ADVANTEST

ADVANTEST CORPORATION

R5361B/62B

Frequency Counter

Operation Manual

MANUAL NUMBER FOE-8324246B02

Accessories

TR1644
R13001B
R13002B

First printing June 1, 1996
Printed in Japan

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

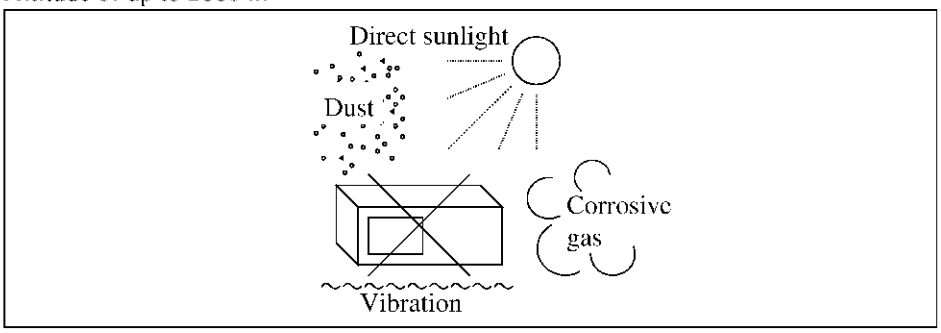


Figure-1 Environmental Conditions

- Operating position

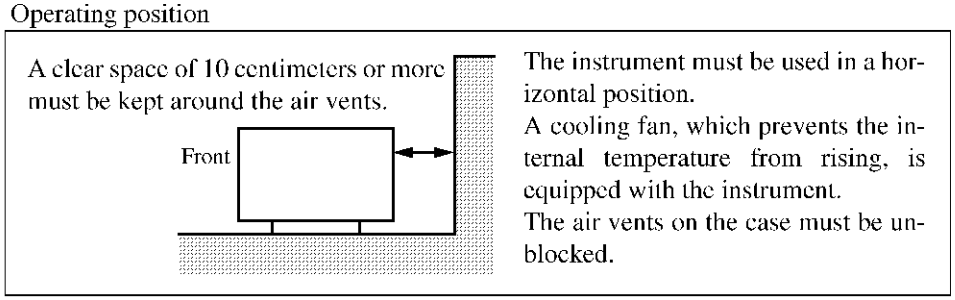


Figure-2 Operating Position

- Storage position

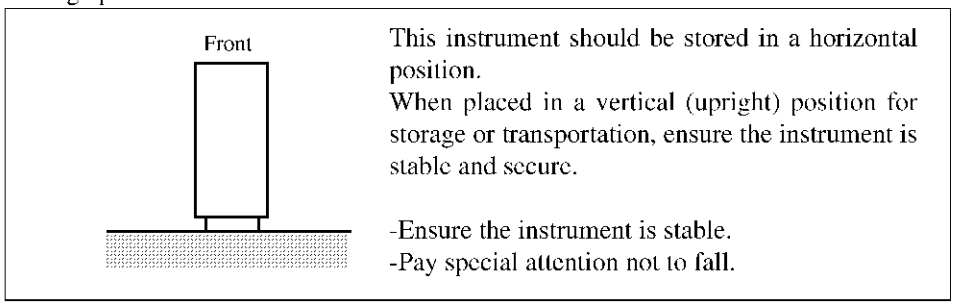


Figure-3 Storage Position

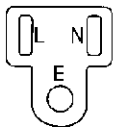
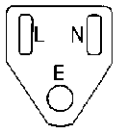
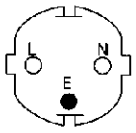
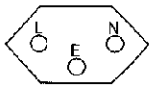
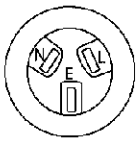
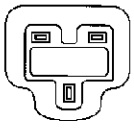
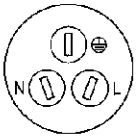
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  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

Certificate of Conformity

CE

This is to certify, that

Frequency Counter

R5361B/R5362B/TR1644/R13001B/R13002B

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN50081-1 and EN50082-1 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.
Tokyo, Japan

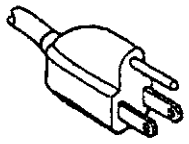
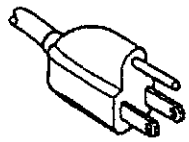
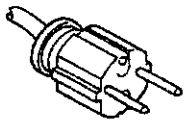
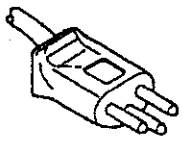
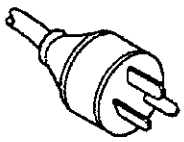
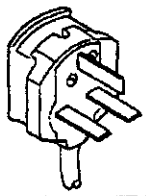
ROHDE&SCHWARZ
Engineering and Sales GmbH
Munich, Germany

5361.00

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		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
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

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1 INTRODUCTION

1.1 Outline of Product

The R5361B/62B reciprocal frequency counters incorporate reciprocal operation and fractional count capabilities, which, in combination, enables a higher frequency resolution and measurement rate than previous models. In addition to frequency counting, the R5361B/62B are capable of measuring periods, positive pulse widths, and totalization. The period measurement feature uses a clock frequency of 10MHz and fractional part multiplication of up to 100. It thus achieves a measurement accuracy equivalent to that obtained with an instrument using a clock frequency of 1GHz. The Calculation Unit (TR1644), BCD Output Unit with 4-digit D/A output (R13001B), and GPIB Adapter with 4-digit D/A output (R13002B) are optionally available to increase the measurement capability of the R5361B/62B. The R13002B is designed to allow remote operation of all the front panel functions of the counters, except the trigger level control.
The R5361B/62B also have the following features:

- AC/DC power supply operation capability.
- Burst signal measuring capability.

1.2 Electrical Performance

(1) Frequency Measurement (FREQ.A)

Measurement range: R5361B; 60MHz to 1000MHz
R5362B; Low frequency range 60MHz to 1500MHz
High frequency range1500MHz to 3000MHz

Gate time: <10ms (somewhere between 0.9ms and 9ms depending on input frequency)
<0.1s (somewhere between 9ms and 90ms depending on input frequency)
<1s (somewhere between 90ms and 900ms depending on input frequency)
<10s (somewhere between 900ms and 9s depending on input frequency)
<100s (somewhere between 9s and 90s depending on input frequency

Number of digits displayed:
Unit display:MHz, GHz
Accuracy: ± 1count ± time base accuracy when the LSD is off.
± fractional part measurement error ± time base accuracy when the LSD is on.
Execution time: Approx. 80ms (to be included in sample rate except in HOLD mode)

Gate time	Display digits	
	LSD OFF	LSD ON
<10ms	6 digits	7 digits
<0.1s	7 digits	8 digits
<1s	8 digits	9 digits
<10s	9 digits	9 digits MSD overflow
<100s	9 digits MSD overflows	9 digits 2 MSDs overflow

(LSD: Least Significant Digit MSD: Most Significant Digit)

(2) Frequency measurement (FREQ. B)

Range: 0.2mHz to 10kHz (direct input) when LPF is ON.
0.8mHz to 100MHz (1/4 prescaled) when LPF is off.

Gate time: <10ms (somewhere between 0.9ms and 9ms depending on input frequency)
<0.1s (somewhere between 9ms and 90ms depending on input frequency)
<1s (somewhere between 90ms and 900ms depending on input frequency)
<10s (somewhere between 900ms and 9s depending on input frequency)
<100s (somewhere between 9s and 90s depending on input frequency

Note 1: ***If the period of the input signal exceeds the value given in parentheses (for example, input frequency is below 111Hz when range is <10ms) when LPF is ON, the period of the input signal will be the gate time.***

Note 2: ***If the 4 periods of the input signal exceed the value given in parentheses (for example, input frequency is below 444Hz when range is <10ms) with LPF off, the 4 periods will be the gate time.***

Note 3: ***The low frequency may not be measured properly due to a distortion of the input waveform or to the noise. If so, set LPF ON (10kHz or less).***

Note 4: ***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.***

Resolution:
Unit display: μ Hz, mHz,Hz, kHz, or MHz
Accuracy: ± trigger error ± 1 count ± time base accuracy
Execution time: Approx. 80ms (to be included in sample rate time except in HOLD mode)

Gate time	Resolution	
	Sine wave measurement mode	Square wave measurement mode
<10ms	1kHz or higher	6 digits
<0.1s	100Hz or higher	7 digits
<1s	10Hz or higher	8 digits
<10s	1Hz or higher	9 digits
<100s	0.1Hz or higher	9 digits MSD overflows

(3) Period measurement (PERIOD B)

Range: 100μs to 5000s (direct input) when LPF is ON.
10ns to 1250s (1/4 prescaled) when LPF is off.
Gate time: <10ms (somewhere between 0.9ms and 9ms depending on input frequency)
<0.1s (somewhere between 9ms and 90ms depending on input frequency)
<1s (somewhere between 90ms and 900ms depending on input frequency)
<10s (somewhere between 900ms and 9s depending on input frequency)
<100s (somewhere between 9s and 90s depending on input frequency

Note 1: ***If the period of the input signal exceeds the value given in parentheses (for example, input signal period exceeds 9ms when range is <10ms) when LPF ON, the period will be the gate time.***

Note 2: ***If the 4 periods of the input signal exceed the value given in parentheses (for example, input signal period exceeds 2.3ms when range is <10ms) with LPF off, the 4 periods will be the gate time.***

Note 3: ***The low frequency may not be measured properly due to a distortion of the input waveform or to the noise. If so, set LPF ON (10kHz or less).***

Note 4: ***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.***

Number of digits displayed: 6 digits (<10ms), 7 digits(<0.1s), 8 digits (<1s), 9 digits (<10s), 9 digits (<100s, with MSD overflow)
Unit display: ps, ns, μs, ms, s, or ks
Accuracy: ± trigger error ± 1 count ± time base accuracy
Execution time Approx. 80ms (to be included in sample rate time expect in HOLD mode)

(4) Time interval measurement (T.I B positive pulse width measurement)

Measurement range: 200ns to 9000s
Multiplier (10^n): 10^0, 10^1, 10^2, or 10^3
Time unit: 100ns
Unit display: ns, μs, ms, s, or ks
Accuracy: ± trigger error ± resolution ± time base accuracy

(5) Totalize (TOT. B)

Measurement range: DC to 50MHz
Count capacity: 0 to 999999999

(6) Input specifications (INPUT A)

Input voltage range: R5361B:
10mVrms to 5Vrms (60MHz to 900MHz)
20mVrms to 5Vrms (900MHz to 1000MHz)
R5362B:
10mVrms to 5Vrms (60MHz to 1500MHz)
35mVrms to 5Vrms (1500MHz to 2800MHz)
50mVrms to 5Vrms (2800MHz to 3000MHz)

The maximum input level of burst signal measurement is 500mVrms.
Maximum 3 Vrms when ANS switch is on.

Input protection fuse: Blows at 12Vrms for less than 1 minute. (R5361B)
Input coupling: AC
Input impedance: Approx. 50Ω
Burst signal measurement:Available with the BURST switch.
Noise rejection: Superimposed noise is suppressed with the Automatic Noise Suppressor (ANS) switch.
(In the R5362B attenuation is inserted automatically in the 60MHz to 1500MHz range.)
Level monitor: Uses three LED indicators:

LOW (green): Comes on below the count start level.
MED (green): Comes on at the count start level.
HIGH (orange): Comes on ar approx. 5Vrms.

(7) Input specifications (INPUT B)

Input coupling: DC or AC switch selectable
Cutoff frequency in AC mode: 10Hz
Input voltage range:

	ATT. 0dB	ATT. 20dB
10kHz or below	25mVrms to 10Vrms	500mVrms to 29Vrms
10kHz to 60MHz	25mVrms to 1Vrms	500mVrms to 10Vrms
60MHz to 100MHz	25mVrms to 500mVrms	500mVrms to 5Vrms

Maximum input: 42Vpeak (ATT. 20dB)
Input impedance: 1MΩ or more//25pF or less
Trigger level: Approx. -1.2V to approx. +1.2V continuously variable. Preset at approx. 0V.
Trigger indicator: LED indicator
Noise rejection: 10kHz low-pass filter
Burst signal measurement: Available with the BURST switch activated.

(8) Time base

Interval reference frequency: 5MHz
Frequency stability:

		Standard type	Option 20	Option 21	Option 22	Option 23
Aging rate*1		5×10^{-8} /day	2×10^{-8} /day	5×10^{-9} /day	2×10^{-9} /day *2	5×10^{-10} /day *2
		1×10^{-7} /month	8×10^{-8} /month	5×10^{-8} /month	2×10^{-8} /month *2	1×10^{-8} /month *2
Long-term stability		2×10^{-7} /year	1×10^{-7} /year	8×10^{-8} /year	5×10^{-8} /year *1	2×10^{-8} /year *1
Temperature characteristics (+25°C ± 25°C)		± 1×10^{-7}	± 5×10^{-8}	± 5×10^{-8}	± 1×10^{-8}	± 5×10^{-9}
Warm-up *1 characteristics	30 minutes later	± 1×10^{-7}	± 5×10^{-8}	± 4×10^{-8}	± 4×10^{-8}	± 4×10^{-8}
	1 hour later	-	-	± 2×10^{-8}	± 1×10^{-8}	± 1×10^{-8}

Note: ***For the standard type, the warm-up characteristic 10 minutes after power on is*** ± 2×10^{-7}

****1: Referred to the frequency 24 hours after power on.***
****2: Referred to the frequency 48 hours after power on.***

Internal reference output: Frequency; 10MHz
Voltage; Approx. 1Vp-p
Impedance; Approx. 50Ω
External reference input: Frequency; 1MHz, 2MHz, 5MHz, or 10MHz
Voltage; 1Vp-p to 5Vp-p
Impedance; Approx. 500Ω

(9) General specifications

Display digits: 9 decimal digits
Display: Green, 7-segment LED display with storage capability.
Sample rate: Approx. 80ms, 320ms, 2.5s, and HOLD
Self check: Counting operation check using the internal reference signal.
Panel setting memory: Available when OVEN switch is on.
Operating environment: Temperature; 0°C to +40°C
Relative humidity; 40% to 85%
Storage temperature: -20°C to +70°C

Power requirements:	AC;	100V to 120V (200V to 240V specification available), 50Hz to 400Hz
	DC;	+10V to +30V
Power consumption:	Not more than 30W for DC operation (R5361B)	
	Not more than 30W for DC operation (R5362B)	
	Not more than 50VA for AC operation	
Dimensions:	Approx. 240 (W) × 88 (H) × 360(D) mm	
Mass:	4.5kg or less	

(10) Accessories

- R13001B BCD data output unit (with D/A output)

Transfer method:	Digit parallel, through a 50pin connector	
Output digits:	6 digits of mantissa and 2 digits of exponent (mantissa is switch selectable from high-order and low-order data.)	
Output:	TTL, active high	
D/A output:	Output voltage;	0V (readout: 0000) to +9.999V (readout: 9999)
	Conversion digits;	4 LSDs of redoubt (Digit shift available with TR1644)
	Offset;	Not available (any offset setting available with use of the TR1644)
	Resolution;	4096 points (Approx. 2.5mV per point)
	Output terminal;	BNC connector
	Output impedance;	Approx. 100Ω

- R13002 GPIB adapter (with D/A output)

Standard:	IEEE Standard 488-1978
Interface capabilities:	Source and accepter handshake Talker/listener addressing Service request Device clear
Code:	ASCII code
Remote control functions:	Aaa front panel functions and TR1644's functions, expect power on/off control and trigger level control on INPUT B.
D/A output:	Same as R13001B.

- TR1644 calculation unit

Operation modes:	Transfer method:	Digit parallel, through a 50pin connector
	·	Operations between measurement data: Shift span, offset difference, maximum shift span, and minimum shift span.
	·	Operations between measurement data and setup data: Arithmetic operations, fixed decimal point numeric display (D/A setting mode), comparison, percentage, and scaling.
	·	Operations between measurement data: Arithmetic operations
Setup digits:	Mantissa;	Up to 9 digits
	Exponent;	1 digits
Display digits:	6, 7, 8, or 9 digits depending on gate time setting.	
Overflow:	Occurs only in the fixed decimal point display mode. All other modes use undderflow processing.	
Available functions:	Any.	

- MEE-22830A-1 Front cover

  Front panel cover of the counter.

- TR16204 Carrying case

  Applicable to all types of the R5361B/5362B

- TR16205 Carring case

  For the counter attached with the battery pack.

- The following panel/rackmounting kits are available.

A02017	Panel mounting kit
A02621-J	JIS Rackmounting kit (For counter only)
A02622-J	JIS Rackmounting kit (For counter and TR1644)
A02621	EIA Rackmounting kit (For counter only)
A02622	EIA Rackmounting kit (For counter and TR1644)

1.3 Accessories

When this unit is delivered, mark sure that it was not damaged during transportation. If any of the accessories are damaged or missing, contact Advantest Customer Engineering Office, nearest Sales branch or representative. Address and telephone number are mentioned at the end of the manual.

Table 1-1 Accessories

No.	Name	Type name	Q'ty		Remarks
			R5361B	R5362B	
1	Input cable	A01036-1500	1	1	
2	DC power cable	MI-71	1	1	
3	AC power cable	A01402	1	1	
4	Conversion adapter	A09034	1	1	
5	DC power fuse	4A quick acting type	2	2	
6	AC power fuse *1	0.8A time lag type	2	2	
7	High-frequency fuse *2		2	0	
8	N-BNC conversion Connector *3		0	1	
9	Operation manual (This manual)	ER5361B/62B	1	1	English

*1: ***For 200VAC to 240VAC specifications, time lag type fuses rated at 0.4A are supplied.***

*2: ***Only R5361B***

*3: ***Only R5362B***

Note: ***Order the addition of the accessory etc. with type name.***

1.4 Preparations for Power-up and General Precautions

1.4.1 Verifying and Replacing a Line Fuse

Two kinds of fuses that are used for AC or DC power are accommodated in the fuse holder on the rear panel. Be careful of the difference of fuses.
To check or replace the fuse, perform the following steps.
Applicable fuses are listed in Table 1-2 and Table 1-3.

Warning

1. ***To prevent fire hazard, use a fuse having the same type and rating as the previous one.***
2. ***If a fuse which does not conform to standards were used, this instrument might be broken.***
3. ***Before replacing the line fuse, even if it is for AC or DC power, be sure to remove the power cord from the power cord receptacle. Be careful that the power line is not shut off by turning the STBY switch to ⏻.***

Steps of replacing a line fuse.

① Turn the STBY switch to ⏻.

② Remove the power cord from the power cord receptacle.

③ Put a flatblade screwdriver on the slot of the fuse holder, turn it counterclockwise by approximately 60 degrees and then release the screwdriver.
When the cap comes out by 3mm or so, pull it by hand.

④ If the fuse has a break in the fuse holder, replace with a new one.

(Note) If you have no applicable fuse, use a fuse having the same specifications as an applicable fuse.

⑤ After replacing the fuse, reinstall the fuse holder and then reconnect the power cord into the power cord receptacle.

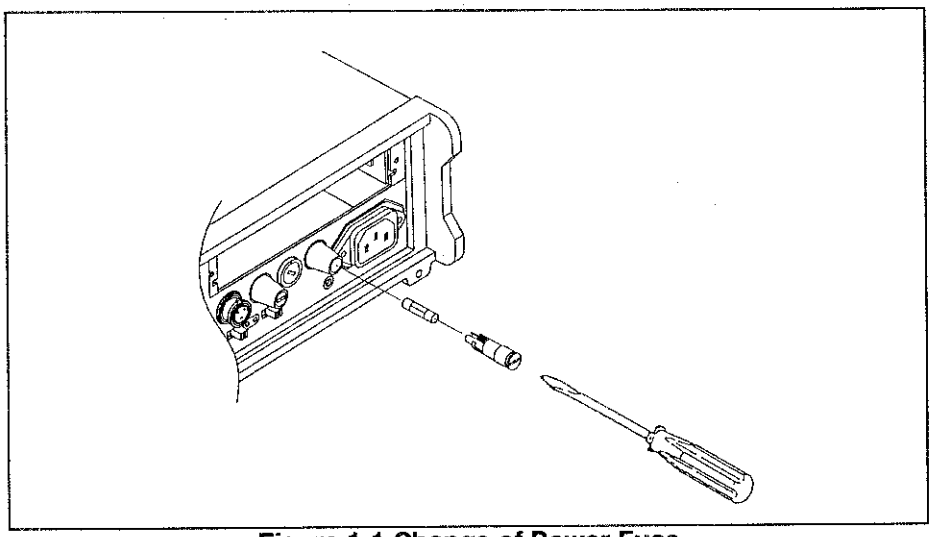
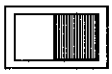


Figure 1-1 Change of Power Fuse

1.4.2 Verifying and Setting AC Line Voltage

Verify that voltage settings of the rear panel has been correct for the local line voltage. If they were not correct, set LINE MODE and V SELECTOR as shown in Table 1-2.

Table 1-2 Rear Settings for AC Line Voltage

Nominal line voltage	LINE MODE setting	V SELECTOR setting (V SELECTOR)	Applicable fuse
100V-120V (Available range 90V to 132V)	⎓ ∿  LINE MODE	V SELECTOR 	218.800 T0.8A/250V
200V-240V (Available range 180V to 249V)	⎓ ∿  LINE MODE	V SELECTOR 	218.400 T0.4A/250V

1.4.3 Verifying and Setting DC Source Voltage

The available range of DC source voltage is from +10V to +30V.
Verify that the voltage settings of the rear panel has agreed with Table 1-3.
If there is a difference, set LINE MODE in accordance with Table 1-3.

Warning

1. ***DC voltage except the specified range might break the instrument.***
2. ***If the DC source voltage exceeds the available range or is opposite in polarity, the protection circuit operates and the fuse opens.***

Table 1-3 Rear Settings for DC Source Voltage

DC source voltage	LINE MODE Setting	Voltage marking (V SELECTOR)	Applicable fuse
+10V-+30V	⎓ ∿  LINE MODE	+10V to +30V	217004 4A/250V

1.4.4 Change of Source Voltage

If you change an AC line voltage setting or use a DC power source, change the voltage settings of the rear panel as follows.

Cautions

1. ***To change voltage settings or a line fuse, even if they are for AC or DC power, be sure to remove the power cord from the power cord receptacle. The power line is not shut off by turning the STBY switch to ⏻ .***
2. ***When LINE MODE (power source selection) and V SELECTOR (AC line voltage selection) are changed, be sure to verify the fuse.***
   For verification and replacement, refer to "1.4.1 Verifying and replacing a line fuse." The applicable fuse is shown in Table 1-2 and 1-3.

(1) LINE MODE setting

Power source is selected.

Power source	LINE MODE setting
AC power source	⎓ ~  LINE MODE
DC power source	⎓ ~  LINE MODE

(2) V SELECTOR setting (AC line voltage selection))

Put a flatblade screwdriver on the slot of V SELECTOR switch and adjust V SELECTOR switch to the local line voltage. (See Table 1-2.)

V SELECTOR

1.4.5 Power cord

Cautions

1. ***Be sure to use an attached power cord which conforms to a national standard.***
   Available nominal AC power-input source is 100V - 120V (and also 200V - 240V, if specified by a selector) with a line frequency ranging from 50Hz to 400Hz.
2. ***Before connecting the power cord, verify that STBY switch is turned to ⏻ .***
3. ***Before installing each accessory unit, remove the power cord and the input cable.***
4. ***Before turning POWER switch on, connect the plug of the power cord to a power source outlet that has a properly grounded protective-ground contact. Don't use an extension cord that has no protective grounding conductor.***
   To prevent hazard, don't cut internal or external protective conductors of this instrument nor remove the protective-ground connection of this instrument.

Warning

1. ***If unusual conditions such as smoke, fire, or a bad smell are encountered, remove the power cord immediately from the power cord receptacle of the instrument.***
2. ***If the ground lead is touched with AC line of power supply terminals or so, there is a possibility that the instrument suffers serious damage. Keep other plugs away.***

1.4.6 Maximum Input Level

INPUTA	5Vrms	
	With BURST switch ON	500mVrms
	With ANS switch ON	3Vrms
INPUT B	42Vpeak (ATT. 20dB)	

Warning

Don't add a signal of maximum input level or more because there is possibility that the instrument breaks.

1.4.7 Ambient Conditions

(1) Location

① Do not use the instrument in these place

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

② Use the instrument under the following conditions:

- Ambient temperature: 0°C to 40°C
- Humidity: 85% or less
- 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 instrument.

(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.

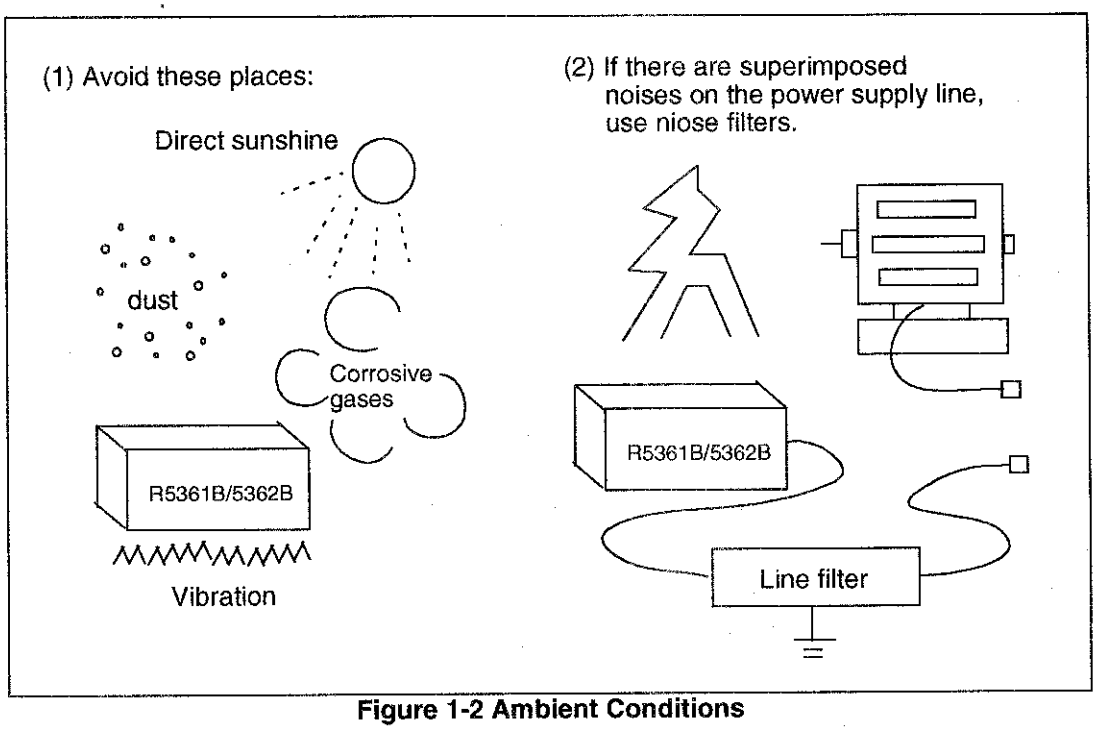


Figure 1-2 Ambient Conditions

1.4.8 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.

1.4.9 Warming up

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

1.4.10 Input Cable

Use the A01036-1500 cable as the input cable of the counter.

Note: A01036-1500 cable is a shielded cable. Do not cut it out carelessly.

1.4.11 Time Base Signal Selection

Internal and external time base signals become useful by selecting the selector switch of STD INT. OUT./EXT. IN., that is located on the rear panel.
When STD INT. OUT. is selected, an internal time base signal is selected and generated.
When STD INT. IN. is selected, the instrument operates with an external time base signal of 1MHz, 2MHz, 5MHz, or 10MHz (that is 1Vp-p to 5Vp-p through a source resistance of 500Ω.)

1.4.12 Mechanical Shock

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

1.4.13 Cleaning, Storage, and Transportation

(1) Cleaning

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

Note: Do not use an organic solvent (for example, benzene and acetone, etc.) which may change quality of plastics.

(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 to 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 sunshine.

Storage conditions: -20°C to +70°C

2 PANEL DESCRIPTION

2.1 Front Panel

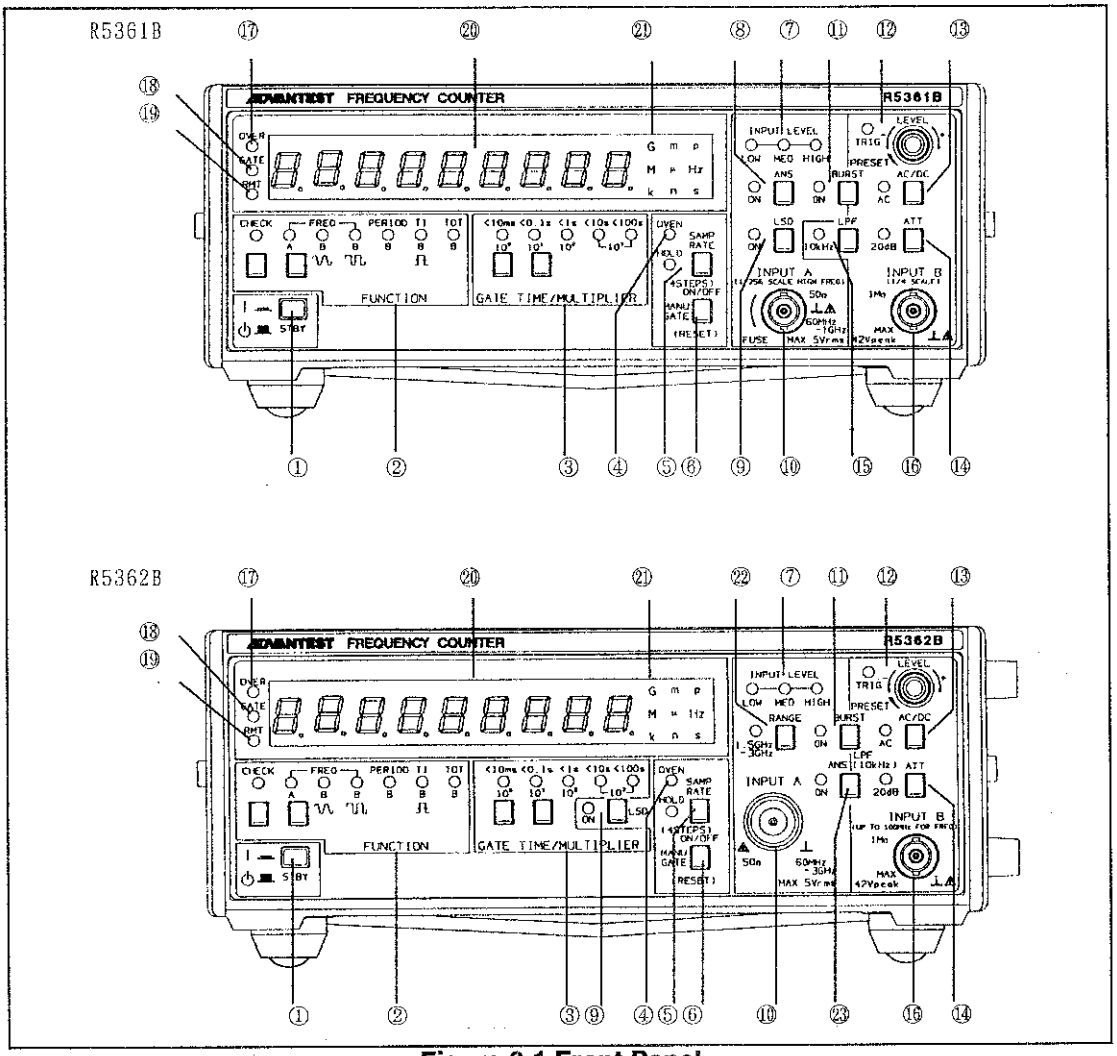


Figure 2-1 Front Panel

① STBY switch

This switch is used to close or open the secondary circuit of the power transformer. When this switch is set to ON, all internal circuitry of the counter is energized. Pressing it a second time places the counter in STBY (standby) state. In the STBY state, with the rear OVEN switch set to ON (the OVEN indicator lamp on the front is on), power is supplied only to the oscillator, 10MHz multiplier, and thermostatic oven within the counter. In this state, Primary power is always supplied to the primary windings of the power transformer. When replacing the power fuse, unplug the power cable either from its supply outlet or from the power receptacle on the rear of the unit.

