DG-4140E

Digital Gauge Counter

Instruction Manual

1. GENERAL

1.1 General Description

The DG-4140E Digital Gauge Counter converts a linear gauge sensor output by multiplying the sensor's 2-phase signal by 4 and displays it as a digital value. It also outputs data corresponding to the displayed value from the serial BCD terminal and executes a comparator output according to the set value.

1.2 Features

- LCD (in units of mm: polarity + 5 digits, in units of inch: polarity + 6 digits)
- Multiplier setting function (× 0.001 to 9.999)
- Peak hold function
- DIN72x72
- Power supply (12 to 24 VDC: terminal strip input, or 12 VDC: AC adapter)
- Dual-color display (comparator interlocking)
- Unit change of mm/inch (displayed as "IN")

1.3 Applicable Gauge Sensors

This equipment can be used in combination with any of the following gauge sensors.

Model	Measuring Range	Resolution
AS-1012	10 mm	1 μm
AS-2012	10 mm	1 μm
BS-102/102W	10 mm	10 μm
BA-112/112W	10 mm	1 μm
GS-100	100 mm	10 μm
GS-102	10 mm	10 μm
GS-251/251W	25 mm	10 μm
GS-503	50 mm	10 μm
GS-5011	50 mm	1 μm

Model	Measuring Range	Resolution
GS-1513A	13 mm	10 μm
GS-1530A	30 mm	10 μm
GS-1613A	13 mm	1 μm
GS-1630A	30 mm	1 μm
GS-4513	13 mm	10 μm
GS-4530	30 mm	10 μm
GS-4613	13 mm	1 μm
GS-4630	30 mm	1 μm

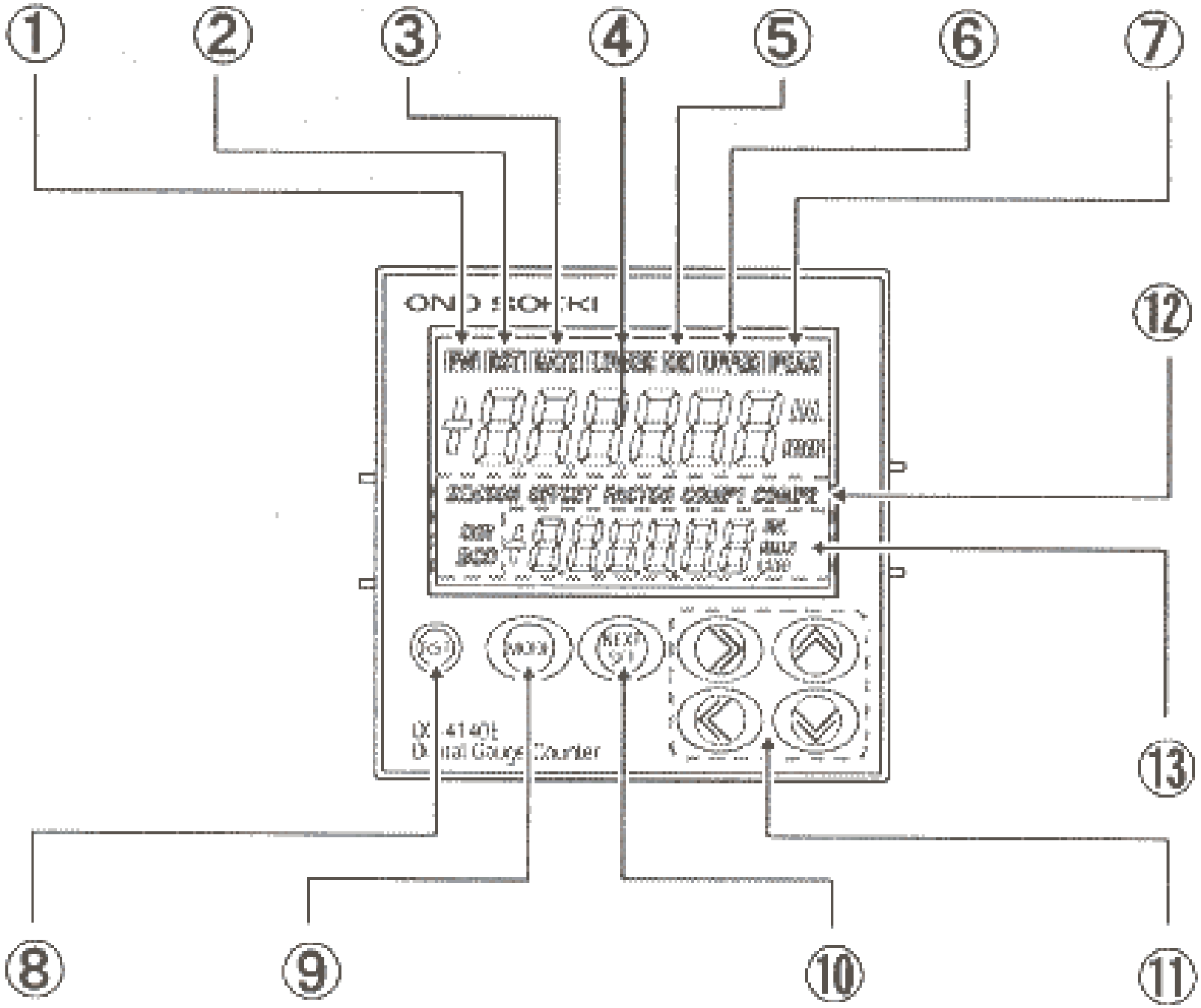
1.4 Accessories

Upon unpacking, check all the following accessories.

Name	Quantity
Panel mounting fixture	1 set
Instruction Manual	1

2. NAMES OF PARTS

2.1 Front Panel



① PW

Indicated when the power is being supplied.

② RST

Indicated when Reset is activated.

③ GATE

Indicated when a comparator gate signal has been input.

④ LOWER

Indicated when a measured value is equal to or smaller than the comparator lower limit value, and the LCD (background color) turns to red.

⑤ OK

Indicated when a measured value is larger than the LOWER setting and smaller than the UPPER setting.

⑥ UPPER

Indicated when a measured value is equal to or larger than the comparator upper limit value, and the LCD (background color) turns to red.

⑦ PEAK

Indicated when the peak hold start signal has been input and turned off when the stop signal has been input.

⑧ RST key

Press for 3 sec. or more to reset a displayed value to zero.
However, the displayed value will not be zero if this key is pressed when an offset value has been set.
The displayed value is retained until the offset value is canceled.

⑨ MODE key

Press for 3 sec. or more to activate the setting mode to change a set value.
Press again to deactivate the setting mode.

⑩ NEXT key

Press to shift to the next setting item.

⑪ Setting change keys

Use to set a numeric value in each setting item.

