ADVANTEST

R6552 Series

Digital Multimeter

Operation Manual

MANUAL NUMBER FOE-8311248D01

Applicable Models

R6552
R6552T
R6552T-R

This product has been discontinued.
The Operation Manual is provided by ADC Corporation under the agreement with Advantest Corporation.

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that ADC Corporation (hereafter referred to as ADC) bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by ADC, the protection provided by the equipment may be impaired.

- **Warning Labels**

  Warning labels are applied to ADC products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest ADC dealer. Our address and phone number are listed at the end of this manual.

  Symbols of those warning labels are shown below together with their meaning.

  DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

  WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

  CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

  Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

  - Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
  - When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
  - When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
  - Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
  - Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protective conductor terminal.
  - Be sure to use fuses rated for the voltage in question.
  - Do not use this instrument with the case open.
  - Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on ADC products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the ADC sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

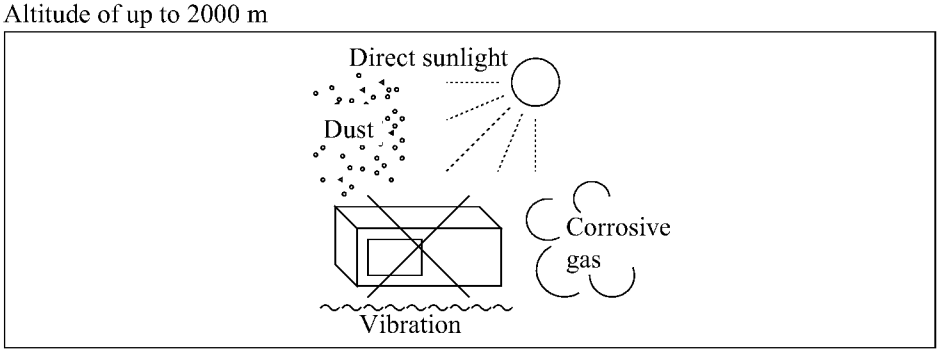


Figure-1 Environmental Conditions

- Operating position

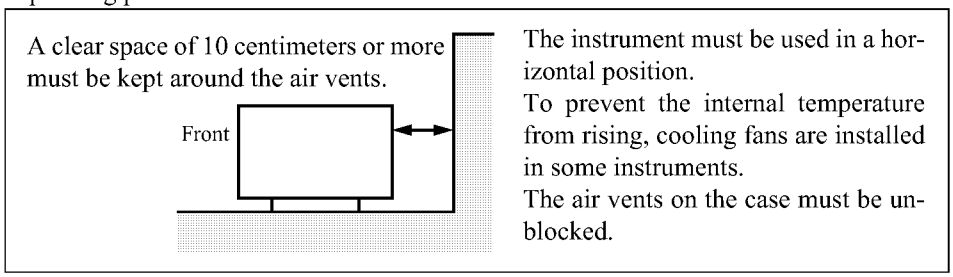


Figure-2 Operating Position

- Storage position

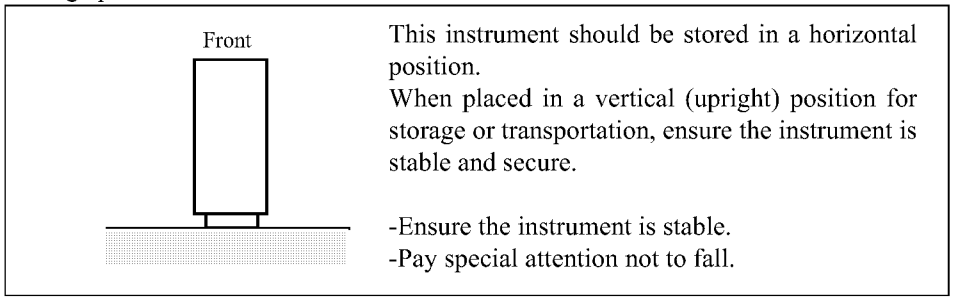


Figure-3 Storage Position

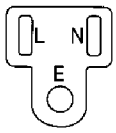
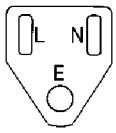
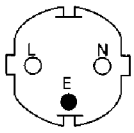
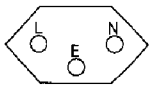
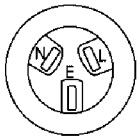
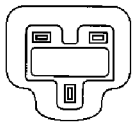
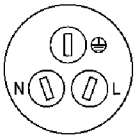
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

Certificate of Conformity

CE

This is to certify, that

Digital Multimeter

R6552 Series

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN61326 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH

Munich, Germany

6552.02

PREFACE

This document provides information on how to handle and maintain the R6552 Series instruments and how to use the measurements functions, along with descriptions of their functions and tips on using them. Before starting to use this instrument, read this document to get the best out of their performance.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1 BEFORE USING THE MEASUREMENTS

1.1 Overview of the Instruments

The instruments covered herein are digital multimeters, with a maximum reading of 319999, that use an integrating A/D converter.

[Features]

- Maximum reading: 319999
- High-resolution measurement: 0.1 μV DC voltage measurement and of 100 μΩ resistance measurement
- Sampling rate: Up to 1,000 cycles/second (R6552 only)
- A long integral time range 100 ms to 60 sec in increments of 10 ms to measure an average value of periodic signals (R6552 only)
- GPIB/RS-232 interfaces connecting to external equipment is provided as standard (The RS-232 interface is R6552 only)
- External trigger input and measurement end signal output that are provided as standard
- Calculation functions: Null, smoothing, scaling, dB/dBm, comparator, and MAX·MIN calculations
- Data memory function (up to 10,000 records of data) (R6552 only)
- Delayed trigger function (R6552 only)
- Setup parameter's backup: Four kinds
- An optimum measurement range setting using the high-speed auto-range function
- Vacuum fluorescent display tube for brighter, easier-to-view displays
- Ripple voltage measurement: 10 μV to 3.199 V (R6522T-R only)

The table below lists the measurement functions provided by the R6552 Series instruments.

Measurement function	Whether functions are available or not		
	R6552	R6552T	R6552T-R
DC voltage measurement (DCV)	Yes	Yes	Yes
Two-wire resistance measurement (2wΩ)	Yes	Yes	Yes
Four-wire resistance measurement (4wΩ)	Yes	Yes	Yes
Low-power two-wire resistance measurement (LP-2wΩ)	Yes	Yes	
Low-power four-wire resistance measurement (LP-4wΩ)	Yes	Yes	
AC voltage measurement (ACV)	Yes		
AC voltage (AC + DC coupling) measurement (ACV (AC+DC))	Yes		
DC current measurement (DCI)	Yes		
AC current measurement (ACI)	Yes		
AC current (AC + DC coupling) measurement (ACI (AC+DC))	Yes		
Frequency measurement (FREQ)	Yes		
Diode measurement ()	Yes		
Ripple voltage measurement (RIPPLE V)			Yes

1.2 Accessory

Table 1-1 List of Accessory

Part name	Part number	Remarks
Input cable	A01041	Standard accessory
	A01001	
	A01006	
Alligator-clip adapter	A08398	Standard accessory
Spring-hook adapter	A08397	
Terminal adapter	TR1111	
Carrying case	R16213	

1.3 Checking Product and Accessories

After unpacking, check the quantity and rating of standard accessories to assure their conformance with Table 1-2. If there are any missing, incorrect or defective (in appearance) items, contact ADVANTEST's Service Department or your nearest ADVANTEST sales office or agency immediately.

Table 1-2 List of Standard Accessories

Part name	Part number	Quantity	Remarks
Power cable *1	A01403	1	Power cable with 3-pin plug
	A09034	1	AC adapter
	ESD-SR-15	1	EMI core
Input cable	A01041	1	Red
		1	Black
Alligator clip adapter	A08398	1	Red
		1	Black
Power fuse	218.250	1	Slow-blowing fuse for 100/120V supply voltage
	218.125	1	Slow-blowing fuse for 220/240V supply voltage
Protective fuse of current terminal	2163.15	1 *2	Current-melt fuse 3.15A
Operation manual	ER6552		This manual

*1 ADVANTEST provides the power cables for each country.
See the yellow pages "Table of Power Cable Options" in this manual.

*2 R6552 uses a current-melt fuse in the front panel mA input terminal.

Use the part numbers when ordering additional accessories.

1.4 Operating Environment

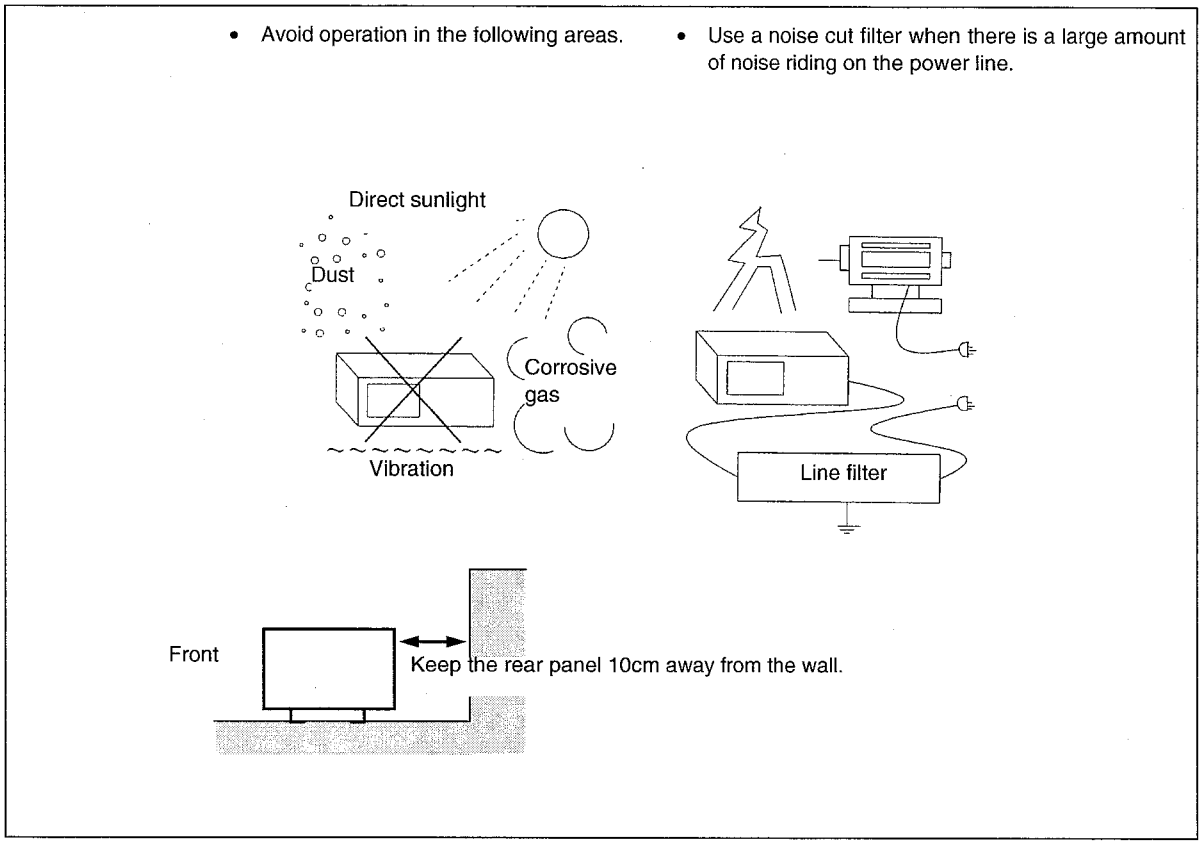


Figure 1-1 Operating Environment

The instrument should be installed in an area which satisfies the following conditions:

- Ambient temperature: 0°C to +50°C (operating temperature)
  -25°C to +70°C (storage temperature)
- Relative humidity: RH 85% or less (no condensation)
- Altitude up to 2000m
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A quiet area

  Although the instrument has been designed to withstand a certain amount of noise riding on the AC power line, it should be used in an area of low noise. Use a noise cut filter when ambient noise is unavoidable.

1.5 Operating Precautions

(1) In case of malfunction

If smoke comes out of the instrument, or an abnormal smell or noise is detected, immediately turn the POWER switch off, pull out the power plug, and contact ADVANTEST's Service Department or your nearest ADVANTEST sale office or agent. The addresses and phone numbers to contact are listed at the end of this manual.

(2) Warm up

To attain high accuracy operation, the instrument must be allowed to warm up to roughly room temperature before turning the POWER switch on, and then be allowed to warm up a further 60 minutes before starting measurement.

1.6 Power Supply

1.6.1 Power Supply Conditions

WARNING:
For safe operation of the instrument, and to avoid damage, be sure to observe the specified power supply conditions.

Table 1-3 Power Supply Conditions

Input Voltage	Voltage Selector	Applicable fuse (Part number)	Frequency	Power consumption
90V - 110V	100V	T250mA/250V (218.250)	48Hz - 66Hz	27VA max.
103V - 132V	120V			
198V - 242V	220V	T125mA/250V (218.125)		
207V - 250V	240V			

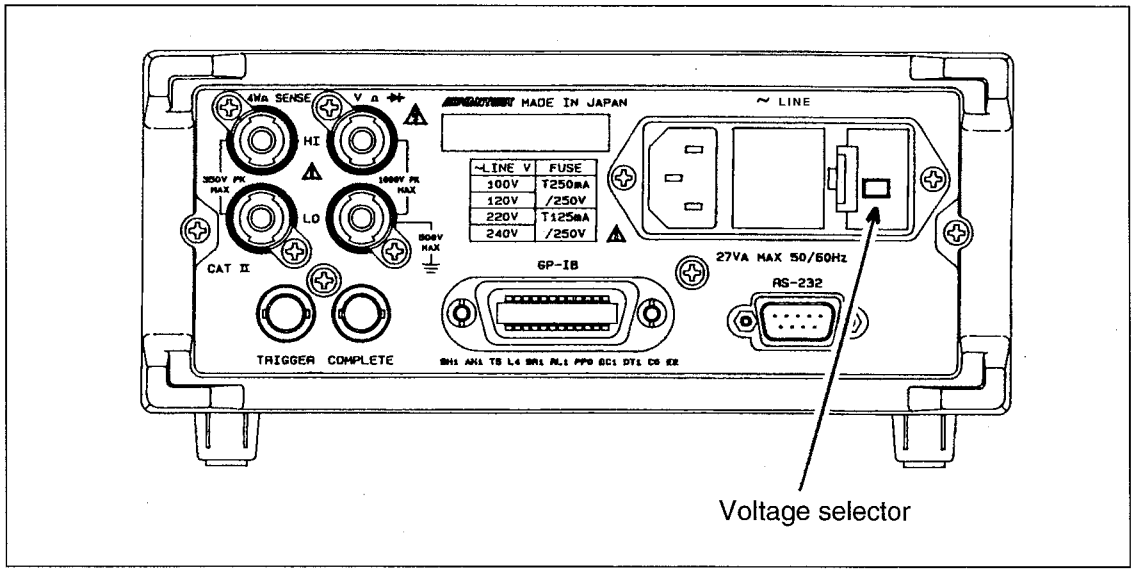


Figure 1-2 Setting Voltage

1.6.2 Changing the Supply Voltage

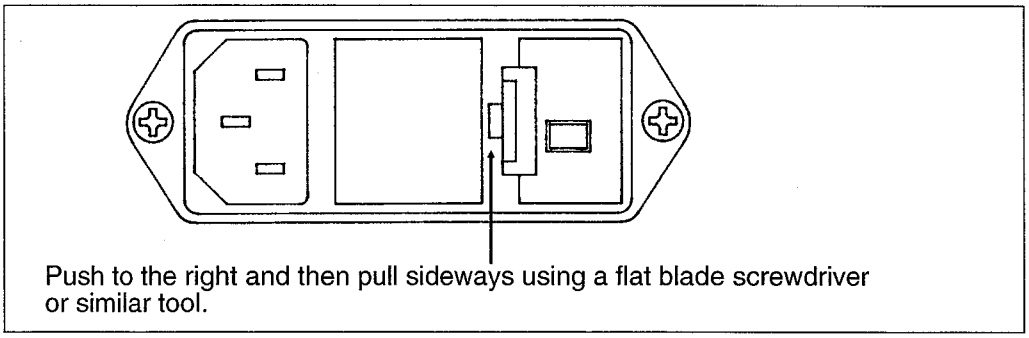
The instrument's supply voltage can be changed with the switch provided in the AC inlet on the rear panel.

WARNING!

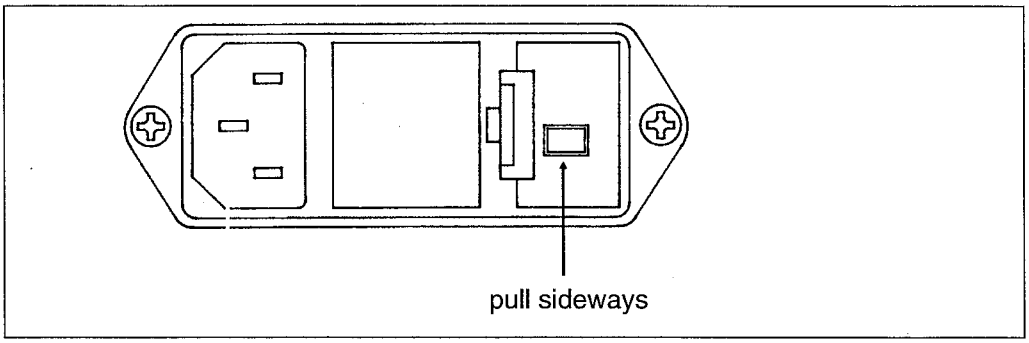
1. ***Before replacing the power fuse, be sure to turn the POWER switch off and pull out the power plug.***
2. ***To protect the instrument from fire, be sure to use the correct power fuse for the supply voltage.***

[Procedure]

① Remove the fuse from the power connector on the rear panel.



② Pull the voltage selector out sideways.



③ The setting voltage (100V, 120V, 220V and 240V) are marked on the 4 sides of the voltage selector.
Change the direction of the voltage selector so that the desired supply voltage marking faces you, and then re-insert the selector. The set voltage is now the value you can read.

1.6.3 Replacing the Fuse

There are two types of fuse on this instrument: a power fuse and a protection fuse. Replace them using the following procedure.

WARNING!

1. ***Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited.***

2. ***Visual inspection is insufficient for checking fuse disconnection. Measure the resistance value to determine whether the connection is good or not. (Normal values are below 15 Ω.)***

3. ***Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.***

(1) Replacing the power fuse

The power fuse is set in the rear panel power connector. Replace the power fuse by the following procedure:

[Procedure]

① Turn off the POWER switch.

② Remove the power cable.

③ Perform the operation in step (2).

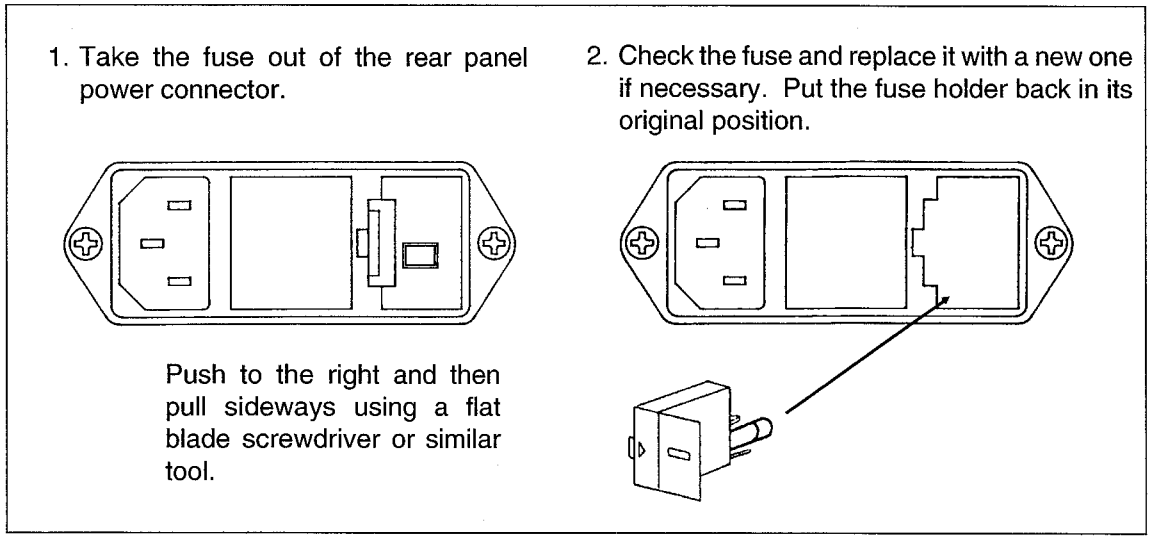


Figure 1-3 Fuse Checking/replacement

(2) Replacing the protective fuse (R6552 only)

The instrument uses a current-melt fuse in the front panel mA input terminal to protect internal circuits from an overcurrent on the input terminal.

[Procedure]

① Remove the cause of overcurrent from the input terminal on the front panel.

② Rotate the input terminal while pushing in it, then pull it out.

③ Replace the fuse with a new one of the proper rating, and put the fuse holder back in its original position.

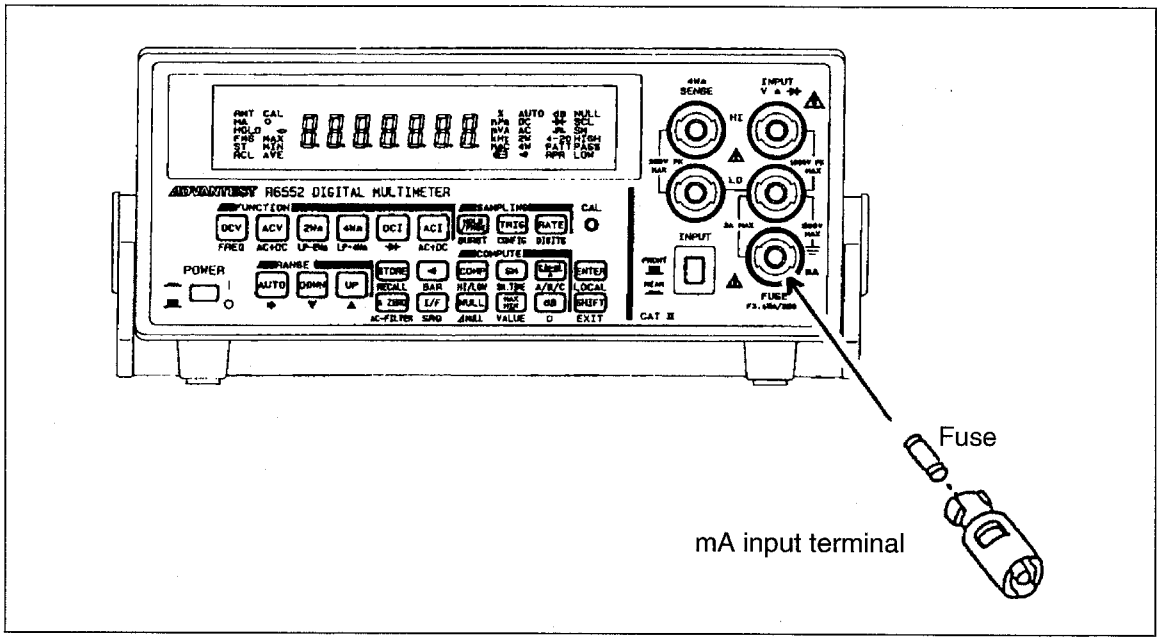


Figure 1-4 Replacing the Protective Fuse

1.6.4 Connecting the Power Cable

WARNING!

1. ***Power cable***
   - ***To prevent electric shock or fire, be sure to use the power cable which comes attached to the instrument.***
   - ***To use the instrument outside Japan, use a power cable which conforms to the applicable safety standard of the country.***
   - ***Be sure to turn the POWER switch off before plugging the power cable into the receptacle.***
   - ***Always grasp the plug and not the cord when disconnecting the power cable from the receptacle.***

2. ***Protective ground***
   - ***Always connect the power plug to a grounded receptacle.***
   - ***Protective grounding is not effective if an ungrounded extension cord is used.***

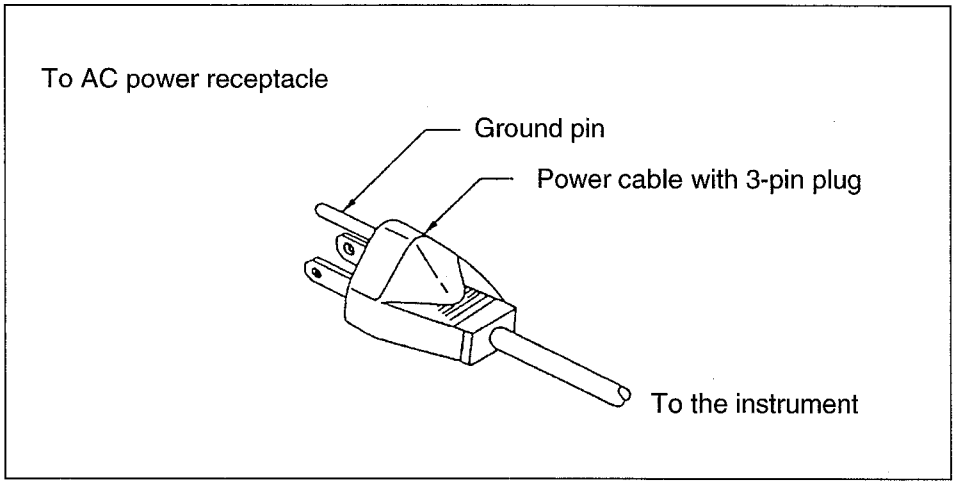


Figure 1-5 Power Cable

ADVANTEST provides the power cables for each country. See yellow page of "Table of Power Cable Options" at this manual.

1.7 Maximum Allowable Applied Voltages and Currents Across Terminals

Table 1-4 lists the maximum voltages and currents that can be safely applied between the measurement terminals (1) and (2).

Table 1-4 Maximum Allowable Applied Voltages and Currents

Product name	Terminal name		Maximum allowable input
	(1)	(2)	
R6552	CHASSIS	INPUT LO 4wΩ SENSE LO	500 V max.
	INPUT HI	INPUT LO	1000 V peak max.
	4wΩ SENSE HI	4wΩ SENSE LO	350V peak max.
	INPUT mA	INPUT LO	3 A max.
R6552T/T-R	CHASSIS	INPUT LO 4wΩ SOURCE LO	200 V max.
	INPUT HI	INPUT LO	200 V peak max.
	4wΩ SOURCE HI	4wΩ SOURCE LO	

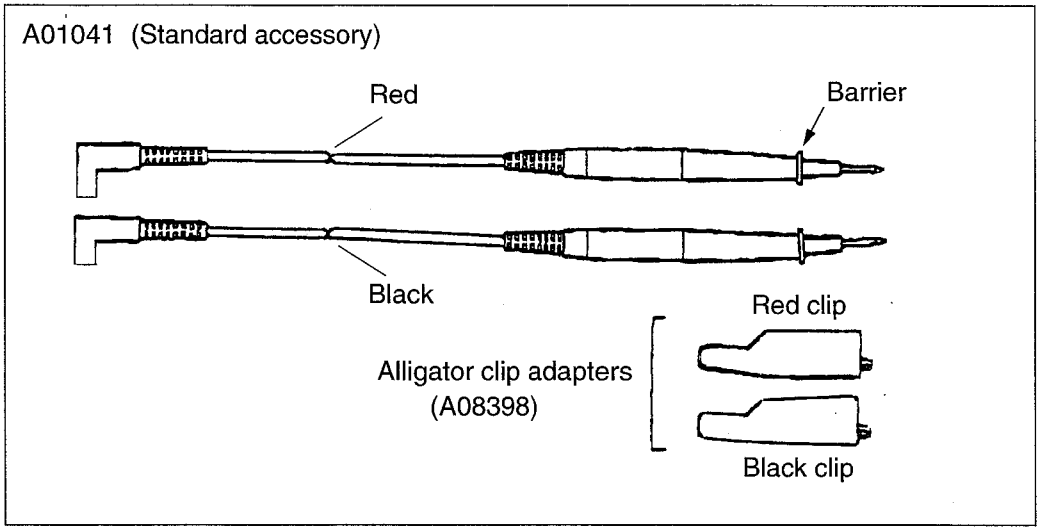
WARNING!
To avoid damage to the instrument, malfunctions, or electrical shock hazards, do not apply voltages or currents in excess of their maximum input ratings.

1.8 Input Cables

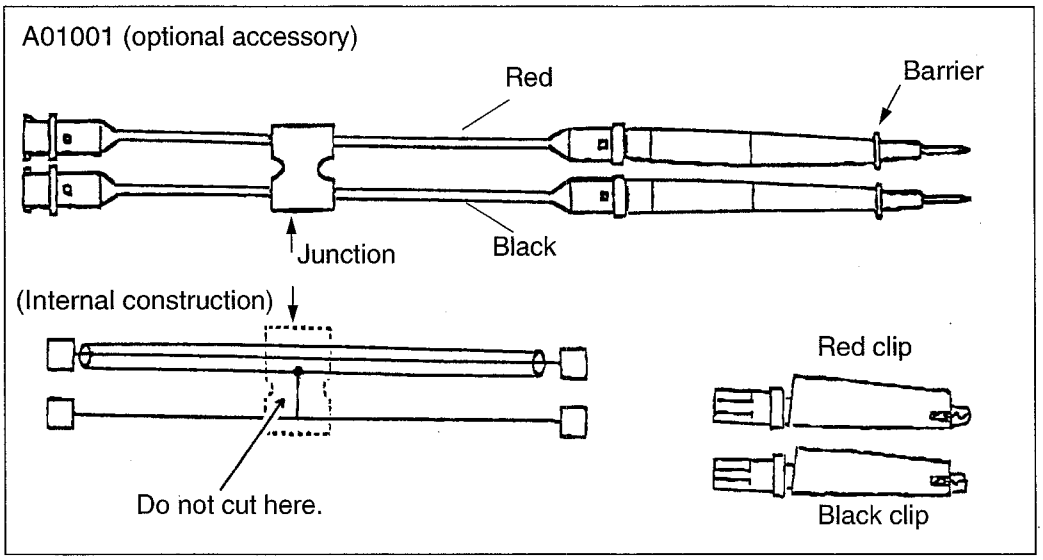
(1) The standard input cables supplied with the R6552 Series instruments are easy-to-use separate red and black cables.

CAUTION!
Use the input cable with caution as it has a sharp tip.

WARNING!
Touching the metal part of the input cable may cause electric shock.



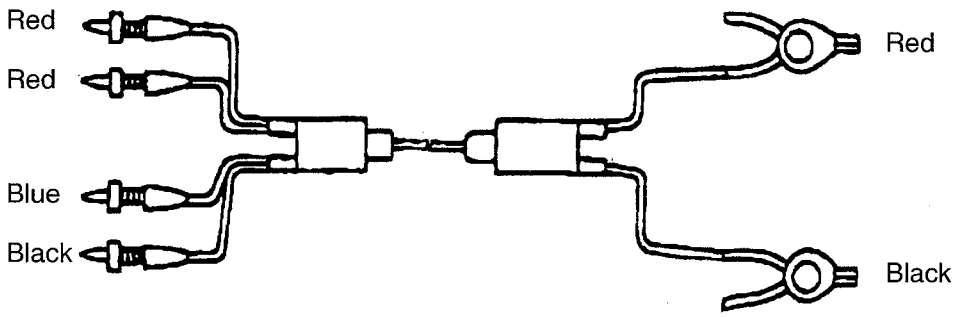
(2) If short-time stability is of concern in measuring high resistances (on the order of megaohms) or high sensitivity (on the order of microvolts), use the optional cable A01001, which has the HI end shielded.



CAUTION!
The red wire in the A01001 is shielded. Be cautious not to cut it inadvertently.
When using these Alligator clip adapters, the voltage rating of the probe lead is reduced to 30V AC, 60V DC.

(3) In four-wire resistance measurement, use the custom input cable A01006.

A01006 (optional accessory)



(4) To measure ripple voltages at a high level of sensitivity (an amplitude of several millivolts is measured), use a shield cable (type: A01035, etc.).

The A01035 type cable consists of three wires (red, black and blue). Connect the red plug (at the other end of the cable) to the INPUT HI terminal of this instrument, and the blue and black plugs to the LO terminal of this instrument.
Connect the red and blue alligator clips to the circuit to be measured. When the black alligator clip is used connect it to the same point as the blue one. Otherwise, leave it unattached.

1.9 Cleaning, Storing and Transporting the Instrument

(1) Cleaning

Dirt on the instrument can be wiped off with a soft (or moist) cloth. When cleaning the instrument, take care of the following:

- Be careful not to leave fibers on the instrument or let water soak into it.
- Do not use any organic solvent which may degrade plastics (such as benzene or acetone).

(2) Storage

When the instrument is not used for a long time, cover it with a vinyl sheet or put it in a corrugated fiberboard box to protect it from dust. Store in a dry place free from direct sunlight.

Storage temperature: -25°C to 70°C

(3) Transportation

To transport the instrument, pack it in its original packing material or the equivalent (5mm or thicker corrugated fiberboard box).

Packing procedure:

① Wrap the instrument in a cushioning material and place in a corrugated fiberboard box.
② Place accessories in the box with the cushioning material on top of them.
③ Close the corrugated fiberboard box, and bind it with packing string.

1.10 Replacing Parts with Limited Life

The R6552 Series uses the following parts with limited life that are not listed in Safety Summary. Replace the parts listed below after their expected lifespan has expired.

Part name	Life
Relay	1,000,000 times

2 PANEL SIDE DESCRIPTIONS

2.1 Front Panel Descriptions

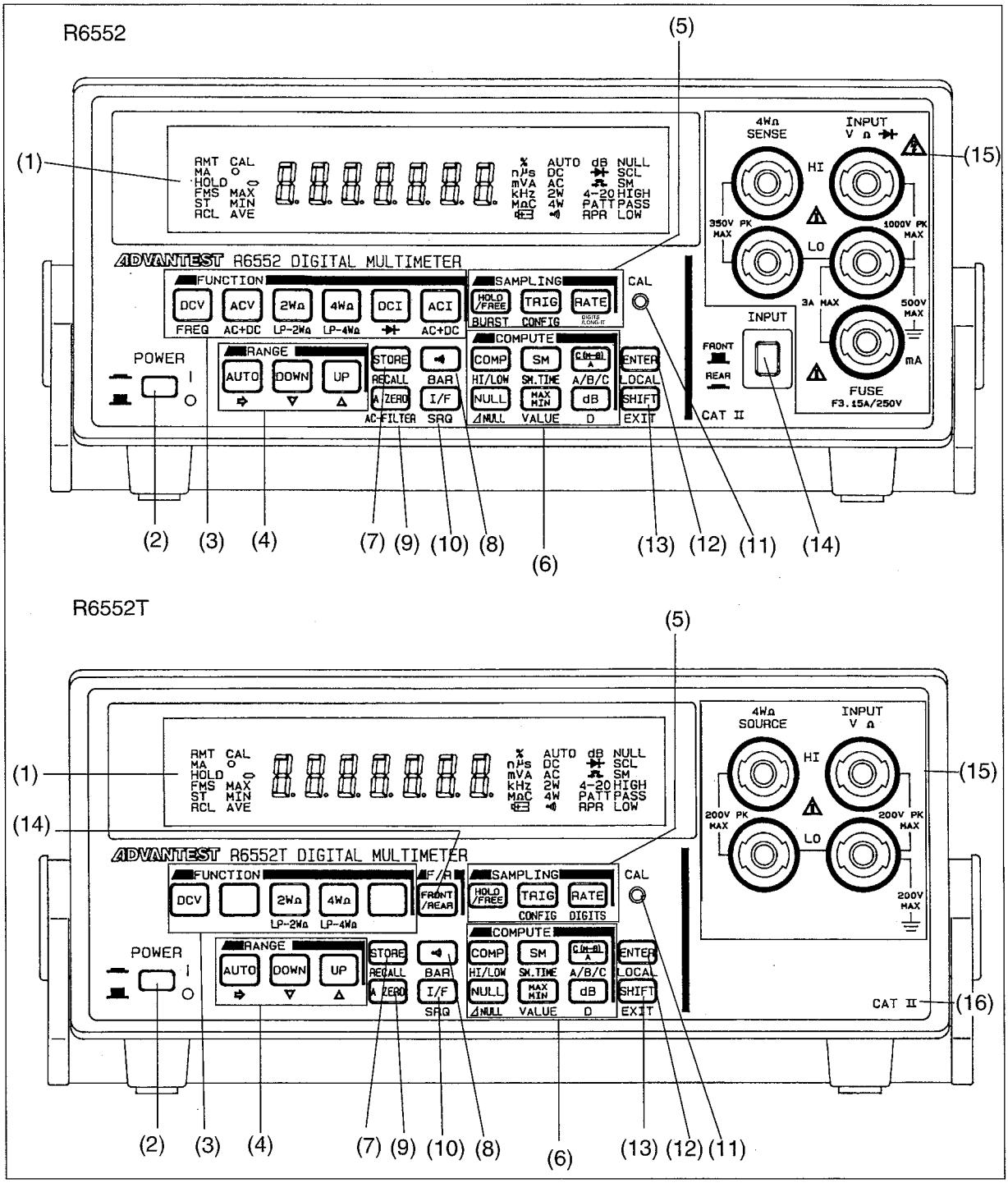


Figure 2-1 Front Panel Descriptions (1 of 2)

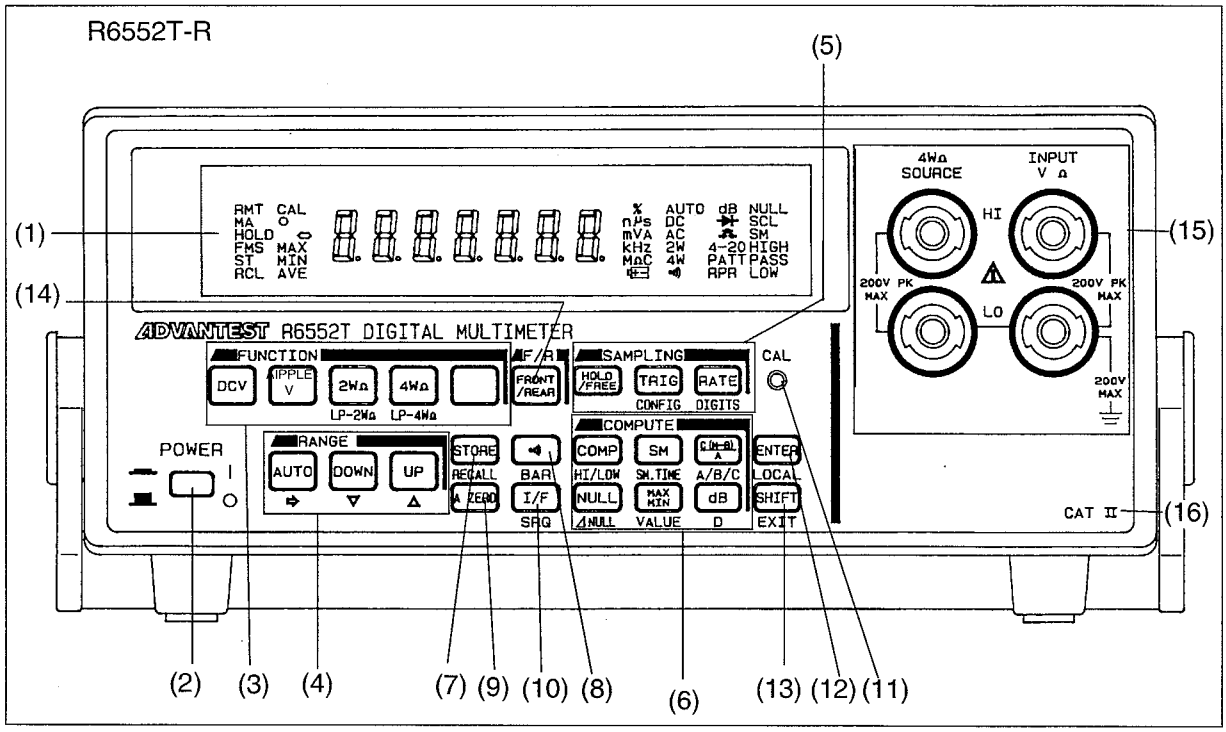
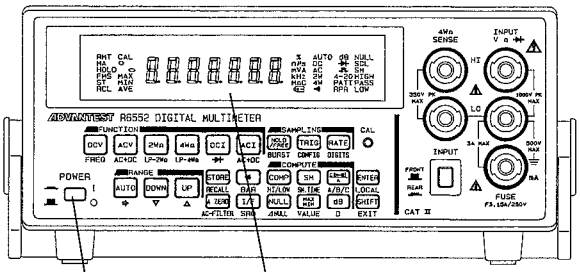
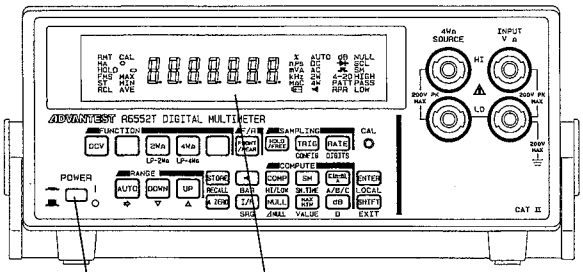


Figure 2-2 Front Panel Descriptions (2 of 2)

R6552



R6552T/T-R



(1) Display section

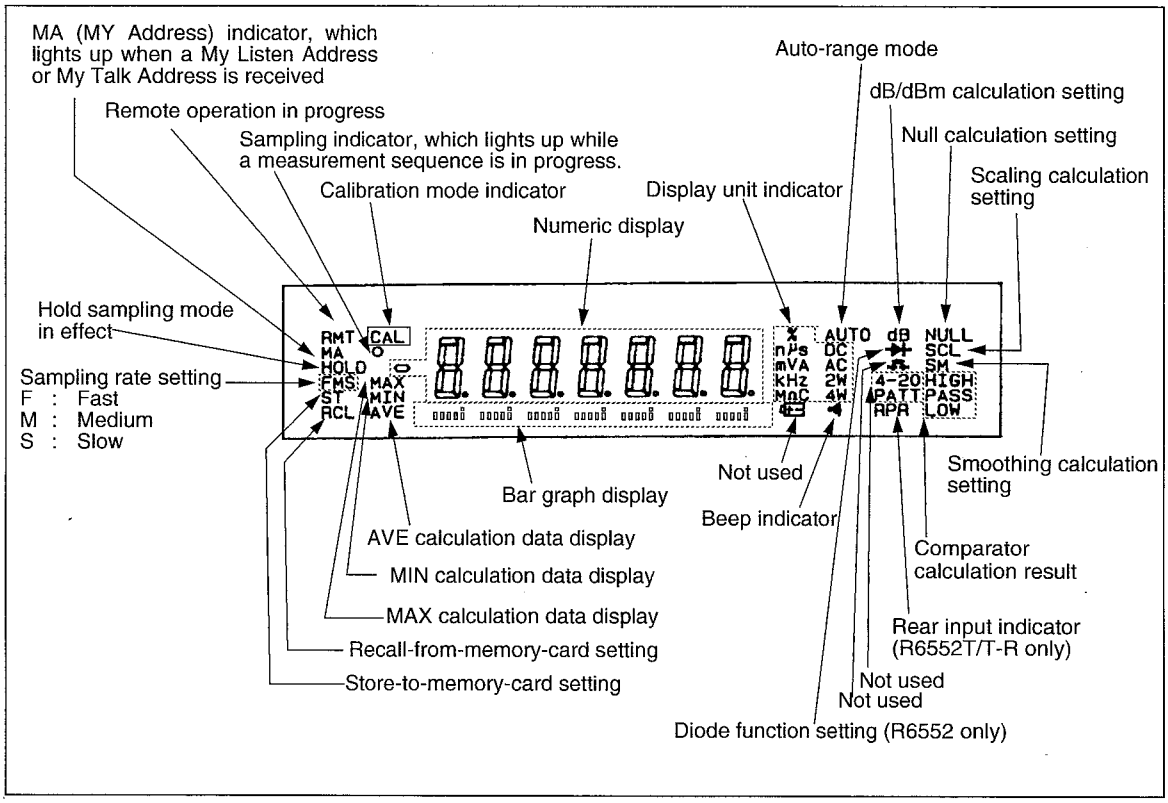
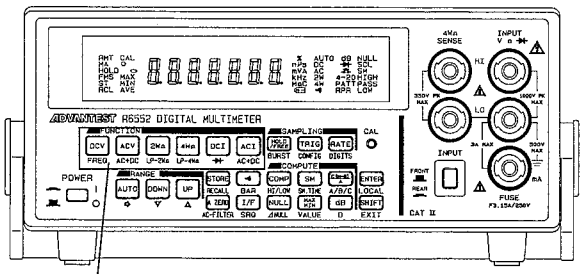


Figure 2-3 Display Section Descriptions

(2) Power supply switch

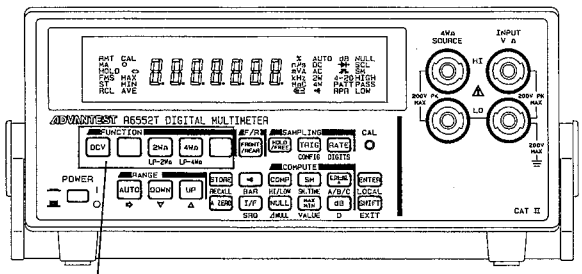
: Press the power supply switch once to turn the instrument on. Press again to turn the instrument off.

