ADVANTEST®

ADVANTEST CORPORATION

R5363

Frequency Counter

Operation Manual

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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 Advantest 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 Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

  Warning labels are applied to Advantest 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 Advantest 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 protected ground 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 Advantest 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 Advantest 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

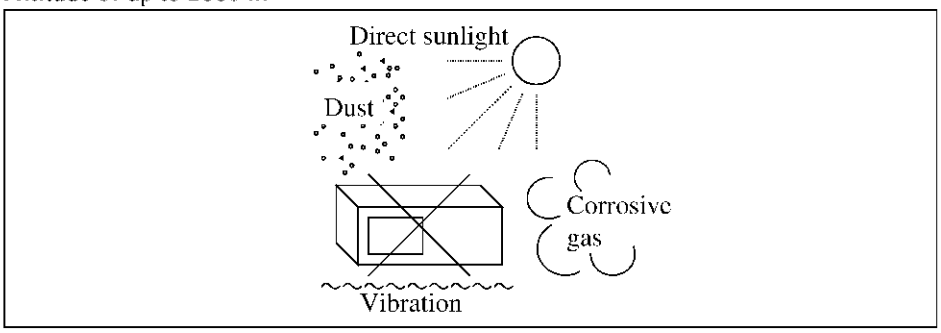


Figure-1 Environmental Conditions

- Operating position

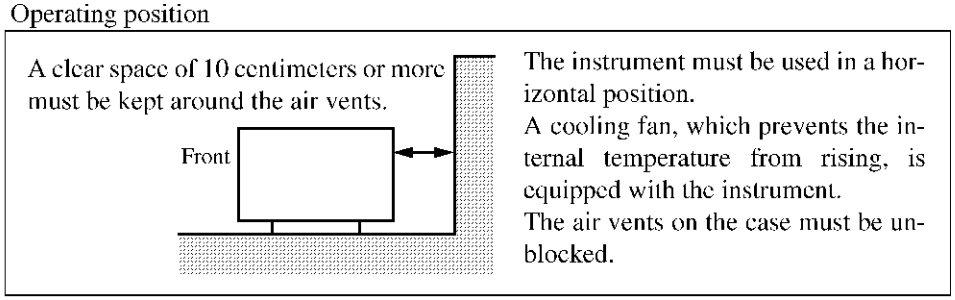


Figure-2 Operating Position

- Storage position

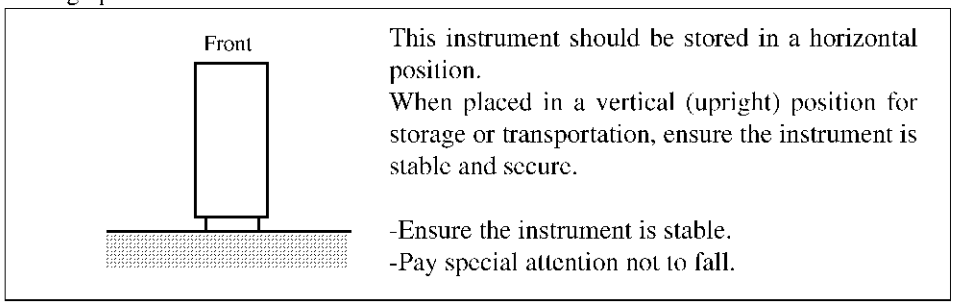


Figure-3 Storage Position

- 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.

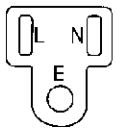
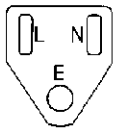
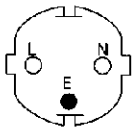
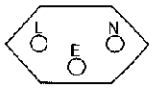
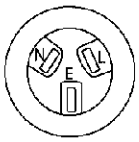
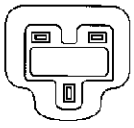
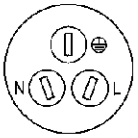
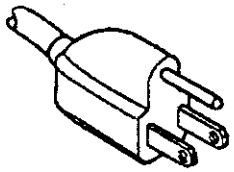
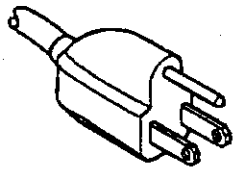
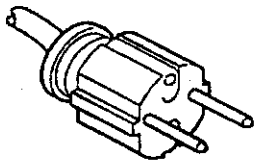
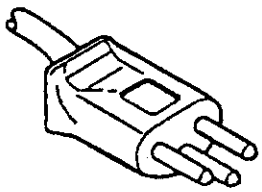
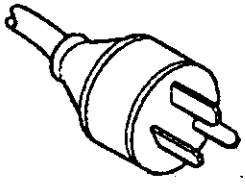
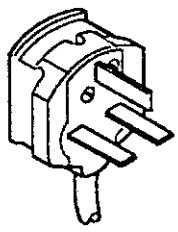
Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) 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

Table of Power Cable options

There are six power cable options (refer to following table).
Order power cable options by Accessory Codes.

	Plug Configuration	Standards	Rationg, Color and Length	Accessory Codes (Option Number)
1		JIS: Japan Law on Electrical Appliances	125V at 7A Black 2m (6ft)	Straight: A01402 (Standard) Angled: A01412
2		UL: United States of America CSA: Canada	125V at 7A Black 2m (6ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe VDE: Germany OVE: Austria SEMKO: Sweden DEMKO: Denmark KEMA: Holland FIMKO: Finland NEMKO: Norway CEBEC: Belgium	250V at 6A Gray 2m (6ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250V at 6A Gray 2m (6ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250V at 6A Gray 2m (6ft)	Straight: A01406 (Option 98) Angled: ------
6		BS: United Kingdom	250V at 6A Black 2m (6ft)	Straight: A01407 (Option 99) Angled: A01417

Safe Use of R5363

1. The instruction manual for R5363 frequency counter (hereafter called an "instrument") explains how to use the instrument and describes its functions, the measurement methods used, and operational and maintenance precautions. Before getting started, be sure to read this manual.

2. The following acronym (abbreviation) are used in this manual:

(1 of 2)

Acronym	Description
(A) AC	ALTERNATING CURRENT
ADJ	ADJUST
ADRS	ADDRESS
ANS	AUTOMATIC NOISE SUPPRESSOR
ATT	ATTENUATOR
AVG	AVERAGE
(B) BRT	BURST
(C) CHK	CHECK
COMP	COMPARISON
CONT	CONTINUE
COUP	COUPLING
(E) ENT	ENTER
EXP	EXPONENT
EXT IN	EXTERNAL INPUT
EXT ST	EXTERNAL START
(I) INSTR PRESET	INSTRUMENT PRESET
INT OUT	INTERNAL OUTPUT
(L) LCL	LOCAL
LPF	LOW PASS FILTER
LSD	LEAST SIGNIFICANT DIGIT
(M) MAX	MAXIMUM
MED	MEDIUM
MIN	MINIMUM

(2 of 2)

Acronym	Description
(O) OFS	OFFSET
(P) P	PERIOD
POLA	POLARITY
(R) RCL	RECALL
RMT	REMOTE
RNG	RANGE
(S) SHF	SHIFT
SLP	SLOPE
STBY	STANDBY
STD	STANDARD
ST/SP	START/STOP
S.R	SAMPLE RATE
(T) TOT	TOTALIZE
TRIG	TRIGGER
T.I	TIME INTERVAL

3. The front panel keys are described in this manual as follows:

Panel Key	Name	Expression
[ENT] LSD	ENT key	[ENT]
	LSD key	[SHF] [ENT] LSD
[COUP] DISP	COUP key	[COUP]
	DISP key	[SHF] [COUP] DISP
[AVG] C.AVG	AVG key	[AVG]
	C.AVG key	[SHF] [AVG] C.AVG

How to Use This Manual

Chapter	Contents
1. GENERAL	Provides an outline and introduces features of instrument and user's options.
2. BEFORE USING THE INSTRUMENT	Describes how to check accessories, environment for use, confirmation and change of power supply, power supply cables, fuses, input cables, and the maximum input voltage and current conditions for measurement terminals. Also, explains precautions for cleaning, transport, and storage.
3. PANEL DESCRIPTIONS	Explains keys, switches, and terminals on both front and rear panels.
4. OPERATION	Describes self test, error messages, basic key operations, and initialization of measurement conditions.
5. MEASUREMENT	Describes various methods of measurement, measurement explanations, and precautions.
6. FUNCTIONS	Explains various functions.
7. CONNECTING VARIOUS INTERFACES	Explains how to use the GPIB, BCD, and DA.
8. OPERATION DESCRIPTION	Describes an easy operation of the instrument.
9. PERFORMANCE TEST	Describes performance test of the instrument.
10. CALIBRATION	Explains the calibration methods of the instrument.
11. PERFORMANCE SPECIFICATIONS	Explains the specifications of the instrument.
APPENDIX	Explains the technical terms and level conversion table.

TABLE OF CONTENTS

1. GENERAL

1.1 Outline of Product

R5363 is the high-speed frequency counter which not only removes the conventional measurement pause time using a new function of continuous measurement, in addition to the measurement for each of frequency, cycle, pulse width, and integrating count, but also allows the continuous measurement for up to 14,000 pieces of data. Also, it allows the high resolution measurement for burst wave measurement using the averaging measurement.

With the ADVANTEST's original technique for measuring a fraction part as well as the Reciprocal Method, the measurement uses the reference clock of 100ns whose fraction can be magnified to a maximum of 1,000 times. It allows the same result to be obtained as obtained when the measurement uses 100ps clock, thus enabling the high resolution measurement with 10-digit display per second.

The instrument is used for versatile analyses and enables measurement results to be processed for final data display with OK/NG decision, PPM display, statistics computing, and other computing functions.

In addition, to ensure automated measurement, it employs the GPIB interface as standard so that the front panel can be controlled from external devices. Its optional accessories include the BCD output unit (R13017) and DA output unit (R13018).

The other features of the instrument are:

- Low radiation design using EMI technique
- Power drive with direct/alternating current and battery drive (using the battery pack "TR15801A/B")
- SAVE/RECALL functions for front panel setting condition

1.2 Accessories

The units which are used to built into the instrument are shown below:

Unit	Model name	Remarks
BCD output unit*	R13017	BCD output unit
D/A output unit*	R13018	Enables to output 4-digit D/A.
Battery pack	TR15801A	Uses a lead-acid battery.
	TR15801B	Uses an Ni-cd battery.

*: Only one unit can be used for the instrument. Select any one of units.

2. BEFORE USING THE INSTRUMENT

2.1 External Appearance and Accessory Check

On receiving the instrument, check it for any shipping damages. Next, check that the model name and the quantity of standard accessories are shown in Table 2-1.
If any crack or damage is found or if any of the standard accessories is missing, contact your nearest dealer, or sales and support offices.
The addresses and telephone numbers are listed at the end of this manual.

Note : When ordering additional accessories, use the type names.

Table 2-1 Standard Accessories

Name	Type name	Quantity	Remarks
Input cable	A01036-1500	1	50Ω BNC cable 1.5m
DC power cable	MI-71	1	
AC power cable	*1	1	
DC power fuse	TMF51NR5(250)	1	
AC power fuse	218001	1	For 100V
	218.500		For 200V
N-BNC conversion adapter	JUG-201A/U	1	
Instruction manual	JR5363	1	Japanese manual
	ER5363		English manual

*1 ADVANTEST provides the power cables for each country.

2.2 Ambient Conditions

(1) Location

① Do not use the instrument in these places:

- Dusty places or those where there is much vibration
- Places exposed to direct sunlight
- Poorly ventilated places
- Places subjected to corrosive or inflammable gases, or steam

② Use the instrument under the following conditions:

- Ambient temperature: 0°C to 50°C
- Humidity: Less than 90%
- Not to give the instrument much vibration or an excessive mechanical shock.
- Setting of the power supply voltage on the rear panel of the instrument is consistent with the commercial supply power voltage to be used.
- Correct fuse must be installed.

(2) Noise reduction

Although the instrument is designed to take account of AC power supply line noise, it should be used under conditions where as little noise as possible will be generated.
If noise cannot be avoided, use noise filters.

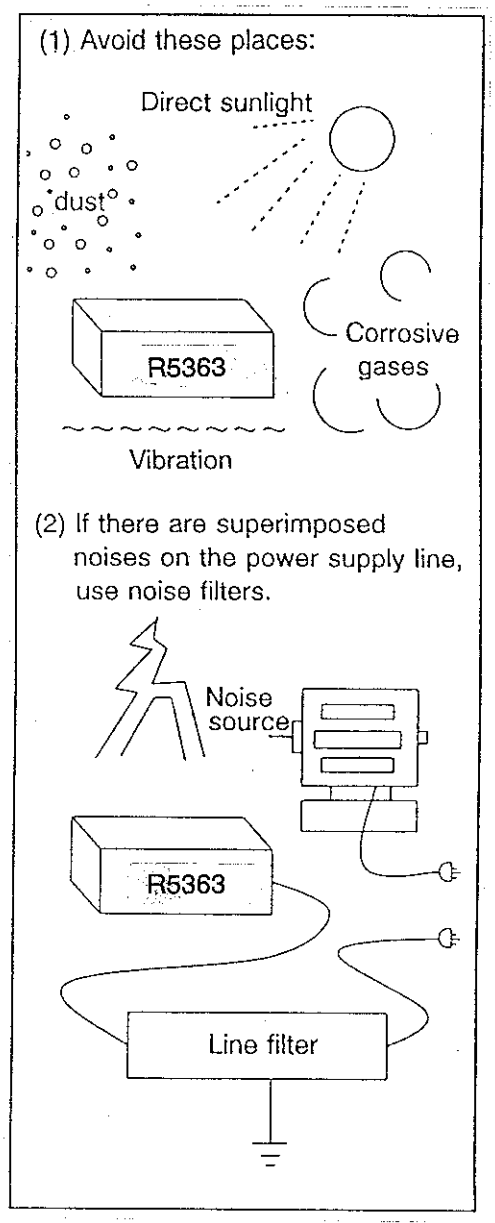


Figure 2-1 Ambient Conditions

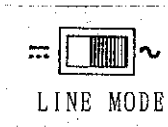
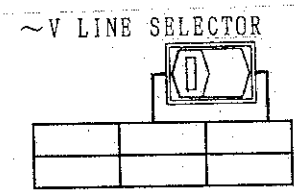
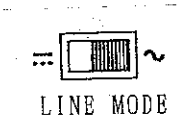
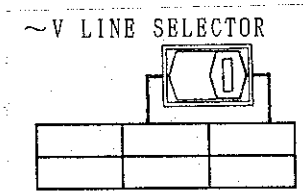
2.3 Before Powering ON

2.3.1 Confirmation and Setting of Power Supply Voltage

(1) Confirmation and Setting of AC Power Supply Voltage

Check that the setting of the power supply voltage on the rear panel of the instrument is consistent with the commercial supply power voltage to be used.

Table 2-2 Commercial Supply Power Voltage vs Power Supply Voltage Setting Display of Counter (on rear panel)

Commercial power supply voltage	Setting of LINE MODE	Power supply voltage setting display of instrument and setting of V LINE SELECTOR	Applicable fuses
100V to 120V			218001 T1.0A/250V
200V to 240V			218.500 T0.5A/250V

(2) Confirmation and setting of DC power supply voltage

The range of DC power supply voltage is + 10V to + 30V.
Check that the setting of the power supply voltage on the rear panel is as shown in Table 2-3.

Table 2-3 DC Power Supply Voltage vs Voltage Display (on rear panel)

DC power supply voltage	Setting of LINE MODE	Voltage display of instrument	Applicable fuses
+10V to +30V	⎓ ~ LINE MODE	+ 10V to + 30V	TMF51NR5(250) 5.0A/250V

(3) Changing power supply voltage

If the power supply voltage setting of the instrument is different from the commercial power supply voltage to be used, or if DC power supply is to be used, change the setting on the rear panel as follows:

CAUTION

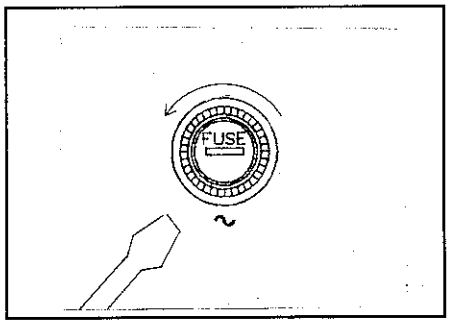
If the power supply voltage setting is changed or if a fuse is replaced for either case of AC and DC drive settings, be sure to remove the power cable from the instrument before the change or replacement. Setting the POWER switch to STBY will not isolate the fuse from the power supply line.

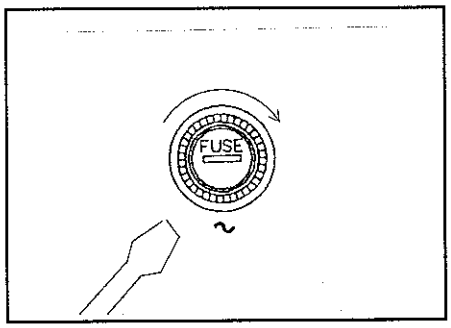
① Setting LINE MODE

Set the drive power supply.

Drive power supply	Setting of LINE MODE
AC power supply drive	⎓ ▮ ~
DC power supply drive	⎓ ▮ ~

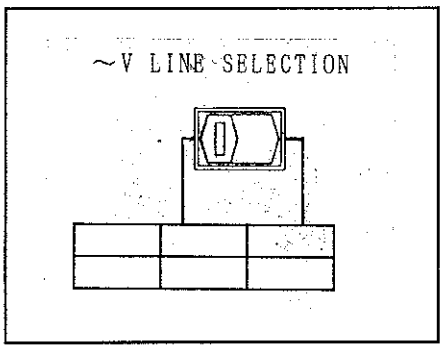
② Replacing power fuse





- Set a minus screw driver in the groove of the fuse holder and turn it counterclockwise by approx. 45 degree while softly pushing it.
  Release the screwdriver from the holder.
- The rotation part will protrude toward you by approx. 3mm.
- Pull out the rotation part and replace the mounted fuse with a new one attached. For the information on applicable fuses, refer to Table 2-2.
- To mount the rotation part, insert it and turn it clockwise by approx. 45 degree while pushing it.

③ Selecting power selection switch (V LINE SELECTION)
(Only for AC power drive setting)



- Set a minus screwdriver in the groove of the power selection switch and move the lever to the power supply voltage setting to be used. (See Table 2-2.)

2.3.2 Power Cable

CAUTION

1. If the instrument is driven with the commercial power or DC power:
   Be sure to use the power cable attached. The range of the commercial power to be used is 100V to 120V and 48Hz to 440Hz.
   (A voltage of 200V to 240V is available depending on the specification.)
2. Before connecting the power cable, make sure that the POWER switch is set to STBY ■ .
3. Before incorporating various kinds of accessory units, remove the power cable and input cable.
4. The instrument should be grounded.

- Power Plug Cables (used in Japan only)
  Power plug cables (standard) conforms to industry standards.
  A three-pin power connector is insufficient for Japan, so a 3-pin-to-2-pin adapter is provided. Is is extremely important when using this adapter for connection to a power outlet to ground the ground pin extending from the adapter, or the grounding terminal on this instrument's rear panel.
  The adapter's pins have different widths. When inserting the adapter in the receptacle, be sure to orient it properly.
  If the adapter (standard) will not into the receptacle, use the optional adapter KPR-13.

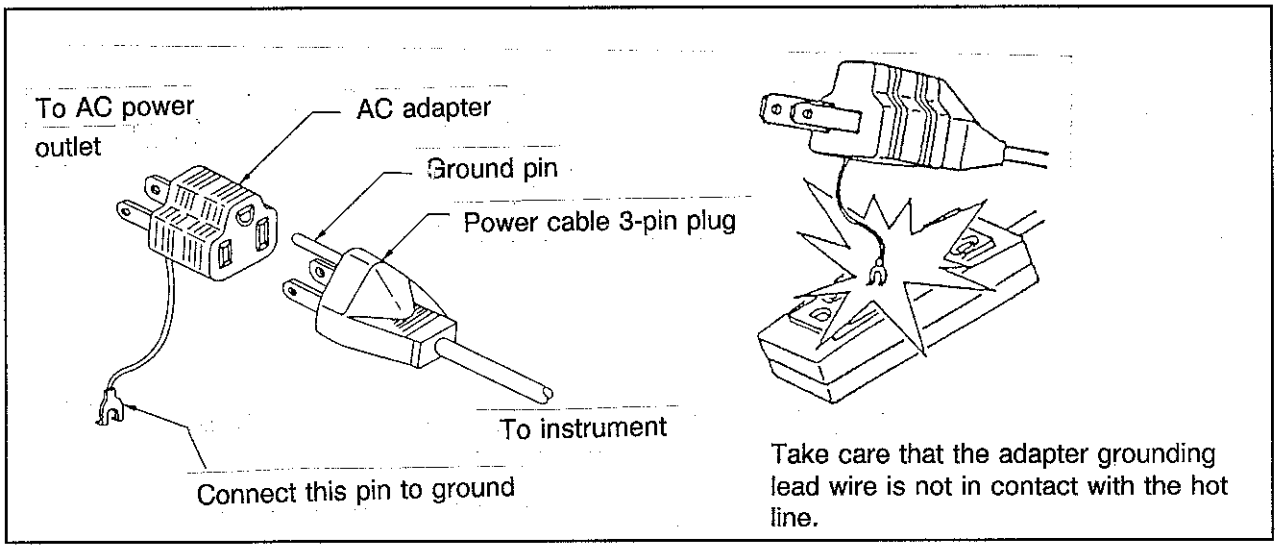
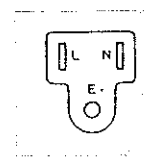
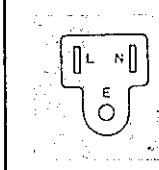
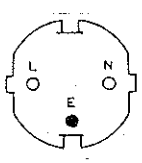
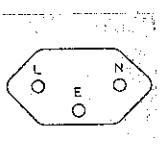
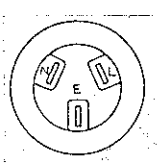
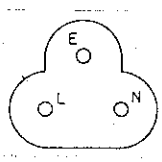


Figure 2-2 Power Cable

- Power Plugs for use outside Japan
  The following types of plugs are available. Consult us if other types of plugs are required.

Table 2-4 Power Plugs for Use outside Japan

Straight type	A01402 (Standard)	A01403 (Opt.95)	A01404 (Opt.96)	A01405 (Opt.97)	A01406 (Opt.98)	A01408
Angle type	A01412	A01413	A01414	A01415	-	-
Applicable Standards	JIS: Japan Law on Electrical Appliances	UL: US CSA: Canada	*	SEV: Switzerland	SAA: Australia New Zealand	
Rating and Color	125 V/7 A, black, 2m	125 V/7 A, black, 2m	250 V/6A, grey, 2m	250 V/6A, grey, 2m	250 V/6A, grey, 2m	250 / 6A
Plug						

CCE: Europe; VED: W. Germany; OVE: Australia; SEMKO: Sweden; DEMKO: Denmark; KEMA: Holland; FIMKO: Finland; NEMKO: Norway; CEBEC: Belgium

2.3.3 Fuses

The instrument uses two types of fuses: for AC power and DC power.

Replacement procedure for power fuse

① Set POWER switch to STBY ■ .

② Remove the power cable.

③ Replace the fuse with a fuse with the same specifications (see Table 2-2).

WARNING

1. For protection against fire occurrence, use fuses with the same type and rating for replacement.
2. Any fuse inconsistent with the specifications may damage the counter.
3. The visual inspection cannot ensure the performance of each fuse.
   Measure the resistance of each fuse and check it does not exceed 15Ω.

2.3.4 Mechanical Shock

Since the instrument uses a quartz oscillator, pay special attention not to give it an excessive mechanical shock.

2.3.5 STBY

When the plug of the instrument is inserted into the outlet and OVEN switch on the rear panel is set to ON, the reference oscillating circuit operates and the instrument is set to the standby (STBY) state.

2.3.6 Warming up

For satisfactory measurement accuracy, warm up the instrument for more than 30 minutes.

2.3.7 Input Cable

Use the MI-02 cable as the input cable of the counter.

CAUTION

MI-02 cable is a shielded cable. Do not cut it out carelessly.

2.3.8 Cooling Fan

If the FAN lamp (red LED) is lit on the front panel of the instrument after the completion of the POWER-ON self test, contact ATCE.

2.4 Cleaning, Storage, and Transportation

(1) Cleaning

Use a silicon cloth or other cloth to clean the instrument.

Note : For maintenance or cleaning, do not use a solvent that will deteriorate plastics (such as benzene, acetone, or other organic solvents).

(2) Transportation

Use the original packing materials for transportation. If the original materials are lost, pack the instrument as follows:

① Pack the instrument in a vinyl sheet.

② Use a corrugated cardboard box at least 5mm thick and insert the instrument into the box using a packing material for cushioning.

③ After packing the instrument, insert the accessories, then insert more cushioning material again. Then seal the box and secure it using packing strings.

(3) Storage

If the instrument is not t be used for a long time, cover it with a vinyl sheet or place it in a corrugated cardboard box and store it in a place with no humidity and away from direct sunlight.

Storage conditions: -20°C to +70°C

2.5 Precautions when Instrument is Discarded

(1) Never disassemble the instrument.
The instrument uses a lithium battery as a RAM backup power supply.

(2) Contact ADVANTEST when discarding the instrument.
(Refer to the end of this manual for our address and other information.)

3. PANEL DESCRIPTIONS

3.1 Description of Front Panel

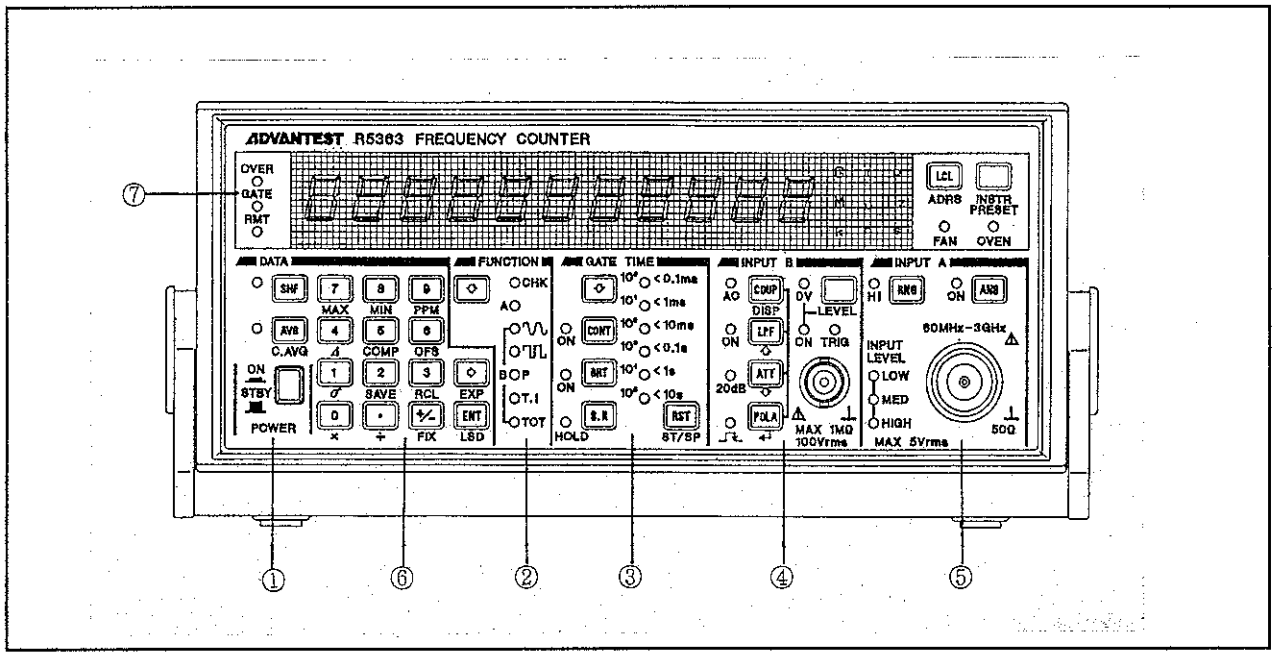


Figure 3-1 Front Panel

No.	Names	Descriptions
①	POWER switch	Connects/disconnects the secondary voltage of the power transformer.
②	FUNCTION block	Selects and sets various kinds of measurement functions.
③	GATE TIME block	• Sets GATE time and magnification. • Sets continuous measurement. • Sets burst wave measurement. • Sets sample rate (switch used to control the measurement repetition speed). • Performs manual reset.
④	INPUT B block	Is the input part for measuring FUNCTION block B.
⑤	INPUT A block	Is the input part for measuring FUNCTION block A.
⑥	DATA block	Selects and sets various kinds of computing modes.
⑦	DISPLAY block	Displays the measurement results or the instrument states.

(1) POWER switch

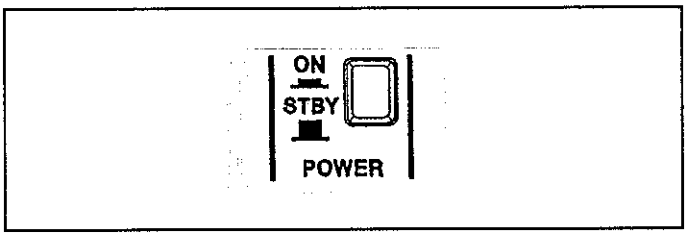


Figure 3-2 POWER switch

The power switch is used to connect/disconnect the secondary voltage of the power transformer. When the switch is pressed, the instrument will be powered ON and all the circuits will operate. Pressing it again will set the instrument to STBY state.
If the OVEN switch is set to ON on the rear panel when the instrument is in STBY state, power is supplied to the oscillating circuit, 10MHz circuit, and constant temperature oven heater and the OVEN lamp is lit on DISPLAY block.

(2) FUNCTION block

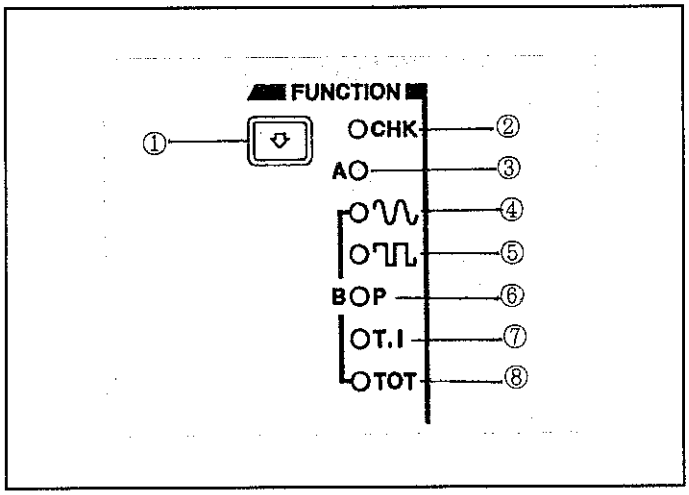


Figure 3-3 FUNCTION Block

No.	Names	Descriptions
①	⇩ key	Selects and sets the measurement function. The selected function is indicated by the lit-up lamp.
②	CHK	Selects CHECK.
③	A	Selects the frequency measurement function for a frequency of 60MHz to 3GHz.

(Cont'd)

No.	Names	Descriptions
④	B ∿	Selects the frequency (sine wave) measurement function for a frequency of 0.2mHz to 100MHz.
⑤	B ⊓	Selects the frequency (rectangular wave) measurement function for a frequency of 0.2mHz to 100MHz.
⑥	B P	Selects the cycle measurement function for a cycle of 10ns to 5000s.
⑦	B T.I	Selects the pulse width measurement function for a pulse of 200ns to 79s (magnification : 10^0).
⑧	B TOT	DC - 50MHz: Selects the integrating count function for up to 9999999999.

(3) GATE TIME block

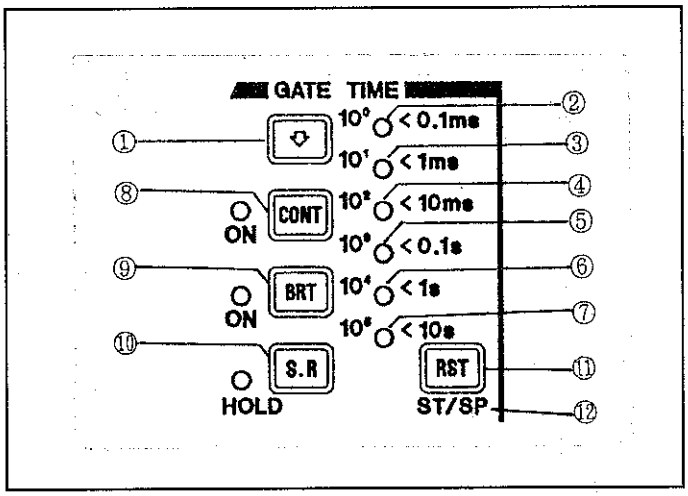


Figure 3-4 GATE TIME Block

No.	Names	Descriptions
①	⇩ key	Selects and sets the GATE time and magnification. The selected GATE time and magnification are indicated by the lit-up lamp. (If FUNCTION block selects T.I, the key is used for magnification. If it selects TOT, it is not necessary to operate the key.)

(Cont'd)

No.	Names	Descriptions
②	< 0.1ms 10^0	Sets the GATE time to any value from 10μs to 90μs. Sets the magnification to 10^0.
③	< 1ms 10^1	Sets the GATE time to any value from 90μs to 900μs. Sets the magnification to 10^1.
④	< 10ms 10^2	Sets the GATE time to any value from 900μs to 9ms. Sets the magnification to 10^2.
⑤	< 0.1s 10^3	Sets the GATE time to any value from 9ms to 90ms. Sets the magnification to 10^3.
⑥	< 1s 10^4	Sets the GATE time to any value from 90ms to 900ms. Sets the magnification to 10^4.
⑦	< 10s 10^5	Sets the GATE time to any value from 900ms to 9s. Sets the magnification to 10^5.
⑧	CONT key	Selects the continuous measurement.
⑨	BRT key	Selects the burst wave measurement.
⑩	S.R key	Controls the measurement repetition time. Each time the key is pressed, the time changes in five stages as follows: Approx. 10ms → approx. 80ms → approx. 320ms → approx. 2.5s → ∞ (infinity) HOLD lamp will be lit up indicating infinity.
⑪	RST key	Is a manual reset key. (Available only when FUNCTION block selects other settings than TOT.)
	ST/SP key [RST]	Is a start/stop key.

(4) INPUT B block

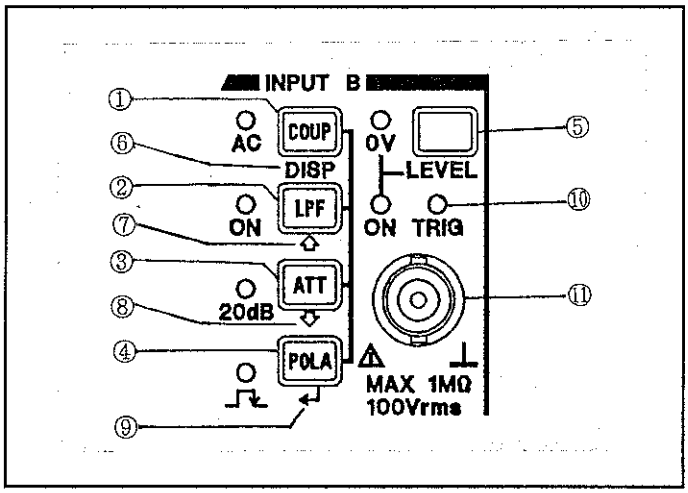


Figure 3-5 INPUT B Block

No.	Names	Descriptions
①	COUP key	Is used to switch the input connection mode. When the lamp is lit: AC connection When the lamp is not lit: DC connection
②	LPF key	Is used to switch ON/OFF of lowpass filter and count method. When the lamp is lit: The lowpass filter is set to ON and the upper limit of the measurement frequency bandwidth is limited to 10kHz.
③	ATT key	Is used to switch 0dB/20dB of the attenuator. When the lamp is lit: The attenuator is set to ON and 20dB resistance attenuator is incorporated into the counter.
④	POLA key	Is used to switch rise/fall of the trigger slope. When the lamp is not lit: Triggered at rise slope. When the lamp is lit: Triggered at fall slope.
⑤	LEVEL key	Is used to switch 0V/ON of the trigger level. When 0V lamp is lit: The trigger level is set to approx. 0V. When ON lamp is lit: The trigger level is set to the preset value.
⑥	DISP key [SHF + COUP]	Is used to enter the trigger level setting mode. It is available only when LEVEL key ⑤ is set to ON.

(Cont'd)

No.	Names	Descriptions
⑦	⇧ key [LPF]	Changes the trigger level toward + at an increment of 10mV. It is available only when the trigger level setting mode ⑥ has been entered.
⑧	⇩ key [ATT]	Changes the trigger level toward - at an increment of 10mV. It is available only when the trigger level setting mode ⑥ has been entered.
⑨	↵ key [POLA]	Makes the trigger level setting valid. It is available only when the trigger level setting mode ⑥ has been entered.
⑩	TRIG lamp	Is lit when the internal wave formation circuit is operating.
⑪	INPUT B input connector (BNC type)	Is a high-input-impedance input connector to be used for FUNCTION block B setting.

