Agilent Technologies
Innovating the HP Way

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies Japan, Ltd.
Manufacturer's Address: Component Test PGU-Kobe
1-3-2, Murotani, Nishi-ku, Kobe-shi,
Hyogo, 651-2241 Japan

Declares, that the product

Product Name: 120 Hz / 1 kHz Capacitance Meter
Model Number: 4268A
Product Options: All options and customized products based on the above

Is in conformity with:

EMC European Council Directive 89/336/EEC and carries the CE-marking accordingly
EMC Standards required by the Australia Radio Communications Act
IEC 61326-1:1997+A1 / EN 61326-1:1997+A1

CISPR 11:1990 / EN 55011:1991 / AS/NZS 2064.1– Group 1 Class A [1]

IEC 61000-4-2:1995 / EN 61000-4-2:1995	(4 kV CD, 8 kV AD)
IEC 61000-4-3:1995 / EN 61000-4-3:1996	(3 V/m 80% AM 27 - 1000 MHz)
IEC 61000-4-4:1995 / EN 61000-4-4:1995	(1 kV power line, 0.5 kV Signal line)
IEC 61000-4-5:1995 / EN 61000-4-5:1995	(0.5 kV line-line, 1 kV line-earth)
IEC 61000-4-6:1996 / EN 61000-4-6:1996	(3 V 80% AM, power line)
IEC 61000-4-11:1994 / EN 61000-4-11:1994	(100% 1cycle)

Safety European Council Directive 73/23/EEC and carries the CE-marking accordingly
IEC 61010-1:1990+A1+A2 / EN 61010-1:1993+A2
CAN / CSA C22.2 No. 1010.1-92

Additional Information:

LEDs in this product are Class 1 in accordance with EN 60825-1:1994.

[1] The product was tested in a typical configuration.

Dec. 15, 1999
Date

Yukihiko Ota
Name Yukihiko Ota / Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Safety Summary

When you notice any of the unusual conditions listed below, immediately terminate operation and disconnect the power cable.
Contact your local Agilent Technologies sales representative or authorized service company for repair of the instrument. If you continue to operate without repairing the instrument, there is a potential fire or shock hazard for the operator.

- Instrument operates abnormally.
- Instrument emits abnormal noise, smell, smoke or a spark-like light during the operation.
- Instrument generates high temperature or electrical shock during operation.
- Power cable, plug, or receptacle on instrument is damaged.
- Foreign substance or liquid has fallen into the instrument.

Herstellerbescheinigung

GERÄUSCHEMISSION

LpA < 70 dB
am Arbeitsplatz
normaler Betrieb
nach DIN 45635 T. 19

Manufacturer's Declaration

ACOUSTIC NOISE EMISSION

LpA < 70 dB
operator position
normal operation
per ISO 7779

Caution

Do not apply DC voltage or current to the UNKNOWN terminal to prevent failure. Special care must be taken for capacitors since they may be charged. Be sure to connect the DUT to the UNKNOWN terminal (or test fixture) after discharging them sufficiently

Agilent 4268A 120Hz/1kHz Capacitance Meter

Operation Manual

Sixth Edition

Agilent Technologies

Agilent Part No. 04268-90020

December 2002

Printed in Japan

Notices

The information contained in this document is subject to change without notice.

Agilent Technologies Japan, Ltd.

Component Test PGU-Kobe

1-3-2, Murotani, Nishi-Ku, Kobe-shi, Hyogo, 651-2241 Japan

Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

December 1998	First Edition (part number: 04268-90000)
May 1999	Second Edition (part number: 04268-90010)
January 2000	Third Edition (part number: 04268-90010)
February 2001	Fourth Edition (part number: 04268-90010)
September 2002	Fifth Edition (part number: 04268-90010)
December 2002	Sixth Edition (part number: 04268-90020)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

NOTE 4268A comply with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. 4268A are INDOOR USE product.

NOTE LEDs in 4268A are Class 1 in accordance with IEC825-1.
CLASS 1 LED PRODUCT

- Ground The Instrument

  To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

- DO NOT Operate In An Explosive Atmosphere

  Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

- Keep Away From Live Circuits

  Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

- DO NOT Service Or Adjust Alone

  Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

- DO NOT Substitute Parts Or Modify Instrument

  Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

- Dangerous Procedure Warnings

  Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING **Dangerous voltages, capable of causing death, are presenting this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. Instruments are warranted for a period of one year. Fixtures and adapters are warranted for a period of 90 days. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when property installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation Of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

IMPORTANT No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Safety Symbol

General definitions of safety symbols used on the instrument or in manuals are listed below.

Instruction Manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instrument manual.

Alternating current.

Direct current.

On (Supply).

Off (Supply).

In position of push-button switch.

Out position of push-button switch.

Frame (or shassis) terminal. A connection to the frame (shassis) of the equipment which normally include all exposed metal structure.

WARNING	**This warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.**
CAUTION	This Caution sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Sample Program Disk

A sample program disk (Part Number 04268-18000) is furnished with this manual. The disk contains the sample programs listed in this manual.

The customer shall have the personal, non-transferable rights to use, copy, or modify SAMPLE PROGRAMS in this manual for the Customer's internal operations. The customer shall use the SAMPLE PROGRAMS solely and exclusively for their own purposes and shall not license, lease, market, or distribute the SAMPLE PROGRAMS or modifications of any part thereof.

Agilent Technologies shall not be liable for the quality, performance, or behavior of the SAMPLE PROGRAMS. Agilent Technologies especially disclaims that the operation of the SAMPLE PROGRAMS shall be uninterrupted or error free. The SAMPLE PROGRAMS are provided AS IS.

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Contents

1 What You Need to Know Before Using the Product

This chapter describes what you need to know before starting operation after you receive the 4268A capacitance meter, including cleaning instructions.

Incoming Inspection

WARNING **To avoid electrical shock, do not turn on the 4286A if there are signs of shipping damage to any portion of the outer enclosure (for example, covers, panel, or display).**

When you receive the product, first inspect the shipping container for damage. If the shipping container or cushioning material appears damaged, it should be kept until the contents of the shipment have been checked for completeness and the 4268A has been checked mechanically and electrically. The contents of the package include:

- 4268A Capacitance Meter
- Power Cable
- Operation Manual (including the Sample Program Disk)

If the contents are incomplete, if there is mechanical damage or defect, or if the product does not pass the power-on self-tests, notify the nearest Agilent Technologies office. If the shipping container appears damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Agilent Technologies office. Keep the shipping materials for the carrier’s inspection.

Providing Clearance to Dissipate Heat at Installation Site

To ensure the specifications and measurement accuracy of the product, you must maintain the proper ambient temperature around the product within the specified range by providing appropriate cooling clearance around the product or, for the rackmount type, by forcefully air-cooling the area inside the rack housing. For information on the ambient temperature required to satisfy the specifications and measurement accuracy of the product, refer to “Measurement accuracy” on page 228 in Chapter 10.

When the ambient temperature around the product is kept within the temperature range of the operating environment specification (refer to “Operational conditions” on page 232), the product conforms to the requirements of the safety standard. Under that temperature environment, it has been confirmed that the product still conforms to the requirements of the safety standard when it is enclosed within the following cooling clearance.

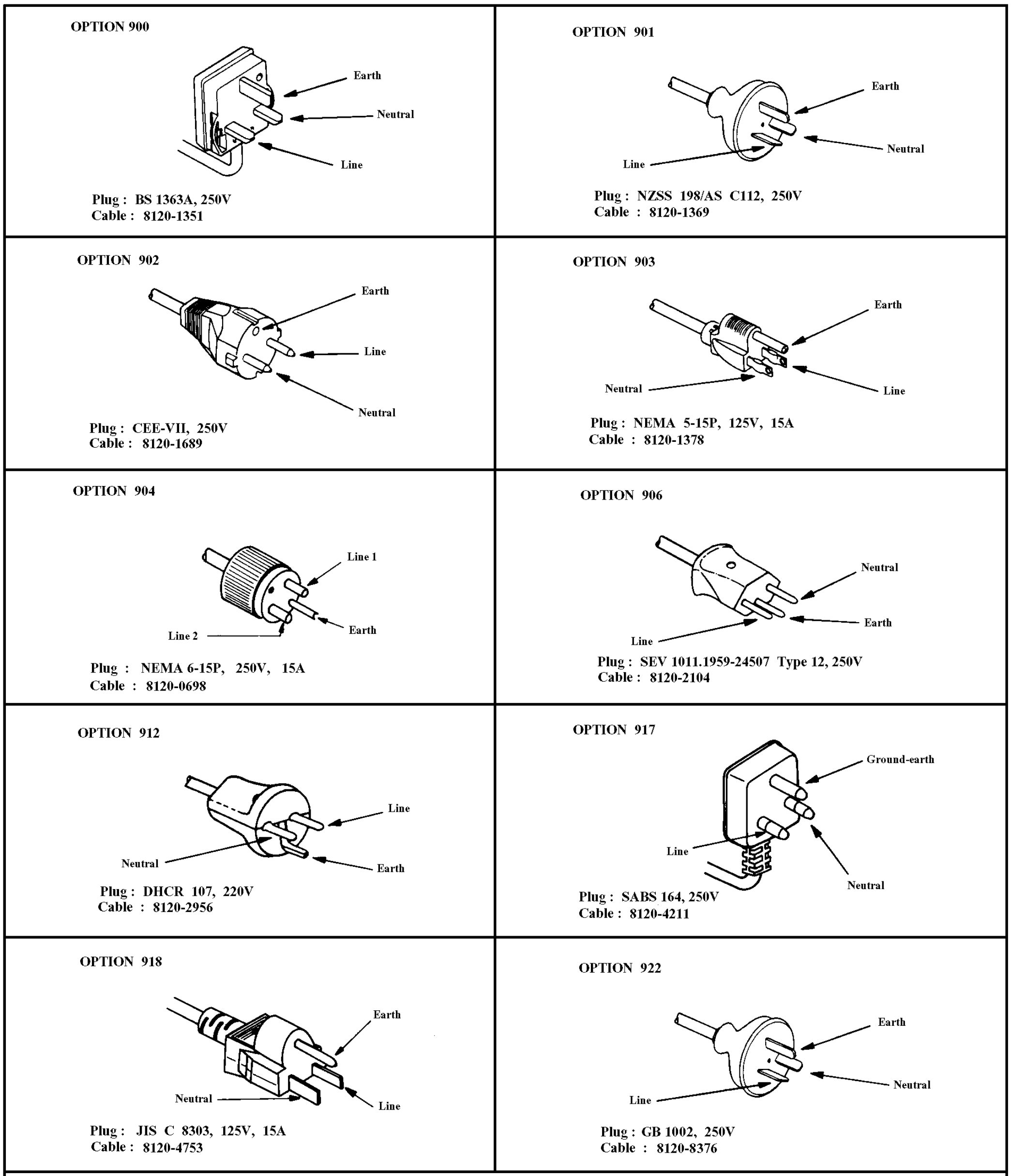
	Conditions
Rear	≥ 400 mm
Side	≥ 100 mm (each for right and left)

Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate AC power outlet, this cable grounds the instrument frame. The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 1-1 for the part numbers of the available power cables.

WARNING **For protection against electrical shock, the power cable ground must not be neglected. The power plug must be plugged into an outlet that connects to adequate protective grounding.**

Figure 1-1 **Power Cables Supplied**



NOTE: Each option number includes a 'family' of cords and connectors of varoius materials and plug body configurations (straight, 90° etc.).

Precautions Before Turning On the Power

Before turning on the power, confirm that the correct fuse is mounted. In addition, use a power supply that has the specified characteristics.

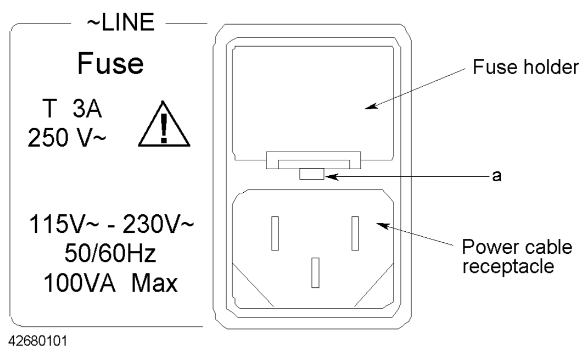
Mounting the fuse

Use a fuse with the following specifications.

UL/CSA type, time delay, 3 A 250 V (Part number: 2110-0381)

If you do not have fuse, contact the nearest Agilent Technologies sales office. The fuse can be checked and replaced by removing the fuse holder shown in Figure 1-2. To remove the fuse holder, first disconnect the power cord, push the ‘a’ part in Figure 1-2upward with a flatblade screwdriver until the fuse holder pops out, and then take it out.

Figure 1-2 **Fuse Holder and Power Cord Socket**



Requirements for Power Supply

The requirements for the power supply for use with the 4268A are:

Voltage: 90 Vac to 132 Vac, 198 Vac to 264 Vac

Frequency: 47 Hz to 66 Hz

Power consumption: 100 VA maximum

WARNING **Properly ground the instrument using the attached 3-wire power cable with grounding prong. If there is no available 3-wire outlet and you use the attached 3-to-2 adaptor, properly ground the grounding conductor of the conversion adaptor.**

Instructions for Cleaning

To clean the surface of the instrument, gently wipe with a soft cloth that has been soaked with water and wrung tightly.

2 Overview

This chapter gives an overview of the 4268A, describes each of its functions, and describes the functions of the front and rear panels.

Product Overview

The 4268A 120 Hz/1 kHz capacitance meter has a built-in comparator function that offers a powerful tool for high-speed sorting of large-capacity ceramic capacitors. A key feature of the 4268A is its measurement signal. For large-capacity ceramic capacitors, the capacitance and dissipation factor may vary depending on the measurement signal voltage, which makes measurement with a constant signal voltage critical. Measurement signal voltage from conventional capacitance meters can drop due to resistance lying in the signal output source and measurement cables and can even vary due to contact resistance with a test fixture and/or contact probe and DUT. To overcome this difficulty, the 4268A has a high-power signal source with low output resistance and employs an automatic signal level control (high-speed ALC) function that corrects decreasing or fluctuating measurement signal voltage. Consequently, the voltage actually applied to DUT is equal to the desired voltage. This enables you to measure DUT at a constant voltage that complies with measurement standards. When integrated with a handler machine, the 4268A provides a synchronous source function to protect a contact probe’s tip against damage by large measurement current. This function allows the measurement voltage to be applied to DUT after being triggered and only during essential measurement periods (ALC and analog measurement), thus avoiding large current flowing through contacts at the moment when DUT is contacted.

The 4268A lets you to select measurement parameters from Cp-D/Q/Rp/G and Cs-D/Q/Rs. Its displayable measurement range covers 0.0001 nF to 999.99 µF (@1k Hz) and 0.001 nF to 9.9999 mF(@120 Hz) for capacitance and 0.0001 to 9.9999 for dissipation factor. Measurement is performed at a basic measurement accuracy of ±0.2%, and the result can be displayed up to five digits. Measurement signal level is adjustable from 0.1 to 1 Vrm in 0.01 Vrm steps. The 4268A offers measurement times of 25, 45, and 60 ms and achieves the highest measurement speed of 25 ms while using ALC.

The 4268A’s built in comparator function can sort measurement results in up to nine bins for capacitance and PASS/FAIL judgement for dissipation factor. Sorted results are available from the handler interface and GPIB. The photo-isolated handler interface simplifies integration of the 4268A with a handler system in production. The 4268A also features GPIB, which allows automated instrument setting and data acquisition. With this feature, you can build a flexible measurement system expandable to a central/distributed network system to facilitate effective data processing. Furthermore, with option 001, the 4268A provides a separate error correction function for each channel when used with a scanner.

Introduction to Each Function

Auto level control (ALC)

The auto level control functions prevents the applied voltage from decreasing due to the output resistance of the voltage source and the resistance of the measurement cable. Turning ON this function allows you to perform measurements by correctly applying the specified voltage to DUT. This function is very useful for measuring large-capacity multilayer ceramic capacitors whose capacity varies depending on applied voltage. For details, refer to "Performing Measurements by Correctly Applying Specified Voltage at DUT (ALC function)" on page 60.

Synchronous source

The synchronous source function allows you to apply the measurement signal to DUT only during measurement. This function prevents the measurement signal from flowing through the contact pin at the instant when it is connected to DUT. Therefore, it provides longer life of the contact pin compared to the conventional measurement method. For details, refer to "Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)" on page 65.

Comparator

The 4268A provides a comparator function that lets you make measurements while checking whether measurement values are within the limit range or while sorting them. The comparator function lets you define up to nine sets of primary parameter (CP, CS) limit ranges and one secondary parameter (D, Q, G, Rp, Rs) limit range and sort measurement values into a maximum of 11 levels (BIN1 - BIN9, OUT_OF_BINS (out of limit range) and AUX_BIN (only secondary parameter out of limit range)). The sorting result is outputted to external equipment via GPIB or the handler interface. For details, refer to "Sorting a Measurement Result (comparator function)" on page 54. For details on the primary and secondary parameters, refer to "Setting the measurement parameters" on page 46.

Deviation measurement

The deviation measurement function displays the measurement result as a relative value, based on deviation from a reference value, instead of an absolute value. You can select how to display the deviation: absolute value of the difference between the measurement value and the reference value (measurement value - reference value) or percentage of the difference between the measurement value and the reference value to the reference value ((measurement value - reference value)/ reference value × 100). For details, refer to "Displaying Measurement Results in Relation to the Reference Value (deviation measurement mode)" on page 59.

Trigger delay / Source delay

The trigger delay function starts the measurement at a specified time after triggering. While the 4268A usually starts measurement immediately after triggering, the trigger delay function lets you define the waiting time between triggering and the start of measurement within a time period between 0 to 1 second. For details, refer to “Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)” on page 67.

The source delay function outputs the measurement signal at a specified time after triggering. This function is available when the synchronous source function is ON. For details, refer to “Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)” on page 65.

Averaging

The averaging function outputs the mean value of a specified number of measurement values as the measurement result. The allowable setting range is 1 to 256. The averaging function is a good ways to obtain stable measurement results. For details, refer to “Obtaining the mean value (averaging function)” on page 69.

Contact check

The contact check function detects the occurrence of contact failure between the contact pin and DUT in four-terminal measurement. If it detects contact failure, it displays, instead of measurement values, the contact failure indication (N.C.) and outputs this status signal via GPIB and the handler interface to external equipment. For details, refer to “Making a Measurement While Checking Contact Failure between the Contact Pin and DUT (contact check function)” on page 68.

Correction

The 4268A provides four types of correction functions: cable length correction, OPEN correction, SHORT correction, and LOAD correction. These correction functions correct additional errors due to test fixture, test lead, and so on. The table below briefly describes each correction function.

Correction type	Description
Cable length correction	Correction of errors caused by the extended measurement path from using due to the 1-m and 2-m test leads.
OPEN correction	Correction of errors caused by the test fixture’s parallel stray admittance
SHORT correction	Correction of errors caused by the test fixture’s series residual impedance
LOAD correction	Correction of various errors, such as amplitude/phase errors, caused by the cable, the test fixture, the scanner and other devices.

Multi-channel correction (option 001)

The multi-channel correction function lets you perform channel-by-channel error correction for multiple measurement channels (up to 64). With this function, correction data for each measurement channel is measured in advance and then selected for use depending on the information of the channel inputted via the scanner interface. This function is available only when the scanner interface is equipped (option 001).

Save/recall

The 4268A lets you save/recall up to ten settings using the built-in nonvolatile memory (EEPROM). For information on the setting items that can be saved/recalled, refer to Table F-1.

Backing up the setting (resume function)

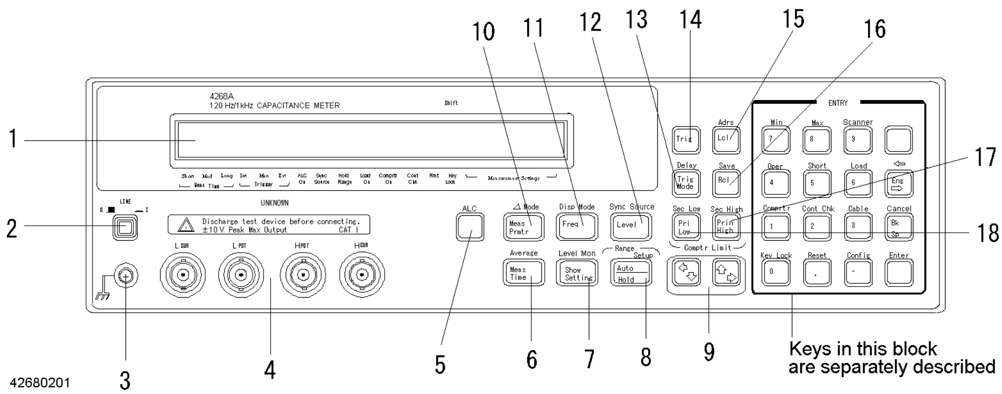
Most setting items are backed up in the built-in back-up memory. Therefore, even after you turn off the power supply, the last setting is restored if you turn on the power supply again within 72 hours. For this reason, to return the setting to the initial status you must perform the reset instead of turning off the power supply. For information on the setting items that can be backed up, refer to Table F-1.

Front and Rear Panel Functions

Front Panel

This section describes each part of the front panel. Each function's name is printed on the front panel. Dark gray print above or on each key indicates its function when only the key is pressed, while blue print indicates the function that becomes operational when the key is pressed after the Shift key (blue key). The details of each function are described below. In the description of each key, the part after <Shift> describes the secondary function (shift function) of the key (refer to 31). For more information about the function executed by pressing each key, refer to Chapter 4.

Figure 2-1 **Front Panel**



1. Display: Displays measurement result, instrument setting, and messages. For details, refer to "Display" on page 32.
2. LINE switch: Turns ON/OFF the 4268A.
3. Guard terminal: Connected to instrument's chassis.
4. UNKNOWN terminals: BNC connectors for test fixtures and measurement cables.

   INSTALLATION CATEGORY I

CAUTION Do not apply DC voltage or current to an UNKNOWN terminal. Special care must be taken for capacitors since they may be charged. Be sure to connect the DUT to an UNKNOWN terminal (or test fixture) only after discharging them sufficiently.

5. Auto Level Control (ALC) key: Turns ON/OFF the auto level control (ALC) function.
6. Measurement Time (Meas Time) key: Selects the measurement time mode from Short, Medium, or Long.
   <Shift>Average key: Sets the averaging count for the measurement result.
7. Show Setting key: Changes the mode of the rightmost Measurement Settings display.
   <Shift>Level Monitor (Level Mon) key: Sets the monitor function for the measurement signal level.
8. Auto/Hold Range (Auto/Hold) key: Toggles the measurement range mode between Auto and Hold.

<Shift>Range Setup key: Selects the measurement range. Performing this setting automatically selects the Hold measurement range mode.

9. Left/Down Arrow (← / ↓) keys and Up/Right Arrow (↑ / →) keys: Each increases or decreases the setting or changes the selection in the arrow direction.

10. Measurement Parameter (Meas Prmtr) key: Selects the measurement parameter.
<Shift>Deviation Measurement Mode (Δ Mode) key: Turns ON/OFF the deviation measurement function. Lets you set the deviation measurement reference value.

11. Frequency (Freq) key: Selects the test signal frequency (120 Hz or 1 kHz).
<Shift>Display Mode (Disp Mode) key: Turns ON/OFF the measurement result display. Lets you set the number of display digits.

12. Level (Level) key: Sets the measurement signal voltage.
<Shift> Sync Source key: Turns ON/OFF the synchronous source function.

13. Trigger Mode (Trig Mode) key: Selects the trigger mode from Internal (Int), Manual (Man), or External (Ext).
<Shift>Trigger Delay (DeIay) key (DeIay) key: Sets the trigger delay time and source delay time.

14. Trigger (Trig) key: Triggers a measurement in the Manual trigger mode.

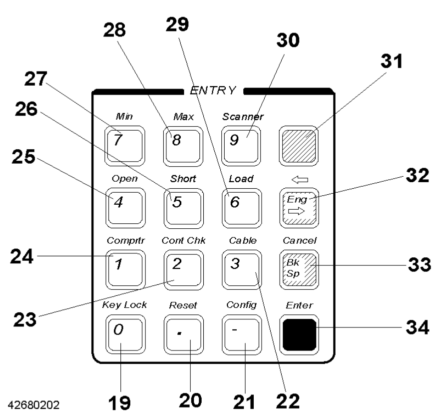
15. Local (Lcl) key: Returns the 4268A from the GPIB Remote mode to the Local mode.
<Shift>Address (Adrs) key: Sets the GPIB address.

16. Recall (Rcl) key: Recalls the instrument setting from internal memory.
<Shift>Save key: Stores the instrument setting to internal memory.
For information on the setting items that can be saved/recalled, refer to Table F-1.

17. Primary Parameter Upper Limit (Pri High) key: Sets the BIN1 upper comparator limit for the primary parameter.
<Shift>Secondary Parameter Upper Limit (Sec High) key: Sets the upper comparator limit for the secondary parameter.

18. Primary Parameter Lower Limit (Pri Low) key: Sets the BIN1 lower comparator limit for the primary parameter.
<Shift>Secondary Parameter Lower Limit (Sec Low) key: Sets the lower comparator limit for the secondary parameter.

Figure 2-2 Keys in the Entry Block



19. 0 key: Enters 0 when setting a numeric value.
<Shift>Key Lock key: Locks out any key operation except for this key.
20. Point (.) key: Enters a decimal point (.) when setting a numeric value.
<Shift>Reset key: Resets the 4268A to the initial state.
21. Minus (-) key: Enters a minus sign (-) when setting a numeric value.
<Shift>Configuration (Config) key: Lets you set the beep sound, use the service test function, and check the firmware version.
22. 3 key: Enters 3 when setting a numeric value.
<Shift>Cable key: Selects the cable length from 0 m, 1 m, or 2 m.
23. 2 key: Enters 2 when setting a numeric value.
<Shift>Contact Check (Cont Chk) key: Turns ON/OFF the contact check function.
24. 1 key: Enters 1 when setting a numeric value.
<Shift>Comparator (Comprtr) key: Turns ON/OFF the comparator. Lets you set the function.
25. 4 key: Enters 4 when setting a numeric value.
<Shift>Open key: Lets you measure and check the correction data for the OPEN correction.
26. 5 key: Enters 5 when setting a numeric value.
<Shift>Short key: Lets you measure and check the correction data for the SHORT correction.
27. 7 key: Enters 7 when setting a numeric value.
<Shift>Minimum (Min) key: Inputs the minimum value when setting a parameter value.
28. 8 key: Enters 8 when setting a numeric value.
<Shift>Maximum (Max) key: Inputs the maximum value when setting a parameter value.
29. 6 key: Enters 6 when setting a numeric value.
<Shift>Load key: Turns ON/OFF the LOAD correction. Lets you measure and check the correction data for the LOAD correction.

30. 9 key: Enters 9 when setting a numeric value.
<Shift>Scanner key: Lets you set the scanner interface. If the scanner interface is not installed (option 002), an error occurs.

31. Shift key (blue): Activates the secondary functions (shift functions) printed above the front panel keys. To operate a shift function, push this key and then push the corresponding blue print key.

    This key is called “blue key” in this manual.

32. Engineering Unit (Eng) key: Enters the engineering units: p, n, μ, m, k, M, and so on. Each press changes the unit in order. Select the desired unit by pressing the “Enter” key (34).

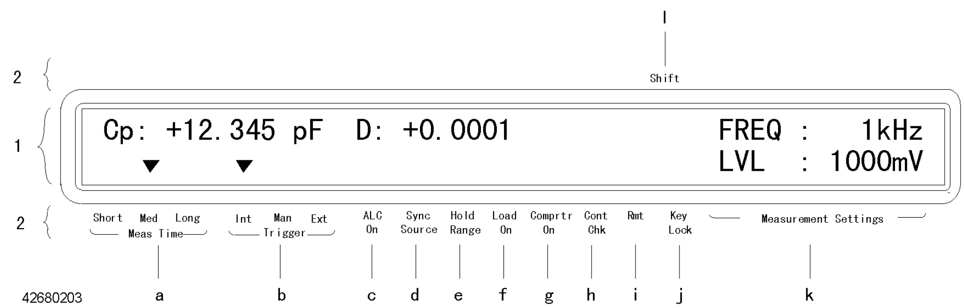
33. Back Space (Bk Sp) key: Erases the last entered character when entering a numeric value.
<Shift>Cancel key: Returns to the immediately previous screen.

34. Enter key: Terminates the entry of a numeral value or determines a selection.

Display

This section introduces the display.

Figure 2-3 Display

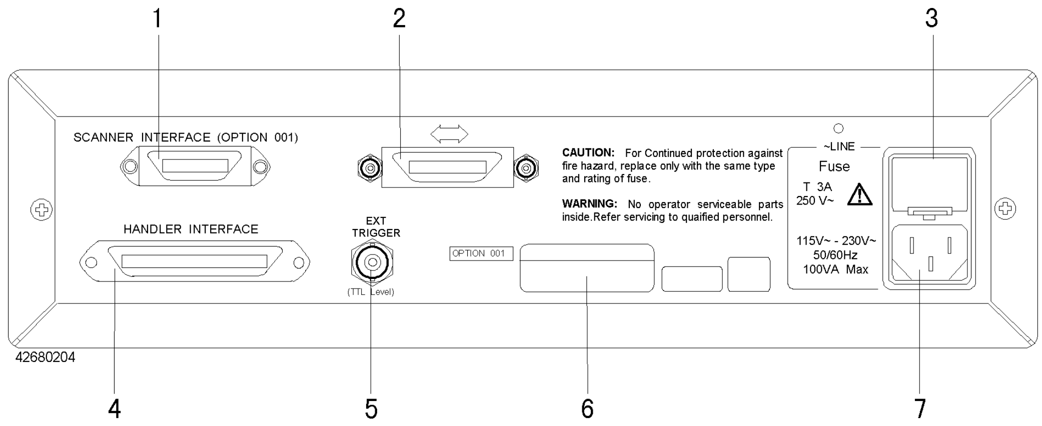


1. Character Display Area: Displays the measurement result, instrument setting menu, instrument setting display (Measurement Settings), and messages.
2. Instrument Setting Display Label Area: The setting display labels indicated by the tsymbol in the Character Display Area show the current setting of the instrument. The meaning of each label is given below.
    a. Meas Time: Indicates the measurement time mode setting. The current setting is shown with the tsymbol displayed above either Short, Med, or Long.
    b. Trigger: Indicates the trigger mode setting. The current setting is shown with the tsymbol displayed above either Int, Man, or Ext.
    c. ALC On: Indicates ON/OFF state of the auto level control function. The tsymbol indicates ON.
    d. Sync Source: Indicates ON/OFF state of the synchronous source function. The tsymbol indicates ON.
    e. Hold Range: Indicates the range mode of the 4268A. When the tsymbol is displayed, it is in the Hold range mode; when no symbol is displayed, it is in the Auto range mode.
    f. Load On: Indicates ON/OFF state of the LOAD correction function. The tsymbol indicates ON.
    g. Comprtr On: Indicates ON/OFF state of the comparator function. The tsymbol indicates ON.
    h. Cont Chk: Indicates ON/OFF state of the contact check function. The tsymbol indicates ON.
    i. Rmt: The tsymbol is displayed when the 4268A is in the GPIB remote mode.
    j. Key Lock: The tsymbol is displayed when the front-panel keys are locked out.
    k. Measurement Settings: The instrument settings such as measurement voltage level and measurement frequency are displayed in the Character Display Area. The tsymbol is not displayed here.
    l. Shift: If the Shift key (blue) is pressed and the shift functions (the functions printed in blue above the key) are operational, the ssymbol is displayed.

Rear Panel

This section describes each part of the rear panel.

Figure 2-4 **Rear Panel**



1. Scanner interface (SCANNER INTERFACE) connector: Connector for the scanner (option 001).
2. GPIB connector: Used to control the 4268A from an external controller via the GPIB.
3. Fuse holder
4. Handler interface (HANDLER INTERFACE) connector: Connector for an external handler.
5. External trigger (EXT TRIGGER) terminal: Trigger input terminal when using an external trigger signal to trigger a measurement.
6. Serial number plate: Serial number is printed.
7. Power cord socket

3 Getting Started

This chapter describes the basic operation of the 4268A. “Learning the Basics of Key Operation” describes the basic operation of the keys. “Learning the Basics of Measurements” describes the basics of measuring capacitance with the 4268A.

Learning the Basics of Key Operation

When a front-panel key of the 4268A is pressed, one of the following three operations is performed.

- Operation is completed by a single key operation
- A menu (item selection) screen appears
- A numeric value entry screen appears

NOTE When a menu screen or a numeric value entry screen appears (also while entering a numeric value), pressing the **Cancel** key (blue key, **Bk Sp** key) returns to the previous screen immediately.

NOTE When using the Shift function (function printed in blue) of the front panel, simply push the blue key first and the desired shift function to activate it.

Each of the basic operations is described below.

When operation is completed by a single key operation

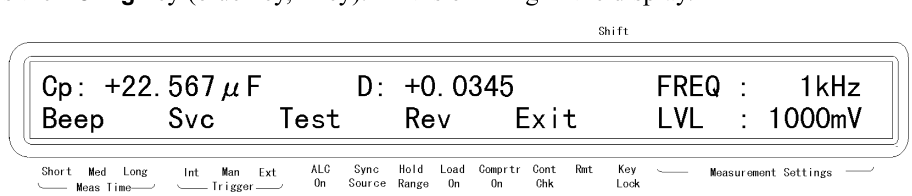
Only pressing a key changes the setting or turns ON/OFF the function, which means it toggles the instrument setting. In other words, each press of a key switches between ON and OFF or changes the available setting in a certain order. See the following examples.

- Pressing **ALC** key toggles ON/OFF the ALC function.
- Pressing **Meas Time** key changes the measurement time setting from the current setting in the order of Short –> Med –> Long –> Short –>...

When a menu (item selection) screen appears

Pressing a key changes the display from the measurement screen to a menu screen that lets you select an item. The blinking item in the menu screen is currently the item to be selected. Pressing the ↑ → key or the ← ↓ key, or pressing the same key again, changes the selected item. When a desired item is blinking, press the Enter key to make the selection. An example is shown below.

Step 1. Press the **Config** key (blue key, **-** key). Exit is blinking in the display.



42680301

Step 2. Press the ↑ → key to blink Test, and then press the **Enter** key.

Step 3. The 4268A starts the self-test. After the completion of the test, the 4268A displays PASS (or if an error occurs, its error code) for several seconds, and then returns to the menu.

Step 4. Make sure that Exit is blinking (if not, operate keys to blink Exit), and then press the **Enter** key to exit from the menu.

NOTE After the selection in the menu, another menu screen or a numeric value entry screen (described below) may appear. In this case, perform a similar operation until the setting is completed.

When a numeric value entry screen appears

Pressing a key changes the display from the measurement screen to a numeric value entry screen. Use the following keys to enter a numeric value and then press the Enter key.

- Numeric (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, . (decimal point), - (minus)) keys
- Back space (Bk Sp) key
- Maximum (Max) key and Minimum (Min) key
- Engineering unit (Eng) key
- Up/right arrow (↑→) key and Left/down arrow (← ↓) key

NOTE Until the **Enter** key is pressed, the previous value is kept even if the displayed value is changed. Therefore, if a key not in the ENTRY block is pressed before pressing the **Enter** key, the entered value is ignored and the instrument setting before the entry is maintained.

How to use each key is described below.

Numeric key

Enter numeric values by pressing the key for each number.

Back space key

Used to correct an entered value. Each press deletes the rightmost character of the displayed value.

NOTE Basically, numeric values can be entered using numeric keys and the back space key only. The Maximum key, Minimum key, Engineering unit key, Up/right arrow key, and Left/down arrow key are used to facilitate entry. Therefore, depending on the instrument setting status when you enter a value, these keys may not be available.

Maximum (Max) key and Minimum (Min) key

You can enter the maximum and minimum numeric values by just pressing these keys.

Engineering unit (Eng) key

Add a unit (engineering unit) to a numeric value entered with the numeric keys. Pressing this key changes the unit. The unit that first appears and available units (that alternately appear each time the key is pressed) vary depending on the instrument setting status when you enter the value.

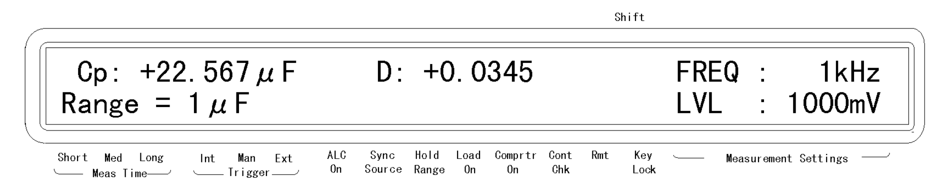
Up/right arrow key and Left/down arrow key

Increases or decreases an entered numeric value. The increased/decreased amount for each press varies depending on the instrument setting status.

Example of operation to enter a numeric value

The following example shows you how to enter a numeric value step by step, assuming that the measurement range is currently set to 1 µF and you want to change the setting to the maximum of the measurement range, 100 µF (when the measurement frequency is 1 kHz). One of the following key operations are available: numeric keys only, Maximum key, numeric key and Engineering unit key, and Up/right arrow key.

Step 1. Press the **Range Setup** key (blue key, **Auto/Hold** key). The measurement range entry screen below appears.



42680302

Step 2. Enter 100µF.

- When using numeric keys only:
  Press the **0** key, **.** key, **0** key, **0** key, **0** key,**1** key in this order.
- When using the Maximum key:
  Press the **Max** key.
- When using numeric keys and Engineering unit key:
  Press the **1** key, **0** key, **0** key. Next, press the **Eng** key repeatedly until ‘µ’ appears.
- When using the Up/right arrow key:
  Press the ↑→ key twice.

Step 3. Press the **Enter** key to finish the setting.

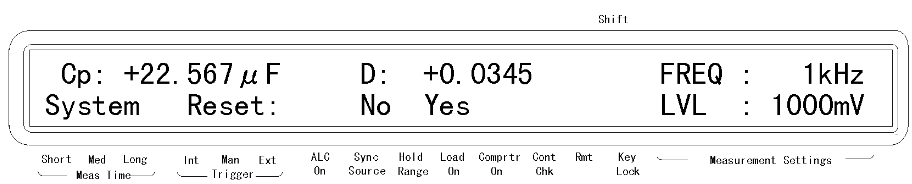
Learning the Basics of Measurements

This chapter helps you to learn the basics of measurement for the 4268A. The following example shows how to measure a capacitor with a test fixture.

Returning the setting to the initial values (resetting)

This section shows you how to return the setting of the 4268A to its initial status (resetting). When you want to specify setting conditions for a measurement (especially when you are not sure about the current setting), it is recommended that you reset the instrument to the initial status as a first step. The default values are defined in Appendix F, where you can get the information required to change the setting according to your desired measurement conditions.

Step 1. Press the **Reset** key (blue key, **.** key). The menu below appears.



42680303

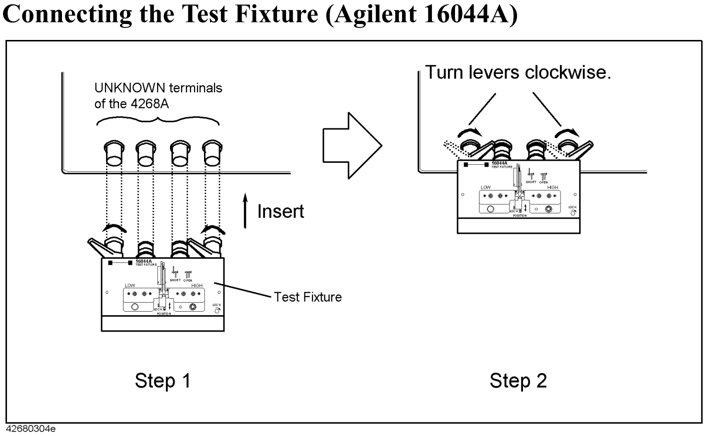
Step 2. Press the ↑→ key to blink Yes, and then press the **Enter** key.

Connecting the test fixture

CAUTION ⚠ Do not apply DC voltage or current to an UNKNOWN terminal. Special care must be taken for capacitors since they may be charged. Be sure to connect the DUT to an UNKNOWN terminal (or test fixture) only after discharging them sufficiently.

It is difficult to connect the DUT (capacitor) directly to the 4268A. Therefore, first connect the test fixture to the 4268A. Use a test fixture that matches the shape of the DUT. Available test fixtures are shown in Appendix G, "Accessories." This example, as shown in Figure 3-1, uses the Agilent 16044A, which is appropriate for measuring of chip capacitors.

Figure 3-1 **Connecting the Test Fixture (Agilent 16044A)**



3.Getting Started

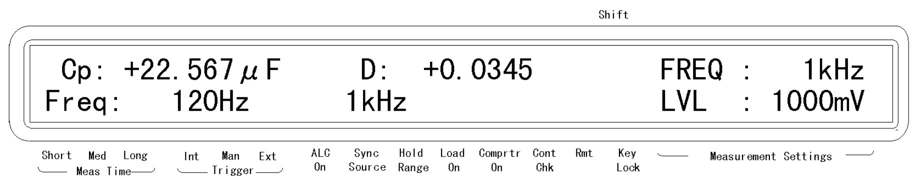
Making the basic setting

This section describes the procedure to make the basic setting for capacitor measurement. Settings not described here must also be made appropriately to achieve required accuracy, take measurement time into consideration, and perform measurements for specific requirements.

Setting the measurement frequency

Set the frequency of the signal applied to the DUT (capacitor) for measurement.

Step 1. Press the **Freq** key. The menu below appears.



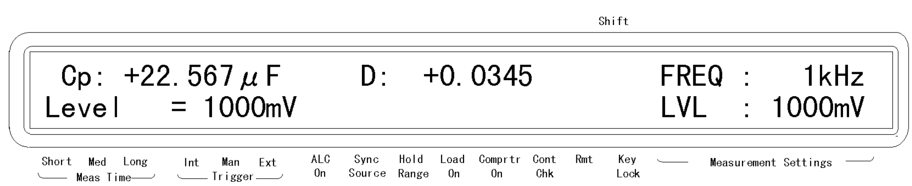
42680305

Step 2. The blinking frequency is the current setting. To change the setting, press the ↑→ key or the **Freq** key again to blink the measurement frequency (120 Hz or 1 kHz) you want to set and then press the **Enter** key.

Setting the measurement signal level

Set the voltage level of the signal applied to the DUT (capacitor) for measurement.

Step 1. Press the **Level** key. The menu below appears.



42680306

Step 2. Using numeric keys and other necessary keys, enter a desired level and press the **Enter** key.

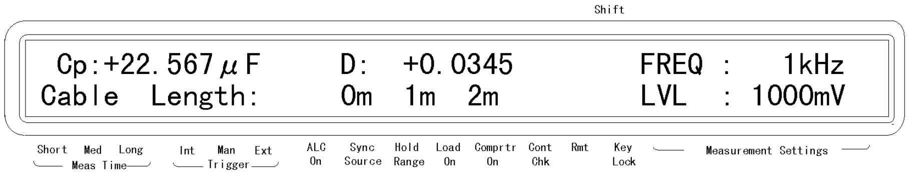
Setting the cable length

To correct an error caused by the extension of the measurement path, set the measurement cable length depending on the test fixture used for the measurement. The 4268A lets you select an appropriate cable length from 0 m, 1 m, or 2 m.

0m	When not using the test lead, i.e., when connecting the test fixture directly to the UNKNOWN terminals
1m	When using the Agilent 16048A or Agilent 16089A/B/C/D test lead
2m	When using the Agilent 16048D test lead

The setting procedure of the measurement cable length is as follows:

Step 1. Press the **Cable** key (blue key, **3** key). The menu below appears.



42680307

Step 2. The blinking value is the current setting of the cable length. To change the setting, use the ↑→ key or ←↓ key to blink the cable length you want to use and then press the **Enter** key.

Measuring capacitance

Setting the measurement parameters

Set the primary parameter and secondary parameter you want to measure. The 4268A lets you select the following combinations of parameters.

Table 3-1 **Measurement parameters**

Primary parameter	Secondary parameter
Cp	D, Q, G, Rp
Cs	D, Q, Rs

The following list briefly described each parameter.

Cp: Capacitance value taking equivalent parallel resistance into consideration

Cs: Capacitance value taking equivalent series resistance into consideration

D: Dissipation factor

Q: Quality factor (inverse of D)

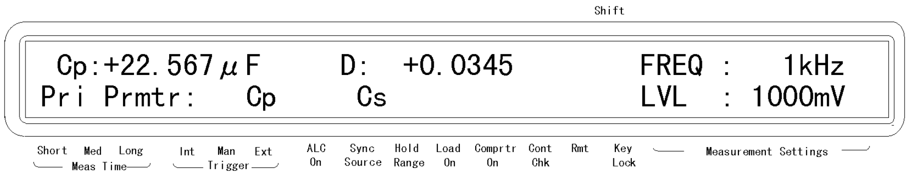
G: Equivalent parallel conductance

Rp: Equivalent parallel resistance

Rs: Equivalent series resistance

These steps show how to set the measurement parameters.

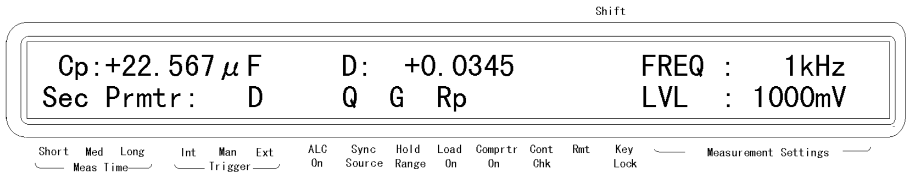
Step 1. Press the **Meas Prmtr** key. The primary parameter selection menu below appears.



42680308

Step 2. The blinking parameter is the current setting of the primary parameter. To change the setting, use the ↑→ key to blink the parameter you want to set and then press the **Enter** key.

Step 3. The secondary parameter selection menu below appears. In the same way as the primary parameter, use the ↑→ key to blink the parameter you want to set and then press the **Enter** key. (The secondary parameters displayed in the menu vary depending on the selected primary parameter. The following example shows the display when Cp is selected.)



42680309

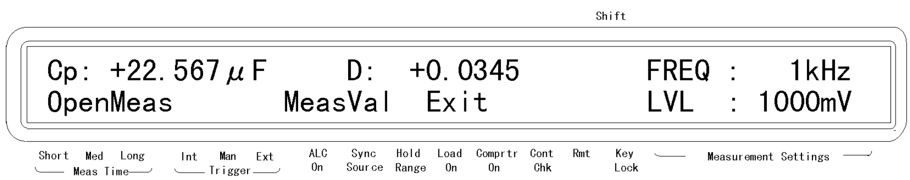
Executing the measurement to correct an error

Before connecting the DUT to the test fixture, measure the residual error of the test fixture. The measurement result is corrected using the error amount.

Performing the OPEN correction The OPEN correction is for canceling the stray admittance in parallel with the DUT. To perform the OPEN correction:

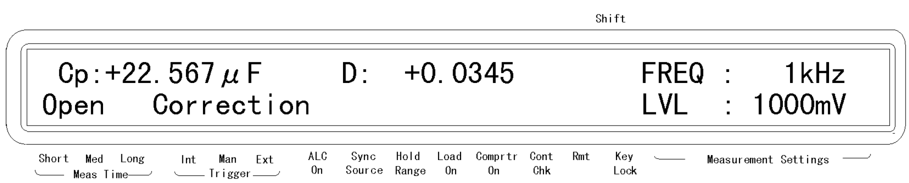
Step 1. Make sure that the electrode of the test fixture connected to the UNKNOWN terminals is either open or in the open correction state.

Step 2. Press the **Open** key (blue key, **4** key). The OPEN correction menu below appears.



42680310

Step 3. Blink OpenMeas using the ↑→ key and press the **Enter** key. The OPEN correction is performed with the following message displayed during the correction.



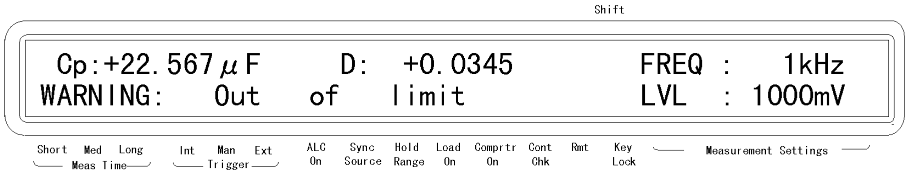
42680311

After a certain time, the 4268A completes the OPEN correction with the message “Open Correction Complete.”

NOTE For Open correction data, the measurement frequency setting is disregarded. Both 120 Hz and 1 Khz are measured and each data frequency is saved. Therefore, even if the measurement frequency is changed there is no need to reset the correction.

If you select MeasVal from the OPEN correction menu, the 4268A displays the OPEN admittance measurement values (OPEN correction data). First, the 4268A displays the measured primary parameter G. Next, when the **Enter** key is pressed, it displays the measured secondary parameter B. Then, when the **Enter** key is pressed, it returns to the OPEN correction menu.

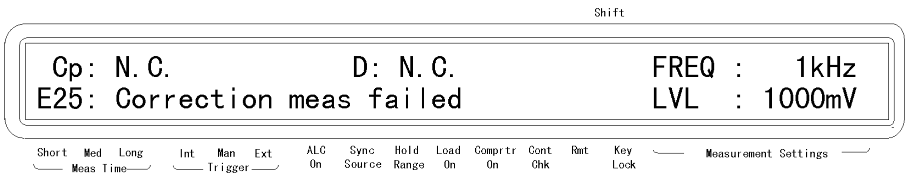
The following warning message is displayed when the OPEN admittance |Yo| is not less than 100 mS and is unsuitable for the OPEN correction data.



42680312

NOTE Even if this warning message is displayed, the OPEN correction data will be used. However, we recommend that you verify there is no error in the connection between the test fixture and the UNKNOWN terminals or in the OPEN correction procedure.

If a measurement failure, such as an overload or contact check failure, occurs during correction data measurement, the following error message is displayed.



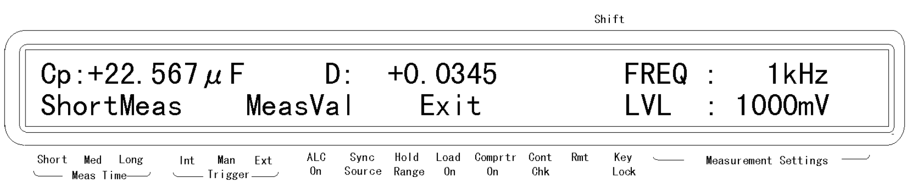
42680315

NOTE When this error message is displayed, the existing correction data before the measurement remains unchanged.

Performing the SHORT correction The SHORT correction is for canceling the effects of the residual impedance in series with the DUT. To perform the SHORT correction:

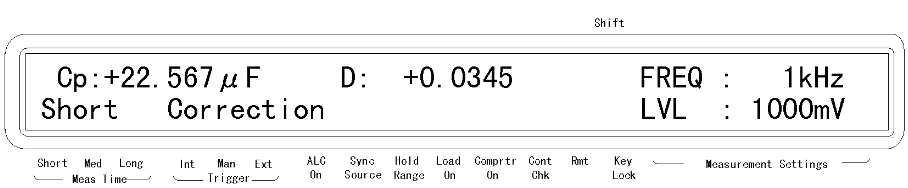
Step 1. Short the measurement electrodes by directly connecting the electrode of the test fixture or by connecting a shorting bar to the test fixture.

Step 2. Press the **Short** key (blue key, **5** key). The SHORT correction menu below is displayed.



42680313

Step 3. Blink ShortMeas using the ↑→ key and press the **Enter** key. The SHORT correction is performed with the following message displayed during the correction.



42680314

After a certain time, the 4268A completes SHORT correction with the message “Short Correction Complete.”

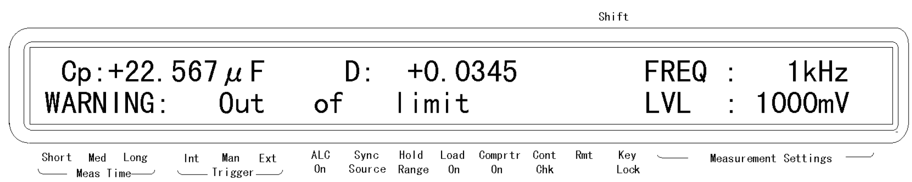
3.Getting Started

NOTE

For Short correction data, the measurement frequency setting is disregarded. Both 120 Hz and 1 Khz are measured and each data frequency is saved. Therefore, even if the measurement frequency is changed there is no need to reset the correction.

If you select MeasVal from the SHORT correction menu, the 4268A displays the SHORT impedance measurement values (SHORT correction data). First, the 4268A displays the measured primary parameter R. Next, when the **Enter** key is pressed, it displays the measured secondary parameter X. Then, when the **Enter** key is pressed, it returns to the SHORT correction menu.

The following warning message is displayed when the SHORT impedance |Zs| is not less than 10 Ω and is unsuitable for the SHORT correction data.

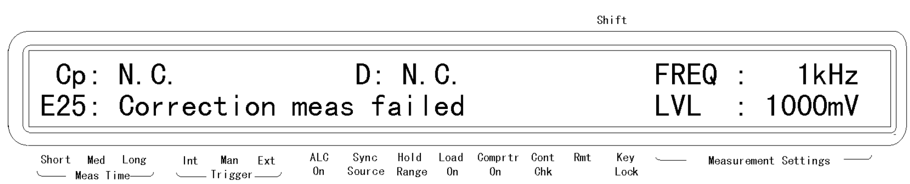


42680312

NOTE

Even if this warning message is displayed, the SHORT correction data will be used. However, we recommend that you verify there is no error in the connection between the test fixture and the UNKNOWN terminals or in the SHORT correction procedure.

If a measurement failure, such as an overload or contact check failure, occurs during correction data measurement, the following error message is displayed.



42680315

NOTE

When this error message is displayed, the existing correction data before the measurement remains unchanged.

Making a measurement with a capacitor connected

Mount a capacitor to the test fixture. The measurement result is shown in the display.

4 Operational Procedures

This chapter describes how to operate the 4268A by using the front panel keys.

Setting the Measurement Conditions

This section describes how to set measurement parameters, frequency and level of the measurement signal, measurement range, measurement time, and cable length.

Setting the measurement parameters

Press the **Meas Prmtr** key, use the ↑→ key and other keys to blink the primary parameter you want to set, and then press the **Enter** key. Next, use the ↑→ key and other keys to blink the secondary parameter and then press the **Enter** key. The 4268A lets you select the following combinations of parameters.

Primary parameter	Secondary parameter
Cp	D, Q, G, Rp
Cs	D, Q, Rs

The following list briefly describes each parameter.

Cp: Measured capacitance value using the parallel equivalent circuit model

Cs: Measured capacitance value using the series equivalent circuit model

D: Dissipation factor

Q: Quality factor (inverse of D)

G: Measured equivalent parallel conductance using the parallel equivalent circuit model

Rp: Measured equivalent parallel resistance using the parallel equivalent circuit model

Rs: Measured equivalent series resistance using the series equivalent circuit model

For details of the operational procedure, refer to “Setting the measurement parameters” on page 41. For details of the selection criteria, refer to “Selection criteria of parallel/series equivalent circuit models” on page 219.

Setting the measurement frequency

Press the **Freq** key, use the ↑→ key and other keys to blink the desired measurement frequency (120 Hz or 1 kHz), and then press the **Enter** key. For details, refer to “Setting the measurement frequency” on page 40.

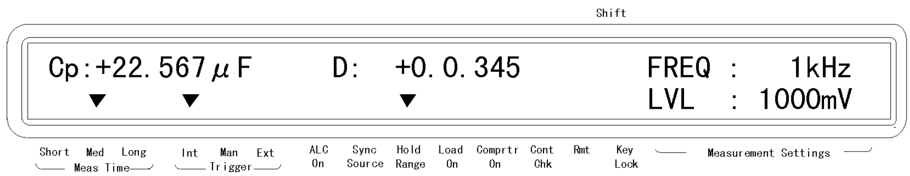
Setting the measurement signal level

Press the **Level** key, use the numeric keys and other keys to enter the desired level, and then press the **Enter** key. For details, refer to “Setting the measurement signal level” on page 40.

