KENWOOD

UNIVERSAL COUNTER

FC-757

INSTRUCTION MANUAL

KENWOOD CORPORATION

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CONTENTS

1. GENERAL

The FC-757 is a universal counter. It can be used to measure frequencies (175MHz Max.), period, frequency ratio, total number, and time interval. Event inputs can be also counted with the counter.

Channel A is an input channel terminated with a resistor of 1.2MΩ and used to measure the frequencies between 5Hz and 175MHz, period and the total number of event inputs.

Channel B is an input channel terminated with a resistor of 1.2MΩ and used to measure frequency ratio and time interval. The signals in the range from 5Hz to 2MHz can be input.

The FC-757 universal counter has an 8-digit high-brightness LED display. The highest display resolution is 0.1Hz.

The FC-757 is a highly functional advanced universal counter with the following functions.

– Period measurement function

The period measurement function is used to measure the period of each input signal. This function would output higher-precision measurement data in relatively low frequency operation mode.

– Time measurement function

The time measurement function is used to measure the interval time between any two edges of different two signals, and between two 'single-shot' pulse signals.

– Event Input total count measurement function

The event input total count measurement function is used to measure the total number of event inputs to the counter. This function can be controlled through panel operations or by inputting gate signals externally.

In addition, the FC-757 universal counter has a self-check function. With this check function, major measurement functions can be tested.

The display function supports a leading-zero blanking and consists of many LEDs indicating a measurement unit, gate activity and overflow occurrence.

The FC-757 multi-functional counter has a high stable crystal oscillator as the time base clock generator. Therefore, high accuracy measurement is not adversely affected by fluctuations in temperature and power supply voltage.

2. SPECIFICATONS

【Frequency Measurement (Channel A)】	
Measurement range	kHz mode : 5Hz to 10MHz MHz mode : 5Hz to 175MHz
Accuracy	±Reference time accuracy±1 count
Resolution	kHz mode : 0.1Hz to 100Hz MHz mode : 1Hz to 1000Hz
Counting time (Gate time)	kHz : 0.01s, 0.1s, 1.0s, 10s MHz : 0.02s, 0.2s, 2.0s, 20s
Unit	kHz, MHz
【Period Measurement (A)】	
Measurement range	0.5μs to 200ms (5Hz to 2MHz)
Accuracy	± 1 count ± reference time accuracy ± trigger error *1
Resolution	100ps to 100ns
Unit	ms, μs
Minimum pulse width	250ns

Magnification (Gate time)	×1, ×10, ×100, ×1000
【Frequency Ratio Measurement (A/B)】	
Measurement range A	5Hz to 10MHz
Measurement range B	5Hz to 2MHz
Denominator magnification	Denominator magnification N : ×1, ×10, ×100, ×1000
Accuracy	$\pm\left(\frac{\text{Freq B}}{\text{Freq A}\times\text{N}}\right)$ ± Trigger error N : magnification
【Time Interval Measuement (A to B)】	
Measurement range	0.5μs to 200ms (5Hz to 2MHz)
Resolution	100ps to 100ns
Accuracy	±1 count ± Reference time accuracy ± Trigger error ±N
Minimum pulse width (A to B)	250ns
Unit	ms, μs
Magnification	×1, ×10, ×100, ×1000

Single-shot pulse processing	Wait by reset
【Event input Total Measurement (A)】	
Measurement range	5Hz to 10MHz
Maximum total count	0 to 99,999,999
Control	Reset/Hold control from the front panel. Alway active except for the case where the Start/Stop input terminal level is 'InActive (active high).
【Input Characteristics (channel A)】	
Frequency band width	5Hz to 175MHz (Coupling : AC coupling)
Sensitivity (sine wave)	kHz mode : 20mVr.m.s. (5Hz to 10MHz) MHz mode : 50mVr.m.s. (5MHz to 125MHz) 100mVr.m.s. (125MHz to 150MHz) 150mVr.m.s. (150MHz to 175MHz)
Impedance	1.2MΩ, 40pF or less
Maximum input voltage	250Vr.m.s. at (5Hz to 60Hz)

Attenuation	×1(1/1), ×10(1×10)
Low pass filter	10kHz, −3dB
slope	+/− selectable
Trigger level	Presetable or variable (about ± 1V)
【Input Characteristics (Channel B)】	
Frequency band width	5Hz to 2MHz (Coupling : AC coupling)
Sensitivity (sine wave)	30mVr.m.s.
Impedance	1.2MΩ, 40pF or less
Maximum input voltage	125Vr.m.s. at (5Hz to 60Hz)
Attenuation	×1 (1/1), ×10 (1/10)
Slope	+/− selectable
【Reference Oscillator】	
Oscillation frequency	10.0MHz (5Hz to 175MHz)

Stabilization (Tenperature factor, aging rate)	3×10^{-6}/0 to 40℃ 5×10^{-7}/month
【Reference Frequency Input】	
Frequency	10MHz
Input sensitivity	1.77Vr.m.s. or less
Coupling	AC
Input impedance	540Ω
【Display Function】	
Display	Eight-digit LED display kHz/μs, MHz/ms, GATE, OVER FLOW
Functions display	FREQ, PER, RATIO, TI(A to B), TOTAL, CHECK
Counting time (Gate time)	0.01s, 0.1s, 1.0s, 10s 1, 10, 100, 1000
【Self-check Function】	
Display	Display a count value of the internal time base timer (10.0MHz)

Counting time (Gate time)	0.01s, 0.1s, 1.0s, 10s
Resolution	0.1Hz to 100Hz
【General Requirements】	
Power supply voltage	100 / 120 / 220 / 240VAC±10% (max.250V), 50/60Hz
Power comsunption	20VA
Within specifications temperature and humidity	23℃±5℃, 70%RH
Operating temperature and humidity	0℃ to 40℃, 80%RH
Dimentions	240(W)×64(H)×190(D)mm [max. 260(W)×70(H)×210(D)mm]
Weight	1.8kg
Accessories	Instruction manual 1 Power supply cable 1 Replacement fuse 1

*1 Trigger error is typically ±0.3% of reading divided by the number of cycles averaged, for input signals having better than 40dB S/N ratio and gr[illegible]r than 100mV amplitude.