(5) INPUT A block

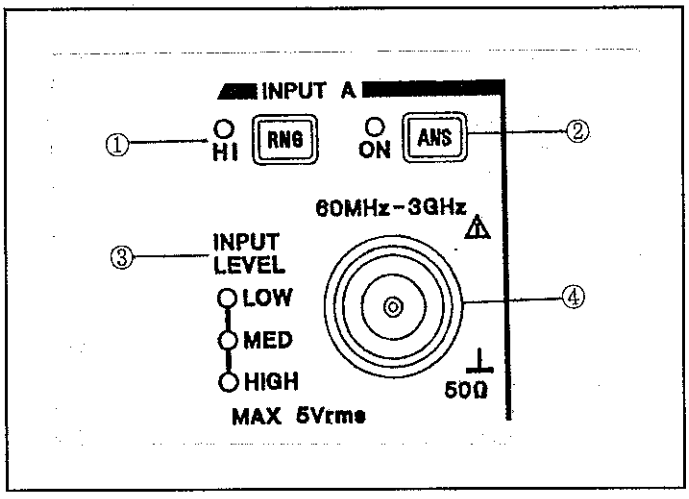


Figure 3-6 INPUT A Block

No.	Names	Descriptions
①	RNG key	Changes LOW/HIGH of the frequency range. When the lamp is not lit: A low frequency from 60MHz to 1500MHz is measured at a low range. When the lamp is lit: A high frequency from 1500MHz to 3000MHz is measured at a high range.
②	ANS key	Changes ON/OFF of AND function. When the lamp is lit: The instrument is set to ON and ANS function operates.
③	INPUT LEVEL lamp	Monitors the signal level which is entered from INPUT A connector.
④	Input connector (N type)	Is an input connector used for FUNCTION block A setting.

(6) DATA block

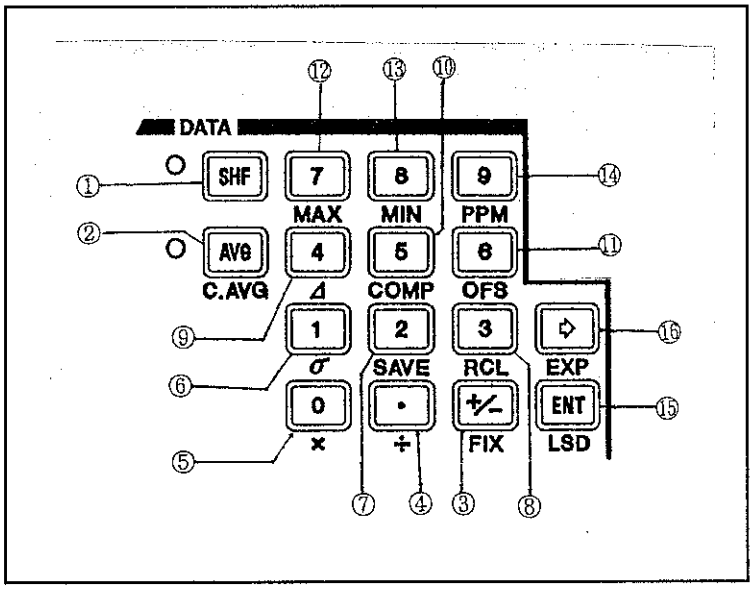


Figure 3-7 DATA block

No.	Names	Descriptions
①	SHF key	Sets all block keys to the shift mode.
②	AVG key	Sets the statistics computing function.
	C.AVG key [SHF + AVG]	Displays the average value when CONT key of GATE TIME block is set to ON (continuous measurement is available).
③	+/- key	Is a symbol setting key to set numeric value data.
	FIX key [SHF + +/-]	Displays a value with fixed point.
④	. key	Is a decimal point setting key to set numeric value data.
	÷ key [SHF + .]	Displays a value obtained by dividing the measurement value by a preset data.
⑤	0 key	Sets numeric value data.
	× key [SHF + 0]	Displays a value obtained by multiplying the measurement value by a preset data.
⑥	1 key	Sets numeric value data.
	σ key [SHF + 1]	Displays a standard deviation.
⑦	2 key	Sets numeric value data.
	SAVE key [SHF + 2]	Stores the front panel settings into the built-in memory.
⑧	3 key	Sets numeric value data.
	RCL key [SHF + 3]	Calls the settings stored in the built-in memory.
⑨	4 key	Sets numeric value data.
	Δ key [SHF + 4]	Displays the maximum or minimum value.
⑩	5 key	Sets numeric value data.
	COMP key [SHF + 5]	Sets the comparator function display (comparison between measurement value and setting value).

(Cont'd)

No.	Names	Descriptions
⑪	6 key	Sets numeric value data.
	OFS key [SHF + 6]	Sets the offset function display (addition/subtraction of measurement value to/from constant).
⑫	7 key	Sets numeric value data.
	MAX key [SHF + 7]	Sets MAX value display (maximum value of measurement values).
⑬	8 key	Sets numeric value data.
	MIN key [SHF + 8]	Sets MIN value display (minimum value of measurement values).
⑭	9 key	Sets numeric value data.
	PPM key [SHF + 9]	Sets PPM display which displays a measurement value in a deviation parts per million based on the reference value.
⑮	ENT key	Sets numeric value data.
	LSD key [SHF + ENT]	Sets LSD function display (one digit is added to the lowest digit position).
⑯	⇨ key	Sets numeric value data.
	EXP key [SHF + ⇨]	Distinguishes the fixed-point part from the exponent part for numeric data setting.

(7) DISPLAY block

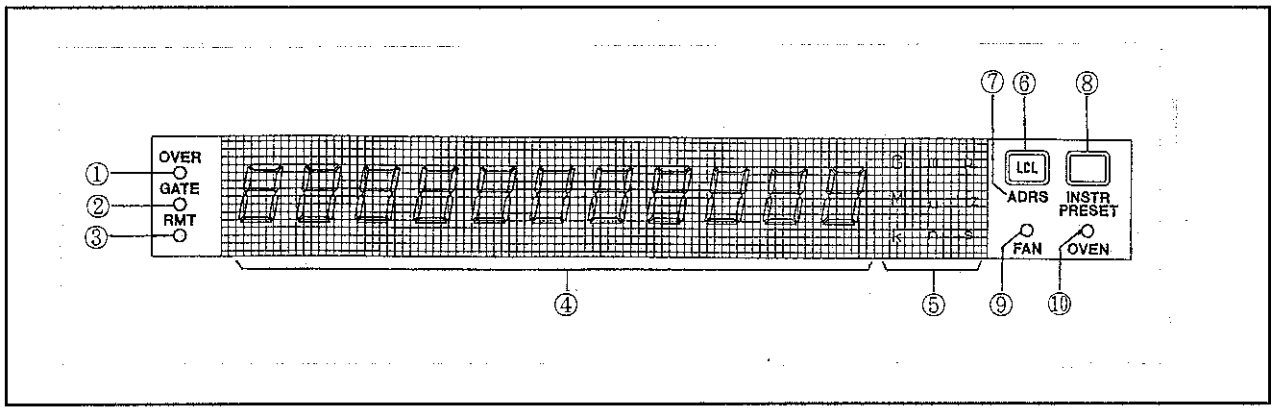


Figure 3-8 DISPLAY block

No.	Names	Descriptions
①	OVER lamp	Is lit when the measurement result exceeds the number of digits displayed.
②	GATE lamp	Is lit during GATE time. For other settings than FUNCTION block and TOT, it is not lit unless the input level of the measured signal exceeds the count level.
③	RMT lamp	Is lit when each function on the front panel is remotely set using the GPIB interface.
④	7-segment LED (green) 11 digits	Displays a numeric part of the measurement result. The lowest digit of the display shows the function selected from various kinds of computing functions of DATA block.
⑤	Unit lamp	Displays the unit of the measurement result.
⑥	LCL key	Is used to exit the remote-control condition when the instrument is in that condition (when RMT lamp ③ is lit).
⑦	ADRS key	Displays the address value of the instrument on the green 7-segment LED ④ when the instrument is in the local condition (when RMT lamp ③ is not lit). Also, it is used to enter the setting mode for address setting ON/OFF, TALK ONLY ON/OFF, and header ON/OFF.
⑧	INSTR PRESET	Initializes the counter.
⑨	FAN lamp (red)	Is lit when the cooling fan stops in the counter.
⑩	OVEN lamp	Is lit when OVEN ON/OFF selection switch is set to ON on the rear panel of the counter. It also be lit when POWER switch is set to ON.

3.2 Description of Rear Panel

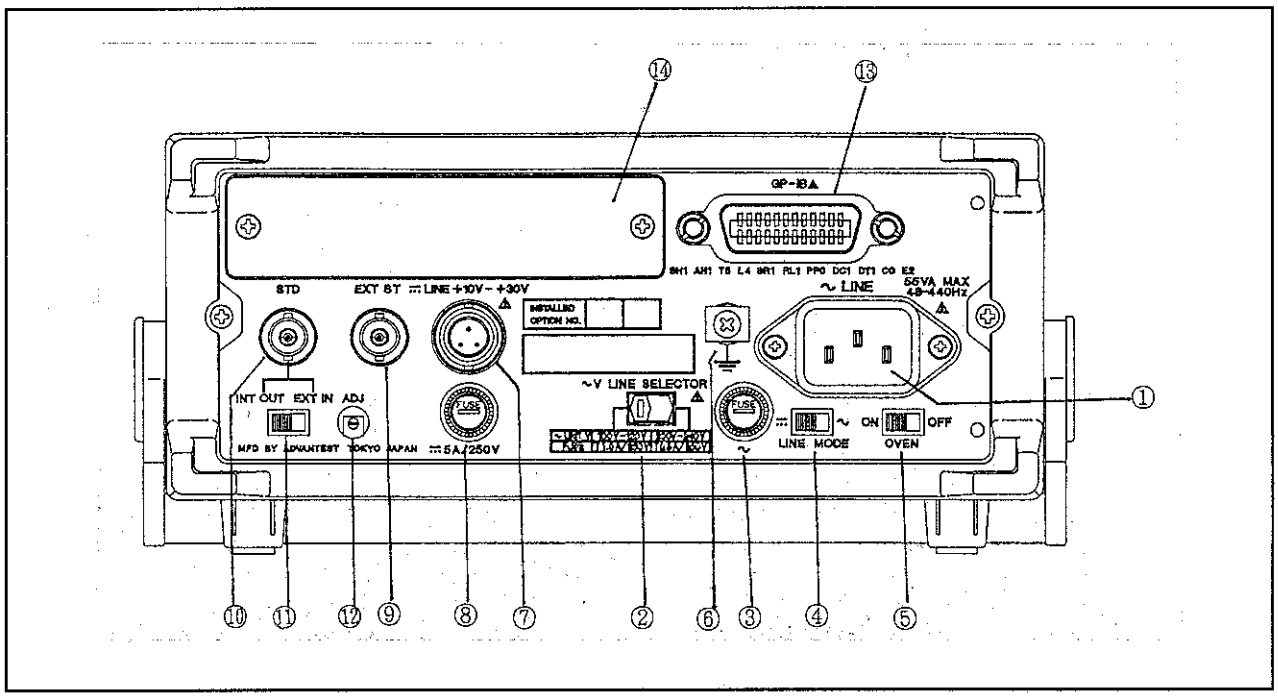


Figure 3-9 Rear Panel

No.	Names	Descriptions
①	AC power supply connector	Is the AC power supply connector. The power cable (A01402) attached as standard is connected here.
②	AC power supply selection switch	Selects the AC voltage from 100V and 200V.
③	AC line fuse	Mounts the AC line fuse.
④	Line mode selection switch	Selects and sets AC (~) /DC (⎓) power drive.
⑤	Oven ON/OFF selection switch	If the switch is set to ON and AC/DC power line is connected although POWER switch on the front panel is in STBY state, it is possible to operate the built-in crystal oscillator, constant temperature bath heater, and 10MHz circuit. (Then, OVEN lamp is lit on the front panel.)
⑥	Earth terminal	Is a terminal for grounding of the counter.
⑦	DC power supply connector	Is the DC power supply connector. The power cable (MI-71) attached as standard is connected here.

(Cont'd)

No.	Names	Descriptions
⑧	DC line fuse	Mounts the DC line fuse.
⑨	EXT ST input connector	Is the input connector for external start.
⑩	STD input/output connector	Is the input/output connector for the reference signal.
⑪	INT OUT/EXT IN selection switch	Is used to determine if the internal reference signal is to be output or the external reference signal is to be input.
⑫	ADJ	Is a calibration volume control for the internal reference signal generator.
⑬	GPIB interface connector	Is a 24-pin connector for bus cable connection.
⑭	Accessory mounting space	Is used to mount either of R13017 (BCD output unit) and R13018 (D/A output unit).

4. OPERATION

4.1 Basic Operation

4.1.1 Selecting Power Supply (AC/DC)

Operate as follows:

① Set LINE MODE selection switch on the rear panel to the drive power supply.

② Set POWER switch to STBY ▣ .

③ • For AC power: Connect the AC power cable to the AC power supply connector for supplying power.

• For DC power: Connect the DC power cable to the DC power supply connector for supplying power.

WARNING

The polarities of DC power cable (MI-71) are indicated by red for " + " (positive) and white for "-" (negative).
Care should be taken because wrong connection may damage the counter.

4.1.2 Selecting Reference Signal

(1) For selecting internal reference signal

With a small minus screwdriver, set the STD EXT IN/INT OUT selection switch to INT OUT and the internal reference signal will be output through the STD connector.

(2) For selecting external reference signal

With a small minus screwdriver, set the STD EXT IN/INT OUT selection switch to EXT IN. In this case, supply the external reference signal through the STD connector.

CAUTION

If no reference signal is supplied to the STD connector when EXT IN is selected, the instrument cannot operate.

4.1.3 Initial Operation

(1) Self test

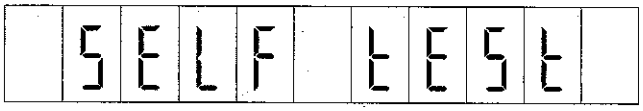
When POWER switch is set to ON (⎓), the instrument will be powered on and automatically operate as follows:

① Lights up the 7-segment LED and the other LEDs. *1
*1: Does not light GATE, LOW, MED, HIGH, and FAN lamps.

② Checks ROM and RAM.
③ Checks BUFFER RAM.
④ Checks BACKUP DATA.
⑤ Checks I/O.

*2, *3

*2: The instrument will display:



*3: For the information on contents and treatment of error messages, refer to "6.4.13 Error Messages".

(2) State of panel settings

Depending on cases, the panel settings of the instrument will be set to either of the initial settings or the previous settings.

① Panel settings to be set to initial settings:

FUNCTION	CHK (CHECK)
GATE TIME	<0.1ms
S.R (SAMPLE RATE)	Approx. 10ms
Settings for input system . . .	Is set to the functions when the lamp is not lit. LEVEL is set to the state when "0V" is lit.

Then "9.999MHz to 10.001MHz" is displayed.

② Only when either of the following conditions is met, the panel can be set to the previous settings:

- OVEN lamp is lit still.
- When POWER switch is turned ON (⎓), the backup battery within the instruments active.

③ If it is desired to return from the previous settings to the initial settings, press INSTR PRESET key and the instrument will return to the state ①.

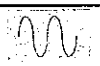
4.2 Basic Key Operation

(1) Setting measurement function

By pressing [⇩] key in FUNCTION block, set each measurement function.

Each time [⇩] key is pressed, the highlighted part moves downward by one line on the LED and the highlighted function is selected for operation.

Table 4-1 Setting Measurement Functions

Functions	Contents	Input Parts
A	Frequency measurement for a frequency from 60MHz to 3000MHz	INPUT A
B  B 	Frequency measurement for a frequency from 0.2mHz to 100MHz	INPUT B
B P	Cycle measurement for a cycle from 10ns to 5000s	
B T.I	Pulse width measurement for a width from 200ns to 79s (magnification : 10^0)	
B TOT	Integrating count for DC to 50MHz	

(2) Setting GATE time and magnification

By pressing [⇩] key on GATE TIME block, set the GATE time/magnification. Each time [⇩] key is pressed, the highlighted part moves downward by one line on the LED and the highlighted GATE time and magnification are selected for operation.

Table 4-2 Setting GATE time/Magnification

GATE time /Magnification	Contents
< 0.1ms/10^0	Range of 10μs to 90μs /1 cycle
< 1ms/10^1	Range of 90μs to 900μs /10 cycles
< 10ms/10^2	Range of 900μs to 9ms /100 cycles
< 0.1s/10^3	Range of 9ms to 90ms /1000 cycles
< 1s/10^4	Range of 90ms to 900ms /10000 cycles
< 10s/10^5	Range of 900ms to 9s /100000 cycles

GATE time: When FUNCTION block selects A, ∿ , ⎍ and P.

Magnification: When FUNCTION block selects T.I.

(3) Setting sample rate

With [S.R] key on the GATE TIME block, set the sample rate time.

Each time [S.R] key is pressed, the setting changes in five stage as follows:

Approx.10ms → approx.80ms → approx.320ms → approx.2.5s → ∞ (infinite)

5. MEASUREMENT INSTRUCTIONS

5.1 Frequency Measurement for A Frequency 60MHz to 3000MHz (1/256 Pre-Scale Input)

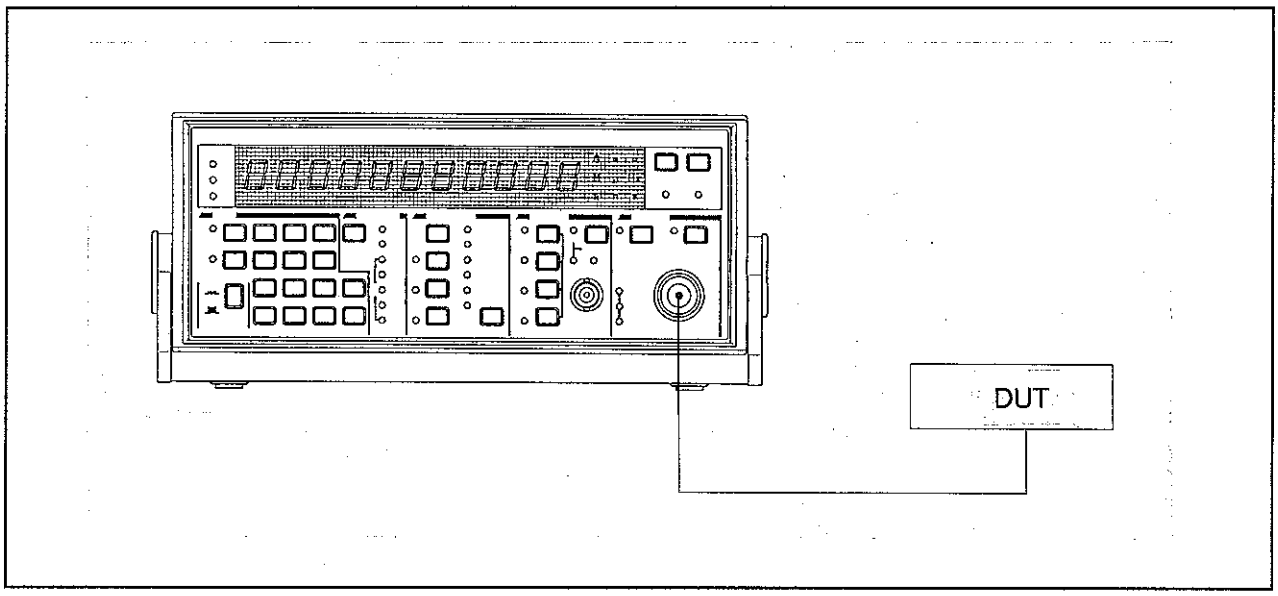


Figure 5-1 Setting and Connection of Each Block

(1) Setting

① FUNCTION: Select A.

② GATE TIME: Select any of <0.1ms, <1ms, <10ms, <0.1s, <1s, or <10s.

③ S.R (SAMPLE RATE): Select any of approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s.

④ RNG (RANGE):
- For measuring a frequency 60MHz to 1500MHz, select a low area range (the lamp does not light).
- For measuring a frequency 1500MHz to 3000MHz, select a high area range (the lamp lights).

⑤ ANS: Set as necessary.

(2) Connection

Connect DUT signal to INPUT A connector as shown in Figure 5-1.

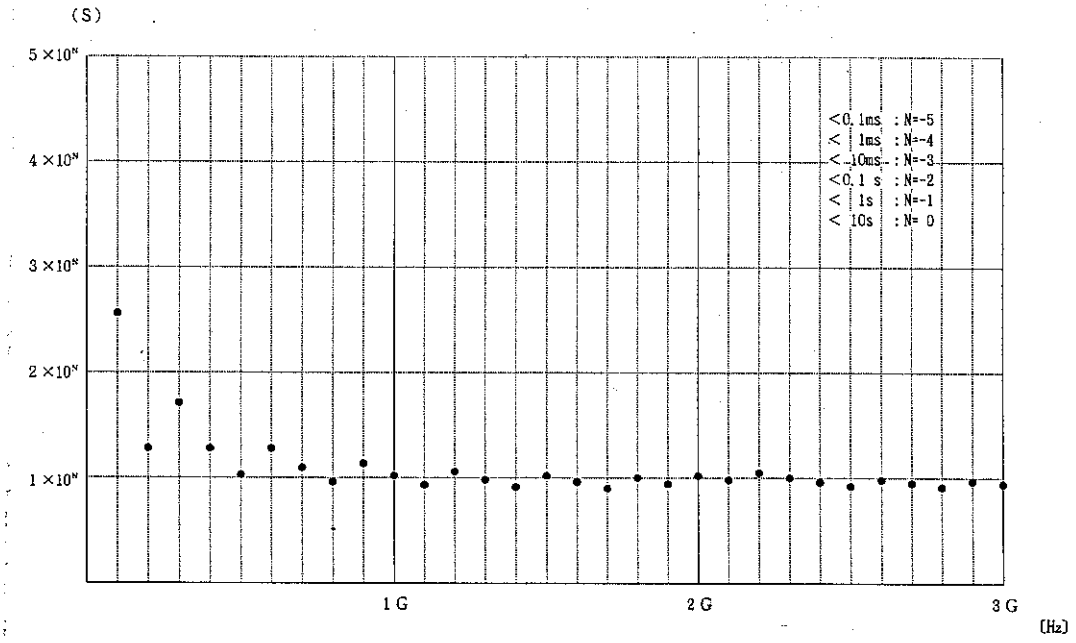
(3) Measurement

① Adjust DUT signal level so that LOW lamp of INPUT LEVEL and MED lamp may be lit up. When both lamps are lit up, GATE lamp will flashes and the measured frequency will be displayed.

WARNING

If HIGH lamp (red LED) of INPUT LEVEL is lit, it may damage the input part of the counter. In such a case, reduce the DUT signal level or remove the connection cable. The maximum input voltage is 5V rms.

② Figure 5-2 shows the relationship between the preset GATE TIMEs, the number of digits displayed, and the actual gate times.



FREQ. \ GATETIME	< 0. 1ms	< 1ms	< 10ms	< 0. 1s	< 1s	< 10s
60M	42. 7μs	427μs	4. 27ms	42. 7ms	427ms	4. 27s
70M	36. 6μs	366μs	3. 66ms	36. 6ms	366ms	3. 66s
80M	32. 0μs	320μs	3. 20ms	32. 0ms	320ms	3. 20s
90M	28. 4μs	284μs	2. 84ms	28. 4ms	284ms	2. 84s
100M	25. 6μs	256μs	2. 56ms	25. 6ms	256ms	2. 56s
200M	12. 8μs	128μs	1. 28ms	12. 8ms	128ms	1. 28s
300M	17. 1μs	171μs	1. 71ms	17. 1ms	171ms	1. 71s
400M	12. 8μs	128μs	1. 28ms	12. 8ms	128ms	1. 28s
500M	10. 3μs	103μs	1. 03ms	10. 3ms	103ms	1. 03s
600M	12. 8μs	128μs	1. 28ms	12. 8ms	128ms	1. 28s
700M	11. 0μs	110μs	1. 10ms	11. 0ms	110ms	1. 10s
800M	12. 8μs	96μs	0. 96ms	9. 6ms	96ms	0. 96s
900M	11. 4μs	114μs	1. 14ms	11. 4ms	114ms	1. 14s
1000M	10. 2μs	102μs	1. 02ms	10. 2ms	102ms	1. 02s
1100M	11. 6μs	93μs	0. 93ms	9. 3ms	93ms	0. 93s
1200M	10. 6μs	106μs	1. 06ms	10. 6ms	106ms	1. 06s
1300M	11. 8μs	98μs	0. 98ms	9. 8ms	98ms	0. 98s
1400M	11. 0μs	91μs	0. 91ms	9. 1ms	91ms	0. 91s
1500M	10. 2μs	102μs	1. 02ms	10. 2ms	102ms	1. 02s
1600M	11. 2μs	96μs	0. 96ms	9. 6ms	96ms	0. 96s
1700M	10. 5μs	90μs	0. 90ms	9. 0ms	90ms	0. 90s
1800M	10. 0μs	100μs	1. 00ms	10. 0ms	100ms	1. 00s
1900M	10. 7μs	94μs	0. 94ms	9. 4ms	94ms	0. 94s
2000M	10. 2μs	102μs	1. 02ms	10. 2ms	102ms	1. 02s
2100M	10. 9μs	98μs	0. 98ms	9. 8ms	98ms	0. 98s
2200M	10. 5μs	105μs	1. 05ms	10. 5ms	105ms	1. 05s
2300M	10. 0μs	100μs	1. 00ms	10. 0ms	100ms	1. 00s
2400M	10. 7μs	96μs	0. 96ms	9. 6ms	96ms	0. 96s
2500M	10. 2μs	92μs	0. 92ms	9. 2ms	92ms	0. 92s
2600M	10. 8μs	98μs	0. 98ms	9. 8ms	98ms	0. 98s
2700M	10. 4μs	95μs	0. 95ms	9. 5ms	95ms	0. 95s
2800M	10. 0μs	91μs	0. 91ms	9. 1ms	91ms	0. 91s
2900M	10. 6μs	97μs	0. 97ms	9. 7ms	97ms	0. 97s
3000M	10. 2μs	94μs	0. 94ms	9. 4ms	94ms	0. 94s

Figure 5-2 Relationship between DUT Signals and Gate Times (FREQ.A)

5.2 Frequency Measurement for Frequency 0.2mHz to 100MHz

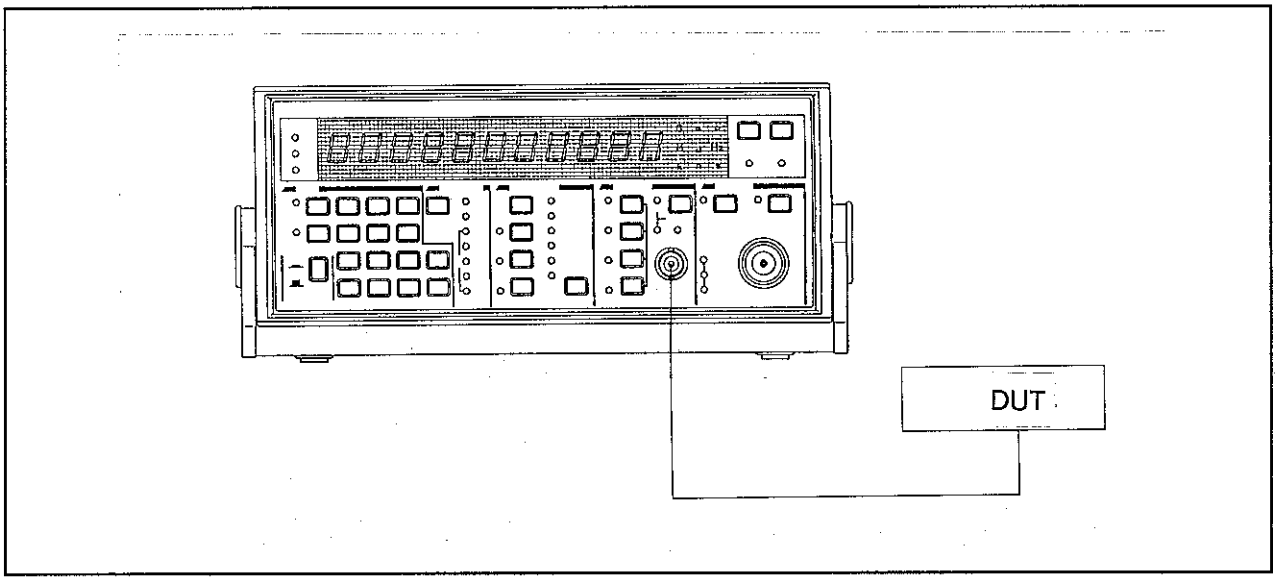


Figure 5-3 Setting and Connection of Each Block

(1) Setting

① FUNCTION: Select , B ∿ or B ⎍ .

Notes:
- Only the difference between these two modes is the number of digits to be displayed and their operation is all common.
- The resolution of B ⎍ mode is increased.

② GATE TIME: Select any of <0.1ms, <1ms, <10ms, <0.1s, <1s, or <10s.

③ S.R (SAMPLE RATE): Select any of approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s.

④ Input block: Set as necessary.
(COUP, LPF*1, ATT, POLA)

*1:
- For frequency measurement for 50mHz to 100MHz, set LPF OFF (when the lamp is not lit).
- For frequency measurement for 0.2mHz to 10kHz, set LPF ON (when the lamp is lit).

(2) Connection

Connect DUT signal to INPUT B connector as shown in Figure 5-3.

(3) Measurement

① When the signal level is proper, TRIG lamp will be lit, GATE lamp will flash, and the measured frequency will be displayed.

WARNING

If an input voltage exceeds the maximum input voltage, it may damage the counter.

② Figure 5-4 shows the relationship between the preset GATE TIMEs, the number of digits displayed, and the actual gate times.

Note: GATE TIME varies depending on LPF ON/OFF.

③ If COUP is set to DC (state where the lamp is not lit), adjust the trigger level to set an optimum value. For the information on how to set the trigger level, refer to "6.3 Trigger Level Change Mode".

Note : In case of frequency measurements, when the rapid switching of input frequency happen, the timing of switched frequency may cause, the measurement time to get longer.

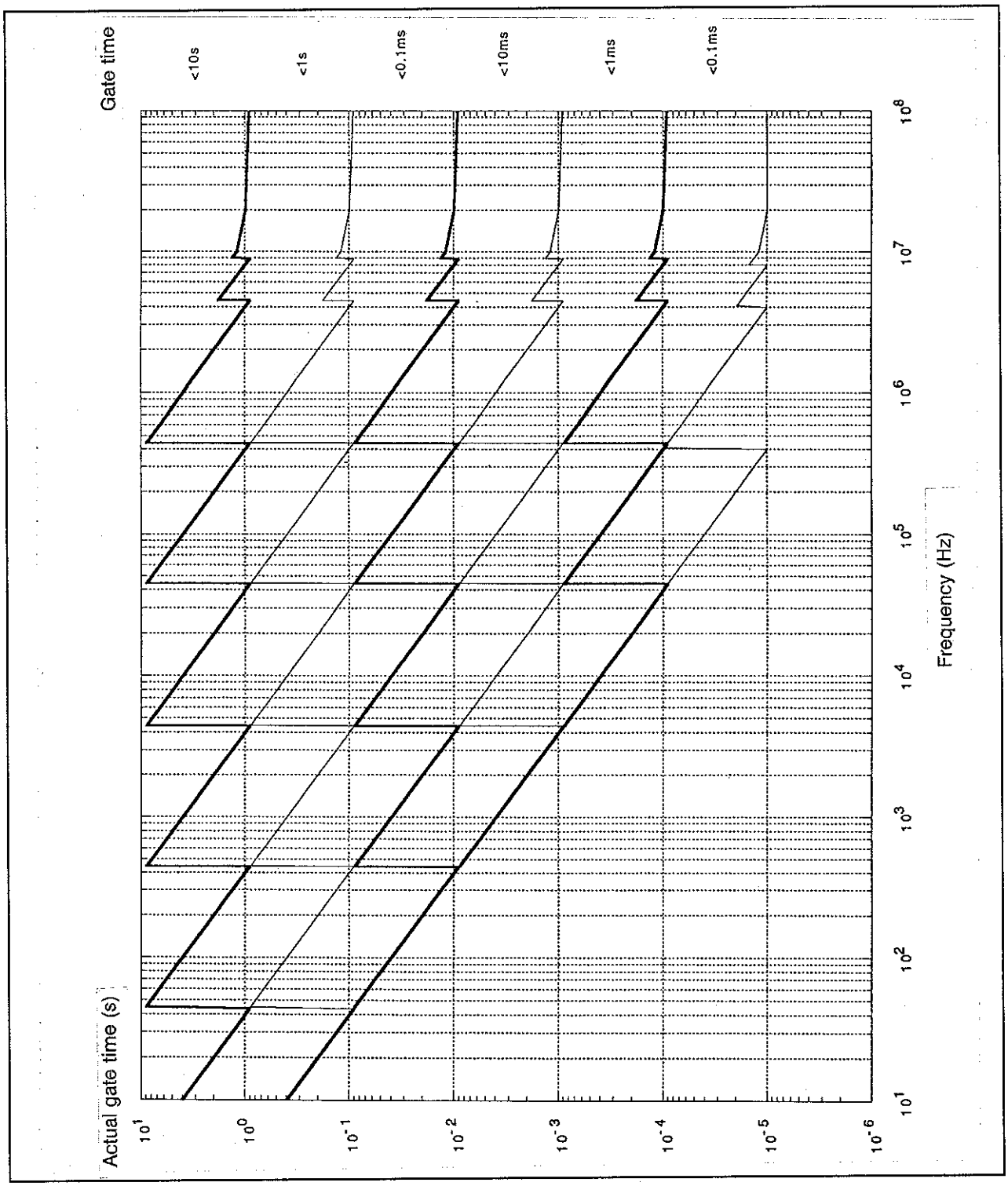


Figure 5-4 Relationship between DUT Signals and Gate Times (FREQ.B)

5.3 Cycle Measurement for A Cycle from 10ns to 5000s

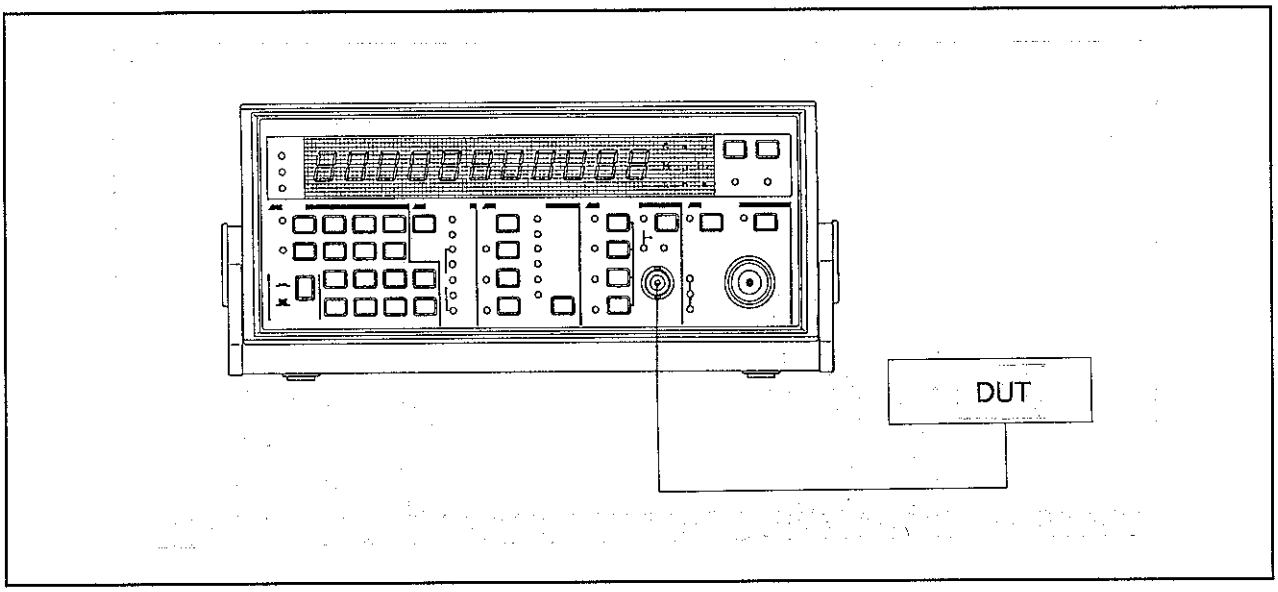


Figure 5-5 Setting and Connection of Each Block

(1) Setting

① FUNCTION: B P

② GATE TIME: Select any of <0.1ms, <1ms, <10ms, <0.1s, <1s, or <10s.

③ S.R (SAMPLE RATE): Select any of approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s.

④ Input block: Set as necessary.
(COUP, LPF*1, ATT, POLA)

*1:
- For cycle measurement for 10ns to 80s, set LPF OFF (when the lamp is not lit).
- For cycle measurement for 100μs to 5000s, set LPF ON (when the lamp is lit).

(2) Connection

Connect DUT signal to INPUT B connector as shown in Figure 5-5.

(3) Measurement

① When the signal level is proper, TRIG lamp will be lit, GATE lamp will flash, and the measured cycle will be displayed.

WARNING

If an input voltage exceeds the maximum input voltage, it may damage the counter.

② If COUP is set to DC (state where the lamp is not lit), adjust the trigger level to set an optimum value. For the information on how to set the trigger level, refer to "6.3 Trigger Level Change Mode".

Note : In case of period measurement, when the rapid switching of input frequency happen, the timing of switched frequency may cause, the measurement time to get longer.

