

LG/SP/MP/RP series
FV/FT/HT/TM series

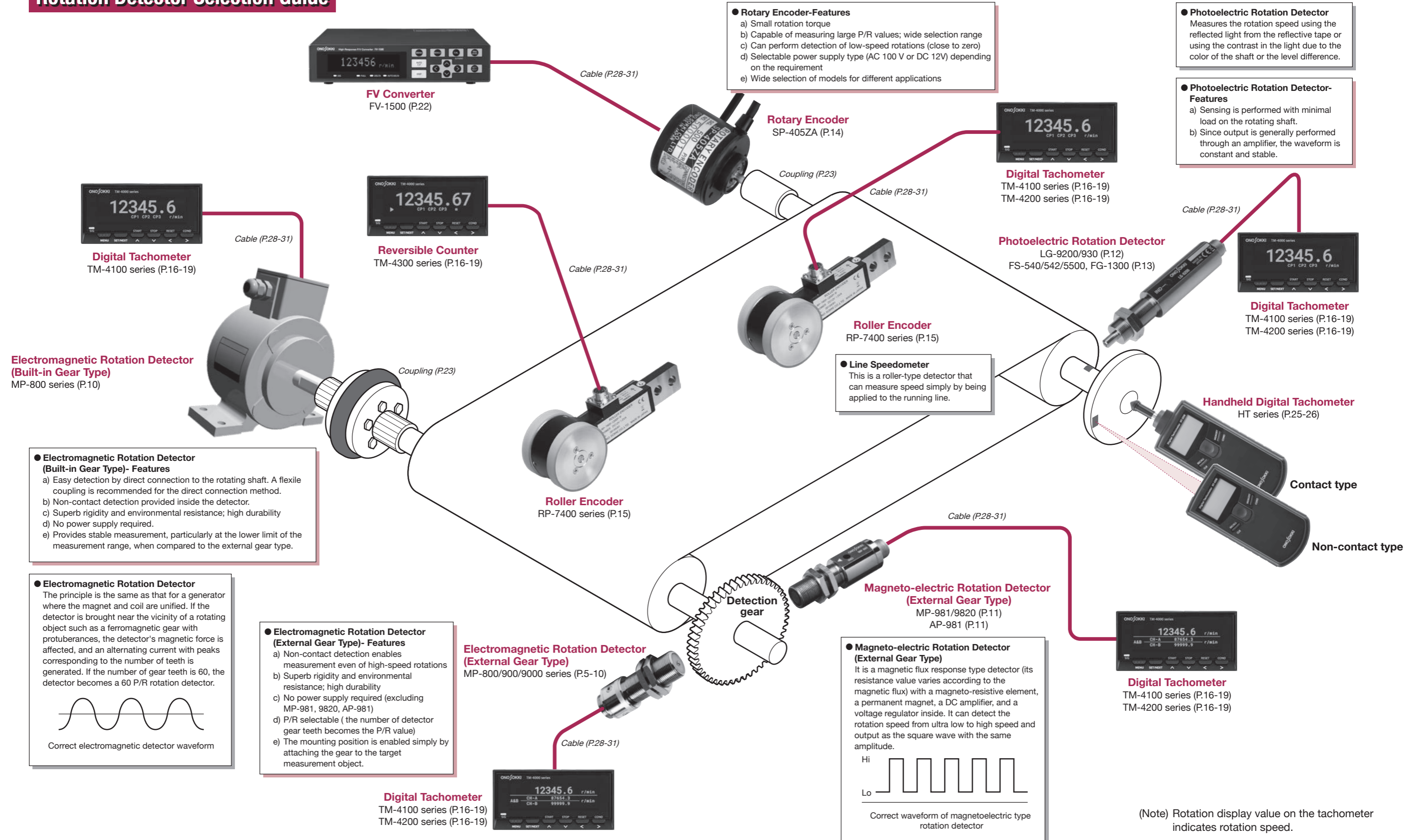
ONOSOKKI

Digital Tachometer



Diverse lineup that Ono Sokki is proud of. Choose the product that satisfies your need.

Rotation Detector Selection Guide



Rotation Detector

Notes on Detection Gears

•Detection Gear

In general, gear made with soft metals (S45C, SS400, etc.) is used as a detection gear, which has magnetic body and large magnetic permeability. When measuring the rotation speed, if the gate time of the counter is 1 second, it can be read directly by the counter using the gear with 60 P/R.

•Shape of a Detection Gear

Fig.1 shows detector output waveforms from various types of external rotors (detection gears etc.)

Involute gear is the most suitable for detection gear.

*Note

- Distortion might appear in output waveform, such as high frequency distortion when triangular teeth / square teeth / round teeth / partially missing teeth are used.
- If the gear is magnetized, output voltage decreases or the abnormal waveform is output due to interference with the permanent magnet inside the detector.

Abbreviation of gears: M=Module Z=number of teeth D=pitch circle diameter of gear

$$M = \frac{D}{Z} \quad \frac{N \text{ (r/min)} \times Z \text{ (number of teeth)}}{60 \text{ (s)}} = C \text{ (Hz)} \quad \text{When } Z=60, N=C$$

•Shape of the gear for the MP-981 and the mounting method

(1) Output signals according to the shape of the gear

(A) Involute gear

(B) Spur gear

(C) Custom gear

Since two pulses may be output for one tooth in the case of (B) and (C) in the figure above, (B) and (C) are not suitable for use as a detection gear.

(2) Mounting method

(A) **(B)** Please avoid the mounting configurations shown in the figures left, as they will cause reciprocal magnetic interference. In the case of (A), a gear with a different module is mounted in the vicinity of the MP-981. In the case of (B), two or more MP-981 units are mounted within the vicinity of one gear.

(3) How to use a custom gear

Reduce the tooth width to 2 mm or less

(5) How to use a gear when M = 3 or more

(Example) M = 16, D = 80, Z = 5P/R. Reduce the tooth width this dimension to 2mm or less

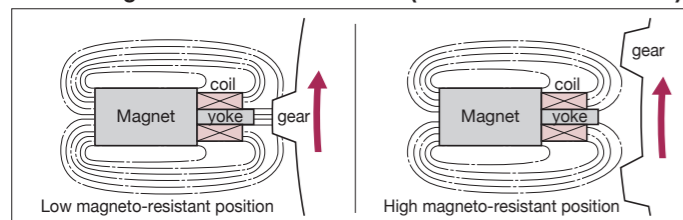
(4) How to calculate Module M

This calculation is for involute gears only

$$\text{Module } M = \frac{\text{Reference pitch circle diameter}}{\text{Number of teeth}}$$

Electromagnetic Rotation Detectors and Magneto-electric Rotation Detectors

Electromagnetic Rotation Detectors (MP-900/MP-9000 series)



Electromagnetic Rotation Detector generates frequency signal of proportional to the rotation speed by bringing it close to the tooth tip of the detection gear attached to the rotating shaft. It consists of a permanent magnet, a detection coil, and a yoke.

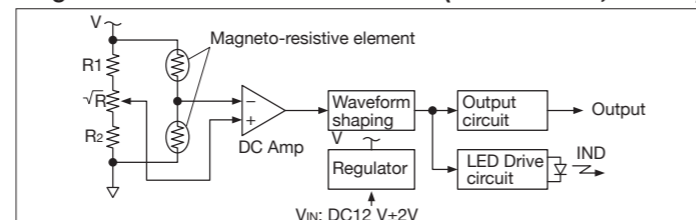
When a magnetic material approaches in the vicinity of the yoke, the magnetic flux passing through the detection coil changes, and an induced voltage of frequency proportional to the change is generated in the detection coil. Magnetic flux pulsates "frequency f = rotation speed x gear". Therefore, this will be output as the rotation signal of the detector.

Features are as follows.

- Easy structure
- No power supply required
- Compact
- No need for maintenance

It provides reliable rotation measurement and is widely used in many ways.

Magneto-electric Rotation Detectors (MP-981/9820, AP-981)



Magneto-electric rotation detector is made by applying a magneto-resistive element whose resistance value varies depending on the intensity of the magnetic field.

Normally, a constant magnetic field is applied by a magnet, and the change in the magnetic field when the detection gear approaches the element is detected as a change in the resistance value.

Changes in resistance value (= differential output) is detected and its signal is amplified by a DC amplifier. The output of the DC amplifier goes through a waveform shaping circuit and is made into a rectangular wave.

Magneto-resistive element is arranged at the tip of the detector. For correct detection, it is necessary that the detection surface and the gear surface face each other with the proper direction and position. As a guide, the detector is marked with an alignment mark. (power supply: DC 12 ± 2 V)

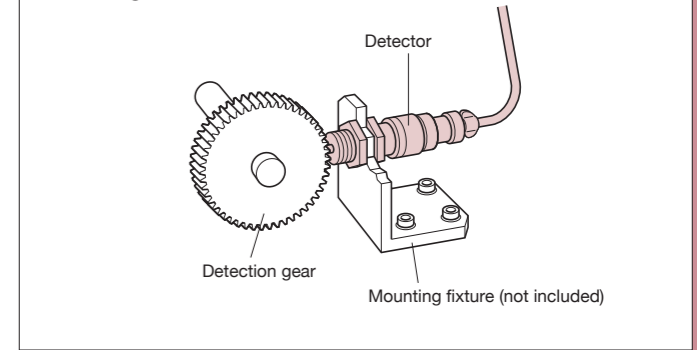


Electromagnetic Type Rotation Detector MP-900/9000 series

By bringing the MP-900/9000 series close to the tooth tip, it detects the frequency signal proportional to the rotation speed (sine wave output). You can select according to the purpose from wide selection, such as general purpose type, special type including oil proof / heat resistant type. Extension cable, signal cable, connector are sold separately (See P28-31).



Mounting method



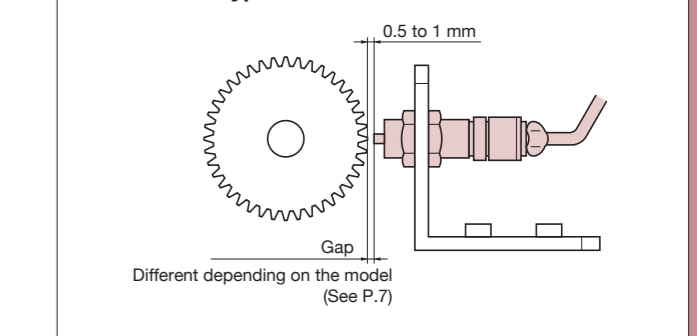
•Features

- General-purpose type MP-9100**
 - Low cost and popular type
- Direct attached cable type MP-911**
 - Cable 5m direct attached type of MP-9100 (cable: 3D-2V)
- Low impedance (high-speed rotation type) MP-9120**
 - Noise-resistant due to low impedance
 - Adapted for detection in high speed range
 - Same size as MP-9100
- Oil-proof type MP-930**
 - Conforms to Japan Electrical Manufacturers Association (JEM) standard (old), JEM-1030-1983*1 oil proof type
 - Direct attached cable 0.5 m
- Oil proof and heat-resistant type MP-935**
 - Conforms to Japan Electrical Manufacturers Association (JEM) standard (old), JEM-1030-1983*1, oil proof type
 - Heat resistant cable up to 150 °C
 - 1 m directly attached type
- Heat resistant type MP-936**
 - Heat resistant up to 220 °C
 - Heat resistant cable 1 m directly attached type
- Long body type MP-940A**
 - Long body type of 105 mm mounting section, suitable for the rotation detection of the rotating object deeply installed.
- Long body type MP-954**
 - Long body type of 81 mm mounting section, suitable for the rotation detection of the rotating object deeply installed.
 - Mounting screw size is same as MP-950
 - Directly attached cable 0.5 m

*1 Protective type F: Not affected harmful by oil droplets/oil spill from any direction.

- Compact type MP-950**
 - Compact (M12), directly attached cable 0.5 m
 - Compact type MP-962**
 - Compact (M8), directly attached cable 0.5 m
 - Ultra-compact type MP-992**
 - Ultra-compact (M5), directly attached cable 0.5 m
 - Compact module type MP-9200**
 - For module 0.5 to 1
 - Medium module type MP-963**
 - For module 3 to 10
- Standard detection gear**
- MP-001 (σ = 62)
 - Module 1, 60 teeth

Non-contact type



* When the electromagnetic type rotation detector MP series is used especially in the place where great importance is placed on reliability, the technical consultation is required. Please consult your nearest distributor or Ono Sokki sales office nearby.

● **MP-900/9000 series specifications**

Items	Detectors		General-purpose	General-purpose (With cable attached)	Low impedance (High-speed rotation type)	Oil-proof (With cable attached)	Oil-proof/Heat-resistant (150 °C) (With cable attached)	Heat-resistant (220 °C) (With cable attached)
	MP-9100	MP-911	MP-9120	MP-930	MP-935	MP-936		
DC resistance value (Ω)*1	850 to 950		85 to 105	850 to 950	600 to 700	800 to 900		
Inductance (mH) [1kHz, T.Y.P.]	300		30	300	270	370		
Impedance (Ω) [1kHz, T.Y.P.]	2 k		240	2 k	1.8 k	2.5 k		
Output voltage (Vp-p) [1kHz, T.Y.P.]*2	2.0 or more							
Detectable frequency range (Hz) *3, *4	200 to 35,000		200 to 80,000	200 to 35,000	300 to 35,000			
Detecting gear module	1 to 3							
Operating temperature range	-10 to 90 °C				-10 to 150 °C	-10 to 220 °C		
Vibration resistance (m/s ²)*5	196							
Shock resistance (m/s ²)*6	1,960							
Weight (g)	Approx. 90	Approx. 300 (Including cable)	Approx. 90	Approx. 100 (Including cable)				
Surrounding magnetic field (T)	0.03 or less				0.02 or less			

Items	Detectors		Long body	Long body (With cable attached)	Compact type (With cable attached)	Compact type (With cable attached)	Ultra-compact type (With cable attached)	For small modules	For medium modules
	MP-940A	MP-954	MP-950	MP-962	MP-992	MP-9200	MP-963		
DC resistance (Ω)*1	500 to 600	2.1 to 2.3 k		1.25 to 1.45 k	160 to 190	850 to 950	3.7 to 4 k		
Inductance (mH) [1kHz, T.Y.P.]	270	400		210	25	300	1800		
Impedance (Ω) [1kHz, T.Y.P.]	1.8 k	3.5 k		2.1 k	250	2 k	16 k		
Output voltage (Vp-p) [1kHz, T.Y.P.]*2	2.0 or more				1.5 or more	0.5 or more	0.6 or more (M=0.75)	2.5 or more	
Detectable frequency range (Hz)*3, *4	300 to 35,000				400 to 35,000	400 to 100,000	300 to 35,000	45 to 15,000	
Detecting gear module	1 to 3						0.5 to 1	3 to 10	
Operating temperature range	-10 to 90 °C				-10 to 120 °C	-10 to 90 °C			
Vibration resistance (m/s ²)*5	196						147		
Shock resistance (m/s ²)*6	1,960								
Weight (g)	Approx. 150	Approx. 90 (Including cable)	Approx. 70 (Including cable)	Approx. 50 (Including cable)	Approx. 3 (Including cable)	Approx. 90	Approx. 200		
Surrounding magnetic field (T)	Up to 0.01				Up to 0.005	Up to 0.001	Up to 0.005	Up to 0.03	

*1: The temperature coefficient for the DC resistance value: 0.4% / °C

*2: Load resistance: 10 kΩ, M=1, gap=0.5 mm (As for MP-963; load resistance 10 kΩ, M=3, gap=1.5 mm)

*3: When using the 60 P/R detection gear, the value for frequency [Hz] and value for rotation speed [r/min] are the same.

*4: When using the Ono Sokki standard MP-001 detection gear (when using a gear with M=3 for MP-963, M=0.75 for MP-9200)

*5: JIS E 4031, five types, 40 Hz, two hours in each of the X and Y directions; four hours in the Z direction

*6: Three times each in the X, Y and Z directions

● **Notes on the Detection Gear**

a) **Gap between the detector and the detection gear**

The smaller the gap, the lower rotation speed can be detected. The gap should normally be set between 0.5 to 1 mm.

b) **Detection gear tooth shape**

An involute gear is recommended.

c) **Gear size**

The module unit (M) is used. This value is used to determine the size of the teeth. Modules with the same number of teeth can be meshed.

$$\text{Module} = \frac{\text{Pitch circle diameter}}{\text{Number of teeth}}$$

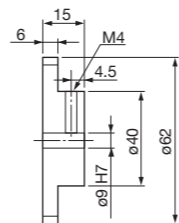
We recommend a module of greater than 1 and the width of teeth 4 mm.

d) **Detection gear material**

Material with a property of being strongly attracted to a magnet, (ferromagnet) is good to use. If you have a choice, we recommend materials such as S45C, SS400, SUS430, etc.