3. PRECAUTIONS FOR USE

a. Turn off the product and then connect it with the AC wall outlet by using the accessory power cable cord.
   Refer to the maintenance section in this document in changing the current power supply voltage to a new level

b. The use of this product under the following ambient conditions is strictly prohibited:
   Direct exposure to the sunlight.
   High-temperature and High-humidity.
   Mechanical vibration and Electrical shock.

c. The maximum input voltage levels of this counter are as follows.
   (Front panel) Channel A Input juck :
   250Vrms (5Hz to 60Hz)
   (Front panel) Channel B Input juck :
   125Vrms (5Hz to 60Hz)
   (Rear panel) TOTALIZE START/STOP
   Input juck : ±5V
   (Rear panel) EXT. IN input juck : 10Vrms

d. This counter can start its operation at the moment when power is applied. However, wait 30 minutes to give it a warm and then start your job with it. Accurate measurement will be assured.

4. PANEL EXPLANATION

4–1 Front panel

① POWER ON /OFF Switch

The POWER ON/OFF switch is provided to apply power to this counter. If pressed( ), the counter will be turned on. If pressed again ( ), the counter will be turned off.

② GATE Indicator (LED)

③ kHz/μs Indicator (LED)

The kHz/μs LED indicator is provided to remind the user of the current measurement data unit.

This LED indicates the unit of the current measurement operation. This LED remains active as long as the measurement unit is not changed with the measurement unit select switch (not pressed).

If the frequency measurement mode or the self-check mode is activated, this indicator means that the measurement value is output in kiloherz. The LED indicates that the measurement value is displayed in microseconds if a period or time interval is being measured. This LED indicator becomes inactive when the frequency ratio measurement mode or the event total count measurement mode has been started up.

④ MHz/ms Indicator (LED)

The MHz/ms LED indicator is provided to remind the user of the current measurement data unit. This LED becomes active as long as the measurement unit is changed with the measurcment unit select switch (pressed).

If the frequency measurement mode or the self-check mode is activated, this indicator means that the measurement value is output in megaherz. The LED indicates that the measurement value is displayed in milliseconds if a period or time interval is being measured.

This LED indicator becomes inactive when the frequency ratio measurement mode or the event total count measurement mode has been started up.

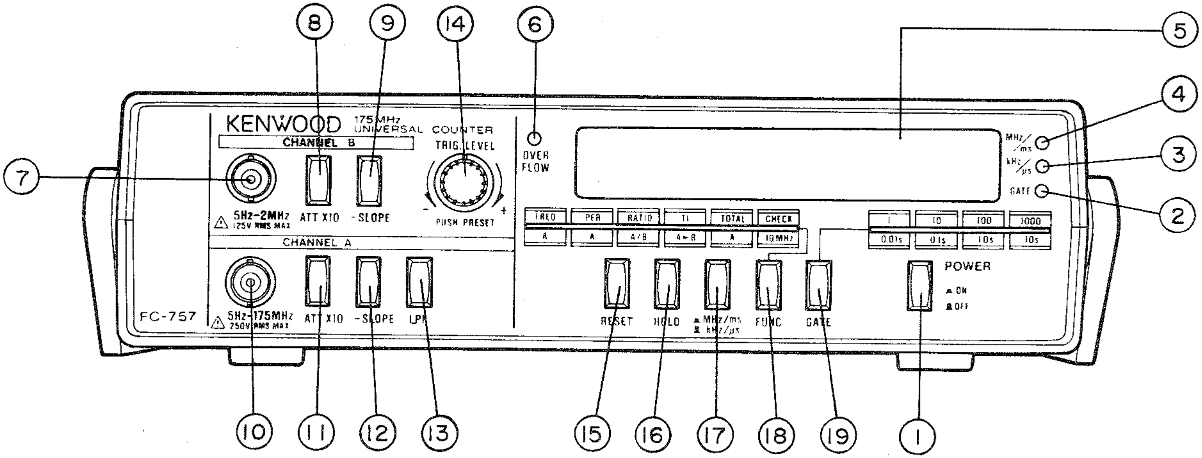


Figure 1. Front panel

⑤ Display (LED)
The display consists of eight-digit LEDs indicating all the current measurement value.

⑥ OVER FLOW Indicator (LED)
The OVER FLOW LED is provided to notify the user that an overflow has occurred.

⑦ CHANNEL B (5Hz to 2MHz) Input juck
The CHANNEL B input juck is provided to allow object signals to enter the counter.
This juck is used for frequency ratio measurement and time interval measurement.
The CHANNEL B input juck is a BNC connector terminated with a resistor of 1.2megaohm.
The maximum input voltage is 125Vrms.

⑧ ATT × 10 Switch
The ATT (enuation) × 10 switch is provided to enable the internal ATTenuator circuit operation.
If this switch is pressed (× 10), the input signal to channel B is attenuated into 1/10 and then reaches the counter.
If this switch is pressed again (× 1), the input signal to channel B reaches the counter without attenuatjon.
Note that this switch can work together with channel B only but does not affect channel A.

⑨ –SLOPE Switch
The –SLOPE switch is provided to permit the user to select positive-going edge or negative-going edge of the CHANNEL B signal for synchronization.
If this switch is pressed ( ), negative-going edge will be selected for synchronization.
If this switch is pressed again ( ), positive-going edge will be selected for synchronization.

⑩ CHANNEL A (5Hz to 175MHz) Input juck
The CHANNEL A input juck is provided to allow signals to be input to the counter for frequency measurement and period measurement.
In the frequency ratio measurement mode, the ratio between the CHANNEL B inputs and the CHANNEL A inputs is measured.
In the time interval measurement mode, the difference in time between the CHANNEL B inputs and the CHANNEL A inputs is measured.
The CHANNEL A input juck is a BNC connector

terminated with a resistor of 1.2 megaohm.
The maximum input voltage is 250Vrms.

⑪ ATT × 10 Switch

The ATT (enuation) × 10 switch is provided to enable the internal ATTenuator circuit operation.

If this switch is pressed ( ), the input signal to channel A is attenuated into 1/10 and then reaches the counter.

If this switch is pressed again ( ), the input signal to channel A reaches the counter without attenuation.

Note that this switch can work together with channel A only but does not affect channel B.

⑫ − SLOPE Switch

The −SLOPE switch is provided to permit the user to select positive-going edge or negative-going edge of the CHANNEL A signal for synchronization.

If this switch is pressed ( ), negative-going edge will be selected for synchronization.

If this switch is pressed again ( ), positive-going edge will be selected for synchronization.

⑬ LPF Switch

The LPF switch is used to enable the low pass filter circuit operation.

If this switch is pressed ( ), the input signal to channel A is forced to enter a low pass filter of about 10kHz.

If pressed again ( ), the input signal reaches the counter directly. This LPF switch does not affect channel B.

⑭ TRIG. LEVEL Control/PUSH PRESET

The TRIG. LEVEL control/PUSH RESET is a knob provided to allow the user to adjust the trigger level of the input signals to the CHANNEL A input juck.