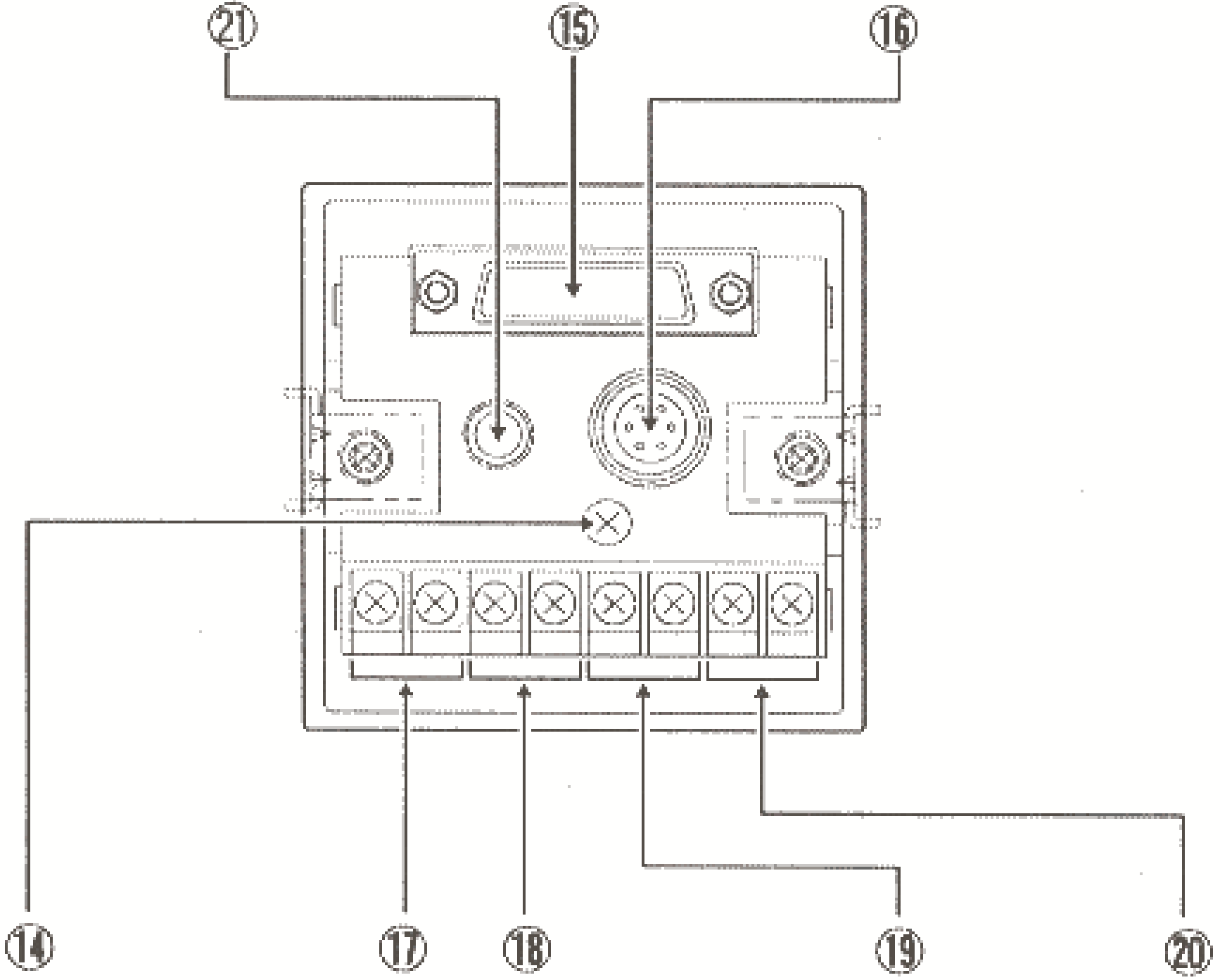
⑫ Setting item display section

Indicates the current setting item in the setting mode.

⑬ Set value display section

Indicates a set value for each setting item.

2.2 Rear Panel



⑭ Ground terminal

Ground for noise elimination. Use an annealed copper line of 2 mm2 or larger and no more than 3 m in length.

⑮ BCD OUT connector

Used for serial BCD output or external command signal output.

⑯ SIG IN connector

Inputs a gauge sensor signal; connect the gauge sensor signal cable.

⑰ DC power input terminal

Inputs 12 to 24 VDC power.

⑱ LOWER output terminal

1-make contact output, turned on when a count value is equal to or smaller than the comparator lower limit value.

⑲ OK output terminal

1-make contact output, turned on when a count value is larger than the LOWER setting and smaller than the UPPER setting.

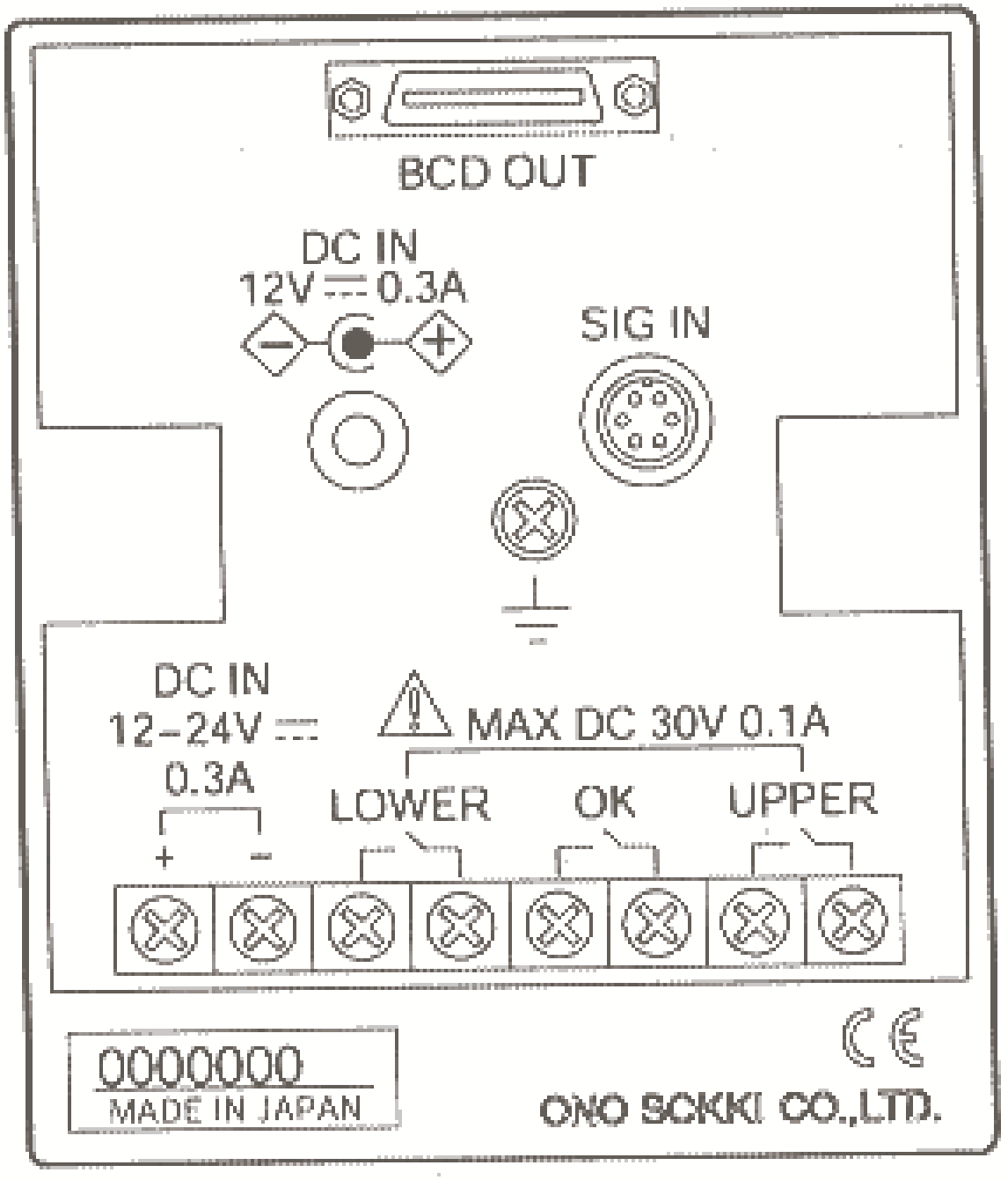
⑳ UPPER output terminal

1-make contact output, turned on when a count value is equal to or larger than the comparator upper limit value.

㉑ Power jack (EIAJ RC5320A, voltage class 4)

Connect the optional AC adapter (12VDC).

Rear Panel Terminal Strip Diagram

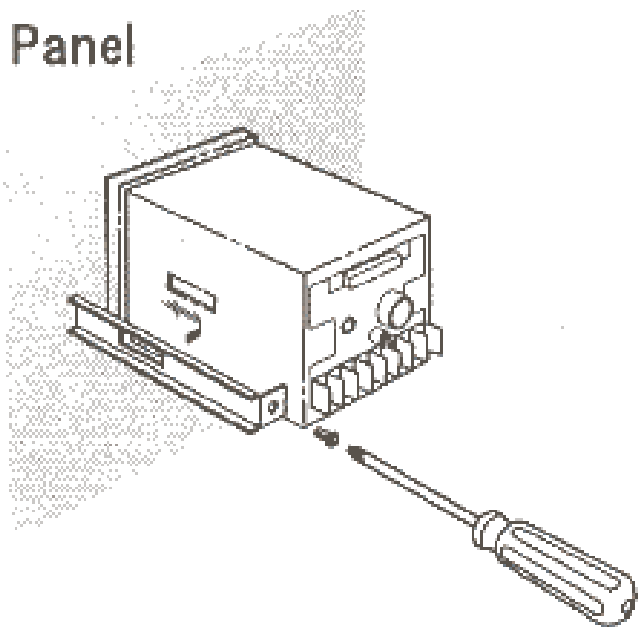


3. INSTALLATION

3.1 Mounting to Panel

This equipment can be mounted to a panel having an opening of $68^{+0.7}_{0} \times 68^{+0.7}_{0}$ mm.