● **Ono Sokki's Standard Detection Gear MP-001**

The detection gear Ono Sokki provides is a module 1 involute gear with 60 teeth.
 Number of teeth: 60
 Module : 1
 Material : SS400 (surface treatment: trivalent chromate)



● **The relationship between the gap and detection range**

- (1) The relationship between the gap from the detector to the detection gear and the detection range (lowest measurable value) is given in the tables below.
- (2) The rotation speed range where an output voltage of 0.5 Vp-p or more can be maintained. (load resistance = 10Ω)
- (3) The measurable rotation speed varies according to the type of display unit used.

● **MP-900/9000 series measurable rotation speed (r/min)**

* When using a detection gear with 60 teeth

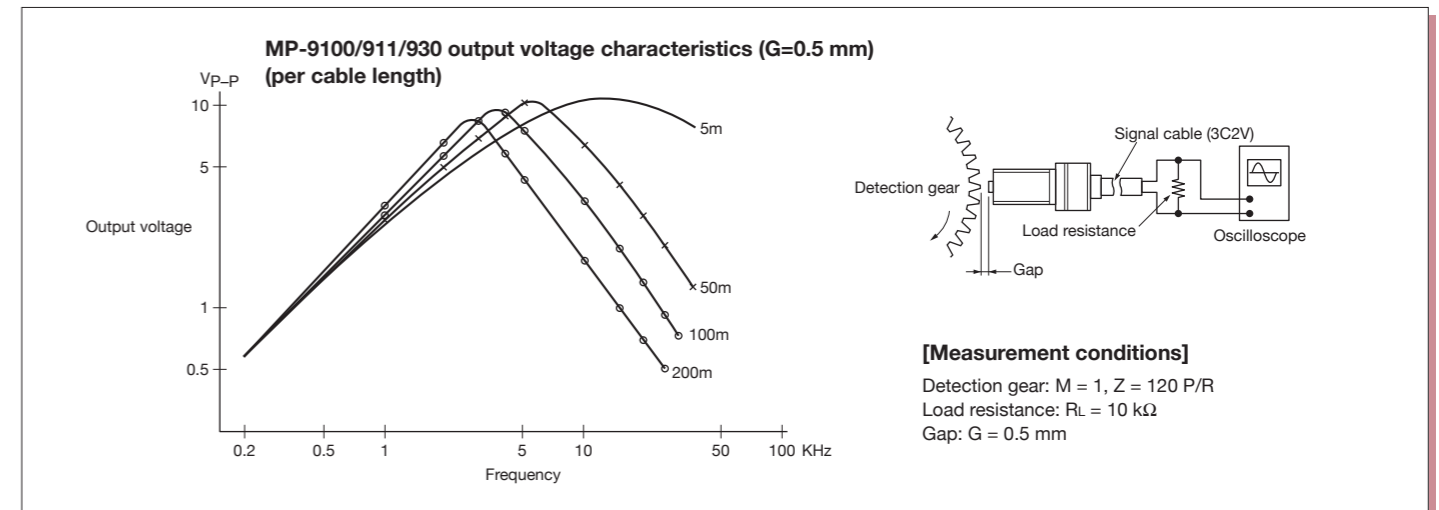
Model	Module	Lower limit of rotation speed						Upper limit of rotation speed
		M=1		M=1.5		M=2		
Gap		0.5	1	0.5	1	0.5	1	
MP-9100		200	500	50	300	30	100	35,000
911		200	500	50	300	30	100	35,000
9120		200	500	50	300	30	100	80,000
930		200	500	50	300	30	100	35,000
935		300	1200	75	300	40	100	35,000
936		300	1000	75	300	40	100	35,000
940A		300	1200	80	300	50	130	35,000
950		300	1000	100	300	60	150	35,000
954		300	1200	100	300	60	150	35,000
962		400	1500	140	420	80	200	35,000

Model	Module	M=1		M=1.5		M=2		Upper limit of rotation speed
		0.2	0.5	0.2	0.5	0.2	0.5	
MP-992		400	1000	230	600	140	330	100,000

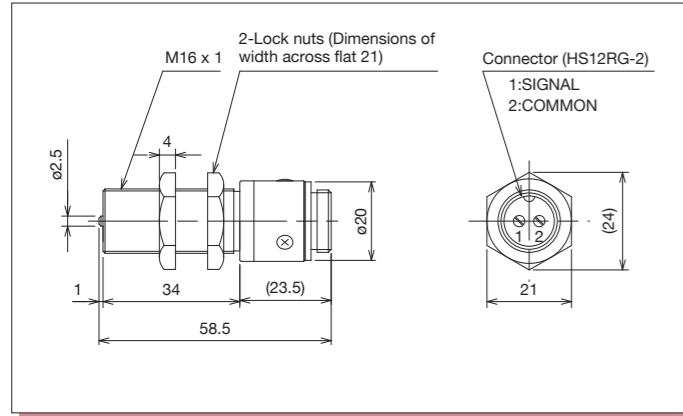
Model	Module	M=0.5		M=0.75		Upper limit of rotation speed
		0.2	0.2	0.2	0.5	
MP-9200		2,000	300	1,000	35,000	

Model	Module	M=3		M=5		M=7.5		Upper limit of rotation speed
		1	2	1	2	1	2	
MP-963		45	90	25	50	20	45	15,000

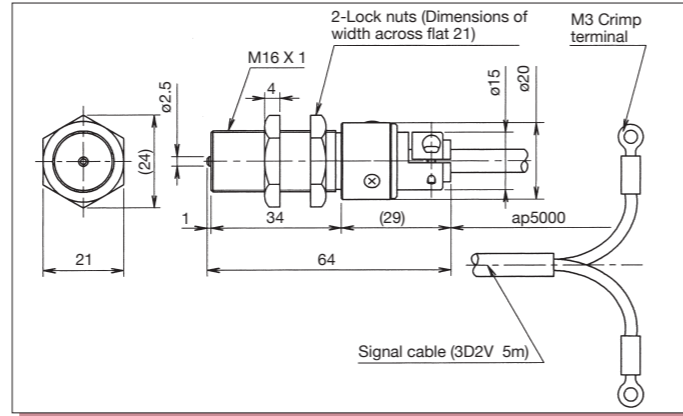
*The data is standard value and do not warrant the operation. When using our rotation detectors.



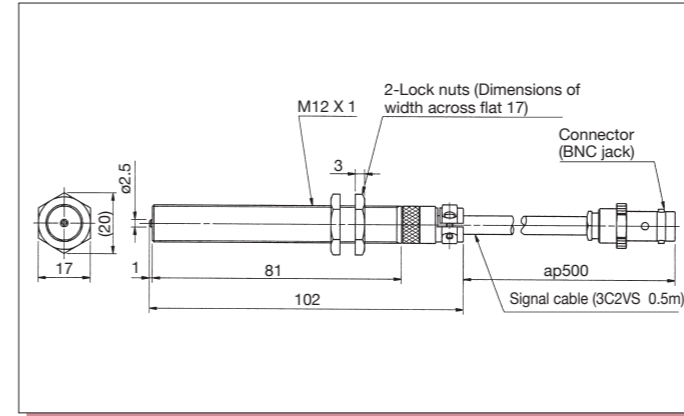
● MP-9100



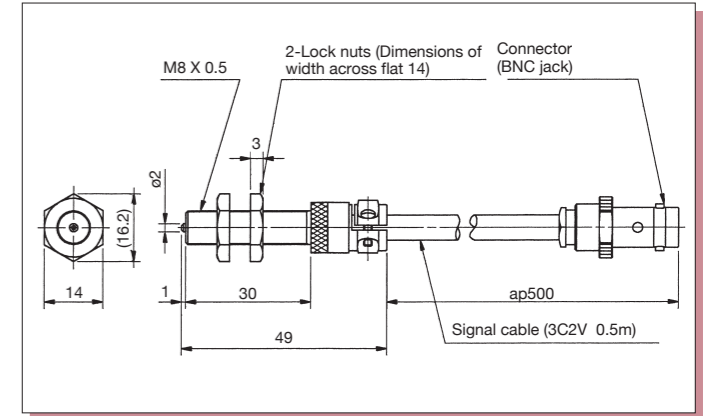
● MP-911



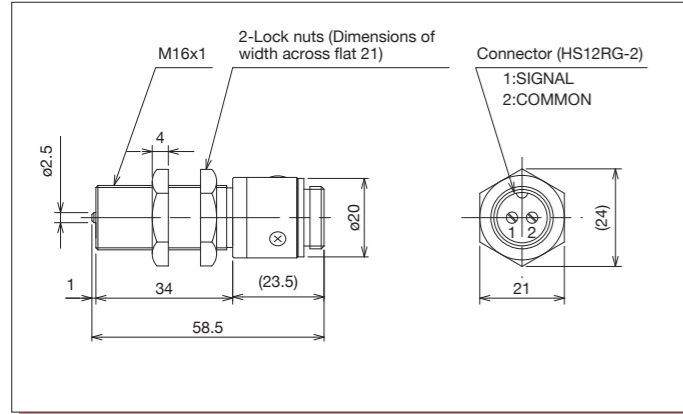
● MP-954



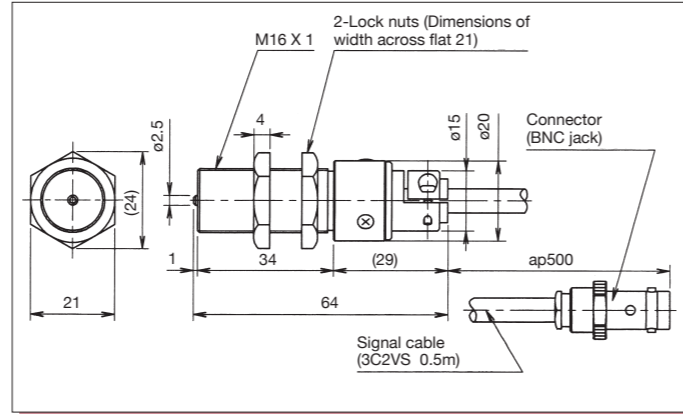
● MP-962



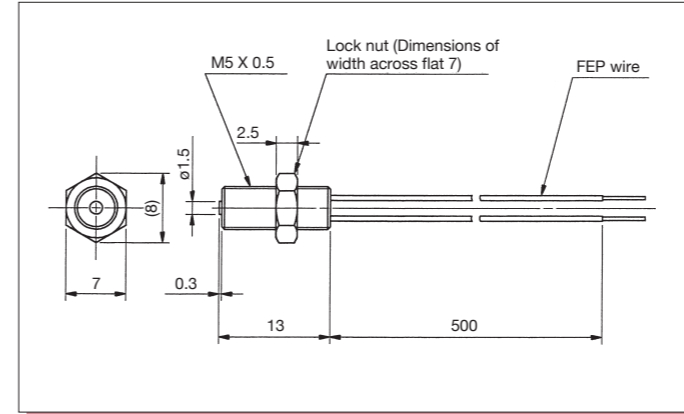
● MP-9120



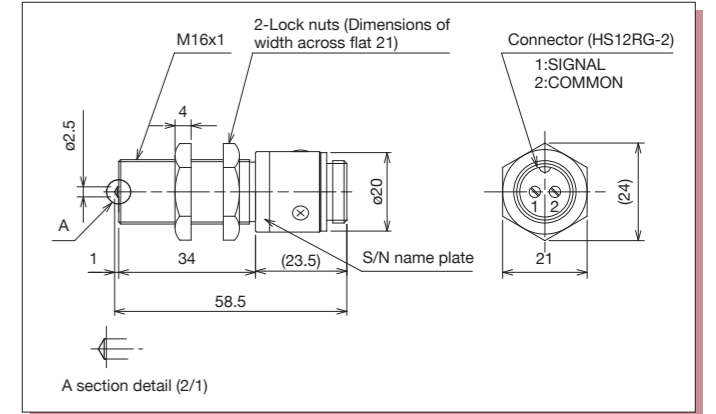
● MP-930



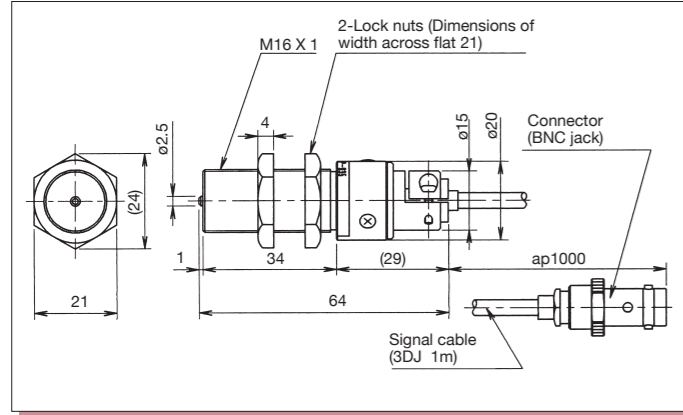
● MP-992



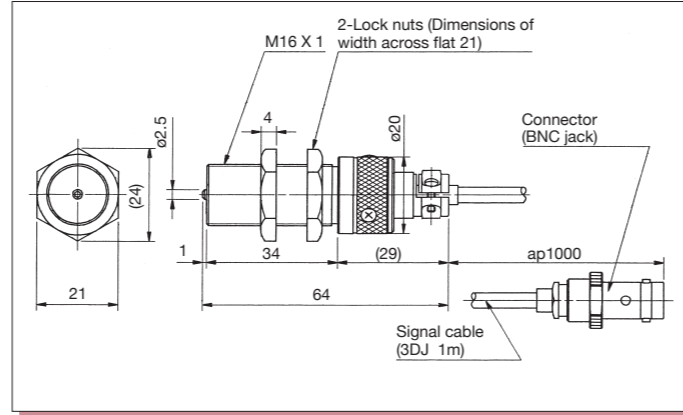
● MP-9200



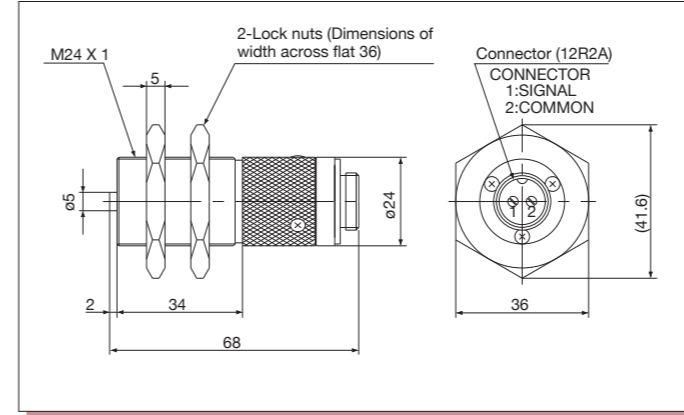
● MP-935



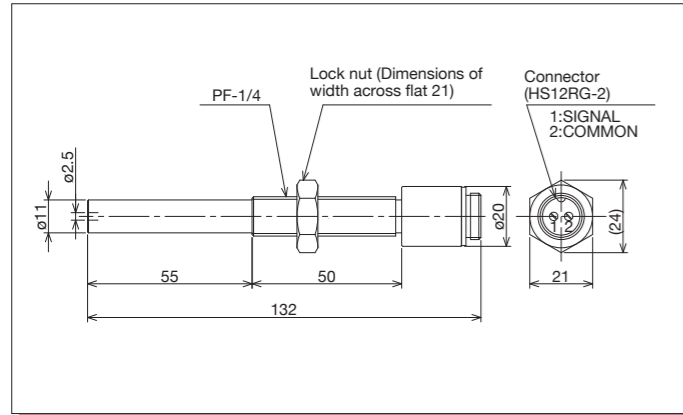
● MP-936



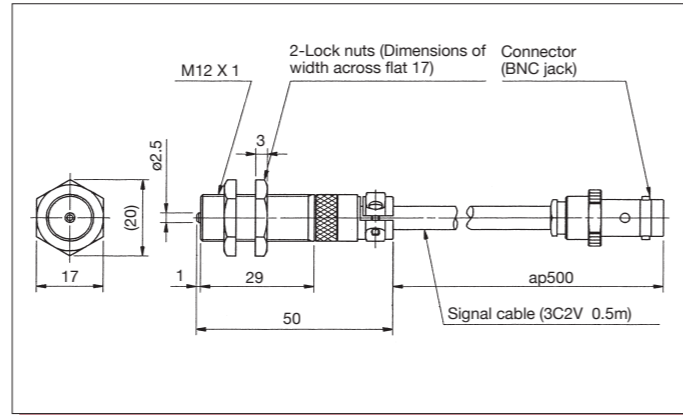
● MP-963



● MP-940A



● MP-950



Electromagnetic Type Rotation Detector MP-800 series

Low-to-medium speed

There are three models in the series, each with a different outer appearance: MP-810, MP-820 and MP-830.



● Features

- There are three models in the series, differentiated by their outer appearances.

