Digital Tachometer
TM-3100 series

- Customize your tachometer with added function, which matches your own application.
- Highly compatible with personal computers and controllers.
- Provided with wide variety of determination output functions.
- All models are applicable to CE marking.

Rotation speed
Line speed
Moving speed
Period
Counter
Frequency
Flow
Passing time

Standard measurement functions

Rotation change rate
Acceleration
Reached speed time
Section data memory

Optional functions

Introducing a new digital tachometer with a clear display and ability to add functions separately and easily!

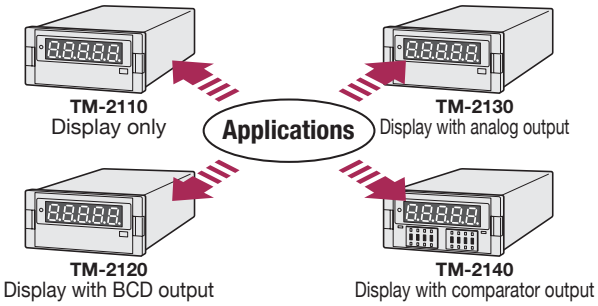
CE

ONO SOKKI

ONO SOKKI's Best Solutions by selecting the suitable tachometer from TM-3100 series depending on the application of your measurement.

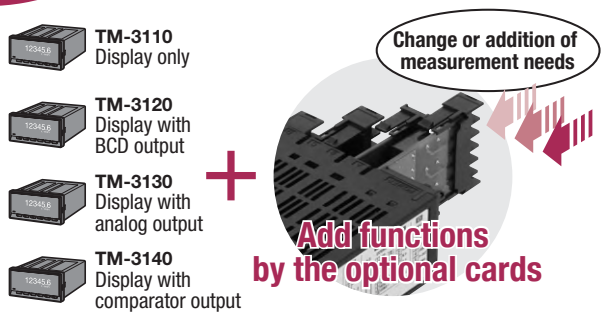
Feature ❶ Choose functions to match your application.

Old Models (TM-2100 series) — **Choose model to match your application**



It is required to purchase another model of "tachometer" itself to match the different or additional applications of the measurement.

New Models (TM-3100 series) — **Add functions to match your application**



Adding the required "function" only to match the different or additional applications of the measurement, it is no requirement to purchase another model of tachometer itself.

As measurement becomes more diverse, it is not easy to select a suitable model that meets your application. Measuring requirements are often changed or added. The TM-3100 series enables you to respond instantly to changes in these diverse needs by adding functions to match the application.

Customer's Benefits

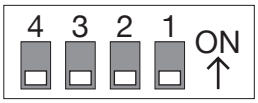
1. Custom-tailor rotation measurement to match your application by adding functions.
2. Even if the application changes, you can continue using your existing tachometer.

Feature ❷ Fluorescent display tube greatly improves readability.

Old Models (TM-2100 series)

- **Setting with bit and rotary switches**
- **7-segment characters are not read easily.**

Setting with bit switch



Even with setting procedures in menu screen, a user's manual is sometimes needed just in order to read the characters correctly.

(Example: ABCD.EI)

New Models (TM-3100 series) — **Character is recognized for reading easily and clearly.**

Character is recognized and read easily and clearly in menu screen.

Unit of measurement can also be selected in menu screen.

The unit of measurement is shown on the fluorescent display. No more need to attach labels of the measuring unit at the front panel of the tachometer!

It is important to have highly visible and durable display because they are sometimes used under severe conditions. For this reason, an LED display is normally used. There are limitations, however, of the character that LEDs can display, causing unreadable character and other problems. The TM-3100 series uses a fluorescent display tube, maintaining durability while greatly improving readability.

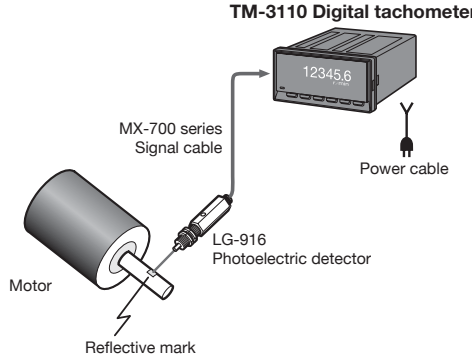
Customer's Benefits

1. Greatly improved readability of the characters reduces errors when setting function.
2. Operating procedure becomes improved, which helps reducing the setup time because the function can be setup in menu screen.

It becomes more easily to use!
New tachometer is finding applications in many different fields!

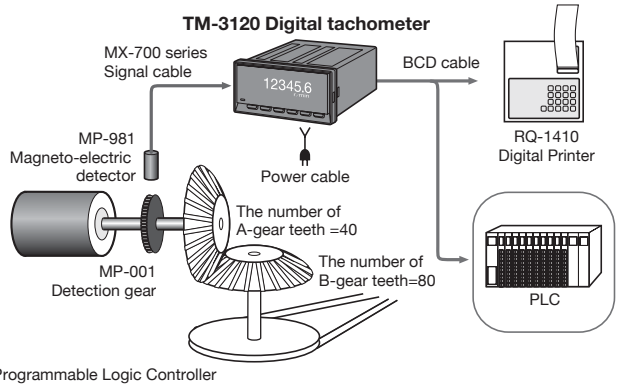
Read the rotation speed (number of rotations) directly (TM-3110)

Attaching an exclusive 12-mm square reflective mark to a shaft of motor or other rotating axis, non-contact rotation speed measurement by using a photoelectric detector is performed.



Output the measurement results to a printer or a PLC* (TM-3120 or TM-0321/0322)

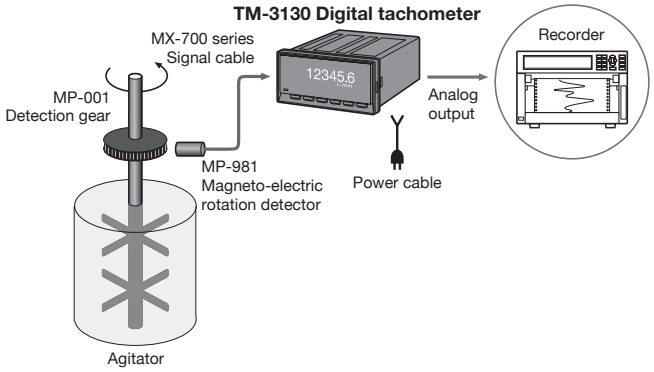
Measure and display the rotation speed of a motor or other shaft, while using the BCD output function of the TM-3120 to send the measurement results to a printer or load them into a PLC. You can also calculate and display the rotation speed of the gear-B shaft by setting the number of teeth on gear-A divided by the number on gear-B (40/80 = 0.500) at TM-3120.