If the knob is pressed ( ), the trigger level of an object sine wave signal is set to its center.

If the knob is pulled ( ) and then rotated counterclockwise, the trigger level moves to an earlier point.

If the knob is pulled ( ) and then rotated clockwise, the trigger level moves to a later point.

⑮ RESET Switch

The RESET switch is provided to clear the counter into 0. This switch can work, independently of any operation mode selected by FUNC switch ⑱.

If this switch is pressed ( ), the counter will be reset to 0.

If this switch is released, a new measurement cycle will be started.

⑯ HOLD Switch

Thc HOLD switch is provided to perform various operations shown below. Note that the HOLD switch functions depend on operational modes selected by FUNC switch ⑱.

a. In the operation modes other than the event total count measurement mode (TOTAL/A) :

If this switch is pressed ( ), the current measuremcnt value indicated by the display LEDs is 'held' and the countcr is reset.

If pressed again ( ), a new measurement will be started.

The display value being 'held' is not updated until the new mcasurement is complete.

b. Event total counter (TOTAL/A) mode :

If this switch is pressed ( ), the current measurement value indicated by the display LEDs is 'held' and the event total count is terminated. If pressed again ( ), a new counting operation will be started. Note that the TTL level of the gate input signal to the TOTALIZE INPUT/STOP input juck⑳ should be High or the terminal should be left 'open' before the new counting operation is started.

⑰ MHz/ms ( )/kHz/μs ( ) Switch

(Hereafter, this switch is explained as the 'display unit select' switch.)

If this switch is pressed ( ) in the frequency measurement mode or the self-check operation mode, the measurement value will be displayed in megaherz, in the period or time interval measurement mode, the measurement value will be displayed in milliseconds.

If this switch is pressed again ( ), the measurement data will be displayed in kiloherz or microseconds.

This switch is helpless in the frequency ratio measurement mode and event total count measurement mode.

⑱ FUNC Switch/Mode display LEDs

The FUNC switch is provided to select the desired operational mode from the available modes.

The mode display LEDs are provided to indicate the measurement mode selected by this switch.

The following operational modes can be selected with this switch.

a. FREQ/A (frequency) mode

The FREQ/A mode is an operational mode in which this counter measures the frequencies of input signals to channel A and outputs them to the display section. They are displayed in either kHz or MegaHerz (MHz). The display unit can be selected with display unit select switch ⑰ and indicated by either display unit indicator LED ③ or ④. The display resolution can be selected with GATE switch ⑲.

The measurement frequency ranges in each display range are as follows :

kHz range :

5Hz to 10MHz

Measurement sensitivity :

5Hz to 5MHz : 20mV rms

MHz range :

1MHz to 175MHz

Measurement sensitivity :

5MH to 125MHz : 50mV rms

125MHz to 150MHz : 100mV rms

150MHz to 175MHz : 150mV rms

The proper range should be used according to input signal frequencies with each range characteristics fully in mind.

b. PER/A (Period) mode

The PER/A mode is an operational mode in which this product measures the period of input signals to channel A and then outputs them to the display section. They are displayed in the unit selected by display unit select switch ⑰. That display unit is indicated by either display unit indicator LED ③ or ④. The display resolution can be selected with GATE switch ⑲.

c. RATIO A/B (frequency ratio) mode

The RATIO A/B mode is an operational mode in which this product measures both signals on channels A and B, and then compares the CHANNEL B signals with those on CHANNEL A (A/B) for ratio calculation.

The display resolution can be selected with GATE switch ⑲.

d. TI/A → B (time interval) mode

The TI/A → B mode is an operational mode in which this counter product measures the time interval between a selected edge of the CHANNEL A signal and a selected edge of the CHANNEL B signal.

The edge can be selected from positive-going and negative-going edges of each signal with −SLOPE switches ⑨ and ⑫. The measurement data is displayed in μs or ms selected by display unit select switch ⑰. That display unit is indicated by either measurement unit display LED ③ or ④. The display resolution can be selected with GATE switch ⑲.

e. TOTAL/A (event input total count) mode

The TOTAL/A mode is an operational mode in which this product measures the number of channel A input cycles and then outputs each count value to the display continuously.

This cycle count and display operations can be externally controlled with the gate signal input to the TOTALIZE START/STOP input juck on the rear panel or HOLD switch ⑯ on the front panel.

f. CHECK/10MHz mode

The CHECK/10MHz mode is an operational mode in which this universal counter checks internal functions. If this self-check mode is selected, the frequency of the internal time base timer (10MHz) will be displayed by the 8-digit 7-segment LEDs.

⑲ GATE Switch/GATE LED

The GATE switch is provided to select a desired display resolution value for the measurement modes started by FUNC switch ⑱. This does not apply to the event total count

(TOTAL/A) mode.
The GATE LED is also provided to indicate the selected display resolution value.

Measurement mode	Resolution			
kHz Frequency mode	0.01s	0.1s	1.0s	10s
MHz Frequency mode	0.02s	0.2s	2.0s	20s
Period/Frequency Ratio/Time Interval measurement mode	×1	×10	×100	×1000

4-2 Rear panel

⑳ TOTALIZE INPUT START/STOP Input juck
The TOTALIZE INPUT START/STOP input juck is provided to control the event input count operation mode.
The event input count operation is enabled if the input signal to this terminal becomes active (TTL level : 'H').
The event input count operation is forced to terminate if the input signal to this terminal becomes inactive (TTL level : 'L'). The event input count operation is also disabled if this terminal is grounded to the chassis ground.

㉑ EXT. IN. Juck
If OSCILLATOR EXT./INT. switch ㉒ is set to the EXT. (left position), this terminal is used as an input terminal for external time base clocks.

㉒ OSCILLATOR EXT./INT. Switch
The OSCILLATOR EXT./INT. switch is provided to select a function for the EXT. IN juck.
In short, either the internal time base oscillator or an external time base clock oscillator can be selected with this switch.

If this switch is set to the EXT. side, the universal counter can be connected with an external 10-MHz time base clock generator via the EXT. IN juck.
If this switch is set to the INT. side, the universal counter can be connected with the internal time base oscillator.

㉓ Power supply voltage selector
The power supply voltage selector is provided to select the supply voltage that is applied to the counter.
When you change the current supply voltage, refer to section 7-1 'Maintenance'.

㉔ Power input connector
The power input connector is provided for connecting a power cord to the counter.
Use the accessory power cord.

