area.

(18) Explanation of resources when the ∗RDT command and ∗RDT? query are used

The ∗RDT command and ∗RDT? query are not used. Furthermore, there is no user data storage area.

(19) Explanation of effect of ∗RST, ∗LRN?, ∗RCL?, and ∗SAV

∗LAN?, ∗RCL?, and ∗SAV are not used. The ∗RST command returns the unit to the initial state.
(Refer to 8.9.1 "Common Commands" (p. 172), 8.10 "Initialized Items" (p. 246).)

(20) Explanation of the range of the self test executed by the ∗TST? query

This is included in the section on ∗TST? (p. 172) in 8.9.1 "Common Commands".

(21) Explanation of additional structure for the status data used in the status report of the Device

This is included in 8.6.4 "About Event Registers" (p. 146).

(22) Explanation of whether each command is an overlap or sequential command

All commands except :MEASure?, :MEMory?, :CORRection:OPEN, :CORRection:SHORt, and :CORRection:LOAD are sequence commands.

(23) Explanation of criteria related to the function requested when an operation end message is generated as a response for a command

The operation end message is generated when the command is analyzed.

Specifications Chapter 9

9.1 Basic Specifications

Product Specifications

Measurement items	C (capacitance) - D (dissipation factor tanδ), C (capacitance) - Q (Quality factor)
Measurement Frequency	1 kHz, 100 kHz (only for 3505), 1 MHz Frequency shift .....1 MHz ±1%, ±2% Frequency accuracy .....±0.01% or less
Measurement Signal Level	Open terminal voltage mode: 500 mV, 1 V Output resistance: Approx. 1 Ω (Above 2.2 μF range at 1 kHz Above 22 nF range at 100 kHz) Approx. 20 Ω (Ranges other than the above-mentioned) Signal level accuracy: ±10% ± 5 mV
Guaranteed Accuracy Range	C : 0.001 fF to 15.0000 μF D : 0.00000 to 1.99999 Q : 0.1 to 19999.9
Measurement Range	C : 100 pF to 10 μF (1 kHz, 16 range) 1 pF to 100 nF (100 kHz, 16 range) (only for 3505) 220 fF to 1 nF(1 MHz, 12 range) Auto, manual (up, down)
Equivalent Circuit Mode	Series and parallel equivalent circuit modes Auto, manual
Measurement Time	Representative value: 2.0 ms (measurement speed: FAST) * The measurement speed differs depending on the measurement speed.
Measurement Speed	FAST, NORMAL, SLOW
Trigger Function	Setting of internal trigger or external trigger is possible
Compensation	Open circuit and Short circuit compensation, Load circuit compensation, Offset circuit compensation
Cable length compensation	0 m, 1 m, 2 m (Adjusted with 1.5D-2V coaxial cables)
Self Calibration	Decreases temperature drift of the measurement value. AUTO..... Calculates compensation after every measurement and enacts self calibration. MANUAL... Takes a self calibration value only when a communication or the signal to acquire the self calibration value is input via the external I/O. Self calibration is enacted each time this occurs. • In the case of EXT.I/O, a standard measurement is executed following input of the TRG signal and then the self calibration value is taken. • In the case of communication, only the self calibration value is acquired, without executing a standard measurement.

Product Specifications

Average	1 to 256 (necessary)
Triggerdelay	0 to 9.999s (0.001s resolution)
Low C Reject Function	Detect contact abnormality (detects OPEN state of 2 terminals during measurement). Output as a contact error if the measurement value is lower than the judgment standard. Judgement standard ..Can be set to 0.001% to 10.000% (0.001% resolution) of the full case of the range. Error output .....LED lights up, as well as error output from EXT I/O.
Measurement Level Monitoring Function	Detect contact abnormalities (detect chattering) Takes the first waveform effective value (the first half of a waveform during FAST setting, otherwise the first waveform effective value) as a basis for comparison, and outputs a contact error if the fluctuation of the following waveform effective values exceeds the judgment standard. Judgment standard ....0.01% to 100.00% (0.01% resolution) of the reference value Error output ..... LEV_E output in the main display area, as well as error output from EXT I/O
Current detection circuit monitoring function	A measurement signal error will be detected if the value is outside the currently set acceptable measurement range. Error output ..... I_HI output in the main display area
Applied voltage monitoring function	If the voltage (monitor voltage) value of both ends of the sample goes outside the judgment standard it will be detected as a measurement signal error. Judgment standard . .The voltage setting can be set from 0.01% to 100.00% (0.01% resolution). Error output . . . . U_Lo output in the main display area, as well as error output from EXT I/O
Trigger Synchronous Output Function	The measurement signal is only applied during analog measurement.
Key Lock Function	The setting and canceling of this function by pressing a key on the front panel is possible
BIN Measurement	C ..... The setting of 13 categories, D-NG, OUT OF BINS (absolute value setting, Δsetting, Δ% setting)
Comparator	C ..... Hi/ IN /Lo D ..... Hi/ IN /Lo (absolute value setting, Δsetting, Δ% setting)
Panel Save and Load	The saving of 70 sets of measurement conditions is possible The reading of any measurement condition (readable settings: ALL, compensation values only, and measurement conditions only) by pressing a key or sending a EXT I/O control signal is possible
Memory Function	The results of 1000 measurements can be saved in the device. (These can be read via RS-232C and GP-IB.)
Buzzer Tone	Setting the buzzer for comparator judgment results (IN or NG) to ON or OFF is possible
Printer Function	Printing measurement values is possible * The 9442 and 9444 options are required

Basic Specifications

Display Device	LED
Operating Temperature and Humidity	0 to 40°C (32 to 104°F), 80% RH or less, no condensation
Storage Temperature and Humidity	-10 to 55°C (14 to 131°F), 80% RH or less, no condensation
Location for Use	Indoors, Pollution degree 2, altitude up to 2000 m (6562-ft.)
Rated Supply Voltage	100, 120, 220, and 240 V AC are settable (Voltage fluctuations of ±10% from the rated supply voltage are taken into account.)
Rated Supply Frequency	50/ 60 Hz
Maximum Rated Power	40 VA
Dimensions	Approx. 260 W × 100 H × 298 D mm (excluding protrusions) (10.24”W × 3.94”H × 11.73”D)
Mass	Approx. 4.8 kg (169.3 oz.)
Guaranteed Accuracy Period	1 year
Applicable Standards	EMC EN61326 Class A EN61000-3-2 EN61000-3-3 Safety EN61010
Effect of radiated radio-frequency electromagnetic field	C: 3% rdg, D: 0.05 at 10 V/m
Effect of conducted radio-frequency electromagnetic field	C: 0.3% rdg, D: 0.05 at 3 V
Dielectric Strength	Between the power wire and ground wire: 1.62 kV AC for 60 seconds
Backup Battery (Lithium Battery) Lifespan	Approx. 6 years
Interfaces	EXT I/O RS-232C Interface GP-IB Interface
Accessories	• 2 pin power cord with ground • Instruction manual • Spare fuse for power supply (Select from 100 to 120 V and 220 to 240 V in accordance with destination) For 100 to 120 V: 250VF1.0AL ϕ5 × 20 mm For 220 to 240 V: 250VF0.5AL ϕ5 × 20 mm