Setting the measurement range

Selecting the measurement range mode

Press the Auto/Hold key. Each press toggles Auto/Hold. Look at the instrument setting indicator at the bottom of the display. If the tsymbol is displayed above Hold Range, Hold is selected; if not, Auto. The following figure shows the Hold setting.



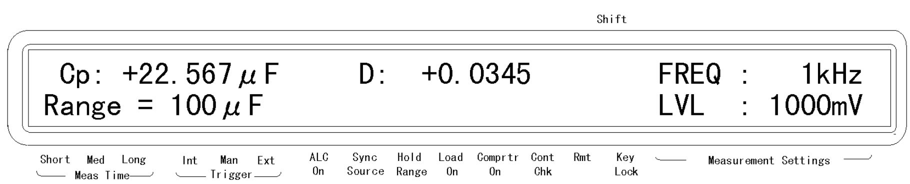
42680401

NOTE The advantage of the Auto mode is that you do not have to consider range selection according to the value of DUT; on the other hand, its disadvantage is that it requires the ranging time, resulting in a longer measurement time than that with to the Hold mode.

NOTE When the Auto mode is set without any connection to the UNKNOWN terminals, it will cause frequent changes in the internal relay, producing a sporadic clicking sound. To prevent this, connect the test fixture or set the Hold mode.

Setting the measurement range manually

Step 1. Press the Range Setup key (blue key, Auto/Hold key). As shown below, the currently selected range is displayed.



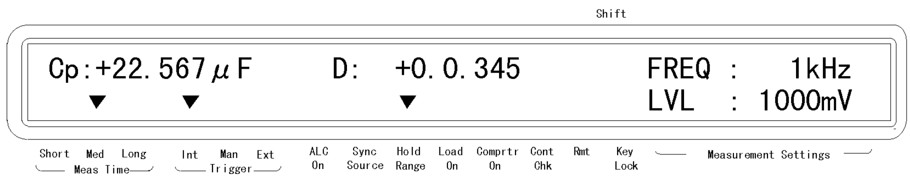
42680402

Step 2. Use the ↑→ key, numeric keys, or other keys to enter a range and then press the **Enter** key.

NOTE If the measurement range is entered manually, the measurement range mode is automatically set to Hold.

Setting the measurement time

Press the Meas Time key. Each press switches Short, Med, and Long in this order, starting from the current setting. Look at the Meas Time indicator at the lower left of the display. The tsymbol above either Short, Med, or Long, indicates the current measurement time setting. The following figure is an example when Med is selected.



42680401

NOTE Distortions are accompanied when measuring large DUTs, causing measurement variations. To eliminate these variations, set the measurement time to either Med or Long. Although the 4268A is designed to counteract distortions, if short measurement is used compared to using med or long a higher possiblity of distortion could occur.

Setting the cable length

Press the **Cable** key (blue key, **4** key), use the ↑→ key to blink the measurement cable length you want to set, and then press the **Enter** key. For details, refer to “Setting the cable length” on page 40.

Correcting Measurement Errors (OPEN/SHORT/LOAD correction function)

Making a measurement for the OPEN correction

Press the **Open** (blue key, **4** key). Use the ↑→ key to blink OpenMeas, and then press the **Enter** key. The OPEN correction is executed. For details, refer to “Performing the OPEN correction” on page 42.

Making a measurement for the SHORT correction

Press the **Short** (blue key, **5** key). Use the ↑→ key to blink ShortMeas and then press the **Enter** key. The SHORT correction is executed. For details, refer to “Performing the SHORT correction” on page 43.

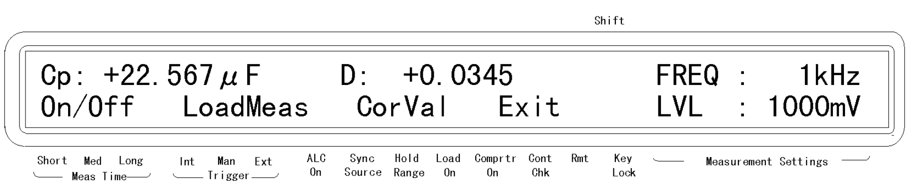
Making a measurement for the LOAD correction

The purpose of the LOAD correction is to eliminate various errors, such as amplitude/phase error, caused by the cable, test fixture, scanner and other devices. To perform the LOAD correction, you have to define the value of an appropriate device as the load standard in advance. (For information on how to select a load standard and how to value it, refer to “Standard for LOAD correction” on page 224.)

Follow these steps to execute the LOAD correction.

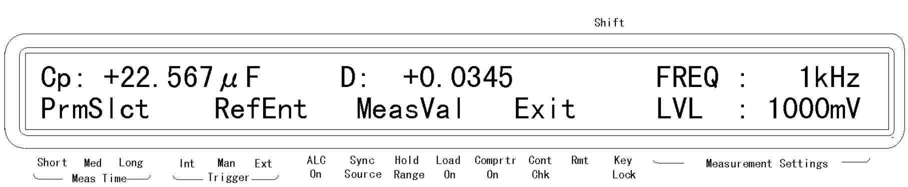
Step 1. Connect the valued load standard to the fixture.

Step 2. Press the **Load** key (blue key, **6** key). The LOAD correction menu below appears.



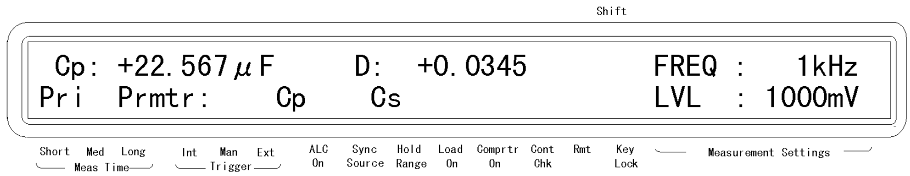
42680403

Step 3. Use the ↑→ key to blink CorVal and then press the **Enter** key. The menu below appears.



42680404

Step 4. Use the ↑→ key to blink PrmSlct and then press the **Enter** key. The menu for selecting the parameter according to which the load standard is valued appears as shown below.



42680405

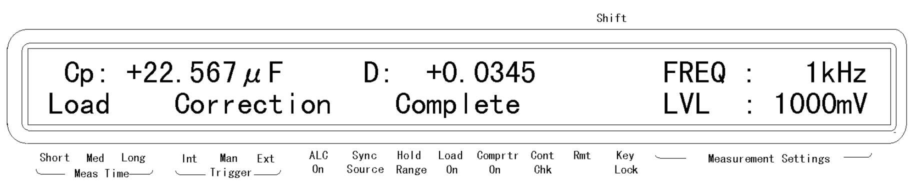
Step 5. Use the ↑→ key to blink the primary parameter for which the load standard is valued and then press the **Enter** key. Then, the secondary parameter selection menu appears. Use the ↑→ key and other keys to blink the valued secondary parameter and then press the **Enter** key. When the selection of the parameters is completed, the display returns to the menu in Step 3.

Step 6. Use the ↑→ key to blink RefEnt and then press the **Enter** key. The screen for entering the reference value (primary parameter) of the load standard appears as shown below. Use the numeric keys and other keys to enter the impedance value of the already valued load standard and then press the **Enter** key.

Step 7. Then, the screen for entering the secondary parameter reference value appears. In the same way as for the primary parameter, enter the value and then press the **Enter** key. When the entry of the reference value is completed, the display returns to the menu in Step 3.

Step 8. Use the ↑→ key to blink Exit and then press the **Enter** key. The display returns to the menu in Step 2.

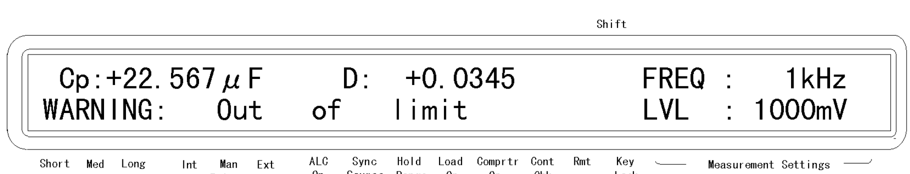
Step 9. Use the ↑→ key to blink LoadMeas and then press the **Enter** key. The load measurement is performed. When the load measurement is completed, the message below (when completed normally) appears, and the display returns to the usual measurement screen.



42680406

If the load standard measurement value differs from the load reference input value by 20% or more, the following warning message is displayed.

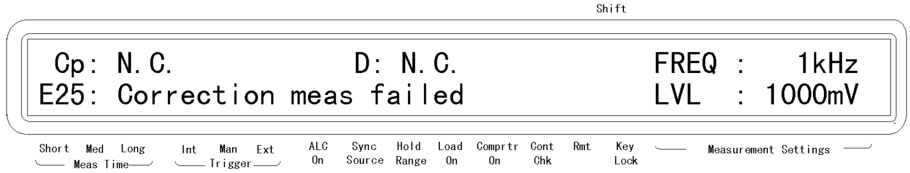
NOTE The data results of a load correction are saved in the system for a specified cable length and measurement frequency. Therefore, when measurement frequency and cable length are changed, re-correction has to be done to save new data.



42680312

NOTE Even if this warning message is displayed, the LOAD correction data is used as it is (when the LOAD correction is ON). However, it is recommended that you check whether the LOAD correction procedure is correct.

If a measurement failure, such as overload or contact check failure, occurs during correction data measurement, the following error message is displayed.



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NOTE When this error message is displayed, the existing correction data before the measurement remains unchanged.

You can select whether to use the LOAD correction value (ON) or not (OFF). Check the instrument setting indicator at the bottom of the display. If tsymbol is displayed above Load ON, ON is selected; if not, OFF.

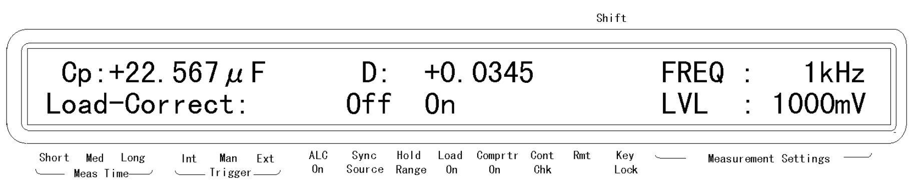
NOTE Executing the LOAD automatically correction enables the LOAD correction value (ON).

NOTE If a Load correction is executed with a different frequency and cable length setting, the Load correction value automatically becomes unusable.

Follow these steps to enable (ON)/disable (OFF) the LOAD correction value.

Step 1. Press the **Load** key (blue key, **6** key) to display the LOAD correction menu.

Step 2. Use the ↑→ key to blink On/Off and then press the **Enter** key. The menu below appears.



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Step 3. The blinking item is the current setting. If you want to change the setting, use the ↑→ key to select On or Off and then press the **Enter** key.

Step 4. The display returns to the LOAD correction menu. Check that Exit is blinking (if not, operate keys to blink Exit) and then press the **Enter** key to exit from the menu.

By selecting MeasVal from the LOAD correction menu, you can check the load standard measurement value (LOAD correction data). First, the primary parameter is displayed. Then, press the **Enter** key to display the secondary parameter. Finally, press the **Enter** key to return to the menu.

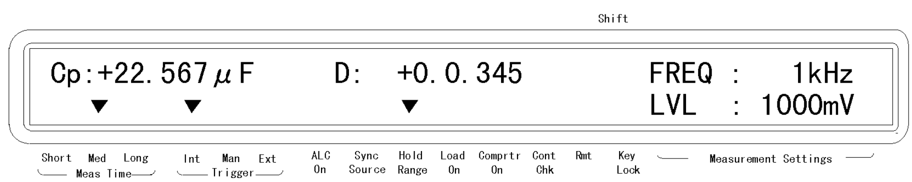
Generating a Trigger Manually or with an External Signal

To generate a trigger manually or by using an external signal, you have to select the trigger mode. The 4268A provides three types of trigger modes you can select from the front panel: Int (internal), Man (manual), and Ext (external).

Int	Automatically generates successive triggers using the internal trigger (initial setting).
Man	Generates a trigger when the **Trig** key on the front panel is pressed.
Ext	Generates a trigger when a trigger signal is inputted from external equipment via the EXT TRIGGER terminal, handler interface, or other device.
(Bus)	Available only in remote operation. For details, refer to "Generating a Trigger from an External Controller" on page 92.

Follow these steps to select the trigger mode.

Press the **Trig Mode** key. Each press switches Int, Man, and Ext in this order, starting from the current setting. Check the Trigger section of the instrument setting indicator at the bottom of the display. The tsymbol, above either Int, Man, or Ext, indicates the current trigger mode setting. The following figure shows an example when Int is selected.



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Generating a trigger manually

Follow these steps to generate a trigger manually.

Step 1. Check the Trigger section of the instrument setting indicator at the bottom of the display. Press the**Trig Mode** key repeatedly until the tsymbol is displayed above Man to set Trig Mode to manual.

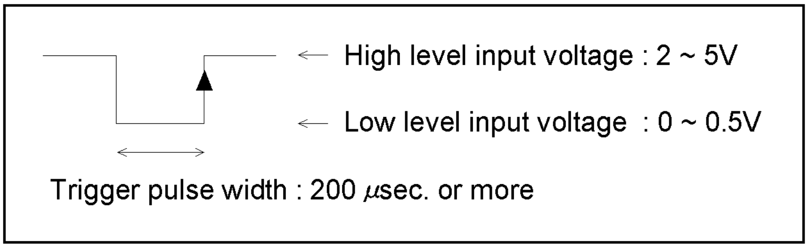
Step 2. Press the **Trig** key to start measurement.

Generating a trigger with an external signal

Follow these steps to generate a trigger by using an external signal.

Step 1. Check the Trigger section of the instrument setting indicator at the bottom of the display. Press the **Trig Mode** key repeatedly until the tsymbol is displayed above Ext to set Trig Mode to external.

Step 2. Input a trigger signal (TTL pulse signal) from the EXT TRIGGER terminal on the rear panel, or by other methods, to indicate the timing of when you want to start measurement. If you input a trigger signal from the EXT TRIGGER terminal, it must satisfy the following requirements.



4268e0422

4.Operational Procedures

Sorting a Measurement Result (comparator function)

This section describes how to sort a measurement result by using the comparator function.

4268A's comparator function lets you define up to nine sets of primary parameter limit ranges (BIN1 - BIN9) and one secondary parameter limit range. Therefore, as described below, you can define up to 11 classes: BIN1 - BIN9, OUT OF BINS, and AUX BIN.

On the other hand, if you define only one primary parameter limit range (BIN1) using the comparator function (and, by necessity, one secondary parameter limit range), you can check whether the measurement result of each DUT is within the specified limit range.

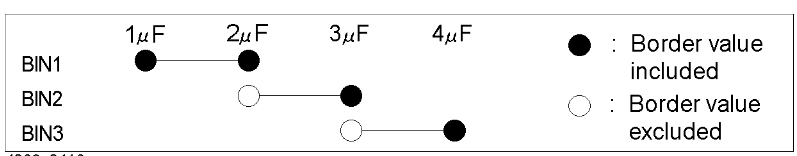
Setting the limit ranges

There are two modes to specify the limit ranges of the primary parameter. One is to specify the limit border values as absolute values (absolute mode), and the other is to specify them as relative boarder values to the reference value (tolerance mode). Note that only the absolute mode is available to specify the limit range of the secondary parameter.

NOTE If the specified upper border value is smaller than the specified lower border value, the limit range is neglected. The operation is the same as when the limit range is not specified at all.

Absolute mode

In the absolute mode, you specify the limit border values as absolute values. You can set border values sequentially, as shown below.



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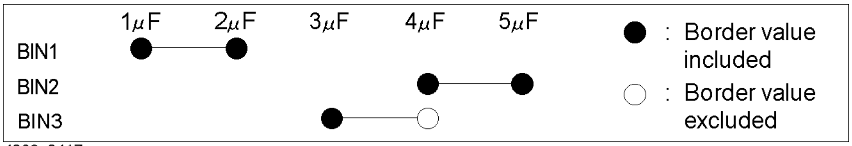
	Limit border value setting	
	Lower limit	**Upper limit**
BIN1	1 μF	2 μF
BIN2	2 μF	3 μF
BIN3	3 μF	4 μF

NOTE If the limit ranges of several BINs overlap and a measurement value falls within the overlapping range, it is sorted into the smallest BIN number. For example, if BIN1's upper border value is the same as BIN2's lower border value and the measurement result is equal to the border value, it is sorted into BIN1.

Note that you do not have to set the limit ranges from the smallest to the largest in the order of BIN numbers. Therefore, the setting below is valid.



4268e0417

	Limit border value setting	
	Lower limit	**Upper limit**
BIN1	1 μF	2 μF
BIN2	4 μF	5 μF
BIN3	3 μF	4 μF

Tolerance mode

In the tolerance mode, you specify limit border values in relative values to the reference value. There are two tolerance modes: absolute tolerance mode, in which you specify border values in absolute values, and percent tolerance mode, in which you specify border values in percentages of the reference value.

- Absolute tolerance mode

  Lower limit   Specified reference value + specified lower limit value

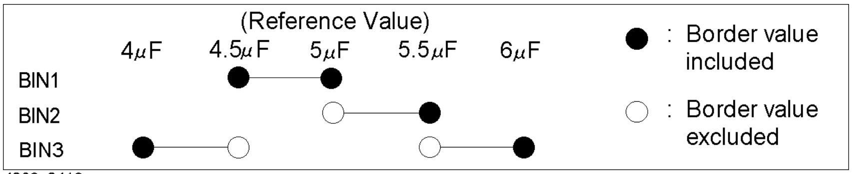
  Upper limit   Specified reference value + specified upper limit value

- Percent tolerance mode

  Lower limit   Specified reference value × (1+ specified lower limit value /100)

  Upper limit   Specified reference value × (1+ specified upper limit value /100)

For example, to set the following limit ranges in each tolerance mode, assuming that the reference value has been set to 5mF, use the limit border value setting shown in Tables 4-1 and 4-2, respectively.



4268e0418

4.Operational Procedures

Table 4-1 **Example of Limit Border Value Setting in Absolute Tolerance Mode**

	Limit border value setting	
	Lower limit	**Upper limit**
BIN1	-0.5 µF	0 µF
BIN2	0 µF	0.5 µF
BIN3	-1 µF	1 µF

Table 4-2 **Example of Limit Border Value Setting in Percent Tolerance Mode**

	Limit border value setting	
	Lower limit	**Upper limit**
BIN1	-10%	0%
BIN2	0%	10%
BIN3	-20%	20%

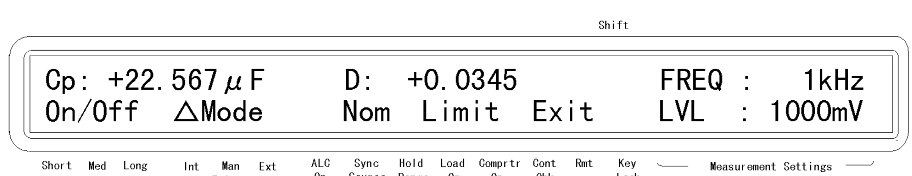
Setting the AUX BIN function

If you set the limit ranges for both the primary parameter and the secondary parameter and the result is out of the secondary parameter limit range, the sorting result varies depending on ON/OFF of the AUX BIN function, as shown below. For details on the sorting result, refer to “Outputting the comparator sorting result” on page 58.

- When the AUX BIN function is OFF (initial setting):
  Always sorted into OUT_OF_BINS.
- When the AUX BIN function is ON:
  If the primary parameter is within the limit range, DUT is sorted into AUX_BIN; if it is out of the limit range, DUT is sorted into OUT_OF_BINS.

Procedure to set the limit ranges

Step 1. Press the **Comprtr** key (blue key, **1** key) to display the comparator function menu screen below.



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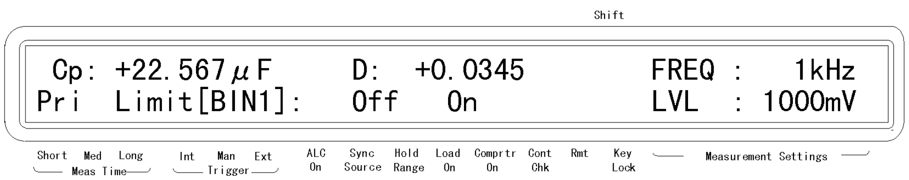
Step 2. Use the ↑→ key to select ΔMode. The screen for entering the primary parameter limit value specification method appears. Then, select the desired mode using the ↑→ key. The meaning of each menu item is as follows:

Off	Absolute mode
ΔABS	Absolute tolerance mode
Δ %	Percent tolerance mode

Step 3. Use the ↑→ key to select Nom. The screen for entering the reference value to specify the limit range appears. Use the numeric keys and other keys to enter the value. If you have selected the absolute mode in Step 2, you don’t have to set the reference value.

Step 4. Use the ↑→ key to select Limit. The screen for entering whether to enable (On)/disable (Off) the primary parameter BIN1 limit range appears.



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Step 5. If On is selected (when the primary parameter BIN1 limit range is used), the BIN1 limit range input screen appears. Enter limit values according to the expression selected in Step 2. If Off is selected, the BIN1 limit range input screen is skipped and the BIN2 setting screen appears (Step 6).

Step 6. When the BIN1 setting is completed, the primary parameter BIN2 setting screen appears. Make the setting in the same way as for BIN1.

Step 7. Repeat Step 6 until the setting of BIN9 is completed.

Step 8. When the setting of the primary parameter BIN1 - BIN9 limit ranges is completed, the secondary parameter limit range setting screen appears. Then, set it in the same way.

Step 9. Then, the AUX BIN function ON/OFF setting screen appears. Make a selection.

Step 10. The display returns to the comparator function menu screen. Use the ↑→ key to select On/Off. The comparator function ON/OFF setting screen appears. Select On.

Step 11. Use the ↑→ key to select Exit to exit from the comparator function menu screen.

If you want to set only 1 primary parameter limit range (BIN1) or the secondary parameter limit range, the following method is also available. If you need to set BIN1 only (for example, to just perform simple screening), this method is useful because it requires fewer key operations.

Step 1. Press the **Pri Low** key and then enter the primary parameter lower limit value.

Step 2. Press the **Pri High** key and then enter the primary parameter upper limit value.

Step 3. Then, if you want to set the secondary parameter limit value also, press the **Sec Low** key (blue key, **Pri Low** key) and enter the secondary parameter lower limit value. In the same way, press the **Sec High** key (blue key, **Pri High** key) to enter the secondary parameter upper limit value.

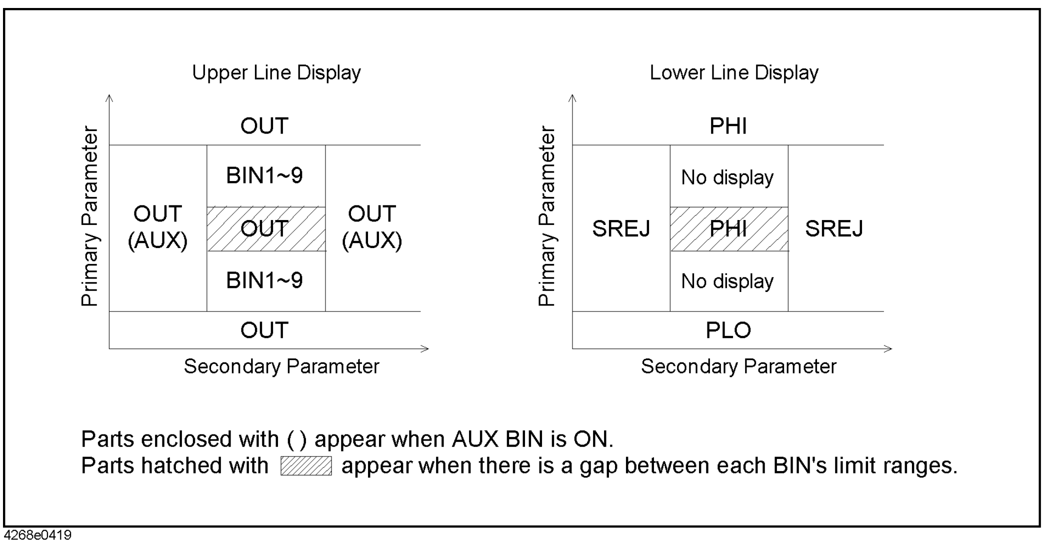
Outputting the comparator sorting result

This section describes how to output (display) the sorting result on the display. For information on the comparator output (sorting result output) when the measurement result is read out by the GPIB command, refer to “Reading in the comparator sorting result” on page 94; for information on the output to the handler interface signals (/BIN1 - /BIN9, /AUX_BIN, /OUT_OF_BINS, /PHI, /PLO, /SREJ), refer to “Outputting the Comparator Result” on page 185.

When you select the handler output page in the Measurement Settings indicator at the right of the display, the comparator result appears. The relationship between this information and the comparator result is shown in Figure 4-1.

NOTE Turning on the comparator function automatically selects the handler output page. For how to change the page of the Measurement Settings indicator, refer to “Changing displayed settings” on page 62.

Figure 4-1 Relationship between Information on Display and Comparator Result



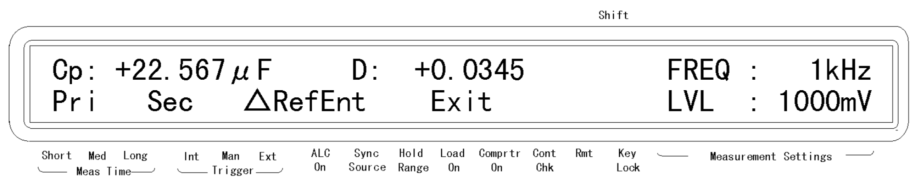
Counting the sorting result

The 4268A lets you count the number of DUTs sorted into each class depending on the comparator sorting result. Note that, this function cannot be accessed from the front panel keys. For how to use this function, refer to “Counting the sorting result” on page 94.

Displaying Measurement Results in Relation to the Reference Value (deviation measurement mode)

This section describes the procedure to display the measurement result as a relative value to the reference value (to use the deviation measurement mode) instead of an absolute value.

Step 1. Press the Δ**Mode** key (blue key, **Meas Prmtr** key). The deviation measurement menu below appears.



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Step 2. Use the ↑→ key to blink ΔRefEnt and then press the **Enter** key.

Step 3. The primary parameter reference value input screen appears. Use the numeric keys and other keys to enter the reference value and then press the **Enter** key. Then, the secondary parameter reference value input screen appears. Enter this value in the same way.

Step 4. The deviation measurement menu appears. Press the ↑→ key to blink Pri and then press the **Enter** key.

Step 5. The screen for selecting the primary parameter expression appears. Blink the desired expression and then press the **Enter** key. The meaning of each menu item is as follows:

Off	Displays the measurement result as an as-is absolute value (usual expression).
ΔABS	Displays the difference between the measurement value and the reference value (measurement value - reference value) as an absolute value.
Δ%	Displays the difference between the measurement value and the reference value as a percentage of the reference value ((measurement value - reference value)/ reference value × 100).

Step 6. Set the secondary parameter in the same way and then select Exit from the deviation measurement menu to complete the setting.

Performing Measurements by Correctly Applying Specified Voltage at DUT (ALC function)

If the impedance of DUT is small, then the output resistance of the signal source, the resistance of the measurement cable or the contact resistance of the contact probe can cause the voltage applied to the DUT to decrease below the specified voltage of the signal source. The auto level control (ALC) function lets you apply the specified voltage to the measurement contact part correctly.

Operational procedure of the ALC function

Press the ALC key. Each press toggles ON/OFF of the ALC function. Check the instrument setting indicator at the bottom of the display. If the tsymbol is displayed above ALC On, the function is ON; if not, OFF.

Operating range of the ALC function

When using the ALC function, be careful of the operating range (refer to “ALC (Auto Level Control) function” on page 234). If the maximum capacity limit of the ALC operating range is exceeded, even if the ALC function is ON, the signal voltage decreases as capacity increases. Even in this case, measurement values are obtained, but it is recommended that you check the actual voltage value applied to the DUT by using the voltage monitor function (refer to “Monitoring the Measurement Signal Level” on page 64).

The status in which capacity further increases and the output current of the signal source approaches the limit (approximately 1 Arms) is judged as overload. In this case, OVLD appears on the display.

Also, if the four-terminal connection is imperfect, the ALC function does not operate correctly. In this case, the operation of the 4268A varies depending on ON/OFF of the contact check function.

- When the contact check function is ON:

  The status is judged as contact check failure. N.C. appears on the display.

  If the status cannot be identified as either overload or contact check failure, simultaneous detection and judgement are done. OVLD N.C. appears on the display.

- When the contact check function is OFF:

  The status is judged as overload. OVLD appears on the display.

NOTE

The Auto Level Control (ALC) operates under the following measurement range:

Measurement frequency 120 Hz : 100 µF range , 1 mF range

Measurement frequency 1 KHz : 10 µF range , 100 µF range

If ALC operates below its measurement range (capacity), where the output resistance of the source signal is less than the DUT's impedance, the presence of ALC becomes irrelevant because the signal voltage applied to the DUT is almost equal to the set voltage. For this reason, ALC becomes ineffective when measuring a small capacity range (120 Hz for 10 µF or less , 1 kHz for 1 µF or less). Its operation stops and its signal level is judged. Thus, when measuring under a small capacity range, the contact resistance causes an error of 10% or more between the applied voltage of the DUT and the set voltage. In such case the following status judgements appear.

Contact check function On: Contact check failure

Contact check function Off: Overload

When the ALC is operated in its capacity range, the above status judgement does not appear even if the signal voltage is adjusted below 10%. Also, if the ALC function is Off (the tsymbol does not appear on the ALC On display), ALC does not operate and the signal level is not judged.

NOTE

If ALC fails to operate properly, it could cause measurement failure and give incorrect results for the comparator. To prevent this, use the ALC and comparator functions simultaneously and set each BIN limit within the operational limits of the ALC function.

NOTE

ALC starts to operate only after the waiting period time has elapsed from when the trigger has been activated. After performing the measurement its operation stops.

Changing Information on the Display

Changing displayed settings

4268A's Measurement Settings indicator at the right of the display provides seven pages (eight pages with option 001) you can select to display different setting items. Table 4-3 describes each page.

Table 4-3 **Description of Each Page of the Measurement Setting Indicator**

Page	Description
FREQ: LVL :	Displays the measurement frequency (FREQ) and the measurement signal level (LVL).
AVG : CBL :	Displays the averaging count (AVG) and the cable length (CBL).
SDLY: TDLY:	Displays the signal output delay time (SDLY) and the trigger delay time (TDLY).
P-H: L:	Displays the BIN1 upper limit (P-H) and lower limit (L) of the primary parameter comparator.
S-H: L:	Displays the upper limit (S-H) and lower limit (L) of the secondary parameter comparator.
HNDL:	Displays the handler output (comparator result).
Vmon: Imon:	Displays the voltage monitor value (Vmon) and the current monitor value (Imon) of the measurement signal.
SCNR: CH:	Displays the ON/OFF status of the MULTI correction function (SCNR) and the selected channel number (CH) (only when option 001 is installed).

To change displayed items, press the **Show Setting** key. Each press changes the displayed items from the current display in descending order as shown in Table 4-3.

Changing the measurement result display digit

Follow these steps to change the measurement result display digit.

Step 1. Press the **Disp Mode** key (blue key, **Freq** key), use the ↑→ key to blink Digit and then press the **Enter** key.

Step 2. The display digit selection screen appears. Use the ↑→ key to blink the desired digit and then press the **Enter** key.

Step 3. Use the ↑→ key to blink Exit and then press the **Enter** key to complete the setting.

Turning ON/OFF the measurement result display

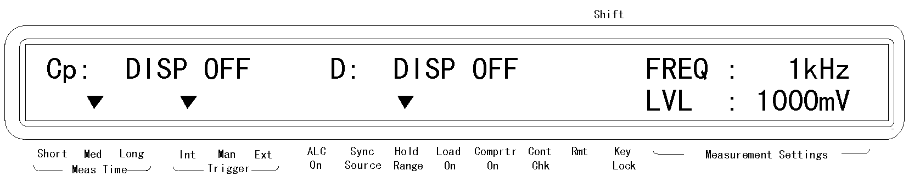
Follow these steps to turn ON/OFF the measurement result display.

Step 1. Press the **Disp Mode** key (blue key, **Freq** key), use the ↑→ key to blink On/Off, and then press the **Enter** key.

Step 2. The measurement result ON/OFF selection screen appears. Use the ↑→ key to blink the desired item and then press the **Enter** key.

Step 3. Use the ↑→ key to blink Exit and then press the **Enter** key to complete the setting.

The following figure shows the display when the measurement result display is turned OFF.



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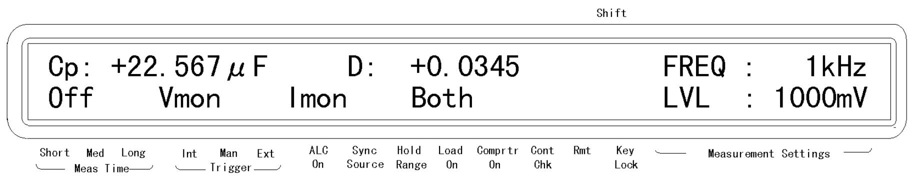
Monitoring the Measurement Signal Level

Follow these steps to monitor the voltage and current of the measurement signal.

Step 1. Press the **Level Mon** key (blue key, **Show Setting** key). The menu as shown below appears.



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Step 2. Use the ↑→ key to blink the item you want to monitor and then press the **Enter** key. The meaning of each item displayed in the menu is shown below. Selecting Vmon, Imon, or Both automatically changes the page of the Measurement Settings indicator at the right of the display to Vmon and Imon.

Off	Turns OFF the measurement signal monitor function.
Vmon	Turns ON the measurement signal voltage monitor function.
Imon	Turns ON the measurement signal current monitor function.
Both	Turns ON both the measurement signal voltage and current monitor functions.

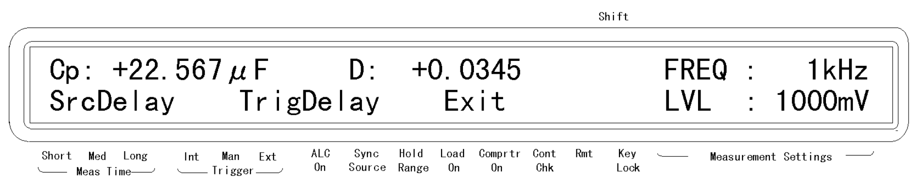
Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)

You can use this function to prevent large current from flowing through the contact pin at the moment of contact with DUT to avoid damaging the contact pin. This function, after a trigger, outputs the measurement signal so that it is applied only during measurement (synchronous source function). The operational procedure is given below.

Press the **Sync Source** key (blue key, **Level** key). Each press toggles ON/OFF of the synchronous source function. Check the instrument setting indicator at the bottom of the display. If the tsymbol is displayed above Sync Source, ON is selected; if not, OFF.

In addition, you can control the measurement signal so that it is outputted after a specified waiting time from triggering (source delay function). Follow these steps.

Step 1. Press the **Delay** key (blue key, **Trig Mode** key). The menu below appears.



42680410

Step 2. Use the ↑→ key and other keys to blink SrcDelay and then press the **Enter** key. The setting screen for specifying the waiting time between the trigger and the start of measurement signal output appears. Use the numeric keys and other keys to enter a value. You can set the waiting time within the range of 0 to 1 second at a minimum of 1-ms resolution.

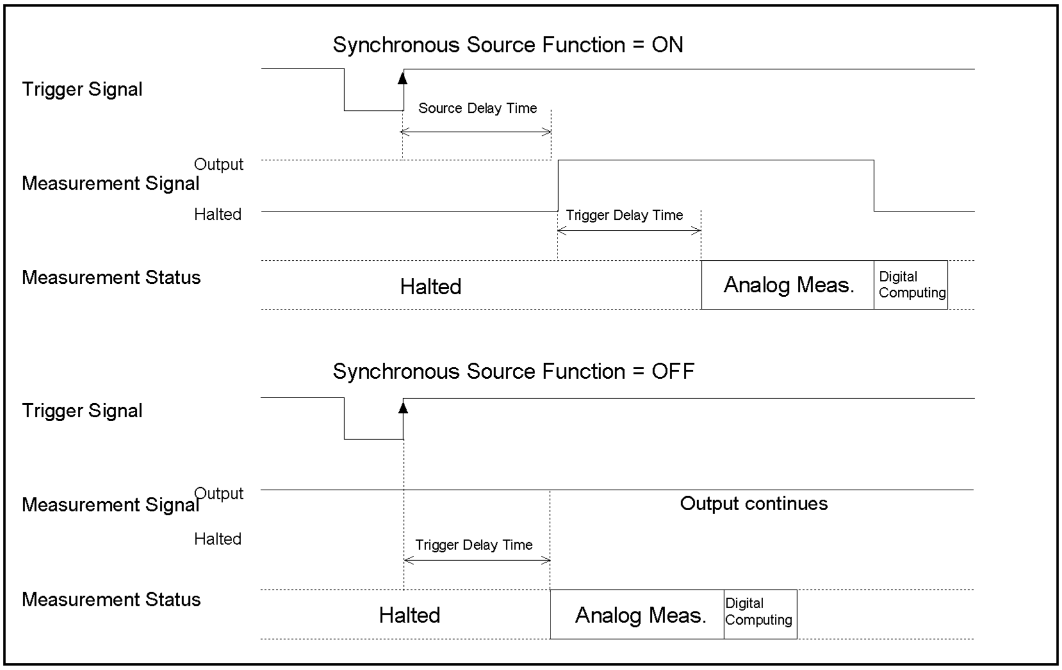
NOTE

The specified source delay time (to delay the start of signal output) is valid only when the synchronous source function is ON.

When the source delay time and trigger delay time are both specified, the source delay time precedes the trigger execution.

Figure 4-2 shows the measurement signal output timing.

Figure 4-2 **Measurement Signal Output Timing**



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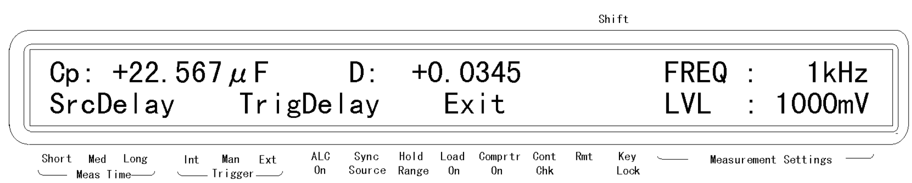
Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)

Chattering may occur when the contact pin comes in contact with DUT. The trigger delay function and the source delay function can be used to eliminate chattering time. While the 4268A usually starts measurement immediately after triggering, it provides the trigger delay function to let you define the waiting time (trigger delay time or source delay time) between a trigger and the start of measurement within the range of 0 to 1 second. Follow these steps to set the trigger delay time. For how to set the source delay time, refer to "Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)" on page 65.

Step 1. Press the **Delay** key (blue key, **Trig Mode** key). The menu below appears.



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Step 2. Use the ↑→ key and other keys to blink TrigDelay and then press the **Enter** key. The setting screen for specifying the waiting time between the trigger and the start of measurement appears. Use the numeric keys and other keys to enter the waiting time during which chattering disappears. You can set the waiting time at a minimum of 1-ms resolution.

NOTE When measuring high-value capacitors, you should use source delay time to avoid the bad effects of chattering on measurement. This delay will protect the contact pin from damage by establishing a solid connection before the large flow of signal current is applied. On the other hand, the trigger delay time has no protective effect on the contact pin since it only extends the starting time of the measurement after the signal has been applied.

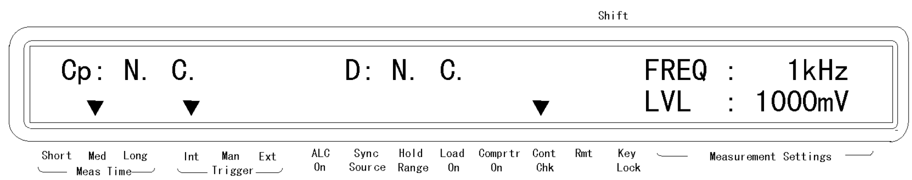
NOTE When the source delay time and trigger delay time are both specified, the source delay time precedes the trigger delay time before execution.

NOTE ALC starts to operate only after the waiting time has elapsed, right after triggering. After performing the measurement ALC stops operating.

Making a Measurement While Checking Contact Failure between the Contact Pin and DUT (contact check function)

Use the contact check function to make measurements while checking for contact failure between the contact pin and DUT.

With the contact check function ON, if contact failure is detected the contact failure indication (N.C.) appears on the display instead of measurement values, as shown below.



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Also, a fixed value (9.9E37) is always read out via GPIB as the measurement value, and the /NO CONTACT signal of the handler interface goes Low. Refer to Appendix E , “Overload/No-Contact Operation,” which provides a summary of display and outputs if contact failure (No-Contact) is detected in contact check.

NOTE When overload and contact failure cannot be distinguished, OVLD N.C. will appear on the display

NOTE The contact check function cannot detect all contact failures completely. It cannot detect subtle contact failures or unstable contact failures such as chattering. For information on the valid range of the contact check function and minimum contact resistance that can be detected, refer to “Contact check function” on page 236.

NOTE The contact check function is available in the four-terminal measurement. For the two-terminal measurement, contact failure cannot be detected.

The operational procedure of the contact check function is as follows:

Press the **Cont Check** key (blue key, **4** key). Each press toggles ON/OFF of the contact check function. Check the instrument setting indicator at the bottom of the display. If the tsymbol is displayed above Cont Chk, the function is ON; if not, OFF.

Obtaining Stable Measurement

Obtaining the mean value (averaging function)

Obtaining the mean value of several measurement values (averaging) is a good way to obtain stable measurement results. The 4268A provides an averaging function to output the mean value of measurement values of the specified number within 1 to 256 as the measurement result. Follow these steps.

Press the **Average** key (blue key, **Meas Time** key). The averaging count specification screen appears. Use the numeric keys and other keys to enter the averaging count (1 to 256).

Eliminating transient effect (measurement variations)

When measuring a capacitor where the value is more than 500μF, transients caused by the source signal output resistance and capacitance produce measurement variations. To overcome this, use the trigger delay function. Measurement starts after the specified waiting time has elapsed and when the trigger has activated. To compute the delay time *Td* , $Td = 10 \times C - 0.005$[sec]; if the capacitor is less than 500μF $Td = 0$ [sec].

In addition, when you measure large DUT with dielectric absorption, transients caused by the capacitor cause measurement variations. To overcome this, use the trigger delay function. Measurement starts after the specified waiting time has elapsed and when the trigger has activated. For how to operate the trigger delay function, refer to "Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)" on page 67.

NOTE Even when the source delay function is used to avoid chattering, it is still necessary to have an additional trigger delay to avoid transient effects (measurement variation) that occur from the onset of the source.

Saving/Recalling the Setting

The 4268A lets you save/recall up to 10 settings by using the built-in nonvolatile memory. For information on the setting items that can be saved/recalled, refer to Table F-1 on page 280.

Saving a setting

Follow these steps to save the instrument setting.

Step 1. Press the **Save** key (blue key, **Rcl** key).

Step 2. The save location (numbers 0 to 9) input screen appears. Use the numeric keys and other keys to enter the desired number. At this time, it is recommended that you record the number entered.

NOTE If there is existing data at the location where you attempt to save data (number), it will be overwritten. Check that there is no necessary setting before entering the save number.

Recalling a saved setting

Follow these steps to recall a saved instrument setting.

Step 1. Press the **Rcl** key.

Step 2. The recall location input screen appears. Use the numeric keys and other keys to enter the location number (0 to 9) where the setting you want to read out is saved.

Preventing Mis-input from the Front Panel Keys (key lock function)

To prevent mis-input, for example when someone touches the front panel keys by accident or if there is no need to operate the keys on the front panel, you can turn on the key lock function the 4268A provides to disable the front panel keys. The operational procedure is given below.

Press the **Key Lock** key (blue key, **0** key). Each press toggles ON/OFF of the key lock function. Check the instrument setting indicator at the bottom of the display. If the tsymbol is displayed above Key Lock, ON is selected; if not, OFF.

When the key lock function is ON, only the blue key and the **Key Lock** key are available.

Reenabling the Front Panel Keys

If input by the front panel keys is not accepted, the following two possible causes are likely.

- The key lock function is ON: the tsymbol is displayed above Key Lock in the instrument setting indicator at the bottom of the display.
- The remote operation mode is selected: the tsymbol is displayed above Rmt in the instrument setting indicator at the bottom of the display.

Follow these steps to clear these settings.

Clearing the key lock

Press the **Key Lock** key (blue key, **0** key). Only this key is available.

NOTE If the key lock has been activated via the handler interface, it cannot be cleared from the front panel keys. Set the /KEY_LOCK signal of the handler interface to High.

NOTE If the key lock has been activated via the GPIB, it cannot be cleared from the front panel keys. Clear the key lock with the GPIB command (“:SYSTem:KLOCk”) on page 174.

Clearing the remote mode

Press the **Lcl** key. Only this key is available. However, if the key lock is set the **Lcl** key will not work. In this case, unlock the key lock and remote mode in that order.

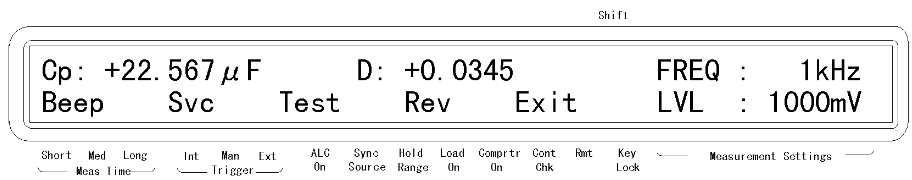
Changing the Conditions for Outputting the Alarm Sound (beep sound)

To change the condition for outputting the alarm sound (beep sound), change the beep mode. The condition differs according to the beep mode as follows:

<table>
<tr><th>Beep mode</th><th colspan="2">Condition for outputting the beep sound</th></tr>
<tr><td>Off</td><td colspan="2">Does not output the beep sound</td></tr>
<tr><td>Fail
(initial setting value)</td><td rowspan="2">When erroneous key operation is performed or when an error, warning, or other type of message is outputted</td><td>When the comparator result is OUT_OF_BIN or AUX_BIN</td></tr>
<tr><td>Pass</td><td>When the comparator result is within BIN 1-9</td></tr>
</table>

Follow these steps to change the beep mode.

Step 1. Press the **Config** key (blue key, **-** key). The menu below appears.



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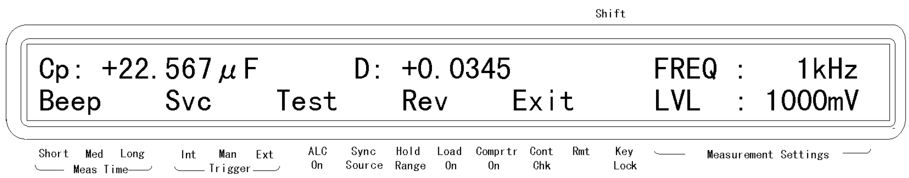
Step 2. Use the ↑→ key and other keys to blink Beep and then press the **Enter** key. The beep mode setting screen appears. Use the ↑→ key and other keys to blink the desired beep mode and then press the **Enter** key.

Confirming There is No Failure

Executing the self-test

The 4268A provides a self-test function. The self-test performs brief checks of the operation of digital parts including memory. Follow these steps to execute the self-test.

Step 1. Press the **Config** key (blue key, **-** key). The menu as shown below appears.



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Step 2. Use the ↑→ key to blink Test and then press the **Enter** key. The “SELF TESTING” message appears and the self-test is executed.

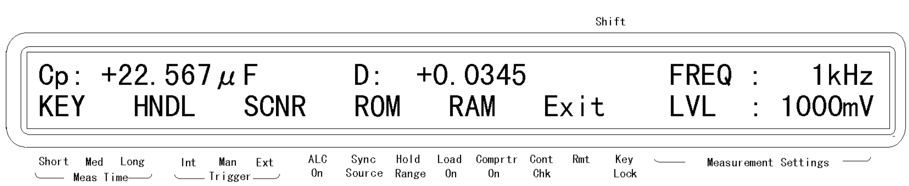
Step 3. When the test is completed, “SELF-TEST:PASS” is displayed for approximately 1 second (if an error occurs, its error number is displayed) and then the menu in Step 1 appears. Check that Exit is blinking (if not, operate keys to blink Exit) and then press the **Enter** key to exit from the menu.

NOTE For details on error numbers displayed when errors occur, refer to Table 6-1 on page 182. If several errors are detected at one time, the sum of their error numbers is displayed.

Executing the function test of the front panel keys

Follow these steps to test the function of a front panel key.

Step 1. Press the **Config** key (blue key, **-** key). Use the ↑→ key to blink Svc and then press the **Enter** key. The service function menu below appears.



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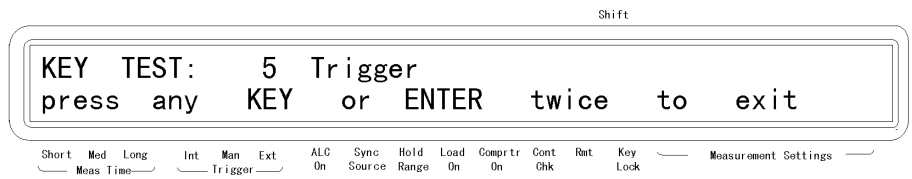
Step 2. Use the ↑→ key to blink KEY and then press the **Enter** key. The front panel key test screen appears.

Step 3. Press a key you want to test. The name of the pressed key is displayed next to KEY TEST: in the upper line of the display. The following figure shows an example when the **Trig** key is pressed. If the name of the key is not displayed correctly, the key does not function. Contact your nearest Agilent Technologies Japan sales office or the company from which you purchased this instrument.



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Step 4. If you want to finish the test, press the **Enter** key twice. The service function menu appears. Check that Exit is blinking (if not, operate keys to blink Exit), press the **Enter** key to return to the immediately previous menu, and then exit from this menu in the same way.

NOTE Refer to **4268A *Service Manual*** for the remaining test, displayed on the Service function menu (HNDL, SCNR, ROM, RAM).

Checking the Firmware Version and the Information on Options

There are 2 ways to check the firmware version and the information on installed options.

- Turn off the power supply and then turn it on again. (Immediately after turning the power on, the firmware version and option information appear on the display.)
- Press the **Config** key (blue key, **-** key), use the ↑→ key to blink Rev, and then press the **Enter** key.

Increasing the Measurement Speed

This section lists possible methods to increase the measurement speed.

- Setting the measurement time to short

  For how to make this setting, refer to “Setting the measurement time” on page 48.

- Setting the measurement range mode to Hold

  If the measurement range mode is set to Auto (automatic), the ranging time is required, and therefore the measurement time becomes longer. For how to make the setting, refer to “Setting the measurement range” on page 47.

- Decreasing the averaging count

  If you want to use the averaging function, set the averaging count to a minimum. For how to make this setting, refer to “Obtaining the mean value (averaging function)” on page 69.

- Setting the trigger/source delay time to 0

  If you do not need to use the trigger/source delay function, check to see if the trigger/signal output delay time is set to 0. For how to check this, refer to“Changing displayed settings” on page 62. For how to make this setting, refer to “Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)” on page 67 and “Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)” on page 65.

- Turning OFF the display

  If you disable displaying, the measurement time can be shortened because there is no need to update the display. For how to make this setting, refer to “Turning ON/OFF the measurement result display” on page 63.

Making measurements with High Accuracy

This section lists possible methods to improve measurement accuracy.

- Setting the measurement time to Long

  Setting the measurement time to Long provides higher measurement accuracy. For how to make this setting, refer to "Setting the measurement time" on page 48.

- Making measurements with the four-terminal pair

  Use the four-terminal pair measurement to decrease measurement errors. For details, refer to "Principle of the four-terminal pair measurement" on page 220.

- Using the correction function

  The OPEN correction eliminates an error caused by parallel stray admittance of the cable and the fixture. For how to make this setting, refer to "Performing the OPEN correction" on page 42.

  The SHORT correction eliminates an error caused by series residual impedance of the cable and the fixture. For how to make this setting, refer to "Performing the SHORT correction" on page 43.

  The LOAD correction eliminates various errors, such as amplitude/phase errors, caused by the cable, test fixture, scanner and other devices. For how to make this setting, refer to "Making a measurement for the LOAD correction" on page 49.

- Using averaging function

  There is no guarantee that accuracy in measurement will be better even if averaging is performed. However, in a noisy environment it is recommended that you perform averaging because this will lead to better measurement results. For how to make this setting, refer to "Obtaining the mean value (averaging function)" on page 69.

- Using Auto Level Control (ALC) function

  When measuring high-value ceramic capacitors it is recommended that you use the ALC function. It has the advantage of applying the correct voltage of the DUT and accurately perform capacitor measurements within the specified conditions. For how to operate this function, refer to "Performing Measurements by Correctly Applying Specified Voltage at DUT (ALC function)" on page 60.

- Using trigger /source delay function

  To eliminate measurement errors caused by chattering during DUT and contact pin connections, set a waiting time after the trigger is activated. For how to make this setting, refer to "Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)" on page 67 and "Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)" on page 65

5 Remote Operation by an External Controller through GPIB

This chapter describes how to perform remote operation by using an external controller through GPIB.

Sending Commands to the Instrument

This section describes the syntax used to send program messages through GPIB. The program message refers to a type of message that the user sends from an external controller to the instrument. A program message consists of a set of commands separated by appropriate separators and terminated by an appropriate message terminator.

Upper/lower case sensitivity

The messages are upper/lower case insensitive.

Program message terminators

A program message must be terminated by one of the following program message terminators: <new line>, <^END>, or <new line><^END>. <^END> indicates that EOI goes to the active level on the GPIB interface at the instant when the immediately previous data byte is sent. For example, the OUTPUT statement of HP BASIC automatically sends the message terminator after the last data byte.

Command structure

GPIB commands can be classified into the following two groups.

4268A GPIB command

Commands specific to the 4268A. These cover all measurement functions and some part of the general-purpose functions. The commands in this group are organized in a hierarchical structure called a command tree (refer to Appendix D, “4268A GPIB Command Tree,”). Each command consists of mnemonics in each level separated by colons (:).

IEEE common command

Commands defined by IEEE 488.2. There is no hierarchical structure for the common commands.

Concept of the command tree

A command at the highest level in the subsystem command tree is called a “root command” or more simply “root”. To access a command at a lower level in this tree structure, you must specify a “path,” like a directory path for DOS files. After power-on or reset, the current path is set to the root. Special symbols in a message change the path setting as follows.

Message terminator
: Message terminators such as the <new line> character set the current path to the root.

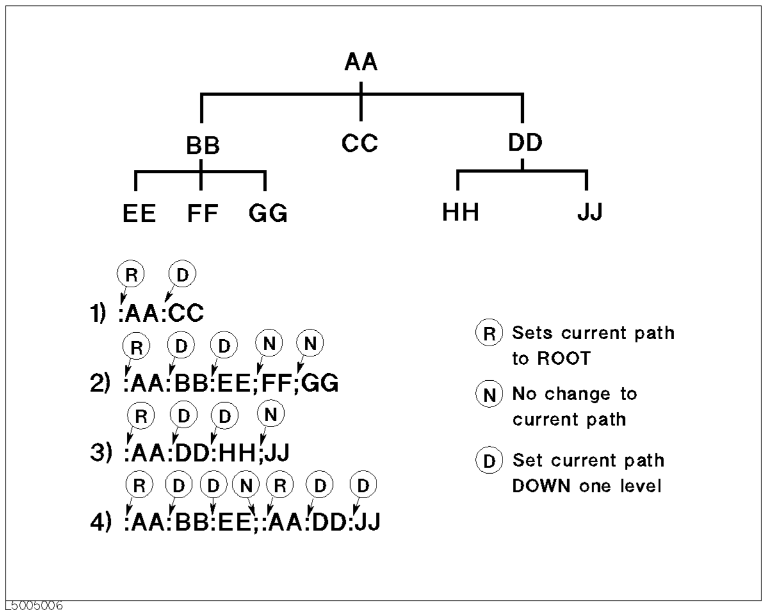
Colon (:)
: A colon between two command mnemonics lowers the level of the current path in the command tree. If a colon is used as the first character in a command, the command mnemonic following it is specified as a root level command.