② FUNCTION block

The selected function is indicated by the corresponding indicator lamp which is on. Pressing → key shifts the function indicator lamp one position to the right so select another function. When the key is released, the readout display is temporarily reset to all 0s, then the counter start operating for the selected function. Similarly, operation of ← key shifts the active indicator lamp one position to the left, the readout display is temporarily reset to all 0s, then the counter starts operation for the selected function. The function can be selected from: CHECK (self-check), FREQ. A (frequency measurement), FREQ.B ∿ (sine wave frequency measurement), FREQ. B ⊓ (square wave frequency measurement), PEIOD B (period measurement), T.I.B (positive plus width measurement), and TOT. (totalization).
When the CHECK function lamp is on, operation of ← key does not select another function, but causes the readout display to be temporarily reset to all 0s.

③ GATE TIME/MULTIPLIER block

The selected gate time or multiplier is indicated by the lighted lamp. GATE TIME is selected when the CHECK FREQ., or PERIOD is selected in the FUNCTION block; MULTIPLIER is selected only if the T.I. function is selected in the FUNCTION block. If the TOT. function is selected in the FUNCTION block, the operation in the GATE TIME/MULTIPLIER block is not required.
Operation of → key shifts the active indicator lamp one position to the right so select a gate time or multiplier 10 times as large. When the key is released, the data display is temporarily reset to all 0s, then the counter continues measurement on the newly selected gate time or multiplier. Similarly, operation of ← key selects a gate time or multiplier one-tenth that of the last selection.
When the <10ms/10^0 lamp is on, operation of ← key does not select another gate time or multiplier, but temporarily resets the data display to 0s, When the <100s/10^3 lamp is on, operation of → key does not select another gate time or multiplier, but temporarily resets the data display to 0s.

④ OVEN lamp

When this lamp indicates that the internal crystal-controlled oscillator is energized. If this lamp is on and the STD INT.OUT./EXT. IN. switch (explained later) is set to INT. OUT., a 10MHz reference signal is available at the rear STD connector.

⑤ SAMPLE LATE switch and HOLD lamp

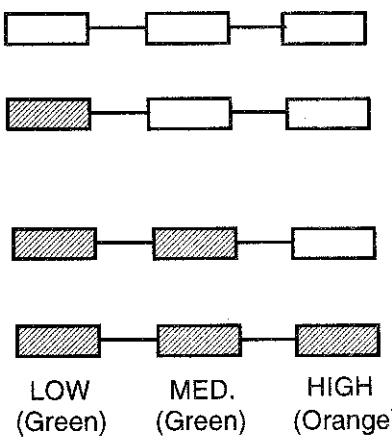
The SAMP. RATE switch controls repeat rate of measurement by varying pause intervals between measurements. (Measurement repeat rate depends on the sum of the selected gate time and the pause interval between measurements. Gate time can be selected by switch operation in the GATE TIME/MULTIPLIER block).
Each operation of the SAMP. RATE switch selects pause intervals in a cyclic manner of approx. 80ms → 320ms → 2.5s → ∞ → 80ms, and so on. If ∞ (infinite) is selected, the HOLD lamp goes on.

⑥ MANU. GATE ON-OFF/RESET switch

If the TOT. function is selected in the FUNCTION block, this switch functions as a manual gate on/off control. Each operation of this switch alternately opens and closes the count gate.
When any function other than TOT. is selected, this switch functions as a manual reset switch (initial state:0).

⑦ INPUT LEVEL monitor lamps

These three lamps, LOW, MED., and HIGH, are used to monitor the input signal level on INPUT A in the following way:



All off
Insufficient input level.

LOW lamp on
Insufficient input level.
The level requires about 2dB more to reach count level.

LOW and MED. lamps on
Normal input level.

All on
Input overload exceeding 5Vrms.

⑧ ANS switch and ANS ON lamp (Only R5361B)

The ANS switch is used to switch the ANS (Automatic Noise Suppressor) function on or off. When the ANS ON lamp is on, the ANS function is activated for the input signal from INPUT A to increase the noise rejection faculty of the input circuit.

⑨ LSD switch

The LSD switch is used to switch the LSD function on or off. If the LSD ON lamp is lit up with the FREQ. A function selected, one LSD (least significant digit) is added to the data display. When the LSD function is on, the measurement accuracy is ± fractional part measurement error ± time base accuracy.

⑩ INPUT A connector

This input connector should be used when the FREQ. A function is selected in the FUNCTION block.
It has a range of 60MHz to 1000MHz on the R5361B and 60MHz to 3000MHz on the R5362B. To protect the input circuit from overload damage, an high-frequency fuse is provided in the INPUT A circuit for R5361B.
The fuse assures safety unless an excessive input level is applied to the input . If it blows, replace it with the supplied spare high-frequency fuse according to the instructions in section 3.7 (the fuse will blow at an input signal level of 12Vrms applied for approx.1 minute).
The signal applied to this input is frequency divided by 256 before being coupled to the counter gate.

⑪ BURST switch and BURST ON lamp

The BURST switch is used to switch the burst signal measurement mode on or off. When the BURST ON lamp goes on, the burst signal measurement mode is selected and is available to the FREQ. A, FREQ.B and PERIOD functions; it is invalid for the CHECK, T.I, or TOT. functions.

⑫ LEVEL control and TRIG. lamp

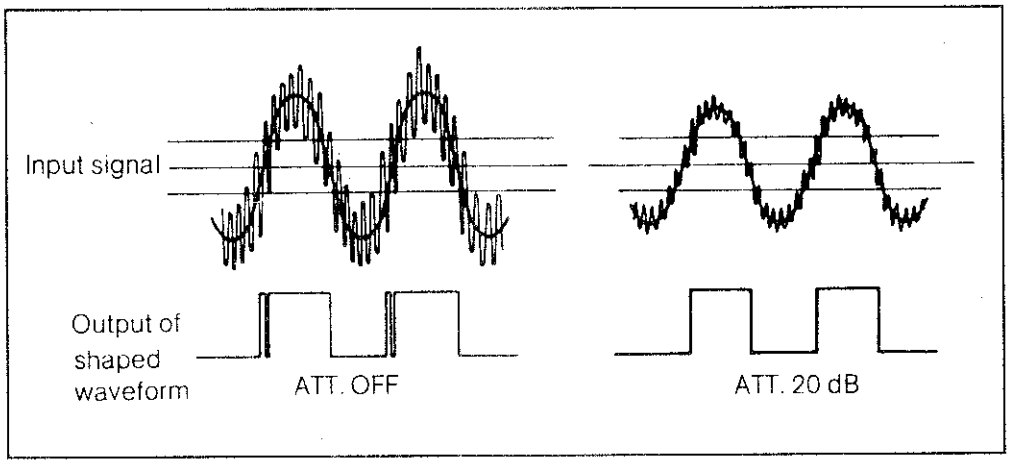
The LEVEL control is used continuously control the trigger level for the signal applied to INPUT B. The controllable range is between approx. -12V and +12V. With the used of the attenuator (ATT. switch on), it is between approx. -12V and +12V. If an appropriate trigger level is set for an input signal exceeding the input sensitivity, the internal waveform shaper is activated to start count operation. The TRIG. lamp goes on when this waveform shaper circuit is activated.
Turning the LEVEL control fully counterclockwise to the detent selects the PRESET state in which the trigger level is fixed to approx. 0V.

⑬ AC/DC switch and AC lamp

The AC/DC switch is used to select the input coupling mode. When the AC lamp is on, the signal applied to INPUT B is AC coupled to the input circuit. When the AC lamp is off, the signal at the same input is DC coupled to the input circuit. In the AC coupled mode, the lower cut-off frequency is 10Hz.

⑭ ATT. switch and 20dB lamp

The ATT switch is used to switch an internal input attenuator on or off. When the 20dB lamp is on, a resistance attenuator of 20dBis inserted into the INPUT B circuit. If the input signal level is sufficiently large, the attenuator may be used to prevent measurement errors due to introduced noise, as illustrated below:



This switch is also used to change previous settings to initial settings. Set STBY switch back to ⏻ and set STBY switch to | again. Then, press ATT switch while the instrument is displaying SELF TEST messages. After these steps, panel settings become initial settings.
For initial settings, see "3.1.3 Initial operation."

⑮ LPF switch and 10MHz lamp (Only R5361B)

The LPF (low-pass filter) switch is used to switch an internal LPF on or off and to select counting system.

When the 10kHz lamp is on (LPF on), the range of INPUT B is limited to 10kHz, which will be effective to reject superimposed noise. In this case, the input signal is directly measured, without frequency division. When the 10kHz lamp is off (LPF off), the input signal is frequency divided by 4 before being counted (when the T.I. or TOT. function is selected, the signal is directly measured without frequency division, however).

⑯ INPUR B connector

This high-impedance input connector is used when the FREQ. (up to 100MHz), PERIOD, T.I., or TOT. function is selected. In the FREQ. or PERIOD mode, the signal applied to this input is frequency divided by 4 before being routed to the counter gate.

⑰ OVER lamp

This lamp goes on if the measurement data exceeds the number of display digits. The nine least significant digits of the measurement data will be displayed as they are, even if this lamp goes on.

⑱ GATE lamp

This lamp us on during count operation busy. When the FREQ. A, FREQ. B, PERIOD, or T.I. function is selected, the GATE lamp does not go on unless the input level exceeds the minimum counting threshold.

⑲ RMT lamp

This lamp goes on if the front panel functions of the counter are controlled by a remote controller via the R13002 GPIB adapter.
When this lamp is on, the functions of all the front panel switches and controls are disabled, except the POWER switch and LEVEL control.

⑳ Data display

A green, 9-digit, 7-segment LED display used to show measurement data.

㉑ Unit indicator area

Indicates the unit for measurement data shown in the data display.
Note that units Hz and s (second) are not displayed when the accessory TR1644 Calculation Unit is used with the counter.

㉒ RANGE switch and 950MHz lamp (Only R5362B)

This switch is used to selectthe measuring range either of the low (60MHz to 960MHz) or the high (950MHz to 1805MHz) frequency band according to the signal applied to INPUT A. When high frequency range is selected, the 950MHz lamp goes on.

㉓ ANS/LPF switch and ANS ON/LPF ON lamp (Only R5362B)

ANS/LPF switch functions as ANS switch when FREQ. A function is set and the lamp indicates ANS ON. Otherwise the key functions as LPF switch and the lamp goes on when LPF ON.
ANS switch is used to select the ON/OFF of Automatic Noise Suppressor. ANS function is effective if the input signal is in the range of 60MHz to 1500MHz. The maximum measuring voltage is 3Vrms. The details of uator will be inserted automatically to prevent the saturation of the input amplifier so as to improve S/N ratio.
LPF switch is mentioned above in 15 along with 10kHz lamp.

2.2 Rear Panel

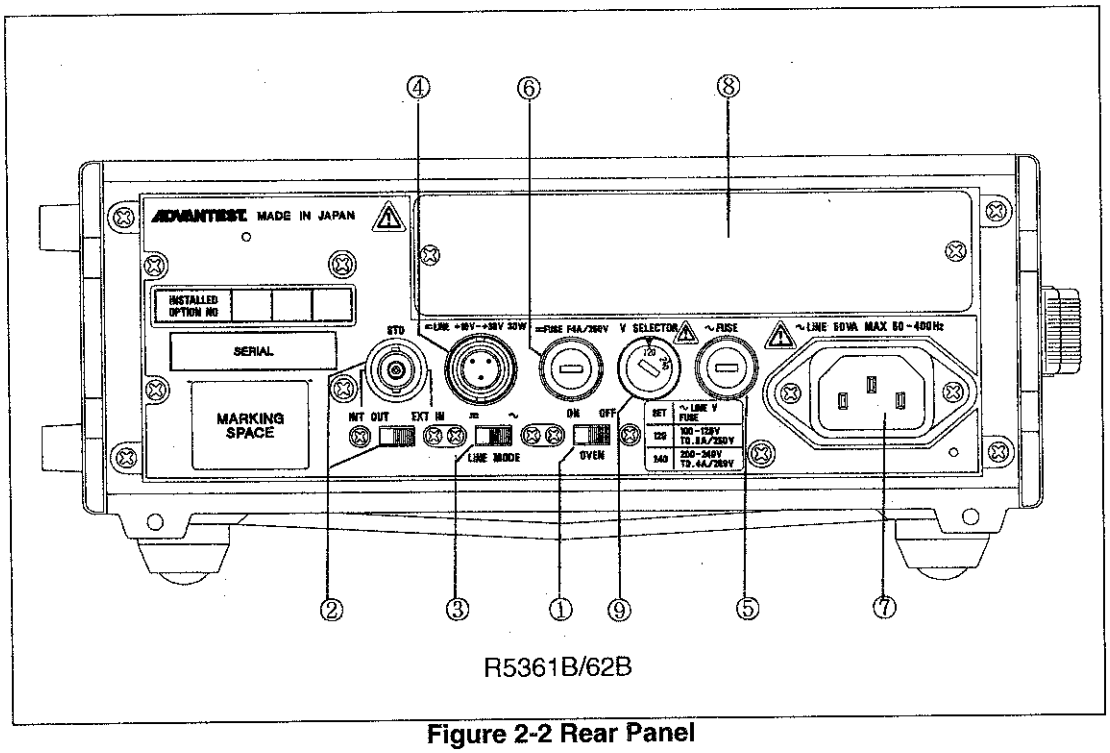


Figure 2-2 Rear Panel

① OVEN switch

If this switch is set to ON, the internal thermostatic oven for crystal oscillator and 10MHz multiplier are energized, even when the STBY switch is set to ⏻. If, in this state, the INT. OUT./EXT. IN. switch is set to INT. OUT., a 10MHz time-base signal is available at the STD connector.

② STD INT. OUT./EXT. IN. switch and STD signal in/out connector

When this switch is set to INT. OUT. (internal standard output), the counter uses its internal time-base signal as the time reference and outputs a 10MHz time-base signal to the STD connector.
When the switch is set to EXT. IN. (external standard input), an external time-base signal applied to the STD connector is used for the time reference for the counter. The external signal should have a voltage range of 1-5Vp-p, with frequency of 1MHz, 2MHz, 5MHz, or 10MHz. The STD input has an input impedance of approx. 500Ω.

③ LINE MODE selector switch

This switch is used to select the type of power source to be used.
When using AC power, set this switch to AC(~); when using a DC power source, set it to DC (⎓).

④ DC power connector

Accepts DC power supply to the counter. Use the Supplied DC power cable (MI-71) for DC power connection.

⑤ DC fuse holder

Contains a fuse for the DC power circuit. For fuse replacement, see item 1.4.1.

⑥ AC fuse holder

Contains a fuse for the AC power circuit. For fuse replacement, see item 1.4.1. For an applicable fuse, see Table 1-2.

⑦ AC power connector

Accepts AC power supply to the counter. Use the supplied AC power cable (A01402) for AC power connection.

⑧ Accessory installation cavity

The cavity is used to install the R13001B (BCD Output Unit) or R13002B (GPIB Adapter). When installing either of these units, remote the blank panel.

⑨ Voltage selector (V SELECTOR)

AC line voltage is selected. For its selection, see Section 1.4.4.

2.3 Right Side Panel

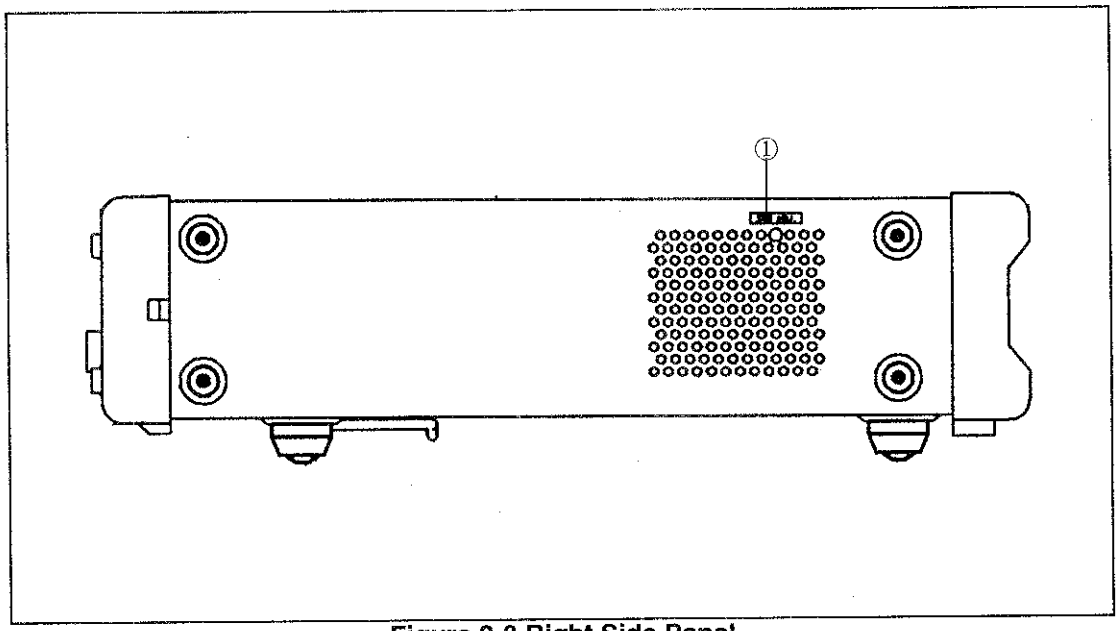


Figure 2-3 Right Side Panel

① STD ADJ.

A screwdriver control for calibrating the internal timr-base oscillator.

MEMO

3 OPERATING PROCEDURE

3.1 Basic Operating Procedure

3.1.1 Selection of POWER Source

① Set the STBY switch to (⏻).

② Set the POWER MODE switch according to the type of power source to be used.

③ When the AC power source is to be used, connect the supplied AC power cable to the rear AC POWER connector. When a DC power source is to be used, connect the supplied DC power cable MI-71 to the DC POWER connector. Connect the other end of the cable to the power source. The cable has a red lead for positive (+) polarity and a white lead for negative (-) polarity.

3.1.2 Selection of Time-base Signal

When an external time-base signal is to be used, set the INT. OUT./EXT. IN. switch to EXT. IN. with a small flat blade, then apply the external time-base signal to the rear STD connector. When switching the signal source from external to internal, disconnect the external signal source from the STD connector, then set the INT. OUT./EXT. IN. switch to INT. OUT. (the STD connector used for both input and output purposes.) Note that the counter will not operate when no external signal is fed to the STD connector with the reference signal selector switch set to EXT. IN. Set the OVEN switch to ON to keep the crystal oscillator energized regardless of STBY switch position.

3.1.3 Initial Operations

When the STBY switch is set to | , the counter will automatically perform the following four steps of operation:

(1) Lamp check in which all indicator lamps on the front panel go on except the INPUT LEVEL, and TRIG. lamps.

(2) RAM is self-tested. At this time, the instrument displays the message of "SELF TEST."

(3) Panel settings can become initial or previous settings.

① Panel settings

- Initial settings
  FUNCTION : CHECK
  GATE TIME: <10ms
  SAMP. RATE: Approx. 80ms
  Input section settingsConditions where all lamps are off.
- Readout display 9.9999MHz to 10.0001MHz, with GATE lamp blinking

② To go back to the previous settings, turn STBY switch | within the permissible operating time of the internal backup battery.

③ To go back to the initial settings, set STBY switch back to (⏻) and set STBY switch to | again. Then, press ATT switch while the instrument is displaying the message of "SELF TEST." The condition of ...@ is set.

If there is something unusual in the previously mentioned (1), the following error message is displayed. When the instrument fails, please contact Advantest Customer Engineering office or your nearest sales office or dealership.

E␣01RAM error

3.2 Self-check

① Set FUNCTION to CHECK

② Set the SAMP.RATE switch to any position except HOLD.

③ The readout display will show the following data acoording to GATE TIME setting.

Table 3-1 Data Display vs Gate Time

GATE TIME	Display	Acttual gate time
<10ms	9.9999MHz to 10.0001MHz	1ms
<0.1s	9.99999MHz to 10.00001MHz	10ms
<1s	9.999999MHz to 10.000001MHz	0.1s
<10s	9.9999999MHz to 10.0000001MHz	1s
<100s	9.99999999MHz to over 0000.00001kHz	10s

The GATE lamp goes on during count operation busy.

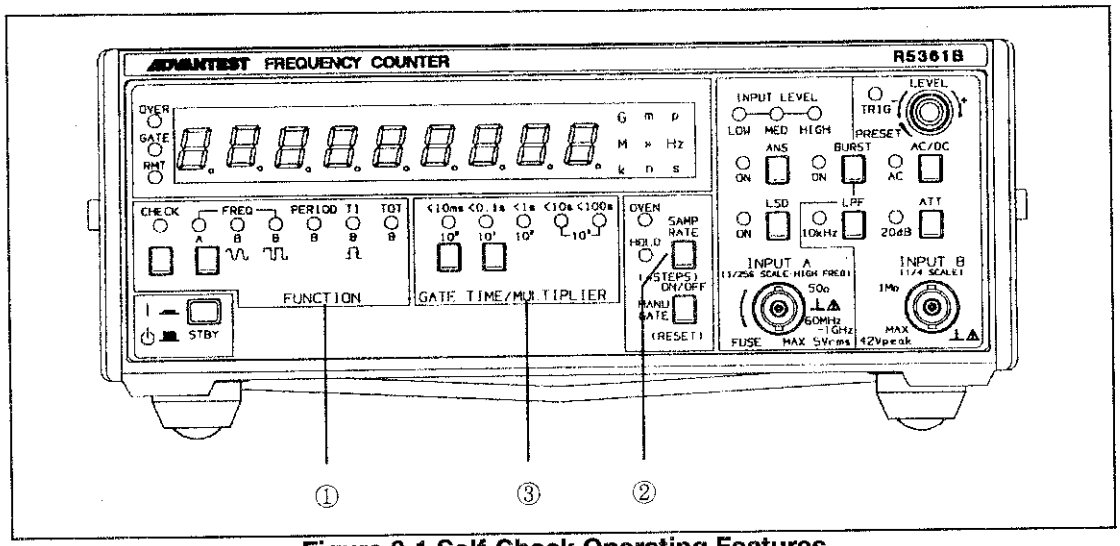


Figure 3-1 Self-Check Operating Features

3.3 Frequency Measurement

3.3.1 FREQ. A
60 MHz to 1000MHz (R5361B)
60 MHz to 3000MHz (R5362B)

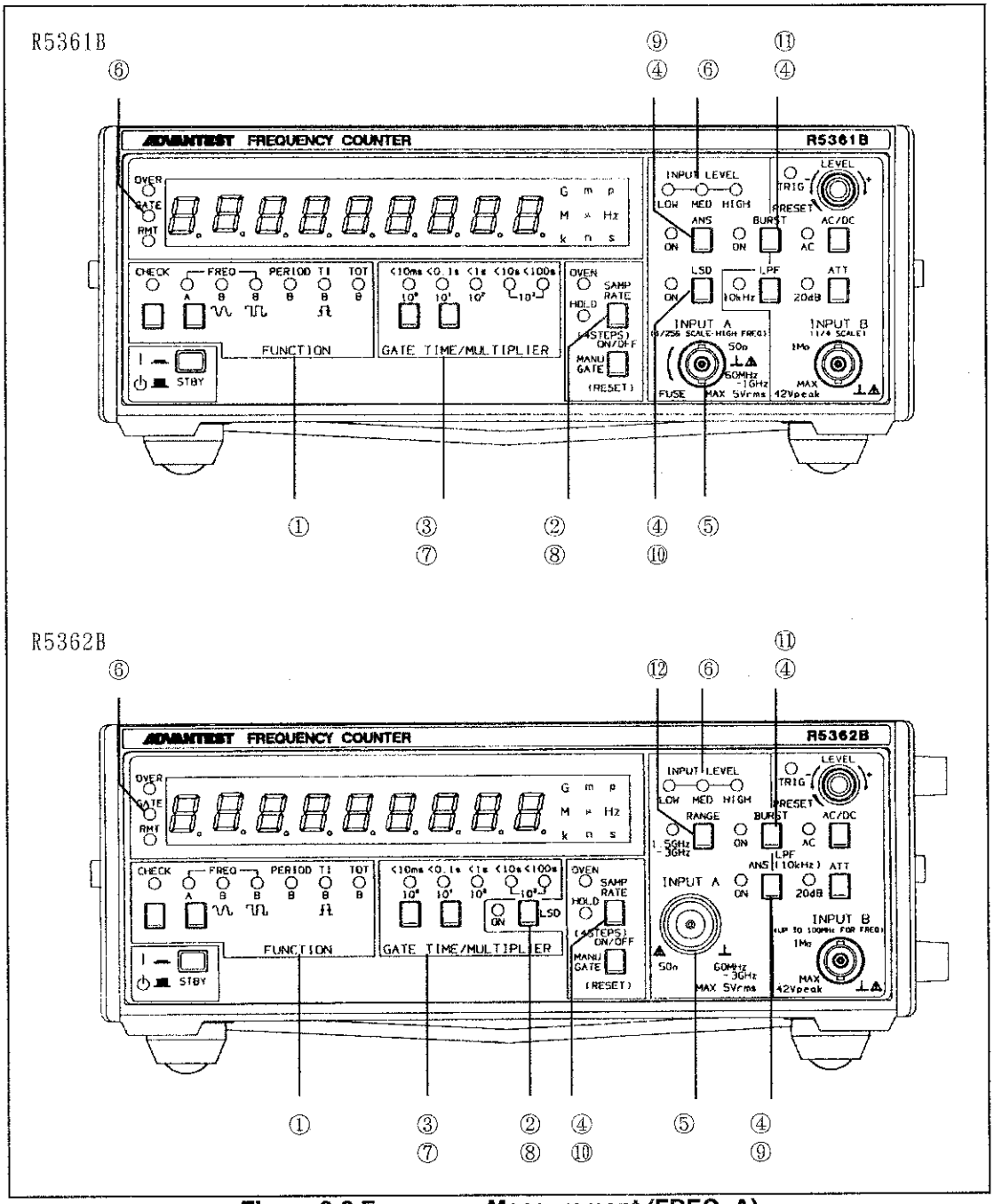


Figure 3-2 Frequency Measurement (FREQ. A)

① Set FUNCTION to FREQ. A.

② Set the SAMP. RATE switch to any sampleing rate except HOLD.

③ Set GATE TIME to <10ms.

④ Set the BURST, ANS, and LSD switches to OFF (lamps off).

⑤ Apply the signal to be measured to the INPUT A connector.

⑥ Adjust the input signal level until both the LOW and MED. lamps of the INPUT LEVEL indicator go on. The GATE lamp starts blinking and the readout display shows the input signal frequency. If the HIGH (orange) lamp of the INPUT LEVEL indicator goes on, reduce the input signal level or disconnect the input cable from INPUT A; otherwise, the high-frequency fuse in the INPUT A connector will blow.

⑦ Select GATE TIME as needed. Table 3-2 shows GATE TIME setting versus the number of display digits and actual gate time25.6ms.

Table 3-2 GATE TIME Setting vs Number of Display Digits and Actual Gate Tme for Frequency Measurement

	GATE TIME	<10ms	<0.1s	<1s	<10s	<100s
	Display digits	6	7	8	9	9
Input signal frequency X 10^N(Hz)	1.00	2.56ms	25.6ms	256ms	2.56s	25.6s
	2.00	1.3ms	13ms	130ms	1.3s	13s
	2.84	0.9<->9ms	9<->90ms	90<->900ms	0.9<->9s	9<->90s
	3.00	8.5ms	85ms	850ms	8.5s	85s
	4.00	6.4ms	64ms	640ms	6.4s	64s
	5.00	5.1ms	51ms	510ms	5.1s	51s
	6.00	4.3ms	43ms	430ms	4.3s	43s
	7.00	3.7ms	37ms	370ms	3.7s	37s
	8.00	3.2ms	32ms	320ms	3.2s	32s
	9.00	2.8ms	28ms	280ms	2.8s	28s
	10.00	2.56ms	25.6ms	256ms	2.56s	25.6s

Note: ***N in the input signal frequency column is 7 to 9.***

⑧ Selct SAMP. RATE as needed.

⑨ Set the ANS switch to ON as needed to reject noise interference.

⑩ Set the LSD switch to ON as needed. Table 3-3 lists the error counts possible when the LSD switch is set to OFF or ON in which the time-base error is not considered.

