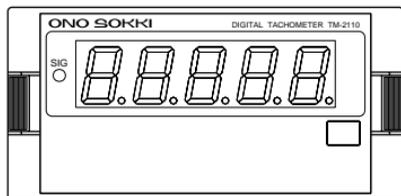


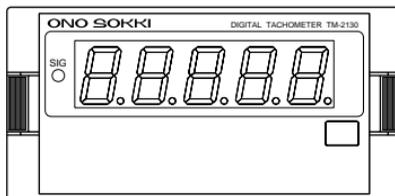
# TM-2100 Series

## Digital Tachometer

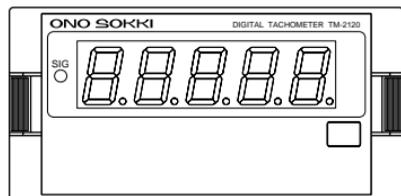
### INSTRUCTION MANUAL



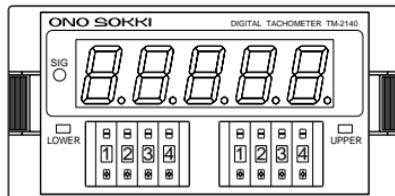
**TM-2110**



**TM-2130**



**TM-2120**



**TM-2140**

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2. The contents of this document are subject to change without notice.
3. This document has been produced based on a series of strict verifications and inspections. Should a failure occur nonetheless, please inform our sales representative or sales office.
4. Ono Sokki shall have no liability for any effect resulting from any operation, whether or not the effect is attributable to a defect in the documentation.

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## Warranty

1. This product is covered by a warranty for a period of one year from the date of purchase.
  2. This warranty covers free-of-charge repair for defects judged to be the responsibility of the manufacturer, i.e., defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
  3. For free-of-charge repair, contact either your sales representative or our sales office nearby.
  4. The following failures will be handled on a fee basis even during the warranty period.
    - (a) Failures occurring through misuse, mis-operation, or modification
    - (b) Failures occurring through mishandling (dropping) or transportation
    - (c) Failures occurring through natural calamities (fires, earthquakes, flooding, and lightning), environmental disruption, or abnormal voltage.
- \* For repairs after the warranty period expired, contact your sales representative or our sales office nearby.

# Preface

This manual describes the operation method, setting method, precaution for use, specifications, etc. of the TM-2100 Series digital tachometer (TM-2110/2120/2130/2140).

To ensure that you get the most out of your new TM-2100 Series digital tachometer, we strongly recommend that you read this manual thoroughly and follow the instruction for operation contained in it. This manual is used as the warranty, too. Keep it carefully after reading it.

## Overview and Features

**Overview** The TM-2100 Series digital tachometer is a revolution indicator of a size of DIN Standard.

**Features**

- Number of revolution, speed, frequency, etc. are indicated directly.
- Function to follow up sharp deceleration.
- Selectable input frequency range.
- BCD output function (Only TM-2120, however)
- Analog output function (Only TM-2130, however)
- Comparator function (Only, TM-2140, however)

# For Your Safety

Please read this document and instruction manual for the TM-2100 Series to ensure safe and proper use of your TM-2100 Series digital tachometer.

Ono Sokki, Ltd. bears no responsibility for or makes any warrantee regarding damages or injury resulting from failure to follow directions given within this document and the instruction manual for the TM-2100 Series during operation.

## Meaning of Symbols

In this document precautions are classified into two categories: **WARNING** and **CAUTION**.

This depends on the degree of danger or damage possible if the precaution is ignored and the product is used incorrectly.

 <b>WARNING</b>	This symbol is used to indicate precautions where there is a risk of death or serious personal injury to the operator if the product is handled incorrectly.
 <b>CAUTION</b>	This symbol is used to indicate precautions where there is a risk of some personal injury to the operator or only material damage to the product if the product is handled incorrectly.



## WARNING

### Before Using

- Do not operate this product in a location where there is explosive gas or vapor.  
Using this product where there is combustible or explosive gas or vapor may result in an explosion.
- Avoid using in locations of high temperature as there may be a risk of fire.  
Avoid using in locations of extremely high temperature. Using this product in a location having a temperature exceeding the operational temperature range may cause the product to catch on fire.
- Do not block the heat radiation system as there is a risk of fire if heat builds up inside the product.  
Place the product away from the wall in a location with the best ventilation possible.
- Do not remove the casing or take apart this product. Use of this product without its casing or while taken apart may result in damage to equipment or electric shock.  
When internal adjustment, inspection or repairs are required please contact the retail store where you bought the product or your nearest Ono Sokki sales office.
- Do not splash or spill water on the product as doing so may cause fire or electric shock due to short or increased heat.  
If water does happen to get inside the product, unplug the power cord immediately and call the retail store where you bought the product or your nearest Ono Sokki sales office as soon as possible.



**WARNING**

### **Precautions Regarding Electric Shock**

- Never cut the internal or external ground wire of a product or disconnect the wire connected to the protective ground terminal of the product as doing so may result in electric shock or damage to the product.
- Before connecting a product to a device to be measured or external circuit, be sure to check that the product is properly grounded and that the product's power is off. Connecting to external equipment while not grounded or while power is still on may result in electric shock.
- Be sure the power always meets specified voltage and frequency requirements.  
Use of power other than that specified may result in electric shock, fire, or damage to the product.
- Check that power is off before touching parts of the product where voltage/current is output or circuits connected to parts where voltage/current is output. Touching such parts without turning power off may result in electric shock. Be sure to sufficiently insulate circuits from output voltage/current.
- If you hear thunder, do not touch any metal parts of the product or the plug as there is a risk of electric shock from conducted lightning.  
Do not use this product outdoors if you hear thunder.



## WARNING

### If a Problem Occurs

- Unplug the product immediately if any metal, water, or foreign object should fall inside.  
Continued use after metal, water, or foreign object has fallen inside may result in fire or electric shock. After unplugging the product immediately, contact the retail store where you bought the product or your nearest Ono Sokki sales office as soon as possible.
- Unplug the product if you sense smoke, strange noise or strange smell coming from the product or if you accidentally drop it or damage it.  
Continued use may result in fire or electric shock. After immediately unplugging the product, contact the retail store where you bought the product or your nearest Ono Sokki sales office as soon as possible.

### About Grounding

- The  $\oplus$  symbol is used to indicate protective grounding. Before turning on the power, be sure to connect the terminal marked with this symbol to the protective grounding terminal on the power supply side. Failure to provide protective grounding may result in electric shock.  
The wire used for this connection should have a cross-sectional area of 1 mm<sup>2</sup> or more and be thicker than the wires used to supply the power.
- Do not supply power when there is no protective grounding or when there is a chance that protective grounding has not been performed properly.



**CAUTION**

## About Installation

- Do not install the product in a location where there is oily smoke or vapor or where there is high humidity or lots of dust.  
Electricity could conduct through the oil, moisture, or dust resulting in fire or electric shock.
- Do not install the product in locations subject to extremely high temperature or direct sunlight as doing so may result in fire.

## Maintenance and Inspection

- When using this product on a rack, check the followings periodically for secure operation (It is not necessary to check frequently).
  - \* Check the mounting screws of the terminal block on the rear panel for looseness.
  - \* Check the cables for breakage and damage of their covers (when the cables are long, in particular).
  - \* Confirm that the input signal is kept at the initial level.



## CAUTION

### Prevention of Noise

- Although this product is so designed that it will not be easily affected by a noise, it may be troubled with a noise, depending on its installation condition.

In this case, take the following measures. H. COUNTER-MEASURES AGAINST NOISE

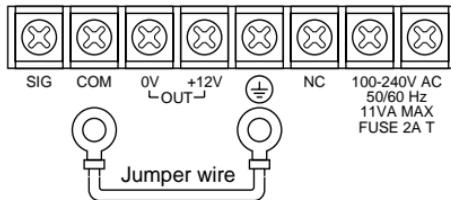
- \* Supply the power to this device through a system independent from the system of the other large-capacity electric devices.
- \* Install the power cable and signal cable apart from each other as far as possible.
- \* Do not increase the signal cable length more than necessary.
- \* Use a shielded cable as the signal cable, as long as possible.

If this device malfunctions because of an external noise (For example, when a value is indicated while the rotating body is at a standstill), consider the using condition of the

connected devices and connect the attached jumper wire as follows, and the effects of the noise may be reduced.

If the common signal wire is connected to the case on the sensor side (the common signal wire is installed), however, two connections of the jumper wire are grounded and the difference of the ground voltage between those two connections is added to the signal, and that can cause malfunction. In this case, do not connect the jumper wire.

[Ground the common signal wire]



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**TM-2110**



**TM-2120**



**TM-2130**

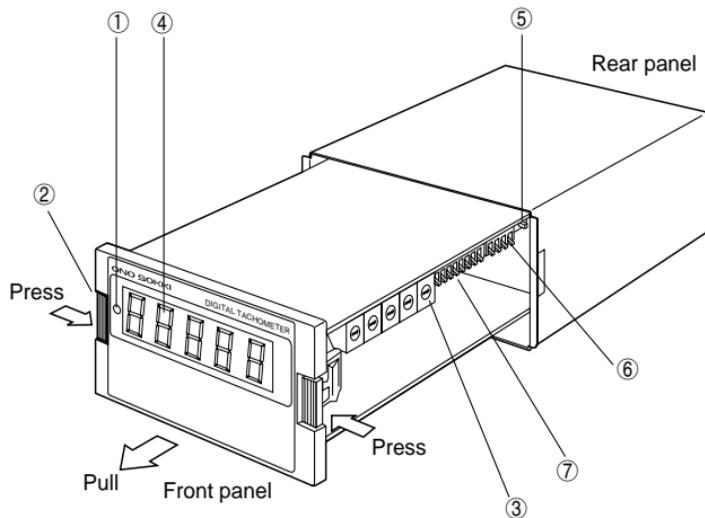


**TM-2140**



# 1. NAMES AND FUNCTIONS OF PARTS

## Names and Functions of Parts of TM-2110



### Initial set values list

- Multiplier setting rotary switch



$\times 1$   $\times 10^{-1}$   $\times 10^{-2}$   $\times 10^{-3}$   $\times 10^{-4}$

Initial set value: 1.0000



Change with a blade-tip screwdriver.

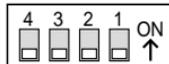
- Input amplification type selector slide switch



DC AC

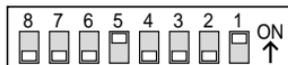
Initial set value: AC amplification

- 4-bit switch for setting input signals



Initial set value: Voltage input  
Filter OFF

- 8-bit switches for setting range indication/range



Initial set value: Wide range  
Index  $\times 1$   
No decimal point

① SIG indicator

Flashes when signals are input from the sensor connected to the TM-2110 digital tachometer.