Basic Specifications

Options	Probes and Fixtures • Model 9262 Test Fixture • Model 9263 SMD Test Fixture • Model 9677 SMD Test Fixture • Model 9699 SMD Test Fixture Printer Related • Model 9442 Printer • Model 9443-01 AC Adapter (for Japan) • Model 9443-02 AC Adapter (for EU) • Model 9444 Connection Cable (for the printer) • Model 1196 Recording Paper Cables • Model 9151-02 GP-IB Connector Cable • Model 9151-04 GP-IB Connector Cable

9.2 Accuracy

Basic Accuracy

Accuracy guarantee for temperature and humidity: 23±5°C (73°±9°F), 80% RH or less (no condensation)
Warm-up time: 1 hour
Guaranteed Accuracy Period: 1 year

Measurement Accuracy = Basic Accuracy × Measurement Signal Level Coefficient × Measurement Speed Coefficient × Cable Length Coefficient × Temperature Coefficient

Measurement signal level	500 mV	1 V
Coefficient	2	1

Measurement speed	FAST	NORMAL	SLOW
Coefficient	1.5	1.2	1

Cable length	0 m	1 m	2 m
Coefficient	1	1.5	2

(When using a 1.5D-2V coaxial cable)

Temperature*1	t = Operating temperature (°C)
Coefficient	1 + 0.1 x | t-23 |

*1: The coefficient is 1 when the operating temperature (t) is 23±5°C.

Measurement Conditions

Measurement signal level: 1 V
Measurement speed: SLOW
Executing open circuit and short circuit compensation
Cable length: 0 m

NOTE

The accuracy specification above is specified using a 1.5D-2V coaxial cable and with the cable length set on the device. When using a cable other than a 1.5D-2V, or when using a cable that differs from the device's cable length setting, there is the possibility of the measurement error becoming greater. When the capacitance (grounded capacitance) between the H terminal and the GND or the L terminal and GND is large, there is a possibility of the measurement error becoming greater. Set the grounded capacitance to 10 pF or lower.

Upper number : C/ Lower number : D,
Cx : the electrical capacity of the sample/ Cr : the electrical capacity of the measurement range

Range		1 kHz	100 kHz (only for 3505)	1 MHz
1	220 fF			0.2%rdg + 1%rdg × (Cr/Cx) 0.004 + 0.002 × (Cr/Cx)
2	470 fF			0.15%rdg + 0.3%rdg × (Cr/Cx) 0.003 + 0.001 × (Cr/Cx)
3	1 pF		0.5%rdg + 0.5%rdg × (Cr/Cx) 0.004 + 0.004 × (Cr/Cx)	0.12%rdg + 0.16%rdg × (Cr/Cx) 0.002 + 0.001 × (Cr/Cx)
4	2.2 pF		0.3%rdg + 0.2%rdg × (Cr/Cx) 0.004 + 0.003 × (Cr/Cx)	0.12%rdg + 0.08%rdg × (Cr/Cx) 0.0012 + 0.0004 × (Cr/Cx)
5	4.7 pF		0.25%rdg + 0.15%rdg× (Cr/Cx) 0.004 + 0.002×(Cr/Cx)	0.12%rdg + 0.04%rdg × (Cr/Cx) 0.0012 + 0.0003 × (Cr/Cx)
6	10 pF		0.25%rdg + 0.1%rdg ×(Cr/Cx) 0.004 + 0.002 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.0012 + 0.0003 × (Cr/Cx)
7	22 pF		0.25%rdg + 0.06%rdg × (Cr/Cx) 0.003 + 0.0015 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
8	47 pF		0.25%rdg + 0.06%rdg × (Cr/Cx) 0.0025 + 0.0015 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
9	100 pF	0.12%rdg + 0.2%rdg × (Cr/Cx) 0.002 + 0.001 ×(Cr/Cx)	0.15%rdg + 0.06%rdg × (Cr/Cx) 0.0015 + 0.001 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
10	220 pF	0.12%rdg + 0.08%rdg × (Cr/Cx) 0.0012 + 0.0004 × (Cr/Cx)	0.15%rdg + 0.04%rdg × (Cr/Cx) 0.0015 + 0.0005 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
11	470 pF	0.12%rdg +0.04%rdg × (Cr/Cx) 0.0012 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
12	1 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.0012 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)
13	2.2 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.0012 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	
14	4.7 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	
15	10 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	
16	22 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	
17	47 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)	0.15%rdg + 0.02%rdg × (Cr/Cx) 0.0015 + 0.0003 × (Cr/Cx)	
18	100 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)	0.2%rdg + 0.02%rdg × (Cr/Cx) 0.002 + 0.0003 × (Cr/Cx)	
19	220 nF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001+0.0003×(Cr/Cx)		
20	470 nF	0.12%rdg+0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)		
21	1 μF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)		
22	2.2 μF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)		
23	4.7 μF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)		
24	10 μF	0.12%rdg + 0.02%rdg × (Cr/Cx) 0.001 + 0.0003 × (Cr/Cx)		

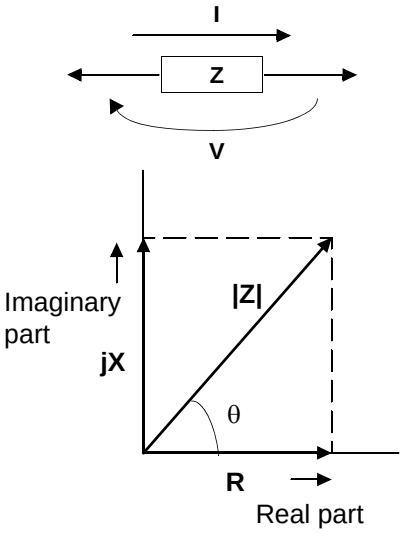
Support for Range Numbers and Range Names

Range No.	Range		
	1 kHz	100 kHz (only for 3505)	1 MHz
1			220 fF
2			470 fF
3		1 pF	1 pF
4		2.2 pF	2.2 pF
5		4.7 pF	4.7 pF
6		10 pF	10 pF
7		22 pF	22 pF
8		47 pF	47 pF
9	100 pF	100 pF	100 pF
10	220 pF	220 pF	220 pF
11	470 pF	470 pF	470 pF
12	1 nF	1 nF	1 nF
13	2.2 nF	2.2 nF	
14	4.7 nF	4.7 nF	
15	10 nF	10 nF	
16	22 nF	22 nF	
17	47 nF	47 nF	
18	100 nF	100 nF	
19	220 nF		
20	470 nF		
21	1 μF		
22	2.2 μF		
23	4.7 μF		
24	10 μF		

NOTE When D>0.1, the measurement values are the reference values.

9.3 Measurement Parameters and Arithmetic Expressions

In general, impedance Z is used to evaluate the characteristics of, for example, circuit components.
Measure voltage and current vectors for circuit components relative to AC measurement frequency signals. The unit uses these values to obtain the impedance Z and phase difference θ. The following values can be obtained from impedance Z by rotating the impedance Z around the complex plane.