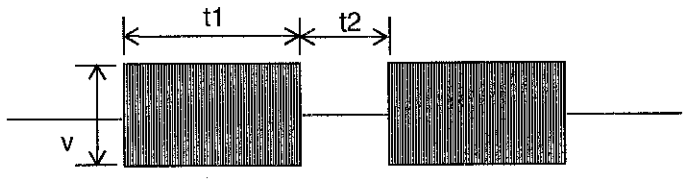
Table 3-3 Error Counts Possible when LSD Switch is set to ON or OFF

Inpur signal frequency (Hz)	LSD switch	
	OFF	ON
1.00×10^N	±1 count	±1 count
2.00×10^N	±1 count	±3 count
2.83×10^N	±1 count	±9 count
2.85×10^N	±1 count	±1 count
3.00×10^N	±1 count	±2 count
4.00×10^N	±1 count	±3 count
5.00×10^N	±1 count	±4 count
6.00×10^N	±1 count	±5 count
7.00×10^N	±1 count	±6 count
8.00×10^N	±1 count	±7 count
9.00×10^N	±1 count	±8 count
9.99×10^N	±1 count	±9 count
10.0×10^N	±1 count	±1 count

Note:N in the input signal frequency column is 7 to 9.

⑪ When measuring a burst signal, set the BURST switch to ON.
Figure 3-3 shows the measurable burst signal condition.

⑫ R5362B need to select the frequency by RANGE switch according to the signal to be measured.
The measuring range consists of the low frequency range of 60MHz to 1500MHz and the high frequency range of 1500MHz to 3000MHz.



t1: Equal to or greater than the selected GATE TIME (for example, 10ms or more when <10ms is selected)

t2: 0.5ms or more

f: The frequency range indentical to that set up when the BURST switch is set to OFF (lamp off)

v: 30mVp-p to 1.5Vp-p

Figure 3-3 Burst Signal Measurement Condition in FREQ.A

3.3.2 FREQ. B
0.2mHz to 100MHz

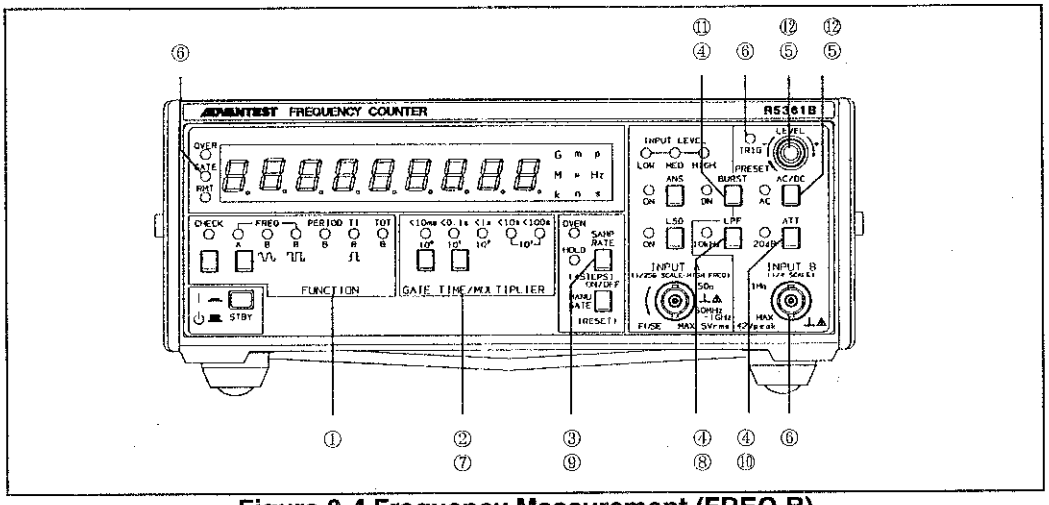
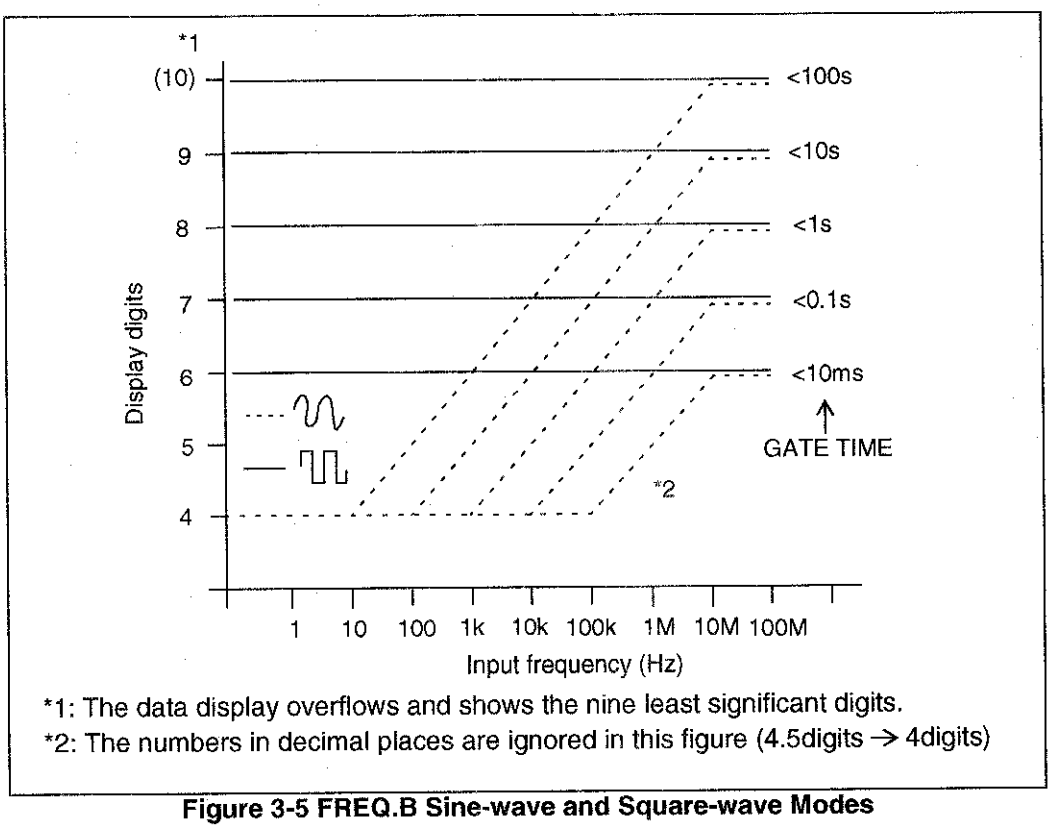


Figure 3-4 Frequency Measurement (FREQ.B)

① Set FUNCTION to FREQ. B ∿ (sine wave) or FREQ.B ⊓ (square wave). These two modes differ only in the number or display digits. (See figure 3-5.) All operations required for these modes are identical.



*1: The data display overflows and shows the nine least significant digits.
*2: The numbers in decimal places are ignored in this figure (4.5digits → 4digits)

Figure 3-5 FREQ.B Sine-wave and Square-wave Modes

② Set the GATE TIME to <10ms.

③ Set the SAMP.RATE switch to any position except HOLD.

④ Set the BURST, LBW, and ATT. switches to OFF (lamps off).

⑤ Set AC/DC switch to AC, and the LEVEL control to PRESET (fully counterclockwise to the detent)

⑥ Connect the signal to be measured to the INPUT B connector. If the signal level is adequate, the TRIG. lamp goes on, the GATE lamp starts blinking, and the readout display shows the signal frequency.

⑦ Change the GATE TIME as needed.

⑧ Set the LPF (10kHz) switch to ON (lamp on) as needed. The actual gate time varies depending on whether the LPF switch is set to ON or OFF. Table 3-4 shows this variation. Note that the number of display digits does not change. The available frequency range also depends on the LPF switch setting as follows:

LPF ON: 0.2mHz to 10kHz (direct input)
LPF OFF: 0.8mHz to 100MHz (1/4 prescaled)

Table 3-4 Actual Gate Times Depending on LPF switch setting

Ffrequency (Hz)	Actual gate time (ms) when GATE TIME setting is <10ms	
	LPF ON	LPF OFF
1.00×10^N	1.0	4.0
1.11×10^N	$0.9 \leftrightarrow 9$	3.6
2.00×10^N	5.0	2.0
3.00×10^N	3.3	1.3
4.00×10^N	2.5	1.0
4.44×10^N	2.3	$0.9 \leftrightarrow 9$
5.00×10^N	2.0	8.0
6.00×10^N	1.7	6.8
7.00×10^N	1.4	5.6
8.00×10^N	1.3	5.2
9.00×10^N	1.1	4.4
10.0×10^N	1.0	4.0

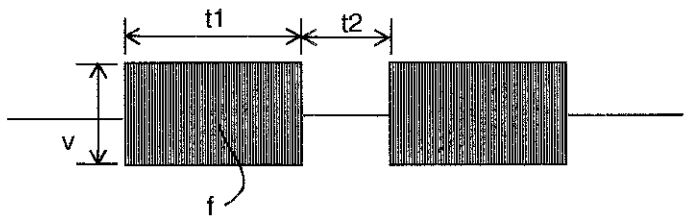
Note1: ***When GATE TIME setting is <0.1s, <1s, <10s, or <100s, the values given in this table should be multiplied by 10,100,1000,and 10000 respectively.***

Note2: ***N in the frequency colimn is 3 when the LPF switch is set to ON and is an integer between 3 and 7 when the switch is set to OFF. If N is 2 or less, the actual gate time will depend on the input signal frequency.***

⑨ Select sample rate as needed with the SAMP. RATE switch.

⑩ Set the ATT. switch to ON (lamp on) as needed.

⑪ When measuring a burst signal frequency, set the BURST switch to ON. Figure 3-6 shows the conditions for burst signal measurement



t1: Equal to or greater than the selected GATE TIME (for example, 10ms or more when <10ms is selected)

t2: 0.5ms or more

f: 50kHz to 100MHz

v: 75mVp-p to 1.5Vp-p (up to 15Vp-p if the ATT. switch is set to 20dB)

Figure 3-6 Condition for Burst Signal Measurement in FREQ. B

⑫ If AC/DC switch is set to DC, adjust the trigger level with the LEVEL control. The trigger level is variable between approx. -1.2V and +1.2V.

Caution: If the input is AC coupled, the lower cut-off frequency is 10Hz.

3.4 Period Measurement (PERIOD B: 10ns to 5000s)

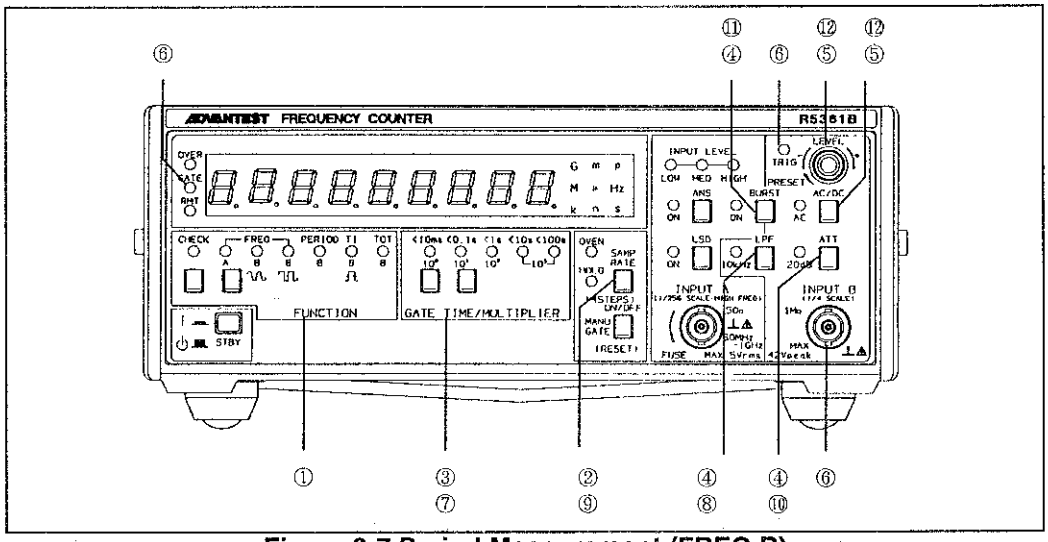


Figure 3-7 Period Measurement (FREQ.B)

① Set FUNCTION to PERIOD B.

② Set the SAMP. RATE switch to anyy rate expect HOLD.

③ Set GATE TIME to <10ms.

④ Set the BURST, LPF, and ATT. switches to OFF (lamp off).

⑤ Set AC/DC switch to AC, and the LEVEL control to PRESET (fully counterclockwise) to the detent).

⑥ Apply the input signal to INPUT B. If the signal level is adequate, the TRIG. lamp goes on, the GATE lamp starts blinking, and the dipslay shows the period of the input signal.

⑦ Change the GATE TIME setting as needed. Table 3-5 lists the GATE TIME setting versus the number of display digits.

Table 3-5 GATE TIME vs Display Digits in Period Measurement

GATE TIME	<10ms	<0.1s	<1s	<10s	<100s
Display digits	6	7	8	9	9*

*: MSD overflow

⑧ Set the LPF (10kHz) switch to ON (lamp on) as needed. The actual gate time depends on whether the LPF switch is set to ON or OFF. (See Table 3-6.) Note that the number if display digits is not affected by the LPF switch setting. The period measurement range also depends on the LPF switch setting as follows:

LPF ON: 100μs to 5000s (direct input)
LPF OFF: 10ns to 1250s (1/4 prescaled)

Table 3-6 Actual Gate Times Depending on LPF switch setting

Single period (s)	Actual gate time (ms) when GATE TIME setting is <10ms	
	LPF ON	LPF OFF
1.00×10^N	1.0	4.0
2.00×10^N	2.0	8.0
3.00×10^N	2.3	9.0 ↔ 0.9
4.00×10^N	3.0	1.2
5.00×10^N	4.0	1.6
6.00×10^N	5.0	2.0
7.00×10^N	6.0	2.4
8.00×10^N	7.0	2.8
9.00×10^N	8.0	3.2
10.0×10^N	9.0 ↔ 0.9	3.6
	1.0	4.0

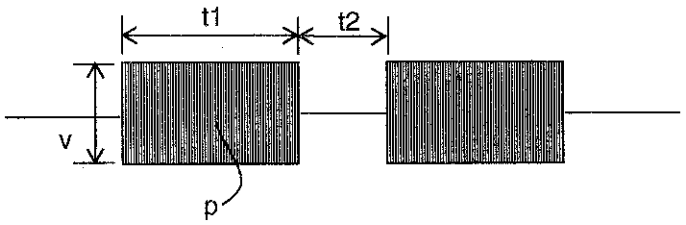
Note1: ***When GATE TIME setting is <0.1s, <1s, <10s, or <100s, the values given in this table should be multiplied by 10,100,1000,and 10000 respectively.***

Note2: ***N in the period colimn is 4 when the LPF switch is set to ON and is an integer between 4 and 8 when the switch is set to OFF. If N is 3 or less, the actual gate time will depend on the input signal period.***

⑨ Select sample rate needed with the SAMP. RATE switch.

⑩ Active the ATT. (20dB) switch as needed.

⑪ When measuring a burst signal, set the BURST switch to ON.
Figure 3-8 shows the conditions for burst signal measurement.



t1: Equal to or greater than the selected GATE TIME (for example, 10ms or more when <10ms is selected)

t2: 0.5ms or more

p: 10ns to 20 s

v: 75mVp-p to 1.5Vp-p (up to 15Vp-p if the ATT. switch is set to 20dB)

Figure 3-8 Condition for Burst Signal Measurement in FREQ. B

⑫ If AC/DC switch is set to DC, adjust the trigger level with the LEVEL control. The trigger level is variable between approx. -1.2V and +1.2V. It is variable between approx. -12V and +12V if the ATT. switch is activated.

Caution: If the input is AC coupled, the lower cut-off frequency is 10Hz.

3.5 Positive Plus Width Measurement (T.I. B: 200ns to 9000s)

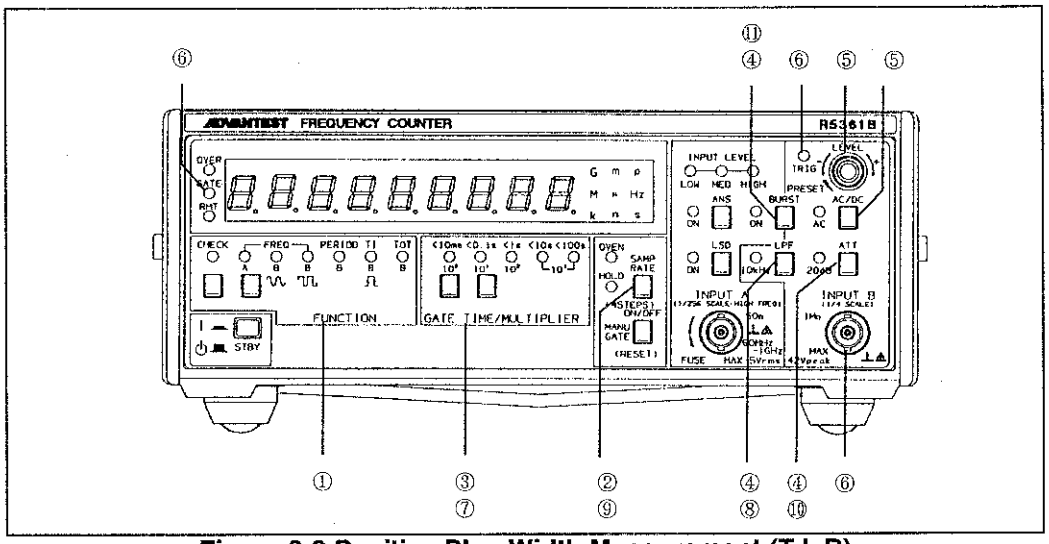


Figure 3-9 Positive Plus Width Measurement (T.I. B)

① Set FUNCTION to T.I. B.

② Set the SAMP. RATE switch to any rate except HOLD.

③ Set MULTIPLIER to 10^0.

④ Set the BURST, LPF, and ATT. switches to OFF (lamp off).

⑤ Set AC/DC switch to DC, and set the LEVEL control to an appropriate position.

⑥ Apply the input signal to INPUT B. If the signal level and the LEVEL control setting are adequate, the TRIG. lamp goes on, the GATE lamp starts blinking, and the readout display shoes the positive plus width measured.

⑦ Select the appropriate MULTIPLIER as needed. Table 3-7 gives the limit of readout resolution, excluding triggering error and timebase error..

Table 3-7 MULTIPLIER vs Readout Resolution

MULTIPLIER	10^0	10^1	10^2	10^3
Readout resolution (ns)	100	32	10	3.2

⑧ Set the LPF (10kHz) switch to ON (lamp on) as needed.

⑨ Select sample rate as needed with the SAMP. RATE switch.

⑩ Activate the ATT. (20dB) switch as needed.

⑪ Burst signal measurement is not possible. Always set the BURST switch to OFF.

3.6 Totalize (TOT. B: DC to 50MHz)

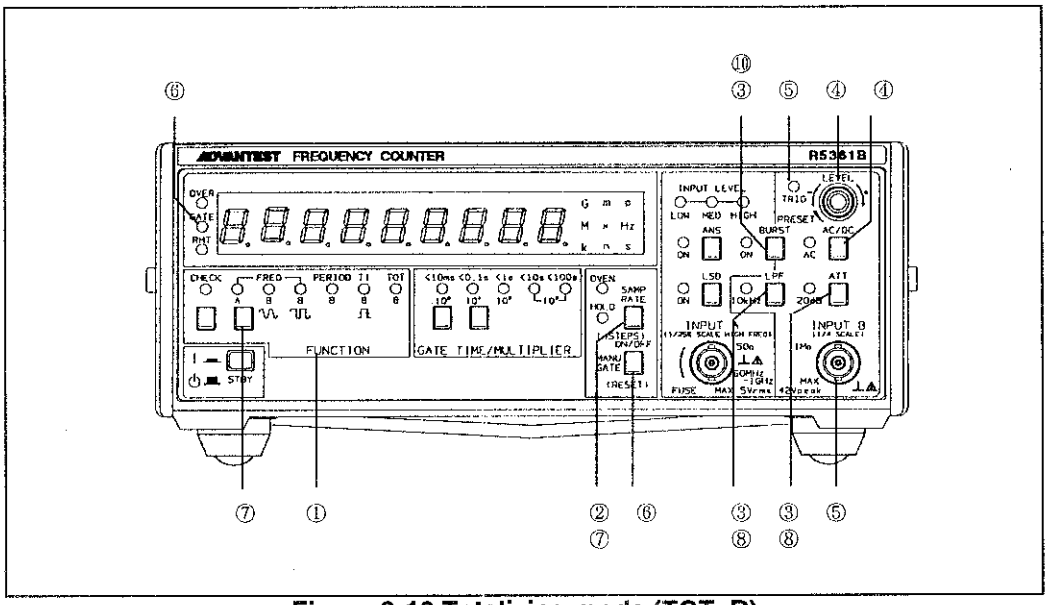


Figure 3-10 Totalizing mode (TOT. B)

① Set FUNCTION to TOT. B.

② Set the SAMP. RATE switch to any rate except HOLD.

③ Set the BURST, LPF, and ATT. switches to OFF (lamp off).

④ Set AC/DC switch to DC, and set the LEVEL control to an appropriate position.

⑤ Apply the input signal to INPUT B. If the input signal level and the LEVEL control setting are both adequate, the TRIG. lamp goes on.

⑥ Press the MANUAL GATE ON/OFF switch once; the GATE lamp goes on and the counter starts counting while showing the counting sequence on the readout display. When the ON/OFF switch is pressed again, the GATE lamp goes off, with the final totalized count shown in the readout display.
Counting starts from zero each time the GATE lamp goes on.

⑦ If step ⑥ above is executed with the SAMP. RATE switch set to HOLD, the last count result will not be cleared when the GATE lamp subsequently goes on, but it totalized on the next count result. To clear the count result, press → key in the FUNCTION block.

⑧ Active the LPF and/or ATT. switch as needed.

⑨ GATE TIME setting is not needed, and does not affect the measurement in this mode.

⑩ Burst signal measurement is not possible. Always set the BURST switch to OFF.

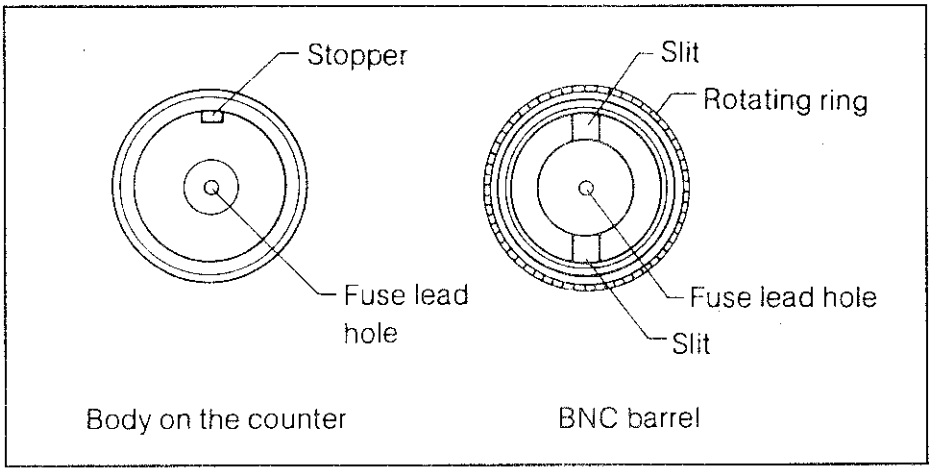
3.7 High-Frequency Fuse Replacement (Only R5361B)

The input high-frequency fuse is contained in the INPUT A connector. When replacing the high-frequency fuse, follow the instructions below:

(1) Fuse rating.

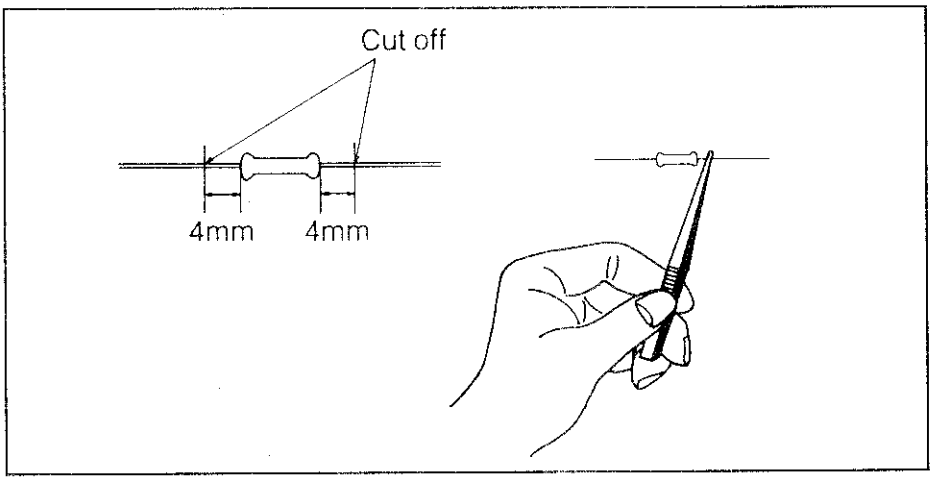
Part No.	Type name	manufacture
251.125	Axial leads 1/8A Picofuse	Littlefuse Inc.

(2) Connector configuration



(3) Cutting fuse leads

To cut the fuse leads, use a pair of pliers or other sharp cutter.
Hold the fuse lead with a pair of tweezers to prevent the fuse from being subjected to excessive stress.



(4) Replacement procedure

① Turn the outer ring on the detachable portion counterclockwise and remove the connector barrel.

② Remove the blown fuse.

③ Insert the replacement fuse (whose leads are already cut) into the center hole in the connector barrel (to facilitate insertion, turn the fuse or the connector barrel).

④ Guide the slit on the BNC barrel to the stopper on the connector body and insert the fuse into the center hole in the connector.

⑤ Lightly turn the outer ring clockwise.

⑥ Tighten the outer ring firmly.

MEMO

4 PRINCIPLES OF OPERATION

4.1 Configuration

The R5361B/5362B may be divided into the following functional blocks:

(1) High-frequency unput block (input A)

(2) Low-frequency input block (input B)

(3) Counting block

(4) Control block

(5) Display block

(6) Operation block

(7) Time-base oscillator block

(8) Power supply block

Figure 4-2 shows a simplified block diagram of the R5361B. Their configurations of power supply block are different from the disgram. R5361B are different in High-frequency input block as shoen in Figure 4-1. The following paragraphs describe the operations of each of these blocks:

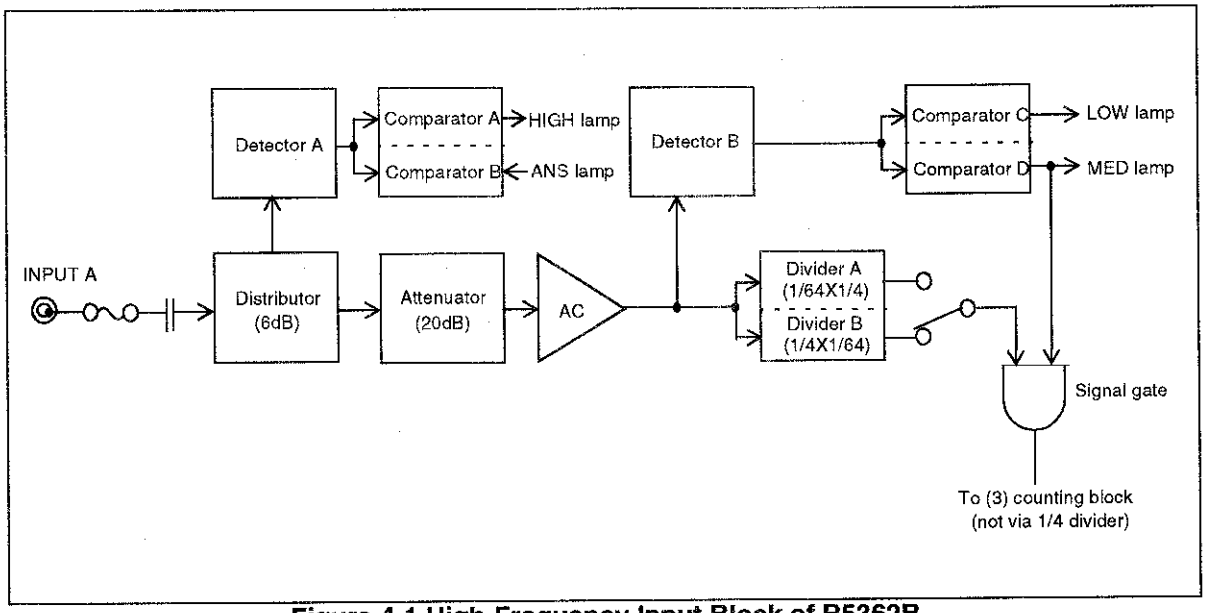


Figure 4-1 High-Frequency Input Block of R5362B

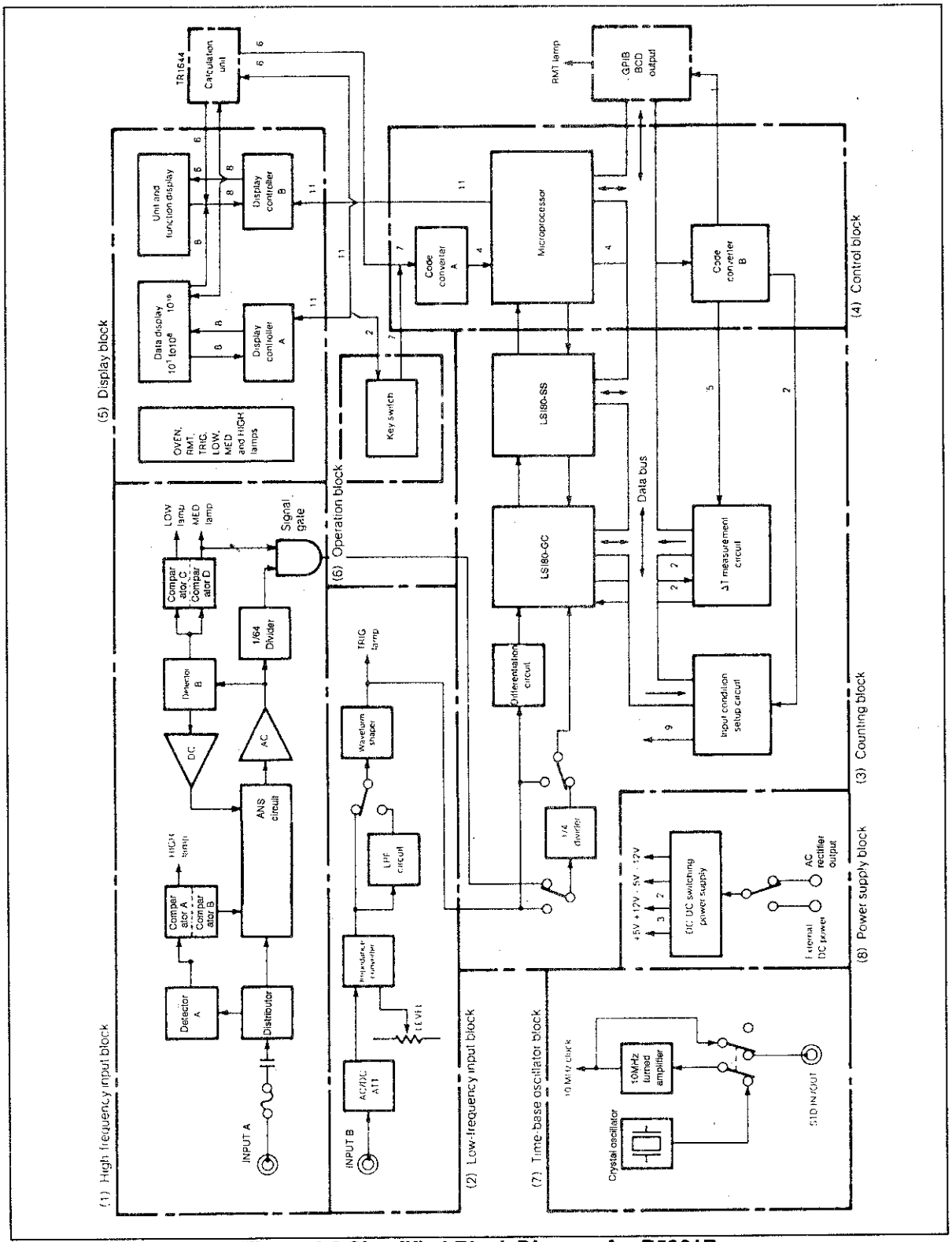


Figure 4-2 Simplified Block Diagram for R5361B

4.2 Operations of Each Block

(1) High-frequency input block (INPUT A)

INPUT A connector contains an high-frequency fuse to protect the circuit from input overload.
The input signal, after passing through the high-frequency fuse and DC blocking capacitor, branches to detector A and the ANS circuit at the distributor. The output of detector A is also coupled to comparator A, where the input signal level is compared with a reference level of 5Vrms. If the input level exceeds approx. 5Vrms, the comparator drives the HIGH indicator lamp of the INPUT LEVEL monitor on the front panel.