MP-810: base mount type

MP-820: dual-shaft type

MP-830: flange type

- Number of output pulses

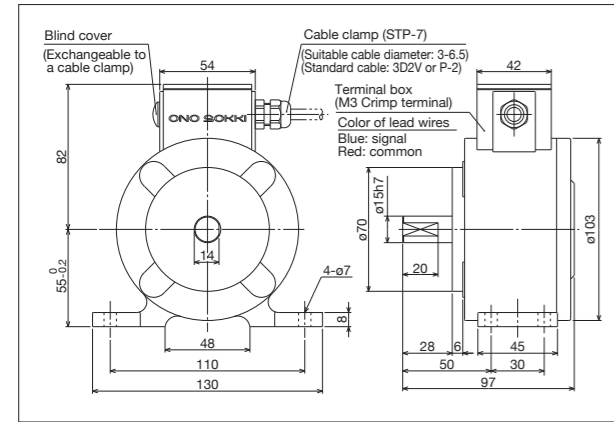
Model	Number of Pulses (P/R)
MP-810F, 820F	300
MP-810G, 820G, 830G	60, 120, 360
MP-810B, 820B, 830B	600

* Models other than MP-810B are made-to-order products.

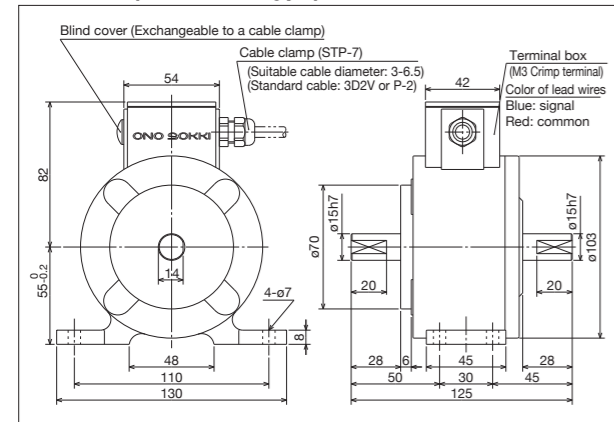
● Specifications

Rotating speed range : 5 to 5,000 r/min
 Output waveform : approximate sine wave
 Output voltage : 0.5 Vp-p or more
 DC resistance value : 770 ±30 Ω
 Inductance : 2 H typ. (at 1 kHz)
 Starting torque : 245 mN·m or less
 Moment of inertia : approx. 1.5 kg·cm²
 Allowable shaft load : radial 147N, thrust 98N
 Vibration resistance : 98 m/s² in each direction of X, Y, Z (for 2 hour)
 Shock resistance : 980 m/s² in each direction of X, Y and Z (three times each)
 Operating temperature : -10 to 80 °C
 Weight : approx. 2 kg
 Connection method : M3 crimp terminal (JIS C 2805 1.25-3) (When using MP-081) See P.36 and P.37
 Cable outlet : cable clamp (complies with IP-68)
 Surrounding magnetic field : up to 0.01 T
 Option : connector output (MP-081)

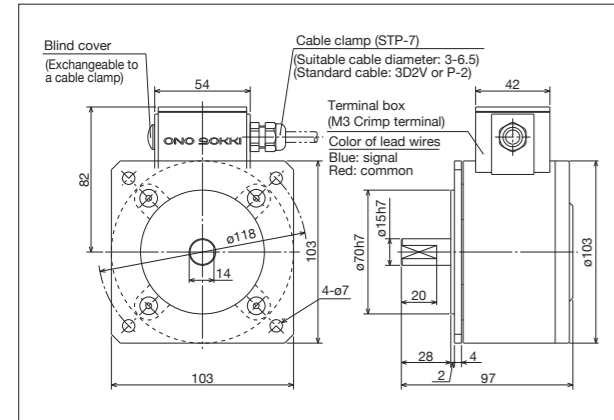
● MP-810 (Base mount type)



● MP-820 (Dual-shaft type)



● MP-830 (Flange type)



<Related product: **MP-837** (low impedance type)>

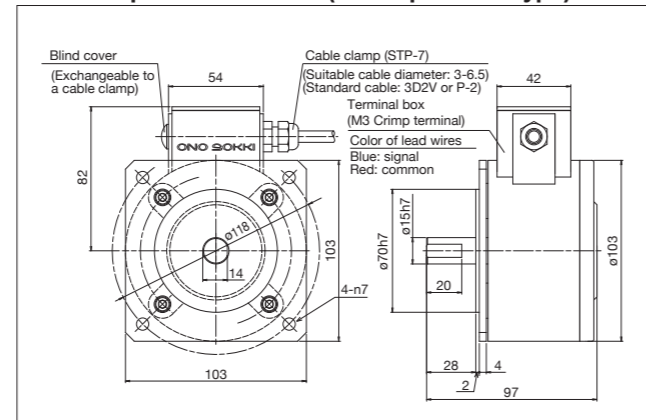
- Number of output pulses

Model	Number of Pulses (P/R)
MP-837J	180
MP-837K	240
MP-837L	300
MP-837M	360
MP-837N	420

● Specifications

Rotation speed : 50 to 2500 r/min
 Output voltage : 1.5 Vp-p or more
 Direct current resistance value : 50 ± 5 Ω
 Inductance : 0.12 H typ. (at 1 kHz)
 * The other than the above are same as MP-810/820/830.

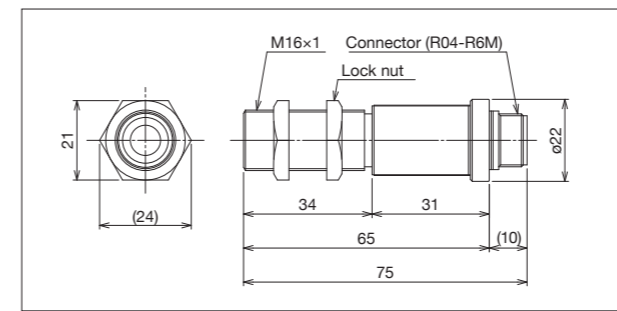
● Related product: **MP-837** (low impedance type)



Magneto-electric Rotation Detector MP-981/9820

General-purpose/ high speed detection type

This is a magnetic flux response type detector (the resistance value changes according to the magnetic flux) which internally has magnetic resistance elements, permanent magnets, a direct current amplifier, and a voltage regulator. It can detect over a wide range of rotation speed from ultra low speed to high, and outputs the results as a square waveform. Three models are provided; General-purpose type (MP-981), high speed detection type (MP-9820), and acid-resistance and waterproof type (AP-981).

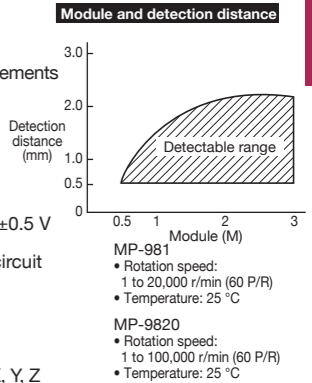


● Features

- Detection from nearly 0 r/min
- Output as a square wave from ultra-low to high speed (1 to 100,000 r/min [60-teeth gear]) (MP-9820)
- Compact, light weight, easy-to-mount

● Specifications

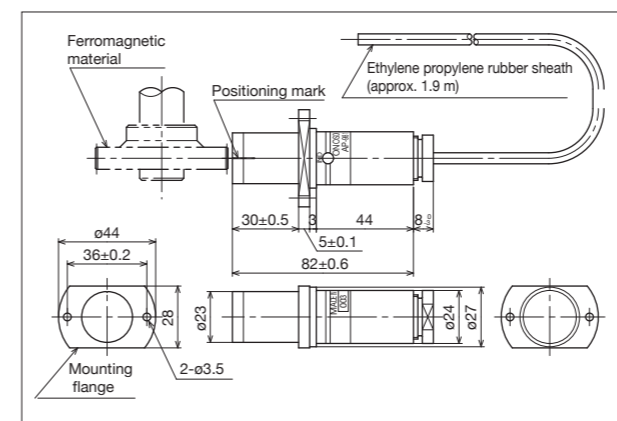
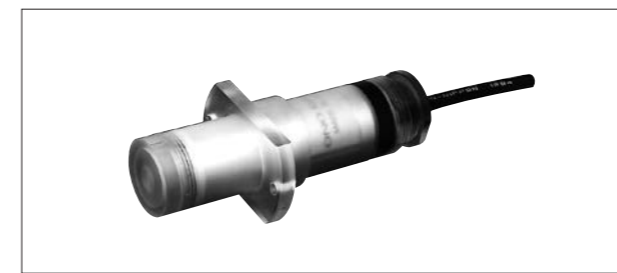
Detection method : detection using magnetic resistance elements
 Detection range : MP-981... 1 Hz to 20 kHz
 MP-9820... 1 Hz to 100 kHz
 Detection gear : ferromagnet (tooth width: at least 3 mm, module: 0.5 to 3)
 Detection distance : see the graph at the right
 Power requirement : 12 ±2 VDC
 Power consumption : approx. 40 mA (at 12 V, 25 °C)
 Output waveform : square wave, Lo; 0.5 V or less, Hi; 5 ±0.5 V
 Output impedance : approx. 330 Ω
 Protective circuit : power source polarity, output short-circuit protection
 Operating temperature : -10 to +70 °C
 Storage temperature : -20 to +80 °C
 Withstand voltage : 250 VDC
 Vibration resistance (conduction) :
 MP-981; 49 m/s² in each direction of X, Y, Z (for 1 hour)
 MP-9820; 49 m/s² (10 to 150 Hz)
 *in 10 to 46 Hz, 1.5 mm (constant amplitude)
 in 46 to 150 Hz, 49 m/s² in each direction of X, Y, Z (for 150 mins each)
 Shock resistance (non-conduction) :
 MP-981; 490 m/s² in each direction of X and Y (three times each)
 MP-9820; 490 m/s² in each direction of X, Y and Z (three times each)
 Connection method : see P.36-37
 Weight : approx. 80g (including the two nuts used for fastening)
 Accessory : nut for fastening x 2, instruction manual x1



Magneto-electric Rotation Detector AP-981

Acid-resistant, waterproof type

The AP-981 is a waterproof model that complies with the JIS C 0920 Protective Class 7 (marking symbol: IPX7) requirements for the waterproof testing of electrical equipment and wiring materials.

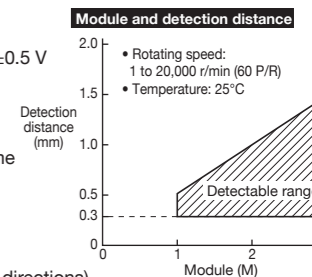


● Features

- Can be used for measurement in locations where nitric acid mist is in the atmosphere, or in environments where the detector may be submerged.
- Performs by non-contact detection
- Output as a square wave with the same amplitude from ultra-low to high speed (1 to 20,000 r/min [60-teeth gear])
- Comes with a 1.9 m length acid-resistance directly attached cable

● Specifications

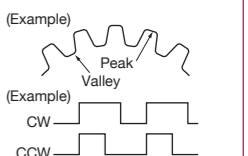
Detection method : detection using magnetic resistance elements and magnetic gears
 Detection range : 1 Hz to 20 kHz
 Detection gear : ferromagnet (tooth width: at least 3 mm, module: 1 to 3)
 Detection distance : see the graph at the right
 Power requirement : 12 ±2 VDC
 Power consumption : approx. 30 mA (at 12 V, 25 °C)
 Output waveform : square wave, Lo; 0.5 V or less, Hi; 5 ±0.5 V
 Output impedance : approx. 330 Ω
 Protective circuit : power source polarity, output short-circuit protection
 Operating temperature : -10 to 70 °C
 -10 to 50 °C (with a nitric acid fume concentration of 10%)
 Storage temperature : -20 to 80 °C
 Withstand voltage : 250 VDC
 Vibration resistance (conduction) :
 1.2 mm compound amplitude, 30 Hz (for 1 hour in each of the X, Y, and Z directions)
 Shock resistance (non-conduction) :
 490 m/s² (three times each in the X and Y directions)
 Outer surface material : polycarbonate
 Connection method : 1.9 m length directly attached cable (other end: open)
 Weight : approx. 130 g (including a signal cable)
 Accessory : instruction manual x1
 *The cable length can be specified as 5, 10, 15 and 20 m.



Caution

MP-981 and AP-981 have been designed for the purpose of detecting rotation speed. Please observe the following points when using these detectors.

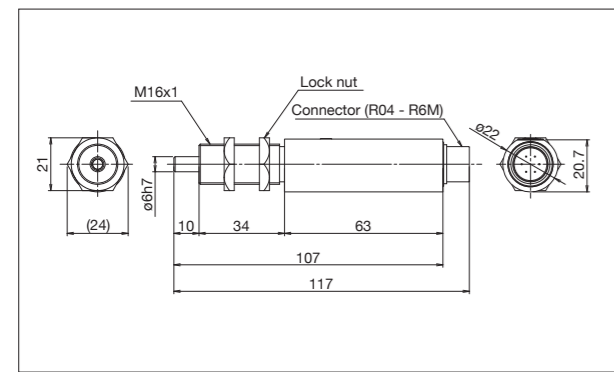
- (1) A square wave with the same amplitude is output as the result of rotation measurement from low speed to high speed (1 to 20,000 r/min: 60 gear teeth per a gear). However, it does not necessarily mean that the high level is appeared at the peak of the gear, the low level at the valley. The starting points may not be the same when using several detectors for synchronous operation.
- (2) The output pulse width may be different depending on the rotating direction of a detection gear (CW direction / CCW direction).



Photoelectric Detector LG-9200

Compact optical detector

LG-9200 is a reflective type photoelectric rotation detector using an optical fiber at the tip. Designed to be resistant against disturbance light using pulse modulation method for the light source emitting modulation.



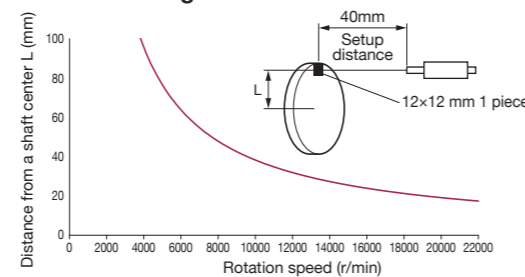
• Features

- Detection from nearly 0 r/min
- Compact and easy-to-use type optical detector
- A unified structure of light source, receiver and amplifier (weight: approx. 150g)
- Light emitting diode is used for light emitting element
- Easy positioning (visible light and operation indicator lighting function)

• Specifications

Detection method : visible light photoelectric reflection method
 Detecting distance : recommended distance 20 to 40 mm (when using a dedicated reflective mark 12 mm square)
 Maximum response speed : 40 m/s (converted to circumferential speed of rotating shaft)
 Response delay time : 0.6 ms (light receiver conversion time) or less
 Light source : light emitting diode (red visible light)
 Light receiving element: phototransistor
 Power requirement : 12 ± 2 VDC
 Current consumption : 60 mA or less (at 12 V)
 Output waveform : rectangular wave; Hi ... 5 ± 0.5 V, Lo ... 0.5 V or less
 Output impedance : 1 kΩ or less
 Connection method : see P. 36, 37
 Operating temperature : -10 to 60 °C
 Storage temperature : -20 to 80 °C
 Vibration resistance : 19.6 m/s² in each direction of X, Y, Z
 Shock resistance : 490 m/s² in each direction of X, Y and Z (three times each)
 Conforming standard : CE marking
 Weight : approx. 150 g (including 2 nuts for fastening)
 Accessory : reflective mark (12 mm square, 25 sheets) × 1, mounting nut × 2, instruction manual × 1

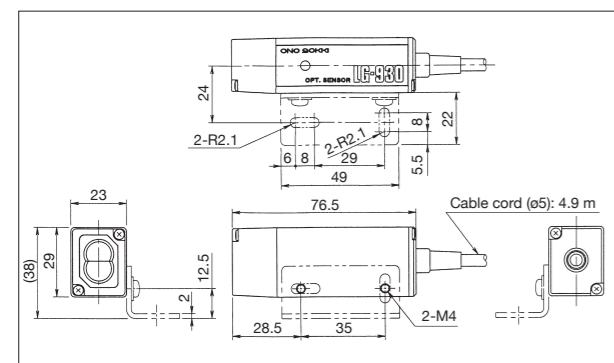
• Measurement range of the LG-9200



Photoelectric Detector LG-930

Compact, optical model designed for the long-distance detection

The LG-930 is a compact reflective type photoelectric rotation detector that can detect the target up to 200 mm away.



• Features

- Can detect the target up to 200 mm away.
- Compact design, only small installation space required. An L-shaped mounting fixture for installation provided.
- Visible light is used for easy positioning, and the built-in operating indicator light enables easy setup.
- The pulse lighting method ensures that the LG-930 is virtually unaffected by ambient light.