Semicolon (;)
: A semicolon separates two commands in a single message without

changing the current path.

Figure 5-1 shows examples of how to use the colon and semicolon to efficiently access various commands in the command tree.

Figure 5-1 **Proper use of Colon and Semicolon**



Parameters

Between the last command mnemonic and the first parameter in a single subsystem command, a space (ASCII code 32) is required.

When sending several parameters in a single command, separate them with commas (,).

Message containing several commands

When sending two or more commands in a single message, separate them with semicolons (;). The following example sends the "*CLS" command and the ":INIT" command of HP BASIC in a single message.

OUTPUT 717;"*CLS;:INIT"

Using an External Controller

GPIB Cable Connections

The GPIB's cable connects the 4268A to an external controller. The GPIB connector can be found at the rear panel of the 4268A.

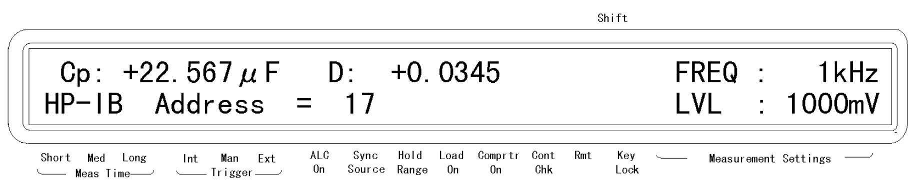
There are certain restrictions on connecting GPIB cables:

- The maximum allowable number of devices that can be connected in an GPIB system is 15.
- The length of cable used between devices must be 2 m or less, for a total length of 20 m or less.
- The type of connection should be linear, star or compound type.

In connecting the GPIB cable do not use a driver; use one only for disconnection.

Setting an GPIB address

Press the **Adrs** key (blue key, **Lcl** key). The GPIB address setting screen below appears. The value initially displayed is the current set address value. If you want to change the setting, enter a value using numeric keys and other keys and then press the **Enter** key.



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Loading Sample Programs

A sample program disk (P/N 04268-18000) is provided together with this manual. This HP BASIC sample program is in text format and the program disk is DOS formatted.

How to Load Sample Programs

To load a sample program use the HP BASIC GET command. See the example below in loading set.bas from the sample program.

GET “set.bas”

Returning the Setting to the Initial Value (reset)

To return the instrument setting of the 4268A to its initial value, use the following two types of commands. The ":SYSTem:PRESet" command provides the same functionality as a reset from the front panel. The "*RST" command provides almost the same functionality as the ":SYSTem:PRESet" command, except for a few differences in the initial setting status when the command is executed. For details, refer to Appendix F , "Initial settings.".

- ":SYSTem:PRESet" on page 174
- "*RST" on page 180

Setting the Measurement Conditions

This section describes how to set the measurement parameters, the frequency and level of the measurement signal, the measurement range, the measurement time, and the cable length by remote operation.

Setting the measurement parameters

To set the measurement parameters, use the following commands.

- ":CALCulate1:FORMat" on page 143
- ":CALCulate2:FORMat" on page 145

You can select one of the parameter combinations shown in the table below. If you set one parameter that does not match any of the combinations using an GPIB command, the other is automatically changed to a setting appropriate for the set parameter. For example, if the primary parameter has been set to Cp and you set the secondary parameter to Rs, the primary parameter is automatically changed to Cs.

Primary parameter	Secondary parameter
Cp	D, Q, G, Rp
Cs	D, Q, Rs

For the meanings of the parameters in the table, refer to "Setting the measurement parameters" on page 46.

Example 5-1 provides a sample program using the above commands.

Setting the measurement frequency

To set the measurement frequency, use the following command.

- ":SOURce:FREQuency[:CW]" on page 169

Example 5-1 provides a sample program using the above command.

Setting the measurement signal level

To set the measurement signal level, use the following command.

- ":SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]" on page 170

Example 5-1 provides a sample program using the above command.

Setting the measurement range

Setting the measurement range mode

To set the measurement range mode, use the following command.

- "[:SENSe][:FIMPedance]:RANGe:AUTO" on page 167

Example 5-1 provides a sample program using the above command.

Setting the measurement range manually

To set the measurement range, use the following command.

- "[:SENSe][:FIMPedance]:RANGe[:UPPer]" on page 168

Example 5-1 provides a sample program using the above command.

NOTE Setting the measurement range automatically sets the measurement range mode to Hold.

Setting the measurement time

To set the measurement time, use the following command.

- "[:SENSe][:FIMPedance]:APERture[:MODE]" on page 166

Example 5-1 provides a sample program using the above command.

Setting the cable length

To set the cable length, use the following command.

- ":CALibration:CABLe" on page 148

Example 5-1 provides a sample program using the above command. (This program is stored in the sample program disk under the file name set.bas.)

This program sets the primary parameter to Cp, the secondary parameter to D, the measurement frequency to 120 Hz, the measurement signal level to 0.5 V, the measurement range to 100 μF, the measurement time to Long, and the cable length to 0 m. Then, it reads out and displays the settings for confirmation.

Lines 70 to 130	Substitutes the above desired settings into variables Pri$, Sec$, Freq, Lvl, Rng$, Tim$, and Cbl, respectively.
Line 150	Triggers a reset.
Lines 170 to 280	Sets the primary parameter to Pri$, the secondary parameter to Sec$, the measurement frequency to Freq, the measurement signal level to Lvl, the measurement range to Rng$, the measurement time to Tim$, and the cable length to Cbl.
Lines 300 to 500	Reads the setting for each measurement condition.
Lines 520 to 600	Displays the read-in measurement condition.

Example 5-1 **Sample program: Setting the measurement conditions**

```
10      DIM Pri$[9],Sec$[9],Rng$[9],Tim$[9]
20      DIM Rtn_pri$[9],Rtn_sec$[9],Auto_mode$[9],Rtn_time$[9]
30      REAL Freq,Lvl,Rtn_freq,Rtn_lvl,Rtn_rng
40      INTEGER Cbl,Auto_val,Rtn_cbl
50      !
60      ASSIGN @Hp4268a TO 717
70      Pri$="CP"
80      Sec$="D"
90      Freq=120
100     Lvl=.5
110     Rng$="100u"
120     Tim$="LONG"
130     Cbl=0
140     !
150     OUTPUT @Hp4268a;":SYST:PRES"
160     !
170     OUTPUT @Hp4268a;":CALC1:FORM ";Pri$
180     OUTPUT @Hp4268a;":CALC2:FORM ";Sec$
190     OUTPUT @Hp4268a;":SOUR:FREQ ";Freq
200     OUTPUT @Hp4268a;":SOUR:VOLT ";Lvl
210     SELECT Rng$
220       CASE "Auto"
230         OUTPUT @Hp4268a;":RANG:AUTO ON"
240       CASE "1n","10n","100n","1u","10u","100u","1m"
250         OUTPUT @Hp4268a;":RANG "&Rng$
260     END SELECT
270     OUTPUT @Hp4268a;":APER ";Tim$
280     OUTPUT @Hp4268a;":CAL:CABL ";Cbl
290     !
300     OUTPUT @Hp4268a;":CALC1:FORM?"
310     ENTER @Hp4268a;Rtn_pri$
320     OUTPUT @Hp4268a;":CALC2:FORM?"
330     ENTER @Hp4268a;Rtn_sec$
340     OUTPUT @Hp4268a;":SOUR:FREQ?"
350     ENTER @Hp4268a;Rtn_freq
360     OUTPUT @Hp4268a;":SOUR:VOLT?"
370     ENTER @Hp4268a;Rtn_lvl
380     OUTPUT @Hp4268a;":RANG:AUTO?"
390     ENTER @Hp4268a;Auto_val
400     IF Auto_val=1 THEN
410       Auto_mode$="Auto"
420     ELSE
430       Auto_mode$="Hold"
440     END IF
450     OUTPUT @Hp4268a;":RANG?"
460     ENTER @Hp4268a;Rtn_rng
470     OUTPUT @Hp4268a;":APER?"
480     ENTER @Hp4268a;Rtn_time$
490     OUTPUT @Hp4268a;":CAL:CABL?"
500     ENTER @Hp4268a;Rtn_cbl
510     !
520     CLEAR SCREEN
530     PRINT "[Measurement Settings]"
540     PRINT " < Parameter  > Pre: "&Rtn_pri$&"   Sec:"&Rtn_sec$
550     PRINT " < Frequency  >";Rtn_freq;"[Hz]"
560     PRINT " <   Level    >";Rtn_lvl;"[V]"
570     PRINT " < Range Mode > "&Auto_mode$
580     PRINT " <   Range    >";Rtn_rng;"[F]"
590     PRINT " <    Time    > "&Rtn_time$
600     PRINT " <Cable Length>";Rtn_cbl;"[m]"
610     END
```

Correcting Measurement Errors (OPEN/SHORT/LOAD correction function)

Turning ON the correction function

If the following conditions are met, the measurement result is corrected.

- OPEN/ SHORT correction

  The user correction function is enabled.

NOTE You cannot enable/disable the OPEN function and the SHORT correction function independently. If you set both G and B of the OPEN correction data (or R and X of the SHORT correction data) to 0 using the "[:SENSe]:CORRection:DATA" command, the result status is the same as that when the OPEN (or SHORT) correction function is disabled.

- LOAD correction

  1. The user correction function is enabled.
  2. The LOAD correction function is enabled.
  3. The settings of the measurement frequency and the cable length are the same as those for the LOAD correction data measurement/setting.

For the LOAD correction, all of the conditions 1 - 3 must be met. If you attempt to use the LOAD correction function from the front panel without satisfying condition 3, the warning message saying "WARNING: Need load meas" appears on the display. (Even in this case, the ▼ mark appears above the Load ON indication at the bottom of the display, but the LOAD correction is not executed.)

To enable/disable the user correction function and the LOAD correction function, use the following commands.

- "[:SENSe]:CORRection[:STATe]" on page 166
- "[:SENSe]:CORRection:COLLect:METHod" on page 162

Example 5-2 provides a sample program using the above commands.

Measuring, setting, and checking the correction data

To measure/set/check the correction data, use the following commands.

NOTE For OPEN and SHORT correction, the measurement frequency setting is disregarded. Both 120 Hz and 1 Khz are measured and each data frequency is saved. Therefore, even if the measurement frequency is changed there is no need to reset the correction.

However for the LOAD correction, data are dependent on the measurement frequency and cable length setting. When these factors are changed a re-correction is needed to save new data.

NOTE If a measurement failure, such as an overload or contact check failure, occurs during correction data measurement, the error message saying that “Correction meas failed” occurs. In this case, the correction data existing before the measurement remains unchanged.

- “[:SENSe]:CORRection:COLLect[:ACQuire]” on page 162
- “[:SENSe]:CORRection:DATA” on page 163

Example 5-2 provides a sample program using the above commands.

Setting the LOAD correction standard

To set the LOAD correction standard, use the following commands.

- “[:SENSe]:CORRection:CKIT:STANdard3” on page 160
- “[:SENSe]:CORRection:CKIT:STANdard3:FORMat” on page 161

Example 5-2 provides a sample program using the above commands. (This program is stored in the sample program disk under the file name corr.bas.)

This program measures the correction data for the OPEN correction, the SHORT correction, and the LOAD correction (correction standard: Cp=10 µF, D=0.01) and reads out and displays the measured correction data.

Lines 60 to 80	Substitutes the settings of the correction standard you use into Ref_Para$, Ref_pri, and Ref_sec.
Line 100	Triggers a reset.
Lines 120 to 170	Prompts you to make a connection for the OPEN correction. After completing the connection, enter "y". The OPEN correction data is measured.
Lines 180 to 250	Checks for the occurrence of correction measurement failure.
Lines 280 to 330	Prompts you to make a connection for the OPEN correction. After completing the connection, enter "y". The OPEN correction data is measured.
Lines 340 to 410	Checks for the occurrence of correction measurement failure.
Lines 440 to 450	Sets the parameter type and the standard values of the LOAD correction standard to Ref_Para$, and Ref_pri and Ref_sec, respectively.
Lines 460 to 510	Prompts you to make a connection for the OPEN correction. After completing the connection, enter "y". The OPEN correction data is measured.
Lines 520 to 590	Checks for the occurrence of correction measurement failure.
Lines 620 to 630	Enables the user correction function and the LOAD correction function.

NOTE In this example, the user correction function and the LOAD correction function are turned ON explicitly. However, in fact, the user correction function is automatically turned ON at the execution of the OPEN/SHORT/LOAD correction data measurement; the LOAD correction function is automatically turned ON at the execution of the LOAD correction data measurement (provided that no overload or contact check failure occurs during measurement).

Lines 650 to 740	Reads in the measured correction data.
Lines 760 to 820	Displays the read-in correction data.

Example 5-2 **Sample program: OPEN/SHORT/LOAD correction**

```
10      DIM Input_val$[9],Buff$[9],Ref_para$[9],Pri$[9],Sec$[9],
Err_mes$[50]
20      REAL Open1,Open2,Short1,Short2,Load1,Load2,Ref_pri,Ref_sec
30      INTEGER Err_no
40      ASSIGN @Hp4268a TO 717
50      CLEAR SCREEN
60      Ref_para$="CPD"
70      Ref_pri=.00001
80      Ref_sec=.01
90      !
100     OUTPUT @Hp4268a;":SYST:PRES"
110     !
120     PRINT "Set Open-Connection"
130     INPUT "OK? [Y/N]",Input_val$
140     IF UPC$(Input_val$)="Y" THEN
150       OUTPUT @Hp4268a;":CORR:COLL STAN1"
160       OUTPUT @Hp4268a;"*OPC?"
170       ENTER @Hp4268a;Buff$
180       OUTPUT @Hp4268a;":SYST:ERR?"
190       ENTER @Hp4268a;Err_no,Err_mes$
200       IF Err_no=0 THEN
210         PRINT "Open Correction Complete"
220       ELSE
230         PRINT "Error: "&Err_mes$
240         PRINT "Open Correction Data is NOT Changed!"
250       END IF
260     END IF
270     !
280     PRINT "Set Short-Connection"
290     INPUT "OK? [Y/N]",Input_val$
300     IF UPC$(Input_val$)="Y" THEN
310       OUTPUT @Hp4268a;":CORR:COLL STAN2"
320       OUTPUT @Hp4268a;"*OPC?"
330       ENTER @Hp4268a;Buff$
340       OUTPUT @Hp4268a;":SYST:ERR?"
350       ENTER @Hp4268a;Err_no,Err_mes$
360       IF Err_no=0 THEN
370         PRINT "Short Correction Complete"
380       ELSE
390         PRINT "Error: "&Err_mes$
400         PRINT "Short Correction Data is NOT Changed!"
410       END IF
420     END IF
430     !
440     OUTPUT @Hp4268a;":CORR:CKIT:STAN3:FORM "&Ref_para$
450     OUTPUT @Hp4268a;":CORR:CKIT:STAN3 ";Ref_pri;",";Ref_sec
460     PRINT "Set Load-Connection"
470     INPUT "OK? [Y/N]",Input_val$
480     IF UPC$(Input_val$)="Y" THEN
490       OUTPUT @Hp4268a;":CORR:COLL STAN3"
500       OUTPUT @Hp4268a;"*OPC?"
510       ENTER @Hp4268a;Buff$
520       OUTPUT @Hp4268a;":SYST:ERR?"
530       ENTER @Hp4268a;Err_no,Err_mes$
```

```
540       IF Err_no=0 THEN
550         PRINT "Load Correction Complete"
560       ELSE
570         PRINT "Error: "&Err_mes$
580         PRINT "Load Correction Data is NOT Changed!"
590       END IF
600     END IF
610     !
620     OUTPUT @Hp4268a;":CORR:COLL:METH REFL3"
630     OUTPUT @Hp4268a;":CORR ON"
640     !
650     OUTPUT @Hp4268a;":CORR:DATA? STAN1"
660     ENTER @Hp4268a;Open1,Open2
670     OUTPUT @Hp4268a;":CORR:DATA? STAN2"
680     ENTER @Hp4268a;Short1,Short2
690     OUTPUT @Hp4268a;":CORR:CKIT:STAN3:FORM?"
700     ENTER @Hp4268a;Buff$
710     Pri$=Buff$[1;2]
720     Sec$=Buff$[3;LEN(Buff$)-2]
730     OUTPUT @Hp4268a;":CORR:DATA? STAN3"
740     ENTER @Hp4268a;Load1,Load2
750     !
760     PRINT "[Correction Data]"
770     PRINT " OPEN   G : ";Open1
780     PRINT "        B : ";Open2
790     PRINT " SHORT  R : ";Short1
800     PRINT "        X : ";Short2
810     PRINT " LOAD   "&Pri$&": ";Load1
820     PRINT "        "&Sec$&" : ";Load2
830     END
```

Generating a Trigger from an External Controller

To generate a trigger from an external controller, use the following commands.

- ":TRIGger[:SEQuence1][:IMMediate]" on page 177
- "*TRG" on page 181

To generate a trigger from an external controller using GPIB with the "*TRG" command, you must change the trigger mode to Bus. To change the trigger mode, use the following command.

- ":TRIGger[:SEQuence1]:SOURce" on page 176

Example 5-11, Example 5-15, and other examples contain examples of how to use the above commands.

If you need more precise trigger control, refer to "Trigger system structure of the 4268A" on page 124.

Sorting a Measurement Result (comparator function)

To enable the comparator function, use the following command to specify ON (or 0).

- ":CALCulate:COMParator[:STATe]" on page 143

Setting the limit ranges

There are two modes for specifying the limit ranges of the primary parameter. One is to specify the limit border values as absolute values (absolute mode), and the other is to specify them as relative boarder values to the reference value (tolerance mode). For details on each mode, refer to "Setting the limit ranges" on page 54. To set the limit range specification, use the following command.

- ":CALCulate:COMParator:MODE" on page 139

To set the reference value after you have specified the tolerance mode, use the following command.

- ":CALCulate:COMParator:PRIMary:NOMinal" on page 141

To set the limit range for each BIN and to enable/disable the BIN limit range, use the following commands.

- ":CALCulate:COMParator:PRIMary:BIN{1-9}" on page 140
- ":CALCulate:COMParator:PRIMary:BIN{1-9}:STATe" on page 141

NOTE If the limit ranges of several BINs overlap and a measurement value falls within the overlapping range, it is sorted into the smallest BIN number. For example, if BIN1's upper border value is the same as BIN2's lower border value and the measurement result is equal to the border value, it is sorted into BIN1.

NOTE If the specified upper border value is smaller than the specified lower border value, the limit range is neglected. The operation is the same as when the limit range is not specified at all.

You can use the absolute mode only to specify the secondary parameter limit range. To set the limit range, use the following commands.

- ":CALCulate:COMParator:SECondary:LIMit" on page 142
- ":CALCulate:COMParator:SECondary:STATe" on page 142

To enable/disable the AUX BIN function (refer to "Setting the AUX BIN function" on page 56) for sorting when a DUT is out of the secondary parameter limit range, use the following command.

- ":CALCulate:COMParator:AUXBin" on page 136

Example 5-3 shows a sample program using these commands.

Reading in the comparator sorting result

The comparator result is read out by the ":FETCh?" (page 156) command or other commands as part of the measurement result, together with the measurement status and the measurement value. The result is read out as an integer between 0 and 11 as follows:

Read-out value	Comparator result
0	Sorted into OUT_OF_BINS.
1	Sorted into BIN1.
2	Sorted into BIN2.
3	Sorted into BIN3.
4	Sorted into BIN4.
5	Sorted into BIN5.
6	Sorted into BIN6.
7	Sorted into BIN7.
8	Sorted into BIN8.
9	Sorted into BIN9.
10	Sorted into AUX_BIN.
11	Sorted into BIN_NA. (when sorting is impossible due to the occurrence of overload or contact check failure during measurement)

For information on the procedure to read out the measurement result using GPIB commands, refer to "Reading in Data from the Instrument" on page 115. For information on the display of the comparator result, refer to "Outputting the comparator sorting result" on page 58; for information on outputs to the handler interface signals (/BIN1 - /BIN9, /AUX_BIN, /OUT_OF_BINS, /PHI, /PLO, /SREJ), refer to "Outputting the Comparator Result" on page 185.

Counting the sorting result

The 4268A lets you count the number of DUTs sorted into each class depending on the comparator sorting result. To use the count function, use the following commands.

- ":CALCulate:COMParator:COUNt:CLEar" on page 138
- ":CALCulate:COMParator:COUNt:DATA?" on page 138
- ":CALCulate:COMParator:COUNt[:STATe]" on page 138

Sample program

Example 5-3 shows a sample program using these commands. (This program is stored in the sample program disk under the file name comprtr.bas.)

This program sets the limit specification method to the percent tolerance mode and the limit reference value to 10 µF and sets the limit range of each BIN to ±0.5%, …, ±4.5% (in steps of 0.5%), respectively. Then, it sets the secondary parameter limit range to 0 - 0.2 and turns ON the AUX BIN function.

Lines 50 to 140	Substitutes the desired comparator settings to corresponding variables.
Line 160	Triggers a reset.
Lines 180 to 210	Sets the limit specification method to Mod$. In addition, if Mod$ is other than "ABS", sets the reference value to Nom.
Lines 220 to 250	Sets the limit range for each BIN (repeated nine times by the FOR statement) to L_lim(Bin) - H_lim(Bin) and enables the limit range.
Lines 270 to 290	Sets the secondary parameter limit range to L_lim_s - H_lim_s, enables the secondary parameter limit range, and then sets the setting of the AUX BIN function to Aux$.
Line 310	Enables the comparator function.
Line 330	Sets the instrument setting indicator at the right of the display to display the comparator result.
Lines 350 to 360	Turns ON the BIN count function and resets the count value to 0.
Lines 380 to 410	Executes the measurement 50 times.
Lines 430 to 510	Reads in and displays the count value of each BIN.

Example 5-3 **Sample program: Comparator function**

```
10      DIM Mod$[5]
20      INTEGER Bin,Cnt(1:11)
30      REAL L_lim(1:9),H_lim(1:9),Nom
40      ASSIGN @Hp4268a TO 717
50      !
60      Mod$="PCNT"
70      Nom=.00001
80      FOR Bin=1 TO 9
90        L_lim(Bin)=Bin*(-.5)
100       H_lim(Bin)=Bin*.5
110     NEXT Bin
120     L_lim_s=0.
130     H_lim_s=.2
140     Aux$="ON"
150     !
160     OUTPUT @Hp4268a;":SYST:PRES"
170     !
180     OUTPUT @Hp4268a;":CALC:COMP:MODE "&Mod$
190     IF Mod$<>"ABS" THEN
200       OUTPUT @Hp4268a;":CALC:COMP:PRIM:NOM ";Nom
210     END IF
220     FOR Bin=1 TO 9
230       OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&"
";L_lim(Bin);",";H_lim(Bin)
240       OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&":STAT ON"
250     NEXT Bin
260     !
270     OUTPUT @Hp4268a;":CALC:COMP:SEC:LIM ";L_lim_s;",";H_lim_s
280     OUTPUT @Hp4268a;":CALC:COMP:SEC:STAT ON"
290     OUTPUT @Hp4268a;":CALC:COMP:AUXB "&Aux$
300     !
310     OUTPUT @Hp4268a;":CALC:COMP ON"
320     !
```

```
330    OUTPUT @Hp4268a;":DISP:TEXT2:PAGE 6"
340    !
350    OUTPUT @Hp4268a;":CALC:COMP:COUN ON"
360    OUTPUT @Hp4268a;":CALC:COMP:COUN:CLE"
370    !
380    OUTPUT @Hp4268a;":TRIG:SOUR BUS"
390    FOR I=1 TO 50
400      OUTPUT @Hp4268a;":TRIG"
410    NEXT I
420    !
430    OUTPUT @Hp4268a;":CALC:COMP:COUN:DATA?"
440    ENTER @Hp4268a;Cnt(*)
450    PRINT "BIN No.      Count"
460    PRINT "--------------------"
470    FOR Bin=1 TO 9
480      PRINT "BIN";Bin;"      ";Cnt(Bin)
490    NEXT Bin
500    PRINT "OUT_OF_BINS ";Cnt(10)
510    PRINT "AUX_BIN     ";Cnt(11)
520    END
```

Displaying the Measurement Result in Relation to the Reference Value (deviation measurement mode)

This section describes the procedure to display the measurement result as a relative value to the reference value (to use the deviation measurement mode) instead of an absolute value.

To use the deviation measurement mode, use the following commands.

- ":CALCulate1:MATH:EXPRession:NAME" on page 144
- ":CALCulate1:MATH:STATe" on page 145
- ":CALCulate2:MATH:EXPRession:NAME" on page 146
- ":CALCulate2:MATH:STATe" on page 147
- ":DATA[:DATA]" on page 149

Example 5-4 is a sample program using the above commands. (This program is stored in the sample program disk under the file name dev.bas.)

This program sets the primary parameter to Cp and the secondary parameter to D and then makes settings to display the primary parameter measurement result as the difference between the measurement value and the reference value (set to 10 μF) as a percentage of the reference value; these settings also display the secondary parameter measurement result as an absolute value of the difference between the measurement value and the reference value (set to 0.01).

Lines 60 to 110	Substitutes the settings of the measurement parameter and the deviation measurement mode into variables Pri$, Sec$, Disp_pri$, Disp_sec$, Ref_pri, and Ref_sec, respectively.
Lines 130 to 140	Sets the primary parameter to Pri$ and the secondary parameter to Sec$.
Lines 160 to 170	Makes a setting to use the deviation measurement mode for the measurement result display of the primary parameter and the secondary parameter.

NOTE Setting a measurement parameter automatically disables the deviation measurement mode. After setting measurement parameters, enable the deviation measurement mode.

Lines 190 to 200	Sets the measurement result display of the primary parameter and that of the secondary parameter to Disp_pri$ and Disp_sec$, respectively.
Lines 220 to 230	Sets the reference values for the primary parameter and the secondary parameter used in the deviation measurement mode to Ref_pri and Ref_sec, respectively.

Example 5-4 **Sample program: Deviation measurement mode**

```
10      DIM Pri$[9],Sec$[9],Disp_pri$[9],Disp_sec$[9]
20      REAL Ref_pri,Ref_sec
30      !
40      ASSIGN @Hp4268a TO 717
50      !
60      Pri$="CP"
70      Sec$="D"
80      Disp_pri$="PCNT"
90      Disp_sec$="DEV"
100     Ref_pri=.00001
110     Ref_sec=.01
120     !
130     OUTPUT @Hp4268a;":CALC1:FORM ";Pri$
140     OUTPUT @Hp4268a;":CALC2:FORM ";Sec$
150     !
160     OUTPUT @Hp4268a;":CALC1:MATH:STAT ON"
170     OUTPUT @Hp4268a;":CALC2:MATH:STAT ON"
180     !
190     OUTPUT @Hp4268a;":CALC1:MATH:EXPR:NAME ";Disp_pri$
200     OUTPUT @Hp4268a;":CALC2:MATH:EXPR:NAME ";Disp_sec$
210     !
220     OUTPUT @Hp4268a;":DATA REF1,";Ref_pri
230     OUTPUT @Hp4268a;":DATA REF2,";Ref_sec
240     END
```

Performing Measurement by Correctly Applying Specified Voltage at DUT (ALC function)

If the impedance of DUT is small, the output resistance of the voltage source and the resistance of the measurement cable causes the voltage applied to the DUT to decrease below the specified voltage of the voltage source. The auto level control (ALC) function lets you apply the specified voltage to the DUT correctly. This section describes how to use the ALC function.

To use the ALC function, use the following command.

- ":SOURce:VOLTage:ALC[:STATe]" on page 169

Example 5-5 contains an example of how to use the above command.

When using the ALC function, be careful of the operating range (refer to "ALC (Auto Level Control) function" on page 234). For details on the operation when the ALC operating range is exceeded, refer to "Operating range of the ALC function" on page 60.

NOTE If the maximum capacity limit of the ALC operating range is exceeded, even if the ALC function is ON, the signal voltage decreases as capacitance increases. Even in this case, measurement values are obtained, but it is recommended that you check the actual voltage value applied to the DUT by using the voltage monitor function (refer to "Monitoring the Measurement Signal Level" on page 101).

Changing Information on the Display

Changing displayed setting items

4268A's Measurement Settings indicator at the right of the display provides seven pages (eight pages with option 001) you can select to display different setting items. For details of each page, refer to Table 4-3 on page 62. To select a displayed page, use the following command.

- ":DISPlay[:WINDow]:TEXT2:PAGE" on page 155

Example 5-5 and Example 5-6 contain examples of how to use the above command.

Changing the measurement result display digit

You can use the following command to select the number of measurement result display digits from 3, 4, or 5.

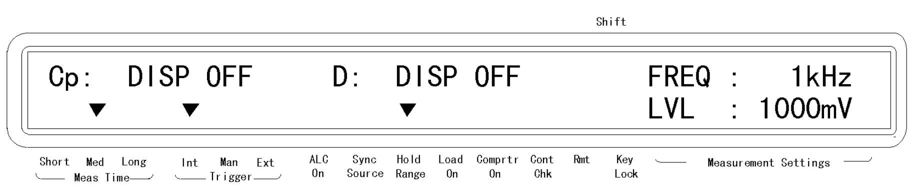
- ":DISPlay[:WINDow]:TEXT1[:DATA]:DIGit" on page 154

Turning ON/OFF the measurement result display

Use the following command to turn ON/OFF the measurement result display.

- ":DISPlay[:WINDow][:STATe]" on page 154

The display, when the measurement result display is OFF, is as shown below.



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Monitoring the Measurement Signal Level

You can use the current/voltage monitor function to monitor the current and voltage of the measurement signal. First, use the following commands to enable the current/voltage monitor function.

- ":CALCulate3:MATH:STATe" on page 147
- ":CALCulate4:MATH:STATe" on page 148

Use the following command to read in the current/voltage monitor result. Also, you can check the result on the display by selecting the current/voltage monitor result display page (page number 7), using the above procedure to select the display page.

- ":DATA[:DATA]" on page 149

Example 5-5 is a sample program using the above commands. (This program is stored in the sample program disk under the file name monitor.bas.)

This program sets the measurement signal level to 1 V, enables the current/voltage monitor function, and executes the measurement 50 times. It reads out and displays the measurement result and the current/voltage monitor result for each measurement. However, if the difference between the actual measurement voltage (voltage monitor result) and the set value (1 V) exceeds 20% of the set value, the measurement is aborted.

Line 50	Substitutes the measurement signal level to variable Lvl.
Line 70	Triggers a reset.
Lines 90 to 100	Sets the measurement signal level to Lvl and enables the auto level control function.
Lines 120 to 130	Enables the current monitor function and the voltage monitor function.
Line 150	Selects the current/voltage monitor result display page.
Line 150	Makes a setting to generate a trigger from an external controller.
Lines 190 to 200	Generates a trigger and reads out the measurement result.
Lines 210 to 240	Reads out the monitor result of the measurement current and the measurement voltage.
Lines 250 to 260	Displays the measurement result and the monitor result.
Lines 270 to 300	If the difference between the actual measurement voltage and the set measurement voltage exceeds 20% of the set value, displays "Source level is NOT correct!" and aborts the repetition of measurements.

NOTE This sample checks the measurement voltage only to provide a simpler example of how to use the current/voltage monitor function.

Example 5-5 **Sample program: Voltage/current monitor function**

```
10      REAL Lvl,Rtn_pri,Rtn_sec,Imon,Vmon
20      INTEGER Rtn_stat
30      !
40      ASSIGN @Hp4268a TO 717
50      Lvl=1.0
60      !
70      OUTPUT @Hp4268a;":SYST:PRES"
80      !
90      OUTPUT @Hp4268a;":SOUR:VOLT ";Lvl
100     OUTPUT @Hp4268a;":SOUR:VOLT:ALC ON"
110     !
120     OUTPUT @Hp4268a;":CALC3:MATH:STAT ON"
130     OUTPUT @Hp4268a;":CALC4:MATH:STAT ON"
140     !
150     OUTPUT @Hp4268a;":DISP:TEXT2:PAGE 7"
160     !
170     OUTPUT @Hp4268a;":TRIG:SOUR BUS"
180     FOR I=1 TO 50
190       OUTPUT @Hp4268a;"*TRG"
200       ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
210       OUTPUT @Hp4268a;":DATA? IMON"
220       ENTER @Hp4268a;Imon
230       OUTPUT @Hp4268a;":DATA? VMON"
240       ENTER @Hp4268a;Vmon
250       PRINT "Stat:";Rtn_stat,"Pri:";Rtn_pri,"Sec:";Rtn_sec
260       PRINT "Imon:";Imon,"Vmon:";Vmon
270       IF ABS((Vmon-Lvl)/Lvl)>.2 THEN
280         PRINT "Source level is NOT correct!"
290         I=51
300       END IF
310     NEXT I
320     END
```

Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)

This section describes how to use the synchronous source function that applies a measurement signal only during measurement to prevent the contact pin from being damaged. To use the synchronous source function, use the following command.

- ":SOURce:VOLTage:MODE" on page 170

In addition, you can control the measurement signal so that it is outputted after a specified waiting time from triggering (source delay function). To use the source delay function, use the following command. For information on the measurement signal output timing when this function is used, refer to Figure 4-2 on page 66.

- ":TRIGger[:SEQuence1]:DELay" on page 175

NOTE The source delay time is valid only when the synchronous source function is ON.

Example 5-6 is a sample program using the above commands. (This program is stored in the sample program disk under the file name delay.bas.)

This program enables the synchronous source function and sets the signal output delay time to 10 ms and the trigger delay time to 5 ms, and selects the delay time display page.

Lines 50 to 60	Substitutes the source delay time and the trigger delay time into variables Src_delay and Trg_delay, respectively.
Line 80	Triggers a reset.
Lines 100 to 110	Enables the synchronous source function and sets the source delay time to Src_delay.
Line 130	Sets the trigger delay time to Trg_delay.
Line 150	Selects the source delay time and trigger delay time display page.

Example 5-6 **Sample program: Synchronous source function and delay function**

```
10      REAL Src_delay,Trg_delay
20      !
30      ASSIGN @Hp4268a TO 717
40      !
50      Src_delay=.01
60      Trg_delay=.005
70      !
80      OUTPUT @Hp4268a;":SYST:PRES"
90      !
100     OUTPUT @Hp4268a;":SOUR:VOLT:MODE SYNC"
110     OUTPUT @Hp4268a;":TRIG:DEL ";Src_delay
120     !
130     OUTPUT @Hp4268a;":TRIG:SEQ2:DEL ";Trg_delay
140     !
150     OUTPUT @Hp4268a;":DISP:TEXT2:PAGE 3"
160     END
```

Making a Measurement While Avoiding Chattering at Contact Timing (trigger delay function/source delay function)

Chattering may occur when the contact pin comes in contact with DUT. To avoid chattering time, the trigger delay function and the source delay function are available. To use the trigger delay function, use the following command. For how to use the source delay function, refer to "Outputting the Measurement Signal Only During Measurement to Protect the Contact Pin (synchronous source function)" on page 103

- ":TRIGger:SEQuence2:DELay" on page 177

Example 5-6 contains an example of how to use the above command.

NOTE When measuring high-value capacitors, you should use source delay time to avoid the bad effects of chattering on measurement. This delay will protect the contact pin from damage by establishing a solid connection before the large flow of signal current is applied. On the other hand, the trigger delay time has no protective effect on the contact pin since it only extends the starting time of the measurement after the signal has been applied.

NOTE When the source delay time and trigger delay time are both specified, the source delay time precedes the trigger before execution.

NOTE ALC starts to measure only after the waiting time has elapsed, right after triggering. After performing the measurement the operation stops.

Making a Measurement While Checking Contact Failure between the Contact Pin and DUT (contact check function)

Use the contact check function to make measurements while checking for contact failure between the contact pin and DUT.

With the contact check function ON, if contact failure is detected, the data read out via GPIB is as follows: the measurement status is 2 (3, if overload is detected at the same time); the measurement values of the primary and secondary parameters are both a fixed value (9.9E37). The contact failure indication (N.C.) appears on the display instead of measurement values. The /NO CONTACT signal of the handler interface goes Low. Refer to Appendix E , "Overload/No-Contact Operation," which provides a summary of display and outputs if contact failure is detected in contact check.

NOTE The contact check function cannot detect all contact failures completely. It cannot detect subtle contact failures or unstable contact failures such as chattering. For information on the valid range of the contact check function and minimum contact resistance that can be detected, refer to "Contact check function" on page 236.

NOTE The contact check function is only available in the four-terminal measurement. For the two-terminal measurement, contact failure cannot be detected.

To use the contact check function, use the following command.

- "[:SENSe][:FIMPedance]:CONTact:VERify" on page 167

Example 5-7 is a sample program using the above command. (This program is stored in the sample program disk under the file name cont_chk.bas.)

This program enables the contact check function and performs the measurement 50 times. It reads out and displays the measurement result for each measurement. However, if a contact check failure occurs, the measurement is aborted.

Line 60	Triggers a reset.
Line 80	Enables the contact check function.
Line 100	Makes a setting to generate a trigger from an external controller.
Lines 120 to 130	Generates a trigger and reads out the measurement result.
Line 140	Displays the measurement result.
Lines 150 to 180	Checks the measurement status. If it is 2 (contact check failure) or 3 (concurrent occurrence of overload and contact check failure), displays "Contact Check Failed!" and aborts the repetition of measurements.

NOTE This sample checks for the occurrence of a contact check failure only to provide a simpler example of how to use the contact check function.

Example 5-7 **Sample program: Contact check function**

```
10     REAL Rtn_pri,Rtn_sec
20     INTEGER Rtn_stat
30     !
40     ASSIGN @Hp4268a TO 717
50     !
60     OUTPUT @Hp4268a;":SYST:PRES"
70     !
80     OUTPUT @Hp4268a;":CONT:VER ON"
90     !
100    OUTPUT @Hp4268a;":TRIG:SOUR BUS"
110    FOR I=1 TO 50
120      OUTPUT @Hp4268a;"*TRG"
130      ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
140      PRINT "Stat:";Rtn_stat,"Pri:";Rtn_pri,"Sec:";Rtn_sec
150      IF Rtn_stat=2 OR Rtn_stat=3 THEN
160        PRINT "Contact Check Failed!"
170        I=51
180      END IF
190    NEXT I
200    END
```

Obtaining Stable Measurement (averaging function)

Obtaining the mean value of several measurement values (averaging) is a good way to obtain stable measurement results. The 4268A provides an averaging function to output the mean value of measurement values of the specified number within 1 to 256 as the measurement result. To use the averaging function, use the following commands.

- “[:SENSe]:AVERage:COUNt” on page 159
- “[:SENSe]:AVERage[:STATe]” on page 159

Example 5-8 is a sample program using the above commands. (This program is stored in the sample program disk under the file name average.bas.)

This program enables the averaging function and sets the averaging count to 16.

Line 50	Substitutes the averaging count into variable Ave_cnt.
Lines 70 to 80	Enables the averaging function and sets the averaging count to Ave_cnt.

Example 5-8 **Sample program: Averaging function**

```
10      INTEGER Ave_cnt
20      !
30      ASSIGN @Hp4268a TO 717
40      !
50      Ave_cnt=16
60      !
70      OUTPUT @Hp4268a;":AVER:COUN ";Ave_cnt
80      OUTPUT @Hp4268a;":AVER ON"
90      !
100     END
```

Saving/Recalling the Setting

The 4268A lets you save/recall up to 10 settings using the built-in nonvolatile memory. For information on the setting items that can be saved/recalled, refer to Table F-1 on page 280. To save/recall the setting, use the following commands.

- "*SAV" on page 180
- "*RCL" on page 180

Preventing Mis-input from the Front Panel Keys (key lock function)

If you want to prevent mis-input, for example when someone touches the front panel keys by accident or if there is no need to operate the keys on the front panel, you can turn on the key lock function the 4268A provides to disable the front panel keys. To lock the front panel keys, use the following command.

- “:SYSTem:KLOCk” on page 174

NOTE If the Key lock command is executed, all key inputs including the **Lcl** key become invalid.

Changing the Conditions for Outputting the Alarm Sound (beep sound)

You can set the conditions for the 4268A to output the alarm sound (beep sound) as follows.

<table>
<tr><th>ON/OFF</th><th>FAIL/PASS</th><th colspan="2">Condition for outputting the beep sound</th></tr>
<tr><td>OFF</td><td>————</td><td colspan="2">Does not output the beep sound</td></tr>
<tr><td rowspan="2">ON
(initial setting value)</td><td>FAIL
(initial setting value)</td><td rowspan="2">When erroneous key operation is performed or when an error, warning, or other type of message is outputted</td><td>When the comparator result is OUT_OF_BIN or AUX_BIN</td></tr>
<tr><td>PASS</td><td>When the comparator result is within BIN 1-9</td></tr>
</table>

To select ON or OFF in the above table, use the following commands. The following two commands have the same functionality.

- ":CALCulate:COMParator:BEEPer[:STATe]" on page 137
- ":SYSTem:BEEPer:STATe" on page 173

To select PASS or FAIL in the above table, use the following command.

- ":CALCulate:COMParator:BEEPer:CONDition" on page 137

The user can output the beep sound using the following command.

- ":SYSTem:BEEPer[:IMMediate]" on page 173

Example 5-9 is a sample program using the above commands. (This program is stored in the sample program disk under the file name beep.bas.)

This program enables the averaging function and sets the averaging count to 16.

Line 30	Triggers a reset.
Line 50	Disables the output of the beep sound.
Line 70	Attempts to output the beep sound from the program. (However, the beep sound is disabled at Line 50, so you cannot hear it.)
Lines 90 to 100	Makes a setting to output the beep sound if the comparator result is within BIN1 - 9 or if erroneous key operation is performed.
Line 120	Attempts to output the beep sound from the program again. (This time, the beep sound is enabled at Line 100, so you can hear it.)

Example 5-9 **Sample program: Beep sound**

```
10      ASSIGN @Hp4268a TO 717
20      !
30      OUTPUT @Hp4268a;":SYST:PRES"
40      !
50      OUTPUT @Hp4268a;":SYST:BEEP:STAT OFF"
60      !
70      OUTPUT @Hp4268a;":SYST:BEEP"
80      !
90      OUTPUT @Hp4268a;":CALC:COMP:BEEP:COND PASS"
100     OUTPUT @Hp4268a;":CALC:COMP:BEEP ON"
110     !
120     OUTPUT @Hp4268a;":SYST:BEEP"
130     END
```

Confirming There is No Failure

The 4268A provides the self-test function. To perform the self-test, use the following command.

- “*TST?” on page 182

NOTE For details on tested items and error numbers read out when errors occur, refer to Table 6-1 on page 182. If several errors are detected at one time, the sum of their error numbers is displayed.

Example 5-10 is a sample program using the above command. (This program is stored in the sample program disk under the file name test.bas.)

This program reads out and displays the product information and the option information of the 4268A and then executes the self-test and displays the result.

Line 70	Triggers a reset.
Lines 90 to 120	Reads out the product information (manufacturer, model number, serial number, firmware version) and the option information.
Lines 140 to 220	Displays the product information and the option information.
Lines 240 to 340	Executes the self-test and displays the result. If any of the items failed, outputs the beep sound 10 times.

Example 5-10 **Sample program: Selftest function**

```
10      DIM Prod$[15],Model$[5],Sn$[10],Fw$[5]
20      INTEGER Opt,Tst_res
30      !
40      CLEAR SCREEN
50      ASSIGN @Hp4268a TO 717
60      !
70      OUTPUT @Hp4268a;":SYST:PRES"
80      !
90      OUTPUT @Hp4268a;"*IDN?"
100     ENTER @Hp4268a USING "15A,X,5A,X,10A,X,5A";Prod$,Model$,Sn$,Fw$
110     OUTPUT @Hp4268a;"*OPT?"
120     ENTER @Hp4268a;Opt
130     !
140     PRINT Prod$&" "&Model$
150     PRINT " Serial Number: "&Sn$
160     PRINT " F/W Version  : "&Fw$
170     IF Opt=0 THEN
180       PRINT " Option        : No option"
190     END IF
200     IF Opt=1 THEN
210       PRINT " Option        : 001"
220     END IF
230     !
240     OUTPUT @Hp4268a;"*TST?"
250     ENTER @Hp4268a;Tst_res
260     IF Tst_res=0 THEN
270       PRINT " SELF TEST     : PASS"
280     ELSE
290       PRINT " SELF TEST     : FAIL"
300       FOR I=1 TO 10
```

```
310        OUTPUT @Hp4268a;":SYST:BEEP"
320        WAIT .1
330      NEXT I
340    END IF
350    END
```

Checking the Firmware Version and the Information on Options

To check the firmware version and the information on installed options, use the following commands.

- "*IDN?" on page 179
- "*OPT?" on page 179

Example 5-6 contains an example of how to use the above commands.

Reading in Data from the Instrument

Data transfer format

When reading in data from the 4268A, you must select the ASCII data transfer format (initial setting) or the real number data transfer format. To select the data transfer format, use the following command.

- ":FORMat[:DATA]" on page 157

NOTE OPEN, SHORT and LOAD correction data are transferred in ASCII format, and data format setting is not required.

Each data transfer format is described below.

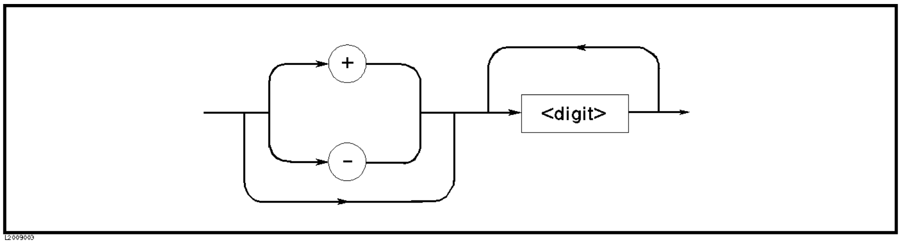
ASCII data transfer format

When data is read in the ASCII data transfer format, numeric values are transferred as ASCII bytes complying with one of the following formats. Numeric values are separated by commas (,) according to the specification of IEEE 488.2.

- NR1 format (integer)

  This format is shown in Figure 5-2. Numeric values are expressed by integers. For example, numeric value 1000 is expressed as "1000".

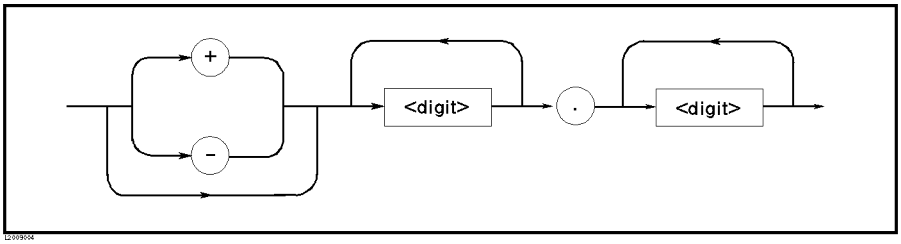
Figure 5-2 **NR1 format**



- NR2 format (fixed point)

  This format is shown in Figure 5-3. Numeric values are expressed in the fixed point format. For example, numeric value 1000 is expressed as "1000.0".

Figure 5-3 **NR2 format**

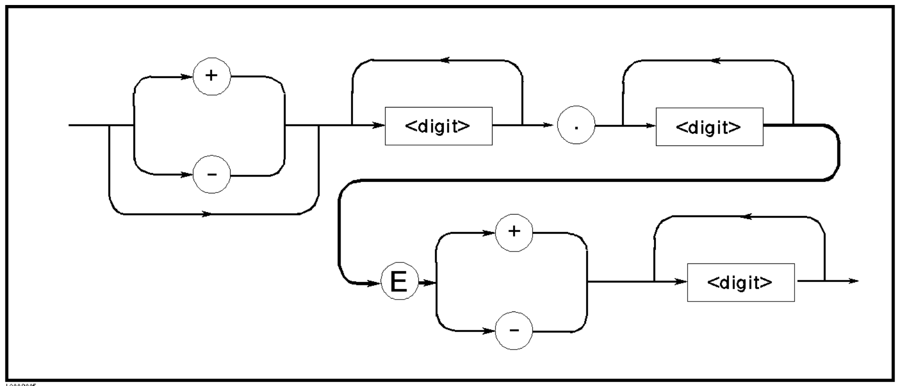


5.Remote Operation by an External Controller through GPIB

- NR3 format (floating point)

  This format is shown in Figure 5-4. Numeric values are expressed in the floating point format. For example, numeric value 1000 is expressed as “1.0E3”.

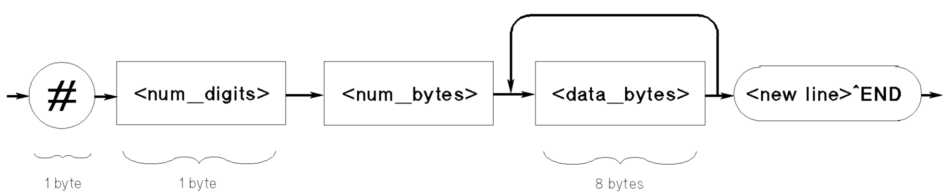
Figure 5-4 **NR3 format**



Real number data transfer format

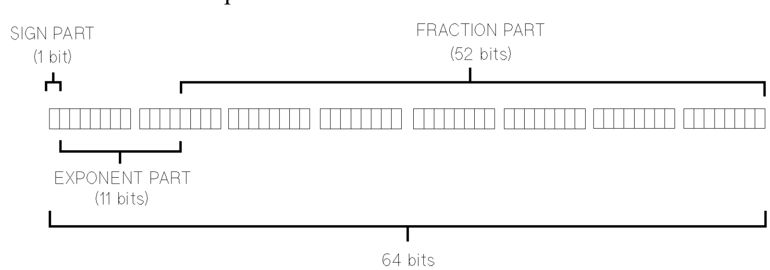
When data is read in the real number (REAL) data transfer format, numeric values are transferred in the format shown in Figure 5-5.

Figure 5-5 **Real number data transfer format**



In this data transfer format, symbol (#) is located at the beginning. The 2nd byte, <digit count>, specifies the number of bytes in <byte count>. <byte count> specifies the length of <data byte>. <new line>^END is the message terminator.

The contents of <data byte> is in the 64-bit IEEE 754 floating point format, as shown below. This is the same format used by Hewlett Packard technical computers, including the HP 9000 series 300 computers.



Real number *RN* used in the floating point format is given by one of the following equations.

- When 0 < e < 11111111111 (2047):

  $RN = (-1)^{s} \times 2^{(EXP - 1023)} \times (1 + f/2^{52})$

- When e = 0

  $RN = (-1)^{s} \times 2^{-1022} \times (f/2^{52})$

- When e = 0 and f = 0:

  $RN = 0$

  where

s.	Value of the sign part (binary)
e.	Value of the exponent part (binary)
EXP.	Exponent part in decimal notation
f.	Mantissa part in decimal notation

Reading in data in the ASCII data transfer format

This is the basic read method. Example 5-11 provides a sample program. (This program is stored in the sample program disk under the file name ascii.bas.) Also, refer to sample programs of Example 5-1, Example 5-5, Example 5-7 and others, which contain examples of how to read in data using this format.

This program performs a measurement once and reads out and displays the measurement result in the ASCII data transfer format.

Line 60	Triggers a reset.
Line 80	Sets the data transfer format to ASCII

NOTE In this example, the format is specified to provide an example of how it's used. However, you do not need to explicitly specify the format after reset. (The ASCII data transfer format is the format in the initial setting status.)

Line 100	Makes a setting to generate a trigger from an external controller.
Lines 110 to 120	Generates a trigger and reads out the measurement result.
Line 130	Displays the measurement result.

Example 5-11 **Sample program: Reading in data (ASCII data transfer format)**

```
10      REAL Rtn_pri,Rtn_sec
20      INTEGER Rtn_stat
30      !
40      ASSIGN @Hp4268a TO 717
50      !
60      OUTPUT @Hp4268a;":SYST:PRES"
70      !
80      OUTPUT @Hp4268a;":FORM ASC"
90      !
100     OUTPUT @Hp4268a;":TRIG:SOUR BUS"
110     OUTPUT @Hp4268a;"*TRG"
120     ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
130     PRINT "Stat:";Rtn_stat,"Pri:";Rtn_pri,"Sec:";Rtn_sec
140     END
```

Reading in data in the real data transfer format

Example 5-12 provides a sample program. (This program is stored in the sample program disk under the file name real.bas.)

This program performs a measurement once and reads out and displays the measurement result in the real number data transfer format.

Line 80	Sets the data transfer format to real number (REAL).
Lines 100 to 120	Makes a setting to generate a trigger from an external controller and generates a trigger.
Line 140	Reads out the beginning symbol (#).
Line 150	Reads the number of digits of the part that indicates the number of bytes of data (the <digit count> part in Figure 5-5).
Line 160	Creates the format to read out the part that indicates the number of bytes of data.
Line 170	Reads out the part that indicates the number of bytes of data (the <byte count> part in Figure 5-5).
Line 180	Calculates the number of numeric values (8 bytes each) contained in the data from the number of bytes of the data and substitutes it into Data_no.
Lines 190 to 210	Reads out numeric values, the number of which is specified by Data_no.
Line 220	Reads out the message terminator.
Line 240	Displays the read-out measurement result.

Example 5-12 **Sample program: Reading data (real number data transfer format)**

```
10    REAL D(1:4)
20    DIM Buff$[9],Digit$[1],Read_form$[9],Byte_no$[8]
30    INTEGER Data_no
40    !
50    ASSIGN @Hp4268a TO 717
60    ASSIGN @Binary TO 717;FORMAT OFF
70    !
80    OUTPUT @Hp4268a;":FORM REAL"
90    !
100   OUTPUT @Hp4268a;":TRIG:SOUR BUS"
110   !
120   OUTPUT @Hp4268a;"*TRG"
130   !
140   ENTER @Binary USING "#,A";Buff$
150   ENTER @Binary USING "#,A";Digit$
160   Read_form$="#,"&Digit$&"A"
170   ENTER @Binary USING Read_form$;Byte_no$
180   Data_no=VAL(Byte_no$)/8
190   FOR I=1 TO Data_no
200     ENTER @Binary;D(I)
210   NEXT I
220   ENTER @Binary USING "#,A";Buff$
230   !
240   PRINT "Stat:";D(1);"  Pri:";D(2);"  Sec:";D(3)
250   END
```

How to read the measurement results

This section describes how to read the measurement results.

The following table summarizes how to read the measurement results:

	Applicable trigger mode	Retrieval steps
Using the "*TRG" command (page 181)	bus	Issue the "*TRG" command. ↓ The command returns the data.
Using the ":FETCh?" command (page 156)	All	Trigger the instrument. ↓ Issue the ":FETCh?" command.[*1] ↓ The command returns the data.
Using the ":READ?" command (page 158)	External Internal	Issue the ":READ?" command. ↓ Trigger the instrument. ↓ The command returns the data.

*1.The end-of-measurement signal must be detected before the ":FETCh?" command is issued.

Using the "*TRG" command to read measurement results

This command actually performs two tasks: it triggers the instrument and returns the results. It is useful, for example, when you want to read measurement results immediately after triggering the instrument from an external controller.

To read measurement results using the "*TRG" command, follow these steps:

Step 1. Issue the ":TRIGger[:SEQuence1]:SOURce" command (page 176) to set the trigger mode to "Bus."

Step 2. Issue the "*TRG" command.

Step 3. Read the measurement results. You can repeat steps 2 and 3 as needed.

Example 5-11 and Example 5-12 are sample programs that demonstrates the use of the "*TRG" command.

Using the “:FETCh?” command to read measurement results

This command is useful when you trigger the instrument without using an external controller or when you need to perform a particular task between triggering and reading.

To read measurement results using the “:FETCh?” command, follow these steps:

Step 1. Set the trigger source as necessary.

Step 2. Trigger the instrument using the method specific to the trigger mode.