R6552



(3)

R6552T/T-R



(3)

(3) Measurement function keys

DCV : Selects DC voltage measurement (DCV).

ACV : Selects AC voltage measurement (ACV) (R6552 only)

2WΩ : Selects two-wire resistance measurement (2WΩ).

4WΩ : Selects four-wire resistance measurement (4WΩ).

DCI : Selects DC current measurement (DCI) (R6552 only).

ACI : Selects AC current measurement (ACI) (R6552 only).

RIPPLE V : Selects ripple voltage measurement (RIPPLE V) (R6552T-R only).

SHIFT + DCV (FREQ) : Selects frequency measurement (FREQ) (R6552 only).

SHIFT + ACV (AC+DC) : Selects AC voltage (AC + DC coupling) measurement (ACV (AC+DC)) (R6552 only).

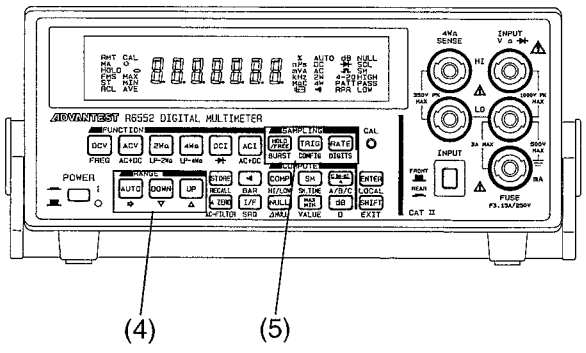
SHIFT + 2WΩ (LP-2WΩ) : Selects low-power two-wire resistance measurement (LP-2WΩ).

SHIFT + 4WΩ (LP-4WΩ) : Selects low-power four-wire resistance measurement (LP-4WΩ).

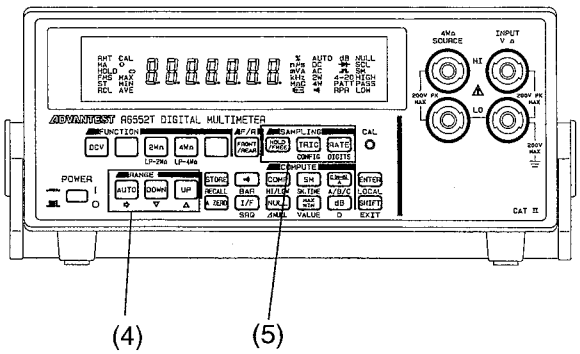
SHIFT + DCI (→|) : Selects diode measurement (→|) (R6552 only).

SHIFT + ACI (AC+DC) : Selects AC current (AC + DC coupling) measurement (ACI (AC+DC)) (R6552 only).

R6552



R6552T/T-R



(4) Measurement range selector keys

AUTO : Selects the measurement range between auto (AUTO) and manual (MANUAL).

DOWN : Selects the manual (MANUAL) measurement range and decreases it by one level.

UP : Selects the manual (MANUAL) measurement range and increases it by one level.

- While the instrument is in the parameter setup mode, use these keys to edit parameters:

AUTO ⇨ : Moves the blinking cursor position to the right.

DOWN ▽ / UP △ : Edit the digit at the blinking cursor position.

(5) Sampling selector keys

HOLD/FREE : Selects the sampling mode between free-run and hold.

TRIG : Directs the instrument to start measurement while it is in the hold sampling mode.

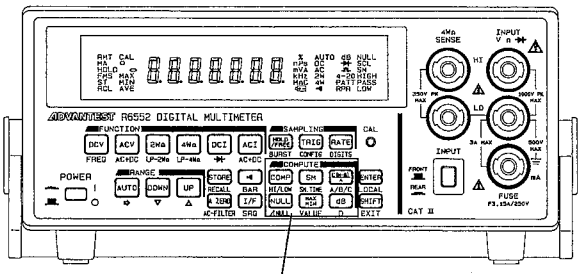
RATE : Selects the sampling rate from among fast (FAST), medium (MED), and slow (SLOW).

SHIFT + HOLD/FREE (BURST) : Enables the burst sampling mode. (R6552 only)

SHIFT + TRIG (CONFIG) : Enables the trigger condition setup mode.

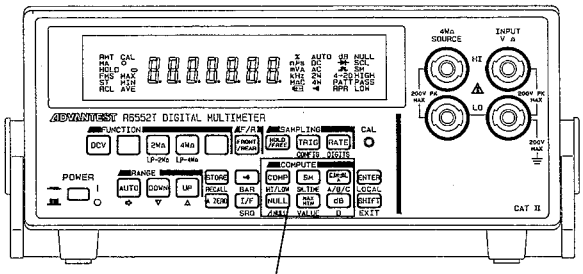
SHIFT + RATE (DIGITS /LONG-IT) : Selects the number of display digits, or sets the LONG-IT measurement (R6552 only).

R6552



(6)

R6552T/T-R



(6)

(6) Calculation selector keys

COMP : Sets or cancels the comparator calculation.

SM : Sets or cancels the smoothing calculation.

C (M-B) / A : Sets or cancels the scaling calculation.

NULL : Sets or cancels the null calculation.

MAX MIN : Sets or cancels the MAX·MIN calculations.

dB : Sets or cancels the dB/dBm calculations.

SHIFT + COMP (HI/LOW) : Enables the mode for setting upper (HI) and lower (LOW) limits for a comparator calculation or for enabling a beep to signify the result of a comparison.

SHIFT + SM (SM TIME) : Enables the mode for setting a moving average count for a smoothing calculation.

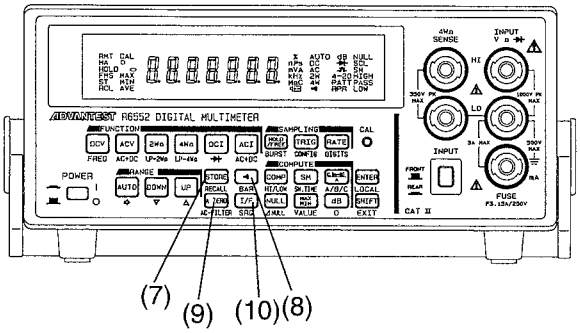
SHIFT + C (M-B) / A (A/B/C) : Enables the mode for setting constant A, B, or C for a scaling calculation.

SHIFT + NULL (Δ NULL) : Enables the mode for setting a null value for a null calculation.

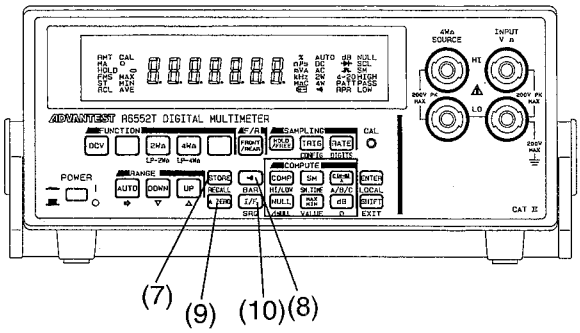
SHIFT + MAX MIN (VALUE) : Enables the mode for selecting measurement values for MAX·MIN calculations.

SHIFT + dB (D) : Enables the mode for setting constant D for dB/dBm calculations.

R6552



R6552T/T-R



(7) Store/recall selector keys

STORE : Enables the mode for storing measurement data (R6552 only) or setup parameters in memory.

SHIFT + STORE (RECALL) : Enables the mode for recalling stored measurement data (R6552 only) or setup parameters from memory.

(8) Beep selector keys

•)) : Enables the beep. Press again to disable the beep. (The beep, if enabled, would sound to indicate key clicks, or the result of a comparator calculation and so on.)

SHIFT + •)) (BAR) : Enables the bar graph display. Press again to disable the bar graph display.

(9) Auto zero function selector keys

A ZERO : Selects or cancels the auto-zero function.

SHIFT + A ZERO (AC-FILTER) : Sets a frequency band for AC voltage and current measurement. (R6552 only)

SHIFT + A ZERO (HPF/LPF) : Sets frequencies for the low-pass filter (LPF) and high-pass filter (HPF) during the ripple voltage measurement. (R6552T-R only)

(10) Interface selector keys

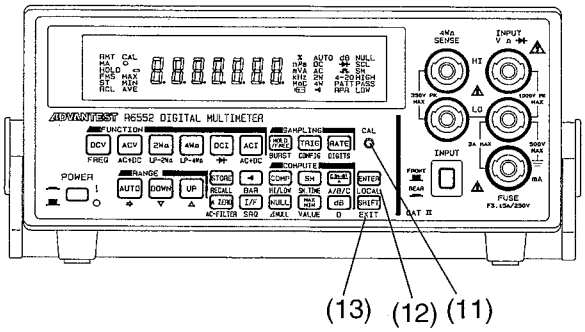
I/F : Enables the interface selection mode.

Available interface types
1. GPIB interface
2. RS-232 interface (R6552 only)

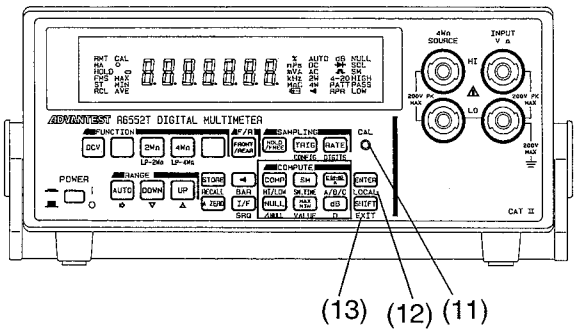
- In remote operations

I/F (SRQ) : Transmits an SRQ signal over the GPIB interface.

R6552



R6552T/T-R



(11) Calibration mode selector key

CAL

◎ : Enables the calibration (CAL) mode. Press again to exit the calibration mode to the normal state of measurement.

(12) ENTER/LOCAL keys

- In the setup mode

ENTER : Verifies settings.

- In remote operations

ENTER (LOCAL) : Switches back to a local operation.

Note: ***This key is not functional when a LLO (Local Lockout) command has been set from the GPIB interface.***

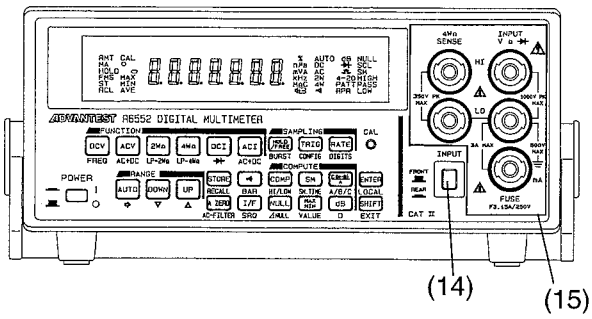
(13) SHIFT/EXIT keys

SHIFT : Enables the shift mode.

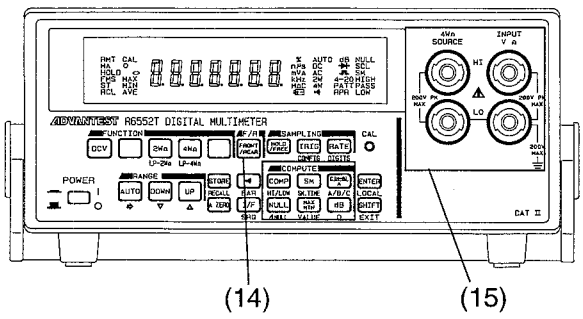
- In the setup mode

SHIFT (EXIT) : Exit the setup mode to the normal state of measurement (without saving alterations).

R6552



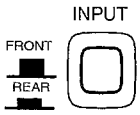
R6552T/T-R



(14) Measurement terminal selector key (switch)

CAUTION!
Do not switch between front and rear measurement terminals while a voltage above 200 Vpeak is present on them.

- R6552



: Push the switch in to select the rear measurement terminals. Press again to switch back to the front measurement terminals.

- R6552T/T-R

: Toggles between the front and rear measurement terminals. The RPR indicator lights up when you select rear input.

(15) Front measurement input terminal section

- R6552

INPUT V Ω ⊣◀	HI terminal	: HI terminal for DC voltage, AC voltage, resistance, diode, or frequency measurement (Current source HI terminal for four-wire resistance measurement)
INPUT V Ω ⊣◀	LO terminal	: LO terminal for DC voltage, AC voltage, resistance, DC current, AC current, diode, or frequency measurement (Current source LO terminal for four-wire resistance measurement).
4WΩ SENSE	HI terminal	: Sense HI terminal for four-wire resistance measurement.
4WΩ SENSE	LO terminal	: Sense LO terminal for four-wire resistance measurement.
mA terminal		: HI terminal for DC current or AC current measurement.

- R6552T/T-R

INPUT V Ω	HI terminal :	HI terminal for DC voltage or resistance measurement (sense HI terminal for four-wire resistance measurement).
INPUT V Ω	LO terminal :	LO terminal for DC voltage or resistance measurement (sense LO terminal for four-wire resistance measurement).
4WΩ SOURCE	HI terminal :	Current source HI terminal for four-wire resistance measurement.
4WΩ SOURCE	LO terminal :	Current source LO terminal for four-wire resistance measurement.

(16) CAT II: Indicates that the R6552 series meets the safety requirements for the setting category II specified by the IEC 61010.
The setting category is classified for a setting system or part of a circuit which has standardized limits to transient over-voltage dependent on nominal line voltage to the ground.

2.2 Rear Panel Descriptions

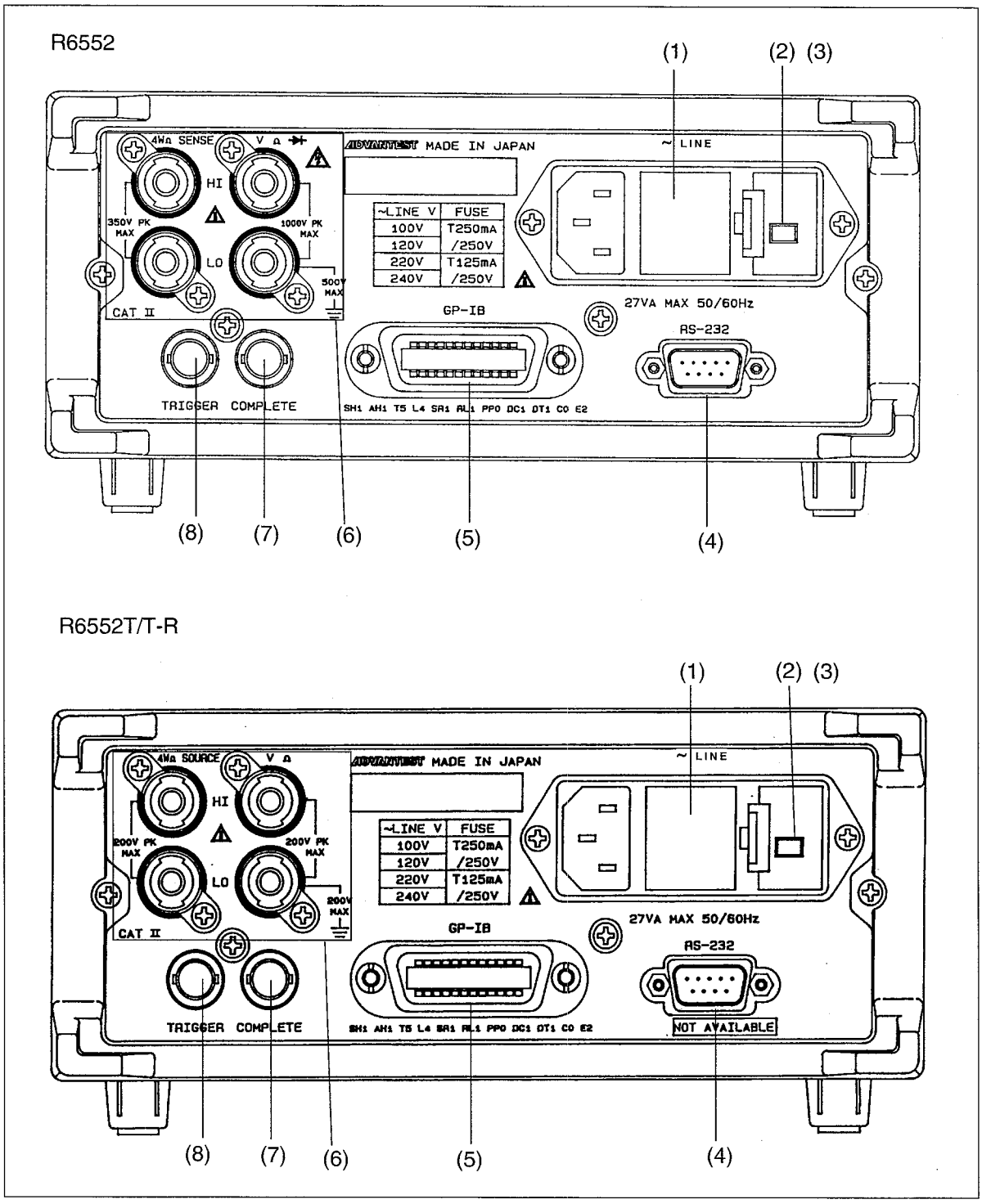


Figure 2-4 Rear Panel Descriptions

(1) Power connector: AC power supply connector, into which the power cable (A01403) supplied with the R6552 Series instruments is inserted.

(2) Voltage changer: Changes power voltages (100 V, 120 V, 220 V, 240 V).

(3) Fuse holder: Encloses a slow-blow fuse.

(4) RS-232 connector: RS-232 interface connector, which permits setting up and controlling data output and measurement conditions. (R6552 only)

Note:The RS-232 interface is not available with R6552T/T-R.

(5) GPIB connector: GPIB interface connector, which permits setting up and controlling data output and measurement conditions.

(6) Rear measurement input terminal section:
Measurement input cables are inserted into these terminals.

(7) COMPLETE: Measurement end signal output.

(8) TRIGGER: External trigger input.

3 OPERATING INSTRUCTIONS

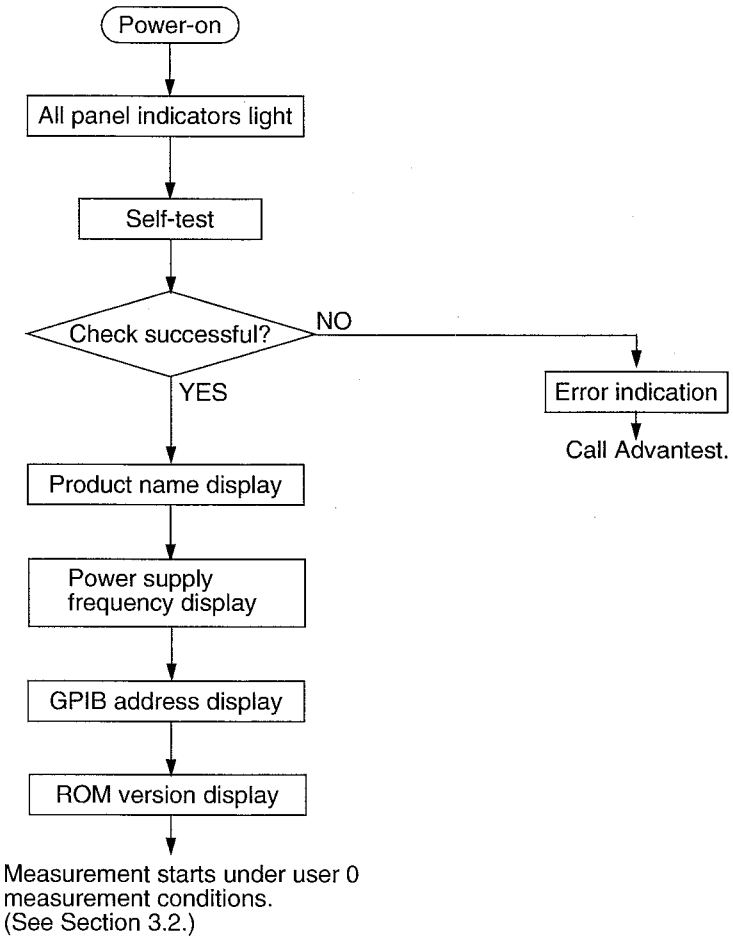
3.1 Power-on

The R6552 Series instruments, when powered on (by turning on the power switch), carry out a self-test automatically before proceeding with a measurement sequence.

(1) Self-test items

1. RAM read/write check
2. ROM read check
3. Backup parameter check
4. Calibration data check
5. Analog function check

(2) Operation flow after the R6552 Series instruments are powered on



3.2 Storing and Holding Measurement Conditions

The R6552 Series instruments do not hold the measurement conditions in effect before they are turned off. Instead, they support four memory locations (called users 0 to 3) to store measurement conditions. If measurement conditions are stored in user 0 memory, the R6552 Series instruments come up with these conditions automatically when they are powered on.

Users 1 to 3 can be supported under different conditions from those in effect at power-on time.

3.3 Initializing Measurement Conditions

To initialize all the measurement conditions to their factory defaults, follow these steps:

(1) Initialize stored measure conditions

For R6552;

Key sequence	Display	
① STORE	MEASStr	Message used to store the measurement data in the internal memory
② DOWN	PArAStr	Message used to save the setup parameters
③ ENTER ▽	S uSEr0	Select USER-0
④ DOWN ▽	init	Select initialization
⑤ ENTER		Pressing the ENTER initializes all parameters (USER-0 through USER-3).

⑥ Turn the power ON again after turning the power OFF.

For R6552T/T-R;

Key sequence	Display	
① STORE	S uSEr0	Select USER-0
② DOWN ▽	init	Select initialization
③ ENTER		Pressing the ENTER initializes all parameters (USER-0 through USER-3).

④ Turn the power ON again after turning the power OFF.

Notes: For parameters to be initialized and their contents, see Section 5.4, "Remote Commands".

(2) Initialize current measure conditions

For R6552;

Key sequence	Display	
① SHIFT + STORE (RECALL)	MEASrcL	Message used to recall the measurement data from the internal memory
② DOWN ▽	PArArcL	Message used to load the setup parameters
③ ENTER	r uSEr0	Select USER-0
④ DOWN ▽	dEFAULT	Select initialize current conditions
⑤ ENTER		Let the instrument start a measurement sequence by initializing the measurement conditions.

For R6552T/T-R;

Key sequence	Display	
① SHIFT + STORE (RECALL)	r uSEr0	Select USER-0
② DOWN ▽	dEFAULT	Select initialize current conditions
③ ENTER		Let the instrument start a measurement sequence by initializing the measurement conditions.

Notes: For parameters to be initialized and their contents, see Section 5.4, "Remote Commands".

3.4 Storing and Recalling Setup Parameters

3.4.1 Storing Measurement Condition Settings in USER-1

For R6552;

Key sequence	Display	
① STORE	MEASStr	Message used to store the measurement data in the internal memory
② DOWN ▽	PArAStr	Message used to save the setup parameters
③ ENTER	S uSEr0	Select USER-0
④ UP △	S uSEr1	Select USER-1
⑤ ENTER		Let the instrument start a measurement sequence by storing the measurement conditions in USER-1.

For R6552T/T-R;

Key sequence	Display	
① STORE	S uSEr0	Select USER-0
② UP △	S uSEr1	Select USER-1
③ ENTER		Let the instrument start a measurement sequence by storing the measurement conditions in USER-1.

3.4.2 Recalling Stored Measurement Condition Settings from USER-2 as Instrument Parameters

For R6552;

Key sequence	Display	
① SHIFT	------	Shift mode
② STORE	MEASrcL	Message used to store the measurement data in the internal memory
③ DOWN ▽	PArArcL	Message used to save the setup parameters
④ ENTER	r uSEr0	Select USER-0
⑤ UP △ UP △	r uSEr2	Select USER-2
⑥ ENTER		Let the instrument start a measurement sequence by recalling the stored measurement conditions from USER-2 as instrument parameters.

For R6552T/T-R;

Key sequence	Display	
① SHIFT	------	Shift mode
② STORE	r uSEr0	Select USER-0
③ UP △ UP △	r uSEr2	Select USER-2
④ ENTER		Let the instrument start a measurement sequence by recalling the stored measurement conditions from USER-2 as instrument parameters.

3.4.3 Special Setting Parameters

Parameter settings are usually stored in volatile memory. If you want to save in non-volatile memory, you should be used USER-0 to USER-3. (See Section 3.2, "Storing and Holding Measurement Conditions.)

However, special setting parameters are always stored in non-volatile memory.

- Select interface : GPIB, RS-232
- Header : ON/OFF
  (Common parameter for GPIB and RS-232)
- GPIB conditions : GPIB Address, Addressable/talk-only
- RS-232 conditions : Baud rate, parity, Data bit length, Stop bit length, Echo, only-mode

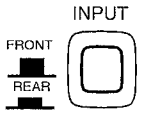
Note: ***In case of the R6552T/T-R, only GPIB parameters are stored because RS-232 is not available with this model.***

4 FUNCTION DESCRIPTIONS

4.1 Switching Measurement Input Terminals

Use either the front (FRONT) or rear (REAR) measurement input terminals.

(1) R6552

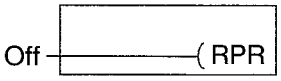


Push in the switch to select the rear measurement terminals. Press again to switch back to the front measurement terminals.

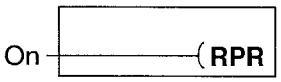
(2) R6552T/T-R

Toggles between the front and rear measurement terminals each time you press the key.

Display



The RPR indicator goes off when you select FRONT input.



The RPR indicator lights when you select REAR input.

4.2 Measurement functions

4.2.1 DC Voltage Measurement (DCV)

CAUTION!
Do not apply voltages above 200V for long with the 3000 mV range or any lower range. Overheated internal protective circuitry could produce errors in the Measurement of those ranges following the voltage input. To prevent errors, observe the relationship between the maximum allowable applied voltage and the input time as expressed in the equation below.

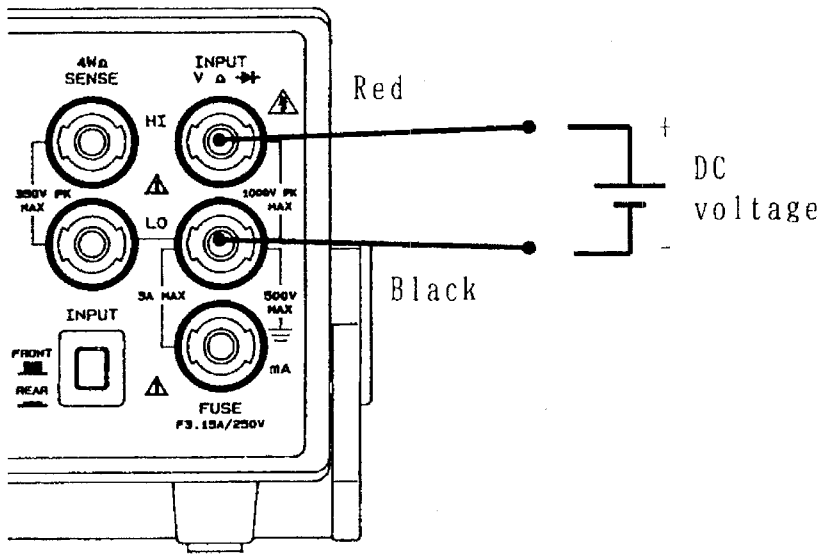
$$t < \frac{10^6}{V^2}$$

t: Input time [sec]
V: Input voltage [V] (1000 Vpeak max.)

Place a device under test between the INPUT terminals HI and LO.

- Maximum allowable applied voltages

Terminal	Maximum allowable applied voltage	
	R6552	R6552T/T-R
Between HI and LO	1000V peak	200V peak
Between LO and chassis	500V	200V



(This figure shows the terminal section of the R6552.)

Figure 4-1 DC Voltage Measurement Input Cable Connection Diagram

4.2.2 AC Voltage Measurement (ACV and ACV (AC+DC)) (R6552 only)

CAUTION!
Do not apply voltages above 200 Vrms for long with the 300 mV range of the AC+DC function. Overheated internal protective circuitry could produce errors in the Measurement of the range following the voltage input. To prevent errors, observe the relationship between the maximum allowable applied voltage and the input time as expressed in the equation below.

$$t < \frac{10^6}{V^2}$$

t: Input time [sec]
V: Input voltage [Vrms] (700 Vrms max.)

① Place a device under test between the INPUT terminals HI and LO.

② If an AC voltage is superimposed with a DC voltage

- To measure only the AC voltage, use the ACV measurement function.
- To measure both the AC and DC voltages, use the AC+DC measurement function.
- Input range: 5% of the full scale or higher
- Crest factor: 3:1
- Maximum allowable applied voltage: Determined by the product of the signal voltage multiplied by the frequency.

Terminal	Maximum allowable applied voltage
Between HI and LO	700 Vrms, 1000V peak, 10000000V·Hz
Between LO and chassis	500V

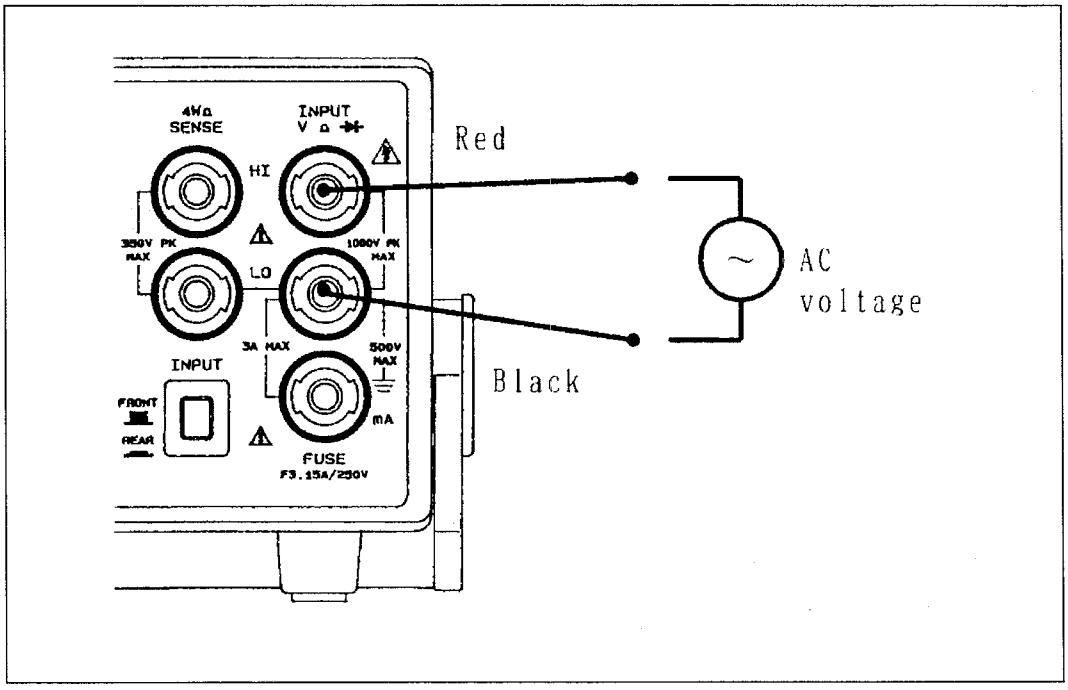


Figure 4-2 AC Voltage Measurement Input Cable Connection Diagram (R6552 only)

(1) About true root-mean-square (rms) value measurement

There are three types of representation for the magnitude of alternating signals: a mean value, a root-mean-square value, and a maximum value. The maximum value refers to a maximum value among instantaneous values. The mean value and root-mean-square value are represented using the following formulas:

Instantaneous value	:e (t)
Mean value	:Eave
Root-mean-square value	:Erms
Period	:T
Maximum value	:Em

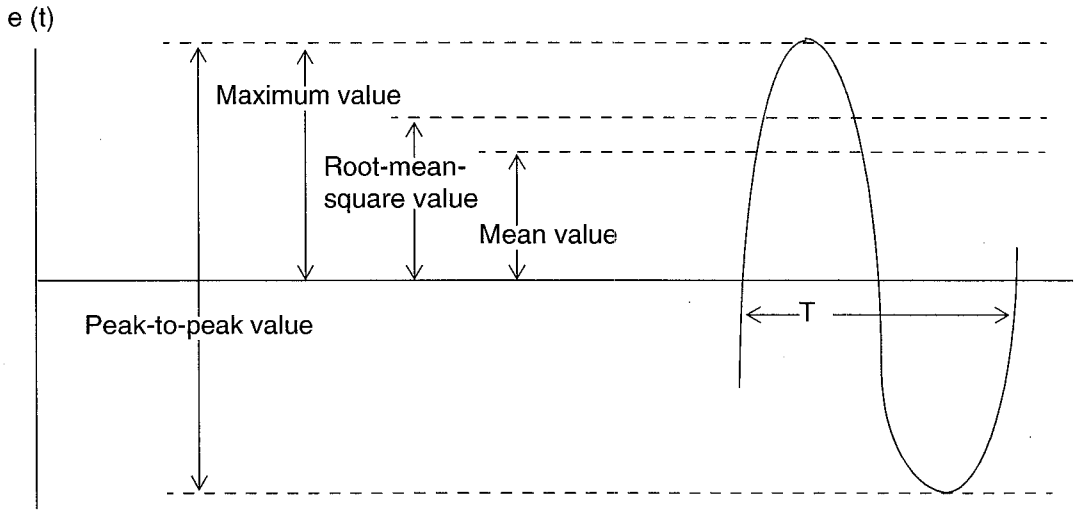
$$Eave = \frac{2}{T}\int_0^{T/2} e(t)\,dt$$

$$Erms = \sqrt{\frac{1}{T}\int_0^{T} [e(t)^2]\,dt}$$

When e(t) is a sine wave Em sinwt, the following approximate values are used.

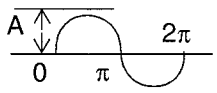
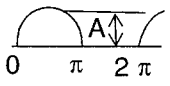
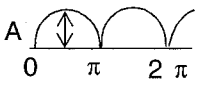
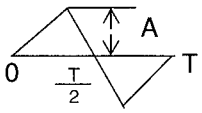
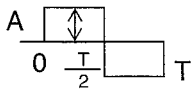
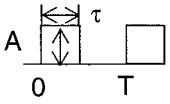
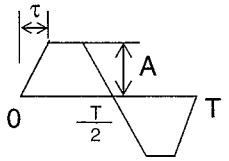
$$Eave = \frac{2}{\pi} Em \fallingdotseq 0.636\ Em$$

$$Erms = \frac{1}{\sqrt{2}} Em \fallingdotseq 0.707\ Em$$



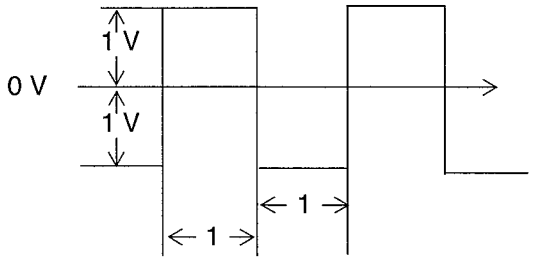
Among these three values, the root-mean-square value is the most proper to express quantity of electricity and heat of an alternating signal. Quantity of heat generated when applying alternating voltage to a resistor R for (t period of time is the same as that generated when applying the same DC voltage value. As a result, using the root-mean-square representation can directly compare effect of a direct current signal and an alternating signal regardless of their waveforms.
When waveforms and their distortions are clearly recognizable as shown in Figure 4-3, mean value and root-mean-square measurement instruments can calculate measurement errors and correct measurement values because form factors and crest factors are known.

However, this measurement method is for measuring sine wave signals. When measuring non-sinusoidal waves such as distorted waves, rectangular waves, pulse waves, triangular waves, noisy ones which are output through inverters or SCRs, the true root-mean-square values cannot be measured due to increased measurement errors.
Figure 4-4 shows a difference in measurement values between the root-mean-square value and the mean value measurement methods for a rectangular wave as its input.
To measure the root-mean-square value, a circuit for squaring, averaging, and calculating the square root of the value just obtained is required.
The instruments such as the R6552, that are equipped with this circuit, can measure the true root-mean-square values for any alternating signals regardless of their waveforms.