* Programmable Logic Controller

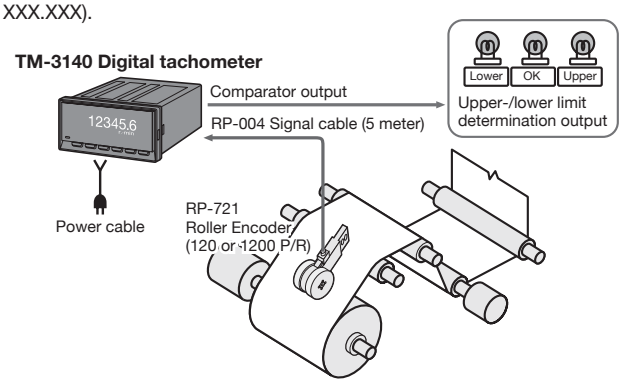
Output the rotation speed to a recorder (TM-3130 or TM-0330)

Setting the rotation detector closely to the teeth of the detection gear which is connected to the main rotating shaft of an agitator, mixer, centrifuge or the like, you can measure and display the shaft's rotation speed as well as record and view changes in rotation on a recorder or the like using analog output.



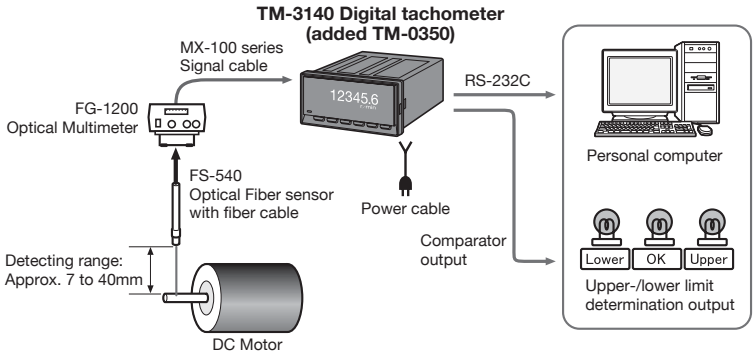
Monitor the line speed (TM-3140 or TM-0340)

Measuring and displaying the line speed of a belt conveyor or the like in the unit of m/min, alarm signal will be output when it exceeds the setup speed or stop any operated machine itself by using comparator output.
The display of the TM-3100 series can be set to show a decimal (up to three decimal places); enabling you to display decimal values (e.g. XXXXX.X or XXX.XXX).



Control from a computer via RS-232C

If the surface of the rotating shaft has irregularities or a black line, the amount of reflected light received by the optical fiber detector will vary periodically. These periodic variations are used to measure the rotation speed. This allows measurement of very small shaft where it is not feasible to affix a reflective mark as well as fan motor and the like where light is not reflected back directly.
This series (except TM-3120) can also communicate with a computer by adding TM-0350 (RS-232C card). This also facilitates data management.



* Suitable rotation shaft diameter: 5mm or more

Add more functions to the TM-3100 series by the

TM-3110

Rotation-display model

Smooth replacement from old models (TM-2100 series) to the TM-3100 series !

- **Basic model for measurement and display.**
- **Wide range of measurement from low to high rotation. (0.1Hz to 100kHz)**

TM-3120

Display with BCD output

- **BCD output with 6-digit**
- **Open collector output for direct connection with a PLC*.**
- **Output mode is selectable from normal or request mode.**

  Normal mode:
  Continuously output the print command at every approx. 100ms.
  Request mode:
  Output the data by the external each request signal.
- **Voltage output (TTL level) function is available by modification as an option.**

* Programmable Logic Controller

TM-3110/3120/3130/3140 Common specifications

Input

Input terminal	M3 free terminal screw
Input impedance	10kΩ or more
Input format	Voltage or non-voltage input
Input amplification format	AC or DC
Applicable detector	Electromagnetic/magneto-electric /photoelectric detector, rotary encoder, proximity switch
[Specifications of input amplification]	
• AC amplifier	
Signal waveform	Sine or Square waveform
Signal voltage range	Sine waveform: 0.2 to 45Vrms Square waveform: 0.6 to 63Vp-p
Signal frequency range	1Hz to 100kHz
• DC amplifier	
Signal waveform	Square waveform having a pulse width at 5μs or more.
Signal voltage range	Hi level: +4 to +30V Lo level: -1 to +1V
Signal frequency range	0.1Hz to 100kHz
Low pass filter	Selectable from OFF, 100Hz, 20kHz

Output

<Pulse output>	
Output voltage	Hi level: +4.5V or more Lo level: +0.5V or less
Output logic	Negative logic
Load resistance	100kΩ or more
Output terminal	M3 free terminal screw

Display

Display device	Fluorescent display tube (selectable of three-stage brightness, 6-digit display)
Display refresh time	Selectable from 0.2s (factory setting), 0.4s, 0.5s, 0.6s, 0.8s, 1.0s to 10s (in 1.0s step)
Unit of measurement	Selectable from below

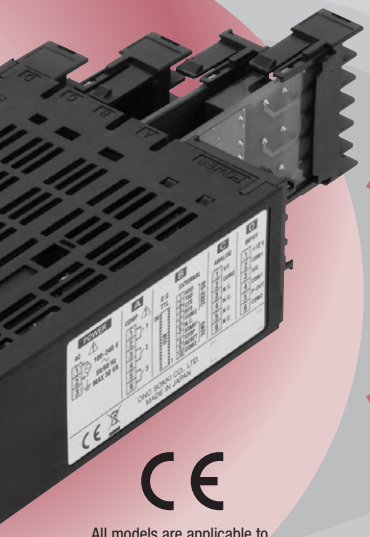
Measurement item	Unit
Rotation speed	r/s, r/min, r/h
Circumferential speed	mm/s, m/s, mm/min, m/min
Moving speed	mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h
Period	s, min
Times (1/s)	1/s, 1/min, 1/h
Frequency	Hz, kHz
Flow	ml/s, ml/min, ml/h, l/s, l/min, l/h
Passing time	s, min
User-defined (Engineering unit)	EU/s, EU/min, EU/h

Number of decimal points	Selectable from OFF (factory setting), number of decimal point of 1, 2 or 3 digit
SIG indicator	Blink in synchronization with input signal
Error display	Backup memory error, board error, input frequency error, display digit error, memory full error, setup value error

optional cards!

Calculation function (Common to all models)

- **Rotation speed, line speed (circumferential speed), moving speed, period, frequency, passing time, times (1/s), flow**
- **Auto zero function** ●**Rapid deceleration follow-up function**
- **Moving average function** ●**Peak-hold function**

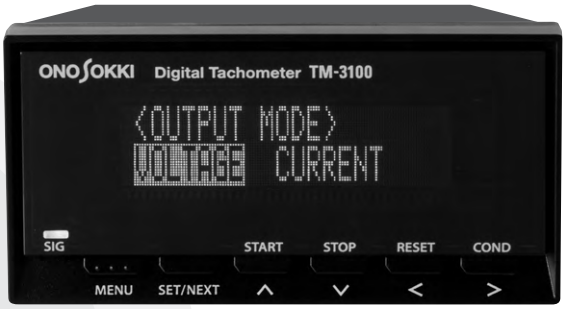


CE

All models are applicable to CE marking.