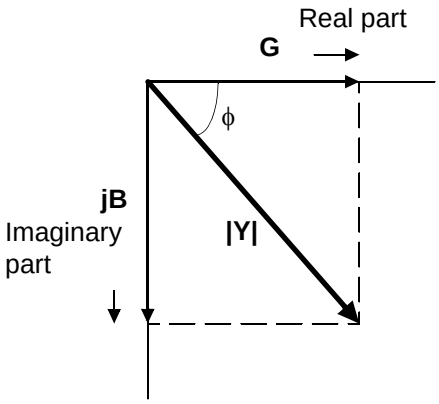
$$Z = R + jX = |Z| \angle \theta$$

$$\theta = \tan^{-1} \frac{X}{R}$$

$$|Z| = \sqrt{R^2 + X^2}$$

Z : Impedance (Ω)
θ : Phase angle (deg)
R : Resistance (Ω)
X : Reactance (Ω)
$|Z|$: Absolute value of impedance (Ω)

Furthermore, admittance Y that is the reciprocal of impedance Z can also be used depending on the characteristics of circuit components. As in the case of impedance Z, the following values can also be obtained from admittance Y by rotating the admittance Y around the complex plane



$$Y = G + jB = |Y| \angle \phi$$

$$\phi = \tan^{-1} \frac{B}{G}$$

$$|Y| = \sqrt{G^2 + B^2}$$

Y : Admittance (S)
ϕ : Phase angel (deg) = $-\theta$
G : Conductance (S)
B : Susceptance (S)
|Y| : Absolute value of admittance (S)

The unit calculates each of the elements using the following arithmetic expressions, based on a voltage V applied between terminals of the measurement sample, a current I that flows through the sample at that time, a phase angle θ between voltage V and current I, and an angle speed ω of the measurement frequency.

Item	Series Equivalent Circuit Mode	Parallel Equivalent Circuit Mode
Z	$\|Z\| = \frac{V}{I} (= \sqrt{R^2 + X^2})$	
C	$Cs = -\frac{1}{\omega \|Z\| \sin\theta}$	$Cp = \frac{\sin(-\theta)}{\omega \|Z\|}$
D	$D = \frac{\cos\theta}{\|\sin\theta\|}$	
Q	$Q = \frac{\|\sin\theta\|}{\cos\theta}$	

Cs indicates the measurement item of C in the series equivalent circuit mode
Cp indicates the measurement item of C in the parallel equivalent circuit mode.

Maintenance and Service Chapter 10

10.1 Inspection, Repair, and Cleaning

To ensure safe use, periodically inspect the unit

⚠WARNING

Never modify the unit. Only Hioki service engineers should disassemble or repair the unit. Failure to observe these precautions may result in fire, electric shock, or injury.

⚠CAUTION

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

In any of the following cases, stop using the unit, disconnect the power cord, and contact your dealer or Hioki representative.

- The unit is clearly damaged.
- Measurement is not possible.
- The unit was stored for a prolonged period of time in a very hot and humid location or other unfavorable conditions.
- Rough transportation resulted in stress being applied.
- The unit has become wet with water or dirty with oil or dust.
- If the unit becomes wet with water or oil and dust enters inside, the risk of an electrical accident or fire will be greatly increased as a result of deterioration of the insulation.

In the following case, submit the unit to be repaired by our repair service personnel.

- Measurement conditions can no longer be saved.
  The unit contains a built-in backup lithium battery, which offers a service life of about six years. Measurement conditions can no longer be saved after the life of the battery runs out.

NOTE

The supply of maintenance and service parts will be continued for a period of seven years from the date of discontinuation of production.

Transportation

NOTE

- Pack the unit so that it will not sustain damage during shipping, and include a description of existing damage. We cannot accept responsibility for damage incurred during shipping.
- Use the original packing materials when transporting the unit, if possible.

Before Submitting the Unit for Repairs

Symptom	Check Item	Solution
No indications appear on the display when the power switch is turned on.	Is the power cord disconnected?	Connect the power cord.
	Is the fuse blown?	Replace the fuse.
Key input is not possible.	Is the key lock set?	Cancel the key lock.
	Is the unit being remotely operated from an external device using GP-IB?	Switch GP-IB to local
	Is the unit being remotely operated from an external device using RS-232C?	Switch RS-232C to local.
	Is the unit set to comparator or BIN measurement mode?	Set to standard measurement mode.
Measurement values are not displayed.	Is the display set to OFF?	Press any key, or set the display to ON. **See** 6.7 "Setting the Display ON/ OFF" (p. 102)
	Is the trigger setting set to external trigger mode?	Please set to internal trigger mode or input the trigger. **See** 3.3.8 "Trigger Signal" (p. 36)
Does not accept EXT I/O trigger signal.	Is the self calibration setting set to AUTO?	Please input the trigger after calibration or set to MANUAL self calibration.
When problems other than the above mentioned, when conditions do not improve despite the above mentioned countermeasures.		Try resetting the system. **See** 6.14 "Performing a System Reset" (p. 114)

Cleaning

To clean the unit, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.

10.2 Replacing the Power Fuse

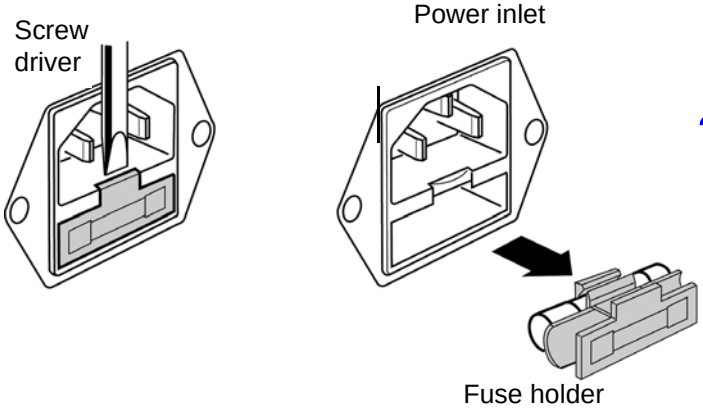
⚠WARNING

- **To avoid an electric accident, be sure to turn the power switch off and disconnect the power cord before replacing the fuse or switching the power voltage.**
  Afterwards, be sure to check that the power voltage set for the power switch with power selectors on the rear of the unit and the voltage to be used match before reconnecting the power cord.
- **Replace the fuse only with one of the specified characteristics and voltage and current ratings. Using a non-specified fuse or shorting the fuse holder may cause a life-threatening hazard.**
  Fuse type: 100 V 120 V setting: 250 V F1.0AL ϕ5 mm x 20 mm
  220 V 240 V setting: 250 V F0.5AL ϕ5 mm x 20 mm
- **Prior to shipment, the power voltage is set and the fuse designated for that power voltage is included (same applies for the spare fuse). If you want to set another power voltage, be sure to replace the fuse with one of the designated rating.**
- **If you want to use a power voltage other than one indicated, set the corresponding power voltage setting shown below.**
  Set the power voltage to 110 V →120 V/ 200V→220 V/230 V→240 V
  See 2.2 "Checking the Power Voltage" (p. 18)

Removing the Fuse Holder

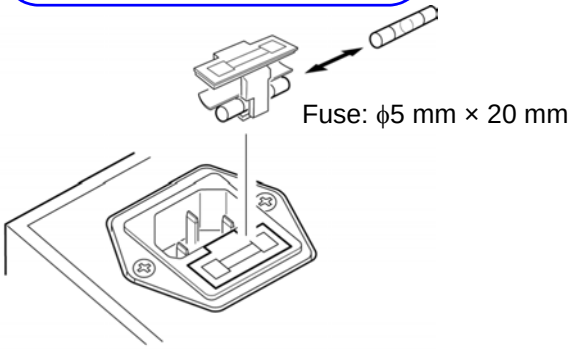
Tools to Prepare: Flat blade screwdriver

Rear panel of the unit



1. Turn off the power switch and disconnect the power cord.
2. Align the flat blade screwdriver with the fuse holder securing part of the power inlet and then remove the fuse holder by pushing the handle of the screwdriver toward the opposite side of the unit.