Waveform	Mean value	Root-mean-square value	Form factor*1	Crest factor*2
Sine wave 	$\frac{2A}{\pi}$	$\frac{A}{\sqrt{2}}$	$\frac{\pi}{2\sqrt{2}}$	$\sqrt{2}$
Half-wave rectifying 	$\frac{A}{\pi}$	$\frac{A}{2}$	$\frac{\pi}{2}$	2
Full-wave rectifying 	$\frac{2A}{\pi}$	$\frac{A}{\sqrt{2}}$	$\frac{\pi}{2\sqrt{2}}$	$\sqrt{2}$
Triangular wave 	$\frac{A}{2}$	$\frac{A}{\sqrt{3}}$	$\frac{2}{\sqrt{3}}$	$\sqrt{3}$
Rectangular wave 	A	A	1	1
Impulse wave 	$\frac{\tau}{T}$ A	$A\sqrt{\frac{\tau}{T}}$	$\sqrt{\frac{T}{\tau}}$	$\sqrt{\frac{T}{\tau}}$
Trapezoidal wave 	$(1-2\frac{\tau}{T})$ A	$A\sqrt{1-\frac{8\tau}{3T}}$	$\frac{\sqrt{1-\frac{8\tau}{3T}}}{1-2\frac{\tau}{T}}$	$\frac{1}{\sqrt{1-\frac{8\tau}{3T}}}$

*1 Form factor: Root-mean-square value/Mean value
*2 Crest factor: Maximum value/Root-mean-square value

Figure 4-3 Simple Waveform Alternating Signal



True root-mean-square value measurement type

$$V=\sqrt{V_{IN}^2} = 1V$$

Mean value measurement,
root-mean-square indication type

V = Mean value x Constant*
=1 × 1.11
=1.11 V

*: For full-wave rectifying wave, 1.11
Measurement error is 0.11 (11 %).

Figure 4-4 Rectangular Wave Measurement

The R6552 obtains true root-mean-square value output (direct current) using an analog AC/DC converter.
When measuring a pulse waveform, for example, a maximum crest factor of 3 can be measured, i.e., a maximum value of three times the size of the full-scale and a duty ratio of 1:9.
Precautions for correct True RMS measurement:
It is necessary to consider the crest factor, duty ratio, and higher harmonic components that show the performance of RMS instruments in addition to external factors such as induction, noise, and a grounding current.

(a) Crest factor

The crest factor is defined as the maximum value of a signal divided by the RMS value of the signal.
The crest factor used in the R6552 is 3:1 at full-scale. As the RMS value can be measured up to full-scale of each range, the following formula is obtained:

Maximum value = Crest factor x RMS value = 3 x full-scale values of each range--- (1)

For the 3 V range, for example, 3 x 3.2 V = 9.6 V, then the maximum value of ±9.6 V can be input.
For an input greater than the above value, the upper and lower limits of the signal are clamped and the value cannot be measured (Figure 4-5).

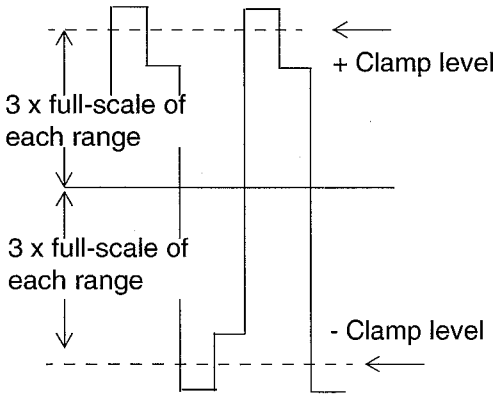


Figure 4-5 Crest factor

(b) Duty ratio

For rectangular waves, the duty ratio is limited. The duty ratio is defined as a ratio of a pulse width to a pulse period. When measuring pulse trains with low duty ratios or asymmetrical waves, signals applied to the instrument contain high peak values which are several times larger than the RMS values. When these high peak values cause over-input for the instrument, distortion occurs and results in deterioration in measurement accuracy. The duty ratio for each range is obtained as follows:

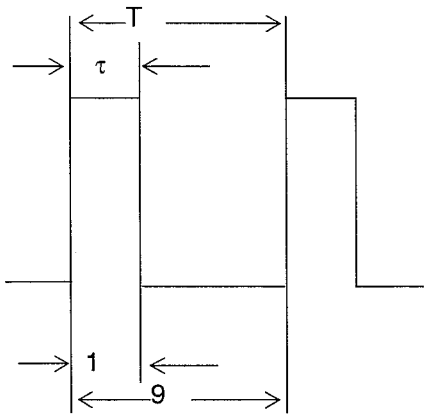
Erms : Root-Mean-Square value up to the full-scale of each range
Em : Maximum value obtained by the formula (1)
T : Period
τ : Pulse width

$$Erms = Em\sqrt{\frac{\tau}{T}}$$

$$3\ Vrms = 9(V)\sqrt{\frac{\tau}{T}}$$

$$\frac{1}{3} = \sqrt{\frac{\tau}{T}}$$

$$\therefore \quad \frac{\tau}{T} = \frac{1^2}{3^2} = \frac{1}{9}$$



$$\text{Duty ratio} = \frac{\tau}{T}$$

Figure 4-6 Duty ratio

Namely, when measuring a rectangular wave with a maximum value of 9 V using the 3 V range, the indication overflows unless the duty ratio $\frac{\tau}{T}$ is less than $\frac{1}{9}$.

(c) Higher harmonic components

When measuring sine waves, electrical performance and measurement accuracy of the R6552 must comply with the specifications of this apparatus. When measuring non-sinusoidal waves, however, it is necessary to consider frequency components of input signals because the waves contain higher harmonic components. The R6552 meets its performance when dominant waves and higher harmonic components are within the guaranteed range. However, 300 kHz or higher frequencies for each range cannot be guaranteed (100 kHz at 300 V range and 20 kHz at 700 V range are guaranteed). Therefore, pay attention when measuring input signals containing frequency components higher than the above frequencies.

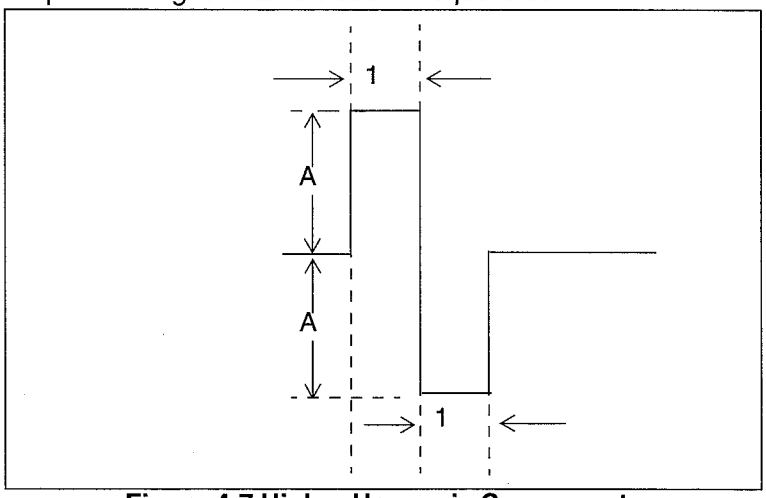


Figure 4-7 Higher Harmonic Components

Example

Frequency components of a rectangular wave are expressed using Fourier series as shown below:

$$F(t) = \frac{4A}{\pi}\left(\sin \omega t + \frac{1}{3}\sin 3\,\omega t + \frac{1}{5}\sin 5\,\omega t + \ldots\right)$$

This formula shows that the wave contains odd frequency components. Consequently, as a frequency of a dominant wave is high, each higher harmonic component will be out of the guaranteed frequencies resulting in increased measurement errors.

(2) About AC and (AC + DC) measurement

Furthermore, when measuring alternating signals superimposed on direct current components, the R6552 can measure an alternating component only (AC measurement) or a total of both components (AC + DC measurement) simply by switching [SHIFT] and [ACV] (AC+DC) buttons. Generally, a direct current component value is less and negligible, but it cannot be neglected when measuring alternating signals with a measurement error of 1 % or less. Alternating signals containing direct current components are used in power control circuits such as motor speed control circuits in which a part of a sine wave is cut off.

Example

When measuring a signal of 100 VAC which is superimposed on the 100 VDC.

When performing AC measurement, Vrms = $\sqrt{AC^2}$ = $\sqrt{(100\ V)^2}$ =100V, only AC component is measured.

When performing (AC + DC) measurement,
Vrms = $\sqrt{DC^2+AC^2}$ = $\sqrt{(100\ V)^2+(100\ V)^2}$ =141.42V, a root-mean-square value of the signal containing both the AC and DC components is measured.

4.2.3 Two-wire Resistance Measurement (2WΩ and LP-2WΩ)

CAUTION!
Do not apply voltages above 200V for long. Overheated internal protective circuitry could produce errors in the Measurement following the voltage input. To prevent errors, observe the relationship between the maximum allowable applied voltage and the input time as expressed in the equation below.

$$t < \frac{10^6}{V^2}$$

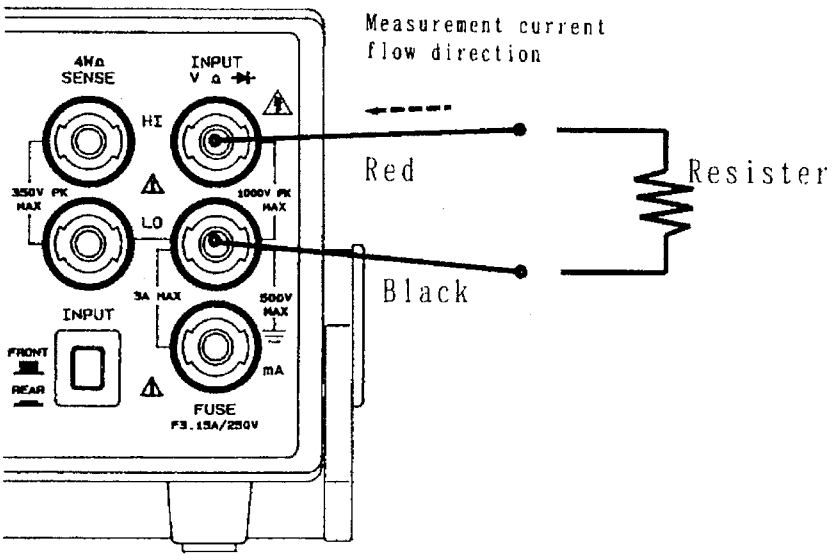
t: Input time [sec]
V: Input voltage [V] (1000 Vpeak max.)

① Place a device under test between the INPUT terminals HI and LO.

② To eliminate the resistance in the input cable, use the null calculation function.

- Voltage across open terminals: 8V max.
- Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage	
	R6552	R6552T/T-R
Between HI and LO	1000V peak	200V peak
Between LO and chassis	500V	200V



(This figure shows the terminal section of the R6552.)

Figure 4-8 Two-wire Resistance Measurement Input Cable Connection Diagram

4.2.4 Four-wire Resistance Measurement (4WΩ and LP-4WΩ)

CAUTION!
Do not apply voltages above 200V for long. Overheated internal protective circuitry could produce errors in the Measurement following the voltage input. To prevent errors, observe the relationship between the maximum allowable applied voltage and the input time as expressed in the equation below.

$$t < \frac{10^6}{V^2}$$

t: Input time [sec]
V: Input voltage [V] (1000 Vpeak max.)

① Place a current source between the INPUT terminals HI and LO and a voltage sense between the 4WΩ SENSE terminals HI and LO. (With the R6552T/T-R, the current source and voltage sense terminals are reversed.)

② In four-wire resistance measurement, the resistance in the input cable does not make a source of measurement error.

- Open-circuit voltage: 8V max.
- Maximum allowable applied voltage

Terminal		Maximum allowable applied voltage	
		R6552	R6552T/T-R
INPUT input	Between HI and LO	1000V peak	200V peak
	Between LO and chassis	500V	200V
4WΩ input	Between HI and LO	350V peak	200V peak
	Between LO and chassis	500V	200V

CAUTION!
In four-wire resistance measurement, the line resistance of input cable is no influence to measurement on fundamental range, but using 300k Ω range with fast sampling rate setting and higher 3000kΩ range, the line resistance is influence, because low terminal sensing is not performed.

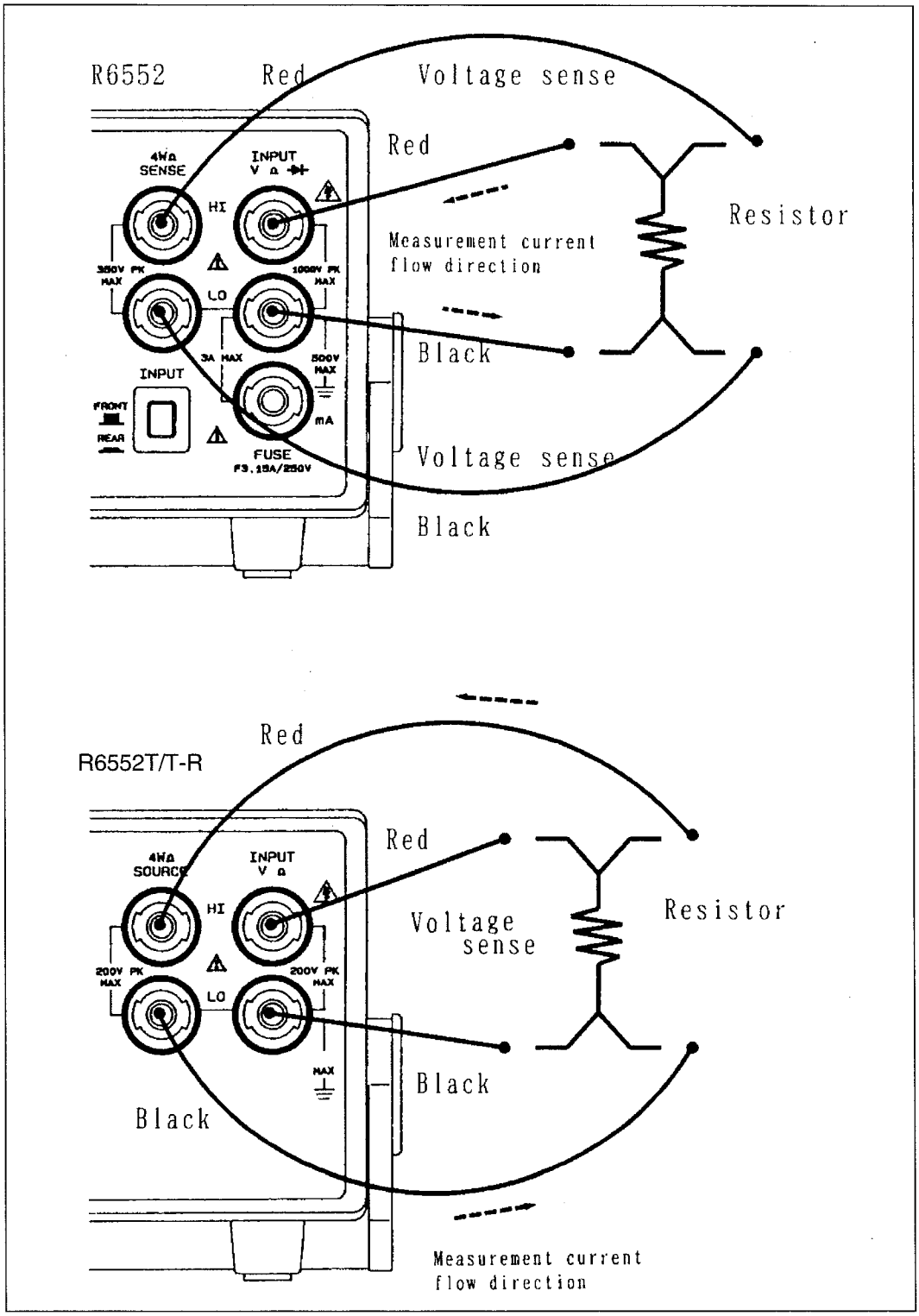


Figure 4-9 Four-wire Resistance Measurement Input Cable Connection Diagram

4.2.5 DC Current Measurement (DCI) (R6552 only)

CAUTIONS!

1. ***When a current of 1 A or higher is measured, the measurement value might be varied within limits of the specifications due to heating of the shunt resistor.***

2. ***Do not apply a current of 1 A or higher with the 300 mA range or any lower range. Overheated internal protective circuitry could produce errors in the Measurement of those ranges following the current input. To prevent errors, observe the relationship between the maximum allowable applied current and the input time as expressed in the equation below.***

$$t < \frac{3}{I}$$

t: Input time [sec]
V: Input current [A] (3 A max.)

3. ***Input current is 3A max. Do not apply a current of 3A or higher.***

Place a device under test between the mA terminal and the INPUT terminal LO.

- Fast-blow protective fuse: 3.15 A/250 V; enclosed in the mA terminal.

  Note: When replacing the fuse, be sure to replace with a fuse of the same rating.

- Resistance between input terminals:

3000μA:	10.5Ω or lower
30 mA:	10.5Ω or lower
300 mA:	0.4Ω or lower
3000 mA:	0.4Ω or lower

- Maximum allowable applied current : 3A max.

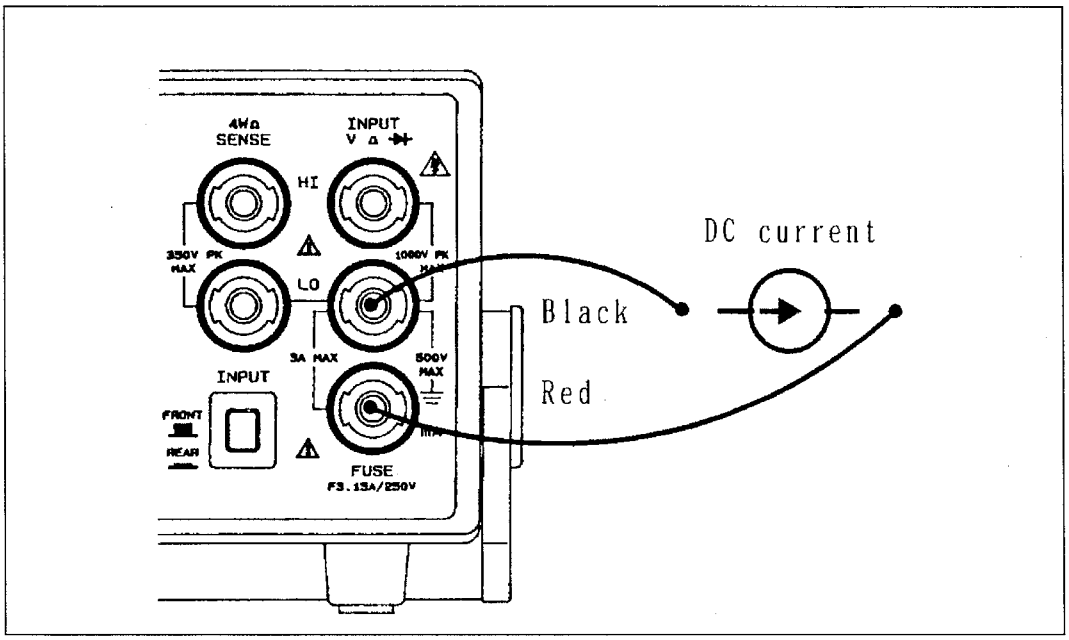


Figure 4-10 DC Current Measurement Input Cable Connection Diagram (R6552 only)

4.2.6 AC Current Measurement (ACI and ACI (AC+DC) (R6552 only)

CAUTIONS!

1. ***When a current of 1 A or higher is measured, the measurement value might be varied within limits of the specifications due to heating of the shunt resistor.***

2. ***Do not apply a current of 1 A or higher with the 30 mA range or any lower range. Overheated internal protective circuitry could produce errors in the Measurement of those ranges following the current input. To prevent errors, observe the relationship between the maximum allowable applied current and the input time as expressed in the equation below.***

$$t < \frac{3}{I}$$

t: Input time [sec]
I: Input current [Arms] (3 Arms max.)

① Place a device under test between the mA terminal and the INPUT terminal LO.

② If an AC current is superimposed with a DC current

- To measure only the AC current, use the ACI measurement function.
- To measure both the AC and DC currents, use the AC+DC measurement function.
- Input range: 5% of the full scale or higher
- Crest factor: 3:1
- Fast-blow protective fuse: 3.15 A/250 V; enclosed in the mA terminal.

  Note: When replacing the fuse, be sure to replace with a fuse of the same rating.
- Resistance between input terminals:

  3000μA: 10.5Ω or lower
  30 mA: 10.5Ω or lower
  300 mA: 0.4Ω or lower
  3000 mA: 0.4Ω or lower
- Maximum allowable applied current : 3Arms max.

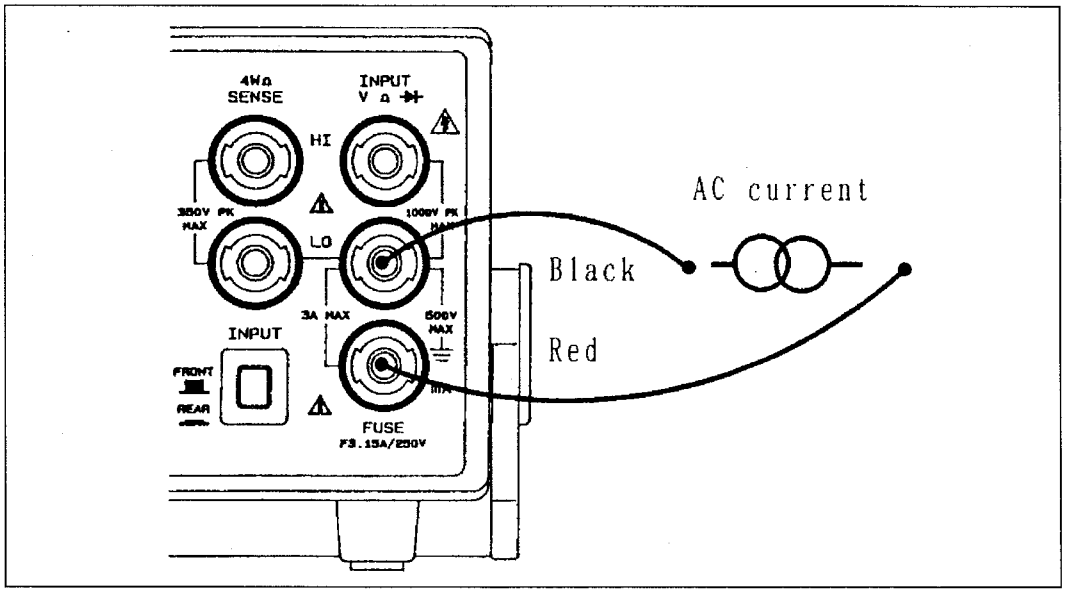


Figure 4-11 AC Current Measurement Input Cable Connection Diagram (R6552 only)

4.2.7 Frequency Measurement (FREQ) (R6552 only)

① Place a device under test between the INPUT terminals HI and LO.

② Measure the frequency of the terminal AC voltage at the zero-cross point after a DC cutoff by AC coupling.

- Measurement method:Reciprocal
- Measured voltage range:100 mVrms to 700 Vrms
- Measured frequency range: 1 Hz to 300 kHz
- Gate time and display digit length: (The gate time depends on the rate setting.)
  10 ms (FAST setting): 4 digits
  100 ms (MED setting): 5 digits
  1 s (SLOW setting): 6 digits

Note: When the measured frequency is low compared to the gate time, a maximum measurement time equal to one or two periods is required.

- Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI and LO	700 Vrms, 1000V peak, 10000000V·Hz
Between LO and chassis	500V

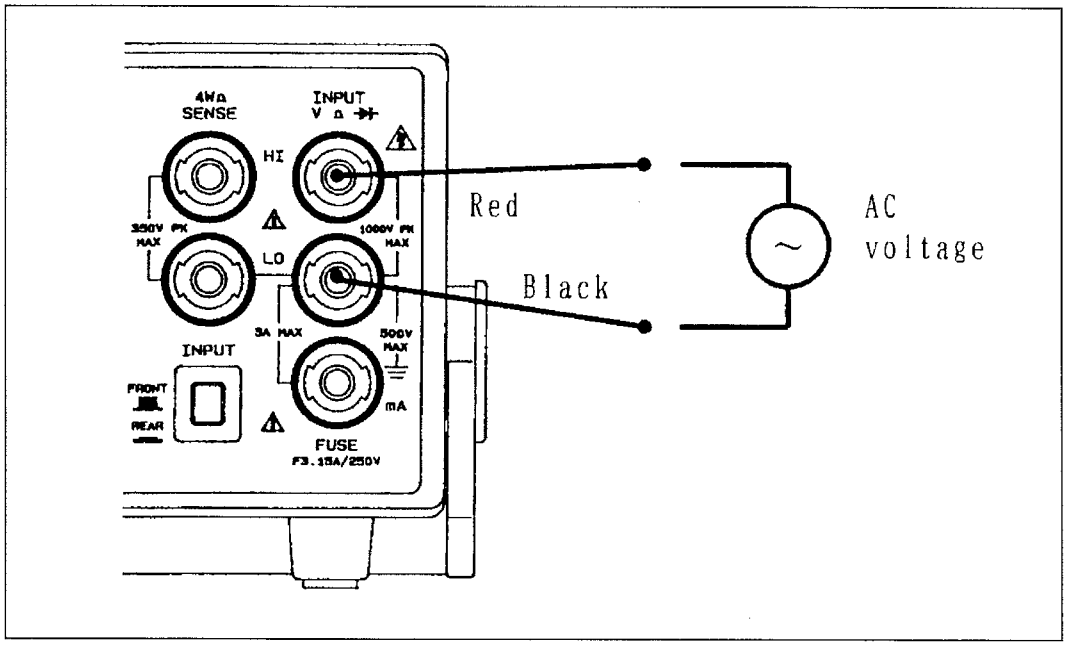


Figure 4-12 Frequency Measurement Input Cable Connection Diagram (R6552 only)

4.2.8 Diode Measurement (⊣▶) (R6552 only)

① Place a diode between the INPUT terminals HI and LO.

② Measure the voltage (forward voltage drop) across the LO and HI terminals as a DC current of about 1 mA flows from the LO to HI terminals.

- Measured voltage range: (Fixed measurement range)
  0 V to 3199.99 mV (MED/SLOW)
  0 V to 3199.9 mV (FAST)

Note: "OL" is displayed for input exceeding the measurement range.

- Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI and LO	1000V peak
Between LO and chassis	500V

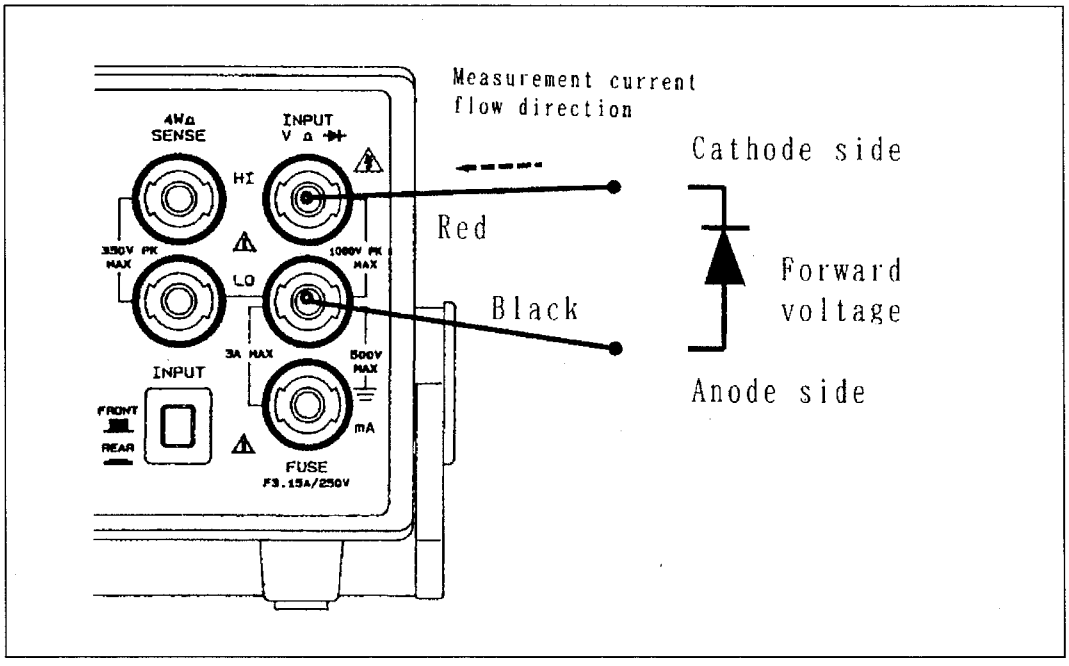


Figure 4-13 Diode Measurement Input Cable Connection Diagram (R6552 only)

4.2.9 Ripple Voltage Measurement (RIPPLE V): (R6552T-R only)

① Connect a device under test between the INPUT terminals HI and LO.

② Measure a peak-to-peak voltage of an alternating voltage which is superimposed on a DC voltage.

- Input range: 3.2 V p-p AC or less
- Maximum allowable applied voltage: Defined as the product of the voltage and the frequency of a signall

Terminal	Maximum allowable applied voltage
Between HI and LO terminals Between LO and chassis	200V peak, 2000000V•Hz 200V

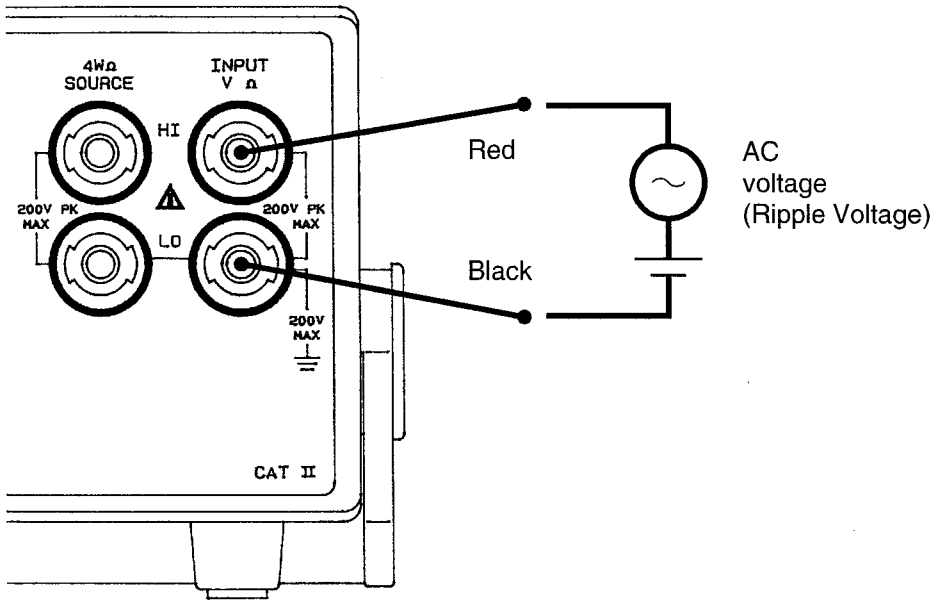
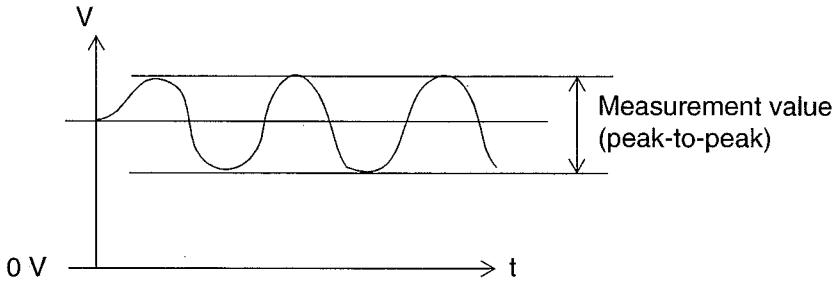


Figure 4-14 Input Cable Connection Diagram for Ripple Voltage Measurement (R6552T-R only)

(1) About ripple voltage measurement (RIPPLE V)

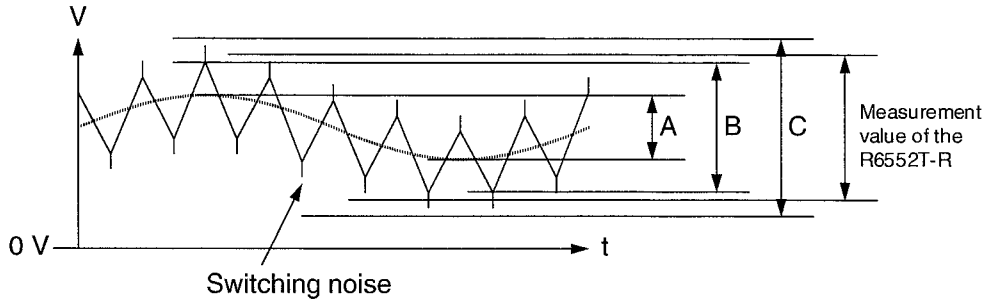
- Measuring method

  The R6552T-R measures a peak-to-peak voltage value of an alternating voltage superimposed on a dc voltage as shown below.



- When measuring output voltage of a switching power supply

  An output waveform of a typical switching power supply is shown in the figure below.

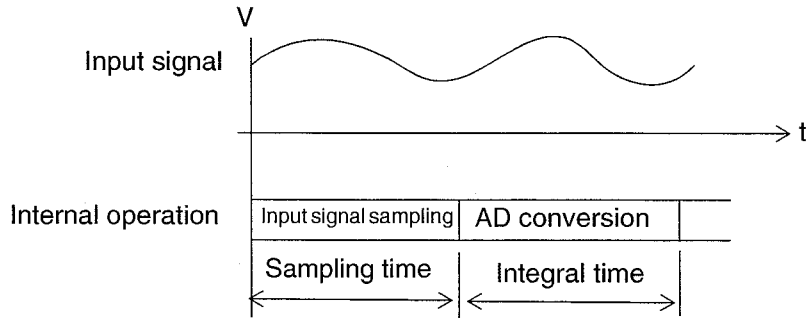


A: Ripple voltage of the power supply frequency
B: Switching ripple voltage
C: A peak-to-peak voltage including switching noise

The R6552T-R measures peak-to-peak values containing noise within an effective frequency band or within a passing band limited by low-pass and high-pass filters.
The R6552T-R effective frequency band is 3 MHz at the maximum. Normally, a peak-to-peak value (marked with C) resulting from switching noise cannot be measured because this type of noise contains components which are outside the frequency band.
The measurable peak-to-peak range of this instrument is between C and A as shown above. Measure a peak-to-peak value as shown below after selecting the filter pass band.
Measure the power supply frequency ripple voltage of A by setting the low-pass filter (LPF) to 1 kHz. Measure the switching ripple voltage of B by setting the low-pass filter to either 10 kHz or 100 kHz depending on the switching frequency.
Measure the switching ripple voltage (B - A) exclusive of the power supply frequency ripple voltage by setting the low-pass filter to 10 kHz or 100 kHz and the high-pass filter to 1 kHz.
For details of the low-pass filter (LPF) and high-pass filter (HPF), see Section 4.9.7, "High-Pass Filter and Low-Pass Filter".

(2) Sampling rate and sampling time

To measure a peak-to-peak voltage value, it is necessary to sample the input signal at least for one period during a measurement.



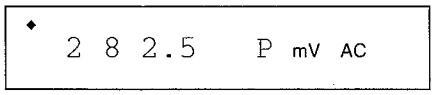
The relationships between the sampling rates, sampling times and integral times are shown below.

Sampling rate	Sampling time	Integral time
FAST	10 ms	1 PLC
MED	100 ms	100 ms
SLOW	1 s	100 ms

When measuring 50 Hz or 60 Hz ripple voltage, set the sampling rate to MED or SLOW.

(3) Display during ripple voltage measurement

For the ripple voltage measurement display, "P" indicating a peak-to-peak value, is displayed in the last digit of seven segments to distinguish the DCV from ACV as shown in the figure below.



(4) Measurement Precautions

- Input cable

When measuring ripple voltages, use a shield cable such as A01035 since it reduces measurement errors caused by external noise.

CAUTION:When taking measurements with the LPF set to 1 MHz or more, be sure to use a shield cable.

- Common mode noise

The common mode noise, which is generated between the ground of this instrument and the ground of the circuit to be measured, can cause a measurement error. Attempt to shorten the distance (between the ground of this instrument and the ground of the circuit to be measured) as much as possible.

- Checking the common mode noise

Check the common mode noise by connecting the HI and LO terminals (at the tip of the input cable) to the Lo terminal of the circuit to be measured.
Attempt to obtain ground connections which give you 0 (zero) mV common mode noise with the measurement range set to 30 mV and both the LPF and HPF set to OFF.

- Output resistance of the circuit to be measured

The output resistance of the circuit to be measured makes up an RC filter together with the input capacitance of this instrument (200 pF) and that of this cable, causing an error in high frequencies.
Reduce this output resistance as much as possible taking the measurement signal frequencies into consideration.

4.3 Setting Ranges

4.3.1 Operations

AUTO : Press to let the instrument run in the auto-range mode from the current measurement range. The instrument runs in the manual range mode when you press this switch while in the auto-range mode.

DOWN : Press to let the instrument run in the manual range mode one range below the current measurement range.

UP : Press to let the instrument run in the manual range mode one range above the current measurement range.

4.3.2 Selectable Ranges

The table below lists the ranges that are selectable according to the measurement function.

Remote code (range)	DCV	ACV *1	2WΩ/4WΩ	LP-2WΩ/ LP-4WΩ *4	DCI/ACI *1	RIPPLE V *5
R1						
R2	30mV *6		30Ω			30 mV
R3	300 mV	300 mV	300Ω	300 Ω		300 mV
R4	3000mV	3000 mV	3000Ω	3000 Ω	3000 μA	3000 mV
R5	30V	30 V	30kΩ	30 kΩ	30 mA	
R6	300V *2	300 V	300kΩ	300 kΩ	300 mA	
R7	1000 V *3	700 V	3000kΩ	3000 kΩ	3000 mA	
R8			30MΩ	30M Ω		
R9			300MΩ *6			

*1 This measurement function is applicable only to the R6552.
*2 The R6552T has a maximum allowable applied voltage of 200 V.
*3 R6552 only
*4 This measurement function is applicable only to the R6552/T.
*5 This measurement function is applicable only to the R6552T-R.
*6 R6552/T only

Note: ***Diode measurement does not have a remote code since it has a fixed range of 3000 mV.***

4.3.3 Auto-Range Mode

(1) The UP and DOWN levels in the auto-range modes are listed below.

Measurement function	Range	Auto-range level	
		DOWN	UP
DCV	30 mV *4	—	32.0000
	300 mV	29.999	320.000
	3000 mV	299.99	3200.00
	30 V	2.9999	32.0000
	300 V	29.999	320.000 (—) *1
	1000 V *2	299.99	—
2WΩ/4WΩ	30 Ω	—	32.0000
	300 Ω	29.999	320.000
	3000 Ω	299.99	3200.00
	30 kΩ	2.9999	32.0000
	300 kΩ	29.999	320.000
	3000 kΩ	299.99	3200.00
	30 MΩ	2.9999	32.0000
	300 MΩ *4	29.999	—
LP-2WΩ/LP-4WΩ *3	300 Ω	—	320.000
	3000 Ω	299.99	3200.00
	30 kΩ	2.9999	32.0000
	300 kΩ	29.999	320.000
	3000 kΩ	299.99	3200.00
	30 MΩ	2.9999	—

*1 The parentheses enclose the values that pertain to the R6552T/T-R.
*2 R6552 only
*3 This measurement function is applicable only to the R6552/T.
*4 R6552/T only

Measurement function	Range	Auto-range level	
		DOWN	UP
ACV *5 ACV (AC+DC)	300 mV	—	320.000
	3000 mV	299.99	3200.00
	30 V	2.9999	32.0000
	300 V	29.999	320.000
	700 V	299.99	—
DCI/ACI *5 ACI (AC+DC)	3 mA	—	3200.00
	30 mA	2.9999	32.0000
	300 mA	29.999	320.000
	3000 mA	299.99	—
→|← *5	3000 mV	—	—
RIPPLE V *6	30 mV	—	32.00
	300 mV	29.9	320.0
	3000 mV	299.	3200.

*5 This measurement function is applicable only to the R6552.
*6 This measurement function is applicable only to the R6552T-R.

