7351A/E

Digital Multimeter

Operation Manual

MANUAL NUMBER FOE-8440238F00

Applicable Models
7351A
7351E

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

This chapter describes the contents of this manual and the product overview of the 7351 Series Digital Multimeter.

1.1 Contents of this Manual

This manual can be used by novices or experienced users of this instrument. This manual can be read from Chapter 1 to learn more about this instrument or it can be used as a reference. Refer to the table of contents, which is found at the beginning of each chapter, and directly jump to the required section.

The contents of each chapter are as follows.

Chapter 1. INTRODUCTION	This chapter describes the contents of this manual and the product overview.
Chapter 2. PRECAUTIONS	This chapter describes precautions when using this instrument. Read this chapter before using this instrument.
Chapter 3. SETUP	This chapter describes how to setup this instrument. After setting up this instrument in an appropriate location, turn on the power and check that this instrument starts correctly.
Chapter 4. QUICK START	This chapter describes the function of each section on the panels of this instrument and how to operate this instrument.
Chapter 5. MENU OPERATION AND FUNCTION DESCRIPTION	This chapter describes the menu structure and functions of this instrument.
Chapter 6. HOW TO USE THE INTERFACE	This chapter describes how to use the interface of this instrument.
Chapter 7. SPECIFICATIONS	This chapter describes the specifications of this instrument.
Chapter 8. MAINTENANCE	This chapter describes how to care for this instrument such as cleaning, calibration, and storage to maintain the high performance and smooth functioning of this instrument. This chapter also describes how to identify problems and the relevant procedures to follow.

1.2 Product Overview

This digital multimeter includes the AD converter of the integration type.

This multimeter is ideal for use as a stand-alone product or in a system.

The main features of this instrument are as follows:

- Simple and easy panel operations, and flexible and various system functions by using menus
- Large and visible fluorescent display
- Wide dynamic range: Maximum display of 199999
- High sensitivity: 1 μV in the DC voltage measurement
- Wide dynamic range: 1 μA to 10 A in the DC current measurement
- Low power resistance measurement function that reduces the self-heating effect of the device
- The USB, GPIB, RS-232, trigger input, and measurement complete signal output are organized as a series with this instrument, and a PC can easily be connected.
- A large variety of calculation functions that can be combined.
- Four files of setting parameters can be saved.
- Conventional and SCPI command systems are included as standard with this instrument.

NOTE: ***The RS-232 is a factory option that is applied to the 7351E only. This option cannot be added after instrument delivery.***

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2. PRECAUTIONS

This chapter describes precautions when using this instrument. Read this chapter before using this instrument.

CAUTION: ***Using this instrument while it is stood on end or stacked with other products is unstable and dangerous.***
Do not push or place heavy loads on this instrument.

2.1 If a Fault Occurs

If any smoke, smell, or noise emanates from this instrument, disconnect this instrument from the power supply by removing the power cable. Contact an ADC CORPORATION sales representative immediately.

2.2 Removing the Case

The case of this instrument should only be opened by ADC CORPORATION service engineers.

WARNING: ***This instrument contains high-voltage and high temperature parts which may cause electrical shocks or burns.***

2.3 Power Fuse

This instrument is protected from overcurrent by a power fuse.

The power fuse, which is located on the rear panel, cuts the power supply if an overcurrent flows. If the power fuse was blown, remove the power cable and separate between the power supply and this instrument. There may be some problems in this instrument and request an ADC CORPORATION sales representative to repair it.

2.4 Electromagnetic Interference

This instrument may cause electromagnetic interference and affect television and radio. If this instrument's power is turned off and any electromagnetic interference that may be present is reduced, then this instrument has caused the interference.

Electromagnetic interference from this instrument may be prevented by the following precautions.

- Changing the direction of the antenna of the television or radio.
- Placing this instrument on the opposite side of the television or radio.
- Placing this instrument away from the television or radio.
- Using a different power source for the television or radio, and this instrument.

In an area where the electric field strength is high, high-frequency noise will occur on a DUT or input cable, and that noise may affect the measured value.

In this case, shield the DUT and input cable from high-frequency noise.

2.5 Note When Turning on the Power

When turning on the power, do not connect any DUTs.

3. SETUP

This chapter describes how to set up this instrument on delivery. The following topics are covered in this chapter.

3.1 Inspection on Delivery

3.2 Installation Environment

3.3 Accessories

3.4 Power Requirements

3.1 Inspection on Delivery

After receiving the product, inspect the outside and the accessories according to the following procedure.

1. Check that the shipping container and the cushioning material are not damaged.

   IMPORTANT: ***If the shipping container or the cushioning material is damaged, keep them until the following inspections are complete.***

2. Check that the outside of the product is not damaged.

   WARNING: ***If any outside components of the product such as the cover, panel (front or rear), power switch, or connector are damaged, do not turn on the power. Doing so may cause an electrical shock.***

3. Check that the standard accessories listed in Table 3-1 are complete and not damaged.

If any of the following occur, contact an ADC CORPORATION sales representative.

- The shipping container or the cushioning material is damaged, or signs of stress are found.
- The outside of the product is damaged.
- The standard accessories are incomplete or are damaged.
- Defects are found in the operation check.

Table 3-1 Standard Accessories

Name	Model	Quantity	Remarks
Power cable	A01402	1	*1
Input cable (Red, Black)	CC010001	Each 1	
Power Fuse (For 100V/120V)	DFT-AAR25A-1	1	*2
Power Fuse (For 220V/240V)	DFT-AAR16A-1		
Overcurrent protection fuse	DFS-AN2A-1	1	
Operation manual	E7351A/E	1	This manual

*1: The power cable included in this instrument depends on the option that was specified when this instrument was purchased (see “Safety Summary”).
Quote the model name or option number when ordering the power cable.

*2: Either one is included according to the specified option.

NOTE: Quote the model name of the accessory when ordering.

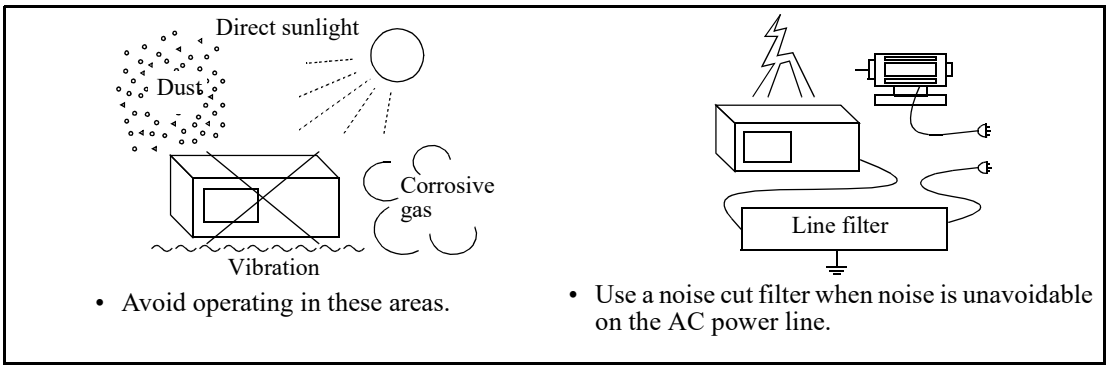
3.2 Installation Environment

This section describes the environment into which this instrument should be installed.

3.2.1 Operating Environment

Install this instrument in an environment in which the following conditions are satisfied.

- Ambient temperature: 0 °C to +50 °C (operating temperature)
  -25 °C to +70 °C (storage temperature)
- Relative humidity: 85 percent or less with no condensation
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A low noise area
  Although this instrument has been designed to withstand a certain amount of noise from the AC power line, it should be used in a low noise area. Use a noise cut filter if ambient noise is unavoidable.



- Avoid operating in these areas.
- Use a noise cut filter when noise is unavoidable on the AC power line.

Figure 3-1 Operating Environment

NOTE: ***Warm-up***
After this instrument reaches room temperature, turn on the power and warm up for 60 minutes or more to perform the high accuracy measurement.

3.2.2 Protecting Against Electrostatic Discharge

To prevent semiconductors from being damaged by electrostatic discharge (ESD), the precautions shown below should be taken. We recommend combining two or more countermeasures to prevent damage from ESD.

(Static electricity can be generated easily by the movement of a person or the friction against insulation.)

Table 3-2 ESD Countermeasures

Human Body	Use a wrist strap (See Figure 3-2).
Work floor	Install a conductive mat, use conductive shoes, and connect to earth. (See Figure 3-2)
Workbench	Install a conductive mat and connect to earth. (See Figure 3-3)

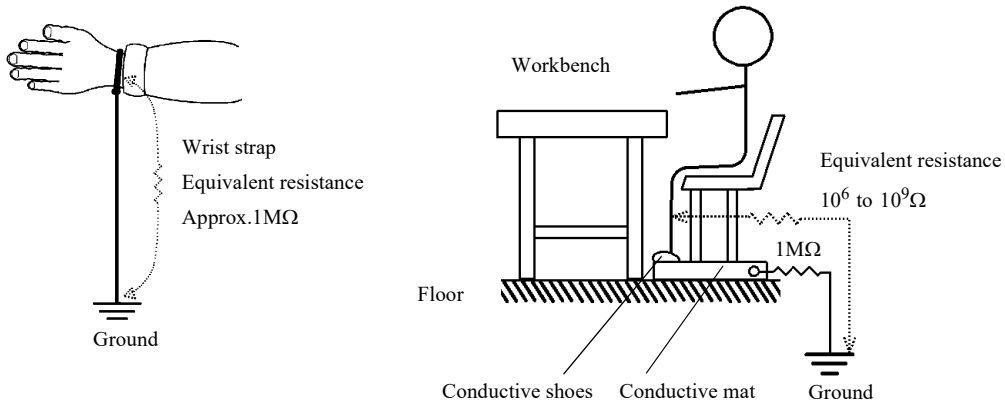


Figure 3-2 Electrostatic Countermeasures for the Work Floor and Human Body

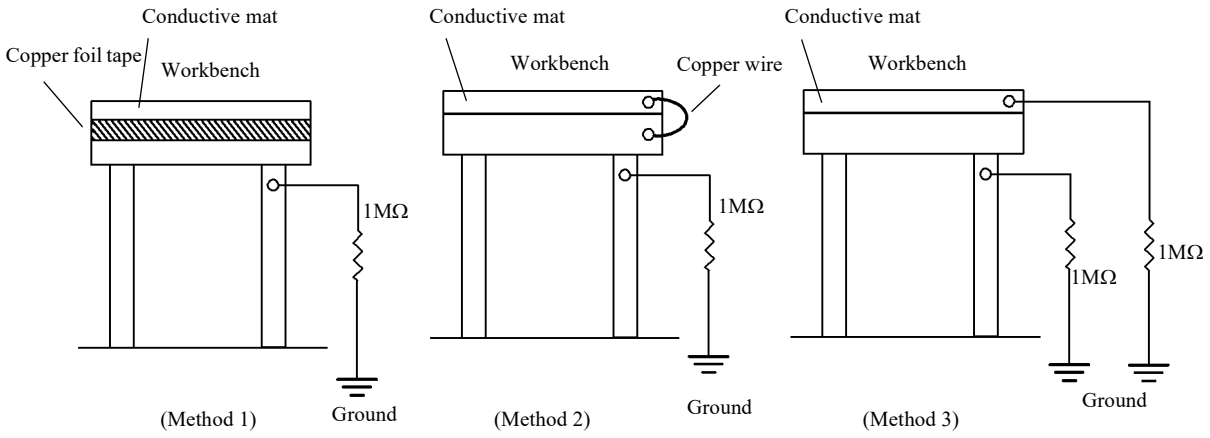


Figure 3-3 Electrostatic Countermeasures for the Workbench

3.3 Accessories

The accessories of this instrument are shown in Table 3-3.

This section describes the accessories necessary to use this instrument.

Table 3-3 Accessories

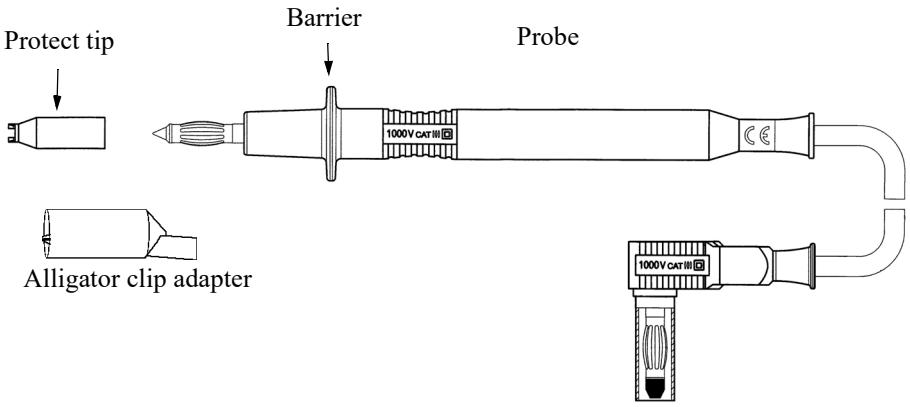
Name	Model	Remarks
Input cable	CC010001	Standard Accessory
	A01001	Shielded cable 33 VAC and 70 VDC or less
Alligator clip adapter	CC015001	33 VAC and 70 VDC or less
Terminal adapter	TR1111	
JIS rack-mount set	A02263	
	A02264	Twins
EIA rack-mount set	A02463	
	A02464	Twins
Panel-mount set	A02039	
	A02040	Twins
RS-232 cable	A01265	

3.3.1 Input Cable

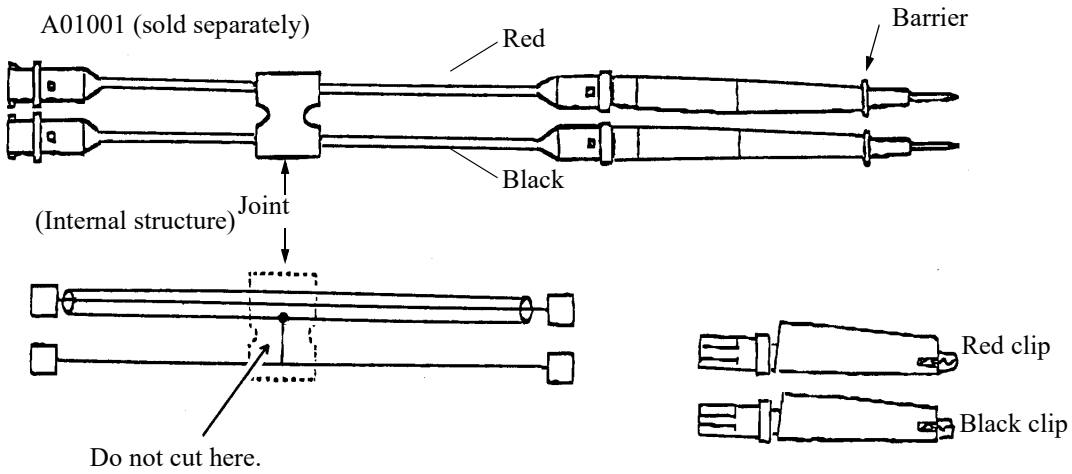
1. The standard input cable (CC010001) consists of red and black and it can be used easily.

CAUTION: ***Handle the input cable with caution because it has a sharp tip. The rating of the alligator clip adapter is 33 VAC and 70 VDC or less.***

WARNING: ***Must not touch the metal part of the input cable to prevent any damage of electrical shock.***



2. To reduce the effects of short-term stability in high resistance (in the order of MΩ) or high sensitivity (in the order of μV) measurements, use the optional input cable A01001 in which the HI side is shielded.



The red wire of A01001 is shielded. Do not cut the joint.

The rating of the probe decreases to 33 VAC and 70 VDC when the alligator clip adapter is attached.

3.3.2 Caution when Connecting Peripherals

When making up a system, which consists of two or more devices, be careful of the following:

1. Before connecting this instrument to a controller and peripherals, check that each device operates correctly according to each manual.
2. Do not use too long a cable to connect the instrument or controller.
3. Use shielded cables which are connected between peripherals.

Setting up the USB port

To use the USB interface of this instrument, the USB driver of our ADC instrument must be installed in a personal computer.

The USB driver of the ADC instrument can be downloaded from the following our home page.

URL http://www.adcmt.com

For more information on how to install the driver, refer to the operation manual that is included in the driver file.

3.4 Power Requirements

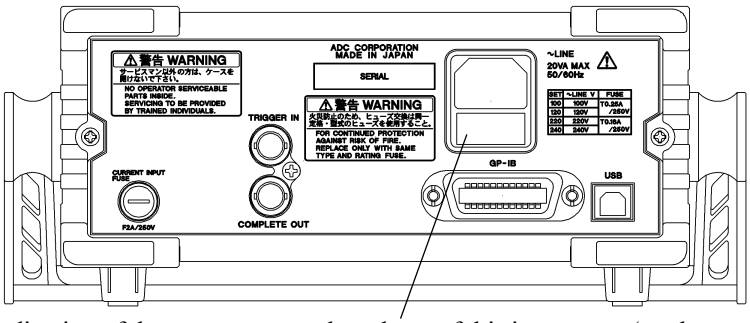
This section describes power requirements and how to connect the power cable.

3.4.1 Checking the Power Supply Voltage

Check that the power supply voltage setting on the rear panel of this instrument accords with the AC power supply voltage to be used.

Table 3-4 Relation Table between AC Power Supply Voltage and Indication of Set Power Supply Voltage

AC power supply voltage	Indication of the set power supply voltage	Specification of the applicable fuse	Frequency	Power consumption
90 V - 110 V	100 V	T250 mA/250 V	48 Hz-66 Hz	20 VA or less
103 V - 132 V	120 V			
198 V - 242 V	220 V	T160 mA/250 V		
207 V - 250 V	240 V			



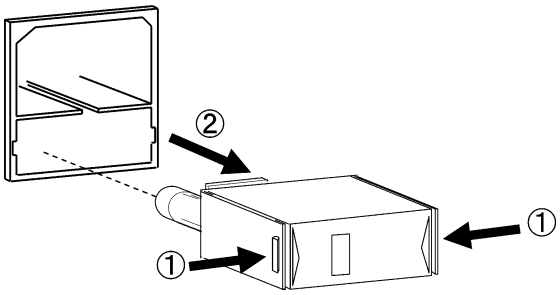
Indication of the set power supply voltage of this instrument (on the rear panel)

Figure 3-4 Indication of the Set Power Supply Voltage

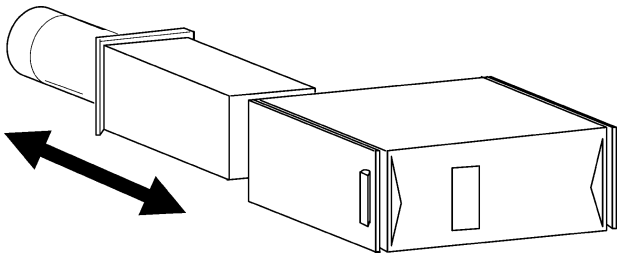
3.4.2 Changing the Power Supply Voltage

1. Remove the fuse holder assembly from the rear panel.

   Push both side of the fuse holder assembly by using flathead screwdrivers (①) and then pull it out (②).



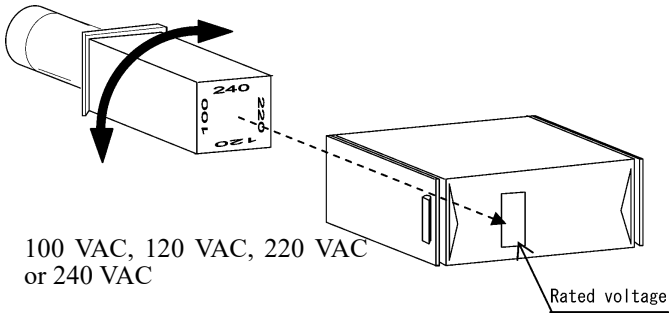
2. Remove the power supply voltage selector from the fuse holder assembly.



   100 VAC or 120 VAC: T250-mA fuse

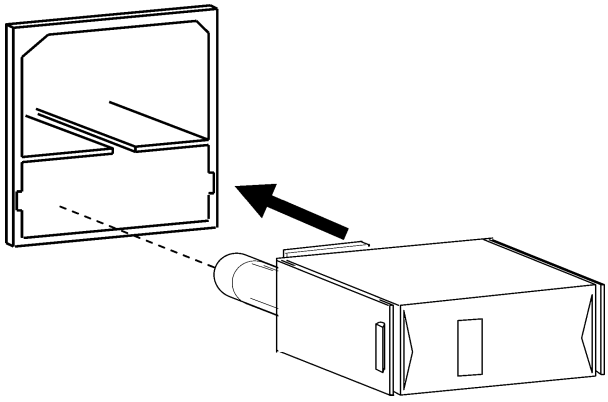
   220 VAC or 240 VAC: T160-mA fuse

3. Rotate the power supply selector to be looked the correct voltage from the window.



4. Replace a fuse that is compliant with the specification (see Table 3-1).

5. Replace the fuse holder assembly into the rear panel.



6. Check that the correct power supply voltage is indicated in the window.

3.4.3 Connecting the Power Cable

This instrument includes a three-core power cable with a grounding conductor. To prevent accidents caused by electric shocks, only use the included power cable and securely connect to the ground through a three-pin power outlet.

1. Check that the included power cable is not damaged.

   WARNING: ***Never use a damaged power cable. Doing so may cause an electrical shock.***

2. Connect the AC power connector on the rear panel of this instrument to a three-pin power outlet that has a ground terminal by using the included power cable (See Figure 3-5).

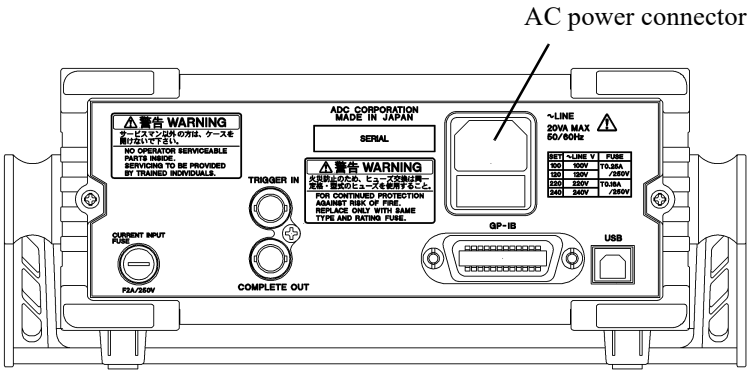


Figure 3-5 Connecting the Power Cable

WARNING:

1. ***Use a suitable power cable for the power supply voltage.***
2. ***To prevent any danger of electrical shock, connect the power cable to a three-pin power outlet that is connected to a ground terminal. The instrument will not be grounded if an extension cord, which does not include a ground terminal, is used.***

3.4.4 Selecting the Power Supply Frequency

Select a power supply frequency according to the area where this instrument is used.

Select the following from 'LINE' in the **9 SYS** category in **MENU**.

50 The commercial power supply frequency is 50 Hz.

60 The commercial power supply frequency is 60 Hz.

For more information on navigating menus, refer to 5., “MENU OPERATION AND FUNCTION DESCRIPTION”.

4. QUICK START

The high speed measurement and high accuracy measurement can be performed in this digital multimeter. To make the performing operations easier, this instrument includes the following functions on the front panel.

Setting the measurement function

Setting the measurement range

Sampling conditions

Setting the NULL and smoothing calculations to ON or OFF.

Chapter 4 describes the front and rear panels and panel operations which do not use MENU. Other settings are set in the layered menus. For more information on function descriptions and how to navigate the menus, refer to Chapter 5.

4.1 Panel Description

4.1.1 Front Panel Description

The front panel consists of the display section, operation keys, and measurement input terminal section.

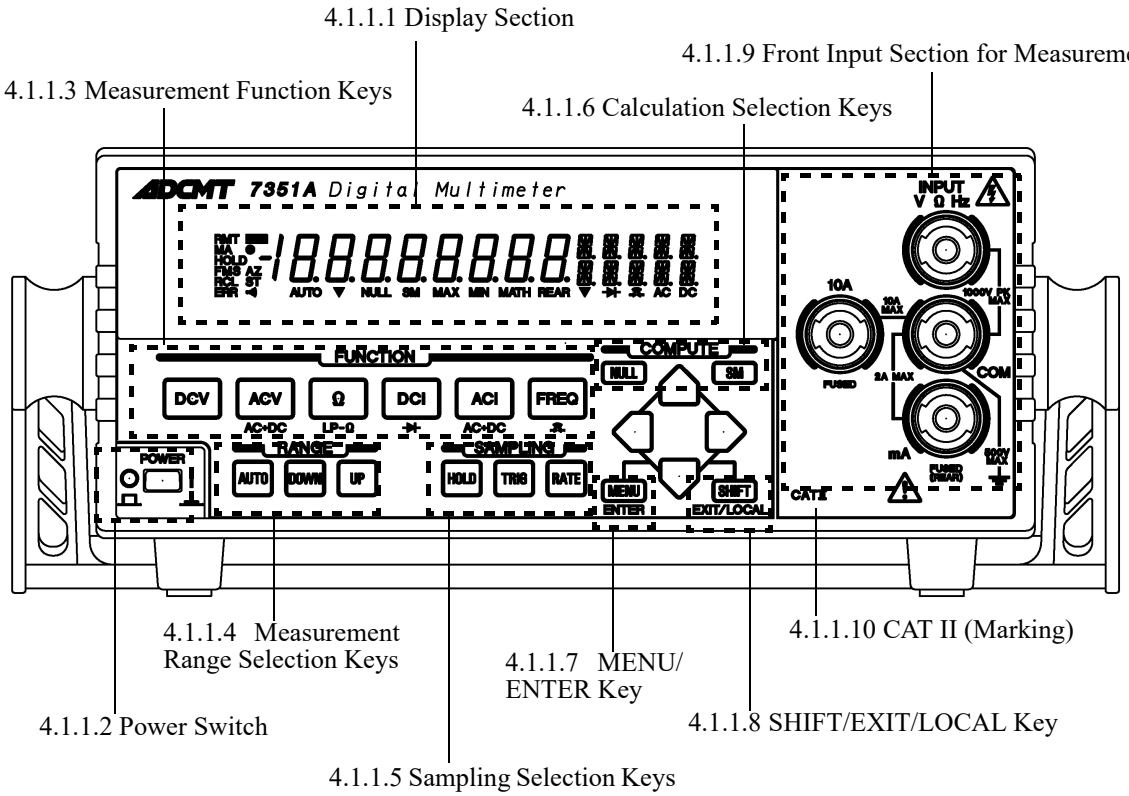


Figure 4-1 Front Panel Description

4.1.1.1 Display Section

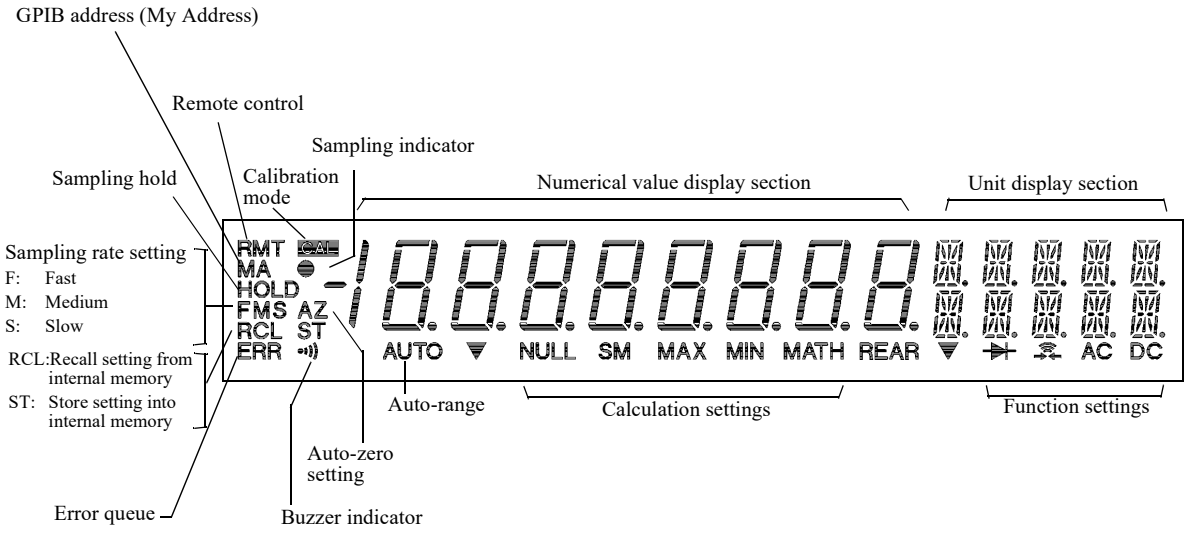


Figure 4-2 Display Section Description

4.1.1.2 Power Switch

1.	POWER switch	Pressing the power switch turns on the power and the power is supplied to this instrument. Re-pressing the power switch turns off the power and the power is shut down.

4.1.1.3 Measurement Function Keys

1.	DCV	Selects the DC voltage measurement (DCV).
2.	ACV	Selects the AC voltage measurement (ACV).
3.	Ω	Selects the resistance measurement (2WΩ) in which the two-wire method is used.
4.	DCI	Selects the DC current measurement (DCI).
5.	ACI	Selects the AC current measurement (ACI).
6.	FREQ	Selects the frequency measurement (FREQ)
7.	AC + DC (SHIFT + ACV)	Selects the AC+DC coupling or AC coupling in the AC voltage measurement.
8.	LP-Ω (SHIFT + Ω)	Selects the low power resistance measurement.
9.	→|← (SHIFT + DCI)	Selects the diode measurement (→|←).

10.	AC + DC (SHIFT + ACI)	Selects the AC+DC coupling or AC coupling in the AC current measurement.
11.	(SHIFT+FREQ)	Selects the continuity measurement ( ).

4.1.1.4 Measurement Range Selection Keys

1.	AUTO	Switches the measurement range between auto-range and fixed range.
2.	DOWN	Decreases the measurement range by one level and fixes the range.
3.	UP	Increases the measurement range by one level and fixes the range.

4.1.1.5 Sampling Selection Keys

1.	HOLD	Holds or releases the sampling mode.
2.	TRIG	Starts the measurement when the sampling mode is set to HOLD.
3.	RATE	Set the sampling rate to the high (FAST), medium (MED), or low speed (SLOW1 or SLOW2).

4.1.1.6 Calculation Selection Keys

1.	NULL	Sets or cancels the NULL calculation.
2.	SM	Sets or cancels the smoothing calculation.

4.1.1.7 MENU/ENTER Key

1.	MENU	This key is used to enter into MENU.
2.	ENTER	Saves the settings when MENU is used.
3.	△ ▽ ◁ ▷	Selects the menu and its layer.

4.1.1.8 SHIFT/EXIT/LOCAL Key

1. SHIFT — Sets or cancels the SHIFT mode.

• In the setting mode

2. EXIT — Exits from MENU and returns to the measurement state display. (The data in process of changing the setting is not saved.)

• In the remote operation

3. LOCAL — Changes to the LOCAL operation when the instrument is in the remote state.

NOTE: ***The LOCAL operation cannot be set if the LLO(LOCAL LOCKOUT) command is set from the GPIB interface.***

4.1.1.9 Front Input Section for Measurement

1. INPUT V Ω Hz terminal — HI terminal used for the DC voltage, AC voltage, resistance, diode, and frequency measurements
2. COM terminal — LO terminal used for the DC voltage, AC voltage, DC current, AC current, resistance, diode, and frequency measurements
3. mA terminal — HI terminal used for the 200-mA and 2000-mA ranges of the DC and AC current measurements
4. 10 A terminal — HI terminal used for the 10-A range of the DC and AC current measurements

4.1.1.10 CAT II (Marking)

This display shows that the safety of this instrument satisfies the measurement category II which is compliant with IEC 61010-1 Ed.2. Measurement category II is for measurements performed on circuits directory connected to the low voltage installation.

4.1.2 Rear Panel Description

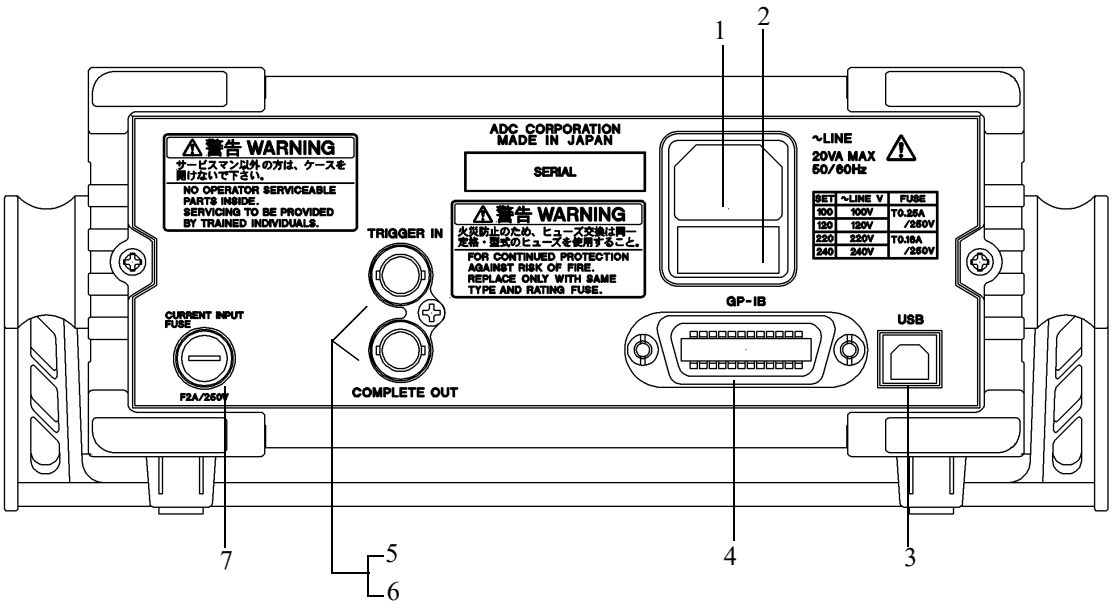


Figure 4-3 Rear Panel Description (7351A)

1.	Power connector	Used to supply the AC power by connecting the included power cable (A01402).
2.	Fuse holder assembly	The power supply voltage can be selected from 100 V, 120 V, 220 V, and 240 V. A slow-blow fuse is put.
3.	USB connector	Connector for USB Used to output data and control remotely.
4.	GPIB connector (7351A)	Connector for GPIB Used to output data and control remotely.
5.	TRIGGER IN (7351A, 7351E + Option 03)	Used to input the external trigger.
6.	COMPLETE OUT (7351A, 7351E + Option 03)	Outputs the complete signal of the measurement.
7.	Overcurrent protection fuse	Protects the overcurrent into the current input terminal (200 mA, 2000 mA range).