• Specifications

Detection method : visible light photoelectric reflection method
 Detection distance : 70 to 200 mm (when using dedicated reflective mark of 12mm square)
 Object detected : reflective mark
 Maximum response speed: 25 m/s (when using the dedicated 12-mm-square reflective mark, affixing interval 48 mm)
 Response delay time : 0.5 ms (light receiver conversion time) or less
 Light source : light emitting diode (red visible light)
 Light receiving element: phototransistor
 Power requirement : 12 ± 2 VDC
 Current consumption : 85 mA or less (at 12 V)
 Output waveform : rectangular wave; Hi: + 5±0.5 V, Lo: 0.5 V or less (load resistance: 100 kΩ or more)
 Output impedance : 1 kΩ or less
 Operating temperature : -10 to + 60 °C
 Storage temperature : -20 to +80 °C
 Input/output connectors : directly attached cable with the other end open
 Cable length : 4.9 m
 Weight : approx. 300 g
 Accessory : reflective mark (12 mm square × 25 sheets) × 1, mounting fixture × 1, screw × 2, instruction manual × 1

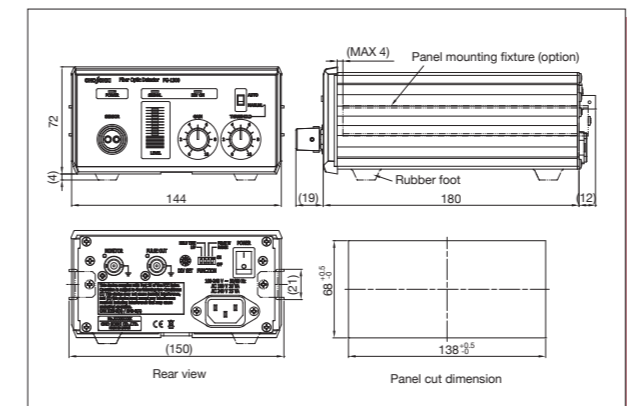
Photoelectric Rotation Detector FS-540/542/5500, FG-1300

Fiber Optic Sensor/Fiber Optic Sensor Amplifier

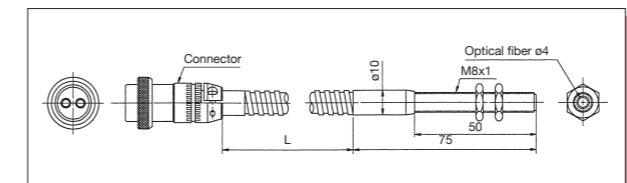
Used with the combination of optical fiber sensor with an optical multimeter. Can be detected up to 69 mm away from the target.



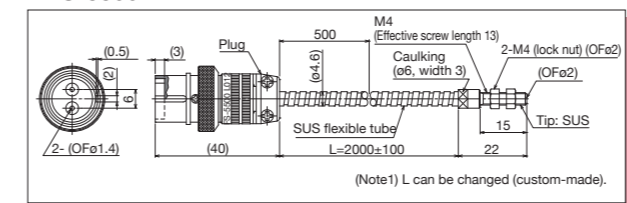
• FG-1300



• FS-540/542



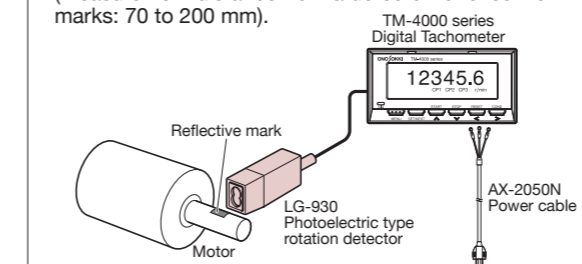
• FS-5500



• Application

• Rotation measurement using photoelectric type non-contact rotation detector

Affix a dedicated 12 mm square reflective mark to the shaft of the motor etc. and measure the rotation speed without contact by an optical fiber sensor. You can measure the target from a distance 200 mm max. (measurement distance from a detector to reflective marks: 70 to 200 mm).



• Features

- 10 kHz of maximum response frequency. Supports detection of high-speed rotation.
- Red visible light adopted, easy to detect an object that is difficult to adjust optical axis position, such as a thin shaft.
- Enables to detect even minimal variation in light intensity, and measure without reflective marks.
- Selectable gain/trigger level adjustment in accordance with applications; manual adjustment using volume control button or auto adjustment using auto trigger.
- Two detection distance adjusting functions are available; normal range and proximity range (from a proximity of 10 mm to the maximum 69 mm)
- Unequal interval pulse which may be generated during measurement can be divided into 1 pulse without reflective mark.

• Specifications

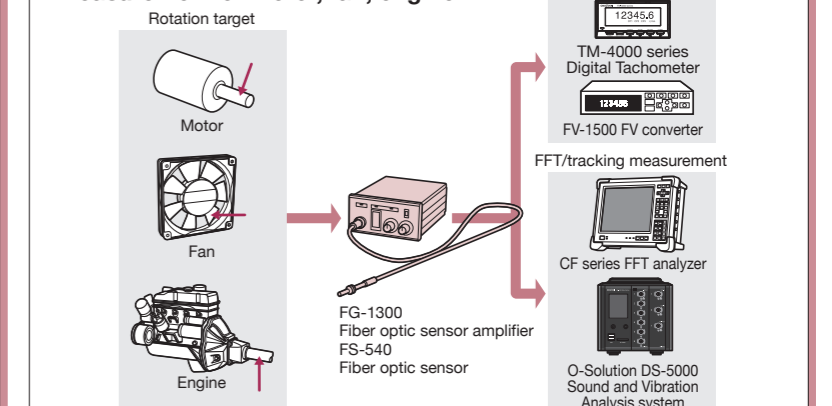
FG-1300 Fiber Optic Sensor Amplifier
 Detection method : detects amount of red visible light reflected light source; red visible light LED, light receiving element; phototransistor
 Detection distance : 7 to 69 mm (FS-540/542), 2 to 50 mm (FS-5500)
 Maximum response frequency : 10 kHz
 Output signal : analog; detects reflected light and outputs signal waveform in proportion to the light amount. output range: 0 to 10 V pulse; outputs pulse signal after the waveform of reflected light is shaped and converted to square wave. output voltage range; Lo level 0.5 V or less Hi level 4.5 V or more
 Load resistance : 10 kΩ or more (analog, pulse)
 Function : gain; can be adjusted by control knob or selection SW. threshold level; can be adjusted manually/automatically by control knob or selection SW. range; the detection distance can be adjusted by selection SW. frequency dividing; divides the PULSE OUTPUT signal in the range of dividing ratio 1 to 10 by selection SW. peak hold time constant; select from 1 s/10 s by selection SW.
 Display : for checking sensitivity; LED bar chart type monitor others; LED indicator
 Connecting method : see P.36-37
 Power supply : 100 to 240 VAC (50 Hz/60 Hz)
 Operating temperature : 0 to 40 °C
 Operating humidity : 5 to 80 % RH (with no condensation)
 Storage temperature range : -10 to +50 °C
 Storage humidity range : 5 to 80 %RH (without condensation)
 Conforming standard : CE marking
 Weight : approx. 1 kg
 Accessory : power cable (AC 100 V)×1, instruction manual×1, rubber foot (4 pieces)×1 set
 Option : stand (FG-0131), panel mounting fixture (FG-0132)

• Specifications (FS-540/542/5500)

	FS-540	FS-542	FS-5500
Detection type	Optical fiber reflection type		
Emitting port diameter at the tip of fiber	ø 4 mm		
Fiber length (L)	1 m	2 m	
Mounting nut	M8 x 1.0		M4 x 0.7
Operating temperature range	-10 to 250 °C		
Vibration resistance	-		50 m/s ² (frequency range; 10 to 500 Hz, at tip only)
Shock resistance	-		1000 m/s ²

* Reflective mark (12 mm square 25 sheets) 1 sheet included. * Fiber cable can be extended.

• Measurement of motor, fan, engine



* For more details of FS-540/542/5500, FG-1300, please refer to the Product Brochure page of our website.

Rotary Encoder SP-405ZA

Ultra-compact type

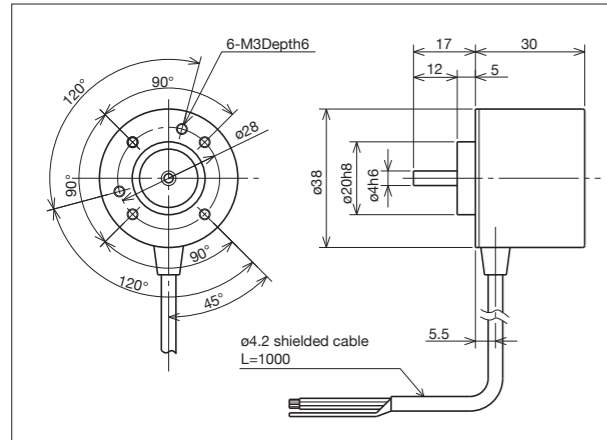


• Features

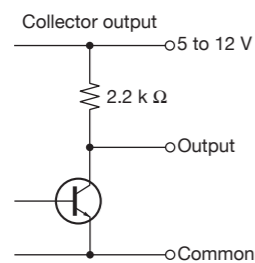
- Economic type designed for OEM needs
- ϕ 38 outer diameter; ultra-compact, light weight model weighing only 100 g
- 2-phase square wave + zero mark signal output
- Choice from 13 pulse output types

• Specifications

Number of output pulses:	40, 50, 60, 100, 200, 250, 300, 360, 400, 500, 600, 800, 900 P/R
Output waveform	: 2-phase square waveform+ zero mark (timing is optional)
Output voltage	: Hi...Power supply voltage -20 % or more Lo...0.5 V or less
Output method	: collector load resistance; 10 k Ω or more *Open collector: 30 VDC, 35 mA or less
Adjacent error	: $\pm 1/15$ P
Power requirement	: 5 to 12 VDC ± 10 %, 50 mA * 24 VDC is also available only when the open collector is selected (option).
Response frequency	: 100 kHz
Connection method	: directly attached cable (1 m) (other end: open)
Maximum rotation speed	: 6000 r/min
Allowable shaft load	: radial; 25 N thrust; 15 N
Starting torque	: 2mN·m
Moment of inertia	: 6g·cm ²
Operating temperature	: -10 to 70 °C
Storage temperature	: -20 to 80 °C
Withstand humidity	: 90 % (with no condensation)
Protection class	: IP 40
Vibration resistance	: 98 m/s ² in each direction of X, Y, Z (for 2 hour)
Shock resistance	: 980 m/s ² in each direction of \pm X, Y and Z (three times each, 18 times), 98 m/s ² at shaft
Weight	: approx. 0.1 kg



• Output circuit



Line Speedometer (Roller Encoder) RP-7400 series

Low to medium speed applications



• Features

- Number of pulses selectable from 120, 200, or 1200 P/R
- Wide variety of output signal
Totem pole (standard), Collector (option)
Emitter (option), Open collector (option)

• Specifications

Electrical specification	
Number of output:	speed; 120, 1200 P/R
pulses	length; 200 P/R
Output waveform:	2-phase rectangular wave
Duty ratio	: 50 \pm 25 %
Phase difference	: 90 \pm 45°
Output voltage (when 12 VDC is supplied.):	Hi; 10 V or more, Lo; 0.5 V or less
Output method	: Totem pole output (load resistance 470 Ω or more) Options; RP-0701 Emitter output RP-0702 Collector output RP-0703 Open collector output
Power supply	: 12 VDC \pm 5 % (100 mA or less)

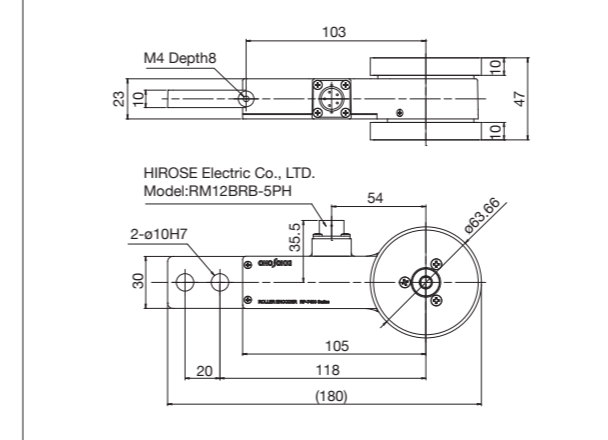
General specification

Operating temperature:	0 to +50 °C (with no freezing, no condensation)
Storage temperature:	-10 to +65 °C (with no freezing, no condensation)
Operating humidity:	35 to 93 % RH or less (with no freezing, no condensation)
Protection class	: IP 40 (when RP-0181/0182 cable used)
Conforming standard	: CE marking
Weight	: approx. 400 g
Accessory	: instruction manual x 1 connector (RM12BPE-5S) x 1;

HIROSE Electric Co., LTD.

Mechanical specification

Speed range	: 0 to 600 m/min *Speed measurement range depends on condition of measurement object.
Measurement unit	: 120 P/R 0.1 m/min 1200 P/R 0.01 m/min 200 P/R 1 mm
Roller material	: mandrel; aluminum rubber; polyurethane rubber baked on the roller (rigidity A90)
Roller outer circumference	: 200 mm
Maximum allowable load	: radial 20 N
Starting torque	: 1 mN·m
Moment of inertia	: 0.6 kg·cm ²
Vibration resistance	: 19.6 m/s ² X/Y/Z each direction (150 minutes each) 10 to 150 Hz sweep, 20 cycles
Shock resistance	: 196 m/s ² \pm X/Y/Z (3 times for each, total 18 times)
Mounting hole (position):	ϕ 10 mm x 2, 20 mm of interval
Option	: RP-0701 Emitter output RP-0702 Collector output RP-0703 Open collector output RP-0181 cable (5 m) P.36-37 RP-0182 cable (5 m) P.36-37



* Please visit our website for more details on RP-7400 series.

Digital Tachometer

Digital Tachometer TM-4000 series

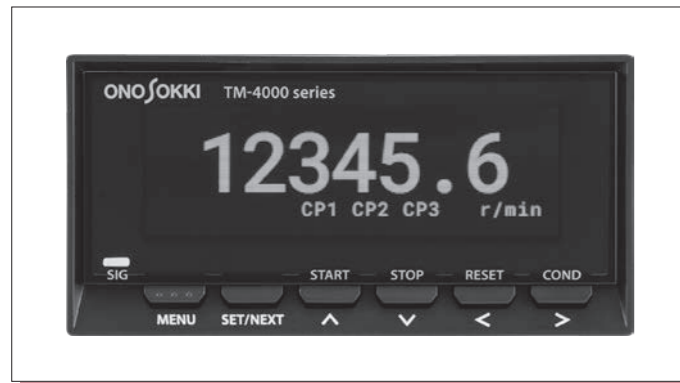
Integrating 4 models & New standard for tachometers

●Features

- Selecting from 4 models: 1-channel input for basic measurement, 2-channel input, reversible counter and passing time/passing speedometer
- Achieves the rotation speed measurement over a wide range with high accuracy, high response
- Clearly visible on the organic EL display
- Ethernet selectable
- Customized according to the connected device

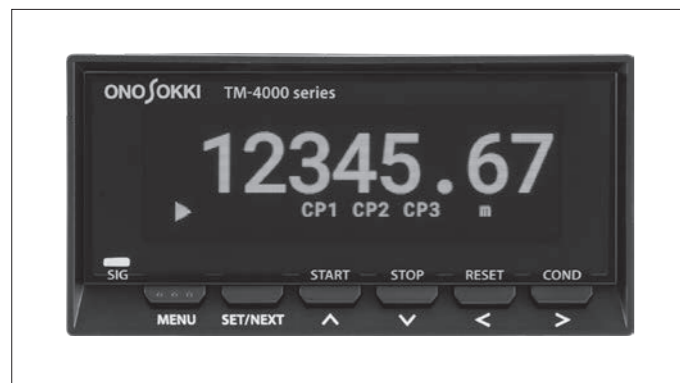


TM-4100 series Digital Tachometer



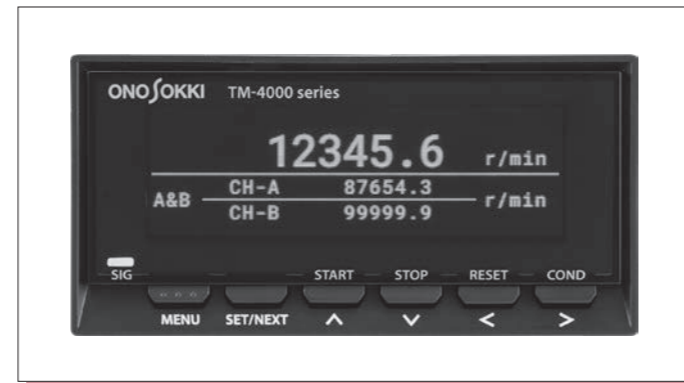
1-channel input type. Since it follows the input/output specifications and outer dimensions of the existing models, you can use your current detectors, cables, and mounting jigs as they are. (Successor model: TM-3100 series)

TM-4300 series Reversible counter



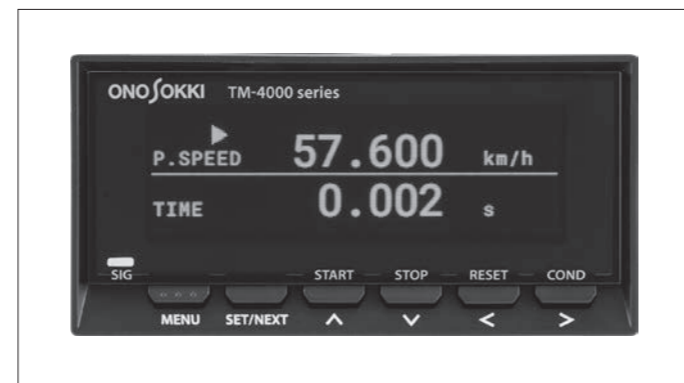
Multiplication/addition/subtraction counter with 7-digit display. In combination with our rotary encoders and roller encoders, it measures the length and distance of materials and finished products flowing through the production line.