NOTE To trigger the instrument from an external controller, use the “:TRIGger[:SEQuence1][:IMMediate]” instead.

Step 3. Issue the “:FETCh?” command upon completion of measurement.

Step 4. Read the measurement results. You can repeat steps 2 through 4 as needed.

Example 5-13 shows a sample program.

This program performs a measurement once and reads out and displays the measurement results.

Example 5-13 **Sample program: Reading data**

```
10     REAL Rtn_pri,Rtn_sec
20     INTEGER Rtn_stat,Dummy
30     !
40     ASSIGN @Hp4268a TO 717
50     !
60     OUTPUT @Hp4268a;":SYST:PRES"
70     OUTPUT @Hp4268a;":TRIG:SOUR EXT"
80     !
90     OUTPUT @Hp4268a;"*CLS"
100    OUTPUT @Hp4268a;":STAT:OPER:ENAB 16"
110    OUTPUT @Hp4268a;"*SRE 128"
120    OUTPUT @Hp4268a;"*OPC?"
130    ENTER @Hp4268a;Dummy
140    !
150    ON INTR 7 GOTO Meas_end
160    ENABLE INTR 7;2
170    PRINT "Waiting for External Trigger!"
180  Meas_wait: GOTO Meas_wait
190  Meas_end: OUTPUT @Hp4268a;":FETC?"
200    ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
210    PRINT "Stat:";Rtn_stat,"Pri:";Rtn_pri,"Sec:";Rtn_sec
220    END
```

Using the “:READ?” command to read measurement results

This command reads the measurement results synchronously with the transition from trigger wait state to end of measurement, without detecting trigger timing in the program. It is useful, for example, when you want to trigger the instrument from an external device, such as a handler, and immediately pass the measurement results to an external controller.

To read measurement results using the “:READ?” command, follow these steps:

Step 1. Issue the “:TRIGger[:SEQuence1]:SOURce” command to set the trigger mode to Internal, External or Manual trigger.

Step 2. Issue the “:READ?” command.

Step 3. Trigger the instrument using the method specific to the trigger source.

Step 4. Read the measurement results. You can repeat steps 2 through 4 as needed.

Example 5-14 shows a sample program.

This program performs a measurement once and reads out and displays the measurement results.

Example 5-14 **Sample program: Reading data**

```
10      REAL Rtn_pri,Rtn_sec
20      INTEGER Rtn_stat
30      !
40      ASSIGN @Hp4268a TO 717
50      !
60      OUTPUT @Hp4268a;":SYST:PRES"
70      OUTPUT @Hp4268a;":TRIG:SOUR EXT"
80      !
90      OUTPUT @Hp4268a;":READ?"
100     PRINT "Waiting for External Trigger!"
110     ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
120     PRINT "Stat:";Rtn_stat,"Pri:";Rtn_pri,"Sec:";Rtn_sec
130     END
```

Reading in data efficiently (Data buffer function)

To read in data efficiently, you can use the data buffer function for several measurements in batch processing. To use the data buffer function, use the following commands.

- ":DATA:FEED" on page 151
- ":DATA:FEED:CONTrol" on page 152
- ":DATA:POINts" on page 153
- ":DATA[:DATA]" on page 149

Example 5-15 is a sample program using the above commands. (This program is stored in the sample program disk under the file name buff.bas.)

This program acquires and displays data for 20 measurements by using the data buffers.

Line 70	Substitutes the size of the data buffer into variable Nop.
Line 90	Makes a setting to generate a trigger from an external controller.
Lines 100 to 110	Specifies the primary parameter measurement result and the secondary parameter measurement result as data fed into data buffer 1 and one fed into data buffer 2, respectively.
Lines 120 to 130	Makes a setting to feed the measurement data into data buffer 1 and data buffer 2.
Lines 140 to 150	Sets the size of data buffer 1 and that of data buffer 2 to Nop.
Lines 160 to 180	Generates a trigger for the number of the specified times, Nop.
Lines 190 to 220	Reads in the primary parameter measurement result into D1(*); the secondary parameter measurement result into D2(*).

NOTE When the measurement result is read out from the data buffer, a set of three data items (the measurement status, the measurement value, and the comparator result) is read out the specified number of times (measurement count, Nop). Therefore, the required size of the data array is three times as large as the size of the measurement count (Nop).

Lines 230 to 250	Displays the read-in measurement status, measurement value (data buffer 1), measurement value (data buffer 2), and comparator result.

NOTE The fed primary parameter measurement result and the fed secondary parameter measurement result have the same measurement status and comparator result data in the measurement result.

Example 5-15 **Sample program: Data buffer function**

```
10    DIM D1(1:60),D2(1:60)
20    INTEGER Nop
30    !
40    CLEAR SCREEN
50    ASSIGN @Hp4268a TO 717
60    !
70    Nop=20
80    !
90    OUTPUT @Hp4268a;":TRIG:SOUR BUS"
100   OUTPUT @Hp4268a;":DATA:FEED BUF1,""CALC1"""
110   OUTPUT @Hp4268a;":DATA:FEED BUF2,""CALC2"""
```

```
120   OUTPUT @Hp4268a;":DATA:FEED:CONT BUF1,ALW"
130   OUTPUT @Hp4268a;":DATA:FEED:CONT BUF2,ALW"
140   OUTPUT @Hp4268a;":DATA:POIN BUF1,";Nop
150   OUTPUT @Hp4268a;":DATA:POIN BUF2,";Nop
160   FOR I=1 TO Nop
170     OUTPUT @Hp4268a;":TRIG"
180   NEXT I
190   OUTPUT @Hp4268a;":DATA? BUF1"
200   ENTER @Hp4268a;D1(*)
210   OUTPUT @Hp4268a;":DATA? BUF2"
220   ENTER @Hp4268a;D2(*)
230   FOR I=1 TO Nop*3 STEP 3
240     PRINT "Stat:";D1(I);"  Pri:";D1(I+1);"  Sec:";D2(I+1);"  Comp:";
D1(I+2)
250   NEXT I
260   END
```

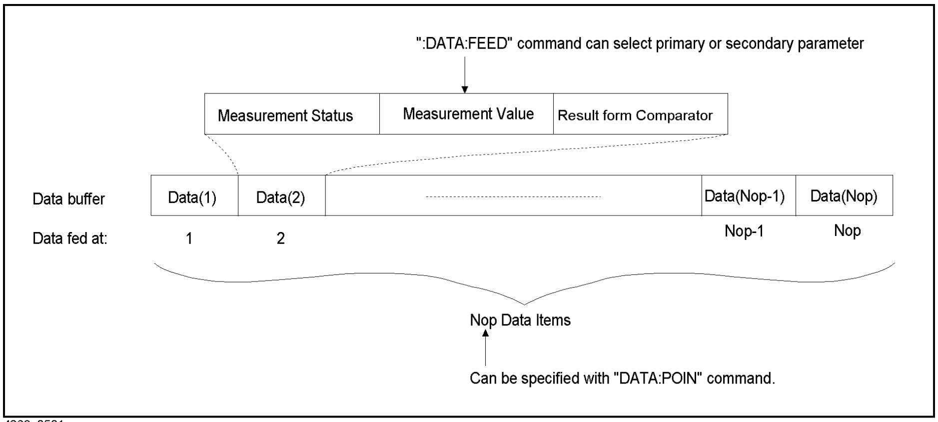
Figure 5-6 shows the relationship between the data buffer and the command. The data feed position in the figure moves as follows:

- When one measurement is completed and the data is fed into the buffer, it proceeds one step.
- When one of the following cases occurs, it goes back to the beginning (1).

1. Data is read in using the “:DATA[:DATA]” command.
2. The size of the data buffer (Nop in the figure) is set using the “:DATA:POINts” command.
3. Data is fed into the data buffer, and its amount exceeds the size of the buffer. (Even if data of this size has been fed, no data has been read in.)

NOTE If case 3 occurs, the beginning data is overwritten and lost.

Figure 5-6 **Relationship between Data Buffer and Command**



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Providing the Timing of Measurements

Making the most of the trigger system

To provide the timing of measurements properly and control measurements precisely, you must generate a trigger properly depending on the status of the trigger system. The trigger system is described below.

Trigger system structure of the 4268A

The trigger system synchronizes measurements of the 4268A with a specified event, which can be either the GPIB trigger command or an input pulse fed from the external trigger connector. In this trigger system, you can specify the number of measurement repetitions and the delay time for the measurement trigger.

Figure 5-7 **Structure of Trigger System**

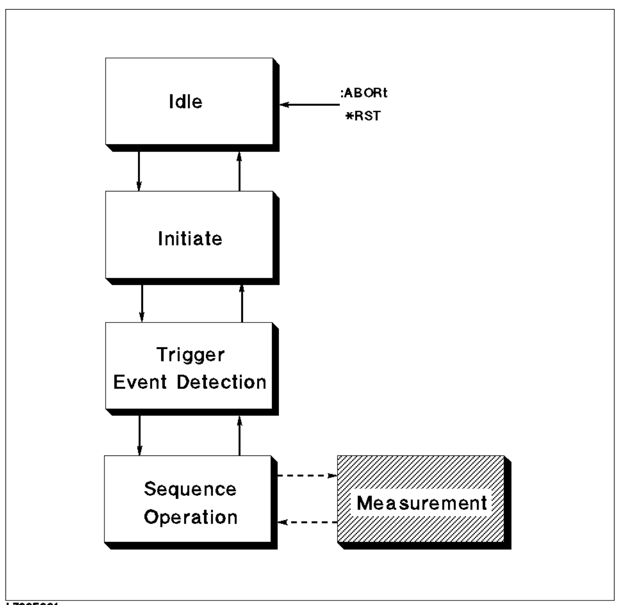


Figure 5-7 shows the structure of the trigger system of the 4268A. The four blocks at the left of the figure represent each trigger state. The 4268A transitions between horizontally adjacent states depending on its status. The status at power-on is called IDLE state. You can use the ":ABORt" command (page 136) or the "*RST" command (page 180) to return the 4268A to the IDLE state. In the initiate (startup) state and the trigger event detection state, the transition of the 4268A between states branches, depending on whether the specified conditions are satisfied. In the sequence operation state, the 4268A performs a measurement and monitors a signal indicating the completion of the measurement. Each state is described below.

- IDLE state

  The trigger system, when the ":INITiate[:IMMediate]" command (page 158) is executed or when ON is specified in the ":INITiate:CONTinuous" command (page 157), exits from the IDLE state and enters the initiate (startup) state. (Note that executing "*RST" turns OFF the setting by the ":INITiate:CONTinuous" command.)

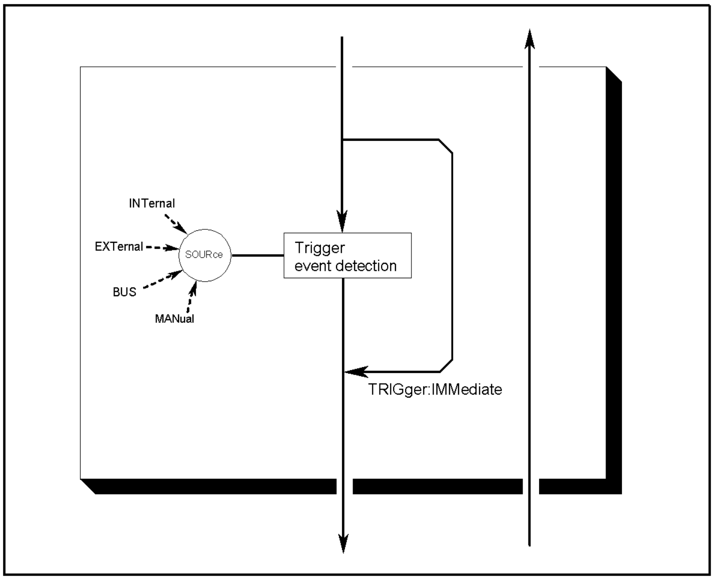
- Initiate (startup) state

  The trigger system, if it is on the descending path, bypasses the initiate (startup) state and transitions to the trigger event detection state. If it is on the ascending path and the setting by the “:INITiate:CONTinuous” command is ON, the trigger system again moves from the INITiate state to the trigger event detection state. If it is on the ascending path and the setting by the “:INITiate:CONTinuous” command is OFF, the 4268A enters the IDLE state.

- Trigger event detection state

  The trigger system, if it is on the descending path, branches as follows.

Figure 5-8 **Inside the Event Detection State**



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SOURce	The “:TRIGger[:SEQuence1]:SOURce” command (page 176) specifies what input can generates a trigger event required to continue the descending path.
IMMediate	The “:TRIGger[:SEQuence1][:IMMediate]” command (page 177) bypasses the detection of events, and causes immediate transition to the sequence operation state.

If the trigger system is on the ascending path, it bypasses the trigger event detection state, and enters into the Initiate (startup) state.

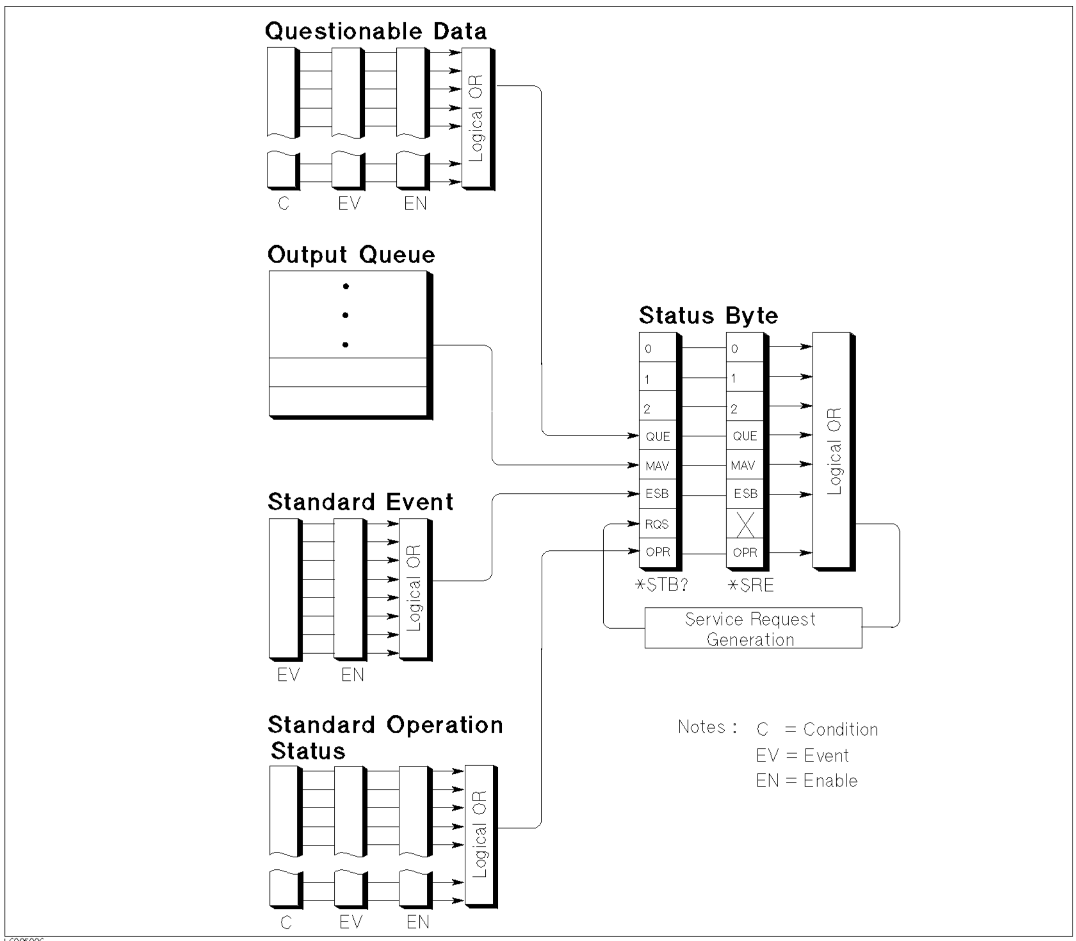
- Sequence operation state

  If the system enters the sequence operation state from a higher level after a lapse of the source delay time set by the “:TRIGger[:SEQuence1]:DELay” command (page 175) and the trigger delay time set by the “:TRIGger:SEQuence2:DELay” command (page 177), the 4268A starts the measurement. When the measurement is completed, the system bypasses the trigger event detection state and goes back to the initiate (startup) state.

Using the status report system

You can use the status report system shown in Figure 5-9 to grasp the status of the instrument and control measurements appropriately. The status report system is described below.

Figure 5-9 **Status Report System**



Service Request (SRQ)

The 4268A can send the SRQ (Service Request) control signal when it needs to request a service from an external controller. The 4268A sets bit 6 in the status byte register (refer to Figure 5-10) or the RQS (Request Service) bit at the instant of generating SRQ. By using the "*SRE" command (page 181) to set the service request enable register, you can select which status byte register's summary message enables the generation of SRQ.

Status byte register

The status byte register is located at the top level of the status report system, consisting of 8 bits to indicate the summary of the lower level registers. You can read the status byte using "*STB?" (page 181) or SPOLL. These return a register value (summation of weights of all bits that are set to "1") in decimal notation.

Figure 5-10 **Status Byte Register**

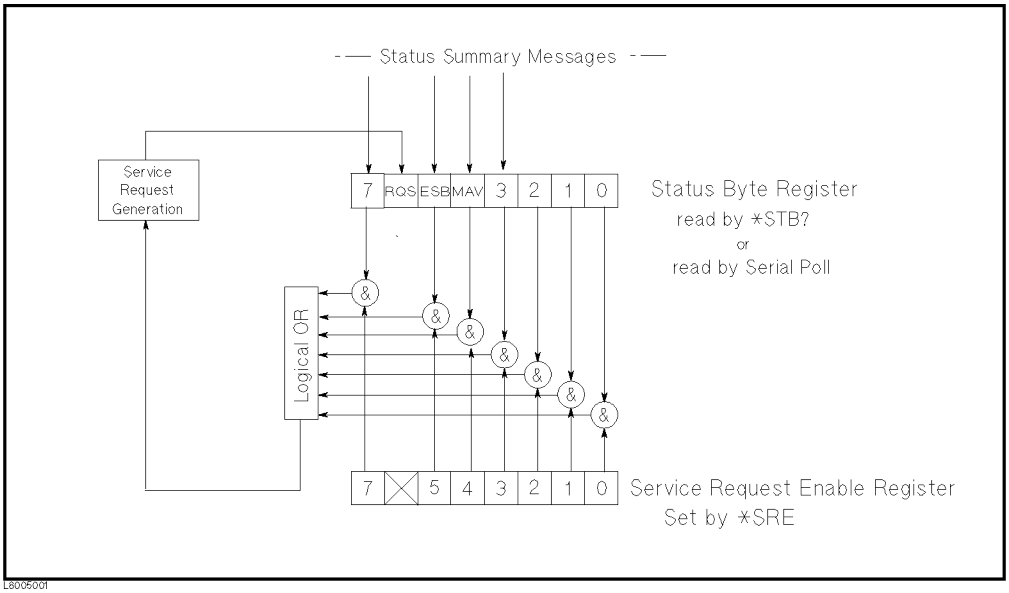


Table 5-1 **Bit Assignment of Status Byte Register**

Bit number	Bit weight	Overview
7	128	Operation status register summary bit
6	64	Request service (RQS) bit. This bit is set to "1" when any valid bit of the status byte is set, or in other words when the 4268A has at least one reason to request a service. This bit is reset to "0" by SPOLL.
5	32	Standard event status register summary bit
4	16	MAV (Message Available) bit. This bit is always set to "1" when the output queue of the 4268A contains any data and reset to "0" when the data is read.
3	8	Questionable status register summary bit
2 to 0	—	Not used (always 0).

Standard event status register

You can control the standard event status register using the “*ESE” command (page 178) and the “*ESR?” command (page 178).

Figure 5-11 **Standard Event Status Register**

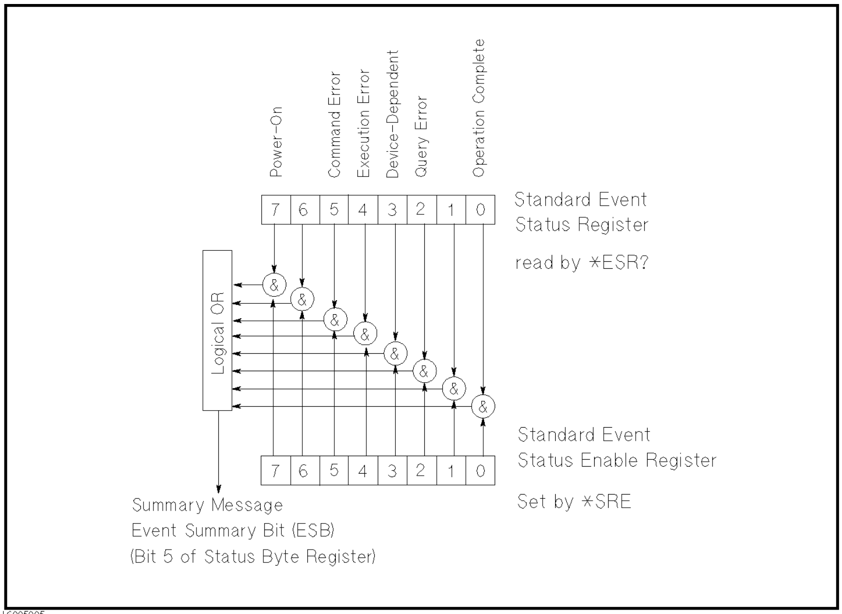


Table 5-2 **Bit Assignment of Standard Event Status Register**

Bit number	Bit weight	Overview
7	128	Power-on bit. This bit is set when the 4268A is turned OFF and then ON again.
6	—	Not used (always 0).
5	32	Command error bit. This bit is set to “1” when an IEEE 488.2 syntax error occurs or when the 4268A receives Group Execution Trigger (GET) in a program message.
4	16	Execution error bit. This bit is set to “1” when a parameter of an GPIB command is out of the input range or is not appropriate for the functionality of the 4268A for some reason.
3	8	Device specific error bit. This bit is set when many errors occur and the error queue becomes full.
2	4	Query error bit. This bit is set to “1” when read an operation from the output buffer that contains no data is attempted or when data is lost.
1	—	Not used (always 0).
0	1	Operation complete bit. This bit is set to “1” when the 4268A has completed all of the specified operations before the “*OPC?” command (page 179) is sent.

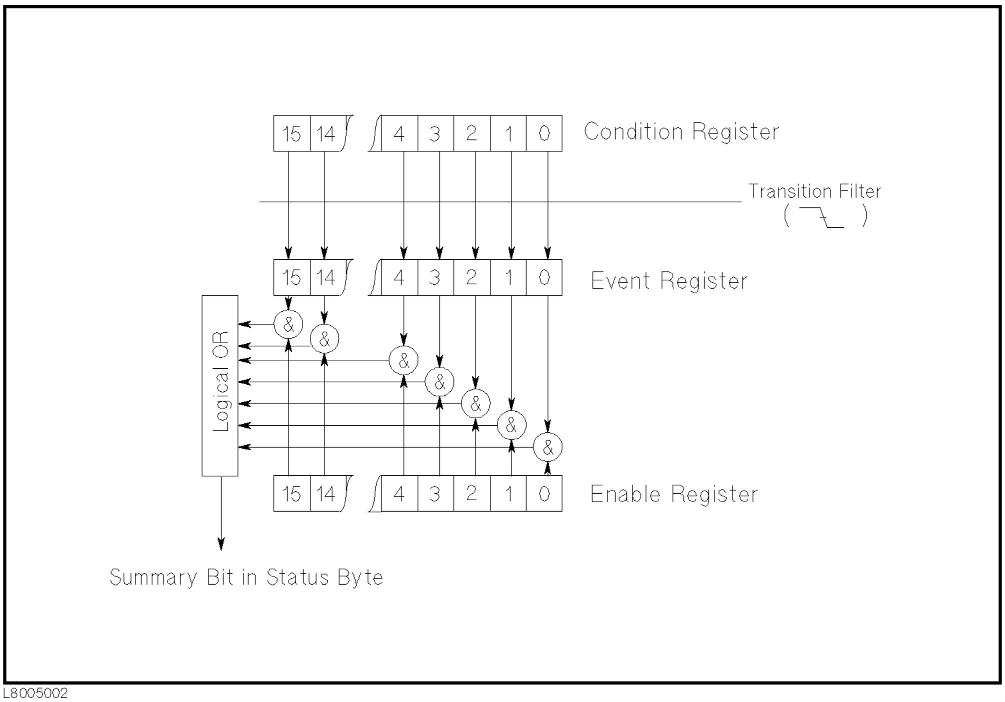
Standard operation status group

The 4268A has two standard operation status groups: the operation (OPERation) status register group and the questionable (QUEStionable) status register group.

Each group includes a condition register, an event register, and an enable register. The condition register reflects the internal state of the 4268A. Therefore, each time the conditions of the 4268A change, condition bits in this register transitions from “0” to “1” or from “1” to “0”. Each bit in the event register has a corresponding bit in the condition register. If one of the condition register bits transitions from “1” to “0”, the applicable event is reported to the event register by the transition filter. The enable register enables the corresponding bit in the event register so that the status summary bit, bit 7 or bit 3 in the status byte, can be set.

The registers in these groups are initialized by executing the “:STATus:PRESet” command (page 172).

Figure 5-12 Structure of Standard Operation Status Group



Operation status register group

The operation status register group provides information related to the status of the measurement system inside the 4268A. You can control the registers in this group by using the following commands.

- “:STATus:OPERation:CONDition?” on page 171
- “:STATus:OPERation:ENABle” on page 171
- “:STATus:OPERation[:EVENt]?” on page 171

Table 5-3 **Bit Assignment of Operation Status Condition Register**

Bit number	Bit weight	Overview
15 to 10	—	Not used (always 0).
9	512	Set to “1” when BUF2 is full.
8	256	Set to “1” when BUF1 is full.
5	128	Set to “1” during correction data measurement.
6	—	Not used (always 0).
5	32	Set to “1” while waiting for a trigger.
4	16	Set to “1” during measurement.
3	—	Not used (always 0).
2	4	Set to “1” while switching the measurement range.
1	2	Set to “1” during the waiting time to stabilize the measurement signal.
0	—	Not used (always 0).

Table 5-4 **Bit Assignment of Operation Status Event Register**

Bit number	Bit weight	Overview
15 to 10	—	Not used (always 0).
9	512	Set to “1” when BUF2 is full.
8	256	Set to “1” when BUF1 is full.
5	128	Set to “1” when the correction data measurement is completed.
6	—	Not used (always 0).
5	32	Set to “1” when entering into the trigger wait status.
4	16	Set to “1” when the measurement is completed.
3	—	Not used (always 0).
2	4	Set to “1” when measurement range switching is completed.
1	2	Set to “1” when the waiting time to stabilize the measurement signal has elapsed.
0	—	Not used (always 0).

Questionable status register group

The questionable status register group provides information related to the quality of output and measurement data inside the 4268A.

The 4268A does not support events of the questionable status register group. Therefore, all of the bits in this register are always 0.

Table 5-5 **Bit Assignment of Questionable Status Register Group**

Bit number	Bit weight	Overview
15 to 0	—	Not used (always 0).

Using the status report system

To use the status report system, use the following commands.

- "*CLS" on page 178
- "*ESE" on page 178
- "*ESR?" on page 178
- "*SRE" on page 181
- "*STB?" on page 181
- ":STATus:OPERation:CONDition?" on page 171
- ":STATus:OPERation:ENABle" on page 171
- ":STATus:OPERation[:EVENt]?" on page 171
- ":STATus:PRESet" on page 172

Example 5-16 provides a sample program using some of the above commands. (This program is stored in the sample program disk under the file name srq.bas.)

This program sets the averaging count to 128 to elongate the time until measurement completion so that you can check the operation in which the instrument waits for measurement completion. Then, it generates a trigger to start a measurement, displays "Now measuring...", and then displays "Done" when the measurement is completed.

Lines 50 to 70	After reset, sets the averaging count to 128 and makes a setting to generate a trigger from an external controller.
Line 90	Enables bit 4 (indicating that measurement is in progress) in the operation status register.
Line 100	Enables bit 7 (operation status register summary bit) in the status byte register.
Lines 120 to 130	Generates a trigger and displays a message saying that measurement is in progress.
Lines 150 to 180	Waits for the operation status register summary bit to be set.
Line 200	Displays a message of measurement completion.

Example 5-16 **Sample program: Status report system**

```
10      INTEGER Rtn_stb
20      !
30      ASSIGN @Hp4268a TO 717
40      !
50      OUTPUT @Hp4268a;":SYST:PRES"
60      OUTPUT @Hp4268a;":AVER:COUN 128"
70      OUTPUT @Hp4268a;":TRIG:SOUR BUS"
80      !
90      OUTPUT @Hp4268a;":STAT:OPER:ENAB 16"
100     OUTPUT @Hp4268a;"*SRE 128"
110     !
120     OUTPUT @Hp4268a;":TRIG"
130     PRINT "Now measuring ..."
140     !
150     REPEAT
160       OUTPUT @Hp4268a;"*STB?"
170       ENTER @Hp4268a;Rtn_stb
180     UNTIL BIT(Rtn_stb,7)
190     !
200     PRINT "Done."
210     END
```

6 GPIB Command Reference

This chapter provides GPIB command reference for the 4268A. The full names of commands appear in alphabetical order in this chapter . If you want to search for commands by their shortened names without the normally omitted parts, see “GPIB commands” in the index. If you want to search for commands by their functionality, refer to Appendix C , “GPIB Command Table.”

Notational Conventions in this Command Reference

This section describes the rules to read the description of commands in this chapter.

Syntax

Part headed with "Syntax" describes the syntax to send a command from the external controller to the 4268A. The syntax consists of a command part and a parameter part. The separator between the command part and the parameter part is a space. If there are several parameters, use a comma (,) as the separator between adjacent parameters.

You can omit any lowercase letters from a syntax. For example, ":CALCulate1:FORMat" can be shortened as ":CALC1:FORM".

The definition of symbols used in the syntax are as follows:

<>	Characters enclosed by angular brackets are necessary parameters when sending the command.
[]	Parts enclosed by square brackets can be omitted.
{}	Braces indicate that you must select one of the items in this part. Each item is separated by a vertical bar (|).

For example, if the following syntax is given, you can use syntax ":CORR:COLL:METH REFL2", ":SENS:CORR:COLL:METH REFL3", and so on.

Syntax [:SENSe]:CORRection:COLLect:METHod {REFL2|REFL3}

Description

The part headed by "Description" describes how to use the command or the operation when executed.

Parameters

The part headed by "Parameter" describes necessary parameters when sending the command. When a parameter is a value type enclosed with <>, information including description, allowable setting range, and initial value is given; when a parameter is a selection type enclosed with { }, information on each selection item is given. When "MAX or MIN is available" is shown for a value type parameter, you can use MAX (or MAXIMUM) or MIN (or MINIMUM) as the parameter instead of a value to specify the maximum or minimum value within the allowable setting range, respectively.

Query response

The part with heading “Query response” describes the data format read out when query (data read-out) is available with this command.

Each read-out parameter is enclosed with {}. If there are several items within {} separated by a vertical bar (|), only one of them is read out.

When several parameters are read out, they are separated with a comma (,). Two points between commas (...) indicate that the data of that part is omitted. For example, {numeric 1},...,{numeric 4} indicates that four data items, {numeric 1}, {numeric 2}, {numeric 3}, and {numeric 4}, are read out.

The <newline ><^END> is a program message terminator attached at the end of the parameter.

Equivalent key sequence/Related keys

The parts headed by “Equivalent key sequence” and “Related key” show the front panel key that has the same effect as this command. “Equivalent key sequence” indicates that only pressing the key executes the function or prompts you to enter the setting. On the other hand, “Related key” indicates the first key that you must press when some steps are required to perform the execution or setting.

4268A GPIB Commands

This section describes GPIB commands available with the 4268A.

:ABORt

Syntax

:ABORt

Description

Resets the trigger system and places the trigger sequence in the idle state. If the ":INITiate:CONTinuous" (page 157) is set to ON, the trigger system is started up. For details of the trigger system, refer to "Trigger system structure of the 4268A" on page 124. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALCulate:COMParator:AUXBin

Syntax

:CALCulate:COMParator:AUXBin {ON|OFF|1|0}

:CALCulate:COMParator:AUXBin?

Description

Determines whether to use AUX_BIN when performing sorting using the comparator function. This function is applicable if a measurement value is out of the limit range of the secondary parameter, as follows. If AUX_BIN is enabled and the measurement value is within the primary parameter limit range, it is sorted into AUX_BIN; if not, into OUT_OF_BINS. If AUX_BIN is disabled, it is always sorted into OUT_OF_BINS.

Parameters

	Description
ON or 1	Enables AUX_BIN.
OFF or 0 (initial value)	Disables AUX_BIN.

Query response

{1|0}<newline><^END>

Related keys

Comprtr key (Blue key, **1** key)

:CALCulate:COMParator:BEEPer:CONDition

Syntax

:CALCulate:COMParator:BEEPer:CONDition {FAIL|PASS}

:CALCulate:COMParator:BEEPer:CONDition?

Description

Determines when the Comparator function outputs a beep sound, that is, when a DUT has failed (sorted into other than BIN1 to BIN9) or when a DUT has passed the test (sorted into one of BIN1 to BIN9).

Parameters

	Description
FAIL (initial value)	Beeps when DUT has failed.
PASS	Beeps when DUT has passed.

Query response

{FAIL|PASS}<newline><^END>

Related keys

Config key (Blue key, - key)

:CALCulate:COMParator:BEEPer[:STATe]

Syntax

:CALCulate:COMParator:BEEPer[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator:BEEPer[:STATe]?

Description

Determines whether to a output beep sound. If the beep sound output is disabled, regardless of the comparator sorting result, the beep sound is never outputted. This command has the same functionality as the ":SYSTem:BEEPer:STATe" command on page 173

Parameters

	Description
ON or 1 (initial value)	Enables the beep sound output.
OFF or 0	Disables the beep sound output.

Query response

{1|0}<newline><^END>

Related keys

Config key (Blue key, -key)

:CALCulate:COMParator:COUNt:CLEar

Syntax

:CALCulate:COMParator:COUNt:CLEar

Description

Resets the count value for each BIN to 0. This command is for the BIN counter function of the comparator function.

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALCulate:COMParator:COUNt:DATA?

Syntax

:CALCulate:COMParator:COUNt:DATA?

Description

Reads out each count value of BIN1 to BIN9, OUT_OF_BINS, and AUX_BIN. This command is for the BIN counter function of the comparator function. (Query only)

Query response

{numeric1},{numeric2},...,{numeric10},{numeric11}<newline><^END>

	{numeric 1}	{numeric 2}	…	{numeric 10}	{numeric 11}
Description	BIN1's count value	BIN2's count value	…	OUT_OF_BINS's count value	AUX_BIN's count value
Unit	Number of DUTs	Number of DUTs	…	Number of DUTs	Number of DUTs

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALCulate:COMParator:COUNt[:STATe]

Syntax

:CALCulate:COMParator:COUNt[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator:COUNt[:STATe]?

Description

Determines whether to use the BIN counter function of the comparator function. When this function is enabled, the number of DUTs sorted into each BIN based on the comparator result is counted. The maximum count value is 999999. If this value is exceeded, the count value remains 999999 and is not updated.

Parameters

	Description
ON or 1	Enables the BIN counter function.
OFF or 0 (initial value)	Disables the BIN counter function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALCulate:COMParator:MODE

Syntax

:CALCulate:COMParator:MODE {ABS|DEV|PCNT}

:CALCulate:COMParator:MODE?

Description

Determines how to specify the limit range of the primary parameter for the comparator function.

Parameters

	Description
ABS (initial value)	Specifies the limit border value as an absolute value (absolute mode).
DEV	Specifies the border value relative to the reference value as an absolute value (absolute tolerance mode).
PCNT	Specifies the border value relative to the reference value as a percentage of the reference value (percent tolerance mode).

For how to set the reference value, refer to ":CALCulate:COMParator:PRIMary:NOMinal" on page 141

Query response

{ABS|DEV|PCNT}<newline><^END>

Related keys

Comprtr key (Blue key, **1** key)

:CALCulate:COMParator:PRIMary:BIN{1-9}

Syntax

:CALCulate:COMParator:PRIMary:BIN{1|2|3|4|5|6|7|8|9} <numeric 1>,<numeric 2>

:CALCulate:COMParator:PRIMary:BIN{1|2|3|4|5|6|7|8|9}?

Description

Lets you set the BIN1 to BIN9 limit ranges for the primary parameter used in the comparator function, depending on the limit range specification method selected using the ":CALCulate:COMParator:MODE" command (page 139).

The command only sets the limit range. Therefore, if the specified BIN is disabled, the set limit range is not valid. Refer to ":CALCulate:COMParator:PRIMary:BIN{1-9}:STATe" on page 141.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Lower limit value of the limit range	Upper limit value of the limit range
Range	-999.99 to 999.99	-999.99 to 999.99
Initial value	0	0
Unit	F (farad) or % (percent)	F(farad) or % (percent)

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied. The unit of the parameter changes depending on the limit range specification method.

MAX or MIN is available to specify the parameters.

Query response

{numeric1},{numeric2}<newline><^END>

Equivalent key sequence

BIN1: **Pri Low** key, **Pri High** key, **Comprtr** key (Blue key, **1** key)

BIN2 to BIN9: **Comprtr** key (Blue key, **1** key)

:CALCulate:COMParator:PRIMary:BIN{1-9}:STATe

Syntax

:CALCulate:COMParator:PRIMary:BIN{1|2|3|4|5|6|7|8|9}:STATe {ON|OFF|1|0}

:CALCulate:COMParator:PRIMary:BIN{1|2|3|4|5|6|7|8|9}:STATe?

Description

Determines whether to use the BIN1 to BIN9 limit range for the primary parameter when using the comparator function.

Parameters

	Description
ON or 1 (initial value of BIN1)	Enables BIN.
OFF or 0 (initial value of BIN2 to BIN9)	Disables BIN.

Query response

{1|0}<newline><^END>

Related keys

BIN1: **Pri Low** key, **Pri High** key, **Comprtr** key (Blue key, **1** key)

BIN2 to BIN9: **Comprtr** key (Blue key, **1** key)

:CALCulate:COMParator:PRIMary:NOMinal

Syntax

:CALCulate:COMParator:PRIMary:NOMinal <numeric>

:CALCulate:COMParator:PRIMary:NOMinal?

Description

Specifies the reference value used when specifying the primary parameter limit range for the comparator function. This value is used when the setting of the limit range specification method is the absolute tolerance mode or the percent tolerance mode.

Parameters

	<numeric>
Description	Reference value used when specifying the primary parameter limit range
Range	-999.99 to 999.99
Initial value	0
Unit	F (farad)

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameter.

Query response

{numeric}<newline><^END>

Related keys

Comprtr key (Blue key, **1** key)

:CALCulate:COMParator:SECondary:LIMit

Syntax

:CALCulate:COMParator:SECondary:LIMit <numeric 1>,<numeric 2>

:CALCulate:COMParator:SECondary:LIMit?

Description

Lets you set the limit range for the secondary parameter used in the comparator function.

The command only sets the limit range. Therefore, if the secondary parameter limit range is disabled, the set limit range is not valid. Refer to ":CALCulate:COMParator:SECondary:STATe" on page 142.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Lower limit value of the limit range	Upper limit value of the limit Range
Range	-99.999E9 to 99.999E9	-99.999E9 to 99.999E9
Initial value	0	0

MAX or MIN is available to specify the parameters.

Query response

{numeric1},{numeric2}<newline><^END>

Equivalent key sequence

(Blue key, **Pri Low** key), (Blue key, **Pri High** key), **Comprtr** key (Blue key, **1** key)

:CALCulate:COMParator:SECondary:STATe

Syntax

:CALCulate:COMParator:SECondary:STATe {ON|OFF|1|0}

:CALCulate:COMParator:SECondary:STATe?

Description

Determines whether to use the limit value for the secondary parameter when using the comparator.

Parameters

	Description
ON or 1 (Initial value)	Enables the secondary parameter limit range.
OFF or 0	Disables the secondary parameter limit range.

Query response

{1|0}<newline><^END>

Related keys

(Blue key, **Pri Low** key), (Blue key, **Pri High** key), **Comprtr** key (Blue key, **1** key)

:CALCulate:COMParator[:STATe]

Syntax

:CALCulate:COMParator[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator[:STATe]?

Description

Determines whether to use the comparator function. This setting is interlocked with ON/OFF of the handler interface. If any measurement parameter is changed, the function is automatically disabled. Care must be taken with the execution order in programming in relation to the measurement parameter setting commands (":CALCulate1:FORMat" (page 143) and ":CALCulate2:FORMat" (page 145)).

Parameters

	Description
ON or 1	Enables the comparator function.
OFF or 0 (initial value)	Disables the comparator function.

Query response

{1|0}<newline><^END>

Related keys

Comprtr key (Blue key, **1** key)

:CALCulate1:FORMat

Syntax

:CALCulate1:FORMat {CP|CS}

:CALCulate1:FORMat?

Description

Specifies the primary parameter to be measured.

If the secondary parameter has been set to G or RP and the primary parameter is set to Cs, the secondary parameter is automatically changed to D. Also, if the secondary parameter has been set to Rs and the primary parameter is set to Cp, the secondary parameter is automatically changed to D.

Parameters

	Description
CP (initial value)	Specifies the capacitance value measured using the parallel equivalent circuit model for the primary parameter.
CS	Specifies the capacitance value measured using the series equivalent circuit model for the primary parameter.

Query response

{CP|CS}<newline><^END>

Equivalent key sequence

Meas Prmtr key

:CALCulate1:MATH:EXPRession:CATalog?

Syntax :CALCulate1:MATH:EXPRession:CATalog?

Description Reads out available parameters used when executing the command (":CALCulate1:MATH:EXPRession:NAME" (page 144)) to specify the expression of the primary parameter in the deviation measurement mode. Query response is always {DEV},{PCNT}. (Query only)

Query response {DEV},{PCNT}<newline><^END> (fixed)

Equivalent key sequence No equivalent keys are available on the front panel.

:CALCulate1:MATH:EXPRession:NAME

Syntax :CALCulate1:MATH:EXPRession:NAME {DEV|PCNT}

:CALCulate1:MATH:EXPRession:NAME?

Description Specifies the expression of the primary parameter used when displaying the measurement result in the deviation measurement mode.

Parameters

	Description
DEV (initial value)	Displays the difference between the measurement value and the reference value as an absolute value (measurement value - reference value).
PCNT	Displays the difference between the measurement value and the reference value as a percentage of the reference value ((measurement value - reference value) / reference value × 100).

For how to set the reference value, refer to ":DATA[:DATA]" on page 149

Query response {DEV|PCNT}<newline><^END>

Related keys Δ **Mode** key (Blue key, **Meas Prmtr** key)

:CALCulate1:MATH:STATe

Syntax

:CALCulate1:MATH:STATe {ON|OFF|1|0}
:CALCulate1:MATH:STATe?

Description

Determines whether to use the function to output the measurement result of the primary parameter in a deviation from the reference value (deviation measurement mode). If any measurement parameter is changed, the function is automatically disabled. Take care with the execution order in programming in relation to the measurement parameter setting commands (":CALCulate1:FORMat" (page 143) and ":CALCulate2:FORMat" (page 145)).

Parameters

	Description
ON or 1	Enables the deviation measurement mode.
OFF or 0 (initial value)	Disables the deviation measurement mode.

Query response

{1|0}<newline><^END>

Related keys

Δ **Mode**key (Blue key, **Meas Prmtr**key)

:CALCulate2:FORMat

Syntax

:CALCulate2:FORMat {D|Q|G|RP|RS}
:CALCulate2:FORMat?

Description

Specifies the secondary parameter to be measured.

If the primary parameter has been set to CP and the secondary parameter is set to RS, the primary parameter is automatically changed to CS. Also, if the primary parameter has been set to CS and the secondary parameter is set to G or RP, the primary parameter is automatically set to CP.

Parameters

	Description
D (initial value)	Specifies the dissipation factor as the secondary parameter.
Q	Specifies the quality factor (inverse value of D) as the secondary parameter.
G	Specifies the equivalent parallel conductance measured using the parallel equivalent circuit model as the secondary parameter.
Rp	Specifies the equivalent parallel resistance measured using the parallel equivalent circuit model as the secondary parameter.
Rs	Specifies the equivalent series resistance measured using the series equivalent circuit model as the secondary parameter.

Query response

{D|Q|G|RP|RS}<newline><^END>

Equivalent key sequence

Meas Prmtr key

:CALCulate2:MATH:EXPRession:CATalog?

Syntax

:CALCulate2:MATH:EXPRession:CATalog?

Description

Reads out available parameters used when executing the command (":CALCulate2:MATH:EXPRession:NAME" (page 146)) to specify the expression of the secondary parameter in the deviation measurement mode. Query response is always {DEV},{PCNT}. (Query only)

Query response

{DEV},{PCNT}<newline><^END> (fixed)

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALCulate2:MATH:EXPRession:NAME

Syntax

:CALCulate2:MATH:EXPRession:NAME {DEV|PCNT}

:CALCulate2:MATH:EXPRession:NAME?

Description

Specifies the expression of the secondary parameter used when displaying the measurement result in the deviation measurement mode.

Parameters

	Description
DEV (initial value)	Displays the difference between the measurement value and the reference value as an absolute value (measurement value - reference value).
PCNT	Displays the difference between the measurement value and the reference value as a percentage of the reference value ((measurement value - reference value) / reference value × 100).

For how to set the reference value, refer to ":DATA[:DATA]" on page 149

Query response

{DEV|PCNT}<newline><^END>

Related keys

Δ **Mode** key (Blue key, **Meas Prmtr** key)

:CALCulate2:MATH:STATe

Syntax

:CALCulate2:MATH:STATe {ON|OFF|1|0}

:CALCulate2:MATH:STATe?

Description

Determines whether to use the function to output the measurement result of the secondary parameter in a deviation from the reference value (deviation measurement mode). If any measurement parameter is changed, the function is automatically disabled. Care must be taken with the execution order in programming in relation to the measurement parameter setting commands (":CALCulate1:FORMat" (page 143) and ":CALCulate2:FORMat" (page 145)).

Parameters

	Description
ON or 1	Enables the deviation measurement mode.
OFF or 0 (initial value)	Disables the deviation measurement mode.

Query response

{1|0}<newline><^END>

Related keys

Δ **Mode** key (Blue key, **Meas Prmtr** key)

:CALCulate3:MATH:STATe

Syntax

:CALCulate3:MATH:STATe {ON|OFF|1|0}

:CALCulate3:MATH:STATe?

Description

Determines whether to use the monitor function of the current flowing through the DUT during measurement.

Parameters

	Description
ON or 1	Enables the current monitor function.
OFF or 0 (initial value)	Disables the current monitor function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Level Mon key (Blue key, **Show Setting** key)

:CALCulate4:MATH:STATe

Syntax

:CALCulate4:MATH:STATe {ON|OFF|1|0}

:CALCulate4:MATH:STATe?

Description

Determines whether to use the monitor function of the voltage applied to the DUT during measurement.

Parameters

	Description
ON or 1	Enables the voltage monitor function.
OFF or 0 (initial value)	Disables the voltage monitor function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Level Mon key (Blue key, **Show Setting** key)

:CALibration:CABLe

Syntax

:CALibration:CABLe <numeric>

:CALibration:CABLe?

Description

Specifies the length of the measurement cable.

Parameters

	<numeric>
Description	Value to specify the cable length
Range	0 to 2
Initial value	0
Unit	m (meter)
Resolution	1

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameter.

Query response

{numeric}<newline><^END>

Equivalent key sequence

Cable key (Blue key, **3** key)

:DATA[:DATA]

Syntax

:DATA[:DATA] {REF1|REF2},<numeric>

:DATA[:DATA]? {REF1|REF2|BUF1|BUF2|IMON|VMON}

Description

When specifying REF1 or REF2 as parameter 1

Specifies the reference value used in the deviation measurement mode for the primary parameter or secondary parameter. This reference value is used when the deviation measurement mode is applied to the primary parameter or secondary parameter (when turned ON with the “:CALCulate1:MATH:STATe” (page 145) command or “:CALCulate2:MATH:STATe” (page 147) command).

When specifying BUF1 or BUF2 as parameter 1 (Query only)

Reads out data from data buffer 1 or data buffer 2. Executing this command returns the pointer to the specified data buffer (from where the measurement data is to be fed) to the start position.

When specifying IMON or VMON as parameter 1 (Query only)

Reads out the measurement value of the current monitor or voltage monitor. If the monitor function is disabled (when turned OFF with the “:CALCulate3:MATH:STATe” command (page 147) or “:CALCulate4:MATH:STATe” command (page 148)) or if a measurement error occurs, 9.9E37 is read out.

Parameters

	Parameter 1: {REF1|REF2|BUF1|BUF2|IMON|VMON}
REF1	Specifies or reads out the reference value used in the deviation measurement mode for the primary parameter.
REF2	Specifies or reads out the reference value used in the deviation measurement mode for the secondary parameter.
BUF1	Reads out data from data buffer 1.
BUF2	Reads out data from data buffer 2.
IMON	Reads out the current monitor.
VMON	Reads out the voltage monitor

	Parameter 2: <numeric>
Description	Reference value used in the deviation measurement mode
Range	-999.99 to 999.99 (for REF1) -99.999E9 to 99.999E9 (for REF2)
Initial value	0

If specified parameter 2 is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify parameter 2.

Query response

- When specifying REF1, REF2, IMON, or VMON as parameter 1

  {numeric}<newline><^END>

  Where, {numeric} is as follows:

For REF1	Reference value used in deviation measurement mode for the primary parameter
For REF2	Reference value used in deviation measurement mode for the secondary parameter
For IMON	Measurement value of the current monitor
For VMON	Measurement value of the voltage monitor

- When specifying BUF1 or BUF2 as parameter 1

  {numeric1},{numeric2},{numeric3},...,{numeric (NOP × 3)}<newline><^END>

  where, NOP is the number of measurement points specified with the":DATA:POINts" (page 153). As shown below, for each measurement point the data set of the measurement status, the measurement value of the parameter specified with":DATA:FEED" (page 151), and the comparator result are read out in this order. The number of data sets is NOP (total: NOP × 3).

  {numeric (n × 3) + 1}: Measurement status (an integer between 0 to 3, as shown below)

  0: No error

  1: Detection of measurement impossibility (overload)

  2: Detection of contact check failure (no contact)

  3: Simultaneous detection of overload and no contact

  {numeric (n × 3) + 2}: Measurement value

  {numeric (n × 3) + 3}: Comparator result (an integer between 0 to 11)

  0: Sorted into OUT_OF_BINS

  1: Sorted into BIN1

  2: Sorted into BIN2

  3: Sorted into BIN3

  4: Sorted into BIN4

  5: Sorted into BIN5

  6: Sorted into BIN6

  7: Sorted into BIN7

  8: Sorted into BIN8

  9: Sorted into BIN9

  10: Sorted into AUX_BIN

  11: Sorted into BIN_NA (sorting impossible)

  where n is an integer between 0 to NOP - 1.

In any case, the data transfer format complies with the setting by the ":FORMat[:DATA]" command (page 157)

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:FEED

Syntax

:DATA:FEED {BUF1|BUF2},{"CALCulate1"|"CALCulate2"|""}

:DATA:FEED? {BUF1|BUF2}

Description

Selects the measurement data fed into data buffer 1 or data buffer 2 from primary parameter, secondary parameter, or no feed. Query response is a character string with double quotation marks (").

Parameters

<table>
<tr><th></th><th>Description of {BUF1|BUF2}</th></tr>
<tr><td>BUF1</td><td>Specifies data buffer 1, to which the {"CALCulate1"|"CALCulate2"|""} setting is applied. Or reads out the setting from data buffer 1.</td></tr>
<tr><td>BUF2</td><td>Specifies data buffer 2, to which the {"CALCulate1"|"CALCulate2"|""} setting is applied. Or reads out the setting from data buffer 2.</td></tr>
</table>

<table>
<tr><th></th><th>Description of {"CALCulate1"|"CALCulate2"|""}</th></tr>
<tr><td>"CALCulate1"</td><td>Specifies the primary parameter as the measurement data fed into the data buffer selected with {BUF1|BUF2}.</td></tr>
<tr><td>"CALCulate2"</td><td>Specifies the secondary parameter as the measurement data fed into the data buffer selected with {BUF1|BUF2}.</td></tr>
<tr><td>"" (initial value)</td><td>Does not feed the measurement data into the data buffer selected with {BUF1|BUF2}.</td></tr>
</table>

Query response

{"CALCulate1"|"CALCulate2"|""}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:FEED:CONTrol

Syntax

:DATA:FEED:CONTrol {BUF1|BUF2},{ALWays|NEVer}

:DATA:FEED:CONTrol? {BUF1|BUF2}

Description

Determines whether to feed the measurement data into data buffer 1 or data buffer 2.

Parameters

	Description of {BUF1|BUF2}
BUF1	Specifies data buffer 1, to which the {ALWays|NEVer} setting is applied. Or reads out the setting from data buffer 1.
BUF2	Specifies data buffer 2, to which the {ALWays|NEVer} setting is applied. Or reads out the setting from data buffer 2.

	Description of {ALWays|NEVer}
ALWays	Feeds the measurement data into the data buffer specified with {BUF1|BUF2} each time a measurement is performed.
NEVer (initial value)	Does not feed the measurement data into the data buffer specified with {BUF1|BUF2}.

Query response

{ALW|NEV}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:POINts

Syntax

:DATA:POINts {BUF1|BUF2},<numeric>

:DATA:POINts? {BUF1|BUF2}

Description

Specifies the size of data buffer 1 or data buffer 2 in the number of measurement points. Executing this command returns the pointer to the specified data buffer (from where the measurement data is to be fed) to the start position.

Parameters

	Description of {BUF1|BUF2}
BUF1	Specifies data buffer 1, to which the <numeric> setting is applied. Or reads out the setting from data buffer 1.
BUF2	Specifies data buffer 2, to which the <numeric> setting is applied. Or reads out the setting from data buffer 2.

	<numeric>
Description	Number of measurement points for the data buffer specified with {BUF1|BUF2}
Range	1 to 200
Initial value	200
Unit	Number of points
Resolution	1

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameters.

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DISPlay[:WINDow][:STATe]

Syntax

:DISPlay[:WINDow][:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow][:STATe]?

Description

Determines whether to display the measurement result.

Parameters

	Description
ON or 1 (Initial value)	Enables the display.
OFF or 0	Disables the display.

Query response

{1|0}<newline><^END>

Related keys

Disp Mode key (Blue key, **Freq** key)

:DISPlay[:WINDow]:TEXT1[:DATA]:DIGit

Syntax

:DISPlay[:WINDow]:TEXT1[:DATA]:DIGit <numeric>

:DISPlay[:WINDow]:TEXT1[:DATA]:DIGit?

Description

Specifies the number of displayed digits of the primary/secondary parameter.

Parameters

	<numeric>
Description	Number of displayed digits of the primary/secondary parameter
Range	3 to 5
Initial value	5
Unit	Number of digits
Resolution	1

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameter.

Query response

{numeric}<newline><^END>

Related keys

Disp Mode key (Blue key, **Freq** key)

:DISPlay[:WINDow]:TEXT2:PAGE

Syntax

:DISPlay[:WINDow]:TEXT2:PAGE <numeric>

:DISPlay[:WINDow]:TEXT2:PAGE?

Description

Selects the page number of the instrument's setting display area located at the right of the display. The relationship between the displayed item and the page number is as follows:

Page number	Description of displayed item
1	Displays the measurement frequency and measurement signal level.
2	Displays the averaging count and cable length.
3	Displays the source delay time and trigger delay time.
4	Displays the comparator limit range (BIN1) for the primary parameter.
5	Displays the comparator limit range for the secondary parameter.
6	Displays the handler output (comparator result).
7	Displays the voltage/current monitor value of the measurement signal.
8	Displays the ON/OFF status of the multi-channel correction function (SCNR) and the selected channel number (CH) (only when option 001 is installed).