5.4 Pulse Width Measurement for A Width from 200ns to 79s (Magnification : 10^0)

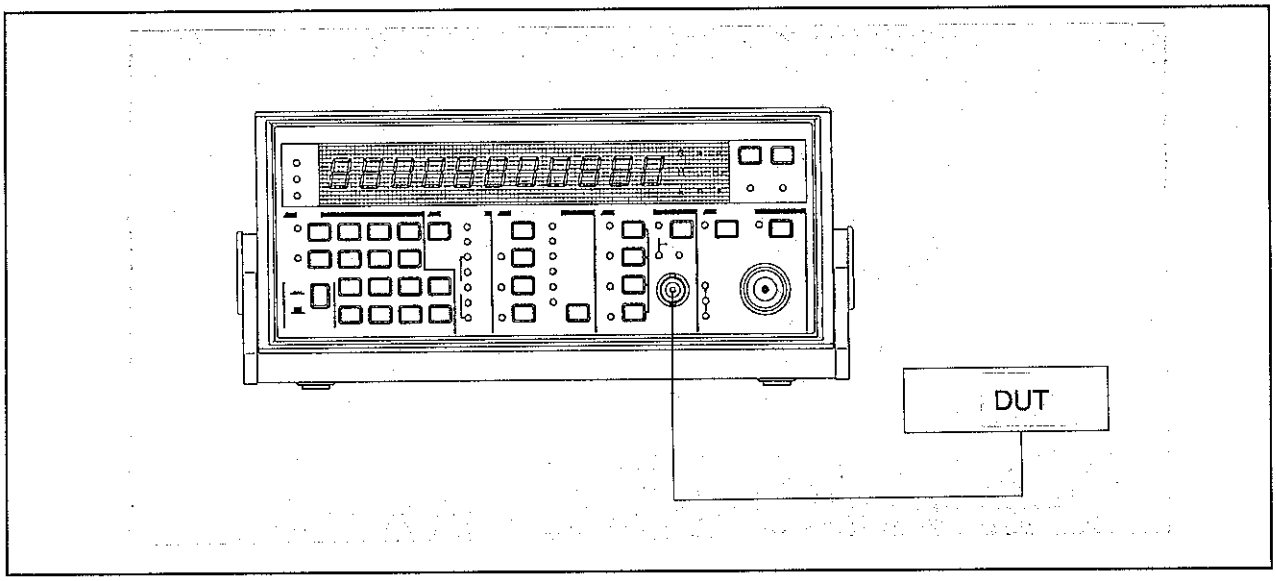
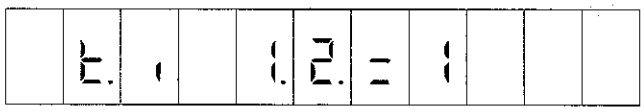


Figure 5-6 Setting and Connection of Each Block

(1) Setting

① FUNCTION: B T.I

Then, the instrument displays:



"1"; Pulse width measurement for a width from 200ns to 79s (magnification : 10^0)
time unit 100ns

"2"; Pulse width measurement for a width from 10μs to 9s
time unit 100ps

- Select "1" or "2" as follows:

Press [1] or [2] key to select it and press [ENT] to set the measurement mode.

② GATE TIME (magnification):

Select any of 10^0, 10^1, 10^2, 10^3, 10^4, 10^5.

Notes: If "2" is selected in step ①, the magnification is fixed to 10^0 and the other magnification is not available.

③ S.R (SAMPLE RATE): Select any of approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s.

④ Input block: Set as necessary.
(COUP, LPF, ATT, POLA)

(2) Connection

Connect DUT signal to INPUT B connector as shown in Figure 5-6.

(3) Measurement

- When the signal level is proper, TRIG lamp will be lit, GATE lamp will flash, and the measured pulse width will be displayed.

5.5 Integrating Count from DC to 50MHz

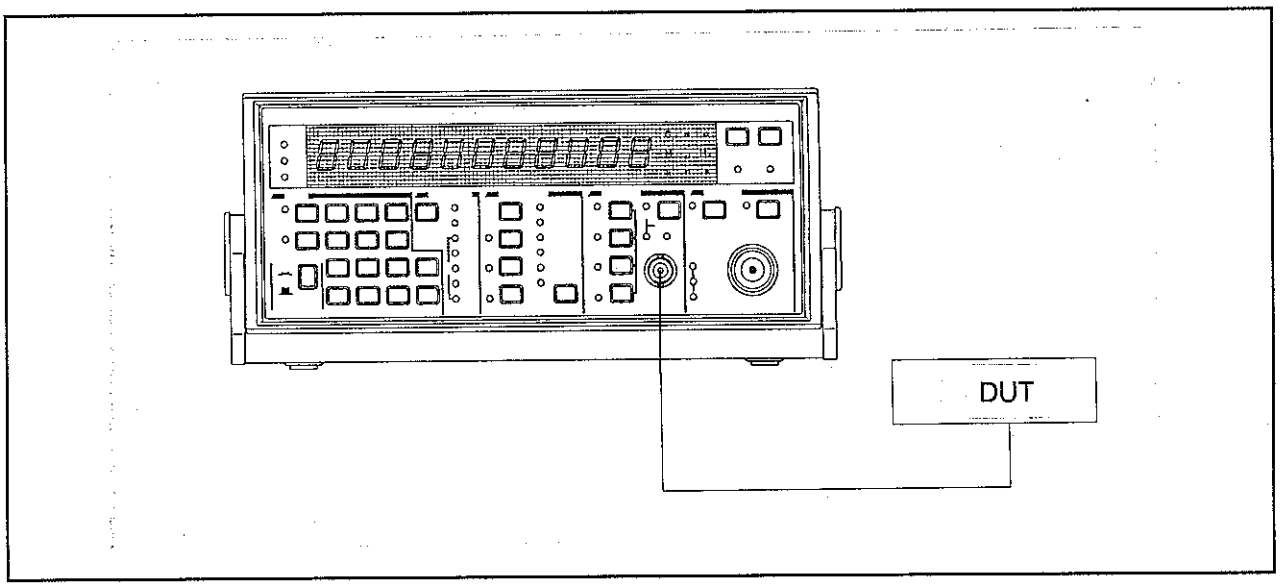


Figure 5-7 Setting and Connection of Each Block

(1) Setting

①	FUNCTION:	B TOT
②	GATE TIME:	Not required.
③	S.R:	Select other setting than HOLD (lamp is not lit) or HOLD (lamp is lit).
④	Input block:	Set COUP to DC. LPF, ATT, POLA } As necessary, set any of LPF, ATT, and POLA.
⑤	Trigger level:	Select a proper trigger level. For the information on how to set the trigger level, refer to "6.3 Trigger Level Change Mode".

(2) Connection

Connect DUT signal to INPUT B connector as shown in Figure 5-7.
Then, if the signal level and trigger level are proper, TRIG lamp will be lit.

(3) Measurement

When RST/ST/SP key in GATE TIME block is pressed once, GATE lamp will be lit and the instrument starts count and displays the process on the LED. When RST/ST/SP key is pressed again, GATE lamp will go off and the instrument shows the final counting result.

Then, if SAMPLE RATE is set to the other setting than HOLD, the instrument starts the count at 0 each time GATE lamp goes on. If SAMPLE RATE is set to HOLD, the instrument starts the count at the previous count value each time GATE lamp goes on.

6. FUNCTIONS

6.1 Continuous Measurement

The function reduce the measurement pause time to zero (dead time) and allows continuous measurement up to 14K pieces of data. Figure 6-1 shows the operation principle.

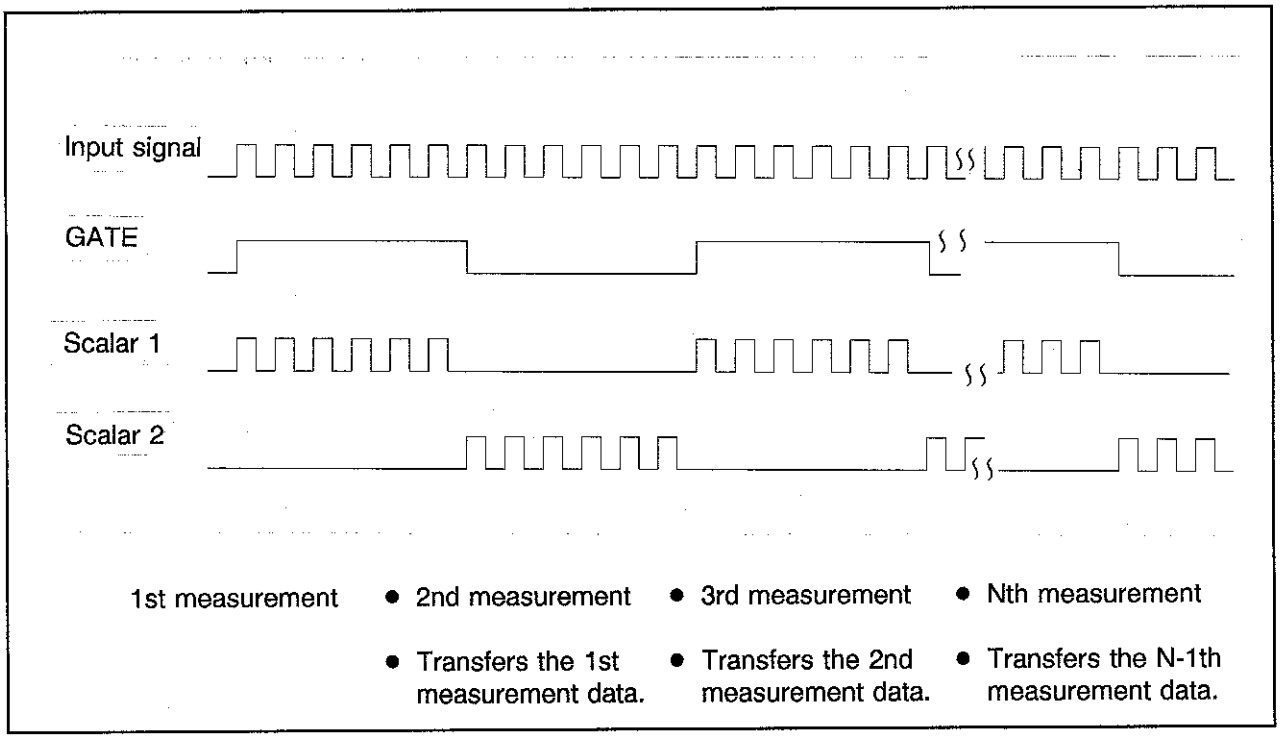


Figure 6-1 Operation Principle of Continuous Measurement

6.1.1 Continuous Measurement for Frequency, Cycle, and Pulse width

(1) Setting

① Basic setting

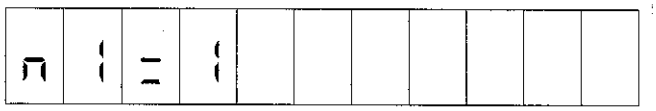
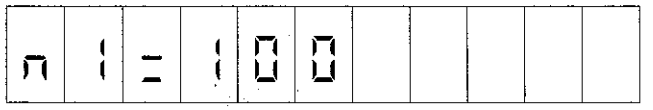
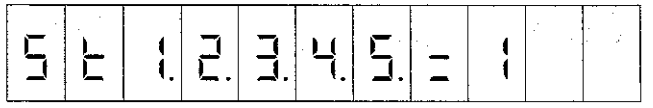
FUNCTION: Select any one of A, B ∿∿ , B ⊓⊔ , B P, and B T.I (T.I-2).

GATE TIME: Select any one of < 0.1ms, <1ms, <10ms, <0.1s, <1s, <10s.
Note: If B T.I (T.I-2) is selected, GATE TIME is fixed to <0.1ms (10^0).

SAMPLE RATE: Pressing [CONT] key fixes the rate to HOLD (lamp ON).

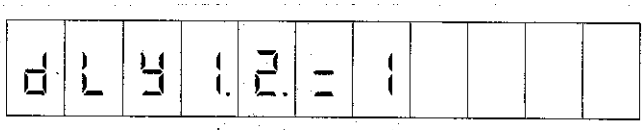
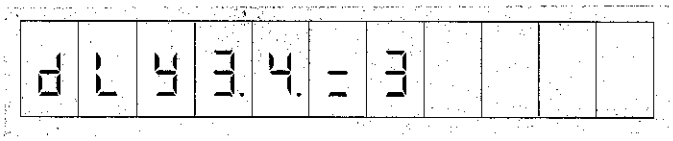
Input block: Set as necessary.

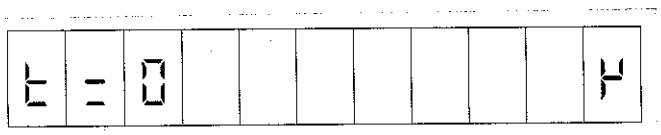
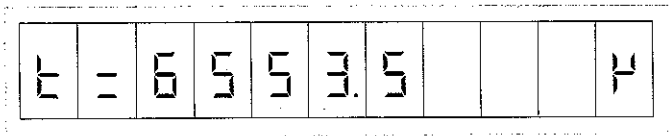
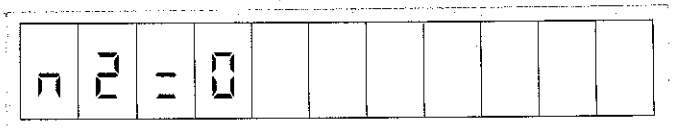
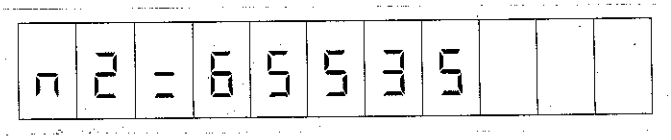
② Function setting

States	Key operation	Display and Description
Enter the setting mode of continuous measurement.	CONT	 ● SAMPLE RATE is fixed to HOLD.
Enter the number of times that the measurement is continuously performed. 1≦n1≦14000 Ex. 100 times	1 0 0 ENT	 When the number of times is entered, the procedure proceeds to the next step.
Enter the start condition.	1 to 5 ENT	 When the start condition is entered, the procedure proceeds to the next step.

Start condition No.	Start descriptions
1	KEY start
2	EXT ST input (pulse) start *1
3	EXT ST input (edge) start *1
4	B input (pulse) start *2
5	B input (edge) start *2

*1, *2: Refer to each item of "(3) Measurement results".

<table>
<tr><th>States</th><th>Key operation</th><th>Display and Description</th></tr>
<tr><td>Setting of start delay
(a) If "1", "3", or "5" is selected in the step of start condition setting:</td><td>1 3
or 5</td><td> 
<table><tr><th>Timer settings</th><th>Descriptions</th></tr><tr><td>1
2</td><td>Start delay OFF
Start delay ON</td></tr></table></td></tr>
<tr><td>(b) If "2" or "4" is selected in the step of start condition setting:</td><td>2 or
4</td><td> 
<table><tr><th>Timer settings</th><th>Descriptions</th></tr><tr><td>3
4</td><td>Start delay OFF
Start delay ON</td></tr></table></td></tr>
<tr><td></td><td>ENT</td><td>• If "2" is selected in step (a), the procedure proceeds to the delay time setting.
• If "4" is selected in step (b), the procedure proceeds to the delay pulse number setting.
• If "1" is selected in step (a) and "3" is selected in step (b), the procedure returns to the step for entering the number of times that measurement is performed. To start the measurement, proceed to "(2) Measurement".</td></tr>
</table>

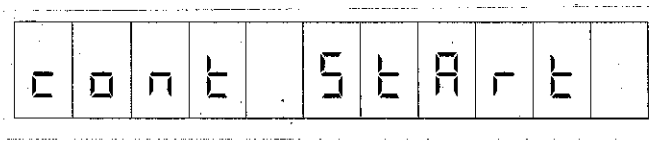
States	Key operation	Display and Description
Setting of delay time *3 0μs≦t≦ 6553.5μs Ex. 6553.5μs	Use [0] to [9] keys and [.] for delay time setting. [6] [5] [5] [3] [.] [5] [ENT]	  When the delay time is entered, the procedure returns to the step for entering the number of times that the measurement is performed. To start the measurement, proceed to "(2) Measurement".
Setting of delay pulse number *4 0≦n2≦65535 Ex. 65535	Use [0] to [9] keys for delay pulse number setting. [6] [5] [5] [3] [5] [ENT]	  When the delay pulse number is entered, the procedure returns to the step for entering the number of times that the measurement is performed. To start the measurement, proceed to "(2) Measurement".

*3, *4: Refer to each item of "(3) Measurement results".

(2) Measurement

Pressing RST (ST/SP) key starts the measurement under the start condition already set.

During measurement, the instrument shows the following on its displays.



(3) Measurement result

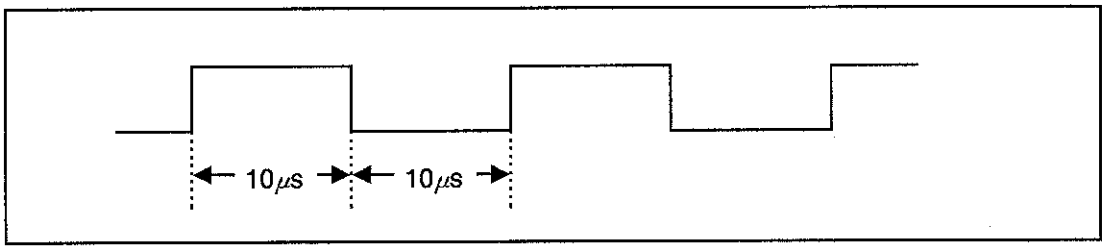
When the measurement has been performed by the specified times, the instrument will display the average value. Also, it can display the maximum value, minimum value, standard deviation, and variation.

If OVER DATA occurs (OVER lamp ON), the instrument ignores that data. The measurement data can be output through the GPIB interface.

*1: When EXT ST (external start signal) is used:

The signals below should be entered through the EXT ST input connector (BNC) on the rear panel of the counter, according to the selected start condition:

- Pulse: The signal with a pulse width more than 10μs (TTL level) should be entered.



- Edge: The trigger signal with a pulse width less than 1μs should be entered at a negative edge.

*2: When B input start (INPUT B start signal) is used:

The signal meeting INPUT B input specification should be entered through the INPUT B input connector (BNC) on the front panel of the counter.

*3: When the delay time is set:

If [RST / ST/SP] key is pressed, the gate will open after the specified delay time has elapsed.

*4: When number of delay pulses is set:

If [RST / ST/SP] key is pressed, the gate will open after the pulse has been counted by the specified number of pulses.

(4) Canceling

To cancel the continuous measurement during setting or measurement, press [CONT] key. Also, press [RST / ST/SP] key to interrupt the measurement and the instrument returns to the display where it is possible to enter the number of times that the measurement is performed.

Note: To perform the measurement under the same condition again, press [RST / ST/SP] key and the instrument returns to the display where it is possible to enter the number of times that the measurement is performed. Pressing [RST / ST/SP] key again starts the measurement.

6.1.2 Continuous measurement for integrating count (B TOT.)

(1) Setting

① Basic setting

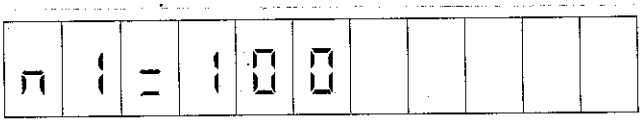
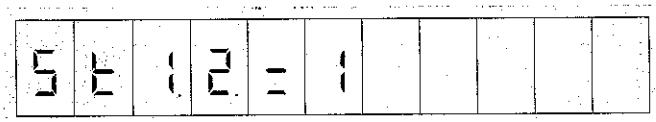
FUNCTION: B TOT.

GATE TIME: Not required.

SAMPLE RATE: Pressing [CONT] key fixes the rate to HOLD (lamp ON).

Input block: Set as necessary.

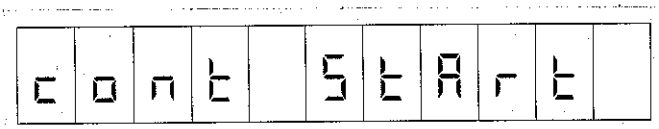
② Function setting

States	Key operation	Display and Description
Enter the setting mode of continuous measurement.	CONT	 ● SAMPLE RATE is fixed to HOLD.
Enter the number of times that the measurement is continuously performed. 1≦n1≦14000 Ex. 100 times	1 0 0 ENT	 When the number of times is entered, the procedure proceeds to the next step.
Enter the start condition.	1 or 2 ENT	 Start condition No. / Start descriptions 1 — KEY start 2 — EXT pulse start *1 When the start condition is entered, the procedure proceeds to the next step. To start the measurement, proceed to "(2) Measurement".

*1: Refer to each item of "(3) Measurement results".

(2) Measurement

During measurement, the instrument shows the following on its displays.



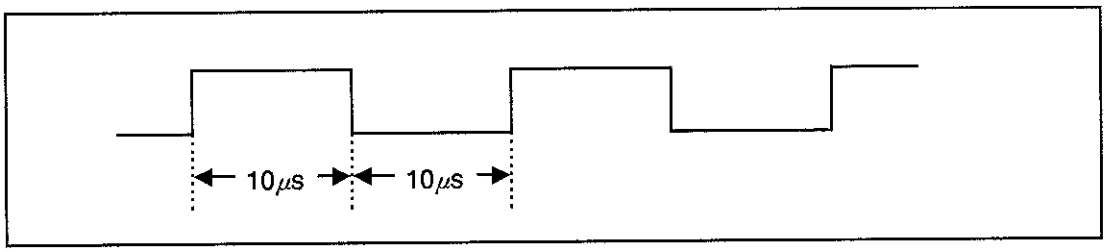
- If the start condition is set to "1", pressing RST (ST/SP) key once starts the 1st measurement and pressing it again starts the 2nd measurement. Repeat the procedure to perform the measurement by the specified times.
- If the start condition is set to "2", pressing RST (ST/SP) key starts the measurement. The measurement is performed each time the pulse is entered into EXT ST to open/close the gate. When the number of times of the measurement reaches the specified value, the measurement stops.

(3) Measurement result

When the measurement has been performed by the specified times, the instrument will display the average value. Also, it can display the maximum value, minimum value, standard deviation, and variation. The measurement data can be output through the GPIB interface.

*1: When EXT ST (external start signal) is used:
The signals below should be entered through the EXT ST input connector (BNC) on the rear panel of the counter, according to the selected start condition:

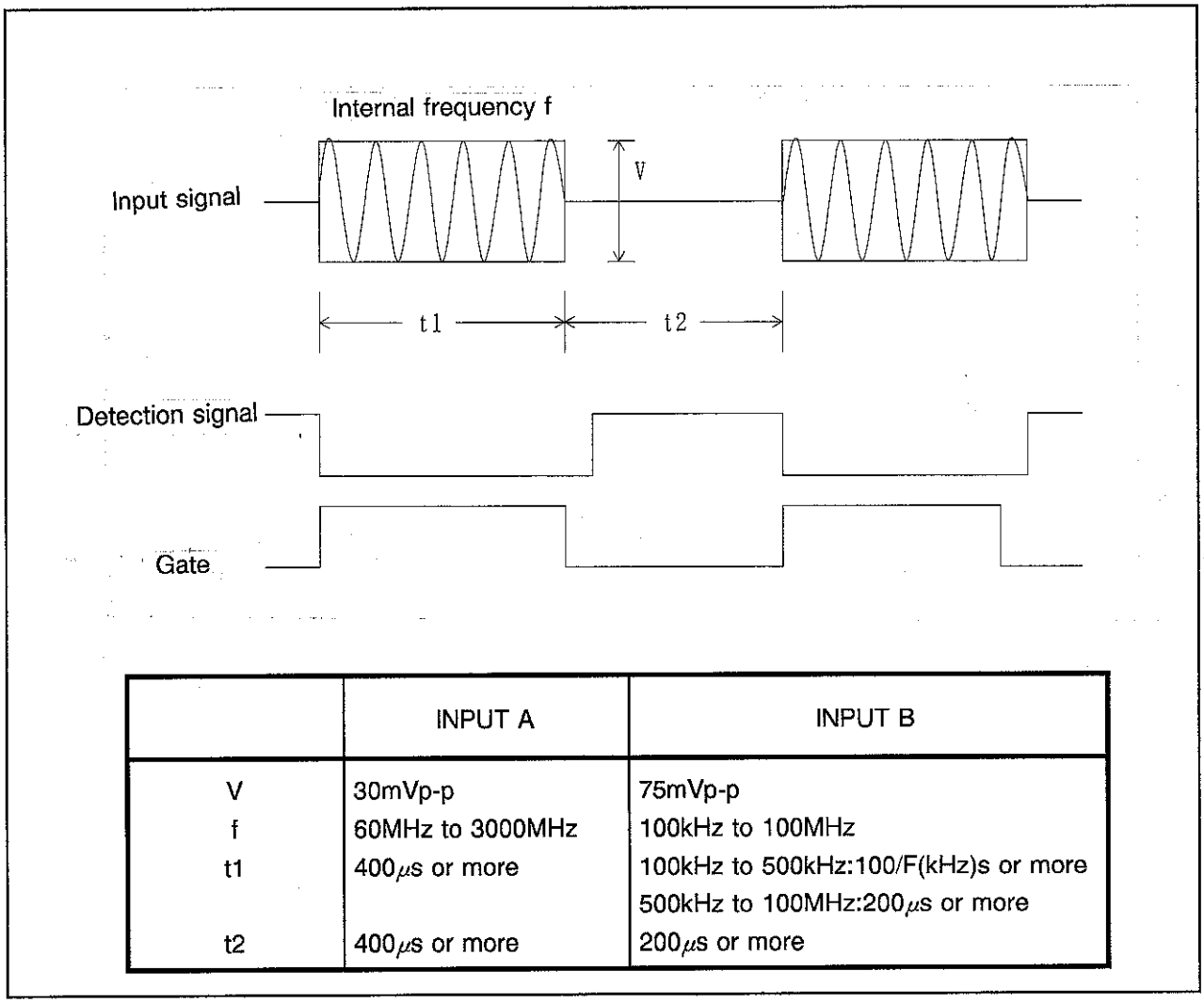
- Pulse: The signal with a pulse width more than 10μs (TTL level) should be entered.



- Edge: The trigger signal with a pulse width less than 1μs should be entered at a negative edge.

6.2 Averaging Measurement for Burst Wave

The function performs the averaging measurement for the burst wave. Figure 6-2 shows the operation of principle. Table 6-1 shows the number of times of the measurement for each setting of GATE TIME when the burst wave is measured.



	INPUT A	INPUT B
V	30mVp-p	75mVp-p
f	60MHz to 3000MHz	100kHz to 100MHz
t1	400μs or more	100kHz to 500kHz:100/F(kHz)s or more 500kHz to 100MHz:200μs or more
t2	400μs or more	200μs or more

Figure 6-2 Burst Wave Signal and Measurement Principle

Table 6-1 Number of Times of Measurement for Each Setting of GATE TIME When Burst Wave Is Measured

t1 \ GATE TIME display digit	<1ms 5	<10ms 6	<0.1s 7	<1s 8	<10s 9
200μs to 900μs	1	10	100	1000	10000
900μs to 9ms	1	1	10	100	1000
9ms to 90ms	1	1	1	10	100
90ms to 0.9s	1	1	1	1	10
0.9s to 9s	1	1	1	1	1

(1) Setting

① Basic setting

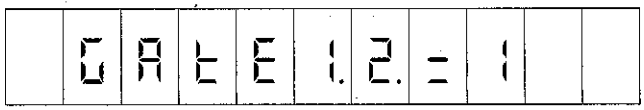
FUNCTION: Select any one of A, B ∿ , and B ⊓⊔ .

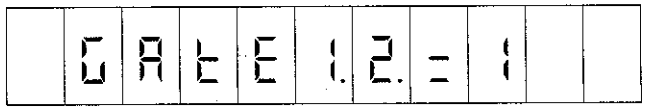
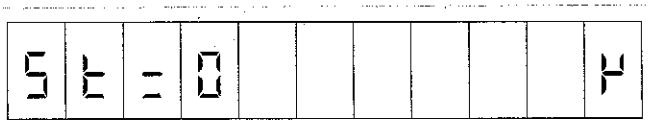
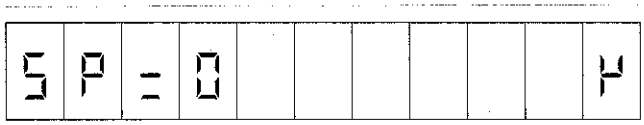
GATE TIME: Select any one of <0.1ms, <1ms, <10ms, <0.1s, <1s, <10s.

SAMPLE RATE: Select any one of approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s.

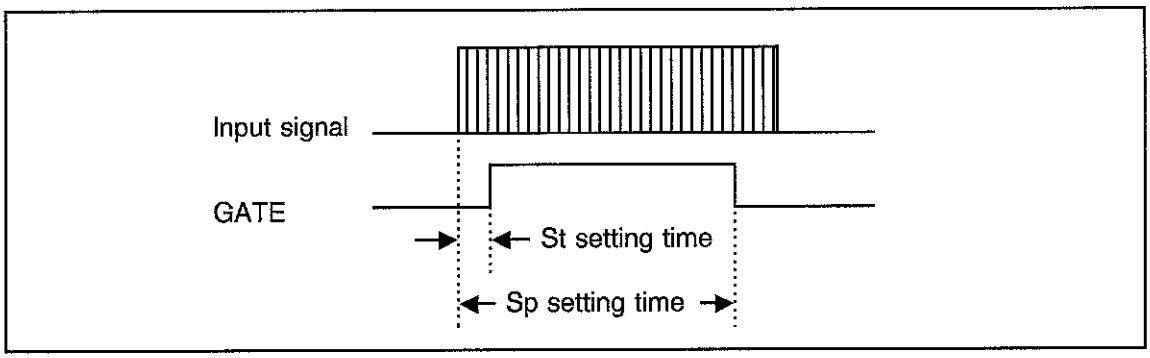
Input block: Set as necessary.

② Function setting

<table>
<tr><th>States</th><th>Key operation</th><th>Display and Description</th></tr>
<tr><td>Enter the setting mode of burst wave measurement.</td><td>BRT</td><td>  </td></tr>
<tr><td>Setting of gate width change.</td><td>1 or 2

ENT</td><td> 
<table><tr><th>Setting of gate width change</th><th>Descriptions</th></tr><tr><td>1
2</td><td>Gate width change OFF
Gate width change ON</td></tr></table>• If the gate width change is set to "1", the instrument will start the measurement.
• If it is set to "2", the procedure proceeds to the step for setting the gate width change.</td></tr>
<tr><td>*1
Setting of the gate width change time ①
0≦St≦
6553.5μs</td><td>0 to 9 and .
ENT</td><td> 
The procedure proceeds to the step for setting the gate width change time ②.</td></tr>
<tr><td>*1
Setting of the gate width change time ②
Sp > St</td><td>0 to 9 and .
ENT</td><td> 
When the gate width change time is entered, the instrument will start the measurement.</td></tr>
</table>

*1: The following are the settings which can be set by the gate width change function.



The gate opens during the time period of Sp minus St.
If input signal <Sp minus St, care should be taken because the counting may be mistakenly performed.

(2) Canceling

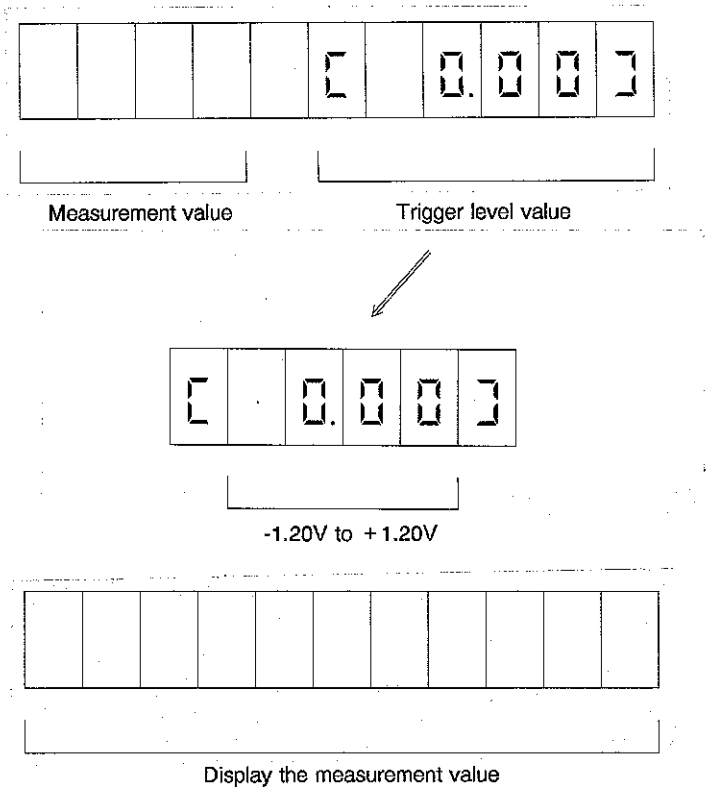
To cancel the averaging measurement for the burst wave during setting or measurement, press BRT key.

6.3 Trigger Level Change Mode

The mode sets the trigger voltage to be entered into the INPUT B input connector.
The range of the level is approx. -1.20V to +1.20V. However, if the attenuator is used (ATT 20dB lamp ON), it is -12V to +12V. If the setting of the trigger level is appropriate for the signal whose amplitude exceeds the input sensitivity level, the internal wave reforming circuit will operate for measurement.
TRIG lamp will go on when the wave reforming circuit operates.

(1) Setting

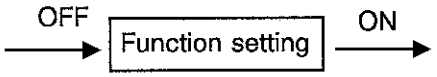
	Contents	Key operation	Display and Description
①	Enter the trigger level change mode. Note: When 0V lamp is on, the trigger level is set to approx. 0 V.	○ LEVEL 0V ○ ON Press LEVEL key to turn on ON lamp.	

	Contents	Key operation	Display and Description
②	• The instrument shows the trigger level setting display. • Set the trigger level. The range of the level is -1.20V to +1.20V with a resolution of 10mV. • The trigger level is determined, the trigger level setting display disappears, and the measurement value is displayed.	SHF, COUP (DISP) LPF ⇧, ATT ⇩ (10mV STEP) or 1 to 9 and . and +/- ENT Press the POLA	

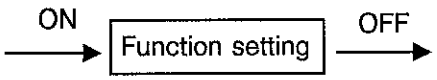
6.4 Computing Display (Keyboard Operation)

6.4.1 Algorithm for Setting and Canceling Computing Function

(1) For the function which requires no data

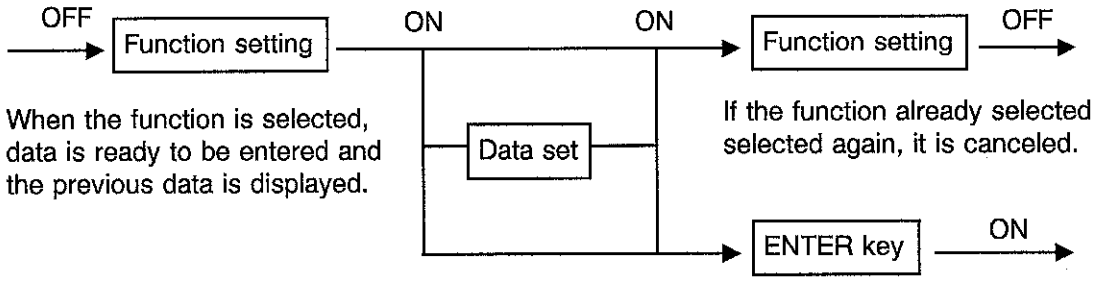


If the OFF-state function is selected, it is set to ON.



If the ON-state function is selected, it is set to OFF.

(2) For the function which requires data



When the function is selected, data is ready to be entered and the previous data is displayed.

If the function already selected is selected again, it is canceled.

When ENTER key is pressed, the data is set for the function and it is set to ON. If no data is entered into the function, pressing ENTER key sets the function to ON with the previous data.

(3) Entering exponent (EXP)

Is used for entry of the exponent. The range of setting is 10^{9} to 10^{-12}.

Pressing [SHF] and [⇨ EXP] displays " E " on the exponent part and the exponent data is ready to be entered.

Example: For setting 10^{4};

[SHF] [⇨ EXP] [4] [ENT]

For setting 10^{-6};

[SHF] [⇨ EXP] [+/-] [6] [ENT]

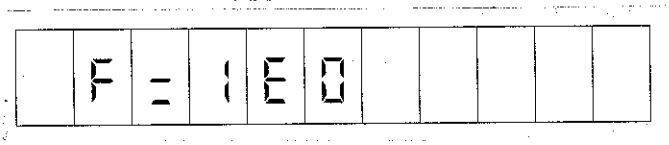
6.4.2 Fixed Point Display (FIX)

Allows the desired final digit display to be set for the measurement value.

(1) Setting fixed point display

The range of number of digits for the fixed point display is 10^{9} to 10^{-12} (unit:Hz). For the fixed point display, values are displayed being shifted to the right. Also, digits lower than the specified digit will not be displayed. For GPIB output, however, the measurement value is output by the floating point display.
If the setting is below the measurement resolution, digits below the resolution are displayed as zeros.

Pressing [SHF] and [+/-] displays the following.
FIX



Example: For fixed point display of the digit of 10kHz:

[SHF] [+/-] [4] [ENT]
FIX

For fixed point display of the digit of 1mHz:

[SHF] [+/-] [+/-] [3] [ENT]
FIX

(2) Canceling fixed point display

Pressing [SHF] and [+/-] cancels the fixed point display.
FIX

6.4.3 LSD function (LSD)

One digit is added to the lowest digit of the measurement value display.

(1) Setting LSD function

When [SHF] and [ENT] (LSD) are pressed, the LSD function is performed immediately and " . " is displayed at the lowest digit as a command message.

(2) Canceling LSD function

Pressing [SHF] and [ENT] (LSD) again cancels the LSD function.

6.4.4 Offset Function (OFS)

Displays a value obtained by adding/subtracting a constant value to/from the measurement value.

(1) Setting offset data

The offset data can be set for all the digits. However, digits below the measurement resolution are not displayed.

Pressing [SHF] and [6] (OFS) displays:

When the offset function is ON, " ▭ " is displayed at the lowest digit as a command message.
The setting data consists of the fixed point part of 12 digits (excluding decimal point, 13 digits when minus symbol exists) and the exponent from 10^{9} to 10^{-12}.