TM-3130

Display with analog output



- **Output signal can be selectable from voltage or current.**
- **D/A conversion allows improving its output refresh time (10ms).**

TM-3140

Display with comparator output

- **Up to three combinations of the determination levels at each upper-/lower limit can be setup.**
- **Output refresh time with high-speed response at approx. 10ms**
- **Equipped with wide variety of output functions**

Calculation	Calculation display	Rotation speed, circumferential speed, moving speed, period, times (1/s), frequency, flow, passing time
	Measurement method	Periodic calculation method
	Calculation time	10ms +1 period time
	Measurement accuracy	Display value × (±0.01%) within ±1count * The display value indicates the count value except the decimal point.
	Auto zero function	The display value becomes zero with no signal input for the setup time in advance. Selectable from below: OFF (11s), 0.5s, 1.0s, 2.0s, 3.0s, 4.0s, 5.0s, 6.0s, 7.0s, 8.0s, 9.0s, 10.0s
	Rapid deceleration follow-up function	If an input signal rapidly decreases and there is no signal input to tachometer approx. 1 second or more, measurement automatically decelerates with this function and then zeroed in approx. 11 seconds later.
	Moving average function	Selectable from below: OFF (factory setting), 2, 4, 8, 16, 32, 64, 128 *Analog output by TM-3130/0330 is obtained by the processing of moving average with the calculation at every 10ms.
	Peak-hold function	Hold the peak value (maximum, minimum, average) between start and stop status.
Memory	Panel condition memory	Memorize 4 kinds of measurement conditions. Setup conditions can be stored and recalled.
Power supply for detector		
	Output voltage	12VDC ±10%
	Maximum output current	100mA

General specifications		
	Power rating	100 to 240VAC (50Hz/60Hz) 30VA max. 11 to 19VA (TM-3110) 13 to 21VA (TM-3120) 16 to 25VA (TM-3130) 12 to 21VA (TM-3140) (Power rating is 20 to 30VA when analog, BCD and comparator output cards are equipped.)
	Withstand voltage	1500VAC (1min)
	Insulation resistance	10MΩ or more (at 500VDC by megohmmeter)
	Operating temperature range	0 to +50°C (with no condensation)
	Storage temperature range	-10 to +60°C (with no condensation)
	Outer dimensions	96(W)×48(H)×148(D)mm
	Weight	Approx. 310g
Applicable standard		
	CE marking	Low Voltage Directive EN61010-1:2001(2nd) Overvoltage Category II/ Pollution Degree 2 EMC (Electromagnetic Compatibility) Directive EN61326-1: 2006 Embedded board type
Accessories		
	Manual	Specification ×1 copy Basic Operation × 1 copy
	Panel mounting fixtures	1 set

* A power cable is sold separately.

Specifications for TM-3120/3130/3140 and optional cards

<table>
<tr><th>Model name</th><th colspan="2">Specifications</th></tr>
<tr><td rowspan="2">TM-3120
・
TM-0322
(BCD–open collector output card)
・
TM-0321
(BCD–TTL output card)</td><td>TM-3120/0322</td><td>TM-0321</td></tr>
<tr><td>● Output signal
Output form : 6-digit parallel output
Output format : Open collector
Sink current : 32mA max.
Output withstand voltage : 24V max.
Output logic : Positive logic
Data refresh time : 100ms or less
● Input signal (request signal)
Input logic : Negative logic (with pulse width at 10μs or more)
Operating edge : Falling edge
Input voltage : TTL
● Output mode
Mode selector : Selectable from normal mode or request mode</td><td>TM-0321 card outputs BCD as TTL output. Operation is same as TM-3120 (BCD-open collector).
● Output signal
Output format : TTL
Output level : Hi level +3.8 to +5.25V
Lo level 0 to +0.4V
Source current : 4mA max. Fun-out 2</td></tr>
<tr><td>TM-3130
・
TM-0330
(Analog output card)</td><td>● Output signal : Selectable from voltage or current
● Output method : 12bit D/A conversion
However, the resolution may decrease depending on the setup value.
● Output range : Voltage range ; Selectable from followings; 0 to 10V, 0 to 5V, 1 to 5V
Current range ; 4 to 20mA, 0 to 16mA
● Load resistance : Voltage output ; 100kΩ or more
Current output ; 500Ω or less
● Linearity : ±0.3%/F.S.</td><td>● Output adjustment : Voltage output ; ±5%/F.S. or more
Current output ; ±3%/F.S. or more
● Setup accuracy : Voltage output ; ZERO±0.5%/F.S.
FULL±0.5%/F.S.
Current output ; ZERO±0.3%/F.S.
FULL±0.75%/F.S.
● Zero drift : ±0.05%/F.S./°C
● Span drift : ±0.05%/F.S./°C
● Output refresh time
: Selectable from followings; 10, 20, 50, 100, 200, 500ms, 1s</td></tr>
<tr><td>TM-3140
・
TM-0340
(Comparator output card)</td><td>● Output function
UPPER,LOWER,OK,ERROR outputs
* It outputs OK signal when both UPPER and LOWER outputs are OFF.
* It outputs ERROR signal when comparator has an abnormal operation.
● Setup
UPPER setup : 6-digit numeric input
The relay is ON when UPPER ≦ displayed value.
LOWER setup : 6-digit numeric input
The relay is ON when LOWER > displayed value.
● Output specification
Format : 1-make contact output
*Three kinds of outputs (COMP1, COMP2 and COMP3) are output independently. (UPPER, LOWER, OK, ERROR for each combination of outputs.)
Ex.) COMP1=LOWER, COMP2=UPPER, COMP3=ERROR
Maximum contact capacity
: 30VDC/1A, 250VAC/1A
Output refresh time : Approx. 10ms</td><td>● Input specification : Reset output level to be contact OFF.
● Other usable function
Automatic recover : The comparator automatically recovers when the rotation speed falls under the setup level again after that the state of contact is ON at OK/UPPER/LOWER output.
*The rotation speed of recovery can be changed by using hysteresis function.
Setup range ; 0 to 20%, can be setup in 1% step.
Output hold : It can hold the state of contact ON unless the reset signal is input.
Shot output : The time of holding the contact ON (shot time) can be changed. The state will automatically recover after the holding time.
• Initial setting ; OFF (factory setting)
• Setup range ; 10 to 2000ms in 10ms steps
Delay : The state will be contact ON when the rotation speed exceeds continuously for the setup time or more in advance.
*Setup range: 0 to 1000ms in 10ms steps</td></tr>
<tr><td>TM-0350
(RS-232C/gate card)</td><td colspan="2">TM-0350 allows RS-232C communication and gate control. New calculation functions below also can be added in order to respond to higher performance of application.
● RS-232C
Communication method : Serial communication (asynchronous)
Baud rate : Selectable from 9600bps or 19200bps
● Gate function
Control function : Start, stop and reset
● Calculation function
Rotation change rate : Change value against reference value is calculated for each measurement item. (rotation speed, circumferential speed, moving speed, period, passing time, number of times, flow).
*Reference value ; Section average value or user setup (1 to 999999 numeric input)
Measurement accuracy ; [±0.02% x maximum section variation±2 counts] / [±0.01% x reference value±1 count]
*Maximum section variation= | (Maximum or minimum value in measurement section whichever having a larger difference from reference value)-reference value |
Section data memory function : Calculate and store the average, maximum, minimum values and section change rate in setup time at every section.
Section time; Selectable from 1s, 5s, 10s, 30s, 1min, 5min, 10min, 30min, 60min
Maximum number of sections; 48 sections
Memory mode; Ring buffer mode or memory full mode
*Ring buffer mode; Delete section memory in order of the oldest one and continue to store the latest section data when number of section data exceeds 48.
*Memory full mode; The storing of the data will be completed after the data for 48 sections are stored.
Acceleration calculation function : The acceleration data is obtained at every 1 second by the calculation of rotation speed, circumferential speed, moving speed.
Display unit; rad/s², r/s², m/s²
Measurement accuracy; ±0.02% x V_{DEF} ±2 counts
*V_{DEF}; Speed difference for 1 second
Reached speed time function : Measuring the time duration until the stop command value is reached from the start command value in rotation speed, circumferential speed, and moving speed.
Start command value, stop command value; 0 to 999999 numeric input
● Control connector : MC1.5/10-ST3.5 Made by Phoenix Contact GmbH & Co. KG (Germany)</td></tr>
<tr><td>TM-0301
(DC power operated option card)</td><td colspan="2">TM-0301 is an optional card which allows using of DC power.
● Power voltage : 12 to 24VDC±5%
● Power rating : TM-3110/3120/3140; Approx. 7VA, TM-3130; Approx. 9VA
*Power rating is approx. 15VA when analog, BCD and comparator output cards are equipped.</td></tr>
</table>