Use the following procedure.



1. Remove the panel mounting fixtures by loosening the screws on the rear side of the equipment.
2. Insert the equipment from the front into the mounting position on the panel.
3. Re-install the panel mounting fixtures from the rear side of the equipment.
4. Tighten the screws of the panel mounting fixtures to secure the equipment to the panel.

3.2 Connecting Cables

1. Remove the protective cover from the rear panel terminal strip, connect a power source (12 to 24VDC) to the power supply input terminal, and reinstall the protective cover to the original position. (Terminal screw M3.5)

   Alternatively, connect the optional AC adapter to the power jack on the rear panel.

2. Connect the gauge sensor signal connector to the SIG IN connector on the rear panel.

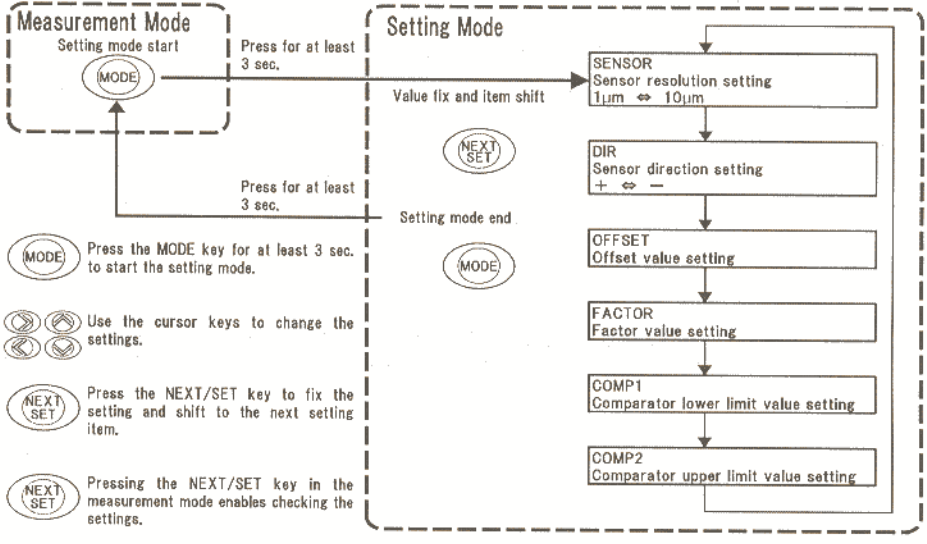
   When necessary to extend the cable, use the extension cable specified by ONO SOKKI. The allowable extension is a maximum of 25m (AA-803 + AA-801).
   Optional extension cable : AA-801 (5 m)/AA-802 (10 m)/AA-803 (20 m)

3. Connect the BCD output cable to the BCD OUT connector on the rear panel.

4. OPERATING INSTRUCTIONS

4.1 Changing the Engineering Unit

To toggle the engineering unit between mm and inch, turn off the power and turn on again the power with both MODE and ⏻ keys pressed.


Measurement Mode
Setting mode start
MODE
Press for at least 3 sec.
Setting Mode
SENSOR
Sensor resolution setting
1μm ⇔ 10μm
Value fix and item shift
NEXT SET
DIR
Sensor direction setting
+ ⇔ −
Press for at least 3 sec.
Setting mode end
OFFSET
Offset value setting
MODE
FACTOR
Factor value setting
COMP1
Comparator lower limit value setting
COMP2
Comparator upper limit value setting
MODE
Press the MODE key for at least 3 sec. to start the setting mode.
Use the cursor keys to change the settings.
NEXT SET
Press the NEXT/SET key to fix the setting and shift to the next setting item.
NEXT SET
Pressing the NEXT/SET key in the measurement mode enables checking the settings.

4.2 Setting Mode

1. Set the resolution according to the sensor to be used.
2. Set the polarity (positive or negative) of the count value indicated when the sensor spindle is pushed in.
3. Set the offset value.
4. Input a multiplier set value, which multiplies the sensor motion distance.
5. Set the comparator lower limit value.*
6. Set the comparator upper limit value.*

CAUTION ! **The display color changes in response to the comparator result. When not using the comparator function, set a minimum value for COMP1 and a maximum value for COMP2.**

4.3 Setting Method

Step 1: Setting the sensor resolution

↓

Step 2: Setting the sensor direction

↓

Step 3: Setting the offset value

↓

Step 4: Setting the factor value

↓

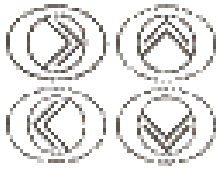
Step 5: Setting the comparator lower limit value

↓

Step 6: Setting the comparator upper limit value

Step 1: Setting the sensor resolution

Select the value according to the sensor resolution.



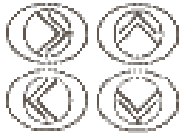
1 µm ⟺ 10 µm

Toggles each time any key is pressed.

Step 2: Setting the sensor direction

(+): Positive counting is used when the gauge sensor spindle is pushed in.

(-): Negative counting is used when the gauge sensor spindle is pushed in.



+ ⟺ −

Toggles each time any key is pressed.

Step 3: Setting the offset value

Select a digit position to set a value using the ◁ and ▷ keys, and the selected digit starts flashing.

Then, set a value using the △ and ▽ keys.

Setting range (unit: mm)

0.000 to ± 99.999 (1um sensor) or

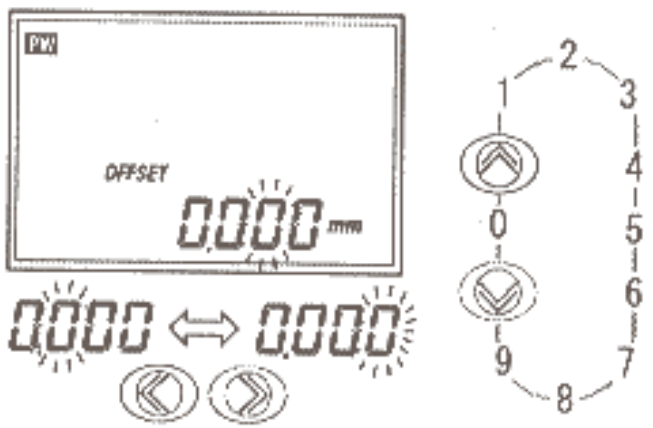
0.00 to ± 999.99 (10um sensor)

Setting range (unit: inch)

0.00000 to ± 9.99995 (1um sensor) or

0.000 to ± 99.9995 (10um sensor)

When the setting mode is turned off, the set offset value is automatically added to the measured value.



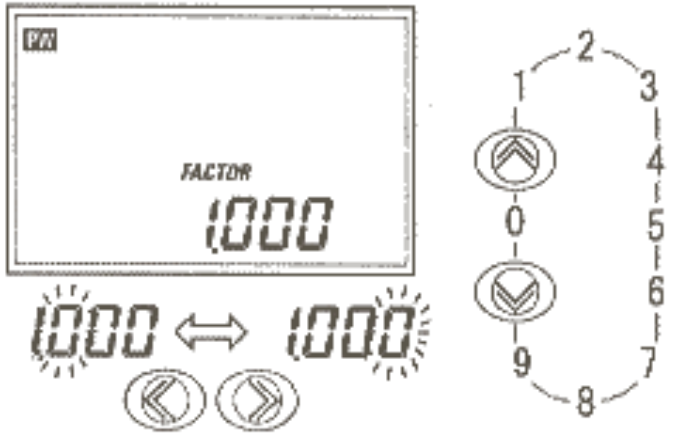
Step 4: Setting the factor value

Select a digit position to set a value using the ◁ and ▷ keys, and the selected digit starts flashing.