Example:

When 1.23MHz (1.23×10^6Hz) is entered for the offset data;

SHF	6 (OFS)			.....	Set ON offset function.
1	.	2	3	.....	Enter fixed point part (1.23).
SHF	⇨ (EXP)	6	ENT	.....	Enter exponent (10^6).

When -50mHz (-50×10^{-3}Hz) is entered for the offset data;

SHF	6 (OFS)			.....	Set ON offset function.
+/-	5	0		.....	Enter fixed point part (-50).
SHF	⇨ (EXP)	+/-	3	ENT	Enter exponent (10^{-3}).

(2) Canceling offset function

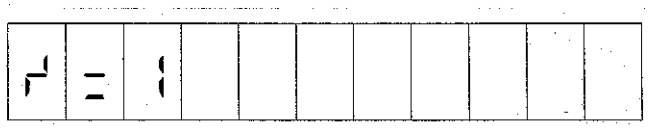
Pressing SHF and 6 (OFS) cancels the offset function.

6.4.5 Division Function (÷)

Displays a value obtained by dividing the measurement value by a constant value.

(1) Setting division data

When [SHF] and [÷ .] are pressed, the instrument displays the following and the division data is ready to be entered.



If the division function is ON, " ⌐ " is displayed at the lowest digit as a command message.

Example: If the measurement value is divided by 123 for display;

[SHF] [÷ .] [1] [2] [3] [ENT]

(2) Canceling division function

Pressing [SHF] and [÷ .] again cancels the division function.

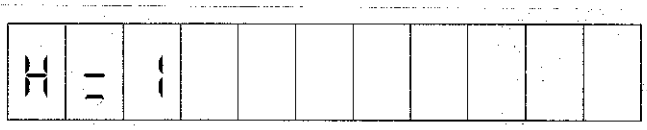
(3) The range of the division data is 0.001 to 99999.999. However, since the exponent cannot be entered, use a numeric value for entry.

6.4.6 Multiply Function (×)

Displays a value obtained by multiplying the measurement value by a constant value.

(1) Setting multiply data

When [SHF] and [0 ×] are pressed, the instrument displays the following and the multiply data is ready to be entered.



If the multiply function is ON, " ⊢ " is displayed at the lowest digit as a command message.

Example: If the measurement value is multiplied by 15 for display;

[SHF] [0 ×] [1] [5] [ENT]

(2) Canceling multiply function

Pressing [SHF] and [0 ×] again cancels the multiply function.

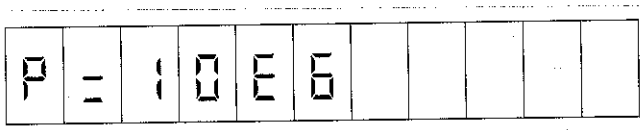
(3) The range of the multiply data is 0.001 to 99999.999. However, since the exponent cannot be entered, use a numeric value for entry.

6.4.7 Parts per million (PPM)

Displays the measurement value using the deviation parts per million based on the reference value.

(1) Setting reference value data

When [SHF] and [9] (PPM) are pressed, the instrument displays the following and the reference value data is ready to be entered.



If the parts per million function is ON, " ⚑ " is displayed at the lowest digit as a command message.
The setting data consists of the fixed point part 12 digits (excluding decimal point) and the exponent from 10^{9} to 10^{-12}.

Example:
If the deviation parts per million of 10MHz (10×10^{6}Hz) is displayed;

[SHF] [9] (PPM)	.....	Set ON parts per million.
[1] [0]	.....	Enter fixed point part (10).
[SHF] [⇨] (EXP) [6] [ENT]	.....	Enter exponent (10^{6}).

(2) Canceling parts per million

Pressing [SHF] and [9] (PPM) again cancels the parts per million.

(3) Computing expression

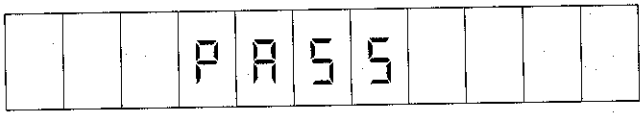
$$\frac{\text{(Measurement value - Reference value)}}{\text{Reference value}} \times 10^{6}$$

6.4.8 Comparator Function (COMP)

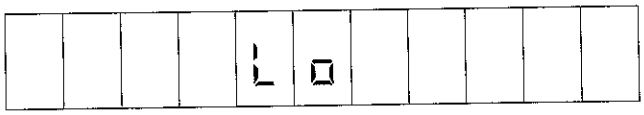
Sets HIGH level and LOW level and checks that the measurement value is within the range between these two levels. Note that the specified number of digits for HIGH and LOW levels is available for all the digits.
According the result of checking the measurement value, the instrument displays it as follows:

Measurement value > HIGH level

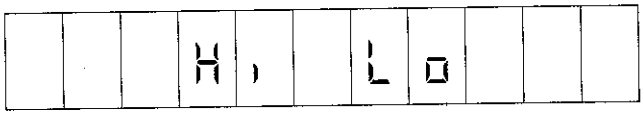
HIGH level ≧ Measurement value ≧ LOW level



Measurement value < LOW level



Measurement value > HIGH level, Measurement value < LOW level



The setting data consists of the fixed point part of 12 digits (excluding the decimal point) and the exponent from 10^{9} to 10^{-12}.

(1) Data setting of HIGH and LOW levels

Press [SHF] and [5] (COMP) keys to display HIGH level and press [ENT] to decide the level. At the same time as the HIGH level is decided, LOW level is displayed. Then press [ENT] to decide LOW level and the instrument will start the measurement.

Setting display for HIGH level

Setting display for LOW level

Example:

When setting HIGH level to 11MHz (11×10^6Hz) and LOW level to 9MHz (9×10^6Hz) :

[SHF] [5] (COMP)	.....	Set the comparator function ON.
[1] [1]	.....	Enter the fixed point part of HIGH level (11).
[SHF] [⇨] (EXP) [6] [ENT]	.....	Enter the exponent of HIGH level (10^6).
[9]	.....	Enter the fixed point part of LOW level (9).
[SHF] [⇨] (EXP) [6] [ENT]	.....	Enter the exponent of LOW level (10^6).

(2) Canceling comparator

Pressing [SHF] and [5] (COMP) cancels the comparator function.

(3) Status byte for comparator

The status byte indicates the result of the comparator function. Also, the measurement result data can be read by the GPIB.

For the information on the status byte, refer to "7.1.6 Service Request".

6.4.9 Maximum Value (MAX), Minimum Value (MIN), and Variation (Δ) Display

The instrument can display the maximum value, minimum value, variation (maximum value minus minimum value).
Pressing any key of [7] (MAX), [8] (MIN), or [4] (Δ) together with the statistics computing switch [AVG] displays the maximum value, minimum value, or variation in the data samples, respectively.
If the over data occurs (OVER lamp ON), the instrument ignores that data.
If the number of samples has not been specified, [AVG] lamp is not lit and the instrument continues to obtain the maximum value, minimum value, and variation permanently.
Press [RST] (ST/SP) key to change the measurement start point. The time point when the RST key is pressed will be a new start point.

(1) Setting the display of maximum value, minimum value, and variation

- Setting the display of maximum value

  Pressing [SHF] and [7] (MAX) displays the maximum value and "  " at the lowest digit as a command message.

- Setting the display of minimum value

  Pressing [SHF] and [8] (MIN) displays the minimum value and "  " at the lowest digit as a command message.

- Setting the display of variation

  Pressing [SHF] and [4] (Δ) displays the variation and "  " at the lowest digit as a command message.

(2) Canceling the display of maximum value, minimum value, and variation

- Canceling the display of maximum value

  When the maximum value is being displayed, press [SHF] and [7] (MAX).

- Canceling the display of minimum value

  When the minimum value is being displayed, press [SHF] and [8] (MIN).

- Canceling the display of variation

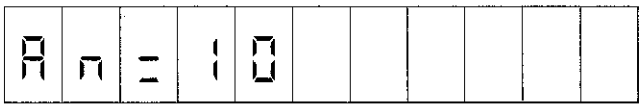
  When the variation is being displayed, press [SHF] and [4] (Δ).

6.4.10 Statistics Computing

Sets the number of samples and displays the average value, maximum value, minimum value, variation, and standard deviation for all the samples.
The number of samples to be set is 1 to 10000.

(1) Setting statistics computing

When [AVG] is set to ON, the LED goes on and the instrument displays the following.



When the measurement has been performed for all the specified samples, the instrument will display the average value.
To restart the measurement during sampling, press [RST] (ST/SP).

Example:
When setting the number of samples to 1200 and displaying the maximum value:

[AVG] [1] [2] [0] [0] [ENT]

To display the maximum value for all the samples, press [SHF] and [7] (MAX)
and the maximum value will be displayed after the measurement has been performed for all the samples.

- To display minimum value:

  Press [SHF] and [8] (MIN).

- To display variation:

  Press [SHF] and [4] (Δ).

- To display standard deviation:

  Press [SHF] and [1] (σ).

- To return the average display:
  Use the same key combination as used for each setting again.

  For example, press [SHF] and [8 MIN] when the maximum value is displayed.

(2) Canceling average value display

Pressing [AVG] again cancels the average value display. However, when the maximum value, minimum value, or variation is selected, pressing the key starts the normal measurement for the maximum value, minimum value, and variation.

CAUTION

When the statistics computing is selected, the instrument cannot be set to HOLD.

(3) Computing expression for standard deviation

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} X^2 - n\overline{X^2}}{n}}$$

n: Number of times for measurement
X: Measurement value

$\overline{X}$: Average value $\overline{X} = \frac{\sum_{i=1}^{n} X}{n}$

6.4.11 Save Function (SAVE)

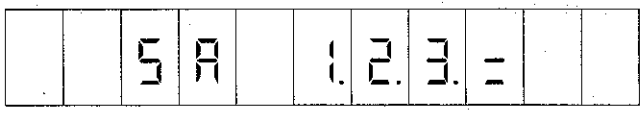
Saves the current setting conditions of functions and parameters in the internal memory.

CAUTION

When the memory where data has already been saved is used to save new data, that data will be destroyed. POWER OFF or PRESET cannot reset the contents which has already been saved.

(1) Setting save function

When [SHF] and [2] SAVE are pressed, the instrument displays the following.



With [1], [2], and [3] keys, specify the save number used to save data in the internal memory.
The number which is not displayed indicates that the memory corresponding to that number has the contents of the setting conditions saved in it.

Example:
When the current setting condition is to be saved in No.1 memory with the save function:

[SHF] [2] SAVE [1] [ENT]

(2) Canceling save function

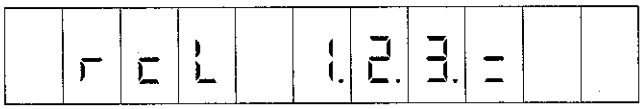
Press [SHF] and [2] SAVE again cancels the save function.

6.4.12 Recall Function (RCL)

Reads out the contents saved in the internal memory.

(1) Setting recall function

When [SHF] and [3] (RCL) are pressed, the instrument displays the following.



Note: The display is in the case where memories No.1, 2, and 3 store the setting conditions.

With [1], [2], and [3] keys, specify the recall number used to read out data from the internal memory corresponding to that number.
The number displayed indicates that the memory corresponding to that number has contents saved and the number not displayed indicates that the corresponding memory has no saved contents.
At this point, if the number not displayed is specified, the instrument will maintain the current settings.

Example:
When the recall function reads out the setting conditions from No.2 memory:

[SHF] [3] (RCL) [2] [ENT]

(2) Canceling recall function

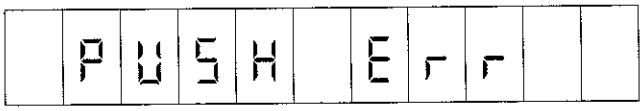
Press [SHF] and [3] (RCL) again cancels the recall function.

6.4.13 Error messages

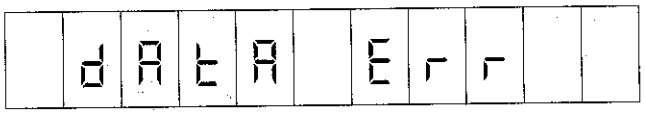
An error message will appear on the LED of the panel for approx. one second if:

- The instrument is improperly operated.
- Data out of range is set.
- An error occurs in the counter.

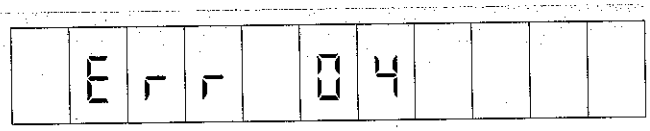
(1) The setting entered from the keyboard is not available for the current measurement condition.



(2) The setting entered from the keyboard is out of range.

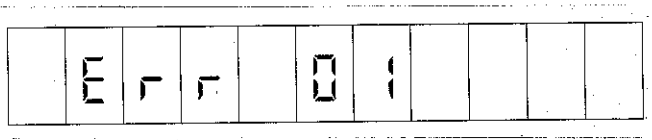


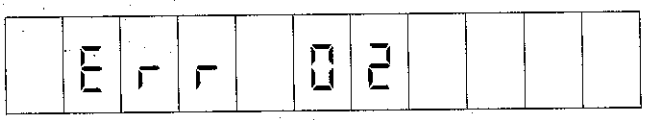
(3) The number of digits for the computing result exceeds the number of digits on the display.



In this case, the result is not output to GPIB, BCD, and D/A.

(4) If the instrument has a failure, the error message below will be displayed. In such a case, contact ATCE or the your nearest dealer.
For the address and telephone number of ADVANTEST, refer to the end of this manual.





7. CONNECTING VARIOUS INTERFACES

7.1 GPIB Interface

R5363 can be connected with an IEEE Standard 488-1978 GPIB (General Purpose Interface Bus).

7.1.1 Outline of GPIB

Beside eight data lines, the GPIB includes three handshaking lines to control asynchronous data transfer among devices, five control lines to control the information flow on the bus, and eight ground lines.

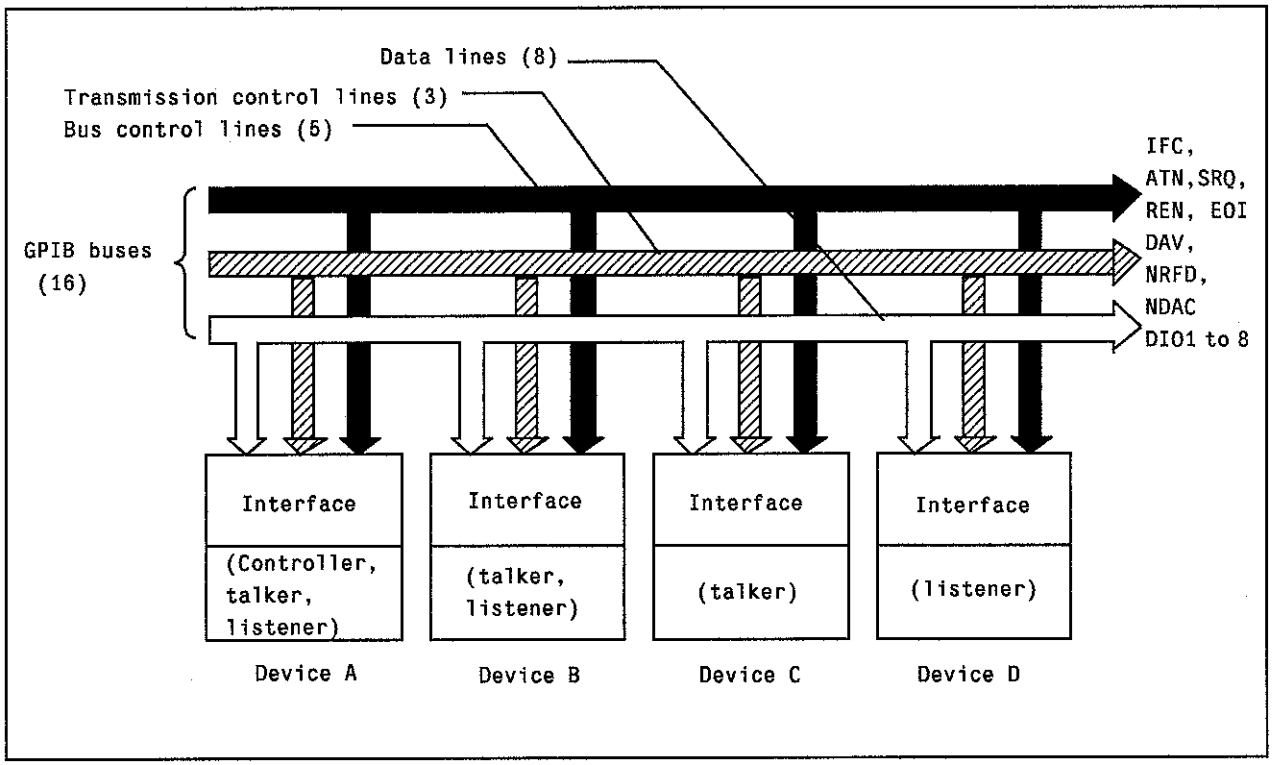


Figure 7-1 Schematic diagram of GPIB

- The following signals are used in the handshake line:

  DAV (Data Valid): Data validity indicating signal
  NRFD (Not Ready For Data): Data reception ready state indicating signal
  NDAC (Not Data Accepted): Data reception completion state indicating signal

- The following signals are used on the control line:

  ATN (Attention): Used to determine whether the signal on data line is address, command, or other information.

IFC (Interface Clear):	Used to clear the interface
EOI (End or Identify):	Used to terminate information transmission
SRQ(Service Request):	Used by any equipment to request controller service
REN (Remote Enable):	Used to control remote programmable equipment

7.1.2 GPIB Specifications

(1) GPIB specifications

Applicable standard:	IEEE standard 488-1978
Applicable code:	ASCII code
Logic level:	Logic 0 high state Higher than +2.4V Logic 1 low state Lower than +0.4V
Signal line termination:	16 bus lines are terminated as shown below.

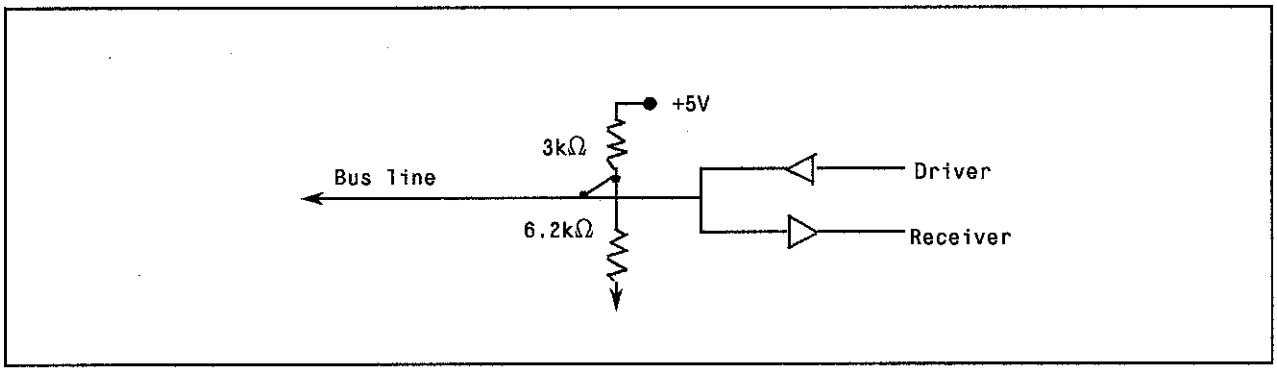


Figure 7-2 Signal Line Terminator

Driver specification:	Three-state type Low state output voltage; +0.4V or less, 48mA High state output voltage; +2.4V or more, -5.2mA
Receiver specification:	Low state at lower than +0.6V High state at higher than +2.0V
Bus cable length:	Total of length of cable connected to the bus line must not exceed 20m.
Addressing:	Allows 31 types of talk/listen addresses to be selected by panel operation.
Connector:	24-pin GPIB connector 57LE-20240-77COD351 (Product of Amphenole Co., Dai-ichi Electronics or equivalent)

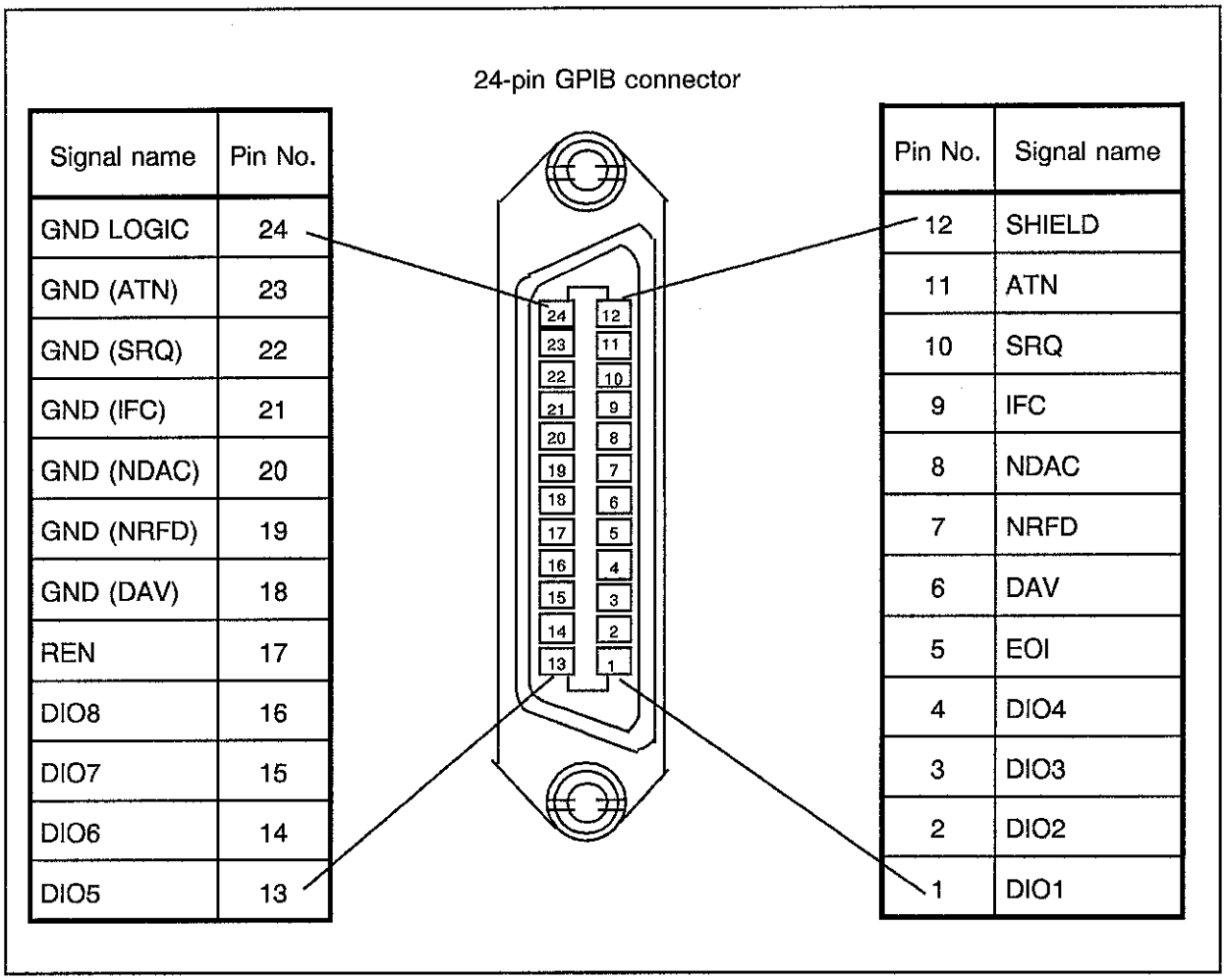


Figure 7-3 GPIB connector pin Assignment

(2) Interface function

Table 7-1 Interface function (1 of 2)

Code	Function and explanation
SH1	Source handshake function
AH1	Acceptor handshake function
T5	Basic talker function, serial polling function, talk only mode function, talker canceling function by listener specification
L4	Basic listener function, listener canceling function by talker specification

Table 7-1 Interface function (2 of 2)

Code	Function and explanation
SR1	Service requesting function
RL1	Remote/Local changeover function
PP0	No parallel function
DC1	Device clear function (permits use of SDC, DCL commands)
DT1	Device trigger function (permits use of GET command)
C0	No controller function
E2	Use of three-state bus driver

(3) Connection with necessary devices

The GPIB system is configured with multiple device and care should be taken for configurating the system as follows:

① Before connection, check the status (preparation) and operation of the controller and peripherals following the instruction manual of each device.

② Care should be taken not to extend the connection cable to the instrument and the bus cable to the controller excessively.
Also, make sure that total length of cables does not exceed 20m.
Note that ADVANTEST provides the cables as standard bus cables:

Table 7-2 Standard Bus Cables (optional)

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

③ When connecting the bus cable, do not pile more than two connectors together. The connector should be firmly secured with connector mounting screws.
The bus cable connector is a piggy-back type and one connector has a pair of male and female threads which can be used in joint.

④ Before powering on each device, check the power requirement, grounding condition as necessary, and setting condition for it.
All the devices connected to the bus must be powered on. If there is a device not powered on, it may not ensure entire system operation.

⑤ Before connecting/removing the bus cable, be sure to check that each device is powered off and remove the power cable from the outlet.

7.1.3 Address Setting and Selection of Header ON/OFF

The panel keys on the instrument are used to specify the GPIB talk/listen addresses and select the header ON/OFF.

① When [LCL / ADRS] is pressed, the initial setting or the previous setting is displayed and two digits of 10^1 and 10^0 for the address setting flash as shown below. A desired address can be selected from 31 kinds of the address codes on Table 7-3. Decimal codes are used for address setting.

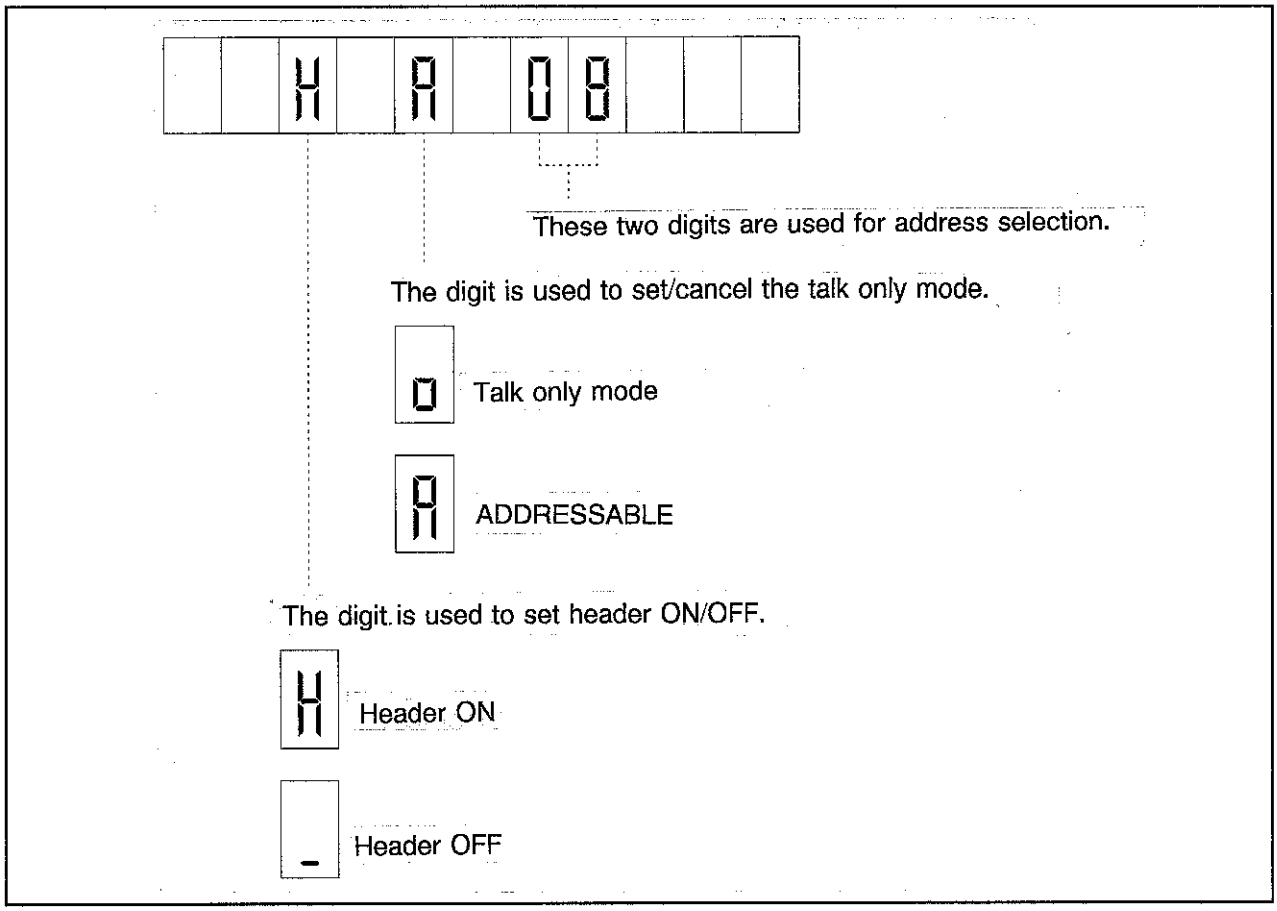


Figure 7-4 Display for Address Setting

② Pressing [⇨] key moves the flashing digit.

③ The following describes how to specify the GPIB talk/listen address and set the header ON/OFF.

- GPIB address setting
  After entering GPIB address value with ten keys, press [ENT] key to decide the entry.
  The range of the GPIB address value is 0 to 30.
- Header ON/OFF setting

Header setting	Key operation
OFF	0 ENT
ON	1 ENT

- Setting/canceling talk only mode

Mode setting	Key operation
ADDRESSABLE	0 ENT
Talk only mode	1 ENT

Note:
1. If more than 30 GPIB addresses has been set, an error message will be displayed.
2. It is required to set the instrument to the talk only mode and also set the address mode of the mating device connected through the bus line to the same mode. If the instrument uses the controller in the talk only mode, it will ignore the instructions from the controller and does not ensure normal operation.
3. When outputting in binary, only the GPIB command control is available.

Table 7-3 Address Codes Table

ASCII Code Characters		Decimal Codes
LISTEN	TALK	
SP	@	00
!	A	01
"	B	02
#	C	03
$	D	04
%	E	05
&	F	06
'	G	07
(	H	08
)	I	09
*	J	10
+	K	11
,	L	12
-	M	13
.	N	14
/	O	15
0	P	16
1	Q	17
2	R	18
3	S	19
4	T	20
5	U	21
6	V	22
7	W	23
8	X	24
9	Y	25
:	Z	26
;	[	27
<	\	28
=	]	29
>	~	30

7.1.4 Talker Format

When R5363 (instrument) is specified as talker, measurement and calculation data are output as shown below.

(1) ASCII output format

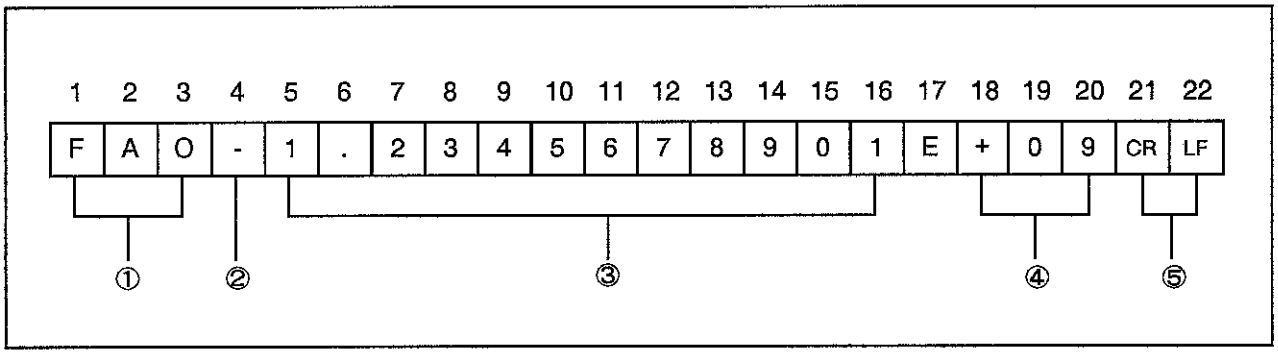


Figure 7-5 ASCII Output Format

① Header

1st header
- F: Frequency (unit; Hz)
- S: Second (unit; s)
- T: Integrating (time)

2nd header
- A: AVERAGE computing ON
- Space: AVERAGE computing OFF

3rd header

O:	Over	High
H:	HIGH	↑
P:	PASS	
L:	LOW	
F:	Offset	Priority
X:	MAX	
N:	MIN	
D:	Δ	
S:	Standard deviation	
M:	Parts per million (PPM)	↓
Space:	The above settings are OFF.	Low

② Data symbols

A "space" is used when the polarity of the measurement data or computing data is plus.
A "minus" is used when the polarity of the measurement data or computing data is minus.

③ Maximum data value (up to 11 digits) + decimal point (one digit)

The instrument outputs the data corresponding to the number of digits for the displayed measurement value.

④ Exponent

+11 to -15

⑤ Delimiter

The instrument outputs CRLF + EOI as initial value (changeable with GPIB command).

(2) ASCII output format of CONT measurement data

When CONT measurement data is output in the ASCII format, the string delimiter (SL0 to 2) is used to separate each piece of measurement data. However, the delimiter selected by DL0 to 2 is used for the final measurement value.

```
HHH D.DDDDDDDDDDE+SS (,)
HHH D.DDDDDDDDDDE+SS (,)
HHH D.DDDDDDDDDDE+SS (,)
        ⋮                          H: Header
        ⋮                          D: Measurement data
HHH D.DDDDDDDDDDE+SS (CRLF+EOI)    S: Exponent data
```

(3) Binary output format

The instrument can output data in the binary format. The binary format used is the 64-bit floating point binary format which is specified by IEEE standard 754-1985.
No head is output. One piece of measurement data consists of eight bytes. The least significant byte of the measurement data has EOI as a delimiter.

```
HSSSSSSS SSSSDDDD DDDDDDDD DDDDDDDD DDDDDDDD DDDDDDDD DDDDDDDD DDDDDDDD+EOI
└──────────────────────────────────────────────────────────────────────────┘
                                  8 Bytes
```

H: Symbol bit of fixed point part (1 bit)
S: Exponent (11 bits)
D: Fixed point part (52 bits)

(4) Binary output format for DMA transfer (available only for CONT measurement data output)

No header is used.
Then pieces of measurement data consist of 8 bytes multiplied by the number of times of the measurement. The data is output starting at the most significant byte of the first piece and ending at the least significant byte of the nth piece of the data. EOI is added as a delimiter to the least significant byte of the final piece of CONT measurement data.

HSSSSSSS SSSSDDDD DDDDDDDD ..... DDDDDDDD DDDDDDDD DDDDDDDD + EOI

Most significant byte of 1st piece — Least significant byte of nth piece

n: The number of times that CONT measurement is performed

7.1.5 GPIB commands

(1) Setting functions

Item	Command	Description	Initial value
CHECK	F0	Internal clock measurement	●
INPUT A	F1		
INPUT B (sine wave)	F2		
INPUT B (rectangular wave)	F3		
PERIOD	F4	Period measurement	
T.I-1	F5	Time interval measurement (100ns resolution)	
T.I-2	F6	Time interval measurement (100ps resolution)	
TOT	F7	Totalize	

(2) Setting resolution (multiplier)

Item	Command	Description	Initial value
<0.1ms (10^0)	GT1		●
<1ms (10^1)	GT2		
<10ms (10^2)	G0 or GT3		
<0.1s (10^3)	G1 or GT4		
<1s (10^4)	G2 or GT5		
<10s (10^5)	G3 or GT6		

(3) Input conditions required for INPUT A

Item	Command	Description	Initial value
ANS OFF	A0		●
ANS ON	A1		
RANGE LOW	A2	60MHz to 1.5GHz	●
RANGE HIGH	A3	1.5GHz to 3GHz	

(4) Input conditions required for INPUT B

(1 of 2)

Item	Command	Description	Initial value
LPF OFF	B0		●
LPF ON	B1		
DC connection	B2		●
AC connection	B3		

(2 of 2)

Item	Command	Description	Initial value
ATT OFF	B4	ATT = 0dB	●
ATT ON	B5	ATT = 20dB	
POLA ↑	B6	Starts at leading edge.	●
POLA ↓	B7	Starts at trailing edge.	

(5) Setting CONT measurement

Item	Command	Description	Initial value
CONT measurement	CONT0	CONT measurement OFF	●
	CONT1	CONT measurement ON	
Setting number of measurement	MD*****	1 to 14000 can be set for the number of the measurement times.	
Setting start	SJ1	Start with ST/SP key.	●
	SJ2	Pulse start of EXT input.	
	SJ3	Edge start of EXT input.	
	SJ4	Pulse start of B input.	
	SJ5	Edge start of B input.	
Setting timer	TM0	Setting timer OFF.	●
	TM1	Delay for the number of pulses	
	TM2	Time delay	
	TN*****	Setting value of the delay for the number of pulses (0 to 65535)	
	TT****.*	Setting value of the time delay (0μs to 6553.5μs)	
Output of measurement data	ALL	Outputs the data enough for the set number of the measurement times.	

(6) Setting burst wave measurement

Item	Command	Description	Initial value
Burst wave measurement	D0	Burst wave measurement OFF.	●
	D1	Burst wave measurement ON.	
Pulse width change	PW0	Pulse width change OFF.	●
	PW1	Pulse width change ON.	
Setting value of pulse width	PWL****.*	Setting start of pulse width (0μs to 6553.5μs).	
	PWH****.*	Setting stop of pulse width (0μs to 6553.5μs).	