Replacing the Power Fuse



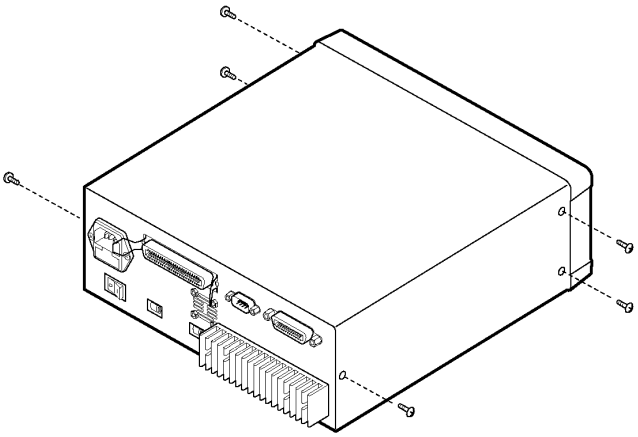
3. Replace the power fuse with a fuse of the designated rating.
4. Reinsert the fuse holder in the power inlet.

10.3 Discarding the Unit

The unit uses a lithium battery as power for storing measurement conditions.

WARNING

- **To avoid electric shock, turn off the power switch and disconnect the power cord, probes, and fixtures before removing the lithium battery.**
- **When disposing of this unit, remove the lithium battery and dispose of battery and unit in accordance with local regulations.**
- **If the protective functions of the unit are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.**

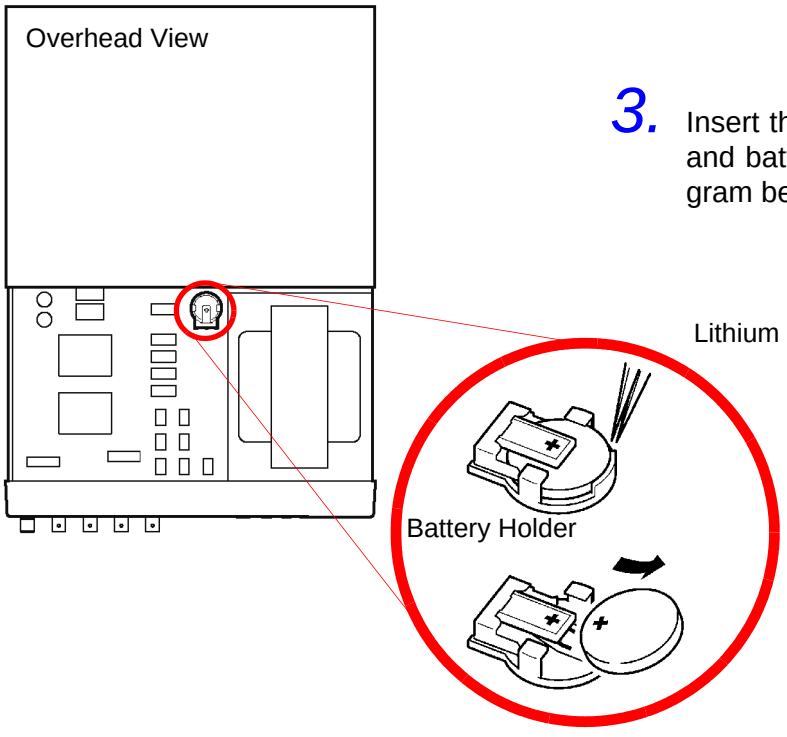


Tools to Prepare:

- One Phillips screwdriver
- Pair of tweezers

1. Remove the six screws from the sides of the unit.

2. Remove the case.



3. Insert the tweezers between the battery and battery holder as shown in the diagram below and lift up the battery.

NOTE

Take care not to short the + and -. Doing so may cause sparks.

CALIFORNIA, USA ONLY
This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Appendix

Appendix 1 Countermeasures Against Incorporation of External Noise

The unit is designed not to malfunction as a result of noise incorporated from the probes, fixture, and power line. However, extremely large levels of noise may still cause measurement errors and malfunctions.

Refer to the following examples of countermeasures against noise when the unit malfunctions, etc.

Appendix 1.1 Countermeasures Against Incorporation of Noise from the Power Line

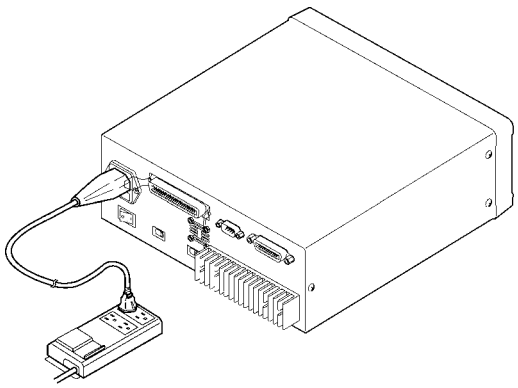
You can use the following countermeasures to reduce the effect of noise being incorporated from the power line.

Grounding Using a Protective Ground Wire

The unit is structured so that the ground wire of the power cable can be used as protective grounding for the unit. Protective grounding plays an important role in not only the prevention of electrical accidents but also the use of an internal filter to eliminate the incorporation of noise from the power line.
Use the supplied power cord.

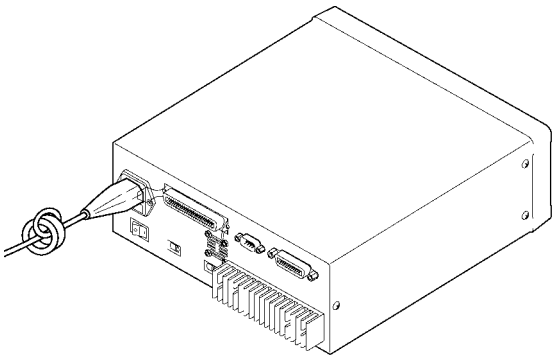
Attaching a Noise Filter to the Power Line

Connect a commercial plug-in noise filter to the power outlet and then connect the unit to the output of the noise filter in order to suppress the incorporation of noise from the power line.
Plug-in noise filters are commercially available from various specialist manufacturers.



Attaching an EMI Suppression Ferrite Core to the Power Cord

Pass the power cord through a commercially available EMI suppression ferrite core and secure the core as close as possible to the AC power inlet of the unit in order to suppress the incorporation of noise from the power line.
Suppression is even more effective if you also attach an EMI suppression ferrite core close to the power plug of the power source.
If a toroidal ferrite core or split ferrite core with a large enough internal diameter is used, the amount of noise suppression can be increased by passing the power cord through the core several times.
EMI ferrite cores and ferrite beads are commercially available from various specialist manufacturers.