TM-4200 series 2-channel Digital Tachometer



Measures the line speed ratio, speed differences, rolling reduction, etc. from two rotation speeds. Effective for improving the quality of production lines.

TM-4400 series Passing Time/Passing Speedometer



Measures the passing time and passing speed between two points with high accuracy. In addition to measuring the passing speed of vehicles and the opening/closing speed of vehicle doors, it is also possible to measure the falling speed and the speed of objects such as pendulums.

●Product Lineup Standard models

A new standard digital tachometer with exactly the functions you want. It is also recommended for those who want to quickly consider a replacement for an existing model.

Product type	Model name	Output type	Power supply type	Features	
1-ch input	TM-4110	For display	AC	Standard models for display only	
	TM-4111		DC		
	TM-4120	BCD output	AC		6-digit BCD output
	TM-4121		DC		Open collector output that can be directly connected to a PLC. There are 2 types of output mode: normal mode, request mode.
	TM-4130	Analog output	AC		Selectable voltage output or current output
	TM-4131		DC		1 ms rapid output refresh time
2-ch input	TM-4140	Comparator output	AC	Highly accurate linearity of 0.1% FS for voltage output and 0.1% of span for current output	
	TM-4141		DC	Equipped with three contact outputs and evaluation conditions can be set for each. Comparison cycle every 1 ms	
Reversible counter	TM-4370	Analog output / Comparator output / 2-ch Voltage input	AC	Equipped with diverse output functions	
			DC	Wide input frequency range: 0.05 Hz to 100 kHz	
Passing time/Passing speedometer	TM-4470	Analog output / Comparator output / 2-ch Voltage input	AC	2 ch calculation function (rotation difference/rotation ratio/rate of change/rotation direction)	
			DC	Reversible counter that measures linear position, displacement, dimensions, etc.	
				Wide input frequency range: DC to 100 kHz	
				Multiplication function (×1/×2/×4) and counting direction switching function are equipped.	
				Calculates the passing speed from the distance and the passing time between two points. Enables passing time measurement at a minimum resolution of 1 μs.	
				Pulse detection condition setup function (HIGH/LOW level, rising edge/falling edge)	

Customized models

You can customize the tachometers according to the connected sensors and external devices. These are made to order products by combining 7 types of signal input/output boards and 2 types of power supply boards.

Selectable measurement functions

- 1-channel input for measurement of rotation speed
- 2-channel input for measurement of rotation speed differences /rotation speed ratio
- Reversible Counter for multiplication/addition/subtraction
- Passing Time/Passing Speedometer

Selectable signal input /output types

- Input: Voltage/Line driver
- Output: Analog/Comparator/BCD
- Communication: RC-232C/Ethernet

Calculation functions (optional software)

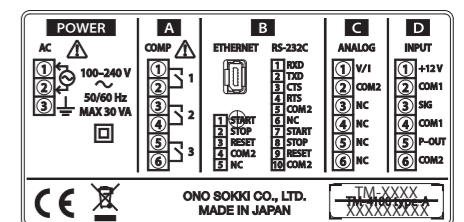
- Achieved speed/time measurement mode
- Calculates the time required from the start condition to the stop instruction measurement value. (TM-4100, 4300 only)



●Table of optional boards/software combination

Slot	POWER		A Comparator output	B				C		D			Software	
	Power			BCD output		RS-232C communication	Ethernet communication	Analog output	Voltage input		Line driver input	Calculation function		
	AC	DC		Voltage output	Open collector output				1ch	2ch		2ch	TM-0470	TM-0480
Specifications														
Model name	TM-0400	TM-0401	TM-0440	TM-0421	TM-0422	TM-0450	TM-0460	TM-0431	TM-0432	TM-0405	TM-0406	TM-0407	TM-0470	TM-0480
TM-4100	○	○	○	○	○	○	○	○		○			○	
TM-4200	○	○	○				○	○			○	○		
TM-4300	○	○	○				○	○			○	○		○
TM-4400	○	○	○				○	○			○			

- Only one board can be installed in each slot.
- Be sure to install a board in slot POWER and slot D.



Terminal arrangement diagram (Ex.TM-4100 series)

*Please refer to the details in the product brochure of TM-4000 series on our web site.

● Specifications

TM-4100 series	
Number of channels	1ch
Input amplification format	Selectable from AC or DC
AC amplifier	Sine wave input: 0.2 to 30 Vrms Square wave input: 0.6 to 42 Vp-p Input frequency: 1 Hz to 100 kHz Input signal: Square waveform having a pulse width of 4 μs or more
DC amplifier	Input voltage range: Hi: 4 to 30 V/Lo: -1 to 1 V Input frequency: 0.05 Hz to 100 kHz Time measurement: 10 ms to 3600 s Within displayed value x (±0.01%) ± 1 count (count value excluding decimal point)
Measurement accuracy	Within 1 ms + 1 cycle time
Measurement time	Within 1 ms + 1 cycle time
Unit display	Rotation Speed: r/s, r/min, r/h Circumferential Speed: mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h s, min Linear Speed: mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h s, min Cycle: s, min Frequency: Hz, kHz Count: 1/s, 1/min, 1/h Flow Rate: mL/s, mL/min, mL/h, L/s, L/min, L/h s, min Passing time: s, min User-defined: EU/s, EU/min, EU/h engineering unit
Number of display digits	6 digits

TM-4200 series	
Number of channels	2ch, 1ch (2-phase)
Input amplification format	Selectable from AC or DC
AC amplifier	Sine wave input: 0.2 to 30 Vrms Square wave input: 0.6 to 42 Vp-p Input frequency: 1 Hz to 100 kHz Input signal: Square waveform having a pulse width of 4 μs or more
DC amplifier	Input voltage range: Hi: 4 to 30 V/Lo: -1 to 1 V Input frequency: 0.05 Hz to 100 kHz Single CH: Within displayed value x (±0.01%) ± 1 count (count value excluding decimal point) B/A or (B-A)/A: 2 × (Single CH measurement accuracy) B-A: ± (CH-B measurement accuracy) ± (CH-A measurement accuracy)
Measurement accuracy	± (CH-B measurement accuracy) ± (CH-A measurement accuracy)
Unit display	Rotation Speed: r/s, r/min, r/h Circumferential Speed: mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h Linear Speed: mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h Frequency: Hz, kHz User-defined: EU/s, EU/min, EU/h engineering unit
Number of display digits	6 digits + sign

Common specifications

Display unit	OLED Display
Power supply for detector	Output voltage: 12 VDC ± 10% Maximum output current: [TM-4100] 100 mA [TM-4200/4400] Total of 2 channels 180 mA [TM-4300] 180 mA
Power supply	AC power supply model: 100 to 240 VAC ± 10%, 50/60 Hz, 30 VA max. DC power supply model: 12 to 24 VDC ± 5%, 1.25 A max.
Operating temperature and humidity	0 to 50 °C/30 to 80 %RH (no condensation)

TM-4300 series	
Number of channels	1ch (2-phase)
Input amplification format	DC
DC amplifier	Input signal: Square waveform having a pulse width of 4 μs or more (when the low-pass filter is OFF) Input voltage range: Hi: 4 to 30 V/Lo: -1 to 1 V Input frequency: DC to 100 kHz

Counting range (internal counter)	0 to ±2 000 000 000 × 1/× 2/× 4 0 to ± 9 999 999
Multiplication	+/-
Offset function	0.00001 × 10E-3 to 9.99999 × 10E+3 EU/Pulse
Counting direction switching function	+/-
Pulse factor	0.00001 × 10E-3 to 9.99999 × 10E+3 EU/Pulse
Unit display	OFF/mm/m/Count/s
Number of display digits	7 digits + sign

TM-4400 series	
Number of channels	2ch
Input amplification format	DC
DC amplifier	Input signal: Square waveform having a pulse width of 4 μs or more (when the low-pass filter is OFF) Input voltage range: Hi: 4 to 30 V/Lo: -1 to 1 V Input frequency: DC to 100 kHz

Measurable cycle	0.1 ms to 3600 s
Minimum resolution	1 μs
Measurement range	10 s/1000 s/3600 s
Measurement item	Selectable from passing time/passing speed
Measurement distance	0.1 to 99 999.9 mm
Prescale function	0.00001 × 10E-3 to 9.99999 × 10E+3 EU/Pulse
Unit display	Passing time (TIME): ms, s Passing speed (P.SPEED): m/s, km/h
Number of display digits	6 digits

Outer dimensions	96 (W) × 48 (H) × 140 (D) mm max.
Weight	[TM-4110] Approx. 340 g [TM-4270/4370/4470] Approx. 400 g
Applicable standards	CE marking FCC/Canada [TM-4100]
Accessories	Mounting jig 1 set (2 pcs) Instruction manual 1 pcs Input connector for D slot made by Phoenix Contact 1 pcs (packed in the D slot) Mounting jig 1 set (2 pcs) Instruction manual 1 pcs

● Power supply, Signal input/output boards

TM-0400/TM-0401 Power Supply Board	Please refer to "Power supply" in [Common specifications].
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TM-0405/0406 Input Voltage Board	
Voltage input specifications	Same as Input unit
Input connector	[TM-0405] Terminal block (D slot SIG-COM1 terminal) [TM-0406] FMC 1,5/10-ST-3,5 1952348x1 made by Phoenix contact

TM-0407 Line Driver Signal Input Board	
Signal input specifications	Equivalent to RS-422A
Input connector	FMC 1,5/10-ST-3,5 1952348x1 made by Phoenix contact

TM-0421/0422 BCD Output Board	
Output form	6-digit parallel output
Output format	[TM-0421] 5 V internal pull-up output [TM-0422] NPN open collector output 32 mA max
Sink current	24 V max
Output withstand voltage	Positive logic
Output logic	100 ms or less
Data refresh time	Selectable from Normal (Continue) mode, Request mode
Operation modes	Negative logic (pulse width 10 μs or more) Falling edge

Request signal input form	Negative logic (pulse width 10 μs or more)
Operating edge	Falling edge
Input voltage	Hi: 4.2 to 5.25 V/Lo: 0 to 0.9 V

TM-0431/0432 Analog Output Board	
Number of output channels	1 ch
Output type	Selectable from voltage or current
Output method	16-bit D/A conversion
Output refresh time	Selectable from 1 ms/10 ms/20 ms/50 ms/100 ms/200 ms/500 ms/1 s
Voltage output	Output range: Selectable from 0 to 10 V/0 to 5V/1 to 5 V Load resistance: 100 kΩ or more Linearity: ± 0.1 % FS Zero temperature drift: ± 0.05 % FS/°C Span temperature drift: ± 0.05 % FS/°C Output range: Selectable from 4 to 20 mA or 0 to 16 mA Load resistance: 500 Ω or less Linearity: ± 0.1 % of span Zero temperature drift: ± 0.05 % of span/°C Span temperature drift: ± 0.05 % of span/°C
Current output (TM-0431 only)	

TM-0440 Comparator Output Board	
Contact output	1 make contact output × 3 (COMP1/COMP2/COMP3) UPPER, LOWER, OK, ERROR
Evaluation conditions	Automatic recover mode, Hold mode (except TM-4400), Shot output mode
Contact operation modes	Output delay function (except TM-4400), Reset function (except TM-4400)
Condition setting	
Maximum contact capacity	30 VDC/1 A 250 VAC/1 A Approx. 10 ms
Output refresh time	

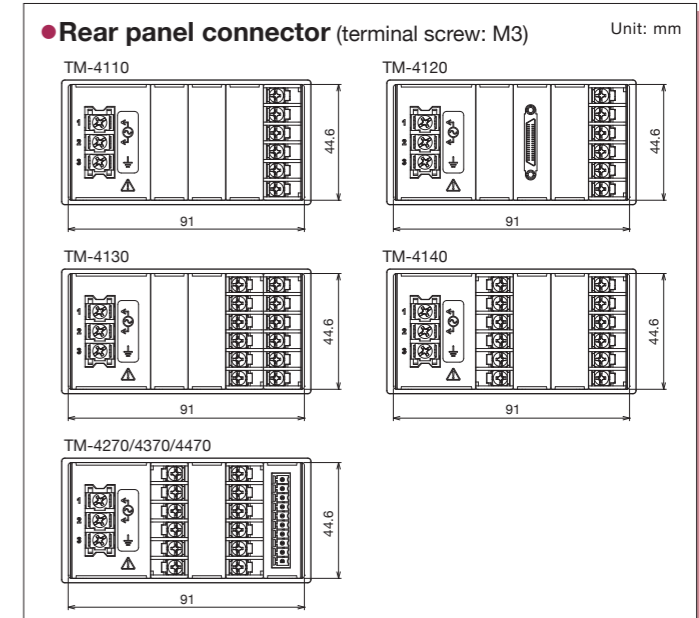
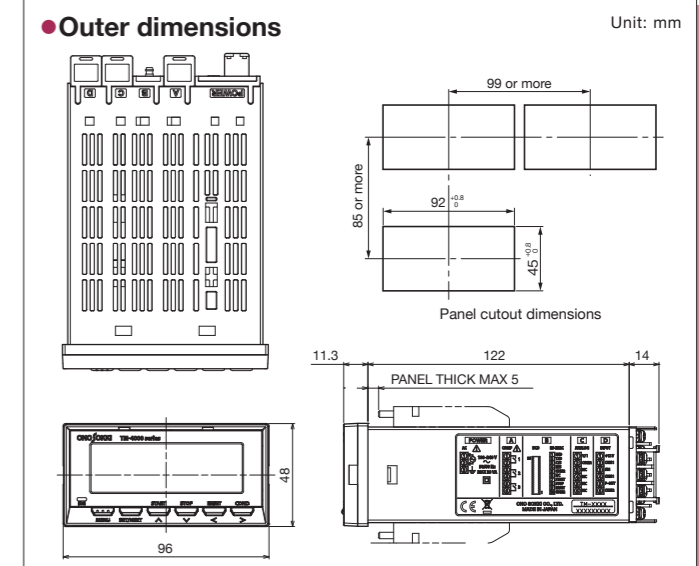
TM-0450 RS-232C Board	
Baud rate	9 600/19 200/115 200 bps
Data bits	8 bit
Parity	None
Stop bits	1-bit
Flow control	Hardware
Terminator	CR+LF

TM-0460 Ethernet Board	
Electrical specifications	IEEE802.3 compliant
Transmission method	10BASE-T/100BASE-T automatically selected
Communication protocol	Socket communication by TCP/IP (IPv4)

Gate Signal Input	
(Valid when any of the BCD output, RS-232C communication, or Ethernet communication board is installed)	
Gate function	[TM-4100/4200] START/STOP/RESET [TM-4300] START, STOP/OFFSET/RESET [TM-4400] START/RESET Hi: 4.2 to 5.25 V/Lo: 0 to 0.9 V Open voltage: 5 V ± 0.25 V Short-circuit current: 1 mA max. Contact resistance: 50 Ω or less
Voltage input	
Non-voltage input	

● Optional software

TM-0470/0480 Calculation function	
Calculation details	Calculate the time required from the start condition to the stop instruction measurement value.
Calculation item	[TM-0470] Selectable from rotation speed/ circumferential speed/moving speed
Unit of measurement	[TM-0480] Pulse accumulated value s (fixed display)



FFT Tachometer FT-2500

Advanced Tachometer

The FT-2500 is a tachometer that performs frequency analysis by FFT calculation processing and measures rotation speed. Even when the rotating shaft is not accessible, it can measure from sound, vibration, etc. and supports various types of rotating objects such as steady rotation of a motor, acceleration / deceleration rotation of an engine.



Features

- No need for reflective mark and special machining to install a detector
- Enables rotation measurement using sound and vibration easily. Machining of the rotating shaft is not required.
- Supports rotation speed change and acceleration/deceleration. (when selecting rotation acceleration/deceleration measurement mode)
- Rotation direction judgment function (FT-0501)
- Easy-to-read indication by fluorescent display tube
- With analog output, pulse output

Specifications

Input section
 Applicable sensor : FT-0501, IP-292/296/3000A/3100, VP-202/1220, OM-1500/1200, Constant Current Line Drive sensors (microphones, accelerometers) and so on.