(7) Setting sample rate

Item	Command	Description	Initial value
10ms	SR1		
80ms	S2 or SR2		●
320ms	S3 or SR3		
2.5s	S4 or SR4		
HOLD	S5 or SR5		

(8) Setting trigger level

Item	Command	Description	Initial value
Trigger level	L0	Trigger level fixed 0V.	●
	L1	Available for trigger level setting.	
Setting value of trigger level	LV**.**	Set the trigger level value (-1.20V to +1.20V).	

(9) Setting SAVE/RECALL

Item	Command	Description	Initial value
SAVE	SAV*	Available for SAVE1 to SAVE3.	
RECALL	RCL*	Available for RECALL1 to RECALL3.	

(10) Setting LSD, fixed point

Item	Command	Description	Initial value
LSD OFF	A4		●
LSD ON	A5		
Fixed point OFF	FIX0		●
Fixed point ON	FIX1	The last display digit can arbitrarily be set.	
Setting the number of display digit	FIXN***	+09 to -12	

(11) Computing

(1 of 2)

Item	Command	Description	Initial value
AVERAGE OFF	AVG0		●
AVERAGE ON	AVG1		
Setting the number of AVERAGE	AVGN*****	Number of averaging times (1 to 10000)	
MAX OFF	MA0		●
MAX ON	MA1	The maximum value measured after the arbitrary time can be obtained.	
MIN OFF	MI0		●
MIN ON	MI1	The minimum value measured after the arbitrary time can be obtained.	

(2 of 2)

Item	Command	Description	Initial value
△ OFF	DELTA0		●
△ ON	DELTA1	(Maximum - Minimum)	
Standard deviation OFF	SIGMA0		●
Standard deviation ON	SIGMA1		
Parts per million OFF	PPM0		●
Parts per million ON	PPM1		
Setting reference value of parts per million	PPMN		
Comparator OFF	COMP0		●
Comparator ON	COMP1		
Setting comparator HIGH level	COMPH		
Setting comparator LOW level	COMPL		
Offset OFF	OFS0		●
Offset ON	OFS1		
Setting value of offset	OFSN		
Division OFF	DIV0		●
Division ON	DIV1		
Setting division data	DIVN		
Multiply OFF	MUL0		●
Multiply ON	MUL1		
Setting multiply data	MULN		
Average value of CONT measurement	CAVG	Average value of CONT measurement	

(12) Setting data value of computing

The mantissa section and exponent section must be set for the setting value of the comparator, parts per million and offset.

Item	Command	Description	Initial value
Setting the comparator HIGH level	COMPHOOOOOOOOOOOOOEOOO	Data can be set up to 13 digits (including a decimal point) for mantissa section and between +09 to -12 for exponent section.	
Setting the comparator LOW level	COMPLOOOOOOOOOOOOOEOOO		
Setting reference value of parts per million	PPMNOOOOOOOOOOOOOEOOO		
Setting value of offset	OFSNOOOOOOOOOOOOOEOOO		
Setting value of division	DIVNOOOOOOOOOO	Input value from 0.001 to 99999.999	
Setting value of multiply	MULNOOOOOOOOO		

Minus data of the offset value can be set up to 14 digits (including a decimal point) for mantissa section.

(13) Setting header ON/OFF

Item	Command	Description	Initial value
Header OFF to ASCII output	H0		●
Header ON to ASCII output	H1		
Binary output to transfer to DMA with header OFF	H2		

(14) Setting measurement conditions

Item	Command	Description	Initial value
START	ST		●
STOP	SP		
INSTR PRESET	IP		

(15) Setting service request

Item	Command	Description	Initial value
Service request ON	S0		
Service request OFF	S1		●

(16) Setting delimiter

Item	Command	Description	Initial value
CRLF&EOI	DL0		●
LF	DL1		
EOI	DL2		

(17) Setting string delimiter

Item	Command	Description	Initial value
, (comma)	SL0		●
Space	SL1		
CRLF	SL2		

(18) Others

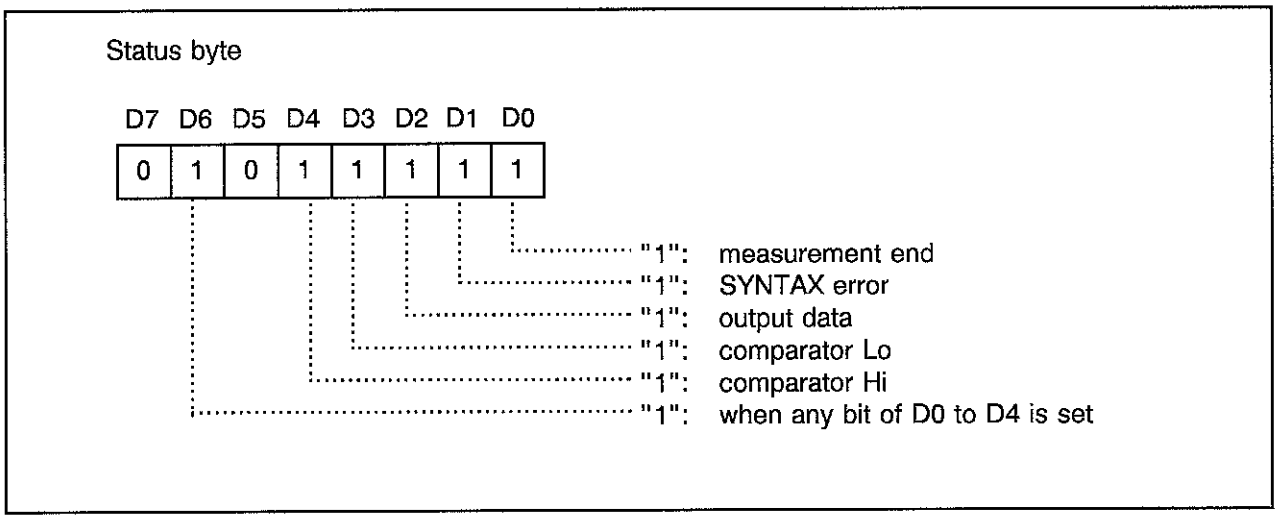
Item	Command	Description	Initial value
Start the measurement	E		
Clear	C	Sets initial value.	

(19) GPIB command

Item	Command	Description	Initial value
Start the measurement	GET		
Clear	DCL		
Clear	SDC		

7.1.6 Service Request

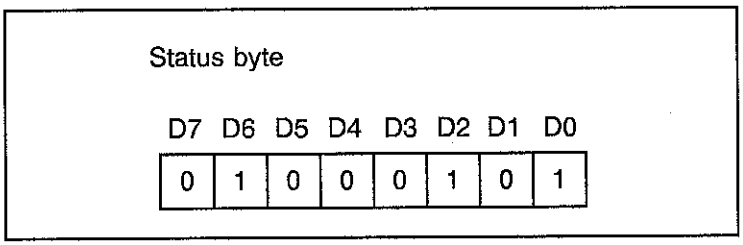
If the GPIB command is set to "S0" mode, the instrument generates the service request (SRQ) to the controller when it receives the measurement end code or an undefined code.
After the instrument generates the service request, the instrument sends the status byte in response to the serial polling of the controller.
If the GPIB command is set to "S1", the instrument does not send the status byte.



Note: Unless any bit of D0 to D4 is "1" with the GPIB command set to "S0", D6 is not set to "1".

(1) Service request by measurement end

For the service request indicating that the instrument ends the measurement, the status byte is set to "69" in decimal code.



(2) Service request by SYNTAX error

For the service request indicating SYNTAX error because of receiving an undefined code, the status byte is set to "66" in decimal code.
The SYNTAX errors include the command error, parameter error, and execution error.

Status byte

D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	0	0	0	1	0

(3) Service request by output-enable data

For the service request indicating that it is possible to output the computing results (AVERAGE, MAX, MIN, Δ, and σ) which have not been read out yet, the status byte is set to "68" in decimal code.

Status byte

D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	0	0	1	0	0

(4) Service request by comparator (Lo)

For the service request indicating that the comparator computing result is Lo, the status byte is set to "77" in decimal code.

Status byte

D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	0	1	1	0	1

(5) Service request by comparator (Hi&Lo)

For the service request indicating that the comparator computing result is Hi&Lo, the status byte is set to "93" in decimal code.

Status byte

D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	1	1	1	0	1

(6) Service request by comparator (Hi)

For the service request indicating that the comparator computing result is Hi, the status byte is set to "85" in decimal code.

Status byte

D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	1	0	1	0	1

7.1.7 Programming

The measurement parameters and input conditions can be entered through key operation on the panel as usual.

(1) When gate time is to be set to "<1s" by A input:

For PC 9801:

```
PRINT   @1:"F1 __ GT5"
  ①      ② ③ ④  ⑤
```

①: Specifies the controller for talker.
②: Sets the GPIB address of the instrument to "1".
③: A input
④: "space" or "comma" is available between commands.
⑤: gate time <1s

(2) Set the gate time to "<1s" and add the offset 50MHz by A input.

For PC 9801:

```
PRINT@1 ;"F1 GT5"
PRINT@1 ;"OFS1 OFSN50E6"
```

7.1.8 Sample Program

(1) Sets the input A, the gate time<1s, and the hold, then obtain the measurement data by the trigger.

- PC9801 sample program

PROGRAM

```
1000 '
1010 ISET IFC
1020 ISET REN
1030 CNT=8
1040 PRINT @CNT;"C"
1050 PRINT @CNT;"H1,F1,GT5,SR5"
1060 PRINT @CNT;"E"
1070 INPUT @CNT;A$
1080 PRINT A$
1090 GOTO 1060
1100 END
```

1010: Interface clear
1020: Remote enable
1030: Sets address of instrument to variable.
1040: Clears counter.
1050: Sets counter.
Header ON, A input, gate time <1s, hold
1060: Trigger (measurement start instruction)
1070: Reads measurement data.
1080: Displays measurement data on CRT.
1090: Returns to line 1060.
1100: Program ends.

DATA

```
F   1.19999961E+09
F   1.19999960E+09
F   1.19999960E+09
F   1.19999961E+09
```

- HP-200 sample program

PROGRAM

```
1000 !
1010 Cnt=708
1020 CLEAR Cnt
1030 OUTPUT Cnt;"H1,F1,GT5,SR5"
1040 TRIGGER Cnt
1050 ENTER Cnt;A$
1060 PRINT A$
1070 GOTO 1040
1080 END
```

1010: Sets address of instrument to variable.
1020: Clears counter.
1030: Sets counter.
Header ON, A input, gate time <1s, hold
1040: Trigger (measurement start instruction)
1050: Reads measurement data.
1060: Displays measurement data on CRT.
1070: Returns to line 1040.
1080: Program ends.

DATA

```
F   1.19999960E+09
F   1.19999960E+09
F   1.19999959E+09
F   1.19999961E+09
```

(2) Sets the input B, the gate time < 0.1s, and the average calculation ON, then obtain the calculation data.

- PC9801 sample program

PROGRAM

```
1000 '
1010 ISET IFC
1020 ISET REN
1030 CNT=8
1040 PRINT @CNT;"C"
1050 PRINT @CNT;"F3,GT4"
1060 PRINT @CNT;"AVG1,AVGN123"
1070 PRINT @CNT;"E"
1080 INPUT @CNT;A$
1090 PRINT A$
1100 GOTO 1070
1110 END
```

1010: Interface clear
1020: Remote enable
1030: Sets address of instrument to variable.
1040: Clears counter.
1050: Sets counter.
B input, gate time < 0.1s
1060: Sets average computing to ON and number of samples to 123.
1070: Trigger (measurement start instruction)
1080: Reads measurement data.
1090: Displays measurement data on CRT.
1100: Returns to line 1070.
1110: Program ends.

DATA

```
5.0000000E+05
5.0000000E+05
5.0000000E+05
5.0000000E+05
```

- HP-200 sample program

PROGRAM

```
1000 !
1010 Cnt=708
1020 CLEAR Cnt
1030 OUTPUT Cnt;"F3,GT4"
1040 OUTPUT Cnt;AVG1,AVGN123"
1050 ENTER Cnt;A$
1060 PRINT A$
1070 GOTO 1050
1080 END
```

1010: Sets address of instrument to variable.
1020: Clears counter.
1030: Sets counter.
B input, gate time <0.1s
1040: Sets average computing to ON and number of samples to 123.
1050: Reads measurement data.
1060: Displays measurement data on CRT.
1070: Returns to line 1050.
1080: Program ends.

DATA

```
5.0000000E+05
5.0000000E+05
5.0000000E+05
5.0000000E+05
```

(3) Sets the instrument to "S0" mode and performs the measurement by the trigger from the controller when required.

The controller can execute another job until the measurement is complete. When the measurement is finished, it receives the service request from the counter. After reading out the data, it can return to another job again.
This example shows that only the instrument originates the service request.

- PC9801 sample program

PROGRAM

```
1000 '
1010 DEF SEG=&H60
1020 A%=PEEK(&H9F3)
1030 A%=A% AND &HBF
1040 POKE &H9F3,A%
1050 ISET IFC
1060 ISET REN
1070 CMD DELIM=0
1080 CNT=8
1090 ON SRQ GOSUB *SRQROUTINE
1100 PRINT @CNT;"C"
1110 PRINT @CNT;"F3,GT4,SR5,S0"
1120 '
1130 '********** MAIN ROUTINE **********
1140 SRQ ON
1150 FOR I=1 TO 1000      :NEXT I
1160 PRINT @CNT;"E"
1170 FLAG=0
1180 IF FLAG=1 THEN 1160
1190 GOTO 1180
1200 END
1210 '
1220 '********** SRQ ROUTINE **********
1230 *SRQROUTINE
1240     POLL 8,S
1250     IF S<>69 THEN 1300
1260     INPUT @CNT;A$
1270     PRINT "STATUS="+STR$(S)
1280     PRINT "FREQ="+A$+"Hz"
1290     FLAG=1
1300     SRQ ON
1310  RETURN
```

1010: Clears SRQ signal in PC9801 GPIB.
to
1040
1050: Interface clear
1060: Remote enable
1070: Designates the delimiter as CR + LF.
1080: Sets address of instrument to variable.
1090: Specifies the first address of SRQ routine.
1100: Clears counter.
1110: Sets counter.
B input, gate time < 0.1s, hold, SRQ ON
1140: Permission for receiving SRQ signal.
1150: Wait time.
1160: Trigger (measurement start instruction)
1170: Clears the flag for interruption end.
1180: Loop of interruption or of ready for interruption.
to
1190
1200: Program ends.
1240: Serial poll.
1250: Goes to line 1300 if no service request is output for generating outputtable data.
1260: Reads measurement data.
1270: Displays measurement data on CRT.
1280: Displays measurement data on CRT.
1290: Sets the flag for interruption end.
1300: Permission for receiving SRQ signal.
1310: Returns to main routine.

DATA

```
STATUS= 69
FREQ=5.0000000E+05 Hz
STATUS= 69
FREQ=5.0000001E+05 Hz
STATUS= 69
FREQ=5.0000000E+05 Hz
```

- HP-200 sample program

PROGRAM

```
1000 !
1010 DIM A$[30]
1020 Cnt=708
1030 ON INTR 7 GOSUB Srq
1040 !
1050 CLEAR Cnt
1060 OUTPUT Cnt;"F3,GT4,SR5,S0"
1070 ENABLE INTR 7;2
1080 TRIGGER Cnt
1090 Flag=0
1100 IF Flag=1 THEN 1080
1110 GOTO 1100
1120 !
1130 Srq:  STATUS 7,1;X
1140       S=SPOLL(Cnt)
1150       IF S<>69 THEN 1190
1160       ENTER Cnt;A$
1170       PRINT A$
1180       Flag=1
1190       ENABLE INTR 7;2
1200       RETURN
1210       END
```

1010: Defines data area.
1020: Sets address of instrument to variable.
1030: Defines the routine for interruption.
1050: Clears counter.
1060: Sets counter.
A input, gate time <0.1s, hold, SRQ ON
1070: Permits interruption by SRQ.
1080: Trigger (measurement start instruction)
1090: Clears the flag for interruption end.
1100: Loop of interruption or of ready for interruption.
to
1110
1130: Routine for interruption.
1140: Serial poll.
1150: Goes to line 1190 if no service request is output for generating outputtable data.
1160: Reads measurement data.
1170: Displays measurement data on CRT.
1180: Sets the flag for interruption end.
1190: Permits interruption by SRQ.
1200: Returns to main routine.
1210: Program ends.

DATA

```
5.0000000E+05 Hz
5.0000001E+05 Hz
5.0000000E+05 HZ
```

(4) In CONT measurement, outputs the measurement data as an ASCII-type data.

- PC9801 sample program

PROGRAM

```
1000 '
1010 ISET IFC
1020 ISET REN
1030 CNT=8
1040 NUM=100
1050 PRINT @CNT;"H1,SL2"
1060 PRINT @CNT;"F3,GT3,B3"
1070 PRINT @CNT;"CONT1,SJ1,TM0"
1080 PRINT @CNT;"MD"+STR$(NUM)
1090 PRINT @CNT;"ST"
1100 '********** AVERAGE **********
1110 PRINT @CNT;"CAVG"
1120 INPUT @CNT;A$
1130 PRINT A$
1140 '********** MAX **********
1150 PRINT @CNT;"MA1"
1160 INPUT @CNT;A$
1170 PRINT A$
1180 '********** MIN **********
1190 PRINT @CNT;"MI1"
1200 INPUT @CNT;A$
1210 PRINT A$
1220 '********** DELTA **********
1230 PRINT @CNT;"DELTA1"
1240 INPUT @CNT;A$
1250 PRINT A$
1260 '********** SIGMA **********
1270 PRINT @CNT;"SIGMA1"
1280 INPUT @CNT;A$
1290 PRINT A$
1300 '********** SOKUTEI DATA **********
1310 PRINT @CNT;"ALL"
1320       FOR K=1 TO NUM
1330       INPUT @CNT;A$
1340       PRINT A$
1350       NEXT K
1360 END
```

1010: Interface clear
1020: Remote enable
1030: Sets address of instrument to variable.
1040: Sets number of measurement.
1050: Sets counter.
to Header ON, string delimiter (CR,LF)
B input, gate time <10ms, AC coupling, CONT measurement ON, start condition (key input), timer not used
1080: Number of measurement.
1090: Measurement start
1110: Sets value of instrument (average value).
1120: Reads measurement data.
1130: Displays measurement data on CRT.
1150: Sets value of instrument (maximum value).
1160: Reads measurement data.
1170: Displays measurement data on CRT.
1190: Sets value of instrument (minimum value).
1200: Reads measurement data.
1210: Displays measurement data on CRT.
1230: Sets value of instrument (variation range).
1240: Reads measurement data.
1250: Displays measurement data on CRT.
1270: Sets value of instrument (standard deviation).
1280: Reads measurement data.
1290: Displays measurement data on CRT.
1310: Sets this instrument.
(Outputs all measurement data.)
1320: Routines enough for the number of measurement times.
1330: Reads measurement data.
1340: Displays measurement data on CRT.
1360: Program ends.

DATA

```
FA  5.000000E+05 ——— Average value
FAX 5.000000E+05 ——— Maximum value
FAN 5.000000E+05 ——— Minimum value
FAD 0.000000E+00 ——— Variation range
FAS 0.00E+00 ————— Standard deviation
F   5.000000E+05 ┐
F   5.000000E+05 │
F   5.000000E+05 ├ 100 measurement data
       :         │
F   5.000000E+05 │
F   5.000000E+05 ┘
```

(5) In CONT measurement, outputs the continuously 5000 times measurement data as an ASCII-type data and saves the result on the file of personal computer.

- PC9801 sample program

PROGRAM

```
1000 ISET IFC
1010 ISET REN
1020   CNT=8
1030   PRINT @CNT;"ALL"
1040 '**********SAVE CONTDATA**********
1050  OPEN "C:CONTDATA.DAT" FOR OUTPUT AS #1
1060    FOR K=1 TO 5000
1070      INPUT @CNT;A#
1080      PRINT #1,K,A#
1090    NEXT K
1100  CLOSE
1110 END
```

1000: Interface clear
1010: Remote enable
1020: Sets address of instrument to variable.
1030: Sets counter.
Header OFF, outputs all measurement data.
1050: Opens "CONTDATA.DAT" file.
1070: Reads measurement data.
1080: Saves the data to file.
1100: Closes the file.
1110: Program ends.

(6) In CONT measurement, outputs the measurement data as a binary data.

- HP-200 sample program

PROGRAM

```
1000 !
1010 OPTION BASE 1
1020 REAL Dt(1000) BUFFER
1030 Cnt=708
1040 OUTPUT Cnt;"H2,SL0"
1050 OUTPUT Cnt;"CONT1,MD1000"
1060 OUTPUT Cnt;"SJ1,TM0"
1070 OUTPUT Cnt;"ST"
1080 OUTPUT Cnt;"ALL"
1090 ASSIGN @Buffer TO BUFFER Dt(*)
1100 ASSIGN @Device TO 708
1120 TRANSFER @Device TO @Buffer;END,WAIT
1130 FOR K=1 TO 1000
1140 PRINT Dt(K)
1150 NEXT K
1160 END
```

1010: Variable declaration
1020: Ensures an area in buffer.
1030: Sets address of instrument to variable.
1040: Sets counter.
to Header OFF, string delimiter (,) CONT measurement ON, number of measurement 1000 times.
1060: Start condition (key input), timer not used.
1070: Measurement start.
1080: Outputs all measurement data.
1090: Ensures measurement data.
1120: Sets address of the device to which measurement data is output.
1130: Transfers measurement data to buffer.
1140: Routines enough for the number of measurement times.
1150: Displays measurement data on CRT.
1160: Program ends.

DATA

```
500000
499999
  :      } 1000 measurement data
500000
500000
```

7.2 R13017 BCD Output Unit

7.2.1 Outline

With R13017 connected to the R5363, it allows the measurement data to be BCD output. The higher six digits are output for normal display value or the higher six digits including the digit optionally selected by the fixed point display are output.

7.2.2 Specifications

Data capacity:	1 digit for function, 6 digits for fixed point part, 1 digit for symbol of exponent, 2 digits for exponent, 1 digit for decimal point, and 1 digit for unit
Data output:	BCD parallel output (8-4-2-1), positive logic
Output level:	TTL level (74HC374 or equivalent)
Output connector:	57-40500 (Dai-ichi Electronics Manufacture) or equivalent
Power:	Supplied from R5363
Usage ambient temperature:	0°C to +50°C
Usage ambient humidity:	relative humidity 90% or less

Table 7-4 BCD Connector Pin Assignment

Pin No.	Signal Names	Pin No.	Signal Names
1	GND	26	2^0
2	2^0	27	2^1 10^3
3	2^1 10^0	28	2^2
4	2^2	29	2^3
5	2^3 Exponent part	30	2^0
6	2^0	31	2^1 10^4
7	2^1 10^1	32	2^2
8	2^2	33	2^3
9	2^3	34	2^0
10	2^0	35	2^1 10^5
11	2^1 Exponent symbol	36	2^2
12	2^2	37	2^3
13	2^3	38	2^0 Function
14	2^0	39	2^1
15	2^1 10^0	40	2^0
16	2^2	41	2^1 Unit
17	2^3	42	2^2
18	2^0	43	2^3
19	2^1 10^1 Fixed point part	44	2^0
20	2^2	45	2^1 Decimal point
21	2^3	46	2^2
22	2^0	47	print instruction signal output
23	2^1 10^2	48	print end signal input
24	2^2	49	N.C
25	2^3	50	GND

Note: Do not use pin 49 for a relay terminal.

7.2.3 Setting Up for Use

On receiving R13017 BDC Output Unit, check that the model name and the quantity of standard accessories are listed in Table 7-5. Next, check the R13017 for any shipping damages. If any of the standard accessories is missing or if any crack or damage is found, contact ATCE, your nearest dealer, or sales and support offices.

Table 7-5 R13017 BCD Output Unit Configurations

Model name	Quantity	Remarks
BCD board with cable	1	
Panel with cable	1	50-pin connector (57-40500: Equivalent to the unit manufactured by Dai-ichi Electronics)
M3 screws	2	

7.2.4 Panel Description

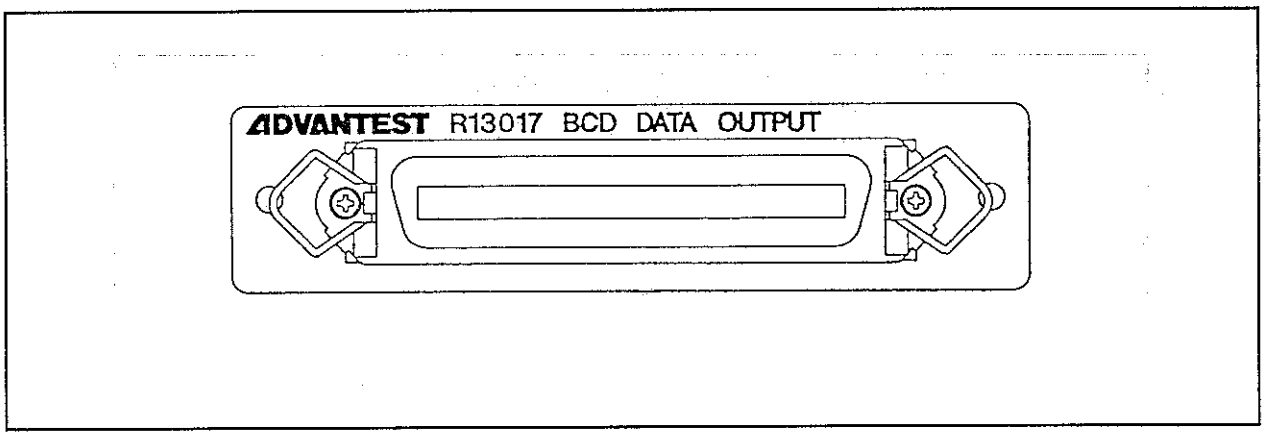


Figure 7-6 BCD Output Unit Panel Surface

The connector is used to output the BCD (8-4-2-1) code data of the display value and to input the printing termination signal.
50-pin connector (Dai-ichi Electronics Manufacture) is used. (positive logic I/O)

7.2.5 Data Output Timing

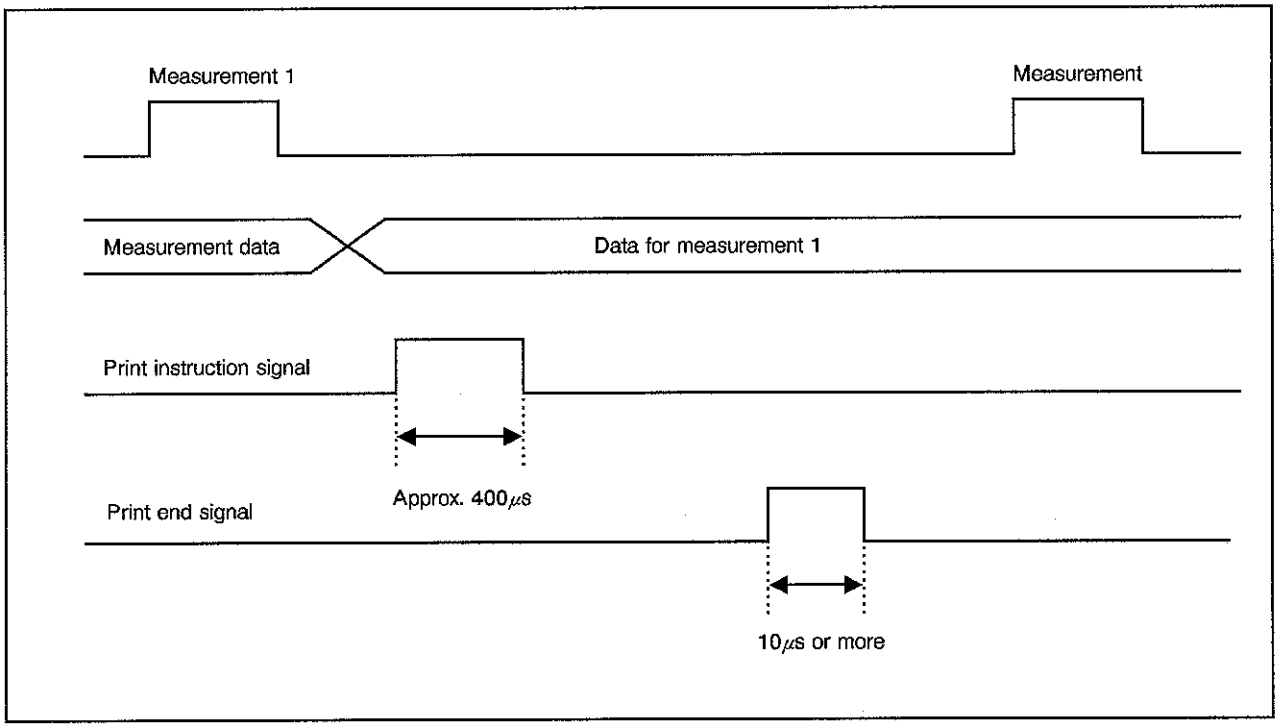


Figure 7-7 Data Output Timing Chart

Note : 1. The print instruction signal from the instrument is output as a 400μs positive pulse after the old data is replaced with new data and the data is decided.

2. The print end signal (EXT.RESET signal) which is an input signal to the instrument requires a positive pulse width more than 10μs.

7.2.6 Data Output Format

(1) Function

When the function is normally used:

Data	Code		Print contents
	2^1	2^0	
Over	0	1	*
Minus	1	0	-
Space	1	1	space

If the comparator computing is used, a code corresponding to the computing result is output to the function.

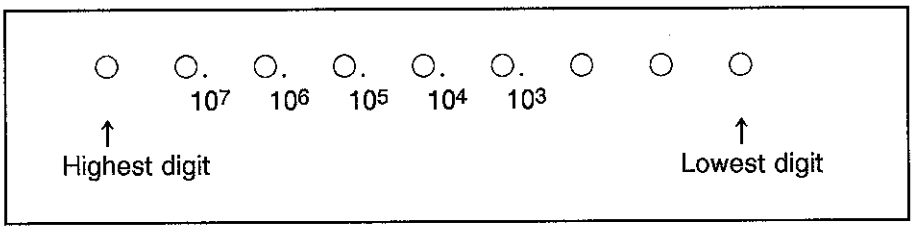
Counter display	Code		Print contents
	2^1	2^0	
Hi	0	1	Outputs * to function. Same as usual for others.
Lo	1	0	Outputs - to function. Same as usual for others.
PASS	1	1	Outputs space to function. Same as usual for others.
Hi Lo	0	1	Outputs * to function. Same as usual for others.

(2) Codes

Code				Data	Unit
2^3	2^2	2^1	2^0		
0	0	0	0	0	
0	0	0	1	1	
0	0	1	0	2	
0	0	1	1	3	
0	1	0	0	4	
0	1	0	1	5	
0	1	1	0	6	
0	1	1	1	7	
1	0	0	0	8	
1	0	0	1	9	
1	0	1	0	-	
1	0	1	1	+	s
1	1	0	0	space	
1	1	0	1	space	
1	1	1	0	space	Hz
1	1	1	1	space	space

(3) Decimal point codes

Code			Data
2^2	2^1	2^0	
0	1	1	10^3
1	0	0	10^4
1	0	1	10^5
1	1	0	10^6
1	1	1	10^7



7.2.7 BCD output for fixed point display

If the number of digits that the instrument displays the measurement result is more than 7 and it is desired to output the lower 6 digits, the higher 6 digits including the final digit set by the fixed point display are BCD output.
For the information on the fixed point display, refer to section 6.4.2.

7.2.8 How to mount the unit

① Power off the instrument and be sure to remove the power cable.

② Remove the blank panel on the rear panel of the counter.

③ Remove M3 screws located at 2 positions on the rear frame of the instrument and remove the rear frame and case.

④ With two M3 screws, fix the board of the unit at the specified two positions.

⑤ Connect the cable of the unit to the counter.

⑥ Connect the attached cable to the rear panel.

⑦ With the attached cable, connect the rear panel with the BCD board connector.

⑧ Insert the unit case into the instrument and mount the rear frame.

⑨ Here, R13017 BCD output unit has been mounted.

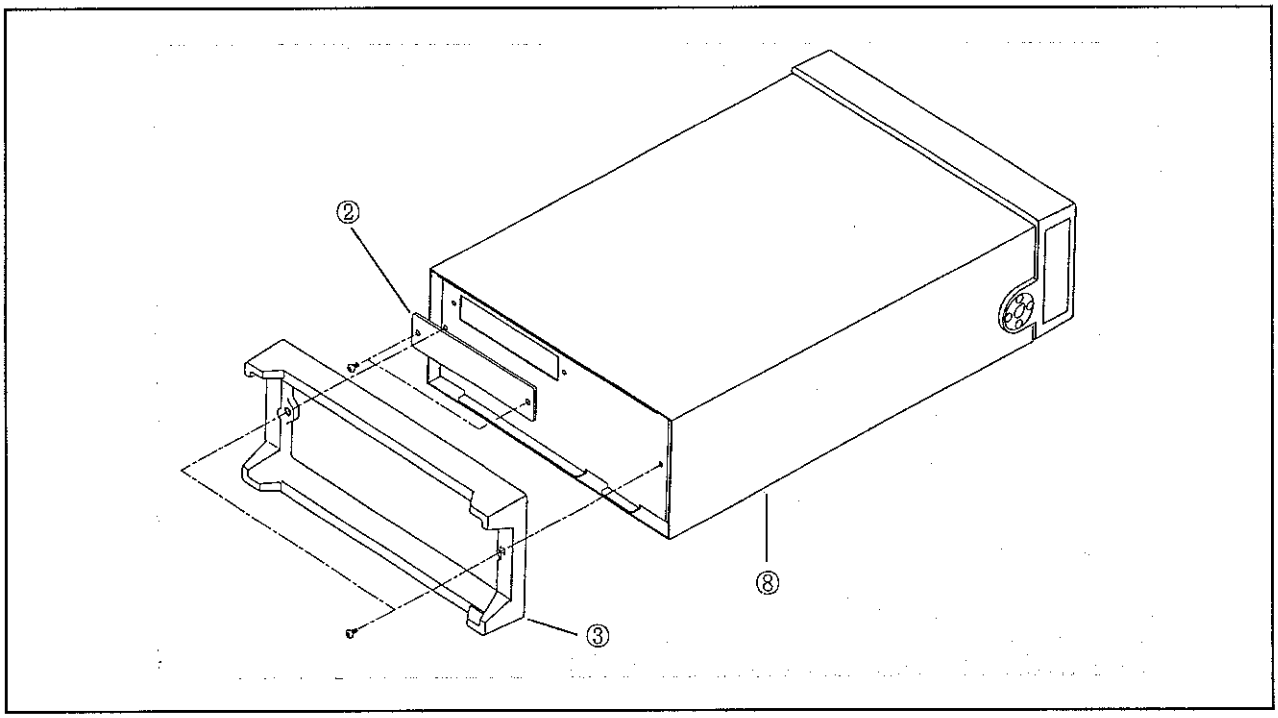


Figure 7-8 How to Remove Rear Frame and Case

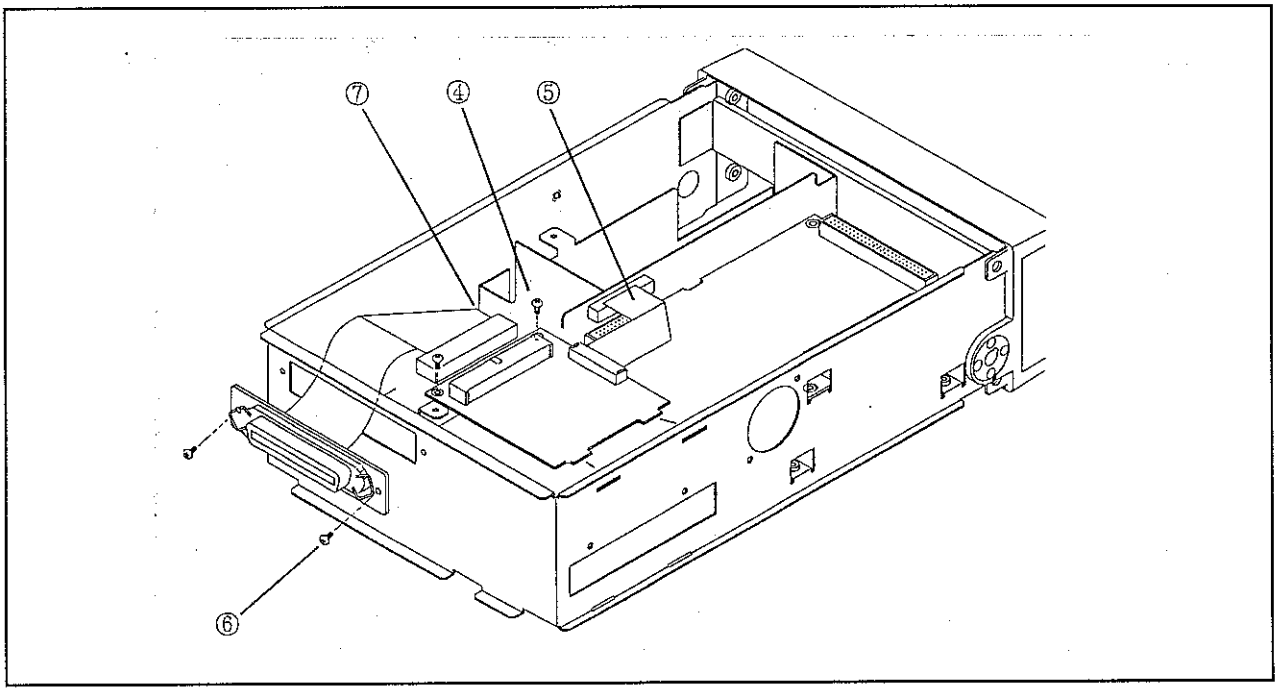


Figure 7-9 How to Mount BCD Output Unit

7.3 R13018 DA output unit

7.3.1 Outline

With R13018 connected to R5363, it allows DA output of the lower four digit of the display digits.