Table of optional card combination

	Name of optional card					
	TM-0321	TM-0322	TM-0330	TM-0340	TM-0350	TM-0301
	BCD output (TTL)	BCD output (open collector)	Analog output	Comparator output	RS-232C	DC power operaed
TM-3110	○	○	○	○	○	○
TM-3120	○	●	○	○	X	○
TM-3130	○	○	●	○	○	○
TM-3140	○	○	○	●	○	○

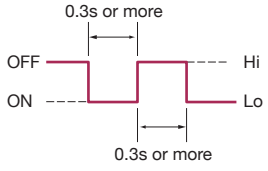
●: Provided as standard. ○: Provided as an option. X : Can not be built-in.

Notes) TM-0321 or TM-0322 and TM-0350 cannot be assembled in the same system configuration at the same time.
TM-0321 and TM-0322 cannot be assembled in the same system configuration at the same time.

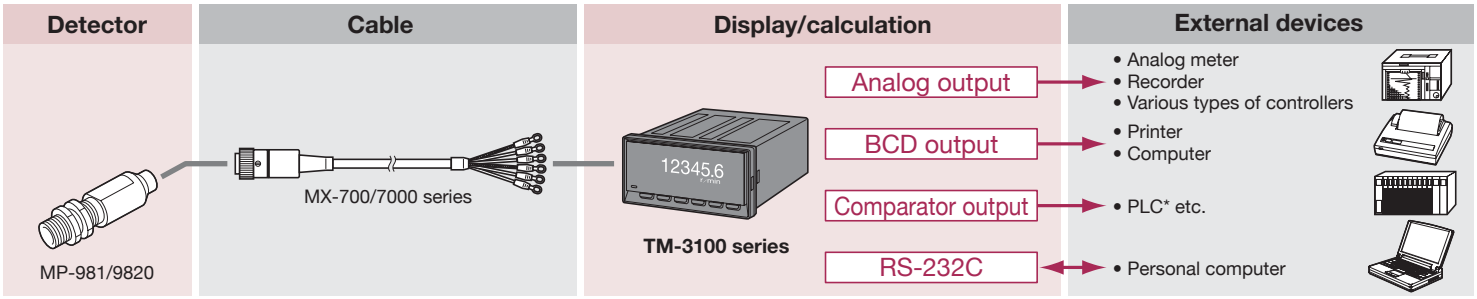
External control signal input (start, stop and reset)

Function : Start, stop and reset
Input voltage : Hi level; +4.2 to +5.25V
Lo level; 0 to +0.9V
Non-voltage input : Open voltage; 5±0.25VDC max.
Short-circuit current; 1mA max.
Contact resistance; 50Ω or less

● **Timing of signal**



System configurations



* Programmable Logic Controller

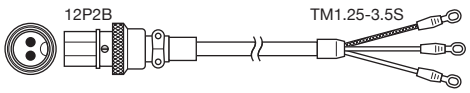
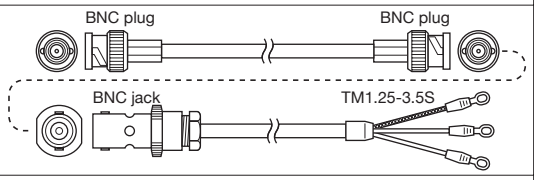
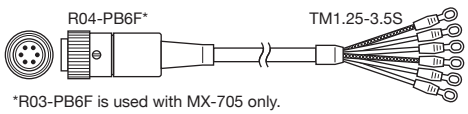
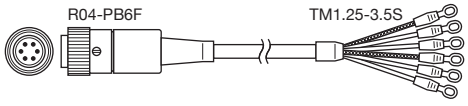
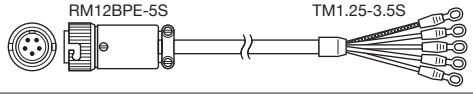
Main rotation detectors

Type	Model name	Features and measurement range
Electro-magnetic type	MP-9100 etc. 	• No power requirement, excels in durability • Oil-proof, heat-resistant, and compact, various types to fulfill the requirements **Measurement range (at 60P/R)** MP-9100: 200 to 35,000r/min
	MP-810B, 610 etc. 	• Direct-coupling to rotation shaft • Selectable from three types; base mount, dual-shaft and flange type (MP-810B) **Measurement range** MP-810B: 5 to 5,000r/min MP-610 : 50 to 15,000r/min
Magneto-electric type	MP-9820, 981 etc. 	• Detection from nearly 0r/min • Output stable square signal from ultra-low to high speed • Acid-resistant, water-proof type (AP-981: protection class IPX7) **Measurement range (at 60P/R)** MP-981 : 1 to 20,000r/min MP-9820: 1 to 100,000r/min
Line speed meter	RP-721 	• Line speed can be easily measured just applying the roller to the measurement object. • Various types are available such as low/medium line speed measurement (120 or 1200P/R) and length measurement (200P/R). **Measurement range** Medium line speed measurement type (120P/R): 0 to 400m/min Low line speed measurement type (1200P/R): 0 to 200m/min

Type	Model name	Features and measurement range
Photoelectric type	LG-916, 930 	• Small type photoelectric detector, a unified structure of light source and receiver • Using a pulse modulation method prevents from being affected by ambient light **Measurement range (Using the exclusive reflective mark HT-011)** LG-916: Maximum response speed 20m/s; Detection distance 20mm max. LG-930: Maximum response speed 25m/s; Detection distance 70 to 200mm
	FS-540+FG-1200 	• Fiber sensor allows using at narrow area. **Measurement range (Using the exclusive reflective mark HT-011)** Maximum passing speed: 60m/s or less Detection distance : 70mm max.
Rotary encoder	RP-432Z etc. 	• Detection form nearly 0r/min • Models with various output pulse types are available. • 2-phase difference (90 degree) wave output **Measurement range (at 600P/R or less)** 0 to 5,000r/min

*Please refer to the exclusive brochure of each model in details.