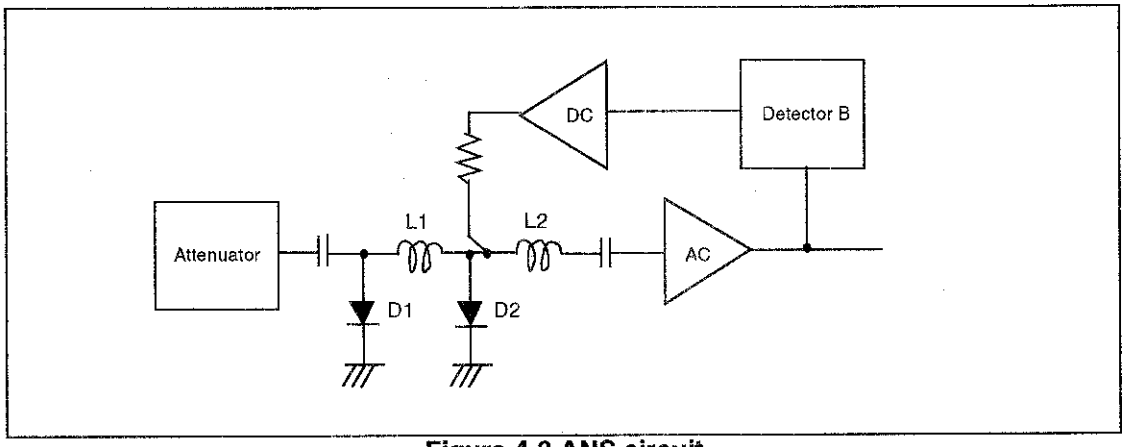


Figure 4-3 ANS circuit

The ANS circuit (See Figure 4-3) is basically a dual-stage, cascade LC filter. Capacitors are realized by using junction capacity of diodes. Since the bias to the diodes varies with the output level of the DC amplifier, the capacity also varies accordingly. When the ANS switch is set to OFF (lamp off), the diodes are biased to cut off, which causes the capacity to be fixed to a low value. As a result, the cut-off frequency of the LC filter is outside the measurement frequency range, and the input signal is not affected by the filter. When the ANS switch is set to ON, the output of the DC amplifier varies with the DC output level of detector B connected to the AC amplifier's output. This changes the bias to the diodes and hence the circuit capacity, resulting in a change in the cut-off frequency of the filter. The feedback loop is so designed that the cut-off frequency is reduced when the output of the AC amplifier is increased.
The output of detector B couples to comparators C and D. Comparator C drives the LOW indicator lamp of the INPUT LEVEL monitor, while comparator D drives the MED. indicator lamp of the same monitor. Comparator D also opens the signal gate for the 1/64 divider output when it activates the MED. indicator lamp.
The input signal is frequency divided by 64 in this input block, and is further divided by 4 in the following counting block (1/256 in all) before being counted up. This unconventionally large prescale ratio is achieved by the reciprocal counting system (in which an inverse of measured period data is operated and displayed).

(2) Low-frequency input block (INPUT B)

The input section for the low frequency is basically DC coupled. When the DC coupling mode is selected, the INPUT B connector is DC coupled to the input of the waveform shaper via an impedance connector. When the AC coupling mode is selected, a capacitor is inserted between the INPUT B connector and impedance converter to block the DC component of the input signal.
The LPF network is composed of a differential amplifier having a bandwidth of 10kHz and a gain of 40dB. When the LPF switch is set to ON, the output of this amplifier is coupled to the waveform shaper. At this time, the sensitivity of the waveform shaper is reduced by approx. 40dB. A large noise rejection effect is achieved by this active low-pass filter. The LPF is also quite effective for square-wave signals.

(3) Counting block

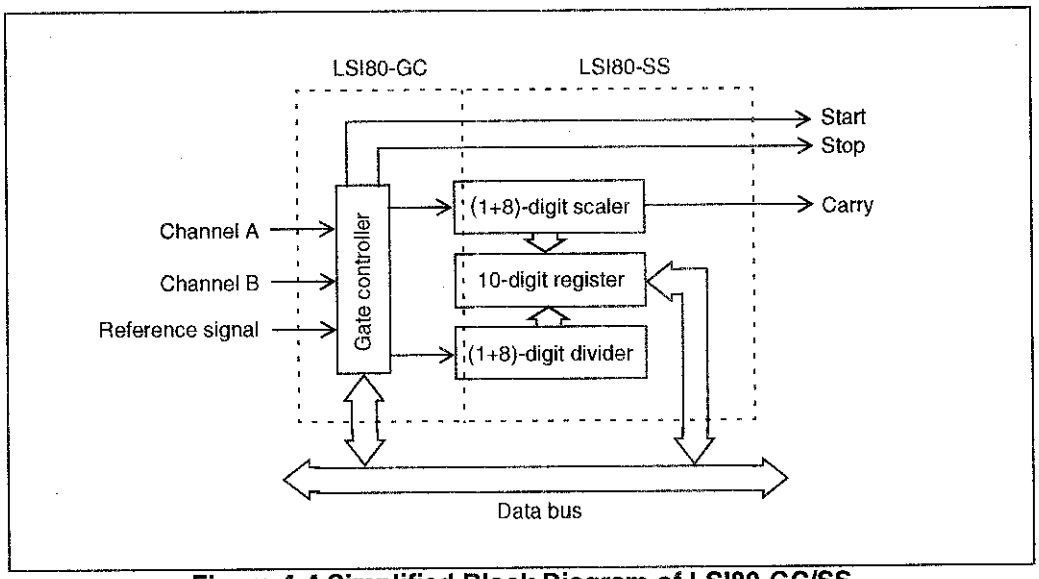


Figure 4-4 Simplified Block Diagram of LSI80-GC/SS

Figure 4-4 shows a simplified block diagram of the high-integration LSI devices LSI80-GC/SS used in the counter. The basic functions of the counter are implemented by these two LSIs. The device functions can be controlled through a data bus, so that they may be controlled by microprocessors.
The ΔT measureing ciycuit is used to measure short time intervals at high accuracy. Figure 4-6 shows its operation timing.

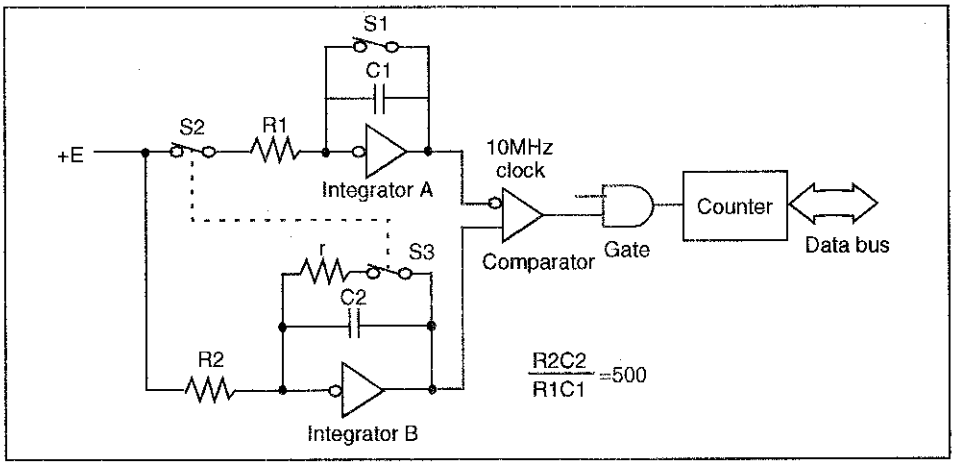


Figure 4-5 Simplified Schematic of the ΔT measuring Circuit

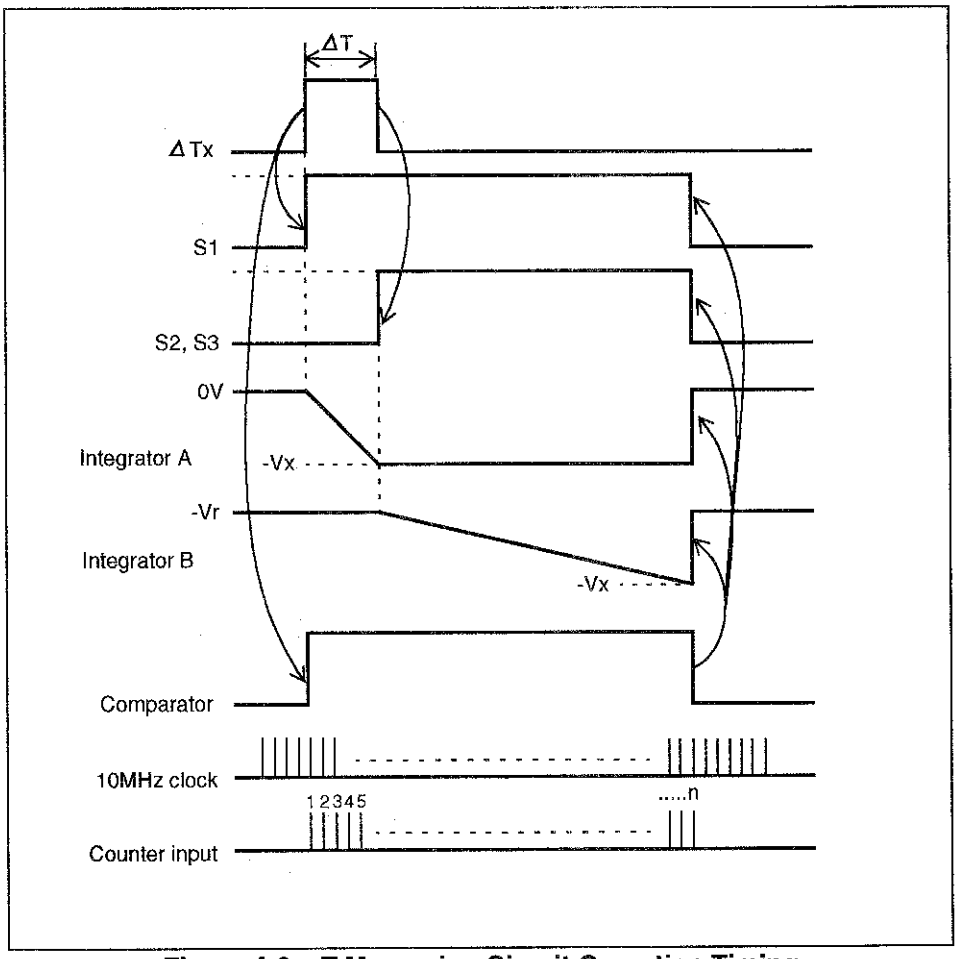


Figure 4-6 ΔT Measuring Circuit Operation Timing

Assume that the time interval to be measured is ΔTx. Switch S1 is opened at the leading edge of ΔTx, causing integrator A and the comparator to start functioning. At the trailing edge of ΔTx, switches S2 and S3 are opened. At this time, the output of integrator A is maintained at -Vx and integrator B start functioning. When the output of integrator B reaches -Vx, the comparator reverses its output state, closing switches S1, S2, and S3 to complete the integration sequence. The time interval from the leading edge of ΔTx to the completion of integrator B's operation is counted by the counter. If the number of 10MHz clock pluses input to the counter is assumed to be n, ΔTx is determined by the following equation.

$$\Delta Tx = \frac{n \times 100ns}{500} \quad \cdots\cdots 1$$

Measurement accuracy can be increased as the time interval is expanded.
During actual measurement, the ΔT measuring circuit operates twice for each measurement. Figure 4-7 shows the timing for this dual operation.

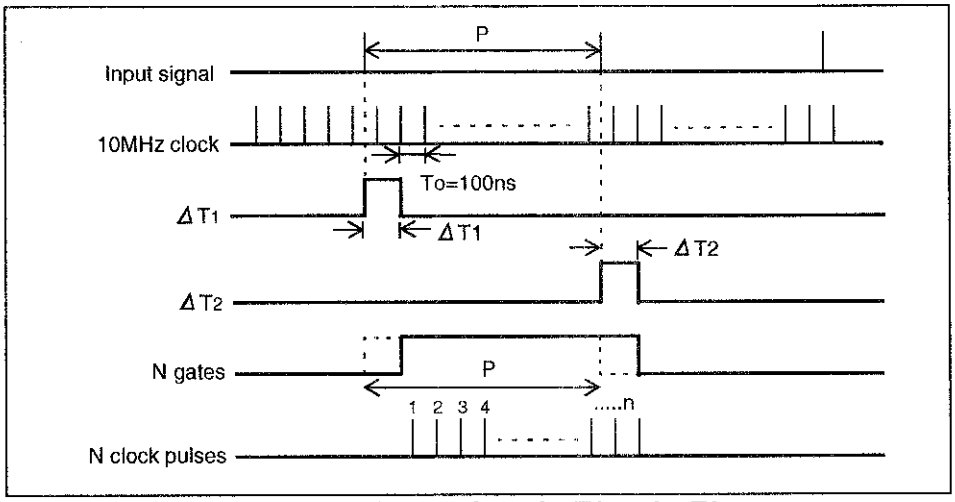


Figure 4-7 Generation of $\Delta T1$ and $\Delta T2$

The frequency is determoned by operating 1/P after determoning P, which is expressed by the followimg.

$P+\Delta T2=NT0+\Delta T1$
$P=NT0+\Delta T1-\Delta T2 \quad \cdots\cdots 2$

Since $\Delta T1$ and $\Delta T2$ can be determined from the same equation from which ΔTx was determined, they are expressed as:

$$\Delta T1 = \frac{n1 \times 100ns}{500} \quad \cdots\cdots 3$$

$$\Delta T2 = \frac{n2 \times 100ns}{500} \quad \cdots\cdots 4$$

As a result, Equation 2 is:

$$P = \frac{(500N + n1 - n2) \times 100ns}{500} = \frac{500N \times n1 - n2}{5} \times 10^{-9}[s]$$

$$f = \frac{1}{P} = \frac{5}{500N + n1 - n2} \times 10^{9}[Hz] \quad \text{..... 5}$$

If the input frequency dividing ratio is assumed to be 1/M, Equation 5 is expressed as:

$$f = \frac{1}{P} = \frac{5M}{500N + n1 - n2} \times 10^{9}[Hz] \quad \text{..... 6}$$

Thus, the input frequency can be determined at high accuracy by measuring the period P of the input signal at high precision.
The ΔT measuring circuit is inoperative in the positive pulse width measurement mode (T.I.) or totalize (TOT.).

(4) Control block

① Self-diagnostic function

At the time of power on, the processor performs ROM check. If an error is found, it causes the readout display to show the pertinent error message for a few seconds. If no error is found, it proceeds to front panel lamp check.

② Control over LSI80-GC/SS

The LSI80-GC/SS are linked to the microprocessor via a data bus and several control lines. Function set-up information and measurement data are transferred between them via the data bus. The control lines are used for the processor to control the LSI80-GC/SS (the processor monitors these control lines while controlling).

③ Data processing

The processor performs necessary arithmetic or logical operations on the data transferred from the two LSI's and ΔT measuring circuit in the counting block.
When the accessory TR1644 calculation unit is used with the counter, the processor performs the secondary operations specified by the functions set up on the calculation unit to produce the final display data.

④ Key switch control

When the panel condition has been changed (by the operator), the processor immediately reads the change and executes the newly set-up function.

⑤ Data transfer to display controllers A and B

The processor transfers the eight high-order digits of numeric data and a decimal point data to display controller A, while it transfers the LSD data plus decimal point data, unit information, and function display data to display controller B.

⑥ Data transfer to interface accessories

When the GPIB or BCD output option is installed in the counter, the processor transfers measurement data to these options. When no option is installed, it performs no data transfer.

⑦ Remote data read

When the GPIB option is installed in the counter and remote data is transferred from an external controller, the processor reads the data and executes necessary operations on the data.

(5) Display block

The display block used two LSIs for display controllers A and B.
The display controllers store display data transferred from the CPU and display the data by dynamically driving the data display.

(6) Operation block

The operation block contains 12 key switches (with conductive rubber contacts) on the front panel.

(7) Time-base oscillator block

The 10MHz multiplier uses a 10MHz tuned amplifier, and thus can provide 1MHz, 2MHz, and 5MHz signals, as well as the 10MHz time base.

(8) Power supply block

The power supply block uses a DC-DC switching power supply.
Each supply output contains a series regulator.

4.3 Measurement Accuracy

(1) FREQ. A

For frequency measurement, the counter uses the reciprocal system in which the measured period data is subject to inverse operation to yield frequency data. Consequently, the measurement accuracy is given by the following.

$\pm$ trigger error $\pm$ resolution $\pm$ operational error $\pm$ time base accuracy 7

The trigger error in the first term of this formula is negligible because the FREQ. A mode has a lower limit frequency range of 60MHz and hence the internal noise level is sufficiently low (60μVrms). The operational error of the third term of this formula is also negligible because the number of display digits is always controlled not to exceed the resolution in the second term of Equation 7.
As a result, Equation 7 can be simplified as follows:

$\pm$ resolution $\pm$ time base accuracy 8

Resolution depends on the performance of the ΔT measuring circuit described in the preceding paragraph. In the sections pertaining to the specifications and operations, resolution is referred to as fractional part measurement error; however, it is not constant over the range range of frequencies, gate time changes and domain conversion from period into frequency is required.

(2) PERIOD B

The formula representing the measurement accuracy is the same as Equation 7. Since operational error is controlled not to exceed resolution, the Equation for PERIOD B can be simplified as follows:

$\pm$ trigger error $\pm$ resolution $\pm$ time base accuracy 9

The trigger error in the first term is derived from either internal or external noise. Trigger error is also inversely proportional to the number of periods during measurement.
The above discussions can be expressed by the following equation:

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

Where: T=Signal period (s)
Es=Signal amplitude (Vrms)
E_N=Noise amplitude (Vrms)

Resolution in the second term of Equation 9 refer to the precision limit of the ΔT measuring circuit, and its weigh differs depending on the signal period and actual gate time.

$$\text{Resolution} = \frac{\text{Signalperiod(s)}}{\text{Actual gate time (s)}} \times 1\text{ns} \quad \text{..... 11}$$

(3) FREQ. B

For FREQ. B, the ,measurement accuracy in the frequency domain is given by the following equation:

(Signal frequency [Hz])^2 × (±trigger error ±resolution ±time base accuracy) ⑫

The absolute value of measurement accuracy in the sine-wave mode ( ) is identical to that in the square-wave mode ( ).
In the sine-wave mode, the LSDs dipslayed are simply masked.

(4) T.I. B

The basic equation representing measurement accuracy for T.I. B is given by:

±trigger error ±resolution ±time base accuracy ..... ⑬

Since no operation is involved in the T.I. B mode, no operational error exists.
The trigger error in the first term if this equation is due to both internal and external noise. Since T.I. B measurement is an independent event, the averaging effect of the MILTIPLIER switch setting is multiplied by $\sqrt{n}$ and is expressed by the following equation:

$$\text{Trigger error} = \frac{1}{\sqrt{\text{Number of multiplier}}} \left(\frac{2.8 \times 10^{-5}}{SR} + 0.32 \times \frac{E_N}{Es} \right) [s] \quad \cdots\cdots ⑭$$

Where: E_N=Noise voltage (Vrms
SR=Siganl's slew rate (V/S)

Figure 3-7 shows slew rate versus amplitude and frequncy.
Resolution in the second term of Equation 13 is enhanced in proportion to the root-mean-square value of the number of multiplications. Therefore, we obtain.

$$\text{Resolution} = \frac{100ns}{\sqrt{\text{Number of multiplier}}} \quad \cdots\cdots ⑮$$

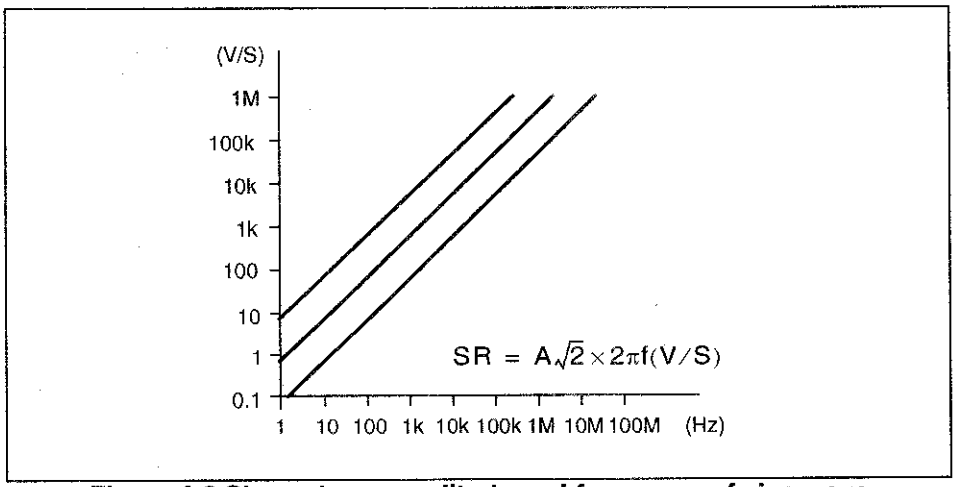


Figure 4-8 Slew rate vs amplitude and frequency of sine wave

5 CALIBRATION

5.1 Introduction

In general, the most significant factor affecting measurement accuracy of an electronic counter is the frequency accuracy of its internal crystal oscillator. This frequency accuracy must always be controlled to a constant value, or its deviation, if any, should be very small. To insure measurement data reliability of an electronic counter, it must be calibrated periodically or its operating environment should be carefully conditioned.

5.2 Calibration Procedure

While calibration methods for an electronic counter may include several different types, the following describes the simplest approach. A frequency standard having an output frequency of 10 MHz and frequency accuracy of at least 1×10^{-9} is required for calibrating the R5361B/62B.

① Apply the output of the frequency standard (SSG) to INPUT B.

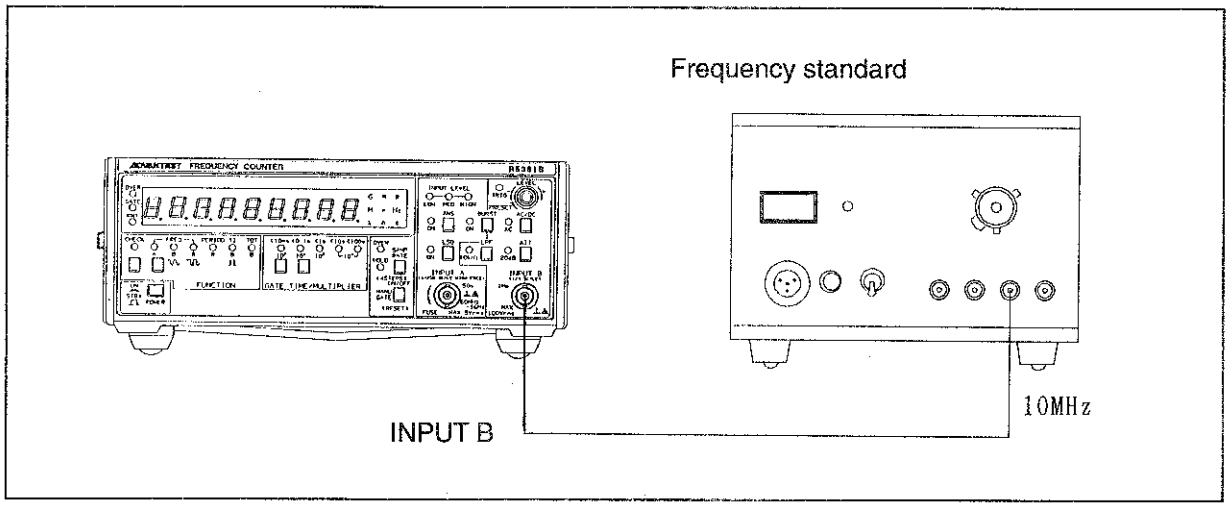


Figure 5-1 Calibration using a frequency standard

② Set the FUNCTION to FREQ. B ⎍, and GATE TIME to <1s.

③ Set the input block switches according to the input signal, and adjust the STD ADJ. at the right side of the counter until the frequency readout is 10.000000 MHz.
This calibration method allows calibration to an accuracy of 1×10^{-7}. If GATE TIME is set to <10s, accuracy can be increased to the order of 1×10^{-8}.

5.3 Precautions on Calibration

The counter should be calibrated annually by using the STD ADJ. on the right side panel of the unit. If proper calibration is not possible with the STD ADJ. control, contact your nearest ADVANTEST representative.

Reference data

Specifications for crystal oscillator (TCO-612B) (for Option 20):

- Output frequency : 5 MHz
- Aging rate : 2×10^{-8}/day
  8×10^{-8}/month
  1×10^{-7}/year
  with reference to the frequency 24 hours after power-on.
- Warmup : Frequency deviation between 30 minutes and 24 hours after power-on is $\pm 5 \times 10^{-8}$.
- Reproducibility : The counter is switched off, then switched on 24 hours later. The frequency deviation at 30 minutes after repowering is $\pm 5 \times 10^{-8}$ with reference to the frequency immediately before power off.

Figure 5-2 shows the annual deviation characteristic of the crystal oscillator.

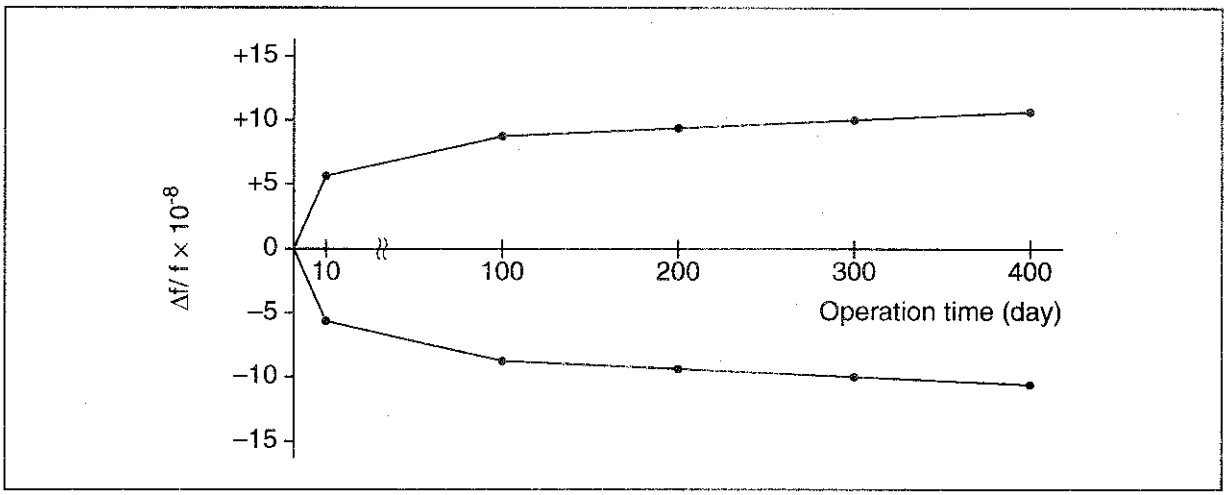


Figure 5-2 Annual deviation characteristic of crystal oscillator

MEMO

6 CHECK AND MAINTENANCE

6.1 Introduction

This section gives some precautions on basic operation check and maintenance for the R5361B/62B, followed by simplified troubleshooting procedure. After the counter is repaired, be sure to carry out an operation check and calibration according to the instructions given in this section and the preceding section.