㉕ Fuse holder
The fuse holder is provided to enabie the user to set a protection fuse in the counter.
For the 100V or 120V-power requirement, use the 0.25A/250V slow-blow type fuse.
For the 220V or 240V-power requirement, use the 0.125A/250V slow-blow type fuse.
When you replace the current fuse, refer to section 7-1 'Maintenance'

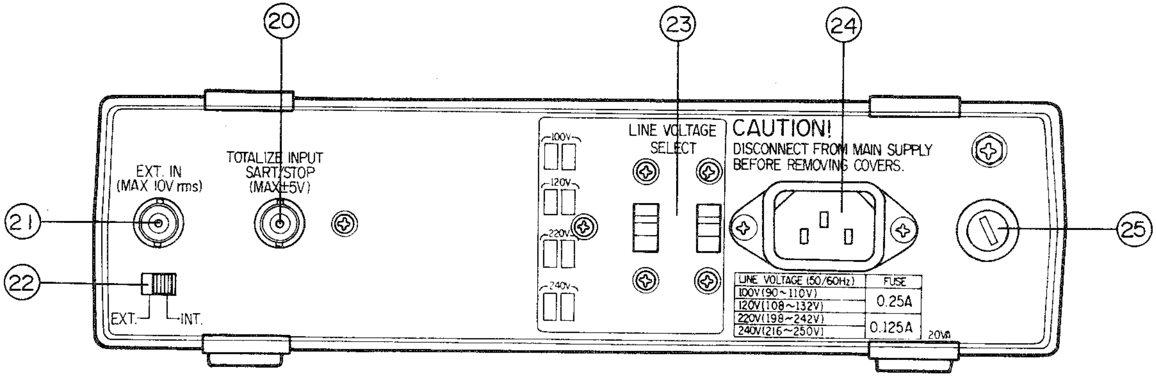


Figure 2. Rear panel

4–3 Case surface

㉖ There is an opening on the case surface. This opening is provided for fine adjustment of the internal TCXO (standard oscillator). The opening is normally covered with a rubber cap. If the TCXO needs to be fine adjusted, please contact your dealer.

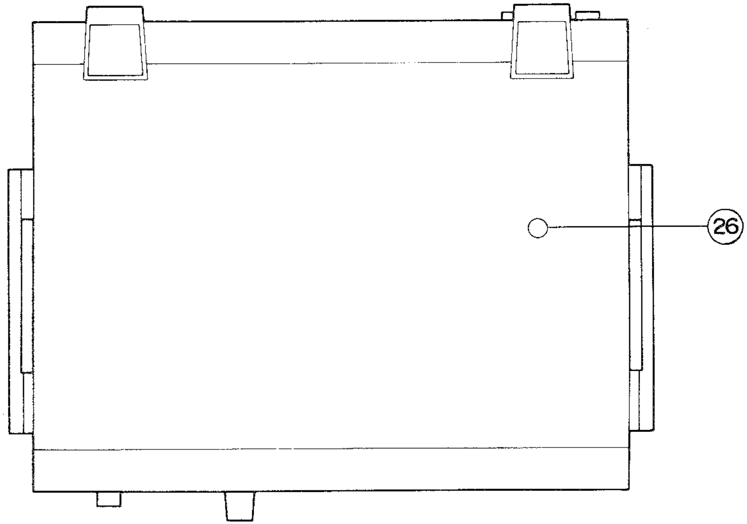


Figure 3. Case surface

5. OPERATING PROCEDURES

Every time when you start using the FC-757 Multi-Functional universal counter, look at the rear panel and verify that the power supply voltage selector setting indicates the level of the supply voltage to be actually applied.

1) Connect the accessory power cord with the power input connector (inlet) of the rear panel and insert the AC plug into the nearby outlet.
2) Press the POWER switch ( ). The counter will be turned on.
3) When the counter is switched on with all the functional switches set to OFF, the LED display indicates '0'.
4) Read carefully Chapter 3 PRECAUTION FOR USE (on page 7) to handle this instrument correctly.

5–1 Frequency measurement

5–1–1 Frequency Measurement with Channel A (5Hz to 175MHz)

(1) Input a target signal (to be measured) to CHANNEL A input juck ⑩.

(2) Select the FREQ/A mode by using FUNC switch ⑱.

(3) Select the measurement unit with display unit select switch ⑰.

If the display unit select switch is pressed ( ), the measurement value will be displayed in MHz/ms. In this case, display unit LED ④ will be turned on.

If the switch is pressed again ( ), the measurement value will be displayed in kHz/μs. In this case, display unit LED ③ will be turned on.

Note : The maximum measurement frequency in each display range varies depending on the measurement modes. In the kHz/μs measurement mode, up to 10MHz-frequency can be processed while the maximum frequency that can be handled in the MHz/ms mode is 175MHz. The proper range should be used according to input signal frequencies with each range characteristics fully in mind.

(4) Select a desired display resolution value (gate time) with GATE switch ⑲.

(5) The frequency of the input signal currently being measured will be output to display ⑤. GATE LED ② blinks during the measurement. The measurement value on the display will be updated at the moment when one measurement interval is over (when the GATE LED becomes inactive).

Note : The measurement may be delayed or display may be unstable. For these unexpected operations, refer to section 5–6 'Display Description'.

(6) If HOLD switch ⑯ is pressed during frequency measurement, the current measurement value on the Display is held as it is. If pressed again, a new measurement cycle will be started. However, the measurement value currently being displayed will remain unchanged until the new measurement cycle is complete. That is, the display value being held by the HOLD switch is updated by the output value from the new measurement operation.

(7) If RESET switch ⑪ is pressed during frequency measurement, the measurement value on the Display will be reset to '0'. If released, a new measurement cycle will be started. However, the measurement value will remain '0' until the new cycle is complete.

Input Adjustment Functions

1) Input Adjustment with an LPF

Press LPF (low pass filter) switch ⑩ to eliminate noise signal components. If the internal LPF circuit function is enabled, the input signal to the CHANNEL A juck is handled first by the LPF circuit (about 10kHz) and then input to the counter. Therefore, the counter processes input signals without high-frequency noises only. As a result, accurate low-frequency measurement is assured.

2) ATT × 10 switch

Press ATT × 10 switch (▂▃) according to input signal levels.

If the internal attenuator circuit is enabled, input signal to the CHANNEL A juck is attenuated into 1/10 before reaching the counter. This attenuates noise-superimposed input signals. In addition, the attenuation circuit preprocesses a signal with rather a high amplitude into a reasonal level. As a result, accurate counting is assured.

3) –SLOPE switch

CHANNEL A –SLOPE switch ⑫ is provided to select negative-going edge or positive-going edge of an input signal to the CHANNEL A input juck for synchronization.

If this switch is pressed ( ), negative-going edge is selected for synchronization with the frequency counter. If pressed again ( ), positive-going edge is selected for synchronization with the counter.