Applicable detector and signal cable

Applicable model	Cable	Specification	Cable model
MP-610/610B/750/9100/ 9120/9200/940A/963 810B/820B/830B (MP-081+MX-500 series)	P-2 (2-core outer shielded cable)		MX-505 5m 510 10m 520 20m
MP-930/935/936/950/954/ 962 FG-1200	3C-2V of MX-100 series (High frequency coaxial cable) P-2 of MX-603 (2-core outer shielded cable)		MX-101 1.5m 105 5m 110 10m 115 15m 120 20m MX-603 0.3m (conjunction cable) *Both any model of MX-100 series and MX-603 are required to connect TM-3100 series.
MP-981 LG-916	D-5 (Composite 5-core vinyl sheath cable)	 *R03-PB6F is used with MX-705 only.	MX-705 5m 710 10m 715 15m 720 20m (MX-705: Another end is processed as open status.) (MX-710/715/720: Another end has crimp terminal.)
MP-9820	D-5 UL (Composite 5-core vinyl sheath cable)		MX-7105 5m 7110 10m 7115 15m 7120 20m (Another end has crimp terminal.) *The MP-9820 is applicable to CE marking only in the use of combination with MX-7000 series.
RP-721	R-6 (Twisted-pair cable)		RP-004 5m 10m
MP-911/992 AP-981 SP-405ZA		No need (Signal cable is directly attached to the detector itself. Another end is processed as open status.)	

Greatly improved functions in all models of TM-3100 series

(provided as standard in all models)

Display function

Displayed refresh time can be changed by customer.

* Select one of the followings as refresh time:
  0.2s, 0.4s, 0.5s, 0.6s, 0.8s, or 1.0 to 10s (1.0s step).

The displayed value shows the average in the setting of refresh time.

Moving average function

The moving average of measurement value can be displayed and output with this function.
It reduces variation in display values and enables changes in rotation speed to be displayed smoothly thus making it easy to check rotation phenomena.

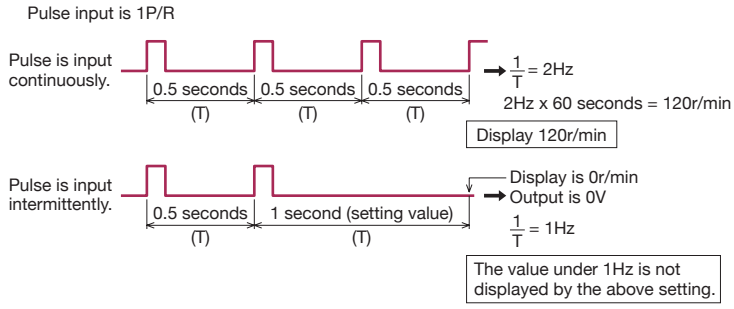
* Select one of the followings as number of moving average rotations:
  OFF, 2, 4, 8, 16, 32, 64, or 128

Auto zero function

This function makes the displayed value at zero when there is no signal input to tachometer for a fixed period of time. It can be also used when you do not want to display a rotation value which falls under the setup level in advance.

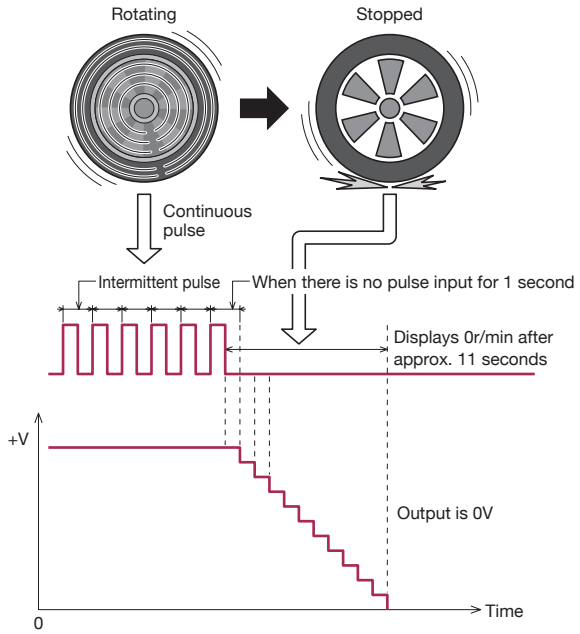
* Select one of the following ranges: OFF, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 seconds
  OFF: The display will show zero if there is no signal input for 11 seconds or more.

Example: If the time for auto zero function is set at 1 second (factory setting at the shipment), it becomes as followings.



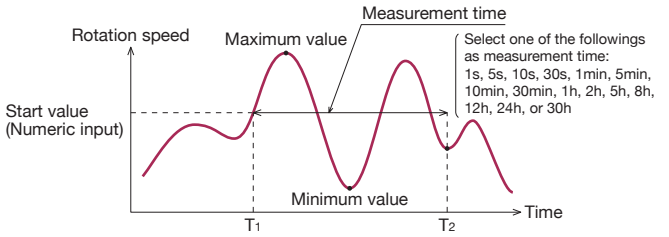
Rapid deceleration follow-up function

If the input signal rapidly decreases and there is no signal input for approx. 1 second or more, the rotation speed (both displaying and output values) decreases automatically and zero is displayed after approx. 11 seconds.

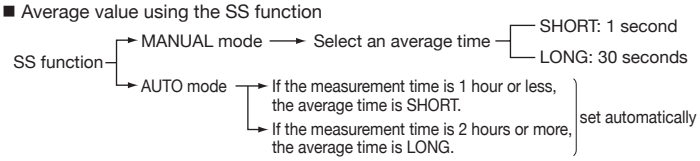


SS function*

This function starts measurement after rotation speed reaches a setup value and continues measurement for a setup period of time. This function can measure the average, maximum, and minimum values between start and stop. This is ideal for checking the stability of rotation speed.



■ Average value using the SS function

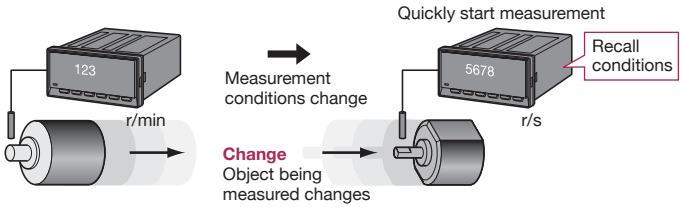


The function calculates the section average value over the measurement time using the average values for the SHORT or LONG.

*SS function : Function for the measurement during the specified time by setting time from **START** to **STOP**

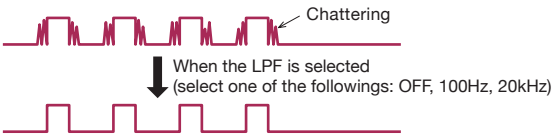
Panel condition memory

This function is used to store and recall the measurement condition (parameter). Up to four sets of conditions can be stored. When the object being measured or the measurement conditions are changed, one of the stored sets of conditions can be recalled, enabling measurement to start immediately.