The flashing speed is synchronized with the input signals. If low-revolution (low-frequency) signals are input, this indicator flashes slowly, and high-revolution (high-frequency) signals are input, this indicator flashes fast.

② Fitting/Removing knobs

The body can be pulled out of the case by pressing the knobs on both sides in the directions of the arrows (⇔) and pulling out them.

**Caution!** Before setting the switches in the body, turn off the power for the TM-2110 and disconnect the all connected wires and pull out the body from the case.

③ Multiplier setting rotary switch

(See X3. SETTING OF DEVICEĒ. (Page 20))

A switch to set the multipliers for reading the input signal directly. Change its set value by turning it with a blade-tip screwdriver.

④ Indicator (Large green LED)/Error indicator

Indicates each measured value by a 5-digit value. If the accurate value cannot be indicated, the following message flashes.

- 11111 (Five 1's flash): Input frequency is higher than 20 kHz.
- 22222 (Five 2's flash): Value is larger than 99999.
- 33333 (Five 3's flash): Bit switches for setting condition are set wrongly.

⑤ Input amplification type selector slide switch  
(See X3. SETTING OF DEVICEĒ. (Page 20))

A slide switch used to set the amplification type of the input signals to AC or DC. The amplification type (AC or DC) depends on the sensor connected to the TM-2110.

⑥ 4-bit switch for setting input signals

(See X3. SETTING OF DEVICEĒ. (Page 20))

- No. 1 Set to ON only when the sensor connected to the TM-2110 is of no-voltage output type.
- No. 2 Set to ON only when the signals input to the TM-2110 is filtered (Effective only when switch 1 set to ON, however).
- No. 3/4 Unused (Keep at OFF).

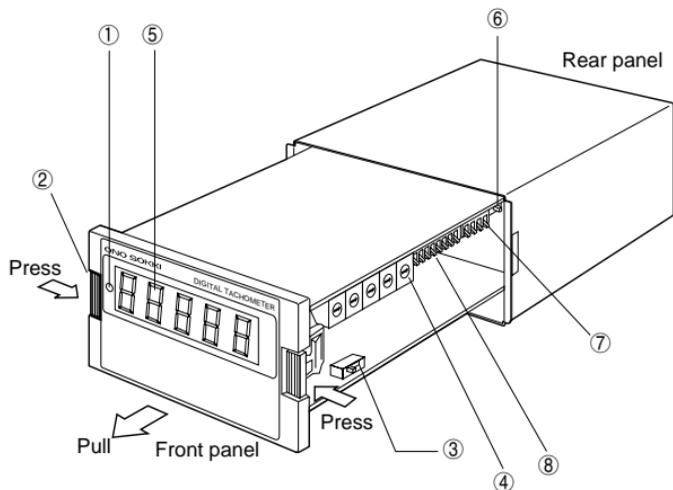
⑦ 8-bit switches for setting indication/range

(See X3. SETTING OF DEVICEĒ. (Page 20))

- No. 1 (Input frequency range setting switch)

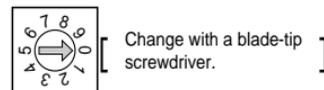
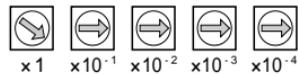
Wide range (0.1 Hz ~ 20 kHz):	ON
High range (1 Hz ~ 20 kHz):	OFF
- No. 2 Unused (Keep at OFF).
- No. 3 ~ 5 Set the indexes to read the indicated value directly.
- No. 6 ~ 8 Set the decimal point of the indicated value.

## Names and Functions of Parts of TM-2120

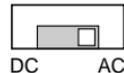


Initial set values list

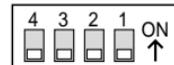
- Multiplier setting rotary switch



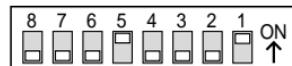
- Input amplification type selector slide switch



- 4-bit switch for setting input signals



- 8-bit switches for setting indication/range



- BCD output mode changeover switch



① SIG indicator

Flashes when signals are input from the sensor connected to the TM-2120 digital tachometer.

The flashing speed is synchronized with the input signals. If low-revolution (low-frequency) signals are input, this indicator flashes slowly, and high-revolution (high-frequency) signals are input, this indicator flashes fast.

② Fitting/Removing knobs

The body can be pulled out of the case by pressing the knobs on both sides in the directions of the arrows (⇔) and pulling out them.

**Caution!** Before setting the switches in the body, turn off the power for the TM-2120 and disconnect the all connected wires and pull out the body from the case.

③ BCD output mode changeover switch (See X4. SETTING OF BCD OUTPUT FUNCTIONE. (Page 27))

Used to change the mode of the digital signals output from the BCD output connector.

④ Multiplier setting rotary switch

(See X3. SETTING OF DEVICEE. (Page 20))

A switch to set the multipliers for reading the input signal directly. Change its set value by turning it with a blade-tip screwdriver.

⑤ Indicator (Large green LED)/Error indicator

Indicates each measured value by a 5-digit value. If the accurate value cannot be indicated, the following message flashes.

- 11111 (Five 1's flash): Input frequency is higher than 20 kHz.
- 22222 (Five 2's flash): Value is larger than 99999.
- 33333 (Five 3's flash): Bit switches for setting condition are set wrongly.

⑥ Input amplification type selector slide switch  
(See X3. SETTING OF DEVICEE. (Page 20))

A slide switch used to set the amplification type of the input signals to AC or DC. The amplification type (AC or DC) depends on the sensor connected to the TM-2120.

⑦ 4-bit switch for setting input signals

(See X3. SETTING OF DEVICEE. (Page 20))

- No. 1 Set to ON only when the sensor connected to the TM-2120 is of no-voltage output type.
- No. 2 Set to ON only when the signals input to the TM-2120 is filtered (Effective only when switch 1 set to ON, however).
- No. 3/4 Unused (Keep at OFF).

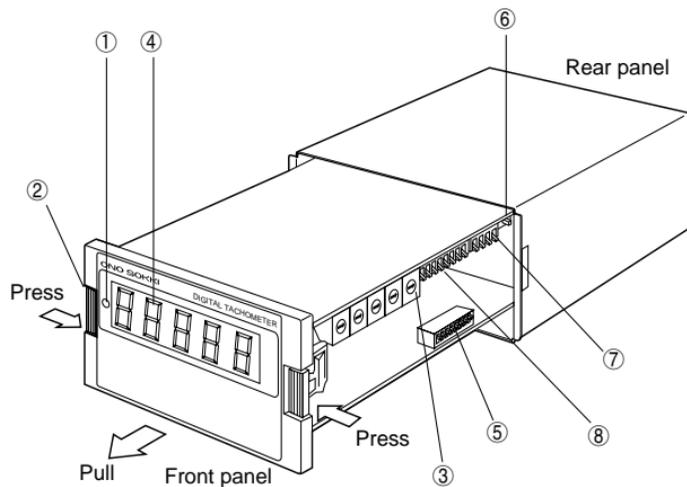
⑧ 8-bit switches for setting indication/range

(See X3. SETTING OF DEVICEE. (Page 20))

- No. 1 (Input frequency range setting switch)

Wide range (0.1 Hz ~ 20 kHz):	ON
High range (1 Hz ~ 20 kHz):	OFF
- No. 2 Unused (Keep at OFF).
- No. 3 ~ 5 Set the indexes to read the indicated value directly.
- No. 6 ~ 8 Set the decimal point of the indicated value.

## Names and Functions of Parts of TM-2130



### Initial set values list

- Multiplier setting rotary switch



Initial set value: 1.0000



Change with a blade-tip screwdriver.

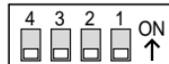
- Input amplification type selector slide switch



DC AC

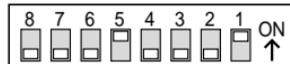
Initial set value: AC amplification

- 4-bit switch for setting input signals



Initial set value: Voltage input  
Filter OFF

- 8-bit switches for setting indication/range



Initial set value: Wide range  
Index x 1  
No decimal point

① SIG indicator

Flashes when signals are input from the sensor connected to the TM-2130 digital tachometer.

The flashing speed is synchronized with the input signals. If low-revolution (low-frequency) signals are input, this indicator flashes slowly, and high-revolution (high-frequency) signals are input, this indicator flashes fast.

② Fitting/Removing knobs

The body can be pulled out of the case by pressing the knobs on both sides in the directions of the arrows (⇔) and pulling out them.

**Caution!** Before setting the switches in the body, turn off the power for the TM-2130 and disconnect the all connected wires and pull out the body from the case.

③ Multiplier setting rotary switch

(See **✕3. SETTING OF DEVICEE.** (Page 20))

A switch to set the multipliers for reading the input signal directly. Change its set value by turning it with a blade-tip screwdriver.

④ Indicator (Large green LED)/Error indicator

Indicates each measured value by a 5-digit value. If the accurate value cannot be indicated, the following message flashes.

- 11111 (Five 1's flash): Input frequency is higher than 20 kHz.
- 22222 (Five 2's flash): Value is larger than 99999.
- 33333 (Five 3's flash): Bit switches for setting condition are set wrongly.

⑤ 8-bit frequency range/response setting switches (See **✕5.1/1 SETTING OF ANALOG OUTPUT FUNCTIONE.** (Page 29))

- No. 1 ~ 7 Frequency range setting switch

- No. 8 Response setting switch

⑥ Input amplification type selector slide switch  
(See **✕3. SETTING OF DEVICEE.** (Page 20))

A slide switch used to set the amplification type of the input signals to AC or DC. The amplification type (AC or DC) depends on the sensor connected to the TM-2130.

⑦ 4-bit switch for setting input signals

(See **✕3. SETTING OF DEVICEE.** (Page 20))

- No. 1 Set to ON only when the sensor connected to the TM-2130 is of no-voltage output type.

- No. 2 Set to ON only when the signals input to the TM-2130 is filtered (Effective only when switch 1 set to ON, however).

- No. 3/4 Unused (Keep at OFF).