Note : If the input signals are handled in the frequency measurement mode and its measurement mode and its measurement value is displayed in MHz/ms, this switch is bypassed. As a result, the count operation is carried out in synchronization with negative-going edge.

4) Trigger Level Adjustment

The trigger level of the input signals to the CHANNEL A input juck can be changed by TRIG LEVEL control ⑭.

The functions of this control are as follows.

a. If the control is pressed (PRESET position), the trigger level is preset to the center point of input signals to the CHANNEL A input juck.

b. If the control is pulled and then rotated, the trigger level moves to the earlier point or the later point from the preset center point. For detailed information, refer to Chapter 6 'Measuring Considerations'.

5–2 Period measurement

In the period measurement mode, the cycle time of each input signal is measured.

The cycle time finally output by the counter is the average of all the cycle times of the number of cycles handled. The number of cycles to be measured can be 1, 10, 100 or 1000.

(1) Input a target signal (to be measured) to the CHANNEL A input juck.

(2) Select the PER/A (period) mode with FUNC switch ⑱.

(3) Select a desired measurement unit with display unit select switch ⑰.

If the switch is pressed ( ), measurement output will be displayed in MHz/ms.

If pressed again ( ), it will be displayed in kHz/μs. In either case, the associated LED (kHz/μs LED ③ or MHz/ms LED ④) will become active.

If the kHz/μs LED turns on, input signals are measured in microseconds.

If the MHz/ms LED turns on, input signals are measured in milliseconds.

(4) Select a desired display resolution value with GATE switch ⑲. This GATE switch is used to specify the number of cycles per period measurement. As already explained, the final cycle time output is the average of all the cycle times. The display resolution LEDs (from the left) indicates 1, 10, 100 and 1000.

The average cycle time of all the period measured is output to Display ⑤.

GATE LED ② blinks during the period measurement.

The measurement value on the display will be updated at the moment when one cycle measurement is complete (when the GATE LED turns off). The GATE LED blinking may not be confirmed with ease because it gets too fast due to high-frequency signal measurement.

Note : The measurement may be delayed or the output value display may be unstable. In this case, refer to section 5–6 'Display Description'.

(5) If HOLD switch ⑯ is turned on during period measurement, the current measurement value on the Display is held as it is. If it is turned off, a new measurement cycle will be started. However, the measurement value currently being displayed will remain unchanged untll the new measurement cycle is complete. That is, the display value being held by the

HOLD switch is updated by the output value from the new measurement operation.

(6) If RESET switch ⑮ is pressed during period measurement, the measurement value on the Display will be reset to '0'. If released, a new measurement cycle will be started. However, the measurement value will remain '0' until the new cycle is complete.

Note : If signals are input to the CHANNEL A input juck with noise and ringing superimposed on, refer to the item 'Input Adjustment Functions' of the preceding section, 'Frequency Measurement'.

5–3 Frequency ratio measurement mode

In the frequency ratio measurement mode, the ratio of CHANNEL A input signal frequency to CHANNEL B input signal frequency is measured.

The frequency of the input signals to the CHANNEL A input juck should be equal to or greater than that of the CHANNEL B input signals for higher resolution. In addition, the frequencies of the input signals on the both channels should be within their ratings.

The frequency ratio between the two channel input signals is defined as follows.

The ratio of number of cycles on CHANNEL A to the total time of the specified number of cycles on CHANNEL B (1, 10, 100 or 1000).

Measurement Procedures

(1) Input target signals to the two channels, CHANNEL A and CHANNEL B.

Note : The frequency ratio of '1' can be gained by inputting the same frequency signals to the two input terminals

(2) Select the RATIO A/B mode with FUNC switch ⑱.

(3) The measurement unit indication LEDs, kHz/μs and MHz/ms, are inactive during this measurement mode because the output value is a ratio between the two frequencies.

(4) Select a desired resolution value by using GATE switch ⑲.

The resolution value can be any one of the four decimal values (1, 10, 100 and 1000 or 1 to 0.001). The measurement data can be displayed without decimal point while with up to third decimal place.

Note : In the frequency ratio measurement mode, display unit select switch (kHz/μs, MHz/ms) ⑰ has no significance.

(5) The frequency ratio data is output to the Display. GATE LED ② blinks during the frequency ratio measurement.

The measurement value on the display will be updated at the moment when one measurement interval is complete (when the GATE LED turns off). The GATE LED blinking may not be confirmed because it gets too fast due to high-frequency signal measurement on CHANNEL B.

Note : The measurement may be delayed or the output value display may be unstable. In this case, refer to section 5–6 'Display Description'.

(6) If HOLD switch ⑯ is turned on during frequency ratio measurement, the current measurement value on the Display is held as it is. If it is turned off, a new measurement cycle will be started. However, the measurement value currently being displayed will remain unchanged until the new measurement cycle is complete. That is, the display value being held by the HOLD switch is updated by the output value from the new measurement operation.

(7) If RESET switch ⑮ is pressed during the frequency ratio measurement, the measurement value on the Display will be reset to '0'. If pressed again, a new measurement cycle will be started. However, the measurement value will remain '0' until the new cycle is complete.

Note : If signals are input to the counter input jucks with noise and ringing superimposed on, refer to the item 'Input Adjustment Functions' of the preceding section, 'Frequency Measurement'.

CHANNEL A and CHANNEL B are both provided with the input adjustment functions.

5–4 Time interval measurement mode

In the time interval measurement mode, the transition time from a specified signal edge on CHANNEL A to a specified signal edge on CHANNEL B is measured.

To gain an accurate measurement result (time interval), input of two signals with stable cycle time to the CHANNEL A and CHANNEL B terminals is required. For example, use the two digital signals from the same clock generator.

If the same signal is input to the two jucks, the duty cycle can be measured. For more details, refer to chapter 6 '6–3. Measuring Considerations'.

Measurement Procedures

(1) Input target signals to channels A and B (⑦ and ⑩).

(2) Select the time interval measurement mode (TI/A→B) with FUNC switch ⑱.

Symbol A→B indicates that the transition time from channel A to channel B is measured.

(3) Specify desired signal edges of the two signals on channels A and B by using CHANNEL A and CHANNEL B –SLOPE switches ⑨ and ⑫. If these switches are pressed (▁), the negative-going edge will be selected. If left open (▆), the positive-going edge will be selected.

Note : If the transition time between the two same edges of the same signal needs to be measured, use the period measurement mode.

For more details, refer to chapter 6 '6–4. Measuring Considerations'.

(4) Press CHANNEL A TRIG LEVEL control ⑭, and the adjust will be set to the PRESET position. In this case, the trigger level of the signals on the two channels is set to the center point (almost average level).