Then, set a value using the △ and ▽ keys.

Setting range is 0.001 to 9.999.

A measured value multiplied by the set factor value is indicated.



Step 5: Setting the comparator lower limit value

Select a digit position to set a value using the ◀ and ▶ keys, and the selected digit starts flashing.

Then, set a value using the ▲ and ▼ keys.

Setting range (unit: mm)

0.000 to ± 99.999 (1um sensor) or

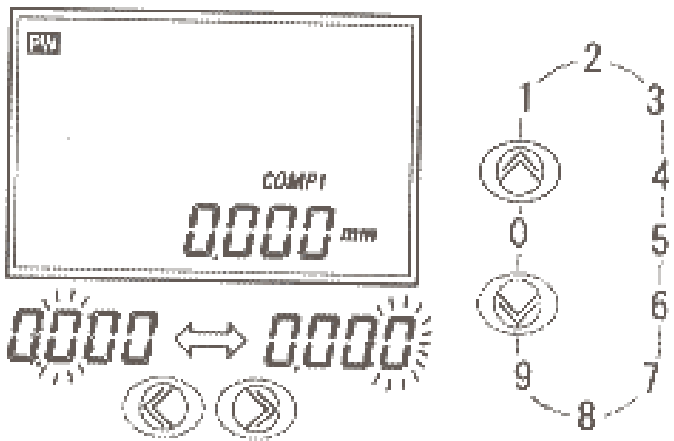
0.00 to ± 999.99 (10um sensor)

Setting range (unit: inch)

0.00000 to ± 9.99995 (1um sensor) or

0.000 to ± 99.9995 (10um sensor)

When the LOWER set value a measured value, the LOWER output photoMOS relay is turned on.



Step 6: Setting the comparator upper limit value

Select a digit position to set a value using the and keys, and the selected digit starts flashing.

Then, set a value using the and keys.

Setting range (unit: mm)

0.000 to ± 99.999 (1um sensor) or

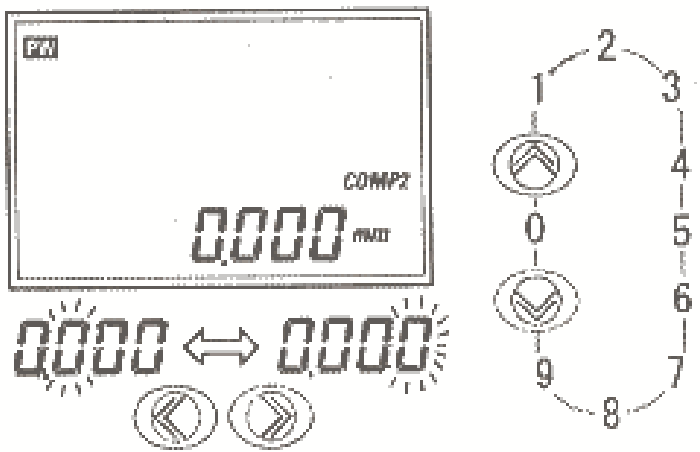
0.00 to ± 999.99 (10um sensor)

Setting range (unit: inch)

0.00000 to ± 9.99995 (1um sensor) or

0.000 to ± 99.9995 (10um sensor)

When the UPPER set value ⟪ a measured value, the UPPER output photoMOS relay is turned on.



4.4 Measurement

1. Move the gauge sensor spindle to verify the displayed value varies correspondingly.

   Press the RESET switch on the front panel for at least 3 sec., or reset by applying one pulse of Lo level voltage signal with a pulse width of minimum 20 us to pin 32 of the BCD OUT connector. After resetting, start measurement.

2. If a count error occurs in the counter circuit of this equipment, the display section begins to flash indicating an error.

   In such a case, restart measurement by pressing the RESET switch on the front panel for at least 3 sec., or resetting by applying one pulse of Lo level voltage signal with a pulse width of minimum 20 us to pin 32 of the BCD OUT connector. However, resetting is not effective when the peak hold start has been made. In this case, first stop the peak hold, and then make the resetting.

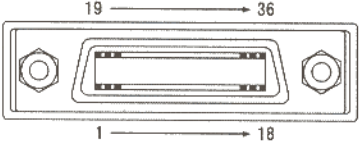
3. To hold the displayed value and BCD output data, enter the Lo level voltage signal to pin 31.

   This feature is not available for comparator output.

5. BCD OUT

5.1 Connector Pin Arrangement

The BCD OUT connector on the rear panel is used to connect the serial BCD output, hold input, reset input, BUSY input, and peak hold start/stop input signals. The pin arrangement of each signal is shown below.



BCD OUT

Pin No.	Signal	Pin No.	Signal
1	CLOCK	19	N.C.
2	DATA	20	N.C.
3	N.C.	21	Peak hold start input
4	N.C.	22	Peak hold stop input
5	N.C.	23	N.C.
6	N.C.	24	N.C.
7	N.C.	25	N.C.
8	N.C.	26	N.C.
9	N.C.	27	N.C.
10	N.C.	28	N.C.
11	N.C.	29	N.C.
12	N.C.	30	N.C.
13	N.C.	31	Hold input
14	N.C.	32	Reset input
15	N.C.	33	BUSY input
16	N.C.	34	Comparator gate input
17	N.C.	35	N.C.
18	N.C.	36	Common

Receptacle	DX10A-36S (manufactured by HIROSE)	
Applicable plug	DX40-36P (Manufactured by HIROSE)	
Die-cast cover	DX36-CV1 (manufactured by HIROSE)	
Applicable cable	Conductor size	AWG#30
	Conductor composition	7/0.1
	Insulator outer dimension	ϕ 0.5
	Cable UL style	UL20276/UL2789

CAUTION ! Limit the maximum cable length to 3 m.

5.2 Explanation of Signals

Serial BCD Output

Pin 1	CLOCK
Pin 2	DATA
Pin 3	COM (0 V)

Specifications

Serial BCD output (transmission method: clock synchronous serial transmission).

Displayed values are output to a printer, etc.

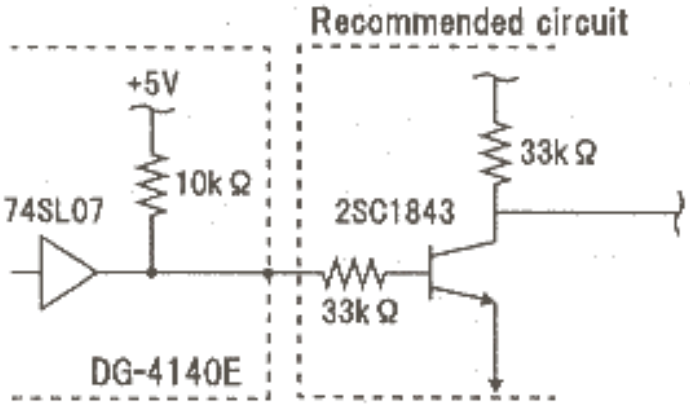
Connector connection

Turn off the power before connecting the BCD output cable.

Electrical characteristics

All the output signals are TTL output.