⑧ 8-bit switches for setting indication/range

(See **✕3. SETTING OF DEVICEE.** (Page 20))

- No. 1 (Input frequency range setting switch)

Wide range (0.1 Hz ~ 20 kHz): ON

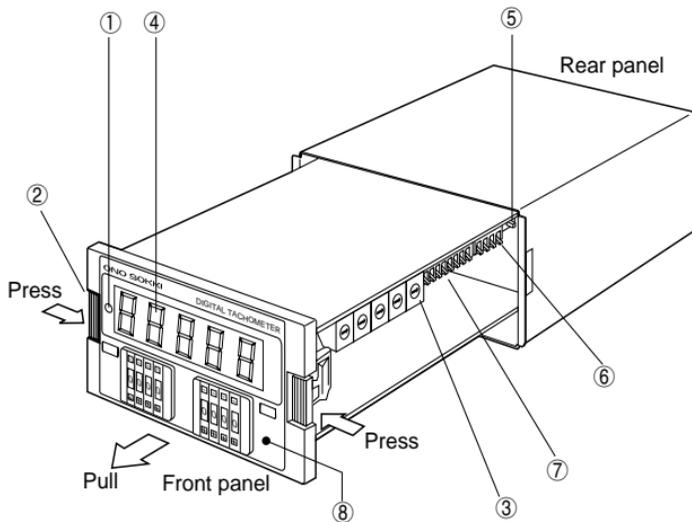
High range (1 Hz ~ 20 kHz): OFF

- No. 2 Unused (Keep at OFF).

- No. 3 ~ 5 Set the indexes to read the indicated value directly.

- No. 6 ~ 8 Set the decimal point of the indicated value.

## Names and Functions of Parts of TM-2140



### Initial set values list

- Multiplier setting rotary switch



$\times 1$   $\times 10^{-1}$   $\times 10^{-2}$   $\times 10^{-3}$   $\times 10^{-4}$

Initial set value: 1.0000



Change with a blade-tip screwdriver.

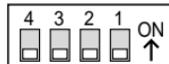
- Input amplification type selector slide switch



DC AC

Initial set value: AC amplification

- 4-bit switch for setting input signals



Initial set value: Voltage input  
Filter OFF

- 8-bit switches for setting indication/range



Initial set value: Wide range

Index  $\times 1$

No decimal point

① SIG indicator

Flashes when signals are input from the sensor connected to the TM-2140 digital tachometer.

The flashing speed is synchronized with the input signals. If low-revolution (low-frequency) signals are input, this indicator flashes slowly, and high-revolution (high-frequency) signals are input, this indicator flashes fast.

② Fitting/Removing knobs

The body can be pulled out of the case by pressing the knobs on both sides in the directions of the arrows (⇔) and pulling out them.

**Caution!** Before setting the switches in the body, turn off the power for the TM-2140 and disconnect the all connected wires and pull out the body from the case.

③ Multiplier setting rotary switch

(See  $\times 3$ . SETTING OF DEVICE $\bar{E}$ . (Page 20))

A switch to set the multipliers for reading the input signal directly. Change its set value by turning it with a blade-tip screwdriver.

④ Indicator (Large green LED)/Error indicator

Indicates each measured value by a 5-digit value. If the accurate value cannot be indicated, the following message flashes.

- 11111 (Five 1's flash): Input frequency is higher than 20 kHz.
- 22222 (Five 2's flash): Value is larger than 99999.
- 33333 (Five 3's flash): Bit switches for setting condition are set wrongly.

⑤ Input amplification type selector slide switch

(See  $\times 3$ . SETTING OF DEVICE $\bar{E}$ . (Page 20))

A slide switch used to set the amplification type of the input signals to AC or DC. The amplification type (AC or DC) depends on the sensor connected to the TM-2140.

⑥ 4-bit switch for setting input signals

(See  $\times 3$ . SETTING OF DEVICE $\bar{E}$ . (Page 20))

- No. 1 Set to ON only when the sensor connected to the TM-2140 is of no-voltage output type.
- No. 2 Set to ON only when the signals input to the TM-2140 is filtered (Effective only when switch 1 set to ON, however).
- No. 3/4 Unused (Keep at OFF).

⑦ 8-bit switches for setting indication/range

(See  $\times 3$ . SETTING OF DEVICE $\bar{E}$ . (Page 20))

- No. 1 (Input frequency range setting switch)

Wide range (0.1 Hz ~ 20 kHz): ON

High range (1 Hz ~ 20 kHz): OFF

- No. 2 Unused (Keep at OFF).
- No. 3 ~ 5 Set the indexes to read the indicated value directly.
- No. 6 ~ 8 Set the decimal point of the indicated value.

⑧ Comparator function setting section (See  $\times 6$ . SETTING OF COMPARATOR FUNCTION $\bar{E}$ . (Page 31))

## 2. MEASUREMENT PROCEDURE

### Check of precautions

See "For Your Safety" ( Page 2 )



### Check of accessories

See "9.SPECIFICATIONS" ( Page 36 )



### Setting of device

\* Be sure to set before connecting the cables.

#### Setting of signal input

Setting of type of input amplification  
Setting of type of sensor output  
Setting of filter input  
Setting of input frequency

A  
B  
C  
D

#### Setting of direct indication

How to obtain coefficient  
Setting of multipliers and indexes  
Setting of decimal point

E  
F  
G

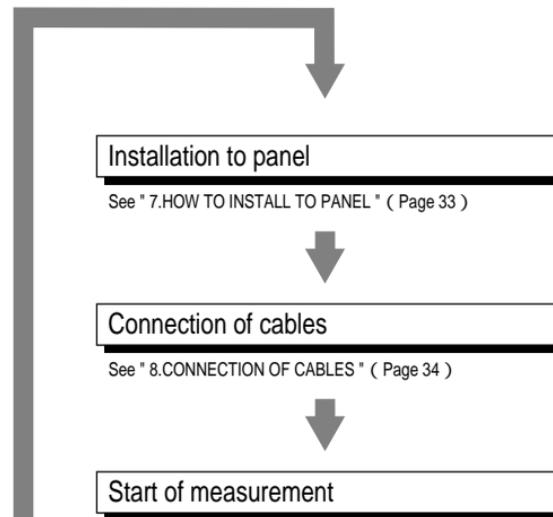
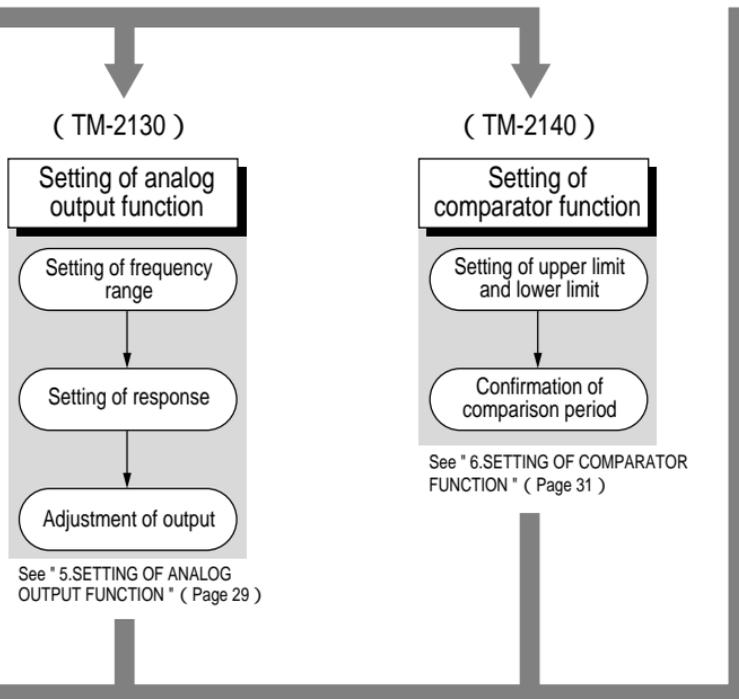
See "3.SETTING OF DEVICE" ( Page 20 )

( TM-2110 )

( TM-2120 )

### Setting of BCD output function

See "4.SETTING OF BCD OUTPUT FUNCTION" ( Page 27 )



## 3. SETTING OF DEVICE

### 3.1 Setting of Signal Input

#### ■ Setting of Type of Input Amplification (AC/DC)

Referring to the following table, set the input amplification type selector slide switch to AC or DC according to the type of the sensor to be connected.

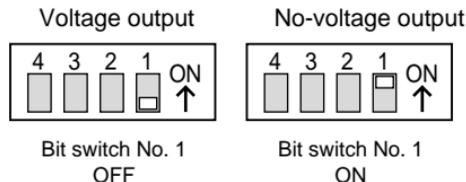


Switch	Sensor	Signal wave form
AC amplification	Electromagnetic sensor (MP-810/910, etc.)	
DC amplification	Magneto-electric sensor (MP-981) Photoelectric sensor (LG-910) Rotary encoder Proximity switch	

#### ■ Setting of Type of Sensor Output

Set the 4-bit switch No. 1 for setting the input signals according to the type of the output of the sensor to be connected; voltage output of sine wave or rectangular wave, or open-collector no-voltage output.

*Memo:* If the 4-bit switch No. 1 for setting the input signals is turned on,



while a voltage-output sensor is connected, the latter will be broken. Accordingly, be sure to turn it on only while an open-collector output sensor or a no-voltage output sensor is connected.

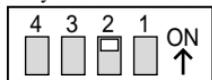
#### ■ Setting of Filter Input

Turn on the filter input to prevent a mistake in counting caused by chattering

Type of output	Sensor
Voltage output	Electromagnetic sensor (MP-910, etc.)
	Magneto-electric sensor (MP-981)
	Photoelectric sensor (LG-910)
	Rotary encoder
No-voltage output	Proximity switch/Photoelectric switch, etc.

only while a no-voltage output sensor is connected, by turning on the 4-bit switch No. 2 for setting input signals.

If the 4-bit switch No. 2 for setting input signals is turned on, the input signals of frequency above about 100 Hz are filtered. The input signals of 20



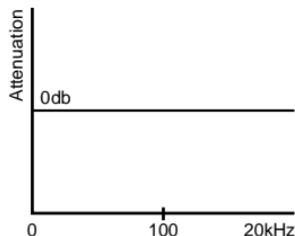
Bit switch No. 2  
ON

kHz are attenuated by -40 dB. This means that the input sensitivity becomes 1/100 of that when the 4-bit switch No. 2 is turned off.

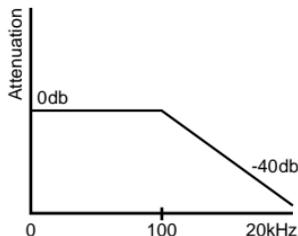
### ■ Setting of Input Frequency

Set the range with the 8-bit switches for setting the indication/range accord-

Bit switch No. 2 OFF



Bit switch No. 2 ON

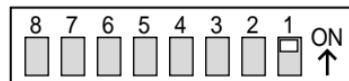


ing to the frequency to be measured.

When indicating the input signals directly, set the multiplier setting rotary switch and the 8-bit switches for setting the indication/range as follows.