(5) Select a desired measurement unit with display unit select switch (kHz/μs, MHz/ms) ⑰.

If the switch is pressed ( ), the transition time will be measured in milliseconds.
If left open ( ), it will be measured in microseconds. The display unit indication LED, kHz/μs ③ or MHz/ms ④, will become active according to the selection.

(6) Select a desired resolution value with GATE switch ⑲.

(7) The time interval measurement value will be output to the Display. GATE LED ② blinks during the measurement. The output measurement data on the Display will be updated at the moment when one measurement interval is over.
The GATE LED blinking may not be confirmed because it gets too fast due to high-frequency input signal.
Note : The measurement may be delayed or the output value display may be unstable. In this case, refer to section 5–6 'Display Description'.

(8) If HOLD switch ⑯ is turned on during measurement, the current measurement value on the Display is held as it is.
If it is turned off, a new measurement cycle will be started. However, the measurement value currently being displayed will remain unchanged until the new measurement cycle is complete. That is, the display value being held by the HOLD switch is updated by the output value from the new measurement operation.

(9) If RESET switch ⑮ is pressed during the time interval measurement, the measurement value on the Display will be reset to '0'.
If pressed again, a new measurement cycle will be started. However, the measurement value will remain '0' until the new cycle is complete.

(10) Time interval measurement between two single-shot pulses.
The time transition from one single shot to another single shot can be measured.
Set GATE switch ⑲ to the 1/0.01s position.
Note that the switch should be always set to this position in the single-shot time

interval measurement mode and otherwise it should be set as indicated in various multi-shot time interval measurement modes.
Select a signal level with the −SLOPE switch according to prediction and then press the RESET switch to place the product in the ready state.
If any two single shots are input to this counter, the time interval between the two will be output to the Display.

Note : If signals are input to the counter input juck with noise and ringing superimposed on, refer to the item 'Input Adjustment Functions' of the preceding section, 'Frequency Measurement'.
CHANNEL A and CHANNEL B are both provided with the input adjustment functions.

5–5 Event-input total count measurement

In the event-input total count measurement mode, the total number of events generated during a fixed certain period is measured.
This measurement period can be set by using the front panel switch or the rear panel gate signal input juck.
The signal input circuit and the counter are coupled with capacitance (AC), which requires at least 5 events per second to be generated.

(1) Select the TOTAL/A (input total measurement) mode with FUNC switch ⑱. The selection by GATE switch ⑲ and display unit select switch ⑰ have no significance in this measurement mode.

(2) If you want to control the event input total measurement (event counting) externally, use the input gate signal to TOTALIZE INPUT START/STOP juck ⑳ on the rear panel.
If the TTL H-level signal is input to that terminal, the event counting is enabled.
If the terminal level becomes inactive (TTL 'L' level), the event processing will be terminated.
In this case, the total numder of events is held by the Display.
If no control signal is input to the TOTALIZE

INPUT START/STOP juck, that is, if the terminal is left 'open', the count operation will be carried out because the terminal level is TTL 'H'.

(3) RESET switch ⑮ is provided to reset the counter display to '0'
If the switch is released with TOTALIZE INPUT START/STOP juck ⑳ left open, the counter operation will be started at the moment. If the switch is released with TOTALIZE INPUT START/STOP juck ⑳ in use, the counting operation will be depend on the TTL level of the terminal. If the terminal level is TTL high, it will be started immediately.

(4) Once the event input total measurement is started, the measurement total value is output to the display LED continuously. The terminal count is 99,999,999 (max.). If the total number of measured events exceeds that terminal count, OVER FLOW LED ⑥ will be turned on while the counting operation still continue.

(5) The counting operation may terminate in the following three cases.

① The TTL level of the input gate signal to the TOTALIZE INPUT START/STOP juck is L. In this case, the counting measurement is terminated and the total count value is held by the Display. If the gate signal changes its TTL level from L to H, the counting measurement will be started again.

② The user has pressed HOLD switch ⑯.
In this case, the counting measurement is terminated and the total count value is held by the Display. If the HOLD switch is pressed again, the counting measurement will be started again.

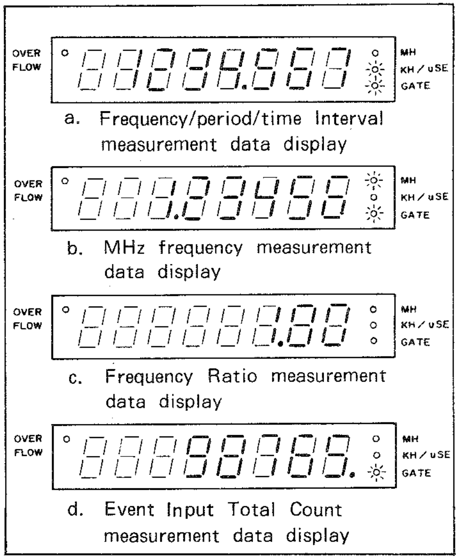
③ The user has pressed RESET switch ⑮.
In this case, the counter is cleared and the display value is reset to '0'. Note that this product is reset each time when this switch is pressed.

Note: The input gate signal to TOTALIZE INPUT START/STOP input juck ⑳ prevents the input signal to CHANNEL A from entering the counter and then terminates the event total count measurement mode. If the FREQ/A measurement mode is selected with FUNC switch ⑱ and the MHz/ms display unit is also selected with display unit select switch ⑰, the input signal to CHANNEL A is allowed to enter the counter. However, in any other measurement mode, the input signal is blocked from going into the counter. For this reason, do not input the gate signal to the TOTALIZE INPUT START/STOP input juck in any measurement mode other than the event total count measurement mode.

Note: If the input signals with noise and ringing superimposed on reach the counter, they may cause an error during event total count measurement. In such a case, refer to the Input Adjustment Functions of section 5-1 'Frequency Measurement'.