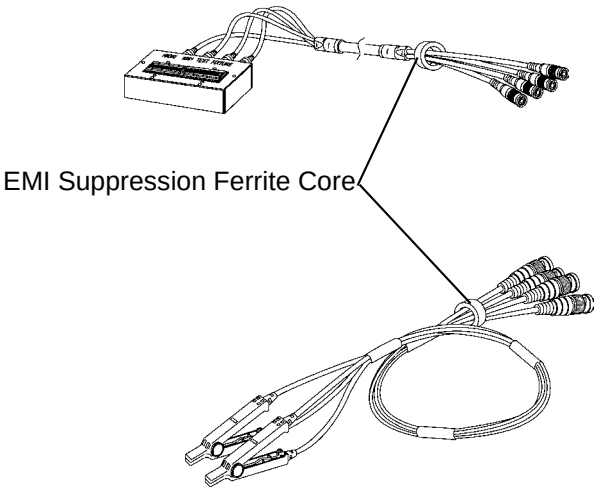


Appendix 1.2 Countermeasures Against Incorporation of Noise from the Input Line (Types of Probe)

You can use the following countermeasures to reduce the effect of noise being incorporated from, for example, a probe or fixture.

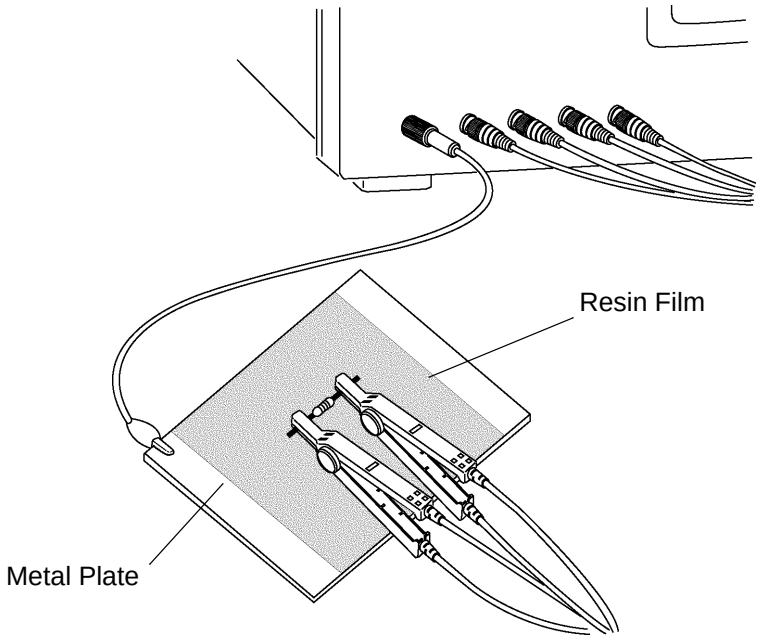
Attaching an EMI Suppression Ferrite Core to Commercial Cables

Noise from things like probes can be suppressed if you pass them through commercially available EMI suppression ferrite cores and secure the cores as close as possible to the measurement terminals. Furthermore, if large enough ferrite cores are used, the amount of noise suppression can be increased by passing things like probes through the cores several times in the same manner as with the power cord.



Appendix 2 Measurement of High Impedance Components

Since high impedance components (for example, capacitors of 1 μF or less) are susceptible to things like external induction noise, measurement values may become unstable. When this happens, stable measurement can be performed by measuring components on a metal plate connected to the GUARD terminal (shielding process).



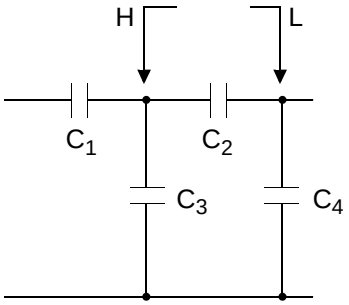
When measuring components on a metal plate, use, for example, resin film as insulation to ensure terminals and the like are not short-circuited.
Open circuit compensation is high impedance measurement, so be sure to use the shielding process. If it is not used, the compensation values may become unstable and affect the measurement values.

Appendix 3 Measurement of In-circuit Components

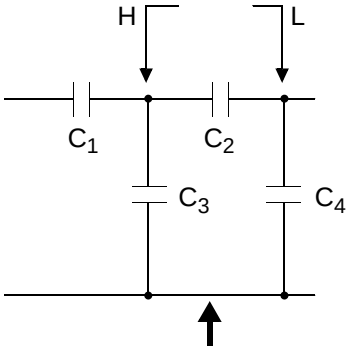
Appendix 3.1 Measurement Using Guarding Technique

Measure an in-circuit component after providing guarding.

$$C = C_2 + \frac{C_3 \times C_4}{C_3 + C_4}$$



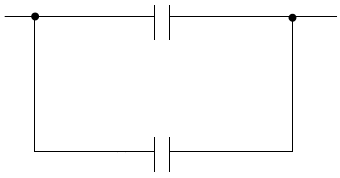
When measuring the capacitance of capacitor C_2 as shown in the diagram, measure the parallel capacitance by adding up the value of the current that flows through capacitor C_2 and the values of the current that flows through capacitors C_3 and C_4, after the probes are connected to both sides of capacitor C_2.



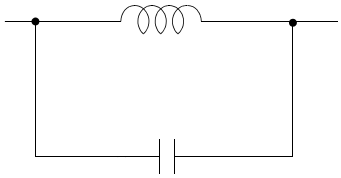
If you use a guard terminal as shown in the diagram, however, the current does not flow through capacitor C_4 and the current that flows through capacitor C_3 is absorbed by the guard terminal so that you can measure the capacitance of capacitor C_2.

NOTE

- However, if, for example, the capacitance of C_2 is less than that of C_3 ($C_2 << C_3$), this technique does not improve measurement precision.
- When two capacitors or a capacitor and a coil are connected in parallel as shown in the diagram, you cannot measure each component separately.



Two capacitors connected in parallel

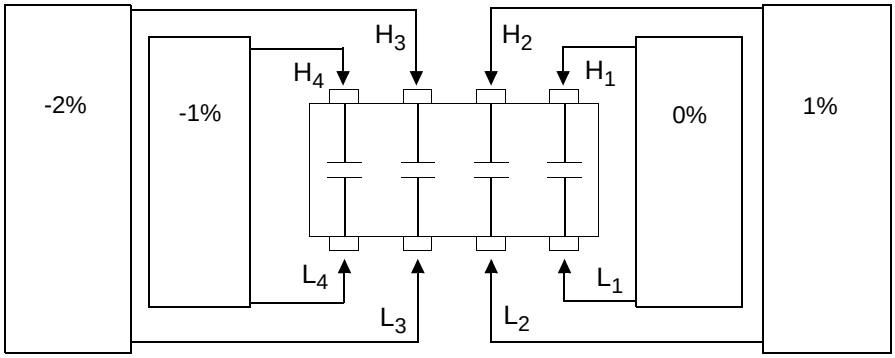


A coil and a capacitor connected in parallel

Appendix 3.2 Synchronous Measurement

You can measure an in-circuit component using multiple 3505/ 3506 units. Configure the units for the state of synchronous measurement and set the measurement signal and frequency for each unit to the same conditions.

See Setting Procedure : 6.6 "Using the Frequency Shift Function" (p. 101)



Appendix 4 Mounting the Unit in a Rack

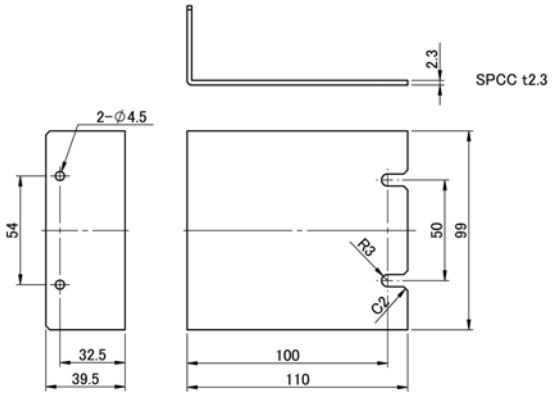
You can remove the screws on the sides of the unit and attach rack mounting brackets.