7.3.2 Specifications

Output voltage:	0V to +9.999V
Number of conversion digit:	Lower four digit of the display digits.
Output connector:	BNC connector
Conversion accuracy:	±0.25% of F.S (23°C ± 5°C)
	±0.4% of F.S (0°C to +50°C)
Resolution:	Approx. 2.5mV
Output impedance:	Approx. 100Ω
Power:	Supplied from R5363
Usage ambient temperature:	0°C to +50°C
Usage ambient humidity:	Relative humidity 90% or less

7.3.3 Preparation before operation

When the unit is delivered to you, check that all components are included and no damage has occurred to them during transportation. If there is any shortage or damage, contact ATCE or your nearest dealer.

Table 7-6 Component of R13018 DA Output Unit

Model name	Quantity	Remarks
DA board with cable	1	
Panel with cable With DA output connector	1	With DA output connector (BNC)
M3 screws	2	

7.3.4 Description of panel

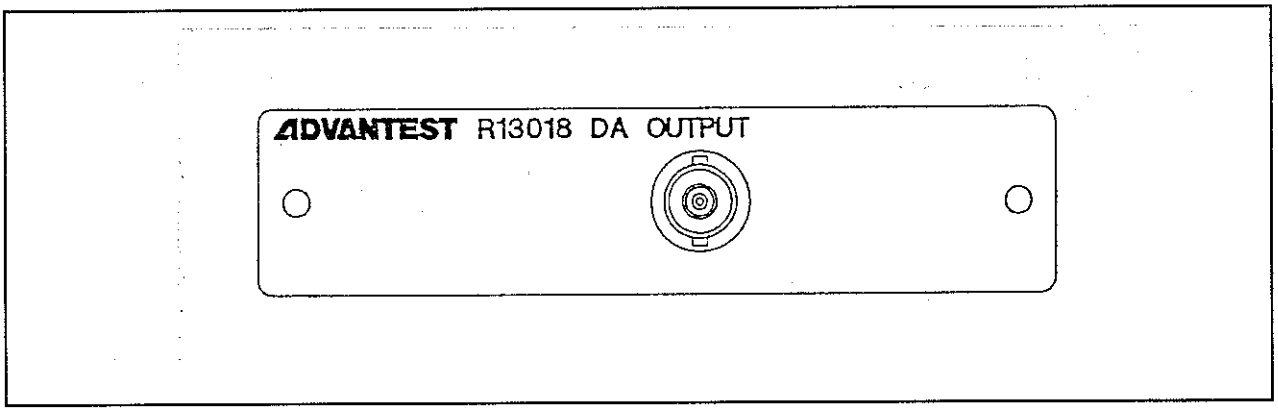


Figure 7-10 Panel of DA Output Unit

Is the digital to analog conversion voltage output connector for lower four digits of display digits (BNC type connector).

7.3.5 Description of DA board

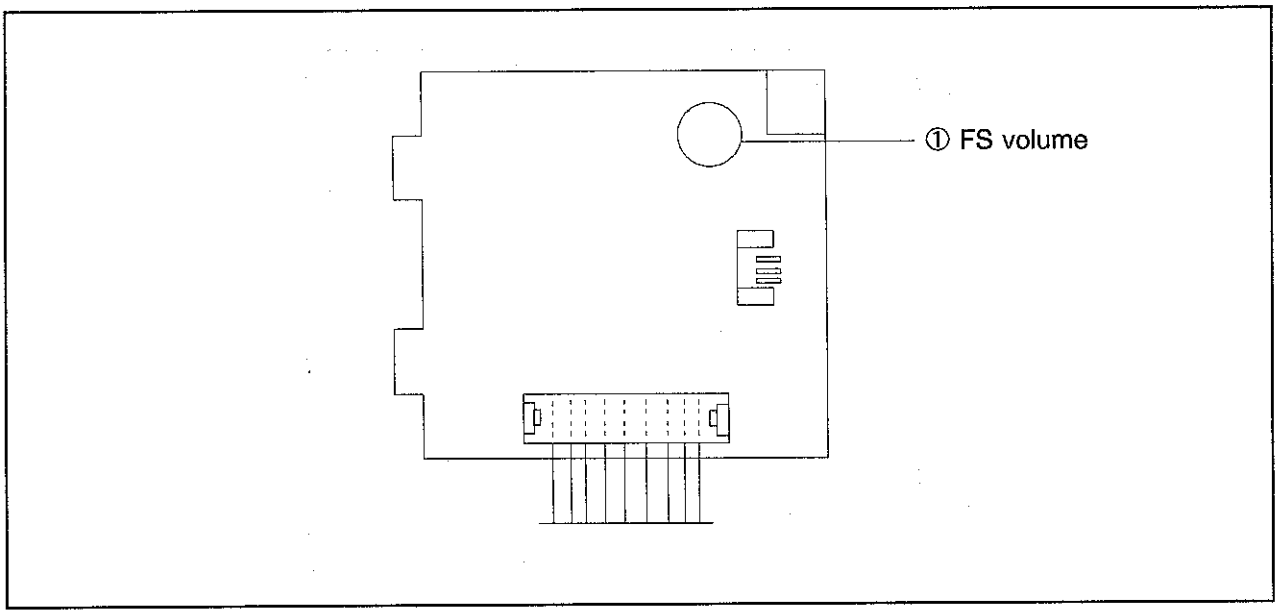


Figure 7-11 FS Volume position

① FS volume

FS volume is used to adjust the full seals value (+ 9.999V) of the DA output voltage.

7.3.6 DA output for fixed point display

DA output can be made for the low-order 14 digits of the fixed-point representation if the arbitrary last display digit of R5363 is set in the form of fixed-point representation.
For the information on the fixed point display, refer to section 6.4.2.

7.3.7 How to mount the unit

① Power off the instrument and be sure to remove the power cable.

② Remove the blank panel on the rear panel of the counter.

③ Remove M3 screws located at 2 positions on the rear frame of the instrument and remove the rear frame and case.

④ With two M3 screws, fix the board of the unit at the specified two positions.

⑤ Connect the cable of the unit to the counter.

⑥ Connect the attached cable to the rear panel.

⑦ With the attached cable, connect the rear panel with the BCD board connector.

⑧ Insert the unit case into the instrument and mount the rear frame.

⑨ Here, R13018 DA output unit has been mounted.

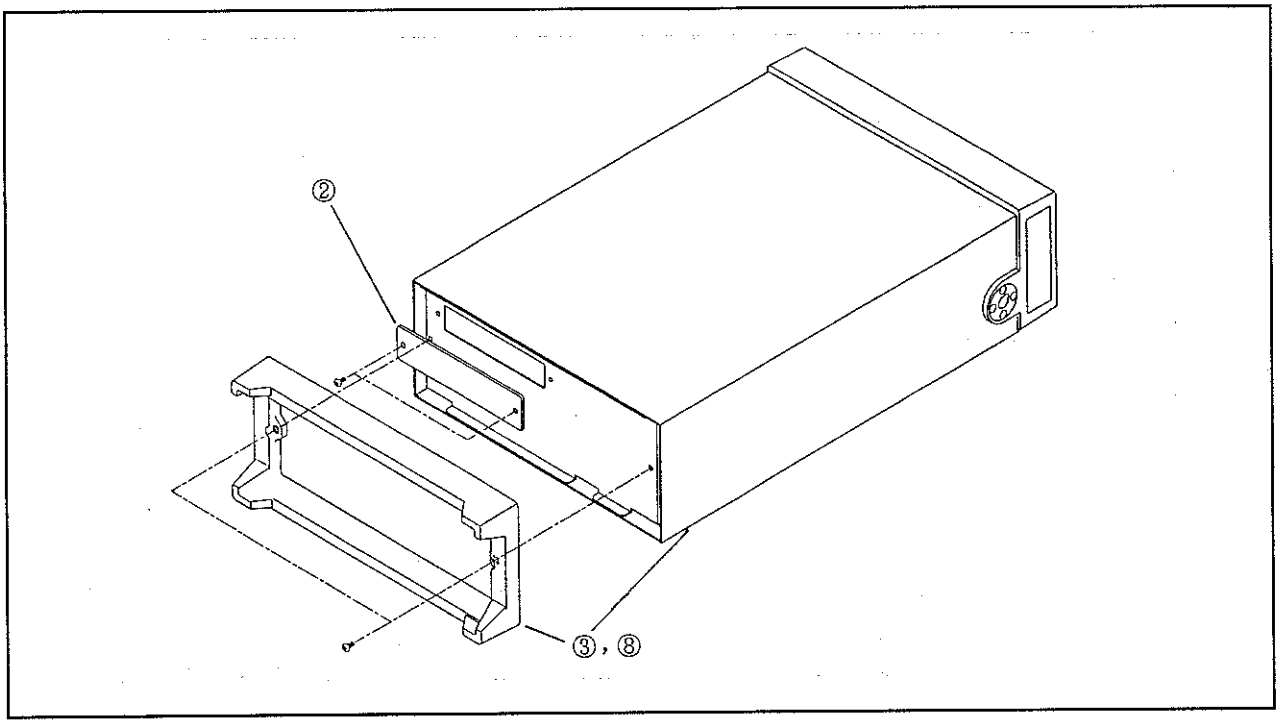


Figure 7-12 How to Remove Rear Frame and Case

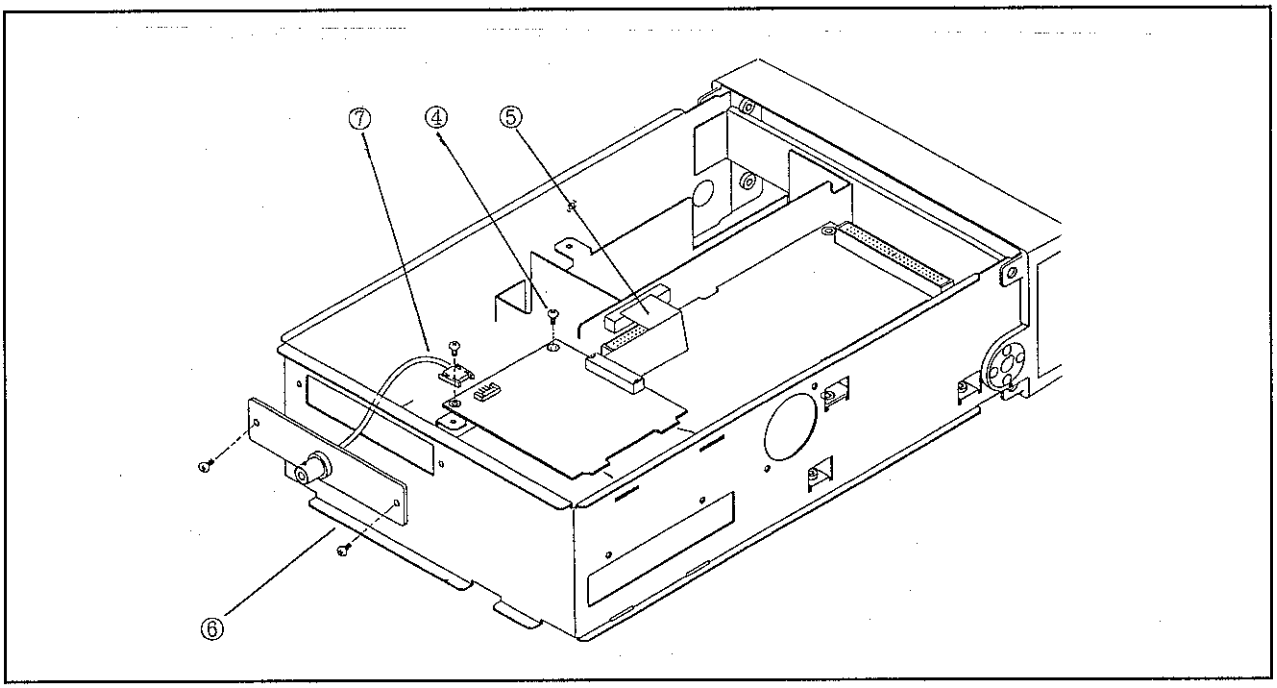


Figure 7-13 How to Mount DA Output Unit

7.3.8 Relationship between display and DA output voltage

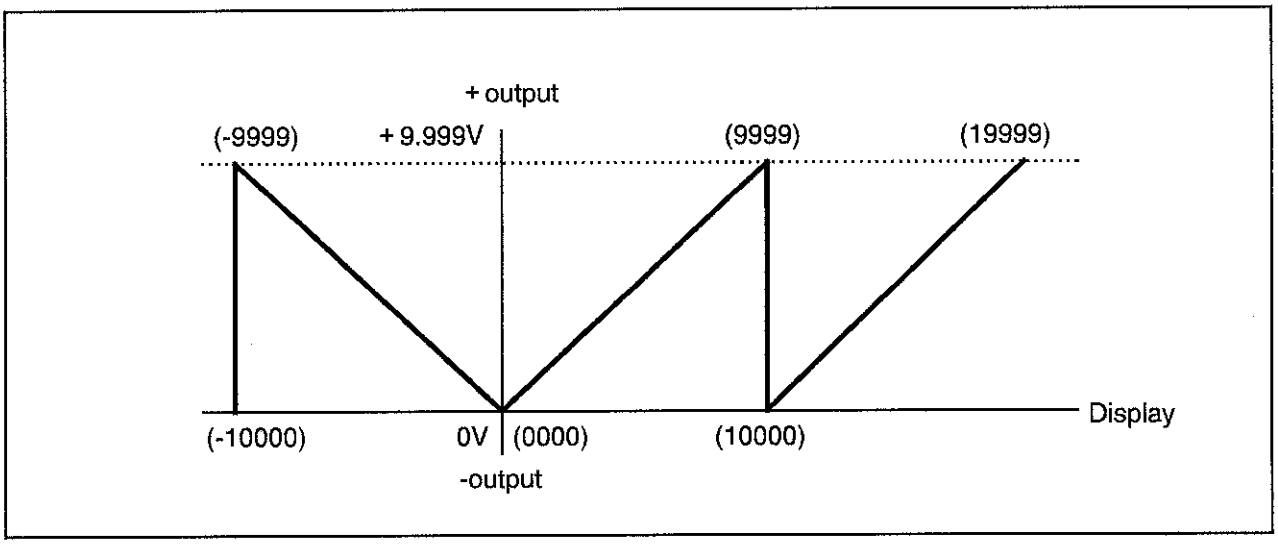


Figure 7-14 DA Output Voltage

Table 7-7 Relationship between Display Value and DA Output Voltage

Display value	DA output voltage
9999	+9.999V
0000	0.000V

7.3.9 Adjustment of DA

If the conversion accuracy of the R13018 is out of range, adjust it as follows:

① Set the power switch of R5363 to STBY and remove the power cable from it.

② Remove the rear frame and case.

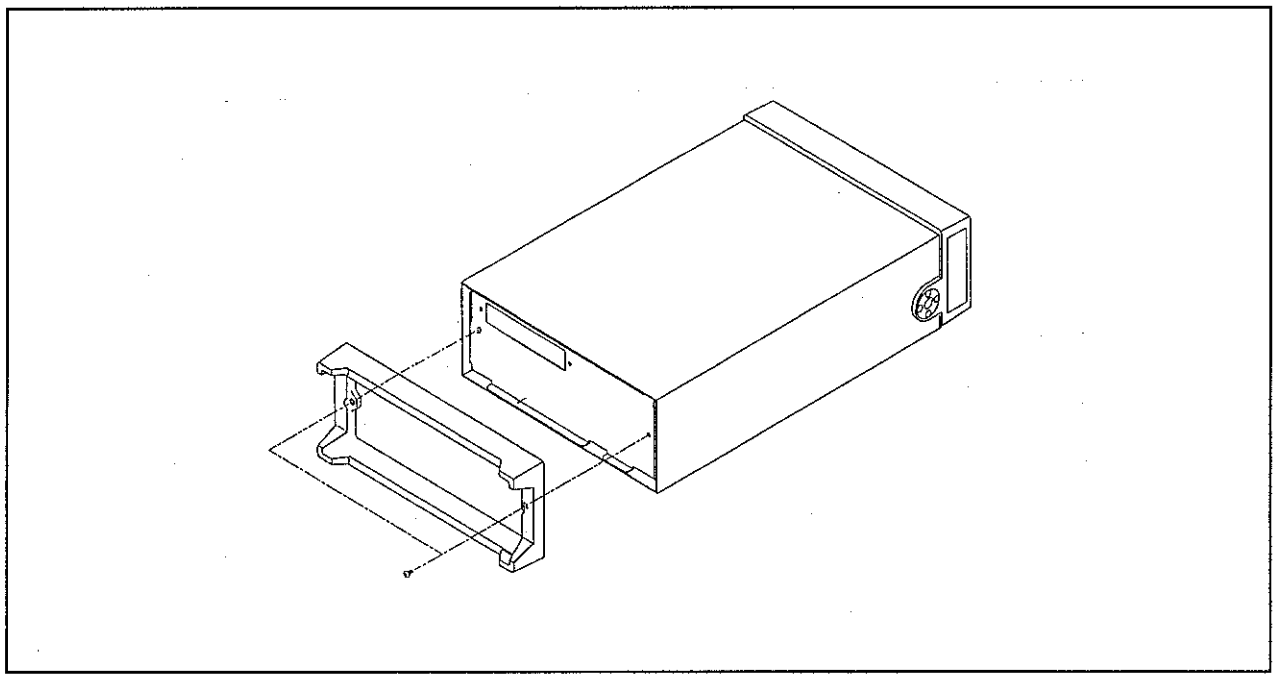


Figure 7-15 How to Remove Rear Frame and Case

③ Connect the instrument which can measure a voltage over +10V at the resolution of 1mV into DA OUT.

④ Connect the power cable to the R1308 and power on it.

⑤ Adjust the counter so that the lower four digits of its display digits are "0000" and check that the DA output voltage is "0.000V".

⑥ Adjust the counter so that the lower four digits of its display digits are "9999" and adjust the DA output voltage by turning the FS volume clockwise or counterclockwise with minus screwdriver so that it is " +9.999V".

⑦ Check the voltage values of step ⑤ and ⑥ again.

⑧ Set the power switch of the counter to STBY and remove the power cable from it. After that, remove the cable of the instrument connected to the DA OUT.

⑨ Mount the case and rear frame.

Here, the DA output voltage has been adjusted.
If the conversion accuracy is out of range after adjustment, contact ATCE or your nearest dealer.

Note : Do not touch other parts than the FS volume with a screwdriver; otherwise, a failure may occur.

8. OPERATION DESCRIPTION

This chapter describes the operation of each block, along the R5363 block diagram.

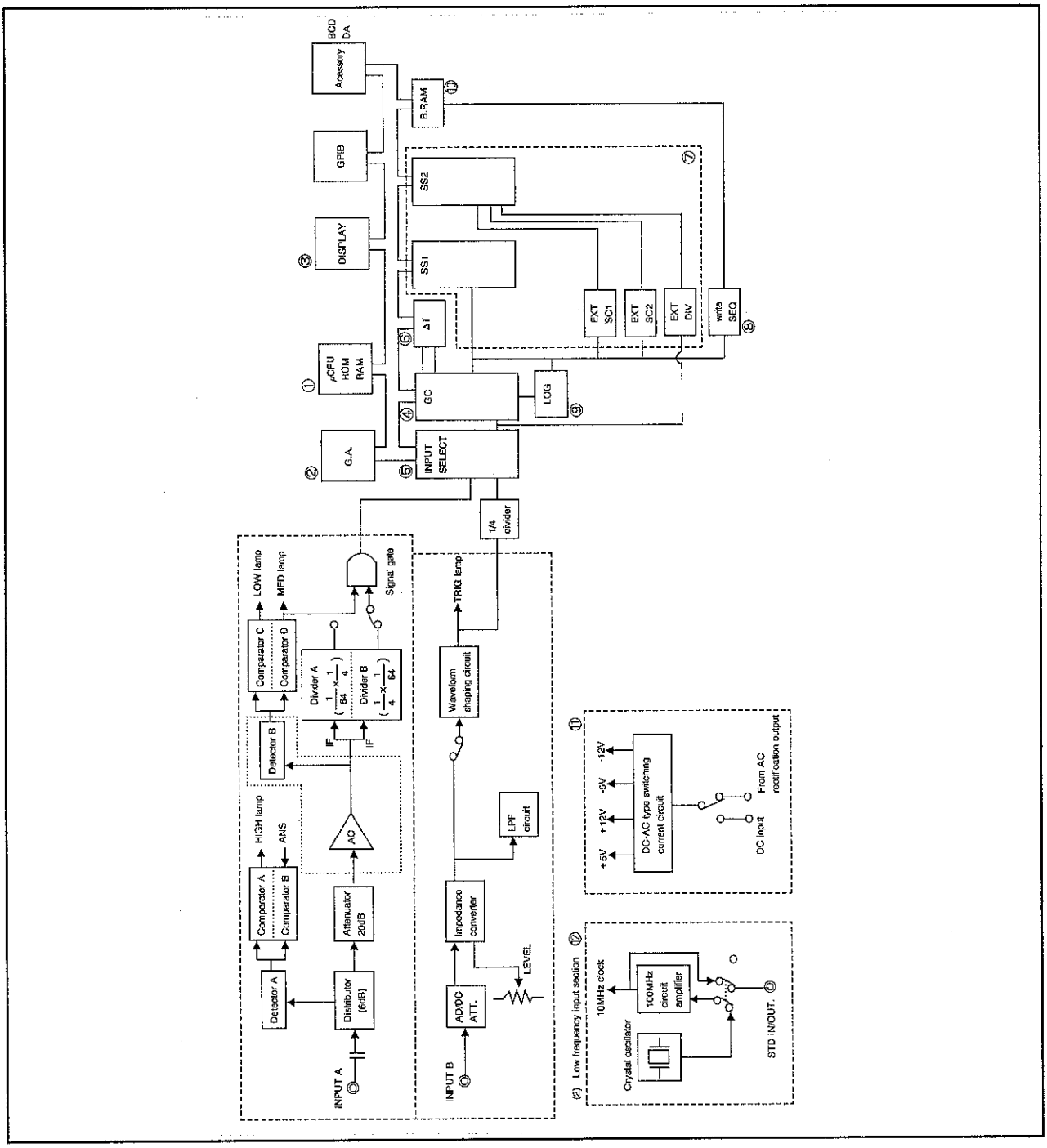


Figure 8-1 R5363 block diagram

<Operation description of each block>

① Performs the main control of the unit and computes measurement data in various ways.

② Performs the main control of the unit.

③ Displays measurement results and the status of the unit .

④ Controls the measurement functions and the gate time.
Performs the sub-control of the unit.

⑤ Controls the measurement functions and input block.

⑥ Measures the fraction time.

⑦ Counts the input signals.
- For normal measurement, the counting uses EXT.SC1.
- For continuous measurement, the counting uses EXT.SC1 and EXT.SS2 alternately.

⑧ Controls the buffer RAM.

⑨ Counts cycles of input signals.

⑩ Stores measurement results.

⑪ Uses the DC-DC type switching power supply and also uses the series regulator for each output line.

⑫ Can use 1MHz, 2MHz, and 5MHz signals with high harmonic wave components of 10MHz as an external reference source.

8.1 Measurement Accuracy

(1) For FREQ.A

The counter employs the Reciprocal Method which performs the inverse computing for measured cycle values and display the results in cycle and the expression representing the accuracy is as follows:

± trigger error ± resolution ± computing error ± reference time accuracy . . . . . ①

Since the lower limit of the measurement bandwidth for FREQ.A is 60MHz and the internal noise is low (60μVrm), the trigger error of the first term can be removed. Also, since the counter is controlled so that the number of displayed digits is always under the resolution of the second term, the computing error of the third term can be removed. Accordingly, the expression ① can be simplified, as follows:

± resolution ± reference time accuracy . . . . . ②

Here, the resolution depends on the performance of the ΔT measurement circuit. However, since the real counting time changes and the dimension is changed form cycles to frequencies, the same value cannot be obtained for the signal frequency.

(2) For PERIOD B

The expression representing the accuracy is the same as the expression ① but all things are considered so that the computing error does not exceed the resolution. Therefore, the expression below will be obtained:

± trigger error ± resolution ± reference time accuracy . . . . . ③

The trigger error of the first term may result from the internal or external noise. Also, the trigger error has a nature which is inversely proportional to cycles at measurement.
These conditions can be represented by the expression below:

$$\text{Trigger error} = \frac{T^2}{\text{Real counting time [s]}} \left(\frac{2.8 \times 10^{-5}}{Es} + 0.32 \times \frac{E_N}{Es} \right) \text{[s]} \quad \ldots\ldots \quad ④$$

T: signal cycles [s]
Es: signal amplitude [Vrms]
E_N: noise amplitude [Vrms]

Since the resolution of the second term of the expression 3 is the accuracy limitation of the ΔT measurement circuit, its weight varies depending on the signal cycle and real counting time.

$$\text{Resolution} = \frac{\text{Signal cycle [s]}}{\text{Real counting time [s]}} \times 1\text{ns} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad ⑤$$

(3) FREQ.B

The expression obtained by (2) above is the basic for this case.
The accuracy at the frequency dimension is:

(Signal frequency [Hz])^2 × (± trigger error ± resolution ± reference time accuracy) ..... ⑥

The accuracy for absolute value is the same both for the sine wave mode (∿) and rectangular wave mode (⊓). For the sine wave mode. the lower displayed digits are merely masked.

(4) For T.I. B

The basic expression is represented as follows:

± T.I. trigger error ± resolution ± reference time accuracy ..... ⑦

Since no computing is made for this case, no computing error will occur. The trigger error of the first term can be classified into one by the internal noise and one by the external noise. Also, since the measurement is made as an independent event, the average effect with setting the multiplier is multiplied by $\sqrt{N}$ and represented as follows:

$$\text{T.I. trigger error} = \frac{1}{\sqrt{\text{Number of multipliers}}} \left(\frac{2.8 \times 10^{-5}}{\text{SR}} + 0.32 \times \frac{E_N}{\text{SR}} \right) \text{[s]} \quad \cdots \quad ⑧$$

Figure 8-2 shows the relationship among SR, amplitude, and frequency for sine wave. The resolution of the second term in the expression ⑦ is increased being proportional to the square root of the number of multipliers. Therefore, the expression below will be obtained:

$$\text{Resolution} = \frac{100\text{ns}}{\sqrt{\text{Number of multipliers}}} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad ⑧$$

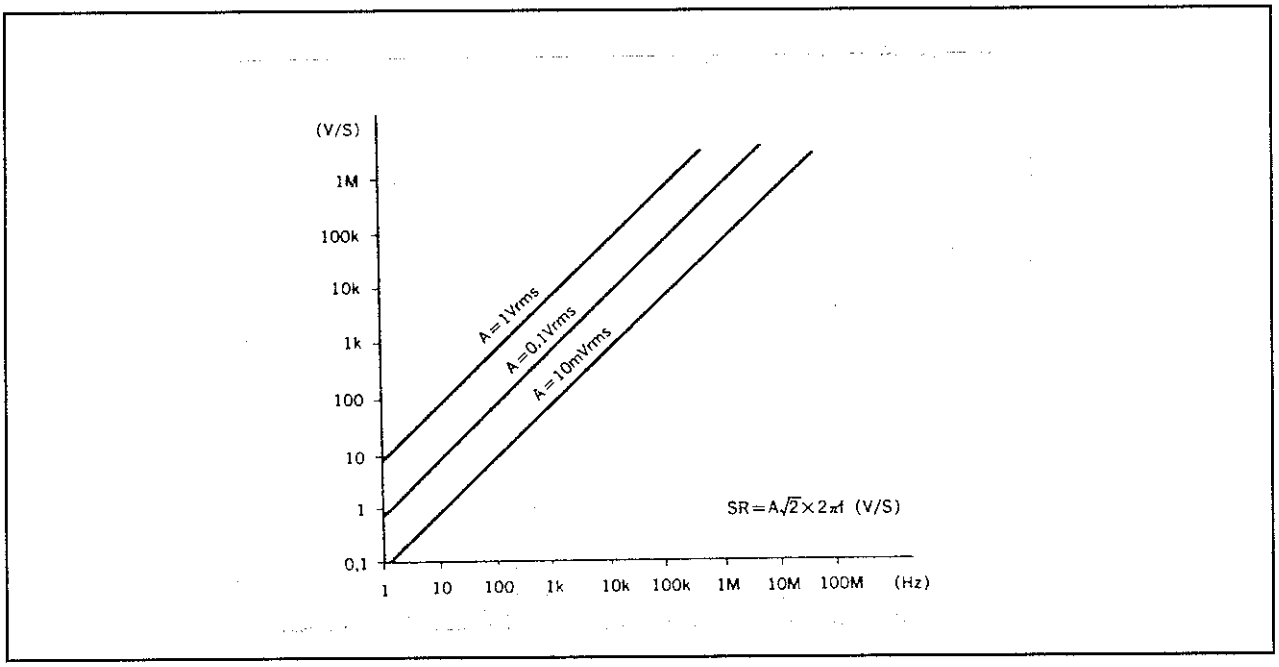


Figure 8-2 Relationship among SR, Amplitude, and Frequency in Sine Wave

9. PERFORMANCES TEST

9.1 Confirming Standards and Performances

Table 9-1 explains how to confirm the standards and performances of the counter.

CAUTION

To confirm the performances, refer to "9.3 Previous Knowledge".

Table 9-1 Confirming Standards and Performances of R5363

Parameters	Standards	Confirming Performances
Measurement frequency range and input sensitivity of INPUT A	Frequency range: 60MHz to 3000MHz Input sensitivity: 60MHz to 1500MHz; 10mVrms to 5Vrms 1500MHz to 2800MHz; 35mVrms to 5Vrms 2800MHz to 3000MHz; 50mVrms to 5Vrms	Confirm with signal generator. Refer to section 9.4.
Measurement frequency range and input sensitivity of INPUT B	Frequency range: 0.2mHz to 100MHz Input sensitivity: 25mVrms to 10Vrms (<10kHz) 25mVrms to 1Vrms (10kHz to 60MHz) 25mVrms to 500mVrms (60MHz to 100MHz)	Confirm with signal generator. Refer to section 9.5.
Cycle measurement	Measurement range: 10ns to 5000s (When LPF switch OFF)	Confirm with signal generator. Refer to section 9.6.
Integrating count	Counting range: DC to 50MHz Counting capacity: 0 to 999999999	Confirm with signal generator. Refer to section 9.7.

9.2 Equipment Necessary for Confirming Performances

Table 9-2 shows the equipment necessary for confirming the performances and Table 9-3 shows the attachment.
For confirming the performances, use the equipment shown in Table 9-2 or equivalents.

Table 9-2 Test Equipment List

Equipment	Necessary Performances		Applied Devices	Remarks
Signal generator	Frequency: Output level: Output wave form:	0.2mHz to 3000MHz -30dBm to 0dBm Sine wave Rectangular wave	ROHDE&SCHWARZ SMX ADVANTEST TR4515	
Field through termination	Impedance:	50Ω ± 1Ω	SONY Tectronix 011-0049-01	

Table 9-3 Attachment

Attachment	Application	ADVANTEST stock No.
Input cable (BNC-BNC)	Connection cable between INPUT A/B of R5363 and signal generator	MI-02

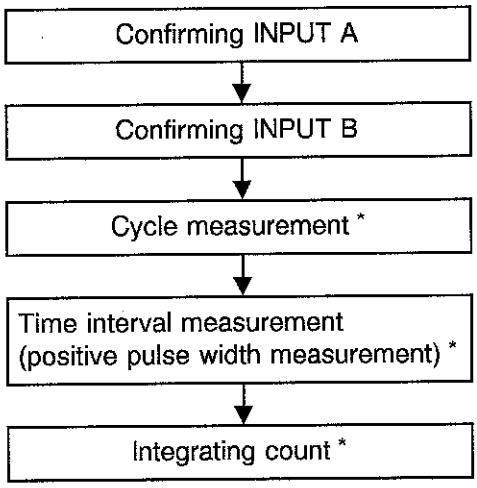
9.3 Previous Knowledge

The most important factor which will affect the measurement accuracy of the frequency counter is the oscillating frequency accuracy of the crystal oscillator generating the internal reference time.
Cautions for the performance test is as follows:

(1) R5363 requires 24-hour pre heating time after powered on.

(2) The performance must be confirmed at an ambient temperature of 23°C ± 5°C and a relative humidity of 70% or less.

(3) The performances must be confirmed in the order as shown below:



*: For confirming the cycle measurement, time interval measurement (positive pulse width measurement), and integrating count, their operations have only to be confirmed by the internal computing based on the performances of INPUT A and B.

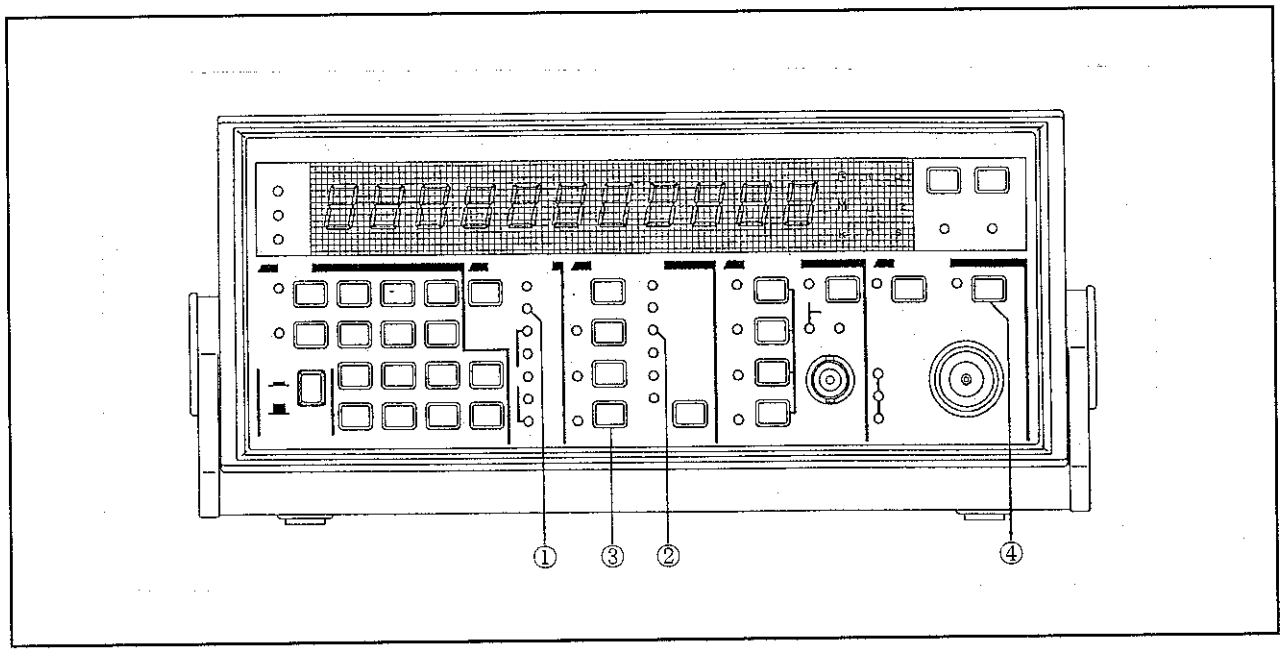
(4) Use the reference signal with the same or higher frequency accuracy as the R5363 for the signal generator which is to be used for confirming the performances of INPUT A and B.

9.4 Performance Confirmation for Frequency Range and Input Sensitivity of INPUT A

Standards: Frequency range; 60MHz to 3000MHz
Input sensitivity; 10mVrms (-27dBm) 60MHz to 1500MHz
35mVrms (-17dBm) 1500MHz to 2800MHz
50mVrms (-14dBm) 2800MHz to 3000MHz

Used equipment: Signal generator (SG)

(1) Setting R5363



① Set FUNCTION to A.

② Set GATE TIME to < 10ms.

③ Set the S.R switch to other setting than HOLD.

④ Set AND switch to OFF (lamp off).

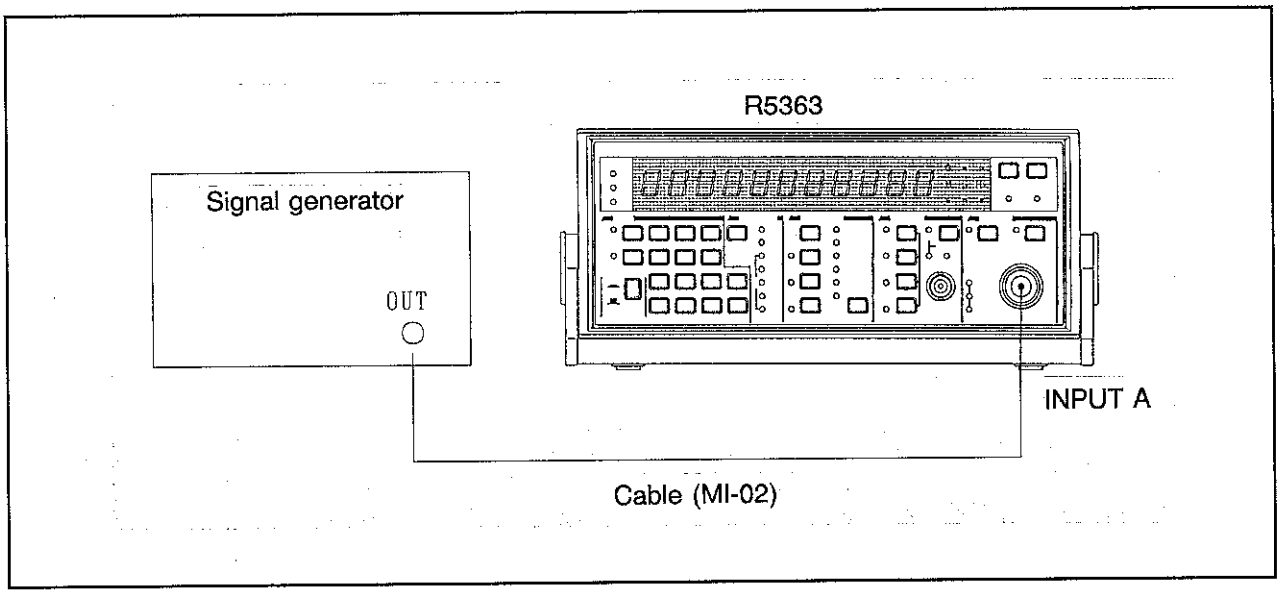
(2) Setting signal generator

① Set the frequency. See Table 9-3 for available measurement frequencies.