(2) Auto-range for the BURST measurement

- During the BURST measurement, the auto-range operation is automatically turned OFF.
- When resetting the BURST measurement, the auto-range operation remains OFF

(3) Auto-range for the LONG-IT measurement

- During the LONG-IT measurement, the auto-range operates only when the range level is UP.

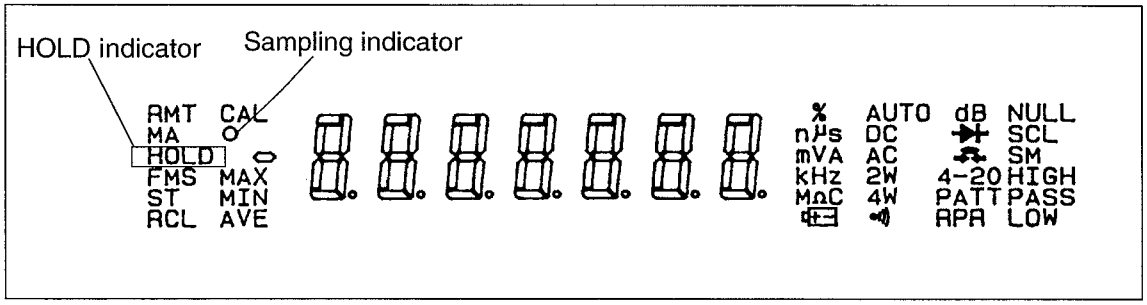
4.4 Sampling Operations

4.4.1 Setting Hold/Free-run Modes

Press (HOLD/FREE) to toggle between the measurement hold mode and the measurement freerun mode.

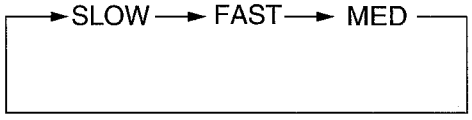
- Hold/free-run mode indications
  When the HOLD indicator is on, it indicates that the instrument is in the measurement hold mode.

  When the HOLD indicator is off, with the sampling indicator blinking, it indicates that the instrument is in the measurement free-run mode.

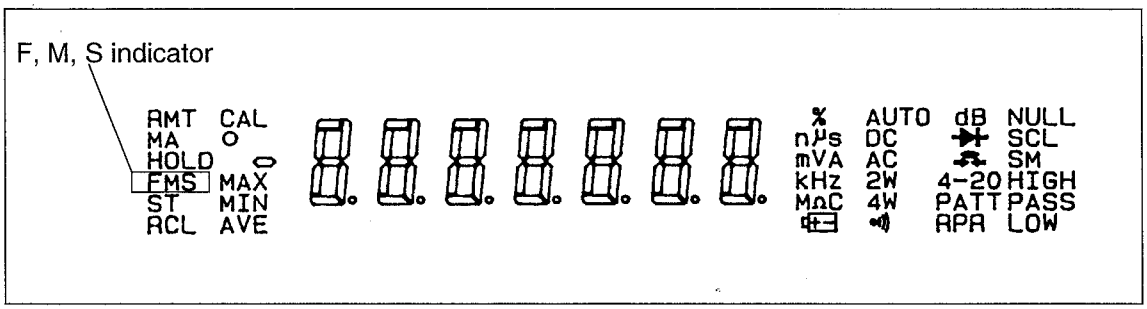


4.4.2 Setting the Sampling Rate

Each time you press (RATE), the sampling rate changes in the following sequence:



- One of the following indicators light according to the sampling rate setting:
  The S indicator lights:SLOW
  The M indicator lights:MEDIUM
  The F indicator lights:FAST



4.4.3 Sampling Rates and Maximum Display Digit Lengths

(1) FAST/MED/SLOW

Measurement function	Range	Sampling rate	
		SLOW/MED	FAST
DCV	30 mV *4	±31.9999	±31.999
	300 mV	±319.999	±319.99
	3000 mV	±3199.99	±3199.9
	30 V	±31.9999	±31.999
	300 V	±319.999	±319.99
	1000 V *1	±1099.99	±1099.9
2WΩ/4WΩ	30 Ω	±31.9999	±31.999
	300 Ω	±319.999	±319.99
	3000 Ω	±3199.99	±3199.9
	30 kΩ	±31.9999	±31.999
	300 kΩ	±319.999	±319.99
	3000 kΩ	±3199.99	±3199.9
	30 MΩ	±31.9999	±31.999
	300 MΩ *4	±319.999	±319.99
LP-2WΩ/LP-4WΩ *2	300 Ω	±319.999	±319.99
	3000 Ω	±3199.99	±3199.9
	30 kΩ	±31.9999	±31.999
	300 kΩ	±319.999	±319.99
	3000 kΩ	±3199.99	±3199.9
	30 MΩ	±31.9999	±31.999
ACV *3	300 mV	319.999	319.99
	3000 mV	3199.99	3199.9
	30 V	31.9999	31.999
	300 V	319.999	319.99
	700 V	709.99	709.9

*1 R6552 only
*2 This measurement function is applicable only to the R6552/T.
*3 This measurement function is applicable only to the R6552.
*4 R6552/T only

Measurement function	Range	Sampling rate	
		SLOW/MED	FAST
DCI *3	3 mA	±3199.99	±3199.9
	30 mA	±31.9999	±31.999
	300 mA	±319.999	±319.99
	3000 mA	±3199.99	±3199.9
ACI *3	3 mA	3199.99	3199.9
	30 mA	31.9999	31.999
	300 mA	319.999	319.99
	3000 mA	3199.99	3199.9
ACV (AC+DC) *3	300 mV	319.99	319.9
	3000 mV	3199.9	3199.
	30 V	31.999	31.99
	300 V	319.99	319.9
	700 V	709.9	709.
ACI (AC+DC) *3	3 mA	3199.9	3199.
	30 mA	31.999	31.99
	300 mA	319.99	319.9
	3000 mA	3199.9	3199.
→|← *3	3000 mV	±3199.99	±3199.9
RIPPLE V *5	30 mV	31.99	31.99
	300 mV	319.9	319.9
	3000 mV	3199.	3199.

Measurement function	Sampling rate		
	SLOW	MED	FAST
FREQ *3	999999	99999	9999

*3 This measurement function is applicable only to the R6552.
*5 This measurement function is applicable only to the R6552T-R.

(2) LONG-IT measurement
The same number of digits as those of the MED are displayed.

4.4.4 Sampling Rates and Integral Times

- The input integral time is set according to the sampling rate and measurement mode in effect.

Measurement function	HOLD/FREE			BURST	LONG-IT
	SLOW	MED	FAST		
DCV DCI *1	100ms	1PLC *2	2ms	500µs	100ms to 60s
2WΩ LP-2WΩ	100ms	1PLC *2	2ms	500µs	–
2WΩ LP-2WΩ *3	100ms	1PLC *2	2ms	500µs	–
4WΩ LP-4WΩ *3 ⊣▶⊢ *1 ACV *1 ACI *1 ACV (AC+DC) *1 ACI (AC+DC) *1	100ms	1PLC *2	2ms	–	–
FREQ *1	–	–	–	–	–
RIPPLE V *4	100ms	100ms	1 PLC	–	–

*1 This measurement function applies only to the R6552.
*2 PLC: Power Line Cycle
*3 This measurement function is applicable only to the R6552/T.
*4 This measurement function is applicable only to the R6552T-R.

4.5 Trigger Operations

4.5.1 TRIG Key

(1) Trigger function

The TRIG key works to trigger the start of the measurement when all of the following conditions are met:

1. The instrument is set in the local state.
2. The instrument is in the HOLD or BURST (R6552 only) mode.

(2) Delayed trigger function (R6552 only)

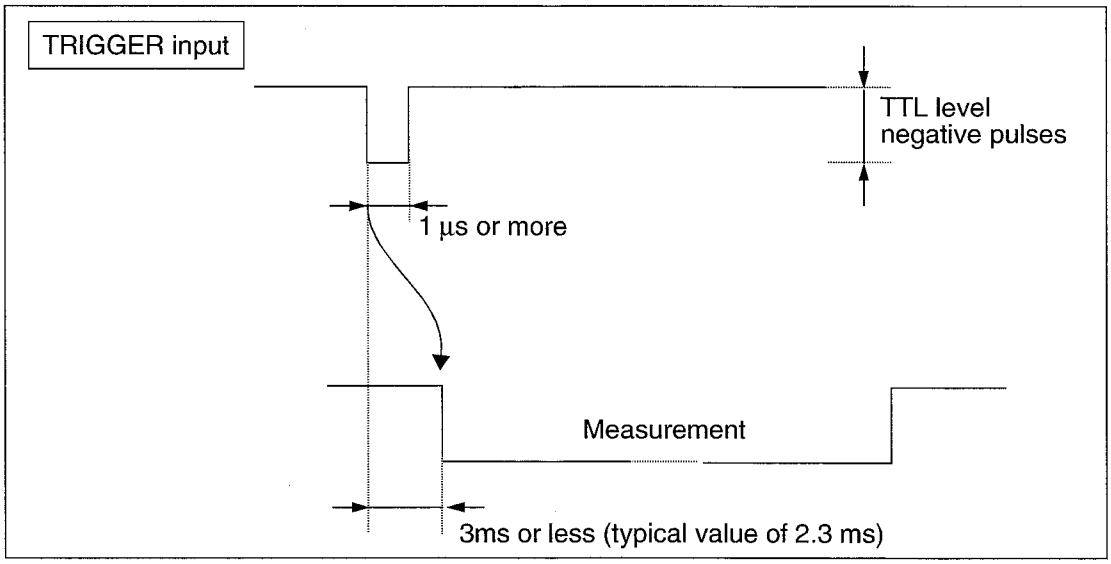
The TRIG key works as a delayed trigger for the BURST mode when all of the following conditions are met (for more details on the delayed trigger function, see Section 4.5.4, "BURST Mode delayed trigger"):

1. The instrument is set in the BURST mode and the delayed trigger level is not set OFF.
2. A BURST mode measurement is already in progress.

4.5.2 I/O Control Functions

(1) TRIGGER input (Rear-panel BNC connector)

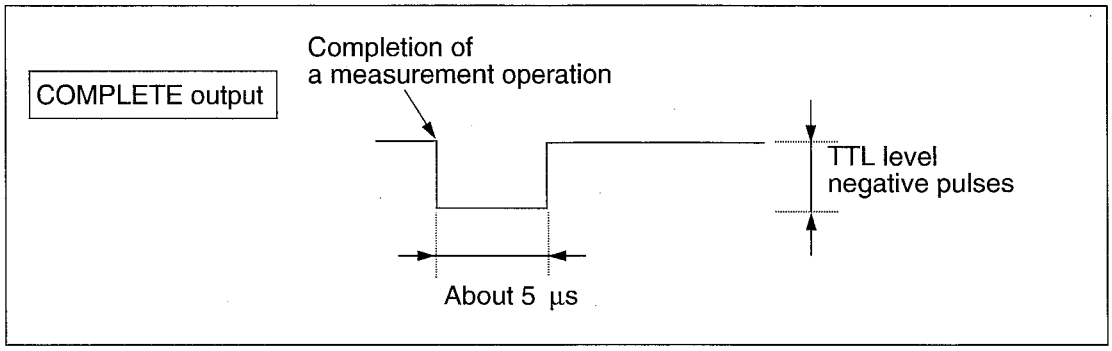
① Trigger input works to trigger the start of the measurement. Also, it is used for controlling the delayed trigger.



(2) COMPLETE output (Rear-panel BNC connector)

① A COMPLETE signal is generated at the end of the measurement operation. (See Section 4.5.3, "Trigger Operations in the Local State," and Section 5.5, "Trigger Operations in the Remote State.")

② The COMPLETE signal is used to effect controls, such as issuing a trigger to an external device.



4.5.3 Trigger Operations

(1) Measurement flow

Figures 4.9 through 4.11 show the operations of the trigger system implemented in the R6552 Series instruments in the local state.

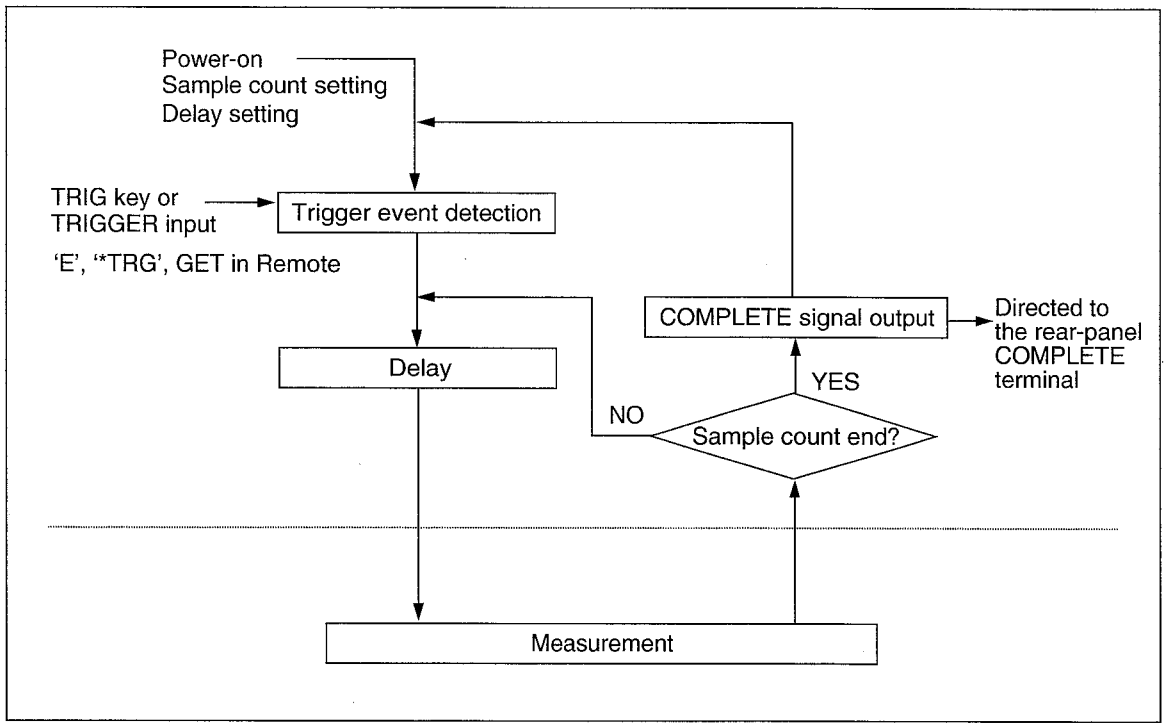


Figure 4-15 Measurement Flow in the HOLD Mode

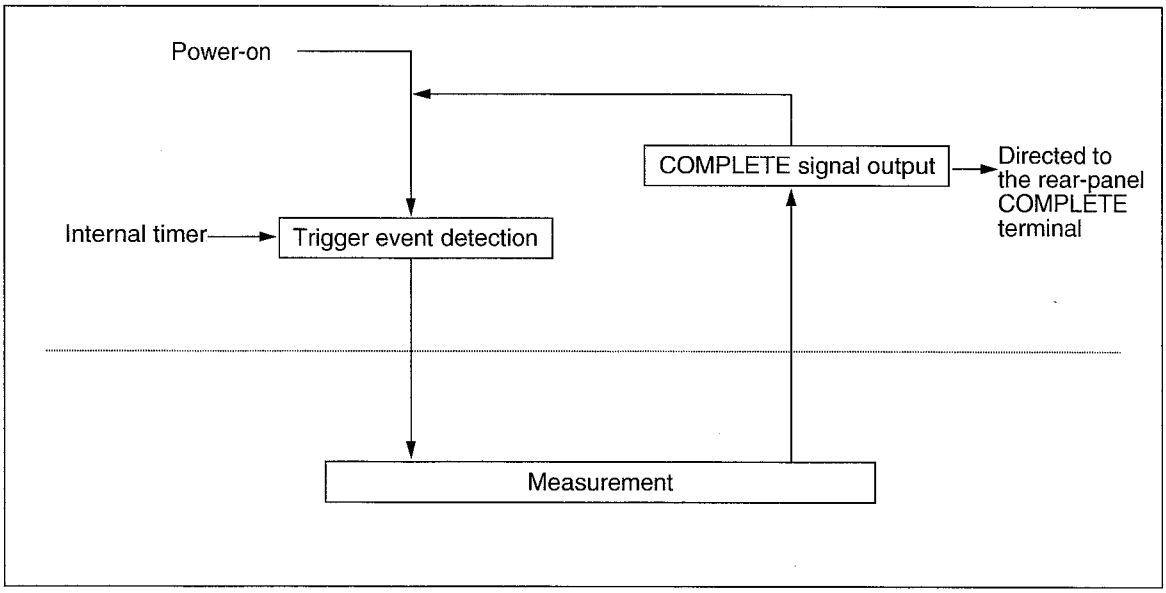


Figure 4-16 Measurement Flow in the FREE Mode

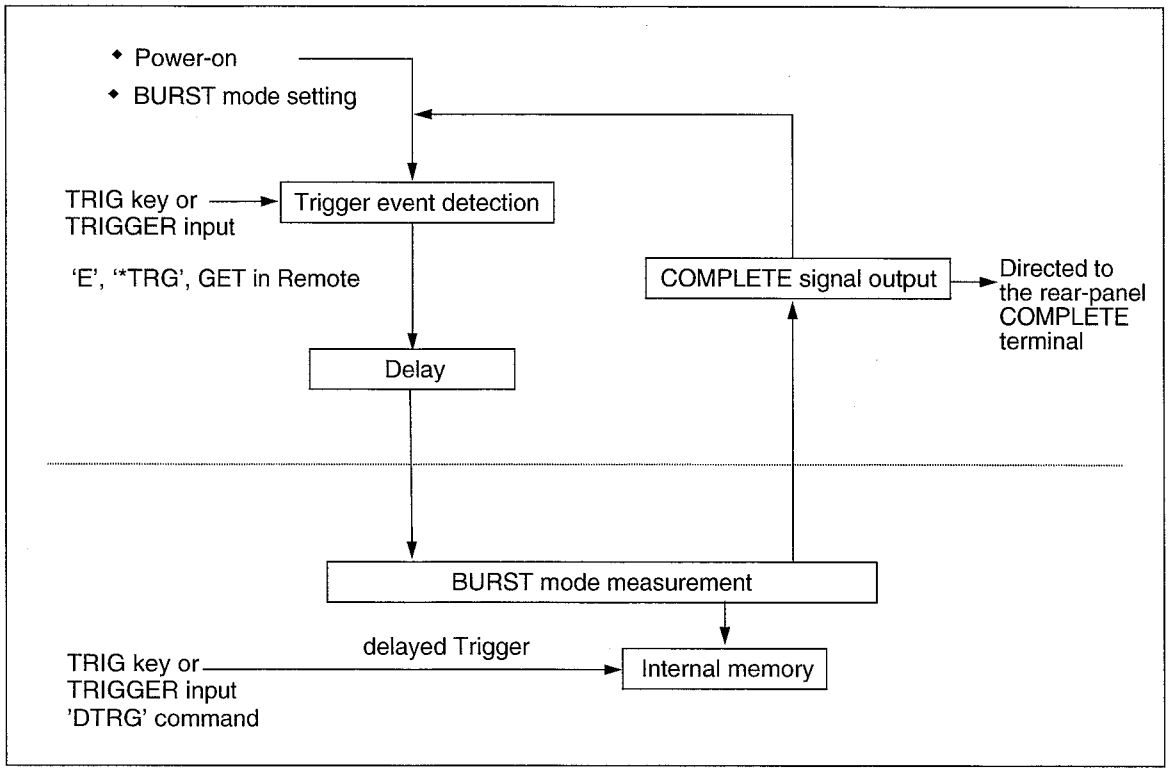


Figure 4-17 Measurement Flow in the BURST Mode

(2) Trigger conditions

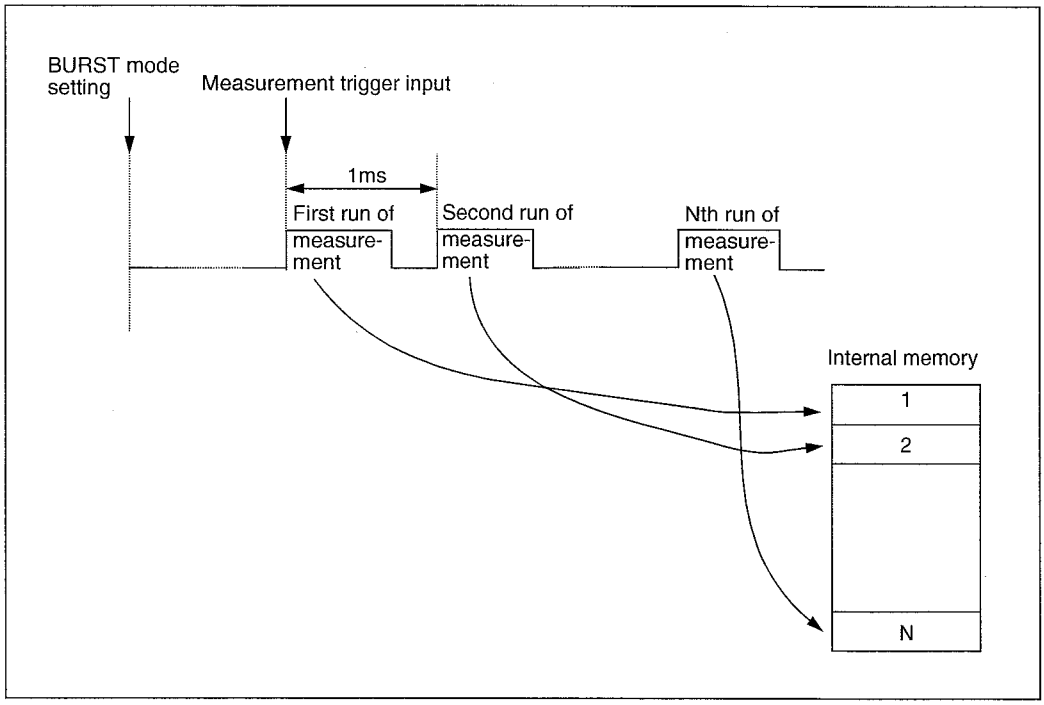
Set trigger conditions in the following manners:

Key sequence	Display	
• Delay setting		
① SHIFT	-------	Shift mode
② TRIG CONFIG	Blinking dELAy indicator	Delay setup mode
③ ENTER	d00.000	Previous delay setting (example)
④ AUTO ⇨ UP △ DOWN ▽	d01.000	Delay setting change
⑤ ENTER	Measurement value display	End of setup
• Sample count setting		
① SHIFT	-------	Shift mode
② TRIG CONFIG	Blinking dELAy indicator	Delay setup mode
③ UP △	Blinking SAMPcnt indicator	Sample count setup mode
④ ENTER	S 0001	Previous sample count setting (example)
⑤ AUTO ⇨ UP △ DOWN ▽	S 0010	Sample count setting change
⑥ ENTER	Measurement value display	End of setup procedure

4.5.4 BURST Mode Measurement (R6552 only)

(1) Operation

BURST mode measurement can be carried out at a sampling rate of 1,000 cycles per second for a preset number of cycles of measurement.



The measurement data can be recalled the same way as the internal memory contents are recalled.

(2) Function

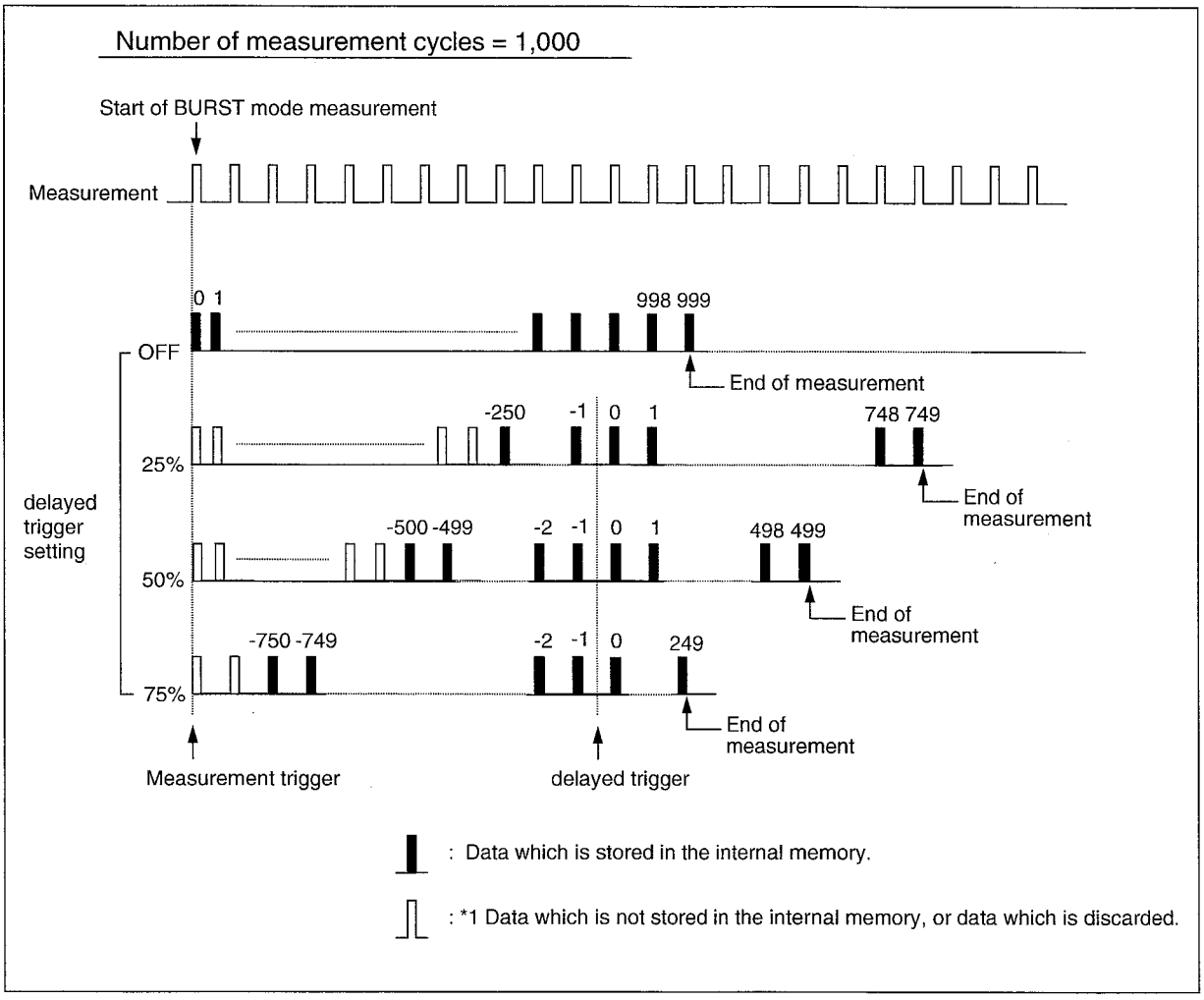
① In BURST mode measurements, the delayed trigger function allows the values in effect to be stored in memory before and after the trigger.

② The trigger position is determined by setting the delayed trigger.

(3) Operation

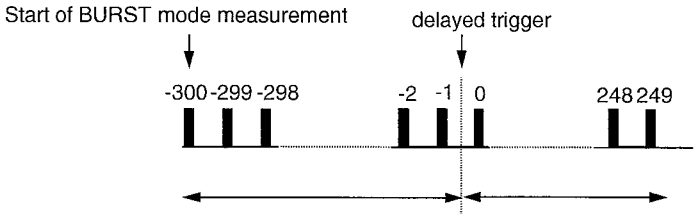
① The size of measurement data which is stored in the internal memory is determined by setting the number of measurement cycles.

② The number of pre-measurement cycles (measurement prior to delayed trigger input) is determined by setting the delayed trigger.



End of pre-measurement preceded by delayed trigger input.

- Number of measurement cycles: 1,000
- Delayed trigger setting: 75%



1,000 cycles x 75% = 750 cycles of measurement
Pre-measurement is terminated by the delayed trigger (1000 cycles x 75% = 750 cycles of measurement) even befor completing the measurement.

1,000 cycles x 25% = 250 cycles of measurement

(4) Display

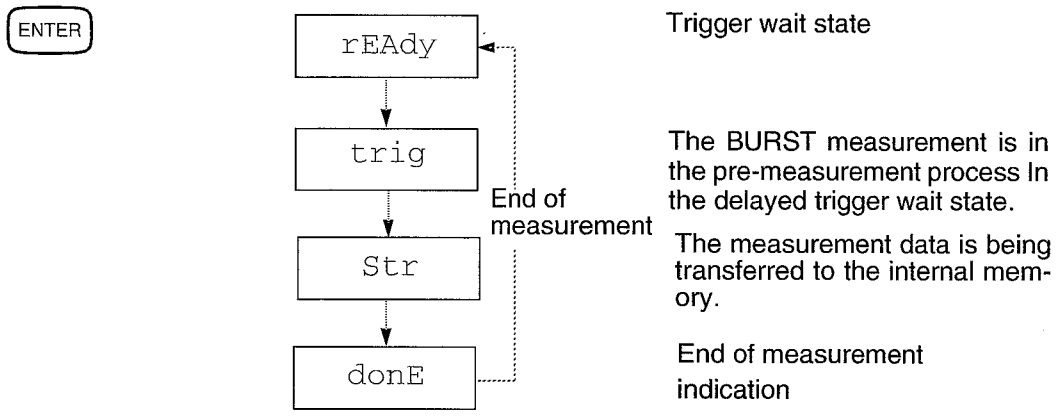
The measurement data is not displayed when you select the BURST mode. The following displays appear depending on the operating status of the instrument:

Key sequence	Display	Operating status
① SHIFT + HOLD (BURST)	b 1000	Set the BURST mode and the number of cycles of measurement.
② ENTER	trg OFF	Select the delayed trigger OFF
UP △	trg 25%	Select the delayed trigger 25%
③ When the delayed trigger is set to OFF.		
ENTER	rEAdy	Trigger wait state
	buSy	Start measurement on trigger input.
	Str	The measurement data is being transferred to the internal memory.
	donE	End of measurement indication

End of measurement

Key sequence	Display	Operating status

④ When the delayed trigger is set to 25 %, 50 %, or 75 %.



(5) Differences from the HOLD/FREE modes of measurement

① Measurement is carried out at a sampling rate of 1,000 cycles per second for the number of measurement cycles preset with SHIFT + HOLD (BURST).

② The trigger count and the sample count are ignored.

③ The measurement functions are DCV, DCI and 2WΩ/LP-2WΩ.

④ The measurement data is not displayed.

⑤ The measurement data is stored in the internal memory, regardless of the store on/off status. (The measurement data is always stored in the first location through subsequent locations in the internal memory for the specified number of samplings. The previous stored data is then cleared)

⑥ The auto zero setting is ignored.

⑦ The auto-range is set to OFF.

⑧ While the BURST mode measurement is in effect:

- Modifications cannot be made to the measurement parameters during measurement.
- The calculation functions are operable even during measurement, though the beep that signifies the result of a comparator calculation is disabled.
- The MAX/MIN calculation data and smoothing calculation data are initialized at the start of a measurement.(SM indicator is lit.)
- When the BURST measurement is reset, all settings for the calculation functions are set to OFF.
- If the NULL constant has already been set, the NULL calculation is operated using the constant. If not set, the NULL calculation is operated using the first measurement value of the BURST measurement as the NULL constant.
- A blinking "F" indicates the sampling rate setting.

(6) Recalling measurement data

Measurement data is stored in the internal memory. For how to recall stored data, see Section 4.8.2, "Recalling Stored Measurement Data."

(7) The end of the BURST mode

Press the HOLD key, or use an M0 or M1 command to end the BURST mode.

4.5.5 LONG-IT Mode Measurement (R6552 only)

(1) Operation

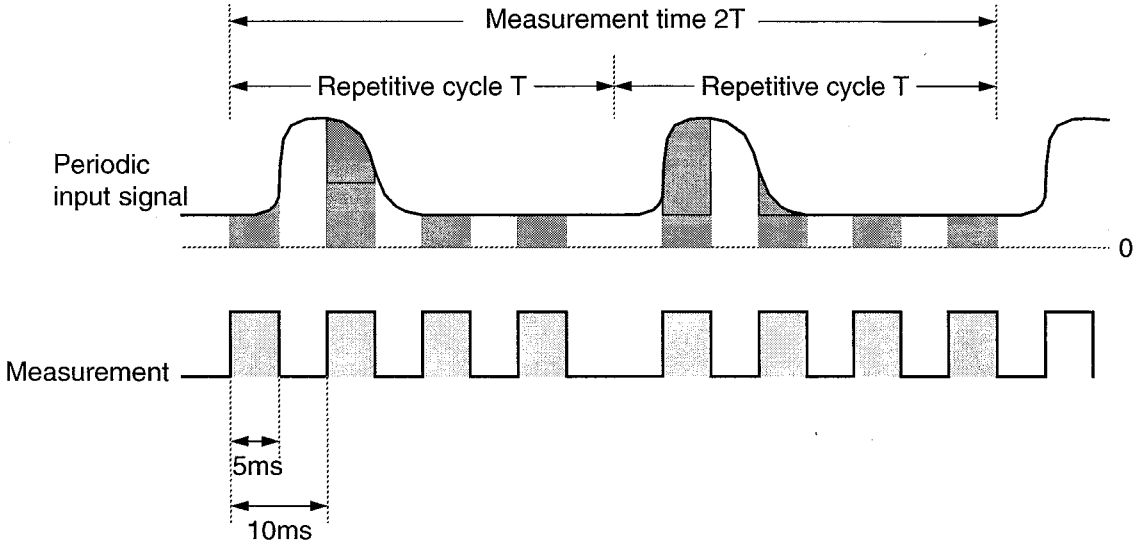
① The LONG-IT measurement is a measurement mode to obtain an average value of accurate periodic signals using an integration operation.
Under the condition that an input signal accurately changes in a constant cycle, any integral time is measured by measuring the input signal twice.

② The sampling time is calculated using the formula below:

Sampling time = (T x 2) + 200 ms

Where, T is the integral time.

(2) Measurement conceptual scheme



(3) Difference between FAST/MED/SLOW and LONG-IT mode settings

① Press the SHIFT and RATE to set an integral time and proceed to the LONG-IT measurement (see Section 4.9.4).

② Available measuring functions are DCV and DCI.

③ The auto-range operates only when the range level is in the UP position.

(4) End of LONG-IT Mode
Press the RATE key to end the LONG-IT mode.

4.6 Auto Zero Operation

(1) Operation

① The auto zero function corrects measurement offset errors automatically.

② The auto zero function, when enabled, measures the internal offset and subtracts that value from the input measurement to remove the offset error, but the measurement takes about twice as long.

③ BURST mode measurement always functions with the auto zero function disabled. (The auto zero function is reset to its initial state when the BURST mode measurement is cleared.)

(2) Executing the auto zero function

The auto zero function works on the following measurement functions in the current measurement range:

Measurement function	SLOW/MED/FAST		BURST	LONG-IT
	auto zero ON	auto zero OFF		
DCV	○	-	-	○
ACV	-	-	-	-
2WΩ/LP-2WΩ	○ *1	-	-	-
4WΩ/LP-4WΩ	-	-	-	-
DCI	○	-	-	○
ACI	-	-	-	-
FREQ	-	-	-	-
ACV (AC+DC)	-	-	-	-
ACI (AC+DC)	-	-	-	-
⊣◀	○	-	-	-
RIPPLE V	○	-	-	-

*1 300kΩ (FAST), 3000kΩ or higher range is not executed auto zero.

○ : Executed - : Not executed

(3) Executing the auto zero function (except during measurement function execution)

The auto zero function is executed under any of the following conditions:

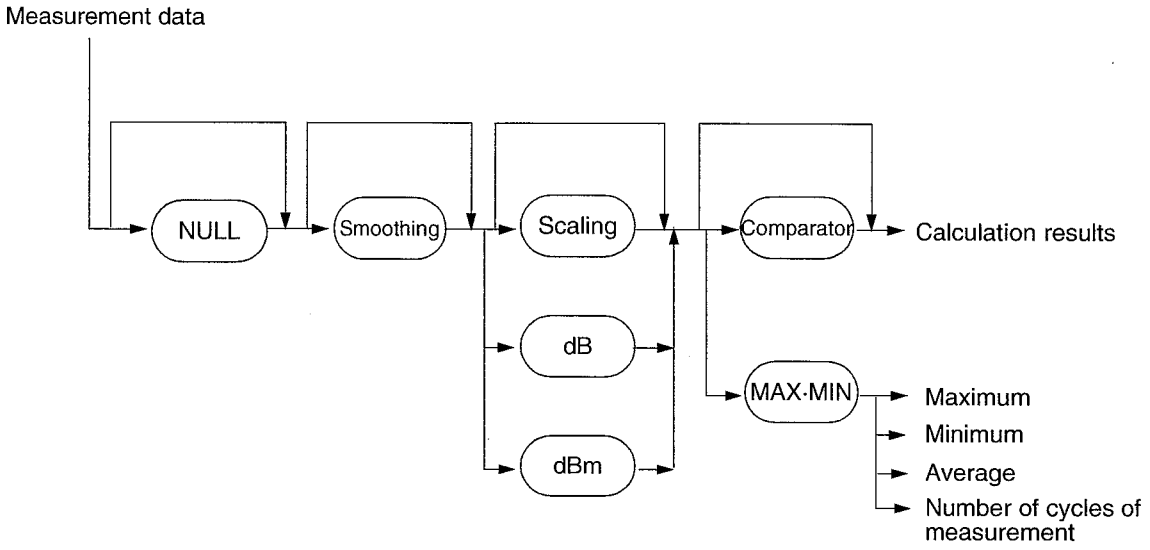
1. Turn on the power.
2. Switch to the function for which the auto zero function is executed.
3. Change the sampling rate.
4. Select the BURST mode.
5. Load measurement parameters.

4.7 Calculation Functions

The R6552 Series instruments support the following seven different calculation functions:

Item	Function
Null calculation	Subtracts a fixed value from a measurement value.
Smoothing calculation	Determines a moving average.
Scaling calculation	Calculates $\left(\frac{M - B}{A}\right) \times C$.
dB calculation	Calculates $20 \log_{10} \left(\frac{M}{D}\right)$.
dBm calculation	Calculates $10 \log_{10} \left(\frac{M^2}{D} \times \frac{1}{10^{-3}}\right)$.
Comparator calculation	Performs a comparative calculation (HIGH/PASS/LOW).
MAX·MIN calculations	Determines maximum, minimum, and average.

4.7.1 Calculation System Diagram



CAUTION!

1. ***Toward the data to be calculated, the following results may happen. This is because the internal resolution of measurement value and the setting value for calculation are greater than the resolution of displayed data and remote output data.***
   - ***In case of MAX·MIN calculation, if the buzzer setting is ON, a buzzer sounds when MAX or MIN value is renewed. However a buzzer may sound even when the displayed data and remote output data don't change.***
2. ***When the calculation setting is enabled, the decimal point and the unit of calculation results do not depend on the current measurement range, as distinct from ordinary measurement values.***

   <Example> 3000 mV range and 1 V input in DC voltage measurement
   Measurement value : 1000.00 mV
   Calculation result : 1.00000 V
3. ***For the BURST mode operation setting, see Section 4.5.4, "BURST Mode Measurement".***

4.7.2 Null Calculation

(1) Function

The null calculation generates a measurement value less a null constant.

Measurement data output = Measurement value - Null constant

When you press [NULL], a calculation is executed and the NULL indicator in the display lights. Press [NULL] again in the null calculation enabled state to clear the calculation and turn off the NULL indicator.

CAUTION!
The actual measurement value is not displayed while the calculation is executed. Remember that any hazardous voltage present on the input connector or test lead could pass unheeded at this time.

(2) Null constant

The measurement value right after the execution of the null calculation (that is, you pressed [NULL]) is assumed as a null constant. The null calculation is not functional in times of OL (overload). The null constant is displayed when you press [SHIFT] + [NULL] (⊿NULL) during the calculation.

The permissible setup range of the null constant is given below.

Setup range	Minimum setting
-999999.E +6 ~ +999999.E + 6	0.00000E - 9

The exponential part is set with a subunit (n, μ, m, K, M).

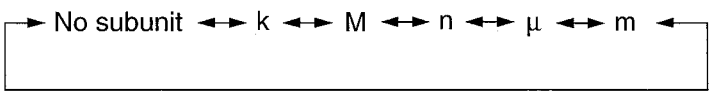
(3) Altering the null constant

① Display the null constant as explained in (2).