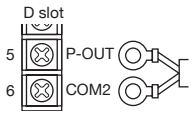
Mount low-pass filter (LPF) on input

The LPF cancels chattering and noise in the input signal. This enables the speed of rotation to be measured more accurately.

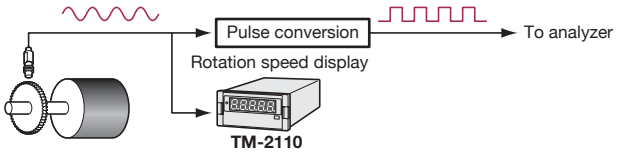


Pulse output function

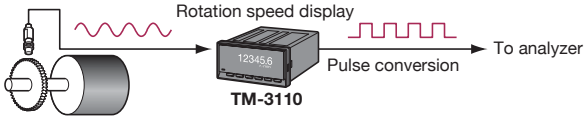
All models are equipped with the pulse output function. This is useful function when the measurement requires the rotational pulse signal such as tracking analysis and so on.



• **Old models (TM-2100 series):** Pulse converter is required.



• **New models (TM-3100 series):** It outputs pulses directly from TM-3100 series.



TM-0350: Supporting the higher performance of the measurement (option)

* The following functions are available by mounting TM-0350 (RS-232C/gate card).

Measurement of the rotation change rate

Measuring the fluctuation in rotation (rotation change rate). Rotation change has an adverse affect on quality, and could damage the rotating body itself.

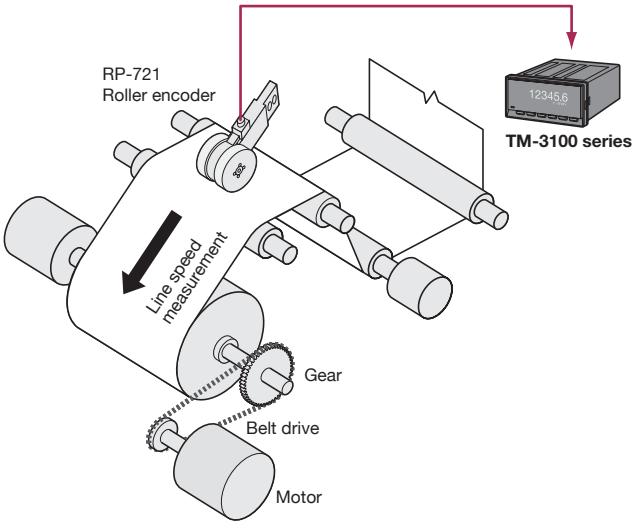
Calculation method

Change rate (%) = | Latest measurement value – reference value | ÷ reference value x 100

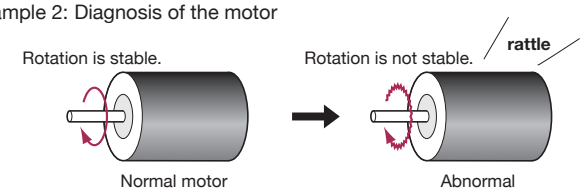
Reference value: (1) User setting value

(2) Average at 1s interval (summation avarage value at every 10ms)

Example 1: Detecting fluctuation in the rotation of the roll for pulp, magnetic tape, or industrial-film winder



Example 2: Diagnosis of the motor



Measurement of the section data

This function is used to calculate and store the average, maximum, minimum values and section change rate in setup time at every section.

Select one of the following time sections as section time:
1s, 5s, 10s, 30s, 1min, 5min, 10min, 30min, and 60min

Maximum number of sections: 48

Memory modes

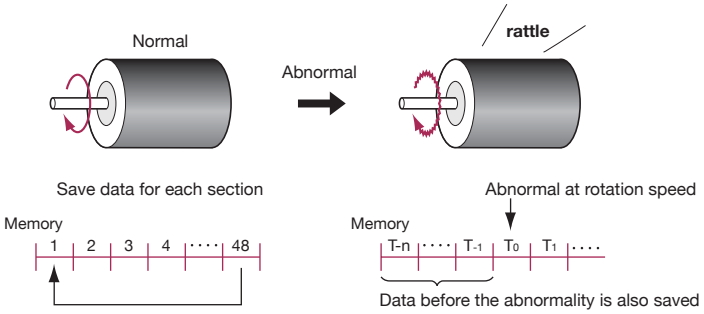
Ring-buffer mode : This function is to delete section memory in order of the oldest one and continue to store the latest section data when number of section data exceeds 48.

Memory-full mode : The storing of the data will be completed after the data for 48 sections are stored.

Section change rate (%) = (Maximum value for each section – average value) ÷ average value x 100

Example: Data just before abnormal rotation can be detected.

<Using ring-buffer mode>



Measurement of the acceleration by calculation

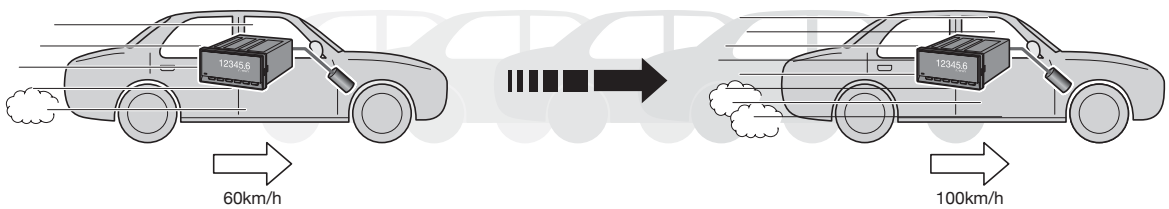
The acceleration can be measured by the calculation of rotation speed, moving speed and circumferential speed.

Example: Measuring acceleration for car acceleration testing or engine idling

Measurement of the reached speed time

Measuring the time duration until the stop command value is reached from the start command value in rotation speed, circumferential speed, and moving speed.

Example: Car acceleration testing



Display the acceleration, which is calculated at every 1 second interval.

Acceleration (rad/s^2) = [rotation speed (latest) – rotation speed (from 1 second earlier)] x RAD ÷ (1 second)

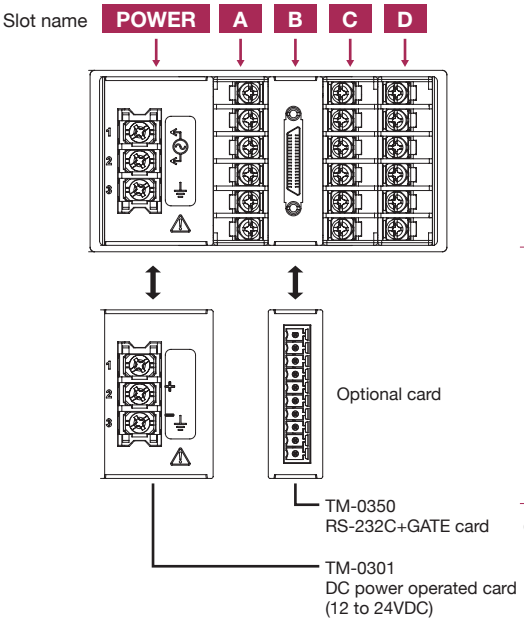
Acceleration (r/s^2) = [circumferential speed (latest) – circumferential speed (from 1 second earlier)] ÷ (1 second)