HIGH : V_{OH}>4.0V/LOW : V_{OL}>0.4V



Explanation of output signals

- CLOCK (pin No. 1)

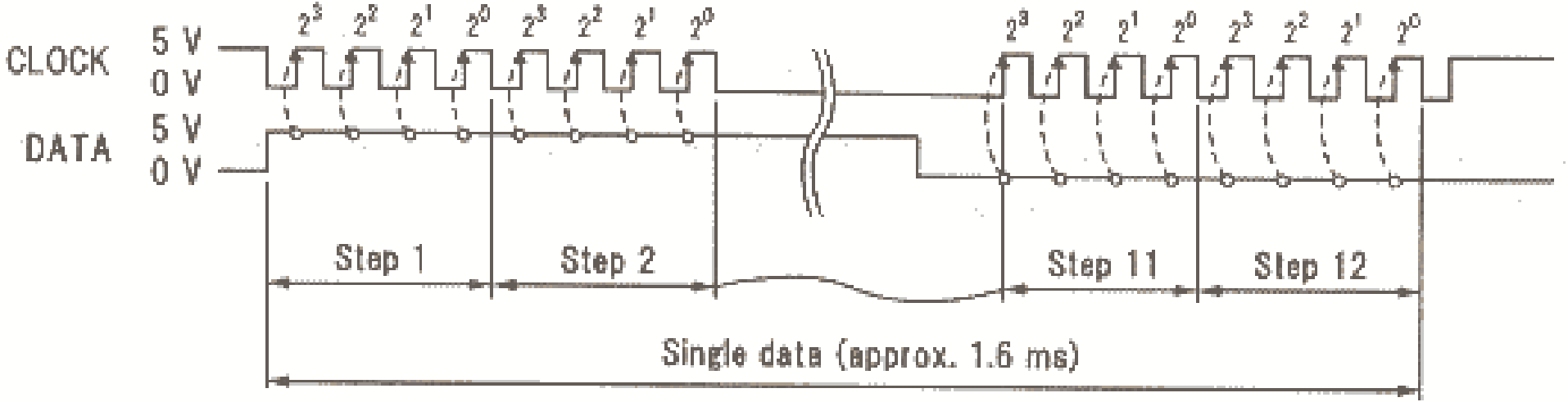
  Timing clock for 4-bit data.
  Frequency: Approx. 40kHz (see the timing chart.)

- DATA (pin No. 2)

  Signals are output in serial mode by expressing each data value in 12 discrete steps as shown in the diagram on the right. Each step consists of four bits.
  Signal common (pin No. 36).
  Common to all signals.

Step	Name	2^3	2^2	2^1	2^0	Description
1	F_H	1	1	1	1	step 1 is indicated by F^H
2	E_H	1	1	1	0	E^H indicates that the next value is the 6th
3	10^5 digit data	2^3	2^2	2^1	2^0	6th digit(10^5)of lineargauge LCD is output
4	10^4 digit data	2^3	2^2	2^1	2^0	5th digit(10^4)of lineargauge LCD is output
5	10^3 digit data	2^3	2^2	2^1	2^0	4th digit(10^3)of lineargauge LCD is output
6	10^2 digit data	2^3	2^2	2^1	2^0	3rd digit(10^2)of lineargauge LCD is output
7	10^1 digit data	2^3	2^2	2^1	2^0	2nd digit(10^1)of lineargauge LCD is output
8	10^0 digit data	2^3	2^2	2^1	2^0	1st digit(10^0)of lineargauge LCD is output
9	Decimal Point	0	0	0		1 2 3 4 5 6 .
		0	0	1		1 2 3 4 5 . 6
		0	1	1		1 2 3 4 . 5 6
		0	1	0		1 2 3 . 4 5 6
		1	0	1		1 2 . 3 4 5 6
		1	0	0		1 . 2 3 4 5 6
		1	1	1		. 1 2 3 4 5 6
	Sign				0	+ sign
					1	− sign
10	Unit	0	0	0	0	No Unit
		0	0	0	1	m/s
		0	0	1	0	inch/s
		0	0	1	1	rps
		0	1	0	0	rpm
		0	1	0	1	inch
		0	1	1	0	mm
11	Error	E				High when an error occurs
	Not use		×			Not used
	MAX			Max		High for maximum display
	MIN				Min	High for minimum display
12	END	0	0	0	0	End of output of one value

Timing chart



5.3 External Command Input

1) Peak hold start input

- Pin 21
- When Lo level voltage signal is input, peak hold is started. A peak hold value is displayed and output to the serial BCD output, continued until the peak hold stop signal is input.

2) Peak hold stop input

- Pin 22
- When Lo level voltage signal is input, peak hold status is canceled, returning the displayed value and serial BCD output to the normal measurement status.

3) Hold input

- Pin 31
- When Lo level voltage signal is input, the displayed value and serial BCD output enter the hold status.
  The hold status is maintained during Lo level input.
  However, the counter circuit continues the counting operation (including the peak hold operation and reset operation) in response to the input signal from the gauge sensor. Accordingly, if the hold status is canceled, the displayed value and serial BCD output data return to the current values at the moment of cancellation.
  If a change is made to the parameter settings during the hold status, the parameter value can be changed, but is not

applied to the displayed value or serial BCD output value until the hold status is canceled.
The comparator output data is output in response to the counting operation regardless of the hold input.

4) Reset input

- Pin 32
- When Lo level voltage signal is input, the displayed value and error indication are reset. The reset status continues during Lo level input. If the displayed value overflows during peak hold start status, both are not reset. In this case, enter the peak hold stop signal once, and then execute the reset operation.

5) BUSY input

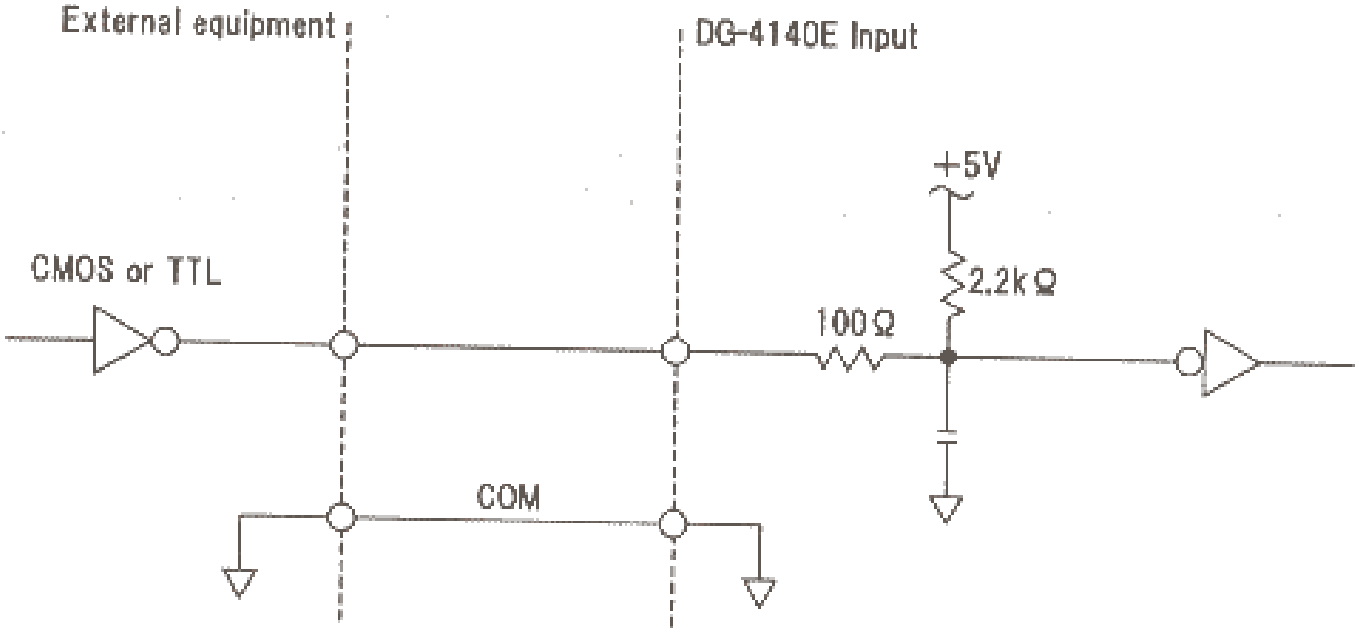
- Pin 33
- Same as the hold input in 3).

6) Comparator gate input

- Pin 34
- Lo level voltage signal input causes Pass/Fail determination to forcibly stop, setting all Pass/Fail determination outputs to OFF. During the ON state, the LCD background color turns to red.