Measurement section
 • Measurement mode: Steady rotation measurement mode
 Arithmetic operation : 1024 points, FFT processing
 Frequency range : 500 Hz, 2 kHz, 10 kHz
 Rotation speed searching : Measurement frequency range (Hz) x 60 / range (Pulse count [P/R])
 Measurement frequency range
 • When 500 Hz range selected; 3.75 Hz to 500 Hz
 • When 2 kHz range selected; 15 Hz to 2 kHz
 • When 10 kHz range selected; 75 Hz to 10 kHz
 Update time : within 500 ms
 Measurement accuracy : ±2 x rotating speed resolution[r/min] ±1 count
 *Measurement accuracy depends on frequency range.
 Rotation speed resolution : Frequency range [Hz] ÷ 12800 × 60 ÷ set pulse count [P/R]
 *12800 = 400 line x 32

• Measurement mode: Rotation acceleration/deceleration measurement mode
 Arithmetic operation : 512 & 256 points, FFT processing
 Frequency range : 250 Hz, 500 Hz, 2 kHz
 Rotation speed measurement : Measurement frequency range (Hz) x 60 / (Pulse count [P/R]) range
 Measurement frequency range
 • When 250 Hz range selected; 3.75 Hz to 250 Hz
 • When 500 Hz range selected; 7.5 Hz to 500 Hz
 • When 2 kHz range selected; 30 Hz to 2 kHz
 Update time : within 250 ms
 Measurement accuracy : ±2 x rotating speed resolution[r/min] ±1 count
 *Measurement accuracy depends on frequency range
 Rotation speed resolution : Frequency range [Hz] ÷ 6400 × 60 ÷ set pulse count [P/R]
 *If the rotation speed is changing, the resolution is worsen.
 *6400 = 200 line x 32

Display section
 • Main display unit
 Display unit : fluorescent display tube (Blue - Green)
 Display update time : 0.5 ± 0.2 second
 Display resolution : 1 r/min, 1 Hz
 Measurement display range : 0 to 999,999 r/min(0 to 10,000 Hz)
 • Level monitor LED
 Display method : 2-color LED
 Unlit : Sensor signal amplitude is small and stable measurement is disabled.
 Red : Sensor signal amplitude exceeds the set voltage range.
 Green : Sensor signal amplitude is appropriate (common to Upper, Lower, Rotation)
 • Comparator monitor LED
 Display method : 2-color LED
 Unlit : Comparator is disabled.
 Red : Comparator is active and measurement values do not meet operating conditions.
 Green : Comparator is active and measurement values meet operating conditions.

Rotation pulse count setting
 Set range : 0.5 to 199.5
 Minimum number of steps : 0.5 [P/R]

Averaging processing
 Averaging type : Moving average
 Allowable count : OFF, 2, 4, 8, 16

Filter function
 Processing type : Specifying the desired measurement rotating speed (frequency) range within the selected frequency range
 Setting : Specifying upper and lower rotation speeds (frequencies)

Rotating direction judgment
 Applicable sensor : FT-0501
 Judgment : CW/CCW
 Judgment output : semiconductor relay, status display
Key protection function
 Setting/Canceling : It can be switched by pressing and holding SET/NEXT key approximately 2 seconds in measurement mode.
 Protection range : All keys except < (SAMPLE) key when returning to measurement ready state in rotation acceleration/ deceleration mode.

Analog voltage output
 • REVO output
 Output contents : displayed value
 Voltage range : 0 to F.S./ 0 to 10 V
 Conversion type : D/A conversion
 Linearity : ±0.3 % of F.S.
 Output update time : steady rotation measurement mode (CONSTANT); 500 ms or less
 rotation acceleration/deceleration mode (ACTIVE); 250 ms or less
 Temperature stability : ±0.05 % F.S./°C (common to ZERO and SPAN)
 Set error : ±0.5 % of F.S. (default error, common to ZERO and SPAN)
 Load resistance : 100 kΩ or more
 Output connector : R03RB3F
 Calibration function : Outputting ZERO/FULL calibration signal
 • SIG output
 Output contents : analog output for monitoring obtained by wave-shaping of sensor signal
 Load resistance : 100 kΩ or more
 Output connector : switching to/from REVO output connector

Comparator output
 Items : LOWER, UPPER, ROTATION, OK
 LOWER : closed when LOWER threshold value > displayed value
 UPPER : closed when UPPER threshold value = displayed value
 ROTATION : closed when comparator ROTATION operating direction setting = measurement value (CW/CCW)
 OK : closed when three comparators above are all open
 Output type : semiconductor relay (Photo-MOS)
 Output connector : D-SUB (15-pin connector)
 Maximum contact capacity : 30 VDC, 0.1A
 Contact ON resistance : 50 Ω or more

Pulse output
 Signal contents : Pulse of power spectrum frequency extracted by FFT operation
 Output voltage : LO; 1 V or less, HI; 4.5 V or more (no load)
 Output update time : steady rotation measurement mode (CONSTANT); 500 ms or less
 rotation acceleration/deceleration mode (ACTIVE); 250 ms or less
 Load resistance : 100 kΩ or more
 Output type : D-SUB (15-pin connector)

Remote input signal
 Remote input signal : Terminal open; measurement start, displayed value update, comparator activated
 Terminal close; measurement stop, display value hold, comparator output hold, analog/pulse output hold
 Input logic switching : enabled by RS-232C communications in setup mode
 Input connector : D-SUB (15-pin connector)
 Input signal type : no voltage contact input, open voltage; +5 V ± 0.25V, short-circuit current; 1 mA or less, contact resistance; 50 Ω or less

Condition memory function
 Function contents : saving parameter settings to nonvolatile memory
 Number of conditions : 3 kinds (selectable in setup mode)
 Target item : set parameters

Communications function
 • RS-232C
 I/F : reading function measurement data, setting parameters, reading parameters
 Connector : HR12-10R-8SDL
 Character code : ASCII
 Baud rate : 2400/4800/9600/19200 bps
 Data length : 8 bit
 Stop bit : 1bit
 Parity check : none
 X parameter control : none
 Hardware control : RTS/CTS
 Terminator : CR + LF

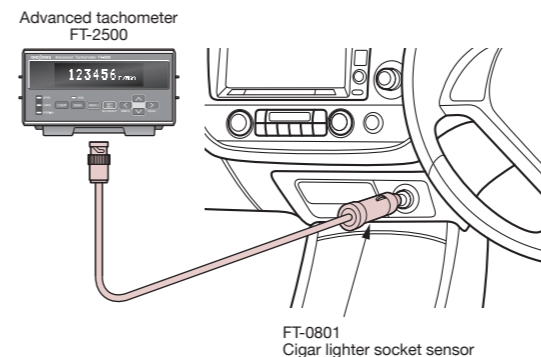
General specifications
 Power requirement : 100 to 240 VAC±10% (50/60 Hz)
 Conforming standard : CE marking
 Outer dimensions : 144(W) × 72(H) × 180(D) mm
 Weight : 2 kg or less
 Power consumption : 22 to 32 VA
 Operating temperature range : 0 to +40 °C
 Storage temperature range : -10 to +55 °C
 Operating (storage) humidity : 20 to 80 %RH (without condensation)
 Withstand voltage : 1500 VAC (between power supply and FG, 1 min)
 Insulation resistance : 5 MΩ or more (between power supply and FG, 500 VDC)
 Accessories : power cable, panel mounting bracket, stand foot, rubber foot, connector, instruction manual
 Options : analog output cable 1.5m (FT-0100) [R03PB3M-BNC245], pulse output cable 1.5 (FT-0110) [D-SUB15PIN-BNC245], RS-232C cable 2m (AX-5022B)

They may be some cases that FT-2500 cannot measure depending on the type of engines and motors, or the measurement range may change. Please confirm with the demonstration machine before order. Please contact the nearest distributors or our sales office for demonstration machines.

Application

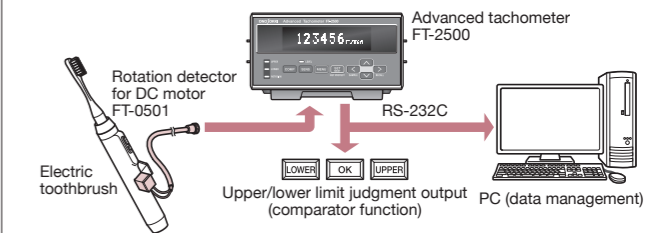
Example of engine rotation speed measurement using cigar lighter socket sensor

Connect to power outlet installed in an automobile or a construction machine. The ignition noise of the voltage output from the power outlet is detected and the rotation speed of engine can be measured by the FT-2500. Compatible with battery 12 and 24 VDC.

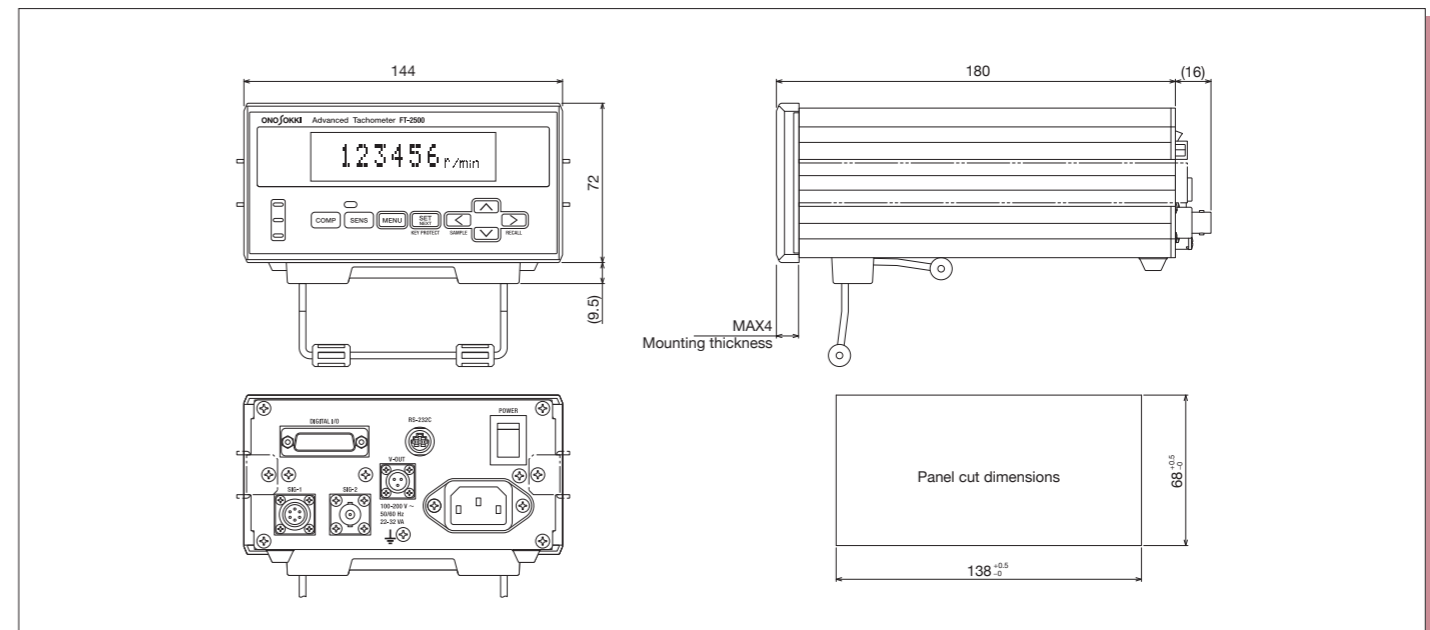


Measurement example of rotation speed of DC motor incorporated in home electric appliances

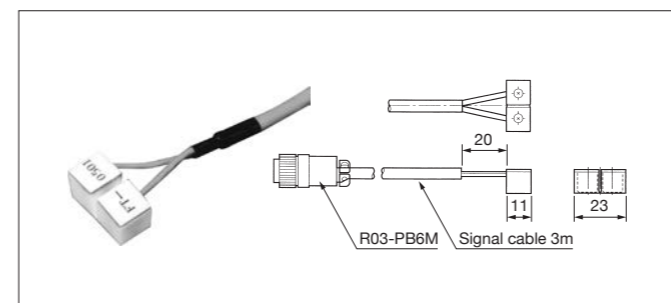
- In this application, we measure the rotation of the electric toothbrush, which DC motor rotation is converted into brush vibration inside. The FT-2500 measures the rotation speed by detecting the magnetic flux leakage from the DC motor incorporated in the toothbrush.
- Detects pulsation of magnetic flux leakage proportional to the number of poles of the DC motor from the completed product.
 - With upper / lower limit comparator output for OK, LOWER, UPPER judgment on production line.
 - Data management with RS-232C
 - System can be upgraded at low price.



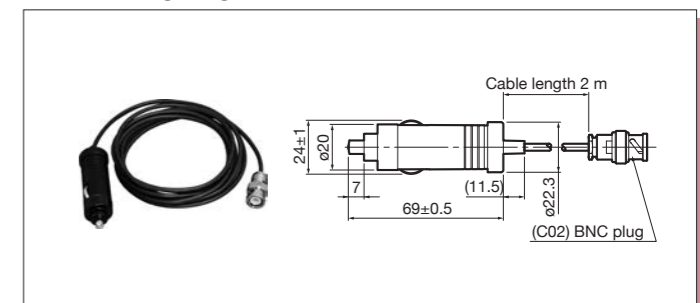
FT-2500 advanced tachometer



FT-0501 Rotation detector for DC motor



FT-0801 Cigar lighter socket sensor



Sensor specification	FT-0501	FT-0801
Measurement target	DC motor etc. (commutator type)	Automobile, construction machine
Detection method	Leakage magnetic flux detection	Voltage noise
Major specifications	Direct attached signal cable 3m With tip connector (R03-PB6M) *It is necessary to set the number of poles of the motor.	Plug in cigarette lighter socket. Cable length 2m With tip connector (C02) (BNC)
Operating temperature range	-10 to 60 °C	0 to 40 °C

* Please contact us for more detail brochure of the FT-2500.

F/V Converter FV-1500

Frequency-to-Voltage/Frequency-to-Current Converter

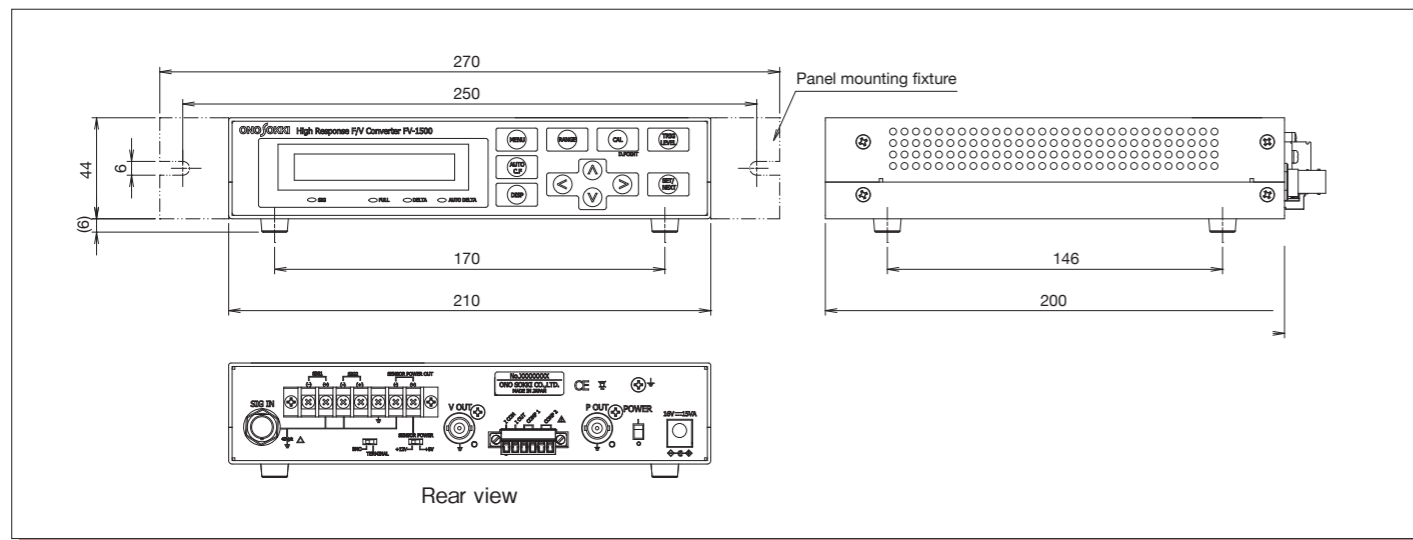
High response type



- Filter : OFF / 20 kHz / 120 kHz low-pass filter
- Analog output terminal signal : voltage output; 0 to 10 V (Full scale mode signal output, direction recognition function OFF) ± 5 V (Full scale output mode, direction recognition function ON, deviation mode, automatic center frequency follow-up mode) Load resistance 100 k Ω or more
- current output; 0 to 16 mA (at the time of shipment)/4 to 20 mA Load resistance 500 Ω or less
- Linearity : voltage output; DC: ± 0.1 % (to 180 kHz), ± 0.2 % (to 320 kHz) AC: ± 0.2 % (to 180 kHz), ± 0.4 % (to 320 kHz) current output; DC: ± 0.7 % (to 180 kHz), ± 1.4 % (to 320 kHz) AC: ± 1.4 % (to 180 kHz), ± 2.8 % (to 320 kHz)
- Analog output low pass filter : OFF/ 3 Hz/ 10 Hz/ 1 kHz selectable
- Analog output terminal : BNC/C02 type (voltage output) or terminal block (phoenix contact: MC1.5/6-STF-3,81) (voltage output) selectable
- D/A resolution : 16-bit
- Display : fluorescent display tube (display range 69.85 mm x 11.45 mm)
- Display unit : Hz, r/min, m/min, USER
- Power requirement for sensor : 12 VDC ± 10 %, 150 mA / 5 VDC ± 10 % 150 mA Selectable by switch on the real panel.
- Operating power voltage range : 16 VDC dedicated AC adapter (100 to 240 VAC) provided as standard
- Operating temperature : 0 to +40 $^{\circ}$ C
- Storage temperature : -10 to 50 $^{\circ}$ C
- Operating humidity : 5 to 80 % RH (with no condensation)
- Storage humidity : 5 to 85 % RH (with no condensation)
- Weight : approx. 1 kg
- Accessory : dedicated AC adapter (AC adapter: PS-P20023D cable: VM1391-VM1700 2m) x 1, instruction manual x 1, connector (MC1.5/6-STF-3.81) x 1 (equipped with the main body)
- CE marking : Low Voltage Directive; 2006/95/EC EN61010-1:2010 EMC Directive; 2004/108/EC EN61326-1:2006 Class A Table 2
- Option : FV-0151 (Automatic center frequency follow-up function) FV-0152 (Comparator output function) FV-0153 (Deviation scale change function) FV-0154 (Open collector output function) FV-0014 (Panel mounting fixture)