4.1.2 Rear Panel Description

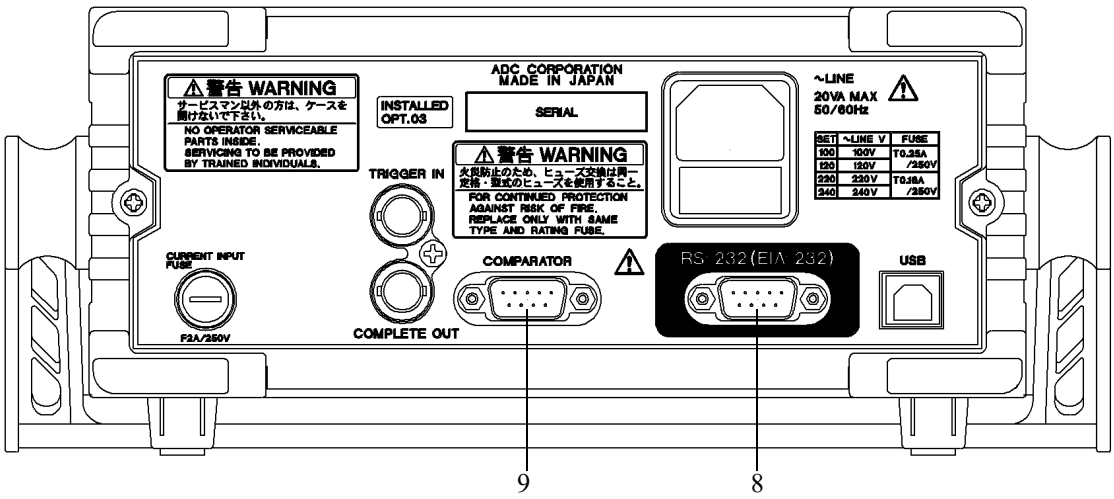


Figure 4-4 Rear Panel Description (7351E + Option 03)

8. RS-232 connector (7351E + Option 03)
   Connector for RS-232
   This connector is used to output data and for remote control.

9. COMPARATOR (7351E + Option 03)
   Outputs the comparator calculation signal.

4.2 Basic Operation

When the power is turned on, this instrument automatically performs the self-test and then proceeds to the measurement sequence.

For more information on the detail of the self-test, refer to Chapter 8, “MAINTENANCE.”

When the self-test is complete correctly, this instrument enters into the measurement state. If any abnormal error occurs, the instrument enters into the error display state. Check the error number by operating MENU and exit from here.

For more information on navigating the menus, refer to Section 5.1, “Menu.”

This instrument saves the set conditions when the power is turned off. The factory defaults are used in the descriptions in Chapter 4. For more information on how to initialize this instrument, refer to Chapter 8.

4.2.1 Measurement Functions

4.2.1.1 DC Voltage Measurement (DCV)

1. Connect a DUT to the COM and V terminals on the front panel.
2. Press **DCV**.

WARNING: ***Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.***

Table 4-1 Maximum Allowable Applied Voltage (DCV)

Between V and COM terminals	1000 Vpeak
Between COM and chassis (grounding)	500 V

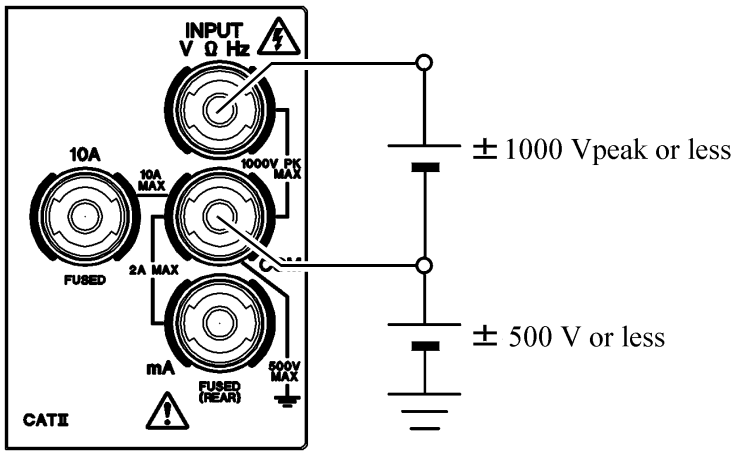


Figure 4-5 DC Voltage Measurement (DCV)

Table 4-2 Measurement range and Input impedance (DCV)

Measurement range	Input impedance
200 mV, 2000 mV	1 GΩ or more
20 V, 200 V, 1000 V	10 MΩ ±1%

4.2.1.2 AC Voltage Measurement (ACV and ACV(AC+DC))

For an AC voltage superimposed on a DC voltage, select the ACV function that measures an effective value of the AC voltage only, or the ACV (AC+DC) function that measures a root-mean-square value of the AC and DC voltages.

1. Connect a DUT to the COM and V terminals on the front panel.
2. <ACV measurement>

   Press **ACV**.

   An effective value of the AC voltage with AC coupling is measured.

   <ACV (AC+DC) measurement>

   Press **SHIFT** and **ACV**.

   ACV and DCV are measured and the root mean square value ($\sqrt{ACV^2+DCV^2}$) is displayed.

   The AC and DC indicators are turned on to show the AC+DC coupling.

WARNING: ***Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.***

Table 4-3 Maximum Allowable Applied Voltage (ACV and ACV (AC+DC))

Between V and COM terminals	1000 Vpeak, 700 Vrms, 2.2×10^7 VHz
Between COM terminal and chassis (grounding)	500 V

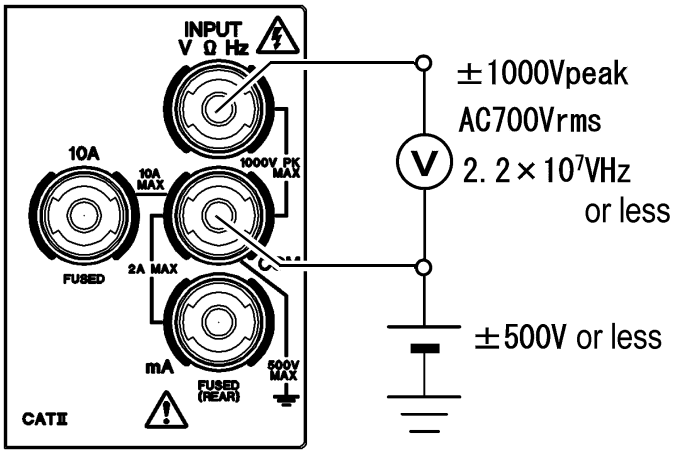


Figure 4-6 AC Voltage Measurement (ACV and ACV (AC+DC))

Measurement method	TrueRMS
Input range	5% or more of a full scale
Crest factor	3 (This is restricted to the maximum allowable applied voltage.)
Filter response time	Approx. 1 sec (Time until the measurement value reaches within 0.1% of the final value)

4.2.1.3 Resistance Measurement (2WΩ and LP-2WΩ)

1. Connect a DUT to the Ω and COM terminals on the front panel.
2. Press [Ω].
   The resistance is measured by using the 2WΩ.
3. Press [SHIFT] and [Ω].
   The resistance is measured in low-power in which the measurement current is reduced.

WARNING: ***Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.***

Table 4-4 Maximum Allowable Applied Voltage (2WΩ and LP-2WΩ)

Between Ω and COM terminals	1000 Vpeak
Between COM terminal and chassis (grounding)	500 V

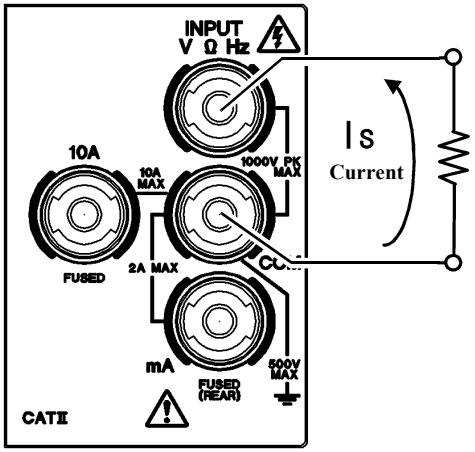


Figure 4-7 Resistance Measurement (2WΩ and LP-2WΩ)

The measurement result includes the input cable resistance and contact resistance. To reject these resistance effects, short the tip of the input cable and set the NULL calculation to ON before the measurement.

Ensure the following when in the high-resistance measurement to reduce the effect of the induction noise.

- Shielding the DUT
- Using the A01001 input cable (sold separately) whose HI side is shielded.
- Securing the input cable to prevent movement

4.2.1.4 DC Current Measurement (DCI)

1. Input terminals differ depending on the measurement range.
   <200 mA and 2000 mA ranges>
   Connect a DUT to the mA and COM terminals on the front panel.
   <10 A range>
   Connect a DUT to the 10 A and COM terminals on the front panel.
2. Press **DCI**.

Table 4-5 Maximum Allowable Applied Current and Protection Function (DCI)

Input terminal	Measurement range	Maximum allowable applied current	Protection function
mA	200 mA, 2000 mA	2 A	F2A / 250 V Fuse
10 A	10 A	10 A	F15A / 250 V Fuse

WARNING: ***Must not measure the current source whose potential is more than 250 V. This instrument may be damaged and injury accidents may be caused.***

The mA and 10 A terminals are protected from any applied over-current by a fast-blow fuse.

For more information on how to replace the over-current protection fuse, refer to Chapter 8, "MAINTENANCE".

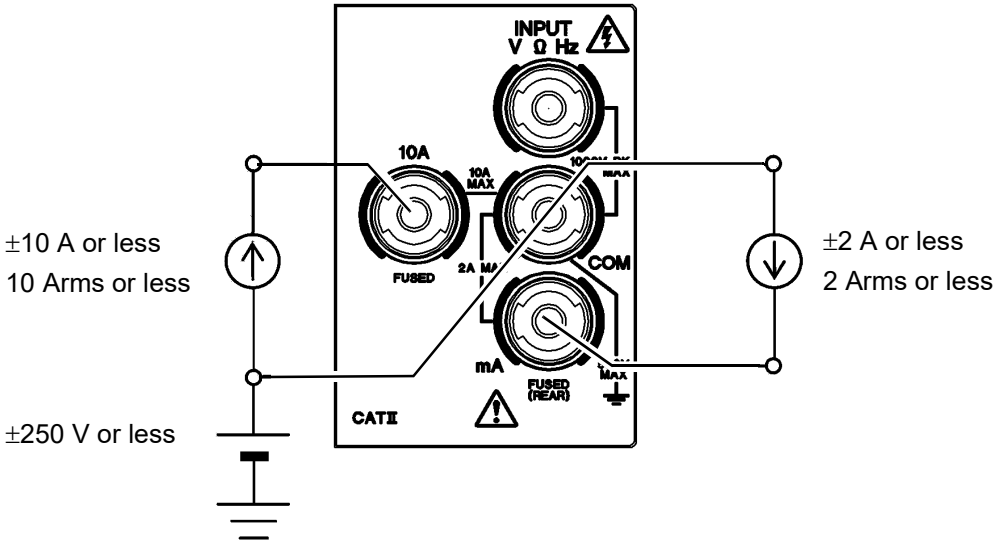


Figure 4-8 DC Current Measurement (DCI)

Auto-range restrictions

The 10 A range is a fixed range. The auto-range cannot function between the 10 A range and 200 mA, 2000 mA ranges.

NOTE: ***Applying a current causes a temperature rise in the input terminals and internal circuits, so thermo-electromotive force is generated by the temperature rise. While in other function measurements, especially high-sensitivity measurements, wait until the temperature stabilizes after applying the current.***

4.2.1.5 AC Current Measurement (ACI and ACI (AC+DC))

For an AC current superimposed on a DC current, select the ACI function that measures an effective value of the AC current only, or the ACI (AC+DC) function that measures a root-mean-square value of the AC and DC currents.

1. Input terminals differ depending on the measurement range.
   <200 mA and 2000 mA ranges>
   Connect a DUT to the mA and COM terminals on the front panel.
   <10 A range>
   Connect a DUT to the 10 A and COM terminals on the front panel.
2. <ACI measurement>
   Press **ACI**.
   An effective value of the AC voltage with AC coupling is measured.
   <ACI (AC+DC) measurement>
   Press **SHIFT** and **ACI**.
   ACI and DCI are measured and the root mean square value ($\sqrt{ACI^2+DCI^2}$) is displayed.
   The AC and DC indicators are turned on to show the AC+DC coupling.

Table 4-6 Maximum Allowable Applied Current and Protection Function (ACI and ACI (AC+DC))

Input terminal	Measurement range	Maximum allowable applied current	Protection function
mA	200 mA, 2000 mA	2 A	F2A / 250 V Fuse
10 A	10 A	10 A	F15A / 250 V Fuse

WARNING: ***Do not apply current that exceeds the maximum allowable applied current. Must not measure the current source whose potential is more than 250 V. Fire or electric shocks due to the failure of this instrument may occur.***

The mA and 10 A terminals are protected from any applied over-current by a fast-blow fuse.

For more information on how to replace the over-current protection fuse, refer to Chapter 8, “MAINTENANCE”.

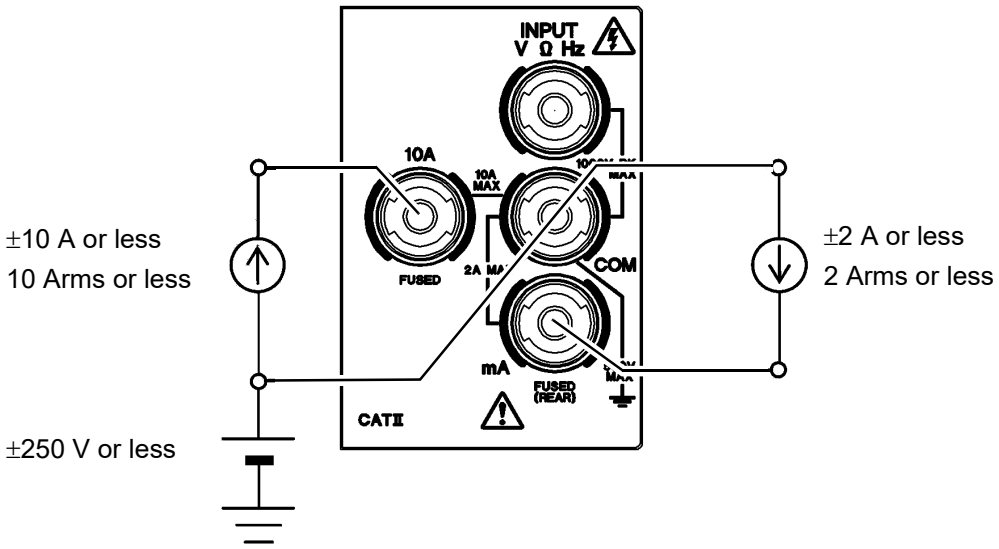


Figure 4-9 AC Current Measurement (ACI and ACI (AC+DC))

Measurement method	TrueRMS
Input range	5% or more of a full scale
Crest factor	3 (This is restricted to the current protection fuse rating.)
Filter response time	Approx. 1 sec (Time until the measurement value reaches within 0.1% of the final value)

Auto-range restrictions

The 10 A range is a fixed range. The auto-range cannot function between the 10 A range and 200 mA, 2000 mA ranges.

4.2.1.6 Continuity Measurement

1. Connect a DUT to the Ω and COM terminals on the front panel.

   The continuity indicator ( ) is activated.

2. Press **SHIFT** and **FREQ**.

   The resistance is measured in 2WΩ. If the measured resistance is lower than the continuity threshold constant, the buzzer sounds.

Measurement range	2000 Ω
Measurement current	1 mA
Continuity threshold constant	1 Ω to 1000 Ω

WARNING: ***Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.***

Table 4-7 Maximum Allowable Applied Voltage (Continuity)

Between Ω and COM terminals	1000 Vpeak
Between COM terminal and chassis (grounding)	500 V

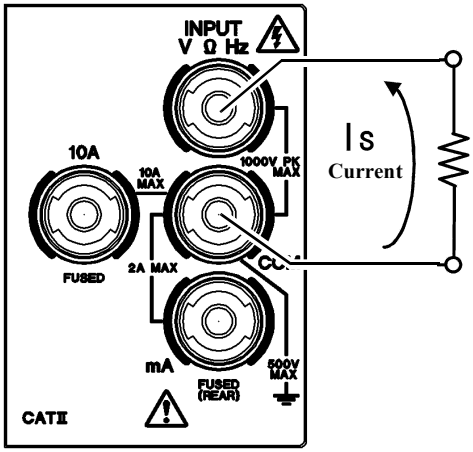


Figure 4-10 Continuity Measurement

4.2.1.7 Diode Measurement

1. Connect a DUT to the V and COM terminals on the front panel.

   The diode indicator (⊣▶⊢) is activated.

2. Press **SHIFT** and **DCI**.

   A current of approximately 1 mA is applied from the COM terminal to the V terminal, and the voltage between both terminals is measured.

   Measurement range 2000 mV

   Measurement current 1 mA

WARNING: ***Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.***

Table 4-8 Maximum Allowable Applied Voltage (Diode)

Between V and COM terminals	1000 Vpeak
Between COM terminal and chassis (grounding)	500 V

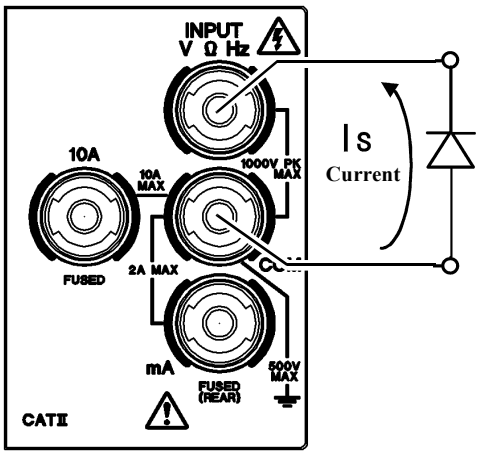


Figure 4-11 Diode Measurement

4.2.1.8 Frequency Measurement (FREQ)

1. Connect a DUT to the V and COM terminals on the front panel.
2. Press **FREQ**.

   The frequency in the ACV measurement function is displayed.

   The DC component of the input signal is cut by using the AC coupling and the frequency is measured at the zero-cross point.

   Measurement method: Reciprocal

   Input voltage range: 100 mVrms to 700 Vrms and 10% or more of the range (Sinusoidal wave)

   The range does not mean the frequency range but the input voltage range.

   Measure the input voltage by using the ACV function and then measure the frequency by using an appropriate voltage range depending on the input voltage. Even if the input voltage exceeds the measurement range, the measurement is performed but the accuracy of the measured value maybe outside of the specifications.

   Gate time

Sampling rate	Gate time	Measurement frequency range	Maximum measurement period	Maximum display
SLOW	1000 ms	1 Hz to 300 kHz	2.2 s	999999
MED	100 ms	10 Hz to 300 kHz	220 ms	99999
FAST	10 ms	100 Hz to 300 kHz	22 ms	9999

   If the input signal cannot be detected because the period of the input signal is longer than the gate time, 0 Hz is displayed.

NOTE: When the sampling rate is set to SLOW, the sampling rate indicator alternates between the dark "S" and bright "S".

WARNING: Do not apply voltage that exceeds the maximum allowable applied voltage. Fire or electric shocks due to the failure of this instrument may occur.

Table 4-9 Maximum Allowable Applied Voltage (FREQ)

Between V and COM terminals	1000 Vpeak, 700 Vrms, 2.2×10^7 VHz
Between COM terminal and chassis (grounding)	500 V

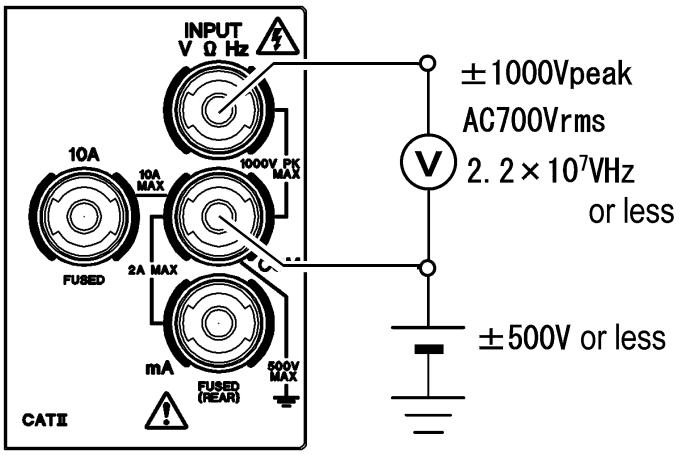


Figure 4-12 Frequency Measurement (FREQ)

4.2.2 Setting the Measurement Range

UP Increases the measurement range by one level and fixes the range.

DOWN Decreases the measurement range by one level and fixes the range.

AUTO Switches the measurement range between auto-range and fixed range.

4.2.3 Changing the Measurement Speed and Display Digit

Press **RATE**.

The measurement speed and display digit are changed as shown in Table 4-10 and Table 4-14.

In the frequency measurement, the sampling rate is used to set the gate time. For more information on the frequency measurement, refer to Section 4.2.1, “Measurement Functions.”

Table 4-10 Measurement Speed (a) when in the HOLD OFF (Trigger source: IMMED)

Sampling rate	Measurement speed (Measurement time)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	140 times/s (7.1 ms)		30 times/s (33 ms)	2 ms
MED (50 Hz)	40 times/s (25 ms)		19 times/s (52 ms)	1 PLC
MED (60 Hz)	40 times/s (25 ms)		19 times/s (52 ms)	1 PLC
SLOW1	9.5 times/s (105 ms)		4.7 times/s (212 ms)	100 ms
SLOW2	4.9 times/s (205 ms)		2.4 times/s (412 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, and Display: OFF

Table 4-11 Measurement Speed (b) when in the HOLD ON (Trigger source: EXT)

Sampling rate	Measurement speed (Measurement time)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	80 times/s (12.5 ms)		45 times/s (22 ms)	2 ms
MED (50 Hz)	32 times/s (31 ms)		17 times/s (58 ms)	1 PLC
MED (60 Hz)	37 times/s (27 ms)		19 times/s (52 ms)	1 PLC
SLOW1	9 times/s (110 ms)		4.5 times/s (218 ms)	100 ms
SLOW2	4.7 times/s (210 ms)		2.3 times/s (418 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, Trigger delay: 0 sec, and GPIB data output

Table 4-12 Measurement Speed (b) when in the HOLD ON (Trigger source: BUS)

Sampling rate	Measurement speed (Measurement time)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	74 times/s (13.5 ms)		42 times/s (23.5 ms)	2 ms
MED (50 Hz)	31 times/s (32 ms)		16 times/s (60 ms)	1 PLC
MED (60 Hz)	35 times/s (28 ms)		18 times/s (53 ms)	1 PLC
SLOW1	9 times/s (111 ms)		4.5 times/s (219 ms)	100 ms
SLOW2	4.7 times/s (211 ms)		2.3 time/s (419 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, Trigger delay: 0 sec, and GPIB

Table 4-13 Measurement Speed (b) when in the HOLD ON (Trigger source: BUS) RS-232

Sampling rate	Measurement speed (Measurement time)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	19 times/s (51 ms)		18 times/s (535 ms)	2 ms
MED (50 Hz)	14 times/s (69 ms)		11 times/s (60 ms)	1 PLC
MED (60 Hz)	15 times/s (65 ms)		11 times/s (85 ms)	1 PLC
SLOW1	6 times/s (150 ms)		3 times/s (251 ms)	100 ms
SLOW2	4 times/s (248 ms)		2 times/s (449 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, and Trigger delay: 0 sec
Baud rate: 9600, Number of data bits: 8, Parity: None, and Number of stop bits: 1
The measurement time is from the *TRG command input → the waiting time of the integration → until measured data is output by using the MD? command.

Table 4-14 Sampling Rate and Display Digits

Sampling rate	DCV DCI 2WΩ LP-2WΩ Continuity Diode	ACV ACI	ACV(AC+DC) ACI(AC+DC)
FAST1	4 1/2-digit display	4 1/2-digit display	3 1/2-digit display
MED	5 1/2-digit display	4 1/2-digit display	3 1/2-digit display
SLOW1	5 1/2-digit display	5 1/2-digit display	4 1/2-digit display
SLOW2	5 1/2-digit display	5 1/2-digit display	4 1/2-digit display

Also refer to Section 5.7, “Sampling Operation.”

Setting HOLD

HOLD Sets the sampling mode to HOLD or cancels.

TRIG Starts the measurement when the sampling mode is set to HOLD.

5. MENU OPERATION AND FUNCTION DESCRIPTION

5.1 Menu

The functions and conditions in this instrument are set by using layered menus.

5.1.1 How to Navigate the Menus

Menus have a three-layer structure. (Some menus have a four-layer structure.)

First layer	Category layer	Selects the menu category.
Second layer	Selection layer	Selects the setting parameters in the category.
Third layer	Entry/Execution layer	Used to enter the values or select the setting.

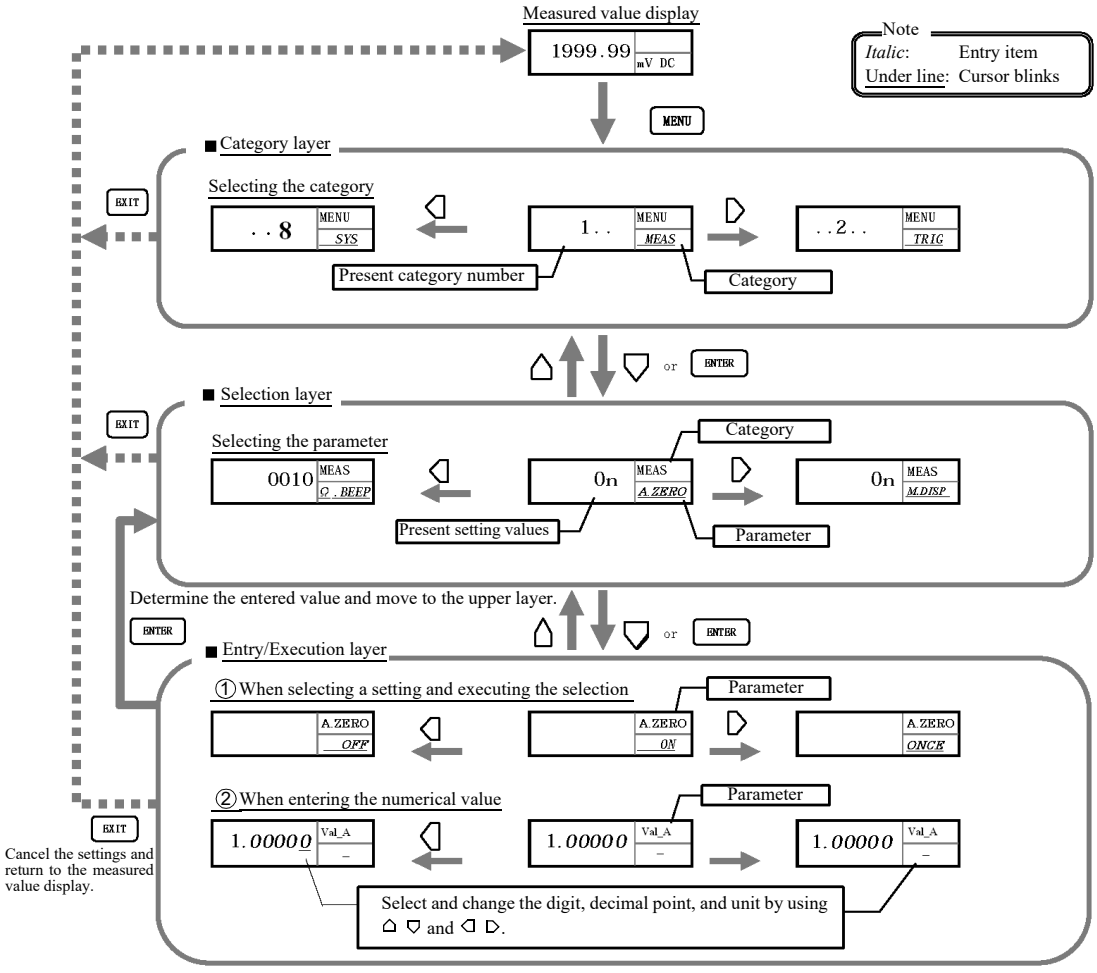


Figure 5-1 Menu Operation

1. Press **MENU**.

   The Category layer in which **1 MEAS** to **9 SYS** be selected is displayed.

2. Select the category by using ◁ and ▷.

3. Press ▽.

   The Selection layer is displayed.

4. Select the parameters by using ◁ and ▷.

5. Press ▽.

   The Entry/Execution layer is displayed.

6. Set the parameters by using △, ▽, ◁, ▷, and the **TRIG** key.

7. Pressing **ENTER** determines the entered parameter settings and moves to the Selection layer.

   If pressing **EXIT/LOCAL** before ENTER, the entered settings are canceled and MENU is quitted.

   "DONE" after "BUSY" is displayed during the process.

Setting the selectable parameters

For the selectable parameter that is set by selecting the item, select the parameter by using ◁ and ▷, and determine it by pressing **ENTER**.

Setting the numerical parameters

For the numerical parameter that is set by entering the numerical value, select either numerical digit, decimal point position, or unit prefix by using ◁ and ▷.

The operation of △ and ▽ varies depending on the target items.

If there is no target item that blinks, the layer is moved to the Selection layer by using △.

If a number blinks, the numerical value can be increased or decreased.

If a decimal point blinks, the decimal point can be moved.

If the unit display section blinks, the unit prefix can be changed in the following order: p, n, μ, m, none, k, M, G, and T

Pressing the **TRIG** key performs the measurement and can set the result as the value of the parameter.

Although any numerical value can be entered into the numerical parameter, it is rounded off to the resolution digit of each parameter.

Table 5-1 shows the key function in each layer.