② Press [AUTO] (⇨) and the position at which an alteration can be made will blink in the following order:

1. From the most significant digit to the least significant digit in the numeric value
2. Subunit (exponential part setting)
3. Decimal point

③ Using [UP] (△) [DOWN] (▽) to move the blinking position, alter the setting.
The subunit will be switched in the following order:



④ Press [ENTER] to conclude the setup procedure.

(4) Clearing the null calculation

The null calculation is cleared under either of the following conditions:

1. Press [NULL] again in the null calculation enabled state.
2. Change the measurement function.
3. Execute *RST or Z command.

4.7.3 Smoothing Calculation

(1) Function

The smoothing calculation tests measurement signals that are superimposed with noises. It determines the moving average of measurement values recorded from a preset number of cycles of smoothing (smoothing count), with the result of narrower variations among the measurement values.
The smoothing calculation equation is given below.

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

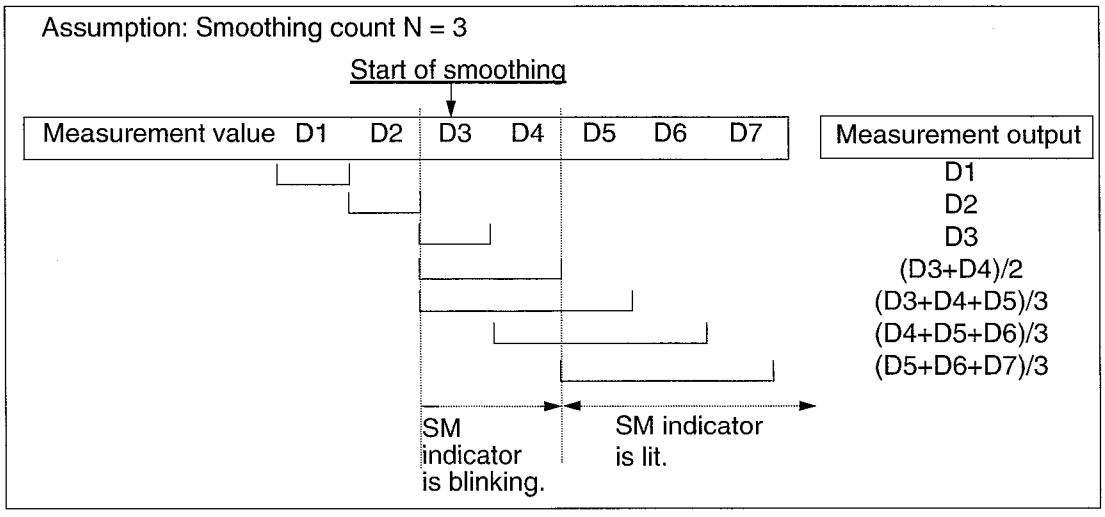
When you press [SM], the smoothing calculation is executed and the SM indicator either blinks or lights. Press [SM] again in the smoothing calculation execution enabled state to clear the calculation and turn off the SM indicator.

The SM indicator blinks until the N-th cycle of smoothing is reached after the start of smoothing, when the SM indicator goes blink off.

Data derived from the N+1st cycle of smoothing is displayed in the following way:

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

Until the preset smoothing count is reached after the start of smoothing, the mean of the measurement values recorded up until now is displayed.



The result of the smoothing calculation D (sm) at the nth cycle of measurement after the start of smoothing is expressed in the following equation:

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

where

D (sm): Result of the smoothing calculation at the nth cycle of measurement
Di: Measurement value (before execution of the smoothing calculation)
T: Smoothing count (from 2 to 100)

(2) Setting the smoothing count

To set the smoothing count, press [SHIFT] [SM (SM TIME)] to enter the count setup mode.
The smoothing count can be set between 2 and 100.

(3) Restarting the smoothing calculation

The smoothing calculation is restarted beginning with N = 1 under any of the following conditions:

1. Turn on the power.
2. Change the smoothing count.
3. Change the null calculation.
4. When starting the measurement in the BURST mode.

(4) Clearing the smoothing calculation

The smoothing calculation is cleared under either of the following conditions:

1. Press [SM] again in the smoothing calculation enabled state.
2. Change the measurement function.
3. Execute *RST or Z command.

(5) Smoothing calculation and OL (overload)

Measurement values are ignored when they constitute an OL (overload) during the smoothing calculation. (All the data derived from the number of cycles of smoothing specified by the smoothing count is accepted as valid data, except for the OL data.)

4.7.4 Scaling Calculation

(1) Function

The scaling calculation equation is given below.

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

When you press [C (M-B) / A], the scaling calculation is executed and the SCL indicator lights. Press [C (M-B) / A] again in the scaling calculation execution enabled state to clear the calculation and turn off the SCL indicator.

CAUTION!
The actual measurement value is not displayed while the calculation is executed. Remember that any hazardous voltage present on the input connector or test lead could pass unheeded at this time.

(2) Setting scaling constants

Follow the steps below to set scaling constants.

[Example of setting scaling constants A and B]

Note: Press [SHIFT / EXIT] to cancel the setup procedure in the middle.

Key sequence				Display	
• Setting constant A					
①	SHIFT			------	Shift mode
②	C (M-B) / A (A/B/C)				Blinking A: Constant A setup mode
③	ENTER			123456	Previous constant A setting (example)
④	AUTO ⇨	UP △	DOWN ▽	120000	New constant A setting See (3), "Setting constants."
⑤	ENTER				End of measurement value display setup procedure
• Setting constant B					
①	SHIFT			------	Shift mode
②	C (M-B) / A (A/B/C)				Blinking A: Constant A setup mode
③	AUTO ⇨				Blinking b: Constant B setup mode
④	ENTER			123456	Previous constant B setting (example)
⑤	AUTO ⇨	UP △	DOWN ▽	123333	New constant B setting See (3), "Setting constants."
⑥	ENTER				End of measurement value display setup procedure

(3) Setting constants

The permissible setup ranges of constants A, B, and C are given below.

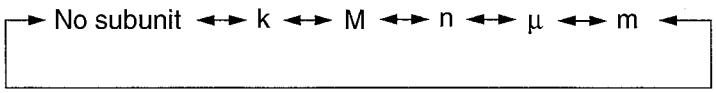
Constant	Setup range	Minimum setting
A	-999999.E +6 ~ +999999.E + 6	0.00001E - 9
B		0.00000E-9
C		

The exponential part is set with a subunit (n, μ, m, K, M).

① Enter the constant setup mode and press (AUTO), and the position at which an alteration can be made will blink in the following order:

1. From the most significant digit to the least significant digit in the numeric value
2. Subunit (exponential part setting)
3. Decimal point

② Using (UP) and (DOWN) to move the blinking position, alter the numeric value and subunit. The subunit will be switched in the following order:



To set a measurement value as a scaling constant, press (TRIG) in this mode.

③ Press (ENTER) to conclude the setup procedure.

(4) S␣OL (Scaling Over)

An "S OL" (Scaling Over) indication will display when the result of a scaling calculation exceeds 999.999E+6,

The current range would not be incremented even if the auto-range mode is implemented at this time (because the auto-range mode determines a range on the basis of the measurement value in effect prior to the execution of the calculation).

(5) Clearing the scaling calculation

The scaling calculation is cleared under either of the following conditions:

1. Press (C (M-A) / A) in the scaling calculation execution enabled state.
2. Change the measurement function.
3. Execute *RST or Z command.

4.7.5 dB/dBm Calculations

(1) Function

The dB calculation executes a decibel conversion. It is functional only during voltage measurement.

The dBm calculation is useful for calculation the power gain per mV. It is functional only during voltage measurement.

If a measurement value of 0 is encountered during a dB or dBm calculation, a calculation error is assumed and an error message displays.

The dB, dBm, and scaling calculations can not be selected at the same time; only one is selectable at a time.

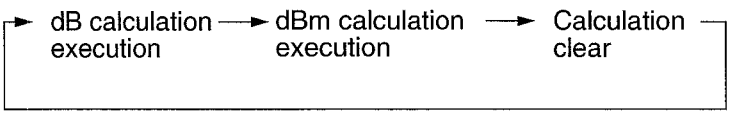
The dB and dBm calculation equations are given below.

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

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

When you press [dB], the calculation is executed and the dB indicator lights. When the dBm calculation is executed, the subunit indicator m will light at the same time.

The function selection is switched in the following order each time you press [dB]:



CAUTION!
The actual measurement value is not displayed while the db/dBm calculations are executed. Remember that any hazardous voltage present on the input connector or test lead could pass unheeded at this time.

(2) Setting constant D

The permissible setup range of constant D is given below.

Setup range	Minimum setting
0.00001E -9 to +999999.E + 6	0.00001E - 9

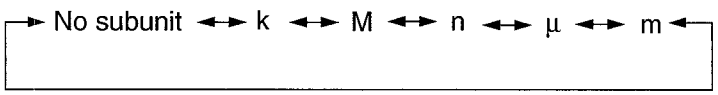
The exponential part is set with a subunit (n, μ, m, K, M).

① Press [SHIFT] and [dB / D] in this order to enter the constant D setup mode.

② Press [AUTO / ⇒], and the position at which an alteration can be made will blink in the following order:

1. From the most significant digit to the least significant digit in the numeric value
2. Subunit (exponential part setting)
3. Decimal point

③ Using [UP / △] and [DOWN / ▽] to move the blinking position, alter the numeric value and subunit. The subunit will be switched in the following order:



To set a measurement value as constant D, press [TRIG] in this mode.

④ Press [ENTER] to conclude the setup procedure.

(3) Clearing the dB/dBm calculations

The dB/dBm calculations are cleared under either of the following conditions:

1. Press [dB] in the dB/dBm calculation execution enabled state until the dB indicator goes off.
2. Change the measurement function.
3. Execute *RST or Z command.

4.7.6 Comparator Calculation

(1) Function

The comparator calculation equations are given below.

HIGH	=	(Measurement value > HI setting)
LOW	=	(Measurement value < LOW setting)
PASS	=	(LOW setting ≤ Measurement value ≤ HI setting)

Handling of special data

- HIGH is assumed in the event of + data OL (overload).
- LOW is assumed in the event of - data OL (overload).
- The comparator calculation is not executed when a dB/dBm calculation error occurs.

When you press (COMP), the HIGH/PASS/LOW indicator light, indicating the comparator mode in action.

Evaluation results can be directed to the indicator indicators, beep, status register, or SRQ. (The beep would sound only if it is enabled.)

The comparator calculation works on all measurement functions. If the MAX·MIN calculations are enabled, the comparator calculation works on the value in effect prior to the MAX·MIN calculations.

(2) Setting evaluation conditions

Follow the steps below to set the HI and LO constants and the beep.

Key sequence	Panel Display	Indicator	
• Setting the HI constant			
① SHIFT	------		Shift mode
② COMP HI/LOW	Blinking H		HI constant setup mode
③ ENTER	654321	HIGH	Previous constant HI setting
④ AUTO ⇨ UP △ DOWN ▽	654321	HIGH	New constant HI setting See (3), "Setting constants."
⑤ ENTER	Measurement value disply		End of setup procedure
• Setting the LO constat			
① SHIFT	------		Shift mode
② COMP HI/LOW	Blinking H		HI constant setup mode
③ AUTO ⇨	Blinking L		LO constant setup mode
④ ENTER	654321	LOW	Previous constant LOW setting
⑤ AUTO ⇨ UP △ DOWN ▽	654321	LOW	New constant LO setting See (3), "Setting constants."
⑥ ENTER	Measurement value disply		End of setup procedure

Key sequence	Display	Indicator	
• Setting the beep			
① SHIFT	_ _ _ _ _		Shift mode
② COMP HI/LOW	Blinking H		HI constant setup mode
③ AUTO ⇨	Blinking L		LO constant setup mode
④ AUTO ⇨	Blinking buZ	•))	Beep setup mode
⑤ ENTER		•)) LOW	Previous beep setting
⑥ UP △ DOWN ▽		•)) HIGH	New beep setting See (4), "Beep setup."
⑦ ENTER	Measurement value disply		End of setup procedure

(3) Setting constants

The permissible setup ranges of the HI and LO constants are given below.

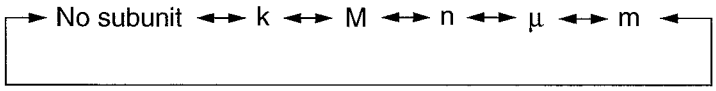
Constant	Setup range	Minimum setting
HI	-999999.E +6 to +999999.E + 6	0.00000E - 9
LO		

The exponential part is set with a subunit (n, μ, m, K, M).

① Press AUTO ⇨, and the position at which an alteration can be made will blink in the following order:

1. From the most significant digit to the least significant digit in the numeric value
2. Subunit (exponential part setting)
3. Decimal point

② Using UP △ and DOWN ▽ to move the blinking position, alter the numeric value and subunit. The subunit will be switched in the following order:



To set measurement values as HI and LO constants, press TRIG in this mode.

③ Press [ENTER] to conclude the setup procedure.

A HI constant < LO constant setting could cause the calculation result to appear "HI and LO." In this case, the HIGH and LOW indicators would light up at the same time.

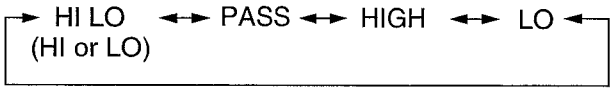
(4) Setting the beep

Beep output can be set according to the results of comparator calculations. Beep output is disabled when •)) is off. To set beep output to suit the results of comparator calculations, follow these steps:

① Enter the beep setup mode as instructed in (2).

② Using [UP] △ and [DOWN] ▽, select the beep setting.

The beep setting will be switched in the following order:



(5) Clearing the comparator calculation

The comparator calculation is cleared under any of the following conditions:

1. Press [COMP] in the comparator calculation execution enabled state.
2. Change the measurement function.
3. Execute *RST or Z command.

(6) Measurement range changes and comparator operation

The comparator function will remain in action even when the measurement range has changed. Evaluation reference values do not change from their previous settings, since they have a unit.

4.7.7 MAX·MIN Calculations

(1) Function

① Calculates the maximum, minimum, and average values when the MAX and MIN calculations are set to ON.
For the BURST mode, calculations are performed between the start of measurement and the end of measurement.

② The MAX·MIN calculations execute all of the following values at the same time:

1. Maximum (MAX)
2. Minimum (MIN)
3. Average (AVE)
4. Measurement count

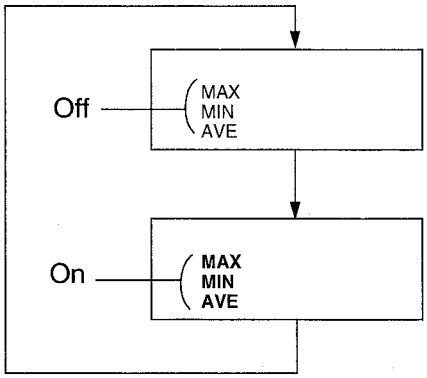
③ All the measurement data is calculated as valid data, except for the OL (overload) data and data in calculation error.

④ If the beep setting is enabled, a beep tone sounds when the maximum or minimum is updated.

However, a beep may sound even when a displayed value does not change. The reason is that measurement resolution is lower than the display resolution.

(2) Setting calculations

The function selection will be switched in the following order each time you press [MAX MIN]:



Calculation clear
All of the MAX, MIN, and AVE indicators go off.

Calculation execution
Any one of the following is displayed (Note):

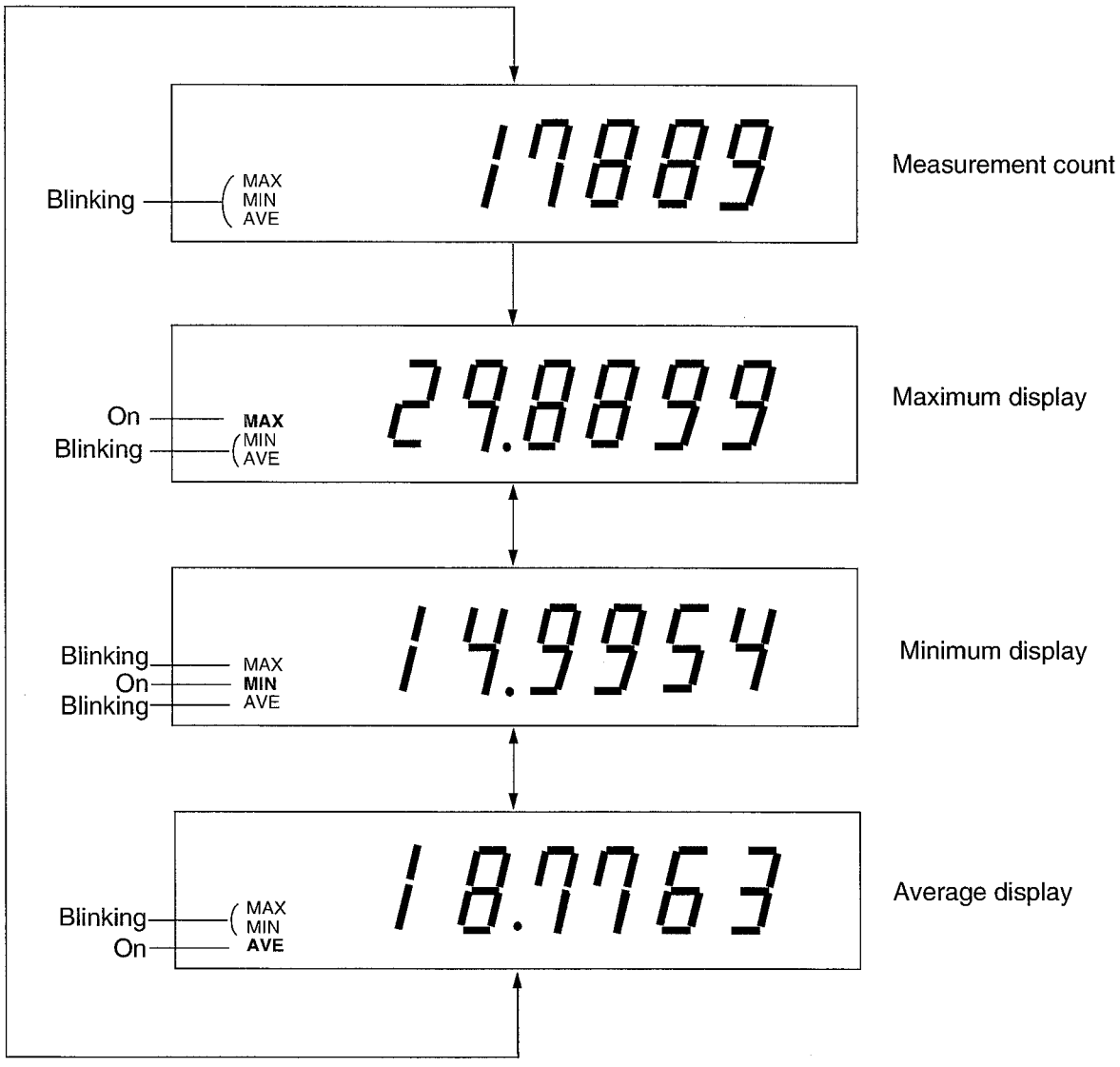
- All of the MAX, MIN, and AVE indicators light.
- MAX blinks.
- MIN blinks.
- AVE blinks.

Note: See (4), "Functions for displaying calculated MAX·MIN values during measurement execution."

(3) Calling MAX·MIN calculation results

① Press [SHIFT] and [MAX MIN] in this order to enter the calculation value display state.

② Press [UP △] and [DOWN ▽] to select the data to display.



(4) Functions for displaying calculated MAX·MIN values during measurement execution

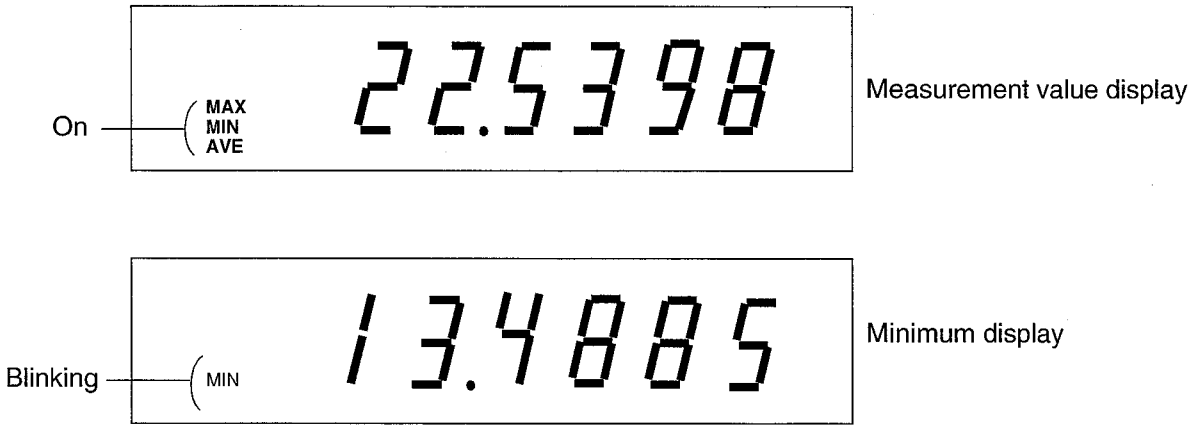
① You can select the following values for display during MAX·MIN calculation execution:

1. Measurement value display (All of the MAX, MIN, and AVE indicators light.)
2. Maximum display (MAX blinks.)
3. Minimum display (MIN blinks.)
4. Average display (AVE blinks.)

② How to set

Select the display screen as instructed in (3), "Calling MAX·MIN calculation results." Press [ENTER] on that screen to display the calculation results selected. If measurement count display was selected, measurement values are displayed.

Sample displays during MAX·MIN calculation execution



(5) Clearing the MAX·MIN calculations

The MAX·MIN calculations are cleared under either of the following conditions:

1. Press MAX·MIN in the [MAX MIN] calculation execution enabled state.
2. Change the measurement function.
3. Execute *RST or Z command.

(6) Restarting the MAX·MIN calculations

The MAX·MIN calculations are restarted by clearing existing measurement values under any of the following conditions:

1. Turn on the power.
2. Change the calculation other than the comparator calculation.
3. When starting the measurement in the BURST mode.

4.8 Setting Measurement Data and the Internal Memory Conditions (R6552 only)

4.8.1 Storing Measurement Data in the Internal Memory

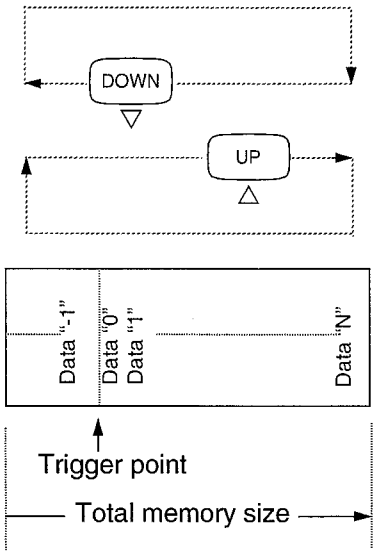
Key sequence	Display	Operation status
① STORE	MEAS.Str	Store measurement data in the internal memory
② ENTER	Mdt oFF	Store off
③ DOWN ▽	Mdt on	Store on
④ ENTER		Let the instrument start a measurement sequence, storing the measurement data in the internal memory with the ST indicator being lit.

4.8.2 Recalling Stored Measurement Data

Key sequence	Display	Operation status
① SHIFT STORE (RECALL)	MEAS.rcL	Recall stored measurement data from the internal memory
② ENTER	RCL 3 1 . 9 9 9 9 mV □□□□□	Data with the measurement number "0" displays, with the RCL indicator going on.

The bar graph shows the location relative to all stored measurement data for the data being recalled from the internal memory.
When the number of stored data does not exceed 100, the full-scale (right end) of the bar graph is 100.

③ Press UP and DOWN to change recall data.



④ Press AUTO when the recalled data appears, to display its measurement number. Press AUTO again to return to the data display.

4.8.3 The Internal Memory and Measurement Data

(1) You can recall measurement data stored in the internal memory by specifying its data number. The recalled data is output in 5 1/2 digits regardless of the measurement resolution (the (AC + DC) measurement, however, is output in 4 1/2 digits).

(2) Clearing stored data

Data stored in the internal memory is cleared under either of the following conditions:
1. Turn on the power.
2. Execute *RST or Z command.
3. Change the measurement data store status from off to on.
4. Start a BURST measurement.

(3) During BURST mode measurement, data is automatically stored in the internal memory. The data that has been stored at the start of the measurement is cleared.

(4) While measurement data is being stored in the internal memory, the ST indicator lights.

(5) Clearing the store operation

1. When changing the measurement data store status from on to off.
2. When the internal memory is full, a beep sounds, the ST indicator begins to blink, and stops data store operation. The measurement data, however, collected up to this point is still stored in the memory.
3. When this instrument is reset to normal measurement mode after exiting BURST measurement mode.

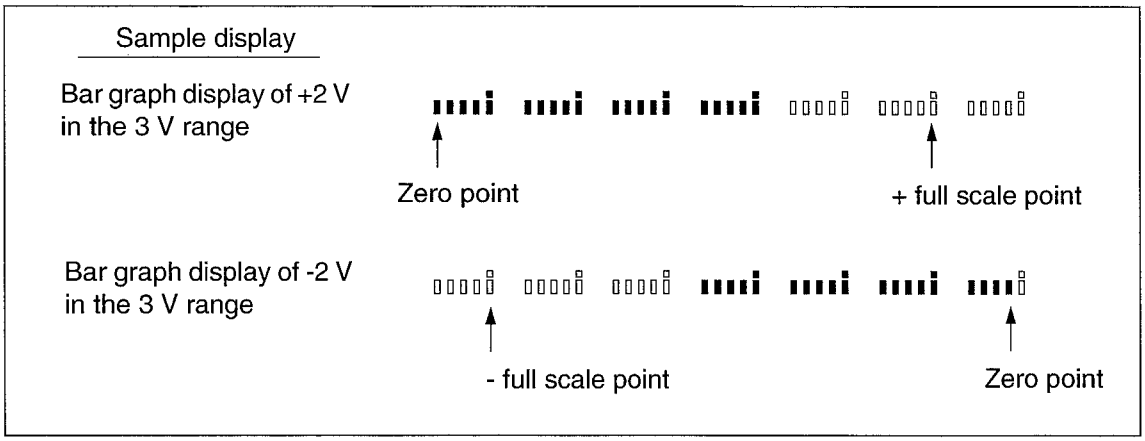
4.9 Other Functions

4.9.1 Bar Graph Display

(1) Press [SHIFT] and [•))) BAR] to execute a bar graph display. Press [SHIFT] and [•))) BAR] again while a bar graph is on display, to exit the bar graph display.

(2) Bar graphs display positive measurement data from left to right, or negative measurement data from right to left.

(3) The frequency measurement function cannot show the bar graph display.



4.9.2 Beep

(1) When you press [•))], the •)) indicator lights and the beep setting is enabled. Press [•))] again while the •)) indicator is on, and the •)) indicator goes off and the beep setting is disabled.

(2) A beep tone will sound under any of the following conditions:

1. A key was entered.
2. The measurement data exceeded its beep setting during comparator calculation execution.
3. The maxim or minimum was updated during MAX/MIN calculation execution.
4. An error occurred.

4.9.3 Display Digit Length

(1) Function

① Selects the length of digits of measurement data to display.

② Measurement data cannot be displayed beyond the display digit length that is determined by the measurement function or sampling rate.

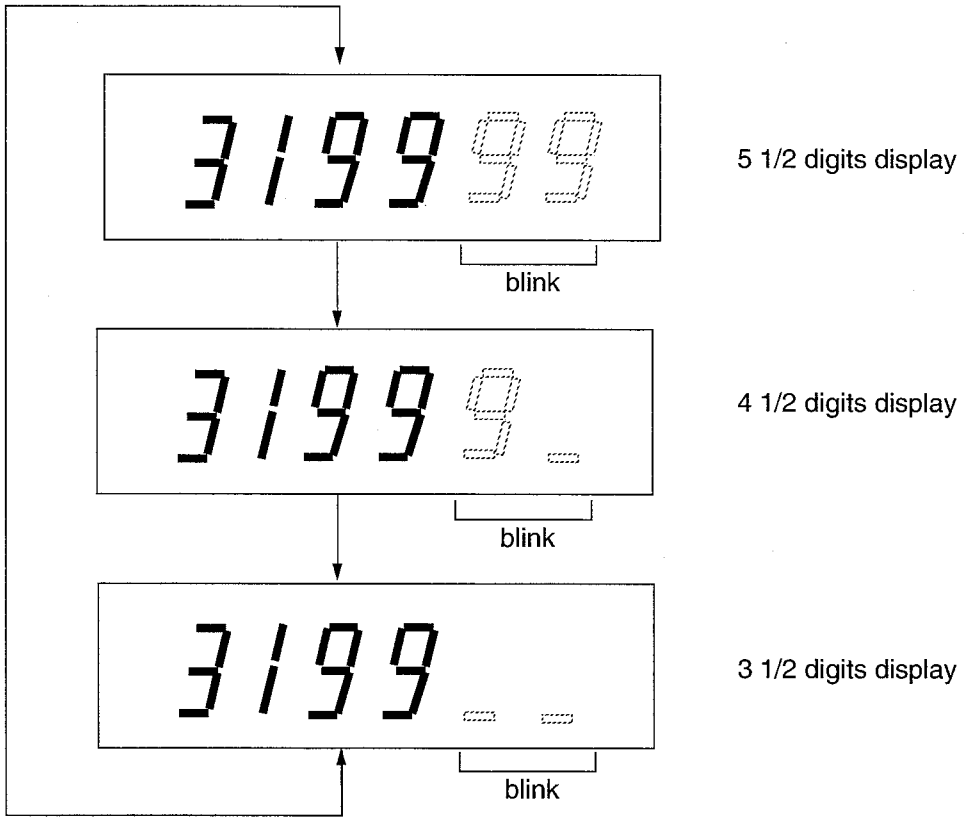
(2) Setting the display digit length

① Press [SHIFT] and [RATE] (DIGIT /LONG-IT) in this order to enter the display digit length setup mode.

② When the display is shown as below, return to the digit length selection screen.

Key sequence	Display	Operation status
[SHIFT] [RATE] (DIGIT /LONG-IT)	Long-IT	Integral time setting screen for LONG-IT
[UP]	digit	Display digit length setting screen
[ENTER]	319999	

③ Press UP and DOWN to select the display digit length.



4.9.4 Integral Time for LONG-IT Measurement

(1) Function

Sets the integral time of the LONG-IT measurement and proceeds to the LONG-IT measurement mode.

(2) LONG-IT measurement setting

① Pressing the [SHIFT] and [RATE] (DIGIT /LONG-IT) shows the display digit length screen or the LONG-IT measurement screen.

When the display digit length screen is shown, display the LONG-IT setting screen referring to Section 4.9.3, "Display Digit length".
However, this screen cannot be used when using a model or function unavailable for the LONG-IT measurement.

② Setting integral time and proceeding to the measurement mode

Key sequence	Display	Operation status
	Long-It	LONG-IT setting screen
ENTER	00.10s	Integral time setting screen
UP △	00.20s	Sets integral time at 0.2 second.
ENTER	Measurement value display (the FMS indicator blinks)	Completes the setting and proceeds to the LONG-IT measurement mode.

4.9.5 SRQ Switch

① Press [IF] (SRQ) while a remote operation is in progress to transmit an SRQ signal over the GPIB interface.

② The act of pressing of the SRQ switch is reflected in the status byte register DSB bit.

4.9.6 AC Filter (R6522 only)

(1) Function

Optimizes low frequency accuracy for the AC voltage measurement ACV(AC + DC) and AC current measurement ACI(AC + DC), or sets a settling time.

Function	AC filter	Guaranteed accuracy range	Settling time
ACV(AC+DC)	FAST	300 Hz to 300 kHz	230 ms or less
	SLOW	20 Hz to 300 kHz	950 ms or less
ACI(AC+DC)	FAST	300 Hz to 5 kHz	230 ms or less
	SLOW	20 Hz to 5 kHz	950 ms or less

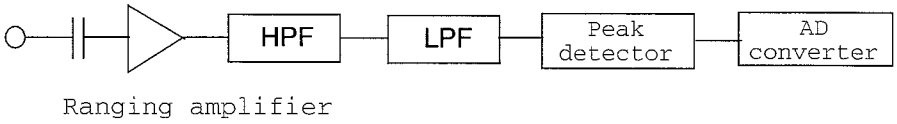
(2) Setting AC filter

Key sequence	Display	Operation status
① SHIFT + A ZERO (AC-FILTER)	FL FAST	AC filter is set to FAST
② DOWN ▽ / UP △	FL SLOW	AC filter is set to SLOW
③ ENTER		The settings are complete.

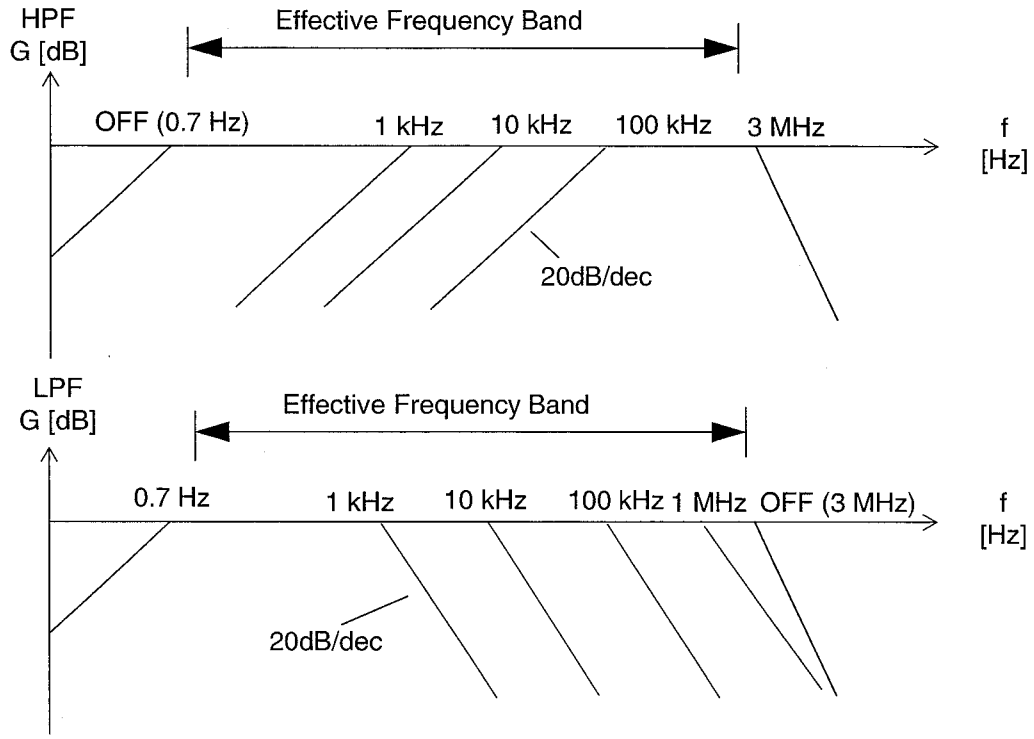
4.9.7 High-Pass Filter (HPF) and Low-Pass Filter (LPF) (R6552T-R only)

(1) Function

This function limits a frequency band for the ripple voltage measurement (RIPPLE V). The HPF and LPF are connected as shown below.



The HPF and LPF used in the R6552 are the primary passive filters. The HPF can select the frequency at -3 dB point from OFF, 1 kHz, 10 kHz or 100 kHz; the LPF can select it from 1 kHz, 10 kHz, 100 kHz, 1 MHz, or OFF (when the LPF is OFF, it becomes the secondary filter with a typical value of approx. 3 MHz. When the HPF is OFF, it becomes the primary filter with a typical value of approx. 0.7 Hz).
With the HPF and LPF already set, the voltage accuracy at the set frequency is at -3 dB (=-29.2 %); at10 times or 1/10 of the frequency, the voltage accuracy is -0.5 %.



Setting example of the HPF and LPF is shown below when measuring the input signal ripple voltage of 50 Hz and 10 kHz:

Input signal component	HPF	LPF
50 Hz	OFF	1 kHz
10 kHz	1 kHz	100 kHz

(2) Setting HPF and LPF

- Setting HPF

	Key sequence	Display	Operation status
①	SHIFT, A ZERO (HPF/LPF)	HPF LPF	HPF is selected (HPF blinks)
②	ENTER	HPF OFF	HPF is OFF
③	UP △	HPF 1 kHz	HPF is set to 1 kHz.
④	UP △	HPF 10 kHz	HPF is set to 10 kHz.
⑤	UP △	HPF 100 kHz	HPF is set to 100 kHz.
⑥	ENTER		The settings are complete.

- Setting LPF

Key sequence	Display	Operation status
SHIFT, A ZERO (HPF/LPF)	HPF LPF	HPF is selected (HPF blinks)
AUTO ⇨	HPF LPF	LPF is selected. (LPF blinks)
ENTER	LPF OFF	LPF is OFF
DOWN ▽	LPF 1000 kHz	LPF is set to 1000 kHz
ENTER		The settings are complete.

4.9.8 Self-Test

(1) Function

Internal operation can be self-tested when turning the power ON, by executing the remote command or by operating manually.
See Table 4-1, Self-Test Items used when turning the power ON, executing the remote command, or operating the instrument manually.

(2) Self-test by manual operation

Normally, the self-tests cannot be carried out by manual operation.
Perform the self-tests according to the following procedure:

① Turn the power ON while pressing the AUTO key.
Continue pressing the key until all panel indicators have been lit.

② Pressing the SHIFT and UP (△) displays the self-test selection screen.

③ Using the UP (△) DOWN (▽), select a test item.

④ Pressing the ENTER executes the self-test.

⑤ When the self-test-terminates normally, "PASS" is displayed.
When the self-test terminates abnormally, "FAIL" is displayed and the self-test is repeated. At this time, the keys will be disabled. To carry out the self-test again, turn the power OFF, then back ON.

5 USING THE INTERFACE

5.1 GPIB Operation

5.1.1 Summary

Using the GPIB (General-Purpose Interface Bus) eases the job of building up an automatic measurement system by allowing external control of the tasks of setting measurement functions for the R6552 Series instruments, setting measurement parameters, and reading measurement data.

The GPIB signals from the R6552 Series instruments are electrically isolated from the internal measurement signal system to keep the measurement values from being affected by any external equipment attached to the instruments.

The R6552 support the same repertoire of remote control commands as the RS-232 commands.

- General specifications

Code	:	ASCII code	
Logic level	:	Logic 0 'high'	+2.4 V or more
		Logic 1 'low'	+0.4 V or less
Interface functions	:	See Table 5.1.	

Table 5-1 GPIB Functions

Code	Function
SH1	Source handshaking
AH1	Acceptor handshaking
T5	Basic talker function, and listener-directed talker clear Talk-only mode, and serial polling
L4	Basic listener function, and talker-directed listener clear
SR1	Service request
RL1	Remote/local switching
PP0	No parallel polling
DC1	Device clear (SDC and DCL commands operable)
DT1	Device trigger (GET command operable)
C0	No controller functions
E2	Tri-state bus driver

5.1.2 Connecting to Component Equipment

A GPIB system, built from mix of different component devices, should deserve special notice with regard to the following:

(1) Before connecting an R6552 Series instrument, controller, or peripherals to the system, verify their correct status (setups) and operations by following the steps suggested in the relevant instruction manuals.

(2) Do not make the instrument cable or the bus cable that go to the controller longer than necessary. Keep cable extensions 20 m or shorter. The table below lists the standard bus cables available from Advantest.
Standard Bus Cables

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

(3) 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, be careful not to stack three or more connectors on top of one another. Be sure to clamp them tight with connector clamping screws.

(4) Verify the power supply conditions and grounding conditions, and where appropriate, setup conditions, of the component devices before turning the power on.
Be sure to turn on all the component devices on the bus. If any device on the bus remains off, successful operations of the system as a whole would be unpredictable.

(5) Cautions when using the GPIB
Use proper caution as noted below when using the GPIB:

① Connecting or disconnecting cables

Turn the power OFF all devices before connecting the GPIB cables. Make sure that the protective earth ground for each device is connected before connecting or disconnecting the GPIB cables.

② ATN interruption occurs while transmitting a message

An ATN interruption generated during message transmission over the interface has the highest priority. If this happens, the previous status is cleared.

③ Do not connect the controller when using the Listen Only mode.

④ A maximum of 251 characters can be recognized as a program command. A program command which exceeds 251 generates an error.

⑤ Maintain the REN line level LOW for at least 5 ms after a program command has been sent.

5.1.3 Setting GPIB

The setup items and the default settings of GPIB are listed below.

Setup item	Default setting
Header ON/OFF	on
Addressable/talk-only	Addresssable
Address	1
Data output format	ASCII

The initial measurement conditions are listed below.