- Features**
- Wide frequency range: 0.2 Hz to 320 kHz
- High-speed response of every signal period
- Rotation direction judgment using two-phase signal input
- Rapid deceleration follow-up function
- Automatic center frequency follow-up function can analyze transient fluctuation component (option)

- Specifications**
- Response : within 1 period time of input frequency + 3.5 μ s
- Input voltage : AC input signal voltage range; 0.3 to 30 Vp-p DC input signal voltage range; Hi +4 to +30 V, Lo 1 V or less
- Input frequency range : 0.2 Hz to 320 kHz For full scale mode output;
 - Can be set between 1 and 320000 Hz every 1 Hz
 - Can be set between 1 and 320000 r/min every 1 r/min
 - Can be set between 1 and 320000 m/min every 1 m/min
 For deviation mode; Selectable from the measurement frequency range up to 320 kHz ± 1 %, ± 5 %, ± 10 %, ± 20 %, ± 50 %, ± 100 % or ± 1 to 180,000 (can be set every 1Hz, 1r/min, or 1m/min.)
- Input terminal : BNC (C02) or terminal block selectable
- Input format : single-phase, AC/DC/non-voltage selectable (+12 V pull-up for open collector devices) Two-phase signal with 90 $^{\circ}$ phase difference (DC input only)

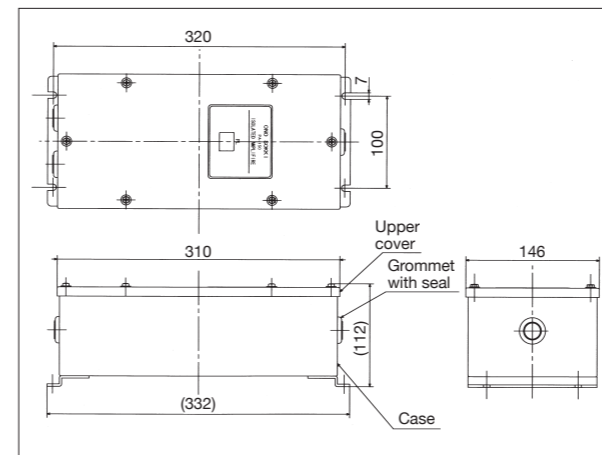


* Please visit our website for more details on FV-1500.

Related Products

Isolated Signal Amplifier PA-150

Signal Amplifier



Features

- Used as an amplifier for electromagnetic detectors under electrically bad environment.
- Converts the input signal into a high-voltage low-impedance signal to transmit the signal to remote locations accurately.
- 12 VDC power terminal for use with various sensors.
- Terminal block allowing easy wiring, sealed structure, a take-off vent for various plumbing and cabling methods.
- Isolated shielded type to allow installation on site. Noise-resistant.

Specifications

- Input amplification : AC amplification
- Input impedance : differential input: approx. 70 k Ω (50 kHz) single-ended input: approx. 45 k Ω (50 kHz)
- Input waveform : sine wave or rectangular wave (with a duty of approx 1:1)
- Input sensitivity : sine wave input ; 0.1 Vrms, rectangular wave input ; 0.3 Vp-p (max. allowable bias voltage: ± 1 VDC)
- Frequency range : 1 Hz to 50 kHz
- Operating voltage range : sine wave input ; 0.1 to 30 Vrms rectangular wave input ; 0.3 to 30 Vp-p
- Max. input apply voltage : sine wave; 100 Vrms, rectangular wave; 100 VDC
- Output waveform : rectangular waveform
- Voltage output : max. peak voltage (Vp-p) ; 12 ± 1 V max. bias voltage (VBIAS) ; 0.5 V or less *When OUT2 and OUT1 is short-circuited and no load between COM2 and OUT1/2.
- Open collector output : output impedance; approx. 330 Ω collector maximum applied voltage; 40 VDC collector maximum input current; 50 mA *Between OUT2 and OUT1; open collector maximum applied voltage, and collector maximum input current
- Power source : 12 VDC ± 5 %, 100 mA max.
- Operating temperature : -10 to 40 $^{\circ}$ C
- Storage temperature : -20 to 70 $^{\circ}$ C
- Power requirement : 100 VAC ± 10 %, 50/60 Hz
- Power consumption : approx. 8 VA
- Weight : approx. 4 kg
- Accessory : crimp terminal x 11, fuse for 200/220V x 1, instruction manual x 1
- Terminal block : applicable to JIS C 2805 2-4 crimp terminal

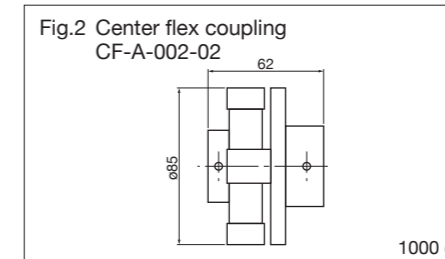
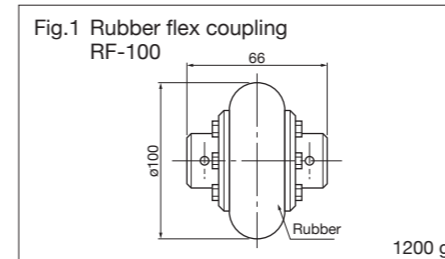
Coupling Selection Guide

When connecting an electromagnetic rotation detector to a device, a rigid coupling will give accurate transmission of rotation and angle. However, if there is misalignment of the centering or allowance in the thrust direction, the bearing will be elastically deformed, which will impair accuracy or damage the detector. For stable and long use with rigid coupling, the shaft misalignment should be within 6/1000 m. When you cannot make shaft centering with that accuracy, it is necessary to use flexible coupling which can accept the differences in shaft center and the allowance in thrust direction. There are various kinds of flexible couplings, such as one with high torsional rigidity, one suitable for general rotation speed measurement. It must be selected according to the application. Please perform the centering work as carefully as possible to prevent dynamic and static loads on the shaft beyond allowance.

Coupling name	Application	Features	Allowable eccentricity, deflection angle [Note 1]	Detaching method	Remarks	Manufacturer
Rub flex coupling RF-100 etc. Fig.1	MP-810B MP-200	<ul style="list-style-type: none"> • Relaxation of rubber impact elasticity • Vibration damping 	Rotation speed: 2000 r/min Deviation: 1.5 mm Deflection angle: 6 $^{\circ}$	Attach the flange to the detector and the machine side. After setting to the dimensions specified in the centering rules, attach the rubber tire. Removable without moving system.	At high speed, expansion of the rubber due to centrifugal power causes a thrust and it damages the detector. Drive side shaft diameter $\phi 10$ to $\phi 22$ [Note 2]	Nitta Chemical Industrial Products Co., Ltd.
Center flex coupling CF-A-002-02 Fig.2		<ul style="list-style-type: none"> • Absorbs vibrations and shocks • Does not occupy wide space in the axial direction 	Rotation speed: 5000 r/min Deviation: 0.5 mm Deflection angle: 1 $^{\circ}$	Attach the flange hub and hub to the detector and the machine side, and attach the rubber body after centering.	Drive side shaft diameter $\phi 10$ to $\phi 25$	Miki Puli Co., Ltd.

[Note 1] Allowable eccentricity and deflection angle are the ranges that guarantee the performance as a coupling. However, please avoid installing in the way that the detector shaft exceeds the specified load even if it is within the allowable range.
 [Note 2] Customers should prepare hole machining on the drive shaft side.

Recommended coupling shape/weight



* For details of coupling, please contact each manufacturer.

Handheld Tachometer

Handheld Tachometer FT-7200

Advanced Handheld Tachometer

FT-7200 FFT calculation method

The FT-7200 is a handy type tachometer that performs frequency analysis by FFT calculation processing and measures rotation speed. Can measure a wide range from steady motor rotation to acceleration/deceleration of engine rotation.



Features

- Enables rotation measurement easily using sound and vibration. Machining of the rotating shaft is not required.
- Supports rotation speed change and acceleration/deceleration.
- Efficient for measuring engine rotation speed of completed vehicles etc.
- Various sensors can be used.
- Both analog and pulse outputs provided as standard. Used for recording rotation speed and as rotation synchronization signals.
- Large LCD with backlight.
- With averaging processing function.

Specifications

Measurement section
 Measurement object : DC motor, compressor, engine or general rotating body
 Calculation method : FFT calculation method
 Measurement time : within 250 ms
 Input frequency range : 3.75 Hz to 2 kHz (3 ranges switching)
 Measurement unit : r/min (rotation speed)
 Measurement accuracy (r/min) : $\pm 2 \times$ rotation speed resolution (r/min) ± 1 count
*Measurement accuracy depends on the frequency range.
 Rotation speed resolution (r/min): frequency range (Hz) \div 6400 \times 60 \div number of set pulses
 frequency range; 250, 500, 2000 (Hz) number of set pulses; 0.5, 1, 1.5, etc. (P/R) 6400 = 200 lines \times 32
*It becomes coarse when the rotation speed is accelerating or decelerating.
 Filter function : Specifies the frequency range (rotation speed range) to be measured within the selected frequency range.
 Averaging processing : moving average processing number of averaging processing... OFF, 2, 4, 8, 16
 Sensor amplifier sensitivity adjustment volume : Sensor amplifier sensitivity can be adjusted with the rotary type volume knob on the right side of the main unit.
Detection section
 Compatible sensors : dedicated for engine rotation measurement OM-1200/1500, VP-1220/202, IP-292/296, IP-3000A/3100, FT-0801 FT-0501+FT-0150, NP-3000 series (with built-in preamplifier), MI series (microphone + preamplifier)
 Input voltage level : 3-range available; 5 V (max ± 5 V), 0.5 V (max ± 0.5 V), 0.05 V (max ± 0.05 V)
 Input coupling : AC coupling
 Power supply for NP series accelerometer : constant current power supply (2.4 \pm 0.5 mA)
*Note on measurement: depending on the type of engine and measuring object, it may not detect properly.

Display section
 LCD display : 5 digits, LCD 7 segments, with backlight (character height 10.2 mm)
 Display update time : 0.5 \pm 0.2 s
 Display resolution : 1 r/min
Measurement mode
 CNS (Constant) : Used when the fluctuation of the rotation speed of the object to be measured is small (when measuring the rated rotation speed, etc.)
 ACT (Active) : Used when the rotation speed of the object to be measured accelerates or decelerates. (However, when it changes suddenly, it may not measure correctly.)

Output section
[ANALOG] analog output (switch to analog output for monitor)
 Output content : Output for the display value of rotation speed.
 Voltage range : 0 to 1 V / 0 to F.S. (F.S. is arbitrarily set.)
 Conversion method : 10 bit D/A conversion method
 Linearity : $\pm 1\%$ of F.S.
 Output update time : within 250 ms
 Temperature stability : $\pm 0.05\%$ of F.S. / $^{\circ}$ C (ZERO & SPAN)
 Setting error : $\pm 0.5\%$ of F.S. (factory setting adjustment error, ZERO & SPAN)
 Load resistance : 100 k Ω or more
 Output connector : mini jack (ϕ 2.5)
[ANALOG] analog output for monitor (switch to analog output)
 Output content : analog output for monitoring after waveform shaping of sensor pulse
 Load resistance : 100 k Ω or more
 Output connector : mini jack (ϕ 2.5/commonly used with ANALOG output)

[PULSE] output
 Signal content : Outputs frequency pulse of the power spectrum extracted by FFT processing.
 Output voltage : Lo... 0.5 V or less, Hi... 4.5 V or more (no load)
 Output frequency range : 3.75 Hz to 2 kHz, equivalent to display rotation speed \times number of set pulses per rotation (P/R)
 Output update time : steady rotation mode (Constant); within 500 ms
 rotation acceleration/deceleration mode (Active); within 250 ms
 Load resistance : 100 k Ω or more
 Output connector : mini jack (ϕ 2.5/commonly used with ANALOG output)

General specification
 Power supply : AAA battery $\times 4$ or dedicated AC adapter (PB-7090, sold separately)
 Battery life : approx. 6 hours (When the backlight is off.) approx. 5 hours (When the backlight is on.) (When alkaline battery is used, at 20 $^{\circ}$ C, excluding when using the NP-3000 series accelerometer^{*1})
*1: When using NP-3000 series accelerometer, consumption current increases due to driving constant current power. We recommend using the dedicated AC adapter.
 Low battery display : The LOW mark is displayed, when the battery voltage drops 4.2 V or less.
 Operating temperature : 0 to 40 $^{\circ}$ C
 Storage temperature : -10 to 50 $^{\circ}$ C
 Operating (storage) humidity : 35 to 85% RH (with no condensation)
 Outer dimensions : 66.0 (W) \times 189.5 (H) \times 47.5 (D) mm
 Conforming standard : CE marking
 Weight : approx. 230g (not including battery)
 Accessory : AAA battery $\times 4$, instruction manual (basic operation, function guide, measurement procedure) $\times 1$ each, carrying case $\times 1$
 Option : relay cable for FT-0501, 0.5 m (FT-0150) output signal cable, 2m (AX-501) dedicated AC adapter (PB-7090) magnet stand (HT-0522) stand jig (HT-0521A) measurement tripod (LA-0203 D) (Airy L 100 manufactured by SLIK)

Handheld Tachometer HT-5500

Handheld Digital Tachometer

HT-5500 Contact/non-contact type · multifunction type

Extensive measurement from 6.0 r/min (low speed rotation) to 99999 r/min (high speed rotation).



Features

- Memory function: up to 20 data of memory can be recorded.
- Both contact and non-contact measurement, line speed measurement is available with non-contact method.
- Both analog and pulse outputs provided as standard. Used for recording rotation speed and as rotation synchronization signals.
- Peak hold function installed: maximum value and minimum value during measurement can be displayed.
- Large LCD with backlight.
- Tripod, stand jig (option) mounting: can be fixed to a tripod etc. for continuous measurement.

Specifications

Detection method : red visible light photoelectric reflection method, contact method (attaching contact adapter)
 Detection distance : 20 to 300 mm
 Display section : LCD, 5 digits, with backlight (character height: 10.2 mm)
 Measurement time : Within 1 s + time for one cycle (however, when the rotation is less than 60 r/min, twice the time for one cycle).
 Display update time : approx. 1 s
 Measurement unit : r/min, r/s (rotation speed), m/min (circumferential speed), ms (period), COUNT (integration count)
 Measurement range :

	Non-contact type	Contact type
r/min (Hi level)	6 to 99999	6 to 20000
r/min (Lo level)	6.0 to 600.0	6.0 to 600.0
r/s	0.10 to 999.99	0.10 to 400.00
m/min	0.6 to 9999.9	0.6 to 400.0
COUNT	0 to 99999	0 to 99999
ms	0.6 to 9999.9	2.5 to 9999.9

Measurement accuracy : display value* $\times (\pm 0.02\%) \pm 1$ count
*Display value is the count value excluding the decimal point.
 (Note)

- The measurement accuracy of circumferential speed depends on the rotation speed of the rotating body.
- The above measurement accuracy is for non-contact measurement. It does not include errors due to camera shake. Contact slippage and accuracy are added at the time of contact measurement.

Measurement function

Peak hold function : maximum value (MAX), minimum value (MIN)
 Memory function : up to 20 data
 Over range function : over range (ERROR mark) is displayed when the measured value exceeds the measurement range.