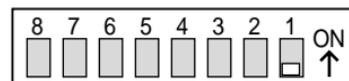
As a typical example, the multipliers and indexes (r/min, r/s, Hz, kHz) for the

Wide range: 0.1Hz - 20 kHz



Switch No. 1  
ON

High range: 1Hz - 20 kHz



Switch No.1  
OFF

pulse rate of 1 P/R and 60 P/R are shown in the following table.

If a pulse rate marked with ☆ is used, the initial set values of the multipliers and indexes can be used as they are.

Unit	Pulse rate	Coefficient	Multiplier	Index
r/min	1 P/R	60	6.000	×10
	☆ 60 P/R	1	1.0000	×1
r/s	☆ 1 P/R	1	1.0000	×1
	60 P/R	0.01666...	1.6667	×1/100
kHz	—	0.001	0.1	×1/100
Hz	☆ —	1	1.0000	×1

## 3.2 Setting for Direct Indication

### ■ How to Obtain Coefficient (Multiplier × Index)

Obtain the coefficient according to the following procedure.

- 1) Select the coefficient expression of the unit to be obtained from the following table.

	Unit	Coefficient expression
Number of revolution	r/min	$\frac{60}{N}$
	r/s	$\frac{1}{N}$
Peripheral speed	m/min	$\frac{60 D}{N}$
	km/h	$\frac{3.6 D}{N}$
	mm/s	$\frac{1000 D}{N}$
	cm/s	$\frac{100 D}{N}$
Frequency	kHz	$\frac{1}{1000}$
	Hz	1

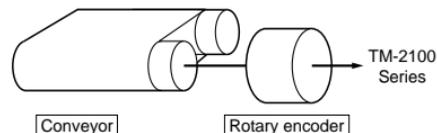
N = Number of pulses in 1 turn of sensor (P/R)

D= Moving distance in 1 turn of sensor (m)

D = Diameter of roller, etc.

- 2) If the peripheral speed is selected, obtain the moving distance in one turn ( $\pi D$ ), referring to the following examples.

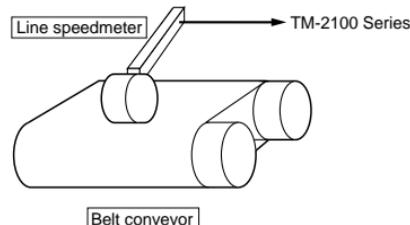
(Example 1) Connect a rotary encoder to a roller of a conveyor to indicate the conveyor speed.



$$\pi D = \text{Moving distance of conveyor in 1 turn of conveyor roller}$$

$$\pi D = 3.1416 \times 0.5 \text{ (Diameter of conveyor roller: m)} = 1.57$$

(Example 2) Connect a line speedometer to indicate the conveyor speed (When PR-721 is used).



$$\pi D = \text{Periphery of roller of line speedometer} = 0.2 \text{ (m)}$$

- 3) Substitute the number of pulses in one turn of the sensor (N) and the moving distance in one turn ( $\pi D$ ) for the coefficient expression to obtain the coefficient. If the unit to be obtained is r/min or r/s, it is not necessary to substitute  $\pi D$ .

## ■ Setting of Multiplier and Index

- 1) Divide the coefficient obtained by above step “(E) How to obtain coefficient” into the multiplier and index. At this time, obtain the multiplier and index by the following formula so that the significant number of digits will be as large as possible.

$$[\text{Coefficient}] = [\text{Multiplier}] \times [\text{Index}]$$

- Settable multiplier and index

Multiplier: 0.0001 - 9.9999 (5 digits)

Index:  $\times 10$ ,  $\times 1$ ,  $\times 1/10$ ,  $\times 1/100$

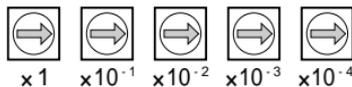
(Example) When coefficient is 0.5

5.0000 (Multiplier)  $\times 1/10$  (Index) ..... ○

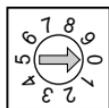
0.5000 (Multiplier)  $\times 1$  (Index) ..... ×

- 2) Set the multiplier to 0.0001 ~ 9.9999 with the multiplier setting rotary switch.

- 3) Set Front panel side 8-bit Rotary No. 2 No. 5 for setting the indication.



(Example) Setting to 1.2345



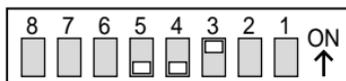
Turn with blade-tip screwdriver.

tion/range.

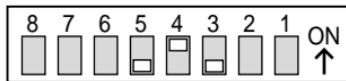
Select one of the following four settings. Any other setting is ineffective.

## ■ Setting of Decimal Point

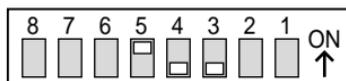
$\times 1/100$  Bit switch No. 3 ON



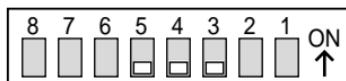
$\times 1/10$  Bit switch No. 4 ON



$\times 1$  Bit switch No. 5 ON



$\times 10$  Bit switch No. 3 - 5 OFF



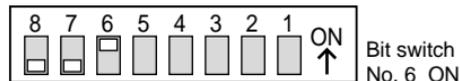
Set the place of the decimal point with the 8-bit switches No. 6 ~ No. 8 for setting the indication/range. It can be set as 00.000, 000.00 or 0000.0, or it may not be set.

(Example) How to set the place of the decimal point when the estimated maximum speed is 1000 r/min

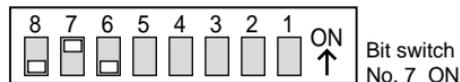
Place of decimal point	Indication	
No decimal point	1000	Indicated by unit of 1r/min.
0000.0	1000.0	Indicated by unit of 0.1r/min.
000.00	Indicator flashes.	× Cannot indicate more than 999.99 r/min.

### Place of decimal point

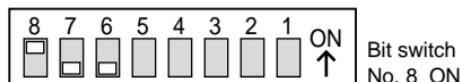
00 . 000



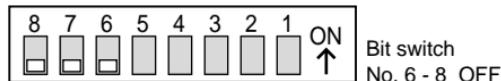
000 . 00



0000 . 0



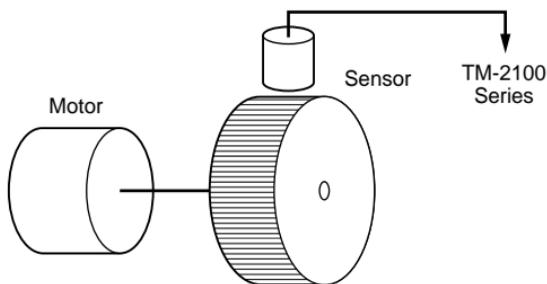
00000 (No decimal point)



### 3.3 Concrete Example of Setting of Device

#### ■ Setting of Motor Speed (Indication by r/min)

An example of setting for measurement of the speed of a motor is explained below.



Max. speed: 3,000 r/min  
 Number pulses in 1 turn of sensor: 120 (P/R)

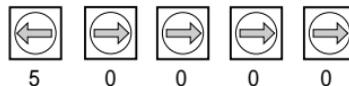
- ① Substitute 60 as the number of pulses in one turn of the sensor for N in the coefficient expression  $(60/N)$  for indication by r/min to obtain the coefficient as shown below.

$$\text{Coefficient} = \frac{60}{120} = 0.5$$

- ② Divide the coefficient 0.5 into the multiplier and index as follows. At this time, obtain them so that the number of the digits of the multiplier will be as large as possible.

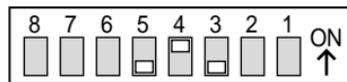
$$0.5 = 5.0000 (\text{Multiplier}) \times \frac{1}{10} (\text{Index})$$

- Setting of multiplier setting rotary switch



- Setting of 8-bit switches for setting indication/range

$$\text{Index: } \times \frac{1}{10}$$

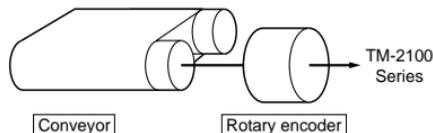


- ③ Set the place of the decimal point to either of the following, considering the maximum speed of 3,000 r/min.

- No decimal point: Indication by unit of 1 r/min
- 000.0: Indication by unit of 0.1 r/min

## ■ Measurement of Belt Conveyor Speed

An example of setting for measurement of the speed of a belt conveyor is explained below.



- Max. speed: 20 m/min
- Number of pulses: 3,600 (P/R)
- Diameter of belt conveyor roller: 0.5 m

- ① Substitute 3,600 as the number of pulses in one turn of the sensor for N in the coefficient expression  $(60\pi D/N)$  for indication by m/min and substitute 0.5 as the roller diameter of the belt conveyor for D to obtain the coefficient as shown below.

$$\text{Coefficient} = \frac{60 \times 3.14 \times 0.5}{3600} \doteq 0.026167$$

- ② Divide the coefficient 0.026167 into the multiplier and index as follows. At this time, obtain them so that the number of the digits of the multiplier will be as large as possible.

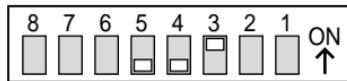
$$0.026167 = 2.6167 (\text{Multiplier}) \times \frac{1}{100} (\text{Index})$$

- Setting of multiplier setting rotary switch



- Setting of 8-bit switches for setting indication/range

$$\text{Index: } \times \frac{1}{100}$$



- ③ Set the place of the decimal point to any one of the following, considering the maximum speed of 20 m/min.
- No decimal point: Indication by unit of 1 m/min
  - 000.0: Indication by unit of 0.1 m/min
  - 000.00: Indication by unit of 0.01 m/min
  - 00.000: Indication by unit of 0.001 m/min

## 4. SETTING OF BCD OUTPUT FUNCTION

(Special function of TM-2120)

Set the BCD output function according to the following procedure for only TM-2120.

Each measured value is output as a digital signal through the BCD output connector.

If a computer, printer, etc. is connected to the BCD output connector, the measured data can be processed digitally.

### ■ Specifications of Connector



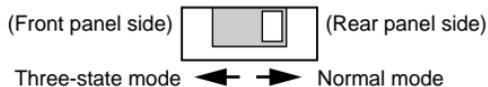
Applicable connector:  
Amphenol 57-30360

Pin	Signal	Pin	Signal
1	BCD output $1 \times 10^0$ $2 \times 10^0$ $4 \times 10^0$ $8 \times 10^0$	19	BCD output $4 \times 10^4$ $8 \times 10^4$
2		20	
3		21	NC
4		22	NC
5	BCD output $1 \times 10^1$ $2 \times 10^1$ $4 \times 10^1$ $8 \times 10^1$	23	NC
6		24	NC
7		25	NC
8		26	NC
9	BCD output $1 \times 10^2$ $2 \times 10^2$ $4 \times 10^2$ $8 \times 10^2$	27	NC
10		28	NC
11		29	NC
12		30	NC
13	BCD output $1 \times 10^3$ $2 \times 10^3$ $4 \times 10^3$ $8 \times 10^3$	31	NC
14		32	NC
15		33	Data request
16		34	NC
17	BCD output $1 \times 10^4$ $2 \times 10^4$	35	Print command
18		36	GND

- BCD output: Positive logic 5-digit parallel output
- Print command output: Negative pulse  
(Pulse width: Approx. 10 ms)
- Request signal: Negative pulse  
(Falling edge) 10  $\mu$ s min.