Table 5-1 Menu Operation Key and Function

	Category layer	Selection layer	Entry/Execution layer		
			Numerical value parameter		Selectable parameter/ execution item
			Parameter: Dark display, No blinking	Target items: Numerical value/decimal point/unit	
⌂	-	Moves to the Category layer.	Moves to the Selection layer.	Increases the value.	Moves to the Selection layer.
▽	Moves to the Selection layer.	Moves to the Entry/Execution layer.	-	Decreases the value.	-
◁	Moves the target item to the left category.	Moves the target item to the left parameter.	Moves the target item to the numerical value.	Moves the target item to the left.	Displays the previous selection.
▷	Moves the target item to the right category.	Moves the target item to the right parameter.	Moves the target item to the unit.	Moves the target item to the right.	Displays the next selection.
TRIG	-	-	Performs the measurement and reflects the result to the parameter. *1		-
ENTER	Moves to the Selection layer.	Moves to the Entry/Execution layer.	Determines the entered value and moves to the Selection layer.		Determines the selection and moves to the Selection layer. *2
EXIT	Leaving the MENU system	Leaving the MENU system	Leaving the MENU system		

*1: Only the constant that is used to calculate the HIGH, LOW, and NULL values
*2: For the execution item, quits MENU.
Example: Parameter SAVE/LOAD

5.1.2 Menu List

Category layer / Selection layer / Entry/Execution layer

MENU

1 MEAS

A.ZERO	Auto-zero OFF/ON/ONCE
M.DISP	Display mode OFF/ON
DIGIT	Number of display digits. 5 1/2 to 3 1/2
ΩBEEP	The threshold in the continuity measurement function 1 Ω to 1000 Ω

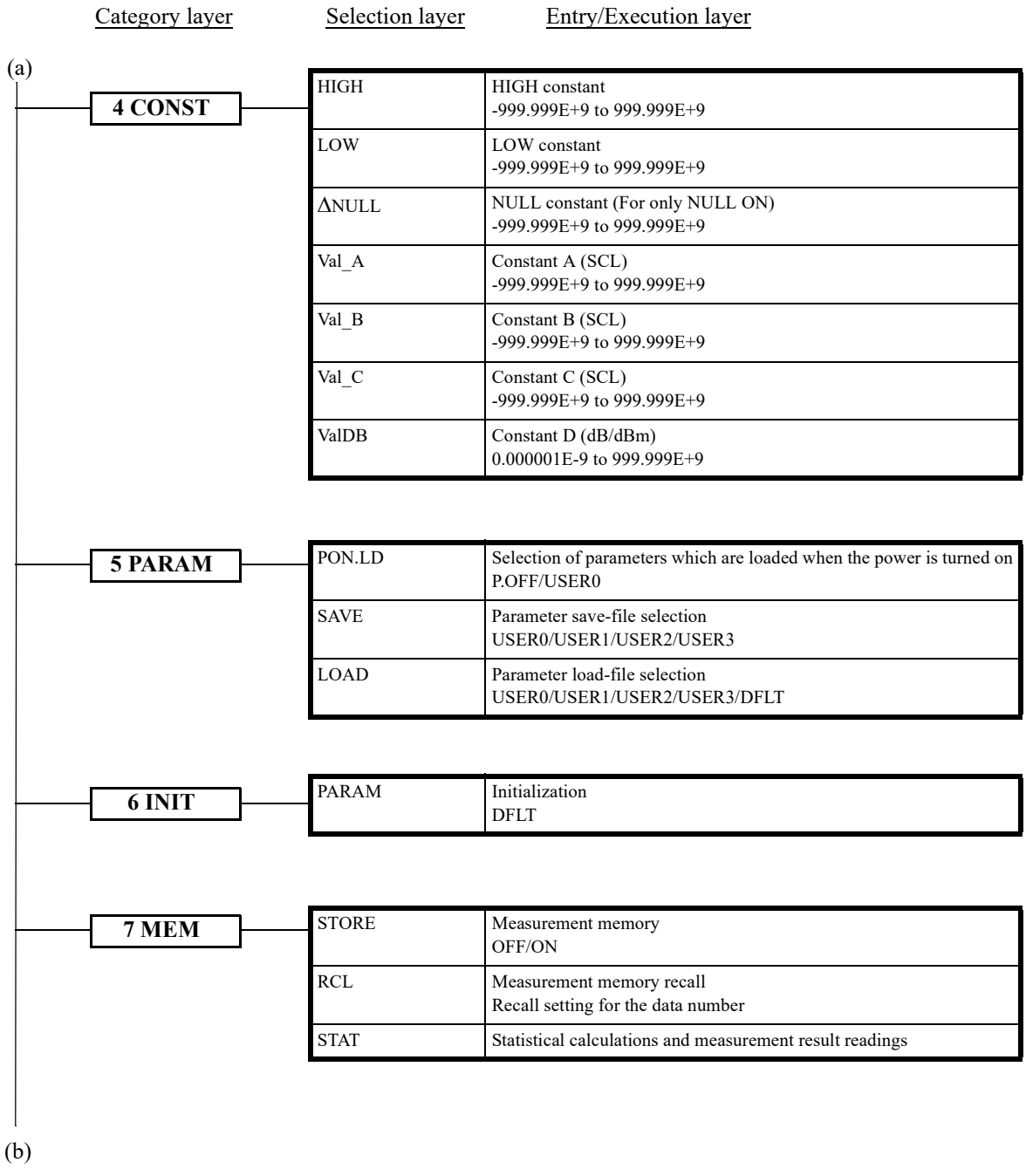
2 TRIG

DELAY	Trigger delay 0 s to 3600 s
SRC	Trigger source Selection IMMED/MAN/EXT/BUS
N.Smpl	Number of samples 1 to 20000

3 CALC

COMP	Comparative calculation OFF/ON
MATH	Other calculations OFF/dB/dBm/SCL
MX/MN	MAX/MIN calculation and selecting the display OFF/ON/MAX/MIN
RSLT	Display of the MAX/MIN calculation result SAMPL/MAX/MIN/AVG
PASS	PASS condition settings LGH/__H/_G_/L__/L_H/LG_/_GH/___
BEEP	Calculation Result and buzzer OFF/PASS/FAIL
SM.CNT	Number of times smoothing is performed 2 to 100 times

(a)


Category layer
Selection layer
Entry/Execution layer
(a)
4 CONST
HIGH
HIGH constant
-999.999E+9 to 999.999E+9
LOW
LOW constant
-999.999E+9 to 999.999E+9
ΔNULL
NULL constant (For only NULL ON)
-999.999E+9 to 999.999E+9
Val_A
Constant A (SCL)
-999.999E+9 to 999.999E+9
Val_B
Constant B (SCL)
-999.999E+9 to 999.999E+9
Val_C
Constant C (SCL)
-999.999E+9 to 999.999E+9
ValDB
Constant D (dB/dBm)
0.000001E-9 to 999.999E+9
5 PARAM
PON.LD
Selection of parameters which are loaded when the power is turned on
P.OFF/USER0
SAVE
Parameter save-file selection
USER0/USER1/USER2/USER3
LOAD
Parameter load-file selection
USER0/USER1/USER2/USER3/DFLT
6 INIT
PARAM
Initialization
DFLT
7 MEM
STORE
Measurement memory
OFF/ON
RCL
Measurement memory recall
Recall setting for the data number
STAT
Statistical calculations and measurement result readings
(b)

Category layer | Selection layer | Entry/Execution layer

(b)

8 I/F

BUS	Interface selection (This selection differs depending on the model or option.) GPIB/RS-232/USB *1
GP.Adr	GPIB address (Only when GPIB is selected for the interface) 0 to 30
USBid	USB ID (Only when USB is selected for the interface) 1 to 127
HEADR	Header OFF/ON
T.Only	Addressable/Talk only (Only when GPIB or RS-232 is selected for the interface) OFF/ON
LANG	Command language selection (This selection differs depending on the interface selection.) ADC/SCPI/R6451
CONT	Initial value selection of the Continue setting OFF/ON (Only when SCPI is selected as the command language.)
BAUD	Baud rate selection (Only when RS-232 is selected for the interface) 9600 - 300 - 600 - 1200 - 2400 - 4800
DATA	Data length selection (Only when RS-232 is selected for the interface) 8 bit/7 bit
P-Bit	Parity selection (Only when RS-232 is selected for the interface) NONE/ODD/EVEN
STOP	Stop bit selection (Only when RS-232 is selected for the interface) 1 bit/2 bit
ECHO	Echo selection (Only when RS-232 is selected for the interface) OFF/ON

*1: When R6451 is selected as the command language, USB cannot be selected. When selecting USB, set the command language to ADC in advance.

(c)

(c)

9 SYS

Category layer	Selection layer	Entry/Execution layer
9 SYS	BEEP	Buzzer setting OFF/ON
	TEST	Self-Test
	P/KEY	Display and key tests
	F.Inhi	Disable function Each function can be set to ENA (Enabling) or DIS (Disabling).
	P.Lock	Panel lock OFF/ON
	PWD	Password (For panel lock) 4 digits password
	LINE	Power supply frequency selection 50 Hz/60 Hz
	CAL	CAL mode OFF/ON
	QUEUE	Error queue No.01 to No.20

5.2 Measurement Functions

For more information on the measurement function description, refer to Chapter 4.

This chapter describes the parameters set in MENU that is used in the measurement function.

5.2.1 Continuity Measurement

Setting the continuity threshold constant

The continuity threshold constant can be selected in the range between 1 Ω and 1000 Ω from 'Ω.BEEP' in **1 MEAS** category in **MENU**.

Press **ENTER** to determine the setting.

5.3 Measurement Range and Auto-Range

5.3.1 Measurement Function and Range Structure

Table 5-2 shows the range structure corresponding to the measurement function.

Table 5-2 Measurement Function and Range Structure

DCV	ACV ACV (AC+DC)	2WΩ	LP-2WΩ	DCI	ACI ACI (AC+DC)	FREQ	Continuity	Diode
200 mV	200 mV					200 mV		
2000 mV	2000 mV	200 Ω	200 Ω			2000 mV		2000 mV
20 V	20 V	2000 Ω	2000 Ω	200 mA	200 mA	20 V	2000 Ω	
200 V	200 V	20 kΩ	20 kΩ	2000 mA	2000 mA	200 V		
1000 V	700 V	200 kΩ	200 kΩ	10 A	10 A	700 V		
		2000 kΩ	2000 kΩ					
		20 MΩ	20 MΩ					
		200 MΩ						

NOTE: The range settings for each function are saved.
For the frequency function, the range is not switched in the frequency range but switched in the voltage range.

5.3.2 Auto-range

When Auto-range is set to ON, the measurement range of this instrument is automatically set to the optimum range depending on the input voltage.

The judgment value used when the range is changed

Range DOWN	When the displayed value is less than 10% of the displayed range (less than 200 V if the DCV 1000 V range and 700 V range are both selected)
Range UP	When the displayed value exceeds the maximum display

Auto-range is set to OFF under the following conditions.

- Frequency measurement
- Diode measurement
- Continuity measurement
- The 10 A range for the DC and AC current measurements

5.4 Auto-Zero Operation

Auto-zero function eliminates the offset error in the measurement system of this instrument.

If Auto-zero is set to ON, the internal offset is measured and the offset error is eliminated because the offset is subtracted from the input measurement value. However, the measurement time is doubled.

Set Auto-zero in 'A.ZERO' in **1 MEAS** in **MENU**.

Auto-zero is performed at the current measurement range in the measurement function and range shown in the following table.

Function	Auto-zero
DCV	Can be performed
ACV AC+DCV	-
2WΩ LP-2WΩ	Can be performed
DCI	Can be performed
ACI AC+DCI	-
FREQ	-
Diode	Can be performed
Continuity	Can be performed

Auto zero can be performed only once according to the measurement condition or measurement timing.

If ONCE is set and Auto-zero is performed, the offset error is eliminated and then Auto-zero is turned off.

5.5 Display Mode Setting

Setting the display mode

Select either ON or OFF in ‘M.DISP’ in **1 MEAS** in **MENU**.
Press **ENTER** to apply the setting.
A time of approximately 1 ms is required for the output to be displayed. (The time may vary depending on conditions.)
Select OFF if sampling at high speed.
An error is displayed even if the display is set to OFF.

5.6 Display Digit Setting

Setting the number of display digits

Set the number of display digits in ‘DIGIT’ in the **1 MEAS** category in **MENU**.
Press **ENTER** to apply the setting.
This setting is disabled in remote output but display.

5.7 Sampling Operation

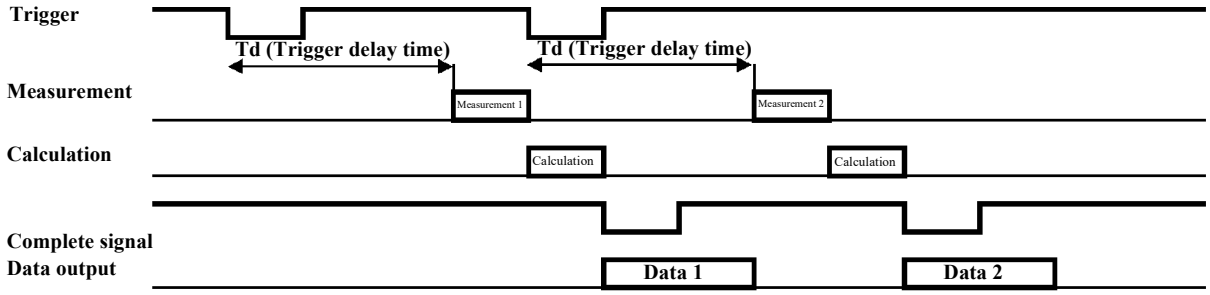
Figure 5-2 shows the measurement sequence of this instrument.

Measurements are performed when the trigger event is received.

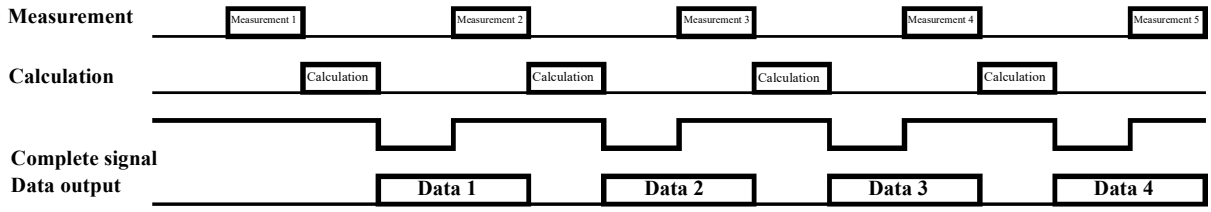
When each measurement is complete, the COMPLETE signal is output and the data output starts.

The measurement data is output to the display or interface.

The complete signal output does not exist in the 7351E.



(a) Hold on / Trigger



(b) Hold off

Figure 5-2 Measurement Sequence

5.7.1 Sampling Count Setting

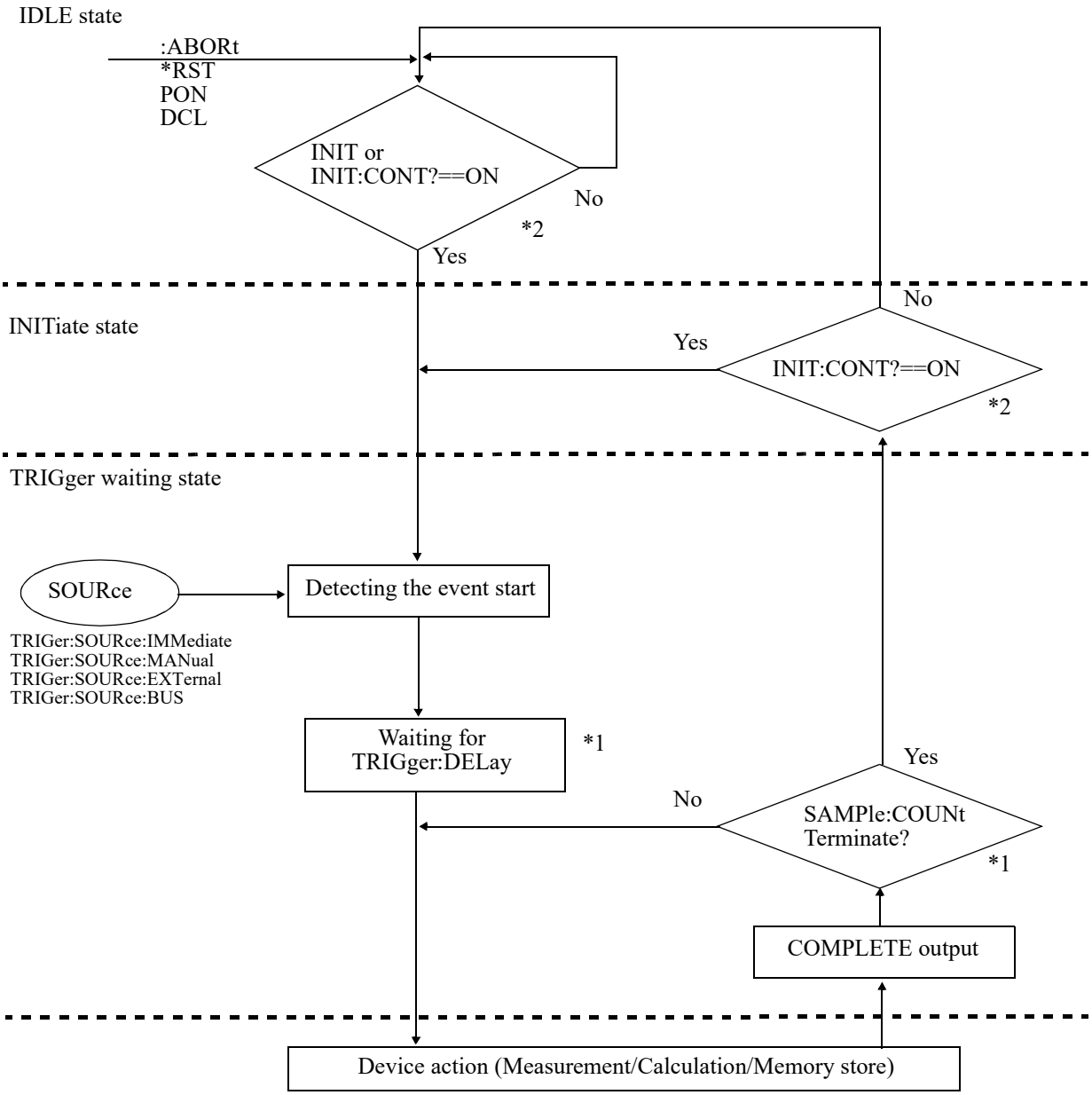
Although sampling is usually performed once when a trigger is detected, sampling can be performed more than once.

Enter the number of sampling in 'N.Smpl' in **2 TRIG** in **MENU**.

Sampling count 1 to 20000 samples/trigger

5.8 Trigger Function

The trigger system of this instrument allows trigger detection and the sampling start to be delayed.
Figure 5-3 shows the trigger model.
In this figure, the external trigger signal and complete signal output are described for illustrative purposes of the trigger model.



*1: This action or judgement is disabled when IMMediate is selected for the trigger source.

*2: This judgment is disabled in the LOCAL mode. (Always “Yes”)

Figure 5-3 Trigger Model

5.8.1 Trigger System Operation

1. IDLE state

   The trigger system is in the IDLE state before the trigger sequence starts, after the trigger sequence is terminated, and while the processes of this system are not performed such as a reset state.

2. INITiate state

   The INITiate state means that the trigger system operation starts.

   The IDLE state is changed to the INITiate state by using either of the following trigger system commands: Starting the trigger system (INITiate), Setting CONTinuous to ON (INITiate:CONTinuous {ON})

   If CONTinuous is set to ON when the measurement is complete, the trigger system enters the INITiate state without returning to the IDLE state and waits for the next trigger.

3. TRIGger waiting state

   When the trigger event is detected from the selected trigger source, the device action starts after the trigger delay time.

   Outputs the complete signal, and returns to the INITiate state.

4. Device action

   The measurement and calculations are performed.

5.8.2 Trigger Source Selection

The trigger source is selected in 'SRC' in the **2 TRIG** category in **MENU**.

Trigger source

IMMED	Performs continuous measurement with a time period that is set by the sampling rate.
MAN	Detects an event when the **TRIG** key is pressed or the trigger signal is input from the external trigger connector.
EXT	Detects an event when the trigger signal is input from the external trigger connector (7351A, 7351E + Option 03).
BUS	Detects an event when the *TRG command or GET command is received from the enabled USB or GPIB bus.

The following shows the parameters whose settings automatically change depending on the trigger source setting.

IMMED	HOLD: OFF
MAN	HOLD: ON
EXT	HOLD: ON
BUS	HOLD: ON

Trigger key

If the **TRIG** key on the front panel is pressed when this instrument is in the local state and HOLD ON, the measurement starts. The trigger key can be used regardless of the trigger source selection.

Trigger event buffer

If triggers are input while this instrument is in the measurement state, one trigger event is buffered. In this case, the operation is the same as when the measurement is complete at the same time a trigger is generated.

5.8.3 Trigger Delay (Td)

Time from a trigger input to sampling start can be delayed by setting the trigger delay.

Because timing with other devices can be adjusted by using this function, the measurement can be started after the input becomes stable.

Table 5-3 shows the trigger delay time and setting resolution.

The trigger delay is set in 'DELAY' in the **2 TRIG** in **MENU**.

Table 5-3 Trigger Delay Time, Setting Resolution, and Accuracy

Trigger delay setting	Resolution *1	Delay time accuracy	
		Ext trigger	Bus trigger
0 to 600 ms	10 µs	0.8 ms or less + resolution	3.2 ms to 3.7 ms + resolution
600.1 m to 6 s	100 µs	0.8 ms or less + resolution	3.2 ms to 3.7 ms + resolution

Table 5-3 Trigger Delay Time, Setting Resolution, and Accuracy

Trigger delay setting	Resolution *1	Delay time accuracy	
		Ext trigger	Bus trigger
6001 m to 60 s	1 ms	0.8 ms or less + resolution	3.2 ms to 3.7 ms + resolution
61 s to 3600 s	1 s	1 s	1 s

*1: If a value that is less than the resolution is set by using the panel or a remote command, the setting value is rounded to the resolution.

5.9 Calculation Functions

This instrument supports the following eight calculation functions.

Item	Function
NULL calculation	Subtracts a fixed value from a measurement value.
Smoothing calculation	Calculates the moving average.
Scaling calculation	Calculates $(\frac{M-B}{A}) \times C$.
dB calculation	Calculates $20 \log_{10}(\frac{M}{D})$.
dBm calculation	Calculates $10 \log_{10}(\frac{M^2}{D} \times \frac{1}{10^{-3}})$.
Comparator calculation	Performs a comparative calculation (HI/GO/LO).
MAX/MIN calculation	Calculates the maximum, minimum and average values.
Statistical calculation	Calculates the maximum value, minimum value, average value, standard deviation, and dispersion.

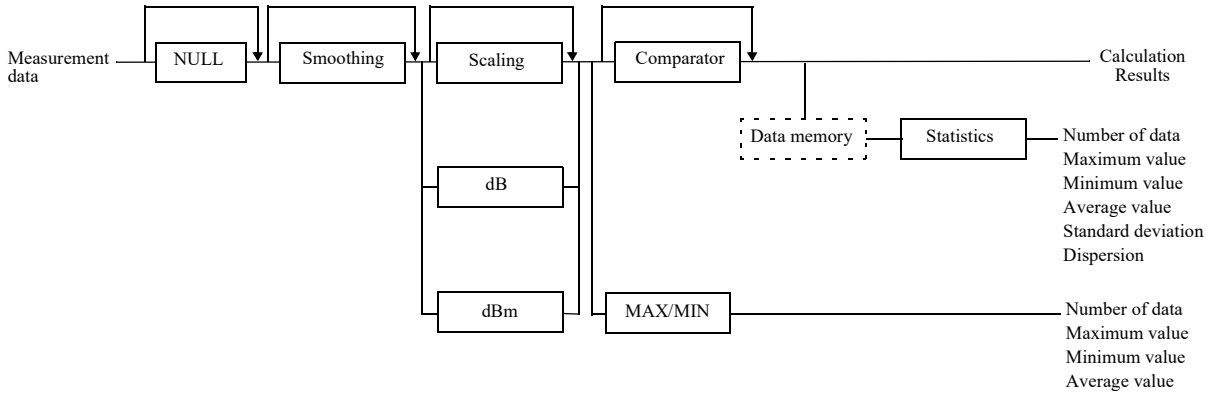


Figure 5-4 Calculation System Diagram

NOTE:

1. ***The following results may be obtained from calculating the data. This is because the internal resolutions of measurement values and setting values for the calculation are higher than the resolutions of the displayed data and remote output data.***
   - ***If the buzzer is set to ON in the MAX/MIN calculation, the buzzer sounds when the MAX or MIN value is renewed. However the buzzer may sound even when the display and remote output data are not changed.***
2. ***If the calculation is set to ON, the display of the calculation result is different from the ordinary measurement values and the decimal point and unit do not depend on the current measurement range.***
   <Example> DC voltage measurement, measurement range: 2000 mV, input voltage: 1 V
   Measurement value:1000.00 mV
   Calculation Result:1.00000 V

5.9.1 NULL Calculation

1. Function

   The NULL calculation subtracts the NULL constant from the measurement value and outputs the result.

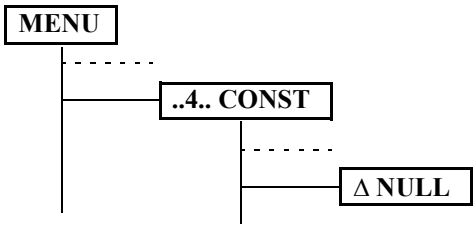
Measurement data output = Measurement value - NULL constant

   Pressing the **NULL** key performs the calculation and turns on the NULL lamp in the display section. When the **NULL** key is re-pressed while the NULL calculation is performed, the calculation is canceled and the NULL lamp turns off.

   CAUTION: ***The actual measurement value is not displayed while the calculation is performed. Remember that any hazardous voltage present on the input connector or test lead may not be detected at this time.***

2. NULL constant

   The measurement value when the **NULL** key is pressed is determined as the NULL constant. The NULL calculation cannot be performed when the overload (OL) occurs. The NULL constant can be checked in **MENU** during the calculation.

   The setting ranges are shown below.

Setting range	Minimum resolution
-999999.E +6 to +999999.E + 6	0.000000E -9

   The exponential part is set by using a unit prefix (p, n, μ, m, k, M, G, T).

3. Changing the NULL constant

   1. Display the NULL constant according to item 2 (previous description).
   2. After pressing ▽, the blinking position of the following items, which can be changed, is moved by using ◁ and ▷.
      - From the most significant digit to the least significant digit in the numeric value
      - Unit prefix (exponential part setting)
      - Decimal point

3. Change the setting value by using △ and ▽ at the blinking position.
   The unit prefix is switched according to the following order.
   p ↔ n ↔ μ ↔ m ↔ No unit prefix ↔ k ↔ M ↔ G ↔ T
4. Press **ENTER** to apply the setting.

4. Canceling the NULL calculation
   The NULL calculation is canceled when any of the following conditions occur.
   - The **NULL** key is pressed while the NULL calculation is performed.
   - The *RST command is executed.

5.9.2 Smoothing Calculation

1. Function
   The smoothing function is used when the noise is superimposed on the measurement signal. Because the measurement values in the specified number of times (smoothing count) are calculated by using the moving averaging method, the dispersion of the measurement values becomes small.
   The smoothing calculation equation is shown below.

Display = (Measurement value 1 + , , , , , + Measurement value N) / N

When the **SM** key is pressed, the calculation is performed and the SM lamp in the display section turns on or blinks.

When the **SM** key is re-pressed while the smoothing calculation is performed, the calculation is canceled and the SM lamp turns off.

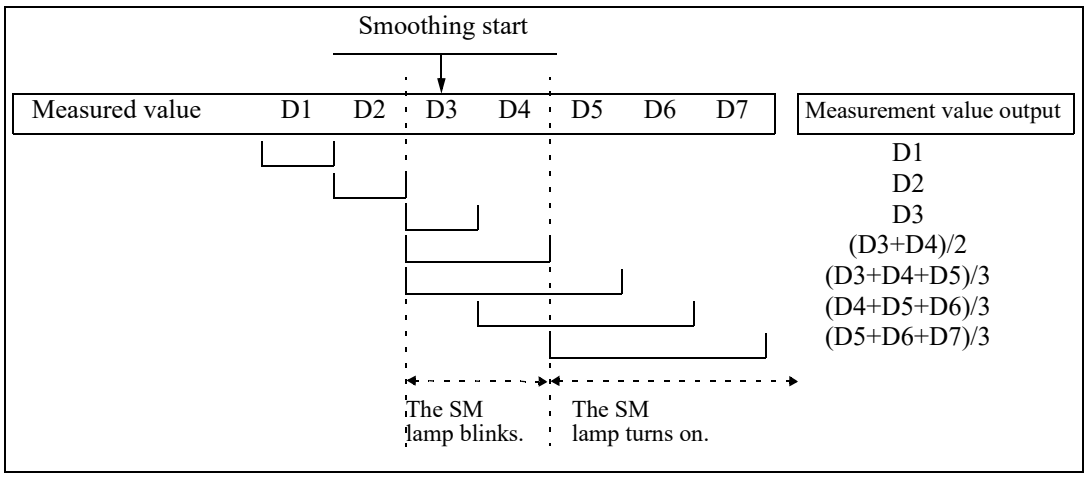
The SM lamp blinks from the smoothing start to the (N - 1)th measurement and turns on after the Nth measurement.

The (N + 1)th data is shown below.

Display = (Measurement value 2 + , , , , , + Measurement value (N + 1)) / N

The average of the measurement values, which have been acquired, is displayed from the smoothing start to the (N - 1)th measurement.

When the smoothing count, N, is set to 3, the operation is as follows.



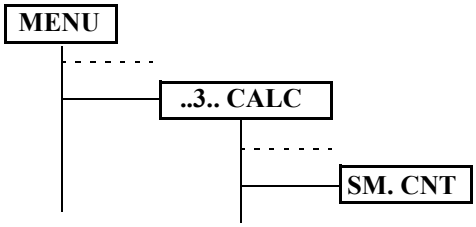
The smoothing calculation result, D (sm), at the n-th measurement, which exceeds the smoothing count, is shown below.

$$\text{Smoothing calculation result D (sm)} = \frac{1}{T}\sum_{i=n-T+1}^{n} Di$$

D (sm):	Smoothing calculation result at the n-th measurement
Di:	Measurement value (before the smoothing calculation)
T:	Smoothing count (2 to 100 can be set.)

2. Setting the smoothing count

   The smoothing count is set in **MENU**.



   The smoothing count can be set between 2 and 100.

3. Restarting the smoothing calculation

   The smoothing calculation restarts from N=1 when any of the following conditions occur.

   - The power is turned on.
   - The smoothing count is changed.
   - The NULL calculation is performed.

4. Canceling the smoothing calculation
   The smoothing calculation is canceled when any of the following conditions occur.
   - The **SM** key is pressed while the smoothing calculation is performed.
   - The measurement function is changed.
   - The *RST command is executed.
5. Smoothing calculation and overload (OL)
   If the overload occurs during the smoothing process, this measurement value is ignored.
   (All measurement data except for OL data can be used in the smoothing calculation.)

5.9.3 Scaling Calculation

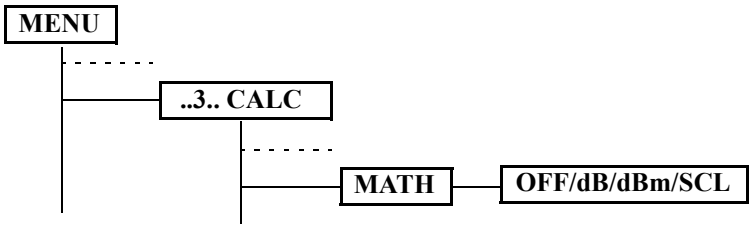
1. Function

   The scaling calculation equation is shown below.

$$\text{Display} = \frac{\text{Measurement value M - Constant B}}{\text{Constant A}} \times \text{Constant C}$$

   When SCL is selected from the MATH item in **MENU**, the MATH lamp in the display section turns on and the scaling calculation is performed.

   If OFF is selected from the MATH item in **MENU** while the scaling calculation is performed, the calculation is canceled and the MATH lamp turns off.

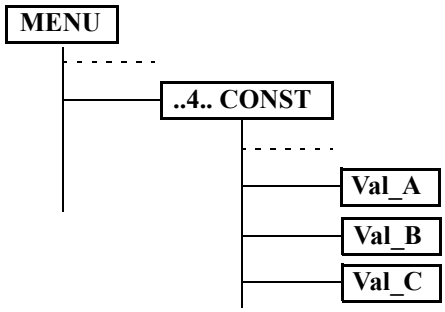


CAUTION: ***The actual measurement value is not displayed while the scaling calculation is performed. Remember that any hazardous voltage present on the input connector or test lead may not detected at this time.***

2. Setting scaling constants

NOTE: ***Press the*** **EXIT/LOCAL** ***key if quitting the setting procedure.***

   1. Set Constants A, B, and C in **MENU**.



   2. After selecting a constant to be set, the constant can be set by pressing ▽.

3. Setting the numerical value of the constant

   The setting ranges of Constants A, B, and C are shown below.

Constant	Setting range	Minimum resolution
A	-999999.E +6 to +999999.E + 6	0.000001E - 9
B		0.000000E - 9
C		

   The exponential part is set by using a unit prefix (p, n, μ, m, k, M, G, T).

   1. In the constant setting mode, the following items, which blink, can be selected by using ◁ and ▷.
      - From the most significant digit to the least significant digit in the numeric value
      - Unit prefix
      - Decimal point
   2. Change the numeric value and unit prefix by using △ and ▽.

      The unit prefix cycles through the following order.

      p ↔ n ↔ μ ↔ m ↔ No unit prefix ↔ k ↔ M ↔ G ↔ T

      Press the **TRIG** key in this mode if setting the measurement value as the scaling constant.
   3. Press **ENTER** to apply the setting.

4. S OL (scaling over)

   "±S OL" is displayed If the scaling calculation result exceeds the values of ±999.999E + 6.

   In this time, the measurement range is not changed to the upper range even if the measurement range is set to Auto-range.

   (Auto-range is determined according to the measurement value acquired before the calculation is performed.)

5. Canceling the scaling calculation

   The scaling calculation is canceled when any of the following conditions occur.

   - OFF is selected from the MATH item in **MENU** while the scaling calculation is performed.
   - The measurement function is changed.
   - The *RST command is executed.
   - The dB or dBm calculation is performed.

5.9.4 dB and dBm Calculation

1. Function

   The dB calculation, in which the decibel conversion is performed, can be performed only in the voltage and current measurements.

   The dBm calculation, which is useful to calculate the power gain per 1 mV, can be performed only in the voltage measurement.

   If the zero is measured while the dB and dBm calculations are performed, the calculation error occurs and error message is displayed.

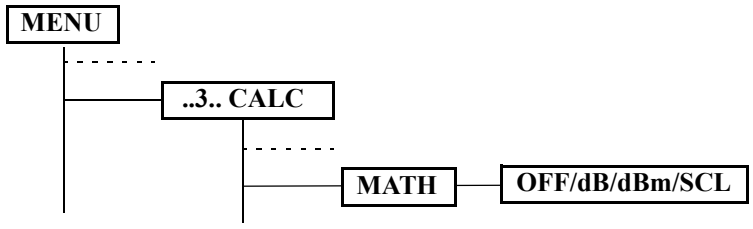
   Only one calculation can be selected from the dB, dBm, and scaling calculations at a time.

   The dB and dBm calculation equations are shown below.

   $$\text{dB:}\quad \text{Display} = 20 \log_{10} \frac{|\,\text{Measurement value}\,|}{\text{Constant D}}$$

   $$\text{dBm:}\quad \text{Display} = 10 \log_{10} \frac{(\text{Measurement value})^2 / \text{Constant D}}{10^{-3}}$$

   When dB or dBm is selected from the MATH item in **MENU**, the MATH lamp in the display section turns on.



CAUTION: ***The actual measurement value is not displayed while the dB or dBm calculation is performed. Remember that any hazardous voltage present on the input connector or test lead may not be detected at this time.***

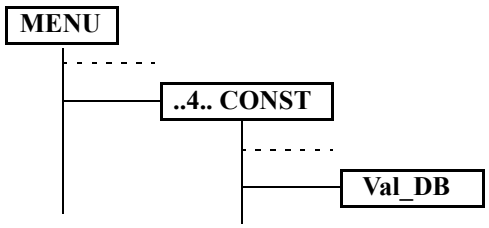
2. Setting Constant D

   The setting range of Constant D is shown below.

Setting range	Minimum resolution
0.000001E -9 to 999999.E + 6	0.000001E - 9

The exponential part is set by using a unit prefix (p, n, μ, m, k, M, G, T).

1. Set Constant D in **MENU**.



2. After the constant setting mode is enabled by pressing ▽, the following items, which blink, can be selected by pressing ◁ and ▷.
   - From the most significant digit to the least significant digit in the numeric value
   - Unit prefix
   - Decimal point

3. Change the numeric value and unit prefix by using △ and ▽.

   The unit prefix cycles through the following order.

   p ↔ n ↔ μ ↔ m ↔ No unit prefix ↔ k ↔ M ↔ G ↔ T

   Press the **TRIG** key in this mode if setting the measurement value as Constant D.

4. Press **ENTER** to apply the setting.

3. Canceling the dB and dBm calculations

   The dB and dBm calculations are canceled when any of the following conditions occur.
   - The scaling calculation is set while the dB or dBm calculation is performed.
   - The measurement function is changed.
   - The *RST command is executed.