6.2 Precautions on Maintenance and Repair

When removing the casing from the counter unit for check, maintenance, or repair, set the STBY switch to ⏻ and the rear OVEN switch to OFF, and disconnect the power cable from the power receptacle on the rear of the unit. Even if the STBY switch is set to ⏻, the power supply section of the unit remains energized as long as the OVEN switch is set to ON to supply power to the internal time-base oscillator. If the STBY switch is set to ⏻ and the OVEN switch is set to OFF, the power transformer remains energized. So, when removing the casing from the unit, be sure to disconnect the power cable from the rear receptacle.

6.3 Transportation

The counter uses a crystal oscillator which is sensitive to physical shock or vibration. When carrying or transporting the unit, exercise utmost care to avoid subjecting the unit to physical shock.

6.4 Performance Check

This paragraph describes how to check the functional integrity of the counter. The following gives the functional check items and checking methods:

(1) Lamp check

When the STBY switch is set to |, check that the following LED indicators go on during the LED check mode:

① All nine digits of the data display show 8 with a decimal point.

② All other LED indicators go on, except the RMT, INPUT LEVEL, and TRIG. lamps.

(2) Checking RAM

If the message of "SELF TEST" is displayed after step (1) above, it is normal. (See item 3.1.3.)

(3) Checking internal time-base signal output

① Set the rear INT. OUT./EXT. IN. switch to INT. OUT.

② Connect an oscilloscope to the rear STD connector, and verify that the internal time-base signal of 10 MHz, approx. 1 Vp-p is present at the connector terminated by 50Ω.

(4) Checking external time-base signal application

① Set the rear INT. OUT/EXT. IN. switch to EXT. IN.

② Apply the following external time-base signal to the rear STD connector:
Frequency : 1 MHz, 2 MHz, 5 MHz, or 10 MHz
Waveform : Sinewave or square wave (with duty factor of 1:1)
Amplitude : 1-5 Vp-p

③ Set FUNCTION of the counter to CHECK, and verify that the counter functions normally on the external time-base signal. (See Item 3.1.3.)

(5) Checking FREQ. B operations

① Set up the front panel switches and controls as follows:
FUNCTION ..... FREQ. B
GATE TIME ..... <1s
SAMP. RATE ..... Approx. 320 ms
LEVEL ..... PRESET
AC/DC ..... AC
ATT. ..... OFF (lamp off)
BURST ..... OFF (lamp off)
LPF ..... OFF (lamp off)

② Using the supplied interconnection cable, connect the rear STD connector to the front INPUT B connector.

③ Verify that the TRIG. lamp is on.

④ Verify that the GATE lamp blinks and the readout display shows one of the following data:
9.999999 MHz
10.000000 MHz
10.000001 MHz

6.5 Error Messages for Operational Fault

In some cases, the microprocessor may not be capable of producing operation results depending on the contents of the operation (for example, operation requiring extra counting capacity or division by zero). In such a case, the data display on the counter shows one of the following error messages.

E␣22 : Overrange in DAC.

E␣23 : Display upper limit exceeded (in excess of operational capacity when TR1644 is used.)

E␣24 : Display lower limit exceeded (in excess of operational capacity when TR1644 is used.)

E␣26 : Division by zero

} Chiefly when the TR1644 is used with the counter.

MEMO

7 TR1644 CALCULATION UNIT

7.1 Introduction

The TR1644 Calculation Unit increases the capability of the R5361B/62B.
The TR1644, when used with the R5361B/62B, allows arithmetic operations between measurement data and any set-up data, offset measurement, deviation measurement, and direct readout of physical values such as flow rate or rotation speed. When used with the R13001B BCD Output Unit, the TR1644 may be used as a simple controller for a GO/NO GO test system.

7.2 Specifications

Operation modes:

Operation between measurement data:

Difference ..... Displays [nth measurement data] - [(n-1)th measurement data]

Offset difference ..... Displays [nth measurement data] - [1st measurement data].

Max. difference ..... Displays [nth measurement data] or [the maximum of the data up to (n-1)th measurement], whichever is greater.

Min. difference ..... Displays [nth measurement data] or [the minimum of the data up to (n-1)th measurement], whichever is less.

Operation between measurement data and setup data:

Addition ..... [Measurement data] + [Positive setup data]

Subtraction ..... [Measurement data] + [Negative setup data]

Multiplication ..... [Measurement data] × [Set up data]

Division ..... [Setup data] ÷ [Measurement data]

Fixed decimal point data display ..... Displays fixed decimal point result of [Measurement data] + [Positive/negative setup data].

Comparison ..... ① If [Measurement data] < [Lower limit setup], [Lower limit set-up] - [Measurement data] with sign "L" is displayed.

② If [Measurement data] > [Upper limit setup], [Measurement data] - [Upper limit setup] with sign "H" is displayed.

③ If [Lower limit setup] ≤ [Measurement data] ≤ [Upper limit setup], sign "P" is displayed.

④ R13001B BCD connector output:

Status / Pin No.	①	②	③
38	0	1	1
39	1	0	1

Note: ***The output buffer is TTL compatible.***

% deviation (Percentage) : $\frac{\text{[Measurement data]} - \text{[Setup data]}}{\text{[Setup data]}} \times 100$

Scailing : $\frac{\text{[Measurement data]} \pm \text{[Setup data B]}}{\text{[}\pm\text{Setup data A]}}$

Operation between the setup data : + − × ÷

Number of setup data digits : Up to 9 digits of mantissa
1 digit of exponent

Operational capacity : 1×10^{-12} or more and less than 1×10^{12}

Number of display digits : Numbers given in the following table depend on the selected GATE TIME. For operations between measurement data or between measurement data and setup data performed with T.I. function, the number of display digits complies with that of measurement data.

GATE TIME	Number of display digits
< 10ms	6
< 0.1s	7
< 1s	8
< 10s	9
< 100s	9

Overflow : Occurs only in fixed decimal point display mode. If an overflow occurs, the OVER lamp on the counter goes on. Other modes use underflow processing.

Usable counter functions : All functions

Control panel : 24 keys and 6 LED indicators.

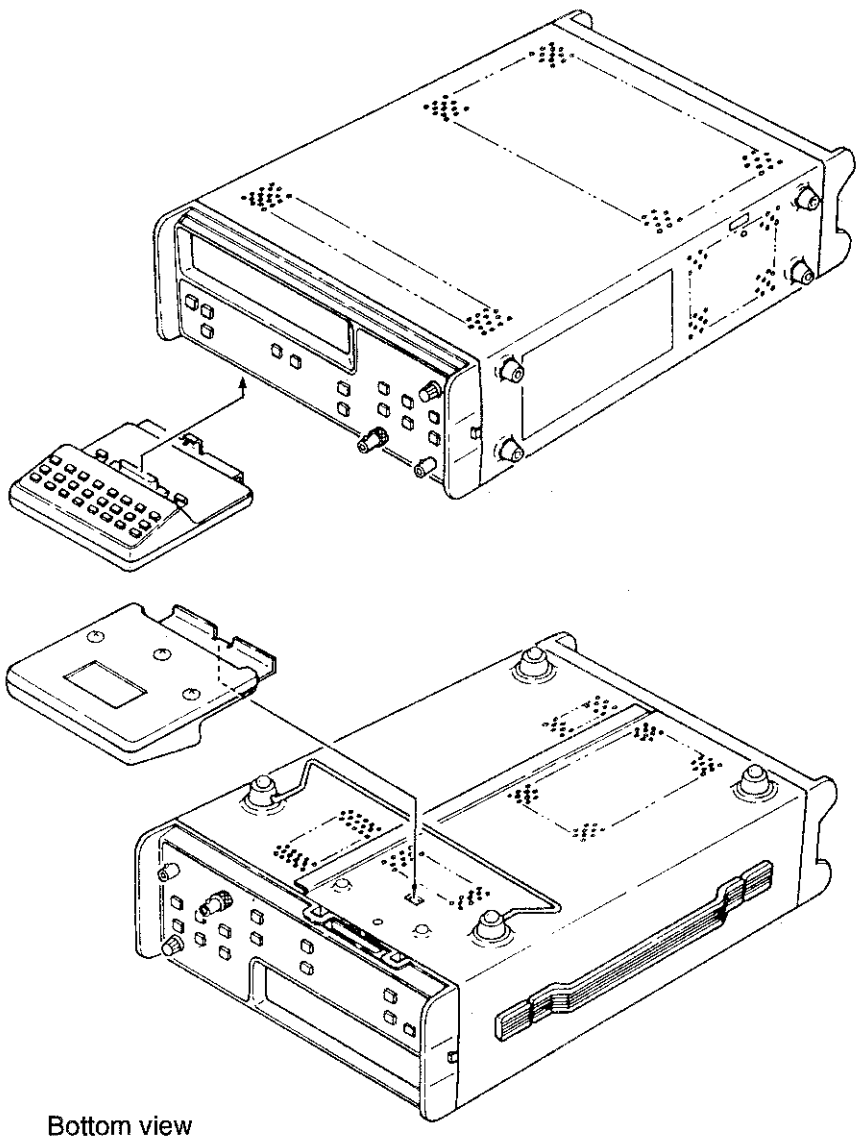
Dimensions : 101(W) × 27(H) × 112(D)

Mass : approx. 150g

7.3 Handling TR1644 Calculation Unit

7.3.1 Installation

When installing or removing the TR1644 Calculation Unit into or from the R5361B/62B, set the STBY switch on the counter to ⏻.

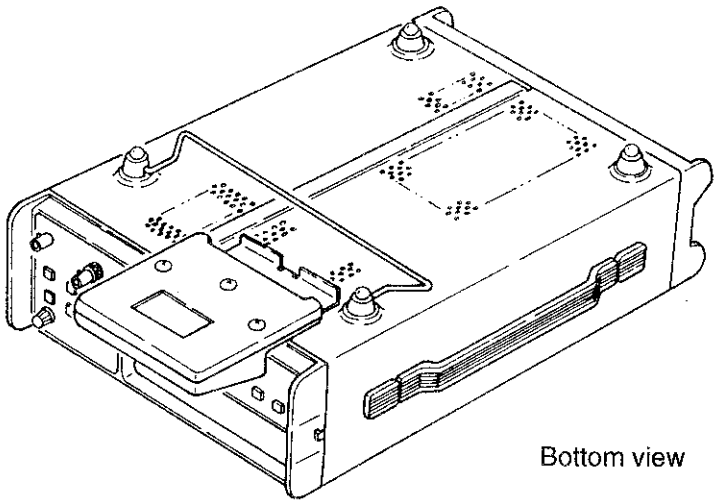


Bottom view

① Fully pull out the center hook of the metal plate.

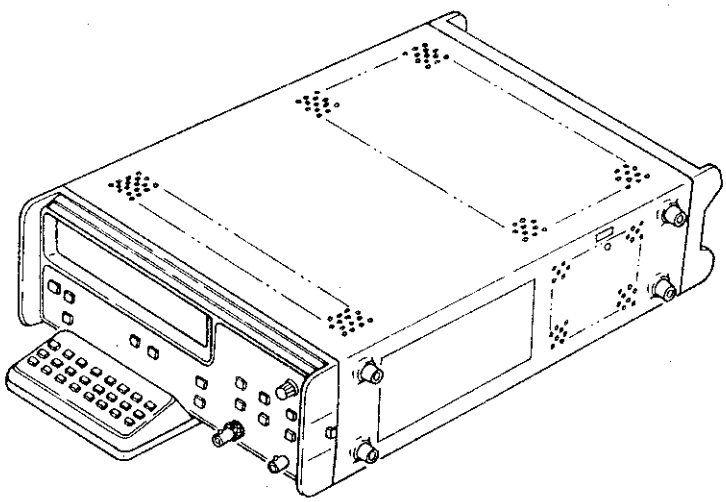
② Fit the hook into the square cavity at the bottom of the counter and the male connector to the female connector, then press down for secure mounting.

③ Push the metal retainer toward the TR1644 to lock it.



Bottom view

TR1644 is installed in the R5361B/62B



7.3.2 Switches and Indicators

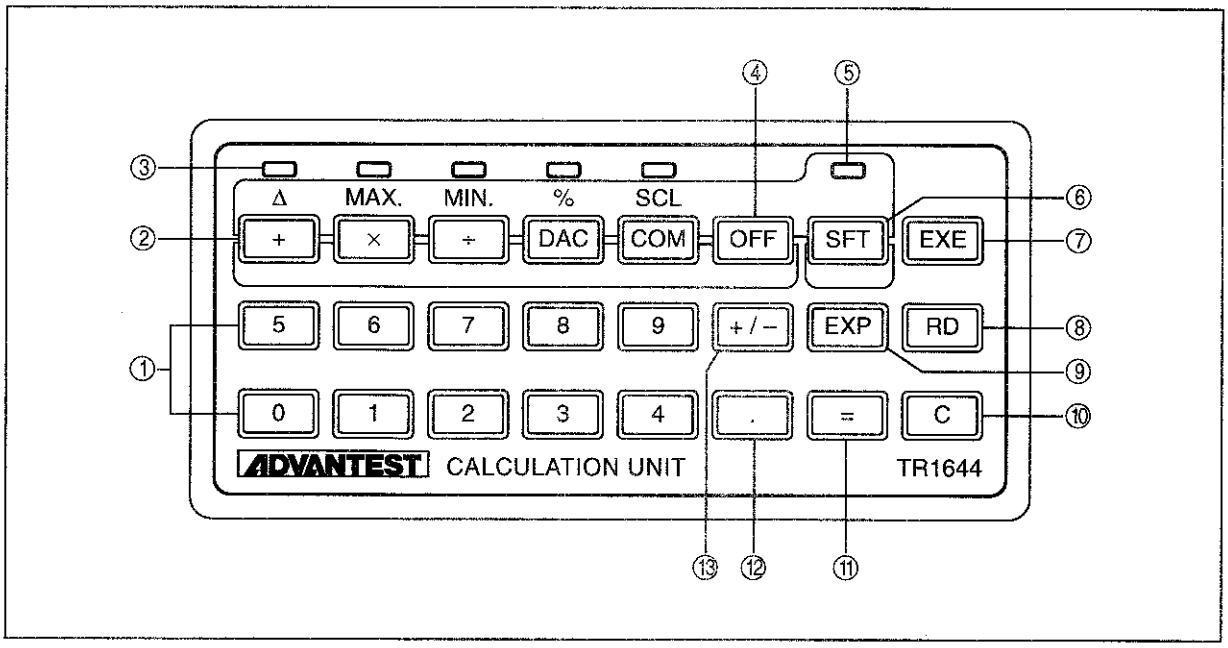


Figure 7-1 Calculation unit panel description

① Numeric data keys [0] to [9]
Used to enter numeric data.

② Operation mode keys
Used to select operation modes. When the indicator just above the [SFT] key is off, the operation modes labeled on each key can be selected; when the same indicator is on, the operation modes labeled just above each key can be selected.

[+] : Used for addition (for subtraction, a negative value is added).
[×] : Used to multiply measurement data by a constant.
[÷] : Used to divide a constant by measurement data.
[DAC] : (Digital-analog conversion mode) used to fix resolution and set up offset.
[COM] : (Comparison mode) used to compare measurement data with setup data.
Δ : Used to determine the difference between new and old measurement data. If [=] is pressed in this mode, the offset difference operation mode is entered.
MAX. : Determined the maximum value.
MIN. : Determines the minimum value.
% : % deviation (percentage)
SCL : (Scaling) composite calculation (measurement data ± L) /H

③ Operation mode indicator lamp
Indicates the selected operation mode.

④ [OFF] key
Used to clear the CAL (Calculation) mode. This key is effective in all modes.

⑤ Shift lamp

Indicates the [SFT] key status.

⑥ [SFT] (Shift) key
Used to control SHIFT modes for the operation mode keys. The lamp just above this key goes on and off alternately each time this key is operated.

⑦ [EXE] (Execute) key
This key serves the following two functions:

a. Selects the CAL mode. If this key is pressed when the CAL mode is not selected, the display shows the following message:

␣␣␣CAL␣␣␣

The counter is now in the CAL mode with all control keys on the calculation unit made effective. Once the CAL mode is selected, it cannot be cleared unless the [OFF] key in ④ is pressed.

b. Starts operation between measurement data and setup data.
For operation between two sets of measurement data, this key need not be operated.
For operation between two sets of setup data, [=] functions as the execution start key.

⑧ [RD] (Read) key
This key is used to read the contents of two numeric data setup registers (H and L registers). Data is read in the following order:

[RD] OOOOOOO␣H ..... Reads and displays the seven least significant digits of the H register.

[RD] OOOOOOO␣H ..... Reads and displays the digits to the right of digit 7 of the H register.

[RD] OOOOOOO␣L ..... Reads and displays the 7 least significant digits of the L register.

[RD] OOOOOOO␣L ..... Reads and displays the digits to the right of digit 7 of the L register.

[RD] OOOOOOO␣H ..... Reads and displays the seven least significant digits of the H register.

Repeated the same

The contents of H and L registers are maintained unless new values are set into them.

⑨ [EXP] (Exponential) key

This key is used to discriminate the mantissa from the exponent when numeric data is set up. It should be operated just before you enter the exponent part of the data. The display will show "E␣O" to the right of the least significant digits.

[1] [2] [.] [3] [4]	␣␣␣12.34␣H
[EXP]	12.34E␣0␣H

The setup capacity for mantissa is nine digits. So, if the mantissa part is set to full nine digits, the data is automatically shifted three digits to the left in the display, and "E␣O" will be shown in the LSD positions, without the need for operating the [EXP] key.

⑩ [C] (Clear) key

This key is used to clear all setup data (all blanked) presently set in the counter, except the contents of the H and L registers.

[1] [2] [.] [3] [4]	␣␣␣12.34␣H
[C]	␣␣␣␣␣␣␣␣.␣H

⑪ [=] key

This key is used to start operation between setup data. If this key is used in the difference (Δ) operation mode, the operation mode is switched to the offset difference operation mode. The data obtained just after [=] is pressed is the offset value. When returning to the difference operation mode, operate the [EXE] or [+] key.

⑫ [.] key

This key is used to insert a decimal point in numeric data.

⑬ [+/−] key

This key is used to place a sign preceding numeric data. It may be effective for either the mantissa or exponent. For the minus sign, the display shows the − symbol while for the plus sign, the display is left blank. Each operation of this key selects the + and − signs alternately.

a. When "E␣n" is displayed in the LSD positions, the sign is effected to the exponent part (n is an integer between 0 and 9).

b. When "E␣n" is not displayed and the setup mantissa is six or fewer digits, the sign is effected to the mantissa.

7.4 Operating Procedure

(1) How to set numeric data

Numeric data setup is completed when the setup data is transferred to the H or L register. (The data shown in the display is for monitoring convenience. Actual operations are made to the numeric data held in the H and L registers). Data transfer to these registers is performed as follows:

a. To transfer typed-in data to the H register, press any of [+], [×], [÷], [DAC] and [COM]. When the SHIFT lamp is on, press either [DAC] or [COM].

b. To transfer typed-in data to the L register:

- When the SHIFT lamp is off in the +, ×, or ÷ operation mode, press [=] or [EXE].
- When the SHIFT lamp is off in the DAC or COM operation mode, press the [EXE] key.
- When the SHIFT lamp is turned on in the % or SCL operation mode, press the [EXE] key.

(2) Operation examples in each operation mode

The most significant digit shows a sign.
Positive value : Space
Negative value: –

① Operation between setup data (the number of resulting digits varies between 6 and 8 digits depending on GATE TIME setting):

a. $12.3 \times 10^3 + 23 \times 10^2 = 14.6 \times 10^3$

[1] [2] [.] [3] [EXP] [3] [+] [2] [3] [EXP] [2]
[=] ----------→ ␣14.600000k (GATE TIME < 10s. Hereafter the same)

b. $12.3 \times 10^3 - 23 \times 10^2 = 10.0 \times 10^3$

[1] [2] [.] [3] [EXP] [3] [+] [+/–] [2] [3] [EXP]
(Select –)
[2] [=] ----------→ ␣10.000000k

c. $12 \times 6 = 72$

[1] [2] [×] [6] [=] ----------→ ␣72.000000

d. $10 \div 0.3 = 33.333....3$

[1] [0] [÷] [0] [.] [3] [=] ----------→ ␣33.333333

② Operation between measurement data and setup data (under CHECK and <10ms setting):

a. Adding 12.3 kHz to the measurement data:

[1] [2] [.] [3] [EXP] [3] [+] [EXE] ---------→ ␣10.0123M

b. Subtracting 12.3 kHz from the measurement data:

[+/−] [1] [2] [.] [3] [EXP] [3] [+] [EXE]
(Select −)

----------→ ␣09.9877M

c. Multiplying the measurement data by 60:

[6] [0] [×] [EXE] ----------→ ␣600.000M

d. Dividing 1.23 by the measurement data

[1] [.] [2] [3] [÷] [EXE] ----------→ ␣123.000n

e. Fixing resolution to Hz and subtracting 5000 Hz from the measurement data (fixation of resolution and offset ..... D/A conversion mode)
Table 7-1 shows readouts in the case when both resolution and offset are fixed.
Table 7-2 shows readouts in the case when only resolution is fixed. (FUNCTION is specified to CHECK.)

[+/−] [5] [0] [0] [0] [EXP] [0] [DAC] [EXE]
(Select −)

----------→ ␣ ␣9995000. (Two LSDs will vary)

Table 7-1 Example of setting resolution and offset

Set value	readout
−1. E6	9.
−01. E6	9.
−001. E6	9.
−1.0 E6	90.
−1.00 E6	900.
− .1 E6	99.
−0.1 E6	99.
−00.1 E6	99.

Table 7-2 Example of setting resolution

Set value	Readout
0. E6	10.
00. E6	10.
000. E6	10.
.0 E6	100.
0.0 E6	100.
00.0 E6	100.
.00 E6	1000.
0.00 E6	1000.

f. Comparison mode

- Checking whether the measurement data falls between 12 and 11 MHz:
  [1] [2] [EXP] [6] [COM] [1] [1] [EXP] [6] [EXE]
  ----→ 01.0000 ␣ LM (measurement data is 1 MHz lower than the lower limit.)
- Checking whether the measurement data falls between 11 and 9 MHz:
  [1] [1] [EXP] [6] [COM] [9] [EXP] [6] [EXE]
  ----------→ ␣ ␣ ␣ ␣ ␣ ␣ ␣ ␣ P (Pass)
- Checking whether the measurement data falls between 9 and 8 MHz:
  [9] [EXP] [6] [COM] [8] [EXP] [6] [EXE]
  ----------→ 01.0000 ␣ HM (1 MHz higher than the upper limit.)

g. Percentage deviation from 9 MHz [Measurement data – 9 MHz] × 100/9 MHz:
[9] [EXP] [6] [DAC] [SFT] [EXE] ----------→ ␣ 011.1111
[SFT] ← may not be pressed when the SHIFT lamp is on.

h. Composite calculation [Measurement data + L register] /H register (H and L registers may be negative values.)

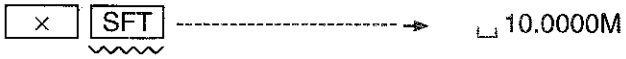
- [Measurement data + 10 MHz] /2
  [2] [COM] [SFT] [1] [0] [EXP] [6] [EXE] ----→ ␣ 10.0000M
  [SFT] ← may not be pressed when the SHIFT lamp is on.
- [Measurement data – 5 MHz] /(–5)
  [+/–] [5] [COM] [SFT] [+/–] [5] [EXP] [6] [EXE] → –1.00000M
  (Select –) [SFT] ↑ (Select –)
  may not be pressed when the SHIFT lamp is on.

③ Operation between measurement data
In any of the following cases, operation of the [SFT] key may be omitted when the SHIFT lamp is on.

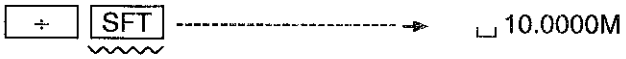
a. Difference mode
[+] [SFT] ----------→ 10.0000M ↓ (the first time) ␣ 00.0000M ↓ –00.0000M

b. Offset difference mode
[+] [SFT] [=] ----------→ 10.0000M ↓ (the first time) ␣ 00.0000M ↓ –00.0000M

c. Maximum difference mode



d. Minimum difference mode



7.5 Operating Precautions

(1) Unnecessary leading zeros may come on depending on the result of operation:

e.g.) Subtracting 12.3 kHz from the measurement data (in CHECK and <10ms setting):

[+/-] [1] [2] [.] [3] [EXP] [3] [+] [EXE]

(Select –)

------→ 09.9877M

↑———— Unnecessary leading zero

(2) The range of the operational capacity results in the following.

$1 \times 10^{-12} \leq$ operation result $< 1 \times 10^{12}$

If this range is exceeded, error message E␣23 or E␣24 is displayed for approx. 3 seconds.

(3) In the DAC mode, an overflow of up to 3 digits is allowed. If an overflow of 4 digits or more occurs, error message E␣22 is displayed.

(4) If FUNCTION is set to TOT. B, TR1644 does not work.

7.6 Principles of Operation

Figure 7-2 shows the configuration of the TR1644 calculation unit. It consists of 24 control keys and 6 LED indicators.

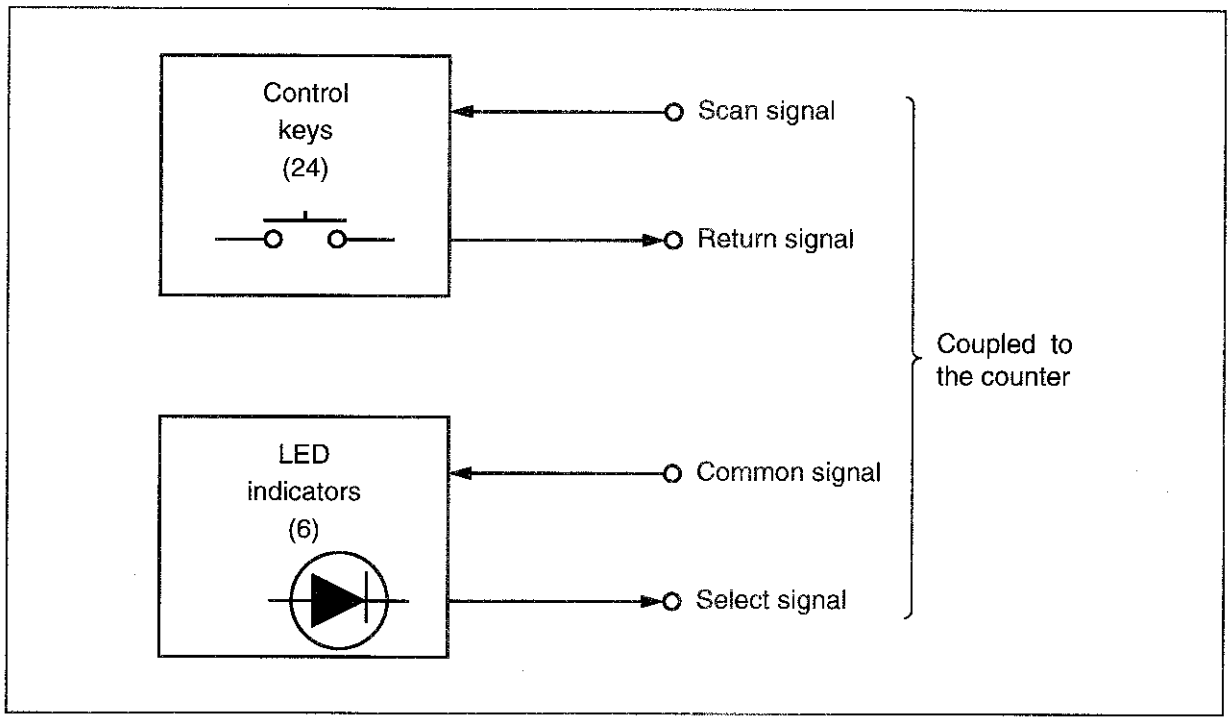


Figure 7-2 Configuration of TR1644

7.7 Performance Check

(1) Lamp check

When the counter is turned on, all six LED indicators on the TR1644 come on to allow you to check their integrity.

(2) Switch and operation check

Switch functions and operations may be checked by executing the operations given in the operation examples in Section 7.4, (2).

MEMO

8 R13001B BCD DATA OUTPUT UNIT

8.1 Introduction

The R13001B is an optional BCD Data Output Unit with D/A output for the R5361B/62B.
The Digital Recorder has 6 print columns, for which the 6 high-order or low-order digits of the data display can be selected. Attaching an analog recorder to the counter permits recording of time-series variation of measurement data. The 4 least significant digits of the data display are converted for the analog output.

8.2 Specifications

(1) D/A output specifications

Output voltage	:	0V to 9.999V
Conversion digits	:	4 least significant digits of data display
Output connector	:	BNC
Conversion rate	:	Not more than 20 ms (from completion of count display to active D/A output)
Conversion accuracy	:	±0.25% of F.S. (23°C ±5°C) ±0.4% of F.S. (0°C to 40°C)
Resolution	:	Approx. 2.5 mV (12 bits)
Output impedance	:	Approx. 100Ω
Column select	:	Available with the TR1644 Calculation Unit.
Offset	:	Available with the TR1644 Calculation Unit.