② Set the output level.
Connect the output of the signal generator to the high frequency power meter and set the output level to 10mVrms (-27dBm).

(3) Connecting R5363 to signal generator

After setting (2), Connect the output of the signal generator to INPUT A of the counter using the attached cable (MI-02).



(4) Confirming performances

With the output level 10mVrms, check that the displayed value of the counter is equal to the setting frequency of the signal generator.
Then, check the level (input sensitivity) at which a value is displayed when 10mVrms is entered by decreasing the output level of the signal generator to the condition where the level is not displayed and increasing it again.

Table 9-4 Performance Confirmation for Frequency Range and Input Sensitivity of INPUT A

Measurement frequency	Displayed value of R5363 *	Input sensitivity
60MHz	59.9999MHz to 60.0001MHz	≧10mVrms
1000MHz	999.999MHz to 1.000001GHz	≧10mVrms
1500MHz	1.499999GHz to 1.500001GHz	≧10mVrms
2700MHz	2.699999GHz to 2.700001GHz	≧35mVrms
3000MHz	2.999999GHz to 3.00001GHz	≧50mVrms

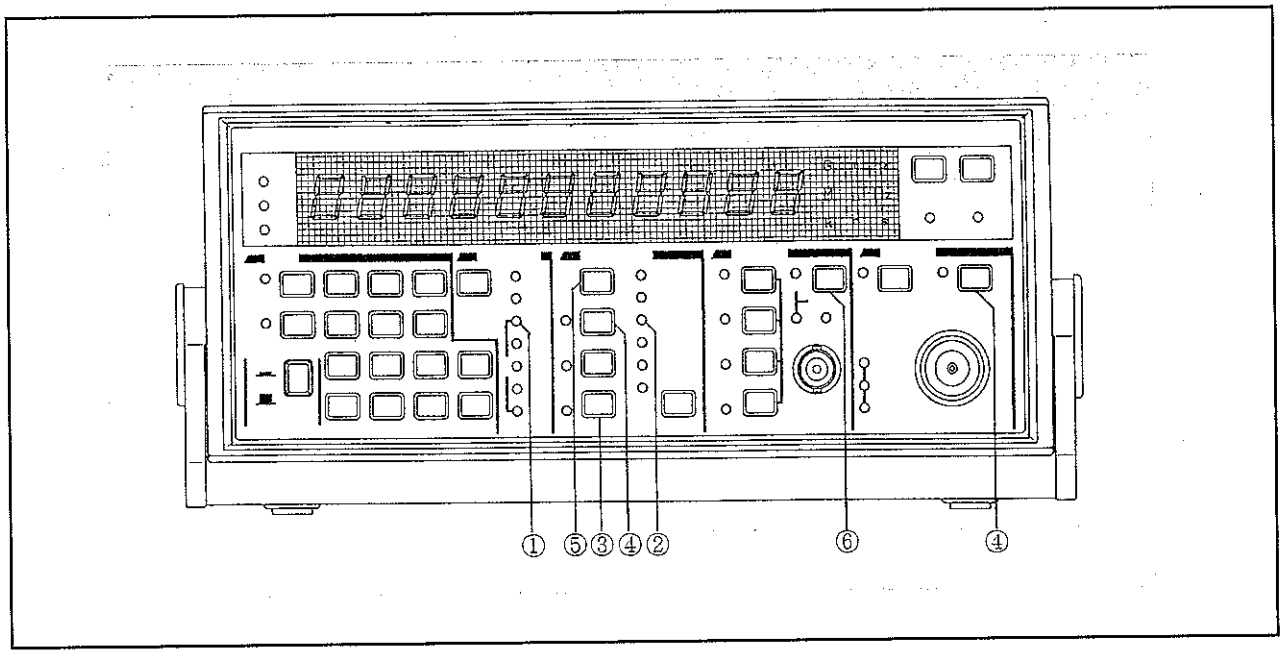
*: Actual displayed values depend on error factors.

9.5 Performance Confirmation for Frequency Range and Input Sensitivity of INPUT B

Standards: Frequency range; 0.2mHz to 100MHz
LPF OFF: 50mHz to 100MHz
LPF ON: 0.2mHz to 10kHz
Input sensitivity; 25mVrms to 10Vrms (<10kHz)
25mVrms to 1Vrms (10kHz to 60MHz)
25mVrms to 500mVrms (60MHz to 100MHz)

Used equipment: Signal generator
Field through termination (50Ω termination)

(1) Setting R5363



① Set FUNCTION to B ⎍⎍ .

② Set GATE TIME to <10ms.

③ Set the S.R switch to other setting than HOLD.

④ Set each switch of LPF and ATT to OFF (lamp off).

⑤ Set COUP switch to AC (lamp on).

⑥ Set LEVEL switch to 0V.

(2) Setting signal generator

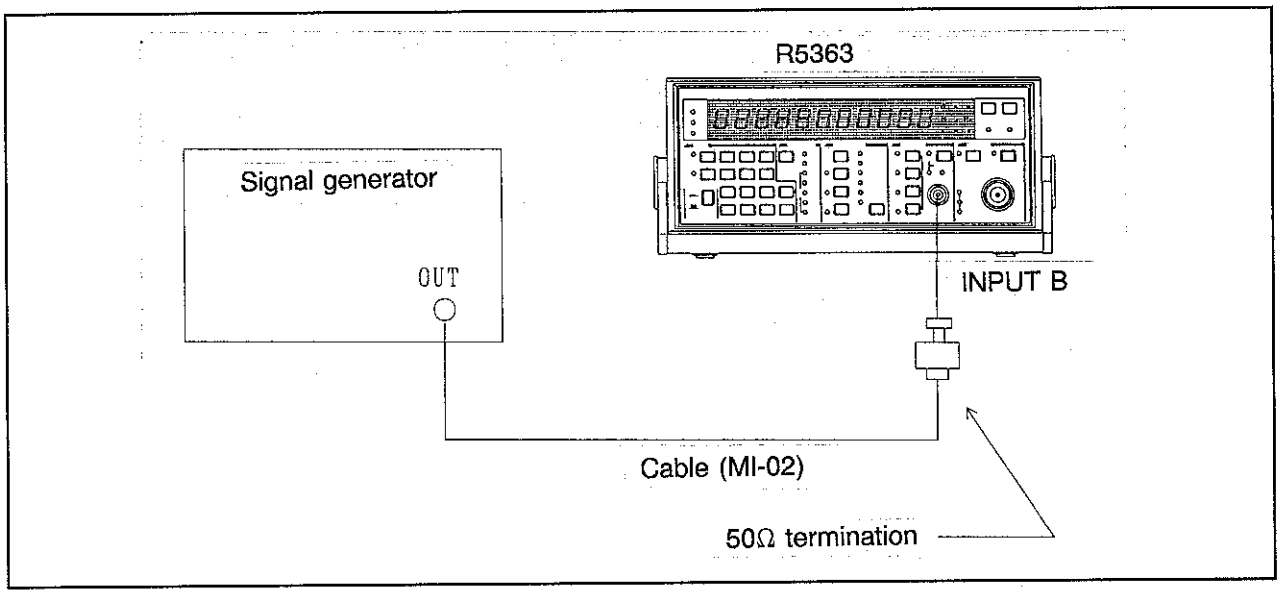
① Set the output wave form to sine wave mode.

② Set the frequency. See Table 9-4 for available measurement frequencies.

③ Set the output level.
Set the output level to 25mVrms (-19dBm).

(3) Connecting R5363 to signal generator

After setting (2), Mount the field through terminators (50Ω termination) both to the output connector of the signal generator and INPUT B connector of the R5363 and connect them using the attached cable (MI-02).



(4) Confirming performances

Check that the setting frequency of the signal generator is displayed as the output level 25mVrms on the display of the counter.
Then, check the level (input sensitivity) at which a value is displayed when 25mVrms is entered by decreasing the output level of the signal generator to the condition where the level is not displayed and increasing it again.

Table 9-5 Performance Confirmation for Frequency Range and Input Sensitivity of INPUT B

Measurement frequency	Displayed value of R5363 *	Input sensitivity
100kHz	99.99999kHz to 100.0001kHz	≧25mVrms
1MHz	999.9999kHz to 1.000001MHz	≧25mVrms
10MHz	9.999999MHz to 10.00001MHz	≧25mVrms
100MHz	99.99999MHz to 100.0001MHz	≧25mVrms

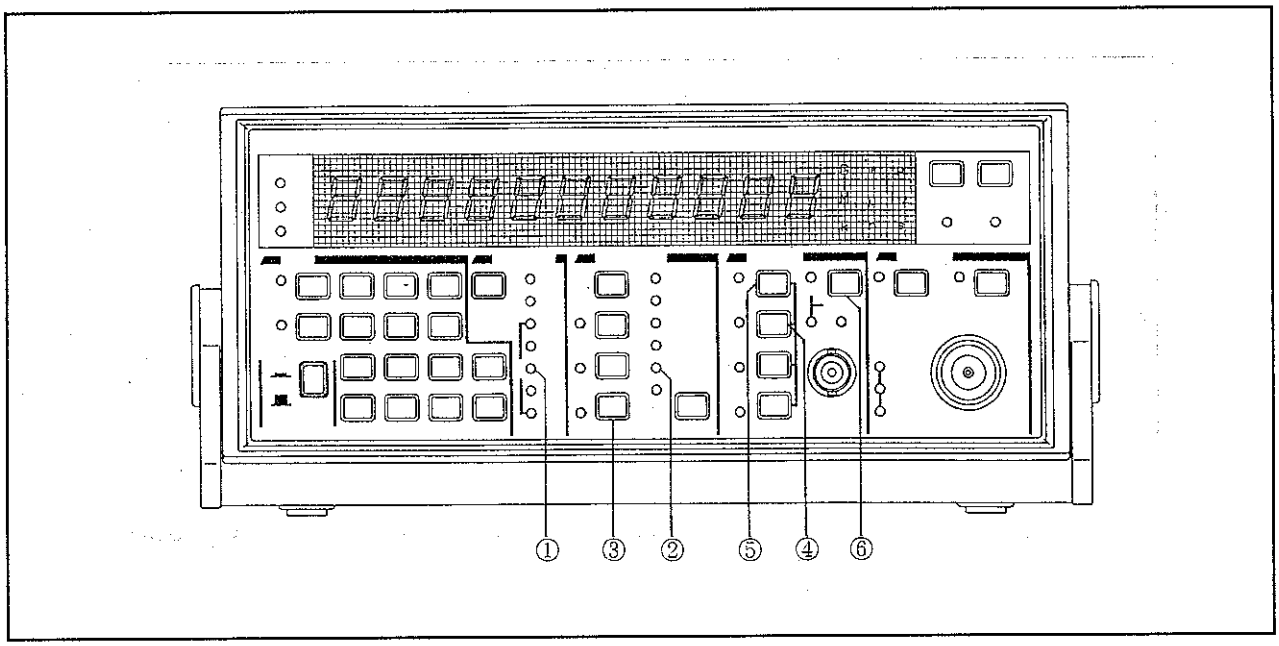
*: Actual displayed values depend on error factors.

9.6 Performance Confirmation for Cycle Measurement (PERIOD.B)

Standards: 10ns to 5000s
LPF OFF: 10ns to 80s
LPF ON: 100μs to 5000s

Used equipment: Signal generator
Field through termination (50Ω termination)

(1) Setting R5363



① Set FUNCTION to B P.

② Set GATE TIME to < 1s.

③ Set the S.R switch to other setting than HOLD.

④ Set each switch of LPF and ATT to OFF (lamp off).

⑤ Set COUP switch to AC (lamp on).

⑥ Set LEVEL switch to 0V.

(2) Setting signal generator

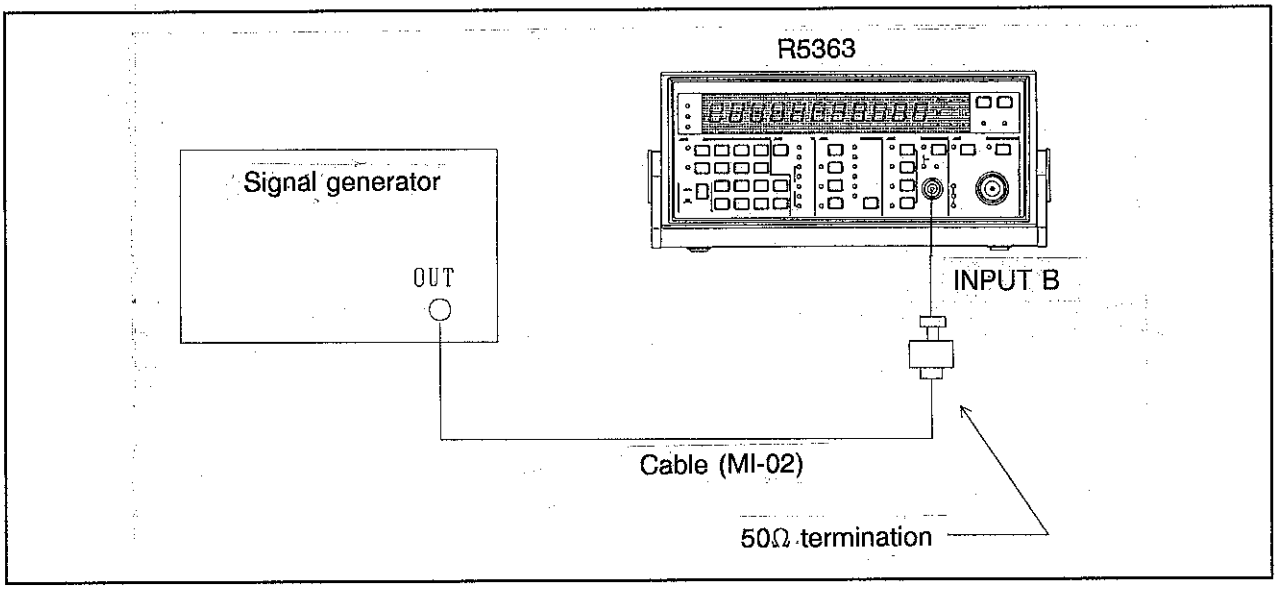
① Set the output wave form to rectangular wave mode.

② Set the frequency to 1MHz.

③ Set the output level to 1Vp-p.

(3) Connecting R5363 to signal generator

After setting (2), Mount the field through terminators (50Ω termination) both to the output connector of the signal generator and INPUT B connector of the R5363 and connect them using the attached cable (MI-02).



(4) Confirming performances

Check that the setting frequency of the signal generator is displayed on the display of the counter.

Measurement frequency	Displayed value of R5363 *
1MHz	999.999999ns to 1.00000001μs

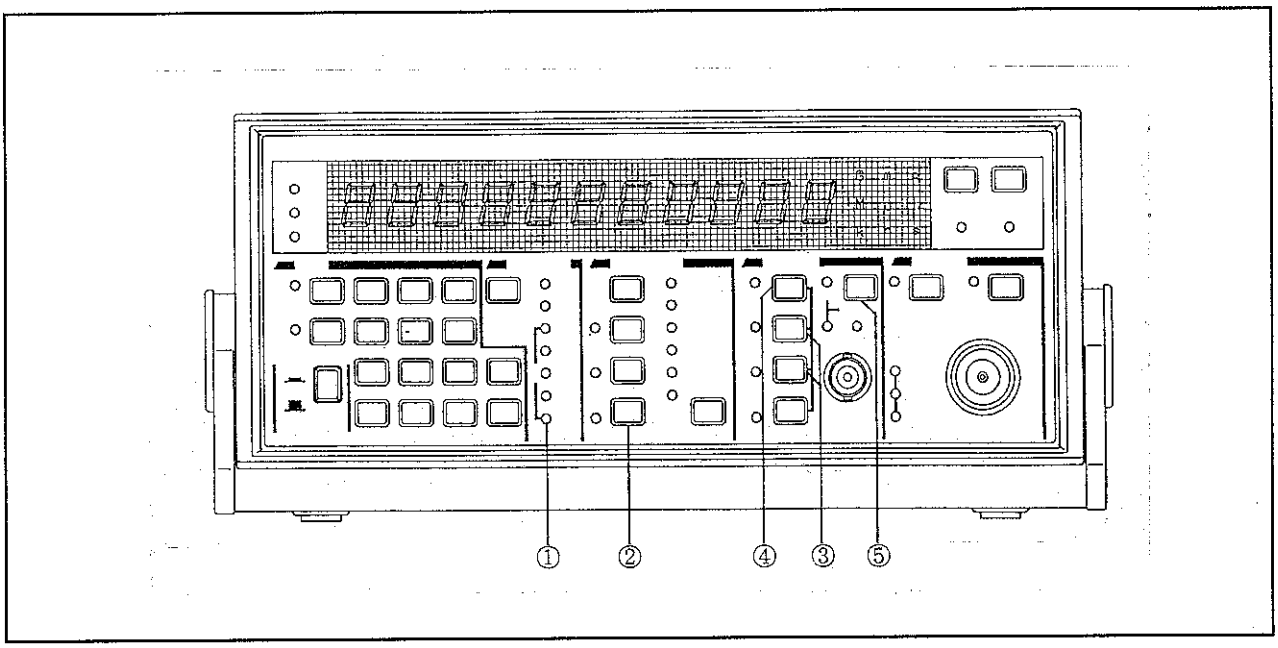
*: Actual displayed values depend on error factors.

9.7 Performance Confirmation for Integrating Count (TOT.B)

Standards: Counting range; DC to 50MHz
Counting capacity; 0 to 99999999999

Used equipment: Signal generator
Field through termination (50Ω termination)

(1) Setting R5363



① Set FUNCTION to B TOT.

② Set the S.R switch to other setting than HOLD.

③ Set each switch of LPF and ATT to OFF (lamp off).

④ Set COUP switch to AC (lamp on).

⑤ Set LEVEL switch to 0V.

(2) Setting signal generator

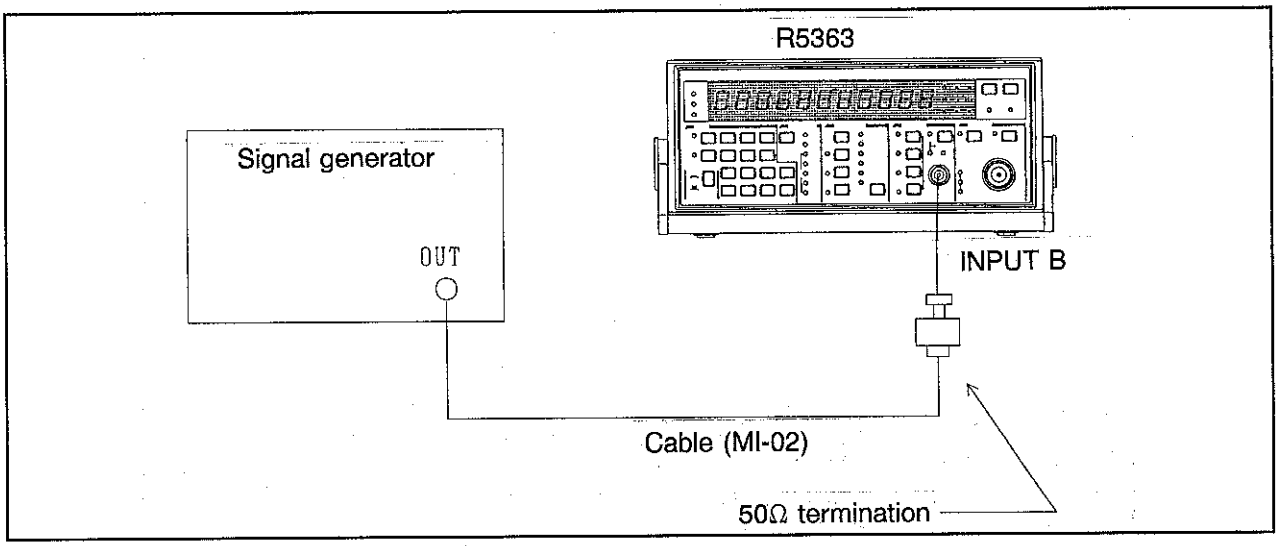
① Set the output wave form to sine wave mode.

② Set the frequency to 1MHz.

③ Set the output level to 1Vp-p.

(3) Connecting R5363 to signal generator

After setting (2), Mount the field through terminators (50Ω termination) both to the output connector of the signal generator and INPUT B connector of the R5363 and connect them using the attached cable (MI-02).



(4) Confirming performances

RST (ST/SP) switch of R5363 is the switch used for starting/stopping the counting.

The performance should be confirmed in the order as follows:

① Press RST (ST/SP) to start the counting. Check that the displayed value increases.

② Press RST (ST/SP) again to stop the counting. Check that the displayed value is maintained.

③ Press RST (ST/SP) again to clear the counted value. Check that the counting starts again at 0.

④ Press the S.R switch of R5363 to set it to HOLD (lamp on).

⑤ After performing steps ① and ② again, press RST (ST/SP) again to check that the integrating count is performed without clearing the displayed value.

9.8 Specification Table

Table 9-6 Specification Table (R5363)

Test items	Reference value (calibration point)	Tolerance
Oscillating frequency of crystal oscillator	$\pm 2\times10^{-8}$/day $\pm 8\times10^{-8}$/month $\pm 1\times10^{-7}$/year	-2×10^{-8}/day to $+2\times10^{-8}$/day -8×10^{-8}/month to $+8\times10^{-8}$/month -1×10^{-7}/year to $+1\times10^{-7}$/year
Measurement frequency range and input sensitivity of INPUT A	60MHz 500MHz 900MHz 1500MHz 2800MHz 3000MHz	10mVrms or less 10mVrms or less 10mVrms or less 10mVrms or less 35mVrms or less 50mVrms or less
Measurement frequency range and input sensitivity of INPUT B	10Hz 100Hz 1kHz 100kHz 1MHz 100MHz	25mVrms or less 25mVrms or less 25mVrms or less 25mVrms or less 25mVrms or less 25mVrms or less
Cycle measurement	1MHz (1μs)	999.999999ns to 1.00000001μs
Time interval measurement	1MHz	500ns or 600ns
Integrating count	1MHz	0 to 99999999999

10. CALIBRATION

Generally, the most important factor which will affect the measurement accuracy of the electronic counter is the frequency accuracy of the crystal oscillator which generates the internal reference time. It is required that the accuracy is always constant or if it deviates, the amount is very small. Therefore, to maintain measurement results of the electronic counter to always be normal values, it is required to regularly calibrate it and to consider the usage conditions.

10.1 Calibrating Oscillating Frequency of Crystal Oscillator

(1) Keep the specified pre-heating time for the calibration devices.

(2) Set STD INT OUT/EXT IN selection switch (slide type switch) on the rear panel of the counter to INT OUT and connect STD input/output connector (BNC connector) to the signal input connector of the frequency comparator through the cable (see Figure 10-1).

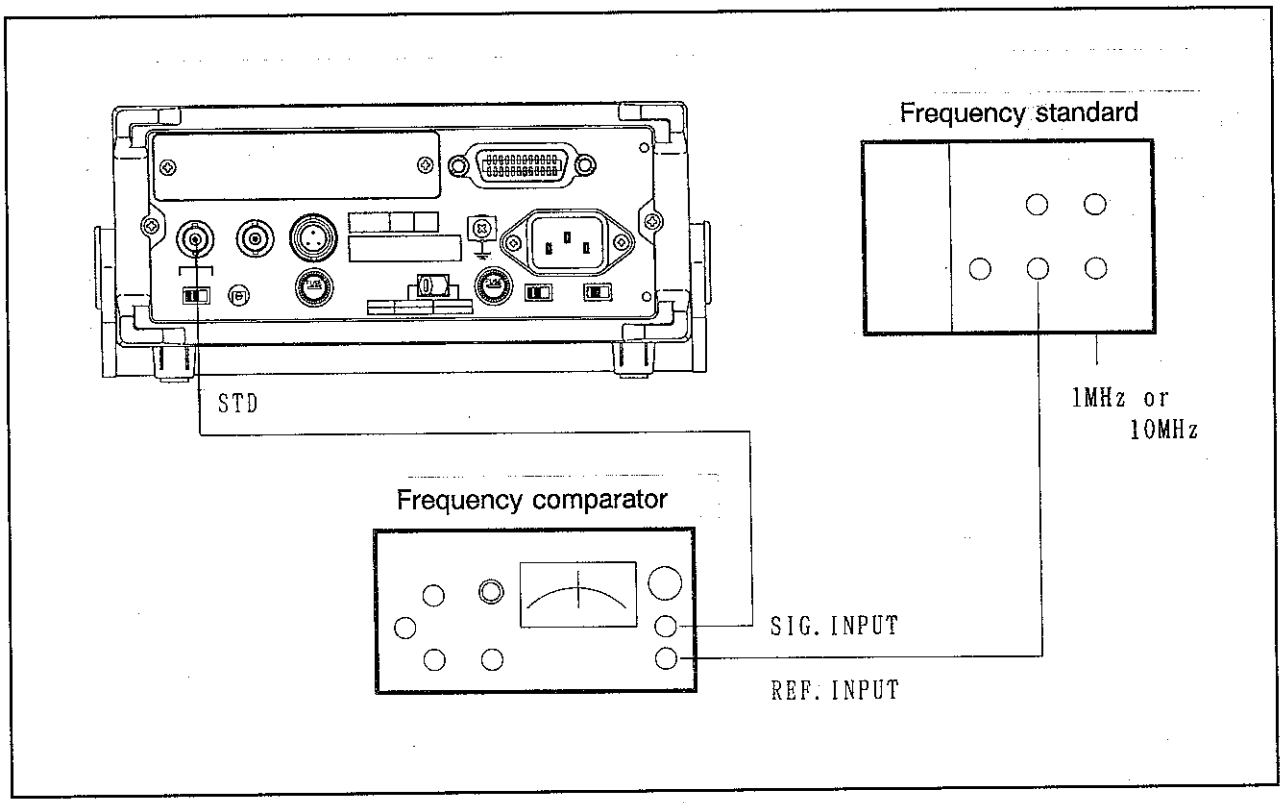


Figure 10-1 Calibrating method by the standard

(3) Connect the output connector of the frequency standard with the reference signal input connector of the frequency comparator through the cable (see Figure 10-1).

(4) Gradually increase the meter range of the frequency comparator according to the specification of the crystal oscillator within the counter, and finally set it as follows:

For standard specification: 10^{-8} range

(5) With the meter indication on the frequency comparator, check that the meter range meets the accuracy specification of the crystal oscillator within the counter.

For standard specification: $\pm 5 \times 10^{-8}$ /day
$\pm 1 \times 10^{-7}$ /month
$\pm 2 \times 10^{-7}$ /year

10.2 Cautions for Calibration

Calibrate the counter by adjusting the ADJ on the rear panel once per year. If adjusting the ADJ does not calibrate the counter, contact ATCE or your nearest branch office.

Reference:
Standard of crystal oscillator (TCO-612B)

- Output frequency; 5MHz
- Aging rate; based on the frequency 24 hours after powered on:
  2×10^{-8}/day
  8×10^{-8}/month
  1×10^{-7} /year
- Rising characteristics; Frequency difference between 30 minutes and 24 hours after powered on.
  $\pm5\times10^{-8}$
- Reproducibility; Based on the frequency immediately before 24 hours after powered off, frequency difference between it and the frequency 30 minutes after powered on again.
  $\pm5\times10^{-8}$

Figure 10-2 shows the one year deviation characteristics of the crystal oscillator.

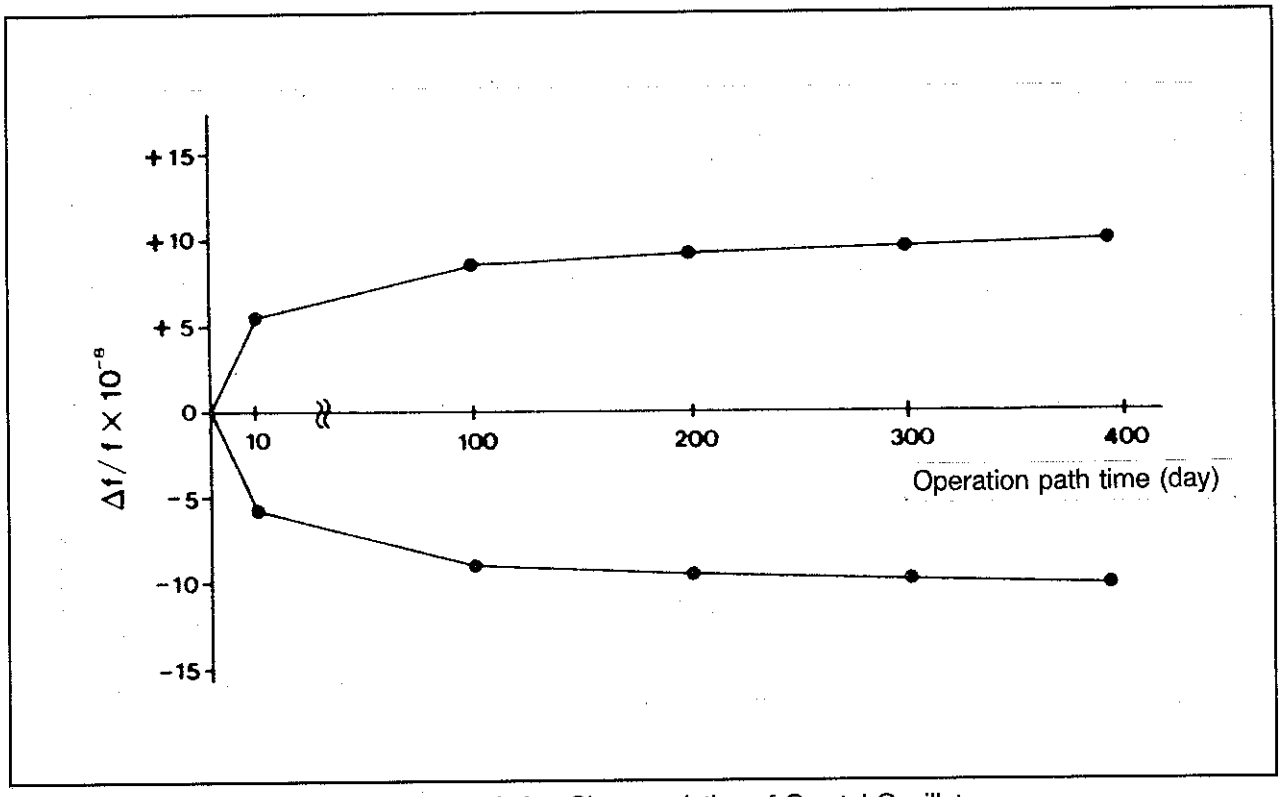


Figure 10-2 Deviation Characteristics of Crystal Oscillator

11. SPECIFICATIONS

(1) Frequency measurement (FREQ.A)

<table>
<tr><td>Measurement range</td><td>60MHz to 3000MHz

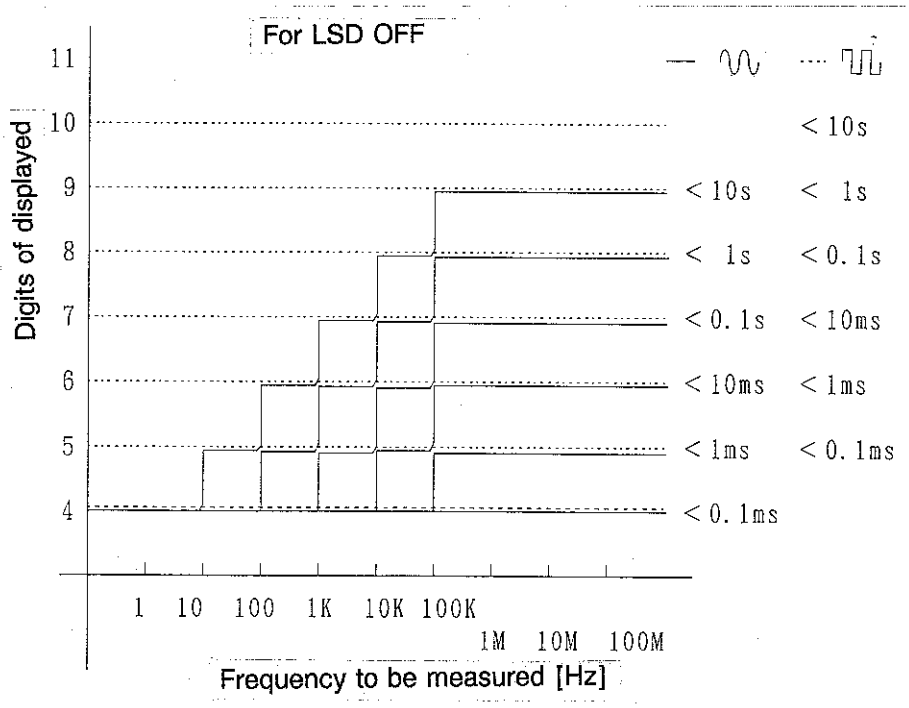
Lower range: 60MHz to 1500MHz
Upper range: 1500MHz to 3000MHz } (1/256 pre scale input)</td></tr>
<tr><td>Counting time</td><td><0.1ms, <1ms, <10ms, <0.1s, <1s, <10s</td></tr>
<tr><td>Computing time</td><td>Approx. 10ms (However, included in the sample rate time for other modes than HOLD.)</td></tr>
<tr><td>Number of digits displayed</td><td><table><tr><th rowspan="2">GATE TIME</th><th colspan="2">Number of digits displayed</th></tr><tr><th>LSD OFF</th><th>LSD ON</th></tr><tr><td><0.1ms</td><td>5 digits</td><td>6 digits</td></tr><tr><td><1ms</td><td>6 digits</td><td>7 digits</td></tr><tr><td><10ms</td><td>7 digits</td><td>8 digits</td></tr><tr><td><0.1s</td><td>8 digits</td><td>9 digits</td></tr><tr><td><1s</td><td>9 digits</td><td>10 digits</td></tr><tr><td><10s</td><td>10 digits</td><td>11 digits</td></tr></table>
Note: If MSD is 3 to 9, the number of digits displayed will be reduced by one digit.</td></tr>
<tr><td>Unit for display</td><td>MHz, GHz</td></tr>
<tr><td>Measurement accuracy</td><td>For LSD OFF: (input frequency [Hz])^2 × (± reference time error *1) ± minimum number of digits displayed
For LSD ON: (input frequency [Hz])^2 × (± reference time error *1 ± fraction measurement error *2)
Note: Represents in frequency dimension.</td></tr>
</table>

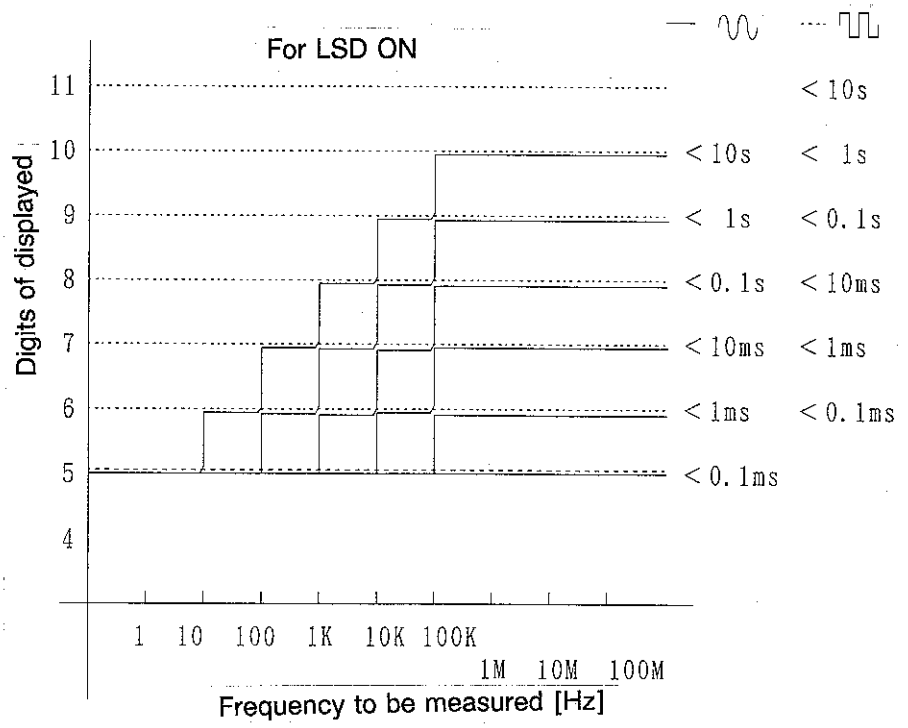
*1, *2: See Remarks.

(2) Frequency measurement (FREQ.B)

Measurement range	For LSD OFF: 0.2mHz to 10kHz (direct input) For LSD ON: 50mHz to 100MHz (1/4 pre scale input)
Counting time	<0.1ms (depending on the frequency, any value of 10μs to 90μs) <1ms (depending on the frequency, any value of 90μs to 900μs) <10ms (depending on the frequency, any value of 900μs to 9ms) <0.1s (depending on the frequency, any value of 9ms to 90ms) <1s (depending on the frequency, any value of 90ms to 900ms) <10s (depending on the frequency, any value of 900ms to 9s) Note 1: When LPF is ON and the cycle of the input signal exceeds the value in parentheses, the cycle is the counting time. (For example, input signal cycle exceeding 100kHz at <0.1ms range) Note 2: When LPF is OFF and the four cycle time of the input signal exceeds the value in parentheses, the time is the counting time. (For example, input signal cycle exceeding 400kHz at <0.1ms range)
Computing time	Approx. 10ms (However, included in the sample rate time for other modes than HOLD.)