Item	Z-command	*RST	When powered on
Status byte	—	—	0
Enable register	—	—	3
Block delimiter	CR/LF+EOI	CR/LF+EOI	CR/LF+EOI
String delimiter	, (comma)	, (comma)	, (comma)

(1) Sample GPIB settings

The GPIB talk or listen address and the header ON/OFF choice are set with the instrument panel keys.

For R6552;

	Key sequence	Display	
①	I/F	SCI on	Interface setup mode
②	UP △ DOWN ▽	gP off	GPIB selection indication
③	ENTER	HA 08	Previous setting
④	AUTO ⇨ UP △ DOWN ▽	HA 01	Header ON, addressable, and GPIB address setting of 1 See (2), "Setting addresses
⑤	ENTER	gP on	Verification of the end of setup procedure
⑥	ENTER	Measurement value display	End of setup procedure

Note:Press EXIT ***to cancel the setup procedure in the middle.***

For R6552T/T-R;

	Key sequence	Display	
①	I/F	HA 08	Previous setting
②	AUTO ⇨ UP △ DOWN ▽	HA 01	Header ON, addressable, and GPIB address setting of 1 See (2), "Setting addresses
③	ENTER	gP on	Verification of the end of setup procedure
④	ENTER	Measurement value display	End of setup procedure

Note:Press EXIT ***to cancel the setup procedure in the middle.***

(2) Setting addresses and output header ON/OFF status

① Produce the display as shown in ③ in (1), "Sample GPIB settings."
Press AUTO ⇨, and the position at which an alteration can be made will blink in the following orders:

1. Output data header

Display	Meaning
H	Header ON
-	Header OFF

2. Addressable/talk-only

Display	Meaning
A	Addressable mode
O	Talk-only mode

3. GPIB address

Display	0 to 30 (31 different addresses)

② Using UP △ and DOWN ▽ to move to the positions requiring alterations, change modes.

5.1.4 Service Request (SRQ)

Figure 5-1 shows the status byte configuration.

(1) Status byte register (STB)

bit	Name	Contents
0	EOM (End of measure)	Set at the end of measurement. Cleared when measurement data is read.
1	CEER (Command/Execute Error)	Set on occurrence of a command header error or command parameter error. Cleared on successful command receipt.
2	Not used	Always 0.
3	DSB (Device Event Status Bit)	Set when any of the events defined in the DESR arises if the corresponding bit of the DESER is 1. Cleared when the DESR is read (DSR?).
4	MAV (Message Available)	Set when output data is set in the output buffer. Cleared when the output data is read.
5	ESB (Standard Event Status Bit)	Set when any of the events defined in the SESR arises if the corresponding bit of the SESER is 1. Cleared when the SESR is read (*ESR?).
6	RQS/MSS	Set when bits 0 to 5 and bit 7 are set.
7	OEB (Operation Event Bit)	Set when any of the events defined in the OER arises if the corresponding bit of the OEER is 1. Cleared when the OER is read (OSR?).

- This register is controlled by the service request enable register (SRER). When a bit in the SRER is set to 1, the corresponding bit in the STB permits transmitting an SRQ.
- The status byte register is cleared by the *CLS command. MAV (bit 4), however, is not cleared when data is present in the output buffer.
- For RQS/MSS (bit 6), RQS is cleared by serial polling and MSS is cleared by the *STB? command or when a status factor does not exist.
- The status byte register is cleared when the power is turned off.

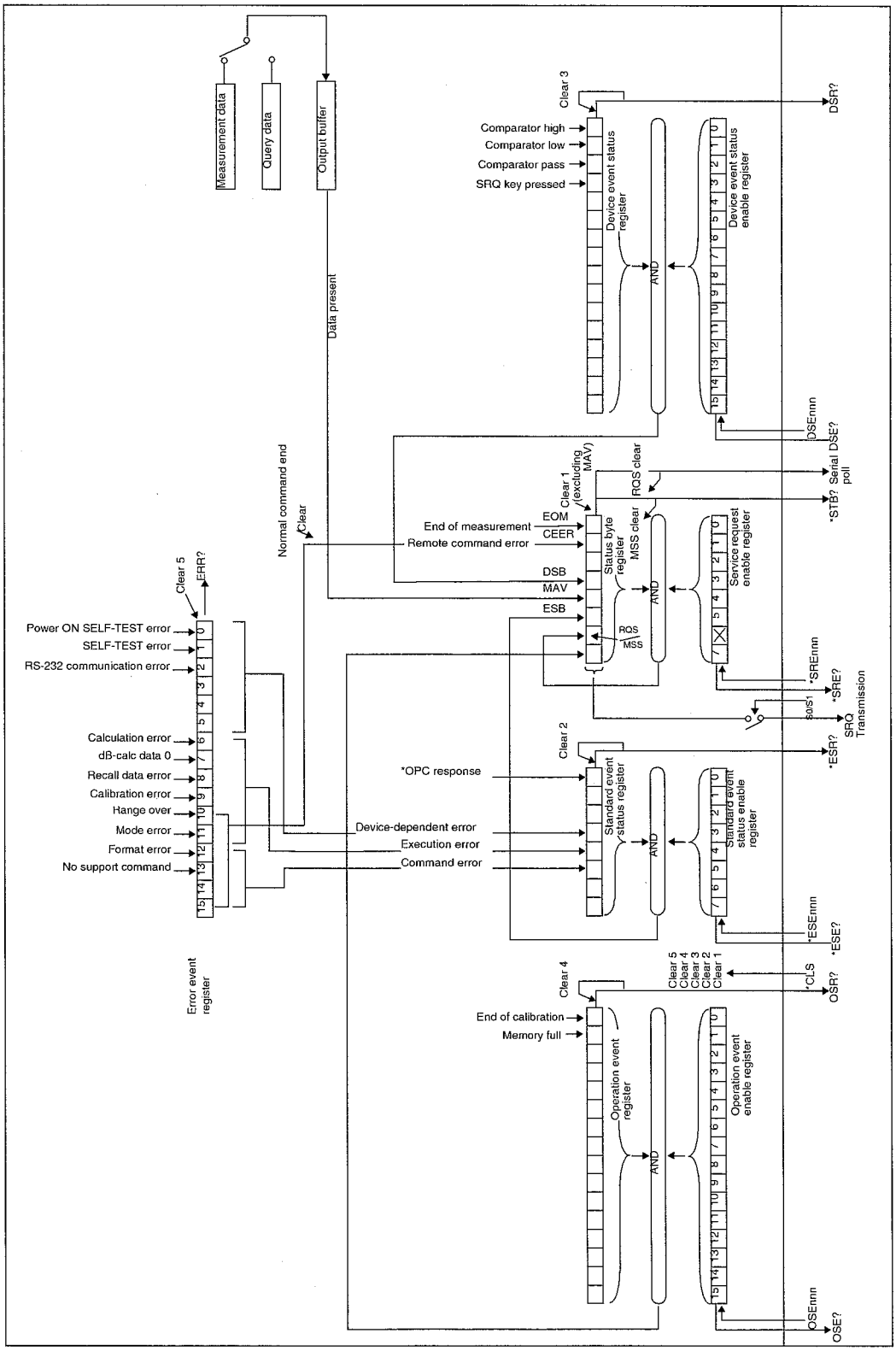


Figure 5-1 Status Byte Configuration

(2) Standard event status register (SESR)

bit	Name	Contents
0	OPC (Operation Complete)	Operation complete. All the operations executed are complete and the next command is now acceptable. Set only as a response to the *OPC command.
1	Not used	Always 0.
2	Not used	Always 0.
3	DDE (Device Dependent Error)	Set when an error dependent on the Device hardware occurs.
4	EXE (Execution Error)	Set when a command is not executable or when an error occurred during the execution of a command.
5	CME (Command Error)	Set when there is an error in the command header received or in a command parameter.
6	Not used	Always 0.
7	Not used	Always 0.

- This register is controlled by the standard event status enable register (SESER).
- When a bit in the SESER is set to 1 and the event defined by the corresponding bit in the SESR occurs, bit 5 of the status byte register is set (ESB).
- This register is cleared when it is read (*ESR?), by the *CLS command, or when the power is turned off.

(3) Device event status register (DESR)

bit	Name	Contents
0	HIGH	Set when the result of a comparator calculation is high.
1	LOW	Set when the result of a comparator calculation is low.
2	PASS	Set when the result of a comparator calculation is pass.
3	SRQ	Set when the front-panel SRQ key is pressed.
4	Not used	Always 0.
5	Not used	Always 0.
6	Not used	Always 0.
7	Not used	Always 0.
8	Not used	Always 0.
9	Not used	Always 0.
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.
16	Not used	Always 0.

- This register is controlled by the device event status enable register (DESER).
- When a bit in the DESER is set to 1 and the event defined by the corresponding bit in the DESR occurs, bit 3 of the status byte register is set (DSB).
- This register is cleared when it is read (DSR?), by the *CLS command, or when the power is turned off.

(4) Operation event register (OER)

bit	Name	Contents
0	CALE (Calibration End)	Set when calibration is ended and cleared when calibration is started.
1	MEMF (Memory Full)	Set when data memory is full.
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	Not used	Always 0.
9	Not used	Always 0.
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.
16	Not used	Always 0.

- This register is controlled by the operation event enable register (OEER).
- When a bit in the OEER is set to 1 and the event defined by the corresponding bit in the OER occurs, bit 7 of the status byte register is set (OEB).
- This register is cleared when it is read (OSR?), by the *CLS command, or when the power is turned off.

(5) Error event register (ERR)

bit	Contents
0	Power ON SELF-TEST error.
1	SELF-TEST error.
2	An RS-232 communication error (parity error, overrun error, etc.) occurred.
3	Always 0.
4	Always 0.
5	Always 0.
6	Calculation error.
7	Measurement value is 0 during a dB or dBm calculation.
8	Recall data error.
9	Calibration error.
10	Command range over.
11	Command mode error.
12	Command format error.
13	No support command.
14	Always 0.
15	Always 0.

- This register is cleared by *CLS command, or when the power is turned off.
- This register is not affected by release of error events.

5.1.5 GPIB Sample Programs

Sample programs that run on a PC-9801 personal computer manufactured by NEC Corporation are given below.

<Sample 1>

Perform measurement in the 20 VDC range. Read the measurement data from the R6552 and display it on the CRT.

Set R6552 address 1 by key entries from the front panel.

```
100 DMM=1                    ' Assign R6552 address 1 to a variable
110 ISET IFC                 ' Interface clear
120 ISET REN                 ' Remote enable
130 CMD DELIM=0              ' Define CR+LF as a delimiter
140 '                        '
150 PRINT @DMM;"Z"           ' Initialize R6552 parameters
160 PRINT @DMM;"F1,R5,PR2"   ' F1:    DC voltage measurement
170                          ' R5:    30 V range
180                          ' PR2:   Sampling rate MED
190 *LOOP                    '
200 INPUT @DMM;A$            ' Read measurement data from the R6552
210 PRINT A$                 ' Display measurement data
220 GOTO *LOOP               ' Branch and read measurement data
230 END                      ' Program end
```

<Sample 2>

Set two-wire resistance measurement and the hold mode, and trigger the start of measurement. Use an SRQ interrupt to monitor the end of measurement and get the measurement data.

```
100 DMM=1                          ' Assign R6552 address 1 to a variable
110 ISET IFC                       ' Interface clear
120 ISET REN                       ' Remote enable
130 CMD DELIM=0                    ' Define CR+LF as a delimiter
140 '                              '
150 DEF SEG=SEGPTR(7)              ' *1  Clear the SRQ signal in the PC-9801
160 A%=PEEK(&H9F3)                 ' *1
170 A%=A% AND &HBF                 ' *1
180 POKE &H9F3,A%                  ' *1
190 '                              '
200 ON SRQ GOSUB *SRQIN            ' Specify the destination of a control jump caused by an SRQ interrupt
210 PRINT  @DDM;"Z"                ' Initialize R6552 parameters
220 PRINT  @DDM;"F3,PR3,M1,S0"     ' F3      :  Two-wire resistance measurement
230                                ' PR3     :  Sampling rate SLOW
240                                ' M1      :  Sampling hold
250                                ' S0      :  Enable SRQ oscillation
260 PRINT @DMM;"*SRE1"             ' *SRE1   :  Set the measurement end bit of the service
270                                '            request enable register to 1
280 SRQ ON                         ' Enable the SRQ interrupt
290 *LOOP                          '
300 WAITF=0                        ' Clear the interrupt receive flag
310 PRINT @DDM;"E"                 ' Trigger the R6552 to start measurement.
320 *WAITSRQ                       '
330 IF WAITF=1 THEN *LOOP          ' Branch if the interrupt receive flag has been set
340                                '
350 GOTO *WAITSRQ                  ' Branch and wait for an SRQ interrupt to occur
360 '                              '
370 END                            ' Program end
380                                '
390 *SRQIN                         ' Subroutine
400  POLL DMM,S                    ' Execute a serial poll and read the R6552 status byte
410                                '
420  IF (S AND 65)=0 THEN *SRQE    ' Branch, unless the measurement end bit of the
430                                ' status byte is 1
440  INPUT @DMM;A$                 ' Read measurement data from the R6552
450  PRINT A$                      ' Display measurement data
460  WAITF=1                       ' Set the interrupt receive flag
470 *SRQE                          '
480  SRQ ON                        ' Enable the SRQ interrupt
490 RETURN                         ' Program end
```

1* On the PC-9801, the GPIB SRQ signal may have to be cleared to allow successful handling of an SRQ. Programming as suggested on lines 150 to 180 is required to use an SRQ.
If running N88-BASIC under MS-DOS, specify the segment base as 'DEF SEG=SEGPTR(7)'; otherwise, specify it as 'DEF SEG=&H60'.

5.2 RS-232 Interface Operation (R6552 only)

5.2.1 Summary

Using the RS-232 interface eases the job of building up an automatic measurement system by setting measurement functions for the R6552 Series instruments, setting measurement parameters, and reading measurement data.

The RS-232 interface signals are electrically isolated from the internal measurement signal system to keep the measurement values from being affected by any external equipment attached to the instruments.

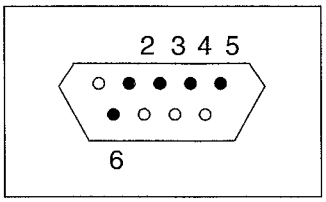
The R6552 support the same repertoire of remote control commands as the GPIB commands. The RS-232 interface is not available with the R6552T/T-R.

- Specifications

Setup item			Default setting
Output data header	:	on, off	on
Talk-only	:	on, off	off
Baud rate	:	9600, 4800, 2400, 1200, 600, 300	9600
Parity	:	even, odd, no	no
Data bit length	:	8, 7	8
Stop bit length	:	1, 2	1
Echo	:	on, off	off

For instructions on how to set these parameters (or how to work with the front panel), see Section 5.2.2.

The instrument rear panel RS-232 connector is a 9-pin connector (DB9, male connector).



Pin number	In/O	Definition	
2	Input	Received Data	(RxD)
3	Output	Transmitted Data	(TxD)
4	Output	Data Terminal Ready	(DTR)
5	—	Signal Ground	(SG)
6	Input	Data Set Ready	(DSR)

The maximum number of characters in one program code transfer is 251.

An error occurs when the number of characters exceeds 251.

Transmitted Data (TxD) monitors the status of Data Set Ready (DSR) within the instruments, so that output is terminated whenever DSR is false. The output is resumed when DSR returns to true.

CAUTION!
The R6552 Series instruments do not support X-parameter (XON/XOFF) flow control.

5.2.2 Setting Up RS-232

The initial measurement conditions are listed below.

Item	Z-command	*RST command	When powered on
Status byte	—	—	0
Enable register	—	—	3
String delimiter	, (comma)	, (comma)	, (comma)

(1) Press [I/F].
Using [UP] △ and [DOWN] ▽, select SCI.
Press [ENTER].

(2) Setting output data header ON/OFF status and the talk-only mode ON/OFF status

① Enter the option setup mode.
Press [AUTO] ⇨, and the position at which an alteration can be made will blink in the following orders:

1. Output data header

Display	Meaning
H	Header ON
-	Header OFF

2. Talk-only mode (in which measurement values are automatically directed to a printer, terminal or the like)

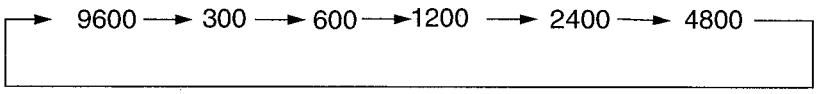
Display	Meaning
O	Talk-only ON
-	Talk-only OFF

② Change the setting by using UP and DOWN to move to the positions requiring alterations, change the setting.

③ Press ENTER.

(3) Setting the baud rate

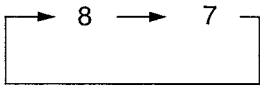
① Enter the baud rate setup mode.
Using UP and DOWN, change the baud rate setting.
The display will be switched to the following order:



② Press ENTER.

(4) Setting the data length

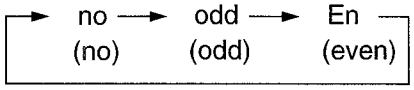
① Enter the data length setup mode.
Using UP and DOWN, change the data length setting.
The display will be switched to the following order:



② Press ENTER.

(5) Setting parity

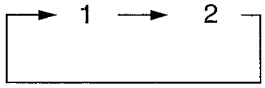
① Enter the parity setup mode.
Using UP and DOWN, change the parity setting.
The display will be switched to the following order:



② Press ENTER.

(6) Setting the stop bit

① Enter the stop bit setup mode.
Using UP and DOWN, change the stop bit setting.
The display will be switched to the following order:



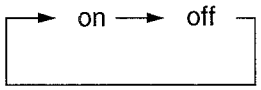
② Press ENTER.

(7) Setting the echo

① Enter the echo setup mode.

Using [UP] and [DOWN], change the echo setting.

The display will be switched to the following order:



② Press [ENTER].

The display SCI On will appear.

③ Press [ENTER].

5.2.3 RS-232 Sample Programs

Sample programs that run on a PC-9801 personal computer manufactured by NEC Corporation are given below. Be sure that you have completed the baud rate, parity, stop bit, and all other relevant settings before you proceed with their execution.

<Sample 1>

Perform measurement in the 30 VDC range in the talk-only mode. Read the measurement data from the R6552 and display it on the CRT.

Set the R6552 into the talk-only mode by key entries from the front panel.

```
100 DMM=1                          ' Assign RS-232 line 1 to a variable
110 OPEN "COM1:" AS #DMM           ' Open RS-232 line 1
120 '                              '
130 PRINT #DMM,"Z,F1,R5,PR2"       ' Initialize R6552 parameters
140                                ' F1:   DC voltage measurement
150                                ' R5:   30 V range
160                                ' PR2:  Sampling rate MED
170                                '
180 *LOOP                          '
190 INPUT #DMM,A$                  ' Read measurement data from the R6552
200 PRINT A$                       ' Display measurement data
210 GOTO *LOOP                     ' Branch and read measurement data
220 CLOSE #DMM                     ' Close RS-232 line 1
230 END                            ' Program end
```

<Sample 2>

Set two-wire resistance measurement and the free-run mode.

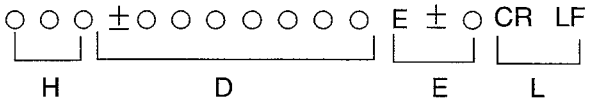
Set the R6552 into the addressable mode, with echo off, by key entries from the front panel.

```
100 DMM=1                          ' Assign RS-232 line 1 to a variable
110 OPEN "COM1:" AS #DMM           ' Open RS-232 line 1
120 '                              '
130 PRINT #DMM,"F3,PR3,M0"         ' F3      :  Two-wire resistance measurement
140                                ' PR3     :  Sampling rate SLOW
150 INPUT #DMM,PROMPT$             ' Read the prompt from the R6552
160 *LOOP                          ' Label
170 PRINT #DMM,"*STB?"             ' Status byte read command
180 INPUT #DMM,SB$                 ' Read the status byte from the R6552
190 INPUT #DMM,PROMPT$             ' Read the prompt from the R6552
200 B=VAL(RIGHT$(SB$,3)            ' Convert a character string variable to a numeric variable
210 IF (SB AND 65)<>0 THEN GOSUB *ENTER
220                                ' Branch, if the measurement end bit of the status byte is 1
230                                '
240 GOTO *LOOP                     ' Branch and read again
250 '                              '
260 CLOSE #DMM                     ' Close RS-232 line 1
270 END                            ' Program end
280 '                              '
290 *ENTER                         '
300  PRINT #DMM,"MD?"              ' Status byte read command
310  INPUT #DMM,A$                 ' Read measurement data from the R6552
320  PRINT A$                      ' Display measurement data
330  INPUT #DMM,PROMPT$            ' Read the prompt from the R6552
340 RETURN                         ' Subroutine end
```

5.3 Output Data Formats

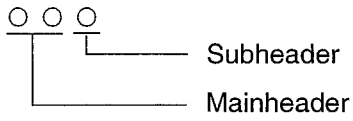
5.3.1 ASCII Format

- Measurement data output format used for ASCII-formatted measurement data.
- Common to both GPIB and RS-232.
- The H0 command sets a header-free ASCII format.
- The H1 command sets a header-prefixed ASCII format.



H : Header (Three-character ASCII code)
D : Mantissa part (Polarity + Decimal point + 4 to 6 digits)
E : Exponential part (E + Polarity + 1 digit)
L : Block delimiter

(1) Kind of header



Header output is suppressed when the header setting is OFF.

(a) Main header

DV : DC voltage measurement
AV : AC voltage (AC coupling, AC + DC coupling) measurement(R6552 only)
R : Two-wire/four-wire resistance measurement
RL : Low-power two-wire/four-wire resistance measurement (R6552/R6552T only)
DI : DC current measurement (R6552 only)
AI : AC current (AC coupling, AC+DC coupling) measurement(R6552 only)
D : Diode measurement (R6552 only)
FQ : Frequency measurement (R6552 only)
RV : Ripple voltage measurement (R6552T-R only)

(b) Subheader

High
Priority
Low

O	:	OL (overload) (including a scaling calculation overload)
E	:	Error D (dB/dBm calculation error)
H	:	Comparator result HIGH
P	:	Comparator result PASS
L	:	Comparator result LOW
M	:	MAX data
m	:	MIN data
A	:	AVE data
B	:	dB calculation
W	:	dBm calculation
S	:	Scaling calculation
N	:	Null calculation
	:	None of above (Space output)

The following subheaders are attached to call MAX·MIN calculation query data:

M	:	Maximum value
m	:	Minimum value
A	:	Average value

(2) Mantissa part

Relationships between the display digit length and the output character length

Display digit length	Mantissa part	Character length
5 1/2	± ○ ○ ○ ○ ○ ○ ○	8
4 1/2	± ○ ○ ○ ○ ○ ○	7
3 1/2	± ○ ○ ○ ○ ○	6

The mantissa part includes a decimal point.

(3) Exponential part

The exponential part is determined by the measurement function and the measurement range in effect.

The chart below lists the data in the mantissa part and the exponential part of a measurement value in a 5 1/2 digits display.

Measurement function	Range	Mantissa part	Exponential part
DCV	30 mV *6	±dd.dddd	E–3
	300 mV	±ddd.ddd	E–3
	3000 mV	±dddd.dd	E–3
	30 V	±dd.dddd	E+0
	300 V	±ddd.ddd	E+0
	1000 V *5	±dddd.dd	E+0
ACV	300 mV	ddd.ddd	E–3
	3000 mV	dddd.dd	E–3
	30 V	dd.dddd	E+0
*1	300 V	ddd.ddd	E+0
*2	700 V	dddd.dd	E+0
DCI	3000 µA	±dddd.dd	E–6
	30 mA	±dd.dddd	E–3
*1	300 mA	±ddd.ddd	E–3
*2	3000 mA	±dddd.dd	E–3
ACI	3000 µA	dddd.dd	E–6
	30 mA	dd.dddd	E–3
*1	300 mA	ddd.ddd	E–3
*3	3000 mA	dddd.dd	E–3
2WΩ	30 Ω	±dd.dddd	E+0
4WΩ	300 Ω	±ddd.ddd	E+0
	3000 Ω	±dddd.dd	E+0
	30 kΩ	±dd.dddd	E+3
	300 kΩ	±ddd.ddd	E+3
	3000 kΩ	±dddd.dd	E+3
	30 MΩ	±dd.dddd	E+6
	300 MΩ *6	±ddd.ddd	E+6
⊣▶⊢ *1	—	±dddd.dd	E–3
FREQ	1 Hz	ddd.ddd	E–3
	10 Hz	d.ddddd	E+0
	100 Hz	dd.dddd	E+0
	1000 Hz	ddd.ddd	E+0
	10 kHz	d.ddddd	E+3
	100 kHz	dd.dddd	E+3
*1	1000 kHz	ddd.ddd	E+3
RIPPLE V	30 mV	dd.dd	E–3
*4	300 mV	ddd.d	E–3
	3000 mV	dddd	E–3

The least significant digit of a measurement value is not output when it is presented in a 4 1/2 digits display; the two least significant digits are not output when it is presented in a 3 1/2 digits display.
When recalling data stored in the internal memory, 5 1/2 digits data is output regardless of the function, range, or sampling rate.

*1: This measurement function is applicable only to the R6552.
*2: The least significant digit of a measurement value is not output when the sampling rate is set to FAST
*3: For (AC+DC) function and FAST sampling rate, the least significant digit of a measurement value is not output.
*4: This measurement function is applicable only to the R6552T-R.
*5: R6552 only.
*6: R6552/R6552T only.

(4) Block delimiter

A block delimiter is output to signify the end of a record of data.

① GPIB

Delimiter	Setup command	Initial value
CR LF +EOI	DL0	○
LF	DL1	
EOI	DL2	

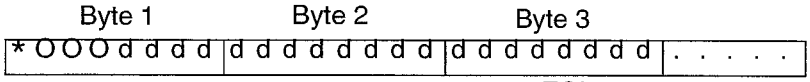
② RS-232

The block delimiter is fixed at CR+LF.

5.3.2 Binary Output Format (R6552 only)

Note: ***The binary output format is not available with the R6552T/T-R.***

- Measurement data output format binary-formatted measurement data.
- Valid only with GPIB.
- Set with the H2 command.
- Each record of data has a fixed data length of 3 bytes.
- The block delimiter is fixed at EOI.



* : Sign (0: + 1: –)
0 : Fixed at 0
d : Data

CAUTION!
Please note that the resulting mantissa are output without showing the appropriate exponential part.

5.3.3 RS-232 Output Data Format (R6552 only)

Note: The RS-232 is not available with the R6552T/T-R.

The RS-232 output data format is essentially identical to the GPIB output data format, except in certain respects.

RS-232 output data can be grouped as follows:

1. Echo
2. Prompt
3. Measurement data
4. Query results (for query commands)

The contents and the output formats of these kinds of output date are described below.

(1) Echo output

Echo output is produced only if the RS-232 setting has echo output set ON. Essentially, echo output data is output as it is received. If <C> (control C), <LF> is input, however, the following data is output instead:

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

Note: The delimiter is fixed at <CR> <LF> and cannot be altered.

(2) Prompt

The result of handling of commands received on the RS-232 interface is indicated by an output prompt. The data begins with an <LF> and is followed by a prompt and a delimiter.

Two kinds of prompts are available as listed below.

Prompt	Explanation
= >	The command has been successfully received, analyzed, and executed.
? >	An error has been detected in the course of receiving, analyzing, and executing the command.

(3) Measurement data output (only mode)

In the only mode, the measurement data is output at the end of the measurement only if data can be transmitted over the RS-232 interface and the send buffer is empty.
Each measurement value is delimited by an output delimiter.

(4) Query output data by query commands

Query output data produced by query commands begins with an <LF> and is followed by the output data, a delimiter, and a prompt.

(<LF>) + (Query result) + (Delimiter : CR + LF) + (Prompt : =>)

5.4 Remote Commands

You should deserve special notice with regard to the following.

(1) Initial value show the selected conditions of factory defaults or the execution of *RST, Z command.

(2) Power ON Initial show the selected conditions of Power ON defaults. Their conditions can not store in USER-0 to USER-3.

(3) The parentheses enclose the values of Initial value and Power ON defaults show the initialized value.

5.4 Remote Commands

Item								Command	Model			Initial vallue	Power ON Initial
									R6552	R6552T	R6552T-R		
Measurement functions	Setup	DCV						F1	○	○	○	○	
		ACV						F2	○				
		ACV(AC+DC)						F7	○				
		DCI						F5	○				
		ACI						F6	○				
		ACI(AC+DC)						F8	○				
		2WΩ						F3	○	○	○		
		LP-2WΩ						F20	○	○			
		4WΩ						F4	○	○	○		
		LP-4WΩ						F21	○	○			
		FREQ						F50	○				
		⊣▶⊢						F13	○				
		RIPPLE V						F15			○		
		Query						F?	○	○	○		
Measurement conditions	Range	DCV	ACV	2WΩ/ 4WΩ	LP-2WΩ/ LP-4WΩ	DC/ACI	RIPPLE V						
		Auto						R0	○	○	○	○	
		30mV*1		30 Ω			30 mV	R2	○	○	○		
		300 mV	300 mV	300 Ω	300 Ω		300 mV	R3	○	○	○		
		3000 mV	3000 mV	3000 Ω	3000 Ω	3 mA	3000 mV	R4	○	○	○		
		30 V	30 V	30 kΩ	30 kΩ	30 mA		R5	○	○	○		
		300 V	300 V	300 kΩ	300 kΩ	300 mA		R6	○	○	○		
		1000 V*2	700 V	3000 kΩ	3000 kΩ	3000 mA		R7	○	○	○		
				30 MΩ	30 MΩ			R8	○	○	○		
				300MΩ *1				R9	○	○	○		
		Fixed in the current range						RX	○	○	○		
		Query						R?	○	○	○		
	Measurement start command							E (*TRG)	○	○	○		
	Measurement data output request (valid for the RS-232 only)							MD?	○				
	Sampling mode...	Freerun						M0	○	○	○	○	
		Hold						M1	○	○	○		
		Burst						M2	○				
		Query						M?	○	○	○		
	Sampling rate	FAST						PR1	○	○	○		
		MED						PR2	○	○	○		
		SLOW						PR3	○	○	○	○	
		Long IT						PR4	○				
		Query						PR?	○	○	○		
	Long IT	Integral time						LITnnnnn 100ms ~ 60000ms Can be set in increments of 10 ms.	○			(100)	
		Query						LIT?	○				
	Auto-zero	OFF						AZ0	○	○	○		
		ON						AZ1	○	○	○	○	
		Off after executing once						AZ2	○	○	○		
		Query						AZ?	○	○	○		
	Power line frequency	50Hz						Automatic setup				○	
		60Hz											
		Query						LF? 50Hz : LF0, 60Hz : LF1	○	○	○		

*1 R6552/T only
*2 R6552 only

Item					Command	Model			Initial value	Power ON Initial
						R6552	R6552T	R6552T-R		
Measurement conditions	AC filter	FAST 300Hz to 300kHz			FL0	○				
		SLOW 20Hz to 300kHz			FL1	○			○	
		Query			FL?	○				
	Low-pass filter (LPF)	OFF			LPF0			○	○	
		1kHz			LPF1			○		
		10kHz			LPF2			○		
		100kHz			LPF3			○		
		1MHz			LPF4			○		
		Query			LPF?			○		
	High-pass filter (HPF)	OFF			HPF0			○	○	
		1kHz			HPF1			○		
		10kHz			HPF2			○		
		100kHz			HPF3			○		
		Query			HPF?			○		
Calculations	NULL	Execution	OFF		NL0	○	○	○	○	
			ON		NL1	○	○	○		
			Query		NL?	○	○	○		
		Constants	Setup		KNL±○○○○○○○E±○ (-999999.E+6 ~ +999999.E+6)	○	○	○	(0)	
			Query		KNL?	○	○	○		
	Smoothing	Execution	OFF		SM0	○	○	○	○	
			ON		SM1	○	○	○		
			Query		SM?	○	○	○		
		Count	Setup		TInnn(2 ~ 100)	○	○	○	(10)	
			Query		TI?	○	○	○		
	Comparator	Execution	OFF		CO0	○	○	○	○	
			ON		CO1	○	○	○		
			Query		CO?	○	○	○		
		Constants	Setup	HIGH	HI±○○○○○○○E±○	○	○	○	(0)	
				LOW	LO±○○○○○○○E±○ (-999999.E+6 to 999999.E+6)	○	○	○	(0)	
				Set the measurement value into the HIGH constant	HIM	○	○	○		
				Set the measurement value into the LOW constant	LOM	○	○	○		
			Query	HIGH	HI?	○	○	○		
				LOW	LO?	○	○	○		
	Scaling	Execution	OFF		SC0	○	○	○	○	
			ON		SC1	○	○	○		
			Query		SC?	○	○	○		
		Constants	Setup	A	KA±○○○○○○○E±○	○	○	○	(1)	
				B	KB±○○○○○○○E±○	○	○	○	(0)	
				C	KC±○○○○○○○E±○ (-999999.E+6 to +999999.E+6)	○	○	○	(1)	
				Set the measurement value into the constant A	KAM	○	○	○		
				Set the measurement value into the constant B	KBM	○	○	○		
				Set the measurement value into the constant C	KCM	○	○	○		
			Query	A	KA?	○	○	○		
				B	KB?	○	○	○		
				C	KC?	○	○	○		

Item					Command	Model			Initial value	Power ON Initial
						R6552	R6552T	R6552T-R		
Calculations	MAX-MIN	Execution	OFF		MN0	○	○	○	○	
			ON		MN1	○	○	○		
			Query		MN?	○	○	○		
		Read	MAX		MAX?	○	○	○		
			MIN		MIN?	○	○	○		
			AVE		AVE?	○	○	○		
			Measurement cycle count		AVN?	○	○	○		
	dB/dBm	Execution	OFF		DB0	○	○	○	○	
			dB ON		DB1	○	○	○		
			dBm ON		DB2	○	○	○		
			Query		DB?	○	○	○		
		Constants	Setup	D	KD±○○○○○○○E±○ (0.00001E-9 to 999999.E+6)	○	○	○	(1)	
				Set the measurement value into the constant D	KDM	○	○	○		
			Query		KD?	○	○	○		
Trigger	Abort				ABO	○	○	○		
	Delay	Setup			TRD±nnnnnnE±n (0 to 99.999S)	○	○	○	(0)	
		Query			TRD?	○	○	○		
	Sampling count	Setup			SPNnnnn(1 to 9999)	○	○	○	(1)	
		Query			SPN?	○	○	○		
	Trigger level	0%(OFF)			PTL0	○			○	
		25%			PTL1	○				
		50%			PTL2	○				
		75%			PTL3	○				
		Query			PTL?	○				
	Delayed trigger instruction				DTRG	○				
	Burst measurement count				BCNnnnnn (1,000 to 10,000, in units of 1,000)	○			(1000)	
	Query				BCN?	○				
Remote output	Header	Header OFF ASCII format			H0	○	○	○		
		Header ON ASCII format			H1	○	○	○	○	
		binary format (valid only with GPIB)			H2	○				
		Query			H?	○	○	○		
	Block delimiterts (valid only with GPIB)	CR/LF+E0I			DL0	○	○	○	○	
		LF			DL1	○	○	○		
		E0I			DL2	○	○	○		
		Query			DL?	○	○	○		
	String delimiters	[,] comma			SL0	○	○	○	○	
		Space			SL1	○	○	○		
		CR/LF			SL2	○	○	○		
		Query			SL?	○	○	○		

Item					Command	Model R6552	Model R6552T	Model R6552T-R	Initial value	Power ON Initial
Status	SRQ (vallid only when GPIB)	SRQ transmission enabled			S0	○	○	○	○	
		SRQ transmission disabled			S1	○	○	○		
		Query			S?	○	○	○		
	Registers	Status byte clear			*CLS	○	○	○		
		Standard event status enable register setup			*ESEnnn(0～255)	○	○	○	(0)	(0)
		Standard event status enable register readout			*ESE?	○	○	○		
		Standard event status register readout			*ESR?	○	○	○		
		Service request enable register setup			*SREnnn(0 to 255)	○	○	○	(3)	(3)
		Service request enable register readout			*SRE? *1	○	○	○		
		Status byte register readout			*STB?	○	○	○		
		Device event status register readout			DSR?	○	○	○		
		Device event status enable register setup			DSEnnnnn(0 to 65535)	○	○	○	(0)	(0)
		Device event status enable register readout			DSE?	○	○	○		
		Operation event enable register setup			OSEnnnnn(0 to 65535)	○	○	○	(0)	(0)
		Operation event enable register readout			OSE?	○	○	○		
		Operation event register readout			OSR?	○	○	○		
		Error event register readout			ERR?	○	○	○		
System	Clear	Device clear			C	○	○	○		
		Device clear and parameter initialization			Z	○	○	○		
	Self-testing	RAM R/W test		TST1	Result (read with *TST?) TST01 : PASS TST01 : FAILdddddd(Error detection address)	○	○	○		
		Panel communication test		TST2	TST02 : PASS TST02 : FAIL	○	○	○		
		CAL data test		TST3	TST03 : PASS TST03 : FAIL	○	○	○		
		Parameter test		TST4	TST04 : PASS TST04 : FAIL	○	○	○		
		A/D communication test		TST5	TST05 : PASS TST05 : FAIL	○	○	○		
		Panel display test		TST6		○	○	○		
		Panel key test		TST7	TST07 : dd (Key code)	○	○	○		
		Panel beep test		TST8		○	○	○		
		A/D zero test		TST9 - TST12	TSTxx : PASS TSTxx : FAIL	○	○	○		
		A/D IR test		TST13 - TST15	TSTxx : PASS TSTxx : FAIL	○	○	○		
		A/D switch test		TST16 - TST24	TSTxx : PASS TSTxx : FAIL	○	○	○		
		Self-test result read		*TST?		○	○	○		
	488.2 common commands	System	Device information	*IDN?	Result ADVANTEST, R6552X, dddddddd, ΔΔΔ dddddddd : Serial No. , ΔΔΔ : Revision No.	○	○	○		
		Internal operation	Device initialization (equivalent to the Z-command)		*RST	○	○	○		
		Synchro-nization	Set the LSB of SESR after completion of all operations		*OPC	○	○	○		
			Reply ASCII 1 after completion of all operations		*OPC?	○	○	○		
			Wait for the completion of all operations		*WAI	○	○	○		
		Trigger	Trigger the device		*TRG	○	○	○		

*1 Bit 6 always return 0.

5.4 Remote Commands

Item			Command	Model			Initial value	Power ON Initial
				R6552	R6552T	R6552T-R		
Display	Display digit length	3 1/2 digits	RE3	○	○	○		
		4 1/2 digits	RE4	○	○	○		
		5 1/2 digits	RE5	○	○	○	○	
		Query	RE?	○	○	○		
	Bar graph	OFF	BAR0	○	○	○	○	
		ON	BAR1	○	○	○		
		Query	BAR?		○	○		
	Buzzer	OFF	BZ0	○	○	○	○	
		ON (if comparator calculation results are HIGH or LOW)	BZ1	○	○	○		
		ON (if comparator calculation results are PASS)	BZ2	○	○	○		
		ON (if comparator calculation results are HIGH)	BZ3	○	○	○		
		ON (if comparator calculation results are LOW)	BZ4	○	○	○		
		Query	BZ?	○	○	○		
Measurement data memor	Store	OFF	ST0	○			○	
		ON	ST1	○				
		Query	ST?	○				
		Initialized stored data	ICL	○				
	Recall	Recall range setting	IRDnnnn, nnnn (0 to 9999) Initial value : IRD0, 0	○			(0, 0)	
		Readout	IRO?	○				
		The number of stored data readout	IRPO?	○				
		Stored data record count readout	IRNO?	○				
Setup parameters	Store	USER-0 parameter	STP0	○	○	○		
		USER-1 parameter	STP1	○	○	○		
		USER-2 parameter	STP2	○	○	○		
		USER-3 parameter	STP3	○	○	○		
		Initialize USER-0 to USER-3	SINI	○	○	○		
	Recall	USER-0 parameter	RCLP0	○	○	○		
		USER-1 parameter	RCLP1	○	○	○		
		USER-2 parameter	RCLP2	○	○	○		
		USER-3 parameter	RCLP3	○	○	○		
		Initialize parameter during measure	RINI	○	○	○		
Measurement input condition	Input terminals	Front	IN0		○	○	○	
		Rear	IN1		○	○		
		Query	IN?		○	○		
Calibration	Calibration mode	Disabled	CAL0	○	○	○	○	
		Enabled	CAL1	○	○	○		
		Query	CAL?	○	○	○		
	Calibration data	Setup	PCdddddd (0 to 999999)	○	○	○		
		Ripple voltage calibration with DC voltage input	RCALdddddd (0 to 999999)			○		
	RIPPLE V DC Calibration mode	Disabled	DCAL0			○		○
		Enabled	DCAL1			○		

5.5 Tips on Setting Remote Commands

- The RS-232 and GPIB remote commands are identical unless otherwise noted.