5.9.5 Comparator Calculation

1. Function

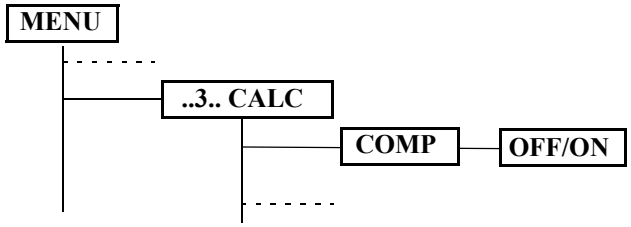
   The comparator calculation equation is shown below.

   HI = (Measurement value > HI setting value)
   LO = (Measurement value < LOW setting value)
   GO = (LOW setting value ≤ Measurement value ≤ HI setting value)

   (Processing the special data)

   - The overload (OL) of plus (+) data is judged as HI.
   - The overload (OL) of minus (-) data is judged as LO.

   The result whether HI, GO, or LO is displayed by setting COMP in **MENU** to ON.



   The judgment result can be output to the display, buzzer, and status register.

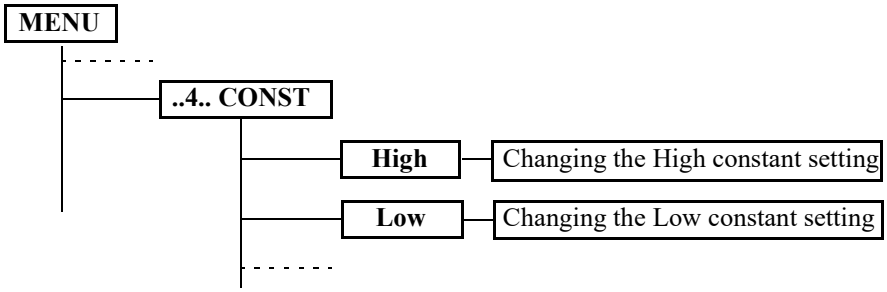
   (The buzzer sounds only when BEEP is set to ON.)

   The comparator calculation can be applied to all measurement functions.

   However, when MAX/MIN calculation is set to ON, the comparator calculation is applied to the value before the MAX/MIN calculation.

2. Setting the judgment conditions

   The setting examples of the High constant, Low constant, and buzzer are shown below.



3. Setting the numerical value of the constant

   The setting ranges of the High and Low constants are shown below.

Constant	Setting range	Minimum resolution
High	-999999.E +6 to +999999.E + 6	0.000001E - 9
Low		

The exponential part is set by using a unit prefix (p, n, μ, m, k, M, G, T).

1. After the constant setting mode is enabled by pressing ▽, the following items, which blink, can be selected by pressing ◁ and ▷.
   - From the most significant digit to the least significant digit in the numeric value
   - Unit prefix
   - Decimal point
2. Change the numeric value and unit prefix by using △ and ▽ at the blinking position.

   The unit prefix cycles through the following order.

   p ↔ n ↔ μ ↔ m ↔ No unit prefix ↔ k ↔ M ↔ G ↔ T

   Press the **TRIG** key in this mode if setting the measurement value as the High or Low constant.
3. Press **ENTER** to apply the setting.

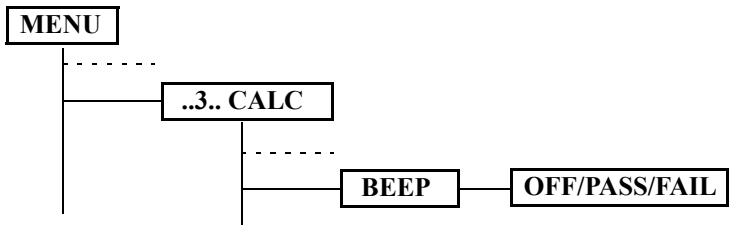
If the constants are set as “High constant < Low constant”, the calculation results may be judged as “HI and LO”. In this case, HI and LO are displayed at the same time.

4. Buzzer setting

   The buzzer output according to the PASS/FAIL judgments can be set.

   However, the buzzer output cannot be performed if •)) turns off.

   The buzzer setting is performed in BEEP in **MENU**.



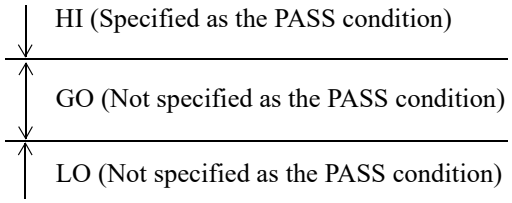
1. Press ▽ on the current setting display (BEEP) to enable the buzzer setting mode.
2. Select OFF, FAIL, or PASS by using ◁ and ▷.

5. PASS condition setting

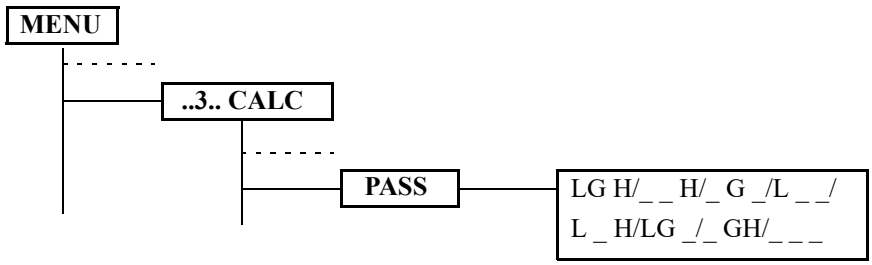
   In the PASS condition setting, each comparator calculation result (HI, GO, and LO) is specified as either PASS or not.

   For example, if HI is specified as the PASS condition and LO and GO are not specified as the PASS conditions, the comparator measurement result of HI is judged as PASS.

   The comparator calculation results of LO and GO are judged as FAIL.



   The PASS conditions are set in **MENU**.



   1. Press ▽ on the current setting display (PASS) to enable the PASS setting mode.
   2. Select the PASS condition by using ◁ and ▷.

6. Canceling the comparator calculation

   The comparator calculation is canceled when any of the following conditions occur.

   - The comparator calculation is set to OFF while the comparator calculation is performed.
   - The measurement function is changed.
   - The *RST command is executed.

7. Changing the measurement range and comparator operation

   The comparator function operates continuously even if the measurement range is changed.

   The reference values for the judgment are not changed because the values and the unit are set.

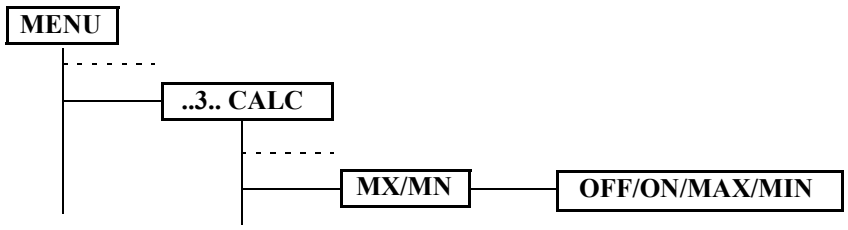
5.9.6 MAX/MIN Calculation

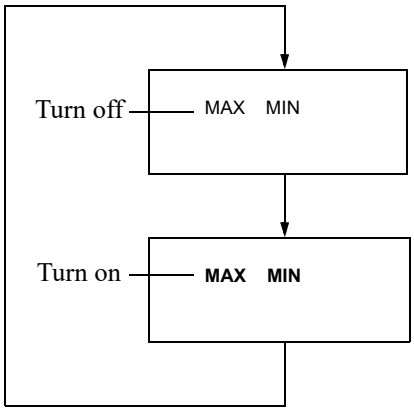
1. Function

    1. This function calculates the maximum, minimum, and average values while the MAX/MIN calculation is performed.
    2. The following calculations are performed at the same time in the MAX/MIN calculation.
        - Maximum value (MAX)
        - Minimum value (MIN)
        - Average value (AVE)
        - Measurement count
    3. All measurement data except for overload (OL) and calculation error data can be used for the calculation.
    4. If BEEP is set to ON, the buzzer sounds when the MAX or MIN value is renewed. However, although the displayed value is not changed, the buzzer may sound. This is because the resolution of measurement value is higher than the resolution of the displayed value.

2. Setting the calculation

    The operation is switched as shown in below by selecting MX/MN in **MENU**.





Canceling the calculation

The MAX and MIN lamps turn off.

Performing the calculation

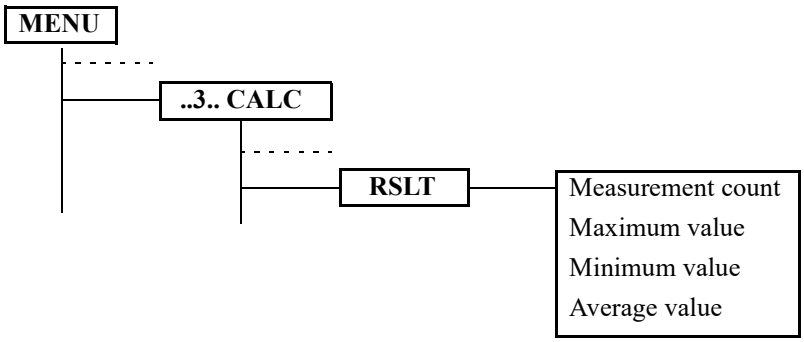
Any one of the following conditions is displayed. (NOTE)

- The MAX and MIN lamps turn on.
- The MAX lamp blinks.
- The MIN lamp blinks.

NOTE: ***Refer to "4. MAX/MIN calculation value display function during the measurement" in this section.***

3. How to call the MAX/MIN calculation result

    1. Select RSLT in **MENU** to see the calculation results display.



    2. Select a display item by pressing ◁ and ▷.

       The measurement count, maximum value, minimum value, and average value are displayed in this order.

4. MAX/MIN calculation value display function during the measurement

    1. The value while the MAX/MIN calculation is performed can be selected and displayed from the following three items.
       - Measurement value display (MAX and MIN lamps turn on.)
       - Maximum value display (MAX lamp blinks.)
       - Minimum value display (MIN lamp blinks.)

    2. How to set

       Select a display item according to “2. Setting the calculation” in this section.

       The selected value is displayed by pressing **ENTER**.

5. Canceling the MAX/MIN calculation

   The MAX/MIN calculation is canceled when any of the following conditions occur.
   - The MAX/MIN calculation is set to OFF while the MAX/MIN calculation is performed.
   - The measurement function is changed.
   - The *RST command is executed.

6. Restarting the MAX/MIN calculation

   The MAX/MIN calculation values are cleared and the MAX/MIN calculation restarts when any of the following conditions occur.
   - The power is turned on.
   - The MAX/MIN calculation is set to ON after it is set to OFF.
   - Any calculation except for the comparator calculation is changed to ON or OFF.
   - The NULL constant or the smoothing count is changed.

5.9.7 Statistical Calculation

1. Function

    1. This function calculates the maximum value, minimum value, average value, standard deviation, and range of the measurement data that is stored in the measurement memory.

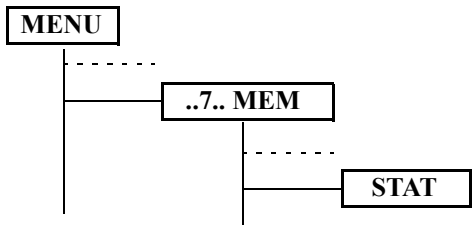
    2. The following calculations are performed at the same time in the statistical calculation.

        - Number of samples S_{CNT} = (Number of data) - (Number of overload), in the specified range
        - Maximum value S_{MAX} = Maximum value of the data to be calculated
        - Minimum value S_{MIN} = Minimum value of the data to be calculated
        - Average value $$S_{AVE} = \frac{1}{S_{CNT}} \sum_{k=1}^{S_{CNT}} Dk$$
        - Dispersion $S_{PTP} = | S_{MAX} - S_{MIN} |$
        - Standard deviation $$S\sigma = \sqrt{\frac{1}{S_{CNT}-1} \sum_{k=1}^{S_{CNT}} (Dk - S_{AVE})^2}$$

    3. All measurement data except for overload (OL) and calculation error data can be used for the calculation

2. Performing the calculation

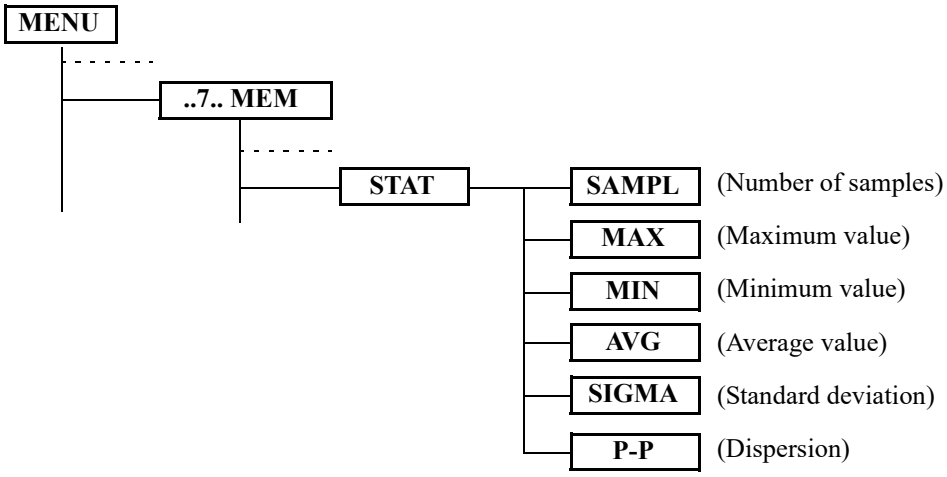
    1. Select STAT in **MENU**



    2. Press **ENTER** to perform the calculation.
    'LAST' is displayed if no data is stored in the measurement data memory.

3. How to call the calculation result

   1. The display item of the calculation results can be selected in STAT in **MENU**.



   2. Select a display item by pressing ◁ and ▷ after the statistical calculation is performed.

5.10 Saving and Loading the Measurement Condition Settings

In this instrument, four files of measurement condition setting parameters can be saved in non-volatile memory USER0 to USER3.

For information on setting parameters, refer to Section 8.9, “System Recovery Procedure” and “Table 8-4 Initial Values of Setting Parameters.”

5.10.1 Auto-Loading when Turning on the Power

This instrument starts under the stored conditions when the power is turned off.

If the same startup conditions are always used, the measurement conditions stored in USER0 can be loaded when the power is turned on.

Select from the followings in ‘PON.LD’ in the **5 PARAM** category in **MENU**.

P.OFF	Starts this instrument under the measurement conditions stored when the power is turned off.
USER0	Loads the measurement conditions in USER0.

Press **ENTER** to apply the setting.

5.10.2 Saving the Setting Parameters

Select a memory from USER0 to USER3 in ‘SAVE’ in the **5 PARAM** category in **MENU**.

Press **ENTER** to save the setting parameters into the selected memory.

5.10.3 Loading the Setting Parameters

Select a memory from USER0 to USER3 and DFLT in ‘LOAD’ in the **5 PARAM** category in **MENU**.

Press **ENTER** to load the setting parameters from the selected memory.

If DFLT is selected, the initial values are loaded.

For more information on initial values, refer to Section 8.9, “System Recovery Procedure”.

5.11 Storing and Recalling the Measurement Data

This instrument includes the measurement data memory, in which the following number of measurement results can be stored.

5.11.1 Memory Store

Select ON or OFF in 'Store' in **MENU** in **7 MEM**.

Pressing **ENTER** determines the setting and turns on the 'ST' indicator.

The measurement data is stored into the measurement data memory by closing MENU and starting the measurement.

When the number of measurement results reaches 20000, the buzzer sounds and the 'ST' indicator blinks.

5.11.2 Memory Recall

Enter the data number to be recalled in 'RCL' in **7 MEM** in **MENU**.

Pressing **ENTER** determines the setting and turns on the 'RCL' indicator.

The data number can be increased and decreased by using ◁ and ▷ before recalling the data number.

5.11.3 Memory Clear

The measurement data memory is cleared when any of the following conditions occur.

- The power is turned on.
- The device clear command is executed from the GPIB or the USB interface.
- The *RST or ICL command is executed.
- The parameter initialization is performed in **6 INIT** in **MENU**.
- The memory store setting of the measurement data is switched from OFF to ON.

5.12 System Settings

5.12.1 Buzzer Setting

Select ON or OFF in 'BEEP' in **9 SYS** in **MENU**.

ON The buzzer sounds.

OFF The buzzer does not sound.

The buzzer does not sound regardless of the result of comparator calculation.

Press **ENTER** to apply the setting.

If an error occurs, the buzzer sounds even when BEEP is set to OFF.

5.12.2 Power Supply Frequency

When the sampling rate is set to MED, the effect of induction noise can be reduced by synchronizing the integration time with the power supply frequency.

Select a power supply frequency according to the area where this instrument is used.

Select the following from 'LINE' in the **9 SYS** category in **MENU**.

50 The commercial power supply frequency is 50 Hz.

60 The commercial power supply frequency is 60 Hz.

5.12.3 Disabling Functions

To prevent incorrect functions from being selected because of malfunctions and to use this instrument safely, some functions can be disabled.

Select each function to be set to ENA or DIS in 'F.Inhi' in **9 SYS** in **MENU**.

Press ▽ to enter in the entry layer and select ENA (Enabling) or DIS (Disabling) by using ◁ and ▷.

Press **ENTER** to apply the setting.

- The relationship according to disabling the function setting

  Although the ENA or DIS can be set for each function, some functions are automatically disabled depending on the settings of other functions.

  If a higher function setting in the dependency relation is disabled, no lower function setting can be changed.

Table 5-4 Relationship according to Disabling the Function

Setting function	Function depending on the function setting					
	Diode	ACV (AC+DC)	ACI (AC+DC)	Continuity	ACI	FREQ
DCV		○				
ACV		○	○		●	●
DCI			○			
ACI			○			●
2WΩ/LP-2WΩ	◎			◎		
FREQ						

◎: Automatically set to ENA or DIS according to a setting function.

○: Disabled if any setting functions are set to DIS, and enabled if all setting functions are set to ENA.

●: Disabled if any of setting functions is set to DIS, and not enabled even if all setting functions are set to ENA.

- Canceling the setting

  To cancel the disabling setting and enable all functions, initialize in **6 INIT** in **MENU** or re-set all functions in 'F.Inhi' in **9 SYS** in **MENU**.

5.12.4 Front Panel Disabling Function

This function disables all panel keys on the front panel in this instrument.
The following shows how to set the front panel disabling function.

Password setting

The password is required to enable or disable the front panel keys.

A four-digit number from 0000 to 9999 can be used for the password.

Set the password according to the following procedure.

	Operation	Character display section
1.	Press **MENU** and select **9 SYS** by using ◁ and ▷.	MENU SYS
2.	Press ▽.	SYS BEEP
3.	Select 'PWD' by using ◁ and ▷.	SYS PWD
4.	Press ▽.	PWD NEW
5.	Select the digit in the numerical value entry section by using ◁ and ▷. Change the numerical value by using △ and ▽ to enter the password.	PWD NEW
6.	Press **ENTER**.	PWD OLD
7.	Enter the current password according to the above procedure.	PWD OLD
8.	Press **ENTER**. If the correct password is entered, PASS is displayed and the password is set.	PWD PASS
	If an incorrect password is entered, FAIL is displayed and the procedure returns to step 3. Re-set by using the correct password.	PWD FAIL
9.	Press **EXIT** to exit from MENU.	

Panel lock setting

Set the panel lock according to the following procedure.

	Operation	Character display section
1.	Press **MENU** and select **9 SYS** by using ◁ and ▷.	MENU SYS
2.	Press ▽.	SYS BEEP
3.	Select 'P.Lock' by using ◁ and ▷.	SYS P.Lock
4.	Press ▽.	P.Lock OFF
5.	Select ON by using ◁ and ▷. and press **ENTER**.	P.Lock ON
6.	Select the digit in the numerical value entry section by using ◁ and ▷. Change the numerical value by using △ and ▽ to enter the password.	PWD
7.	Press **ENTER**. If a correct password is entered, LOCK is displayed and exit from MENU. If an incorrect password is entered, the procedure returns to step 3. Re-set by using the correct password.	PWD LOCK

Canceling the panel lock

Cancel the panel lock according to the following procedure.

	Operation	Character display section
1.	If pressing any key while the panel lock is set, the entry layer of P.Lock is set.	PWD LOCK
2.	Select the digit in the numerical value entry section by using ◁ and ▷. Change the numerical value by using △ and ▽ to enter the password.	PWD LOCK
3.	Press **ENTER**.	
	If a correct password is entered, PASS is displayed and the password is set.	PWD PASS
	If an incorrect password is entered, FAIL is displayed and the procedure returns to step 3.	PWD FAIL

NOTE: ***The panel lock cannot be released if the password is forgotten. Do not forget the password. Copying the password onto paper is recommended.***

5.12.5 Error Queue

If any error occurs in this instrument, the error number is recorded and the 'ERR' indicator turns on.

Only the error number can be read from the front panel menu.

The error number and error message can be read from the GPIB or USB by using the query command.

Up to 20 errors can be recorded.

For more information on error numbers and solutions, refer to Section 8.11, "Error Message List."

Reading the error queue

Errors are displayed in order by pressing ▽ in 'QUEUE' in **9 SYS** in **MENU**.

Clearing the error queue

The error queue is cleared by reading the errors.

6. HOW TO USE THE INTERFACE

The 7351 series include the following standard interfaces according to the model.

7351A USB and GPIB interfaces

7351E USB interface
RS-232 interface (Option 03)

However, both interfaces cannot be used at the same time. Select either one.

6.1 Interface Selection

The interface can be selected and set only from MENU on the front panel.

1. Because the setting of the interface selection is saved in the nonvolatile memory, the setting does not change even if the power is turned off or the interface is reset.
2. The address specific to the instrument is set in the interface. To identify each DMM on the USB interface, the address of the USB interface (USB.ID) is set.
   The address is displayed by turning on the power or using the address setting in MENU.

The interface setting item and the initial setting when shipping are shown below.

Setting item	Initial setting when shipping
Header ON/OFF	ON
GPIB address/USB.ID	1
GPIB talker function	Addressable

Select the interface from GPIB and USB in 'BUS' in **8 I/F** in **MENU**.

Press **ENTER** to apply the setting.

Header ON/OFF

Select ON or OFF in 'HEADR' in **8 I/F** in **MENU**.

Press **ENTER** to apply the setting.

6.1.1 Response to the *IDN? Command

This instrument has changed its model name from "ADCE7351A/E" to "7351A/E." Accordingly, the response to the *IDN? command has also been changed. Note that an old model name response can also be set to maintain the compatibility with the application software.

The new model name is set when the instrument is shipped.

A new or old model name response setting does not change by the initialization command or the factory shipment initialization operation.

The new model name response to the *IDN? command is applied to software revision C00 or later.

6.1.1 Response to the *IDN? Command

Specification of response to *IDN?

New model name response	ADC Corp.,xxxxx,nnnnnnnnn,mmm xxxxx: 7351A or 7351E (Product model name) nnnnnnnnn: Serial No. mmm: Revision No.
Old model name response	ADC Corp.,xxxxxxxxx,nnnnnnnnn,mmm xxxxxxxxx: ADCE7351A or ADCE7351E (Product model name) nnnnnnnnn: Serial No. mmm: Revision No.

Changing the response to *IDN? by key operation

1. To change to the old model name response, turn on the power while pressing the **SHIFT** key.
2. After all displays are lit, “OLD *IDN?” is displayed and the response is changed to the old model name.
3. When the response is set to the old model name, the ‘▼’ indicator is activated at the lower right of the display section.
4. To change to the new model name response, turn on the power while pressing the **SHIFT** key again.
5. After all displays are lit, “NEW *IDN?” is displayed and the response is changed to the new model name.
6. When the response is set to the new model name, the ‘▼’ indicator at the lower right of the display section is turned off.

Changing the response to *IDN? by remote command

	Command	Description	Initial value
ADC command	OID0	The new model name is the response to *IDN?.	●
	OID1	The old model name is the response to *IDN?.	
	OID?	Response: OID0 or OID1	
SCPI command	:OIDentity {ON,1|OFF,0}	OFF,0: The new model name is the response to *IDN?.	●
		ON,1: The old model name is the response to *IDN?.	
	:OIDentity?	Response: 1 or 0	

When the response is set to the old model name, the ‘▼’ indicator is activated at the lower right of the display section.

6.2 GPIB (7351A)

6.2.1 Overview

The automatic measurement system can be set up easily by using GPIB (General Purpose Interface Bus) because measurement functions and parameters can be set and measurement data can be read by using the external control.

The measurement values are not affected by any external devices connected to this instrument, because the GPIB signals from this instrument are electrically isolated from the measurement signal system.

The remote commands are common to the USB commands.

- General Specifications

  Standard: IEEE-488

  Code: ASCII code

  Logical level: Logic 0 “High” state +2.4 V or more

  Logic 1 “Low” state +0.4 V or less

Table 6-1 Interface Functions

Code	Function
SH1	Source handshake function
AH1	Acceptor handshake function
T5	Basic talker function, Listener-specified talker cancel function, Talk-Only mode function, Serial polling function
L4	Basic listener function, Talker-specified listener cancel function
SR1	Service request function
RL1	Remote/Local switching function
PP0	No parallel polling function
DC1	Device clear function (The SDC and DCL commands can be used.)
DT1	Device trigger function (The GET command can be used.)
C0	No controller function
E2	Using the tri-state bus driver

6.2.2 Precautions in Use of GPIB

1. Do not use too long a bus cable to connect any instrument or controller. Ensure that the total cable length does not exceed 20 m. ADC CORPORATION uses the following cables as the standard bus cable.

Table 6-2 Standard Bus Cable

Length	Name
0.5 m	408JE-1P5
1 m	408JE-101
2 m	408JE-102
4 m	408JE-104

2. Bus cables have piggyback connectors. A piggyback connector has both a male connector and a female connector by itself. The male and female connectors can be stacked on top of each other.

   When connecting bus cables, do not stack three or more connectors. Secure the connectors with the clamping screws.

3. Check the power requirements, grounding conditions, and setting conditions of each device before turning on the power of each device.

   Ensure that all devices on the bus are turned on. If any device on the bus is not turned on, the system may not operate correctly.

4. Connecting or disconnecting cables

   Turn off all devices on the bus before connecting or disconnecting GPIB cables. Check that the chassis of the devices on the bus are connected to each other and to the ground before connecting or disconnecting any GPIB cables.

5. ATN interruption while transmitting a message

   If an ATN interruption request is received on the bus while the messages are transmitted among devices, the request is allowed and previous status is cleared.

6. Do not connect the controller when using the Talk-Only mode.

7. Up to 255 characters in one transmission can be recognized as a program command. If the program command exceeds 255 characters, an error occurs.

8. Retain LOW on the REN line for 5 ms or more after the program command has been sent.

9. The next command can be received before the execution of the INI(ADC),INITiate(SCPI), or *TRG command is complete.
   To delay the execution of the next command until the current command is complete, use the *OPC, *OPC?, or *WAI command. Describe the *OPC, *OPC?, or *WAI command at the end of a line in the program.

   Example “:INIT;*OPC”
   “:INIT;*OPC?”
   “:INIT;*WAI”

6.2.3 GPIB Setting

The following setting menu can be used when the GPIB is selected as the interface.

Address setting

1. Enter any address from 0 to 30 in 'GP.Adr' of **8 I/F** in **MENU**.
2. Press **ENTER** to apply the setting.

Talk-Only setting

1. Select the following from 'T.ONLY' of **8 I/F** in **MENU**.
   ON: Talk-Only
   OFF:Addressable
2. Press **ENTER** to apply the setting.

6.3 RS-232[EIA-232] (7351E + Option 03)

NOTE: ***The RS-232 is a factory option that is applied to 7351E only. This option cannot be added after instrument delivery.***

6.3.1 Overview

By using the RS-232 interface, setting measurement functions and parameters of this instrument and reading the measured data can be remotely controlled, and the automatic measurement system can be easily built up.

Because the interface is electrically isolated from the measurement signal system, measured values are not affected by external devices.

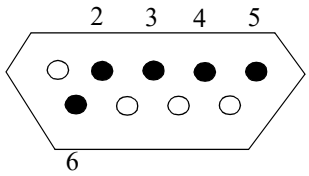
The remote commands are common to the GPIB commands.

- Specifications

Setting item		Factory default
Header of output data	on, off	on
Talk-Only	on, off	off
Baud rate	9600, 4800, 2400, 1200, 600, 300	9600
Parity	even, odd, None	None
Number of data bits	8, 7	8
Number of stop bits	1, 2	1
Echo	on, off	off

For more information on how to set RS-232 (Operation on the front panel), refer to 6.3.2, “RS-232 Setting“.

The 9-pin connector (DB-9 male connector) used for the RS-232 interface is located on the rear panel of this instrument.



Pin No.	Input/output	Description
2	Input	Receive data (RxD)
3	Output	Transmit data (TxD)
4	Output	Data terminal ready (DTR)
5	-	Signal ground (SG)
6	Input	Data set ready (DSR)

Up to 251 characters in one transmission can be recognized as a program code.

If a program code exceeds 251 characters, an error occurs.

If the DSR (data set ready) status is false when it is checked in this instrument, the transmit data (TxD) output is stopped.

Data transmission restarts when DSR is true.

CAUTION: ***This instrument cannot use the flow control performed by the X parameter (XON/XOFF).***

6.3.2 RS-232 Setting

Header of output data

1. Select the following from 'HEADR' of **8 I/F** in **MENU**.
2. Press **ENTER** to apply the setting.

Talk-Only setting

1. Select the following from 'T.ONLY' of **8 I/F** in **MENU**.
   ON: Talk-Only
   OFF: Addressable
2. Press **ENTER** to apply the setting.

Baud rate

1. Select the following from 'BAUD' of **8 I/F** in **MENU**.
   9600 - 300 - 600 - 1200 - 2400 - 4800
2. Press **ENTER** to apply the setting.

Number of data bits

1. Select the following from 'DATA' of **8 I/F** in **MENU**.
   8 bit/7 bit
2. Press **ENTER** to apply the setting.

Parity

1. Select the following from 'P-Bit' of **8 I/F** in **MENU**.
   NONE - ODD - EVEN
2. Press **ENTER** to apply the setting.

Number of stop bits

1. Select the following from 'STOP' of **8 I/F** in **MENU**.
   1 bit/2 bit
2. Press **ENTER** to apply the setting.

Echo

1. Select the following from 'ECHO' of **8 I/F** in **MENU**.
   ON/OFF
2. Press **ENTER** to apply the setting.

6.3.3 RS-232 Output Data Format

Part of the output data format differs between RS-232 and GPIB.

Data output from RS-232 is as follows:

1. Echo
2. Prompt
3. Measured data
4. Inquiry result (For inquiry command)

Data for each output and output format are as follows:

1. Echo output

   The echo output is enabled when its interface setting is set to ON.

   Identical received data is output. However, if <^C> (CONTROL C) and <LF> are entered, the following data is output:

   (<LF>) + (Prompt) + (Delimiter)

   NOTE: The delimiter has been set to <CR>...<LF> and it cannot be changed.

2. Prompt

   An execution result for a command received by RS-232 is output by using a prompt.

   First, <LF> is output, followed by a prompt and delimiter (<CR><LF>).

   The following two prompts are used:

Prompt	Description
=>	A command was correctly received, analyzed, and executed.
?>	An error occurred when a command was received, analyzed, and executed.

3. Measured data output (For the Only mode)

   For the Only mode, the measured data is output only if the RS-232 transmission is enabled and the transmission buffer is empty after the measurement was complete.

   The delimiter (<CR><LF>) is output for each measured value.

   The measurement data output format is the same between GPIB and RS-232.

   However, for RS-232, the block delimiter has been set to <CR><LF> and it cannot be changed.

4. Output of an inquiry result executed by an inquiry command

   For the output of an inquiry result executed by an inquiry command, <LF> is output first, followed by an inquiry result and delimiter, and finally a prompt at the end.

   <LF> + Inquiry result + Delimiter (<CR><LF>) + <LF> + Prompt (=>) + Delimiter (<CR><LF>)

6.3.4 Sample Program (RS-232)

This section describes an example program that controls this instrument from a personal computer through RS-232.