WARNING

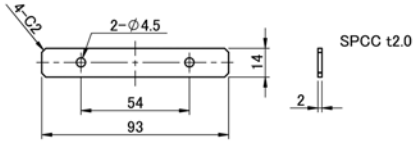
To avoid damage to the unit or an electrical accident, be sure to observe the following precautions on using screws.

- **Ensure that the screws used to attach the rack mounting brackets to the sides of the unit are not screwed into the unit more than 6 mm.**
- **If the rack mounting brackets are removed, be sure to use screws identical to the ones used originally.**
  (Support legs: M3 x 6 mm, side covers: M4 x 6 mm)

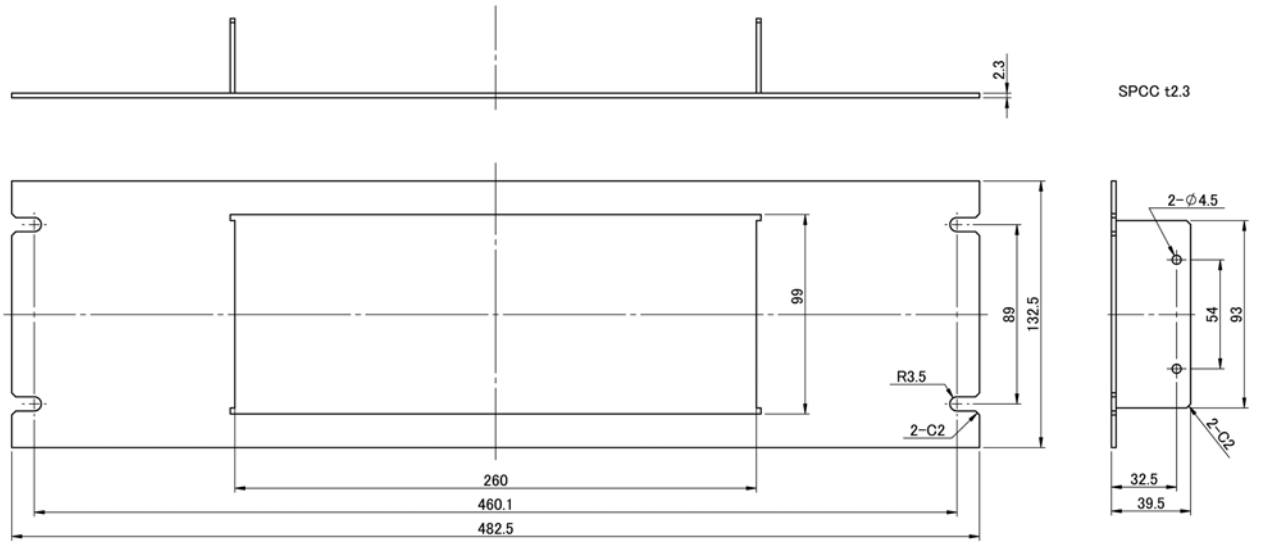
Reference Diagrams and Attachment Procedure for Rack Mounting Brackets



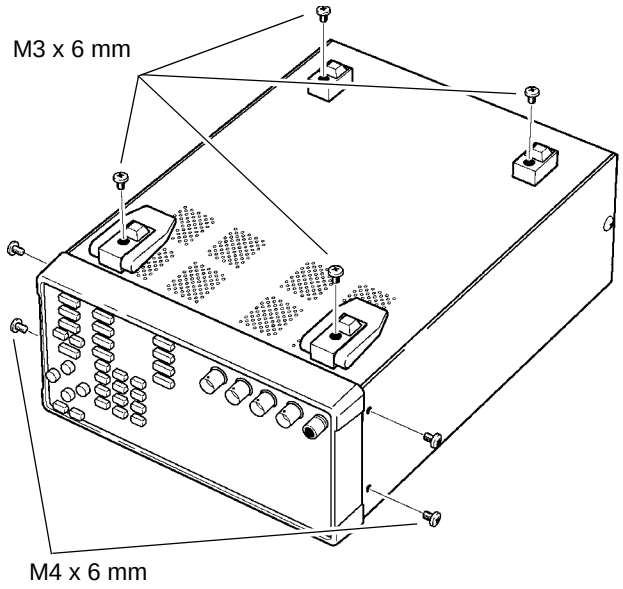
Rack Mounting Bracket (JIS)



Spacers (Use 2)

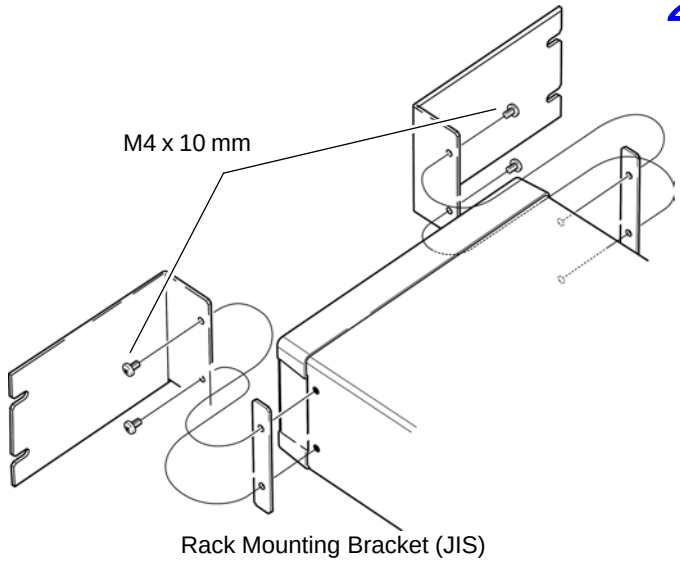


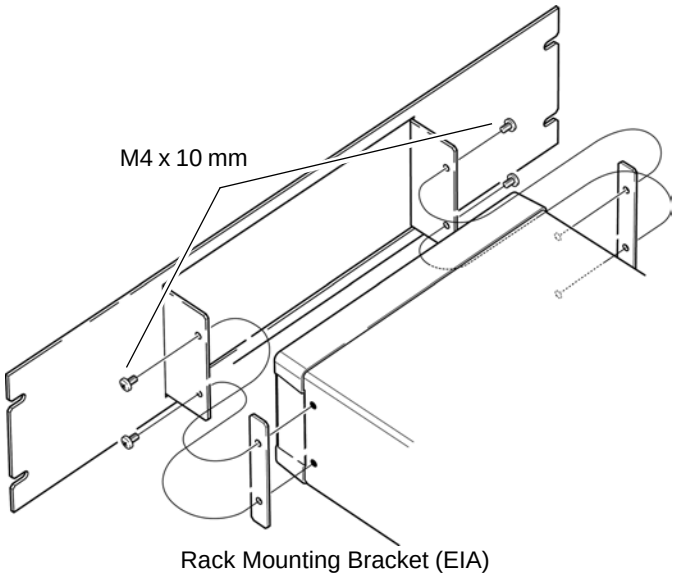
Rack Mounting Bracket (EIA)