(1) Remote command format

Remote commands are broken down into two groups depending on how they maintain arguments:

1. Commands consisting solely of a header, without arguments

   <Example> E (Measurement start command)
   RINI (Setup parameter initial)

2. Commands consisting of a header and an argument

   <Example> F1 (Set the measurement function DCV)
   HI±nnnnnnE±n
   (Set the comparator HI constant)

(2) Linking a header and an argument

The following two ways of linkage are valid, and any other character or symbol is assumed a syntax error.

1. Write a header and an argument in succession.

   <Example> PR1 (Set the sampling rate FAST)

2. Insert a space between a header and an argument.

   <Example> PR␣2 (Set the sampling rate MED)

(3) Linking commands (Separator)

The following three ways of linkage are valid, and any other character or symbol is assumed a syntax error.

1. Write commands in succession.

   <Example> F1R2 (Set the measurement function DCV and the 30 mV range)

2. Insert a space between commands.

   <Example> M1␣E (Set the HOLD sampling mode and trigger)

3. Insert a comma (,) between commands.

   <Example> RE3,BAR0,BZ0
   (Set 3 1/2 digits display, bar graph OFF, and buzzer OFF)

(4) Rules of command execution

- Commands are executed in the order in which they appear on the program line.
- Invalid commands are treated as an error, instead of being executed.
- If an error is encountered in a chain of commands written on a program line
  - Valid commands that precede the error are executed.
  - Valid commands that follow the error are ignored.

(5) Compatibility with the R6551

The R6552 Series instruments running remote programs written for the R6551 may require modifications to service request commands.
For a detailed description of the status byte structure supported by the R6552 Series instruments, see Section 5.1.4, "Service Request (SRQ)."
Figure 5.2 shows that part of the status byte configuration pertains to the issue of compatibility with the R6551.

① Detecting a calibration error

To associate the occurrence of a calibration error with a bit indication in the status byte register, insert the following command into the remote program where the R6552 Series instruments are initialized:

```
OSE1 : set bit 0 of the operation event enable register to 1
```

Bit 7 of the status byte register is set to 1 when bit 0 of the operation event register is 1 (calibration error present) and bit 0 of the operation event enable register is 1.

② To associate the depression of the front-panel SRQ key with a bit indication in the status byte register, insert the following command into the remote program where the R6552 Series instruments are initialized:

```
DSE8 : set bit 3 of the device event status enable register to 1
```

Bit 3 of the status byte register is set to 1 when bit 3 of the device event status register is 1 (SRQ key pressed) and bit 3 of the device event status enable register is 1.

③ DS command

The DS command will terminate in error because the display ON/OFF function is removed.

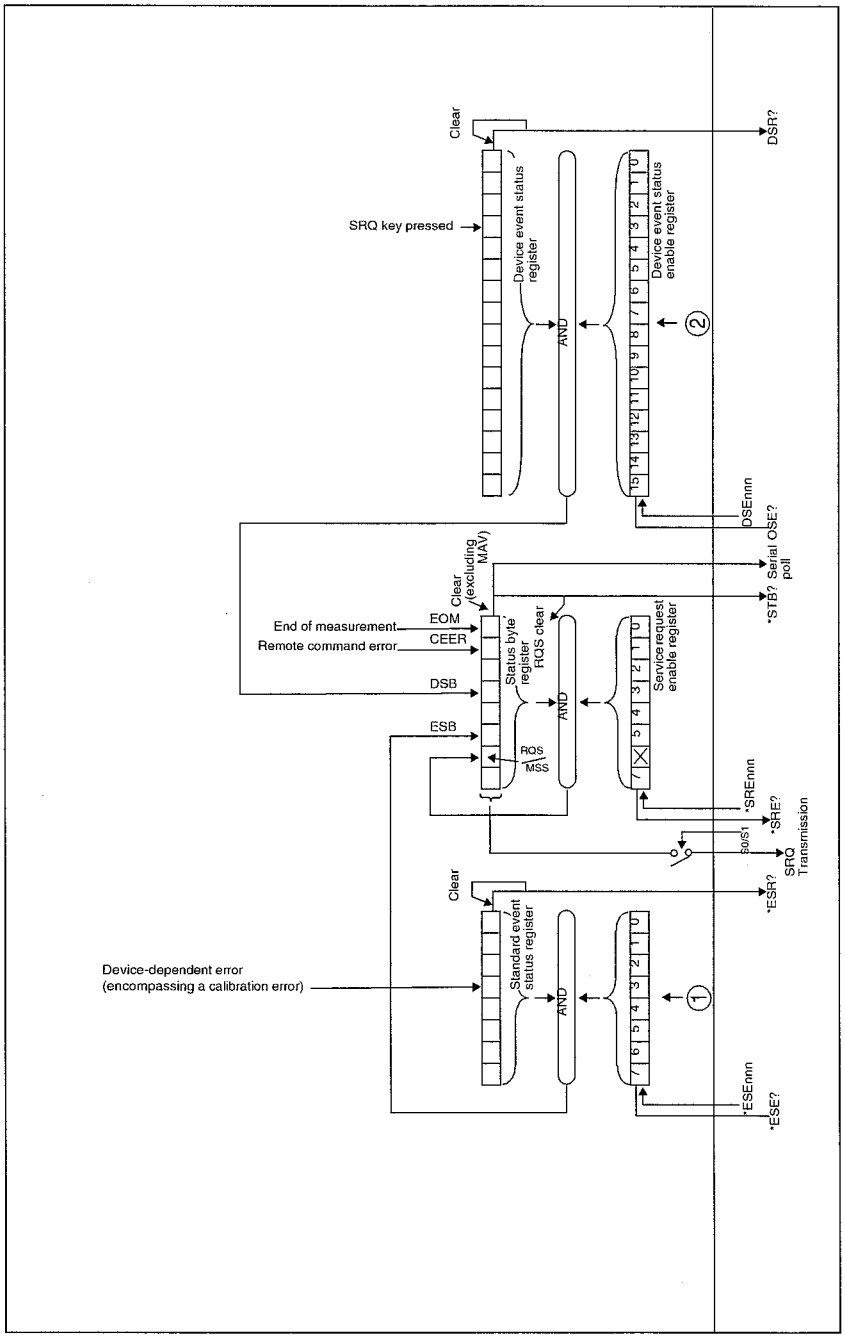


Figure 5-2 Status Byte Configuration (pertaining to the issue of compatibility with the R6551)

6 OPERATION DESCRIPTION

6.1 Operation Summary

The R6552 Series instruments incorporate a microprocessor (CPU) based high-precision A/D converter with a 5 1/2 digits display.

Figure 6-1 is a block diagram of the R6552 Series instruments.

Major component blocks

- Attenuator to divide the DC voltage
- Function/range selection to choose from among voltage, resistance, and current measurement
- Ranging amplifier to normalize input signals to the A/D converter
- Ohm/DC converter to introduce a reference current through the resistance under test and convert it to a DC voltage
- AC/DC converter to convert an AC voltage to a DC voltage
- Current/voltage converter to convert a current to a voltage
- A/D converter to digitize analog voltages
- A/D converter control, function/range selection control, and CPU communications control
- Isolator to electrically separate the measurement block and the CPU
- Panel CPU to control displays and panel keys
- CPU to control the measurement block and implement I/O interfacing and calculations
- Power supply

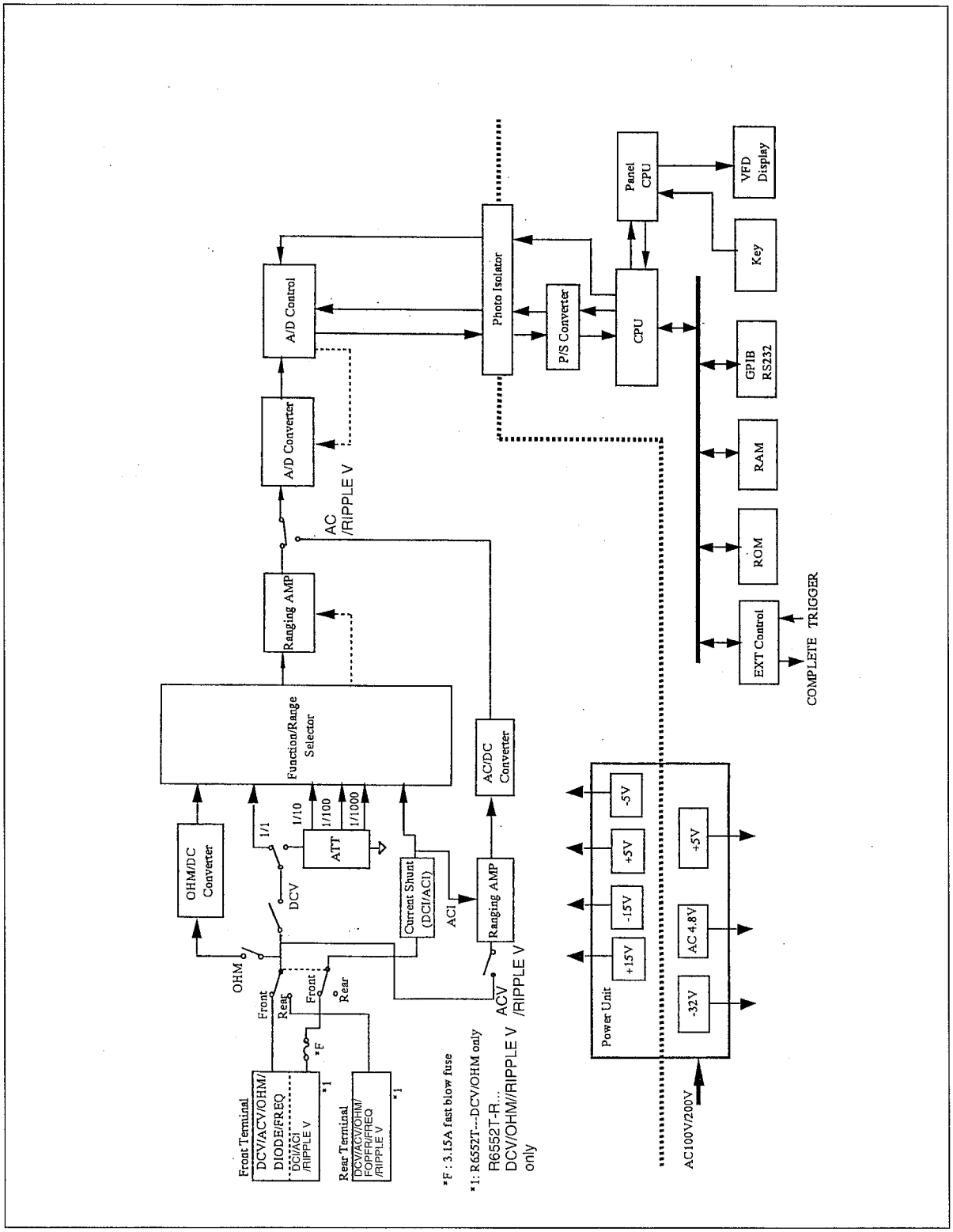


Figure 6-1 Block Diagram

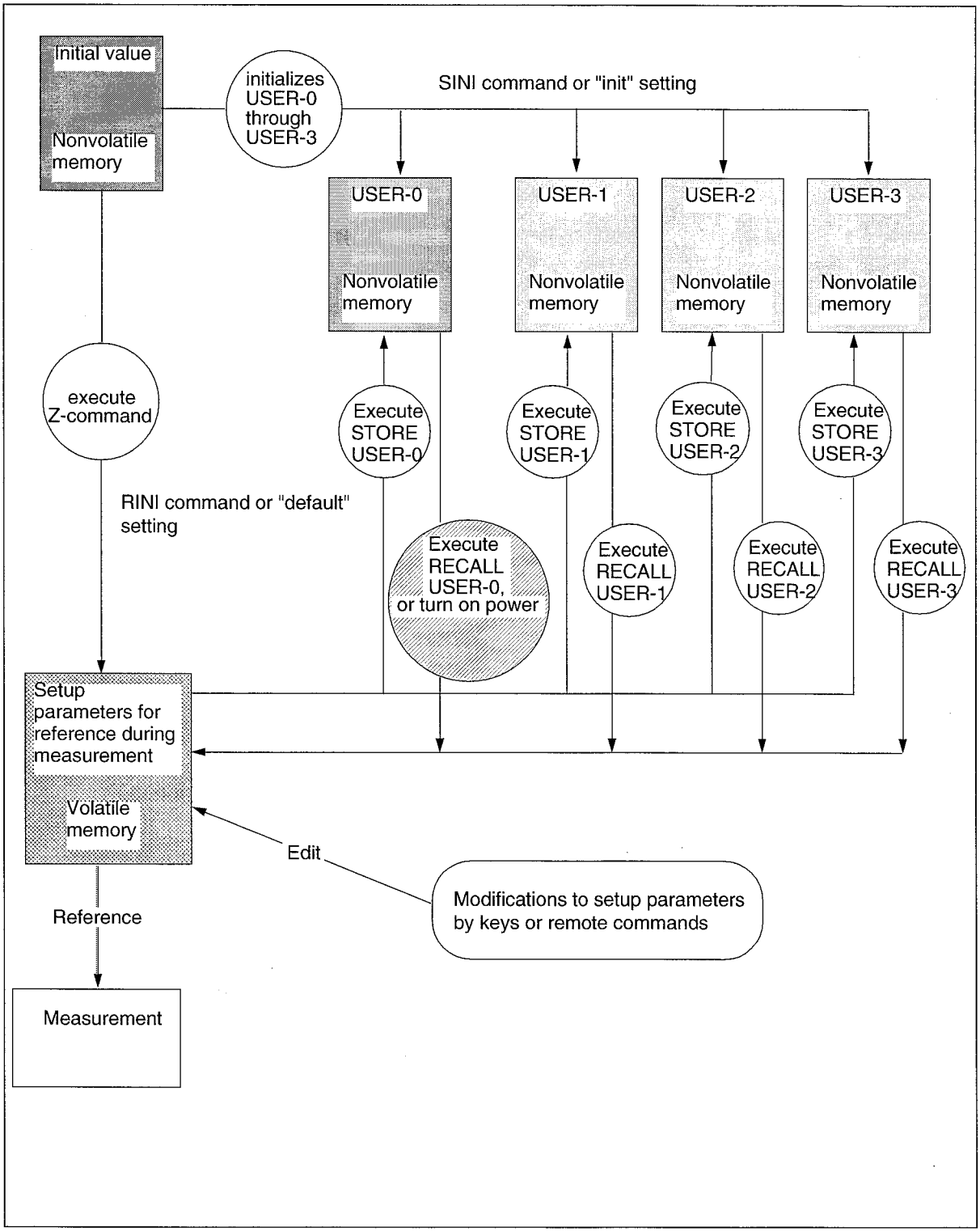


Figure 6-2 Scheme of Storing and Holding Setup Parameters

7 CALIBRATION

Calibrate the R6552 Series instruments at least once for each interval of the warranty period (1 year) to preserve their measurement accuracies.

7.1 Preparing for Calibration

(1) Power supply

Use an AC power supply with a power line frequency of 50 or 60 Hz not exceeding the voltage rating indicated on the rear panel (90 to 110 V, 103 to 132 V, 198 to 242 V, 207 to 250 V).

(2) Ambient

Carry out calibration in the following ambient conditions:

Temperature: +23°C±1°C
Humidity: 70%RH or less
Places that are not subjected to dust, vibration, winds, and noises.

(3) Warm-up time

Warm up the instrument for at least 60 minutes before proceeding with calibration. Remember also to warm up the apparatus needed to carry out calibration.

7.2 Calibration Standards

Standard	Operating range	Accuracy	Model		
			R6552	R6552T	R6552T-R
Standard DC voltage generator	30mV to 1000V *1	±0.00075% or less	○	○	○
Standard AC voltage generator	1mVrms to 700Vrms, 1kHz	±0.015% or less	○		○
Standard DC current generator	3mA to 30mA	±0.003% or less	○		
	300mA to 3A	±0.012% or less	○		
Standard AC current generator	3mArms to 3Arms, 1kHz	±0.09% or less	○		
Standard resistor	30Ω to 3MΩ	±0.0009% or less	○	○	○
	30MΩ	±0.07% or less	○	○	○
	300MΩ	±0.15% or less	○	○	○

*1: The R6552T/T-R has a maximum permissible input voltage of 200 V.
○: Apparatus required for calibration

7.3 Calibration Method

7.3.1 Calibration Tips

(1) Calibration point

1. Perform calibration for each range of each measurement function.
2. For DC voltage measurement, DC current measurement, and resistance measurement, calibrate the zero point and the full-scale point.
3. For AC voltage measurement, AC current measurement and ripple voltage measurements, calibrate the 1/10 full-scale point and the full-scale point.
4. For 2WΩ/LP-2WΩ measurement, only calibrate the zero point.
5. For the (AC + DC) alternating current measurement, calibrate the meter by inputting a direct current. The (AC + DC) alternate voltage measurement does not need to be calibrated.

(2) Notes

1. For 2WΩ/LP-2WΩ measurement, first calibrate the 4WΩ/LP-4WΩ, and then only calibrate 2WΩ/LP-2WΩ at the zero point.
2. Calibration for ripple voltage measurement (using the DC standard input) can also be performed using the remote commands. In such cases, note the following:
   - For the 30 mV range, calibration is performed by attenuating input voltage to the 1/10 of the input voltage internally. So, the input range is the same as those of 300 mV range.
     When calibrating at the full scale of 3 V range, do not apply any voltages which exceed 2.2 V.
   - Since noise in the DC voltage standard causes a calibration error, suppress the noise below 100 µV p-p at DC to 1 kHz. To check noise, carry out the ripple voltage measurement by setting the LPF to 1 kHz.
     Induction noise from the power supply also causes a calibration error. Be careful of the input power connection to both the R6552 and the standard power supply, and their grounding. If necessary, put a noise filter on the standard power supply output.
   - Execute the remote command using "RCAL dddddd" after setting this instrument to the DC calibration mode using "DCAL 1."
     "dddddd" is set to 200000 when using the 2 V full scale.
     A calibration mode using AC input is activated when you turn the DC calibration mode off (using "DCAL 0") after completing a calibration.
   - Calibrate in the following order: 3V range ---> 300 mV range ---> 30 mV range."
3. The calibrations for other functions and ranges can be executed in no particular order.

Measurement function	Range	Recommended input range			Model		
		Zero	Full scale	1/10 full scale	R6552	R6552T	R6552T-R
DCV	30mV	0mV	+28mV to +32mV	-	○	○	○
	300mV		+280mV to +320mV				
	3000mV		+2.8V to +3.2V				
	30V		+28V to +32V				
	300V		+280V to +320V *1				
	1000V		+800V to +1000V *2			-	-
ACV	300mV	-	280mV to 320mV,1kHz	28mV to 32mV,1kHz	○	-	-
	3000mV		2.8V to 3.2V,1kHz	280mV to 320mV,1kHz			
	30V		28V to 32V,1kHz	2.8V to 3.2V,1kHz			
	300V		280V to 320V,1kHz	28V to 32V,1kHz			
	700V		500V to 700V,1kHz	50V to 70V,1kHz			
DCI	3000μA	0mA	+2.8mA to +3.2mA	-	○	-	-
	30mA		+28mA to +32mA				
	300mA		+280mA to +320mA				
	3000mA		+2.8A to +3.0A				
ACI/ACI(AC+DC)	3000μA	-	2.8mA to ±3.2mA,1kHz	0.28mA to ±0.32mA,1kHz	○	-	-
	30mA		28mA to 32mA,1kHz	2.8mA to ±3.2mA,1kHz			
	300mA		280mA to 320mA,1kHz	28mA to 32mA,1kHz			
	3000mA		2.8A to 3.0A,1kHz	280mA to 320mA,1kHz			
2WΩ/LP-2WΩ 4WΩ/LP-2WΩ	30Ω	0Ω	28Ω to 32Ω	-	○	○	○
	300Ω		280Ω to 320Ω				
	3000Ω		2.8kΩ to 3.2kΩ				
	30kΩ		28kΩ to 32kΩ				
	300kΩ		280kΩ to 320kΩ				
	3000kΩ		2.8MΩ to 3.2MΩ				
	30MΩ		28MΩ to 32MΩ				
	300MΩ		280MΩ to 320MΩ				
RIPPLE V (For AC voltage inputs)	30mV	-	+28mVp-p to +32mVp-p	+0.8mVp-p to +3.2mVp-p,1kHz	-	-	○
	300mV		+280mVp-p to +320mVp-p	+0.8mVp-p to +32mVp-p,1kHz			
	3000mV		+2.8Vp-p to +3.2Vp-p	+0.8mVp-p to +320mVp-p,1kHz			
RIPPLE V (For DC voltage inputs)	30mV	-	+180mV to +220mV *3	8mV to 12mV *3	-	-	○
	300mV		+180mV to +220mV *3	8mV to 12mV *3			
	3000mV		+1.8V to +2.2V *3	80mV to 120mV *3			

*1 180 to 220V for R6552T/T-R
*2 R6552 only
*3 DC voltage
Note: When "OL" is shown on the measurement display before the calibration, calibration cannot be made.

7.3.2 Calibration Procedures (Panel Operation)

① Setting the calibration mode

Press the front-panel CAL switch. The [CAL] indicator lights up, indicating that the instrument is now in the calibration mode.

CAUTION!

- ***With measurement functions that do not have a calibration point, pressing the CAL switch does not set the calibration mode.***
- ***Turn the calibration mode off before turning off the power. Calibration data is stored in internal nonvolatile memory. Writing takes place at once when the calibration mode is turned off.***
- ***When pressing the recessed CAL switch, a narrow blunt instrument (such as a mechanical pen) is needed, however, avoid using something sharp.***

② Set the measurement function to calibrate.

③ Set the range to calibrate.

CAUTION!
When calibration values are set by remote control, they are tested right-justified. Be sure to set a calibration value to fill a 5 1/2 digits display even with ranges having a 4 1/2 digits display.

④ Range-specific calibration

(a) When function and range setups are complete, apply input within the recommended input range.

(b) Press [STORE] for a numeric value to be displayed.
Use [AUTO] ⇨, [DOWN] ▽, and [UP] △, to changes the value to an input value. If it is necessary to cancel calibration for reasons, such as an entry error, press [SHIFT] EXIT to return to the state in effect just before (b).

(c) Press [ENTER] to execute calibration.

⑤ To calibrate another function or range, repeat steps ② through ④.

⑥ Release the calibration mode

- Press the front-panel CAL switch once again.
- When the calibration mode is turned off, a regular measurement operation is resumed with the previously selected measurement function and range.

8 SPECIFICATIONS

8.1 Measurement AccuracyMeasurement Function

8.1.1 DC Voltage Measurement (DCV)

• Range, Maximum display, Resolution, Input impedance

Range	Maximum display		Resolution		Input impedance
	SLOW/MED/LONG-IT	FAST/BURST	SLOW/MED/LONG-IT	FAST/BURST	
30 mV *4	31.9999 mV	31.999 mv	100 nV	1 µV	> 1000 MΩ
300 mV	319.999 mV	319.99 mv	1 µV	10 µV	
3000 mV	3199.99 mV	3199.9 mv	10 µV	100 µV	
30 V	31.9999 V	31.999 V	100 µV	1 mV	11.1 MΩ ±1%
300 V	319.999 V	319.99 V	1 mV	10 mV	10.1 MΩ ±1%
1000 V *3	1099.99 V	1099.9 V	10 mV	100 mV	10.0 MΩ ±1%

• Measurement Accuracy *2 ±(% of reading + digits) (Sampling rate SLOW, 5 1/2 digits, Auto zero ON)

Range	24 hours (23°C±1°C) *1	90 days (23°C±5°C)	1 year (23°C ± 5°C)
30 mv *4	0.003 + 30	0.01 + 40	0.015 + 40
300 mV	0.002 + 5	0.006 + 7	0.014 + 7
3000 mV	0.002 + 2	0.006 + 3	0.01 + 3
30 V	0.002 + 3	0.007 + 6	0.015 + 6
300 V	0.002 + 2	0.006 + 3	0.014 + 3
1000 V *3	0.002 + 2	0.006 + 3	0.014 + 3

• Temperature coefficient ±(% of reading + digits) / °C

Range	Auto zero ON	Auto zero OFF
30 mv *3	0.0005 + 5	0.0005 + 35
300 mV	0.0005 + 1	0.0005 + 5
3000 mV	0.0005 + 0.1	0.0005 + 1.3
30 V	0.0005 + 1	0.0005 + 2
300 V	0.0005 + 0.1	0.0005 + 1.3
1000 V *3	0.0005 + 0.1	0.0005 + 1.2

• Maximum allowable applied voltage

Terminal	Maximum alowable applied voltage	
	R6552	R6552T/T-R
Between HI - LO	1000 Vpeak	200 Vpeak
Between LO- chassis	500 V	200 V

*1 Relative value with respect to calibration reference.
*2 Add 2 to the digits term for the MED sampling rate.
Add 2 digits +20µV for a 4 1/2 digits display for the FAST sampling rate.
Add 3 digits +20µV for a 4 1/2 digits display for the BURST mode.
For the LONG-IT measurement, settings shown in Section 8.2 are added.
*3 R6552 only
*4 R6552/T only

• Noise rejection ratio

Sampling rate	Effective CMR (with a balanced impedance of 1kΩ)		NMR
	50Hz/60Hz ±0.08%	DC	50Hz/60Hz ±0.08%
SLOW/MED	120 dB	130 dB	60 dB
FAST	60 dB	130 dB	0 dB
BURST	60 dB	130 dB	0 dB
LONG-IT	82 dB	130 dB	22 dB

8.1.2 AC Voltage Measurement (ACV, ACV(AC+DC)); R6552 only

• Range, Maximum display, Resolution, Input impedance

AC					
Range	Maximum display		Resolution		Input impedance
	SLOW/MED	FAST	SLOW/MED	FAST	
300 mV	319.999 mV	319.99 mV	1 µV	10 µV	1.2 MΩ ± 5% 140 pF or less
3000 mV	3199.99 mV	3199.9 mV	10 µV	100 µV	
30 V	31.9999 V	31.999 V	100 µV	1 mV	1.0 MΩ ± 2% 140 pF or less
300 V	319.999 V	319.99 V	1 mV	10 mV	
700 V	709.99 V	709.9 V	10 mV	100 mV	

AC+DC					
Range	Maximum display		Resolution		Input impedance
	SLOW/MED	FAST	SLOW/MED	FAST	
300 mV	319.99 mV	319.9 mV	10 µV	100 µV	1.2 MΩ ±5% 500 pF or less
3000 mV	3199.9 mV	3199. mV	100 µV	1 mV	1.0 MΩ ±10% 140 pF or less
30 V	31.999 V	31.99 V	1 mV	10 mV	
300 V	319.99 V	319.9 V	10 mV	100 mV	
700 V	709.9 V	709. V	100 mV	1 V	

• Measurement Accuracy *1 ±(% of reading + digits) (5 1/2 digits, 1 year, 23°C ± 5°C)

AC, AC+DC					
Frequency Range *2	Range				
	300 mV	3000 mV	30 V	300 V	700 V
20 Hz to 45 Hz	0.28+100	0.28+100	0.30+100	0.30+100	0.28+100
45 Hz to 100 Hz	0.12+100	0.12+100	0.12+100	0.12+100	0.12+100
100 Hz to 10 kHz	0.06+100	0.06+100	0.06+100	0.06+100	0.06+100
10 kHz to 20 kHz	0.1 +100	0.1 +100	0.1 +100	0.1 +100	0.1 +100
20 kHz to 50 kHz	0.2 +150	0.2 +150	0.2 +150	0.2 +150	-
50 kHz to 100 kHz	0.5 +300	0.5 +300	0.5 +300	0.5 +300	-
100 kHz to 300 kHz	3 +500	3 +500	3 +500	-	-

*1 Additional Crest Factor Errors:

Crest factor	Error (digits)
1 to 2	150
2 to 3	450

*2 Guaranteed at above 300Hz for FAST AC-Filter.

• Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI - LO	700 Vrms, 1000 Vpeak, 10000000 V·Hz
Between LO- chassis	500 V

• Measurement method : True RMS

• The accuracy is prescribed by input of a sine wave with 5% or more of full scale.

• Crest factor : 3:1 at full scale

• Temperature coefficient : (1/10 of measurement accuracy) / °C
within the frequency range for each range.

• Response time : AC-Filter FAST --- within 230ms
AC-Filter SLOW --- within 950ms
(Time until the voltage falls within 0.1% of the input step with fixed range)

8.1.3 Resistance Measurement (2WΩ, LP-2WΩ, 4WΩ, LP-4WΩ)

• Range, Maximum display, Resolution, measurement current

2WΩ/4WΩ, LP-2WΩ/LP-4WΩ *4						
Range	Maximum display		Resolution		Measurement current	
	SLOW/MED	FAST/BURST	SLOW/MED	FAST/BURST	2WΩ/4WΩ	Low-Power 2WΩ/4WΩ
30 Ω	31.9999 Ω	31.999 Ω	100 μΩ	1 mΩ	1 mA	–
300 Ω	319.999 Ω	319.99 Ω	1 mΩ	10 mΩ	1 mA	100 μA
3000 Ω	3199.99 Ω	3199.9 Ω	10 mΩ	100 mΩ	1 mA	100 μA
30 kΩ	31.9999 kΩ	31.999 kΩ	100 mΩ	1 Ω	100 μA	10 μA
300 kΩ	319.999 kΩ	319.99 kΩ	1 Ω	10 Ω	10 μA	0.9 μA
3000 kΩ	3199.99 kΩ	3199.9 kΩ	10 Ω	100 Ω	1 μA	1 μA
30 MΩ	31.9999 MΩ	31.999 MΩ	100 Ω	1 kΩ	90 nA	90 nA
300 MΩ *5	319.999 MΩ	319.99 MΩ	1 kΩ	10 kΩ	10 nA	–

• Measurement Accuracy *3 ±(% of reading + digits) (Sampling rate SLOW, 5 1/2 digits, Auto zero ON)

2WΩ/4WΩ *2			
Range	24 hours (23°C±1°C) *1	90 days (23°C±5°C)	1 year (23°C ± 5°C)
30 Ω	0.003 + 30	0.01 + 40	0.015 + 40
300 Ω	0.002 + 5	0.008 + 11	0.015 + 11
3000 Ω	0.002 + 3	0.007 + 3	0.012 + 3
30 kΩ	0.002 + 3	0.007 + 3	0.013 + 3
300 kΩ	0.002 + 3	0.009 + 3	0.014 + 3
3000 kΩ	0.007 + 14	0.03 + 19	0.03 + 19
30MΩ	0.06 + 14	0.18 + 19	0.2 + 19
300MΩ *5	0.6 + 14	1.7 + 19	2 + 19

LP-2WΩ/LP-4WΩ *2 *4			
Range	24 hours (23°C±1°C) *1	90 days (23°C±5°C)	1 year (23°C ± 5°C)
300 Ω	0.003 + 30	0.008 + 40	0.015 + 40
3000 Ω	0.002 + 5	0.008 + 11	0.015 + 11
30 kΩ	0.002 + 5	0.008 + 11	0.015 + 11
300 kΩ	0.007 + 5	0.03 + 11	0.03 + 11
3000 kΩ	0.06 + 20	0.18 + 33	0.2 + 33
30MΩ	0.6 + 20	1.7 + 33	2 + 33

*1 Relative value with respect to calibration reference.
*2 Auto-zero ON for 2WΩ measurement.
For 2WΩ and LP-2WΩ, add a cable resistance and maximum of 200 mΩ.
For 4WΩ and LP-4WΩ, maximum measurement cable resistance should be equal to 1/15 of full-scale or less.
*3 Add 2 to the digits term for the MED sampling rate.
Add 2 digits +20mΩ for a 4 1/2-digit display for the FAST sampling rate.
Add 3 digits +20mΩ for a 4 1/2-digit display for the BURST mode.
*4 For LP-2WΩ and LP-4WΩ, R6552/T only.
*5 R6552/T only

• Temperature coefficient ±(% of reading + digits) / °C

2WΩ/4WΩ *1		
Range	2WΩ Auto zero ON, 4WΩ	2WΩ Auto zero OFF
30 Ω	0.0007 + 5	0.0007 + 50
300 Ω	0.0007 + 1	0.0007 + 6
3000 Ω	0.0007 + 0.2	0.0007 + 1.4
30 kΩ	0.0007 + 0.2	0.0007 + 1.4
300 kΩ	0.0007 + 0.2	0.0007 + 1.4
3000 kΩ	0.003 + 1.3	0.003 + 1.4
30 MΩ	0.01 + 1.3	0.01 + 1.4
300 MΩ *2	0.1 + 1.3	0.1 + 1.4

LP-2WΩ/LP-4WΩ *1 *2		
Range	2WΩ Auto zero ON, 4WΩ	2WΩ Auto zero OFF
300 Ω	0.0007 + 5	0.0007 + 50
3000 Ω	0.0007 + 1	0.0007 + 6
30 kΩ	0.0007 + 1	0.0007 + 6
300 kΩ	0.003 + 1	0.003 + 6
3000 kΩ	0.01 + 1.3	0.01 + 1.4
30 MΩ	0.1 + 1.3	0.1 + 1.4

*1 For 2WΩ and LP-2WΩ, add a cable temperature coefficient and maximum of 20 mΩ / °C.
*2 R6552/T only

• Maximum allowable applied voltage

Terminal		Maximum allowable applied voltage	
		R6552	R6552T/T-R
INPUT terminals	Between HI - LO	1000 Vpeak	200 Vpeak
	Between LO- chassis	500 V	200 V
4WΩ terminals	Between HI - LO	350 Vpeak	200 Vpeak
	Between LO- chassis	500 V	200 V

• Open-circuit voltage : 8.0V max

• Response time : within 0.5 sec
(Time until the voltage falls within 0.1% of the input step with 3000kΩ and 30 MΩ ranges)
within 5 sec
(Time until the voltage falls within 0.1% of the input step with 300 MΩ range)

8.1.4 DC Current Measurement (DCI); R6552 only

• Range, Maximum display, Resolution, Resistance between input terminals

Range	Maximum display		Resolution		Resistance between input terminals
	SLOW/MED/LONG-IT	FAST/BURST	SLOW/MED/LONG-IT	FAST/BURST	
3000 µA	3199.99 µA	3199.9 µA	10 nA	100 nA	10.5 Ω or less
30 mA	31.9999 mA	31.999 mA	100 nA	1 µA	
300 mA	319.999 mA	319.99 mA	1 µA	10 µA	0.4 Ω or less
3000 mA	3199.99 mA	3199.9 mA	10 µA	100 µA	

• Measurement Accuracy *1 ±(% of reading + digits) (Sampling rate SLOW, 5 1/2 digits, Auto zero ON)

Range	90 days (23°C±5°C)	1 year (23°C ± 5°C)
3000 µA	0.03 + 40	0.05 + 40
30 mA	0.03 + 6	0.05 + 6
300 mA	0.06 + 40	0.1 + 40
3000 mA	0.085 + 6	0.12 + 6

*1 Add 2 to the digits term for the MED sampling rate.
Add 2 to the digits term for a 4 1/2-digit display for the FAST sampling rate.
Add 3 to the digits term for a 4 1/2-digit display for the BURST mode.
For the LONG-IT measurement, an error shown in Section 8.2 is added.

• Temperature coefficient ±(ppm of reading + digits) / °C

Range	Auto zero ON	Auto zero OFF
3000 µA	0.003 + 4	0.003 + 35
30 mA	0.003 + 0.6	0.003 + 7
300 mA	0.005 + 4	0.005 + 35
3000 mA	0.005 + 0.6	0.005 + 7

• Maximum allowable applied current : Between mA-LO terminals 3A (DC or AC rms) continuous
: Overcurrent protection using 3.15A fuse (changeable from front panel)

8.1.5 AC Current Measurement (ACI, ACI(AC+DC)); R6552 only

• Range, Maximum display, Resolution, Resistance between input terminals

AC					
Range	Maximum display		Resolution		Resistance between input terminals
	SLOW/MED	FAST	SLOW/MED	FAST	
3000 µA	3199.99 µA	3199.9 µA	10 nA	100 nA	10.5 Ω or less
30 mA	31.9999 mA	31.999 mA	100 nA	1 µA	
300 mA	319.999 mA	319.99 mA	1 µA	10 µA	0.4 Ω or less
3000 mA	3199.99 mA	3199.9 mA	10 µA	100 µA	

AC+DC					
Range	Maximum display		Resolution		Resistance between input terminals
	SLOW/MED	FAST	SLOW/MED	FAST	
3000 µA	3199.9 µA	3199. µA	100 nA	1 µA	10.5 Ω or less
30 mA	31.999 mA	31.99 mA	1 µA	10 µA	
300 mA	319.99 mA	319.9 mA	10 µA	100 µA	0.4 Ω or less
3000 mA	3199.9 mA	3199. mA	100 µA	1 mA	

• Measurement Accuracy *1 ±(% of reading + digits) (5 1/2 digits, 1 year, 23°C ± 5°C)

AC, AC+DC				
Frequency *2	Range			
	3 mA	30 mA	300 mA	3000 mA
20 Hz to 45 Hz	0.45+200	0.45+200	0.45+200	0.5 +200
45 Hz to 100 Hz	0.25+200	0.25+200	0.35+200	0.4 +200
100 Hz to 1 kHz	0.2 +200	0.2 +200	0.3 +200	0.35+200
1 kHz to 5 kHz	0.4 +200	0.4 +200	0.25 +200	0.3 +200

*1 Additional Crest Factor Errors ±(% of reading + digits)

Range	Crest factor	
	1 to 2	2 to 3
3000 µA	0 + 150	0 + 450
30 mA	0.2 + 150	6.7 + 450
300 mA	0 + 150	0 + 450
3000 mA	0 + 150	0.07 + 450

*2 Guaranteed at above 300 Hz for FAST AC-Filter

• Measurement method : True RMS

• The accuracy is prescribed by input of a sine wave with 5% or more of full scale.

• Crest factor : 3:1 at full scale

• Temperature coefficient : (1/10 of measurement accuracy) / °C within the frequency range for each range.

• Response time : AC-Filter FAST --- within 230ms
AC-Filter SLOW --- within 950ms
(Time until the voltage falls within 0.1% of the input step with fixed range)

- Maximum allowable applied current : Between mA-LO terminals 3A (DC or AC rms) continuous
  : Overcurrent protection using 3.15A fuse (changeable from front panel)

8.1.6 Frequency Measurement (FREQ); R6552 only

- Measurement range, Input signal range, Input impedance

Measurement range	Input signal range	Input impedance
1 Hz to 300 kHz	100 mVrms to 700 Vrms	1.1 MΩ ±20% 140 pF or less

- Measurement Accuracy ±(% of reading)

Frequency range	Measurement Accuracy
1 Hz to 10 kHz	0.05
10 Hz to 300 kHz	0.02

- Sampling rate, Gate time, Maximum display

Sampling rate	Gate time	Maximum display
FAST	10 ms	9999
MED	100 ms	99999
SLOW	1 s	999999

- Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI - LO	700 Vrms, 1000 Vpeak, 10000000 V·Hz
Between LO- chassis	500 V

- Measurement method : Reciprocal
- Measurement time : GATE TIME setting --- 2 × (one period of the input signal)

8.1.7 Diode Measurement (⇾); R6552 only

• Maximum display, Resolution, Measurement current

Maximum display		Resolution		Measurement current
SLOW/MED	FAST	SLOW/MED	FAST	
3199.99 mV	3199.9 mV	10 µV	100 µV	1 mA

• Measurement Accuracy *1 ±(% of reading + digits) (Sampling rate SLOW, 5 1/2 digits, Auto zero ON)

1 year (23°C ± 5°C)
0.012 + 3

*1 Add 2 to the digits term for the MED sampling rate.
Add 2 to the digits term for a 4 1/2 digits display for the FAST sampling rate.
Add 3 to the digits term for a 4 1/2 digits display for the BURST mode.
Add offset voltage error (cable resistance + 200mΩ) × 1mA.