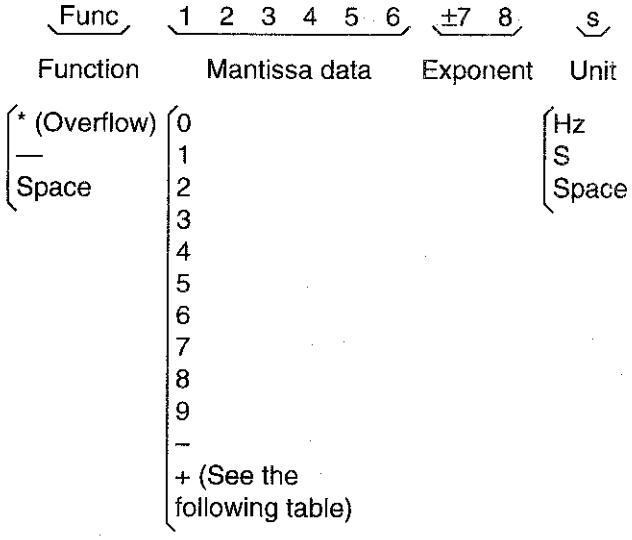
(2) BCD output specifications

Data output	:	Digit parallel (8-4-2-1 code)
Data capacity	:	6 digits of mantissa, 3 digits of exponent (one out of the 3 digits is a sign), and unit
Data shift function	:	With the PRINT DATA switch, output data can be selected from the 6 most or least significant digits of the data display.
LOWER	:	6 LSDs of the data display
UPPER	:	6 MSDs of the data display
Output level	:	TTL level
Output connector	:	Equivalent to 57-40500 manufactured by Daiichi Denshi Kogyo Co., Ltd.
Conversion rate	:	Not more than 20 ms (from completion of data display to output of data output command)

(3) General specifications

Dimensions	:	approx. 140(W) × 30(H) × 150(D) mm
Operating environment	:	Temperature : 0°C to +40°C Relative humidity : 40% to 90%
Power consumption	:	Approx. 3 watts
Weight	:	Approx. 300g

8.3 Print Format



The following table shows the input codes corresponding to the function display in COM mode available when the TR1644 Calculation Unit is installed:

Counter display (digit 9)	Input code				Print contents
	8	4	2	1	
H	0	0	0	1	Prints an asterisk (*) for the function. All others are the same as usual.
L	0	0	1	0	Prints a hyphen (-) for the function. All others are the same as usual.
P	0	0	1	1	Prints a plus sign (+) at digit 6 of the mantissa. All other digits are spaced.

(1) Output signal level

TTL level, active high

(2) BCD output code table

Table 8-1 BCD output code table

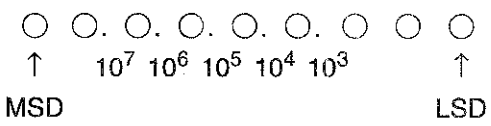
Input code				Data	Function	Unit
8	4	2	1			
0	0	0	0	0		
0	0	0	1	1	*	
0	0	1	0	2	–	
0	0	1	1	3	Space	
0	1	0	0	4		
0	1	0	1	5		
0	1	1	0	6		
0	1	1	1	7		
1	0	0	0	8		
1	0	0	1	9		
1	0	1	0	–		
1	0	1	1	+		S
1	1	0	0	Space		
1	1	0	1	Space		
1	1	1	0	Space		Hz
1	1	1	1	Space		Space

Note: ***No codes other than the above will be output.***

(3) Decimal point code table

Table 8-2 Decimal point code table

Input code			Decimal point position
4	2	1	
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



8.4 BCD Output Connector Pin Configuration

Table 8-3 Connector pin configuration

Pin No.	Signal name	Pin No.	Signal name
1	GND (0V)	26	2^0 } 10^3
2	2^0 } 10^0	27	2^1
3	2^1	28	2^2
4	2^2	29	2^3
5	2^3	30	2^0 } 10^4
6	2^0 } 10^1 Expo-nent	31	2^1
7	2^1	32	2^2
8	2^2	33	2^3
9	2^3	34	2^0 } 10^5 Mantissa
10	2^0 } Sign	35	2^1
11	2^1	36	2^2
12	2^2	37	2^3
13	2^3	38	2^0 } Function
14	2^0 } 10^0	39	2^1
15	2^1	40	2^0 } Unit
16	2^2	41	2^1
17	2^3	42	2^2
18	2^0 } 10^1	43	2^3
19	2^1	44	2^0 } Decimal point
20	2^2	45	2^1
21	2^3	46	2^2
22	2^0 } 10^2	47	Data output command
23	2^1	48	External reset signal
24	2^2	49	N.C.
25	2^3	50	GND (0V)

Exponent part

Mantissa

Notes: ***• No internal connection for pin 49.***
• The external reset is an input signal. All other signals are output signals.

(1) Data Output Command signal

Figure 8-1 shows the timing relationship between the Data Output Command and the BCD data output.

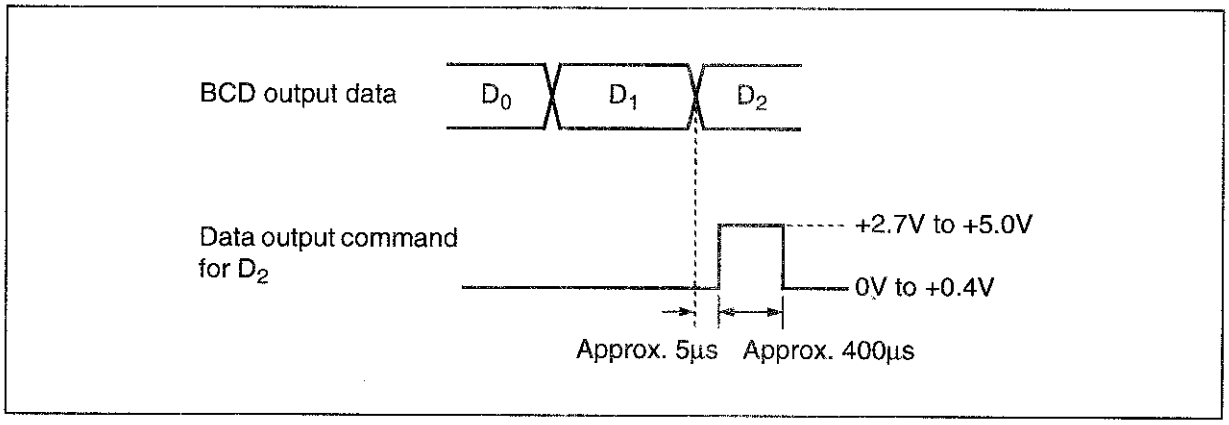


Figure 8-1 Timing relationship between BCD data output and Data output command signal

(2) External reset signal

Figure 8-2 shows the timing relationship between an external reset signal and start of counter measurement.

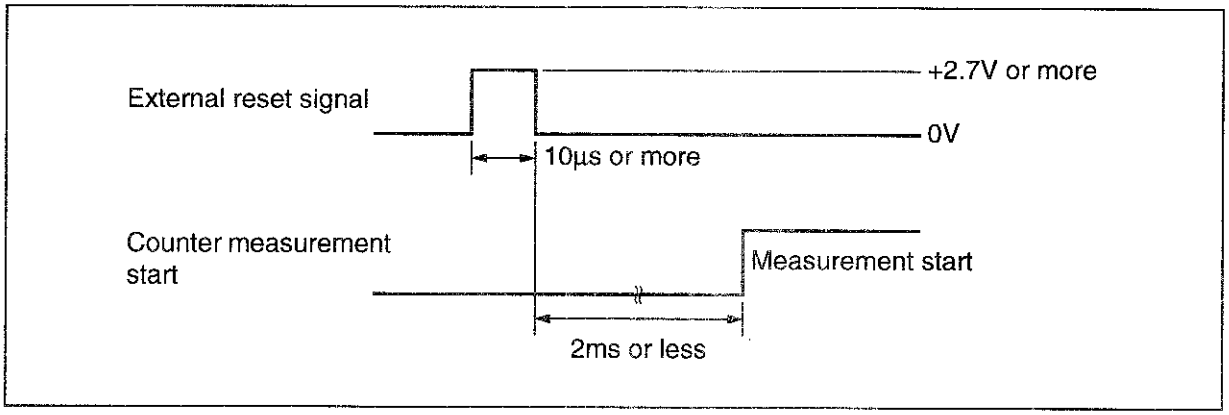


Figure 8-2 Timing relationship between an external reset signal and start of counter measurement

(3) Input and output circuits

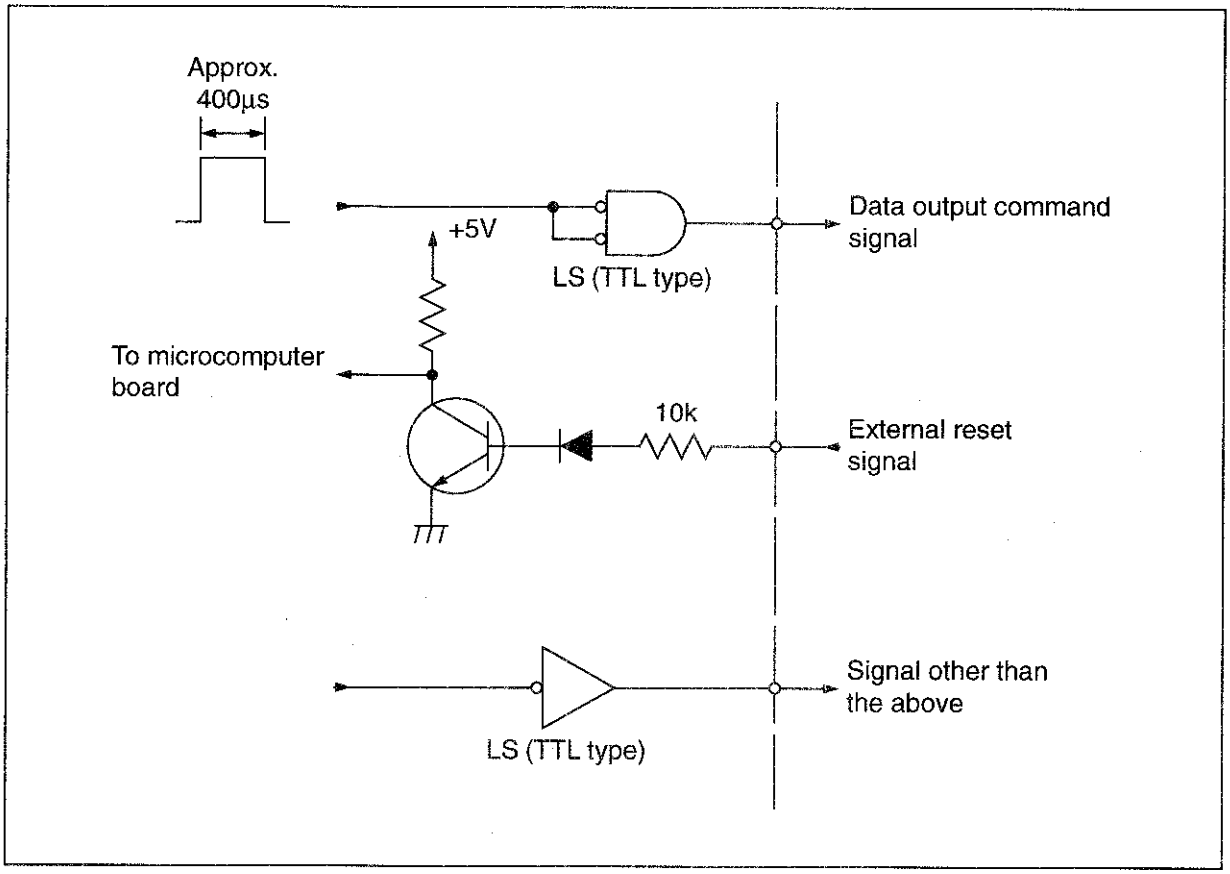


Figure 8-3 Input and output circuits

① Data Output Command signal
Pulse width ..... Approx. 400µs, active high
Logical 1 ..... V_{OH} = +2.7V to +5.0V
Logical 0 ..... V_{OL} = 0V to +0.4V

② External reset signal
Pulse width ..... 10µs or more, active high
Logical 1 ..... $V_{IH} \geq +2.7V$
Logical 0 ..... $V_{IL} \leq +0.8V$

③ Signals other than the above (output)
Logical 1 ..... V_{OH} = +2.7V to +5.0V
Logical 0 ..... V_{OL} = 0V to +0.4V

8.5 Description of Panel and Top-Cover Functions

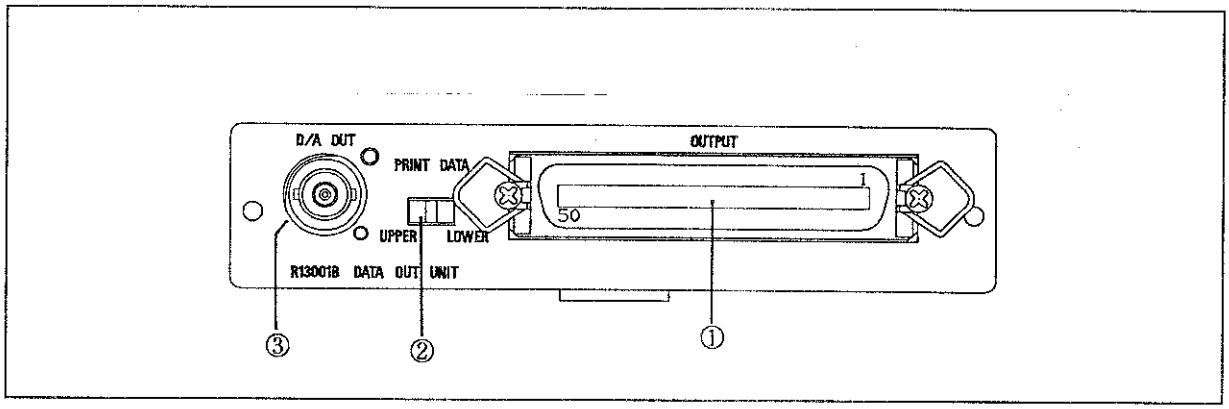


Figure 8-4 Panel description

① OUTPUT connector

This connector is used to output the BCD (8-4-2-1) code for measurement data and to accept a data receipt completion signal. It uses a 50 pin connector (equivalent to ??? 57-40500). The signal level is TTL, active high.

② PRINT DATA UPPER/LOWER selector switch

This switch is used to select the output data (at the OUTPUT connector) from the 6 most or least significant digits of the counter's data display.

LOWER : Selects the 6 LSDs of the display data.

UPPER : Selects the 6 MSDs of the display data.

③ D/A OUT. connector

A BNC connector providing an analog output.

8.6 Handling Precautions

8.6.1 Introduction

The following paragraphs describe preparation, handling precautions, and installation of the R13001B BCD Data Output Unit.

8.6.2 Precautions for Check, Storage, and Repacking on Shipping

(1) Check

Upon receipt of the unit, inspect it for any damage sustained in transit, paying special attention to the control knobs and terminals. Should any damage be found or if the unit does not operate properly, contact your nearest ADVANTEST representative.

(2) Storage

If the unit is not to be used for a long period of time, place it in a vinyl bag or cardboard box and keep it in a dry place out of direct sunlight.

(3) Repacking on shipping

Should it become necessary to repack the unit for shipment, use the original packing materials. If you have discarded the original materials, use the following alternative procedure:

① Wrap the unit in a vinyl bag.

② Place the unit in a cardboard box with a wall thickness of more than 5 mm, then put fillers all around the unit.

③ Close the box and wrap it with shipping cords.

8.6.3 General Precautions

(1) Power supply

When installing the R13001B in the R5361B/62B, make sure that the STBY switch on the counter is in the ⏻ position.

(2) Operating environment

Do not operate the unit in place where it will be exposed to excessive dust, direct sunshine, or corrosive gases. The operating temperature range should be between 0°C and +40°C, with relative humidity between 40% and 85%.

(3) Physical shock

Avoid exposing the unit to excessive physical shock or vibration.

8.6.4 Installation

DANGER

1. ***Before installing the interface unit into the instrument, remove the power cord and the input cable to avoid an electric shock or not to break the instrument.***
2. ***To protect electric circuits against static electricity, use a personal ground strap. The interface unit is made of parts that tend to break by static electricity as easily as CMOS.***

① Set the STBY switch on the counter to ⏻, then disconnect the power cable from the rear socket of the counter.

② Remove the blank panel from the rear of the counter. (See Figure 8-5.)

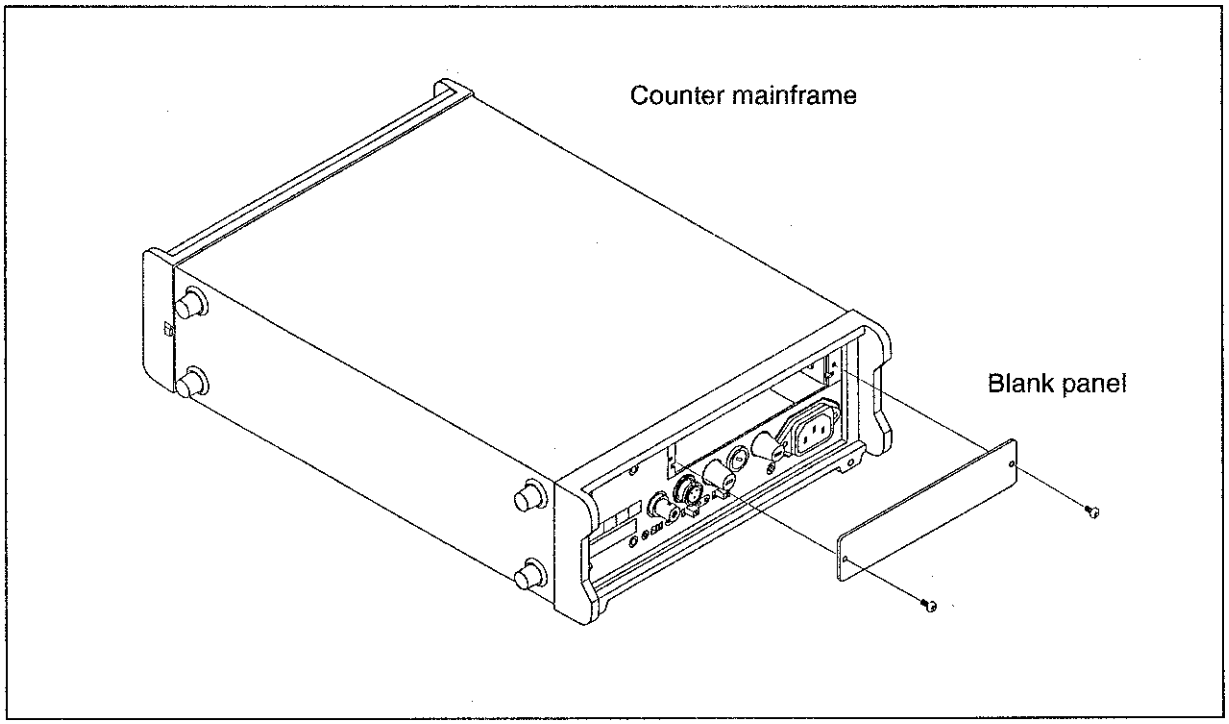


Figure 8-5 Removing the blank panel

③ Install the unit in the counter as shown in Figure 8-6.

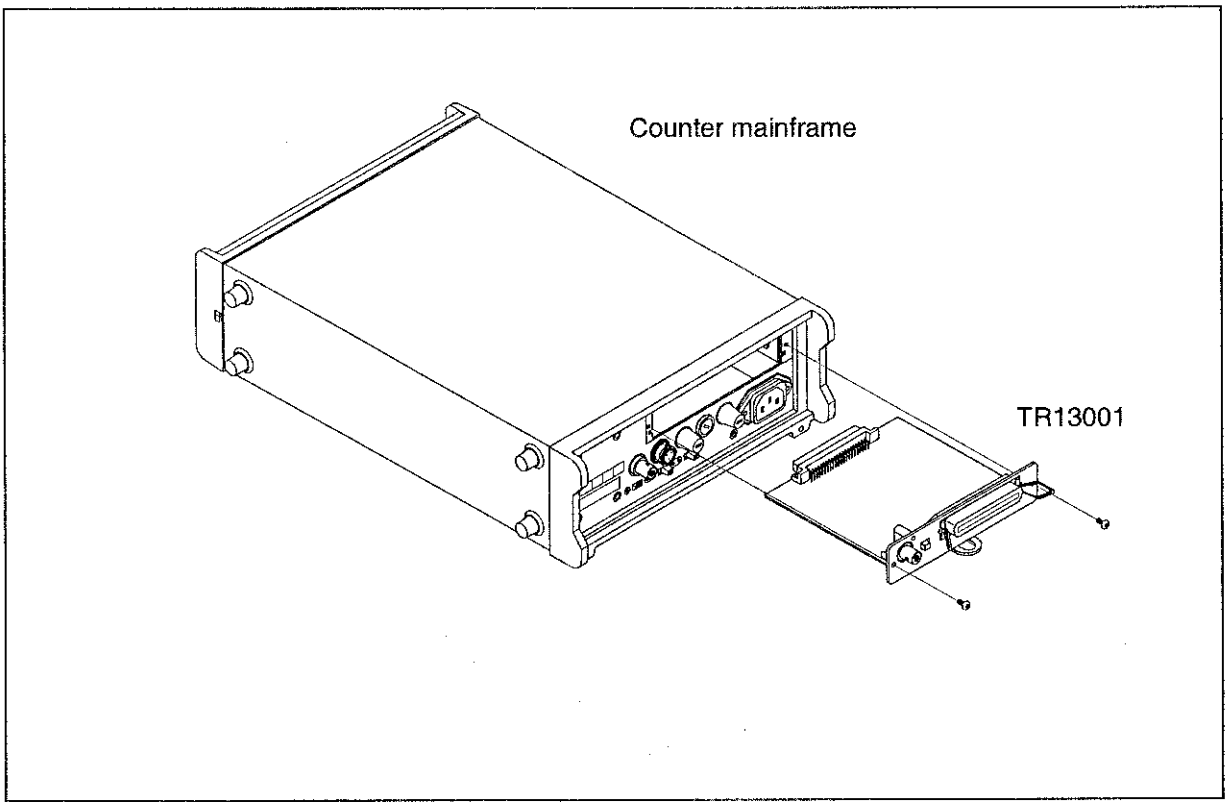


Figure 8-6 Installing the BCD unit in the counter

④ Plug the power cable into the rear socket of the counter, then set the STBY switch to | .

8.6.5 D/A Output

① Connect a voltmeter (with more than +10V fullscale and resolution of 1mV) to the D/A OUT. connector on the R13001B unit.

② Verify that the voltmeter reading is within the conversion accuracy of the 4 least significant digits of the counter's data display. If the voltmeter reading is outside the conversion accuracy, contact your nearest ADVANTEST representative.

MEMO

9 R13002B GPIB ADAPTER

9.1 Introduction

The R13002B GPIB Adapter, when installed on the R5361B/62B, provides an interface between the counter and the General Purpose Interface Bus (GPIB), the instrumentation bus specified in IEEE Standard 488-1978. The R13002B allows remote operation of all the front panel functions of the R5361B/62B and TR1644 Calculation Unit, with the exception of the STBY switch and trigger level control for INPUT B.
When an analog recorder is attached to the D/A OUT. of the R13002B GPIB Adapter, time-series variation of measurement data can be recorded. The D/A converter within the R13002B converts the 4 least significant digits of the counter's data display.

9.2 GPIB Outline

The GPIB is an interface system that uses simple passive cabling between the components of an instrumentation system, including a controller.
The GPIB is much easier to use than conventional interface systems and includes a greater expansion capacity. Since it has electrical, mechanical and functional compatibility with other suppliers' instruments, a wide variety of systems can be built, from relatively simple systems to high performance automatic instrumentation systems, just by using passive cabling.
In a GPIB system, the "addresses" of individual components connected to the bus should be first set. Each of these devices may be a controller, talker, or listener, or two of the three functions at one time. During system operation, several listeners can be active simultaneously but only one talker can be active at one time. The controller designates the talker and listener addresses to cause the talker to transfer data from the talker to the listener. The controller can designate itself as a talker to transfer measurement conditions or other information to a listener.
The GPIB transfers data between the components of an instrumentation system on eight bit-parallel, byte-serial, bidirectional data lines. Data is transferred asynchronously. Because of the asynchronous nature of the bus, high-speed and low-speed devices can be mixed on the bus.
Data (messages) transferred over the bus include measurement data, measurement conditions (program), and commands. All the information uses ASCII code.
In addition to the eight data lines, GPIB also includes three handshake lines to control asynchronous data transfer between components, and five control lines that control data flow on the bus.

- The handshake lines use the following signals:

  DAV (Data Valid) : Indicates data validity.
  NRFD (Not Ready For Data) : Indicates data receive ready.
  NDAC (Not Data Accepted) : Indicates completion of data reception.

- The control lines include the following signals:

  ATN (Attention) : Used to determine whether the information on the data lines is an address/command or other information.
  IFC (Interface Clear) : Clears the interface.
  EOI (End or Identify) : Used to identify the end of data transfer.
  SRQ (Service Request) : Used by any device to request service to the controller.
  REN (Remote Enable) : Used to remotely control a remote programmable device.

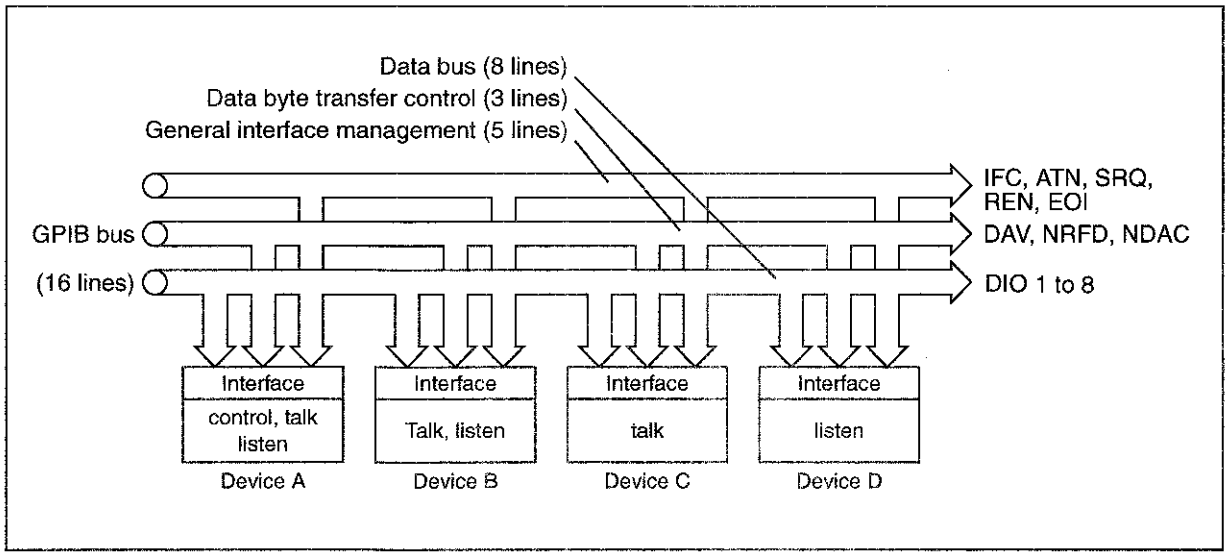
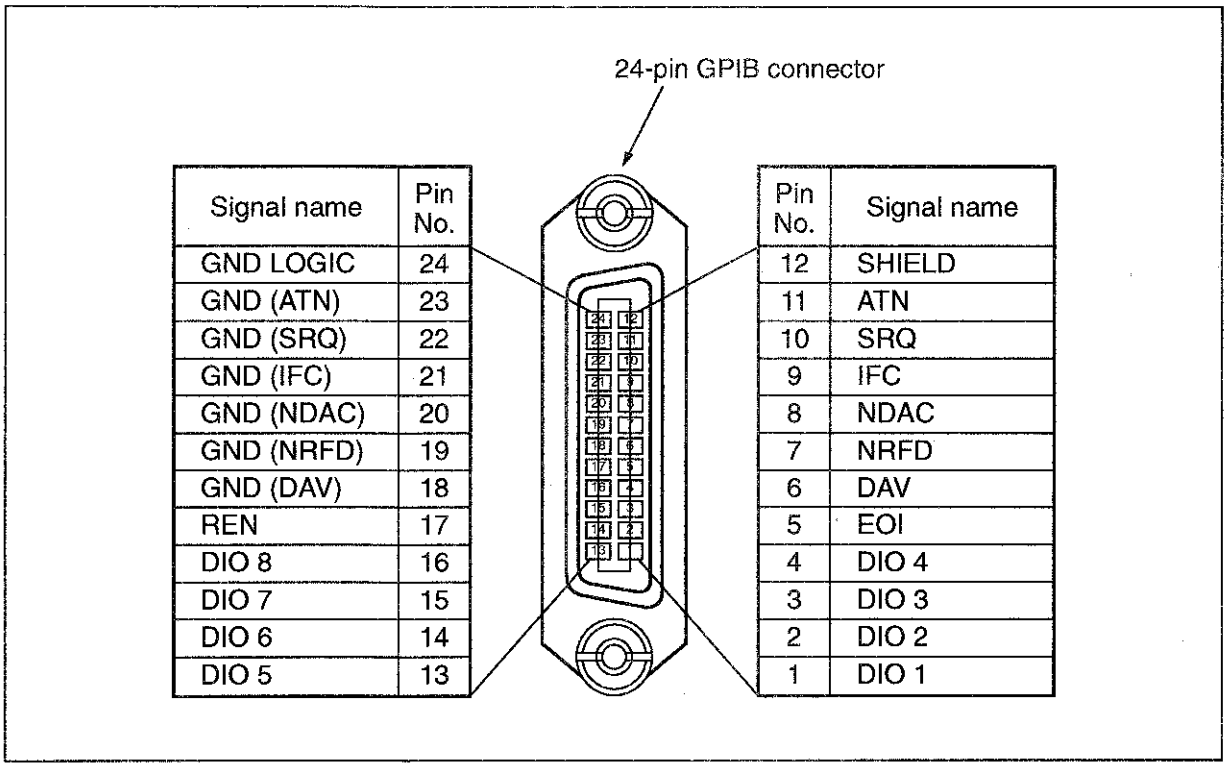


Figure 9-1 GPIB configuration

9.3 Specifications

9.3.1 GPIB Specifications

Standard	:	IEEE Standard 488-1978
Code	:	ASCII
Logical level	:	Logical 0 : High +2.4V or more Logical 1 : Low +0.4V or less
Driver	:	Open collector Output voltage for Low : +0.4V or less, 48mA Output voltage for High : +2.4V or more, –5.2mA
Receiver	:	Low at +0.6V or less. High at +2.0V or more.
Bus cable length	:	The total bus cable length should be the number of on-bus devices × 2 meters or less, and should not exceed 20 meters.
Address set	:	Up to 31 talker/listener addresses can be selected with the ADDRESS switch at the rear of the unit. The TALK ONLY mode can be specified.
Connector	:	24 pin GPIB connector 57-20240-D35 (equivalent to Daiichi Denshi Kogyo Co., Ltd.)