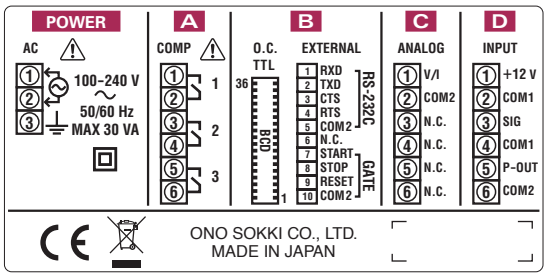
Acceleration (m/s^2) = [moving speed (latest) – moving speed (from 1 second earlier)] ÷ (1 second)

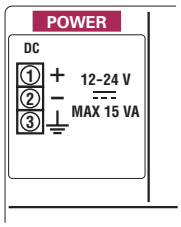
* RAD = 6.2832 radians/second

Rear panel Terminal block screw: M3

<Example>





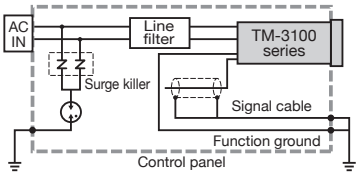


Noise measures installation diagram

Parts list (Recommended by ONO SOKKI)

Parts name	Manufacturer	Model name
Line filter	TDK Corporation	ZHC2203-11*
Surge killer	Phoenix Contact GmbH & Co. KG (Germany)	F-MS 12ST*
Surge killer		VAL-MS 230ST*
Surge killer		VAL-MS 230ST*
Base for surge killer		VAL-MS-BE*

*Or equivalent model



* Make the signal cable as short as possible.
To shield all input and output signal cables, connect both ends to the ground terminal of the panel for grounding.

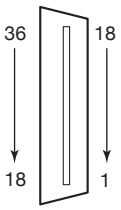
Cautions on installation for CE marking and EMC

- Use the TM-3100 series tachometer to be mounted in a rack or the like.
- Use a shielded cable as the signal cable.
- Separate the instrument as much as possible from an apparatus which generates strong high frequency signal or surge in order to use a surge killer and a line filter.
- After grounding the FG terminal (⏚) of the digital tachometer to the panel, connect the panel to ground.

Slot name	Standard		Option	
POWER AC power input unit	**Common to all models**	100 to 240VAC (50/60Hz)	**TM-0301** DC power operated card	12 to 24VDC ±5%
Slot **A** Comparator output unit	**TM-3140** (Comparator output)	3 outputs of 6-digit upper-/lower limit settings	**TM-0340** Comparator output card	3 outputs of 6-digit upper-/lower limit settings
Slot **B** External output unit	**TM-3120** (BCD output, open collector output)	BCD open-collector 6-digit parallel output Applicable connector: HDRA-E36MA+ (connector) HDRA-E36LPTH (case) 36-pin 0.8mm pitch Honda Tsushin Kogyo Co., Ltd. (Japan)	**TM-0321** BCD output card (TTL level)	BCD TTL 6-digit parallel output Applicable connector: HDRA-E36MA+ (connector) HDRA-E36LPTH (case) 36-pin 0.8 mm pitch Honda Tsushin Kogyo Co., Ltd. (Japan)
			TM-0350 RS-232C/gate card	Applicable connector : MC1.5/10-ST3.5 Phoenix Contact GmbH & Co. KG (Germany)
Slot **C** Analog output unit	**TM-3130** (Analog output)	Selectable from voltage or current Output voltage range: 0 to 10V, 0 to 5V, 1 to 5V Output current range: 4 to 20mA, 0 to 16mA	**TM-0330** Analog output card	Selectable from voltage or current Output voltage range: 0 to 10V, 0 to 5V, 1 to 5V Output current range: 4 to 20mA, 0 to 16mA
Slot **D** Signal input unit	**Common to all models**	Selectable from AC or DC amplification Voltage/non-voltage output Applicable detector : MP, LG, RP series		

BCD output terminal (TM-3120, TM-0322, TM-0321)

Pin number and signal



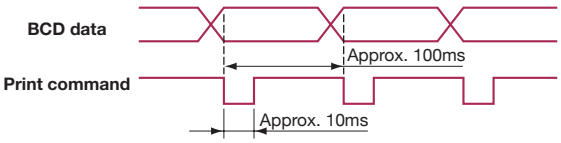
HDRA-E36MA+ (connector)
HDRA-E36LPTH (case)
36-pin 0.8mm pitch

BCD pin assignment

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

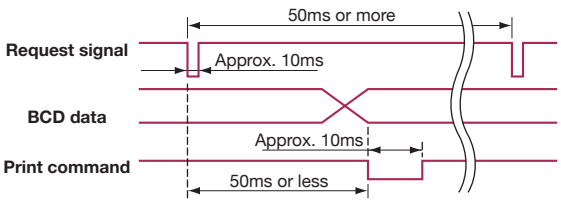
- **Normal mode**

Output the print command at every approx. 100ms.



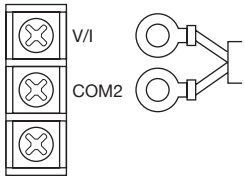
- **Request mode**

Output the data by the each external request signal. The minimum interval between request signals is 50ms.



Analog output (TM-3130, TM-0330)

Connection of the output cable

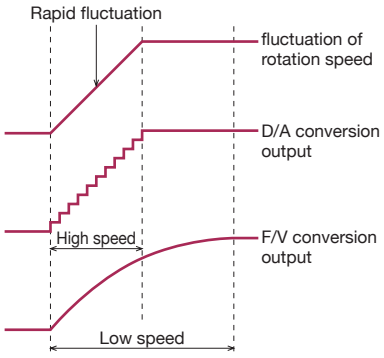


Voltage or current output is selectable.

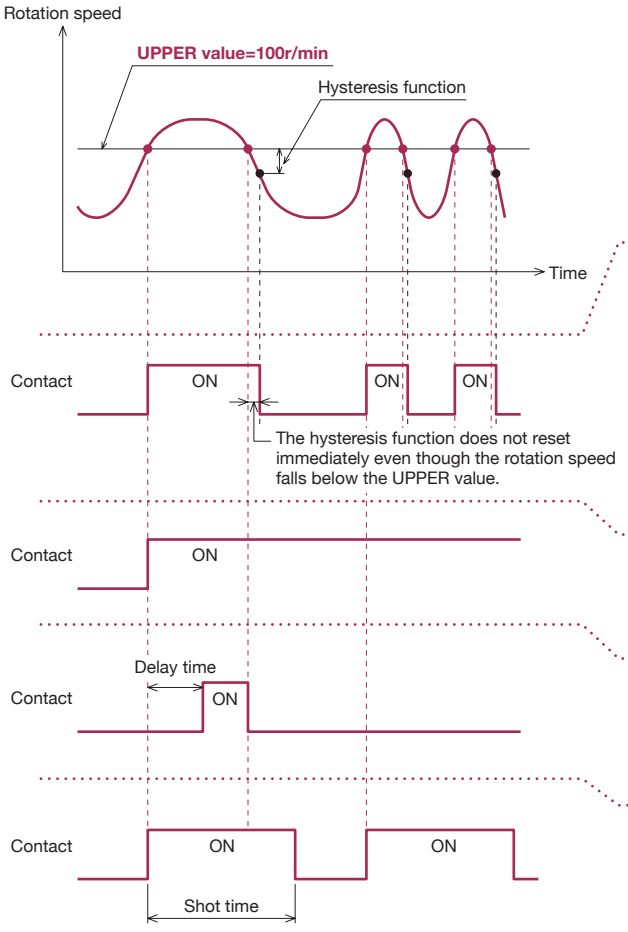
It outputs the analog signal with high-speed response at any measurement even though there is rapid fluctuation. Each and every instantaneous rotation speed can be measured accurately.