Language used: Microsoft Excel Visual Basic Application

Control used: Microsoft Communications Control (RS-232 control)

Example 1:

Sets the measurement function to the 2WΩ measurement, detects the measurement end by using the status byte, reads the measurement data, and then displays it for a cell.

```
Dim dt As String * 20           'Buffer for receiving data
Dim stb As String               'Buffer for receiving status byte
Dim sts As Integer              'Status byte after numerical conversion.

UserForm1.MSComm1.CommPort = 1  'Uses COM1.
UserForm1.MSComm1.Settings = "9600,N,8,1"
                                '9600 bps, Non parity, Data length: 8 bits, and Number of stop bits: 1
UserForm1.MSComm1.InputLen = 0  'Reads all of the buffers when the Input property is used.
UserForm1.MSComm1.PortOpen = True
                                'Opens the port.
UserForm1.MSComm1.InBufferCount = 0
                                'Clears the receiving buffer.
UserForm1.MSComm1.DTREnable = True
                                'Enables DTR.

dt = Space(20)                  'Initializes the buffer for receiving data

UserForm1.MSComm1.Output = "*RST" & Chr(10)
                                'Initializes *RST:DMM.
Call rx_prompt                  'Receives a prompt.


UserForm1.MSComm1.Output = "F3,PR2,TRS3,H0" & Chr(10)
                                'Sends each setting command.
                                'F3: 2WΩ resistance measurement
                                'PR2: Sets the sampling rate to MED.
                                'TRS3: Sets the trigger source to BUS.
                                'H0: Header OFF
Call rx_prompt                  'Receives a prompt.
```

6.3.4 Sample Program (RS-232)

```
UserForm1.MSComm1.Output = "*TRG" & Chr(10)
                                '*TRG: Triggers.
Call rx_prompt                  'Receives a prompt.

Do
    UserForm1.MSComm1.Output = "MSR?" & Chr(10)
                                'MSR?: Sends the command for reading the measurement event register.
    Call rx_data(msr, 5)        'Reads the measurement event register (5 characters) and stores them in msr.
    sts = Val(msr) And 256      'Converts the 5 characters, which are stored in msr, to a numerical value and stores
                                the value in sts.
Loop While (sts <> 256)         'Repeats until EOM is set.

UserForm1.MSComm1.Output = "MD?" & Chr(10)
                                'MD?: Sends the command for reading the measured data.
Call rx_data(dt, 14)            'Reads the measured data (14 characters) and stores them in dt$.

Cells(1, 1) = "'" & Left(dt, 12)
                                'Displays the measured data for a cell.

UserForm1.MSComm1.PortOpen = False
                                'Closes the port.

------------------------------------------------------------------------------
Private Sub rx_prompt()         'Subroutine procedure for receiving a prompt
    Dim prompt As String

    Do                          'Repeats.
       If UserForm1.MSComm1.InBufferCount >= 5 Then
                                'If there is received data, it is read.
          prompt = UserForm1.MSComm1.Input
                                'Reads data from the receiving buffer.
          If InStr(prompt, "=>") Then
                                'Checks whether to have received "=>".
             Exit Do            'Exits Do While Loop.
          End If                'Terminates If.
       End If                   'Terminates If.
    Loop                        'Terminates Do While Loop.
End Sub                         'Terminates the subroutine procedure.
------------------------------------------------------------------------------
Private Sub rx_data(dt As String, dt_len As Integer)
                                'Subroutine procedure for receiving data and a prompt

    Do                          'Repeats.
      If UserForm1.MSComm1.InBufferCount >= (5 + dt_len) Then
                                'If there is received data, it is read.
         dt$ = UserForm1.MSComm1.Input
                                'Reads data from the receiving buffer.
         If InStr(dt, "=>") Then
                                'Checks whether to receive "=>".
           dt = Mid(dt, 2, dt_len)
                                'Separates a prompt from received data.
           Exit Do              'Exits Do While Loop.
         End If                 'Terminates If.
      End If                    'Terminates If.
   Loop                         'Terminates Do While Loop.
End Sub
```

6.4 USB

6.4.1 Overview

A USB (Universal Serial Bus), which is compliant with the USB1.1 standard, is included in this instrument as standard.

By connecting multiple instruments to the USB ports on a personal computer, the functions of the instruments can be set, measurement data can be read from the personal computer, and the automatic measurement system can be set up easily.

NOTE: This instrument may not operate with all personal computers, hubs, etc.

6.4.2 USB Specifications

- Standard: Compliance with USB1.1
- Connector: USB B type (female)
- ID: Any number from 1 to 127 can be set as USBid.
- Remote/Local: Function is available.
- Input command: ASCII strings command which sets functions and the query command
- Output format ASCII strings which describe measurement data and query reply output
- Driver: The USB driver for ADC instruments is used.

6.4.3 Setting Up the USB Port

6.4.3.1 Connecting to a Personal Computer

Connect the connection cable to the USB connector (B type) on the rear panel of this instrument and the USB connector on the personal computer.

Insert the connector completely when connecting.

Use the USB hub when connecting several instruments to a personal computer.

6.4.3.2 USBid Setting

The USBid setting menu can be used when USB is selected for the interface.

1. Enter any address from 1 to 127 in 'USBid' in **8 I/F** in **MENU**.
2. Press **ENTER** to apply the setting.

6.5 Control Signal (7351A, 7351E + Option 03)

6.5.1 External Trigger Terminal (TRIGGER IN)

This instrument can be triggered by inputting a negative logic pulse from the external trigger terminal (TRIGGER IN) on the rear panel.

Select EXTernal as the trigger source when using this terminal.

Input the TTL level or contact signal as a trigger signal.

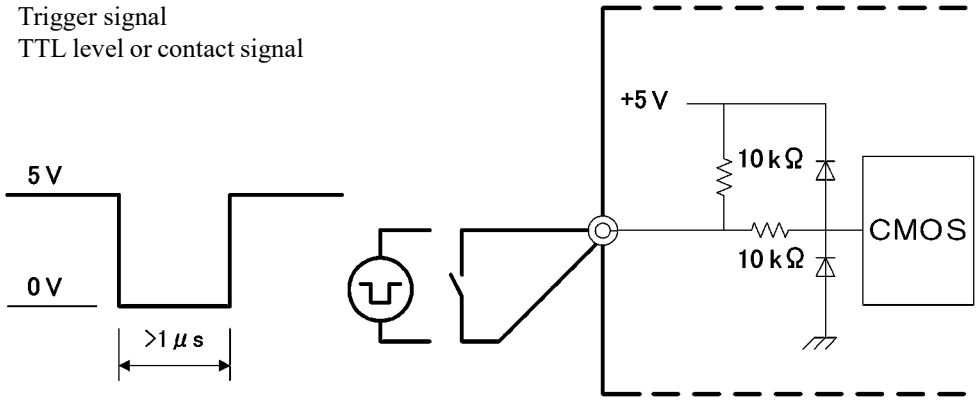


Figure 6-1 Simple Equivalent Circuit of Trigger Input Terminal

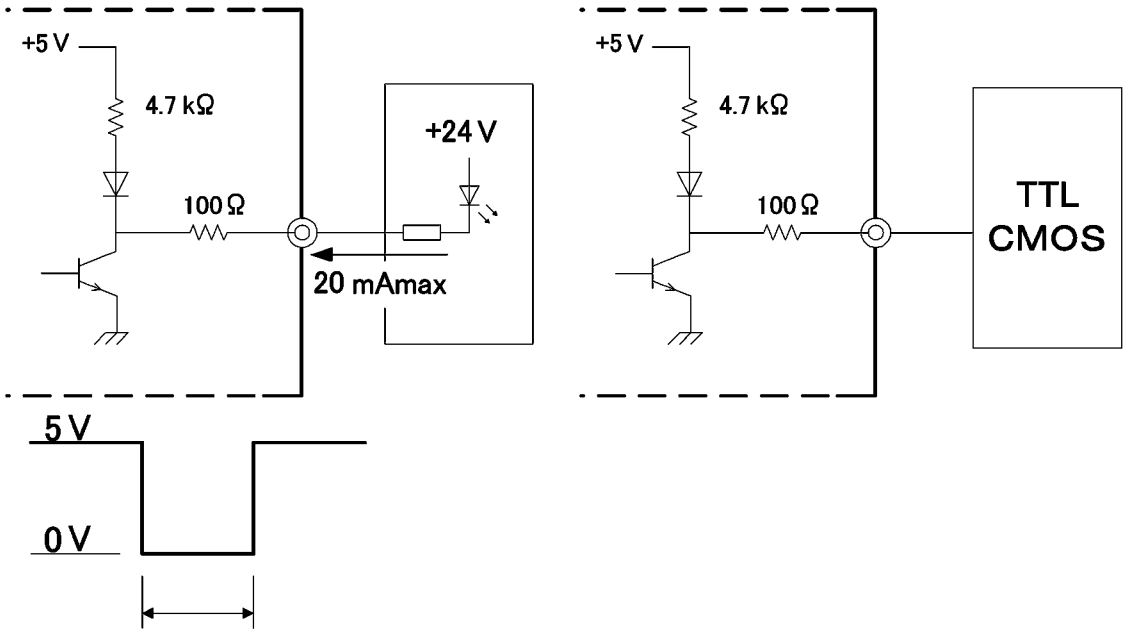
6.5.2 Measurement Complete Signal Terminal (COMPLETE OUT)

A negative logic pulse is output from the measurement complete signal terminal (COMPLETE OUT) on the rear panel when the measurement is complete.

Pulse width: Approx. 100 µsec

Approx. 900 µs (7351E + Option 03)

The measurement complete signal can be used as the TTL level and input signals that can be directly connected to the programmable controller.



Approx. 100 µs

Approx. 900 µs (7351E + Option 03)

Figure 6-2 Simple Equivalent Circuit of Complete Signal Output Terminal

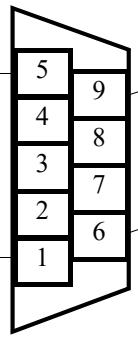
6.6 Comparator Output (7351E + Option 03)

The comparator calculation result is output from the comparator output terminal (COMPARATOR) on the rear panel as the TTL signal and the optical semiconductor relay contact signal.

Specifications

Connector	Dsub 9-pin
a. Optical semiconductor relay contact	
Allowable contact voltage (for break)	DC30 V
Allowable contact current	DC120 mA
Withstand voltage between contact and GND	30 V
Contact operating time	1 ms or less
Contact output	LO: 4 pin and 8 pin
	HI: 3 pin and 7 pin
	PASS: 2 pin and 6 pin
b. TTL output	
Output level	TTL
Maximum allowable applied voltage	12 V peak
Overload characteristics	Short-circuit (continuous)

Pin name	Pin number
Signal GND	5
RELAY LO	4
RELAY HI	3
RELAY PASS	2
TTL PASS	1



Pin number	Pin name
9	TTL FAIL
8	RELAY LO
7	RELAY HI
6	RELAY PASS

Figure 6-3 Signal Output Pin

The calculation result signals of Hi, Go, and Lo are output to the signal output pins of HI, PASS, and LO. The output to the PASS pin depends on the PASS conditions as shown in Table 6-3 and Table 6-4.

Table 6-3 Optical Semiconductor Relay Contact and TTL Logical Output (a)

Judgment result	Contact/TTL output pin			
	RELAY HI	RELAY PASS/TTL PASS	RELAY LO	TTL FAIL
Hi	make	See Table 6-4	break	See Table 6-4
Go	break		break	
Lo	break		make	

Table 6-4 Optical Semiconductor Relay Contact and TTL Logical Output (b)

PASS conditions				RELAY PASS TTL PASS			TTL FAIL		
				Judgment result			Judgment result		
Panel setting	Remote Command (ADC command)			Lo	Go	Hi	Lo	Go	Hi
LGH	LOP1	MIP1	HIP1	L	L	L	H	H	H
--H	LOP0	MIP0	HIP1	H	H	L	L	L	H
-G-	LOP0	MIP1	HIP0	H	L	H	L	H	L
L--	LOP1	MIP0	HIP0	L	H	H	H	L	L
L-H	LOP1	MIP0	HIP1	L	H	L	H	L	H
LG-	LOP1	MIP1	HIP0	L	L	H	H	H	L
-GH	LOP0	MIP1	HIP1	H	L	L	L	H	H
---	LOP0	MIP0	HIP0	H	H	H	L	L	L

H: break or Hi, L: make or Low

6.7 Command Reference

This section describes the command reference of this instrument.

6.7.1 Selecting the Command Language

This instrument can be operated remotely by using the following commands.

The command selection procedure is shown below.

1. Select the **8 I/F** category from the **MENU** mode and press ▽ to enter the selection layer.
2. Select the LANG parameter by pressing ◁ and ▷, and press ▽ to enter in the entry layer.
3. Select from SCPI, ADC, and R6451 by pressing ◁ and ▷, and press **ENTER** to apply the setting.

   SCPI: SCPI Command

   ADC: Command used in ADC CORPORATION

   R6451: Command used in ADC CORPORATION's R6451
   For more information on operations, refer to “R6451 Series Digital Multimeter Operation Manual”.

6.7.1.1 Compatibility

If the R6451 command is selected, this instrument receives the R6451 command and executes it.

CAUTION:

1. ***In the compatibility mode, note that the operations such as the measurement timing may be different from other commands.***
2. ***Commands, which are related to non-existent functions in this instrument such as the 4-20 mA measurement or memory card control, cannot be used.***

Command enabled when R6451 is selected	Command disabled when R6451 is selected
E	TRSn
M n	MSR?
Z	MSEn
BZ n	MSE?
BZ?	QSR?
MS	QSEn
IDN?	QSE?
CS	*PSC
SB? (RS-232 only)	*PSC?
	*ESR?
	*ESE
	*ESE?
	LOP
	LOP?
	MIP
	MIP?
	HIP
	HIP?
	BP
	BP?
	OSE
	OSE?

By selecting the R6451 language, commands for R6441 can be received and executed.

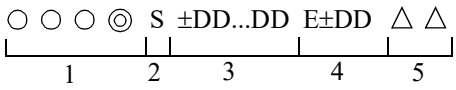
CAUTION: When using commands for R6441, ensure the following:

1. ***For the DC voltage measurement function, the R2 (20 mV range) command for R6441 sets R3 (200 mV range) for this instrument. The measured value is output with the 200 mV range format.***
2. ***For the DC current measurement function, the R5 (20 mA range) command for R6441 sets R6 (200 mA range) for this instrument. The measured value is output with the 200 mA range format.***
3. ***The F14 (High-speed AC voltage measurement function) command cannot be used. Substitute the F2 (AC voltage measurement function) command.***
4. ***The F34 (High-speed AC current measurement function) command cannot be used. Substitute the F6 (AC current measurement function) command.***
5. ***A mantissa of the output data format is one digit more than R6441.***

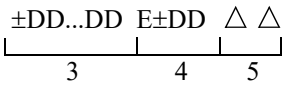
6.7.2 Output Data Format

1. Measurement data output Format (1 measurement result)

   With header

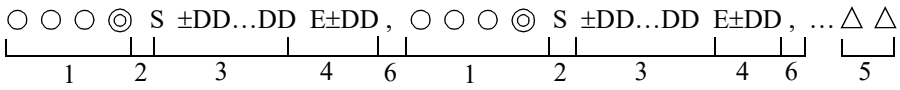
   Without header

2. Output format of the measurement data memory

   When two or more measurement results are output from the measurement data memory, the comma "," is output as a data delimiter.

   With header

   Without header

   In the above case, header (1) and space (2) are not output.

1	○ ○ ○ ◎	Main header of 3 characters (○ ○ ○) + Sub header of 1 character (◎)
2	S	Space
3	Mantissa	Polarity + Decimal point + 6 digits numerical value
4	Exponent	E + Polarity + 2 digits numerical value
5	Block delimiter	
6	Separator of measurement data	

Main header	Description	
DCV	Measurement function	DC voltage measurement (DCV)
ACV		AC voltage measurement (ACV)
R2W		Resistance measurement (2WΩ)
DCI		DC current measurement (DCI)
ACI		AC current measurement (ACI)
ADV		AC voltage (AC+DC coupling) measurement (ACV(AC+DC))
ADI		AC current (AC+DC coupling) measurement (ACI(AC+DC))
DOD		Diode measurement (Diode)
R2L		Low power resistance measurement (2WΩ)
RCT		Continuity test (Cont)
FRQ		Frequency measurement (Freq)

Sub header	Description			Priority
O	Error information	Range over		1
O		Calculation	Scaling error	1
E			Err D (dB/dBm calculation error)	2
H	Calculation result information	Comparator result	HIGH	3
P			GO	3
L			LOW	3
M		MAX data		4
I		MIN data		4
A		AVE data		4
B		dB data		5
W		dBm data		5
S		Scaling calculation data		6
N		NULL calculation data		7
_	None of the above			8

3. Measurement data

   ±○○○○○○○E±○○ (5 1/2-digit display)

Overload (OL)	±9.99999E+37
OVER of the scaling calculation result	±9.99999E+36
dB/dBm calculation error	±9.99999E+35

DCV	200 mV	±ddd.dddE-03
	2000 mV	±dddd.ddE-03
	20 V	±dd.ddddE+00
	200 V	±ddd.dddE+00
	1000 V	±dddd.ddE+00
ACV	200 mV	±ddd.dddE-03
	2000 mV	±dddd.ddE-03
	20 V	±dd.ddddE+00
	200 V	±ddd.dddE+00
	700 V	±dddd.ddE+00
ACV(AC+DC)	200 mV	±ddd.dddE-03
	2000 mV	±dddd.ddE-03
	20 V	±dd.ddddE+00
	200 V	±ddd.dddE+00
	700 V	±0ddd.ddE+00
2WΩ	200 Ω	±ddd.dddE+00
	2000 Ω	±dddd.ddE+00
	20 kΩ	±dd.ddddE+03
	200 kΩ	±ddd.dddE+03
	2000 kΩ	±dddd.ddE+03
	20 MΩ	±dd.ddddE+06
	200 MΩ	±ddd.dddE+06
DCI	200 mA	±ddd.dddE-03
	2000 mA	±dddd.ddE-03
	10 A	±dd.ddddE-03
ACI	200 mA	±ddd.dddE-03
	2000 mA	±dddd.ddE-03
	10 A	±dd.ddddE+00

ACI(AC+DC)	200 mA	±ddd.dddE-03
	2000 mA	±dddd.ddE-03
	10 A	±dd.ddddE+00
FREQ	(<10 Hz)	(±d.dddddE+00)
	(<100 Hz)	(±dd.ddddE+00)
	(<1000 Hz)	(±ddd.dddE+00)
	(<10 kHz)	(±d.dddddE+03)
	(<100 kHz)	(±dd.ddddE+03)
	(<1000 kHz)	(±ddd.dddE+03)
LP-2WΩ	200 Ω	±ddd.dddE+00
	2000 Ω	±dddd.ddE+00
	20 kΩ	±dd.ddddE+03
	200 kΩ	±ddd.dddE+03
	2000 kΩ	±dddd.ddE+03
	20 MΩ	±dd.ddddE+06
DIODE	1 range	±dddd.ddE-03
CONT	1 range	±dddd.ddE+00

( ): The Talker format in the frequency measurement function depends on the measurement range.

6.7.3 ADC Command Reference

This section describes the ADC command reference of this instrument.

“Initial value” shows the status when the *RST command is executed.

"R6451" shows a command used when the R6451 command language is selected.

A "-" shows that any related command does not exist.

A blank shows that the same command as the 7351 series can be used.

CAUTION: ***Ensure the following when using the USB interface.***
The device setting conditions are output by reading the data after executing the query command.
When executing the query command, set a wait time of 20 ms after the last command.

Item		Command	Description	Initial value	R6451
Measurement	Function	F1	DC voltage measurement (DCV)	●	
		F2	AC voltage measurement (ACV)		
		F3	Resistance measurement (2WΩ)		
		F5	DC current measurement (DCI)		
		F6	AC current measurement (ACI)		
		F7	AC voltage (AC+DC coupling) measurement (ACV(AC+DC))		
		F8	AC current (AC+DC coupling) measurement (ACI(AC+DC))		
		F13	Diode measurement (Diode)		
		F20	Low power resistance measurement 2WΩ		-
		F22	Continuity test (Cont)		
		F50	Frequency measurement (Freq)		
		F?	Reply: One of F1, F2, F3, F5, F6, F7, F8, F13, F20, F22 or F50		-
	Invalid function	INH?n	Reads the invalid state of the function. n: 1 (DC voltage measurement) to 50 (Frequency measurement) Reply 0: Valid state of the function selection 1: Invalid state of the function selection		-
	Trigger	*TRG	Trigger command		E
	Measurement data output request (Only RS-232)	MD?	Reply: See Section 6.7.2, “Output Data Format.”		

Item		Command	Description	Initial value	R6451
Measurement	Measurement data memory	ST0	Store: OFF	●	-
		ST1	Store: ON		-
		ST?	Reply: ST0 or ST1		-
		IRDn, m	Readout range setting n, m: 0 to 19999	(0, 0)	-
		IRO?	Data reading Reply: See Section 6.7.2, “Output Data Format.”		-
		IRPO?	Number of measurement results readings Reply: IRPOdddd		-
		IRNO?	Data range reading Reply: IRNOddddd, ddddd No data: IRNO+00000,-00001		-
		ICL	Measurement data memory initialization		-
Trigger system	Start	INI	Leaves the IDLE state.		-
	Continue	INIC0	CONTINUOUS OFF		-
		INIC1	CONTINUOUS ON	●	-
		INIC?	Reply: INIC0 or INIC1		-
	Trigger abort	ABO	Moves to the IDLE state.		-
	Trigger source selection	TRS0	IMMEDIATE	●	-
		TRS1	MANUAL		-
		TRS2	EXTERNAL (7351A, 7351E + Option 03)		-
		TRS3	BUS		-
		TRS?	Reply: One of TRS0 to TRS3		-
	Trigger delay	TRDn	n: 0 to 3600 (seconds)	(0)	-
		TRD?	Reply: TRD+d.ddddE±dd (The position of the decimal point depends on the setting.)		-
	Sampling count	SPNn	n: 1 to 20000 (counts)	(1)	-
		SPN?	Reply: SPNddddd		-

6.7.3 ADC Command Reference

Item		Command	Description									Initial value	R6451
Measurement condition	Measurement range		DCV	ACV	ACV (AC+DC)	2WΩ	DCI	ACI	ACI (AC+DC)	LP-2WΩ	Freq		
		R0	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO		●	
		R3	200 mV	200 mV	200 mV	200 Ω	-	-	-	200 Ω	(200 mV)		*1
		R4	2000 mV	2000 mV	2000 mV	2000 Ω	-	-	-	2000 Ω	(2000 mV)		
		R5	20 V	20 V	20 V	20 kΩ	-	-	-	20 kΩ	(20 V)		
		R6	200 V	200 V	200 V	200 kΩ	200 mA	200 mA	200 mA	200 kΩ	(200 V)		
		R7	1000 V	700 V	700 V	2000 kΩ	2000 mA	2000 mA	2000 mA	2000 kΩ	(700 V)		
		R8	-	-	-	20 MΩ	10 A	10 A	10 A	20 MΩ	-		
		R9	-	-	-	200 MΩ	-	-	-	-	-		
		R?	Reply: One of R0, R3 to R9										-
	Range Fix	RX	Range switching from AUTO to MANUAL										
	Sampling rate	PR1	FAST										
		PR2	MED										
		PR3	SLOW1										
		PR4	SLOW2 (The same as PR3 in the frequency measurement)									●	-
		PR?	Reply: One of PR1 to PR4										-
	Number of display digits	RE3	3 1/2-digit display										
		RE4	4 1/2-digit display										
		RE5	5 1/2-digit display									●	
		RE?	Reply : One of RE3 to RE5										-
	Auto-zero	AZ0	OFF										-
		AZ1	ON									●	-
		AZ2	ONCE (Auto-zero is set to OFF after executing once.)										-
		AZ?	Reply: AZ0 or AZ1										-
	Continuity threshold constant	KOMn	n:1 to 1000 (Ω) setting resolution: 1 Ω									(10)	-
		KOM?	Reply: KOMdddd										-

*1: Part of the range configuration differs from the 7351 series.

Item		Command	Description	Initial value	R6451
Calculation	NULL calculation	NL0	OFF	●	
		NL1	ON		
		NL?	Reply: NL0 or NL1		-
		KNLn	NULL constant setting n:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9 Note: The setting is disabled when the NULL calculation is set to OFF.	(0)	
		KNL?	Reply: KNL±d.ddddE±dd *2		-
	Smoothing calculation	SM0	OFF	●	
		SM1	ON		
		SM?	Reply: SM0 or SM1		-
		TIn	Smoothing count n: 2 to 100 (counts)	(10)	
		TI?	Reply: TIddd		-
	Scaling calculation	SC0	OFF	●	
		SC1	ON		
		SC?	Reply: SC0 or SC1		-
		KAn	Constant A (Zero cannot be set). n:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(1)	
		KBn	Constant B n:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(0)	-
		KCn	Constant C n:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(1)	-
		KAM	Sets Constant A to the measurement value.		
		KBM	Sets Constant B to the measurement value.		
		KCM	Sets Constant C to the measurement value.		
		KA?	Reply: KA±d.ddddE±dd *2		-
		KB?	Reply: KB±d.ddddE±dd		-
		KC?	Reply: KC±d.ddddE±dd		-

*2: The position of the decimal point in the reply is fixed.

Item		Command	Description	Initial value	R6451
Calculation	dB/dBm calculation	DB0	dB calculation OFF	●	
		DB1	dB calculation ON For the voltage and current measurement functions, ON can be set.		
		DB2	dBm calculation ON For the voltage measurement function, ON can be set.		
		DB?	Reply: One of DB0 to DB2		-
		KDn	Constant D n:0.000001E-9 to 999999.E+6	(1)	
		KDM	Sets Constant D to the measurement value.		
		KD?	Reply: KD±d.dddddE±dd *2		
	MAX•MIN calculation ○○○ : Header (Refer to Section 6.7.2, "Output Data Format.")	MN0	MAX•MIN calculation OFF	●	
		MN1	MAX•MIN calculation ON		*3
		MN?	Reply: One of MN0 to MN1		-
		MAX?	MAX value reading *2 Reply: ○○○ M ±d.ddddE±dd		-
		MIN?	MIN value reading *2 Reply: ○○○ I ±d.ddddE±dd		-
		AVE?	AVE value reading*2 Reply: ○○○ A ±d.ddddE±dd		-
		AVN?	Measurement count reading *2 Reply: AVN±d.dddddE±dd		-
	Comparator calculation	CO0	OFF	●	
		CO1	ON		
		CO?	Reply: CO0 or CO1		-
		HIn	HIGH constant n:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(0)	
		LOn	LOW constant n:-999999.E+6 to +999999.E+6 Setting resolution:0.000001E-9	(0)	
		HIM	Sets the HIGH constant to the measurement value.		
		LOM	Sets the LOW constant to the measurement value.		
		HI?	Reply: HI±d.ddddE±dd *2		-
		LO?	Reply: LO±d.ddddE±dd *2		-

*2: The position of the decimal point in the reply is fixed.
*3: MN1/MN2 (MAX calculation ON/MIN calculation ON)

Item		Command	Description	Initial value	R6451
Calculation	PASS condition range setting	LOP0	Calculation result LO is not specified as the PASS condition.	●	
		LOP1	Calculation result LO is specified as the PASS condition.		
		LOP?	Reply: LOP0 or LOP1		
		MIP0	Calculation result GO is not specified as the PASS condition.		
		MIP1	Calculation result GO is specified as the PASS condition.	●	
		MIP?	Reply: MIP0 or MIP1		
		HIP0	Calculation result HI is not specified as the PASS condition.	●	
		HIP1	Calculation result HI is specified as the PASS condition.		
		HIP?	Reply: HIP0 or HIP1		
	Statistical	SIRDn,m	Statistical calculation range setting and performing the calculation n, m: 0 to 19999 Note: 1. An error occurs if no data exists in the range set by the measurement data memory. 2. No parameters can be omitted. (0, -1)	(0, -1)	-
		SIRD?	Statistical calculation range reading Reply:SIRDddddd, ddddd Initial state: SIRD+00000, -00001		-
		SCNT?	Number of samples reading Reply: SCNT+d.dddddE+dd *2		-
		SMAX?	Maximum value reading Reply: SMAX±d.dddddE±dd *2		-
		SMIN?	Minimum value reading Reply: SMIN±d.dddddE±dd *2		-
		SAVE?	Average value reading Reply: SAVE±d.dddddE±dd *2		-
		SSIG?	Standard deviation value reading Reply: SSIG±d.dddddE±dd *2 However, if the number of samples is 1 or less: Outputs SSIG+9.99999E+30		-
		SPTP?	MAX-MIN reading Reply: SPTP±d.dddddE±dd *2		-

*2: The position of the decimal point in the reply is fixed.

Item		Command	Description	Initial value	R6451
System	Buzzer	BZ0	OFF	●	
		BZ1	ON		*6
		BZ?	Reply: One of BZ0 to BZ1		-
	Comparator result buzzer	BP0	OFF	●	-
		BP1	The buzzer sounds when the comparator calculation result is FAIL.		-
		BP2	The buzzer sounds when the comparator calculation result is PASS.		-
		BP?	Reply: One of BP0 to BP2		-
	Measurement data display	DS0	OFF		-
		DS1	ON	●	
		DS?	Reply: DS0 or DS1		-
	Power supply frequency	LF0	50 Hz	● *5	-
		LF1	60 Hz		-
		LF?	Reply: LF0 or LF1		-
	Initialization	*RST	Parameter initialization		Z -
		C	Device clear		
	Changing the response to *IDN? *7	OID0	The new model name is the response to *IDN?.	●	
		OID1	The old model name is the response to *IDN?.		
		OID?	Response: OID0 or OID1		
	Instrument information	*IDN?	New model name response ADC Corp.,xxxxx,nnnnnnnnn,mmm xxxxx: 7351A or 7351E (Product model name) nnnnnnnnn: Serial No. mmm: Revision No. The new model name response is applied to software revision C00 or later. Old model name response ADC Corp.,xxxxxxxxx,nnnnnnnnn,mmm xxxxxxxxx: ADCE7351A or ADCE7351E (Product model name) nnnnnnnnn: Serial No mmm: Revision No.		IDN?
	Header	H0	Header OFF		
		H1	Header ON	● *5	
		H?	Reply: H0 or H1		-
	Block delimiter *4	DL0	CR/LF+EOI	●	
		DL1	LF		-
		DL2	EOI		
		DL?	Reply: One of DL0 to DL2		-

*4: EOI is a GPIB function. EOI is not output in USB.
*5: This cannot be initialized by the *RST command.
*6: There are BZ1 to BZ4 according to comparator calculation results.
*7: This command is applied to software revision C00 or later.

Item		Command	Description	Initial value	R6451
System	SRQ	S1	Prohibition of SRQ transmitting		
		S0	Permission of SRQ transmitting	●	
		S?	Reply: S0 or S1		-
	Status	*CLS	Clears each status byte.		CS
	Status	*STB?	Reads the status byte register Reply: ddd		
		*SREn	Sets the service request enable register (SRER). n: 0 to 255 (However, bit6 cannot be set.)		-
		*SRE?	Reply: ddd		-
		*ESR?	Reads the standard event status register (SESR). Reply: ddd		-
		*ESEn	Sets the standard event status enable register (SESER). n:0 to 255		-
		*ESE?	Reply: ddd		-
		MSR?	Reads the measurement event register (MER). Reply: ddddd		-
		MSEn	Sets the measurement event enable register (MEER). n:0 to 65535		-
		MSE?	Reply: ddddd		-
		QSR?	Reads the questionable event register (QER). Reply: ddddd		-
		QSEn	Sets the questionable event enable register (QEER). n:0 to 65535		-
		QSE?	Reply: ddddd		-
		OSR?	Reads the operation event register (OER). Reply: ddddd		-
		OSEn	Sets the operation event enable register (OEER). n:0 to 65535		-
		OSE?	Reply: ddddd		-
		*PSCn	n:-32767 to +32767 If "n" is set to any value except for zero, SRER and SESER are cleared when the power is turned on. If "n" is set to zero, SRER and SESER are not cleared when the power is turned on.		-
		*PSC?	Reply: 0 or 1 (When any value except for zero is set.)		-
	Option	*OPT?	Reads the option information. Reply: Option name (RS-232, COMPARATOR) or 0		-
	Operation complete	*OPC	Sets the operation complete bit (bit0) of the Standard Event Status Register after all operations are complete.		-
		*OPC?	Reply: 1 (After all operations are complete.)		-
		*WAI	Waits for the completion of all operations. (GPIB only)		-

Item		Command	Description	Initial value	R6451
System	Self-Test	*TST?	Performs the self- test and reads the result. (It takes time to perform the self-test. Read the result after the self-test is complete.) Reply 0 : Pass 1 : Fail		*8
	Calibration	CAL0	Sets the calibration mode to OFF. (Writes the calibration factor when leaving the calibration mode.)	●	
		CAL1	Sets the calibration mode to ON.		
		CAL?	Reply: CAL0 or CAL1		-
		XOUT	Cancels (sets to OFF) the calibration mode. (Does not write the calibration factor.)		-
		PCn	Enters the STD value. (Displayed count value) n:0 to ±999999		
		XDTn	Enters the STD value. (Displayed value) n: Displayed value on STD		-
		CMNT "str"	Sets the calibration information. Enclose the character strings by using (") or ('). Up to 50 characters (one byte alphanumeric characters) can be stored.		-
		CMNT?	Reply: CMNT"xxxx・・・xxx" Up to 50 characters		-
	Setting parameter	*SAVn	n:0 to 3 Saves the setting parameters in area [n] of the non-volatile memory.		-
		SINI	Sets the values when shipping to all area from [0] to [3].		-
		*RCLn	n:0 to 3 Loads the setting parameters from area [n] of the non-volatile memory.		-
		RINI	Loads the values when shipping as the setting parameters.		-
	Error log reading	ERR?	Reads the error details. Reply: ±ddd,"xxxxxxxxxx" Error character strings (Up to 80 characters) Error code • Up to 20 error queues can be stored. The error is output according to the FIFO system. • If more than 20 errors occur, the last error is replaced with -350, “Queue overflow”. Any errors after this are not saved. • If no error occurs, +000, “No error” is returned.		-

*8: Self-test items differ.

6.7.4 SCPI Command Reference

This section describes the syntax to explain each SCPI command.

The syntax, which is used when the command is sent from the external controller to this instrument, is described. The syntax consists of a command section and a parameter section. The command and parameter sections are delimited by a space.

Commas (,) are used to delimit two or more parameters. The ellipsis (...) displayed between commas shows that the parameters are omitted at that position.

For example, the description "<numeric value 1>",...,"<numeric value 4>" shows "<numeric value 1>, <numeric value 2>, <numeric value 3>, <numeric value 4>".

The part, which is written by lowercase alphabetical characters in the syntax, shows that it can be omitted.

For example, ":CALibration:CABLe" can be abbreviated to ":CAL:CABL".

The symbols used in the syntax are defined as follows:

< >	Shows a parameter required for sending a command
[ ]	Shows that the command is optional. It can be omitted.
{}	Shows that only one item need be selected from multiple items.
|	Written in curly brackets {..} and used as a delimiter for multiple items.

When the parameter is a numeric type or a character (string) type, it is enclosed in angle brackets (< >).

If the parameter is optional, it is enclosed in braces { }.

Optional items are delimited by (|) and the multiple descriptions in one optional item are delimited by (,).

Example 1: {ON,1|OFF,0}

This example shows that “ON” has the same meaning of “1”, “OFF” has the same meaning of “0”, and the following four options: ON, 1, OFF, and 0 can be selected.

If the range of the value to be entered is restricted, the range is shown as [Minimum value| Default value| Maximum value] or [Minimum value| Maximum value].