Parameters

	<numeric>
Description	Page number
Range	1 to 7 (1 to 8 with option 001)
Initial value	1
Resolution	1

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameters.

Query response

{numeric}<newline><^END>

Equivalent key sequence

Show Settingkey

:FETCh?

Syntax

:FETCh?

Description

Returns the measurement data of the immediately preceding measurement. If the ":CALCulate:COMParator[:STATe]" command (page 143), which specifies ON/OFF of the comparator function, is ON, four data items (the measurement status, the measurement value of the primary parameter, and the measurement value of the secondary parameter, and the comparator result) are returned in this order. If a measurement error occurs, that is, the measurement status is other than 0, the measurement values of the primary parameter and secondary parameter are 9.9E37, and the comparator result is 11. The data transfer format complies with the setting by the ":FORMat[:DATA]" command (page 157). (Query only)

Query response

{numeric 1},{numeric 2},{numeric 3},{numeric 4}<newline><^END>

If the comparator function is disabled (when turned OFF with the ":CALCulate:COMParator[:STATe]" command (page 143)), only three data items {numeric 1}, {numeric 2}, and {numeric 3} are read out.

Details of {numeric 1}, {numeric 2}, {numeric 3}, and {numeric 4} are as follows:

{numeric 1}: Measurement status (an integer between 0 and 3, as shown below)

0: No error

1: Detection of measurement impossibility (overload)

2: Detection of contact check failure (no contact)

3: Simultaneous detection of overload and no contact

{numeric 2}: Measurement value of primary parameter

{numeric 3}: Measurement value of secondary parameter

{numeric 4}: Comparator result (an integer between 0 and 11, as shown below)

0: Sorted into OUT_OF_BINS

1: Sorted into BIN1

2: Sorted into BIN2

3: Sorted into BIN3

4: Sorted into BIN4

5: Sorted into BIN5

6: Sorted into BIN6

7: Sorted into BIN7

8: Sorted into BIN8

9: Sorted into BIN9

10: Sorted into AUX_BIN

11: Sorted into BIN_NA (sorting impossible)

Equivalent key sequence

No equivalent keys are available on the front panel.

:FORMat[:DATA]

Syntax

:FORMat[:DATA] {ASCii|REAL[,64]}

:FORMat[:DATA]?

Description

Specifies the transfer format applied to output data of the ":DATA[:DATA]" (page 149), ":FETCh?" (page 156), and ":READ?" (page 158) commands. For details of the data transfer format, refer to "Data transfer format" on page 115.

Parameters

	Description
ASCii (Initial value)	Specifies the ASCII data transfer format.
REAL	Specifies the 64-bit real number data transfer format.

Query response

{ASC|REAL}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:INITiate:CONTinuous

Syntax

:INITiate:CONTinuous {ON|OFF|1|0}

:INITiate:CONTinuous?

Description

Determines whether to start up the trigger system successively. This setting is initialized OFF when the "*RST" command (page 180) is executed. For details on the trigger system, refer to "Trigger system structure of the 4268A" on page 124.

Parameters

	Description
ON or 1 (Initial value)	Performs successive startup.
OFF or 0	Does not perform successive startup.

Query response

{1|0}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:INITiate[:IMMediate]

Syntax

:INITiate[:IMMediate]

Description

If the trigger system is in the idle state, executing this command starts up the trigger system. After one trigger cycle is executed, it returns to the idle state. If the trigger system is not in the idle state or the successive startup of the trigger system is enabled (when turned ON with the “:INITiate:CONTinuous” command (page 157)), executing this command causes an error. For details on the trigger system, refer to “Trigger system structure of the 4268A” on page 124. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

:READ?

Syntax

:READ?

Description

If the trigger mode is set to Int (internal) or Ext (external) (when INT or EXT has been specified with the “:TRIGger[:SEQuence1]:SOURce” command (page 176)), executing this command starts up the trigger system and then returns the measurement data at the completion of the measurement if the trigger system is in the idle state. (Query only)

If the trigger mode is set to Man (Manual) or Bus (when Man or Bus has been specified by the “:TRIGger[:SEQuence1]:SOURce” command (page 176)), executing this command will disenable the trigger and cause an error. Thus, in this case the the command is not executed.

NOTE

If the trigger mode is Ext (external), subsequent commands are not accepted until an external trigger is inputted. To clear this status without inputting an external trigger, send Device Clear ("CLEAR" instruction in HP BASIC) to the GPIB port.

Query response

{numeric 1},{numeric 2},{numeric 3},{numeric 4}<newline><^END>

For details, refer to “:FETCh?” (page 156),which makes the same query response.

Equivalent key sequence

No equivalent keys are available on the front panel.

[:SENSe]:AVERage:COUNt

Syntax

[:SENSe]:AVERage:COUNt <numeric>

[:SENSe]:AVERage:COUNt?

Description

Specifies the averaging count applied to the measurement value used in the averaging function. Averaging is not available only with this setting. Use the "[:SENSe]:AVERage[:STATe]" (page 159) command to enable the averaging function.

Parameters

	<numeric>
Description	Averaging count
Range	1 to 256
Initial value	1
Resolution	1

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameters.

Query response

{numeric}<newline><^END>

Equivalent key sequence

Average key (Blue key, **Meas Time** key)

[:SENSe]:AVERage[:STATe]

Syntax

[:SENSe]:AVERage[:STATe] {ON|OFF|1|0}

[:SENSe]:AVERage[:STATe]?

Description

Determines whether to use the averaging function. If you use the front panel keys to set the averaging count, the averaging function is automatically enabled.

Parameters

	Description
ON or 1 (Initial value)	Enables the averaging function.
OFF or 0	Disables the averaging function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Average key (Blue key, **Meas Time** key)

[:SENSe]:CORRection:CKIT:STANdard3

Syntax

[:SENSe]:CORRection:CKIT:STANdard3 <numeric 1>,<numeric 2>

[:SENSe]:CORRection:CKIT:STANdard3?

Description

Specifies the reference values for the LOAD correction. Use the "[:SENSe]:CORRection:CKIT:STANdard3:FORMat" command (page 161) to set the parameter type of the reference values.

With the multi-channel correction function active (ON, with the "[:SENSe]:CORRection:MULTiple[:STATe]" command (page 165)), if the channel-by-channel reference value setting is enabled (ON, with the "[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe]" command (page 165)), you can select a channel with the "[:SENSe]:CORRection:MULTiple:CHANnel" command (page 164) and set the reference values for the channel.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Reference value for the primary parameter	Reference value for the secondary parameter
Range	-999.99 to 999.99	-99.999E9 to 99.999E9
Initial value	1E-6	1E-3

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify the parameters.

Query response

{numeric 1},{numeric 2}<newline><^END>

Related keys

Load key (Blue key, **6** key)

[:SENSe]:CORRection:CKIT:STANdard3:FORMat

Syntax

[:SENSe]:CORRection:CKIT:STANdard3:FORMat {CPD|CPQ|CPG|CPRP|CSD|CSQ|CSRS}

[:SENSe]:CORRection:CKIT:STANdard3:FORMat?

Description

Specifies the parameter types used when setting the reference values for the LOAD correction (“[:SENSe]:CORRection:CKIT:STANdard3” (page 160)).

Parameters

	Description
CPD (Initial value)	Specifies CP as the primary parameter; D as the secondary parameter.
CPQ	Specifies CP as the primary parameter; Q as the secondary parameter.
CPG	Specifies CP as the primary parameter; G as the secondary parameter.
CPRP	Specifies CP as the primary parameter; RP as the secondary parameter.
CSD	Specifies CS as the primary parameter; D as the secondary parameter.
CSQ	Specifies CS as the primary parameter; Q as the secondary parameter.
CSRS	Specifies CS as the primary parameter; RS as the secondary parameter.

For details on CP and CS, refer to “:CALCulate1:FORMat” (page 143). For details on D, Q, RP, and RS, refer to “:CALCulate2:FORMat” (page 145).

Query response

{CPD|CPQ|CPG|CPRP|CSD|CSQ|CSRS}<newline><^END>

Related keys

Load key (Blue key, **6** key)

[:SENSe]:CORRection:COLLect:METHod

Syntax

[:SENSe]:CORRection:COLLect:METHod {REFL2|REFL3}

[:SENSe]:CORRection:COLLect:METHod?

Description

Determines whether to use the LOAD correction. With the LOAD correction enabled, changing the measurement frequency (setting, with the ":SOURce:FREQuency[:CW]" command (page 169)) or the cable length (setting, with the ":CALibration:CABLe" command (page 148)) automatically disables the LOAD correction.

Parameters

	Description
REFL2 (Initial value)	Disables the LOAD correction.
REFL3	Enables the LOAD correction.

Query response

{REFL2|REFL3}<newline><^END>

Related keys

Load key (Blue key, **6** key)

[:SENSe]:CORRection:COLLect[:ACQuire]

Syntax

[:SENSe]:CORRection:COLLect[:ACQuire] {STANdard1|STANdard2|STANdard3}

Description

Measures the correction data for the user correction function (OPEN/SHORT/LOAD correction) and saves the result.

When the multi-channel correction function is enabled (ON, with the "[:SENSe]:CORRection:MULTiple[:STATe]" command (page 165)), the result is saved as the correction data for the channel selected during the measurement.

Executing this command automatically enables the user correction function (ON, with the "[:SENSe]:CORRection[:STATe]" command (page 166)). In addition, if the correction data measurement is for the LOAD correction, the LOAD correction function is automatically enabled (REFL3, with the "[:SENSe]:CORRection:COLLect:METHod" command (page 162)). (No query)

Parameters

	Description
STANdard1	Specifies the correction data measurement for the OPEN correction.
STANdard2	Specifies the correction data measurement for the SHORT correction.
STANdard3	Specifies the correction data measurement for the LOAD correction.

Related keys

Open key (Blue key, **4** key), **Short** key (Blue key, **5** key),
Load key (Blue key, **6** key)

[:SENSe]:CORRection:DATA

Syntax

[:SENSe]:CORRection:DATA {STANdard1|STANdard2|STANdard3},<numeric 1>,<numeric 2>

[:SENSe]:CORRection:DATA? {STANdard1|STANdard2|STANdard3}

Description

Sets the OPEN correction data, SHORT correction data, or LOAD correction data.

When the multi-channel correction function is enabled (ON, with the "[:SENSe]:CORRection:MULTiple[:STATe]" command (page 165)), the correction data is set for the currently selected channel.

Parameters

	Parameters 1: {STANdard1|STANdard2|STANdard3}
STANdard1	Specifies the <numeric 1> and <numeric 2> setting as the OPEN correction data. Or reads out the OPEN correction data.
STANdard2	Specifies the <numeric 1> and <numeric 2> setting as the SHORTcorrection data. Or reads out the SHORT correction data.
STANdard3	Specifies the <numeric 1> and <numeric 2> setting as the LOAD correction data. Or reads out the LOAD correction data.

- When specifying STANdard1 as parameter 1

	Parameters 2: <numeric 1>	**Parameters 3: <numeric 2>**
Description	Conductance value	Susceptance value
Range	-99.999E9 to 99.999E9	-99.999E9 to 99.999E9
Initial value	0	0
Unit	S (siemens)	S (siemens)

- When specifying STANdard2 as parameter 1

	Parameters 2: <numeric 1>	**Parameters 3: <numeric 2>**
Description	Resistance value	Reactance value
Range	-99.999E9 to 99.999E9	-99.999E9 to 99.999E9
Initial value	0	0
Unit	Ω	Ω

- When specifying STANdard3 as parameter 1

	Parameters 2: <numeric 1>	**Parameters 3: <numeric 2>**
Description	Primary parameter value specified with "[:SENSe]:CORRection:CKIT:STANdard3:FORMat"	Secondary parameter value specified with "[:SENSe]:CORRection:CKIT:STANdard3:FORMat"
Range	-999.99 to 999.99	-99.999E9 to 99.999E9
Initial value	1E-6	1E-3
Unit	F (farad)	Depends on the parameter type

In any case, if the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied.

MAX or MIN is available to specify parameter 2 and parameter 3.

Query response {numeric 1},{numeric 2}<newline><^END>

Related keys **Open** key (Blue key, **4** key), **Short** key (Blue key, **5** key), **Load** key (Blue key, **6** key) are available to obtain for verifying but not for changing those settings.

[:SENSe]:CORRection:MULTiple:CHANnel

Syntax [:SENSe]:CORRection:MULTiple:CHANnel <numeric>

[:SENSe]:CORRection:MULTiple:CHANnel?

Description Specifies a channel number used in the multi-channel correction function. You can specify the channel number also via the scanner interface. Therefore, if a channel number has been set with this command and then another channel number is specified via the scanner interface, the channel specified via the scanner interface is selected. If you execute this command using the product without the scanner interface (option 001), an error occurs.

Parameters

	<numeric>
Description	Selection of channel number
Range	0 to 63
Initial value	0
Resolution	1

If the specified parameter is out of the allowable setting range, an error occurs.

MAX or MIN is available to specify the parameter.

Query response {numeric}<newline><^END>

Related keys **Scanner** key (Blue key, **9** key)

[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe]

Syntax

[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe]?

Description

Determines whether to use channel-by-channel setting for the reference values when performing the LOAD correction using the multi-channel correction function. If you execute this command using the product without the scanner interface (option 001), an error occurs.

Parameters

	Description
ON or 1	Enables channel-by-channel setting.
OFF or 0 (initial value)	Disables channel-by-channel setting.

Query response

{1|0}<newline><^END>

Related keys

Scanner key (Blue key, **9** key)

[:SENSe]:CORRection:MULTiple[:STATe]

Syntax

[:SENSe]:CORRection:MULTiple[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection:MULTiple[:STATe]?

Description

Determines whether to use the multi-channel correction function. This setting is interlocked with the setting for whether to use the scanner interface. If you execute this command using the product without the scanner interface (option 001), an error occurs.

Parameters

	Description
ON or 1	Enables the multi-channel correction function.
OFF or 0 (initial value)	Disables the multi-channel correction function.

Query response

{1|0}<newline><^END>

Related keys

Scanner key (Blue key, **9** key)

[:SENSe]:CORRection[:STATe]

Syntax

[:SENSe]:CORRection[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection[:STATe]?

Description

Determines whether to use the user correction (OPEN/SHORT/LOAD correction) function. Performing correction data measurement, with the "[:SENSe]:CORRection:COLLect[:ACQuire]" command (page 162) or the front panel keys, automatically enables the user correction function. This setting is initialized to ON with the ":SYSTem:PRESet" command (page 174); OFF, with the "*RST" command (page 180).

Parameters

	Description
ON or 1 (Initial value)	Enables the user correction function.
OFF or 0	Disables the user correction function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

[:SENSe][:FIMPedance]:APERture[:MODE]

Syntax

[:SENSe][:FIMPedance]:APERture[:MODE] {SHORt|MEDium|LONG}

[:SENSe][:FIMPedance]:APERture[:MODE]?

Description

Selects the measurement time from Short, Medium, or Long. For information on actual measurement times of Short, Medium, and Long, refer to "Measurement time" on page 235.

Parameters

	Description
SHORt	Specifies Short.
MEDium (Initial value)	Specifies Medium.
LONG	Specifies Long.

Query response

{SHOR|MED|LONG}<newline><^END>

Equivalent key sequence

Meas Time key

[:SENSe][:FIMPedance]:CONTact:VERify

Syntax

[:SENSe][:FIMPedance]:CONTact:VERify {ON|OFF|1|0}

[:SENSe][:FIMPedance]:CONTact:VERify?

Description

Determines whether to use the contact check function.

Parameters

	Description
ON or 1	Enables the contact check function.
OFF or 0 (Initial value)	Disables the contact check function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Cont Chk key (Blue key, **2** key)

[:SENSe][:FIMPedance]:RANGe:AUTO

Syntax

[:SENSe][:FIMPedance]:RANGe:AUTO {ON|OFF|1|0}

[:SENSe][:FIMPedance]:RANGe:AUTO?

Description

Selects the measurement range mode from Auto (automatic switching) or Hold (fixed). Setting the measurement range, with the “[:SENSe][:FIMPedance]:RANGe[:UPPer]” command (page 168) or the front panel keys, automatically selects Hold.

Parameters

	Description
ON or 1 (Initial value)	Specifies Auto.
OFF or 0	Specifies Hold.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Auto/Hold key

[:SENSe][:FIMPedance]:RANGe[:UPPer]

Syntax

[:SENSe][:FIMPedance]:RANGe[:UPPer] <numeric>[PF|P|NF|N|UF|U|MF|M|F]

[:SENSe][:FIMPedance]:RANGe[:UPPer]?

Description

Specifies the measurement range. If the measurement range is 1E-9, changing the measurement frequency to 120 Hz automatically changes the measurement range to 10E-9; if the measurement range is 1E-3, changing the measurement frequency to 1 kHz automatically changes the measurement range to 100E-6. Setting the measurement range with this command automatically selects Hold range mode (OFF, with the "[:SENSe][:FIMPedance]:RANGe:AUTO" command (page 167)).

Parameters

	<numeric>
Description	Measurement range
Range	When the measurement frequency is 120 Hz: 6 points only: 10E-9,100E-9,1E-6,10E-6,100E-6,1E-3 When the measurement frequency is 1 kHz: 6 points only: 1E-9,10E-9,100E-9,1E-6,10E-6,100E-6
Initial value	10E-6

If the specified parameter is not a valid value, a possible minimum value greater than the specified parameter is set. If the specified parameter exceeds the maximum value, the maximum value is applied.

MAX or MIN is available to specify the parameter.

Query response

{1E-9|10E-9|100E-9|1E-6|10E-6|100E-6|1E-3}<newline><^END>

Equivalent key sequence

Range Setup key (Blue key, **Auto/Hold** key)

:SOURce:FREQuency[:CW]

Syntax

:SOURce:FREQuency[:CW] <numeric>[HZ|KHZ|K]

:SOURce:FREQuency[:CW]?

Description

Specifies the measurement frequency. Depending on this, available measurement ranges vary (setting, with the "[:SENSe][:FIMPedance]:RANGe[:UPPer]" command (page 168)).

Parameters

	<numeric>
Description	Measurement frequency
Range	2 points only: 120, 1E3
Initial value	1E3

If the specified parameter is smaller than 500, 120 Hz is set; if equal to or greater than 500, 1 kHz.

MAX or MIN is available to specify the parameter.

Query response

{120|1E3}<newline><^END>

Equivalent key sequence

Freq key

:SOURce:VOLTage:ALC[:STATe]

Syntax

:SOURce:VOLTage:ALC[:STATe] {ON|OFF|1|0}

:SOURce:VOLTage:ALC[:STATe]?

Description

Determines whether to use the auto level control function (ALC function).

Parameters

	Description
ON or 1	Enables the ALC function.
OFF or 0 (Initial value)	Disables the ALC function.

Query response

{1|0}<newline><^END>

Equivalent key sequence

ALC key

:SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Syntax

:SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude] <numeric>[MV|M|V]

:SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]?

Description

Specifies the measurement signal level.

Parameters

	<numeric>
Description	Measurement signal level
Range	100E-3 to 1
Initial value	1
Unit	V
Resolution	10E-3

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied. A fraction below the resolution is rounded off.

MAX or MIN is available to specify the parameters.

Query response

{numeric}<newline><^END>

Equivalent key sequence

Level key

:SOURce:VOLTage:MODE

Syntax

:SOURce:VOLTage:MODE {CONTinuous|SYNChronous}

:SOURce:VOLTage:MODE?

Description

Determines whether to use the synchronous source function (to output the measurement signal only during measurement) or not (to always output the measurement signal). The synchronous source function lets you set the source delay time with the ":TRIGger[:SEQuence1]:DELay" command (page 175), to suspend the signal output during the waiting time after a trigger is generated.

Parameters

	Description
CONTinuous	Always outputs the measurement signal.
SYNChronous	Outputs the measurement signal only during measurement.

Query response

{CONT|SYNC}<newline><^END>

Equivalent key sequence

Sync Source key (Blue key, **Level** key)

:STATus:OPERation:CONDition?

Syntax :STATus:OPERation:CONDition?

Description Reads out the value of the condition register of the Standard Operation Status group. (Query only)

Query response {numeric}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:OPERation:ENABle

Syntax :STATus:OPERation:ENABle <numeric>

:STATus:OPERation:ENABle?

Description Sets the value of the enable register of the Standard Operation Status group.

Parameters

	<numeric>
Description	Value of the enable register
Range	0 to 32767
Initial value	0
Resolution	1

If the specified parameter is out of the allowable setting range, the bit-by-bit logical product (AND) with 32767 (0x7fff) is applied.

Query response {numeric}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:OPERation[:EVENt]?

Syntax :STATus:OPERation[:EVENt]?

Description Reads out the value of the event register of the Standard Operation Status group. (Query only)

Query response {numeric}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:PRESet

Syntax :STATus:PRESet

Description Initializes each register of the Standard Operation and Questionable Status groups. (No query)

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:QUEStionable:CONDition?

Syntax :STATus:QUEStionable:CONDition?

Description Reads out the value of the condition register of the Standard Questionable Status group. (Query only)

Query response {numeric}<newline><^END>

The 4268A does not support the Standard Questionable Status group. Therefore, the query response is always 0.

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:QUEStionable:ENABle

Syntax :STATus:QUEStionable:ENABle <numeric>

:STATus:QUEStionable:ENABle?

Description Sets the value of the enable register of the Standard Questionable Status group. However, because the 4268A does not support the Standard Questionable Status group, executing this command does not cause anything to occur.

Query response {numeric}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

:STATus:QUEStionable[:EVENt]?

Syntax :STATus:QUEStionable[:EVENt]?

Description Reads out the value of the event register of the Standard Questionable Status group. (Query only)

Query response {numeric}<newline><^END>

The 4268A does not support the Standard Questionable Status group. Therefore, the query response is always 0.

Equivalent key sequence No equivalent keys are available on the front panel.

:SYSTem:BEEPer[:IMMediate]

Syntax :SYSTem:BEEPer[:IMMediate]

Description Produces a beep sound. If the beep sound output is disabled (OFF with ":SYSTem:BEEPer:STATe" command (page 173)), executing this command does not produce a beep sound. (No query)

Equivalent key sequence No equivalent keys are available on the front panel.

:SYSTem:BEEPer:STATe

Syntax :SYSTem:BEEPer:STATe {ON|OFF|1|0}

:SYSTem:BEEPer:STATe?

Description Determines whether to output the beep sound. This command has the same functionality as that of the ":CALCulate:COMParator:BEEPer[:STATe]" command (page 137).

Parameters

	Description
ON or 1 (Initial value)	Outputs the beep sound.
OFF or 0	Does not output the beep sound.

Query response {1|0}<newline><^END>

Related keys **Config** key (Blue key, - key)

:SYSTem:ERRor?

Syntax :SYSTem:ERRor?

Description Reads out the oldest error remaining in 4268A's error queue. The size of the error queue is 10. (Query only)

Query response {numeric 1},{string 1}<newline><^END>

	<numeric 1>	<string 1>
Description	Error number	Error message (A character string with double quotation marks ("))

Equivalent key sequence No equivalent keys are available on the front panel.

:SYSTem:KLOCk

Syntax

:SYSTem:KLOCk {ON|OFF|1|0}

:SYSTem:KLOCk?

Description

Determines whether to lock the front panel keys.

Parameters

	Description
ON or 1	Locks the keys.
OFF or 0 (Initial value)	Unlocks the keys.

Query response

{1|0}<newline><^END>

Equivalent key sequence

Key Lock key (Blue key, **0** key)

:SYSTem:PRESet

Syntax

:SYSTem:PRESet

Description

Triggers a reset to the initial setting status. For details on the initial setting status, refer to Appendix F , “Initial settings.”(No query)

Equivalent key sequence

Reset key (Blue key, -key)

:SYSTem:VERSion?

Syntax

:SYSTem:VERSion?

Description

Returns the SCPI version number to that with which the instrument complies. (Query only)

Query response

{string}<newline><^END>

The read-out data format is YYYY.V. YYYY indicates the yearly version; V the version number within the year.

Equivalent key sequence

No equivalent keys are available on the front panel.

:TRIGger[:SEQuence1]:DELay

Syntax

:TRIGger[:SEQuence1]:DELay <numeric>[MS|M|S]

:TRIGger[:SEQuence1]:DELay?

Description

Specifies the waiting time between when a trigger is inputted and when the measurement signal is outputted (source delay time). The source delay time is valid only when the synchronous source function is enabled (SYNC, with the “:SOURce:VOLTage:MODE” command (page 170)).

Parameters

	<numeric>
Description	Source delay time
Range	0 to 1
Initial value	0
Unit	S (second)
Resolution	1E-3

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied. A fraction below the resolution is rounded off.

MAX or MIN is available to specify the parameter.

Query response

{numeric}<newline><^END>

Related keys

Delay key (Blue key, **Trig Mode** key)

:TRIGger[:SEQuence1]:SOURce

Syntax

:TRIGger[:SEQuence1]:SOURce {INTernal|MANual|EXTernal|BUS}

:TRIGger[:SEQuence1]:SOURce?

Description

Selects the trigger mode from the following four types.

Internal	Uses the internal trigger to generate successive triggers automatically.
Manual	Generates a trigger when the **Trig** key is pressed.
External	Generates a trigger when the trigger signal is inputted via the Ext TRIGGER terminal, the handler interface, and other such means.
Bus	Generates a trigger when the command or the “*TRG” command (page 181) is executed.

Parameters

	Description
INTernal (Initial value)	Specifies Internal.
MANual	Specifies Manual.
EXTernal	Specifies External.
BUS	Specifies Bus.

Query response

{INT|MAN|EXT|BUS}<newline><^END>

Equivalent key sequence

Trig Mode key

Note that you cannot set the trigger mode to Bus from the front panel.

:TRIGger[:SEQuence1][:IMMediate]

Syntax

:TRIGger[:SEQuence1][:IMMediate]

Description

Immediately generates a trigger and executes a measurement when the trigger system is in the trigger event detection state. If the trigger system is not in the trigger event detection state, executing this command causes an error. For details on the trigger system, refer to “Trigger system structure of the 4268A” on page 124. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

:TRIGger:SEQuence2:DELay

Syntax

:TRIGger:SEQuence2:DELay <numeric>[MS|M|S]

:TRIGger:SEQuence2:DELay?

Description

Specifies the waiting time between when a trigger is inputted and when the measurement is started (trigger delay time).

Parameters

	<numeric>
Description	Trigger delay time
Range	0 to 1
Initial value	0
Unit	S (second)
Resolution	1E-3

If the specified parameter is out of the allowable setting range, the minimum value (if the lower limit of the range is not reached) or the maximum value (if the upper limit of the range is exceeded) is applied. A fraction below the resolution is rounded off.

MAX or MIN is available to specify the parameter.

Query response

{numeric}<newline><^END>

Related keys

Delay key (Blue key, **Trig Mode** key)

IEEE Common Commands

This section describes the IEEE common commands.

*CLS

Syntax

*CLS

Description

Initializes the Status Byte, Operation Status, Questionable Status, and Standard Event Status registers. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

*ESE

Syntax

*ESE <numeric>

*ESE?

Description

Specifies the value of the Standard Event Status enable register.

Parameters

	<numeric>
Description	Set value in the register
Range	0 to 255
Initial value	0
Resolution	1

If the parameter is out of the allowable setting range, the bit-by-bit logical product (AND) with 255 (0xff) is set.

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

*ESR?

Syntax

*ESR?

Description

Reads out the value of the Standard Event Status register. (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

*IDN?

Syntax *IDN?

Description Reads out the manufacturer, model number, serial number, and firmware version number. (Query only)

Query response {string 1},{string 2},{string 3},{string 4}<newline><^END>

Read-out data is as follows:

{string 1}	Manufacturer. HEWLETT-PACKARD is always read out.
{string 2}	Model number. 4268A is always read out.
{string 3}	10-digit serial number (example: JP1KF00101).
{string 4}	Firmware version number (example: 01.00).

Related keys **Config** key (Blue key, -key) is available to obtain similar information.

*OPC

Syntax *OPC

Description Sets the OPC bit (bit 0) in the Standard Event Status register when all pending operations are completed. (No query)

Equivalent key sequence No equivalent keys are available on the front panel.

*OPC?

Syntax *OPC?

Description Reads out 1 when all pending operations are completed. (Query only)

Query response {1}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

*OPT?

Syntax *OPT?

Description Reads out the identification number of an option installed in the 4268A. (Query only)

Query response {numeric}<newline><^END>

If there is no installed option, 0 is read out.

Related keys **Config** key (Blue key, -key) is available to obtain similar information.

*RCL

Syntax *RCL <numeric>

Description Recalls the instrument setting saved in the register of the specified number on the EEPROM. For details on the recalled instrument setting, refer to Appendix F , “Initial settings.” (No query)

Parameters

	<numeric>
Description	Specified number
Range	0 to 9
Resolution	1

If the specified parameter is out of the allowable setting range, an error occurs.

Equivalent key sequence **Rcl** key

*RST

Syntax *RST

Description Triggers a reset to the initial setting status. Although this initial setting status is almost the same as that of the reset result with the “:SYSTem:PRESet” command (page 174), there are some differences. For details, refer to Appendix F , “Initial settings.”(No query)

Equivalent key sequence No equivalent keys are available on the front panel.

*SAV

Syntax *SAV <numeric>

Description Saves the instrument setting into the register of the specified number on the EEPROM. For details on the saved instrument setting, refer to Appendix F , “Initial settings.”(No query)

Parameters

	<numeric>
Description	Specified number
Range	0 to 9
Resolution	1

If the specified parameter is out of the allowable setting range, an error occurs.

Equivalent key sequence **Save** key (Blue key, **Rcl** key)

*SRE

Syntax

*SRE <numeric>

*SRE?

Description

Sets the value of the Service Request enable register.

Parameters

	<numeric>
Description	Set value in the register
Range	0 to 255
Initial value	0
Resolution	1

If the parameter is out of the allowable setting range, the bit-by-bit logical product (AND) with 255 (0xff) is set. Note that you cannot set bit 6 to 1.

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

*STB?

Syntax

*STB?

Description

Reads out the value of the Status Byte register. (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

*TRG

Syntax

*TRG

Description

If the trigger mode is set to BUS (BUS, with the “:TRIGger[:SEQuence1]:SOURce” command (page 176)), this command generates a trigger and, after the completion of the measurement, reads out the measurement data.

Query response

{numeric 1},{numeric 2},{numeric 3},{numeric 4}<newline><^END>

Query response is the same as that of the “:FETCh?” command, so for details refer to “:FETCh?” (page 156).

Equivalent key sequence

No equivalent keys are available on the front panel.

*TST?

Syntax

*TST?

Description

Executes the self-test for the following items and reads out the result. (Query only)

Table 6-1 Self-test Items

Test item	Test description	Error code
RAM	Verifies that the RAM data bus is connected correctly and there is no faulty memory cell.	1
Boot ROM	Verifies that the checksum of Boot ROM is correct.	2
Flash ROM	Verifies that the checksum of Flash ROM is correct.	4
Calibration data	Verifies that the checksum of the calibration data in the EEPROM (Factory Calibration Data) is correct.	8
User correction data	Verifies that the checksum of the user correction data in the EEPROM (User Correction Data) is correct. Even if the test fails, the correction data is not initialized.	16
A1 main board	Verifies that the board ID of the A1 main board (analog board) is correct and that the A/D converter operates normally.	32
Backup RAM	Verifies that the instrument setting value in the backup memory (RAM) is correct. Even if the test fails, the instrument setting value is not initialized.	64

Query response

{numeric}<newline><^END>

The read-out data is the sum of the error codes of failed tests. If no error occurred, 0 is read out.

Related keys

Config key (Blue key, - key)

*WAI

Syntax

*WAI

Description

Waits for all commands sent before this command is completed. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

7 Using the Handler Interface

This chapter describes how to use the handler interface.

Overview

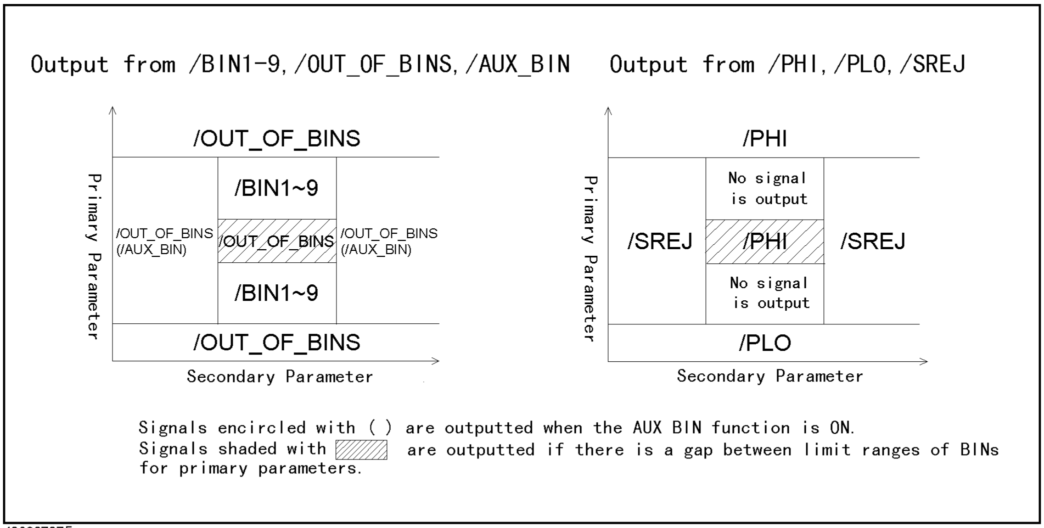
By using the handler interface, you can output the measurement completion signal, the screening result of the comparator function, the result of the contact check function, and so on to external devices from the 4268A. You can also input the external trigger signal and the key lock signal to the 4268A. With this interface and the comparator function, you can build an automatic screening system composed of the 4268A and the handler.

Outputting the Comparator Result

Via the handler interface, the sorting result of the comparator is outputted. The relationship between the comparator result and the output signals of the handler interface (/BIN1 - /BIN9, /AUX BIN, /OUT OF BINS, /PHI, /PLO, /SREJ) is shown below.

NOTE If the comparator function is OFF, the signals are not outputted except for /INDEX, /EOM, and /ALARM. /INDEX and /EOM are kept outputted (Low). /ALARM is outputted when an error occurs, in the same way as when the comparator is ON. EXT TRIG is valid regardless of ON/OFF of the comparator function if the trigger mode is Ext (external).

Figure 7-1 **Output of Comparator Result to Handler Interface**



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Pin Assignment of the Input/Output Signals

Figure 7-2 shows the pin assignment of each input/output signal of the handler interface connector. Table 7-1 describes the input/output signals.

NOTE The / (slash) before signal names means that the signal is negative logic (activity low).

Figure 7-2 **Pin Assignment of Handler Interface Connector**

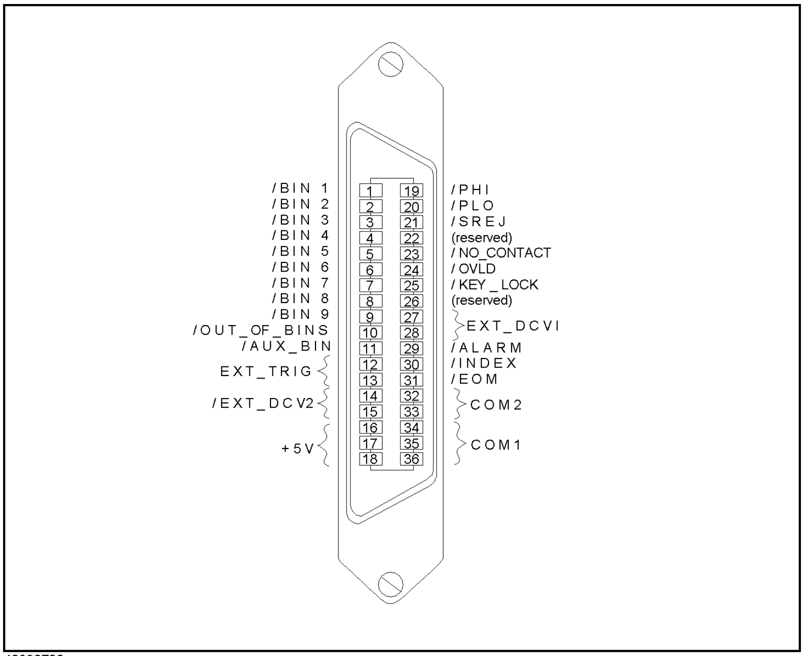

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Table 7-1 Description of Handler Interface Input/Output Signals

Pin Number	Signal Name	Description
1	/BIN1	Screening result signals (output). A BIN signal for the screening result (one of the pins 1 to 11) goes Low. If a contact check failure occurs or if measurement is impossible, these signals do not go Low.
2	/BIN2	
3	/BIN3	
4	/BIN4	
5	/BIN5	
6	/BIN6	
7	/BIN7	
8	/BIN8	
9	/BIN9	
10	/OUT_OF_BINS	
11	/AUX_BIN	
12, 13	EXT_TRIG	External trigger signals (input). These are valid when the trigger mode is set to Ext (external). The rising edge of a pulse generates a trigger.
14, 15	EXT_DCV2	External DC voltage (input). These supply voltage for the input signals (EXT TRIG, /KEY LOCK) and the operation output signals (/ALARM, /INDEX, /EOM). The input voltage range is from +5 V to +15 V.
16, 17, 18	+5V	Internal DC voltage (output).
19	/PHI	Over primary parameter upper limit signal (output). If the upper limit value of BIN1 to BIN9 is exceeded, it goes Low.
20	/PLO	Below primary parameter lower limit signal (output). If the lower limit value of BIN1 to BIN9 is not reached, it goes Low.
21	/SREJ	Secondary parameter out-of-limit signal (output). If the secondary parameter goes out of the allowable limit, it goes Low.
22	(reserved)	Not used at present. Do not connect anything.
23	/NO_CONTACT	Contact check failure signal (output). If the contact check is failed, it goes Low.
24	/OVLD	Measurement impossibility signal (output). If the measurement is impossible at the analog measurement part, it goes Low.

Table 7-1 Description of Handler Interface Input/Output Signals

Pin Number	Signal Name	Description
25	/KEY_LOCK	Key lock signal (input). Setting this signal to Low disables the use of all of the front panel keys on the 4268A.
26	(reserved)	Not used at present. Do not connect anything.
27, 28	EXT_DCV1	External DC voltage (input). These supply voltage for the judgement output signals (/BIN1 - /BIN9, /AUX BIN, /OUT OF BINS, /PHI, /PLO, /SREJ, /OVLD, /NO CONTACT). The input voltage range is from +5 V to +24 V.
29	/ALARM	Error occurrence signal (output). In the case of an abnormal self-test result, momentary failure of the power supply, or abnormal operation of a certain circuit, it goes Low. In the case of momentary failure of the power supply, it is Low only while the power supply is down
30	/INDEX	Analog measurement completion signal (output). When the analog measurement is completed, it goes Low. When the handler receives this signal, it gets ready for the next DUT to be connected. Until it receives the /EOM signal, measurement data cannot be obtained.
31	/EOM	Measurement cycle completion signal (output). When a series of measurement steps is completed and the measurement data screening result becomes valid, it goes Low
32, 33	COM2	Common for the external DC voltage of EXT DCV2 (pins 14 and 15).
34, 35, 36	COM1	Common for the external DC voltage of EXT DCV1 (pins 27 and 28).

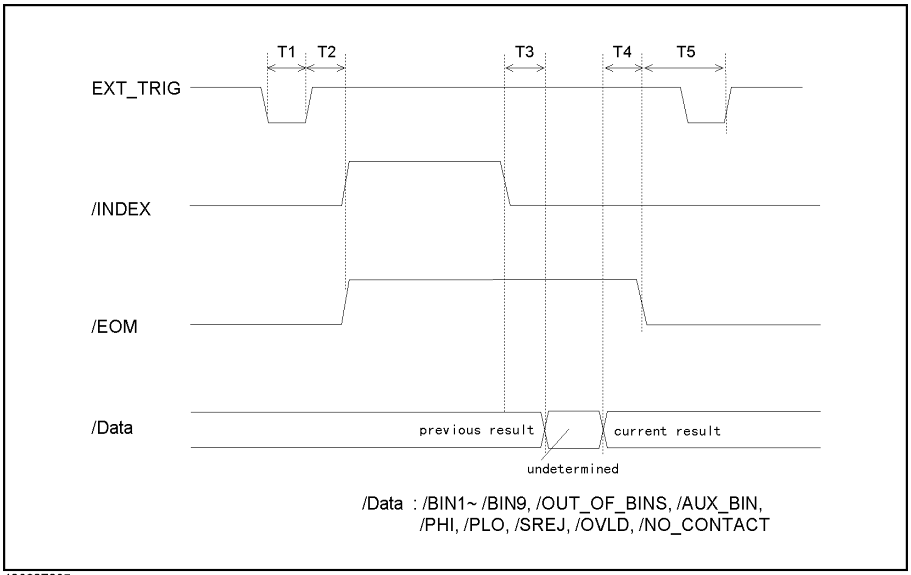
Timing Chart

Figure 7-3 shows the timing chart. T1 to T5 in the figure indicate the time periods described in the following table. The undefined section in /Data indicates that the 4268A is processing data after analog measurement and therefore the output signal is invalid.

Time		Minimum	Maximum
T1	Trigger pulse width	1[μs]	———
T2	Measurement start delay time	———	600[μs]*1
T3	Screening result output hold time	0[μs]	———
T4	Screening result output setup time	1[μs]	———
T5	Trigger setup time	0[μs]	———

*1.When the display has been turned off.

Figure 7-3 **Timing Chart**



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Electrical Characteristics

Output signals

Each output signal is outputted via an open collector by using a photo-coupler. The voltage of each output is obtained by connecting pull-up resistors, inside or outside of the 4268A. The output signals can be divided into two groups: judgment output signals and operation output signals. Table 7-2 shows the electrical characteristics of the output signals. Figures 7-4 and 7-5 show circuit diagrams of the judgment output signals and the operation output signals, respectively.

Table 7-2 **Electrical Characteristics of Handler Interface Output Signals**

Output signal	Output voltage [V]		Maximum current [mA]
	Low	High	
Judgment output signals: /BIN1 to /BIN9, /AUX_BIN, /OUT_OF_BINS, /PHI, /PLO, /SREJ, /OVLD, /NO_CONTACT	0 to 0.5	DCV1*1	6
Operation output signals: /INDEX, /EOM, /ALARM	0 to 0.5	DCV2*2	6

*1.+5V or +12V when internal power supply used
EXT_DCV2(+5V to +15V) when external power supply used
*2.+5V or +12V when internal power supply used
EXT_DCV2(+5V to +15V) when external power supply used

Figure 7-4 **Circuit Diagram of Handler Interface Judgment Output Signals**

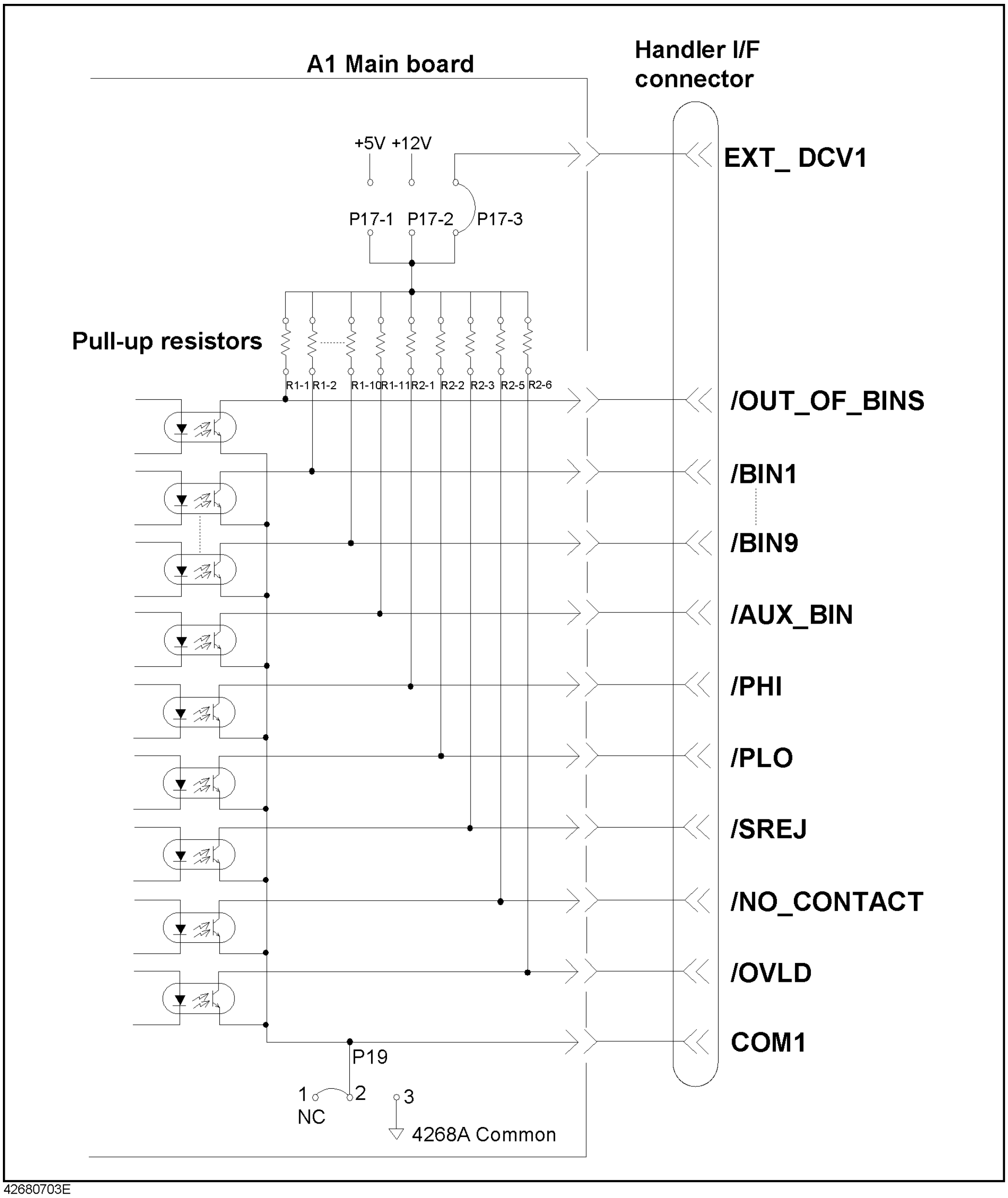
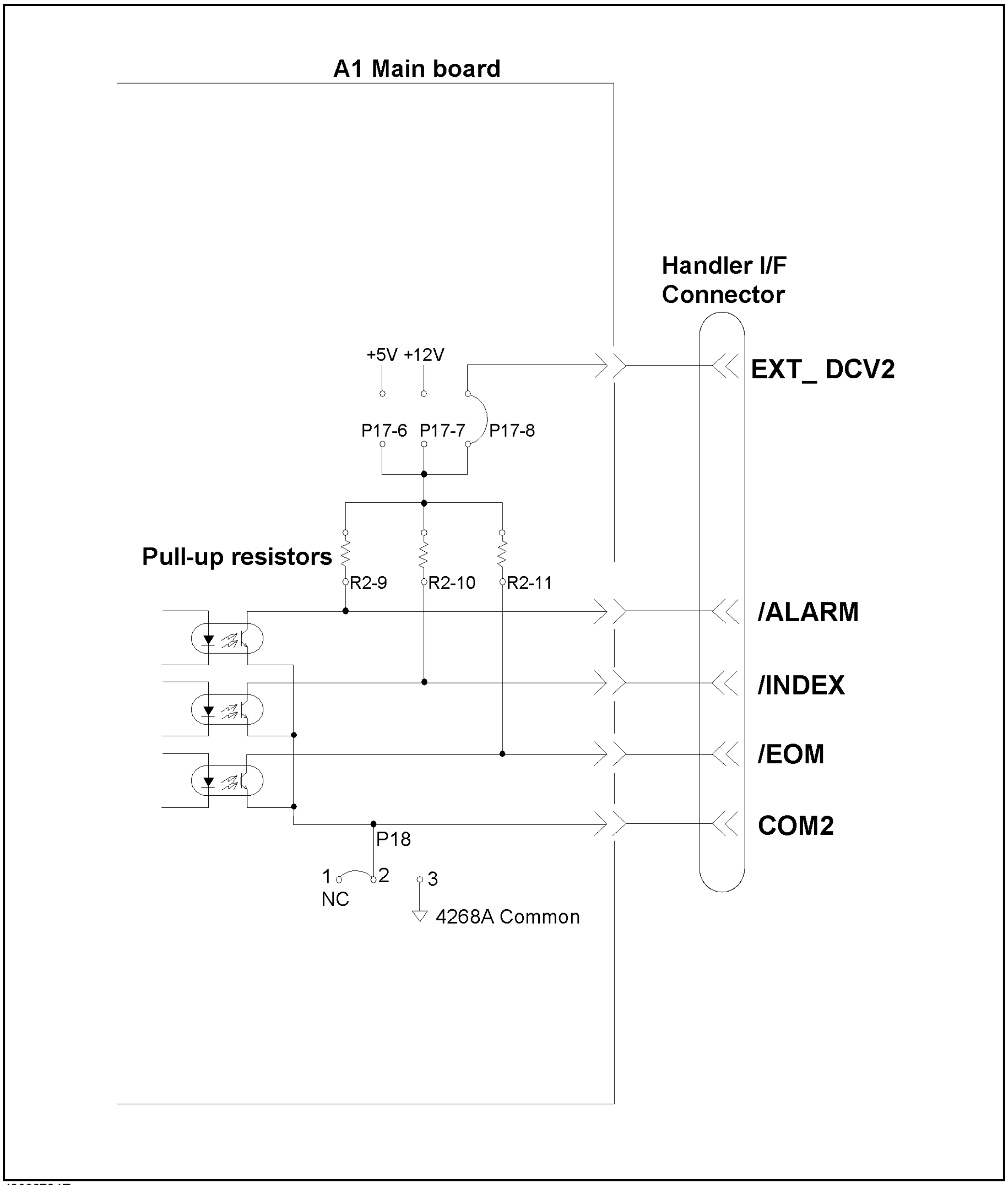


Figure 7-5 **Circuit Diagram of Handler Interface Operation Output Signals**



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Input signals

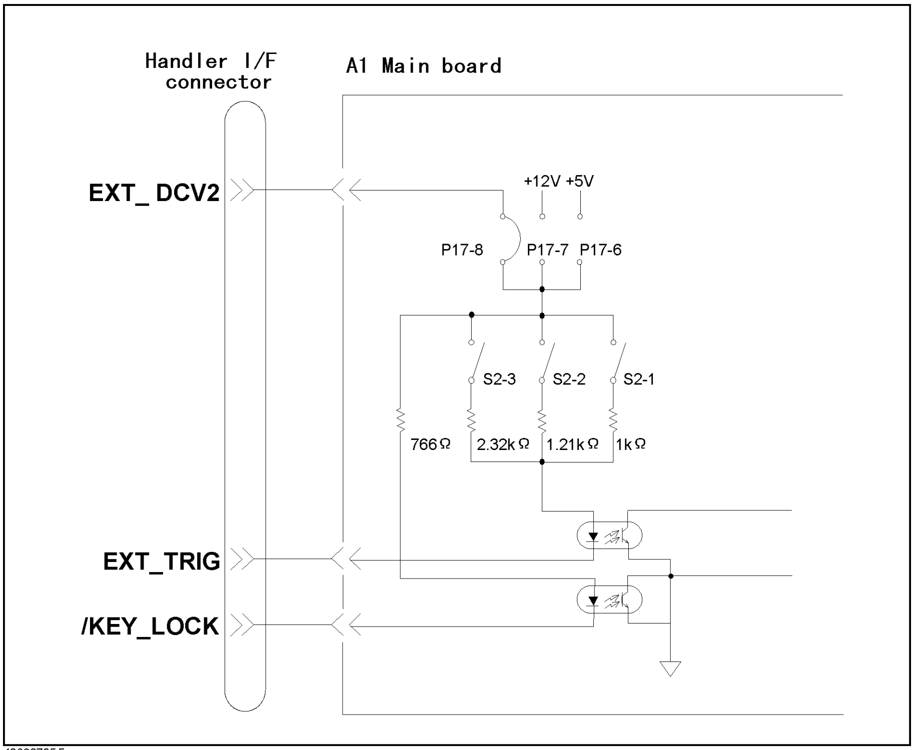
Each input signal is connected to the LED (cathode side) of the photo-coupler. The LED (anode side) is connected to the pull-up power supply voltage. Table 7-3 shows the electrical characteristics of the input signals. Figure 7-6 shows the circuit diagram of the input signals. The amount of current flowing through the LED varies depending on the pull-up power supply voltage and the setting of the pull-up resistor setting switch (S2). For information on the pull-up power supply voltage and the setting of S2, refer to “Preparations for Using the Handler Interface” on page 195.

Table 7-3 Electrical Characteristics of Handler Interface Input Signals

Input signal	Input voltage [V]		Input current (at Low) [mA] (typical)		
			Pull-up power supply voltage DCV2*1		
	Low	High	5V	12V	15V
EXT_TRIG	0 to 1	DCV2*1	3.7	4.6	5.9
/KEY_LOCK			5	14	18

*1.+5V or +12V when internal power supply used
EXT_DCV2(+5V to +15V) when external power supply used

Figure 7-6 Circuit Diagram of Handler Interface Input Signals



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Power supply

The power supply for the judgment output signal pull-up and that for the operation output signal pull-up and input signal drive can be set separately. As shown below, you can select them from +5 V or +12 V of the internal power supply or external power supply. For information on how to select the power supply, refer to "Setting the jumper (P17)" on page 195.

Table 7-4 Selecting the Input/Output Signal Pull-Up/Drive Power Supply

	Internal power supply		External power supply
Judgment output signal pull-up power supply	+5V	+12V	EXT_DCV1 +5V to +24V
Operation output signal pull-up power supply and input signal drive power supply	+5V	+12V	EXT_DCV2 +5V to +15V

The circuit common for each power supply is set as shown below. COM1and COM2 in the table can be connected to the internal common independently. For information on how to set the common, refer to "Setting the jumpers (P18, P19)" on page 197.

Table 7-5 Setting of Circuit Commons

	When internal power supply used	When external power supply used
Judgment output signal pull-up power supply	Internal common	COM1
Operation output signal pull-up power supply	Internal common	COM2

Preparations for Using the Handler Interface

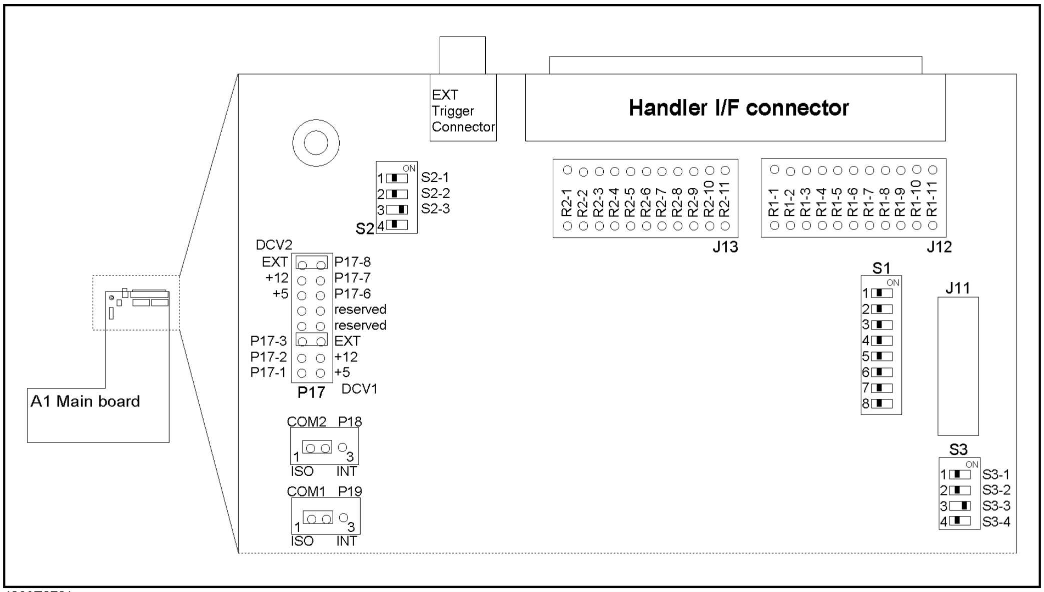
Before using the handler interface, you are required to set the input/output signal drive/pull-up power supplies and the pull-up resistors.