1. Remove the support legs from the bottom of the unit and screws from the side covers (4 screws at the front).

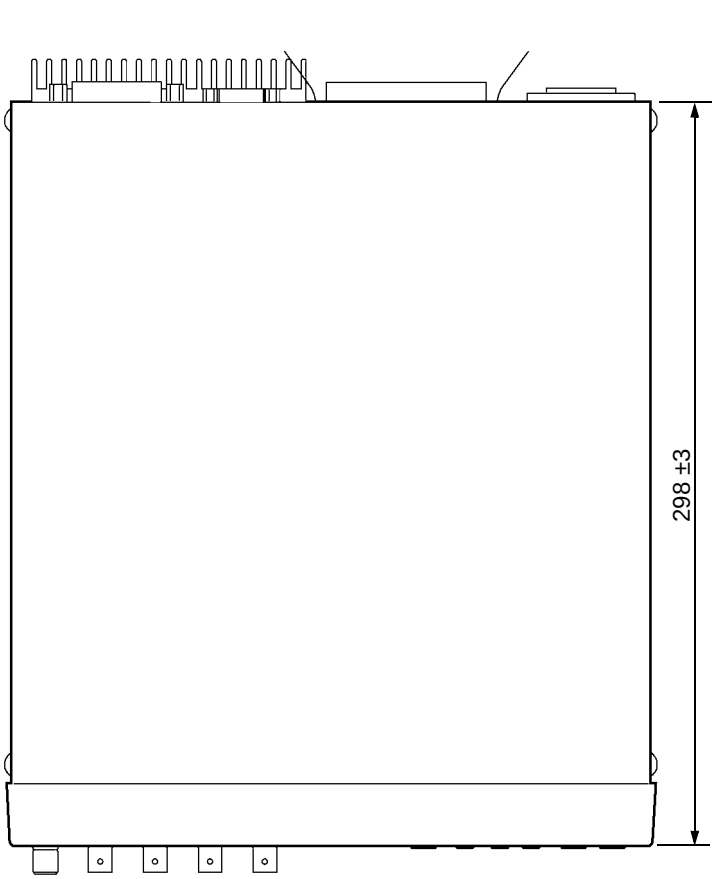
2. Insert spacers on both sides of the unit and attach the mounting brackets with M4 x 10 mm screws.

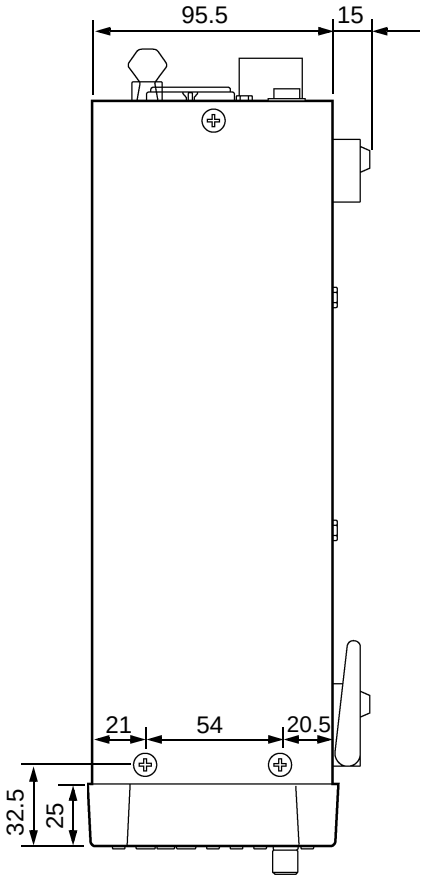


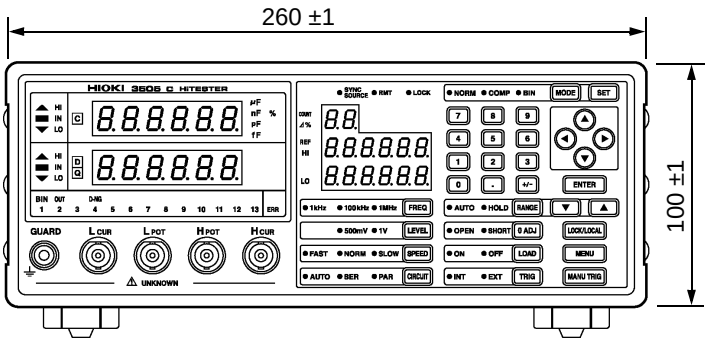


When mounting the unit in a rack, use, for example, a commercially available base for reinforcement

Appendix 5 External View



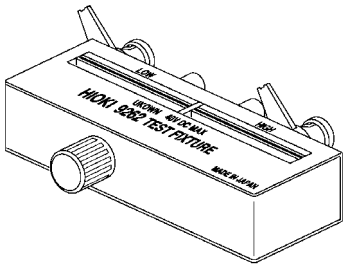
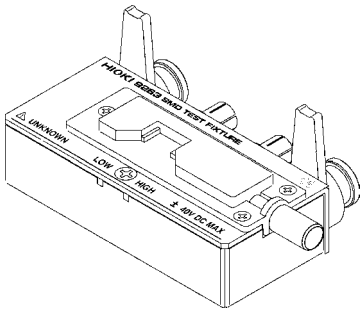
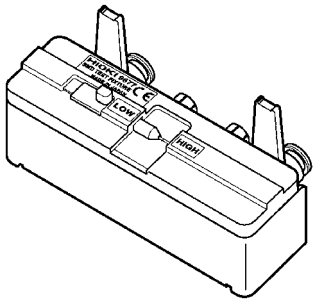
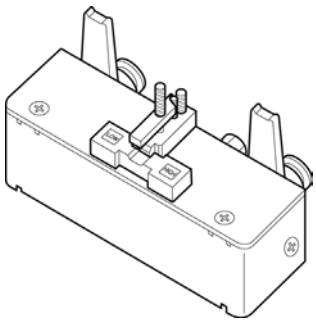




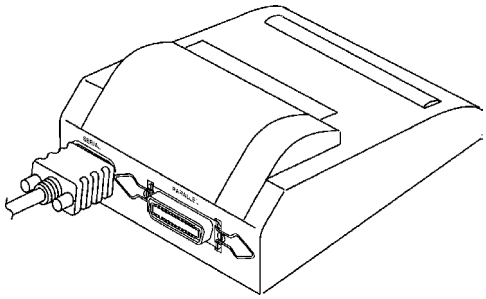
(Unit: mm)

Appendix 6 Options

Fixtures

9262 Test Fixture	
9263 SMD Test Fixture This fixture is suitable for measuring components such as chips.	
9677 SMD Test Fixture	
9699 SMD Test Fixture	

Printer

9442 Printer Use this cable when using the synchronous measurement function • 9443-01 AC Adapter (when using the printer in Japan) • 9443-02 AC Adapter (when using the printer in the EU) • 9444 Connection Cable • 1196 Recording Paper	