In this manual, parameter types are described in the following formats:

<int_d>	Shows a numeric value that can be entered in each format of NR1, NR2, and NR3 and is rounded to an integer in this instrument. “d” shows the number of digits.
<real_d>	Shows a numeric value that can be entered in each format of NR1, NR2, and NR3 and is rounded to a real number in this instrument. “d” shows the number of decimals.
<str>	Shows a character string or alphanumeric symbols enclosed in quotation (') or double quotation (") marks.
<func>	Shows the same character string as the query reply to the [:SENSe]:FUNCtion command.

Example 2: {MAXimum|MINimum|MEASurement}

If MAXimum is selected, the maximum value is set. If MINimum is selected, the minimum value is set.

If MEASurement is selected, the measurement is performed and the measured value is set.

NOTE: ***When using the SCPI commands via USB, note the following point.***
After sending a setting command, send a query command and receive its response.
Sending more than one setting command in succession may cause unintended behavior or an error to occur.
As query command for setting commands, error check by ":SYSTem:ERRor?" and completion check by "*OPC?" are generally used.

1. Measurement function and trigger system relevant command

Item		SCPI command	Description		Initial value
Measurement	Measurement function	[:SENSe]:FUNCtion “<function>”	“<function>”:		
			“VOLTage:DC”	DC voltage measurement (DCV)	●
			“VOLTage:AC”	AC voltage measurement (ACV)	
			“RESistance”	Resistance measurement (2WΩ)	
			“CURRent:DC”	DC current measurement (DCI)	
			“CURRent:AC”	AC current measurement (ACI)	
			“VOLTage:ACDC”	AC voltage (AC+DC coupling) measurement (ACV(AC+DC))	
			“CURRent:ACDC”	AC current (AC+DC coupling) measurement (ACI(AC+DC))	
			“DIODe”	Diode measurement (Diode)	
			“RESistance:LPOWer”	Low power resistance measurement (LP-2WΩ)	
			“CONTinuity”	Continuity test (Cont)	
			“FREQuency”	Frequency measurement (Freq)	
		[:SENSe]:FUNCtion?	Reply: “VOLT:DC”, “VOLT:AC”, “RES”, “CURR:DC”,CURR:AC”, “VOLT:ACDC”, “CURR:ACDC”, “DIOD”,”RES:LPOW”, “CONT” or “FREQ”		
		:CONFigure:<function {<real>|MAXimum |MINimum} *1	Changing to the specified measurement function <real>: Range setting (0 ≤ Setting value ≤ Maximum value for the measurement range) (For the frequency measurement, the maximum value is 750(V)) This function cannot be set for the continuity and diode measurements.		
		:CONFigure?	Reply: "Function +d.dddddddE ±dd" +d.dddddddE ±dd" shows a measurement range.		

*1: <Function>: Specifies a function, which is not enclosed by double quotes, for "measurement function".

Item		SCPI command	Description	Initial value
Measurement	Disable function	:INHibit:FUNCtion :<function>? *1	Reads a status in which the function setting is disabled. Reply:1 or 0 (1: Invalid, 0: Valid)	
	Trigger	*TRG	Trigger command	
	Measurement operation	:MEASure?	Sets the DCV measurement function and reads the measured data.	
		:MEASure:<function>? *1	Performs the measurement once and reads the measured value.	
		:READ?	Initializes the trigger system and reads the measured data.	
		:FETCh?	Only reads the measured data. Reply: Refer to “Output Data Format”.	
	Measurement data memory	:TRACe:STATe {ON,1|OFF,0}	Store setting	
			ON, 1: ON	
			OFF, 0: OFF	●
		:TRACe:NUMBer <int>,<int>	Readout range setting <int>: 0 to 19999	
		:TRACe:DATA?	Data reading Refer to Section 6.7.2,“Output Data Format.”	
		:TRACe:DATA:POINts?	Number of measurement results reading Reply: ddddd	
		:TRACe:DATA:NUMBer?	Data range reading Reply: ddddd	
		:TRACe:CLEar	Initialization	
Trigger system	Start	:INITiate	Exits the IDLE state and moves to the trigger waiting state.	
	Continue	:INITiate:CONTinuous {ON,1|OFF,0}	ON, 1: CONTINUOUS ON	
			OFF, 0: CONTINUOUS OFF	●
		:INITiate:CONTinuous?	Reply: 1 or 0	
	Trigger abort	:ABORt	Forcibly moves to the IDLE state.	
	Trigger source selection	:TRIGger:SOURce {IMMediate|MANual|EXTernal|BUS}	IMMediate	●
			MANual	
			EXTernal (7351A, 7351E + Option 03)	
			BUS	
		:TRIGger:SOURce?	Reply: IMM, MAN, EXT, or BUS	
	Trigger delay	:TRIGger:DELay {<real>|MAXimum|MINimum}	<real>: 0 to 3600 (seconds)	(0)
		:TRIGger:DELay? {MAXimum|MINimum}	Reply: +d.dddE±dd	
	Sampling count (1 trigger)	:SAMPle:COUNt {<int>|MAXimum|MINimum}	<int>: 1 to 20000	(1)
		:SAMPle:COUNt? {MAXimum|MINimum}	Reply: ddddd	

*1: <Function>: Specifies a function, which is not enclosed by double quotes, for "measurement function".

2. Measurement condition command

Item		SCPI command	Description	Initial value
Measurement condition	Measurement range	[:SENSe]:<function>:RANGe :AUTO {ON,1|OFF,0} *1	Auto-range setting	
			ON, 1: Auto-range ON	●
			OFF, 0: Auto-range OFF This function cannot be set for the continuity, diode, and frequency measurements.	
		[:SENSe]:<function>:RANGe :AUTO? *1	Reply: 1 or 0	
		[:SENSe]:<function>:RANGe {<real>|MAXimum|MINimum} *1	Fixed range setting <real>:0 ≤ Setting value ≤ Maximum value for the measurement range (For the frequency measurement, the maximum value is 750(V)) This function cannot be set for the continuity and diode measurements.	
		[:SENSe]:<function>:RANGe? {MAXimum|MINimum} *1	Reply: +d.dddddE ±dd The reply is the maximum value for the specified range.	
	Sampling rate	[:SENSe]:<function>:SRATe {FAST|MED|SLOW|SSLow} *1	FAST: FAST	
			MED: MED	
			SLOW: SLOW1	
			SSLow: SLOW2	●
			The setting is applied to all functions.	
		[:SENSe]:<function>:SRATe? *1	Reply: FAST, MED, SLOW, or SSL	
	Number of display digits	[:SENSe]:<function>:DIGits {3|4|5|MAXimum|MINimum} *1	3: 3 1/2-digit display	
			4: 4 1/2-digit display	
			5: 5 1/2-digit display	●
			The setting is applied to all functions.	
		[:SENSe]:<function>:DIGits? {MAXimum|MINimum} *1	Reply: 3, 4, or 5	
	Auto-zero	[:SENSe]:ZERO:AUTO {ON,1|OFF,0|ONCE}	ON, 1: ON	●
			OFF, 0: OFF	
			ONCE: (Auto-zero is set to OFF after executing once.)	
		[:SENSe]:ZERO:AUTO?	Reply: 1 or 0	
	Continuity threshold constant	[:SENSe]:CONTinuity:THReshold {<real>|MAXimum|MINimum}	<real>: 1 to 1000 (Ω) setting resolution: 1 Ω	(10)
		[:SENSe]:CONTinuity:THReshold? {MAXimum|MINimum}	Reply: dddd	

*1: <Function>: Specifies a function, which is not enclosed by double quotes, for "measurement function".

3. Measurement condition command

Item		SCPI command	Description	Initial value
Calculation	NULL calculation	[:SENSe]:<function>:REFerence :STATe {ON,1|OFF,0} *1	ON, 1: ON	
			OFF, 0: OFF	●
		[:SENSe]:<function>:REFerence :STATe? *1	Reply: 1 or 0	
		[:SENSe]:<function>:REFerence {<real>|MAXimum|MINimum} *1	NULL constant setting <real>: -999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9 Note: The setting is disabled when the NULL calculation is set to OFF.	(0)
		[:SENSe]:<function>:REFerence? {MAXimum|MINimum}	Reply: ±d.ddddE ±dd	
	Smoothing calculation	:CALCulate:SMOothing {ON,1|OFF,0}	ON, 1: ON	
			OFF, 0: OFF	●
		:CALCulate:SMOothing?	Reply: 1 or 0	
		:CALCulate:SMOothing:POINts {<int>|MAXimum|MINimum}	Smoothing count <int>: 2 to 100 (counts)	(10)
		:CALCulate:SMOothing:POINts? {MAXimum|MINimum}	Reply: ddd	
	Scaling calculation	:CALCulate:SCALing {ON,1|OFF,0}	ON, 1: ON	
			OFF, 0: OFF	●
		:CALCulate:SCALing?	Reply: 1 or 0	
		:CALCulate:SCALing:A {<real>|MAXimum|MINimum|MEASurement}	Constant A (Zero cannot be set) <real>:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(1)
		:CALCulate:SCALing:B {<real>|MAXimum|MINimum|MEASurement}	Constant B <real>:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(0)
		:CALCulate:SCALing:C {<real>|MAXimum|MINimum|MEASurement}	Constant C <real>:-999999.E+6 to +999999.E+6 Setting resolution: 0.000001E-9	(1)
		:CALCulate:SCALing:A? {MAXimum|MINimum}	Reply: ±d.ddddE ±dd	
		:CALCulate:SCALing:B? {MAXimum|MINimum}		
		:CALCulate:SCALing:C? {MAXimum|MINimum}		

*1: <Function>: Specifies a function, which is not enclosed by double quotes, for "measurement function".

Item		SCPI command	Description	Initial value
Calculation	dB/dBm calculation	:CALCulate:DB {DB|DBM|OFF}	DB: dB calculation ON For the voltage and current measurement functions, ON can be set.	
			DBM: dBm calculation ON For the voltage measurement function, ON can be set.	
			OFF: dB/dBm calculation OFF	●
		:CALCulate:DB?	Reply: DB, DBM, or OFF	
		:CALCulate:DB:D {<real>|MAXimum|MINimum|MEASurement}	Constant D <real>: 0.00001E-9 to 999999.E+6	
		:CALCulate:DB:D? {MAXimum|MINimum}	Reply: ±d.dddddE ±dd	
	MAX•MIN calculation	:CALCulate:AVERage {ON,1|OFF,0}	ON, 1: ON	
			OFF, 0: OFF	●
		:CALCulate:AVERage?	Reply: 1 or 0	
		:CALCulate:AVERage:MAXimum?	MAX value reading	
		:CALCulate:AVERage:MINimum?	MIN value reading	
		:CALCulate:AVERage:AVERage?	AVE value reading	
		:CALCulate:AVERage:COUNt?	Measurement count reading	
			Reply: ±d.dddddE ±dd	
	Comparator calculation	:CALCulate:LIMit {ON,1|OFF,0}	ON, 1: ON	
			OFF, 0: OFF	●
		:CALCulate:LIMit?	Reply: 1 or 0	
		:CALCulate:LIMit:UPPer {<real>|MAXimum|MINimum|MEASurement}	HIGH constant <real>: -0.00001E-9 to 999999.E+6 Setting resolution:0.000001E-9	(0)
		:CALCulate:LIMit:LOWer {<real>|MAXimum|MINimum|MEASurement}	LOW constant <real>: -0.00001E-9 to 999999.E+6 Setting resolution:0.000001E-9	(0)
		:CALCulate:LIMit:UPPer? {MAXimum|MINimum}	Reply: ±d.dddddE ±dd	
		:CALCulate:LIMit:LOWer? {MAXimum|MINimum}		

Item		SCPI command	Description	Initial value
Calculation	PASS condition range setting	:CALCulate:LIMit:PASS:LOWer {ON,1|OFF,0}	ON, 1: Calculation result LOW is specified as the PASS condition.	
			OFF, 0: Calculation result LOW is not specified as the PASS condition.	●
		:CALCulate:LIMit:PASS:LOWer?	Reply: 1 or 0	
		:CALCulate:LIMit:PASS:MED {ON,1|OFF,0}	ON, 1: Calculation result GO is specified as the PASS condition.	●
			OFF, 0: Calculation result GO is not specified as the PASS condition.	
		:CALCulate:LIMit:PASS:MED?	Reply: 1 or 0	
		:CALCulate:LIMit:PASS:UPPer {ON,1|OFF,0}	ON, 1: Calculation result HI is specified as the PASS condition.	
			OFF, 0: Calculation result HI is not specified as the PASS condition.	●
		:CALCulate:LIMit:PASS:UPPer?	Reply: 1 or 0	
	Statistical calculation	:CALCulate:STATistics <int>,<int>	Calculation range specifying and performing <int>: 0 to 19999	
		:CALCulate:STATistics:COUNt?	Number of samples reading Reply: ±d.ddddE±dd	
		:CALCulate:STATistics:MAXimum?	Maximum value reading Reply: ±d.ddddE±dd	
		:CALCulate:STATistics:MINimum?	Minimum value reading Reply: ±d.ddddE±dd	
		:CALCulate:STATistics:AVERage?	Average value reading Reply: ±d.ddddE±dd	
		:CALCulate:STATistics:DEViation?	Standard deviation value reading Reply: ±d.ddddE±dd	
		:CALCulate:STATistics:MAXMin?	MAX-MIN value reading Reply: ±d.ddddE±dd	

4. System relevant command

Item		SCPI command	Description	Initial value
System	Buzzer	:CALCulate:LIMit:BEEPer {OFF|FAIL|PASS}	OFF: OFF	●
			FAIL: The buzzer sounds when the comparator calculation result is FAIL.	
			PASS: The buzzer sounds when the comparator calculation result is PASS.	
		:CALCulate:LIMit:BEEPer?	Reply: OFF, FAIL, or PASS	
		:SYSTem:BEEPer:STATe {ON,1|OFF,0}	ON, 1: Buzzer ON	
			OFF, 0: Buzzer OFF	●
		:SYSTem:BEEPer:STATe?	Reply: 1 or 0	
	Measurement data display	:DISPlay {ON,1|OFF,0}	ON, 1: ON	●
			OFF, 0: OFF	
		:DISPlay?	Reply: 1 or 0	
	Power supply frequency	[:SENSe]:LFRQency {50|60}	50: 50 Hz	
			60: 60 Hz	
		[:SENSe]:LFRQency?	Reply: 50 or 60	
	Initialization	*RST	Parameter initialization	
	Changing the response to *IDN? *1	:OIDentity {ON,1|OFF,0}	OFF,0: The new model name is the response to *IDN?.	●
			ON,1: The old model name is the response to *IDN?.	
		:OIDentity?	Response: 1 or 0	
	Instrument information	*IDN?	New model name response: ADC Corp.,xxxxx,nnnnnnnnn,mmm xxxxx: 7351A or 7351E (Product model name) nnnnnnnnn: Serial No. mmm: Revision No. The new model name response is applied to software revision C00 or later. Old model name response ADC Corp.,xxxxxxxxx,nnnnnnnnn,mmm xxxxxxxxx: ADCE7351A or ADCE7351E (Product model name) nnnnnnnnn: Serial No. mmm: Revision No.	
	Block delimiter	:SYSTem:GPIB:DELimiter :BLOCk {CRLF|LF|EOI}	CRLF: CRLF+EOI	●
			LF: LF	
			EOI: EOI	
		:SYSTem:GPIB:DELimiter :BLOCk?	Reply: CRLF, LF, or EOI	

*1: This command is applied to software revision C00 or later.

Item		SCPI command	Description	Initial value
System	Status	*CLS	Clears each status byte.	
		*STB?	Reads the status byte register Reply: ddd	
		*SRE <int>	Sets the service request enable register. <int>: 0 to 255 (However, bit6 cannot be set.)	
		*SRE?	Reply: ddd	
		*ESR?	Reads the standard event status register. Reply: ddd	
		*ESE <int>	Sets the standard event status enable register. <int>: 0 to 255 (However, bit6 cannot be set.)	
		*ESE?	Reply: ddd	
		:STATus:MEASurement:EVENt?	Reads the measurement event register. Reply: ddddd	
		:STATus:MEASurement:ENABle <int>	Sets the measurement event enable register. <int>: 0 to 65535	
		:STATus:MEASurement:ENABle?	Reply: ddddd	
		:STATus:QUEStionable:EVENt?	Reads the questionable event register. Reply: ddddd	
		:STATus:QUEStionable:ENABle <int>	Sets the questionable event enable register. <int>: 0 to 65535	
		:STATus:QUEStionable:ENABle?	Reply: ddddd	
		:STATus:OPERation:EVENt?	Reads the operation event register. Reply: ddddd	
		:STATus:OPERation:ENABle <int>	Sets the operation event enable register. <int>: 0 to 65535	
		:STATus:OPERation:ENABle?	Reply: ddddd	
		*PSC <int>	<int>: -32767 to +32767 If "int" is set to any value except for zero, SRER and SESER are cleared when the power is turned on. If "int" is set to zero, SRER and SESER are not cleared when the power is turned on.	
		*PSC?	Reply: 0 or 1 (When any value except for zero is set.)	
	Operation complete	*OPC	Sets the operation complete bit (bit0) of the Standard Event Status Register after all operations are complete.	
		*OPC?	Reply: 1 (After all operations are complete.)	
		*WAI	Waits for the completion of all operations. (GPIB only)	
	Self-Test	*TST?	Performs the self- test and reads the result. (It takes time to perform the self-test. Read the result after executing the *WAI command.) Reply 0 : Pass 1 : Fail	

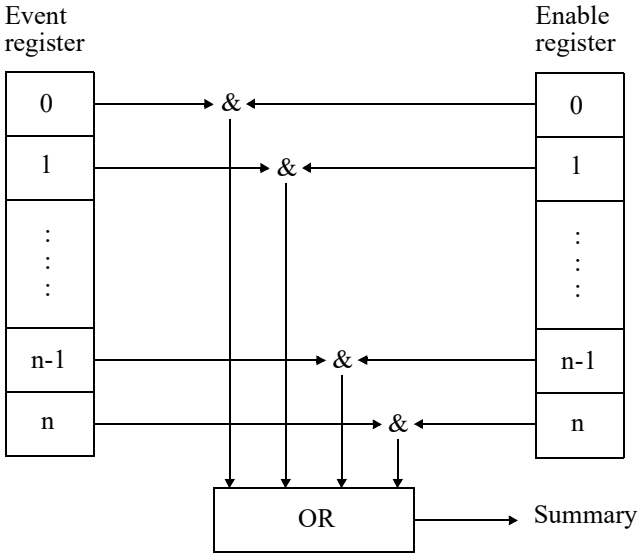
Item		SCPI command	Description	Initial value
System	Calibration	:CALibration:SECure:STATe {ON,1|OFF,0}	ON, 1: Sets the calibration mode to ON.	
			OFF, 0: Sets the calibration mode to OFF. (Writes the calibration factor when leaving the calibration mode.)	●
		:CALibration:SECure:STATe?	Reply: 1 or 0	
		:CALibration:ABORt	Cancels (sets to OFF) the calibration mode. (Does not write the calibration factor.)	
		:CALibration <int>	Enters the STD value. (Displayed count value) <int>: 0 to ±999999	
		:CALibration:VALue <real>	Enters the STD value. (Displayed value) <real>: Displayed value on STD	
		:CALibration:STRing <"str">	Sets the calibration information. <"str">: Enclose the character strings by using ("). Up to 50 characters (one byte alphanumeric characters) can be stored.	
		:CALibration:STRing?	Reply: CMNT"xxxxx・・・xxx" Up to 50 characters	
	Setting parameter	*SAV <int>	<int>: 0 to 3 Saves the setting parameters in area [int] of the non-volatile memory.	
		*RCL <int>	<int>: 0 to 3 Loads the setting parameters from area [int] of the non-volatile memory.	
	Error log reading	:SYSTem:ERRor?	Reads the error details.	
			Reply: ±ddd,"xxxxxxxxxx" Error character strings (Up to 80 characters) Error code • Up to 20 error queues can be stored. The error is output according to the FIFO system. • If more than 20 errors occur, the last error is replaced with -350, "Queue overflow". Any errors after this are not saved. • If no error occurs, +000, "No error" is returned.	
	SCPI version	:SYSTem:VERSion?	Reads SCPI version. Reply: 1991.0	

6.7.5 Status Register Structure

This instrument has a layered status register structure that is compliant with IEEE standard 488.2-1987 and can send various statuses of this instrument to the controller. This section describes the operation model of status structure and allocation of events.

1. Status register

   This instrument adopts the model of the status register defined in IEEE standard 488.2-1987. The status register consists of the event register and enable register.



- Event register

  The event register latches and retains statuses correspondent to each event. (Sometimes the changes are retained.)

  Once this register is set, the setting value is kept until it is read by a query or cleared by *CLS.

  Data cannot be written into the event register.

- Enable register

  The enable register specifies which bit in the event register is set as an effective status to generate a summary. The enable register is ANDed with the event register and the OR of the result is generated as a summary. The summary is written into the status byte register.

  Data can be written into the enable register.

This instrument uses the following five types of status registers:

- Status Byte Register (STB)
- Standard Event Status Register (SESR)
- Measurement Event Register (MER)
- Questionable Event Register (QER)
- Operation Event Register (OER)

The status register structure in this instrument is shown in Figure 6-4 and Figure 6-5.

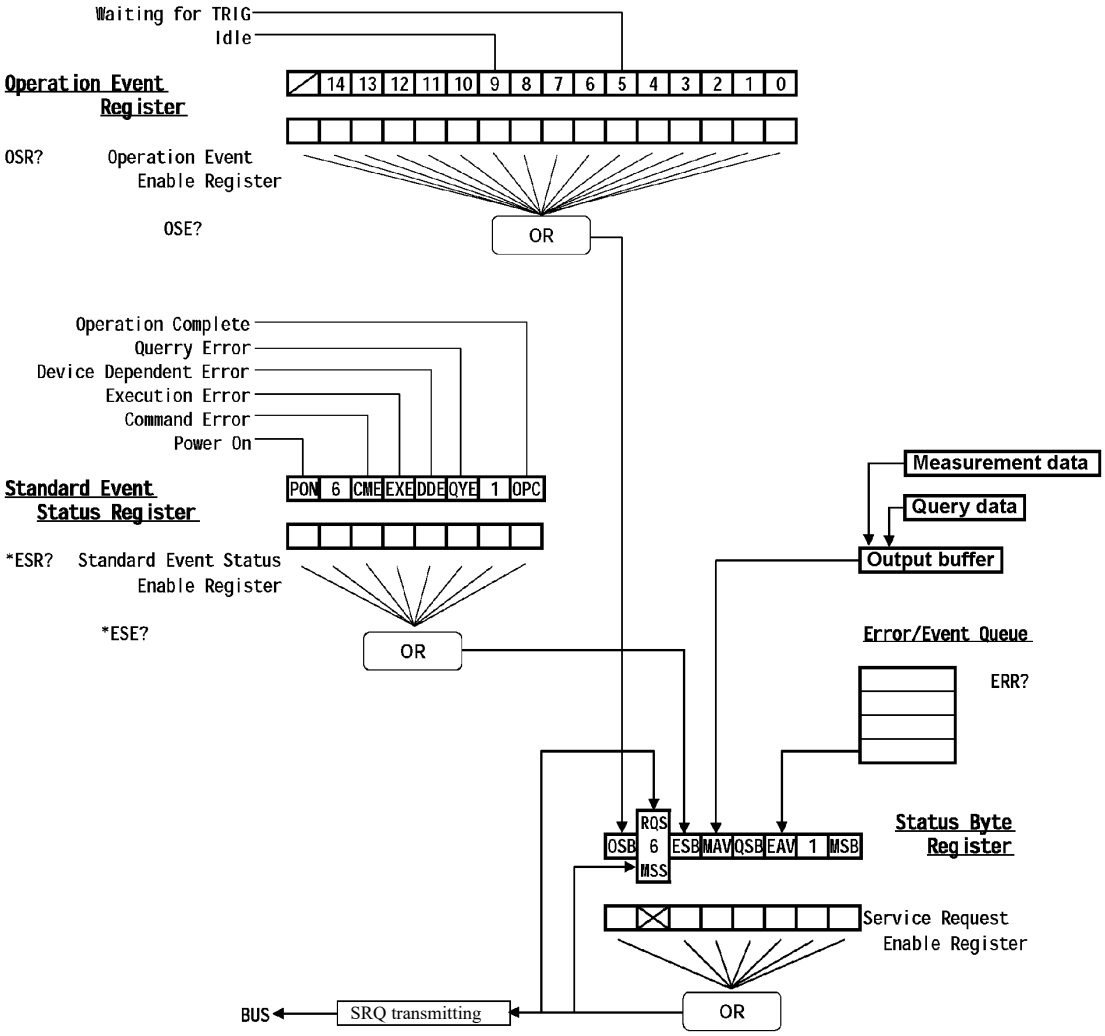


Figure 6-4 Status Register Structure (1/2)

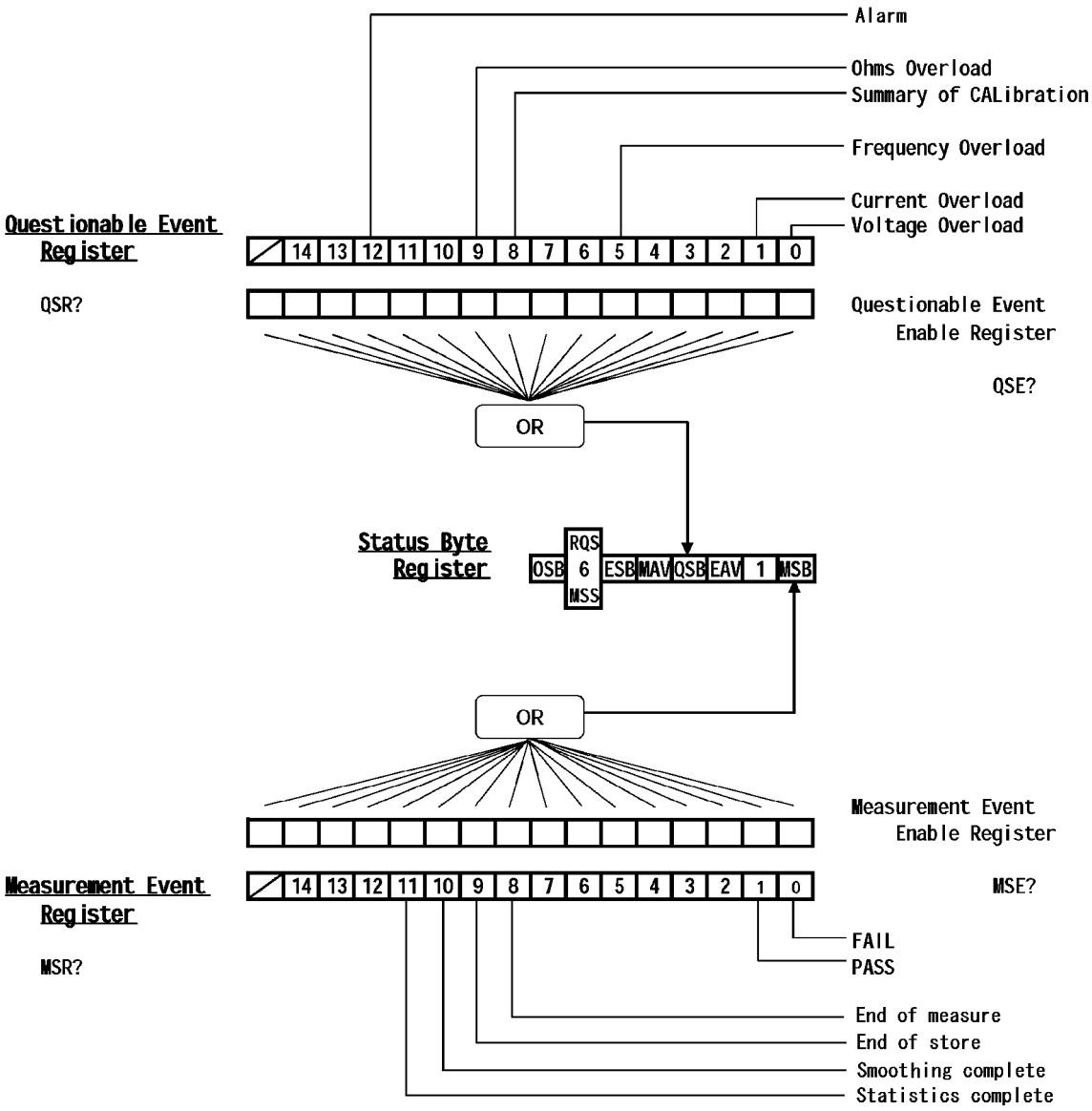


Figure 6-5 Status Register Structure (2/2)

2. Event enable register

   Each event register has an enable register that determines which bit is to be enabled. The enable register sets the corresponding bit in decimal.

   - Service Request Enable Register (SRER) setting: *SRE
   - Standard Event Status Enable Register (SESER) setting: *ESE
   - Measurement Event Enable Register (MEER): MSE
   - Questionable Event Enable Register (QEER): QSE
   - Operation Event Enable Register (OEER) OSE

3. Status byte register

The status byte register summarizes the information from the status register. A summary of this status byte register is sent to the controller as a service request. Therefore, the status byte register operates slightly differently than the status register structure. This section describes the status byte register.

The status byte register structure is shown in Figure 6-6.

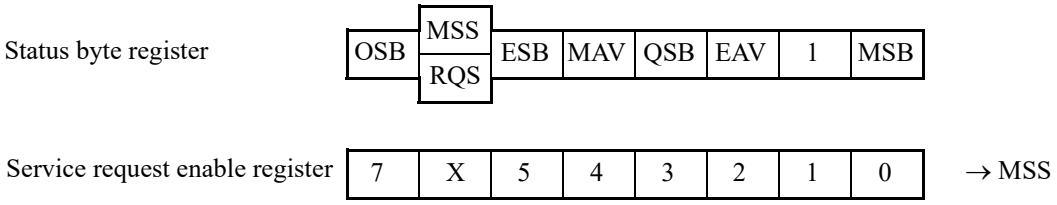


Figure 6-6 Status Byte Register Structure

This status byte register follows the status register except for the following three points:

- The summary of the status byte register is written to bit6 of the status byte register.
- Bit6 of the enable register is always enabled and cannot be changed.
- Bit6 (MSS) of the status byte register writes the RQS of the service request.

This register responds to the serial polling from the controller. When the register responds to the serial polling, bit0 to bit5, bit7, and the RQS of the status byte register are read, and then the RQS is reset to 0. No other bits are cleared until each factor is set to 0.

The status byte register, RQS, and MSS can be cleared by executing "*CLS". Consequently, the SRQ line is set to FALSE.

A description of each bit in the status byte register is shown in Table 6-5.

Table 6-5 Status Byte Register (STB)

bit	Name	Description
0	MSB Measurement Summary Bit	ON: When any event of Measurement Event Register occurs and Measurement Event Register is set to 1, this bit is set to 1 if the corresponding bit of the Measurement Event Enable Register is set to 1. OFF: This bit is set to 0 when Measurement Event Register is cleared by being read.
1	Not used	Always 0
2	EAV Error Available	ON: This bit is set to 1 when the error information is stored in Error Queue. OFF: This bit is set to 0 when the error information is read from Error Queue and no data has existed in Error Queue.
3	QSB Questionable Summary Bit	ON: When any event of Questionable Event Register occurs and Questionable Event Register is set to 1, this bit is set to 1 if the corresponding bit of the Questionable Event Enable Register is set to 1. OFF: This bit is set to 0 when Questionable Event Register is cleared by being read.
4	MAV Message Available	ON: This bit is set to 1 when the output data is entered in the output buffer. OFF: This bit is set to 0 when the data is read from the output buffer.
5	ESB Standard Event Status	ON: When any event of SESR occurs and SESR is set to 1, this bit is set to 1 if the corresponding bit of the SESER is set to 1. OFF: This bit is set to 0 when SESR is cleared by being read (*ESR?).
6	MSS Master Summary	ON: When any event of STB occurs, this bit is set to 1 if the corresponding bit of the SRER is set to 1.
	RQS Request Service	ON: If MSS is set to 1, SRQ is generated and RQS is set to 1. OFF: When STB is read in the serial polling, RQS is set to 0.
7	OSB Operation Summary Bit	ON: When any event of Operation Event Register occurs and Operation Event Register is set to 1, this bit is set to 1 if the corresponding bit of the Operation Event Enable Register is set to 1. OFF: This bit is set to 0 when Operation Event Register is cleared by being read.

Conditions which clear the status byte register

- When the power is turned on.
- When the *CLS command is executed. However, the MAV bit is not cleared if data exists in the output buffer.
- The status byte register is not cleared by executing *STB? command.

Conditions which clear the service request enable register

- When the power is turned on. (When the PSC flag is set to 1)
- When the *SRE0 command is executed.

4. Standard event status register

   Allocation in the standard event register is shown in Table 6-6.

Table 6-6 Standard Event Status Register (SESR)

bit	Name	Description
0	OPC Operation Complete	ON: This bit is set to 1 when all operations are complete after receiving the *OPC command.
1	Not used	Always 0
2	QYE Query Error	ON: This bit is set to 1 under any of the following conditions. • When the data is read, but no data exists in the output buffer and no data to be output exists. • When data in the output buffer is lost.
3	DDE Device Dependent Error	ON: This bit is set to 1 when the error, which depends on the device, occurs.
4	EXE Execution Error	ON: This bit is set to 1 when the received command cannot be executed. This bit is set to 1 when the command parameter contains an error.
5	CME Command Error	ON: This bit is set to 1 when the received command spelling is incorrect.
6	Not used	Always 0
7	PON Power On	ON: This bit is set to 1 when the power is turned on.

Conditions which clear the standard event status register

- When the power is turned on.
- When the *CLS command is executed.
- When the *ESR? command is executed.

Conditions which clear the standard event status enable register

- When the power is turned on. (When the PSC flag is set to 1)
- When the *ESE0 command is executed.

5. Measurement event register

Allocation in the measurement event register is shown in Table 6-7.