Recommended Interface

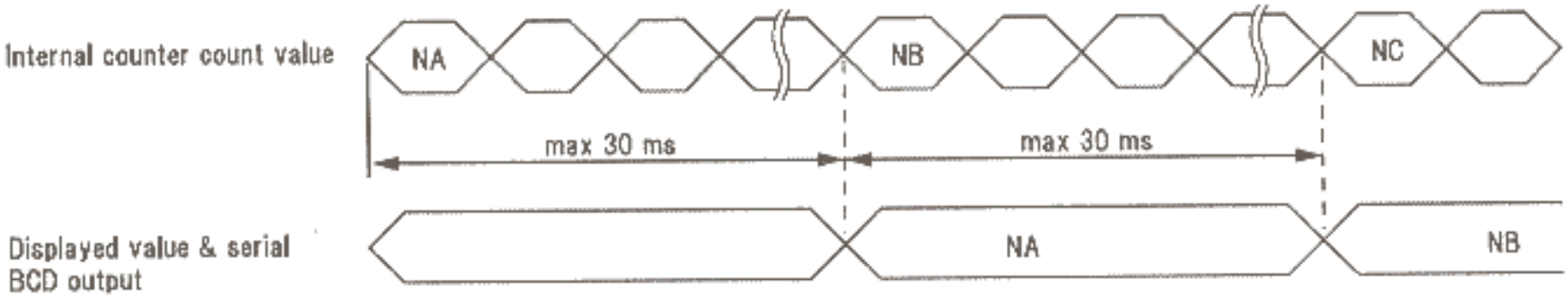
Peak hold start input, peak hold stop input, hold input, reset input, BUSY input, comparator gate input



Lo level input voltage	0 to 1.4 V
Hi level input voltage	3 to 5.25 V
Input impedance	1kΩ or larger

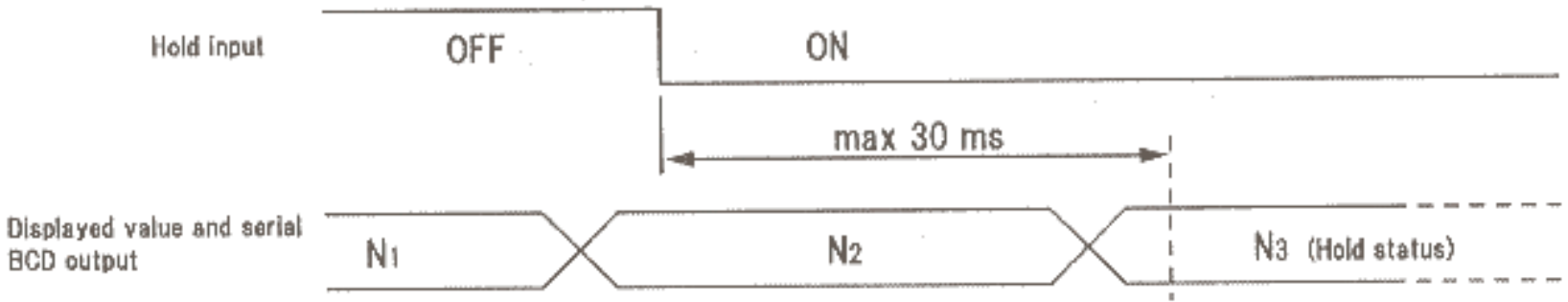
Timing Charts

- Data update timing chart



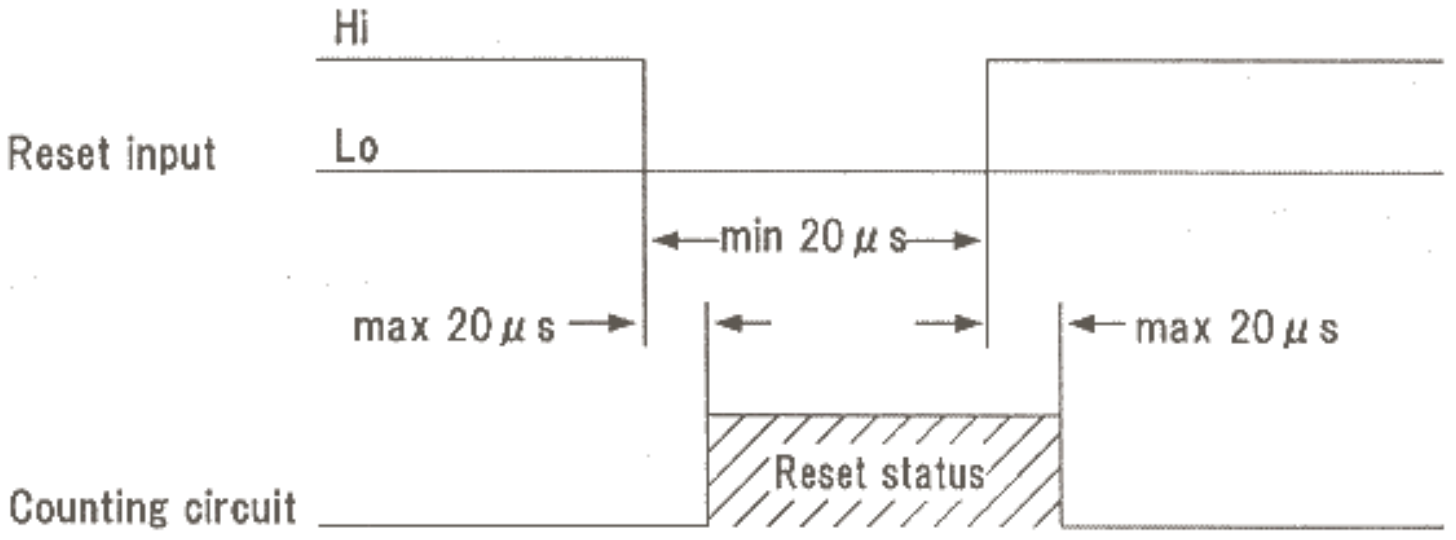
- Hold input and BUSY input timing chart

  Maximum time is 30 ms from hold signal input until the displayed value and serial BCD output data enter the hold status.



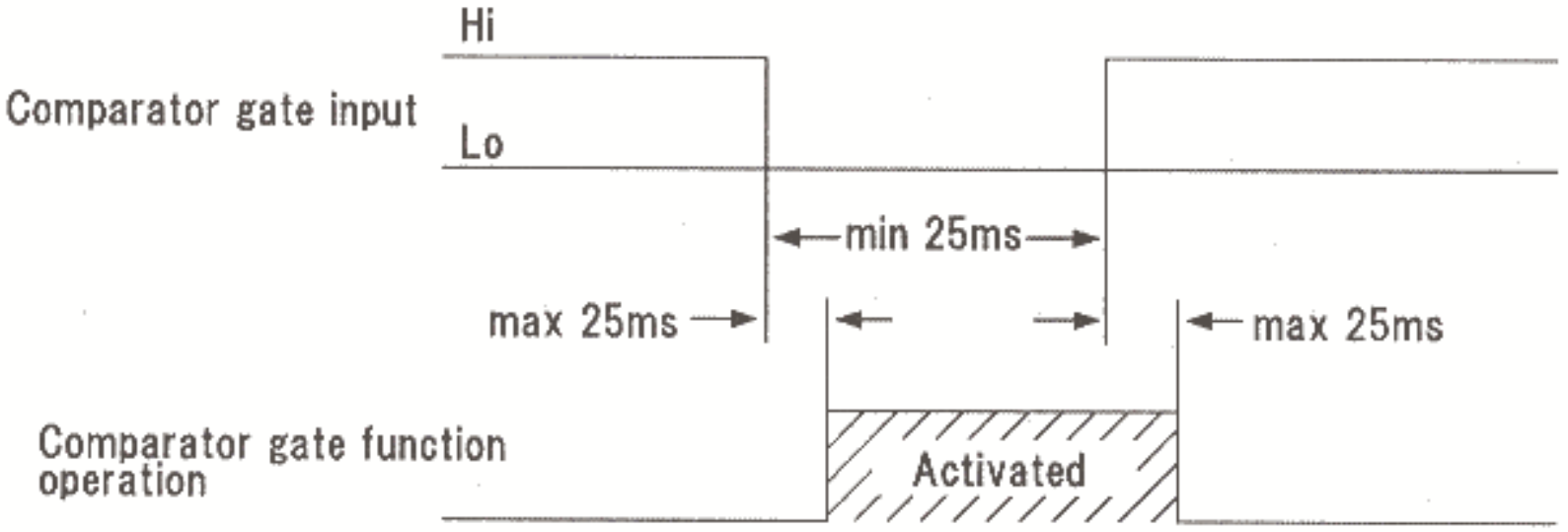
- Reset input timing chart (BCD OUT connector)

  The reset signal must have a minimum pulse width of 20 us.
  Both the time from reset signal input to reset status entry and the time from reset signal cancellation to reset status cancellation are maximum 20 us.