NOTE The information described here is designed for Internal Use Only in the Agilent Technologies service center. Request the Agilent Technologies service center to perform the setting described here as necessary to use the handler interface.

Setting the drive/pull-up power supply

The drive/pull-up power supply is set using the jumper (P17) and the DIP switch (S2) on the A1 main board. For information on the location and socket numbers of P17 and the location and switch numbers of S2, refer to Figure 7-7.

Figure 7-7 **A1 Main Board**



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Setting the jumper (P17)

P17-6, P17-7, and P17-8 let you set the operation output signal pull-up and input signal drive power supply (DCV2). Setting one of the following jumpers selects external power supply (EXT DCV2), internal power supply (+12 V), or internal power supply (+5 V).

Socket number	Power supply setting when the jumper is set (shorted)	Factory setting
P17-8	For the operation output signal pull-up and input signal drive power supply, external power supply (EXT DCV2) is specified.	Short
P17-7	For the operation output signal pull-up and input signal drive power supply, internal power supply (+12 V) is specified.	Open
P17-6	For the operation output signal pull-up and input signal drive power supply, internal power supply (+5 V) is specified.	Open

NOTE Set (short) only one from among P17-6, P17-7, and P17-8. Do not set (short) two or more at the same time.

NOTE P17-5 and P17-4 are not used at present. Do not connect anything to them.

P17-3, P17-2, and P17-1 let you set the judgment output signal pull-up power supply (DCV1). Setting one of the following jumpers selects external power supply (EXT DCV1), internal power supply (+12 V), or internal power supply (+5 V).

Socket number	Power supply setting when the jumper is set (shorted)	Factory setting
P17-3	For the judgment output signal pull-up power supply, external power supply (EXT DCV1) is specified	Short
P17-2	For the judgment output signal pull-up power supply, internal power supply (+12 V) is specified.	Open
P17-1	For the judgment output signal pull-up power supply, internal power supply (+5 V) is specified.	Open

NOTE Set (short) only one from among P17-3, P17-2, and P17-1. Do not set (short) two or more at the same time.

The external power supplies (EXT DCV1 and EXT DCV2) must be set within the following voltage ranges.

	Voltage range [V]
EXT_DCV1	+5 to +24
EXT_DCV2	+5 to +15

Setting the jumpers (P18, P19)

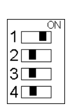
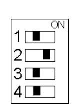
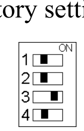
P17-5 and P17-4 let you set the circuit common.

Socket number	Circuit common setting when the jumper is set (shorted)	Factory setting
P18 1-2	External power supply's (EXT DCV2) common (COM2) and 4268A's internal circuit common are not connected. The operation output signals and input signals are isolated.	Short
P18 2-3	External power supply's (EXT DCV2) common (COM2) and 4268A's internal circuit common are connected. The operation output signals and input signals are not isolated.	Open
P19 1-2	External power supply's (EXT DCV1) common (COM1) and 4268A's internal circuit common are not connected. The judgment output signals are isolated.	Short
P19 2-3	External power supply's (EXT DCV1) common (COM1) and 4268A's internal circuit common are connected. The judgment output signals are not isolated.	Open

NOTE When using +5 V (pins 16, 17, and 18) of the handler interface connector, set (short) 2-3 of P18 or 2-3 of P19 to connect 4268A’s internal circuit common and COM1 or COM2 so that COM1 or COM2 is used as the power supply circuit common.

Setting the switches (S2)

Each switch of the switch (S2) must be set as follows, depending on the voltage setting of the operation output signal pull-up and the input signal drive power supply (DCV2).

Voltage setting of the operation output signal pull-up and input signal drive power supply (DCV2)		
$5V \leq DCV2 \leq 6V$	$6V < DCV2 \leq 9V$	$9V < DCV2 \leq 15V$
		(factory setting) 

Setting the pull-up resistors

The pull-up resistors for the operation output signals and judgment output signals must be set using J12 and J13 on the A1 main board. The following table shows the location where the resistor for each signal should be mounted, the equation to calculate the pull-up resistor values, and the typical resistance values. For information on the location of J12 and J13 and the location of the resistors for J12 and J13, refer to Figure 7-7.

Signal Name	Resistor location	Resistance value [kΩ]	Typical resistance value[Ω][*1]				
			DCV1 or DCV2 voltage				
			5V	9V	12V	15V	24V
/OUT_OF_BINS	R1-1	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/BIN1	R1-2	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/BIN2	R1-3	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
:	:	:	:	:	:	:	:
/BIN8	R1-9	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/BIN9	R1-10	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/AUX_BIN	R1-11	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/PHI	R2-1	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/PLO	R2-2	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/SREJ	R2-3	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
(reserved)	R2-4	———	——	——	——	——	——
/NO_CONTACT	R2-5	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
/OVLD	R2-6	DCV1 / 3	1.78k	3.16k	4.22k	5.11k	8.25k
(reserved)	R2-7	———	——	——	——	——	——
(reserved)	R2-8	———	——	——	——	——	——
/ALARM	R2-9	DCV2 / 3	1.78k	3.16k	4.22k	5.11k	——
/INDEX	R2-10	DCV2 / 3	1.78k	3.16k	4.22k	5.11k	——
/EOM	R2-11	DCV2 / 3	1.78k	3.16k	4.22k	5.11k	——

*1.The Product Numbers of the resistors are as follows;

1.78kΩ	0757-0278
3.16kΩ	0757-0279
4.22kΩ	0698-3154
5.11kΩ	0757-0438
8.25kΩ	0757-0441

The resistors are not factory-mounted. R2-4, R2-7, and R2-8 are reserved. Do not connect anything.

Procedure to remove the cover

This section describes how to disconnect the cables that hinder the operator from removing and attaching the cover when setting the drive/pull-up power supply or mounting pull-up resistors.

WARNING **Perform this work after 10 minutes or more have elapsed from when disconnecting the power cord. When the 4268A is operating or immediately after the power is turned off, dangerous electrical energy or voltage exists. Therefore, sufficient time is required after disconnecting the power cord to discharge the internal capacitor.**

NOTE When removing the cover, setting the drive/pull-up power supply, and mounting pull-up resistors, perform the work in a place with static protection and wear a ground strap.

Step 1. Disconnect 4268A's power cord and wait for 10 minutes.

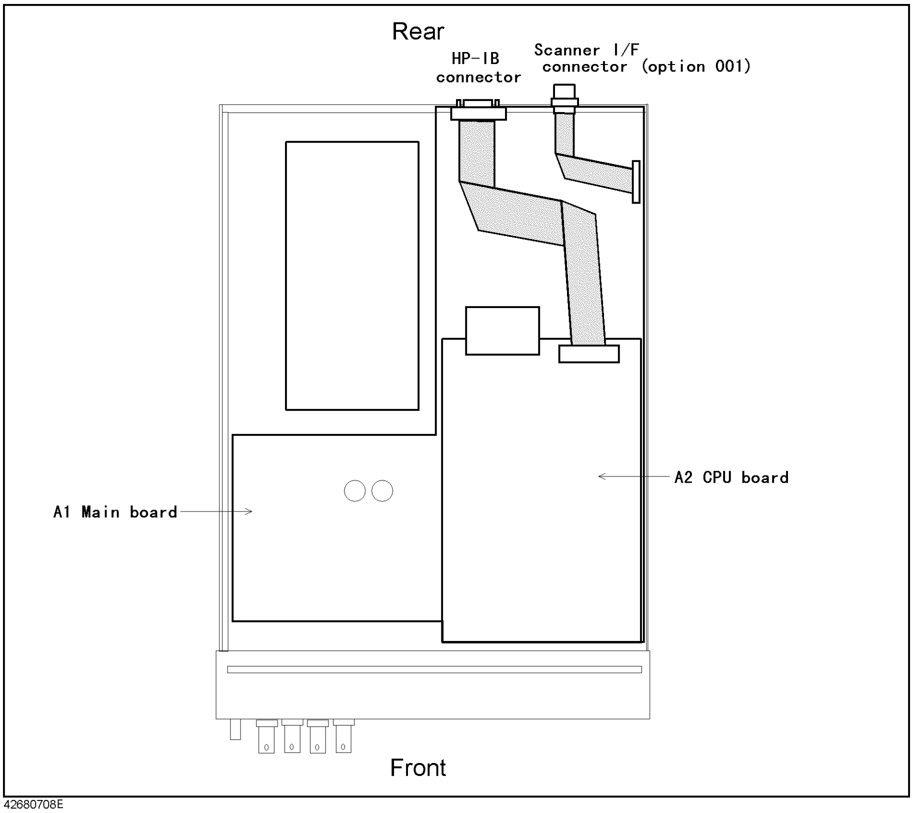
Step 2. Remove the 2 screws that secure the cover on the rear panel of the chassis.

Step 3. While holding the front panel bezel, slide the cover backward to remove it.

Step 4. Disconnect the cable connected to the A2 CPU board from the GPIB connector on the rear panel.

Step 5. If the scanner interface is installed (option 001), disconnect the cable connected to the A1 main board from the scanner interface connector on the rear panel.

NOTE When mounting pull-up resistors, exercise care not to damage the surrounding parts including cables and connectors with a solder iron or other tool.



8 Measurement Applications (sample programs)

This chapter provides measurement examples (sample programs).

Basic Capacitor Measurement

A sample program for basic capacitor measurement is given in Example 8-1. (This program is stored in the sample program disk under the file name bsc_meas.bas.)

This program performs a basic capacitor measurement according to “Learning the Basics of Measurements” on page 39. First, connect a fixture to the 4268A and then start the program. “Set Open-Connection” is displayed. Make a connection specific to the fixture to measure data for the OPEN correction. Press the y key and then the Return key. “Set Short-Connection” is then displayed. Measure data for the SHORT correction in a similar manner. “Set DUT” is displayed. Mount a discharged capacitor to the fixture. Press the y key and then the Return key. The measurement is executed and the measurement result is displayed.

Lines 80 to 120	Substitutes the measurement conditions (measurement frequency, 1 kHz; measurement signal level, 1 V; cable length, 0 m; primary parameter, Cp; secondary parameter, Q) into variables Freq$, Lvl$, Cbl$, Pri$, and Sec$, respectively.
Line 140	Triggers a reset.
Lines 160 to 200	Sets the measurement frequency to Freq$, the measurement signal level to Lvl$, the cable length to Cbl$, the primary parameter to Pri$, the secondary parameter to Sec$.
Lines 230 to 300	Prompts you to make a connection for the OPEN correction. After completing the connection, press the y key and then Return key. The measurement of the OPEN correction data is executed. (If you press the Return key only, the measurement is skipped. This is true for the following operations.)
Lines 320 to 390	Prompts you to make a connection for the SHORT correction. After completing the connection, press the y key and then Return key. The measurement of the SHORT correction is executed.
Line 410	Makes a setting to generate a trigger from the external controller.
Lines 430 to 480	Prompts you to connect a capacitor. After completing the connection, press the y key and then Return key. The measurement is executed and the result is read in.
Lines 500 to 590	Reads in the setting of each measurement condition.
Lines 620 to 670	Displays the measurement result and the measurement conditions.

Example 8-1 **Sample program: Basic capacitor measurement**

```
10    DIM Pri$[9],Sec$[9],Freq$[9],Lvl$[9],Cbl$[9],Rtn_pri$[9],Rtn_sec$[9]
20     DIM Buff$[9],Input_val$[9]
30     REAL Rtn_freq,Rtn_lvl
40     INTEGER Rtn_cbl
50     !
60     ASSIGN @Hp4268a TO 717
70     !
80     Freq$="1000"
90     Lvl$="1.0"
100    Cbl$="0"
110    Pri$="CP"
120    Sec$="Q"
```

```
130    !
140    OUTPUT @Hp4268a;":SYST:PRES"
150    !
160    OUTPUT @Hp4268a;":SOUR:FREQ ";Freq$
170    OUTPUT @Hp4268a;":SOUR:VOLT ";Lvl$
180    OUTPUT @Hp4268a;":CAL:CABL ";Cbl$
190    OUTPUT @Hp4268a;":CALC1:FORM ";Pri$
200    OUTPUT @Hp4268a;":CALC2:FORM ";Sec$
210    !
220    CLEAR SCREEN
230    PRINT "Set Open-Connection"
240    INPUT "OK? [Y/N]",Input_val$
250    IF UPC$(Input_val$)="Y" THEN
260      OUTPUT @Hp4268a;":CORR:COLL STAN1"
270      OUTPUT @Hp4268a;"*OPC?"
280      ENTER @Hp4268a;Buff$
290      PRINT "Open Correction Complete"
300    END IF
310    !
320    PRINT "Set Short-Connection"
330    INPUT "OK? [Y/N]",Input_val$
340    IF UPC$(Input_val$)="Y" THEN
350      OUTPUT @Hp4268a;":CORR:COLL STAN2"
360      OUTPUT @Hp4268a;"*OPC?"
370      ENTER @Hp4268a;Buff$
380      PRINT "Short Correction Complete"
390    END IF
400    !
410    OUTPUT @Hp4268a;":TRIG:SOUR BUS"
420    !
430    PRINT "Set DUT"
440    INPUT "OK? [Y/N]",Input_val$
450    IF UPC$(Input_val$)="Y" THEN
460      OUTPUT @Hp4268a;"*TRG"
470      ENTER @Hp4268a;Rtn_stat,Rtn_pri,Rtn_sec
480    END IF
490    !
500    OUTPUT @Hp4268a;":CALC1:FORM?"
510    ENTER @Hp4268a;Rtn_pri$
520    OUTPUT @Hp4268a;":CALC2:FORM?"
530    ENTER @Hp4268a;Rtn_sec$
540    OUTPUT @Hp4268a;":SOUR:FREQ?"
550    ENTER @Hp4268a;Rtn_freq
560    OUTPUT @Hp4268a;":SOUR:VOLT?"
570    ENTER @Hp4268a;Rtn_lvl
580    OUTPUT @Hp4268a;":CAL:CABL?"
590    ENTER @Hp4268a;Rtn_cbl
600    !
610    CLEAR SCREEN
620    PRINT "[Measurement Result]"
630    PRINT " "&Rtn_pri$&":";Rtn_pri,Rtn_sec$&":";Rtn_sec
640    PRINT "[Measurement Settings]"
650    PRINT " < Frequency  >";Rtn_freq;"[Hz]"
660    PRINT " <   Level    >";Rtn_lvl;"[V]"
670    PRINT " <Cable Length>";Rtn_cbl;"[m]"
680    END
```

Measuring Large-capacity Ceramic Capacitors

This section gives you sample programs to measure capacitors (one is for using the handler and the other is for using the scanner) in which, assuming that you want to measure large-capacity ceramic capacitors, you use the auto level control (ALC) function to prevent the measurement signal level from decreasing while monitoring the measurement voltage.

NOTE A waiting time setting has to be established after triggering when measuring large DUTs with dielectric absorption or whose capacitive value is 500 µF or more. (Refer to "Eliminating transient effect (measurement variations)" on page 69).

NOTE Distortions are accompanied when measuring large DUTs, causing measurement variations. To eliminate this variations set the measurement time to either Med or Long.

Making a measurement using the handler

The following sample program, Example 8-2, sets the measurement conditions of the 4268A and reads in the measurement result via GPIB in a measurement system using the handler. (This program is stored in the sample program disk under the file name hdl_meas.bas.)

The operation of this program is as follows. First, complete the preparations for the measurement system and then start the program. "Set Open-Connection" is displayed. Make a connection to measure data for the OPEN correction. Press the y key and then the Return key. Then, "Set Short-Connection" is displayed. Measure data for the SHORT correction in a similar manner. When the measurement of the correction data is completed, the 4268A waits for a trigger from external equipment. At this timing, set a capacitor in the measurement system and generate a trigger. After the completion of 200 measurements, the measurement result and voltage monitor result of each measurement are displayed.

Lines 90 to 180	Substitutes the measurement conditions (primary parameter, Cp; secondary parameter, D; measurement frequency, 120 Hz; measurement signal level, 1 V; measurement range, 1 mF; measurement time, Short; source delay time, 10 ms; trigger delay time, 100 ms; cable length, 1 m) into variables Pri$, Sec$, Freq, Lvl, Rng$, Tim$, Src_delay, Trg_delay, and Cbl, respectively. Also substitutes the measurement count, 200, into Nop.
Lines 200 to 390	Substitutes the limit ranges of the comparator function into variables.
Line 410	Triggers a reset.
Lines 430 to 490	Sets the primary parameter to Pri$, the secondary parameter to Sec$, the measurement frequency to Freq, the measurement signal level to Lvl, the measurement range to Rng$, the measurement time to Tim$, and the cable length to Cbl.
Lines 520 to 590	Prompts you to make a connection for the OPEN correction. After completing the connection, press the y key and then Return key. The measurement of the OPEN correction data is executed. (If you press the Return key only, the measurement is skipped. This is true for the following operations.)

Lines 610 to 680	Prompts you to make a connection for the SHORT correction. After completing the connection, press the y key and then Return key. The measurement of the SHORT correction is executed.
Lines 700 to 780	Sets the primary parameter limit for each BIN in the absolute mode, and enables the BIN. At this time, if both the upper limit value and lower limit value of a BIN are 0, this BIN is disabled.
Lines 790 to 810	Sets the limit of the secondary parameter and enables the limit range, and then enables the AUX BIN function.
Line 820	Enables the comparator function.
Lines 840 to 860	Sets the source delay time to Src_delay and the trigger delay time to Trg_delay and enables the synchronous source function.
Line 870	Enables the ALC function.
Line 880	Enables the voltage monitor function.
Line 890	Enables the contact check function.
Lines 900 to 920	Makes a setting to feed the measurement result of the primary parameter into data buffer 1 and sets the size of data buffer 1 to Nop.
Line 930	Makes a setting to generate a trigger from external equipment.
Line 950	Initializes the status byte register and the operation status register.
Line 960	Enables bit 4 (indicating that measurement is in progress) in the operation status register.
Line 970	Enables bit 7 (operation status register summary bit) in the status byte register.
Lines 1000 to 1040	After triggering from external equipment (for example, handler) and the completion of the measurement, waits for the operation status register summary bit to be set.

NOTE At this timing, set a capacitor in the measurement system and generate a trigger.

Line 1050	Initializes the status byte register and the operation status register.
Lines 1060 to 1070	Reads in the voltage monitor result. Repeats the procedure from Line 1000 to here the specified number of times, Nop.
Lines 1100 to 1160	Reads in the contents of data buffer 1 in the real number data transfer format.
Lines 1190 to 1210	Displays the measurement result and the voltage monitor result.

Example 8-2 **Sample program: Measurement using the handler**

```
10      DIM Pri$[9],Sec$[9],Rng$[9],Tim$[9],Buff$[9],Input_val$[9]
20      REAL Lim_l(1:9),Lim_u(1:9),Stat(1:200),Dat(1:200),Comp(1:200),
Vmon(1:200)
30      REAL L_lim_sec,H_lim_sec,Freq,Lvl,Src_delay,Trg_delay
40      INTEGER Cbl,Nop,Rtn_stb
50      !
60      ASSIGN @Hp4268a TO 717
70      ASSIGN @Binary TO 717;FORMAT OFF
80      !
90      Pri$="CP"
100     Sec$="D"
110     Freq=120
120     Lvl=1.0
130     Rng$="1m"
140     Tim$="SHOR"
150     Src_delay=.01
160     Trg_delay=.1
170     Cbl=1
180     Nop=200
190     !
200     L_lim(1)=.000325
210     H_lim(1)=.000375
220     L_lim(2)=.000375
230     H_lim(2)=.000425
240     L_lim(3)=.000425
250     H_lim(3)=.000475
260     L_lim(4)=.000475
270     H_lim(4)=.000525
280     L_lim(5)=.000525
290     H_lim(5)=.000575
300     L_lim(6)=.000575
310     H_lim(6)=.000625
320     L_lim(7)=.000625
330     H_lim(7)=.000675
340     L_lim(8)=0.
350     H_lim(8)=0.
360     L_lim(9)=0.
370     H_lim(9)=0.
380     L_lim_sec=0.
390     H_lim_sec=.2
400     !
410     OUTPUT @Hp4268a;":SYST:PRES"
420     !
430     OUTPUT @Hp4268a;":CALC1:FORM ";Pri$
440     OUTPUT @Hp4268a;":CALC2:FORM ";Sec$
450     OUTPUT @Hp4268a;":SOUR:FREQ ";Freq
460     OUTPUT @Hp4268a;":SOUR:VOLT ";Lvl
470     OUTPUT @Hp4268a;":RANG ";Rng$
480     OUTPUT @Hp4268a;":APER ";Tim$
490     OUTPUT @Hp4268a;":CAL:CABL ";Cbl
500     !
510     CLEAR SCREEN
520     PRINT "Set Open-Connection"
530     INPUT "OK? [Y/N]",Input_val$
540     IF UPC$(Input_val$)="Y" THEN
550       OUTPUT @Hp4268a;":CORR:COLL STAN1"
560       OUTPUT @Hp4268a;"*OPC?"
570       ENTER @Hp4268a;Buff$
580       PRINT "Open Correction Complete"
590     END IF
600     !
```

```
610    PRINT "Set Short-Connection"
620    INPUT "OK? [Y/N]",Input_val$
630    IF UPC$(Input_val$)="Y" THEN
640      OUTPUT @Hp4268a;":CORR:COLL STAN2"
650      OUTPUT @Hp4268a;"*OPC?"
660      ENTER @Hp4268a;Buff$
670      PRINT "Short Correction Complete"
680    END IF
690    !
700    OUTPUT @Hp4268a;":CALC:COMP:MODE ABS"
710    FOR Bin=1 TO 9
720      IF L_lim(Bin)=0. AND H_lim(Bin)=0. THEN
730        OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&":STAT OFF"
740      ELSE
750        OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&" ";L_lim(Bin);",";H_lim(Bin)
760        OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&":STAT ON"
770      END IF
780    NEXT Bin
790    OUTPUT @Hp4268a;":CALC:COMP:SEC:LIM ";L_lim_sec;",";H_lim_sec
800    OUTPUT @Hp4268a;":CALC:COMP:SEC:STAT ON"
810    OUTPUT @Hp4268a;":CALC:COMP:AUXB ON"
820    OUTPUT @Hp4268a;":CALC:COMP ON"
830    !
840    OUTPUT @Hp4268a;":TRIG:DEL ";Src_delay
850    OUTPUT @Hp4268a;":TRIG:SEQ2:DEL ";Trg_delay
860    OUTPUT @Hp4268a;":SOUR:VOLT:MODE SYNC"
870    OUTPUT @Hp4268a;":SOUR:VOLT:ALC ON"
880    OUTPUT @Hp4268a;":CALC4:MATH:STAT ON"
890    OUTPUT @Hp4268a;":CONT:VER ON"
900    OUTPUT @Hp4268a;":DATA:FEED BUF1,""CALC1"""
910    OUTPUT @Hp4268a;":DATA:FEED:CONT BUF1,ALW"
920    OUTPUT @Hp4268a;":DATA:POIN BUF1,";Nop
930    OUTPUT @Hp4268a;":TRIG:SOUR EXT"
940    !
950    OUTPUT @Hp4268a;"*CLS"
960    OUTPUT @Hp4268a;":STAT:OPER:ENAB 16"
970    OUTPUT @Hp4268a;"*SRE 128"
980    !
990    FOR I=1 TO Nop
1000     !  Triggering
1010     REPEAT
1020       OUTPUT @Hp4268a;"*STB?"
1030       ENTER @Hp4268a;Rtn_stb
1040     UNTIL BIT(Rtn_stb,7)
1050     OUTPUT @Hp4268a;"*CLS"
1060     OUTPUT @Hp4268a;":DATA? VMON"
1070     ENTER @Hp4268a;Vmon(I)
1080   NEXT I
1090   !
1100   OUTPUT @Hp4268a;":FORM REAL"
1110   OUTPUT @Hp4268a;":DATA? BUF1"
1120   ENTER @Binary USING "#,6A";Buff$
1130   FOR I=1 TO Nop
1140     ENTER @Binary;Stat(I),Dat(I),Comp(I)
1150   NEXT I
1160   ENTER @Binary USING "#,A";Buff$
1170   !
1180   CLEAR SCREEN
1190   FOR I=1 TO Nop
1200     PRINT "Stat:";Stat(I),"Data:";Dat(I),"Comp:";Comp(I),"Vmon:";Vmon(I)
1210   NEXT I
1220   END
```

Making a measurement using the scanner (option 001)

The following sample program, Example 8-3, sets the measurement conditions of the 4268A, selects the correction data, and reads out the measurement result via GPIB in a measurement system using the scanner. (This program is stored in the sample program disk under the file name scn_meas.bas.)

This program assumes the measurement system in which the data for the OPEN/SHORT/LOAD correction for each channel has been measured and saved in the 4268A. First, complete the preparations for the measurement system and then start the program. The 4268A waits for a trigger from external equipment. Use the scanner interface signal to provide the timing, select a channel in the measurement system, and then generate a trigger. After the completion of measurement of all the channels, the measurement result and voltage monitor result for each channel are displayed.

Lines 90 to 180 — Substitutes the measurement conditions (primary parameter, Cp; secondary parameter, D; measurement frequency, 1 kHz; measurement signal level, 1 V; measurement range, 100 mF; measurement time, Short; source delay time, 5 ms; trigger delay time, 50 ms; cable length, 1 m) into variables Pri$, Sec$, Freq, Lvl, Rng$, Tim$, Src_delay, Trg_delay, and Cbl, respectively. Also, substitutes the number of channels you use, 50 (channel 0 to channel 49), into Chan.

NOTE When using this program, modify it so that the settings of the measurement frequency and cable length are the same as those specified for the LOAD correction data measurement.

Lines 200 to 400 — Substitutes the limit ranges of the comparator function into variables. Also, substitutes the limit reference value into variable Nom.

Line 420 — Triggers a reset.

Lines 440 to 500 — Sets the primary parameter to Pri$, the secondary parameter to Sec$, the measurement frequency to Freq, the measurement signal level to Lvl, the measurement range to Rng$, the measurement time to Tim$, and the cable length to Cbl.

Lines 520 to 610 — Sets the limit reference value to Nom, sets the primary parameter limit for each BIN in the percent tolerance mode, and enables the BIN. At this time, if both the upper limit value and lower limit value of a BIN are 0, this BIN is disabled.

Lines 620 to 640 — Sets the limit of the secondary parameter, enables the limit range, and then enables the AUX BIN function.

Line 650 — Enables the comparator function.

Lines 670 to 690 — Sets the source delay time to Src_delay and the trigger delay time to Trg_delay, and enables the synchronous source function.

Line 700 — Enables the ALC function.

Line 710 — Enables the voltage monitor function.

Line 720 — Enables the contact check function.

Lines 730 to 750 — Makes a setting to feed the measurement result of the primary parameter into data buffer 1 and sets the size of data buffer 1 to the number of channels you use (Chan).

Line 760 — Makes a setting to generate a trigger from external equipment.

Lines 780 to 790	Enables the LOAD correction function and the user correction function.
Line 800	Enables the MULTI correction function (scanner function).
Line 820	Initializes the status byte register and the operation status register.
Line 830	Enables bit 4 (indicating that the measurement is in progress) in the operation status register.
Line 840	Enables bit 7 (operation status to register summary bit) in the status byte register.
Line 870	Selects a channel used in the MULTI correction function of the 4268A.
Lines 880 to 920	After triggering from external equipment and the completion of the measurement, waits for the operation status register summary bit to be set.

NOTE At this timing, select a channel in the measurement system and generate a trigger. You can select a channel used in the MULTI correction function of the 4268A via the scanner interface. In this case, delete Line 870 and select a channel of the 4268A via the scanner interface when selecting a channel of the measurement system.

Line 930	Initializes the status byte register and the operation status register.
Lines 940 to 950	Reads in the voltage monitor result. Repeats the procedure from Line 870 to here until the measurement of all the channels you use is completed (the specified number of times, Chan).
Lines 980 to 1040	Reads in the contents of data buffer 1 in the real number data transfer format.
Lines 1070 to 1090	Displays the measurement result and the voltage monitor result.

Example 8-3 **Sample program: Measurement using the scanner**

```
10      DIM Pri$[9],Sec$[9],Rng$[9],Tim$[9],Buff$[9]
20      REAL Lim_l(1:9),Lim_u(1:9),Stat(0:63),Dat(0:63),Comp(0:63),Vmon
(0:63)
30      REAL Nom,L_lim_sec,H_lim_sec,Freq,Lvl,Src_delay,Trg_delay
40      INTEGER Cbl,Chan,Rtn_stb
50      !
60      ASSIGN @Hp4268a TO 717
70      ASSIGN @Binary TO 717;FORMAT OFF
80      !
90      Pri$="CP"
100     Sec$="D"
110     Freq=1000
120     Lvl=1.0
130     Rng$="100u"
140     Tim$="SHOR"
150     Src_delay=.005
160     Trg_delay=.05
170     Cbl=1
180     Chan=50
190     !
200     L_lim(1)=-2.0
210     H_lim(1)=2.0
220     L_lim(2)=-4.0
230     H_lim(2)=4.0
240     L_lim(3)=-6.0
250     H_lim(3)=6.0
260     L_lim(4)=-8.0
270     H_lim(4)=8.0
280     L_lim(5)=-10.0
290     H_lim(5)=10.0
300     L_lim(6)=0.
310     H_lim(6)=0.
320     L_lim(7)=0.
330     H_lim(7)=0.
340     L_lim(8)=0.
350     H_lim(8)=0.
360     L_lim(9)=0.
370     H_lim(9)=0.
380     Nom=.00005
390     L_lim_sec=0.
400     H_lim_sec=.2
410     !
420     OUTPUT @Hp4268a;":SYST:PRES"
430     !
440     OUTPUT @Hp4268a;":CALC1:FORM ";Pri$
450     OUTPUT @Hp4268a;":CALC2:FORM ";Sec$
460     OUTPUT @Hp4268a;":SOUR:FREQ ";Freq
470     OUTPUT @Hp4268a;":SOUR:VOLT ";Lvl
480     OUTPUT @Hp4268a;":RANG ";Rng$
490     OUTPUT @Hp4268a;":APER ";Tim$
500     OUTPUT @Hp4268a;":CAL:CABL ";Cbl
510     !
520     OUTPUT @Hp4268a;":CALC:COMP:MODE PCNT"
530     OUTPUT @Hp4268a;":CALC:COMP:PRIM:NOM ";Nom
540     FOR Bin=1 TO 9
550       IF L_lim(Bin)=0. AND H_lim(Bin)=0. THEN
560         OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&":STAT OFF"
570       ELSE
580         OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&" ";L_lim(
Bin);",";H_lim(Bin)
590         OUTPUT @Hp4268a;":CALC:COMP:PRIM:BIN"&VAL$(Bin)&":STAT ON"
```

```
600      END IF
610     NEXT Bin
620     OUTPUT @Hp4268a;":CALC:COMP:SEC:LIM ";L_lim_sec;",";H_lim_sec
630     OUTPUT @Hp4268a;":CALC:COMP:SEC:STAT ON"
640     OUTPUT @Hp4268a;":CALC:COMP:AUXB ON"
650     OUTPUT @Hp4268a;":CALC:COMP ON"
660     !
670     OUTPUT @Hp4268a;":TRIG:DEL ";Src_delay
680     OUTPUT @Hp4268a;":TRIG:SEQ2:DEL ";Trg_delay
690     OUTPUT @Hp4268a;":SOUR:VOLT:MODE SYNC"
700     OUTPUT @Hp4268a;":SOUR:VOLT:ALC ON"
710     OUTPUT @Hp4268a;":CALC4:MATH:STAT ON"
720     OUTPUT @Hp4268a;":CONT:VER ON"
730     OUTPUT @Hp4268a;":DATA:FEED BUF1,""CALC1"""
740     OUTPUT @Hp4268a;":DATA:FEED:CONT BUF1,ALW"
750     OUTPUT @Hp4268a;":DATA:POIN BUF1,";Chan
760     OUTPUT @Hp4268a;":TRIG:SOUR EXT"
770     !
780     OUTPUT @Hp4268a;":CORR:COLL:METH REFL3"
790     OUTPUT @Hp4268a;":CORR ON"
800     OUTPUT @Hp4268a;":CORR:MULT ON"
810     !
820     OUTPUT @Hp4268a;"*CLS"
830     OUTPUT @Hp4268a;":STAT:OPER:ENAB 16"
840     OUTPUT @Hp4268a;"*SRE 128"
850     !
860     FOR I=0 TO Chan-1
870       OUTPUT @Hp4268a;":CORR:MULT:CHAN ";I
880       !  Triggering
890       REPEAT
900         OUTPUT @Hp4268a;"*STB?"
910         ENTER @Hp4268a;Rtn_stb
920       UNTIL BIT(Rtn_stb,7)
930       OUTPUT @Hp4268a;"*CLS"
940       OUTPUT @Hp4268a;":DATA? VMON"
950       ENTER @Hp4268a;Vmon(I)
960     NEXT I
970     !
980     OUTPUT @Hp4268a;":FORM REAL"
990     OUTPUT @Hp4268a;":DATA? BUF1"
1000    ENTER @Binary USING "#,6A";Buff$
1010    FOR I=0 TO Chan-1
1020      ENTER @Binary;Stat(I),Dat(I),Comp(I)
1030    NEXT I
1040    ENTER @Binary USING "#,A";Buff$
1050    !
1060    CLEAR SCREEN
1070    FOR I=0 TO Chan-1
1080      PRINT "Ch:";I,"Stat:";Stat(I),"Data:";Dat(I),"Comp:";Comp(I),
"Vmon:";Vmon(I)
1090    NEXT I
1100    END
```

9 Technical Information

This chapter provides technical information on the operating principles of the 4268A and the basic principles of capacitance measurement.

Operating Principles of the 4268A

This section describes the measurement principle of the 4268A and the operating principle of the auto level control (ALC) function.

Measurement principle

This section describes the principle of impedance measurement of DUT using the 4268A.

Figure 9-1 **Circuit Model of Impedance Measurement**

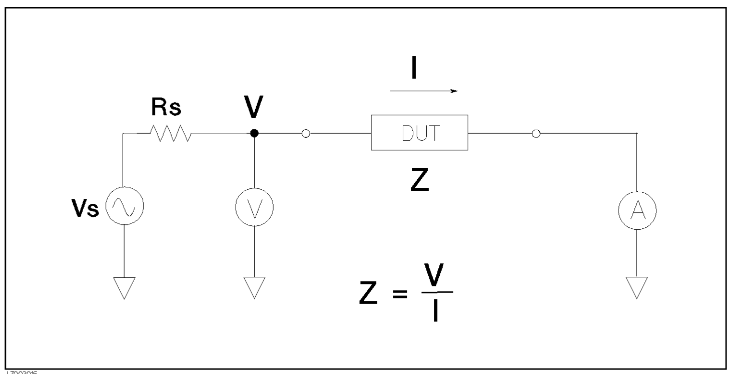
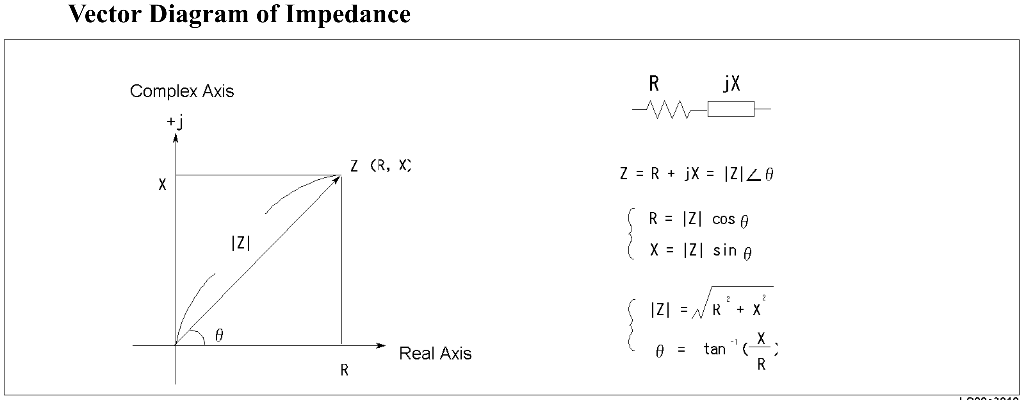


Figure 9-1 illustrates the circuit model of impedance measurement using the 4268A. Vs is the measurement power supply voltage, and Rs is the output resistance of the 4268A. When voltage applied to DUT is V and current flowing through DUT is I, impedance Z is expressed by the equation Z = V/I.

Z consists of a real part and an imaginary part. Figure 9-2 shows the vector diagram of impedance.

Figure 9-2 **Vector Diagram of Impedance**

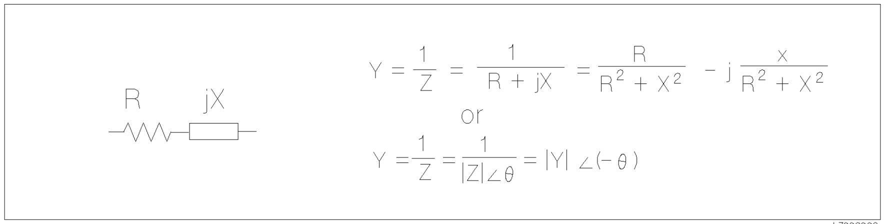


Symbols used in Figure 9-2 have the following meanings:

R	Resistance
X	Reactance
|Z|	Absolute value of impedance
θ	Phase of impedance

Another way to express impedance Z is the use of admittance Y. The relationship between admittance Y and impedance Z is Y = 1/Z.

Figure 9-3 **Relationship between Impedance and Admittance**



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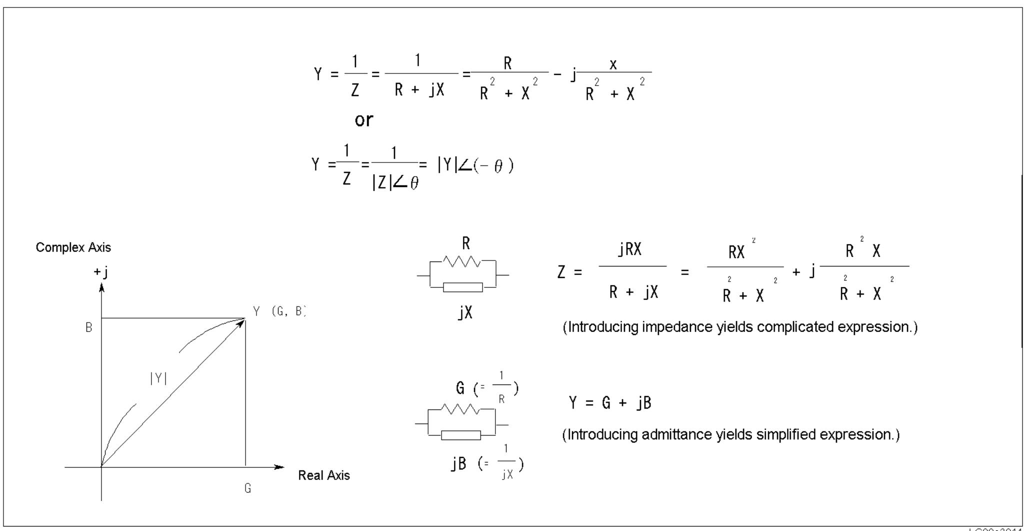
For a parallel connection, using admittance Y is more convenient.

Figure 9-4 **Vector Diagram of Admittance**



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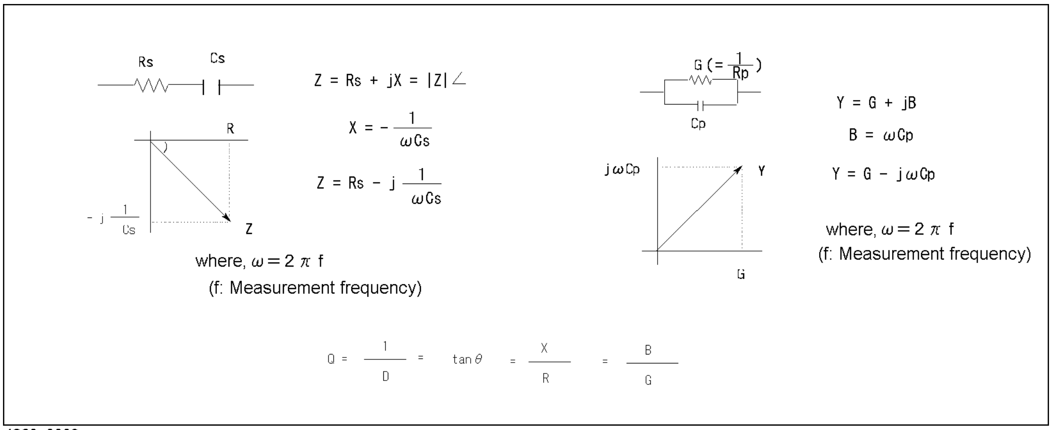
Symbols in Figure 9-4 have the following meanings:

G	Conductance
B	Susceptance
|Y|	Absolute value of admittance

The 4268A measures a vector value of impedance Z of DUT and indicates the result as the circuit constants of the equivalent circuit shown in Figure 9-5.

Figure 9-5 Relationship between Measurement Parameters



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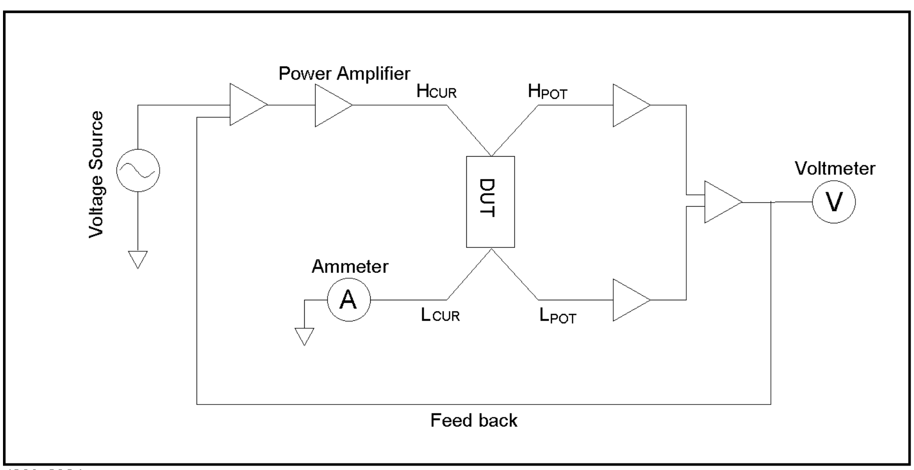
Operating principle of the auto level control function

When the auto level control function is ON, the 4268A, as shown in Figure 9-6, monitors the voltage between H_{POT} and L_{POT} of DUT and feeds it back to the voltage source so that the specified voltage is controlled and correctly applied to DUT.

Figure 9-6 Operating Principle of Auto Level Control Function



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Precautions for Using a Transformer in Measuring High-value Standard Capacitors

The following precautions should be taken in measuring high value standard capacitors using a transformer.

- Turn Off the Auto Level Control (ALC) function

  If a transformer is used to measure the DUT while the ALC function is On, this causes the ALC feedback loop to be unstable (refer to Figure 9-6). This can lead to measurement variations, overload and other problems.

  To eliminate this problem turn off the ALC function. The measurement voltage will not cause any change in the value of the capacitor even if the ALC function is off.

- Connect a DC blocking capacitor to the H_{CUR} terminal if the measurement value is gradually changing.

  For high-speed measurement, the DC blocking capacitor is not present in the 4268A. For this reason, a small amount of DC voltage accumulates at the H_{CUR} and L_{CUR} terminals. Although the amount of DC voltage is relatively small at a few milli volts, this causes a small amount of DC current to flow into the transformer, affecting its characteristics and leading to measurement variations.

  To solve this problem, connect a DC blocking capacitor to the H_{CUR} terminal. Use a DC blocking capacitor whose size is similar to the standard capacitor to be measured. The size of DC blocking capacitors does not have any direct affect on the measurement value, and electrolytic capacitors can also be used.

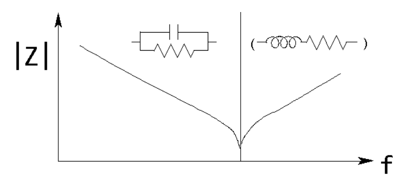
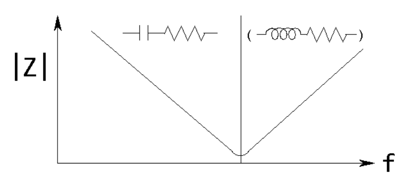
Basic Principles of Capacitance Measurement

This section describes the useful basics when measuring capacitance with the 4268A.

Typical characteristics of capacitance DUT

As shown in Table 9-1, the impedance characteristics of capacitance parts change depending on the actual operating conditions. Therefore, to measure impedance accurately, it is necessary to make measurements under the actual operating conditions in which the part is used.

Table 9-1 Typical Characteristics of Capacitance DUT

DUT	Example of Characteristics	Measurement function
Small C		Cp-D, Cp-Q, Cp-G, Cp-Rp
Large C		Cs-D, Cs-Q, Cs-Rs

Selection criteria of parallel/series equivalent circuit models

There are two equivalent circuit models used for capacitance measurement: parallel mode and series mode, as shown in Table 9-2. You must select one of them before measurement, depending on the magnitude of reactance and the effect of the equivalent parallel resistance (Rp) and equivalent series resistance (Rs) on it.

Table 9-2 Parallel/Series Equivalent Circuit Models and Measurement Function of the 4268A

Circuit model	Measurement function of the 4268A	Definition of D, Q, G
Parallel equivalent circuit model	Cp-D, Cp-Q, Cp-G, Cp-Rp	D = 1/(2πfCpRp) Q = 1/D = 2πfCpRp G = 1/Rp
Series equivalent circuit model	Cs-D, Cs-Q, Cs-Rs	D = 2πfCsRs Q = 1/D = 1/(2πfCsRs)

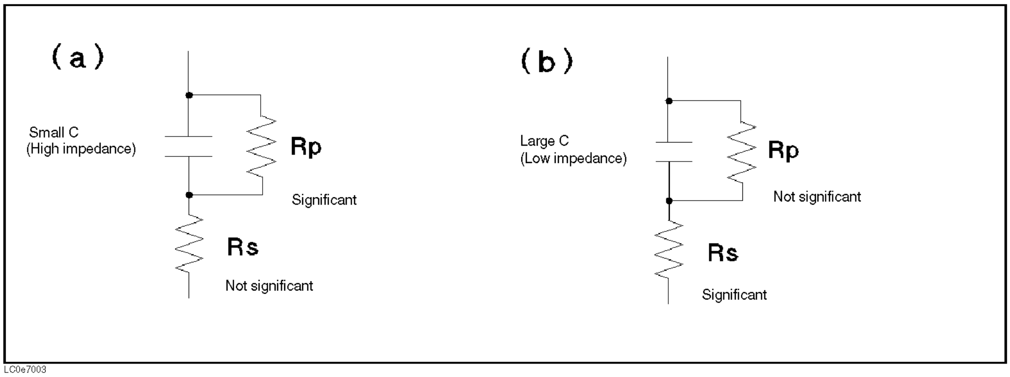
- When capacitance is small:

  When capacitance is small, reactance is large. Therefore, the effect of Rp is greater than that of Rs. When Rs is small, its effect can be neglected compared to capacitive reactance. In this case, use the parallel equivalent circuit model shown in Figure 9-7 (a).

- When capacitance is large:

  When capacitance is large, reactance is small. Therefore, the effect of Rs is greater than that of Rp. In this case, use the series equivalent circuit model shown in Figure 9-7 (b).

Figure 9-7 Selection of Capacitance Measurement Circuit Model



Principle of the four-terminal pair measurement

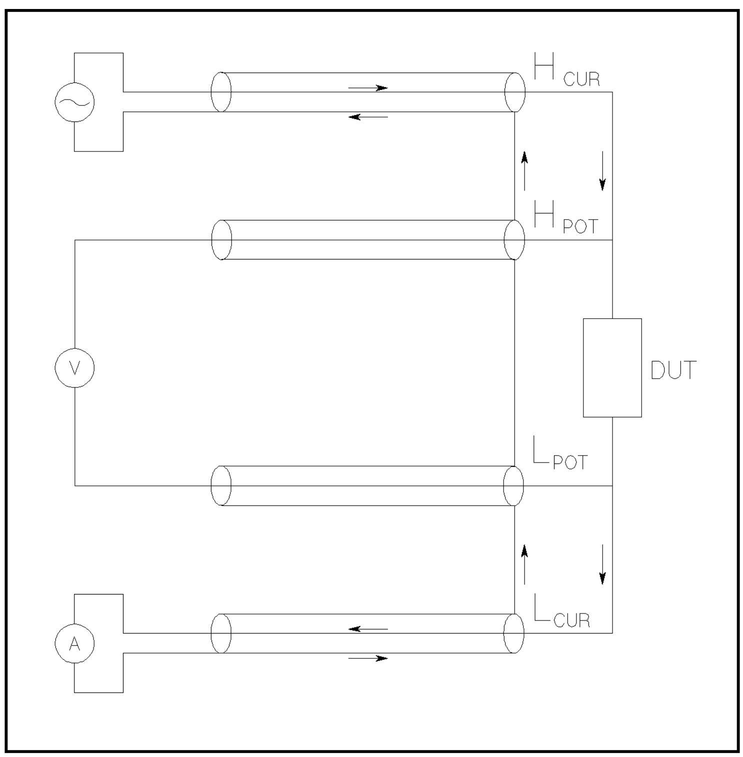
Generally, in connection methods using common terminal structures, mutual inductance, interference between measurement signals, and unnecessary residual elements (especially at higher frequencies) significantly affect measurements.

The 4268A adopts a four-terminal pair structure to reduce the limitations on measurements due to these factors and to facilitate stable and accurate measurements.

Figure 9-8 shows the principle of four-terminal pair measurement. The UNKNOWN terminals are four coaxial connector terminals.

- H_{CUR}: Current high terminal
- H_{POT}: Voltage high terminal
- L_{POT}: Voltage low terminal
- L_{CUR} : Current low terminal

Figure 9-8 Principle of Four-terminal Pair Measurement



The 4 terminal pair measurement method has advantages in both low and high impedance measurements. The outer shield conductors serve as the return path of the measurement signal current (not grounded). Current of the same amplitude flows through the core conductor and the surrounding shield conductor (in opposite directions), and therefore no external magnetic field occurs around both conductors (that is, the magnetic field caused by the inner conductor and that caused by the outer conductor cancel each other completely). The measurement signal current does not cause any induction field and, therefore, the test leads do not increase the error due to their self inductance or mutual inductance between different leads.

Precautions for the four-terminal pair measurement

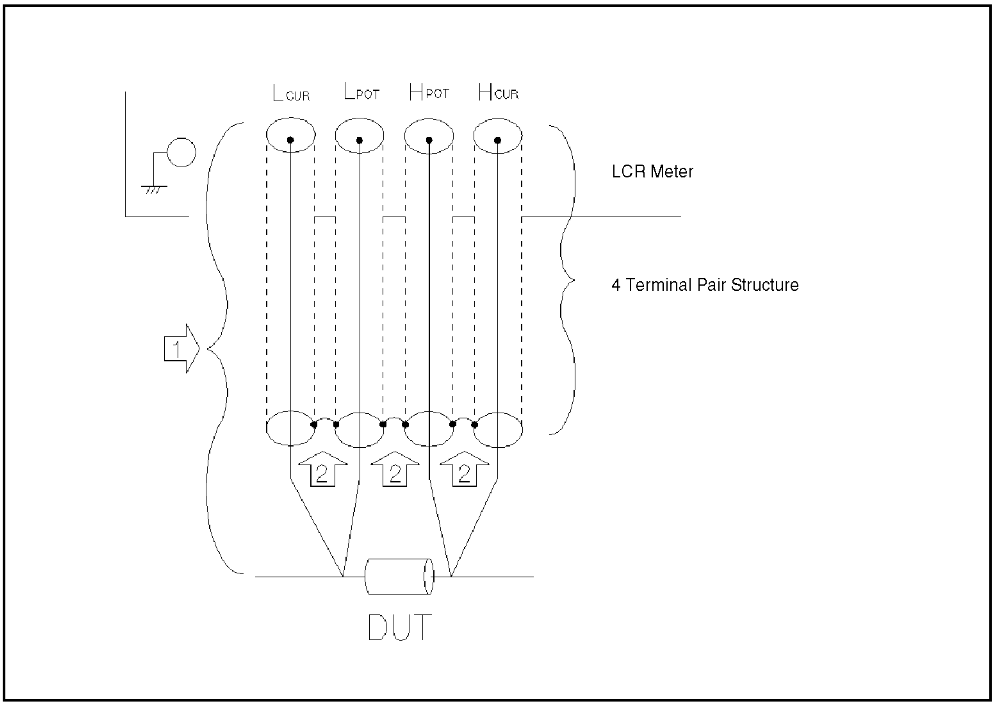
This section describes general precautions and techniques for using the four-terminal structure efficiently.

Measurement contacts

To realize high-accuracy measurements when using the 4 terminal pair measurement, the measurement contacts must meet the following requirements.

- Make the signal path between the capacitance meter and DUT (indicated by 1 in Figure 9-9) as short as possible.
- For a four-terminal pair measurement circuit configuration, the outer shields of H_{CUR} and H_{POT}, L_{CUR}, and L_{POT} terminals must all be connected together at a point as near as possible to the DUT. (Refer to 2 in Figure 9-9.)

Figure 9-9 **Measurement Contacts**



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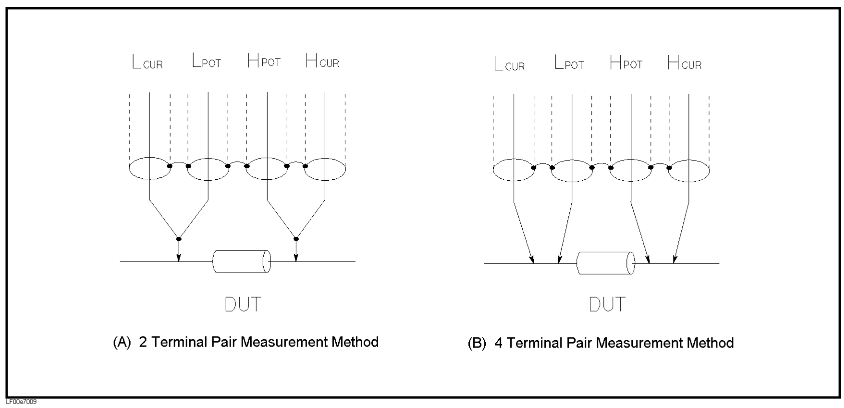
Contact resistance

Due to contact resistance between the DUT contacts and DUT, a measurement error occurs when measuring large capacitance values, especially for measurement of D (dissipation factor).

For measurement of large capacitance values, the four-terminal pair measurement method has an advantage over the two-terminal method in that measurement errors are smaller. Select the four-terminal measurement test fixture that secures DUT to stabilize the connection and minimize contact resistance.