Signal name	Pin No.
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13

Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 9-2 GPIB connector pin configuration

9.3.2 Interface functions

Table 9-1 Interface functions

Code	Function and description
SH1	Source handshake
AH1	Acceptor handshake
T5	Basic talker, Serial poll, Talk only mode, Unaddressed to talk if addressed to listen
L4	Basic listener, Unaddressed to listen if addressed to talk
SR1	Service request
RL1	Remote function
PP0	No parallel poll function
DC1	Device clear (SDC and DCL commands are available.)
DT1	Device trigger (GET command is available.)
C0	No controller function
E1	Open collector driver.

9.3.3 D/A OUT. Specifications

Output voltage : 0V to +9.990V

Conversion digits : 4 least significant digits of counter's data display

Output connector : BNC

Conversion rate : Not more than 20 ms (from completion of data display to output of data output command)

Conversion accuracy : ±0.25% of F.S. (23°C ±5°C)
±0.4% of F.S. (0°C to 40°C)

Resolution : Approx. 2.5mV (12 bits)

Output impedance : Approx. 100Ω

Column select : Available with the TR1644 calculation unit

Offset : Available with the TR1644 calculation unit

9.3.4 General Specifications

Outer dimensions : approx. 140 (W) × 30 (H) × 150 (D)

Operating environment : Temperature : 0°C to +40°C
Relative humidity: 40% to 90%

Power consumption : Approx. 3 watts

Mass : Approx. 300g

9.4 Data Format

9.4.1 Talker Format (Data Output Format)

Send data has the following general format:
ASCII format:

$$\underbrace{HH}_{(1)}\ \underbrace{S}_{(2)}\ \underbrace{D_0.D_1D_2D_3D_4D_5D_6D_7D_8}_{(3)}\ \underbrace{ESD_9D_{10}}_{(4)}\ \underbrace{CR\ \begin{matrix}LF\\EOI\end{matrix}}_{(5)}$$

(1) Header

H H
- Overflow
- Unit

Note: ***If the HEADER section of the ADDRESS switch is set to OFF, the header is always two space code "␣ ␣".***

"O" : Overflow present

"␣" : No overflow present

"F" : Output data has the unit of "Hz"
Output when CHECK, FREQ. A, FREQ. B (⎍), FREQ. B (⎍).

"S" : Output data has the unit of "sec."
Output when PERIOD B, T.I. B

"␣" : Output data has no engineering unit.
Output when TOT. B.

(2) Data sign

"␣" (space) when positive (+).
"–" when negative (–).
When COM is selected in Calculation mode, the high-order data is indicated by "+", and the low-order data is indicated by "–."

(3) Data

Data (9 digits) + decimal point (1 digit)
The decimal point is fixed at the 2nd digit next to the MSD.

(4) Exponent sign

E + 09 to E – 15

(5) Data delimiter

CR/LF • EOI
A data delimiter consists of a CR, which is output first, followed by simultaneous output of LF and EOI. EOI signifies data validity.

9.4.2 Listener Format (Program Code)

(1) Measurement start command

Program code "E" causes measurement to be started. A GET command can also start measurement.

(2) SRQ output mode

The SRQ (service request) send mode can be specified with program code S0 and S1.

S0 mode : Sends an SRQ. If the device is addressed to talk when measurement is completed, it directly sends data, without sending an SRQ. If it is not addressed to talk upon completion of measurement, it sends an SRQ to request to listen.

S1 mode : Sends no SRQ.

The following table lists device status changes caused by commands:

Table 9-2 Device status changes caused by commands

Command	Talker (with lamp)	Listener (with lamp)	SRQ (with lamp)	Status	Send data	Remote setup value
POWER ON	Clear	Clear	Clear	Clear	Clear	Initialization
IFC	Clear	Clear				
DCL, SDC, or C			Clear	Clear	Clear	Initialization
GET or E				Clear "Send Data Present" bit.	Clear	
Addressing to talk	Set	Clear				
Unaddressing to talk	Clear					
Addressing to listen	Clear	Set				
Unaddressing to listen		Clear				
Serial polling			Clear			

Note: ***A slash (/) denotes no status change.***
DCL : Device Clear
SDC : Selected Device Clear
GET : Group Execute Trigger

(3) Function and range setting

① Function select codes

Code	Function
F0	CHECK
F1	FREQ. A
F2	FREQ. B (∿)
F3	FREQ. B (⊓)
F4	PERIOD
F5	T.I. B
F6	TOT. OFF
F7	TOT. ON

② GATE TIME (MULTIPLIER) setting

Code	GATE TIME (MULTIPLIER)	
G0	< 10ms	(10^0)
G1	< 100ms	(10^1)
G2	< 1s	(10^2)
G3	< 10s	(10^3)
G4	< 100s	(10^3)

③ Common input condition setting for INPUT A/B

Code	Input condition	
D0	BURST	OFF
D1	BURST	ON

④ INPUT A condition setting

Code	Input condition		
A0	ANS	OFF	(RANGE LOW*)
A1	ANS	ON	(RANGE HIGH*)
A2	LSD	OFF	
A3	LSD	ON	

*: for R5362B

⑤ INPUT B condition setting

Code	Input condition
B0	LPF OFF (LPF or ANS OFF*)
B1	LPF ON (LPF or ANS ON*)
B2	DC coupling
B3	AC coupling
B4	ATT. OFF
B5	ATT. ON

*: for R5362B

⑥ Sample rate setting

Code	Sample rate
S2	SAMP. RATE 80ms FAST
S3	SAMP. RATE 320ms MED.
S4	SAMP. RATE 2.5s SLOW
S5	SAMP. RATE HOLD

⑦ Calculation mode setting

Code	Calculation mode
I0	Upper limit of [COM]
I1	Lower limit of [COM]
I2	[DAC]
I3	[÷]
I4	[×]
I5	[+]
J0	High-order data of [SCL]
J1	Low-order data of [SCL]
J2	[%]
J3	[MIN]
J4	[MAX]
J5	[Δ]
J6	[Δ] & [=] OFFSET

- For the details of operation, see Chapter 7. TR1644 Calculation unit.

⑧ SRQ mode setting code

Code	Function
S0	SRQ output
S1	No SRQ output

- See item 9.4.1, (2).

⑨ Delimiter setting code

Code	Function
DL0	CR LF & EOI
DL1	LF
DL2	EOI

⑩ Other codes

Code	Function
E	Trigger (same as GET)
C	Clear (same as DCL, SDC)

These codes initialize the device to be used before starting measurement.

GET ..... Measurement start

SDC, DCL ..... Device initialization

See item 9.4.2 (1), 9.4.3 and Table 9-2.

⑪ Calculation data setting (except for J3, J4, J5, and J6)

$\underbrace{C_1C_2}_{a.}\ \underbrace{S}_{b.}\ \underbrace{D_0.D_1D_2D_3D_4D_5D_6D_7D_8}_{c.}\ \underbrace{S}_{d.}\ \underbrace{D_9}_{e.}$

a. Calculation code section

C_1 C_2

- C_2 — Numeric value
- C_1 — Alphabet

Set the desired code for "numeric value."

b. Data sign
"+" for positive
"–" for negative.

c. Data
Data (9 digits max.) + decimal point (1 digit)
Be sure to place a decimal point just after D_0.

d. Exponent sign
"+" for positive.
"–" for negative.

e. Exponent part data
0 to 9

9.4.3 Initial Values

When the R13002B GPIB Adapter is powered on or it receives a universal command DCL, addressing command SDC, or program code C from the controller, the system is set up for the following initial condition:

FUNCTION : F0 (CHECK)
GATE TIME : G0 (10ms)
Service request : S1 (send no SRQ.)
Sample rate : S2 (FAST)

9.4.4 Service Request

Cause of service request:

Measurement has been completed and measurement data to be sent has been produced.

Status byte:

When a service request is issued, the R13002B sends the following status byte to the controller in response to serial polling from the controller:

(MSB) D8	D7	D6	D5	D4	D3	D2	D1
0	1	0	0	0	0	0	1

D1 = 1
Measurement end bit

D2 = 0
SYNTAX error bit for
SYNTAX error : 1

Note: ***In S1 mode (SRQ OFF), D7 on the adapter is not set to 1.***

9.5 Handling Precautions

9.5.1 Check

Upon receipt of the unit, inspect it for any damage sustained in transit, paying special attention to the control knobs and terminals. Should any damage be found or if the unit does not operate properly, contact your nearest ADVANTEST representative.

9.5.2 Storage

If the unit is not to be used for a long period of time, place it in a vinyl bag or cardboard box, and keep it in a dry place out of direct sunlight.

9.5.3 Repacking

Should it become necessary to repack the unit for shipment, pack it by using the original packing material. Of you have discarded the original packing materials, use the following alternative method:

① Wrap the unit in a vinyl bag.

② Place to unit in a cardboard box with a wall thickness of more than 5 mm, then put fillers all around the unit.

③ Close the box and wrap it with shipping cords.

9.5.4 General Precautions

(1) Power supply

When installing the R13002B Adapter in the R5361B/62B, make sure that the STBY switch on the counter is in the ⏻ position.

(2) Operating environment

Do not operate the unit in a place where it will be subject to excessive dust, direct sunshine, or corrosive gases.

(3) Physical shock

Avoid exposing the unit to excessive physical shock or vibration.

9.5.5 Installation

DANGER

1. ***Before installing the interface unit into the instrument, remove the power cord and the input cable to avoid an electric shock or not to break the instrument.***
2. ***To protect electric circuits against static electricity, use a personal ground strap. The interface unit is made of parts that tend to break by static electricity as easily as CMOS.***

① Set the counter STBY switch to (⏻), then disconnect the power cable from the rear socket of the counter.

② Remove the blank panel from the rear of the counter. (See Figure 9-3.)

③ Install the unit in the counter as shown in Figure 9-4.

④ Plug the power cable into the rear socket, then set the STBY switch to | .

Note: ***If the counter is powered fro a DC power source, the R13002B GPIB Adapter will not operate.***

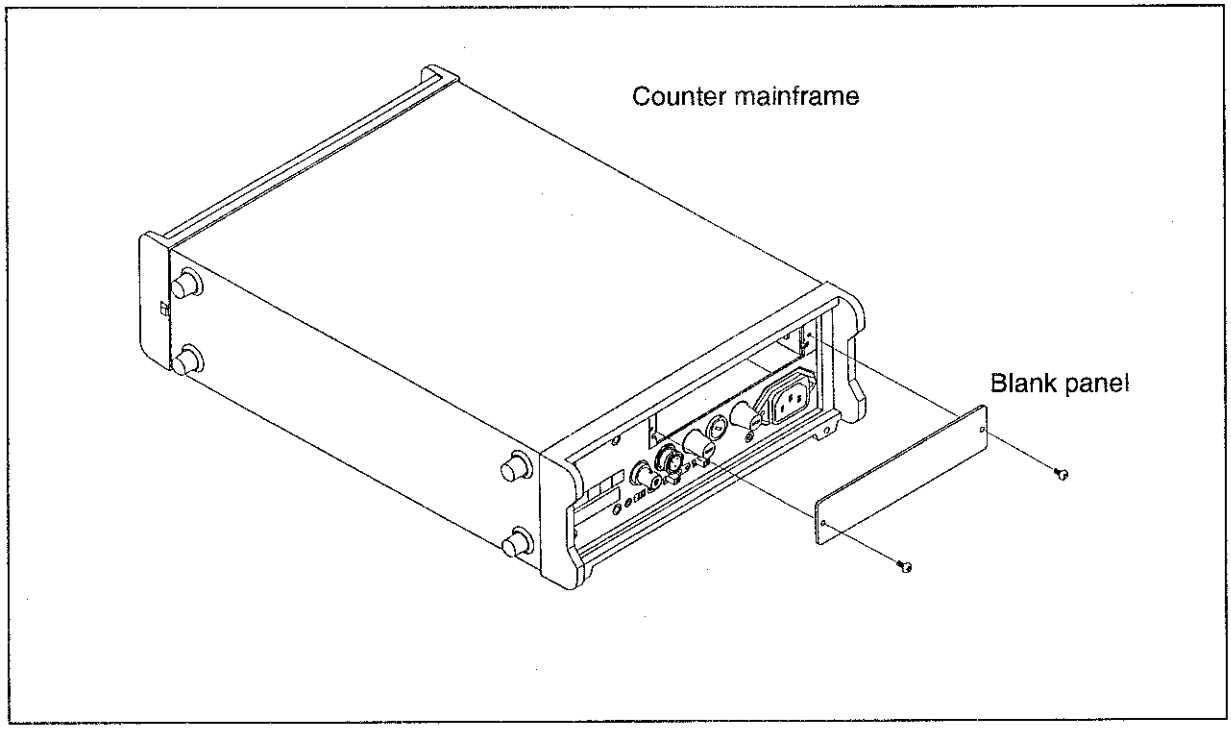


Figure 9-3 Removing the blank panel

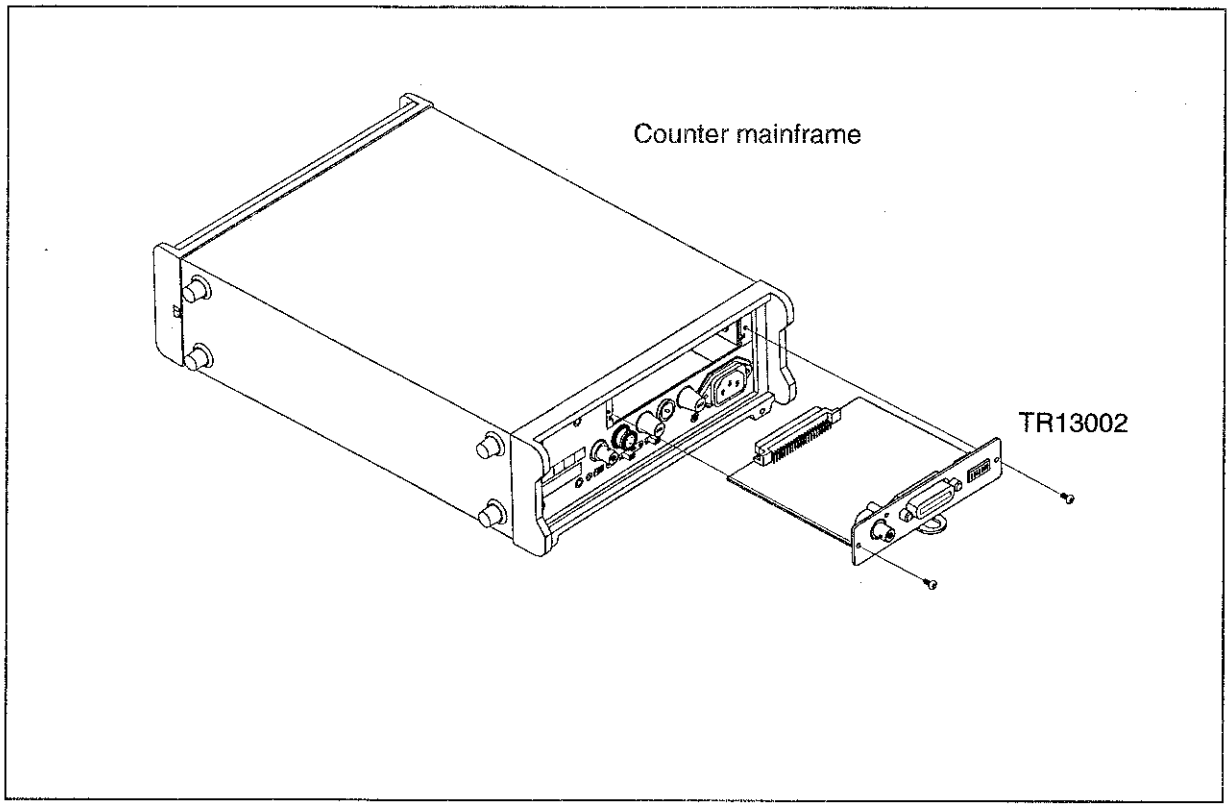


Figure 9-4 Installing the R13002B Adapter

9.5.6 System Connection

A GPIB system consists of more than one system component. For connections between the components, note the following:

(1) Before starting system connection, carefully read the instruction manuals for the R5361B/62B, controller, and other peripheral devices to familiarize yourself with the status and operations of each device.

(2) Use minimum necessary lengths of interconnecting bus cables. The total bus cable length should be (the number of on-bus devices) × 2 meters or less, and should not exceed 20 meters.
The following standard bus cables are available from ADVANTEST:

Table 9-3 Standard bus cable (optional)

Length	Name
0.5m	408JE-1P5
1m	408JE-101
2m	408JE-102
5m	408JE-104

(3) Bus cable connectors are the piggy-back type: that is, each connector has both male and female plugs to allow stacked use. But do not stack more than two connectors for each bus connection. Secure each cable connector with its clamping screws.

(4) Before powering on each system device, check the power requirements, grounding conditions, and setup conditions where needed, for each device.
For proper system operation, all devices connected to the bus should be turned on. If any of the devices remain turned off, proper system operation will not be guaranteed.

(5) When plugging or unplugging a bus cable connector, be sure to turn off the power to the entire system, and disconnect the power cable for the pertinent device from its receptacle.

9.5.7 Description of Panel and Top-Cover Features

(1) Panel description

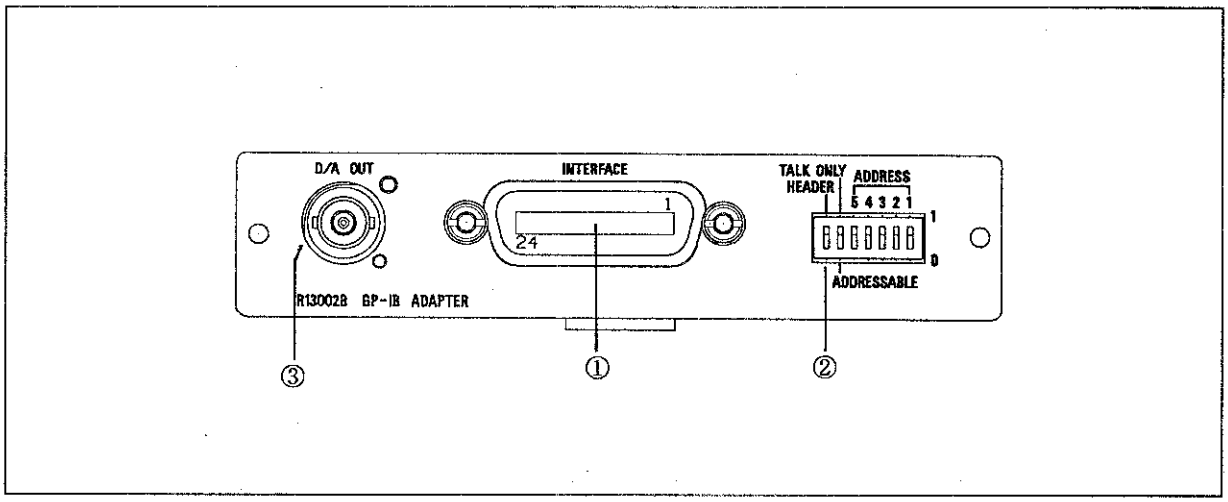


Figure 9-5 Panel description

① INTERFACE connector

A 24-pin connector for bus cable connection. This connector is a piggy-back type allowing stacked use of the standard bus cables. However, do not stack more than two connector plugs.

② ADDRESS switch

This DIP switch is used to set the address (talker or listener address) for the R13002B Adapter on the bus. Sections 1 through 5 of this switch may be used to set the address code. If section 6 is set to ADDRESSABLE, the address of the device can be set by the controller. If it is set to TALK ONLY, the Adapter is addressed to talk, with no regard to the address setting on sections 1 to 5 of the DIP switch. If section 7 is set to 1, a header is sent with send data. If it is set to 0, space codes are placed in the header.

③ D/A OUT. connector

A BNC connector at which the D/A output is available.

9.5.8 Address Setting

The talk or listen address for the GPIB Adapter can be set with the ADDRESS switch on the Adapter's panel.
The ADDRESS switch consists of a 7-section DIP switch, of which sections 1 through 5 are used to set u to 31 addresses.
In the example shown in Figure 9-6, the switch is set to 00100, which means "4" in decimal notation. The ASCII representation for this code is "D" for talker, and "S" for listener, as shown in Table 9-4.
If section 6 of the DIP switch is set to ADDRESSABLE, the Adapter can respond to addressing from the controller only if the address from the controller agrees with the address set on the Adapter (ADDRESS 1-5).
If section 6 is set to TALK ONLY, the Adapter is addressed to talk, with no regard to the address setting on the ADDRESS switch.
If section 7 is set to 1, a three-character header is sent together with send data. If it is set to 0, three space codes are placed in the header.

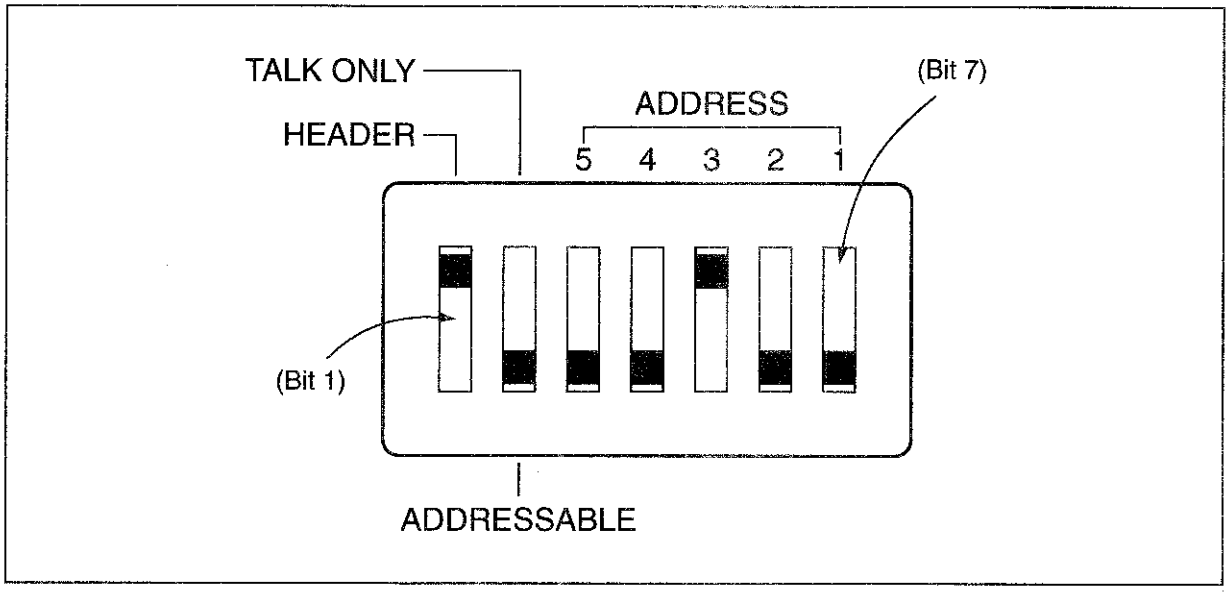


Figure 9-6 ADDRESS switch

Table 9-4 Address code table

ASCII code character		ADDRESS switch					Decimal code
LISTEN	TALK	A5	A4	A3	A2	A1	
SP	@	0	0	0	0	0	00
!	A	0	0	0	0	1	01
"	B	0	0	0	1	0	02
#	C	0	0	0	1	1	03
$	D	0	0	1	0	0	04
%	E	0	0	1	0	1	05
&	F	0	0	1	1	0	06
'	G	0	0	1	1	1	07
(	H	0	1	0	0	0	08
)	I	0	1	0	0	1	09
*	J	0	1	0	1	0	10
+	K	0	1	0	1	1	11
,	L	0	1	1	0	0	12
-	M	0	1	1	0	1	13
.	N	0	1	1	1	0	14
/	O	0	1	1	1	1	15
0	P	1	0	0	0	0	16
1	Q	1	0	0	0	1	17
2	R	1	0	0	1	0	18
3	S	1	0	0	1	1	19
4	T	1	0	1	0	0	20
5	U	1	0	1	0	1	21
6	V	1	0	1	1	0	22
7	W	1	0	1	1	1	23
8	X	1	1	0	0	0	24
9	Y	1	1	0	0	1	25
:	Z	1	1	0	1	0	26
;	[	1	1	0	1	1	27
<	\	1	1	1	0	0	28
=	]	1	1	1	0	1	29
>	~	1	1	1	1	0	30

9.5.9 General Operating Precautions

(1) Note on only-mode operations

If the Adapter is to be used in the only mode, set the ADDRESS switch to TALK ONLY, then place the other device also in the only mode. When using the only mode, do not use (activate) the controller. If a controller is used when the Adapter is placed in the only mode, the Adapter will ignore commands sent from the controller, resulting in unsatisfactory system operations.

(2) Power failure

If a power intermission has occurred during operation of a GPIB system including the TR13002 Adapter, proper system operation will not be guaranteed after the power is restored. Normally, the entire system is initialized when the power is restored.
Also care must be used to other devices in the system at the time of power failure.

(3) Controller interrupt during data transfer between components

In a GPIB system, data can be transferred between two non-controller devices.
If the controller wants serial polling or makes an interrupt request (for addition of a new listener, for example) during data transfer between two non-controller devices, data transfer is suspended. When the interrupt is completed, transfer of suspended. When the interrupt is completed, transfer of suspended data is resumed.
If data transfer between two non-controller devices is expected, the control sequence should be programmed so that the controller can monitor the data transfer status on those devices.

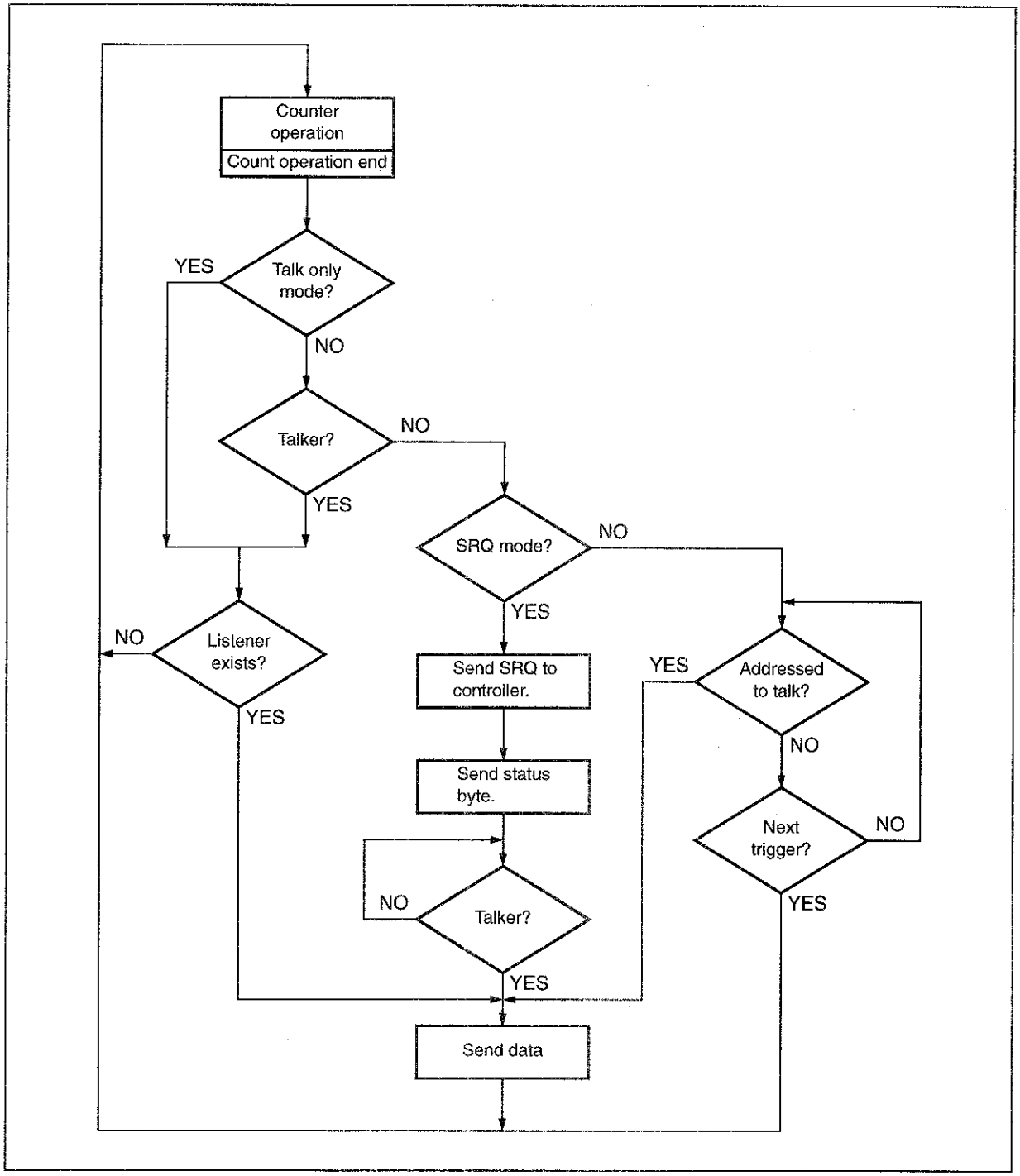
(4) ADDRESS switch setting change during operation

If the ADDRESS switch setting is changed during system operation, the new setting is ignored, and the system continues to use the old address setting. So address setting should be changed before the system power is turned on. The ADDRESSABLE-TALK ONLY switch should also be set before turning on system power. The HEADER switch setting may be changed during system operation; the change will be recognized by the system.