- Comparator gate input timing chart (BCD OUT connector)

The comparator gate signal must have a minimum pulse wide of 30 ms.
Both the time from comparator gate signal input to function activation and the time from comparator gate signal cancellation to function cancellation are maximum 30 ms.



6. TROUBLESHOOTING

6.1 Measurement Error (Displayed Value Flashing)

If a measurement error occurs, the displayed value starts flashing; this does not imply a failure of this device.
If a displayed value overflows, it does not flash.

Measurement Error

1. Speed of the sensor spindle has exceeded the maximum response speed specified for each sensor.

   The maximum response speed may be exceeded due to impact generated at the moment of spindle contact to the object under measurement.

2. Sensor input signal has been influenced by external noise.
3. "90o phase difference" of the sensor output signal has deviated from normal.
4. Displayed value has exceeded the maximum value.

Troubleshooting

1. Reduce the speed of the measured object or sensor so that the speed of the sensor spindle will be reduced.
2. a. Change the wiring route when the sensor signal cable is near a noise source (motor, etc.).

   b. Minimize the sensor signal cable length.
3. Replace the sensor with a new unit.
4. Check the offset and factor settings, then modify the settings to prevent the displayed value from exceeding the maximum value.

Recovery from measurement errors

Upon completion of taking proper measures, reset this equipment.

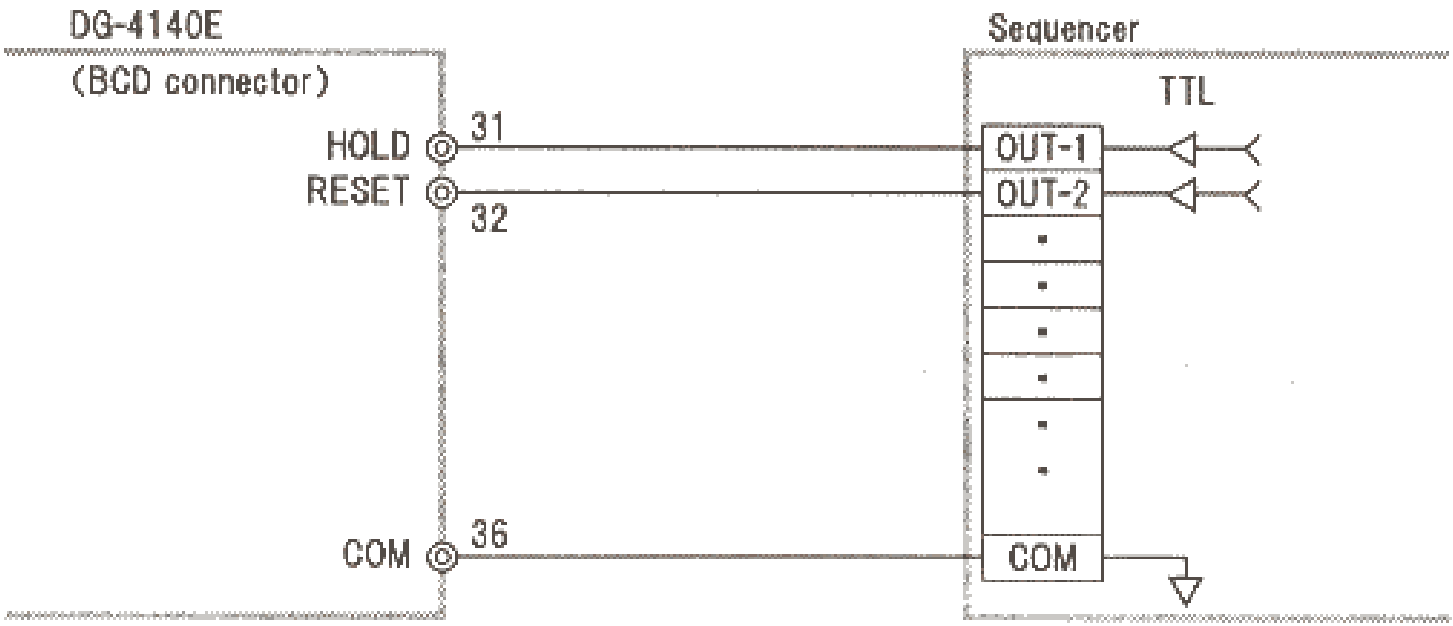
- If this equipment remains in the error state after the above troubleshooting, contact Ono Sokki.

7. SEQUENCER CONNECTION

7.1 Connecting control signals

To connect the hold or reset signal, enter the TTL signal to each pin of the BCD connector.

Example connection



CAUTION ! **Care must be taken that the BCD connector receives a hold or reset signal for voltage signal input.**

SPECIFICATIONS

8.1 Counter signal input section

<table>
<tr><td>Amplification type</td><td colspan="2">2-channel waveform shaping</td></tr>
<tr><td>Signal waveform</td><td colspan="2">Square wave and 90° phase difference signal</td></tr>
<tr><td rowspan="3">Input impedance</td><td colspan="2">47 kΩ min.</td></tr>
<tr><td>Lo level input</td><td>0 to 1.4V</td></tr>
<tr><td>Hi level input</td><td>3 to 5.25V</td></tr>
<tr><td>Frequency range</td><td colspan="2">DC to 300kHz (with ONO SOKKI sensor)</td></tr>
<tr><td>Input plug receptacle</td><td colspan="2">R03-R6F (Manufactured by Tajimi-Radio) See the table below for line connection.
<table>
<tr><td>Pin No.</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr>
<tr><td>Signal</td><td>SIG 1</td><td>SIG 2</td><td>+5 V</td><td>- - -</td><td>COM</td><td>- - -</td></tr>
</table></td></tr>
</table>

8.2 Count display section

Counting system	Reversible counting	
No. of counter digits	Decimal 6 digits	
No. of display digits	1 digit for polarity and 6 digits for numerics	
Display range	Only minus symbol "-" displayed for polarity	
	Unit (mm)	0.000 to ± 99.999 or 0.00 to ± 99.9999
	Unit (inch)	0.00000 to ± 9.99995 or 0.0000 to ± 99.9995
Min. measuring unit	1 μm/10 μm	
Zero suppression	Digits to left of 1mm digit are zero-suppressed.	
Display device	7-segment LCD	
Background color	Interlock with the comparator (ON: Green, UPPER/LOWER: Red)	
Character height	10 mm	
Error indication	Flashing	
Unit indication	mm/inch switching (indicated as mm/IN)	

8.3 BCD I/O section

Input plug receptacle: DX10-36S (Manufactured by HIROSE)

①	Serial BCD output	CLOCK and DATA
②	Peak hold start input	When Lo level voltage signal is input, peak hold is started. A peak hold value is displayed and output to the serial BCD output.
③	Peak hold stop input	When Lo level voltage signal is input, peak hold status is canceled, returning the displayed value and serial BCD output to the normal measurement status.
④	Hold input	When Lo level voltage signal is input, the displayed value and serial BCD output enter the hold status. The hold status is maintained during Lo level input.
⑤	Reset input	When Lo level voltage signal is input, the displayed value and error indication are reset. The reset status continues during Lo level input.
⑥	BUSY input	When Lo level voltage signal is input, the displayed value and serial BCD output enter the hold status. The hold status is maintained during Lo level input.
⑦	Comparator gate input	Lo level voltage signal input causes Pass/Fail determination to forcibly stop, setting all Pass/Fail determination outputs to OFF.

Common to ② to ⑦.

Lo level input voltage	0 to 1.4 V
Hi level input voltage	3 to 5.25 V
Input impedance	1kΩ or larger

CAUTION ! **Limit the maximum BCD cable length to 3 m.**

8.4 Comparator output section

No. of set digits	1 digit for polarity and 5 or 6 digits for numerics (decimal point is the same as in the count display section)	
No. of set steps	2 steps	
Output conditions	LOWER	ON when LOWER set value ≧ count value
	OK	ON when LOWER set value < count value< UPPER set value
	UPPER	ON when UPPER set value ≦ count value However, if the comparator gate signal is input, the Pass/Fail determination and output are turned off.
Output method	Semiconductor relay (each 1-make contact)	
Max. contact capacity	30 VDC, 0.1A	
Contact ON resistance	50 Ω max.	