• Open-circuit voltage : 8.0V max

• Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI - LO	1000 Vpeak
Between LO- chassis	500 V

8.1.8 Ripple voltage measurement (RIPPLE V) (R6552T-R only)

• Effective frequency range (at -3 dB point)
1 Hz to 1 MHz

• Range, maximum display, resolution, and input impedance

Range	maximum display	resolution	input impedance
30 mV	31.99	10 µV	1 MΩ ± 5% 200 pF or less
300 mV	319.9	100 µV	
3000 mV	3199	1 mV	

• Measurement accuracy *1 ±(% of reading + digits) (3 1/2 digits, 1 year, 23°C ± 5°C)
Sampling rate for alternating voltage: SLOW/MED

Frequency range	Range		
	30 mV	300 mV	3000 mV
20 Hz to 45 Hz	0.7+45	0.7+8	0.7+7
45 Hz to 50 kHz	0.5+35	0.5+7	0.5+6
50 kHz to 100 kHz	0.6+35	0.6+7	0.6+6
100 kHz to 300 kHz	1+35	1+7	1+6
300 kHz to 1 MHz	5+45	3+8	3+7

*1 Add one of the following values to the digits term for a 3 1/2 display for the FAST sampling rate (for 100Hz or higher):
For the 30 mV range, add 10.
For the 300mV or 3V range, add 2.

• Filter

Low-pass filter (LPF) and high-pass filter (HPF) can each be set to the following frequencies:

Filter	Setting					Frequency accuracy (at -3 dB point)
	OFF	1	2	3	4	
LPF	1 MHz or higher	1 kHz	10 kHz	100 kHz	1 MHz	± 10%
HPF	1 Hz or lower	1 kHz	10 kHz	100 kHz		

• Maximum allowable applied voltage

Terminal	Maximum allowable applied voltage
Between HI and LO terminals	200 Vpeak, 2000000 V·Hz
Between LO terminal and chassis	200 V

• Sampling rate

Integral time and sampling time change depending upon sampling rate as shown below:

Sampling rate	Integral time	Sampling time
FAST	1 PLC	10 ms
MED	100 ms	100 ms
SLOW	100 ms	1 s

* Set sampling time to one period of a device under test voltage or longer.

8.2 LONG-IT Measurement Error

(1) Input waveform conditions

- A repetitive period of an input signal must coincide with the set LONG-IT integral time.
- Minimum pulse width of an input signal

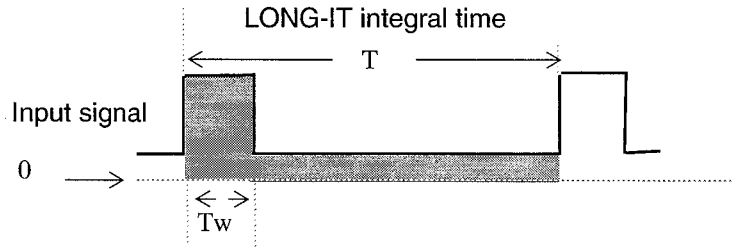
  DC voltage measurement: 2 ms or greater
  DC current measurement: 100 µs or greater
- A peak value of an input signal should not exceed full-scale of a measurement range.

(2) Accuracy

Accuracy = ± (basic accuracy + periodic error)

- Basic accuracy

  DC voltage measurement: DC voltage measurement accuracy for the FAST sampling rate
  DC current measurement: DC current measurement accuracy for the FAST sampling rate
- Periodic error

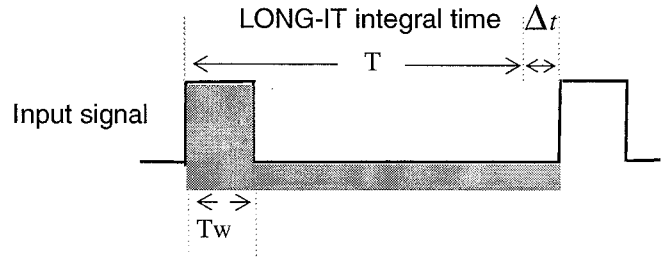


T: LONG-IT integral time
Tw: a peak duration time of an input signal
D: Duty factor of an input pulse (Tw / T)

$$\text{rdg error} = \frac{0.02}{D} \text{ (\% of rdg)}$$

(3) Periodic error (occurred due to a time lag between an input signal and an integral time)

When an input signal does not coincide with the set LONG-IT integral time, the following error is added.



$$\text{rdg error} = \frac{200 * \Delta t/T}{D} \text{ (\% of rdg)}$$

8.3 Measurement Speed

- Measurement speed in Free-run, Calculation Functions off (samples/s)
  The value in brackets is applied when the auto zero function is turned on.
  When in BURST, the auto zero function is automatically turned off.

Measurement Function	FAST	MED	SLOW	BURST	LONG-IT
DC Voltage measurement	100 (50)	20 (10)	5 (2.5)	1000	*1
AC Voltage measurement	100	20	5	–	–
AC Voltage (AC+DC) measurement	20	10	4	–	–
2WΩ measurement	100 (50)	20 (10)	5 (2.5)	1000	–
4WΩ measurement	50	10	2.5	–	–
LP-2WΩ measurement	100 (50)	20 (10)	5 (2.5)	1000	–
LP- 4WΩ measurement	50	10	2.5	–	–
DC Current measurement	100 (50)	20 (10)	5 (2.5)	1000	*1
AC Current measurement	100	20	5	–	–
AC Current (AC+DC) measurement	20	10	4	–	–
Diode measurement	100 (50)	20 (10)	5 (2.5)	–	–
RIPPLE V	20 (10)	3.3 (2.5)	0.8 (0.7)	–	–

*1 Measuring time = (two times the measured integral time) + 200 ms.

8.4 Calculation Functions

- Null Calculation : Subtracts a fixed value from a measurement value.

  Measurement data output = Measurement value - Null constant

- Smoothing Calculation : The moving average is obtained from the measured data for the set number of smoothing operations.

- Comparator : The calculation expressions are given below.

  HIGH = HI setting < Measurement value
  LOW = Measurement value < LOW setting
  PASS = LOW setting $\leq$ Measurement value $\leq$ HI setting

- Scaling Calculation : The calculation equation is given below.

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

- MAX·MIN Calculation : Determines maximum, minimum, and average.

- dB/dBm Calculation : The dB/dBm Calculation is available only for the voltage measurement functions.

  The calculation equations are given below.

$$\text{dB Measurement data output} = 20 \log_{10} \frac{\text{Measurement value}}{\text{Constant D}}$$

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

8.5 Interface Specifications

- GPIB interface

  Either GPIB or RS-232 selectable from the front panel. (RS-232; R6552 only)

Specifications	:	Conforming to IEEE488.2-1987.
Connector	:	24-pin Anphenol
Interface functions	:	SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
Output format	:	Selectable between ASCII and binary. (binary; R6552 only)
Addressing	:	31 kinds of talker/listener addresses specified from the front panel.

- RS-232 interface (R6552 only)

  Either GPIB or RS-232 selectable from the front panel.

Specifications	:	RS-232
Connector	:	Dsub 9-pin
Baudrate	:	9600, 4800, 2400, 1200, 600, 300
Parity	:	Even (EVEN), odd (ODD), Non
Data bit length	:	7 or 8 bits
Stop bit length	:	1 or 2 bits
Echo	:	ON or OFF

- Trigger signal input

Manual	:	Front-panel TRIG key
External	:	Rear-panel TRIGGER connector TTL level, negative pulses, fall edge. Pulse width 1 µs or more
Remote	:	Remote commands E, *TRG

- Measurement end signal output

  Available from the rear-panel BNC connector;
  TTL level, negative pulses, pulse width about 5µs

8.6 General Specifications

- Operating environment : Operating temperature: 0°C to +50°C
  Operating humidity: 85%RH or less
  (75%RH or less for resistance measurement ranges of 30 MΩ, 300 MΩ)
- Storage environment : -25°C to +70°C
- Warm-up time : 60 minutes
- Display : 7-segment vacuum fluorescent display tube, Bar-graph display
- Range selection : Auto and manual
- Input method : Floating
- Measurement method : Integration
- Overload indication : OL
- Input switching : FRONT and REAR.
  Manual switching for the R6552;
  manual and remote switching for the R6552T/T-R.
- Internal data memory capacity : Up to 10,000 records of data (R6552 only)
- Power supply : AC power supply, 100V/120V/220V/240V (user-selectable)

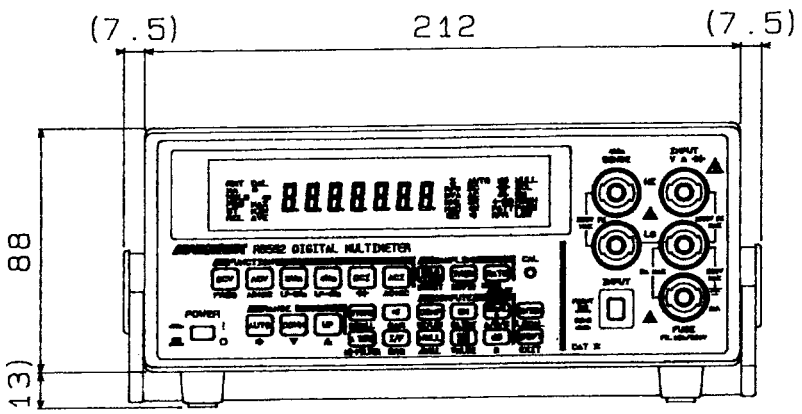
Option number	Standard	32	42	44
Power voltage	100V	120V	220V	240V

- Power line frequency : 50/60Hz
- Power consumption : 27 VA max.
- Dimensions : Approx. 212 (W) x 88 (H) x 350 (D) mm
- Mass : 3.3 kg max.
- Safety : IEC 61010 certified (INSTALLATION CATEGORY II)

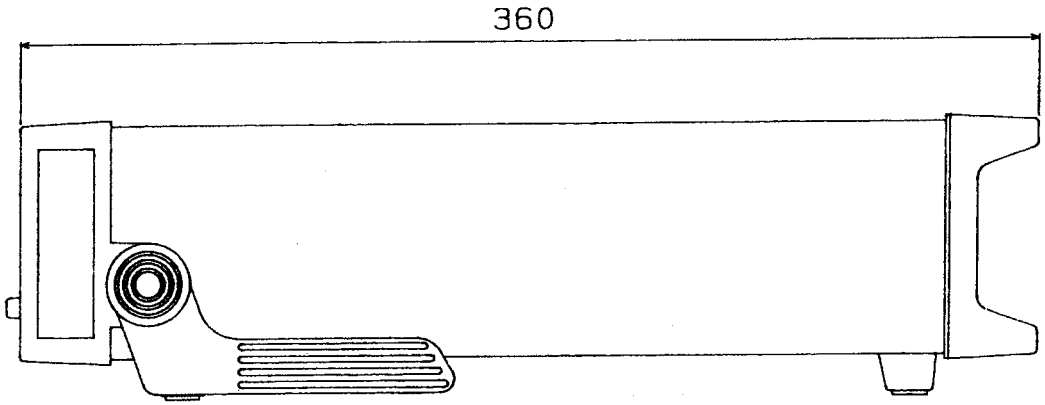
APPENDIX

A.1 Error Messages

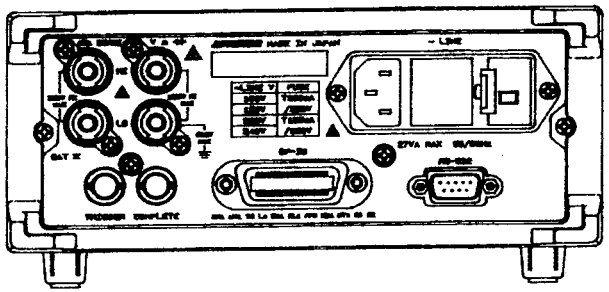
Error code	Description
ERR 01	RAM READ/WRITE error An abnormality is detected in the result of RAM READ/WRITE test executed in the self test mode.
ERR 03	CAL data error An error is detected in the sum check of calibration data.
ERR 04	Program data error An error is detected in the sum check of program data.
ERR 06	Setting parameter error An error is detected in the sum check of setting parameters.
ERR 07	Communication error for analog part An abnormality is detected in the communication check for analog part.
ERR 08	Basic operation error for analog part An abnormality is detected in the A-D converter test of analog part.
ERR 09	Measurement data error for analog part Abnormal conditions are detected in the zero-data input test of an analog section.
ERR 10	Remote control error An error is detected in the receiving, analysis, or execution of the remote command.
ERR 11	Calibration data error An abnormality is detected in the calibration data.
ERR 38	Recall data number error An error is detected in the data number to recalled measurement data from internal memories.
ERR 39	Recall data error An error is detected in the measurement data that try to recall from internal memories. The measurement data was tried to be recalled though no data had been stored in the internal memory.
ERR 40	RS-232 communication error
ERR 90	The measurement has not terminated normally.
ERR d	dB/dBm calculation error The measurement value become zero during the execution of the dB or dBm calculation.



FRONT VIEW



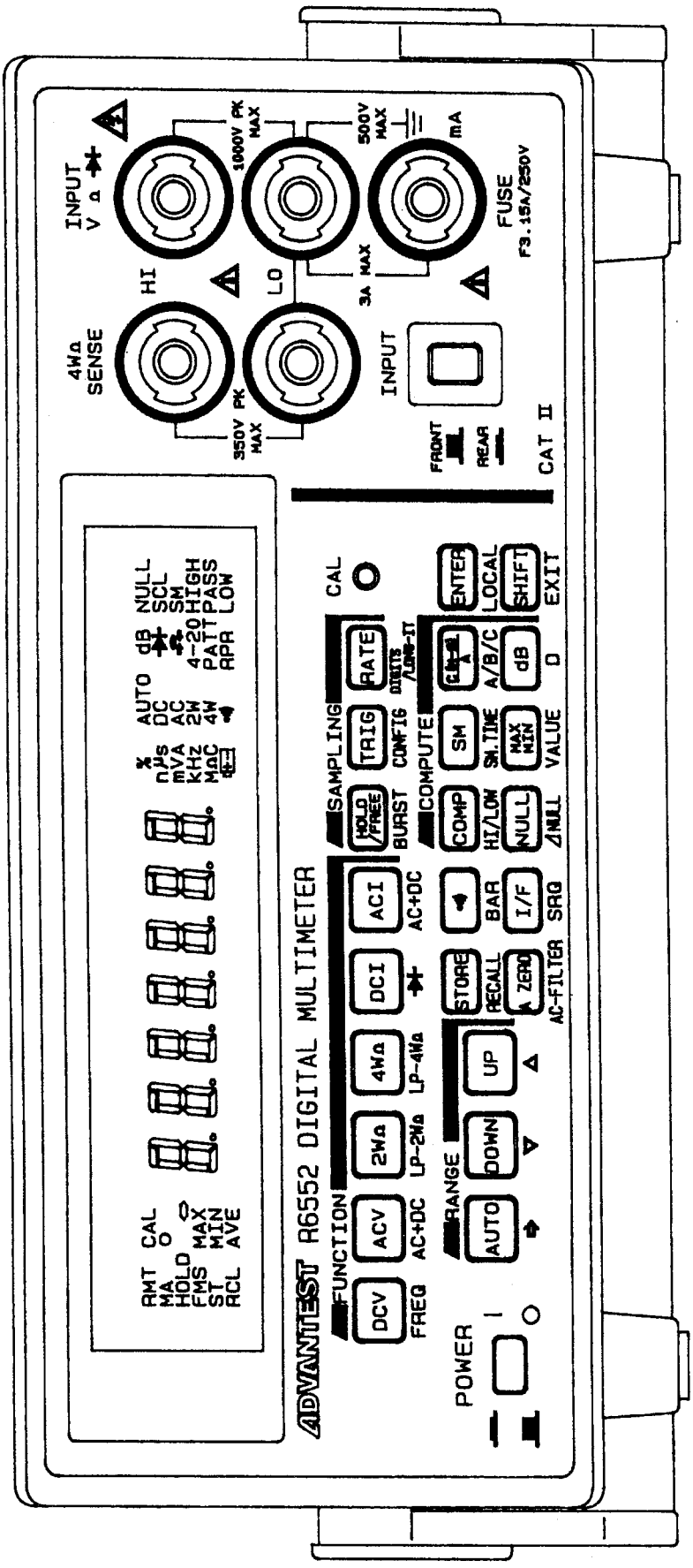
SIDE VIEW



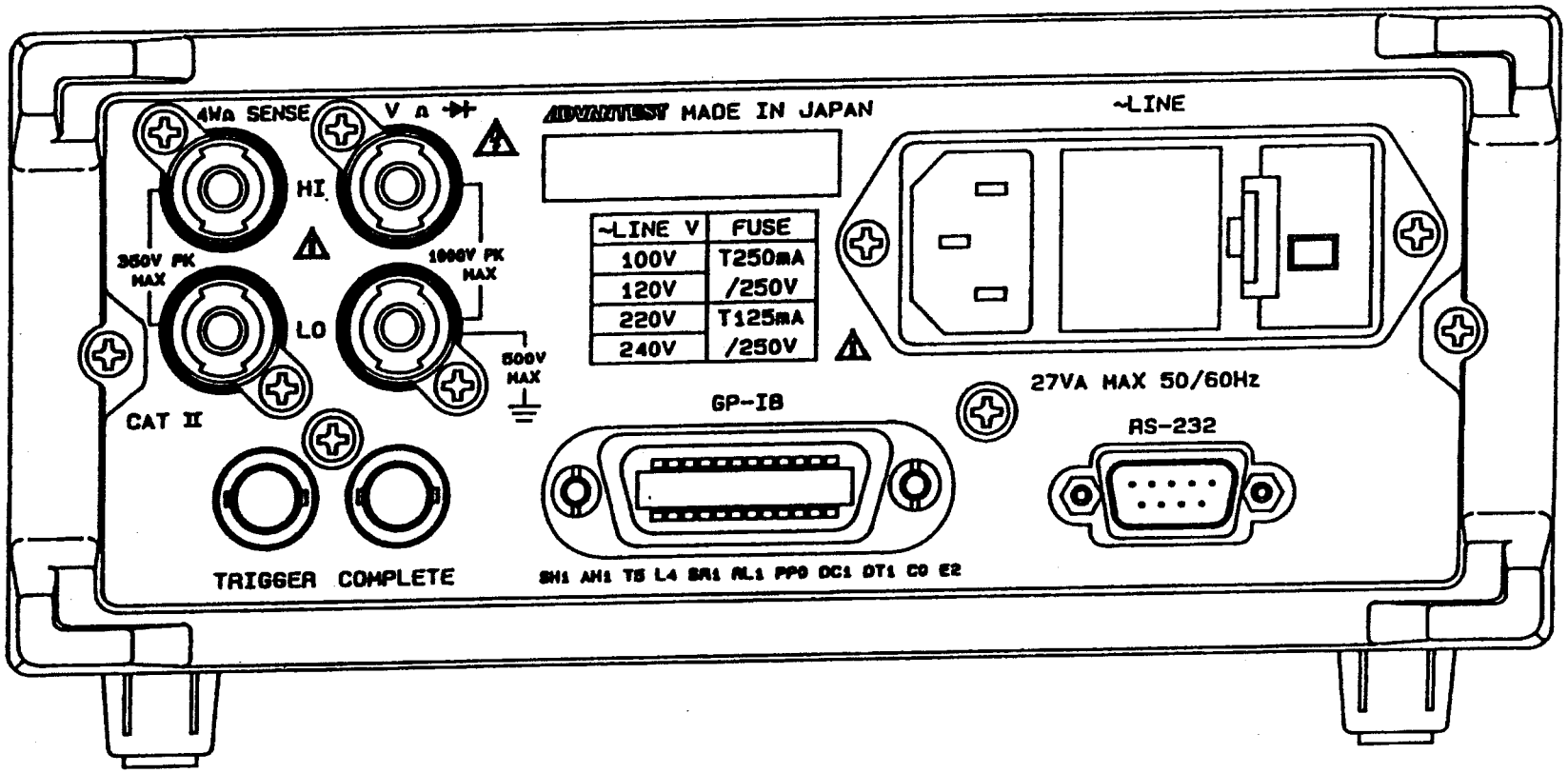
REAR VIEW

Unit : mm

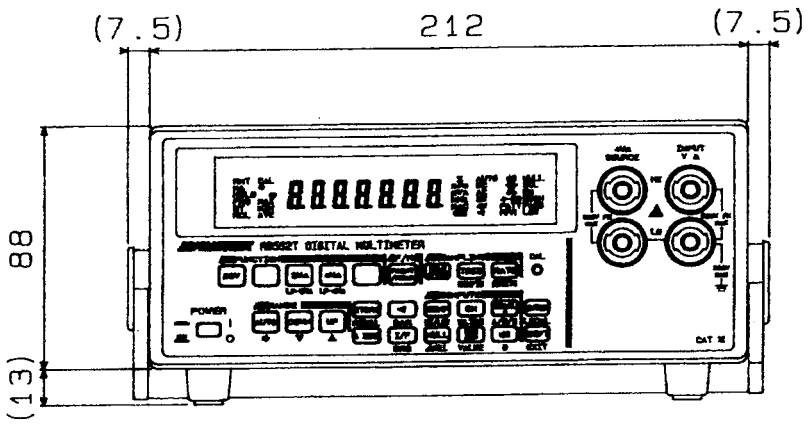
R6552 EXTERNAL VIEW



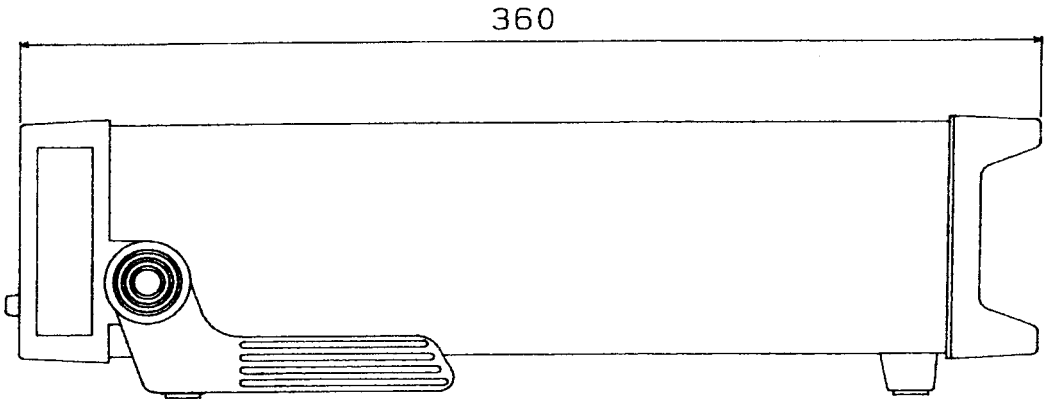
R6552 FRONT VIEW



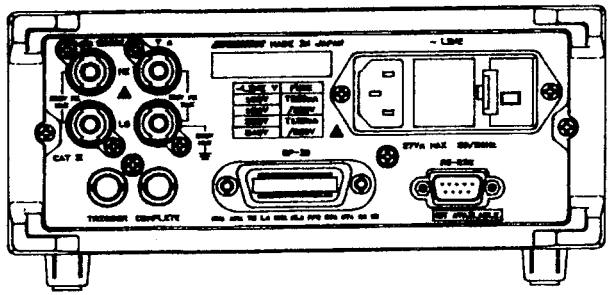
R6552 REAR VIEW



FRONT VIEW



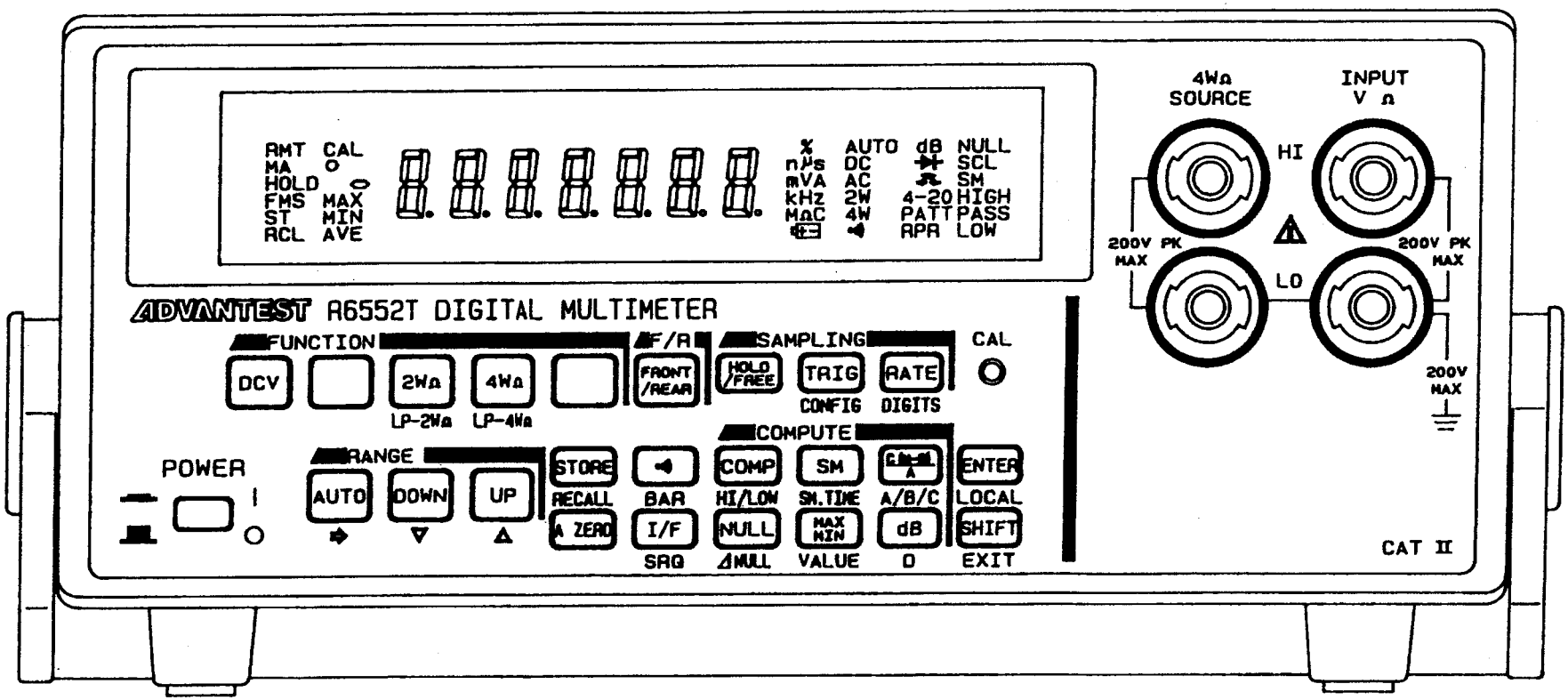
SIDE VIEW



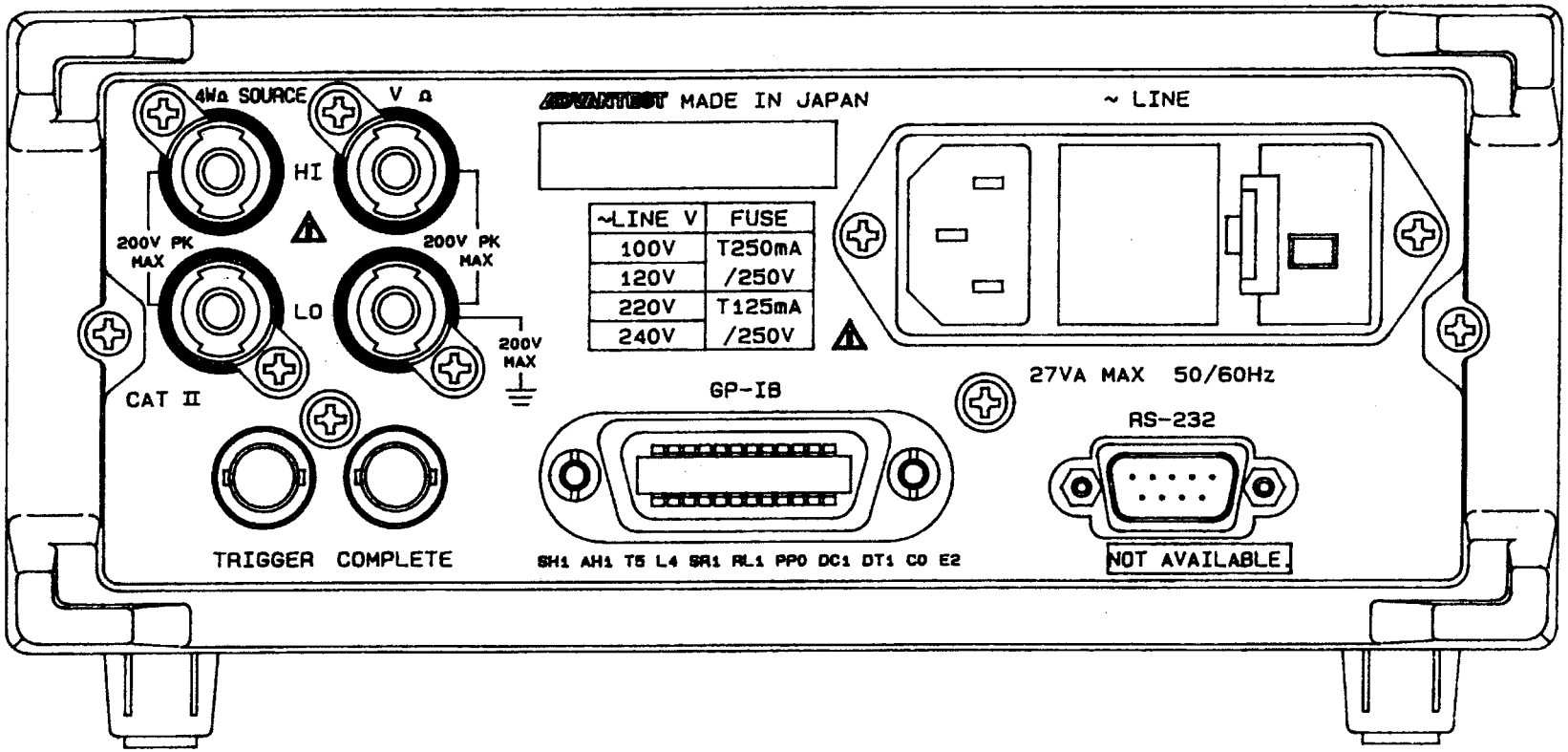
REAR VIEW

Unit : mm

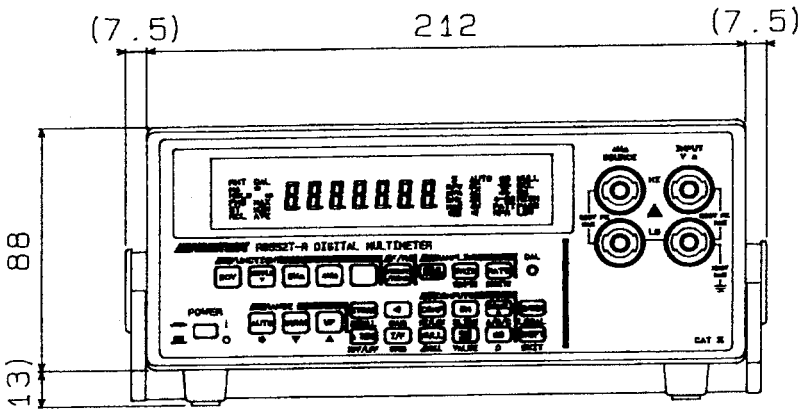
R6552T EXTERNAL VIEW



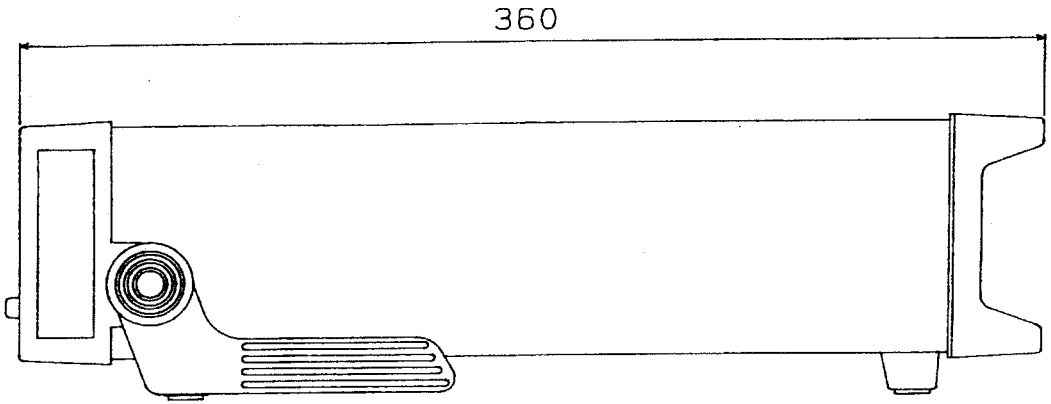
R6552T FRONT VIEW



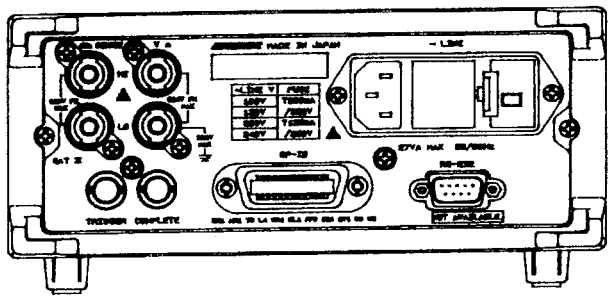
R6552T REAR VIEW



FRONT VIEW



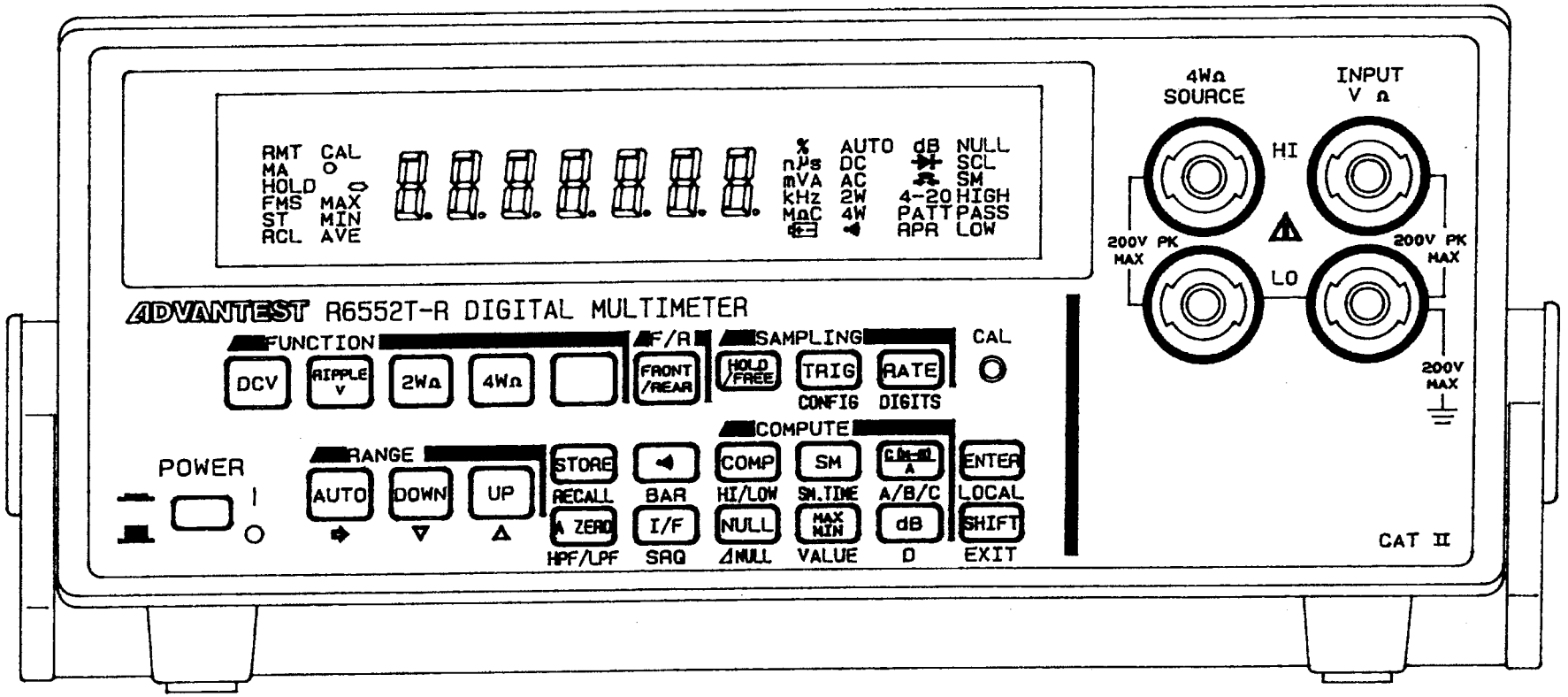
SIDE VIEW



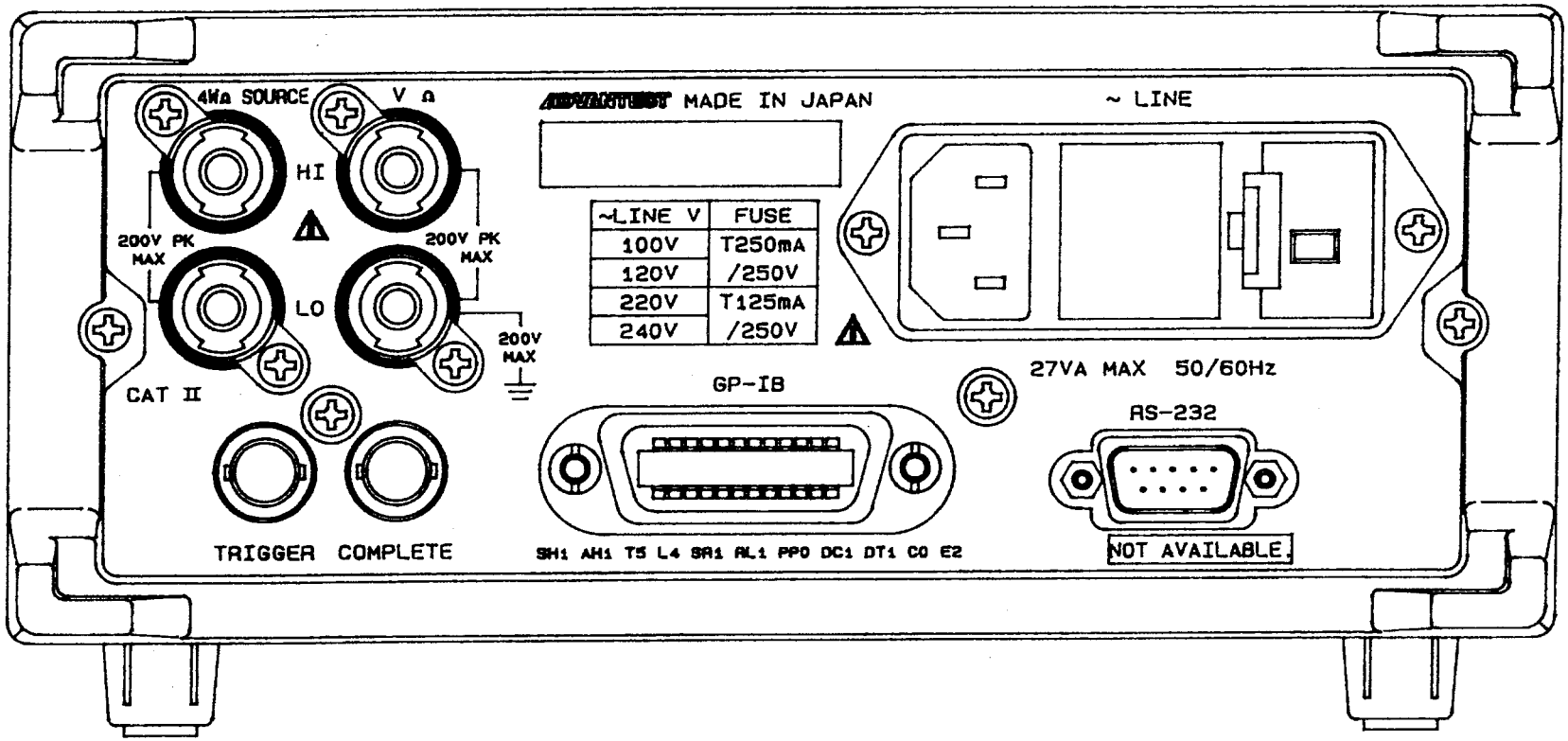
REAR VIEW

Unit : mm

R6552T-R EXTERNAL VIEW



R6552T-R FRONT VIEW



R6552T-R REAR VIEW

ALPHABETICAL INDEX

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