Connection Cables for GP-IB

- 9151-02 GP-IB Connection Cable
- 9151-04 GP-IB Connection Cable

Appendix 7 Initial Settings Table

Yes: Available/ ←: The same as the left/ No: Unavailable

Setting Items			Initial Setting	Operate from Front Panel	:PRESet	∗RST	Return to Initial Settings when Power is Turned On	Save	Back Up
Measurement Parameter			D	←	←	←	No	Yes	Yes
Measurement Signal	Frequency		1 kHz	←	←	←	No	Yes	Yes
	Frequency Shift		0%	No Change	No Change	0%	No	Yes	Yes
	Signal Level		1 V	←	←	←	No	Yes	Yes
Measurement Range	Switch		AUTO	←	←	←	No	Yes	Yes
	Range		1 nF	←	←	←	No	Yes	Yes
Equivalent Circuit Mode	Switch		AUTO	←	←	←	No	Yes	Yes
	Mode		Par(parallel)	←	←	←	No	Yes	Yes
Measurement Speed			SLOW	←	←	←	No	Yes	Yes
Average	ON/ OFF		ON	←	←	←	No	Yes	Yes
	Number of Times		1	←	←	←	No	Yes	Yes
Trigger	Mode		Int(Internal)	←	←	←	No	Yes	Yes
	Delay	ON/ OFF	ON	←	←	←	No	Yes	Yes
		Time	0.0s	←	←	←	No	Yes	Yes
Trigger Synchronous Function	ON/ OFF		OFF	←	←	←	No	Yes	Yes
	Wait Time	1 kHz	2 ms	←	←	←	No	Yes	Yes
		100 kHz (only for 3505)	2 ms	←	←	←	No	Yes	Yes
		1 MHz	2 ms	←	←	←	No	Yes	Yes
Open Circuit Compensation	Compensation Value	Compensation of G	0S	No Change	No Change	0S	No	Yes	Yes
		Compensation of B	0S	No Change	No Change	0S	No	Yes	Yes
	Parameter Type		GB	No Change	No Change	GB	No	Yes	Yes
	Open Compensation Conditions		63	←	←	←	No	No	Yes
Short Circuit Compensation	Compensation Value	Compensation of R	0 Ω	No Change	No Change	0 Ω	No	Yes	Yes
		Compensation of X	0 Ω	No Change	No Change	0 Ω	No	Yes	Yes
	Parameter Type		RSX	No Change	No Change	RSX	No	Yes	Yes
	Short Compensation Conditions		63	←	←	←	No	No	Yes
Load Circuit Compensation	Compensation Value	Impedance Coefficient	1	No Change	No Change	1	No	Yes	Yes
		Phase Coefficient	0	No Change	No Change	0	No	Yes	Yes
	Parameter Type		CD	No Change	No Change	CD	No	Yes	Yes
	Reference Value	Reference Value of C	100000	No Change	No Change	100000	No	Yes	Yes
		Reference Value of D (Q)	0	No Change	No Change	0	No	Yes	Yes

Appendix 7 Initial Settings Table

Yes: Available/ ←: The same as the left/ No: Unavailable

Setting Items			Initial Setting	Operate from Front Panel	:PRESet	∗RST	Return to Initial Settings when Power is Turned On	Save	Back Up
Offset Circuit Compensation	ON/OFF		OFF	No Change	No Change	OFF	No	Yes	Yes
	Compensation Value	Compensation Value of C	0	No Change	No Change	0	No	Yes	Yes
		Compensation Value of D (Q)	0	No Change	No Change	0	No	Yes	Yes
Self Calibration	AUTO/ MANU		AUTO	←	←	←	No	Yes	Yes
	Number of Times		50	←	←	←	No	Yes	Yes
	Measurement Speed		FAST	←	←	←	No	Yes	Yes
Cable Length			0 m	←	←	←	No	Yes	Yes
Measurement Value Memory Function	Save ON/ OFF		OFF	←	←	←	No	No	Yes
	Memory Size		1000	←	←	←	No	No	Yes
:MEASure:VALid			Enable All	←	←	←	Yes	No	No
Judgment Mode			Count Judgment	←	←	←	No	Yes	Yes
Comparator Function	ON/ OFF		OFF	←	←	←	No	Yes	Yes
	Count Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
	Compensation Count Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
		Reference value of C	100000	←	←	←	No	Yes	Yes
		Reference value of D (Q)	0	←	←	←	No	Yes	Yes
	Compensation Percent Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
		Reference Value of C	100000	←	←	←	No	Yes	Yes
		Reference Value of D (Q)	0	←	←	←	No	Yes	Yes

Yes: Available/ ←: The same as the left/ No: Unavailable

Setting Items			Initial Setting	Operate from Front Panel	:PRESet	*RST	Return to Initial Settings when Power is Turned On	Save	Back Up
BIN Function	ON/ OFF		OFF	←	←	←	No	Yes	Yes
	Count Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
	Compensation Count Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
		Reference Value of C	100000	←	←	←	No	Yes	Yes
		Reference Value of D (Q)	0	←	←	←	No	Yes	Yes
	Compensation Percent Setting Value	Upper Limit Values	OFF	←	←	←	No	Yes	Yes
		Lower Limit Values	OFF	←	←	←	No	Yes	Yes
		Reference Value of C	100000	←	←	←	No	Yes	Yes
		Reference Value of D (Q)	0	←	←	←	No	Yes	Yes
Low C Reject Function	ON/ OFF		OFF	←	←	←	No	Yes	Yes
	Limit Values		0.000%	←	←	←	No	Yes	Yes
Measurement Level Monitoring Function	ON/ OFF		OFF	←	←	←	No	Yes	Yes
	Limit Values		10.0%	←	←	←	No	Yes	Yes
Current Detection Circuit Monitoring Function	ON/ OFF		ON	←	←	←	No	No	Yes
Applied Voltage Monitoring Function	ON/ OFF		ON	←	←	←	No	No	Yes
	Limit Values		25.0%	←	←	←	No	No	Yes
Panel Save			Clear Contents	No Change	No Change	Clear Contents	No	-	Yes
Load Conditions			ALL	←	←	←	No	No	Yes
Display	ON/ OFF		ON	←	←	←	No	Yes	Yes
Voltage and Current Monitor Value	ON/ OFF		OFF	←	←	←	Yes	No	No
Keylock Function	ON/ OFF		OFF	No Change	No Change	OFF	No	Yes	Yes
Setting Beep Tones	Key		ON	←	←	←	No	Yes	Yes
	Judgment Results	ON/ OFF	OFF	←	←	←	No	Yes	Yes
		Mode	NG	←	←	←	No	Yes	Yes
EXT I/O Judgment Results Reset	ON/ OFF		ON	←	←	←	No	Yes	Yes
EXT I/O output	Delay Time for Judgement Result Input ↔ $\overline{\text{EOM}}$ Output Period		0.0	←	←	←	No	No	Yes

Appendix 7 Initial Settings Table

Yes: Available/ ←: The same as the left/ No: Unavailable

Setting Items		Initial Setting	Operate from Front Panel	:PRESet	∗RST	Return to Initial Settings when Power is Turned On	Save	Back Up
Setting Interface	Interface	GP-IB	←	No Change	No Change	No	No	Yes
	Address	1	←	No Change	No Change	No	No	Yes
	Terminator	LF with EOI	←	No Change	No Change	No	No	Yes
Header		OFF	←	←	←	Yes	No	No
Status Byte Register		0	No Change	No Change	No Change	Yes	No	No
Event Register		0	No Change	No Change	No Change	Yes	No	No
Enable Register		0	No Change	No Change	No Change	Yes	No	No

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- The Declaration of Conformity for instruments that comply to CE mark requirements may be downloaded from the HIOKI website.
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