5–6 Display Description

5–6–1 Display Layout



a. Frequency/period/time Interval measurement data display

b. MHz frequency measurement data display

c. Frequency Ratio measurement data display

d. Event Input Total Count measurement data display

Figure 4. Various display examples

Figure 4 shows the display examples.
Figure 4 a indicates the value of "1234.567" with kHz/μs LED ③ active. This means that the counter is now measuring the frequency, period, or time interval selected by FUNC switch ⑱. If it is assumed that a frequency is being measured, the display resolution value is 0.001kHz, that is 1Hz. This means that the gate time (display resolution) has been set to 100/1.0s.
With those functional parameters left unchanged, use the display unit select switch to select the MHz/ms mode. The display value will change to the one as shown in Figure 4 b. This means that the same frequency is still being measured but the measurement value is now displayed in MHz. In other words, the display resolution value has not been changed with GATE switch ⑲ but the display resolution value has changed from 1Hz (0.001kHz) to 10Hz (0.00001MHz).
If Figure 4 a shows that a period or time interval is being measured and the MHz/ms mode is selected with display unit select switch ⑰, the display value will changes to '1.234567'. Unlike the frequency measurement, the display resolution (0.001μs = 0.000001ms) does not change but the display unit is changed (In this case, the decimal point moves three digits in the left direction.).
Figure 4 c shows that the same signal is input to the CHANNELs A and B input jucks and that the frequency ratio between the two signals is measured during the same gate time of Figure 4 a and b. In this case, the two display unit indication LEDs become inactive because the frequency ratio is output to the Display.
Figure 4 d shows the typical event total count example. The output value is displayed in integer (no data following the decimal point is displayed) because the event total count requires no display unit.
If relatively high-frequency signals are handled in the event total count mode, low-

order digits change very quickly, so that it becomes difficult to follow the display values with eyesight.

5-6-2 Unstable Display

The least significant digit (±1 digit) of a measurement value may have an error at digital measurement. In this section, errors other than that will be explained.
If noise or ringing is superimposed on an input signal, these unexpected signal waves may work as pseudo trigger signals to cause unstable display. Under such operating conditions, measurement values may be output to display as if they were true.
However, they might be inaccurate due to the superimposed noise or ringing.
To solve the above problems, use the input adjustment functions of this frequency counter to secure the exact synchronization timings.
In addition, unstable frequency input signal may cause an error. In the period measurement and time interval measurement modes, pseudo trigger signal may cause measurement error. This measurement error can be reduced by increasing the number of measurement cycles (by selecting a greater GATE time value). That is, a smaller resolution value than the current one should be set for that purpose.
However, if many cycles are handled in the time interval measurement mode, a count error per interval may occur. The number of such count errors will be increased as the number of measurement intervals increases. As a result, all the resolution values selected by the GATE switch will be equal and the number of display digits will be also increased. This means that the number of digits to be possibly affected by jitter increases. Any cycle is a reciprocal of its associated frequency while any frequency is a reciprocal of its associated cycle.
If relatively low-frequency signal is measured, the period measurement mode should be used instead of the frequency measure-

ment mode because higher precision data can be displayed. If relatively high-frequency signal is measured, the frequency measurement mode should be used instead of the period measurement mode because higher precision measurement data can be output. Either measurement mode should be employed with a frequency of 10kHz in mind.

5-6-3 Measurement Delay

Display measurement data on the display is updated at the moment when each measurement period (or interval) elapses. This applies to every measurement mode except for the event total measurement mode. The GATE LED remains active during the measurement period. This period is dependent on a selected measurement mode and specified resolution value. That is, the end of the period can be defined differently. This delay has significance in some cases. When you are about to change resolution values, operational modes, or to use the hold or reset function, you should take that delay into consideration because a new measurement operation will start.

In the following paragraphs, the relationship between measurement modes and measurement delays will be discussed.

(1) Frequency measurement mode

The relationship between the operational modes, resolution values and measurement periods in the frequency mode is shown below.

Measurement mode	Resolution value setting	Gate time
kHz / μs	100 Hz	0.01s
kHz / μs	10 Hz	0.1s
kHz / μs	1 Hz	1 s
kHz / μs	0.1 Hz	10s
MHz / ms	1 kHz	0.02s
MHz / ms	100 Hz	0.2s
MHz / ms	10 Hz	2 s
MHz / ms	1 Hz	20 s

As the above table shows, the gate time will be short if a low resolution value is selected. This will be helpful in fine-adjusting an oscillator, which requires quick update. The measurement interval will be longer if a highed resolution value is selected.

(2) Period measurement mode and time interval mode

The period measurement mode processes the specified number of cycles and then outputs the average cycle time. The desired number of cycles can be specified by using the GATE switch. The relationship between the number of cycles and the GATE switch is shown in the table below.

Measurement mode	Resolution value setting	No. of cycles measured (No. of time intervals)
kHz / μs	0.1μs	1
kHz / μs	0.01μs	10
kHz / μs	0.001μs	100
kHz / μs	0.0001μs	1000
MHz / ms	0.0001ms	1
MHz / ms	0.00001ms	10
MHz / ms	0.000001ms	100

(3) Frequency ratio mode

The frequency ratio mode requires two signals to be input to the counter input jucks. CHANNEL A and CHANNEL B input jucks. The counter starts measuring each of the input signals and stops it when the number of counts on the CHANNEL B reaches a specified value. In this case, the counter outputs the counter value on the CHANNEL A to the Display. This output counter value is modified with a given decimal point and then displayed as the output frequency ratio.

In this measurement mode, the GATE switch is used to specify a specific standard value (No. of signal arrivals) for the CHANNEL B. The standard count values on the channel are as follows.

GATE switch setting	No. of arrival signals on CHANNEL B
1	1
10	10
100	100
1000	1000

(4) Interval between measurements

The interval between measurements (GATE LED OFF period) is fixed to 200 milliseconds in all the measurement modes. However, if signal frequencies are measured in the MHz/ms mode, that period is fixed to 400 milliseconds.

If event inputs are counted for totalization, the count operation may continue even during this interval.

Note that these fixed intervals have nothing to do with the gate times, number of cycles and input frequencies.

6. MEASURING CONSIDERATIONS

6–1 Use of attenuator probe

The input impedance (1.2Megaohm, and 40pF or less) of the CHANNEL A input juck is not affected through manipulation of ATT × 10 switch ⑪.

The circuit load can be reduced by connecting the attenuator probe to the CHANNEL A input juck. Set the attenuator probe to the × 10 position to reduce the circuit load. This applies to CHANNEL B.

NOTE : If 10 : 1 attenuator probe is used, verify that the amplitude of the signal input to the counter satisfies the following condition.

Minimam signal level < Attenuated input signal level

6–2 Change in measurement mode and resolution

A new measurement operation is started each time when a measurement mode or resolution value is changed. The measurement display data on the Display is not updated untill the new measurement cycle is completed.

Even if decimal point place and leading zeroes are corrected, and a new measurement value then appears on the LED display, it may be inaccurate due to display delay. Please keep it in mind.

6–3 Duty cycle measurement mode

The duty cycles of digit signals can be measured by placing the counter in the time interval measurement mode.

The duty cycle can be measured by specifying the two edges (negative-going edge and positive-going edge) of the two signals on channels A and B. Select the positive-going edge (leading edge of T1) of the signal on channel A while select the negative-going edge (tailing edge of T1) of the signal on channel B.