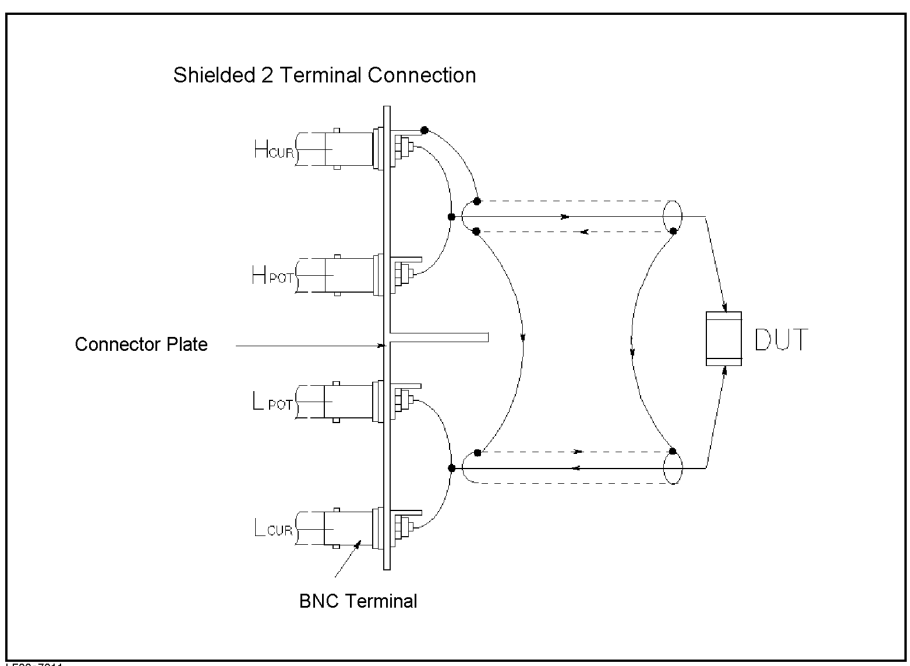
Figure 9-10 **Configuration of Contacts**



Extending the test leads

If you cannot make measurement contact with the four-terminal pair structure, use the connection method shown in Figure 9-11.

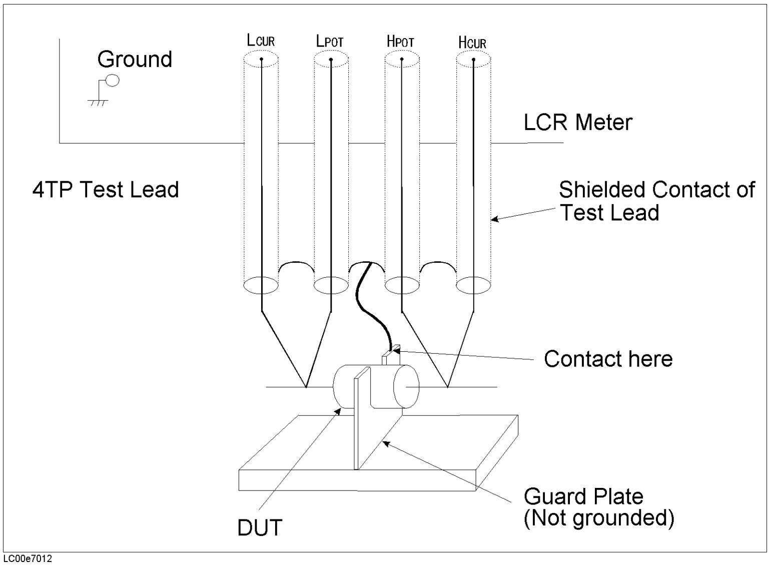
Figure 9-11 **Measurement Contacts When Test Leads Are Extended**



Guarding when measuring small capacitance

When measuring small capacitance values, for example those small-capacitance chip capacitors, use a guard plate to minimize measurement errors caused by stray capacitance. Figure 9-12 shows an example of using a guard plate with the measurement contacts of a four-terminal pair structure .

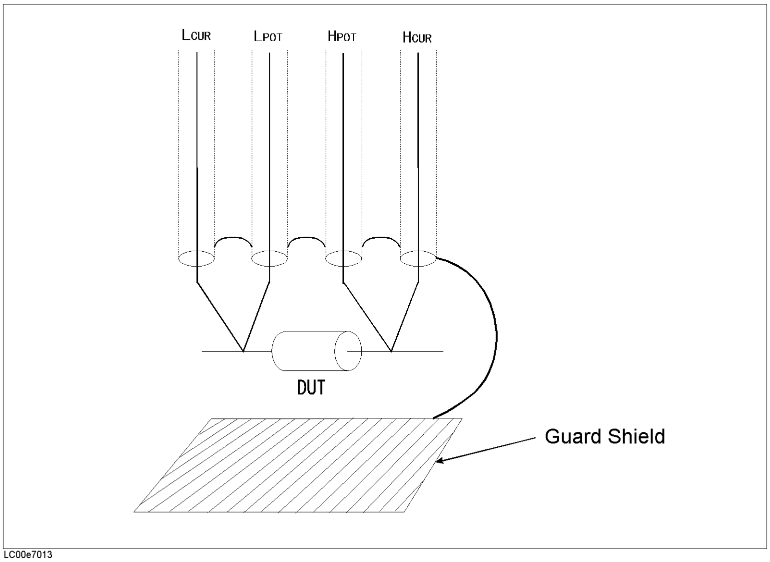
Figure 9-12 **Example of Connecting Guard Plate to DUT**



Shield

By using a shield, the effect of electrical noise picked up by the test leads can be significantly decreased. Therefore, prepare a shield plate and connect it to the outer shield conductor of the four-terminal pair test leads, as shown in Figure 9-13.

Figure 9-13 **Guard Shield**



9.Technical Information

Standard for LOAD correction

To perform the LOAD correction, you must prepare a device used as a standard for the LOAD correction data measurement. You can use anything for the LOAD standard as long as it has a stable, known value. It is not necessary for the device type of the LOAD standard and that of DUT to be the same. For example, you can use resistance as the LOAD standard even if you want to measure capacitors.

When using a known standard:

Any device with an accurate value (guaranteed specification) can be used as the LOAD standard.

When using a general-purpose LCR part as the standard:

If you cannot prepare an existing standard, you can use a general-purpose device including capacitors and resistors as the LOAD device after valuing it with a high-accuracy LCR meter. In other words, you use an impedance value already measured as the reference value. Considerations when selecting a LOAD standard are as follows:

- If you want to measure DUT of only one fixed impedance value, use a device that has impedance close to the impedance value of DUT. If you want to measure DUT of various values, use a device of approximately 100 to 1 kΩ that can be valued accurately.
- Use a stable device that is not sensitive to the measurement environment: temperature, magnetic field, and so on. Capacitors or resistors are more suitable than inductors, which are susceptible to the measurement environment.

Value the LOAD standard as accurately as possible. Follow these steps to value a device.

Step 1. Connect a direct-coupling test fixture such as the Agilent 16047A to the high-accuracy LCR meter and execute the OPEN/SHORT correction.

Step 2. Set the valuing frequency to the frequency used when measuring DUT.

Step 3. To realize high-accuracy valuing, set the measurement conditions (setting the measurement time to Long, increasing the averaging count, and so on).

Step 4. Connect the LOAD standard to the direct-coupling test fixture and perform a measurement. Use this measurement value as the reference value of the LOAD standard.

Method of setting standard values when using a standard resistor

When standard resistors are used as LOAD standard, transformation is needed to convert the R-X form to its Rs-Cs equivalent. Since you cannot enter the value of the R-X form that serves as the standard value, the following conversion must be done:

Equation 9-1 **R-X value Conversion**

$$Rs = R, Cs = -1/(2\pi fX)$$

where f is the measurement frequency.

10 Specifications and Supplemental Performance Characteristics

This chapter describes the specifications and supplemental performance characteristics of the 4268A capacitance meter.

Basic Specifications

Measurement parameters

- Cp-D, Cp-Q, Cp-Rp, Cp-G
- Cs-D, Cs-Q, Cs-Rs

where

Cp:	Measured capacitance value using the parallel equivalent circuit model
Cs:	Measured capacitance value using the series equivalent circuit model
D:	Dissipation factor
Q:	Quality factor (inverse of D)
G:	Measured equivalent parallel conductance using the parallel equivalent circuit model
Rp:	Measured equivalent parallel resistance using the parallel equivalent circuit model
Rs:	Measured equivalent series resistance using the series equivalent circuit model

Measurement conditions

- Measurement signal

Frequency	120 Hz ±1%, 1 kHz ±0.05%
Level	0.1 V to 1.0 V, resolution 0.01 V, accuracy ±10%
Output mode	Continuous, synchronous
Source delay time	0 to 1.000 s, resolution 1 ms (effective when Output mode is set to synchronous mode)

- Measurement cable length

  0 m, 1 m, 2 m (n.b. DC resistance of H_{CUR} and L_{CUR} cable : 0.3Ω or less per cable)

- Measurement time mode

  Short, Med, Long

- Measurement range selection

  Automatic (Auto), manual (Hold)

- Measurement range

  When the measurement frequency is 120 Hz:
  10 nF, 100 nF, 1 μF, 10 μF, 100 μF, 1 mF

  When the measurement frequency is 1 kHz:
  1 nF, 10 nF, 100 nF, 1 μF, 10 μF, 100 μF

- Averaging

  1 to 256 times
- Trigger mode

  Internal (INT), manual (MAN), external (EXT), bus (BUS)
- Trigger delay time

  0 to 1.000 s, resolution 1 ms

Display range of measurement value

Parameter	Display range of measurement value
Cs, Cp	-9.9999mF to -0.0001nF, 0, 0.0001nF to 9.9999mF
D	-9.9999 to -0.0001, 0, 0.0001 to 9.9999
Q	-9999.9 to -0.1, 0, 0.1 to 9999.9
Rs, Rp	-999.99MΩ to -0.01mΩ, 0, 0.01mΩ to 999.99MΩ
G	-9.9999kS to -0.0001µS, 0, 0.0001µS to 9.9999kS
Δ%	-999.99% to -0.01%, 0, 0.01% to 999.99%

Measurement accuracy

Accuracy is defined as meeting all of the following conditions.

- Warm up time is 30 min or more.
- The OPEN and SHORT corrections have been performed.
- D≤ 0.5

Accuracy of Cp and Cs

Accuracy Ae[%], which is the basis of the accuracy of Cp and Cs (*Cpe* and *Cse*[%]), is calculated as follows:

Equation 10-1 **Equation to calculate Ae**

$$Ae = [A + B \times K_L \times \beta + 100 \times E \times (2 \times \pi \times f \times Cx)] \times K_T$$

where

$\beta = Cr/Cx$ when Cr≤100 µF(@120 Hz) or Cr≤10 µF(@1 kHz)
$\beta = Cr/Cx + Cx/Cr$ when Cr=1 mF(@120 Hz) or Cr=100 µF(@1 kHz)
(n.b. if $\beta<1$, $\beta=1$.)

Cx: Measurement value of Cp or Cs

Cr: Measurement range (1 nF,10 nF,100 nF,1 µF,10 µF,100 µF,1 mF)

f: Measurement frequency

A: Proportional error term (values are shown in Table 10-3)

B: Offset error term (values are shown in Table 10-3)

K_L: Coefficient for measurement signal level (values are shown in Table 10-1)

E: Residual when shorted, the value is E=600 µΩ (fixed)

K_T: Coefficient for ambient temperature (values are shown in Table 10-2)

Table 10-1 **Coefficient Caused by Measurement Signal Level K_L**

Measurement signal level *Level* [V]	K_L
0.1 to 0.3	0.3/*Level*
0.31 to 0.5	0.5/*Level*
0.51 to 1.0	1.0/*Level*

Table 10-2 **Coefficient Caused by Ambient Temperature K_T**

Ambient temperature T [°C]	K_T
$0 \le T < 18$	3
$18 \le T \le 28$	1
$28 < T \le 55$	3

Table 10-3 **Proportional Term *A* and Offset Term *B***

Cr (Measurement range)		120 Hz			1 kHz		
		SHORT	MED	LONG	SHORT	MED	LONG
1 nF	*A*	——	——	——	0.18	0.14	0.14
	B	——	——	——	0.062	0.052	0.049
10 nF	*A*	0.28	0.14	0.14	0.18	0.14	0.14
	B	0.1	0.054	0.05	0.041	0.036	0.035
100 nF	*A*	0.28	0.14	0.14	0.18	0.14	0.14
	B	0.077	0.037	0.035	0.041	0.036	0.035
1 µF	*A*	0.28	0.16	0.16	0.18	0.14	0.14
	B	0.077	0.037	0.035	0.041	0.036	0.035
10 µF	*A*	0.28	0.16	0.16	0.18	0.14	0.14
	B	0.077	0.037	0.035	0.041	0.036	0.035
100 µF	*A*	0.4	0.4	0.4	0.4	0.4	0.4
	B	0.077	0.037	0.035	0.066	0.049	0.044
1 mF	*A*	0.8	0.8	0.8	——	——	——
	B	0.106	0.052	0.045	——	——	——

Cpe and *Cse*[%] are derived from the calculated accuracy Ae[%], using the equation "$Cpe = Cse = \pm Ae$ [%]". If the measured D value, *Dx*, exceeds 0.1, multiply *Cpe* and *Cse* by $(1 + Dx^2)$.

NOTE If the secondary parameter is not D, calculate D with an equation in Table 10-4.

Table 10-4 **Calculating D**

Measurement parameter	Equation to calculate D
Cp-Q, Cs-Q	$D = 1/Qx$
Cp-G	$D = Gx/(2 \times \pi \times f \times Cpx)$
Cp-Rp	$D = 1/(2 \times \pi \times f \times Cpx \times Rpx)$
Cs-Rs	$D = 2 \times \pi \times f \times Csx \times Rsx$

In Table 10-4, *Cpx, Qx, Gx, Rpx, Csx*, and *Rsx* are measured values, and *f* is the measurement frequency.

Accuracy of D

The accuracy of D, *De*, is calculated as follows using Ae[%]:

Equation 10-2 **Equation to calculate *De* when *Dx*<0.1 and Ae≤10[%]**

$$De = \pm Ae/100$$

Equation 10-3 **Equation to calculate *De* when 0.1<*Dx*≤0.5 and Ae≤10[%]**

$$De = \pm(Ae/100) \times (1 + Dx) \times \sqrt{1 + Dx^2}$$

NOTE The accuracy of D is expressed in an absolute value instead of a percentage.

Accuracy of Q

The accuracy of Q, *Qe*, is calculated as follows using the accuracy of D, *De*:

Equation 10-4 **Equation to calculate *Qe***

$$Qe = \pm Qx^2 \times De/(1 \mp Qx \times De)$$

where *Qx* is the measured Q value. If $Qx \times De$ is 1 or more, $Qe = \pm\infty$.

NOTE The accuracy of Q is expressed in an absolute value instead of a percentage.

Accuracy of G

The accuracy of G, *Ge*[%], is calculated as follows using the base accuracy for Cp, Ae[%]:

Equation 10-5 **Equation to calculate *Ge***

$$Ge = \pm Ae/(Gx/(2 \times \pi \times f \times Cpx))$$

where *Gx* is the measured G value, *Cpx* is the measured Cp value, and f is the measurement frequency.

If *Dx* exceeds 0.1, multiply *Ge* by $(1 + Dx^2)$.

Accuracy of Rp

The accuracy of Rp, *Rpe*[%], is calculated as follows using the accuracy of G, *Ge*[%]:

Equation 10-6 **Equation to calculate *Rpe***

$$Rpe = \pm Ge/(1 \mp Ge/100)$$

If *Ge* is 100[%] or more, $Rpe = \pm\infty$[%].

Accuracy of Rs

The accuracy of Rs, *Rse*[%], is calculated as follows using the base accuracy for Cp and Cs, Ae[%]:

Equation 10-7 **Equation to calculate *Rse***

$$Rse = \pm Ae/(2 \times \pi \times f \times Csx \times Rsx)$$

where *Rsx* is the measured Rs value, *Csx* is the measured Cs value, and f is the measurement frequency.

If Dx exceeds 0.1, multiply Rse by $(1 + Dx^2)$.

Measurement support functions

- Measurement signal level monitor function

  The measurement voltage and measurement current can be monitored.

- Correction function

  The OPEN correction, SHORT correction, and LOAD correction are available.

- Display

  40-digit × 2-line LCD display

- Deviation measurement function

  Deviation from the reference value and the percent deviation from the reference value can be outputted as the result.

- Comparator function

  Bin sort: Primary parameters can be sorted into 9 Bin, Out of Bins, and Aux Bin; the secondary parameters, into High, In, and Low.

  Limit setting: absolute mode, absolute tolerance mode, percent tolerance mode

  Bin count: 0 - 999999 can be counted.

- Save/recall function

  Up to 10 setting conditions can be saved/recalled using the built-in nonvolatile memory.

- Resume function

  The instrument setting is automatically saved at power-off.

- Key lock function

  The front-panel keys can be disabled.

- Contact check function

  Automatic detection of contact failure between the measurement terminal and the DUT. (Available in the four-terminal measurement)

- GPIB interface

  Compliance with IEEE 488.1,2 and SCPI.

- Handler interface

  Negative-logic input/output signals. Opto-isolated open collector signal

Output signals	Bin 1-Bin 9, Out of Bins, Aux_Bin, P-Hi, P-Lo, S-Reject, INDEX, EOM, Alarm, OVLD, NC
Input signals	Keylock, Ext-Trigger

- Scanner interface (option 001)

  The OPEN/SHORT/LOAD corrections of 64 channels are available.

General Specifications

Power supply

Voltage 90 Vac to 132 Vac, 198 Vac to 264 Vac

Frequency 47 Hz to 66 Hz

Power consumption
40 W maximum/100 VA maximum

Operational conditions

Temperature 0°C to 45°C

Humidity (≤40°C, without condensation)
15% to 95% RH

Altitude 0 m to 2000 m

Non-operational conditions

Temperature -40°C to 70°C

Humidity (≤65°C, without condensation)
0% to 90% RH

Altitude 0 m to 4572 m

EMC

- Compliance with “CISPR 11 (1990)/EN 55011 (1991): Group 1, Class A”
- Compliance with “EN 61000-3-2 (1995)/IEC 61000-3-2 (1995)”
- Compliance with “EN 61000-3-3 (1995)/IEC 61000-3-3 (1994)”
- Compliance with “EN 50082-1 (1992)/IEC 61000-4-2 (1995): 4 kV CD, 8 kV AD”
- Compliance with “EN 50082-1 (1992)/IEC 61000-4-3 (1995): 3 V/m, 80% AM, 27 MHz to 1000 MHz”
- Compliance with “EN 50082-1 (1992)/IEC 61000-4-4 (1995): 0.5 kV Signal Lines, 1 kV Power Lines”

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Safety

- Compliance with “IEC 61010-1 (1990) +A1(1992) +A2(1995), CAN/CSA C22.2 No.1010.1-92”

Outer dimensions

Approximately 320 (width) × 100 (height) × 450 (depth) mm

Figure 10-1 **Front View**

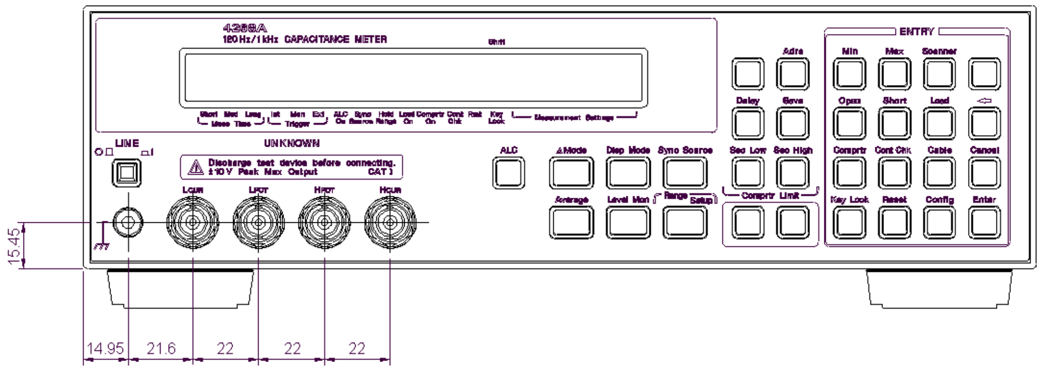


Figure 10-2 **Rear View**

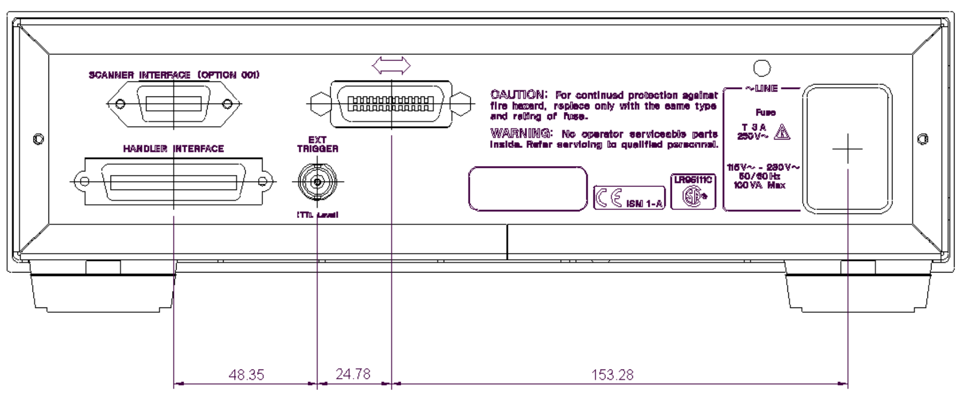
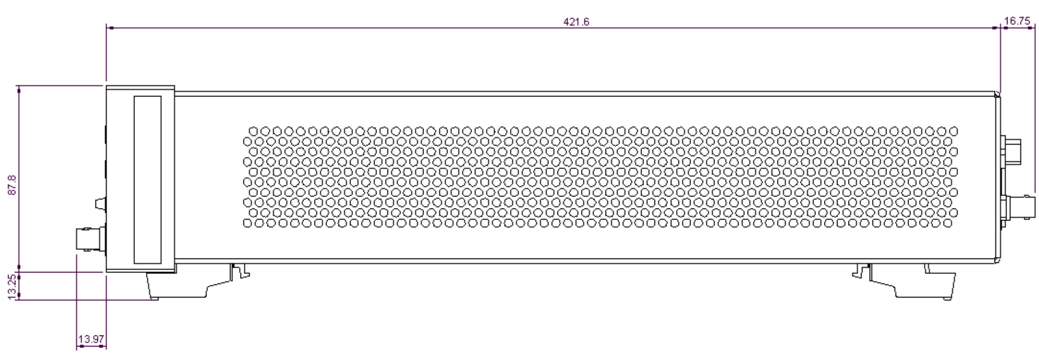


Figure 10-3 **Side View**



Weight

Approximately 5 kg

Supplemental Performance Characteristics

This section presents the reference data related to the operation of the 4268A other than the specifications. These data are not specifications but typical characteristics useful for operating the instrument.

ALC (Auto Level Control) function

- Operating measurement range setting

  When the measurement frequency is 120 Hz: 100 µF range, 1 mF range

  When the measurement frequency is 1 kHz: 10 µF range, 100 µF range

  If ALC is to operate below its measurement range, the output of the signal voltage level will be judge depending on whether the conditions below are satisfied.

  $$\text{Vset} \times 0.9 < \text{Vmon} < \text{Vset} \times 1.1$$

  Vset : measurement signal voltage setting

  Vmon : Applied signal voltage to the DUT

- Operating range

Table 10-5 Operating range of ALC

Measurement frequency	DUT		Measurement Voltage	
	Dissipation factor D	Capacitance C	Minimum	Maximum
120 Hz	D≤0.2	C≤600 µF	0.1 V	1.0 V
		600 µF<C≤1200 µF	0.1 V	(600 µF/C) V
		C>1200 µF	Out of range	
	0.2<D≤0.5	C≤600 µF	0.1 V	1.0 V
		C>600 µF	Out of range	
	D>0.5	All		
1 kHz	D≤0.2	C≤70 µF	0.1 V	1.0 V
		70 µF<C≤140 µF	0.1 V	(70 µF/C) V
		C>140 µF	Out of range	
	0.2<D≤0.5	C≤70 µF	0.1 V	1.0 V
		C>70 µF	Out of range	
	D>0.5	All		

Figure 10-4 **Operating range of the ALC function**

Measurement time

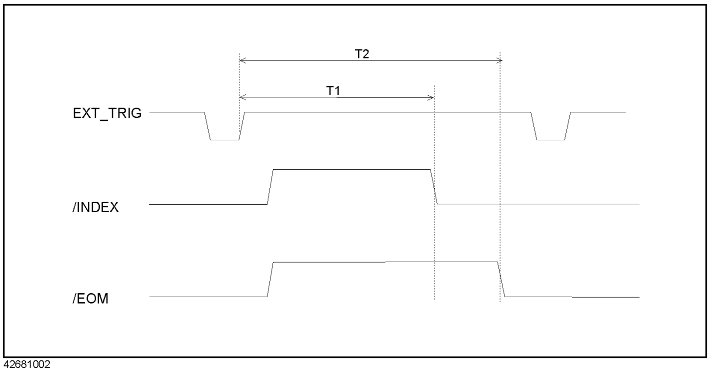
Table 10-6 shows the measurement times when the measurement settings are as follows.

Display	Off
Measurement Range Mode	Hold
Averaging	1
Source Delay Time	0 ms
Trigger Delay Time	0 ms

Table 10-6 **Measurement Time**

Measurement time		Short		Med		Long		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
T1	Analog measurement time	16 (20)	19 (23)	34 (38)	37 (41)	50 (54)	53 (57)	ms
T2	Measurement time	20 (24)	25 (30)	38 (42)	43 (48)	54 (58)	59 (64)	ms

The values in () are the measurement times when the contact check function is ON.



10.Specifications and Supplemental Performance Characteristics

Measurement range

The recommended measurement range and effective measurement range are shown in table 10-7 below (where the dissipation factor D≤0.5). Recommended Measurement Ranges are given for better measurement accuracy while Effective Measurement Ranges are provided to avoid overloads.

Table 10-7 **Measurement Range of Capacitance**

Measurement range	Recommended measurement range[F]		Effective measurement range[F]	
	Measurement frequency: 120 Hz	Measurement frequency: 1 kHz	Measurement frequency: 120 Hz	Measurement frequency: 1 kHz
1 nF	————	0.2 n to 2 n	————	0 to 2 n
10 nF	2 n to 20 n	2 n to 20 n	0 to 20 n	0 to 20 n
100 nF	20 n to 200 n	20 n to 200 n	0 to 200 n	0 to 200 n
1 µF	0.2 µ to 2 µ	0.2 µ to 2 µ	0 to 2 µ	0 to 2 µ
10 µF	2 µ to 20 µ	2 µ to 20 µ	0 to 20 µ	0 to 20 µ
100 µF	20 µ to 200 µ	20 µ to 200 µ	0 to 200 µ	0 to ∞
1 mF	0.2 m to 2 m	————	0 to ∞	————

Contact check function

- Effective measurement range (D≤0.5)

Table 10-8 **Effective Measurement range (D≤0.5)**

Measurement range	Effective measurement range[F]			
	Measurement frequency: 120 Hz		Measurement frequency: 1 kHz	
	Minimum	Maximum	Minimum	Maximum
1 nF	———	———	100 p	2 n
10 nF	1 n	20 n	1 n	20 n
100 nF	10 n	200 n	10 n	200 n
1 µF	100 n	2 µ	100 n	2 µ
10 µF	1 µ	20 µ	1 µ	20 µ
100 µF	10 µ	200 µ	10 µ	200 µ
1 mF	200 µ	2 m	———	———

- Minimum contact impedance that can be detected:

  5 MΩ

Measurement signal source output impedance

When the auto level control function is OFF

1.5 Ω or less (without extension cable)

When the auto level control function is ON

When the measurement frequency is 120 Hz

Measurement range: 10 nF to 10 μF

1.5 Ω or less (without extension cable)

Measurement range: 100 μF to 1 mF

0.1 Ω or less (without extension cable)

When the measurement frequency is 1 kHz

Measurement range: 1 nF to 1 μF

1.5 Ω or less (without extension cable)

Measurement range: 10 μF to 100 μF

0.1 Ω or less (without extension cable)

Measurement voltage monitor function

Accuracy ±(2%+2 mV)

Resume function

Data holding time 72 hours (23±5°C)

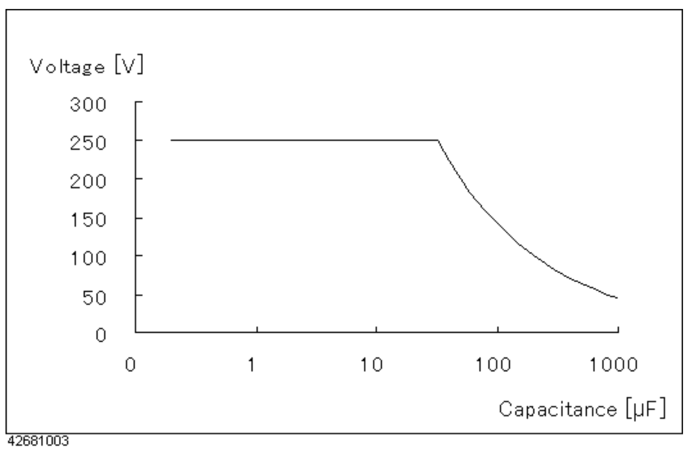
Measurement circuit protection

The following table shows the maximum discharge withstand voltage below which the internal circuit is protected even if a charged capacitor is connected to UNKNOWN terminals.

NOTE Connect a capacitor to the UNKNOWN terminals or test fixture only after it has discharged.

Maximum capacitor voltage	Range of capacitance *C* of measured DUT
250 V	$C < 32\ \mu F$
$\sqrt{2/C}$ V	$C \geq 32\ \mu F$

Figure 10-5 **Maximum Capacitor Voltage**



Sample Calculation of Measurement Accuracy

This section gives sample calculations of the measurement accuracy for each measurement parameter, assuming the measurement conditions shown below.

Measurement frequency 1 kHz

Measurement level 1 V

Measurement range 10 μF

Measurement time Med

Ambient temperature 28°C

Measurement parameter: Cp (or Cs)-D

The following sample calculation shows how to calculate the Cp (or Cs) accuracy, *Cpe* or *Cse* [%], and the D accuracy, *De*, assuming that the measured Cp (or Cs) value is 9.8765 μF and the measured D value is 0.0123.

The measurement range is 10μF and the measured Cp (or Cs) value is 9.8765 μF. Therefore, β=10 μ/9.8765 μ=1.0125, measurement frequency *f*=1000, A=0.14, B=0.036 (from Table 10-3), K_L=1.0/1.0=1(from Table 10-1), E=0.0006, β=10 μ/9.8765 μ= 1.0125, and K_T=1(from Table 10-2). Substitute these values into the equation. The result is

$Ae = [0.14 + 0.036 \times 1 \times 1.0125 + 100 \times 0.0006 \times (2 \times \pi \times 1000 \times 9.8765 \times 10^{-6})] \times 1$
$= 0.180$ [%]. Because D<0.1, *Cpe* or *Cse* is ±0.180[%]. On the other hand, the measured D value is 0.0123 and the calculated Ae value is 0.180[%] and, therefore, using Equation 10-2 $De = \pm 0.180/100 \cong \pm 0.0018$ is obtained. As a result, the true Cp (or Cs) value falls within $9.8765 \pm (9.8765 \times 0.0018) = 8.7825 \pm 0.0178$ [μF], i.e. a range between 9.8587 and 9.8943 [μF]; the true D value, 0.0123 ± 0.0018, falls within a range between 0.0105 and 0.0141.

Measurement parameter: Cp (or Cs)-Q

The following sample calculation shows how to calculate the Cp (or Cs) accuracy, *Cpe* (or *Cse*) [%], and the Q accuracy, *Qe*, assuming that the measured Cp (or Cs) value is 9.8765 μF and the measured Q value is 9.8765.

The measurement frequency is 1 kHz and the measured Cp (or Cs) is 9.8765 μF. By performing calculation in the same way as Cp-D, $Ae = 0.180$ [%] is obtained. Because $D = 1/9.8765 \cong 0.1013 > 0.1$, multiply by $(1 + 0.1013^2)$. The calculated *Cpe* (or *Cse*) is ±0.182[%]. On the other hand, the calculated D value is 0.1013 and the calculated *Ae* value is 0.180[%]. To obtain *De*, first use Equation 10-3. The result is

$De = \pm(0.180/100) \times (1 + 0.1013) \times \sqrt{1 + 0.1013^2} \cong \pm 0.0020$. Then, use the obtained *De* and Equation 10-4. The result is

$Qe = \pm 9.8765^2 \times 0.0020/(1 \mp 9.8765 \times 0.0020) = -0.1913 \sim 0.1990$. As a result, the true Cp (or Cs) value falls within a range between 9.8586 and 9.8944 [μF]; the true Q value falls within a range between 9.6852 and 10.076.

Measurement parameter: Cp-G

The following sample calculation shows how to calculate the Cp accuracy, *Cpe*[%], and the G accuracy, *Ge*[%], assuming that the measured Cp value is 9.8765 μF and the measured G value is 0.0123.

$D = 0.0123/(2 \times \pi \times 1000 \times 9.8765{\times}10^{-6}) \cong 0.1982 > 0.1$. Therefore, multiply the calculated *Ae* value by $(1 + 0.1982^2)$. The result of *Cpe* is ±0.187[%]. On the other hand, from Equation 10-5, $Ge = \pm 0.180/(0.0123/(2 \times \pi \times 1000 \times 9.8765{\times}10^{-6})) = \pm 0.908$ [%]. Because D>0.1, multiply by $(1 + 0.1982^2)$ in the same way as *Cpe*. The final result of *Ge* is ±0.943[%].

Measurement parameter: Cp-Rp

The following sample calculation shows how to calculate the Cp accuracy, *Cpe*[%], and the Rp accuracy, *Rpe*[%], assuming that the measured Cp value is 9.8765 μF and the measured Rp value is 123.45 Ω.

$D = 1/(2 \times \pi \times 1000 \times 9.8765{\times}10^{-6} \times 123.45) \cong 0.1305 > 0.1$. Therefore, multiply the calculated *Ae* by $(1 + 0.1305^2)$. The result of *Cpe* is ±0.183[%]. On the other hand, $Gx = 1/Rpx = 1/123.45 = 0.0081$. Therefore, perform the calculation in the same way as Cp-G. The result of *Ge* is ±1.402[%]. From Equation 10-6, $Rpe = \pm 1.402/(1 \mp 1.402/100) = -1.383 \sim 1.422$ [%] is obtained.

Measurement parameter: Cs-Rs

The following sample calculation shows how to calculate the Cs accuracy, *Cse*[%], and the R accuracy, *Rse*[%], assuming that the measured Cs value is 9.8765 μF and the measured Rs value is 2.3456 Ω.

$D = 2 \times \pi \times 1000 \times 9.8765{\times}10^{-6} \times 2.3456 \cong 0.1456 > 0.1$. Therefore, multiply the calculated *Ae* by $(1 + 0.1456^2)$. The result of *Cse* is ±0.182[%]. On the other hand, from Equation 10-7, $Rse = 0.180/(2 \times \pi \times 1000 \times 9.8765{\times}10^{-6} \times 2.3456) \cong 1.237$ [%]. Because D>0.1, multiply by $(1 + 0.1456^2)$ in the same way as *Cse*. The final result of *Rse* is ±1.263[%].

11 Troubleshooting

This chapter describes items you should recheck if you have a problem while using the 4268A and explains the error messages that the 4268A outputs.

Items to Recheck When You Have a Problem

The instrument does not operate (no display appears)

- Check to see if the power cord is disconnected.
- Check to see if the fuse is blown.

  For how to remove the fuse, refer to “Mounting the fuse” on page 20.

Frequent relay changes

- Connect the test fixture to the UNKNOWN terminals or set the measuring range mode to Hold.

  If nothing is connected to the UNKNOWN terminals and the measurement range mode is set to Auto, there will be frequent changes in the internal relay, creating flashes and noise. To set the measurement range mode, refer to “Setting the measurement range” on page 47.

Front panel keys are not accepted

- Check to see if the keys are locked.

  Look at the instrument setting indicator at the bottom of the display. If the keys are locked, the ▼symbol is displayed above Key Lock. For how to clear the key lock, refer to “Clearing the key lock” on page 72.

- Check to see if the remote mode is selected.

  Look at the instrument setting indicator at the bottom of the display. If the remote mode is selected, the ▼symbol is displayed above Rmt. For how to exit from the remote mode, refer to “Clearing the remote mode” on page 72.

The instrument does not respond to the external controller or malfunctions

- Check to see if the GPIB address is set correctly.

  For how to check/set it, refer to “Setting an GPIB address” on page 82.

- Check to see if the GPIB cable connection is loose.
- Check to see if the GPIB address is assigned to another instrument connected via the GPIB cable.
- Check to see if the GPIB cable connection is looped.

There are problems with measurement values

- Has correction data measurement failed?

  Take correction data again. For how to measure correction data, refer to “Performing the OPEN correction” on page 42, “Performing the SHORT correction” on page 43, and “Making a measurement for the LOAD correction” on page 49.

An error message is displayed.

- If an error message is displayed or read out via GPIB, refer to “Error Messages” on page 244, determine the status of the 4268A, and correct the error.

Error Messages

The following pages describe instrument errors, GPIB errors, and warning messages.

Instrument errors

11 **RAM test failed**

Indicates that the RAM test at power-on failed. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

12 **BOOT ROM test failed**

Indicates that the boot ROM test at power-on failed. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

13 **FLASH ROM test failed**

Indicates that the flash ROM test at power-on failed. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

14 **EEPROM test failed**

Indicates that the EEPROM test at power-on failed. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

15 **A1 board test failed**

Indicates that the A1 main board (analog board) test at power-on failed. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

16 **ADC failure**

Indicates that a problem occurred in the A/D converter during measurement. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

17 **Fan stopped**

Indicates that the fan stopped. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

18 **Calibration memory lost**

Indicates that the calibration data (FactoryCalibrationData) in EEPROM was lost at power-on. If this error occurs, the 4268A generates a beep sound and stops. The hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

19 **User data lost**

Indicates that the user correction data (UserCorrectionData) in EEPROM was lost at power-on. The correction data is initialized to the factory setting. Possible causes include hardware failure and power-off during write operation to EEPROM.

20 **Previous setting lost**

Indicates that instrument setting values in the backup memory were lost at power-on. These values are initialized to the factory setting. No beep sound is outputted. Possible causes include a lapse of 72 hours or more after power-off and hardware failure.

21 **Save failed**

Indicates that the instrument setting was not saved into EEPROM when save was attempted. Even if this error occurs, the 4268A does not stop. However, the hardware is broken and repair is required. Contact the company you purchased this instrument from or your nearest Agilent Technologies sales office.

22 **Recall failed**

Indicates that the instrument setting was not saved in the specified register on EEPROM when recall was attempted. The instrument setting is not changed, and returns to the status before the execution of recall. Check whether the register number you specified when executing recall is correct.

23 **Lockout by handler**

Front panel key input has been disabled via the handler. This status cannot be cleared by using the front panel keys or GPIB commands. Set the /KEY_LOCK signal of the handler interface to High.

24 **Option not installed**

This error occurs when you attempt to operate a front panel key or execute an GPIB command related to the scanner interface but your 4268A does not have the scanner interface (option 002).

25 **Correction meas failed**

When an overload (OVLD) or a contact check failure (N.C.) occurs during user correction data, this error message will be displayed to inform that a measurement failure has occurred. The correction data before measurement will not be changed. Check that proper connections are made and specified procedures are followed when user correction is performed.

GPIB errors

-100 **Command error**

Indicates that a comprehensive syntax error occurred for which the 4268A cannot detect further details. This error code simply indicates that a command error defined by IEEE 488.2,11.5.1.1.4. occurred.

-101 **Invalid character**

Indicates that invalid characters exist in the command character string. This error occurs, for example, when an ampersand (&) is inserted by mistake (e.g., “:&SENS”).

-102 **Syntax error**

Indicates that there is a command or data type that cannot be recognized. This error occurs, for example, when an the 4268A that does not accept any character string receives a character string.

-103 **Invalid separator**

Indicates that the parser (syntax analysis program) expected a separator, but a character other than a separator was sent. This error occurs, for example, when a semicolon (;) is missing after a program message unit (e.g., ":AVER:COUN 128:AVER ON").

-104 **Data type error**

Indicates that the parser recognized impossible data elements. This error occurs, for example, when block data is sent but a numeric value or character string data.

-105 **GET not allowed**

Indicates that a group execution trigger (GET) was received in a program message (refer to IEEE 488.2,7.7).

-108 **Parameter not allowed**

Indicates that the number of parameters is larger than that required by the command. This error occurs, for example, when, although the "[:SENSe]:AVERage:COUNt" (page 159) command requires 1 parameter, ":AVER:COUN 2,4" is received.

-109 **Missing parameter**

Indicates that the number of parameters is smaller than that required by the command. This error occurs, for example, when, although the "[:SENSe]:AVERage:COUNt" (page 159) command requires 1 parameter, ":AVER" is received.

-112 **Program mnemonic too long**

Indicates that the length of the header exceeds 12 characters (refer to IEEE 488.2,7.6.1.4.1).

-113 **Undefined header**

Indicates that a header not defined for the 4268A was received. This error occurs, for example, when "*XYZ", which is not defined for the 4268A, is received.

-121 **Invalid character in number**

Indicates that an invalid character occurred in the data type of a syntax analysis target. This error occurs, for example, when an alphabetical character exists in a decimal value, or when "9" exits in octal data.

-123 **Exponent too large**

Indicates the absolute value of the exponent exceeds 32000 (refer to IEEE 488.2,7.7.2.4.1).

-124 **Too many digits**

Indicates that the number of digits of the mantissa of a decimal numeric value data element exceeds 255, excluding preceding 0s (refer to IEEE 488.27.7.2.4.1).

-128 **Numeric data not allowed**

Indicates that a numeric value data element (not violating the standard) was received when the 4268A does not accept any numeric value data element.

-131 **Invalid suffix**

Indicates that the suffix does not comply with the syntax defined by IEEE 488.2,7.7.3.2 or is inappropriate for the 4268A.

-138 **Suffix not allowed**

Indicates that a suffix is added after a numeric value element to which no suffix can be added.

-140 **Character data error**

Indicates that an error that cannot be classified into error numbers between -141 and -149 occurred during syntax analysis of a character data element.

-141 **Invalid character data**

Indicates that there are invalid characters in a character data element or the received parameters are not valid. This error occurs, for example, when ":CALC1:FORM RP" (valid parameter is CP or CS) is received.

-144 **Character data too long**

Indicates that the length of the character data element exceeds 12 characters (refer to IEEE 488.2,7.7.1.4).

-148 **Character data not allowed**

Indicates that a character data element (not violating the standard) was received when the 4268A does not accept any character data element. This error occurs, for example, when a parameter must be enclosed with double quotation marks (") but they are missing.

-150 **String data error**

Indicates that an error that cannot be classified into error numbers between -151 and -159 occurred during syntax analysis of a character string data element.

-151 **Invalid string data**

Indicates that character string data was expected but the provided character string data was invalid for some reason (refer to IEEE 488.2,7.7.5.2). This error occurs, for example, when the END message is received before the closing quotation mark character appears.

-158 **String data not allowed**

Indicates that a character string data element was received when the 4268A does not accept any character string data element.

-160 **Block data error**

Indicates that an error that cannot be classified into error numbers between -161 and -169 occurred during syntax analysis of block data.

-161 **Invalid block data**

Indicates that block data was expected but the provide block data was invalid for some reasons (refer to IEEE 488.2,7.7.6.2). This error occurs, for example, when the END message is received before the length is reached.

-168 **Block data not allowed**

Indicates that a block data element was received when the 4268A does not accept any block data element.

-170 **Expression error**

Indicates that an error that cannot be classified into error numbers between -171 and -179 occurred during syntax analysis of expression data.

-171 **Invalid expression**

Indicates that the expression data element is invalid (refer to IEEE 488.2,7.7.7.2). This error occurs, for example, when parentheses are not paired or when a character violates the standard.

-178 **Expression data not allowed**

Indicates that an expression data element was received when the 4268A does not accept any expression data element.

-200 **Execution error**

Indicates that a comprehensive execution error occurred for which the 4268A cannot detect further details. This error code simply indicates that an execution error defined by IEEE 488.2,11.5.1.1.5. occurred.

-211 **Trigger ignored**

Indicates that a trigger command or trigger signal was received and recognized by the 4268A but ignored due to the timing to the 4268A (for example, when the 4268A is not ready to respond).

-213 **Init ignored**

Indicates that a measurement start request was ignored because another measurement was being executed.

-214 **Trigger deadlock**

Indicates that the ":READ?" (page 158) command was ignored because the trigger source setting was MAN or BUS.

-220 **Parameter error**

Indicates that an error that cannot be classified into error numbers between -221 and -229 occurred during analysis of a program data element. This error occurs, for example, when you attempt to specify invalid values (values not finite when converted to an R-X format impedance value) as the LOAD correction data or LOAD correction reference data. If this error occurs, the command is ignored. This error also occurs when you attempt to specify an invalid LOAD correction reference value using front panel keys.

Type of Parameter Setting		values not finite when converted to an R-X format impedance value
Primary Parameter	Secondary Parameter	
Cp	D	Independent of D value, Cp is 0
Cp	Q	Independent of Q value, Cp is 0, also Independent of Cp value, Q is 0
Cp	G	Cp and G are both 0
Cp	Rp	Independent of Cp value, Rp is 0
Cs	D	Independent of D value, Cs is 0
Cs	Q	Independent of Q value, Cs is 0, also Q is 0 independent of Cs value
Cs	Rs	Cs is 0 independent of Rs value

-221 **Setting confict**

Indicates that a program data element complying with the syntax standard was analyzed but the 4268A cannot execute it in its current status.

-222 **Data out of range**

Indicates that a data element (not violating the standard) out of the range that the 4268A defines was received. This error occurs, for example, when 10 (allowable setting range of the parameter is between 0 and 9) is specified as the parameter of the “*RCL” (page 180) command.

-223 **Too much data**

Indicates that the received block, expression, or character string type program data complies with the standard but its amount exceeds the limit that the 4268A can deal with due to memory or conditions specific to memory-related devices.

-230 **Data corrupt or stale**

Indicates that the data is probably invalid. Also indicates that a newly initiated read operation has not been completed since the latest access.

-241 **Hardware missing**

Indicates that the received command or Query complies with the standard but cannot be executed due to hardware-related reasons (for example, the option is not installed).

-310 **System error**

Indicates that one of the "system errors" defined for the 4268A has occurred.

-311 **Memory error**

Indicates that an error was detected in the memory of the 4268A.

-350 **Queue overflow**

The error queue is filled to its capacity. This code indicates that an error occurred but due to insufficient space in the queue it has not been recorded.

-400 **Query error**

Indicates that a comprehensive Query error occurred for which the 4268A cannot detect further details. This code simply indicates that a Query error defined by IEEE 488.2,11.5.1.1.7 and 6.3. has occurred.

-410 **Query INTERRPUTED**

Indicates that a status occurs that may cause an "INTERRUPTED" Query error (refer to IEEE 488.1,6.3.2.3). This error occurs, for example, when after a Query data byte (DAB) or GET is received before its response is completely sent.

-420 **Query UNTERMINATED**

Indicates that a status occurs that may cause an "UNTERMINATED" Query error (refer to IEEE 488.2,6.3.2). This error occurs, for example, when the 4268A is specified as a talker and an incomplete program message is received.

-430 **Query DEADLOCKED**

Indicates that a status occurs that may cause a "DEADLOCKED" Query error (refer to IEEE 488.2,6.3.1.7). This error occurs, for example, when both input and output buffers become full and the 4268A cannot continue processing.

-440 **Query UNTERMINATED after indefinite response**

Indicates that, in a certain program message, a Query requesting an indefinite response was executed and then another Query was received (refer to IEEE 488.2,6.5.7.5.7).

Warning message (WARNING)

Warning messages are displayed to prompt the user to take caution.

WARNING: Out of limit

Displayed when, during user correction data measurement, correction data does not fall within a proper range. The proper ranges are as follows:

Correction type	Proper range
OPEN correction	$\lvert Y \rvert < 100\ \mu S$
SHORT correction	$\lvert Z \rvert < 10\ \Omega$
LOAD correction	$\lvert Zref \rvert \times 0.8 < \lvert Z \rvert < \lvert Zref \rvert \times 1.2$

In the above table, Y is admittance, Z is impedance, and Zref is the reference value for the LOAD correction.

WARNING: Need load meas

This message is displayed if you attempt to enable the LOAD correction function using the front panel keys but the setting of the measurement frequency and/or cable length differs from that used when the LOAD correction data was measured and set.

A Manual Changes

This appendix contains information required to adapt this manual to versions or configurations of the 4268A that appeared earlier than the current printing date of this manual. The information in this manual applies specifically to 4268A units whose serial number prefix is listed on the title page of this manual.

Manual Changes

To adapt this manual to your 4268A, refer to Tables A-1 and A-2.

Table A-1 **Manual Changes by Serial Number**

Serial Prefix or Number	Make Manual Changes

Table A-2 **Manual Changes by Firmware Version**

Version	Make Manual Changes

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (Figure A-1). The first five characters are the serial prefix and the last five digits are the suffix.

For how to check the firmware version, refer to “Checking the Firmware Version and the Information on Options” on page 76.

Figure A-1 **Example of Serial Number Plate**

B Using the Scanner Interface

This chapter explains how to use the scanner interface.

Overview

The scanner interface is a function equipped only when your 4268A has option 001.

By using the scanner interface, you can select and use up to 64 sets of correction data that have been measured and saved in advanced using the multi-channel correction function. This function lets you perform the OPEN/SHORT/LOAD correction for each channel of the scanner and to cancel variations in measurement values between channels due to differences in their measurement paths, resulting in highly reliable measurements. In addition, this function inputs/outputs the timing control signals to coordinate measurement and scanner operation, letting you build efficient scanning systems.

Using the Multi-channel Correction Function

This section describes how to use the multi-channel correction function, which performs error correction using the correction data (OPEN, SHORT, LOAD) provided for each channel of the scanner.

To use the multi-channel correction function, it is necessary to measure correction data for each channel in advance. The measurement procedure of correction data is the same as that for usual correction, except that a setting must be made to perform measurement channel by channel as follows.

1. Turning ON the multi-channel correction function

   Make the setting to enable the multi-channel correction function (turn ON the multi-channel correction function).

NOTE If the multi-channel correction function is not ON, even if a channel is selected, data is not saved as correction values for the channel.

NOTE If the multi-channel correction function is not ON, channel number input from the scanner interface (/CH0 - /CH5, /CH_VALID) is ignored, and only /INDEX and /EOM are outputted (Low). Note that /EXT_TRIG is valid regardless of the ON/OFF state of the multi-channel correction function as long as the trigger mode is Ext (external).

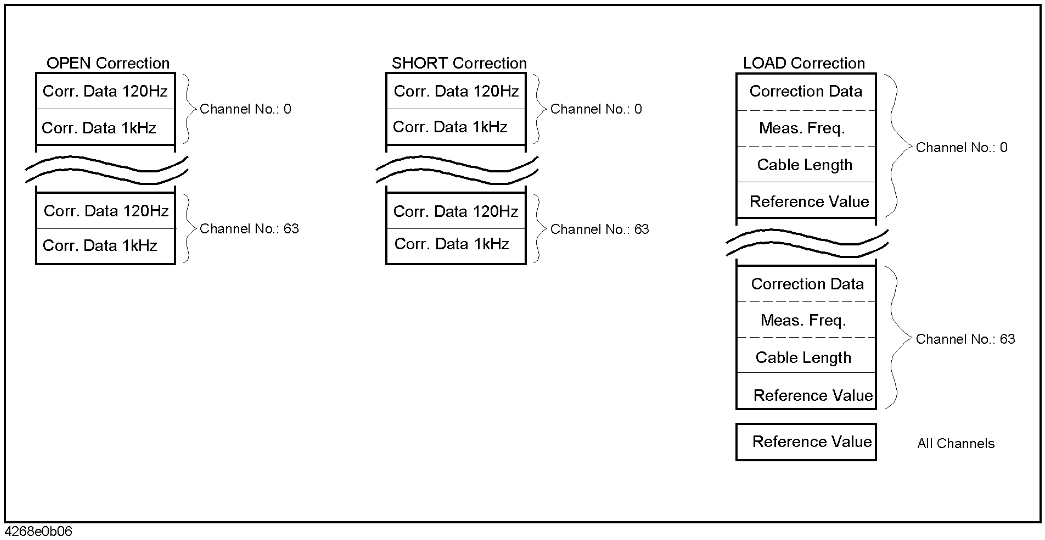
2. Selecting the LOAD reference value setting method

   You have to specify whether to enable/disable channel-by-channel setting of reference values for the LOAD correction. If channel-by-channel setting is enabled, entered reference values are saved as the reference values applied to only the channel selected at entry; if disabled, they are saved as the data applied to all channels, regardless of which channel is selected. Refer to Figure B-1.

3. Selecting a channel

   If the multi-channel correction function is ON, measurement values are saved as correction data for the channel selected during measurement. Therefore, the desired channel must be specified before correction data measurement. Correction data is saved in the structure shown in Figure B-1.

Figure B-1 Structure of Correction Data for Multi-channel Correction Function



The basic flow of the correction data measurement is as follows: first, make the setting of 1 and 2 above and then repeat 3 and correction data measurement according to the number of desired channels.

NOTE The correction data for the multi-channel correction function cannot be initialized (the values are maintained even if reset or power-off is performed).

The following pages describe how to set the three items above when using the following methods: setting from the front panel, setting via GPIB, and setting via the scanner interface (only for channel selection). For how to measure correction data, refer to "Correcting Measurement Errors (OPEN/SHORT/LOAD correction function)" on page 49.

Setting from the front panel

This section describes how to use the multi-channel correction function using front panel keys.

- Turning ON the multi-channel correction function

Step 1. Press the **Scanner** key (blue key, **9** key). The multi-channel correction function setting menu appears.

Step 2. Use the ↑→ key and other keys to blink On/Off and then press the **Enter** key. The multi-channel correction function ON/OFF screen appears. The blinking item indicates the current setting. If you want to change the setting, use the ↑→ key to select On or Off and then press the **Enter** key.

- Selecting the LOAD reference value setting method

Step 1. Press the **Scanner** key (blue key, **9** key). The multi-channel correction function setting menu appears.

Step 2. Use the ↑→ key and other keys to blink LoadRef and then press the **Enter** key. The LOAD reference value setting method selection screen appears. The selection items are described below. The blinking item indicates the current setting. If you want to change the selection, use the ↑→ key and other keys to blink the desired item and then press the **Enter** key.

Single	Sets the same LOAD correction reference values for all channels.
Multi	Sets the LOAD correction reference values channel by channel.

- Selecting a channel

Step 1. Press the **Scanner** key (blue key, **9** key). The multi-channel correction function setting menu appears.

Step 2. Use the ↑→ key and other keys to blink Channel and then press the **Enter** key. The channel selection screen appears.

Step 3. Use numeric keys and other keys to enter the channel number (0 - 63) you want to select.

Setting via GPIB

This section describes how to use the multi-channel correction function using GPIB commands. To use the multi-channel correction function, use the following commands.

- “[:SENSe]:CORRection:MULTiple:CHANnel” on page 164
- “[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe]” on page 165
- “[:SENSe]:CORRection:MULTiple[:STATe]” on page 165

Example B-1 shows a sample program. (This program is stored in the sample program disk under the file name scanner.bas.)

This program measures the OPEN and SHORT correction data while selecting a channel number from 0 to 63.

Line 50	Turns ON the multi-channel correction function.
Lines 70 to 100	Sets a channel number to Chan and then reads and displays the setting for checking.
Lines 110 to 170	Prompts you to make a connection for the OPEN correction and measures the OPEN correction data when “y” is entered after the completion of the connection.
Lines 180 to 240	Prompts you to make a connection for the SHORT correction and measures the SHORT correction data when “y” is entered after the completion of the connection.