	TM-2130 (old model) F/V conversion	TM-3130 (new model) D/A conversion
Response	120ms±20ms or 700ms±100ms	Selectable from followings: 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s
Feature	It outputs signals smoothly even though the rotation of measurement object is not stable.	It outputs signals with high-speed response to rotational fluctuation.*

*Moving average function reflects the result of analog output.



Comparator output (TM-3140, TM-0340)



- **Output refresh time : 10ms**
- **The contact becomes ON when it is "UPPER ≦ rotation speed". The contact becomes ON when it is "LOWER > rotation speed".**

Example:

Set the upper limit value at 100r/min in order to output signal when the measured value exceeds 100r/min. (UPPER setup)

Automatic recover function

- The comparator automatically recovers when the rotation speed falls below the setup upper level (100r/min in this example).
- The rotation speed of comparator recovery can be changed by using hysteresis function.
  When the hysteresis is setup at 10%, rotation speed recovers when it is 90r/min.
  100r/min−100r/min x 0.1=90r/min
  *Setup range: 0 to 20% in 1% step
  When the hysteresis is setup at 0%: Rotation speed to be contact ON=Rotation speed of recovery
  When the hysteresis is setup at other than 0%: Rotation speed to be contact ON≠Rotation speed of recovery

Output hold function

- The state of contact ON is held unless the reset signal is input. When the rotation speed exceeds 100r/min, the comparator signal is output and held its state.

Delay function

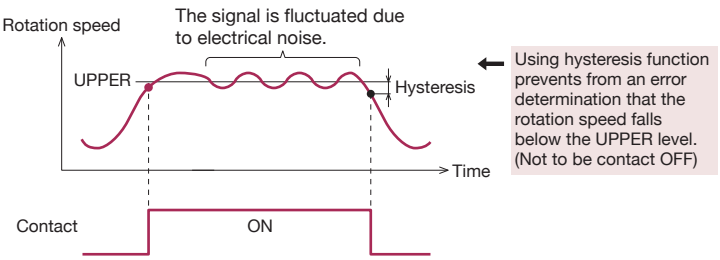
- The state will be contact ON when the rotation speed continuously exceeds the setup value for a certain period of time (delay time).
  *Setup range: 0 to 1000ms in 10ms steps

Shot output function

- The time of holding contact ON (shot time) can be setup.
  The state will be automatically contact OFF after the holding time.
  *Setup range: OFF, 10 to 2000ms, in 10ms steps

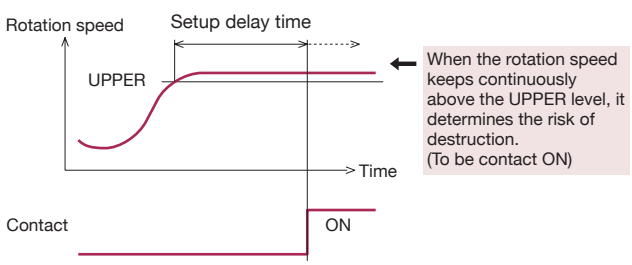
- **Prevent from an error determination due to the affect of noise**

  Use the hysteresis function of automatic recover function



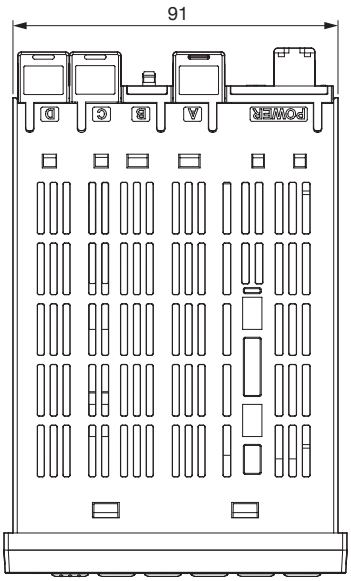
- **Prevent the device from being destroyed**

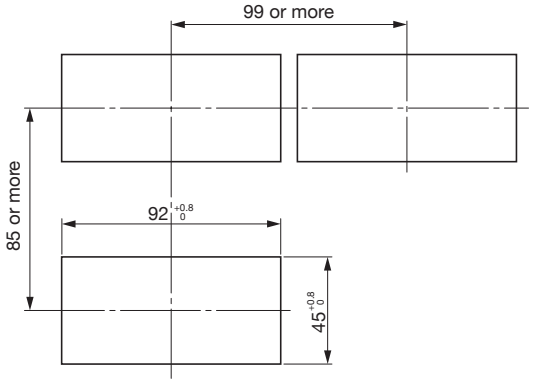
  Use the delay function



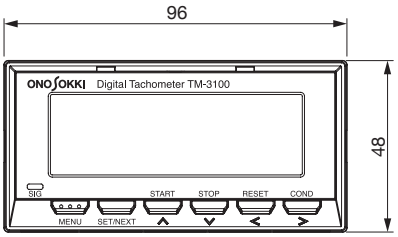
Outer Dimensions

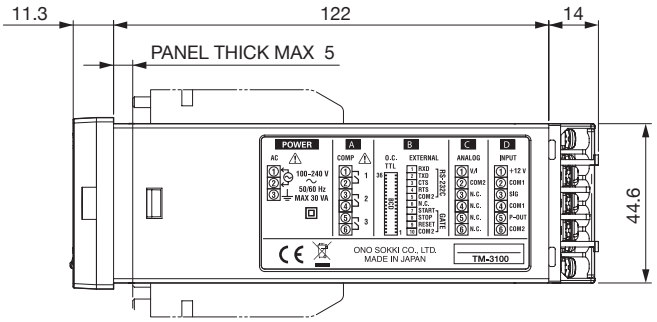
(unit: mm)





Panel cutout dimensions





Model name	Product name	Remarks
TM-3110	Digital Tachometer	Display only
TM-3120	Digital Tachometer	BCD output (open collector)
TM-3130	Digital Tachometer	Analog output
TM-3140	Digital Tachometer	Comparator output
TM-0321	BCD TTL output card	TTL level
TM-0322	BCD open collector output card	Open collector
TM-0330	Analog output card	
TM-0340	Comparator output card	
TM-0350	RS-232C card/gate card	RS-232C, GATE
TM-0301	DC power operated card	
AA-8207	BCD cable	3m, another end is processed as open status.
HT-011	Reflective mark	12-mm square seal

ONO SOKKI

* Outer appearance and specifications are subject to change without prior notice.

URL: http://www.onosokki.co.jp/English/english.htm

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