The duty cycle measurement mode can start when the positive-going edge of the channel-A signal is detected and then ends when the negative-going edge of the channel-B signal is detected.

Use (+) slope for the CHANNEL A selection while (−) slope for the CHANNEL B selection. See Figure 5.

Next, the period (place the counter in the period measurement mode that is to be discussed next) should be measured. The measurement period data will be used in the following expression to calculate the duty cycle.

Duty cycle = T1/cycle × 100%

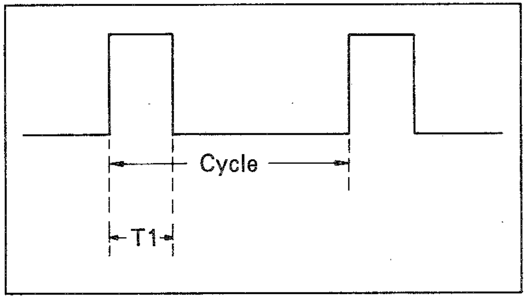


Figure 5 Duty cycle measurement

6–4 Relationship between period measurement mode and time interval mode

It is strongly recommended that the period measurement mode be used instead of the time interval measurement mode to measure the time interval between two similar edges of the same signal (for example, the time interval between one positive-going edge and the next positive-going edge of the same signal is measured.).

The reasons are as follows :

If fine resolution is selected, the period measurement mode outputs higher precision measurement data than the time interval measurement mode does. In the time interval measurement mode, as the number of time intervals (1, 10, 100, and 1000) increases, the error rate will be bigger and bigger accordingly. As a result, jitter-affected output values may be displayed more often because the better resolution requires more display digits for more accurate measurement is not assured.

The period measurement mode produces the same measurement error, irrespective of resolution settings.

6–5 Use of TRIG LEVEL control

TRIG LEVEL control ⑭ is provided to adjust the trigger levels of the input signals to CHANNEL A. If the adjust is pressed (set to the PRESET position), almost the average level of the input signals is selected as the trigger level. Almost the all the operations can be performed based on that trigger level. However, this level should be changed if the signal waveforms shown in figure 6 are processed.

The trigger level to be selected by setting the controller to the PRESET position is indicated by the broken line at the bottom in the Figure. This trigger level is an average of the pulse string. However, this level nears the noise found in the signal waveform. As a result, it may cause a pseudo trigger error.

To change the triggering position to prevent the trigger error, use the TRIG LEVEL control.

If the controller is pulled and rotated in either direction (clockwise or counterclockwise), the current level position moves to either a desired earlier position or later position.

The proper trigger level shown in the figure is indicated by the broken line at the top.
That is, it is set almost above the noise signal level.

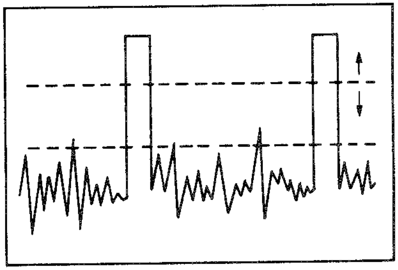

Adjustable into this level.
PRESET-IN level (average center)

Figure 6. Example trigger level adjustment

6–6 Self check mode

The self check mode is provided to check the internal general functions of the FC-757 universal frequency counter for a short time.

(Operational procedure)

(1) Select the CHECK/10MHz mode with FUNC switch ⑱.
When the universal counters enters this mode, the counter input is logically connected to the time base oscillator.

(2) Change the resolution values by using the GATE switch with display unit select switch ⑰ pressed after the counter has entered the self-check mode, and then verify that the output results agree to those listed below.

Resolution value setting	Output display	GATE time *2 (measurement interval period)
0.01s/1	10000.0 kHz	0.01 second
0.1s/10	10000.00 kHz	0.1 second
1.0s/100	10000.000 kHz	1 second
10s/1000	0000.0000 kHz (OVER FLOW LED lights up)	10 seconds

*2 GATE LED ② remains active during the interval period. The measurement interval is 200 milliseconds.

(3) Change the resolution values by using the GATE switch with display unit select switch ⑰

left open after the counter has entered the self-check mode, and then verify that the output results agree to those listed below.

Resolution *3 value setting	Output display	GATE time (measurement *4 interval period)
0.01s/1 0.1s/10 1.0s/100	10000.0 kHz 10000.00 kHz 10000.000 kHz	0.01 second 0.1 second 1 second

*3 In the self-check mode, any one of the resolution values 100Hz, 10Hz and 1Hz can be selected with these resolution setting values.

*4 GATE LED ② remains active during the interiod. The measurement interval is 200 milliseconds.

(4) If the MHz/ms mode is selected with the display unit select switch and additionally the resolution of 10s/1000 is specified by the GATE switch, the display data will be "88.8.8.8.8.8.8". At the same time, the MHz/ms indication LED and the OVER FLOW LED will both turn on. And the GATE LED will become active for 10 seconds. Otherwise, the counter has some circuit trouble.

(5) press HOLD switch ⑯, the current measurement value on the display will be held. The GATE LED remains inactive while the HOLD switch is being held down. The GATE LED will resume blinking at the moment when the HOLD switch is released. (If a resolution value is changed, display data will be updated at the moment when the first GATE interval period is over.)

(6) Press RESET switch ⑮, and the current display value will be cleared.
The GATE LED remains inactive while the RESET switch is being held down.
The GATE LED will resume blinking at the moment when the RESET switch is released.
The measurement data on the display will be updated when the first GATE interval time is over.

7. MAINTENANCE

> CAUTION
> Be sure to disconnect the power cable from the socket, before conducting the following operation.

1. **Fuse replacement**

   When the fuse is broken, check what caused it and remove the fuse.
   If the power supply voltage is 100V to 120V, use a slow-blow fuse with the rating of 0.25A/250V for replacement.

   If the power supply voltage is 220V to 240V, use a slow blow fuse with the rating of 0.125A/250V for replacement.
   The broken fuse should be replaced with a new in the following manner.
   - Remove the fuse hold on the real panel with a minus driver.
   - Replace the broken fuse with a proper fuse.

2. **Change in power supply voltage**

   If a different-level power supply voltage needs to be applied to the product, use power supply voltage selector (labeled as LINE VOLTAGE SELECT) ㉓ according to the voltage select information on its left.
   Bear in mind that voltage change results requires a new fuse rating.
   Case 1 : Voltage change from 100V/120V to 220V/240V
   Fuse rating : 0.25A/250V to 0.125A/250V

   Case 2 : Voltage change from 220V/240V to 100V/120V
   Fuse rating : 0.125A/250V to 0.25A/250V

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