Example B-1 **Sample program: Multi channel correction function**

```
10      INTEGER Chan,Rtn_chan
20      DIM Buff$[9]
30      ASSIGN @Hp4268a TO 717
40      CLEAR SCREEN
50      OUTPUT @Hp4268a;":CORR:MULT ON"
60      FOR Chan=0 TO 63
70        OUTPUT @Hp4268a;":CORR:MULT:CHAN ";Chan
80        OUTPUT @Hp4268a;":CORR:MULT:CHAN?"
90        ENTER @Hp4268a;Rtn_chan
100       PRINT "HP4268A Channel Setting: ";Rtn_chan
110       PRINT "Set connection -> OPEN (@Channel ";Rtn_chan;")"
120       INPUT "OK? [y/n]",Buff$
130       IF UPC$(Buff$)="Y" THEN
```

```
140        OUTPUT @Hp4268a;":CORR:COLL STAN1"
150        OUTPUT @Hp4268a;"*OPC?"
160        ENTER @Hp4268a;Buff$
170      END IF
180      PRINT "Set connection -> SHORT(@Channel ";Rtn_chan;")"
190      INPUT "OK? [y/n]",Buff$
200      IF UPC$(Buff$)="Y" THEN
210        OUTPUT @Hp4268a;":CORR:COLL STAN2"
220        OUTPUT @Hp4268a;"*OPC?"
230        ENTER @Hp4268a;Buff$
240      END IF
250    NEXT Chan
260    END
```

Setting via the scanner interface

To select a channel via the scanner interface, use /CH0 to /CH5 and /CH_VALID signals. For information on these signals, refer to “Pin Assignment of Input/Output Signals” on page 259.

Channel numbers are expressed in binary form by High level (0) or Low level (1) of the /CH0 to /CH5 signals. The /CH5 signal is the most significant bit, and the /CH0 signal is the least significant bit. For example, if the /CH5 signal is Low and the /CH0 to /CH4 signals are High, they indicate 32; if the /CH0 to /CH1 signals are Low and the /CH2 to /CH5 signals are High, they indicate 3.

The /CH_VALID signal determines whether to use the setting of the /CH0 to /CH5 signals. More specifically, if the /CH_VALID signal is Low, a channel of the 4268A of the channel number expressed by the /CH0 to /CH5 signals is selected.

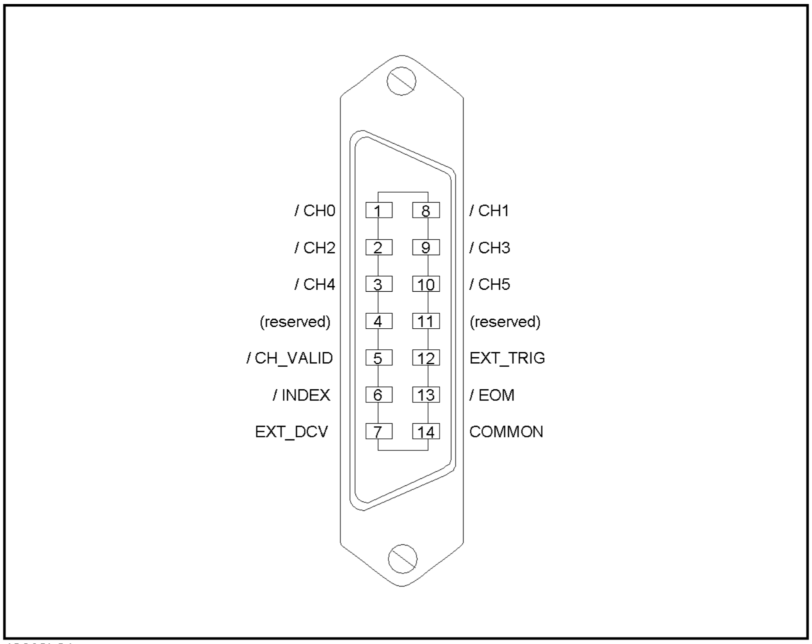
Pin Assignment of Input/Output Signals

Figure B-2 shows the pin assignment of each input/output signal in the scanner interface connector. Table B-1 gives a description of input/output signal.

NOTE

"/" (slash) preceding a signal name indicates that the signal is of negative logic (active Low).

Figure B-2 **Pin Assignment of Scanner Interface Connector**



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B.Using the Scanner Interface

Table B-1 **Description of scanner interface input/output signals**

Pin number	Signal name	Description
1	/CH0	Channel number selection signals (6-bit binary input). Selects correction data for a specified channel of the scanner. The most significant bit is /CH5 (pin 10); the least significant bit is /CH0 (pin 1).
2	/CH2	
3	/CH4	
4	(reserved)	Not used at present.
5	/CH_VALID	Channel number identification signal (input). Enables (Low level) or disables (High level) the channel number set by the channel number selection signals.
6	/INDEX	Analog measurement completion signal (output). When the analog measurement is completed, this signal goes Low. Once this signal is received, you can change the channel. Note that, you cannot obtain measurement data until the /EOM signal is received.
7	EXT_DCV	External DC voltage (input). Supplies voltage to input signals (EXT_TRIG, /KEY_LOCK) and operation output signals (/ALARM, /INDEX, /EOM). The input voltage range is between +5 V and +15 V.
8	/CH1	Channel number selection signals (6-bit binary input). Selects correction data for a specified channel of the scanner. The most significant bit is /CH5 (pin 10); the least significant bit is /CH0 (pin 1).
9	/CH3	
10	/CH5	
11	(reserved)	Not used at present.
12	EXT_TRIG	External trigger signal (input). This is valid when the trigger mode is set to Ext (external). The trigger is generated at the rising edge of a pulse.
13	/EOM	Measurement cycle completion signal (output). When a set of measurement tasks is completed and the measurement data becomes valid, this signal goes Low.
14	COMMON	Common for external DC voltage of EXT_DCV (pin 7).

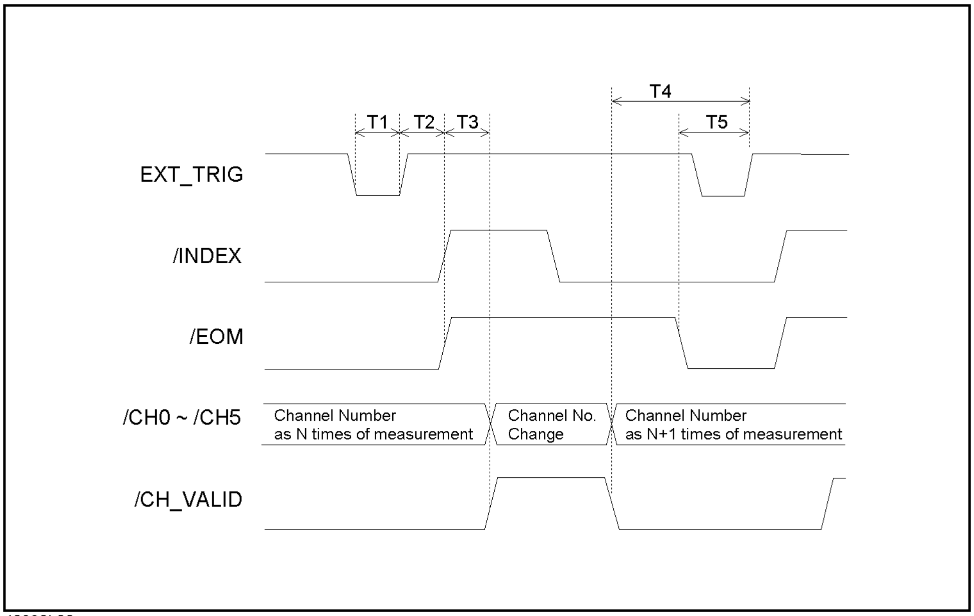
Timing Chart

Figure B-3 shows the timing chart. T1 - T5 in the figure indicate the time periods described in the following table. The channel can be changed at the period shown as “Channel No. Change” in Figure B-3.

Time		Min.	Max.
T1	Trigger pulse width	1 [μs]	—
T2	Measurement start delay time	—	600 [μs][*1]
T3	Channel number input hold time	0 [μs]	—
T4	Channel number input setup time	0 [μs]	—
T5	Trigger setup time	0 [μs]	—

*1.When the display has been turned off.

Figure B-3 **Timing Chart of Scanner Interface**



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Electrical Characteristics

Output signals

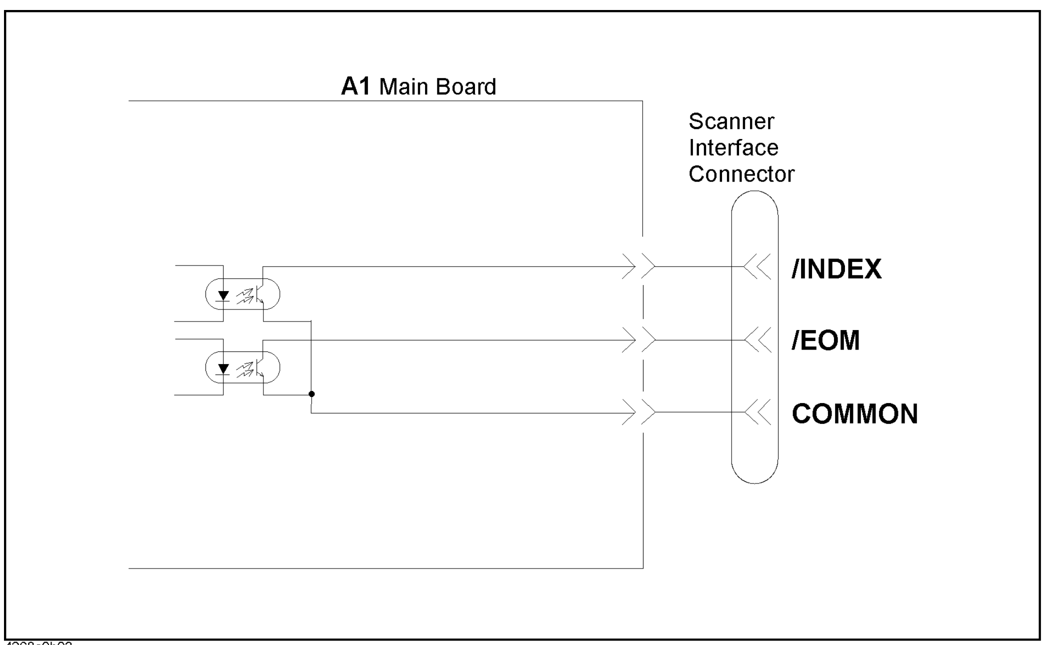
Each output signal is outputted via an open collector by using a photo-coupler. The voltage of each output is obtained by connecting pull-up resistors outside of the 4268A. Table B-2 shows the electrical characteristics of the output signals. Figure B-4 shows the circuit diagram of the output signals.

Table B-2 Electrical characteristics of scanner interface output signals

Output signal	Output voltage [V]		Max. current [mA]
	Low	High	
/INDEX, /EOM	0 to 0.5	EXT_DCV*1	6

*1.EXT_DCV: +5V to +15V

Figure B-4 Circuit Diagram of Scanner Interface Output Signals



Input signals

Each input signal is connected to the LED (cathode side) of the photo-coupler. The LED (anode side) is connected to the pull-up power supply voltage. Table B-3 shows the electrical characteristics of the input signals. Figures B-5 and B-6 show the circuit diagram of the input signals. The amount of current flowing through the LED varies, depending on the pull-up power supply voltage and the setting of the channel control (/CH0 - /CH5, /CH_VALID) signal pull-up resistor setting switch (S1) and the external trigger (EXT_TRIG) signal pull-up resistor setting switch (S3). For how to set S1 and S3, refer to “Preparations for Using the Scanner Interface” on page 265.

Table B-3 Electrical characteristics of scanner interface input signals

Input signal	Input voltage [V]		Input current (at Low) [mA] (typical) Pull-up power supply voltage: EXT_DCV		
	Low	High	5V	12V	15V
/CH0 to /CH5, /CH_VALID	0 to 1	EXT_DCV	9.0	12.7	16.2
EXT_TRIG			3.7	4.6	5.9

Figure B-5 Circuit Diagram of Scanner Interface Input Signals (channel control signals)

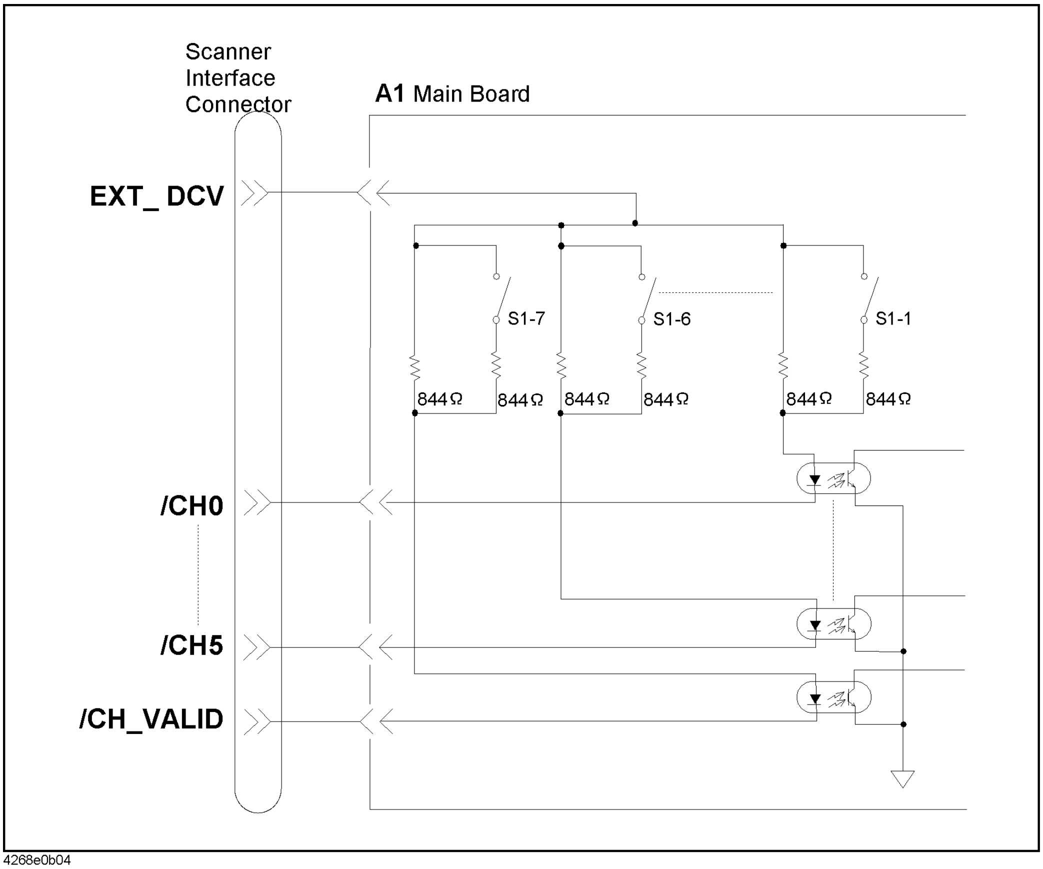
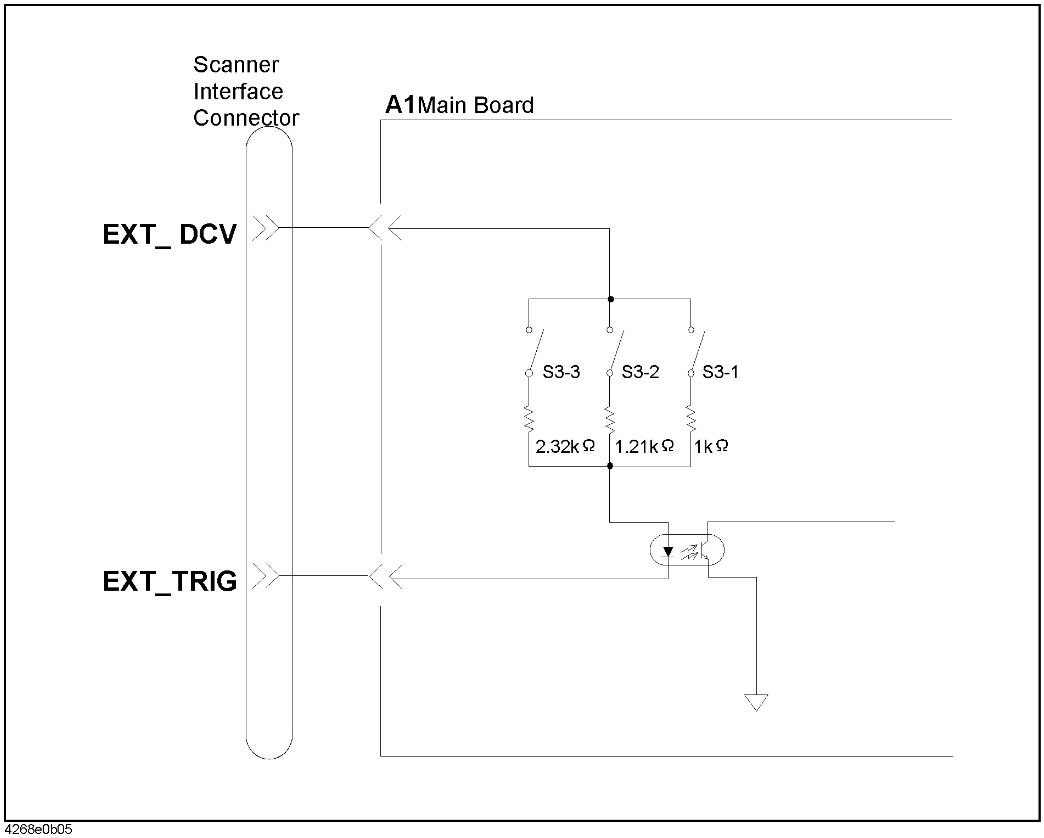


Figure B-6 **Circuit Diagram of Scanner Interface Input Signals (external trigger signal)**



Power supply

Only external power supply (EXT_DCV) is available as a power supply. Set the external power supply within the following voltage range.

	Voltage range [V]
EXT_DCV	+5 to +15

Preparations for Using the Scanner Interface

Before using the scanner interface, the input/output signal pull-up resistors must be set according to the external power supply (EXT_DCV) used.

Setting the output signal pull-up resistors

Mount the output signal (/INDEX,/EOM) pull-up resistors externally. The equations to calculate pull-up resistor values and typical resistance values are given below.

Signal name	Resistance value[kΩ]	Typical resistance values when EXT_DCV is 5, 9, 12, and 15 V[Ω][*1]			
		5 V	9 V	12 V	15 V
/INDEX	EXT_DCV / 3	1.78 k	3.16 k	4.22 k	5.11 k
/EOM	EXT_DCV / 3	1.78 k	3.16 k	4.22 k	5.11 k

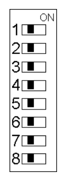
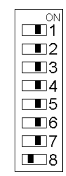
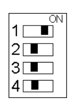
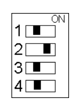
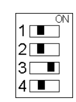
*1.The Product Numbers of the resistors are as follows;

1.78 kΩ	0757-0278
3.16 kΩ	0757-0279
4.22 kΩ	0698-3154
5.11 kΩ	0757-0438

Setting the input signal pull-up resistors

The input signal pull-up resistors are set by using the channel control (/CH0 - /CH5, /CH_VALID) signal pull-up resistor setting switch (S1) and the external trigger (EXT_TRIG) signal pull-up resistor setting switch (S3). For the locations of S1 and S3, see Figure 7-7 on page 195. For how to remove the cover, refer to “Procedure to remove the cover” on page 198.

NOTE The information described here, work performed after removing the cover, is provided for Internal Use Only in the Agilent Technologies service center. Contact the nearest Agilent Technologies service center to change the S1 and S3 settings for use with the scanner interface.

Switch	**Setting of external power supply (EXT_DCV) voltage [V]**			
	5<EXT_DCV≤6	**6<EXT_DCV≤8**	**8<EXT_DCV≤9**	**9<EXT_DCV≤15V**
S1 setting	(factory setting) 			
S3 setting				(factory setting) 

C GPIB Command Table

This section provided the 4268A GPIB command list sorted according to function.

GPIB Command Table

Table C-1 lists the 4268A GPIB commands sorted according to function. Table C-1 additionally provides compatible Agilent 4278A GPIB commands. Refer to Chapter 6, “GPIB Command Reference,” for more detailed information on 4268A to the operation manual of Agilent 4278A for its detailed information.

Table C-1 GPIB Command Table (4268A command v.s. Agilent 4278A command)

Function	Setting/Operation		GPIB Command 4268A	GPIB Command 4278A
Measurement Condition	Reset		:SYSTem:PRESet (page 174), *RST (page 180)	*RST
	Signal	Frequency	:SOURce:FREQuency[:CW] (page 169)	FREQ1, FREQ2
		Level	:SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude] (page 170)	OSC=
		ALC	:SOURce:VOLTage:ALC[:STATe] (page 169)	None
		Output Mode	:SOURce:VOLTage:MODE (page 170)	None
		Source Delay Time	:TRIGger[:SEQuence1]:DELay (page 175)	None
	Parameter	Primary	:CALCulate1:FORMat (page 143)	MPAR1, MPAR2, MPAR3, MPAR4, MPAR5, MPAR6
		Secondary	:CALCulate2:FORMat (page 145)	
	Deviation measurement	On / Off	:CALCulate1:MATH:STATe (page 145), :CALCulate2:MATH:STATe (page 147)	None
		Mode	:CALCulate1:MATH:EXPRession:NAME (page 144), :CALCulate2:MATH:EXPRession:NAME (page 146)	None
		Reference Value	:DATA[:DATA] (page 149)	None
	Range	Auto Range	[:SENSe][:FIMPedance]:RANGe:AUTO (page 167)	RA0
		Range	[:SENSe][:FIMPedance]:RANGe[:UPPer] (page 168)	RA1, RA2, RA3, RA4, RA5, RA6, RA7
	Measurement Time		[:SENSe][:FIMPedance]:APERture[:MODE] (page 166)	ITIM1, ITIM2, ITIM3
	Average	On / Off	[:SENSe]:AVERage[:STATe] (page 159)	None
		Count	[:SENSe]:AVERage:COUNt (page 159)	AVE=
	Cable Length		:CALibration:CABLe (page 148)	CABL0, CABL1, CABL1
	Trigger Delay Time		:TRIGger:SEQuence2:DELay (page 177)	DTIM=
	Trigger Mode		:TRIGger[:SEQuence1]:SOURce (page 176)	TRIG1, TRIG2, TRIG3
Trigger	Triggering		:TRIGger[:SEQuence1][:IMMediate] (page 177), *TRG (page 181)	*TRG
	Trigger System Reset		:ABORt (page 136)	None
	Trigger System Operation		:INITiate[:IMMediate] (page 158)	None
	Trigger System Operation Setting		:INITiate:CONTinuous (page 157)	None

Table C-1 GPIB Command Table (4268A command v.s. Agilent 4278A command)

Function	Setting/Operation		GPIB Command 4268A	GPIB Command 4278A
Data Output	Data Transfer Format setting		:FORMat[:DATA] (page 157)	DFMT1, DFMT2
	Read Data		:DATA[:DATA] (page 149), :FETCh? (page 156), :READ? (page 158)	DATA?
	Data Transfer Format		:FORMat[:DATA] (page 157)	None
	Data Buffer Setting	Data Feed	:DATA:FEED (page 151)	None
		Feed (Yes or No)?	:DATA:FEED:CONTrol (page 152)	None
		Size: Number of Points	:DATA:POINts (page 153)	None
Comparator Function	On / Off		:CALCulate:COMParator[:STATe] (page 143)	COMP0, COMP1
	Primary Parameter Limit	On / Off	:CALCulate:COMParator:PRIMary:BIN{1-9}:STATe (page 141)	None
		Limit Setting	:CALCulate:COMParator:PRIMary:BIN{1-9} (page 140)	BIN1=, BIN2=, BIN3=, BIN4=, BIN5=, BIN6=, BIN7=, BIN8=, BIN9=, BLIM=
		Mode Setting	:CALCulate:COMParator:MODE (page 139)	None
		Reference Value	:CALCulate:COMParator:PRIMary:NOMinal (page 141)	NOM=
	Secondary Parameter Limit	On / Off	:CALCulate:COMParator:SECondary:STATe (page 142)	None
		Area	:CALCulate:COMParator:SECondary:LIMit (page 142)	SLIM=
	AUX BIN Function On / Off		:CALCulate:COMParator:AUXBin (page 136)	AUX0, AUX1
	BIN Count Function	On / Off	:CALCulate:COMParator:COUNt[:STATe] (page 138)	CNT0, CNT1
		Clear Count	:CALCulate:COMParator:COUNt:CLEar (page 138)	RCNT
		Count Data	:CALCulate:COMParator:COUNt:DATA? (page 138)	COUN?
Correction Function	User Correction function On / Off		[:SENSe]:CORRection[:STATe] (page 166)	OPEN0, OPEN1, SHOR0, SHOR1, STD0, STD1
	Load Correction function On / Off		[:SENSe]:CORRection:COLLect:METHod (page 162)	STD0, STD1
	Measure Correction Data		[:SENSe]:CORRection:COLLect[:ACQuire] (page 162)	XOP, XSH, XSTD
	Set Correction Data		[:SENSe]:CORRection:DATA (page 163)	None
	Read Data Correction		[:SENSe]:CORRection:DATA (page 163)	OPM?, STM?, STM?
	Standard Value for Load Correction	Standard value	[:SENSe]:CORRection:CKIT:STANdard3 (page 160)	CSTD=, DSTD=, GSTD=, STR?
		Parameter Type	[:SENSe]:CORRection:CKIT:STANdard3:FORMat (page 161)	SPAR1, SPAR2

Table C-1 GPIB Command Table (4268A command v.s. Agilent 4278A command)

Function	Setting/Operation		GPIB Command 4268A	GPIB Command 4278A
Scanner Function	Multi Channel Correction	On / Off	[:SENSe]:CORRection:MULTiple[:STATe] (page 165)	MCOM0, MCOM1
		Channel Number Setting	[:SENSe]:CORRection:MULTiple:CHANnel (page 164)	CN0=
		Load Standard value (ALL or each channel)	[:SENSe]:CORRection:MULTiple:CKIT:STANdard 3[:STATe] (page 165)	None
Other Measurement Support Functions	Current Monitor	On / Off	:CALCulate3:MATH:STATe (page 147)	None
		Read Display Data	:DATA[:DATA] (page 149)	None
	Voltage Monitor	On / Off	:CALCulate4:MATH:STATe (page 148)	None
		Read Display Data	:DATA[:DATA] (page 149)	None
	Contact Check Function On / Off		[:SENSe][:FIMPedance]:CONTact:VERify (page 167)	None
	Save / Recall	Save	*SAV (page 180)	STOR
		Recall	*RCL (page 180)	LOAD
	Display	On / Off	:DISPlay[:WINDow][:STATe] (page 154)	None
		Display Setting	:DISPlay[:WINDow]:TEXT1[:DATA]:DIGit (page 154)	DDIG4, DDIG5, DDIG6
		Display Page Setting	:DISPlay[:WINDow]:TEXT2:PAGE (page 155)	VMON0, VMON1, VMON2, VMON3, VMON4, VMON5, VMON6
	Key Lock Function On / Off		:SYSTem:KLOCk (page 174)	None
	Beep Output	On / Off	:CALCulate:COMParator:BEEPer[:STATe] (page 137) :SYSTem:BEEPer:STATe (page 173)	None
		Mode	:CALCulate:COMParator:BEEPer:CONDition (page 137)	None
		Beep Sound Output	:SYSTem:BEEPer[:IMMediate] (page 173)	None

Table C-1 GPIB Command Table (4268A command v.s. Agilent 4278A command)

Function	Setting/Operation		GPIB Command 4268A	GPIB Command 4278A
Status Reporting Structure	Clear		*CLS (page 178)	*CLS
	Read Status Byte Register Value		*STB? (page 181)	*STB?
	Mask setting for Service Request Enable Register		*SRE (page 181)	*SRE
	Standard Event Status Register	Read Register Value	*ESR? (page 178)	None
		OPC bit setting when operation completes	*OPC (page 179)	None
		Mask setting for Enable Register	*ESE (page 178)	None
	Standard Operation Status Group	Clear	:STATus:PRESet (page 172)	None
		Read Register Value	:STATus:OPERation:CONDition? (page 171), :STATus:QUEStionable:CONDition? (page 172)	None
		Mask setting for Enable Register	:STATus:OPERation:ENABle (page 171), :STATus:QUEStionable:ENABle (page 172)	None
		Read Event Register Value	:STATus:OPERation[:EVENt]? (page 171), :STATus:QUEStionable[:EVENt]? (page 172)	None
Others	Self Test Operation		*TST? (page 182)	TENT, TNO=, TST, TAB, TDA?, TEND
	Read Product Information		*IDN? (page 179)	*IDN?
	Read Option Information		*OPT? (page 179)	*OPT?
	Read 1 when operation completes		*OPC? (page 179)	None
	Read Error Information		:SYSTem:ERRor? (page 173)	ERR?
	Read SCPI Version		:SYSTem:VERSion? (page 174)	None
	Wait for Command		*WAI (page 182)	None

GPIB Command Table

D 4268A GPIB Command Tree

This appendix provides 4268A GPIB command tree.

Command Tree

Table D-1 shows the 4268A GPIB command tree.

Table D-1 4268A GPIB Command Tree

<table>
<tr><th>Command</th><th>Parameter</th><th>Note</th></tr>
<tr><td>ABORt</td><td></td><td>[No query]</td></tr>
<tr><td>CALCulate</td><td></td><td></td></tr>
<tr><td>:COMParator</td><td></td><td></td></tr>
<tr><td>:AUXBin</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:BEEPer</td><td></td><td></td></tr>
<tr><td>:CONDition</td><td>{PASS|FAIL}</td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:COUNt</td><td></td><td></td></tr>
<tr><td>:CLEar</td><td></td><td>[No query]</td></tr>
<tr><td>:DATA?</td><td></td><td>[Query only]</td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:MODE</td><td>{ABS|DEV|PCNT}</td><td></td></tr>
<tr><td>:PRIMary</td><td></td><td></td></tr>
<tr><td>:NOMinal</td><td><numeric></td><td></td></tr>
<tr><td>:BIN{1|2|3|4|5|6|7|8|9}</td><td><numeric>,<numeric></td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:SECondary</td><td></td><td></td></tr>
<tr><td>:LIMit</td><td><numeric>,<numeric></td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>CALCulate1</td><td></td><td></td></tr>
<tr><td>:FORMat</td><td>{CP|CS}</td><td></td></tr>
<tr><td>:MATH</td><td></td><td></td></tr>
<tr><td>:EXPRession</td><td></td><td></td></tr>
<tr><td>:CATalog?</td><td></td><td>[Query only]</td></tr>
<tr><td>:NAME</td><td>{DEV|PCNT}</td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>CALCulate2</td><td></td><td></td></tr>
<tr><td>:FORMat</td><td>{D|Q|G|RP|RS}</td><td></td></tr>
<tr><td>:MATH</td><td></td><td></td></tr>
<tr><td>:EXPRession</td><td></td><td></td></tr>
<tr><td>:CATalog?</td><td></td><td>[Query only]</td></tr>
<tr><td>:NAME</td><td>{DEV|PCNT}</td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>CALCulate3</td><td></td><td></td></tr>
<tr><td>:MATH</td><td></td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>CALCulate4</td><td></td><td></td></tr>
<tr><td>:MATH</td><td></td><td></td></tr>
<tr><td>:STATe</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>CALibration</td><td></td><td></td></tr>
<tr><td>:CABle</td><td><numeric></td><td></td></tr>
<tr><td>DATA</td><td></td><td></td></tr>
<tr><td>[:DATA]</td><td>{REF1|REF2},<numeric></td><td></td></tr>
<tr><td>[:DATA]?</td><td>{BUF1|BUF2}</td><td>[Query only]</td></tr>
<tr><td></td><td>{IMON|VMON}</td><td>[Query only]</td></tr>
<tr><td>:FEED</td><td>{BUF1|BUF2},{"CALCulate1"|"CALCulate2"|""}</td><td></td></tr>
<tr><td>:CONTrol</td><td>{BUF1|BUF2},{ALWays|NEVer}</td><td></td></tr>
<tr><td>:POINts</td><td>{BUF1|BUF2},<numeric></td><td></td></tr>
</table>

Table D-1 4268A GPIB Command Tree

<table>
<tr><th colspan="6">Command</th><th>Parameter</th><th>Note</th></tr>
<tr><td colspan="6">DISPlay</td><td></td><td></td></tr>
<tr><td></td><td colspan="5">[:WINDow]</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:TEXT1</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:DATA]</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">:DIGit</td><td><numeric></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:TEXT2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:PAGE</td><td><numeric></td><td></td></tr>
<tr><td colspan="6">FETCh?</td><td></td><td>[Query only]</td></tr>
<tr><td colspan="6">FORMat</td><td></td><td></td></tr>
<tr><td></td><td colspan="5">[:DATA]</td><td>{ASCii|REAL[,64]}</td><td></td></tr>
<tr><td colspan="6">INITiate</td><td></td><td></td></tr>
<tr><td></td><td colspan="5">:CONTinuous</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td colspan="5">[:IMMediate]</td><td></td><td>[No query]</td></tr>
<tr><td colspan="6">READ?</td><td></td><td>[Query only]</td></tr>
<tr><td colspan="6">[SENSe]</td><td></td><td></td></tr>
<tr><td></td><td colspan="5">:AVEage</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:COUNt</td><td><numeric></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td colspan="5">[:FIMPedance]</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:APERture</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:MODE]</td><td>{SHORt|MEDium|LONG}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:CONT</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:VERify</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:RANGe</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:AUTO</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:UPPer]</td><td><numeric>[PF|P|NF|N|UF|U|MF|M|F]</td><td></td></tr>
<tr><td></td><td colspan="5">:CORRection</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:CKIT</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:STANdard3</td><td><numeric>,<numeric></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">:FORMat</td><td>{CPD|CPQ|CPG|CPRP|CSD|CSQ|CSRS}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:COLLect</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:ACQuire]</td><td>{STANdard1|STANdard2|STANdard3}</td><td>[No query]</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:METHod</td><td>{REFL2|REFL3}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:DATA</td><td>{STANdard1|STANdard2|STANdard3},<numeric></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:MULTiple</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:CHANnel</td><td><numeric></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">:CKIT</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">:STANdard3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td colspan="6">SOURce</td><td></td><td></td></tr>
<tr><td></td><td colspan="5">:FREQuency</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">[:CW]</td><td><numeric>[HZ|KHZ|K]</td><td></td></tr>
<tr><td></td><td colspan="5">:VOLTage</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:ALC</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">[:LEVel]</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">[:IMMediate]</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">[:AMPLitude]</td><td><numeric>[MV|M|V]</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">:MODE</td><td>{CONTinuous|SYNChronous}</td><td></td></tr>
</table>

Table D-1 4268A GPIB Command Tree

Command			Parameter	Note
STATus				
	:OPERation			
		:CONDition?		[Query only]
		:ENABle	<numeric>	
		[:EVENt]?		[Query only]
	:PRESet			[No query]
	:QUEStionable			
		:CONDition?		[Query only]
		:ENABle	<numeric>	
		[:EVENt]?		[Query only]
SYSTem				
	:BEEPer			
		[:IMMediate]		[No query]
		:STATe	{ON|OFF|1|0}	
	:ERRor?			[Query only]
	:KLOCk		{ON|OFF|1|0}	
	:PRESet			[No query]
	:VERSion?			[Query only]
TRIGger				
	[:SEQuence1]			
		:DELay	<numeric>[MS|M|S]	
		[:IMMediate]		[No query]
		:SOURce	{INTernal|MANual|EXTernal|BUS}	
	:SEQuence2			
		:DELay	<numeric>[MS|M|S]	

E Overload/No-Contact Operation

This appendix provides a summary of operations when the Agilent Technologies detects Overload, No-Contact, or Display-Range-Over.

Overload/No-Contact Operation

Table E-1 summarizes the operations when the following phenomena are detected.

- Overload: Measurement value is out of the measurable range.
- No-Contact: The contact failure is detected in contact check.
- Overload & No-Contact: Overload and No-Contact are detected at the same time.
- Display-Range-Over: Measurement value is out of the display range (refer to “Display range of measurement value” on page 227).

Table E-1 Overload/No-Contact Operation

	Display			GPIB Output			Handler Output
	Measurement value	Voltage / Current monitor value	Comparator result	Measurement status	Measurement value	Comparator result	
Overload	OVLD	***	****	1	9.9E37	11	/OVLD
No-Contact	N.C.	***	****	2	9.9E37	11	/NO_CONTACT
Overload & No-Contact	OVLD N.C.	***	****	3	9.9E37	11	/OVLD, /NO_CONTACT
Display-Range -Over	-------	---	Normal operation	Normal operation	Normal operation	Normal operation	Normal operation

NOTE If the measurement value is out of the display range it will not appear on the display. However, the measurement remains in normal operation.

F Initial settings

This appendix provides initial settings and information on the settings that can be saved/recalled and those that can be backed up.

Initial Settings and Settings that can be Backed up

Table F-1 shows the following items.

- Initial settings (factory settings)
- Settings reset from the front panel or the GPIB by ":SYSTem:PRESet" on page 174
- Settings reset from the GPIB by "*RST" on page 180
- Settings that can be saved/recalled

  Table F-1 uses the following symbols.

  ● : Settings that can be saved/recalled

  × : Settings that cannot be saved/recalled

- Settings that can be backed up

  Table F-1 uses the following symbols.

  ❍ : Settings that can be backed up in the back-up memory (maximum 72 hours)

  ● : Settings that can be backed up in the EEPROM

  × : Settings that cannot be backed up

Table F-1 Initial settings and settings that can be backed up

Setting items		Initial setting (Factory settings)	Reset: Front Panel key (:SYST:PRES)	Reset: *RST	Save/ Recall	Backup
Measurement signal	Frequency	1000[Hz]	←	←	●	❍
	Level	1[V]	←	←	●	❍
	ALC	off	←	←	●	❍
	Sync/Cont	Cont	←	←	●	❍
	Souece delay time	0	←	←	●	❍
Measurement parameter	Primary	CP	←	←	●	❍
	Secondary	D	←	←	●	❍
Deviation measurement	On/Off	Off	←	←	●	❍
	Mode	DEV(ABS)	←	←	●	❍
	Reference value	0	←	←	●	❍
Measurement range	Ranging	Auto	←	←	●	❍
	Range	10μF Range	←	←	●	❍
Measurement time		MED	←	←	●	❍

Table F-1 Initial settings and settings that can be backed up

Setting items			Initial setting (Factory settings)	Reset		Save/ Recall	Backup
				Front Panel key (:SYST:PRES)	*RST		
Averaging	On/Off		On	←	←	●	❍
	Number		1	←	←	●	❍
Cable length			0	←	←	●	❍
Trigger	Mode		Int	←	←	●	❍
	Delay time		0	←	←	●	❍
	:INIT:CONT		On	←	Off	×	×
Contact check function			Off	←	←	●	❍
Comparator	On/Off		Off	←	←	●	❍
	Limit On/Off	BIN1	On	←	←	●	❍
		BIN2-9	Off	←	←	●	❍
		Secondary parameter	On	←	←	●	❍
	Limit settings	Upper limit	0	←	←	●	❍
		Lower limit	0	←	←	●	❍
		Mode	ABS	←	←	●	❍
		Reference value	0	←	←	●	❍
	AUX BIN function On/Off		Off	←	←	●	❍
	BIN count On/Off		Off	←	←	●	❍
Beep output	On/Off		On	←	←	●	❍
	mode		FAIL	←	←	●	❍
Voltage/Current monitor function			Off	←	←	●	❍
Display	On/Off		On	←	←	●	❍
	Digit		5	←	←	●	❍
	Page		1	←	←	●	❍
User correction function			On	←	Off	●	❍
Open correction value			0[S]	←	←	×	❍
Short correction value			0[Ω]	←	←	×	❍

Table F-1 Initial settings and settings that can be backed up

Setting items			Initial setting (Factory settings)	Reset		Save/ Recall	Backup
				Front Panel key (:SYST:PRES)	*RST		
Load correction	On/Off		Off	←	←	●	❍
	Primary parameter	Correction value	1[μF]	←	←	×	❍
		Standard value	1[μF]	←	←	×	❍
		Type	CP	←	←	●	❍
	Secondary parameter	Correction value	0.001	←	←	×	❍
		Standard value	0.001	←	←	×	❍
		Type	D	←	←	●	❍
Multi channel correction	On/Off		Off	←	←	●	❍
	Channel Number		0	←	←	●	❍
	Load standard value setting (ALL channnel or each channel)		ALL channel	←	←	●	❍
	Correction value		—	No effect	←	×	●
	Load standard value		—	No effect	←	×	●
Data transfer format			ASCII	←	←	×	×
Data buffer	Feed data		None	←	←	×	×
	Feed/Not feed		Not feed	←	←	×	×
	Size (Number of point)		200	←	←	×	×
Key lock On/Off			Off	No effect	Off	×	×
Standard event status register value			0	No effect	←	×	×
Service request enable register value			0	No effect	←	×	×
Register value of standard operation status group			0	←	←	×	×
GPIB address			17	No effect	←	×	●

"←" in Table F-1 indicates that the value is the same as that indicated to the left.

G Accessories

This appendix provides available accessories for the 4268A.

Accessories

Agilent 16034E	Test Fixture (for SMD or Chip type DUT)
Agilent 16034G	Test Fixture (for SMD or Chip type DUT)
Agilent 16034H	Test Fixture (for SMD or Chip type DUT)
Agilent 16044A	Test Fixture (4-terminal contact, for SMD or Chip type DUT)
Agilent 16047A	Test Fixture (for Axial or Radial DUT)
Agilent 16047B	Test Fixture (for Axial or Radial DUT)
Agilent 16047C	HF Test Fixture (for Axial or Radial DUT)
Agilent 16047D	Test Fixture (for Axial or Radial DUT)
Agilent 16048A	Test Leads (1 m, BNC)
Agilent 16048B	Test Leads (1 m, SMC)
Agilent 16048D	Test Leads (2 m, BNC)
Agilent 16065A	External Bias Test Fixture
Agilent 16065C	External Bias Adapter
Agilent 16085B	Terminal Adapter: Converts 4 terminal pair connector to APC7 connector.
Agilent 16089A	Kelvin Clip Leads (1 m, two large clips)
Agilent 16089B	Kelvin Clip Leads (1 m, two medium clips)
Agilent 16089C	Kelvin Clip Leads (1 m, two IC clips)
Agilent 16089D	Alligator Clip Leads (1 m, four medium clips)
Agilent 16089E	Kelvin Clip Leads (1 m, two large clips)
Agilent 16092A[*1]	RF Spring Clip
Agilent 16093A[*1]	RF Two-Terminal Binding Post
Agilent 16093B[*1]	RF Three-Terminal Binding Post
Agilent 16191A[*1]	Side Electrode SMD Test Fixture
Agilent 16192A[*1]	Parallel Electrode SMD Test Fixture
Agilent 16193A[*1]	Small Side Electrode SMD Test Fixture
Agilent 16334A	Test Fixture (for SMD or Chip type DUT)
Agilent 16451B	Dielectric Test Fixture
Agilent 16452A	Magnetic Test Fixture

*1.Agilent 16085B adapter required.

NOTE It is possible that available accessories have been changed. Refer to the most recent accessories catalogue for the latest information.

H 4268A vs. 4288A GPIB Command Correspondence Table

This appendix gives the correspondence between the Agilent 4268A GPIB commands and those of the Agilent 4288A.

4268A vs. 4288A GPIB Command Correspondence Table

Table H-1 (by function) and Table H-2 (by alphabetical order) provide at-a-glance lists of the GPIB command correspondences between the 4268A and the 4288A.

Table H-1 At-a-glance GPIB command correspondence between 4268A and 4288A (by function)

Function	Item to Be Set Up/Executed		GPIB command		Note
			4268A	4288A	
Measurement condition	Reset		**:SYST:PRES**	←	The 4288A does not reset compensation data.
			***RST**	←	
	Measurement parameter setup	Primary parameter	**:CALC1:FORM**	←	
		Secondary parameter	**:CALC2:FORM**	←	
	Measurement signal setup	Frequency	**:SOUR:FREQ**	←	
		1 MHz frequency shift	N/A	**:SYST:FSH**	
		Level	**:SOUR:VOLT**	←	
		Auto level control (ALC) function ON/OFF	**:SOUR:VOLT:ALC**	N/A	The 4288A does not support the ALC function.
		Output mode	**:SOUR:VOLT:MODE**	N/A	The 4288A does not support the synchronous source function.
	Measurement range setup	Ranging (auto/manual)	**:RANG:AUTO**	←	
		Range	**:RANG**	←	
	Measurement time mode setup		**:APER**	←	
	Averaging setup	ON/OFF	**:AVER**	←	
		Number of counts	**:AVER:COUN**	←	
	Cable length setup		**:CAL:CABL**	←	
	Source delay setup		**:TRIG:DEL**	N/A	The 4288A supports only trigger delay.
	Trigger delay setup		**:TRIG:SEQ2:DEL**	**:TRIG:DEL**	
	Trigger mode setup		**:TRIG:SOUR**	←	

Table H-1 At-a-glance GPIB command correspondence between 4268A and 4288A (by function)

Function	Item to Be Set Up/Executed		GPIB command 4268A	GPIB command 4288A	Note
Compensation	Entire compensation set ON/OFF		**:CORR**	N/A	The 4268A turns on/off all types of compensation. (Only the LOAD compensation can be turned on/off separately.) The 4288A turns on/off OPEN/SHORT/LOAD compensation individually.
	OPEN compensation ON/OFF		N/A	**:CORR:OPEN**	
	SHORT compensation ON/OFF		N/A	**:CORR:SHOR**	
	LOAD compensation ON/OFF		**:CORR:COLL:METH**	**:CORR:LOAD**	
	LOAD standard definition	Value setup	**:CORR:CKIT:STAN3**	←	
		Definition parameter setup	**:CORR:CKIT:STAN3:FORM**	←	
	Compensation data	Measurement	**:CORR:COLL**	←	
		setup and read out	**:CORR:DATA**	←	
	Offset compensation ON/OFF		N/A	**:CORR:OFFS**	The 4268A does not support the offset compensation.
	Offset compensation data setup		N/A	**:CORR:OFFS:DATA**	
Scanner(multi compensation)	ON/OFF		**:CORR:MULT**	←	
	Channel setup		**:CORR:MULT:CHAN**	←	
	LOAD standard definition method setup		**:CORR:MULT:CKIT:STAN3**	←	
Trigger	Triggers a measurement		**:TRIG**, ***TRG**	←	
	Trigger mode setup		**:TRIG:SOUR**	←	
	Trigger delay time setup		**:TRIG:SEQ2:DEL**	**:TRIG:DEL**	
	Trigger system	Resets	**:ABOR**	←	
		Initiates	**:INIT**	←	
		Continuous activation ON/OFF	**:INIT:CONT**	←	
Measured data output	Data transfer format setup		**:FORM**	←	The 4288A also controls data transfer format of compensation data.
	Data readout	Measurement result	**:FETC?**, **:READ?**	←	
		Data buffer	**:DATA? {BUF1|BUF2}**	←	The 4288A can also use BUF3.
		Measurement signal monitor result	**:DATA? {IMON|VMON}**	←	
	Data buffer setup	Feeding target parameter	**:DATA:FEED**	←	
		Control (feed/not feed)	**:DATA:FEED:CONT**	←	
		Buffer size	**:DATA:POIN**	←	

4268A vs. 4288A GPIB Command Correspondence Table

Table H-1 At-a-glance GPIB command correspondence between 4268A and 4288A (by function)

Function	Item to Be Set Up/Executed		GPIB command 4268A	GPIB command 4288A	Note
Comparator	ON/OFF		:CALC:COMP	←	
	Limit range reset		N/A	:CALC:COMP:CLE	
	Primary parameter limit range setup	ON/OFF	:CALC:COMP:PRIM:BIN{1-9}:STAT	←	
		Lower/Upper Limit value	:CALC:COMP:PRIM:BIN{1-9}	←	
		Limit range designation method (mode selection)	:CALC:COMP:MODE	←	
		Reference (nominal) value	:CALC:COMP:PRIM:NOM	←	
	Secondary parameter limit range setup	ON/OFF	:CALC:COMP:SEC:STAT	←	
		Lower/Upper Limit value	:CALC:COMP:SEC:LIM	←	
	AUX BIN function ON/OFF		:CALC:COMP:AUXB	←	
	Low C reject function	ON/OFF	N/A	:CREJ	The 4268A does not support the Low C reject function.
		Limit value setup	N/A	:CREJ:LIM	
	BIN count function	ON/OFF	:CALC:COMP:COUN	←	
		Resets all count values	:CALC:COMP:COUN:CLE	←	
		Readout of count values	:CALC:COMP:COUN:DATA?	←	
		Readout of count value of overload	N/A	:CALC:COMP:COUN:OVLD?	The 4268A cannot count overload.
		Readout of count values for each channel	N/A	:CALC:COMP:COUN:MULT:DATA?	The 4268A cannot count for each channel.
		Readout of count value of overload for each channel	N/A	:CALC:COMP:COUN:MULT:OVLD?	
Measurement signal monitor	Current monitor	ON/OFF	:CALC3:MATH:STAT	←	
		Monitor value readout	:DATA? IMON	←	
	Voltage monitor	ON/OFF	:CALC4:MATH:STAT	←	
		Monitor value readout	:DATA? VMON	←	
Save/Recall	Save		*SAV	←	
	Recall		*RCL	←	

Table H-1 At-a-glance GPIB command correspondence between 4268A and 4288A (by function)

Function	Item to Be Set Up/Executed			GPIB command: 4268A	GPIB command: 4288A	Note
Display	ON/OFF			**:DISP**	←	
	Number of digits setup			**:DISP:TEXT1:DIG**	←	
	Fixed point display setup	ON/OFF		N/A	**:DISP:TEXT1:FMSD**	The 4268A has a fixed floating point display.
		the value of the highest digit		N/A	**:DISP:TEXT1:FMSD:DATA**	
	Deviation measurement mode setup	Primary parameter	ON/OFF	**:CALC1:MATH:STAT**	←	
			Mode	**:CALC1:MATH:EXPR:NAME**	←	
		Secondary parameter	ON/OFF	**:CALC2:MATH:STAT**	←	
			Mode	**:CALC2:MATH:EXPR:NAME**	←	
		Reference value		**:DATA {REF1|REF2}**	←	
	Setup of displayed page of the instrument setup display area			**:DISP:TEXT2:PAGE**	←	
Contact check	ON/OFF			**:CONT:VER**	N/A	The 4288A does not support the contact check function.
Key lock	ON/OFF			**:SYST:KLOC**	←	
Beeper	ON/OFF			**:CALC:COMP:BEEP** **:SYST:BEEP:STAT**	←	
	Beep mode setup			**:CALC:COMP:BEEP:COND**	←	
	Generation of a beep			**:SYST:BEEP**	←	
Status report structure	Clear			***CLS**	←	
	Status byte register value readout			***STB?**	←	
	Service request enable register setup			***SRE**	←	
	Standard event status register	Register value readout		***ESR?**	←	
		OPC bit setup		***OPC**	←	
		Enable register setup		***ESE**	←	
	Operation status register	Clear		**:STAT:PRES**	←	
		Condition register value readout		**:STAT:OPER:COND?**	←	
		Enable register setup		**:STAT:OPER:ENAB**	←	
		Event register value readout		**:STAT:OPER?**	←	
Others	Executes self-test			***TST?**	←	
	Readout of the model name and firmware version			***IDN?**	←	
	Readout of the installed option number			***OPT?**	←	
	Reads 1 when operation completes			***OPC?**	←	
	Readout of the occurred error information			**:SYST:ERR?**	←	
	Readout of SCPI version			**:SYST:VERS?**	←	
	Waits for the completion of operation			***WAI**	←	

The "←" symbol in Table H-1 indicates that the value is the same as that of the 4268A.

4268A vs. 4288A GPIB Command Correspondence Table

Table H-2 At-a-glance GPIB command correspondence between 4268A and 4288A (by alphabetical order)

4268A	4288A
[:A]	
:ABORt	←
[:C]	
:CALCulate:COMParator:AUXBin	←
:CALCulate:COMParator:BEEPer:CONDition	←
:CALCulate:COMParator:BEEPer[:STATe]	←
:CALCulate:COMParator:COUNt:CLEar	←
:CALCulate:COMParator:COUNt:DATA?	←
:CALCulate:COMParator:COUNt[:STATe]	←
:CALCulate:COMParator:MODE	←
:CALCulate:COMParator:PRIMary:BIN{1-9}	←
:CALCulate:COMParator:PRIMary:BIN{1-9}:STATe	←
:CALCulate:COMParator:PRIMary:NOMinal	←
:CALCulate:COMParator:SECondary:LIMit	←
:CALCulate:COMParator:SECondary:STATe	←
:CALCulate:COMParator[:STATe]	←
:CALCulate1:FORMat	←
:CALCulate1:MATH:EXPRession:CATalog?	←
:CALCulate1:MATH:EXPRession:NAME	←
:CALCulate1:MATH:STATe	←
:CALCulate2:FORMat	←
:CALCulate2:MATH:EXPRession:CATalog?	←
:CALCulate2:MATH:EXPRession:NAME	←
:CALCulate2:MATH:STATe	←
:CALCulate3:MATH:STATe	←
:CALCulate4:MATH:STATe	←
:CALibration:CABLe	←
[:D]	
:DATA[:DATA]	←
:DATA:FEED	←
:DATA:FEED:CONTrol	←
:DATA:POINts	←
:DISPlay[:WINDow][:STATe]	←
:DISPlay[:WINDow]:TEXT1[:DATA]:DIGit	←
:DISPlay[:WINDow]:TEXT2:PAGE	←
[:F]	
:FETCh?	←
:FORMat[:DATA]	←
[:I]	
:INITiate:CONTinuous	←
:INITiate[:IMMediate]	←
[:R]	
:READ?	←
[:S]	
[:SENSe]:AVERage:COUNt	←
[:SENSe]:AVERage[:STATe]	←
[:SENSe]:CORRection:CKIT:STANdard3	←
[:SENSe]:CORRection:CKIT:STANdard3:FORMat	←
[:SENSe]:CORRection:COLLect:METHod	[:SENSe]:CORRection:LOAD[:STATe]
[:SENSe]:CORRection:COLLect[:ACQuire]	←
[:SENSe]:CORRection:DATA	←
[:SENSe]:CORRection:MULTiple:CHANnel	←
[:SENSe]:CORRection:MULTiple:CKIT:STANdard3[:STATe]	←

Table H-2 **At-a-glance GPIB command correspondence between 4268A and 4288A (by alphabetical order)**

4268A	4288A
[:SENSe]:CORRection:MULTiple:[:STATe]	←
[:SENSe]:CORRection:[:STATe]	N/A
[:SENSe][:FIMPedance]:APERture[:MODE]	←
[:SENSe][:FIMPedance]:CONTact:VERify	N/A
[:SENSe][:FIMPedance]:RANGe:AUTO	←
[:SENSe][:FIMPedance]:RANGe[:UPPer]	←
:SOURce:FREQuency[:CW]	←
:SOURce:VOLTage:ALC[:STATe]	N/A
:SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]	←
:SOURce:VOLTage:MODE	N/A
:STATus:OPERation:CONDition?	←
:STATus:OPERation:ENABle	←
:STATus:OPERation[:EVENt]?	←
:STATus:PRESet	←
:STATus:QUEStionable:CONDition?	←
:STATus:QUEStionable:ENABle	←
:STATus:QUEStionable[:EVENt]?	←
:SYSTem:BEEPer[:IMMediate]	←
:SYSTem:BEEPer:STATe	←
:SYSTem:ERRor?	←
:SYSTem:KLOCk	←
:SYSTem:PRESet	←
:SYSTem:VERSion?	←
[:T]	
:TRIGger[:SEQuence1]:DELay	N/A
:TRIGger[:SEQuence1]:SOURce	←
:TRIGger[:SEQuence1][:IMMediate]	←
:TRIGger:SEQuence2:DELay	:TRIGger[:SEQuence1]:DELay
[*]	
*CLS	←
*ESE	←
*ESR?	←
*IDN?	←
*OPC	←
*OPC?	←
*OPT?	←
*RCL	←
*RST	←
*SAV	←
*SRE	←
*STB?	←
*TRG	←
*TST?	←
*WAI	←

The "←" symbol in Table H-2 indicates that the value is the same as that of the 4268A.

4268A vs. 4288A GPIB Command Correspondence Table

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