8.5 Power supply section

Source voltage	12 to 24 VDC (terminal strip input)
	12VDC AC adapter (power jack input)
Current consumption	0.3A max.
Voltage fluctuation	± 10%

8.6 Others

External dimensions	74 (W) x 142 (H) x 303 (D) mm
Weight	Approx. 1.9kg

8.7 Environmental conditions

Operating temperature range	0 to +40 ℃
Storage temperature range	-10 to +55 ℃
Operating humidity range	Max. 95% (no condensation)
Storage humidity range	Max. 95% (no condensation)
Pollution degree	Degree 2
Installation category	Category II
Max. altitude	2000 m Indoor operation only

8.8 Accessories

Panel mounting fixture	1 set
Instruction manual	1

8.9 Options

Dedicated AC adapter	MODEL S8459 (manufactured by Kaga Component)	
	INPUT	100 to 240 VAC, 50/60Hz
	OUTPUT	12 VDC, 1A
Terminal strip input power unit (recommended)	MODEL: S82K-00724 (manufactured by OMRON)	
	INPUT	100 to 240 VAC, 50/60Hz
	OUTPUT	24 VDC, 0.3A
Sensor extension cable	AA-801	5 m
	AA-802	10 m
	AA-803	20 m

8.10 Conformance standards

CE marking conformance standard (EMC command)

Emission: EN61000-6-4

Immunity: EN61000-6-2

FCC18, class A satisfied

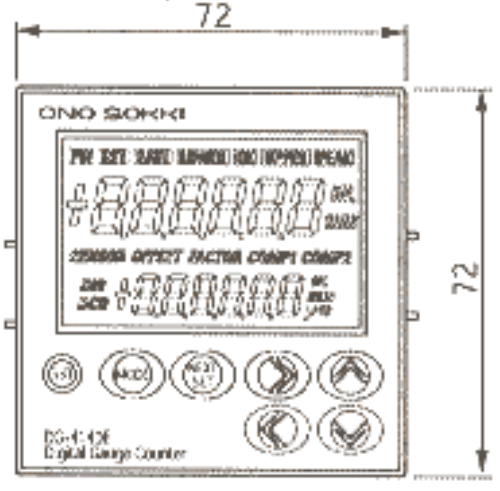
This equipment has been tested and found to comply with the limitsfor a Class A digital device, pursuant to Part 18 of the FCC Rules.

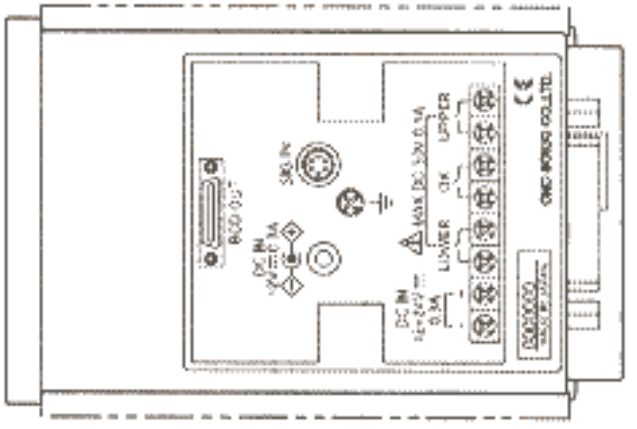
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

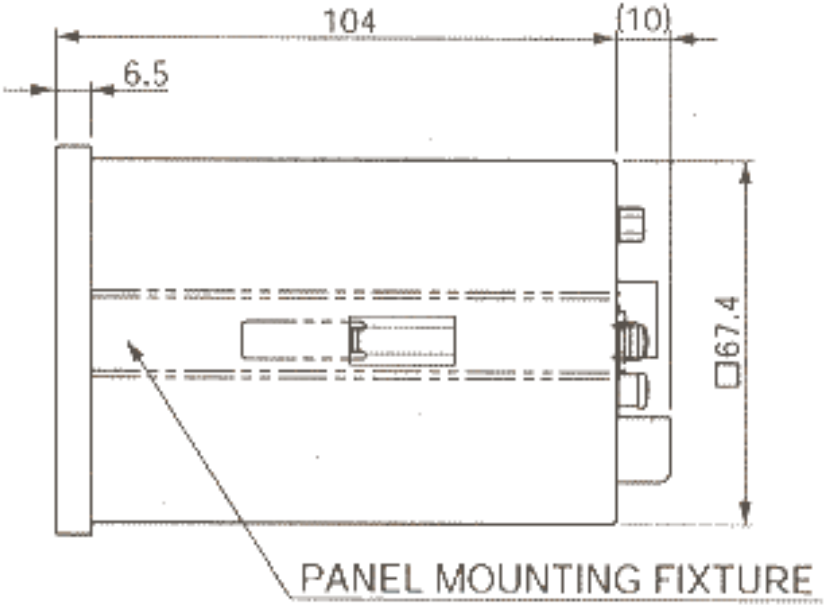
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

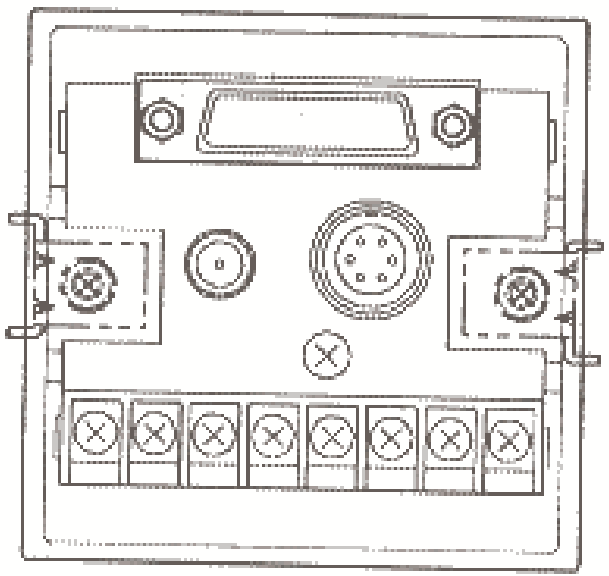
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

9. DIMENSIONAL OUTLINE DRAWINGS

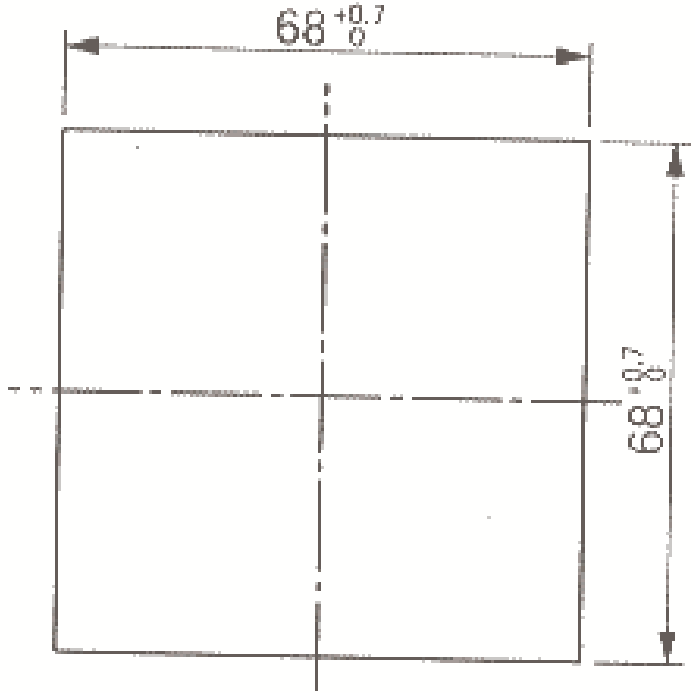








Be sure that the panel mounting plate thickness shall be 1 to 3.2mm.



PANEL CUTOUT DIMENSIONS