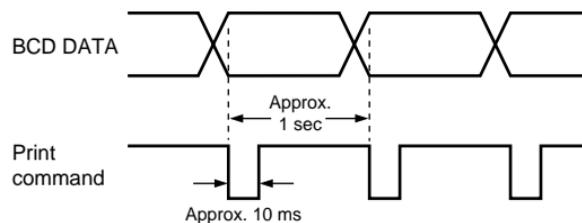
## ■ Setting of Mode

As the output method, the normal mode or three-stage mode is selected with the mode changeover switch.



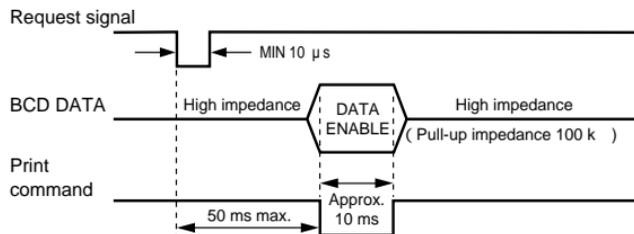
### • Normal mode

The print command is output at the interval of about 1 sec.



### • Three-state mode

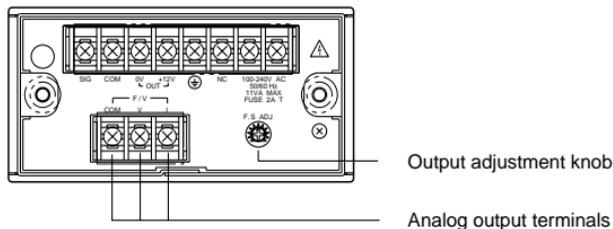
If a request signal is received from outside, the data are output. The minimum interval of the request signal is 50 ms.



## 5. SETTING OF ANALOG OUTPUT FUNCTION (Special function of TM-2130)

Set the analog output function according to the following procedure for only TM-2130.

A voltage of a current is output through the analog output terminals, and they can be applied to an analog indicator, recorder and various control devices. The output value and indicated value are processed independently from each other, however.



### ■ Setting of Frequency Range

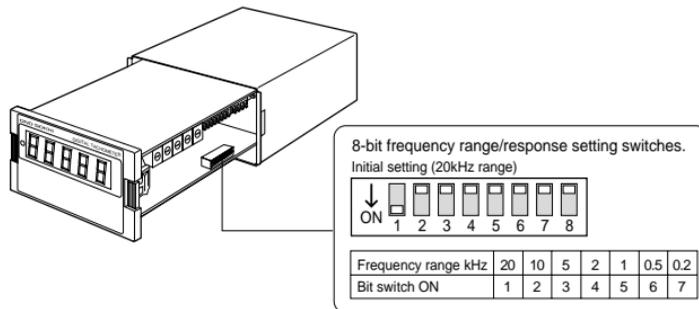
- Obtain the maximum frequency input from the sensor by the following expression.

$$\text{Max. input frequency (Hz)} = \frac{\text{Max. turning speed of rotor (r/min)} \times \text{Number of pulses in 1 turn of sensor (P/R)}}{60 \text{ (sec)}}$$

- Select a frequency range to cover the maximum input frequency from 20 kHz, 10 kHz, 5 kHz, 2 kHz, 1 kHz, 0.5 kHz and 0.2 kHz.

The frequency range selected in ② above is the maximum scale. At the maximum scale, the voltage output is 10 V and the current output is 20 mA. The voltage output and the current output at 0 Hz 0 V and 4 mA respectively.

- Set the frequency with the 8-bit frequency range/response setting switches. The bit switches No. 1 ~ No. 7 are used to set the frequency range. Turn on only the bit switch(es) corresponding to the frequency range.



### ■ Setting of Response

Set the response with the 8-bit frequency range/response setting switch.

If the 8-bit frequency range/response setting switch No. 8 is turned on, the response is set to 700 ms. If the former is turned off, the latter is set to 120 ms.

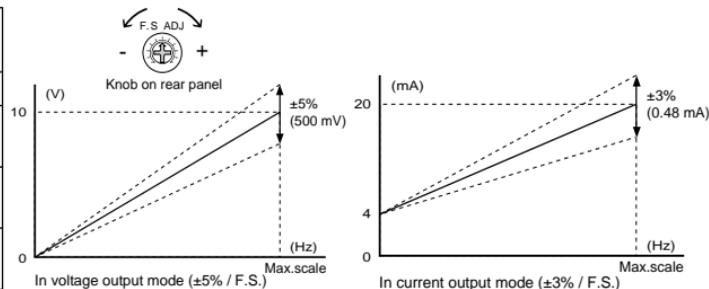
If 120 ms is selected, the response becomes high, but the ripple is increased. Referring to the following table, set a proper response for each purpose and use.

Frequency range (kHz)	Ripple (AT input of 1% of frequency range)	
	Response: 120 ms	Response: 700 ms
20/10/5	0.3%/Max. scale (0.03 V)	0.2%/Max. scale (0.02 V)
2	0.5%/Max. scale (0.05 V)	0.3%/Max. scale (0.03 V)
1	1.5%/Max. scale (0.15 V)	0.4%/Max. scale (0.04 V)
0.5	3.0%/Max. scale (0.30 V)	0.7%/Max. scale (0.07 V)
0.2	6.5%/Max. scale (0.65 V)	1.5%/Max. scale (0.15 V)

- Accuracy of response at 120 ms:  $\pm 20$  ms  
Accuracy of response at 700 ms:  $\pm 100$  ms
- The values in ( ) are converted into the values in the voltage output mode.

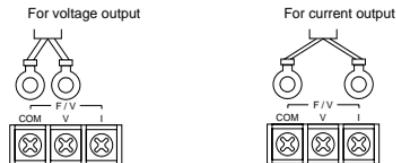
## ■ Adjustment of Output

The voltage and current outputs can be adjusted finely with the output adjustment knob on the rear panel. They do not need to be adjusted normally, since they are adjusted when shipped.

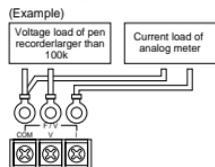


## ■ Connection of Output Cable

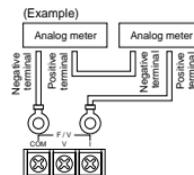
Connect the output cable to the analog output terminal block on the rear panel as shown below.



When a voltage load exceeds 100k  $\Omega$ , it and a current load can be connected simultaneously.



Connect current loads (Electromagnetic oscilloscope, analog meter, etc.) in series, and limit the total load to 500  $\Omega$ .

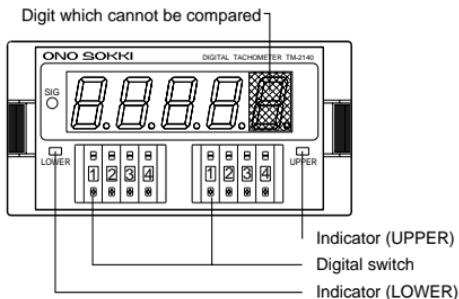


## 6. SETTING OF COMPARATOR FUNCTION

(Special function of TM-2140)

Set the comparator function according to the following procedure for only TM-2140.

The comparator function means the function to compare the upper four digits of each indicated value with a set value and outputs the result as a relay output. This function can be used as the alarm of a control device, etc. The upper limit and lower limit can be set freely.



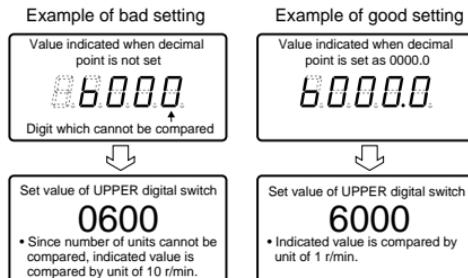
### ■ Setting of Upper Limit and Lower Limit

Set the four-digit upper and lower limits with the UPPER (Right side: Upper limit) and LOWER (Left side: Lower limit) digital switches.

The set four-digit number is compared with the upper four digits of the five-digit value indicated by the indicator (The lowest digit is not compared).

### ● Example of setting

The following is an example of setting of the upper limit to 6000 r/min and judging by the unit of 1 r/min.



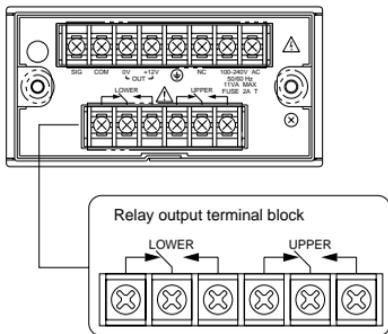
If the UPPER digital switch is set to 0000, neither of the upper and lower limits is compared. Accordingly, set 0001 or a larger value to the UPPER digital switch even if only the lower limit needs to be compared.

### ■ Relay Output

When the relationship between the values of the UPPER and LOWER digital switches and the indicated values is as follows, the relay is turned on.

- Set value of UPPER digital switch  $\leq$  Indicated value
  - Set value of LOWER digital switch  $>$  Indicated value
- Comparison error: Set value  $\pm 1$  count

If the relay is turned on, either UPPER or LOWER indicator lights up.



## ■ Explanation of Comparison Period

The set values of the UPPER and LOWER judgment are converted into frequencies (See the following formula), and the comparison period is set by the result as shown below.

- Method to convert set value for judgment into frequency

$$\text{Judgment frequency (Hz)} = \frac{\text{Set value of comparator (4 digits)} \times 10}{\text{Index} \times \text{Multiplier} \times \text{Multiplication factor of decimal point}^{*1}}$$

\*1. Multiplication factor

No decimal point	→ ×1
0.0	→ ×10
0.00	→ ×100
0.000	→ ×1000

- Comparison periods list

Judgment frequency range	Comparison period	Example
100 Hz < a ≤ 20 kHz	Approx. 0.2 s	—
10 Hz ≤ a ≤ 100 Hz	Approx. 0.2 s + 2 periods*2	At 10 Hz: Approx. 0.4 s At 100 Hz: Approx. 0.2 s
0.1 Hz ≤ a < 10 Hz	Approx. 2 periods*2	At 0.1 Hz: Approx. 20 s At 9.9 Hz: Approx. 0.2 s

\*2: How to obtain period (s)

$$\text{Period} = \frac{1}{\text{Judgment frequency (Hz)}}$$

- How to obtain comparison period (Example)

The following is an example to obtain the judgment frequency and comparison period under a given condition.