Display resolution





Unit for display	μHz, mHz, Hz, kHz, MHz
Measurement accuracy	For LSD OFF: (input frequency [Hz])^2 × (± trigger error *3 ± reference time error *1) ± minimum number of digits displayed For LSD ON: (input frequency [Hz])^2 × (± trigger error *3 ± reference time error *1 ± fraction measurement error *2) Note: Represents in frequency dimension.

*1, *2, *3: See Remarks.

(3) Cycle measurement (PERIOD B)

Measurement range	For LSD OFF: 100μs to 5000s (direct input) For LSD ON: 10ns to 80s (1/4 pre scale input)
Counting time	< 0.1ms (depending on the frequency, any value of 10μs to 90μs) < 1ms (depending on the frequency, any value of 90μs to 900μs) < 10ms (depending on the frequency, any value of 900μs to 9ms) < 0.1s (depending on the frequency, any value of 9ms to 90ms) < 1s (depending on the frequency, any value of 90ms to 900ms) < 10s (depending on the frequency, any value of 900ms to 9s) Note 1: When LPF is ON and the cycle of the input signal exceeds the value in parentheses, the cycle is the counting time. (For example, input signal cycle exceeding 10μs at < 0.1ms range) Note 2: When LPF is OFF and the four cycle time of the input signal exceeds the value in parentheses, the time is the counting time. (For example, input signal cycle exceeding 2.5μs at < 0.1ms range)
Computing time	Approx. 10ms (However, included in the sample rate time for other modes than HOLD.)

<table>
<tr><td>Number of digits displayed</td><td>
<table>
<tr><th rowspan="2">GATE TIME</th><th colspan="2">Number of digits displayed</th></tr>
<tr><th>LSD OFF</th><th>LSD ON</th></tr>
<tr><td><0.1ms
<1ms
<10ms
<0.1s
<1s
<10s</td><td>5 digits
6 digits
7 digits
8 digits
9 digits
10 digits</td><td>6 digits
7 digits
8 digits
9 digits
10 digits
11 digits</td></tr>
</table>
</td></tr>
<tr><td>Unit for display</td><td>ps, ns, μs, ms, s, ks</td></tr>
<tr><td>Measurement accuracy</td><td>For LSD OFF: ± trigger error *3 ± reference time error *1 ± minimum number of digits displayed
For LSD ON: ± trigger error *3 ± reference time error *1 ± fraction measurement error *2)</td></tr>
</table>

*1, *2, *3: See Remarks.

(4) Time interval measurement (T.I 1pulse width measurement)

Measurement range	200ns to 79s (magnification : 10^0)
Magnification (10^n)	10^0, 10^1, 10^2, 10^3, 10^4, 10^5
Time unit	100ns
Unit for display	ns, μs, ms, s, ks
Measurement accuracy	± T.I trigger error *4 ± resolution*5 ± reference time error *1

*1, *4, *5: See Remarks.

(5) Time interval measurement (T.I 2pulse width measurement)

Measurement range	10μs to 9s
Magnification (10^n)	10^0
Time unit	100ps
Unit for display	ns, μs, ms, s
Measurement accuracy	± T.I trigger error *4 ± reference time error *1 ± 1.5ns

*1, *4: See Remarks.

(6) Integrating count (TOT.B)

Counting range	DC to 50MHz
Counting capacity	0 to 99999999999

(7) Continuous measurement (FREQ.A, FREQ.B, T.I 2, TOT.B)

Measurement items	Can be measured with each function of FREQ.A, FREQ.B, T.1 2, and TOT.B.
Counting time	Each setting of < 0.1ms, < 1ms, < 10ms, < 0.1s, < 1s, and < 10s by number of pieces of setting data
Measurement pause time	0s
Memory	14,000 pieces of data
Display	Displays any of average value, maximum value, minimum value maximum value minus minimum value, and statistical computing for the number of pieces of setting data.
Others	For specifications, same as each measurement item excluding sample rate above.

Remarks

*1: Reference time error = input cycle(s) × reference time accuracy

*2: $$\text{Fraction measurement error(s)} = \frac{1\text{ns}}{\text{Real counting time (s)}} \times \text{input cycle (s)}$$

*3: $$\text{Trigger error(s)} = \frac{T^2}{\text{Real counting time (s)}} \left(\frac{2.8 \times 10^{-5}}{Es} + 0.32 \times \frac{E_N}{Es} \right)$$

*4: $$\text{T.I trigger error(s)} = \frac{1}{\sqrt{\text{Number of multipliers}}} \left(\frac{2.8 \times 10^{-5}}{SR} + 0.32 \times \frac{E_N}{SR} \right)$$

*5: $$\text{Resolution (s)} = \frac{100\text{ns}}{\sqrt{\text{Number of multipliers}}}$$

Es: Signal voltage
E_N: Noise voltage
SR: Signal through rate

(8) Input sepcifications

• INPUT A Input voltage range	10mVrms to 5Vrms (60MHz to 1500MHz) 35mVrms to 5Vrms (1500MHz to 2800MHz) 50mVrms to 5Vrms (2800MHz to 3000MHz)
Attenuator	Automatically inserted (20dB) if the input signal is about 500mVrms or more.
Input connection mode	AC connection
Input impedance	Approx. 50Ω
Burst wave measurement	Repeat time: 800μs or more Burst pulse width: 400μs or more
Superimposed noise suppression	Available when ANS (Automatic Noise Suppressor) switch is ON. 3Vrms maximum

<table>
<tr><td>Level monitor</td><td>Indicated by three types of LED.
LOW; Lights at the level below the counter level.
MED; Lights at the counter level.
HIGH; Lights at the level of about 5Vrms or more.</td></tr>
<tr><td>• INPUT B
Input connection</td><td>Switches between DC mode and AC mode</td></tr>
<tr><td>Minimum bandwidth in AC mode</td><td>10Hz</td></tr>
<tr><td>Input voltage range</td><td><table>
<tr><td></td><td>ATT. 0dB</td><td>ATT. 20dB</td></tr>
<tr><td>10kHz or less</td><td>25mVrms to 10Vrms</td><td>500mVrms to 100Vrms</td></tr>
<tr><td>10kHz to 60MHz</td><td>25mVrms to 1Vrms</td><td>500mVrms to 10Vrms</td></tr>
<tr><td>60MHz to 100MHz</td><td>25mVrms to 500mVrms</td><td>500mVrms to 5Vrms</td></tr>
</table></td></tr>
<tr><td>Input impedance</td><td>1MΩ more/25pF or less</td></tr>
<tr><td>Trigger level</td><td>Approx. -1.2V to Approx. +1.2V (10mV STEP), preset approx. 0V, available for remote setting.</td></tr>
<tr><td>Trigger indicator</td><td>LED display</td></tr>
<tr><td>Superimposed noise suppression</td><td>10kHz low pass filter</td></tr>
<tr><td>Burst wave measurement</td><td>Repeat time: 400μs or more
Burst pulse width: 200μs or more</td></tr>
</table>

(9) Reference time

<table>
<tr><td>Internal reference frequency</td><td>5MHz</td></tr>
<tr><td>Frequency stability</td><td>
<table>
<tr><td colspan="2"></td><td>Standards</td><td>OPT 20</td><td>OPT 21</td></tr>
<tr><td colspan="2">Aging rate</td><td>5×10^{-8}/day
1×10^{-7}/month</td><td>2×10^{-8}/day
8×10^{-8}/month</td><td>5×10^{-9}/day
5×10^{-8}/month</td></tr>
<tr><td colspan="2">Long-term stability</td><td>2×10^{-7}/year</td><td>1×10^{-7}/year</td><td>8×10^{-8}/year</td></tr>
<tr><td colspan="2">Temperature characteristics
(+25°C±25°C)</td><td>$\pm1\times10^{-7}$</td><td>$\pm5\times10^{-8}$</td><td>$\pm5\times10^{-8}$</td></tr>
<tr><td rowspan="2">Rise time characteristics</td><td>30 minutes after</td><td>$\pm1\times10^{-7}$</td><td>$\pm5\times10^{-8}$</td><td>$\pm4\times10^{-8}$</td></tr>
<tr><td>1 hour after</td><td>-</td><td>-</td><td>$\pm2\times10^{-8}$</td></tr>
</table>
<table>
<tr><td colspan="2"></td><td>OPT 22</td><td>OPT 23</td></tr>
<tr><td colspan="2">Aging rate</td><td>2×10^{-9}/day
2×10^{-8}/month</td><td>5×10^{-10}/day
1×10^{-8}/month</td></tr>
<tr><td colspan="2">Long-term stability</td><td>5×10^{-8}/year</td><td>2×10^{-8}/year</td></tr>
<tr><td colspan="2">Temperature characteristics
(+25°C±25°C)</td><td>$\pm1\times10^{-8}$</td><td>$\pm5\times10^{-9}$</td></tr>
<tr><td rowspan="2">Rise time characteristics</td><td>30 minutes after</td><td>$\pm4\times10^{-8}$</td><td>$\pm4\times10^{-8}$</td></tr>
<tr><td>1 hour after</td><td>$\pm1\times10^{-8}$</td><td>$\pm1\times10^{-8}$</td></tr>
</table>
</td></tr>
<tr><td>Internal reference output</td><td>Frequency: Any of 10MHz, voltage: approx. 1Vp-p, impedance: approx. 50Ω</td></tr>
<tr><td>External reference input</td><td>Frequency: 1MHz, 2MHz, 5MHz, 10MHz, voltage: approx. 1Vp-p to 5Vp-p, impedance: approx. 500Ω</td></tr>
</table>

(10) General specifications

<table>
<tr><td>EXT.START gate</td><td>TTL level</td></tr>
<tr><td>Display</td><td>Green 7-segment LED, decimal 11digits</td></tr>
<tr><td>Sample rate</td><td>Approx. 10ms, approx. 80ms, approx. 320ms, approx. 2.5s and HOLD</td></tr>
<tr><td>Self test</td><td>Checks counter operation according to the internal reference signal.</td></tr>
<tr><td>Memory of panel setting</td><td>Saving and recalling are available for the setting data.</td></tr>
<tr><td>Usage ambient condition</td><td>Temperature; 0°C to 50°C, relative humidity; 90% or less</td></tr>
<tr><td>Storage temperature range</td><td>-20°C to +70°C</td></tr>
<tr><td>Power supply</td><td>AC: 100V to 120V
200V to 240V (OPT40)
48Hz to 440Hz

DC; +10V to +30V
(A type can be used only when AC power supply.)</td></tr>
<tr><td>Power consumption</td><td><table><tr><td></td><td>Power consumption</td></tr><tr><td>For DC supply drive</td><td>40W or less</td></tr><tr><td>For AC supply drive</td><td>55VA or less</td></tr></table></td></tr>
<tr><td>Dimensions</td><td>Approx. 212 (w) × 88 (H) ×360 (D) mm</td></tr>
<tr><td>Weight</td><td>4.2kg or less</td></tr>
</table>

(11) Accessories

Accessory	Model name	Stock No.	Quantity	Remarks
Input cable	MI-02	DCB-FF0386	1	BNC-BNC
DC power cable	MI-71	DCB-MS0736X01B	1	
AC power cable	A01402	DCB-DD2428X01	1	3-pin power cable
	-	JCD-AL003EX03	1	2-pin adapter
DC power fuse	TMF51NR5(250)	DFN-AA5A	2*	
AC power fuse	218001	DFT-AA1A	2*	For 100V
	218.500	DFT-AAR5A		For 200V
N-BNC conversion adapter	JUG-201A/V	JCF-AF001EX03	1	N-BNC
Instruction manual	-	JR5363	1	Japanese manual
	-	ER5363		English manual

Note: *; One out of two is housed in the fuse holder on the mainframe rear panel.

(12) Option

Option 20, 21, 22, 23	Reference time (refer to reference time)

APPENDIX

A.1 Technical Terms

ANS (Automatic Noise Suppresser):

ADVANTEST's patented technology, i.e., a circuit for automatically eliminating only noise components superimposed on a measurement signal.

Averaging:

Usually, the averaging function of an electronic counter is implemented via two types of circuit construction methods. In the first method, which employs time-interval measurements, the respective time intervals to be measured are counted by a counter circuit, and are then accumulated. In this case, ± 1 count/$\sqrt{N}$ (N is the number of measurements) is one factor that determines the measurement accuracy. In the second method, which employs period measurements, a gate is generated from a period signal to be measured, and then the gate time is measured using an internal time base. In this case, ± 1 count/N is one factor that determines the measurement accuracy.

Although both methods aim at improving the measurement accuracy of an electronic counter, there is an upper limit to the number of effective measurements because the error factors inherent in an instrument itself (e.g., the difference between the propagation delays of two inputs, and the maximum hysteresis error of a shaping circuit) are not improved in any way.

To employ the averaging function, it is necessary to ensure that the ± 1 count error is random. Usually, when a signal to be measured is introduced to a counting gate circuit in a counter, it is not synchronized with the internal time base. Therefore, errors can be regarded as occurring in a random manner.

Expanding Reciprocal Method:

In an electronic counter, the method for performing a period measurement, calculating an inverse (1/period), and indicating a frequency is known as the reciprocal method. the reciprocal method is advantageous in that the frequency measurement can be performed with a high resolution and high accuracy to an extent determined by an internal time base for the period measurement.

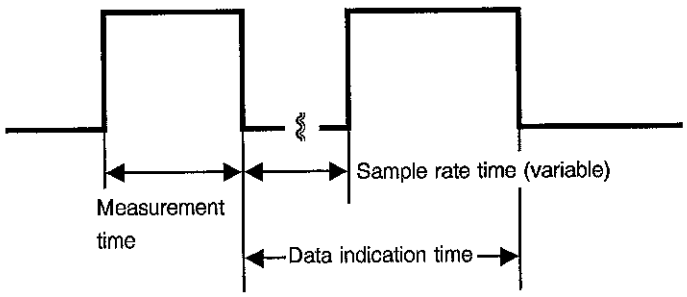
For example, when the time base is 100×10^{-9} s, if a frequency (not more than 10MHz) is measured by using a measurement time (gate) of one second, a 7-digit indication is always possible. According to this method, to obtain a 10-digit indication with a measurement time (gate) of one second, the internal time base needs to be reduced to 100×10^{-12} s (corresponding to 10GHz). By using the expanding reciprocal method, a high-resolution, high-accuracy frequency measurement can be realized as a result of combining the reciprocal method with a time expander method, in order to realize this 10GHz time base equivalently. (Note: See "Time Expander Method.")

Oven Lamp: The lamp that indicates when an AC power source is connected to a power line, and that the thermostatic oven heater and the internal time base circuit of a quartz oscillator are operating is not related to the power switch.

Counting Resolution: The value of the lowest digit of indication. The resolution depends on the measurement time. In an ordinary counter, the resolution is 1 Hz when the measurement time is one second.

Gate Time: The time over which a counter measures an input signal. During the gate time, a lamp usually called a "gate lamp" stays on to inform a user that a counting operation is in progress.

Sample Rate: The function of continuously changing the indication time of a measurement result. Actually, the measurement time is determined by the resolution of a counter. The time from the end of one measurement to the start of the next measurement is varied by the sample rate function to enable the indication time to be changed arbitrarily. Therefore, the data indication time can be varied by making the sample rate time variable.

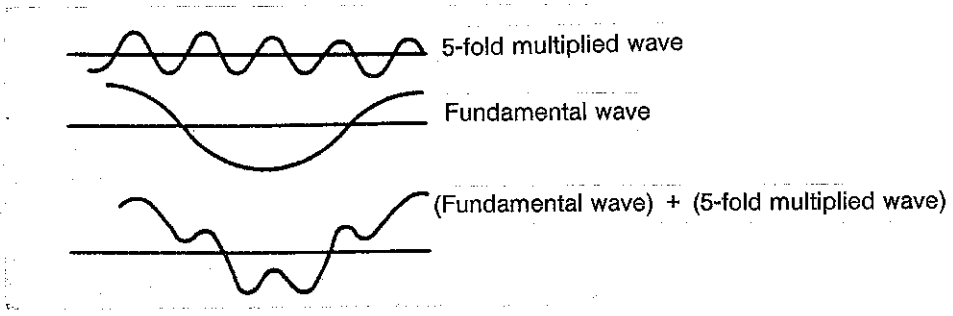


(Data indication time) = (measurement time) + (sample rate time)

Bandwidth:

In an electronic counter, since it may cause an erroneous counting result, noise should be sufficiently considered while seeking a good balance with the sensitivity. A bandwidth switch is used to eliminate high-frequency components as shown in the figure below by using a low-pass filter of, for example, 10MHz or 5MHz.

In particular, the bandwidth switch is effective in a frequency multiplication circuit or the like to measure an oscillation wave or a multiplied wave.

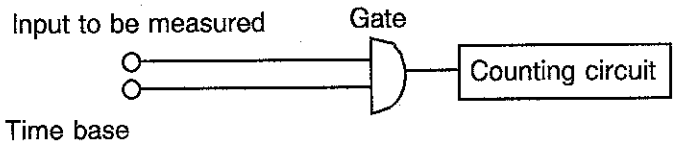


Time Expander Method:

A ±1-count error, which results from the relationship between the internal time base (e.g., 10MHz) of an electronic counter and the time interval to be measured or a single-cycle time, is treated as the effective time quantity. If remainder times at the head and tail of a time interval to be measured are respectively denoted as $\triangle T_1$ and $\triangle T_2$, the time interval Tx is expressed as $Tx = N \cdot T_0 \pm \triangle T_1 - \triangle T_2$. ($T_0$ is the internal time base and N is a positive integer.) By converting the remainder times to analog voltages using a high-speed, time-voltage converter and then A/D-converting those analog voltages at high speed and with high accuracy, the difference $\triangle T_1 - \triangle T_2$ can be read with an accuracy improved by a factor of 100 or 1,000. In this case, if the time base is 100×10^{-9} s, Fx corresponds to the resolution of 1×10^{-9} or 100×10^{-12} s, When the time expander method is used, the remainder times are expanded in the above manner.

Direct Counting:

When the direct counting method is used, a measurement is performed according to the definition of frequency, as shown in the figure below. This method is used over a wide range of audible frequencies to a UHF band. When the direct counting method is used, the measurable upper limit frequency is determined by the frequency resolutions of a gate and a counting circuit. Due to improvements in semiconductor device performance and advances in circuit-mounting technologies, direct-counting counters of 1GHz are presently available.



Trigger Level:

To detect an input signal as a signal and then measure it using a frequency counter, a certain level (also called a threshold) must be crossed. This level is called the trigger level, and it can usually be changed with a volume of the input signal.

Trigger Slope:

Two conditions must be satisfied before a frequency counter can detect an input signal. First, the signal must cross the trigger level. Second, the slope of the input signal must match the trigger slope that is set in the counter. Specifically, when the trigger slope setting is (+), the counter detects the input signal when the input signal crosses a trigger level from the minus (-) side to the plus (+) side.

Int./Ext. Time Base:

A frequency counter measures time intervals or counts the number of pulses in a predetermined time. Therefore, to obtain accurate measurement results, a "means" of generating a correct time is necessary. Such a means is known as a time base generator. In most counters, a quartz oscillator is used as the time base generator, i.e., an internal time base generator. That is, the correctness of the time base generator determines the correctness of a frequency counter. The measurement accuracy of a counter can further be improved by replacing the internal generator with an external generator (if it exists), which is more correct than the internal generator. This external generator is known as an external time base generator.

Input Coupling:

There are two coupling types. The first is AC coupling in which an input DC signal component is cut so that only AC components will pass. The second one is DC coupling, which is used to measure low-frequency signals.

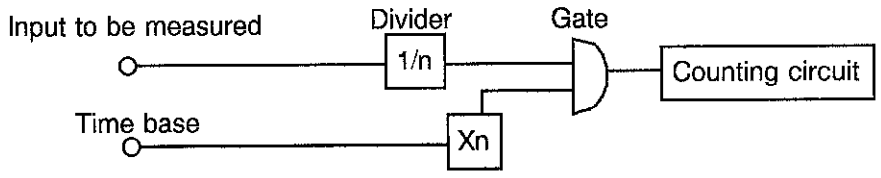
Hysteresis: Two related quantities are said to have hysteresis if the value of a first quantity corresponds to different values of a second quantity when the first quantity reaches that value while increasing, and when the first value reaches the same value while decreasing.

Time Interval Average, Period Average:

If a counter determined a period, a time interval, etc. based on a single measurement, the indicated measurement results would vary from one value to another and would be hard to recognize if noise were introduced into an input signal or if the input signal proved to be unstable. In addition, those measurement results would be unreliable. Therefore, counters have an averaging function of, for instance, 10 or 100 measurement results to reduce the influence of noise or variation in an input signal. This function is called time interval average, period average, etc. to distinguish it from a case that is based on a single measurement. The measurement time increases in an averaging measurement by a factor of the number of measurements.

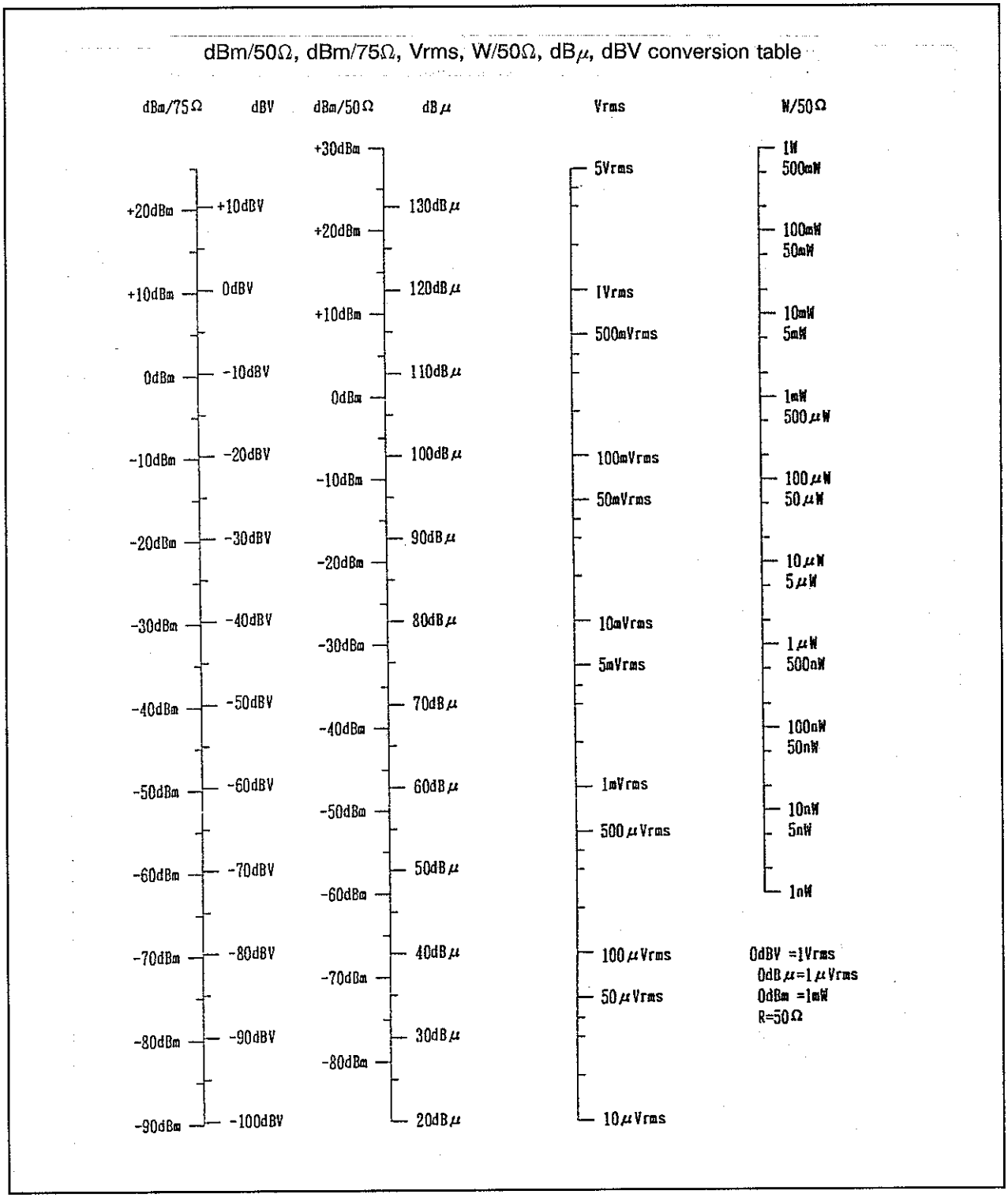
Prescale Method: When the prescale method is used, an input signal is counted after its frequency is divided into 1/n by a frequency divider as shown in the figure below. Since counting the frequency by dividing it into 1/n using the frequency divider produces a counting result that is 1/n of the input signal frequency, the time base is multiplied by n to indicate the correct measurement frequency. As a result, a counting time that is n times that of the direct counting method is required. If the counting time is the same as that used with the direct counting method, the resolution is reduced to 1/n. The measurable upper limit frequency of the prescale counter is determined by the frequency resolution of the divider. Since a gate operates at a frequency of 1/n, this type of counter can measure frequencies higher than the direct-counting counter.

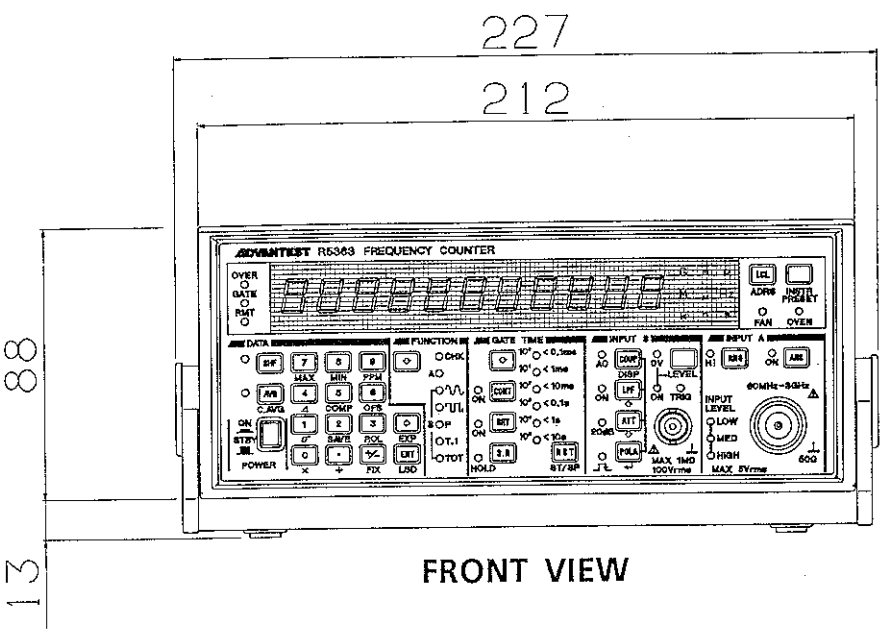
Prescale counters of 1.5GHz are presently available.



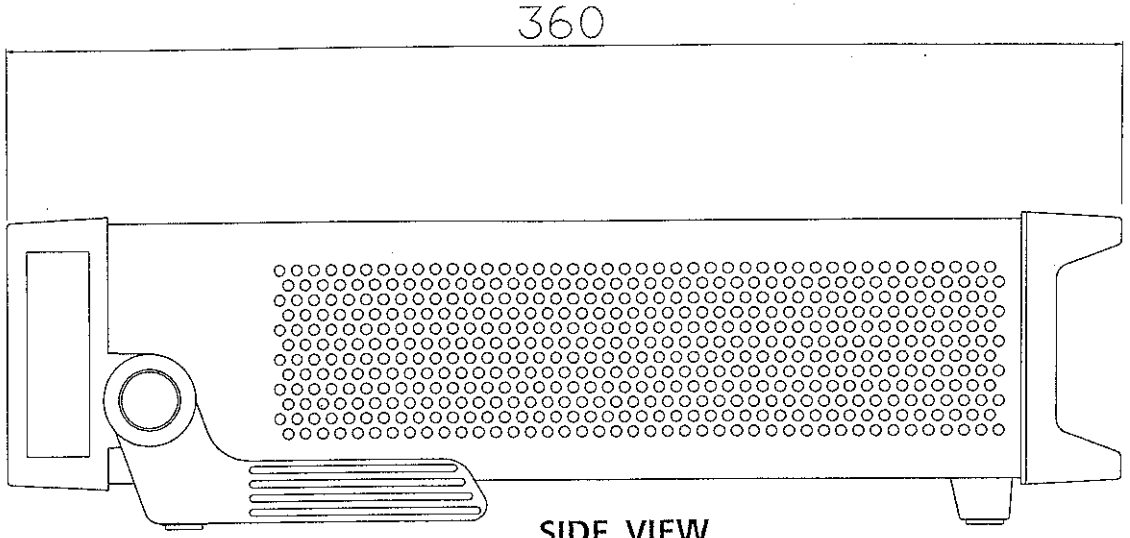
Acquisition Time: The acquisition time is that time from when a counter is reset to when a counting operation starts. While the acquisition time is approximately zero in ordinary counters, this should not be the case for counters in a microwave band. In the case of ADVANTEST's R5372/R5373-series counters, the acquisition time means the time elapsed until the phase of an oscillator in a counter is locked after an input signal is issued.

A.2 Level Conversion Table



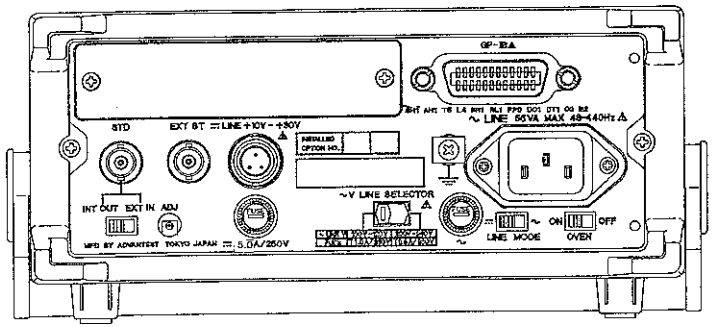


FRONT VIEW



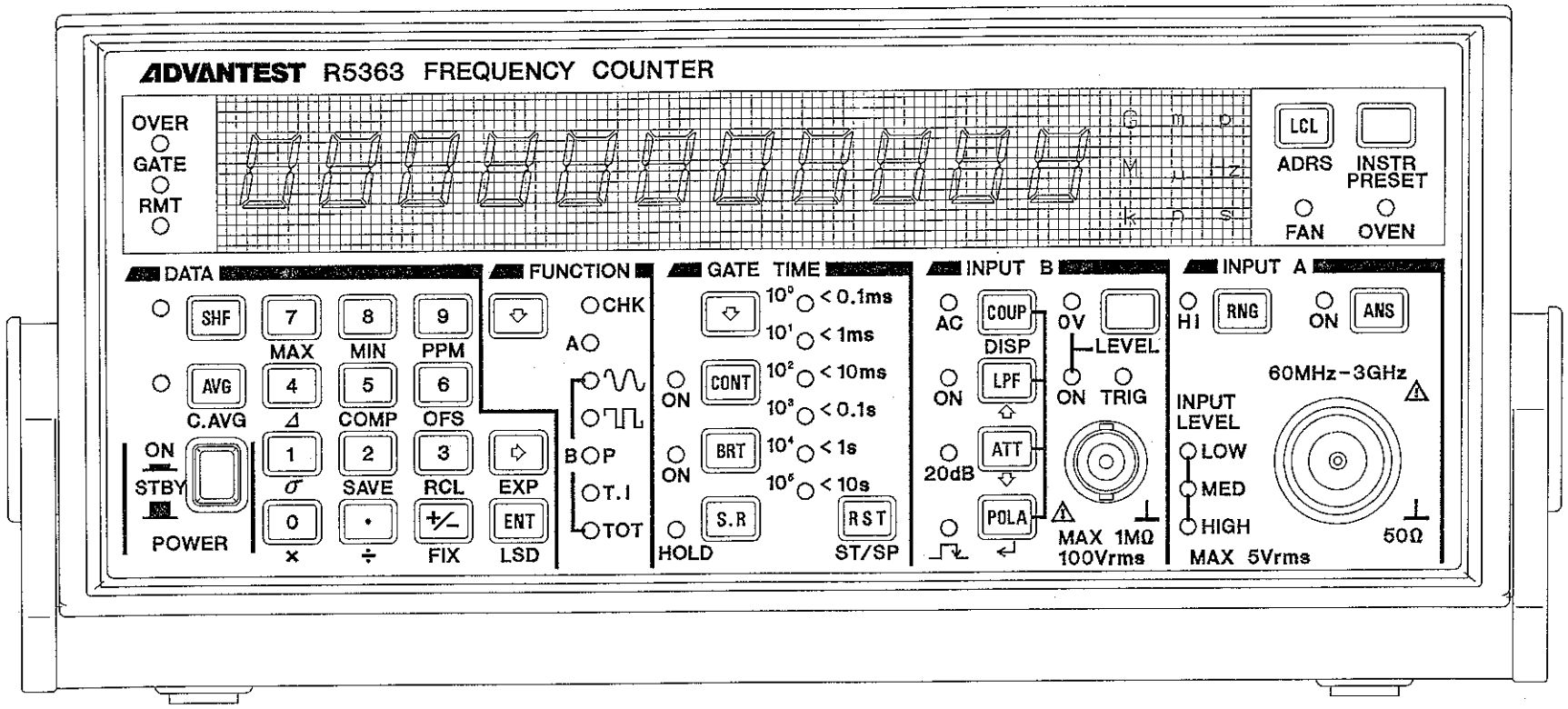
SIDE VIEW

Unit; mm



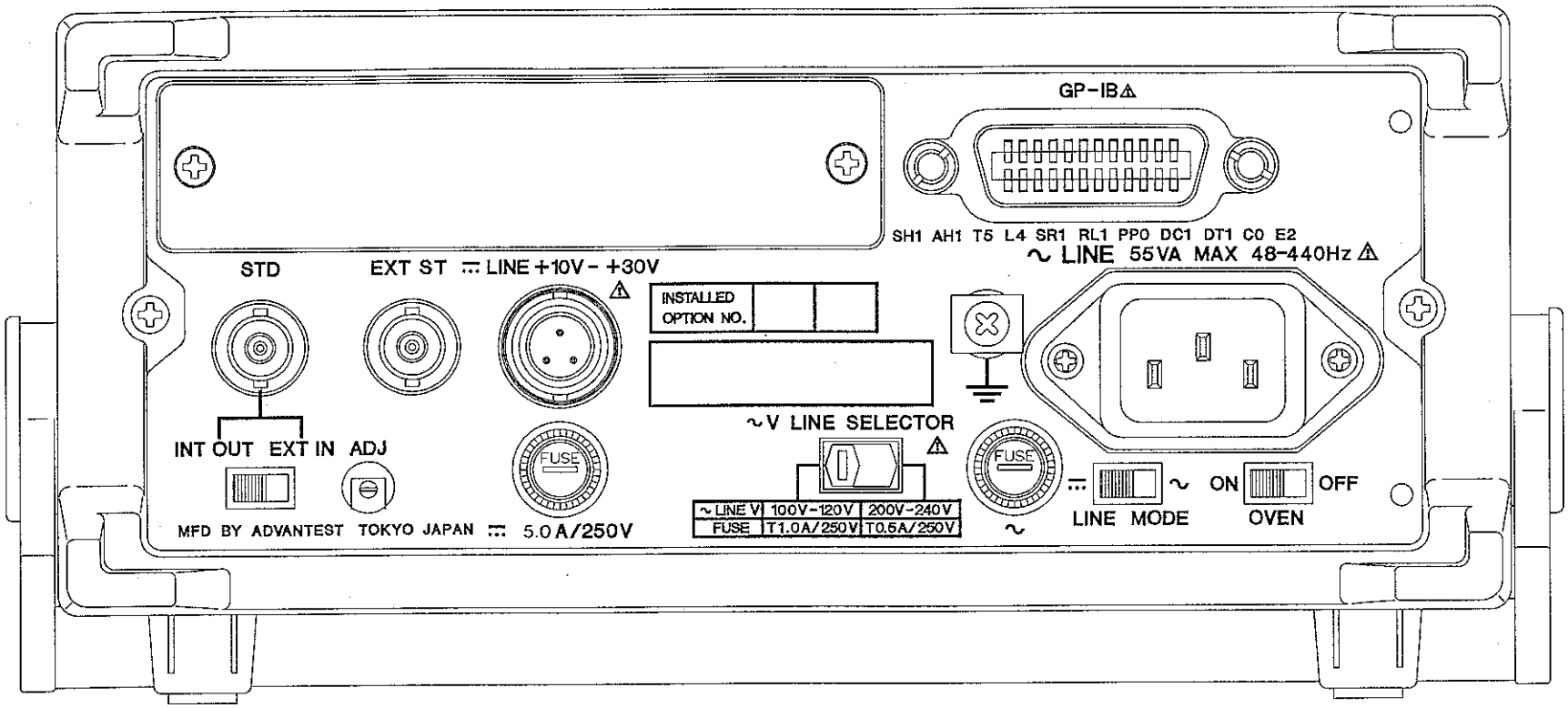
REAR VIEW

R5363 EXTERNAL VIEW



R5363 FRONT VIEW

EXT2-9403-A



R5363 REAR VIEW

ALPHABETICAL INDEX

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2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

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CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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