Table 6-7 Measurement Event Register (MER)

bit	Name	Description
0	FL FAIL	ON: This bit is set to 1 when the comparator calculation result satisfies the FAIL conditions.
1	PS PASS	ON: This bit is set to 1 when the comparator calculation result satisfies the PASS conditions.
2	Not used	Always 0
3	Not used	Always 0
4	Not used	Always 0
5	Not used	Always 0
6	Not used	Always 0
7	Not used	Always 0
8	EOM End of measure	ON: This bit is set to 1 when the measurement is complete.
9	EOS End of store	ON: This bit is set to 1 when no more measurement data can be stored in the measurement memory.
10	SM Smoothing complete	ON: This bit is set to 1 when the smoothing count reaches the specified number.
11	STAT Statistics complete	ON: This bit is set to 1 when the statistical processing is complete.
12	Not used	Always 0
13	Not used	Always 0
14	Not used	Always 0
15	Not used	Always 0

Conditions which clear the measurement event register

- When the power is turned on.
- When the *CLS command is executed.
- When the :STATus:MEASurement[:EVENt]? command is executed.
- When the MSR? command is executed.

Conditions which clear the measurement event enable register

- When the power is turned on.
- When the :STATus:MEASurement:ENABle 0 command is executed.
- When the MSE0 command is executed.

6. Questionable event register

Allocation in the questionable event register is shown in Table 6-8.

Table 6-8 Questionable Event Register (QER)

bit	Name	Description
0	Voltage Overload	ON: This bit is set to 1 when OL occurs in the voltage or diode measurement.
1	Current Overload	ON: This bit is set to 1 when OL occurs in the current measurement.
2	Not used	Always 0
3	Not used	Always 0
4	Not used	Always 0
5	Frequency Overload	ON: This bit is set to 1 when OL occurs in the frequency measurement.
6	Not used	Always 0
7	Not used	Always 0
8	Summary of Calibration	ON: This bit is set 1 when the default calibration values or the calibration values acquired in previous power ON is used due to the calibration data SUM failure in the power ON check.
9	Ohms Overload	ON: This bit is set to 1 when OL occurs in the resistance measurement.
10	Not used	Always 0
11	Not used	Always 0
12	Alarm	ON: This bit is set to 1 when an alarm occurs in the measurement.
13	Not used	Always 0
14	Not used	Always 0
15	Not used	Always 0

Conditions which clear the questionable event register

- When the power is turned on.
- When the *CLS command is executed.
- When the :STATus:QUEStionable[:EVENt]? command is executed.
- When the QSR? command is executed.

Conditions which clear the measurement event enable register

- When the power is turned on.
- When the :STATus:QUEStionable:ENABle 0 command is executed.
- When the QSE0 command is executed.

7. Operation event register
   Allocation in the operation event register is shown in Table 6-9.

Table 6-9 Operation Event Register (OER)

bit	Name	Description
0	Not used	Always 0
1	Not used	Always 0
2	Not used	Always 0
3	Not used	Always 0
4	Not used	Always 0
5	Waiting for TRIG	ON: This bit is set to 1 when this instrument is in Trigger Layer.
6	Not used	Always 0
7	Not used	Always 0
8	Not used	Always 0
9	Idle	ON: This bit is sets to 1 when this instrument is in the Idle state.
10	Not used	Always 0
11	Not used	Always 0
12	Not used	Always 0
13	Not used	Always 0
14	Not used	Always 0
15	Not used	Always 0

Conditions which clear the operation event register

- When the power is turned on.
- When the *CLS command is executed.
- When the :STATus:OPERation[:EVENt]? command is executed.
- When the OSR? command is executed.

Conditions which clear the operation event enable register

- When the power is turned on.
- When the :STATus:OPERation:ENABle 0 command is executed.
- When the OSE0 command is executed.

6.8 Sample Programs (Command used in ADC CORPORATION)

This section describes examples of a program in which a computer controls this instrument through GPIB.

The USB driver includes examples of a program in which this instrument is controlled through USB.

For more information on the USB driver, refer to 3.3.2, “Caution when Connecting Peripherals”.

Computer: OptiPlex GX270 (OS:WindowsXP) made by Dell Computer Corp.

GPIB hardware: PCI-GPIB made by NATIONAL INSTRUMENTS

Module: Niglobal.bas, Vbib-32.bas (Included software in PCI-GPIB)

Compatible language: Microsoft Excel Visual Basic for Application

NOTE: These samples are programmed assuming that the 7351A is used.

Example 1 Measures a voltage in the DCV 20 V range and reads the measurement data from the 7351A. The GPIB address of the 7351A is set to 1 and the header is set to OFF.

```
Dim DMM_ADR As Integer          ' Declares the variable of the 7351A GPIB address.
Dim dmm As Integer              ' Declares the variable of the device descriptor.
Dim dt As String * 100          ' Declares the variable of the buffer used for receiving the GPIB data.

DMM_ADR = 1                     ' The GPIB number of the 7351A

Call ibdev(0, DMM_ADR, 0, T10s, 1, 0, dmm)
                                ' Initializes the GPIB I/F.
Call ibconfig(dmm, IbcUnAddr, 1)
                                ' Sets the transmitting and receiving addresses individually.
Call ibwrt(dmm, "*RST" & Chr(10))
                                ' Initializes the 7351A.
Call ibwrt(dmm, "F1" & Chr(10))
                                ' Sets the measurement function to DCV.
Call ibwrt(dmm, "R5" & Chr(10))
                                ' Sets the measurement range to 20 V.
Call ibwrt(dmm, "PR4" & Chr(10))
                                ' Sets the sampling rate to SLOW2.

Call ibrd(dmm, dt)              ' Reads the measurement value data.

Cells(1, 1) = "'" & Left(dt, 12)
                                ' Substitutes the measurement value for a cell.

Call ibonl(dmm, 0)              ' Terminates.
```

Example 2 Sets the measurement function to the 2WΩ measurement, detects the measurement end by using the status byte, and reads the measurement data from the 7351A. The GPIB address of the 7351A is set to 1 and the header is set to OFF.

```
Dim DMM_ADR As Integer          ' Declares the variable of the 7351A GPIB address.
Dim dmm As Integer              ' Declares the variable of the device descriptor.
Dim dt As String * 100          ' Declares the variable of the buffer used for receiving the GPIB data.

DMM_ADR = 1                     ' The GPIB number of the 7351A

Call ibdev(0, DMM_ADR, 0, T10s, 1, 0, dmm)
                                ' Initializes the GPIB I/F.
Call ibconfig(dmm, IbcUnAddr, 1)
                                ' Sets the transmitting and receiving addresses individually.
Call ibwrt(dmm, "*RST" & Chr(10))
                                ' Initializes the 7351A.
Call ibwrt(dmm, "F3" & Chr(10))
                                ' Sets the measurement function to 2 WΩ
Call ibwrt(dmm, "R4" & Chr(10))
                                ' Sets the measurement range to 2 kΩ
Call ibwrt(dmm, "PR2" & Chr(10))
                                ' Sets the sampling rate to MED.
Call ibwrt(dmm, "TRS3" & Chr(10))
                                ' Specifies "BUS" as the trigger.
Call ibwrt(dmm, "*CLS" & Chr(10))
                                ' Clears the status byte.

Call ibwrt(dmm, "*TRG" & Chr(10))
                                ' Triggers.

Do                              ' Reads the status byte.
  Call ibwrt(dmm, "*STB?" &Chr(10))
                                ' Requests the contents of the status byte.
  Call ibrd(dmm, dt)            ' Writes the contents of the status byte into the variable dt.
  dt = dt And 16                ' Performs the AND operation in bit4 (MAV).
Loop While (dt <> 16)

Call ibrd(dmm, dt)              ' Reads the measurement data.

Cells(1, 1) = "'" & Left(dt, 12)
                                ' Substitutes the measurement value for a cell.

Call ibonl(dmm, 0)              ' Terminates.
```

6.9 Sample Programs (SCPI command)

This section describes examples of a program in which a computer controls this instrument through GPIB.

Computer: OptiPlex GX270 (OS:WindowsXP) made by Dell Computer Corp.

GPIB hardware: PCI-GPIB made by NATIONAL INSTRUMENTS

Module: Niglobal.bas, Vbib-32.bas (Included software in PCI-GPIB)

Compatible language: Microsoft Excel Visual Basic for Application

Example 1 Measures a voltage in the DCV 20 V range and reads the measurement data from the 7351A. The GPIB address of the 7351A is set to 1 and the header is set to OFF.

```
Dim DMM_ADR As Integer          ' Declares the variable of the 7351A GPIB address.
Dim dmm As Integer              ' Declares the variable of the device descriptor.
Dim dt As String * 100          ' Declares the variable of the buffer used for receiving the GPIB data.

DMM_ADR = 1                     ' The GPIB address of the 7351A

Call ibdev(0, DMM_ADR, 0, T10s, 1, 0, dmm)
                                ' Initializes the GPIB I/F.
Call ibconfig(dmm, IbcUnAddr, 1)
                                ' Sets the transmitting and receiving addresses individually.
Call ibwrt(dmm, "*RST" & Chr(10))
                                ' Initializes the 7351A.

Call ibwrt(dmm, ":SENSE:FUNCTION 'VOLTAGE:DC'" & Chr(10))
                                ' Sets the measurement function to DCV.
Call ibwrt(dmm, ":SENSE:VOLTAGE:DC:RANGE 19" & Chr(10))
                                ' Sets the measurement range to 20 V.
Call ibwrt(dmm, ":SENSE:VOLTAGE:DC:SRATE SSLOW" & Chr(10))
                                ' Sets the sampling rate to SLOW2.

Call ibwrt(dmm, ":READ?" & Chr(10))
                                ' Requests the measurement value data.
Call ibrd(dmm, dt)              ' Substitutes the measurement value for a variable.

Cells(1, 1) = "'" & Left(dt, 12)
                                ' Substitutes the measurement value for a cell.

Call ibonl(dmm, 0)              ' Terminates.
```

Example 2 Sets the measurement function to the 2WΩ measurement, detects the measurement end by using the status byte, and reads the measurement data from the 7351A. The GPIB address of the 7351A is set to 1 and the header is set to OFF.

```
Dim DMM_ADR As Integer          ' Declares the variable of the 7351A GPIB address.
Dim dmm As Integer              ' Declares the variable of the device descriptor.
Dim dt As String * 100          ' Declares the variable of the buffer used for receiving the GPIB data.

DMM_ADR = 1                     ' The GPIB address of the 7351A

Call ibdev(0, DMM_ADR, 0, T10s, 1, 0, dmm)
                                ' Initializes the GPIB I/F.
Call ibconfig(dmm, IbcUnAddr, 1)
                                ' Sets the transmitting and receiving addresses individually.
Call ibwrt(dmm, "*RST" & Chr(10))
                                ' Initializes the 7351A.

Call ibwrt(dmm, ":SENSE:FUNCTION 'RESISTANCE'" & Chr(10))
                                ' Sets the measurement function to 2 WΩ.
Call ibwrt(dmm, ":SENSE:RESISTANCE:RANGE 1999" & Chr(10))
                                ' Sets the measurement range to 2 kΩ.
Call ibwrt(dmm, ":SENSE:RESISTANCE:SRATE MED" & Chr(10))
                                ' Sets integration time to MED.
Call ibwrt(dmm, ":TRIGGER:SOURCE BUS" & Chr(10))
                                ' Specifies "BUS" as the trigger.
Call ibwrt(dmm, "*CLS" & Chr(10))
                                ' Clears the status byte.
Call ibwrt(dmm, ":INITIATE;*WAI" & Chr(10))
                                ' Waits for the trigger.

Call ibwrt(dmm, "*TRG" & Chr(10))
                                ' Triggers.

Do                              ' Reads the status byte.
  Call ibwrt(dmm, "*STB?" & Chr(10))
                                ' Requests the contents of the status byte.
  Call ibrd(dmm, dt)            ' Writes the contents of the status byte into the variable dt.
  dt = dt And 16                ' Performs the AND operation in bit4 (MAV).
Loop While (dt <> 16)

Call ibwrt(dmm, ":FETCH?" & Chr(10))
                                ' Requests the measurement data.
Call ibrd(dmm, dt)              ' Reads the measurement data.

Cells(1, 1) = "'" & Left(dt, 12)
                                ' Substitutes the measurement value for a cell.

Call ibonl(dmm, 0)              ' Terminates.
```

7. SPECIFICATIONS

7.1 Specifications

Unless otherwise specified, the measurement accuracy of this instrument is guaranteed for one year under the following conditions: Temperature; 23 ±5°C, relative humidity; 85% or less (75% or less in a resistance measurement of larger than 20 MΩ and low power resistance measurement of larger than 2MΩ)

7.1.1 DC Voltage Measurement (DCV)

Input terminal	Range	Maximum display		Resolution		Input impedance	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
		FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
V-COM	200 mV	199.99	199.999	10 µV	1 µV	More than 1 GΩ	0.012+2	0.012+7	0.012+6	15+0.85	15+2
	2000 mV	1999.9	1999.99	100 µV	10 µV	More than 1 GΩ	0.011+2	0.011+5	0.011+2	15+0.2	15+1.5
	20 V	19.999	19.9999	1 mV	100 µV	10 MΩ ±1%	0.015+2	0.015+5	0.015+5	20+0.25	20+1.5
	200 V	199.99	199.999	10 mV	1 mV	10 MΩ ±1%	0.015+2	0.015+5	0.015+5	20+0.25	20+1.5
	1000 V	1099.9	1099.99	100 mV	10 mV	10 MΩ ±1%	0.015+2	0.015+5	0.015+5	20+0.25	20+1.5

*1 For AZ ON. For AZ OFF, two digits are added to the digit section.

Maximum allowable applied voltage

Between V and COM terminals	1000 Vpeak
Between COM and the chassis	500 V

Noise rejection ratio

	FAST	MED/SLOW1, 2
Effective common mode noise rejection ratio (Unbalanced impedance of 1 kΩ) 50/60 Hz ±0.08%	Approx. 60 dB	Approx. 120 dB
Normal mode noise rejection ratio 50/60 Hz ±0.08%	0 dB	Approx. 60 dB

7.1.2 AC Voltage Measurement (ACV, ACV(AC+DC))

Measurement method	True RMS measurement, RMS display
Input range	5% or more of a full scale
Crest factor	3:1 at a full scale (This is restricted to the maximum allowable applied voltage.)
Temperature coefficient	(1/10 of measurement accuracy that includes the additional error)/°C in each range and frequency range
Response time	Approx. 1 s (Time until the measurement value reaches within 0.1% of the final value in the same range)

ACV

Input terminal	Range	Maximum display		Resolution		Input impedance
		FAST/MED	SLOW1, 2	FAST/MED	SLOW1, 2	
V-COM	200 mV	199.99	199.999	10 µV	1 µV	1 MΩ ±2%, 140 pF or less
	2000 mV	1999.9	1999.99	100 µV	10 µV	
	20 V	19.999	19.9999	1 mV	100 µV	
	200 V	199.99	199.999	10 mV	1 mV	
	700 V	749.9	749.99	100 mV	10 mV	

RATE setting	Range	Measurement accuracy *1 ±(% of reading + digits)				
		20 Hz - 45 Hz	45 Hz - 100 Hz	100 Hz - 20 kHz	20 kHz - 50 kHz	50 kHz - 100 kHz
FAST/MED	200 mV	0.38+14	0.11+12	0.1+12	0.25+15	0.7+24
	2000 mV	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
	20 V	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
	200 V	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
	700 V	0.38+10	0.11+10	0.1+10	-	-
SLOW1, 2	200 mV	0.38+140	0.11+120	0.1+100	0.25+150	0.7+240
	2000 mV	0.38+140	0.11+120	0.1+100	0.2+150	0.6+240
	20 V	0.38+140	0.11+120	0.1+100	0.2+150	0.6+240
	200 V	0.38+140	0.11+120	0.1+100	0.2+150	0.6+240
	700 V	0.38+100	0.11+100	0.1+100	-	-

*1 For sinusoidal wave input

ACV(AC+DC)

Input terminal	Range	Maximum display		Resolution		Input impedance
		FAST/MED	SLOW1, 2	FAST/MED	SLOW1, 2	
V-COM	200 mV	199.9	199.99	100 µV	10 µV	1 MΩ ±12%, 140 pF or less
	2000 mV	1999	1999.9	1000 µV	100 µV	
	20 V	19.99	19.999	10 mV	1000 µV	
	200 V	199.9	199.99	100 mV	10 mV	
	700 V	749	749.9	1000 mV	100 mV	

Range	Measurement accuracy *1 ±(% of reading + digits)				
	20 Hz - 45 Hz	45 Hz - 100 Hz	100 Hz - 20 kHz	20 kHz - 50 kHz	50 kHz - 100 kHz
200 mV	0.38+14	0.11+12	0.1+12	0.25+15	0.7+24
2000 mV	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
20 V	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
200 V	0.38+14	0.11+12	0.1+12	0.2+15	0.6+24
700 V	0.38+10	0.11+10	0.1+10	-	-

*1 For sinusoidal wave input

Additional error depending on the crest factor (For a non-sinusoidal input voltage)

1 - 2	0.05% of range
2 - 3	0.15% of range

Maximum allowable applied voltage

Between V and COM terminals	700 Vrms, 1000 Vpeak, 2.2×10^7 V・Hz
Between COM terminal and chassis	500 V

7.1.3 Resistance Measurement (2WΩ, LP-2WΩ)

2WΩ measurement

Range	Maximum display		Resolution		Measurement current	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
	FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
200 Ω	199.99	199.999	10 mΩ	1 mΩ	1 mA	0.02+2	0.02+9	0.02+8	20+1	20+2
2000 Ω	1999.9	1999.99	100 mΩ	10 mΩ	1 mA	0.02+2	0.02+5	0.014+3	15+0.25	15+1.5
20 kΩ	19.999	19.9999	1 Ω	100 mΩ	100 µA	0.02+2	0.02+5	0.014+3	15+0.25	15+1.5
200 kΩ	199.99	199.999	10 Ω	1 Ω	10 µA	0.02+2	0.02+5	0.02+5	20+0.25	20+1.5
2000 kΩ	1999.9	1999.99	100 Ω	10 Ω	1 µA	0.03+2	0.03+10	0.03+10	35+2	35+5
20 MΩ	19.999	19.9999	1 kΩ	100 Ω	100 nA	0.2+2	0.2+10	0.2+10	155+2	155+5
200 MΩ	199.99	199.999	10 kΩ	1 kΩ	10 nA	1.5+2	1.5+10	1.5+10	1500+2	1500+5

*1 The offset error, which consists of the measurement cable resistance and 0.3 Ω, is added to the measurement accuracy. For AZ ON. For AZ OFF, two digits are added to the digit section.

Low Power 2WΩ measurements (LP-2WΩ)

Range	Maximum display		Resolution		Measurement current	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
	FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
200 Ω	199.99	199.999	10 mΩ	1 mΩ	1 mA	0.02+2	0.02+9	0.02+8	20+1	20+5
2000 Ω	1999.9	1999.99	100 mΩ	10 mΩ	100 µA	0.02+2	0.02+9	0.03+8	20+1	20+3
20 kΩ	19.999	19.9999	1 Ω	100 mΩ	10 µA	0.02+2	0.02+9	0.03+8	20+1	20+3
200 kΩ	199.99	199.999	10 Ω	1 Ω	1 µA	0.02+2	0.02+9	0.03+8	30+1	30+3
2000 kΩ	1999.9	1999.99	100 Ω	10 Ω	100 nA	0.2+2	0.2+12	0.2+12	150+2	150+5
20 MΩ	19.999	19.9999	1 kΩ	100 Ω	10 nA	1.5+5	1.5+50	1.5+50	1500+2	1500+5

*1 The offset error, which consists of the measurement cable resistance and 0.3 Ω, is added to the measurement accuracy. For AZ ON. For AZ OFF, two digits are added to the digit section.

Response time: 200 MΩ = 2 s
(Time until the measurement value reaches within 0.1% of the final value)
20 MΩ = 0.5 s
(Time until the measurement value reaches within 0.1% of the final value)

Voltage between input terminals without connections:
7.5 V or less

Maximum allowable applied voltage

Between Ω and COM terminals	1000 Vpeak
Between COM terminal and the chassis	500 V

7.1.4 DC Current Measurement (DCI)

Input terminal	Range	Maximum display		Resolution		Resistance between input terminals	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
		FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
mA-COM	200 mA	199.99	199.999	10 µA	1 µA	0.5 Ω or less	0.03+2	0.03+10	0.03+10	40+1	40+2
	2000 mA	1999.9	1999.99	100 µA	10 µA	0.5 Ω or less	0.05+2	0.05+7	0.05+6	50+0.7	50+1.5
10 A-COM	10 A	10.999	10.9999	1 mA	100 µA	0.06 Ω or less	0.15+2	0.15+7	0.15+6	50+0.7	50+1.5

*1 For AZ ON. For AZ OFF, two digits are added to the digit section.

	Maximum allowable applied current	Input protection	Fuse replacement
Between mA and COM terminals	2000 mA	2 A/250 V fast-blow fuse which is compliant with IEC60127 sheet1	On the rear panel
Between 10 A and COM terminals	10 A	15 A/250 V fast-blow fuse with 10000 A breaking capacity	Contact us to repair

7.1.5 AC Current Measurement (ACI, ACI(AC+DC))

Measurement method	True RMS measurement, RMS display
Input range	5% or more of a full scale
Crest factor	3:1 at a full scale (This is restricted to a current protection fuse rating.)
Temperature coefficient	(1/10 of measurement accuracy that includes the additional error)/°C in each range and frequency range
Response time	Approx. 1 s (Time until the measurement value reaches within 0.1% of the final value in the same range)

ACI

Input terminal	Range	Maximum display		Resolution		Resistance between input terminals
		FAST/MED	SLOW1, 2	FAST/MED	SLOW1, 2	
mA-COM	200 mA	199.99	199.999	10 µA	1 µA	0.5 Ω or less
	2000 mA	1999.9	1999.99	100 µA	10 µA	0.5 Ω or less
10 A-COM	10 A	10.999	10.9999	1 mA	100 µA	0.06 Ω or less

RATE setting	Range	Measurement accuracy *1 ±(% of reading + digits) 23°C±5°C		
		20 Hz - 45 Hz	45 Hz - 1 kHz	1 kHz - 5 kHz
FAST/MED	200 mA	0.4+20	0.3+20	0.3+10
	2000 mA	0.5+20	0.35+10	0.35+20
	10 A	0.5+20	0.35+20	0.7+20
SLOW1, 2	200 mA	0.4+200	0.3+200	0.3+100
	2000 mA	0.5+200	0.35+100	0.35+200
	10 A	0.5+200	0.35+200	0.7+200

*1: For sinusoidal wave input

ACI(AC+DC)

Input terminal	Range	Maximum display		Resolution		Resistance between input terminals
		FAST/MED	SLOW1, 2	FAST/MED	SLOW1, 2	
mA-COM	200 mA	199.99	199.99	100 µA	10 µA	0.5 Ω or less
	2000 mA	1999.9	1999.9	1000 µA	100 µA	0.5 Ω or less
10 A-COM	10 A	10.999	10.999	10 mA	1000 µA	0.06 Ω or less

Range	Measurement accuracy *1 ±(% of reading + digits)		
	20 Hz - 45 Hz	45 Hz - 1 kHz	1 kHz - 5 kHz
200 mA	0.4+20	0.3+20	0.3+10
2000 mA	0.5+20	0.35+10	0.35+20
10 A	0.5+20	0.35+20	0.7+20

*1: For sinusoidal wave input

Additional error depending on the crest factor (For a non-sinusoidal input current)
±(% of reading + % of range)

Range	Crest factor	
	1 - 2	2 - 3
200 mA	0+0.05	0.1+0.15
2000 mA	0+0.05	0.1+0.15
10 A	0+0.05	0.03+0.15

	Maximum allowable applied current	Input protection	Fuse replacement
Between mA and COM terminals	2000 mA	2 A/250 V fast-blow fuse which is compliant with IEC60127 sheet1	On the rear panel
Between 10 A and COM terminals	10 A	15 A/250 V fast-blow fuse with 10000 A breaking capacity	Contact us to repair

7.1.6 Frequency Measurement (FREQ)

Measurement method
Reciprocal

Measurement frequency range	Measurement accuracy (Sinusoidal wave)
10 Hz - 300 kHz	0.02% of reading

A frequency over the above range is displayed but not guaranteed.

Input signal voltage range — 100 mVrms to 700 Vrms and 10% of each voltage range or more (sinusoidal wave)

(However, the input signal is restricted to the maximum allowable applied voltage.)

Gate time

Sampling rate	Gate time	Measurement frequency range	Maximum measurement period	Maximum display
SLOW	1000 ms	1 Hz to 300 kHz	2.2 s	999999
MED	100 ms	10 Hz to 300 kHz	220 ms	99999
FAST	10 ms	100 Hz to 300 kHz	22 ms	9999

Maximum allowable applied voltage

Between V and COM terminals	700 Vrms, 1000 Vpeak, 2.2×10^7 V•Hz
Between COM terminal and chassis	500 V

7.1.7 Diode Measurement

Range	Maximum display		Resolution		Measurement current	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
	FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
2000 mV	1999.9	1999.99	100 µV	10 µV	1 mA	0.014+2	0.014+5	0.014+3	15+0.25	15+1.5

*1 The offset error, which is calculated by the following formula; (the measurement cable resistance + 0.3 Ω) × 1 mA, is added to the measurement accuracy
For AZ ON. For AZ OFF, two digits are added to the digit section.

The specifications other than the above are the same as those of 2000 Ω range in 2WΩ measurement.

7.1.8 Continuity Measurement

Range	Maximum display		Resolution		Measurement current	Measurement accuracy *1 ±(% of reading + digits)			Temperature coefficient ±(ppm of reading + digits)/°C	
	FAST	MED/ SLOW1, 2	FAST	MED/ SLOW1, 2		FAST	MED	SLOW1, 2	AZ ON	AZ OFF
2000 Ω	1999.9	1999.99	100 mΩ	10 mΩ	1 mA	0.014+2	0.014+5	0.014+3	15+0.25	15+1.5

*1 For AZ ON. For AZ OFF, two digits are added to the digit section.

The specifications other than the above are the same as those of 2000 Ω range in 2WΩ measurement.

7.1.9 Measurement Time and Display Digits

For HOLD OFF (Trigger source: IMMED)

RATE setting	Measurement speed (In Auto-range OFF)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	140 times/s (7.1 ms)		30 times/s (33 ms)	2 ms
MED (50 Hz)	40 times/s (25 ms)		19 times/s (52 ms)	1 PLC
MED (60 Hz)	40 times/s (25 ms)		19 times/s (52 ms)	1 PLC
SLOW1	9.5 times/s (105 ms)		4.7 times/s (212 ms)	100 ms
SLOW2	4.9 times/s (205 ms)		2.4 times/s (412 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, and Display: OFF

For HOLD ON (Trigger source: EXT)

RATE setting	Measurement speed (In Auto-range OFF)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	80 times/s (12.5 ms)		45 times/s (22 ms)	2 ms
MED (50 Hz)	32 times/s (31 ms)		17 times/s (58 ms)	1 PLC
MED (60 Hz)	37 times/s (27 ms)		19 times/s (52 ms)	1 PLC
SLOW1	9 times/s (110 ms)		4.5 times/s (218 ms)	100 ms
SLOW2	4.7 times/s (210 ms)		2.3 times/s (418 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, Trigger delay: 0 sec, and GPIB data output

For HOLD ON (Trigger source: BUS)

RATE setting	Measurement speed (In Auto-range OFF)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	74 times/s (13.5 ms)		42 times/s (23.5 ms)	2 ms
MED (50 Hz)	31 times/s (32 ms)		16 times/s (60 ms)	1 PLC
MED (60 Hz)	35 times/s (28 ms)		18 times/s (53 ms)	1 PLC
SLOW1	9 times/s (111 ms)		4.5 times/s (219 ms)	100 ms
SLOW2	4.7 times/s (211 ms)		2.3 times/s (419 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, Trigger delay: 0 sec, and GPIB

For HOLD ON (Trigger source: BUS) RS-232

RATE setting	Measurement speed (In Auto-range OFF)			Integration time
	DCV DCI 2WΩ LP-2WΩ	ACV ACI Continuity Diode	ACV(AC+DC) ACI(AC+DC)	
FAST	19 times/s (51 ms)		18 times/s (53 ms)	2 ms
MED (50 Hz)	14 times/s (69 ms)		11 times/s (90 ms)	1 PLC
MED (60 Hz)	15 times/s (65 ms)		11 times/s (85 ms)	1 PLC
SLOW1	6 times/s (150 ms)		3 times/s (251 ms)	100 ms
SLOW2	4 times/s (248 ms)		2 times/s (449 ms)	200 ms

Conditions: Auto-range: OFF, Auto-zero: OFF, Calculation: OFF, Display: OFF, and Trigger delay: 0 sec
Baud rate: 9600, Number of data bits: 8, Parity: None, and Number of stop bits: 1
The measurement time is from the *TRG command input → the waiting time of the integration → until measured data is output by using the MD? command.

7.1.10 Calculation Functions

- NULL calculation
  Display value (NULL) = Measurement value - NULL constant
- Smoothing calculation
  Display value (SM) = Moving average over a specified number of measurements
- Comparator calculation
  Display (HIGH) ← HIGH setting value < Measurement value
  Display (LOW) ← Measurement value < LOW setting value
  Display (GO) ← LOW setting value ≤ Measurement value ≤ HIGH setting value
- Scaling calculation
  Display (SCL) = (Measurement value - B)/A × C
  A, B, and C are constants. (Setting values)
- MAX and MIN calculation
  Display value (MAX) = Maximum measurement value after the calculation starts
  Display value (MIN) = Minimum measurement value after the calculation starts
  Display value (AVE) = Arithmetic mean after the calculation starts (Remote output only)
- dB and dBm calculation
  dB display = 20 log (Measurement value/D)
  dBm display value = 10 log ((Measurement value)^2/D)/10^{-3}
  D is a constant. (Set by the user)
- Statistical calculation

Number of samples	Display value (SAMPLE) = Number of measurement values in the specified range of the measurement memory
Maximum value	Display value (MAX) = Maximum measurement value in the specified range of the measurement memory
Minimum valu	Display value (MIN) = Minimum measurement value in the specified range of the measurement memory
Average value	Display value (AVE) = Average value in the specified range of the measurement memory
Standard deviation	Display value (SIGMA) = Standard deviation in the specified range of the measurement memory
Dispersion	Display value (P-P) = ((Maximum measurement value) - (Minimum measurement value)) in the specified range of the measurement memory

7.2 Interface Specifications

Item	Specifications
Remote control	
Remote command	Compliance with the command format for ADC, SCPI and R64 series.
Interface	
7351E	USB
7351E + Option 03	RS-232, USB, Comparator output, External trigger signal, Complete signal output
7351A	GPIB, USB, External trigger signal, Complete signal output
USB	
Standard	Compliance with USB1.1
Connector	Type B
GPIB (7351A)	
Standard	Compliance with IEEE488.2
Connector	24-pin Anphenol
Interface functions	SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
Output format	ASCII
Addressing	31 kinds of talker/listener addresses can be specified from the front panel.
RS-232 (7351E + Option 03)	
Standard	Compliance with EIA-232
Connector	D-Sub9 pin
Baud rate	9600, 4800, 2400, 1200, 600, 300
Parity	Even number (EVEN), odd number (ODD), or none
Number of data bits	7 bits or 8 bits
Number of stop bits	1 bit or 2 bits
Echo	ON, OFF

Item	Specifications
Comparator output (7351E + Option 03)	
Output signal	TTL Output: PASS/FAIL Relay Output: PASS/Hi/Lo (PASS/FAIL Output can be set individually)
Connector	Dsub 9-pin
a.Optical semiconductor relay contact	
Allowable contact voltage (for break)	DC30 V
Allowable contact current	DC120 mA
Withstand voltage between contact and GND	30 V
Contact operating time	Approximately 1 ms or less
b. TTL Output	
Output level	TTL Selecting the positive or negative logic
Maximum allowable applied voltage	12 Vpeak
External trigger signal (7351A, 7351E + Option 03)	
Connector	BNC
Signal level	TTL Detecting the falling edge
Pulse width	1 μs or more
Complete signal output (7351A, 7351E + Option 03)	
Connector	BNC
Signal level	TTL Negative pulse
Sink Current	20 mA or below
Pulse width	Approx. 100 μs (7351A) Approx. 900 μs (7351E + Option 03)

CAUTION: ***Option 03 is a factory option that is applied to 7351E only. This option cannot be added after instrument delivery.***

7.3 General Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Operation environment</td><td>Ambient temperature: 0°C to +50°C
Relative humidity: 85%RH or less no condensation</td></tr>
<tr><td>Storage environment</td><td>Ambient temperature: -25°C to +70°C</td></tr>
<tr><td>Warm-up time</td><td>60 minutes or more</td></tr>
<tr><td>Display</td><td>7-digit fluorescent display A digit is displayed by seven segments.</td></tr>
<tr><td>Range switching</td><td>Automatic and manual</td></tr>
<tr><td>Input method</td><td>Floating</td></tr>
<tr><td>Measurement method</td><td>Integration</td></tr>
<tr><td>Overload display</td><td>OL</td></tr>
<tr><td>Trigger function</td><td>External trigger (7351A, 7351E + Option 03)</td></tr>
<tr><td>Memory</td><td>Data memory: Up to 20,000 data
Condition setting memory: 4 (USER0 to USER3)</td></tr>
<tr><td>Power supply</td><td>AC power supply: 100 V/120 V/220 V/240 V
(Can be switched by user)
<table><tr><td>Option number</td><td>Standard</td><td>OPT.32</td><td>OPT.42</td><td>OPT.44</td></tr><tr><td>Power supply voltage</td><td>100 V</td><td>120 V</td><td>220 V</td><td>240 V</td></tr></table>
Specify the option when ordering.
Use a power cable and fuse that are compliant with the safety standard when changing the power supply voltage.</td></tr>
<tr><td>Power supply frequency</td><td>50 Hz/60 Hz</td></tr>
<tr><td>Power consumption</td><td>20 VA or below</td></tr>
<tr><td>Dimensions</td><td>Approx. 212 (width) × 88 (height) × 340 (depth) mm</td></tr>
<tr><td>Mass</td><td>3.4 kg or less</td></tr>
<tr><td>Safety</td><td>Compliance with IEC61010-1 Ed.2, Category II</td></tr>
<tr><td>EMI</td><td>Compliance with EN61326 classA
Compliance with FCC classA</td></tr>
</table>

8. MAINTENANCE

This chapter describes the following information which relates to the maintenance of this instrument.