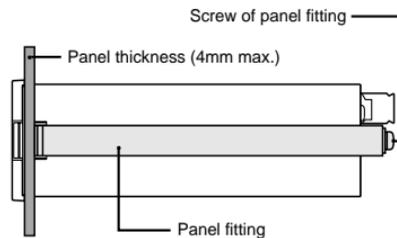
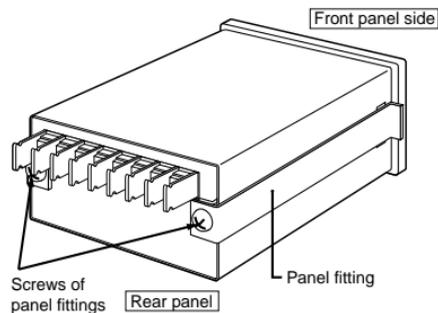
- Value of comparator: 0020
- Multiplier: 5.0000
- Index: 1/10 (= 0.1)
- Decimal point: 0.0 (Multiplication factor of decimal point: ×10)

$$\begin{aligned} \text{Comparison period} &= \text{Approx. } 0.2s + \frac{1}{40 \text{ Hz}} \times 2 \\ &= \text{Approx. } 0.2s + 0.025s \times 2 \\ &= \text{Approx. } 0.25s \end{aligned}$$

## 7. HOW TO INSTALL TO PANEL

Install the TM-2110 to a panel according to the following procedure. The maximum thickness of the panel to install the device is 4 mm.

- ① Insert the body of the TM-2110 in the panel.
- ② Install the attached panel fittings, and secure them with the attached screws.

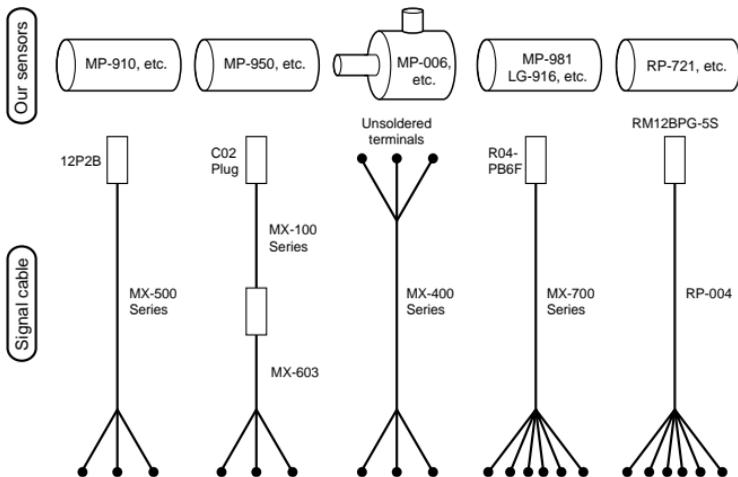




## ■ Connection Method of Signal Cable

### ● Selection of signal cable

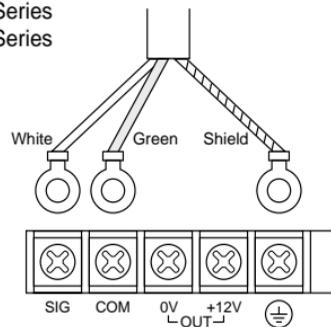
The type of the signal cable to be used depends on the type of the sensor as shown below. Use a proper cable for the sensor to be used.



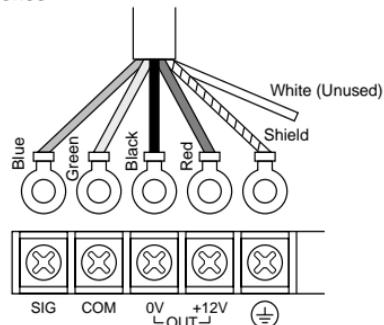
### ● Connection of signal cable

Connect the signal cable according to the following procedure.

- MX-500 Series
- MX-400 Series
- MX-603



- MX-700 Series
- PR-004



## 9. SPECIFICATIONS

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### Specifications of TM-2110

#### ■ Input Section

Input terminal screw:	M3 free terminal screw
Input impedance:	30 k $\Omega$ min (at 20 kHz)
Type of input amplification:	AC or DC <sup>*1</sup>
Applicable sensors:	Electromagnetic sensor, magneto-electric sensor, photoelectric sensor, rotary encoder, proximity switch

#### \*1. Specifications of input amplification

##### ● AC amplification section

Signal wave form:	Sine wave or square wave
Signal voltage range:	Sine wave: 0.2 to 45 Vrms Square wave: 0.6 to 63 Vp-p

Signal frequency range: 1 Hz to 20 kHz

##### ● DC amplification section

Signal waveform:	Rectangular wave with a pulse width of 20 $\mu$ s or more
Signal voltage range:	High level: +4 to 30V Low level: -1 to +1V

Signal frequency range: 0.1 Hz to 20 kHz

\* Open-collector output and no-voltage contact output can be input by pull-up method (Changeable with bit switches).

Low-pass filter:	Cut-off frequency: Approx. 100 Hz Attenuation at 20 kHz is approx. -40 dB (Changeable with bit switches).
------------------	--

#### ■ Direct Reading Conversion Section

Setting of count

##### ● Multiplier section

Setting range: 0.0001 ~ 9.9999  
(Set with 5-digit rotary switch)

##### ● Index section

Setting range:  $\times 10$ ,  $\times 1$ ,  $\times 1/10$ ,  $\times 1/100$   
(Set with bit switches)

Indication of decimal point

No decimal point, 0.0, 0.00, 0.000  
(Set with bit switches)

#### ■ Indicator Section

Indicator: Green 7-segment LED (5 digits)/  
Letter height: 14.2 mm

Indicating time: Repeated indication at interval of about 1 sec

SIG indicator: Flashes synchronizing with input signal.

Other items:

- Over-input frequency:  
Indicator flashes (Indicated value: 5 1's).
- Over-indicated number of digits:  
Indicator flashes (Indicated value: 5 2's).
- Setting error:  
Indicator flashes (Indicated value: 5 3's).

## ■ Calculating Section

Reference measuring time: Crystal oscillator (16 MHz)  
Measurement accuracy: Indicated value  $\times (\pm 0.02\%) \pm 1$  count  
\* Counted value without decimal point is indicated here.

Measuring method: Period calculation method

Range changeover switch:

- Wide range      Measurement range: 0.1 Hz to 20 kHz  
\* If signal is not input for 11 sec or more, frequency (indicated) becomes zero.
- High range      Measurement range: 1 Hz to 20 kHz  
\* If signal is not input for 2 sec or more, frequency (indicated) becomes zero.

Function to follow up sharp deceleration:

Operates when input signal lower sharply from 20 kHz to 5 Hz and any signal is not input for 0.2 sec.  
If this function operates, indicated value lowers automatically (Effective only during deceleration, however).

## ■ Power Output for Sensor

Output voltage: 12VDC ( $\pm 0.6V$ )  
Max. output current: 100 mA  
Ripple: 100 mVp-p max.

## ■ General Specifications

Source voltage: 100 ~ 240VAC, 50/60 Hz  
Withstand voltage: 1500VAC for 1 min  
Insulation resistance: 5 M $\Omega$  or more  
Current consumption: 20 VA (11 VA or less with 100 VAC)  
Mass: Approx. 630 g  
Using temperature range: 0°C to +40°C  
Storage temperature range: -10°C to +55°C  
Outside dimensions: 96 (W)  $\times$  48 (H)  $\times$  140 (D) mm  
\* A 2A T (time lag) type fuse is used for the primary power line.  
Replacement of only the fuse is not allowed.

## ■ Accessories

Instruction manual: 1 copy (This manual)  
Unit seal: 1 sheet  
r/min, min<sup>-1</sup>, Hz, kHz, m/min, r/s, s<sup>-1</sup>, km/h, mm/s, ml/min, l/h  
Panel fitting: 1 set  
Jumper wire: 1 set  
(For between SIG-COM and GND)

## ■ Options

Power cable: AX-204 (For 100VAC)  
Signal cable: MX Series  
Revolution sensor: MP Series, LG Series, etc.

## Specifications of TM-2120

### ■ Input Section

Input terminal screw:	M3 free terminal screw
Input impedance:	30 k $\Omega$ min (at 20 kHz)
Type of input amplification:	AC or DC*1
Applicable sensors:	Electromagnetic sensor, magneto-electric sensor, photoelectric sensor, rotary encoder, proximity switch

#### \*1. Specifications of input amplification

##### ● AC amplification section

Signal wave form:	Sine wave or square wave
Signal voltage range:	Sine wave: 0.2 to 45 Vrms Square wave: 0.6 to 63 Vp-p
Signal frequency range:	1 Hz to 20 kHz

##### ● DC amplification section

Signal waveform:	Rectangular wave with a pulse width of 20 $\mu$ s or more
Signal voltage range:	High level: +4 to 30V Low level: -1 to +1V
Signal frequency range:	0.1 Hz to 20 kHz

\* Open-collector output and no-voltage contact output can be input by pull-up method (Changeable with bit switches).

Low-pass filter:	Cut-off frequency: Approx. 100 Hz Attenuation at 20 kHz is approx. -40 dB (Changeable with bit switches).
------------------	--

### ■ Direct Reading Conversion Section

Setting of count

- Multiplier section  
Setting range: 0.0001 to 9.9999  
(Set with 5-digit rotary switch)
- Index section  
Setting range:  $\times 10$ ,  $\times 1$ ,  $\times 1/10$ ,  $\times 1/100$   
(Set with bit switches)

Indication of decimal point

No decimal point, 0.0, 0.00, 0.000  
(Set with bit switches)

### ■ Indicator Section

Indicator: Green 7-segment LED (5 digits)/  
Letter height: 14.2 mm

Indicating time: Repeated indication at interval of about 1 sec

SIG indicator: Flashes synchronizing with input signal.

- Other items:
- Over-input frequency:  
Indicator flashes (Indicated value: 5 1's).
  - Over-indicated number of digits:  
Indicator flashes (Indicated value: 5 2's).
  - Setting error:  
Indicator flashes (Indicated value: 5 3's).

## ■ Calculating Section

Standard measuring time: Crystal oscillator (16 MHz)  
Measurement accuracy: Indicated value  $\times (\pm 0.02\%) \pm 1$  count  
\* Counted value without decimal point is indicated here.