(5) A none on program codes in a program

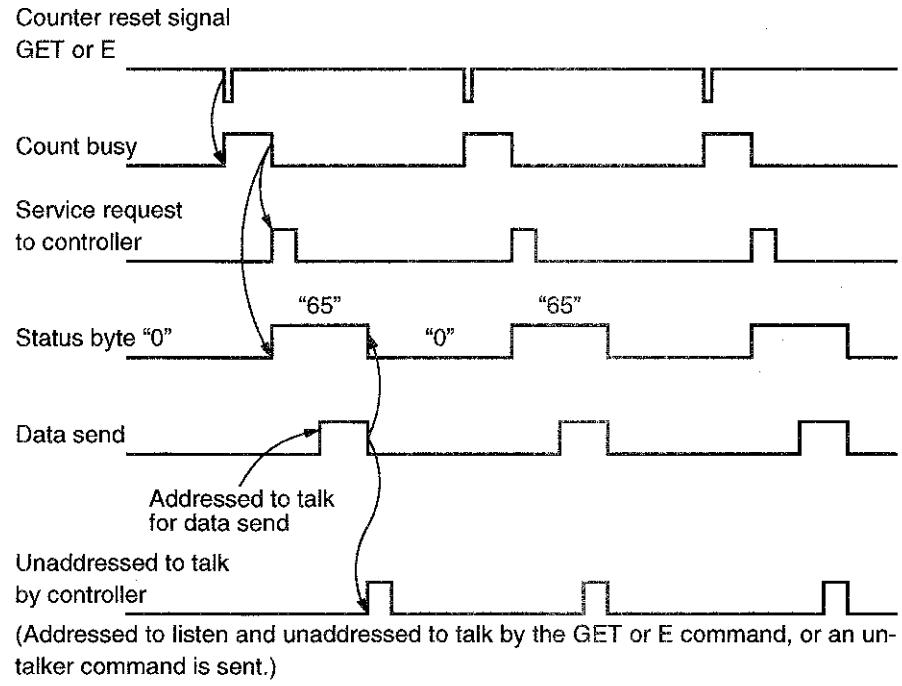
If a code that is not shown in "9.4.2 Listener Format (Program Code)" is used in a program, a normal operation is not insured.

(6) Simplified operation flow chart (for data send)



Note: ***When interrupted in the SRQ mode, the interrupt is made to complete by addressing the device to talk for sending out the data without normal interrupt processing.***

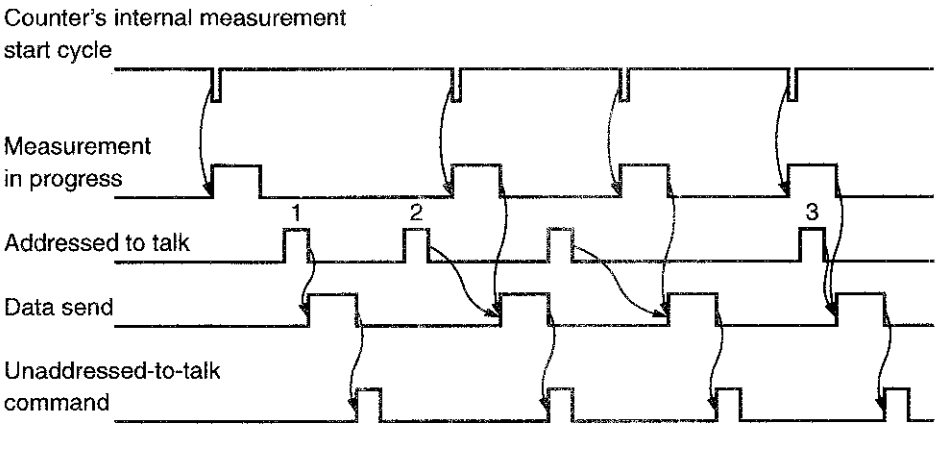
(7) Service request operation timing



(Addressed to listen and unaddressed to talk by the GET or E command, or an untalker command is sent.)

(8) Data send timing (by addressing to talk)

The following shows timings of data send initiated by addressing a device to talk. If the counter is addressed to talk, it can send data only once when measurement ends or after measurement ends.



(If measurement is initiated by the GET or E command, the unaddressed-to-talk command is not needed. The device is unaddressed to talk when it is addressed to listen.)

① The counter starts sending data immediately when it is addressed to talk after completing measurement.

② If the counter is addressed to talk after it has sent data, it starts sending the next data send when the counter completes the next measurement sequence.

③ If the counter is addressed to talk when it is busy measuring, it sends data when measurement is completed.

9.6 Performance Check

9.6.1 GPIB

A performance check on the GPIB should be performed by referring to the program examples listed at the item 9.6.3. If the data given in those program examples is not obtained, contact your nearest ADVANTEST representative.

9.6.2 D/A Output

① Connect a voltmeter (with more than +10V fullscale and a resolution of 1mV) to the D/A OUT. connector on the TR!34002 Adapter.

② Verify that the data given in the program examples listed at the end of this section is obtained. After printout (or display) on the controller is completed, check if the voltmeter reading is within the conversion accuracy with respect to the 4 least significant digits of counter's display. If the voltmeter reading is outside the conversion accuracy, contact your nearest ADVANTEST representative.

9.6.3 Programming Examples

The followings are examples of programs that have steps of setting functions, specifying the counter send as talker, and transferring data.

(1) Example of HP200 series

- Programing example

```
10      DIM AS[20]
20      CLEAR 701
30      OUTPUT 701:
        "F1,G0,S5"
40      TRIGGER 701
50      ENTER 701:A$
60      PRINT A$
70      WAIT 2
80      GOTO 40
90      END
```

Program description

10 : Dimension

20 : Initialize the counter.

30 : Set up measurement mode.
A input
GATE TIME < 10ms
HOLD (A space or a comma is available from one command to another.)

40 : Trigger

50 : Read data.

60 : Print data.

70 : Wait for 2 sec.

80 : Return to line 40.

- Data printout

```
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
```

(2) Example of PC9801 series

- Programing example

```
1010    ISET IFC
1020    ISET REN
1030    CNT=1
1040    PRINT @CNT;"C"
1050    PRINT @CNT;"F1,G0,S5"


1060    PRINT @CNT;"E"
1070    INPUT @CNT;A$
1080    PRINT A$
1090    GOTO 1060
1100    END
```

Program description

1010 : Interface clear

1020 : Remote enable

1030 : Sets the address of the instrument as a variable.

1040 : Clears the settings of the instrument.

1050 : Sets the instrument with A input, gate time less than 10ms, and HOLD condition.

1060 : Trigger

1070 : Read the data of the instrument.

1080 : Prints data.

1090 : Goes to 1060.

1100 : Ends the program.

- Data printout

```
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
1.00000000E+07
```

MEMO

APPENDIX

A.1 GLOSSARY

- Acquisition Time

  Acquisition time means the time from counter resetting to the start of counter operation. The acquisition time of ordinary counters is virtually zero, whereas microwave-band counters require a certain acquisition time. For the R5300 series counters of Advantest, the acquisition time refers to the time required until the internal oscillator is phase locked to the input signal.

- ALC (Automatic Level Control)

  A function to detect and correct the DC fluctuation in the circuit caused by temperature drift from the input terminal to the output of the wide-band amplifier.

- ANS (Automatic Noise Suppressor)

  Advantest's patented technique.
  A circuit that automatically suppresses the noise riding on the signal to be measured.

- Automatic Filler

  Cutoff frequency is automatically selected according to the incoming frequency to eliminate random noise or noise added on the input signal, thereby preventing errors associated with noise. Automatic filter makes up for the disadvantages that the ANS capability contributes little to the suppression of random noise, impulse noise or noise larger than the signal of interest while it serves well for suppression of the superimposed noise.

- Automatic Trigger Setting

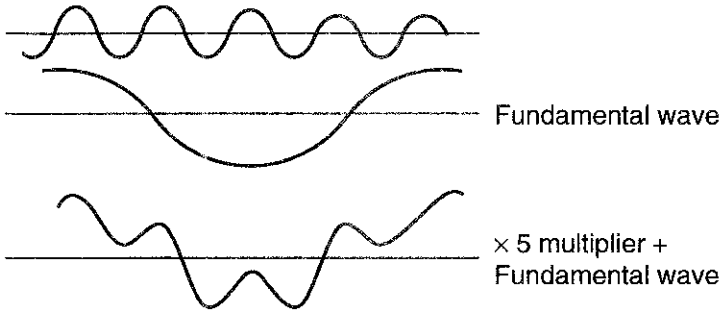
  Trigger level setting is quite difficult and bothersome when the signal to be measured is small. This setting operation is simplified by the automatic trigger setting. Trigger level is automatically set at the 50% level between the maximum and minimum peaks of the input signal. This capability facilitates the trigger level setting on the pulsed signal with the offset voltage or of different duty cycles, and minimizes false counting.

- Averaging

  Two circuit methods are usually used for averaging in electronic counters. One is used in the time interval measurement to count each time interval with the counting circuit and accumulate. Let N be the number of measurements, and ± 1 count/$\sqrt{N}$ is part of measurement precision. The other method is the one used in period measurement to form a gate with the period signal to be measured to measure the gate time with the internal time base. One factor of measurement precision is ± 1 count/N. Both averaging methods are used to enhance measurement precision of electronic counters; however, the inherent error factors inside the instrument (propagation delay time difference, Schmitt trigger circuit hysteresis band) cannot be improved. Therefore, the upper limit of the number of effective measurements accrues. In using the averaging function, the ± 1 count error must be guaranteed to occur at random. A counter usually sends the signal to be measured to the counter gate circuit completely asynchronous with the internal time base and the error can be regarded to occur at random.

- Bandwidth

  For electronic counters, noise is a cause of counting errors and must be considered in relation to sensitivity.
  The bandwidth switch is used to remove the high-frequency component (see figure below) with a low-pass filter of 10 MHz, 5 MHz, etc. This function is useful in measurement of oscillation and multiplied waves in a multiplier circuit.



- COM-SEP Switch

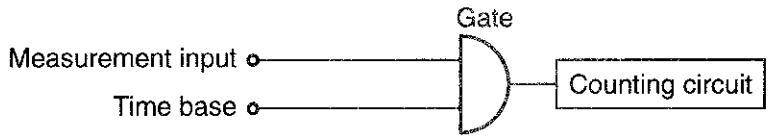
  A switch to be selected to suit the signal to be measured in time interval measurement. When this switch is set to COM., the start and stop signals are internally connected enabling a time interval measurement on a single signal. SEP. switch separates the start and stop signals, requiring the two signals, of start and stop, to be measured. (COM: Common; SEP: Separate)

- Counting Resolution

  The least significant digit on the readout. Counting resolution differs with gate time. At a gate time of 1 second, the resolution is 1Hz with a typical counter.

- Direct Counting

  The direct counting is the most fundamental method to measure the frequency. (See the figure below.) This scheme is widely used from the audio frequency band to the UHF band. In the direct counting method, the upper limit of frequency measurement is determined by the gate time and the frequency resolution. Enhancement of the performance of the semiconductor devices and advanced circuit board technology have realized a counter of 1 GHz utilizing the direct counting techniques.



- Expanding Reciprocal Method

  The method used by electronic counters to measure a period, execute inverse calculation (1/period), and display the frequency is called the reciprocal method.
  The main feature of this method is that, in period measurement, it enables frequency measurement of high-resolution and high-precision up to the order of the internal time base. For example, let the time base be 100×10^{-9}s, then 7-digit display is always possible when a frequency (10 MHz or less) is measured at a gate time of 1 second. To obtain a 10-digit display at a gate time of 1 second with this method, the internal time base must be 100×10^{-12}s (equivalent to 10 GHz). To realize a 10 GHz time base, the time expander method is used together with the reciprocal method, thus enabling a high-resolution high-precision frequency measurement. This method is called the expanding reciprocal method. (*See Time Expander Method.)

- Gate Time

  The time during which a counter measures the input signal. During this time, the GATE lamp usually goes on to notify the user that the input signal is being measured.

- Input Coupling

  There are two input coupling methods: the AC coupling that cuts out the DC input signal and passes the AC component alone, and the DC coupling to measure low frequencies.

- Masking

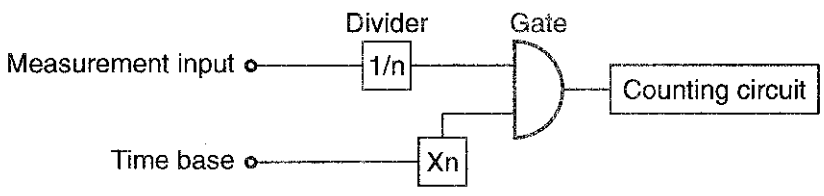
  With a masking function, regardless of the magnitude of noise, desired signal alone is made available by inhibiting for a required period of time the wave-shaped output. By adjusting the masking time, this function makes possible the measurements of the signal in noise including a chattering noise or the modulated wave signal.

- Oven Lamp

  A lamp that indicates activation of the crystal-oven heater and the internal reference circuit when the counter is connected to the AC power source regardless of the POWER switch operation.

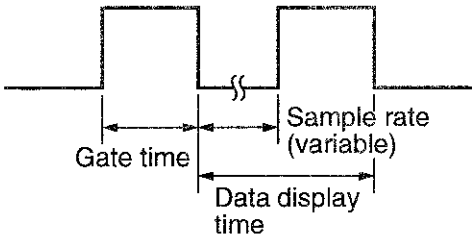
- Prescaler

  The prescaler divides the input frequencies by a factor of n with a divider for counting. (See the figure below.) In this case, the counting result is 1/n of the actual frequency; therefore, the time base is multiplied by n to display the frequency measurement. This requires a gate time equal to n times that required for the direct counting method; with the same gate time, the resolution-is1/n. In the prescaler, the upper limit of the measured frequency is determined by the frequency resolution of the divider. The gate is operated by the 1/n frequency, enabling measurement of higher frequencies than by the direct counting method. At present, a 1.5 GHz prescaling counter is available.



- Sample Rate

  A function to continuously vary the display time of the measurement result. As a matter of fact, the gate time is determined by the resolution of the counter. The display time can be changed by varying the time from the end of a measurement to the start of the next measurement by using the sample rate function. Thus, the data display time can be altered by varying the sample rate.



Data display time = Gate time + Sample rate time

- Time Base, Internal/External

  Frequency counters are used for measuring time or counting the number of pulses during a certain period of time. To obtain an accurate measurement result, a time base generator is needed to generate an accurate time. Most counters incorporate a crystal oscillator as the internal time base generator. The accuracy of this generator determines the accuracy of the frequency counter.
  If a generator with greater accuracy than the built-in generator is externally available, greater measurement accuracy of the counter is obtained by replacing the internal generator with the output of the external generator. The output of this external generator is called the external time base.

- Time Expander Method

  The ±1 count error caused by the relationship between the electronic counter internal time base (for example, 10 MHz) and the time interval to be measured or 1-cycle time is used as a significant time value. Let the difference time occurring at the leading edge of the time to be measured be ΔT_1 and the difference time occurring at the trailing edge be ΔT_2, then the time to be measured $Tx = N \cdot T_0 \pm \Delta T_1 - \Delta T_2$ (where T_0 = internal time base, N = positive integer). $\Delta T_1 - \Delta T_2$ can be read at a better precision by a factor of 100 or 1,000 by converting the difference times to analog voltages by a high-speed time-voltage converter, then A/C converted with a high speed and high precision. Assuming the time base to be 100×10^{-9}s, Tx is equal to resolution 1×10^{-9}s or 100×10^{-12}s. This method of expanding the difference time is the time expander method.

- Time Interval Average, Period Average

  Counters can measure period and time interval. With a single measurement, the display is unstable and difficult to read or the measurement value is not reliable if the input signal is interfered with noise or unstable. To solve this problem, counters have a feature to average 10 or 100 measurement values to reduce the influence of noise and input variation. This function is called the time interval average and period average to distinguish from a single measurement. Time required for average measurement is as many times longer as the number of averages taken.

- Trahet Method

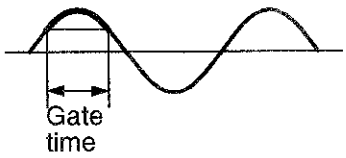
  Advantest's patented technique (US PAT. No. 3932814).
  This method uses a YIG tuning oscillator with excellent linearity, taking advantage of this transfer oscillator and the heterodyne conversion techniques.

- Trigger Level

  When a signal is input to a frequency counter, the input signal must cross a certain level (also called the threshold value) for the counter to sense it as a signal and measure it. This level is called the trigger level. The level can usually be varied with a potentiometer, etc.

- Trigger Monitor Output

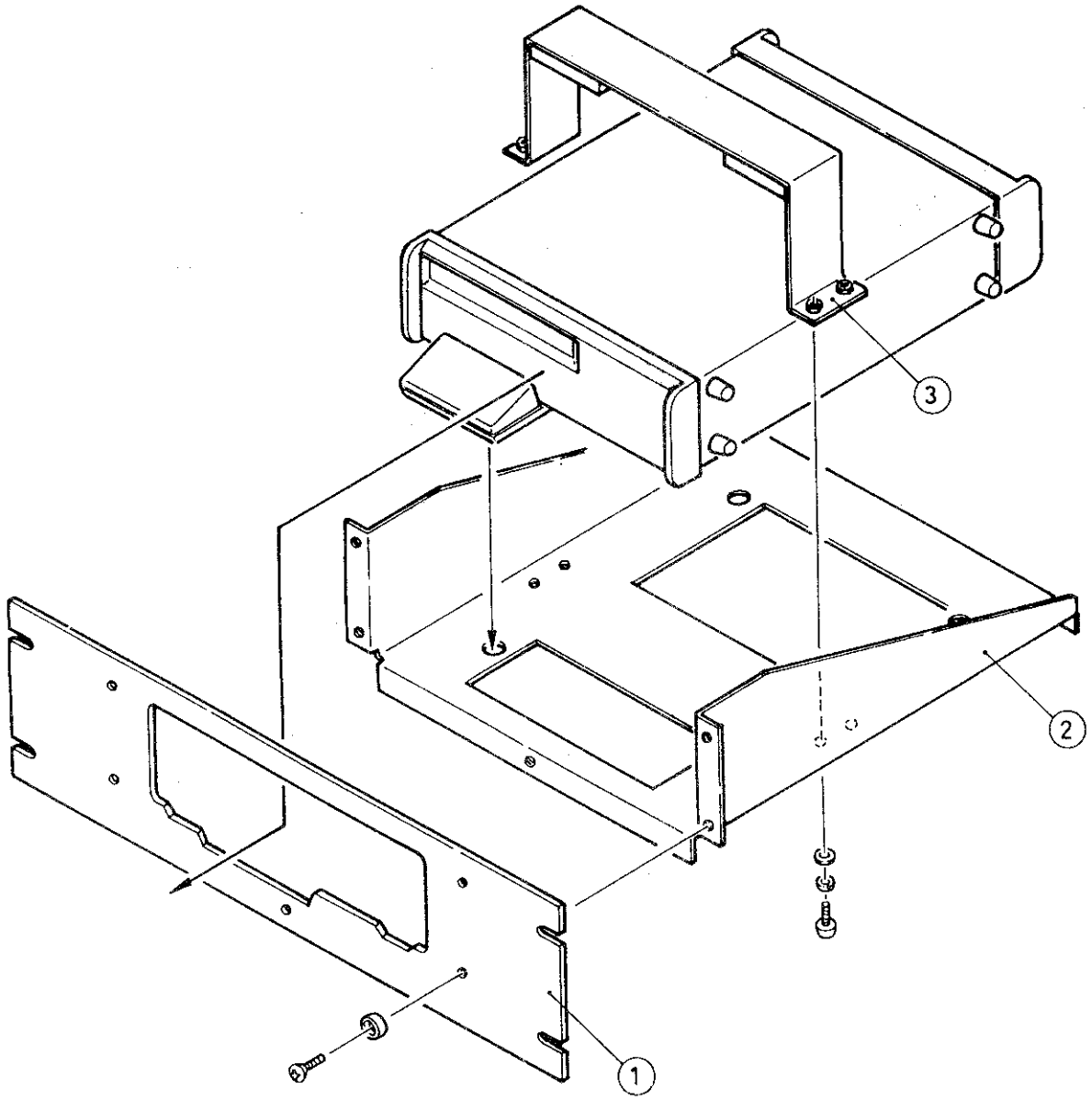
  A signal output from the trigger monitor circuit as an auxiliary means when a counter is measuring time interval. An oscilloscope (with Z-axis modulation terminal) shows intensity modulation on the waveform the each gate time. The measured portion on the trace is intensified as shown below.



- Trigger Slope

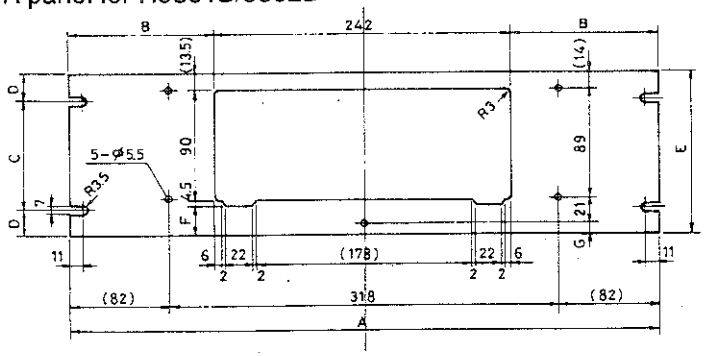
  For a frequency counter to sense an input signal, the input signal should meet the two requirements. One is that the signal must cross the trigger level, and the other is that the slope of the input signal must match the preset trigger slope. With the trigger slope set to plus (+), the counter senses the input signal when the input signal crosses the trigger level from minus (–) to plus (+).

A.2 How to Built a Rack Mount

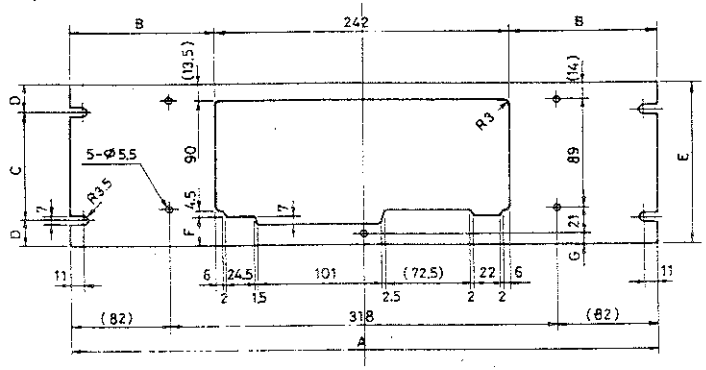


① Dimensional drawing of a panel

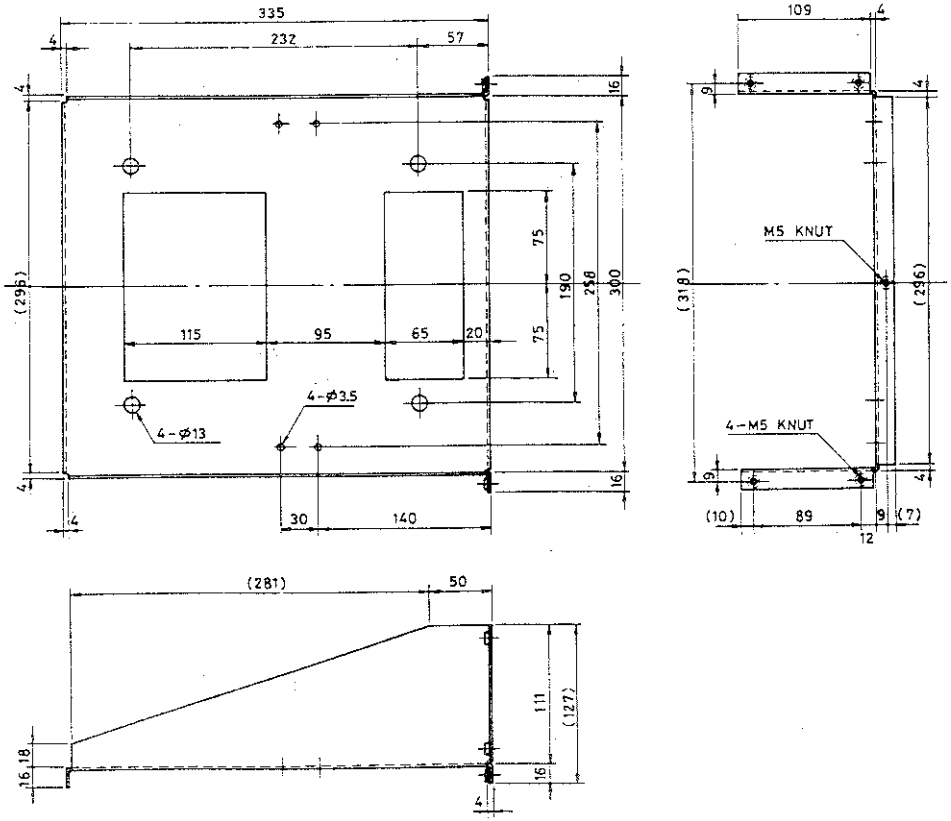
(1) A panel for R5361B/5362B



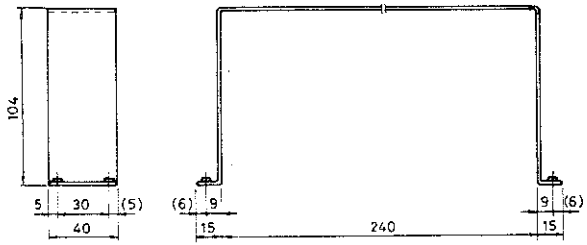
(2) A panel for TR1644



② Dimensional drawing of a fixing belt

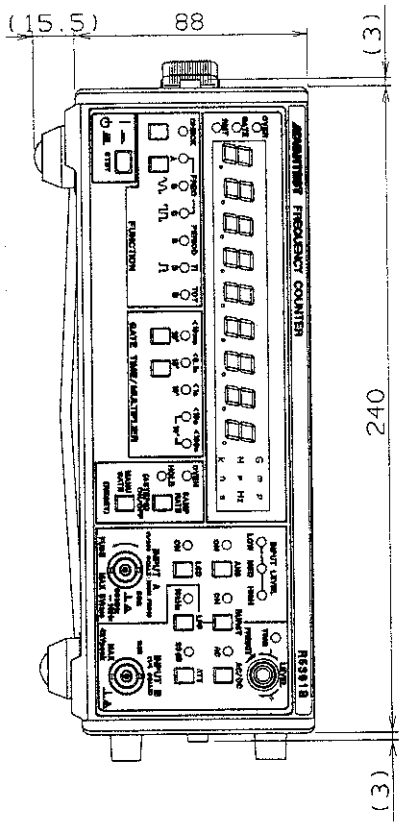


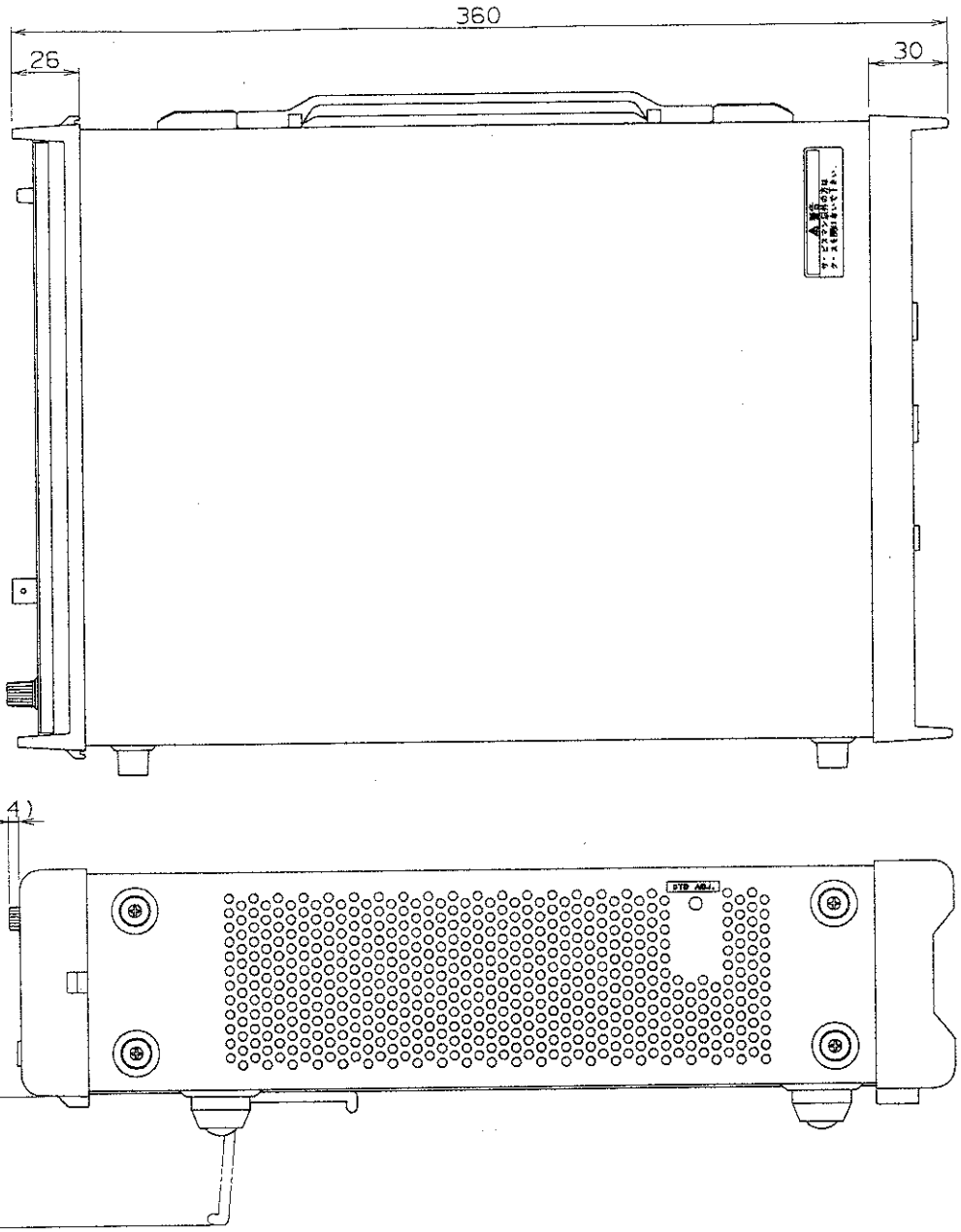
③ Dimensional drawing of a chassis



Unit : mm

Name	Stock No.	A	B	C	D	E	F	G
Panal mount set	A02017							
Rack mount set (EIA mark)	A02621 A02622 (with TR1644)	482	120	89	21.5	132	24	8
Rack mount set (JIS mark)	A02621-J A02622-J (with TR1644)	480	119	100	24.5	149	32.5	16.5





Unit : mm

CAUTION
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

IMPORTANT INFORMATION FOR ADVANTEST SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by Advantest (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by Advantest (hereafter referred to as "PRODUCTS").

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LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

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.

5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

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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.

SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

ADVANTEST®

http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Phone: +81-3-3214-7500