8.1 Replacing Fuses

8.2 Cleaning

8.3 Calibration

8.4 Replacing Parts with Limited Life

8.5 Product Disposal and Recycle

8.6 Storage

8.7 Transportation

8.8 Notes Regarding Repair, Replacement, and Periodic Calibration

8.9 System Recovery Procedure

8.10 Self-Test

8.11 Error Message List

8.1 Replacing Fuses

This instrument includes a power fuse and protection fuse. Replace them according to the following procedure.

CAUTION:

1. ***To prevent fire and electrical shock, replace with a fuse listed in Table 3-1. Never use an incompatible fuse and short-circuit the fuse holder.***
2. ***Whether a fuse has blown cannot be checked by observation. Measure the resistance of the fuse and judge whether the fuse has blown. (If the resistance is 15 Ω or less, the fuse has not blown.)***
3. ***Do not cut any of the internal ground wiring in this instrument or disconnect this instrument from ground. This instrument may become unsafe to operate.***

8.1.1 Replacing a Power Fuse

The power fuse is placed in the AC power supply connector on the rear panel.

For more information on how to check and replace the power fuse, refer to Section 3.4.2, “Changing the Power Supply Voltage.”

8.1.2 Replacing a Protection Fuse

To prevent fire and injuries when an over-current is supplied to the mA current input terminal, a fast-blow fuse is included on the rear panel of this instrument.

8.1.2.1 How to Check Protection Fuses

Measure the resistance of the protection fuse and check that the fuse is not open.

This instrument can measure the resistance of the protection fuse by connecting the terminals as shown in Figure 8-1.

a. For the mA terminal

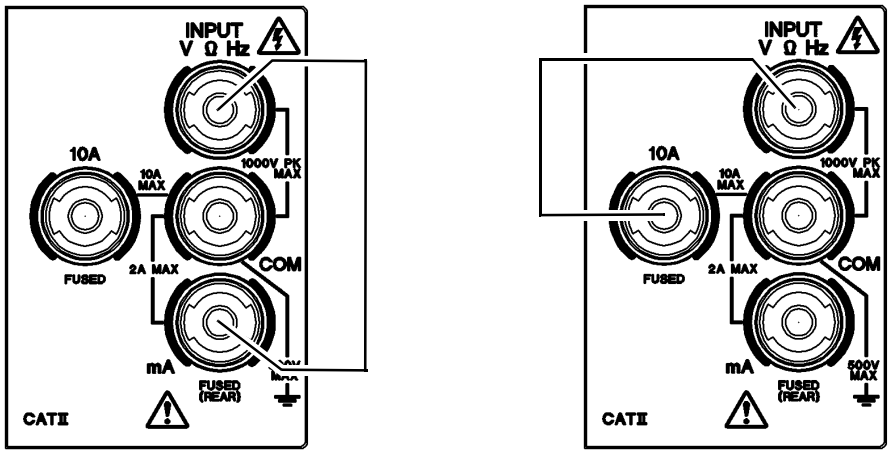
   Connect the mA and Ω terminals.

   Set the resistance measurement function and measure the resistance of the protection fuse.

b. For the 10 A terminal

   Connect the 10 A and Ω terminals.

   Set the resistance measurement function and measure the resistance of the protection fuse.



a. For the mA terminal　　b. For the 10 A terminal

Figure 8-1　How to Check Protection Fuses

8.1.2.2 How to Replace Protection Fuses

1. Rotate the fuse cap in the counter-clockwise direction by using a flathead screwdriver and remove the fuse.
2. Replace with a fuse, which is compliant with the standard and listed in Table 3-1, and secure the fuse cap.

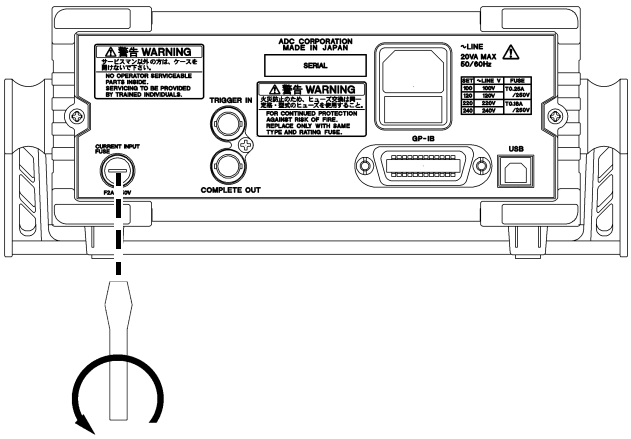


Figure 8-2 Input Terminal Protection Fuse

A protection fuse for the 10 A current input terminal is assembled inside this instrument.

Measure the resistance between the 10 A and COM terminals. If the protection fuse is open, contact ADC CORPORATION or a sales representative to repair this instrument.

8.2 Cleaning

This section describes the cleaning procedure of this instrument and warning messages.

WARNING: ***To prevent accidents caused by electric shocks, remove all cables from this instrument. Never attempt to remove the cover to clean the inside of this instrument.***

8.2.1 Cleaning the Outside

Use a soft or damp cloth to clean this instrument.

NOTE:

1. ***Do not allow water inside this instrument or lint on this instrument.***
2. ***Do not use an organic solvent such as benzene or acetone for cleaning because it degrades the plastic.***

8.2.2 Cleaning Others

Take appropriate precautions to protect this instrument from dust.

WARNING: ***Periodically remove any dust which builds up on the AC power connector and plug. The tracking phenomenon, which can be caused by wet dust, may cause a fire.***

8.3 Calibration

To maintain the measurement accuracy of this instrument, perform calibration at least once a year; warranty period.

8.3.1 Preparing for Calibration

1. Power supply
   Use an AC power supply in a voltage range listed in Table 3-4 and frequency of 50 Hz or 60 Hz.
2. Environment
   Perform calibration in following conditions.
   Temperature: +23 ±3°C
   Humidity: 70% or less
   An area free from dust, vibration, wind, and noise
3. Warm-up time
   Perform calibration after allowing a warm up time of 60 minutes or more.
   Sufficient warm-up time is also required for the instrument used for calibration.

8.3.2 Calibration Standards

Calibration standard	Operation range		Accuracy
DC voltage	190 mV - 1000 V		±15 ppm
AC voltage	5 mVrms	1 kHz sinusoidal wave	±1400 ppm
	10 mVrms - 100 mVrms	1 kHz sinusoidal wave	±1000 ppm
	100 mVrms - 700 mVrms	1 kHz sinusoidal wave	±200 ppm
Resistance	190 Ω		±50 ppm
	1.9 kΩ - 190 kΩ		±20 ppm
	1.9 MΩ		±50 ppm
	19 MΩ, 100 MΩ		±1000 ppm
DC current	190 mA - 1.9 A		±150 ppm
	10 A		±1000 ppm
AC current	1.9 mA - 190 mA	1 kHz sinusoidal wave	±500 ppm
	1.9 A	1 kHz sinusoidal wave	±1000 ppm
	10 A	1 kHz sinusoidal wave	±1000 ppm

8.3.3 Calibration Point

1. Perform calibration for each range of each measurement function. For more information on relationships between functions and ranges, refer to Table 5-2.
2. First, calibrate the zero point in each range calibration.
3. In the DC voltage measurement and DC current measurement, calibrate the zero point and full-scale point.
4. In the resistance measurement, calibrate the zero point and full-scale point.
5. In the low-power resistance measurement, calibrate the zero point and full-scale point.
6. In the AC voltage measurement and AC current measurement, calibrate the zero point, calibration point1, calibration point2, and calibration point3.
7. In the ACV(AC+DC) and ACI(AC+DC) measurements, no calibration is required because the instrument is calibrated when the calibration is performed in the DC voltage and AC voltage measurements.
8. In the continuity and diode measurements, no calibration is required because the instrument is calibrated when the calibration is performed in the DC voltage and AC voltage measurements.
9. In the frequency measurement, no calibration is required.

Recommended input range: +5% to -10% for each calibration point

Table 8-1 Calibration Point (1 of 2)

Measurement function	Range	Zero	Calibration point1	Calibration point2	Calibration point3
DCV	200 mV	Short	190 mV	-	-
	2000 mV	Short	1900 mV	-	-
	20 V	Short	19 V	-	-
	200 V	Short	190 V	-	-
	1000 V	Short	1000 V	-	-
ACV ACV(AC+DC)	200 mV	Short	5 mV, 1 kHz	19 mV, 1 kHz	190 mV, 1 kHz
	2000 mV	Short	50 mV, 1 kHz	190 mV, 1 kHz	1900 mV, 1 kHz
	20 V	Short	500 mV, 1 kHz	1900 mV, 1 kHz	19 V, 1 kHz
	200 V	Short	5000 mV, 1 kHz	19 V, 1 kHz	190 V, 1 kHz
	700 V	Short	7 V, 1 kHz	70 V, 1 kHz	700 V, 1 kHz
2WΩ	200 Ω	Short	190 Ω	-	-
	2000 Ω	Short	1900 Ω	-	-
	20 kΩ	Short	19 kΩ	-	-
	200 kΩ	Short	190 kΩ	-	-
	2000 kΩ	Short	19000 kΩ	-	-
	20 MΩ	Short	19 MΩ	-	-
	200 MΩ	Short	100 MΩ	-	-

Table 8-1 Calibration Point (2 of 2)

Measurement function	Range	Zero	Calibration point1	Calibration point2	Calibration point3
LP-2WΩ	200 Ω	Short	190 Ω	-	-
	2000 Ω	Short	1900 Ω	-	-
	20 kΩ	Short	19 kΩ	-	-
	200 kΩ	Short	190 kΩ	-	-
	2000 kΩ	Short	1900 kΩ	-	-
	20 MΩ	Short	19 MΩ	-	-
DCI	200 mA	Open	190 mA	-	-
	2000 mA	Open	1900 mA	-	-
	10 A	Open	10 A	-	-
ACI ACI(AC+DC)	200 mA	Open	5 mA, 1 kHz	19 mA, 1 kHz	190 mA, 1 kHz
	2000 mA	Open	50 mA, 1 kHz	190 mA, 1 kHz	1900 mA, 1 kHz
	10 A	Open	100 mA, 1 kHz	1 A, 1 kHz	10 A, 1 kHz

8.3.4 Calibration Procedure

Perform calibration in following procedure.

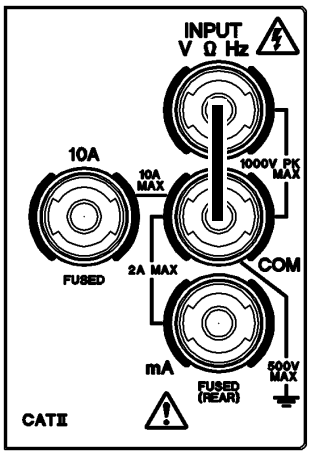
1. Set the calibration mode.
2. Short-circuit the VΩ and COM terminals and then open the mA and 10 A terminals.
3. Calibrate the zero point in a function and range to be calibrated.
4. Connect the calibration standard to the input terminal.
5. Calibrate the full-scale point in a function and range to be calibrated.
6. Cancel the calibration mode.

Setting the calibration mode

1. Select ON from 'CAL' in **9 SYS** in **MENU**.
2. Press **ENTER** to determine the setting.
   The CAL indicator is turned on and indicates that the calibration mode is set.
3. Press **EXIT** to exit from MENU.
4. Set a function to be calibrated.

Calibrating the zero point

5. Short-circuit between the VΩ and COM terminals and open the mA and 10 A terminals.



6. Set a range to be calibrated.

7. Pressing the **HOLD** key displays the measurement value as a setting value.
8. Adjust the setting value to the calibration value by using the △, ▽, ◁, and ▷ keys.

NOTE: ***Press the* EXIT *key if calibration must be cancelled due to a mistake such as entering an incorrect number.***

---

9. Press the **ENTER** key to execute the calibration.
10. Repeat steps 6 to 9 when calibrating other ranges.

Calibrating the full-scale point

11. Connect the calibration standard to the input terminal.
12. Set a range to be calibrated.
    For multiple calibration points, calibrate them in the order of calibration point 1, 2, and 3.
13. Input a voltage equivalent to the calibration point.
14. Pressing the **HOLD** key displays the measurement value as a setting value.
15. Adjust the setting value to the calibration value by using the △, ▽, ◁, and ▷ keys.

NOTE: ***Press the* EXIT *key if the calibration must be cancelled due to a mistake such as entering an incorrect number.***

---

16. Press the **ENTER** key to execute the calibration.
17. Repeat steps 12 to 16 when calibrating other ranges.
18. Repeat steps 4 to 17 when calibrating other functions.

Canceling the calibration mode

19. Select OFF from 'CAL' in **9 SYS** in **MENU**.
20. Press **ENTER** to determine the setting.
    The CAL indicator is turned off and indicates that the calibration mode is canceled.
21. Press **EXIT** to exit from MENU.

NOTE:

1. ***The*** **AUTO** **,** **RATE** **,** **TRIG** **,** **NULL** ***, and*** **SM** ***keys are disabled in the calibration mode.***
   Only **8 I/F** ***and*** **9 SYS** ***can be selected in*** **MENU** ***.***
2. ***Before turning off the power, cancel the calibration mode.***
   Calibration data is stored in internal nonvolatile memory and written in it at once when the calibration mode is canceled.

8.4 Replacing Parts with Limited Life

Parts with limited life used in this instrument are listed in the following table.

Contact an ADC CORPORATION sales representative to replace any parts, referring to the limited lives listed in the following table.

Note that the life span may be shorter than that described depending on the operating environment, frequency of use, and storage environment.

MEMO: ***The table shows the life spans of parts and the number of times parts can be used before requiring replacement, but they are not guaranteed.***

Table 8-2 Parts with Limited Life

Name	Expected lifespan
Relays for switching functions and ranges	1,000,000 operations
Panel keys	500,000 operations
Fluorescent display tube	20,000 hours
USB connector	1,500 operations

8.5 Product Disposal and Recycle

Disposal of this product should comply with the regulations and laws that are established by your country and municipality.

When treating this product, separately collect components according to this chapter to prevent the spread of substances, which may be harmful to humans, and to protect the global environment.

Components, which must be separately collected, are shown in the following table.

The treatment of this product should comply with the relevant laws of your country and waste-disposal regulations of your company.

Substance/Component	Used/ Not used	Location	Unit	Component	Quantity in maximum configuration
Polychlorinated biphenyls (PCB) containing capacitors	Not used	-	-	-	-
Mercury containing components	Not used	-	-	-	-
Batteries	Not used	-	-	-	-
Printed circuit boards	Used	Main frame	MAIN	Printed circuit board	1
Toner cartridges	Not used	-	-	-	-
Plastic containing brominated flame retardants	Used	Main frame	BPL-032930 BPL-033237	Connector, diode, zener diode, optocoupler, FET, analog IC, logic IC, FLASH, and transistor	18
Asbestos waste and components which contain asbestos	Not used	-	-	-	-
Cathode ray tubes	Not used	-	-	-	-
Chlorofluorocarbons (CFC), Hydrochlorofluorocarbons (HCFC), Hydrofluorocarbons (HFC) or Hydrocarbons (HC)	Not used	-	-	-	-
Gas discharge lamps	Not used	-	-	-	-
Liquid crystal displays of a surface greater than 100 square centimeters	Not used	-	-	-	-
External electric cables	Used	Main frame		Power cable Input probe	1 2
Components containing refractory ceramic fibers	Not used	-	-	-	-

Substance/Component	Used/ Not used	Location	Unit	Component	Quantity in maximum configuration
Components containing radioactive substances	Not used	-	-	-	-
Electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionately similar volume)	Not used	-	-	-	-
Arsenic and Arsenic compounds	Used	Main frame	Electronic components	Optocoupler and logic IC	2
Nickel and Nickel compounds	Used	Main frame		Electronic components and mechanical parts	Nickel-plated parts
Lead and Lead compounds	Used	Main frame	BPL-032930 BPL-033237	Lead solder used for assembling electronic components on printed circuit boards	34
Polyvinyl chloride (PVC)	Used	Main frame		PVC resin components	2
Antimony and Antimony compounds	Used	Main frame		Electronic components	24

8.6 Storage

If not using this instrument for a long time, put it in a carton case and store it in an area away from dust and direct sunlight.

Storage temperature: -25°C to +70°C

8.7 Transportation

When transporting this instrument, use the packing materials used for the shipping of this instrument or equivalent materials (thickness of carton case is 5 mm or more).

Packing procedure

1. Place the cushioning materials inside the carton case and cover all sides of this instrument with cushioning materials.
2. Place accessories in the carton case and then place the cushioning materials.
3. Close the carton case and bind it with packing strings.

8.8 Notes Regarding Repair, Replacement, and Periodic Calibration

8.8.1 Before Asking for Repair

Before asking for repair, refer to and check Table 8-3.

Table 8-3 Before Asking for Repair

Problem	Check item	Solution
The power supply cannot be turned on.	Check the power cable.	Change the power cable.
	Check the power fuse.	Replace the power fuse.
Key malfunction.	Check whether the RMT indicator is on (in remote operation).	Press the LOCAL key to return to the local state.
	Panel lock functions.	Release the panel lock.
Voltage and resistance cannot be measured.	Check that the input cable is correctly connected to the VΩ and COM terminals.	Securely connect the input cable to the VΩ and COM terminals.
	Check whether the input cable is in good condition and not broken.	Change the input cable.
Current cannot be measured.	Input terminals differ depending on the measurement range. Check that the input cable is correctly connected to the current input terminals. 200 mA and 2000 mA ranges: mA and COM terminals 10 A range: 10 A and COM terminals	Securely connect the input cable to the correct terminals.
	Check whether the protection fuse is serviceable and not open. (For more information on how to check, refer to 8.1, “Replacing Fuses”.)	Replace the fuse. For the 10 A terminal, contact ADC CORPORATION or a sales representative to repair this instrument.
	Check whether the input cable is in good condition and not broken.	Change the input cable.
For the high-resistance measurement, the measurement value is not stable.	Induction noise is superimposed on the input cable.	Shield the DUT. Use a shielded input cable.
	Check that the power supply frequency setting is the same as the local commercial power supply frequency.	Correctly set the power supply frequency to 50 Hz or 60 Hz.
Sampling does not operate.	Check whether the HOLD indicator is on (in HOLD operation).	Press the TRIG or HOLD key and check whether sampling operates. (During the remote operation, panel keys do not function. Therefore, after releasing the remote operation, press any panel key.)
	A long trigger delay time is set.	Check the trigger delay time.

8.8.2 Contacting ADC CORPORATION for Repair or Calibration

When sending this instrument to ADC CORPORATION sales representative, attach a tag that indicates the following information.

- Your company name and address
- Name of the person in charge
- Serial number (on the rear panel)
- What work to request. (Repair or periodic calibration)

8.8.3 Address and Phone Number

Contact an ADC CORPORATION sales representative.

8.9 System Recovery Procedure

Initialization

The following shows how to initialize the setting parameters.

1. Select **6 INIT** from the **MENU** mode and press ▽ to enter the selection layer.
2. The 'Param' parameter is displayed. Press ▽ to enter the entry layer.
3. Press **ENTER** while 'DFLT' is displayed.

The parameters can be initialized by selecting and executing 'DFLT' when loading the parameter setting.

For more information on how to initialize the parameters, refer to Section 5.10, "Saving and Loading the Measurement Condition Settings."

Initial value when shipping

The following shows how to set all parameters except for the calibration value and calibration memo to the values when shipping.

1. Turn on the power while pressing the **NULL** and **UP** keys.

Quitting MENU

Press **EXIT** to quit the operation in MENU.

MENU is closed even if any layer in MENU is operated.

NOTE: ***Changing parameters, which are not determined by pressing*** **ENTER** ***, is canceled.***

Initial value

The list of conditions, under which the setting parameters are initialized, and initial values are shown in Table 8-4.

Table 8-4 Initial Values of Setting Parameters (1 of 2)

Parameter	When shipping	Selecting DFLT from 6INIT in MENU	Selecting P.OFF from 'PON.LD'	'LOAD' in 5PARAM		*RST	*CLS	DCL
				DFLT	USER setting			
Function	DCV	DCV	Saved value	DCV	Selecting USER0-3	DCV		
Range	Highest	Highest	Saved value	Highest	Selecting USER0-3	Highest		
Auto-range	ON	ON	Saved value	ON	Selecting USER0-3	ON		
Number of display digits.	Maximum	Maximum	Saved value	Maximum	Selecting USER0-3	Maximum		
Auto-zero	ON	ON	Saved value	ON	Selecting USER0-3	ON		
NULL calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
NULL constant	0	0	Saved value	0	Selecting USER0-3	0		
COMP calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
HIGH value	0	0	Saved value	0	Selecting USER0-3	0		
LOW value	0	0	Saved value	0	Selecting USER0-3	0		
MAX/MIN calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Selecting the MAXIMUM and MINIMUM display	NORMAL	NORMAL	Saved value	NORMAL	Selecting USER0-3	NORMAL		
Smoothing calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Smoothing count	10	10	Saved value	10	Selecting USER0-3	10		
Scaling calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Constant A	1	1	Saved value	1	Selecting USER0-3	1		
Constant B	0	0	Saved value	0	Selecting USER0-3	0		
Constant C	1	1	Saved value	1	Selecting USER0-3	1		
dB calculation	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Constant D	1	1	Saved value	1	Selecting USER0-3	1		
Sampling HOLD	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Sampling rate	SLOW2	SLOW2	Saved value	SLOW2	Selecting USER0-3	SLOW2		
Trigger delay	0	0	Saved value	0	Selecting USER0-3	0		
Continuity threshold constant	10 Ω	10 Ω	Saved value	10 Ω	Selecting USER0-3	10 Ω		
Trigger source	IMMediate	IMMediate	Saved value	IMMediate	Selecting USER0-3	IMMediate		
PASS/FAIL buzzer	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Buzzer	OFF	OFF	Saved value	OFF	Selecting USER0-3	OFF		
Interface	GPIB	GPIB	Saved value					
GPIB address	1	1	Saved value					
USB ID	1	1	Saved value					
Baud rate	9600	9600	Saved value					
Data length	8	8	Saved value					
Parity	None	None	Saved value					

Blank: No Action

Saved value: Last setting value when the power is turned off.

Table 8-4 Initial Values of Setting Parameters (2 of 2)

Parameter	When shipping	Selecting DFLT from 6INIT in MENU	Selecting P.OFF from 'PON.LD'	'LOAD' in 5PARAM		*RST	*CLS	DCL
				DFLT	USER setting			
Stop bits	1	1	Saved value					
Echo	OFF	OFF	Saved value					
Talk only	OFF	OFF	Saved value					
Header output	ON	ON	Saved value					
Panel lock	OFF		Saved value					
Disabling function	ENA	ENA	Saved value					
Selecting power supply frequency	50 Hz	50 Hz	Saved value					
PSC flag	1	1	Saved value					
Programming language	ADC	ADC	Saved value					
Continue setting	OFF	OFF	Saved value			*1		
Password	0000		Saved value					
GPIB input output buffer	Empty	Empty	Empty	Empty	Empty			Empty
Block delimiter	CR/LF+EOI	CR/LF+EOI	CR/LF+EOI	CR/LF+EOI	CR/LF+EOI	CR/LF+EOI		
SRQ	ON	ON	ON	ON	ON			
Display ON/OFF	ON	ON	ON	ON	ON	ON		
Calibration mode	OFF	OFF	OFF			OFF		
Status register QEER	0	0	0					
Status register OEER	0	0	0					
Status register SESER	0	0	*2					
Status register MEER	0	0	0					
Status register SRER	0	0	*2					
Status register QER	0	0	0				0	
Status register SESR	0	0	0				0	
Status register STB	0	0	0				0	
Status register OER	0	0	0				0	
Status register MER	0	0	0				0	
Error queue	Empty	Empty	Empty				Empty	
Calibration memo	""							

Blank: No Action

Saved value: Last setting value when the power is turned off.

*1: By selecting the initial value for continue setting

*2: By setting the *PSCn command

8.10 Self-Test

8.10.1 Self-Test

The self-test can be performed from the panel operations or by executing the remote command.

The self-test is performed by selecting 'TEST' from **9 SYS** in **MENU** or executing the *TST? remote command.

The test items are shown in Table 8-5.

Table 8-5 Self-Test Items

Item	Can be performed from the Panel or by Remote	Can be performed when the power is turned on
ROM check sum	-	○
RAM read/write check	-	○
Panel display check	-	○
Alarm status check	-	○
Calibration data check	○	○
Parameter check	○	○
Analog to logic communication check	○	○
AD operation check in analog	○	○
Range operation check in analog	○	○
Reference voltage check in analog	○	○
Reference current check in analog	○	○

8.10.2 Display and Key Tests

Turn on all segments of the display and check whether they light.

Pressing panel keys display their names.

Test according to the following procedure.

	Operations	Display
1.	Press **MENU** and select **9 SYS** by using ◁ and ▷.	MENU SYS
2.	Press ▽.	SYS BEEP

	Operations	Display
3.	Select ‘P/KEY’ by using ▷.	SYS P/KEY
4.	Press ▽.	P/KEY ENTER
5.	Press **ENTER**.	All segments of the display are turned on.
	The display changes after a few seconds.	KEY Push
6.	Press a key to be checked.	KEY Key name to be pressed
7.	To quit the key test, press **SHIFT**.	KEY SHIFT
	The display changes from “SHIFT” to “DONE”.	KEY DONE
8.	Press **EXIT** to exit from MENU.	Measurement state

8.11 Error Message List

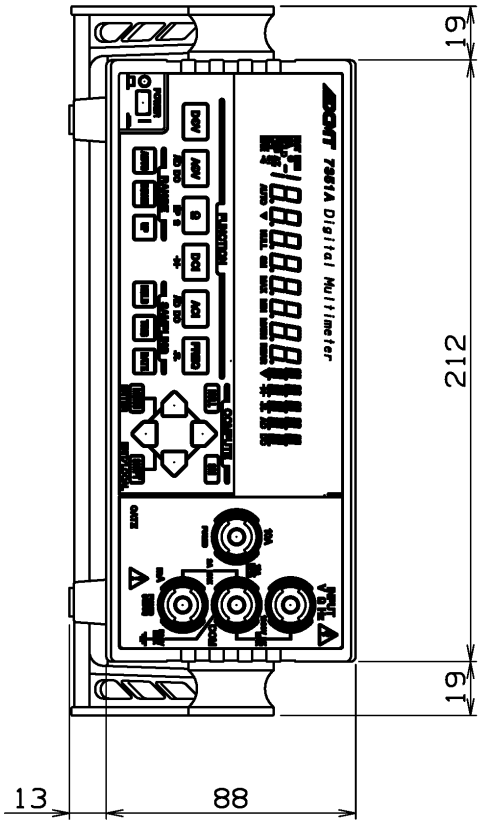
This section describes the error number and how to deal with error displayed on this instrument.

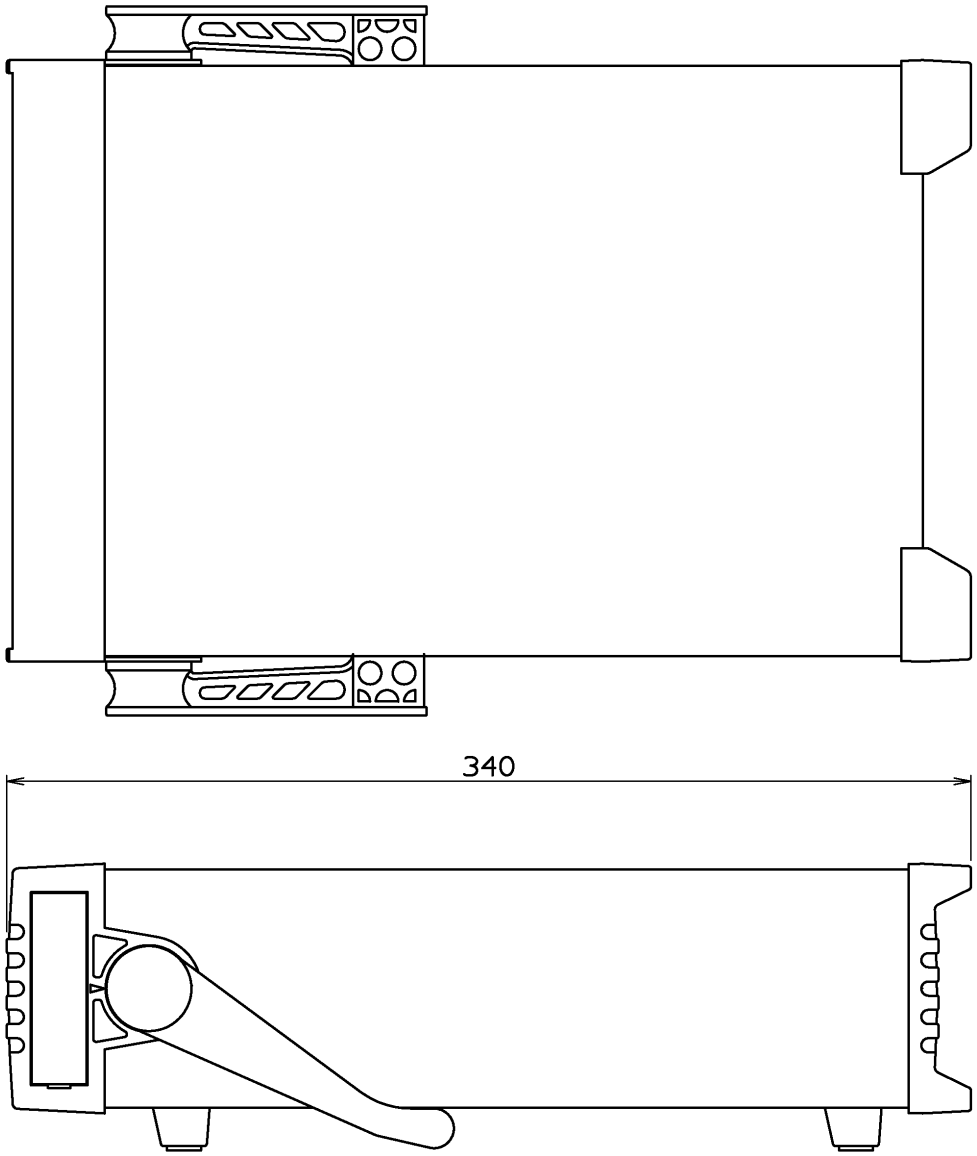
No.	Error display	Error description [ ]: Response to the ERR? command	Solution
1	Err1	RAM read/write error [RAM read/write failed]	Repair
2	Err2	Display RAM test error or Communication error [Front panel does not respond]	Repair
3	Err3	Calibration data check SUM error [Calibration memory lost]	Repair
4	Err4	ROM check SUM error [ROM Chk SUM]	Repair
5	Err6	Parameter check SUM error [Save/recall memory lost]	Repair
6	Err16	FLASH memory writing error [FLASH memory error]	Repair
7	Err101	The function cannot be set. [Inhibited function]	Solution1
8	Err140	RS-232 communication error [RS-232 Communication Error]	Solution10
9	Err150	USB communication error [Illegal packet received]	Solution2
10	Err200	Ratio test error of IR1 to IR2 in AD [AD Ratio 1-2]	Repair
11	Err201	Ratio test error of IR2 to IR3 in AD [AD Ratio 2-3]	Repair
12	Err205	AC×1 zero measurement test error in analog operation [AC ×1 Zero Check]	Repair
13	Err206	L ×1 zero measurement test error in analog operation [L ×1 Zero Check]	Repair
14	Err207	L×10 zero measurement test error in analog operation [L ×10 Zero Check]	Repair
15	Err208	L×100 zero measurement test error in analog operation [L ×100 Zero Check]	Repair
16	Err209	DC×10 zero measurement test error in analog operation [DC ×10 Zero Check]	Repair
17	Err210	Communication error in Analog [Communication error (Analog)]	Repair
18	Err215	1/100 ATT measurement test error in analog operation [ATT 1/100 Check]	Repair

No.	Error display	Error description [ ]: Response to the ERR? command	Solution
19	Err216	1/500 ATT measurement test error in analog operation [ATT 1/500 Check]	Repair
20	Err500	Calibration data error [CAL data]	Solution3
21	Err501	ZERO calibration is not performed. [before ZERO]	Solution4
22	Err-102	Command syntax error [Cmd Syntax]	Solution5
23	Err-113	The command cannot be used. [Undefined header]	Solution5
24	Err-121	Unrecognized character as the numerical value [Invalid character in number]	Solution5
25	Err-141	Invalid character string parameter is entered. [Invalid character data]	Solution5
26	Err-151	Error as the character string data (Quotation mark error) [Invalid string data]	Solution5
27	Err-200	Execution error (Command which cannot be executed now) [Execution error]	Solution6
28	Err-213	The INITiate command is ignored because the measurement is performing. [Init ignored]	Solution6
29	Err-214	The READ? or MEAS? command is received when any trigger source except for IMM is set. [Trigger deadlock]	Solution6
30	Err-222	Entered value is outside the setting range or lacking for necessary parameters [Data out of range]	Solution6
31	Err-313	Calibration data is lost. [Calibration memory lost]	Solution7
32	Err-314	Parameters saved by “*SAV” command are lost. [Save/recall memory lost]	Solution8
33	Err-315	Saved parameters are lost. [Configuration memory lost]	Solution6
34	Err-330	Self-test error [Self-test failed]	Repair
35	Err-350	Error queue overflows. [Queue overflow]	Solution9

Solution1	Set the correct function.
Solution2	Check the USB cable connection.
Solution3	Calibrate according to the correct procedure.
Solution4	Perform the ZERO cancellation.
Solution5	Send the correct command.
Solution6	Check the settings.
Solution7	Re-calibrate.
Solution8	Re-set.
Solution9	Read out the error queue.
Solution10	Check the RS-232 cable connection

If the error cannot be fixed by the described solution, contact an ADC CORPORATION sales representative this instrument.





Unit : mm

NOTE
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

[M]

[N]

[O]

[P]

[Q]

[R]

[S]

[T]

[U]