Measuring method: Period calculation method

Range changeover switch:

- Wide range Measurement range: 0.1 Hz to 20 kHz  
\* If signal is not input for 11 sec or more, frequency (indicated) becomes zero.
- High range Measurement range: 1 Hz to 20 kHz  
\* If signal is not input for 2 sec or more, frequency (indicated) becomes zero.

Function to follow up sharp deceleration:

Operates when input signal lower sharply from 20 kHz to 5 Hz and any signal is not input for 0.2 sec. If this function operates, indicated value lowers automatically (Effective only during deceleration, however).

## ■ Power Output for Sensor

Output voltage: 12VDC ( $\pm 0.6V$ )  
Max. output current: 100 mA  
Ripple: 100 mVp-p max.

## ■ General Specifications

Source voltage: 100 to 240VAC, 50/60 Hz  
Withstand voltage: 1500VAC for 1 min  
Insulation resistance: 5 M $\Omega$  or more  
Current consumption: 20 VA (11 VA or less with 100 VAC)  
Mass: Approx. 630 g  
Using temperature range: 0°C to +40°C  
Storage temperature range: -10°C to +55°C  
Outside dimensions: 96 (W)  $\times$  48 (H)  $\times$  140 (D) mm

\* A 2A T (time lag) type fuse is used for the primary power line.  
Replacement of only the fuse is not allowed.

## ■ BCD Output

BCD output: Positive logic 5-digit parallel output  
Output level: Hi level: 4.4 to 5.25V  
Lo level: 0 to 0.1V  
Output current: 4 mA max., fan out 2  
Print command output: Negative pulse approx. 10 ms wide  
Hi level: 4.4 to 5.25V  
Lo level: 0 to 0.1V  
Output current: 4 mA max., fan out 2  
Request signal: Negative pulse (Falling edge) 10  $\mu$ s min. (TTL level sink current: 0.4 mA)  
Change of mode: Normal mode/Three-status mode

## ■ Accessories

Instruction manual:	1 copy (This manual)
Unit seal:	1 sheet r/min, min <sup>-1</sup> , Hz, kHz, m/min, r/s, s <sup>-1</sup> , km/h, mm/s, mℓ/min, ℓ/h
Panel fitting:	1 set
Jumper wire:	1 set (For between SIG-COM and GND)

## ■ Options

Power cable:	AX-204 (For AC100V)
Signal cable:	MX Series
Revolution sensor:	MP Series, LG Series, etc.

## Specifications of TM-2130

### ■ Input Section

Input terminal screw: M3 free terminal screw  
Input impedance: 30 k $\Omega$  min (at 20 kHz)  
Type of input amplification: AC or DC<sup>\*1</sup>  
Applicable sensors: Electromagnetic sensor, magneto-electric sensor, photoelectric sensor, rotary encoder, proximity switch

#### \*1. Specifications of input amplification

##### ● AC amplification section

Signal wave form: Sine wave or square wave  
Signal voltage range: Sine wave: 0.2 ~ 45 Vrms  
Square wave: 0.6 ~ 63 Vp-p

Signal frequency range: 1 Hz ~ 20 kHz

##### ● DC amplification section

Signal wave form: Rectangular wave of pulse 20  $\mu$ s or wider

Signal voltage range: High level: +4 ~ 30V  
Low level: -1 ~ +1V

Signal frequency range: 0.1 Hz ~ 20 kHz

\* Open-collector output and no-voltage contact output can be input by pull-up method (by changing bit switches).

Low-pass filter: Cut-off frequency: Approx. 100 Hz  
Attenuation at 20 kHz is approx. -40 dB (Changeable with bit switches).

### ■ Direct Reading Conversion Section

Setting of count

##### ● Multiplier section

Setting range: 0.0001 ~ 9.9999  
(Set with 5-digit rotary switch)

##### ● Index section

Setting range:  $\times 10$ ,  $\times 1$ ,  $\times 1/10$ ,  $\times 1/100$   
(Set with bit switches)

Indication of decimal point

No decimal point, 0.0, 0.00, 0.000  
(Set with bit switches)

### ■ Indicator Section

Indicator: Green 7-segment LED (5 digits)/  
Letter height: 14.2 mm

Indicating time: Repeated indication at interval of about 1 sec

SIG indicator: Flashes synchronizing with input signal.

Other items: ● Over-input frequency:  
Indicator flashes (Indicated value: 5 1's).  
● Over-indicated number of digits:  
Indicator flashes (Indicated value: 5 2's).  
● Setting error:  
Indicator flashes (Indicated value: 5 3's).

## ■ Calculating Section

Standard measuring time: Crystal oscillator (16 MHz)  
Measurement accuracy: Indicated value  $\times (\pm 0.02\%) \pm 1$  count  
\* Counted value without decimal point is indicated here.

Measuring method: Period calculation method

Range changeover switch:

- Wide range  
Measurement range: 0.1 Hz ~ 20 kHz  
\* If signal is not input for 11 sec or more, frequency (indicated) becomes zero.
- High range  
Measurement range: 1 Hz ~ 20 kHz  
\* If signal is not input for 2 sec or more, frequency (indicated) becomes zero.

Function to follow up sharp deceleration:

Operates when input signal lower sharply from 20 kHz ~ 5 Hz and any signal is not input for 0.2 sec. If this function operates, indicated value lowers automatically (Effective only during deceleration, however).

## ■ Power Output for Sensor

Output voltage: DC 12V ( $\pm 0.6$ V)  
Max. output current: 100 mA  
Ripple: 100 mVp-p max.

## ■ General Specifications

Source voltage: AC 100 ~ 240V, 50/60 Hz  
Withstand voltage: AC 1500V for 1 min  
Insulation resistance: 5 M $\Omega$  min.  
Current consumption: 23 VA or less  
(16 VA or less in 100 VAC operation)  
Mass: Approx. 630 g  
Using temperature range: 0°C ~ +40°C  
Storage temperature range: -10°C ~ +55°C  
Outside dimensions: 96 (W)  $\times$  48 (H)  $\times$  140 (D) mm

## ■ Accessories

Instruction manual: 1 copy (This manual)  
Unit seal: 1 sheet  
r/min, min<sup>-1</sup>, Hz, kHz, m/min, r/s, s<sup>-1</sup>  
km/h, mm/s, m $\ell$ /min,  $\ell$ /h  
Panel fitting: 1 set  
Jumper wire: 1 set  
(For between SIG-COM and GND)

## ■ Options

Power cable: AX-204 (For AC100V)  
Signal cable: MX Series  
Revolution sensor: MP Series, LG Series, etc.

### ■ TM-2130 (Excluding common specifications)

Frequency range:	20, 10, 5, 2, 1, 0.5, 0.2 kHz
Linearity:	$\pm 0.3\%$ /Max. scale
Output voltage:	0 ~ 10V for each frequency range (Load: 1 k $\Omega$ min.)
Output current:	4 ~ 20 mA for each frequency range (Load: 500 $\Omega$ max.) * When voltage load is above 100 k $\Omega$ , voltage and current can be output simultaneously.
Output adjustment:	Approx. $\pm 5\%$ (Voltage), approx. $\pm 3\%$ /Max. scale (Current)
Zero setting accuracy:	$\pm 0.5\%$ /Max. scale (Voltage output, room temperature), $\pm 0.3\%$ /Max. scale (Current output, room temperature)
Zero drift:	$\pm 0.01\%$ /Max. scale/ $^{\circ}\text{C}$
Span drift:	$\pm 0.025\%$ /Max. scale/ $^{\circ}\text{C}$
Response:	Selection from 120 ms and 700 ms
Ripple:	See "Setting of response" in this manual.

## Specifications of TM-2140

### ■ Input Section

Input terminal screw:	M3 free terminal screw
Input impedance:	30 k $\Omega$ min (at 20 kHz)
Type of input amplification:	AC or DC <sup>*1</sup>
Applicable sensors:	Electromagnetic sensor, magneto-electric sensor, photoelectric sensor, rotary encoder, proximity switch

#### \*1. Specifications of input amplification

##### ● AC amplification section

Signal wave form:	Sine wave or square wave
Signal voltage range:	Sine wave: 0.2 ~ 45 Vrms Square wave: 0.6 ~ 63 Vp-p

Signal frequency range: 1 Hz ~ 20 kHz

##### ● DC amplification section

Signal wave form:	Rectangular wave of pulse 20 $\mu$ s or wider
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Signal voltage range:	High level: +4 ~ 30V Low level: -1 ~ +1V
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Signal frequency range: 0.1 Hz ~ 20 kHz

\* Open-collector output and no-voltage contact output can be input by pull-up method (by changing bit switches).

Low-pass filter:	Cut-off frequency: Approx. 100 Hz Attenuation at 20 kHz is approx. -40 dB (Changeable with bit switches).
------------------	--

### ■ Direct Reading Conversion Section

Setting of count

#### ● Multiplier section

Setting range: 0.0001 ~ 9.9999  
(Set with 5-digit rotary switch)

#### ● Index section

Setting range:  $\times 10$ ,  $\times 1$ ,  $\times 1/10$ ,  $\times 1/100$   
(Set with bit switches)

Indication of decimal point

No decimal point, 0.0, 0.00, 0.000  
(Set with bit switches)

### ■ Indicator Section

Indicator: Green 7-segment LED (5 digits)/  
Letter height: 14.2 mm

Indicating time: Repeated indication at interval of about 1 sec

SIG indicator: Flashes synchronizing with input signal.

Other items:

#### ● Over-input frequency:

Indicator flashes (Indicated value: 5 1's).

#### ● Over-indicated number of digits:

Indicator flashes (Indicated value: 5 2's).

#### ● Setting error: Indicator flashes

(Indicated value: 5 3's).

## ■ Calculating Section

Standard measuring time: Crystal oscillator (16 MHz)  
Measurement accuracy: Indicated value  $\times (\pm 0.02\%) \pm 1$  count.

\* Counted value without decimal point is indicated here.

Measuring method: Period calculation method

Range changeover switch:

- Wide range

Measurement range: 0.1 Hz ~ 20 kHz  
\* If signal is not input for 11 sec or more, frequency (indicated) becomes zero.

- High range

Measurement range: 1 Hz ~ 20 kHz  
\* If signal is not input for 2 sec or more, frequency (indicated) becomes zero.

Function to follow up sharp deceleration:

Operates when input signal lower sharply from 20 kHz – 5 Hz and any signal is not input for 0.2 sec. If this function operates, indicated value lowers automatically (Effective only during deceleration, however).

## ■ Power Output for Sensor

Output voltage: DC 12V ( $\pm 0.6V$ )

Max. output current: 100 mA

Ripple: 100 mVp-p max.

## ■ General Specifications

Source voltage: AC 100 ~ 240V, 50/60 Hz

Withstand voltage: AC 1500V for 1 min

Insulation resistance: 5 M $\Omega$  min.

Current consumption: 20 VA or less  
(11 VA or less in 100 VAC operation)

Mass: Approx. 630 g

Using temperature range: 0°C ~ +40°C

Storage temperature range: -10°C ~ +55°C

Outside dimensions: 96 (W)  $\times$  48 (H)  $\times$  140 (D) mm

## ■ TM-2140 (Excluding common specifications)

UPPER limit setter: 4-digit digital switch.  
Compares set value with upper four digits, and turns on relay if set UPPER limit  $\leq$  Indicated value.

LOWER limit setter: 4-digit digital switch.  
Compares set value with upper four digits, and turns on relay if set LOWER limit  $>$  Indicated value.

Type of output: 1 transfer contact output (1 each for UPPER and LOWER limits)

Max. contact capacity:

DC30V/1A, AC250V/1A  
(Resistance load)

\* If the more capacity is required, amplify contacts.

## ■ Accessories

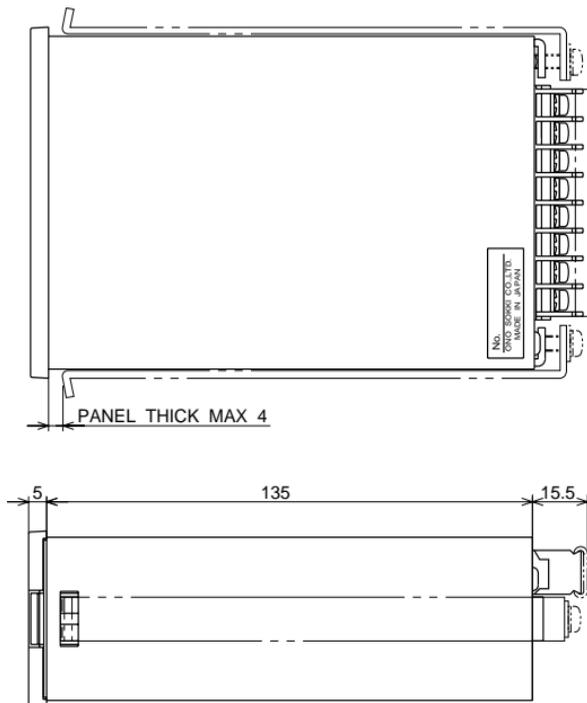
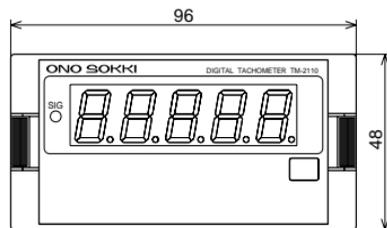
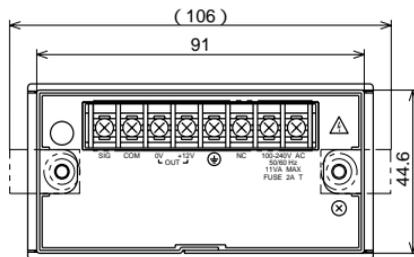
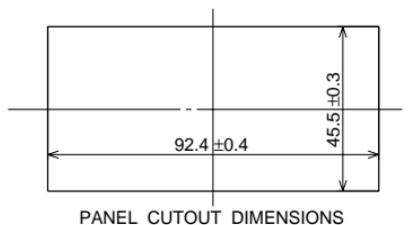
Instruction manual:	1 copy (This manual)
Unit seal:	1 sheet
	r/min, min <sup>-1</sup> , Hz, kHz, m/min, r/s, s <sup>-1</sup> , km/h, mm/s, mℓ/min, ℓ/h
Panel fitting:	1 set
Jumper wire:	1 set
	(For between SIG-COM and GND)

## ■ Options

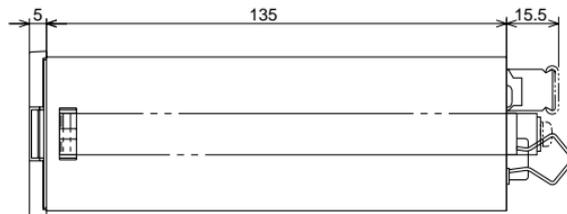
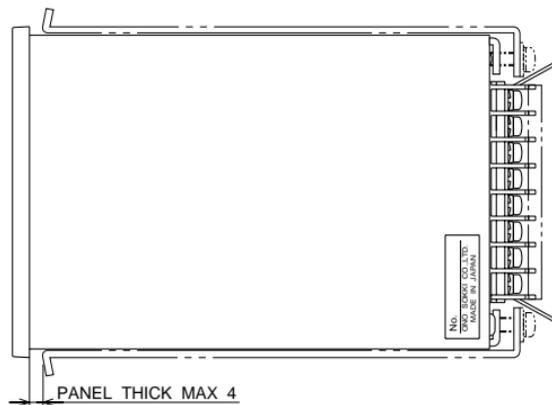
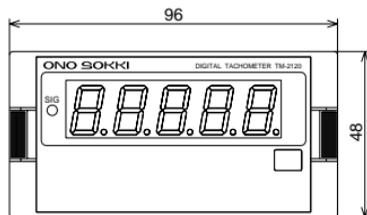
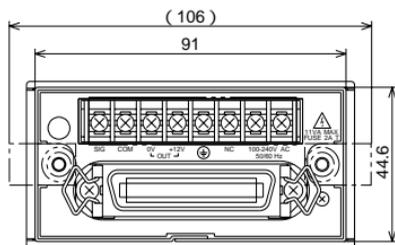
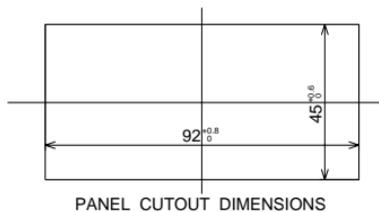
Power cable:	AX-204 (For AC100V)
Signal cable:	MX Series
Revolution sensor:	MP Series, LG Series, etc.

## 10. EXTERNAL DIMENSIONS

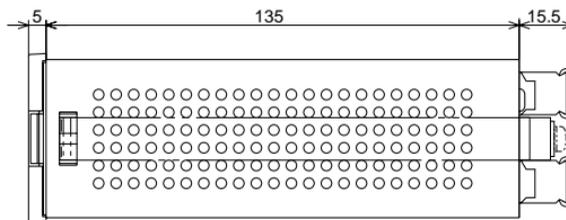
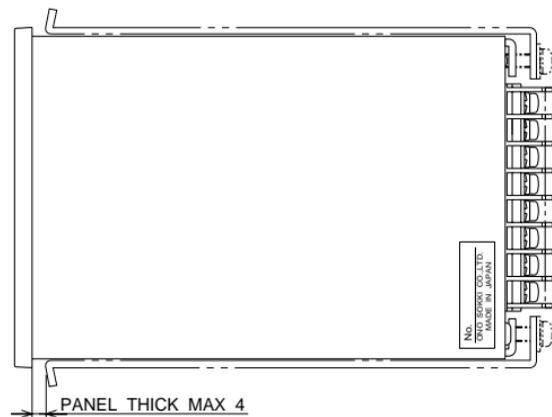
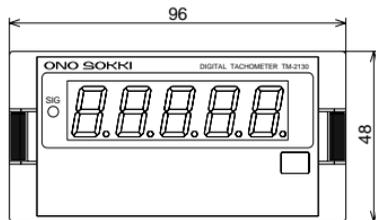
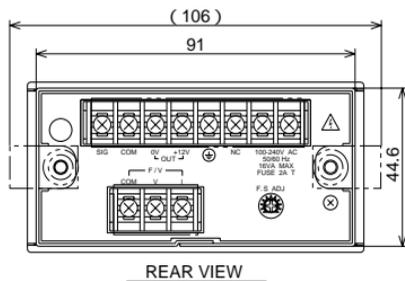
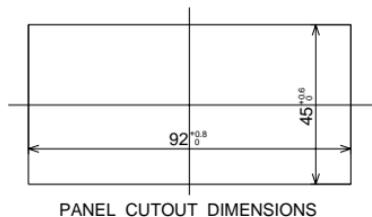
### External Dimensions of TM-2110



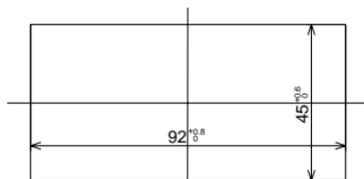
## External Dimensions of TM-2120



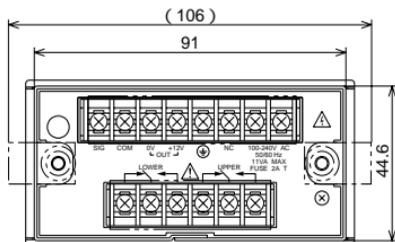
## External Dimensions of TM-2130



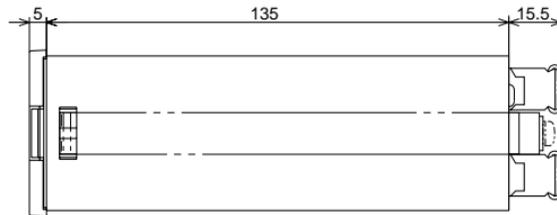
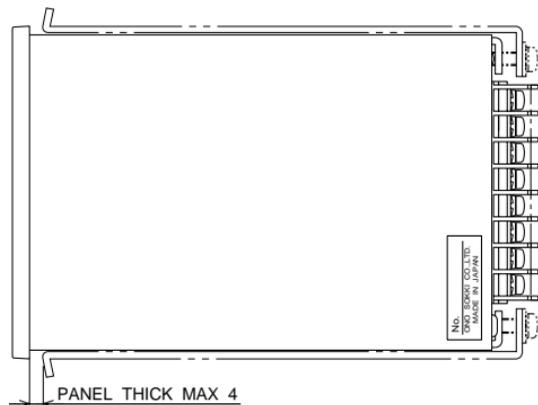
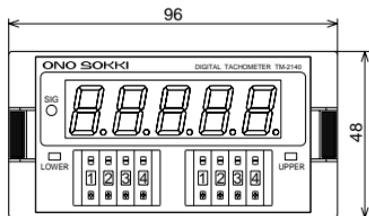
## External Dimensions of TM-2140



PANEL CUTOUT DIMENSIONS



REAR VIEW



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# ONO SOKKI

**ONO SOKKI**

**WORLDWIDE**

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Fax : 03-5482-7431

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B00000772/IM96022701(3),982(UT)02K