Rotation upper limit warning function : When the rotation speed exceeds a preset upper limit value, upper limit warning (↑ mark) is displayed.
 Circumferential speed calculation function : [non-contact type] circumferential speed is calculated with the preset diameter (mm) and the measured rotation speed. [contact type] circumferential ring KS-100/200 is used.
 Integration count function : Performs integration pulse counting of input signal
*Note: The display is updated every display update time.
 Period measurement function : Measures the period of input pulse (however, average value of input pulse if it is 1 second or more)
 Rotation speed : non-contact type (with reflective mark), contact type (using KS-300)

Output section [analog output]

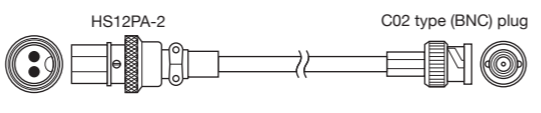
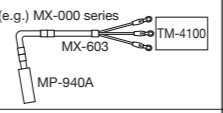
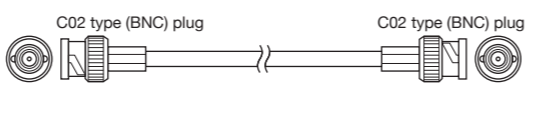
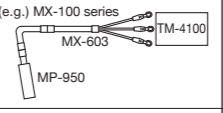
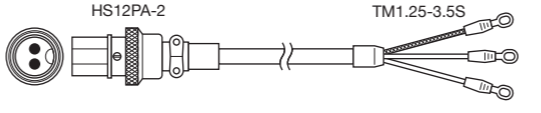
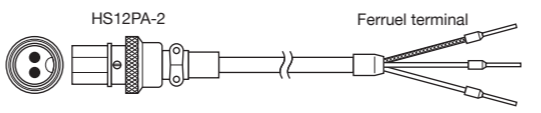
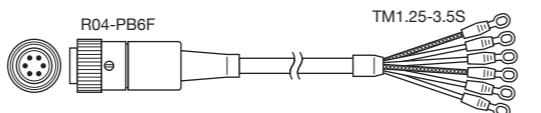
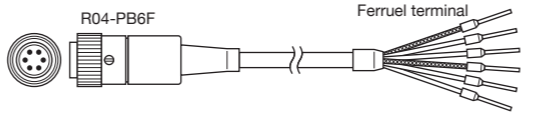
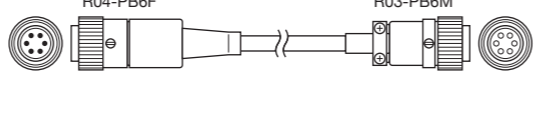
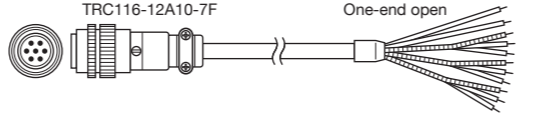
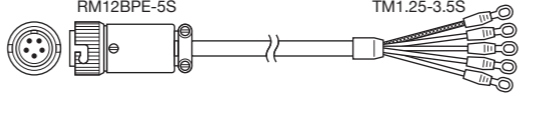
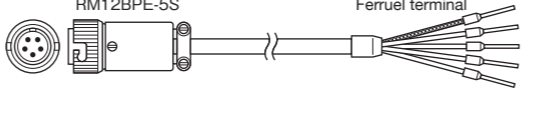
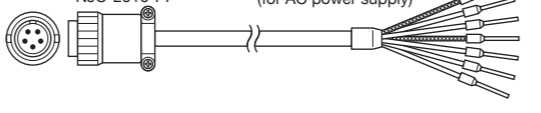
Output voltage : 0 to 1 V / 0 to F.S. (Full scale is arbitrarily set.)
 Conversion method : 10 bit D/A conversion method
 Linearity : $\pm 1\%$ F.S.
 Output update time : 50 ms + input pulse within 1 period time
 Temperature stability : $\pm 0.05\%$ / F.S. / $^{\circ}$ C (span & zero)
 Full scale setting error : $\pm 0.5\%$ / F.S.
 Load resistance : 100 k Ω or more
Output section [pulse output]
 Output voltage : Hi level... 4.5 V or more (when detecting with reflective mark)
 Lo level... 0.5 V or less
 Output logic : positive logic
 Load resistance : 100 k Ω or more

General specifications

Power : AAA battery $\times 4$ or dedicated AC adapter (PB-7090: sold separately)
 Battery life : approx. 32 hours (when the backlight is OFF) approx. 8 hours (when the backlight is ON) (When alkaline dry battery used, at 20 $^{\circ}$ C)
 Low battery display : The LOW mark is displayed, when the battery voltage drops 4.5 V or less.
 Operating temperature : 0 to 40 $^{\circ}$ C
 Storage temperature : -10 to 50 $^{\circ}$ C
 Operating (storage) humidity : 35 to 85% RH (with no condensation)
 Outer dimensions : 66 (w) \times 180.5 (H) \times 47.5 (D) mm (only main unit) 66 (W) \times 237.2 (H) \times 57.5 (D) mm (contact adapter + rotation contact tip)
 Conforming standard : CE marking
 Weight (excluding batteries) : approx. 220g (only main unit) approx. 282g (contact adapter+ rotation contact)
 Accessory : contact adapter (HT-0502) $\times 1$, rotation contact tip (KS-300) $\times 1$, circumferential ring (KS-200 for m/min) $\times 1$, reflective mark (12mm square, 25 sheets) $\times 1$, AAA battery $\times 4$, carrying case $\times 1$, instruction manual (function guide: Japanese/English, basic operation: Japanese/English) $\times 1$
 Option : pulse output cable; 2 m (AX-501) dedicated AC adapter (PB-7090) reflective mark; 12 mm square 25 sheet, 10 sheet 1 set (HT-011) circumferential ring for m/s (KS-100) circumferential ring for m/min (KS-200) rotation contact tip (KS-300) contact adapter (HT-0502) extension relay shaft for KS-300 (KS-700) stand jig (HT-0521B) magnet stand (HT-0522) measurement tripod (LA-0203D) (Airy L 100 manufactured by SLIK)

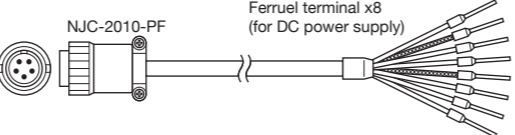
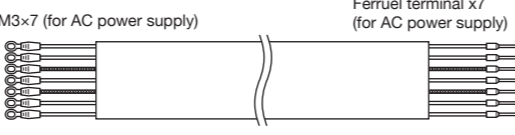
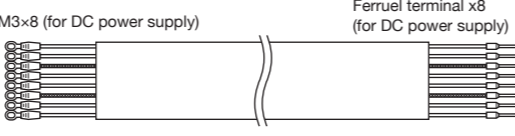
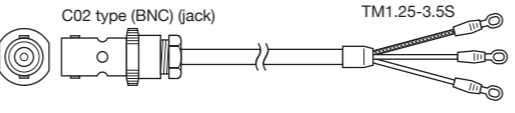
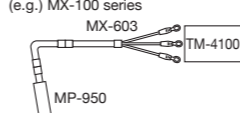
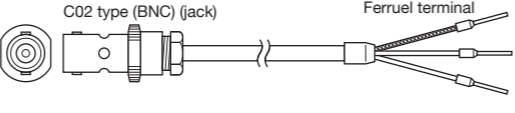
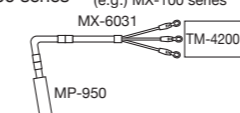
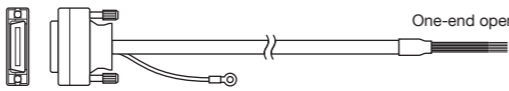
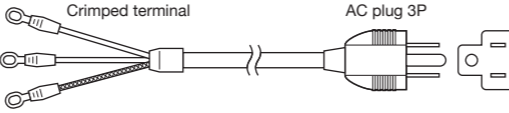
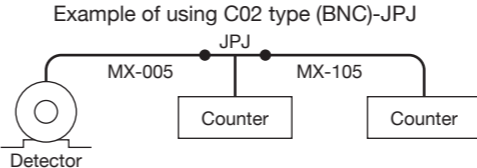
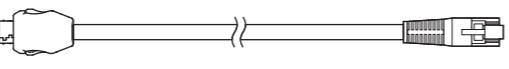


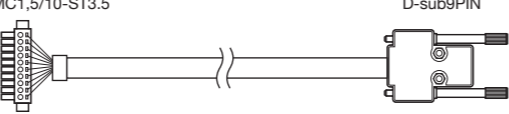
Signal Cable

Table of Signal Cable

Item	Compatible Products	Cable	Model Name	Specifications	Compatible Products	Non-compatible Products	Remarks																																																		
Signal cable (Sensors ↔ Counter)																																																									
1	MP-9100/9120/9200/940A/963 MP-810/820/830 (MP-081+MX-005 series)	3C-2 V (High-frequency coaxial cable)	MX-005 5 m 010 10 m 015 *15 m 020 *20 m		CT-6710 FV-1500	TM-4100/4200/4300/4400 series Counter without a BNC input connector * However, if the input connector is connected to the terminal block's display unit, connection is enabled by using a cable combination (MX-000 series+ MX-603 or MX-6031.) 	<table border="1"> <thead> <tr> <th>Connector</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SIG</td> </tr> <tr> <td>2</td> <td>COM</td> </tr> </tbody> </table>	Connector	Signal	1	SIG	2	COM																																												
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2	MP-930/935/936/950/954/962 FG-1300	3C-2 V (High-frequency coaxial cable)	MX-101 1.5 m 105 5 m 110 *10 m 115 *15 m 120 *20 m		CT-6710 FV-1500	TM-4100/4200/4300/4400 series Counter without a BNC input connector * However, if the input connector is connected to the terminal block's display unit, connection is enabled by using a cable combination (MX-000 series+ MX-603 or MX-6031.) 	<table border="1"> <thead> <tr> <th>Connector</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>Center contact</td> <td>SIG</td> </tr> <tr> <td>Shell</td> <td>COM</td> </tr> </tbody> </table> The following models have a directly attached cable. MP-930: 0.5 m MP-950: 0.5 m 935: 1 m 954: 0.5 m 936: 1 m 962: 0.5 m	Connector	Signal	Center contact	SIG	Shell	COM																																												
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3	MP-9100/9120/9200/940A/963 MP-810/820/830/837 (MP-081+MX-500 series)	P-2 (2-core outer shield cable)	MX-505 5 m 510 10 m 520 20 m		FV-1500 PA-150 TM-4100 series	TM-4200/4300/4400 series	<table border="1"> <thead> <tr> <th>Connector</th> <th>Color of Code</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>Contact 1</td> <td>White</td> <td>SIG</td> </tr> <tr> <td>Contact 2</td> <td>Green</td> <td>COM</td> </tr> <tr> <td>Housing</td> <td>Shield</td> <td>Case Ground</td> </tr> </tbody> </table>	Connector	Color of Code	Signal	Contact 1	White	SIG	Contact 2	Green	COM	Housing	Shield	Case Ground																																						
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4	MP-9100/9120/9200/940A/963 MP-810/820/830/837 (MP-081+MX-5205)	P-2 (2-core outer shield cable)	MX-5205 5 m		TM-4200/4300/4400 series	FV-1500 PA-150 TM-4100 series	<table border="1"> <thead> <tr> <th>Connector</th> <th>Color of Code</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>Contact 1</td> <td>White</td> <td>SIG</td> </tr> <tr> <td>Contact 2</td> <td>Green</td> <td>COM</td> </tr> <tr> <td>Shell</td> <td>Shield</td> <td>Case Ground</td> </tr> </tbody> </table>	Connector	Color of Code	Signal	Contact 1	White	SIG	Contact 2	Green	COM	Shell	Shield	Case Ground																																						
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5	MP-981/9820 LG-9200	D5-UL (Composite 5-core vinyl sheath cable)	MX-7105 5 m 7110 10 m 7115 15 m 7120 20 m		FV-1500 PA-150 TM-4100 series	TM-4200/4300/4400 series	<table border="1"> <thead> <tr> <th>Connector</th> <th>Color of Code</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Blue</td> <td>SIG</td> </tr> <tr> <td>B</td> <td>White</td> <td>Unused</td> </tr> <tr> <td>C</td> <td>Red</td> <td>+12 V</td> </tr> <tr> <td>D</td> <td>Shield</td> <td>Case Ground</td> </tr> <tr> <td>E</td> <td>Green</td> <td>COM</td> </tr> <tr> <td>F</td> <td>Black</td> <td>0 V</td> </tr> </tbody> </table>	Connector	Color of Code	Signal	A	Blue	SIG	B	White	Unused	C	Red	+12 V	D	Shield	Case Ground	E	Green	COM	F	Black	0 V																													
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7	MP-981/9820 LG-9200	D5-UL (Composite 5-core vinyl sheath cable)	MX-8105 5 m 8110 10 m 8115 15 m 8120 20 m		CT-6710 TS-2800 (LG-9200 cannot be used.)	Counters other than those listed in the column at the left	The connector pin arrangement is the same as MX-7105 to 7120.																																																		
8	RP-432Z	R8 (4 twisted pairs twist with 3 shield cables)	RP-0169 5 m		TM-4100 series	TM-4200/4300 series	<table border="1"> <thead> <tr> <th>Connector</th> <th>Color of Code</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Blue</td> <td>SIG1</td> </tr> <tr> <td>B</td> <td>White</td> <td>SIG2</td> </tr> <tr> <td>C</td> <td>Orange</td> <td>SIGZ</td> </tr> <tr> <td>D</td> <td>Gray/Green, Brown/Green, Green</td> <td>COM</td> </tr> <tr> <td>E</td> <td>Red</td> <td>+5 V or +12 V</td> </tr> <tr> <td>F</td> <td>Black</td> <td>COM</td> </tr> <tr> <td>G</td> <td>Shield</td> <td>Case Ground</td> </tr> </tbody> </table>	Connector	Color of Code	Signal	A	Blue	SIG1	B	White	SIG2	C	Orange	SIGZ	D	Gray/Green, Brown/Green, Green	COM	E	Red	+5 V or +12 V	F	Black	COM	G	Shield	Case Ground																										
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11	RP-1700 series (AC power supply)	20276-VSV-4P	PE3534952 (PS-D11144) 5 m		TM-4200/4300 series	TM-4100 series	<table border="1"> <thead> <tr> <th rowspan="2">Encoder Connector</th> <th rowspan="2">Color of Code</th> <th colspan="2">Encoder output Signal</th> </tr> <tr> <th>Totem pole, Collector, Open collector</th> <th>Line driver</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Blue</td> <td>SIGA</td> <td>SIGA</td> </tr> <tr> <td>2</td> <td>White</td> <td>SIGB</td> <td>SIGB</td> </tr> <tr> <td>3</td> <td>Orange</td> <td>SIGZ</td> <td>SIGZ</td> </tr> <tr> <td>4</td> <td>Green</td> <td>COM</td> <td>-SIGA</td> </tr> <tr> <td>5</td> <td>Gray</td> <td>COM</td> <td>-SIGB</td> </tr> <tr> <td>6</td> <td>Red</td> <td>COM</td> <td>COM</td> </tr> <tr> <td>7</td> <td>Yellow</td> <td>COM</td> <td>-SIGZ</td> </tr> <tr> <td>8</td> <td>Unused</td> <td>Unused</td> <td>Unused</td> </tr> <tr> <td>9</td> <td>Unused</td> <td>Unused</td> <td>Unused</td> </tr> <tr> <td>10</td> <td>Brown</td> <td>COM</td> <td>COM</td> </tr> <tr> <td>Shell</td> <td>Shield</td> <td>Folding shield</td> <td>Folding shield</td> </tr> </tbody> </table>	Encoder Connector	Color of Code	Encoder output Signal		Totem pole, Collector, Open collector	Line driver	1	Blue	SIGA	SIGA	2	White	SIGB	SIGB	3	Orange	SIGZ	SIGZ	4	Green	COM	-SIGA	5	Gray	COM	-SIGB	6	Red	COM	COM	7	Yellow	COM	-SIGZ	8	Unused	Unused	Unused	9	Unused	Unused	Unused	10	Brown	COM	COM	Shell	Shield	Folding shield	Folding shield
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12	RP-1700 series (DC power supply)	20276-VSV-4P	PE3534953 (PS-D11145) 5 m	 <p>NJC-2010-PF Ferrule terminal x8 (for DC power supply)</p>	TM-4200/4300 series	TM-4100 series	<table border="1"> <thead> <tr> <th rowspan="2">Encoder Connector</th> <th rowspan="2">Color of Code</th> <th colspan="2">Encoder output Signal</th> </tr> <tr> <th>Totem pole, Collector, Open collector</th> <th>Line driver</th> </tr> </thead> <tbody> <tr><td>1</td><td>Blue</td><td>SIGA</td><td>SIGA</td></tr> <tr><td>2</td><td>White</td><td>SIGB</td><td>SIGB</td></tr> <tr><td>3</td><td>Orange</td><td>SIGZ</td><td>SIGZ</td></tr> <tr><td>4</td><td>Green</td><td>COM</td><td>-SIGA</td></tr> <tr><td>5</td><td>Gray</td><td>COM</td><td>-SIGB</td></tr> <tr><td>6</td><td>Unused</td><td>COM</td><td>COM</td></tr> <tr><td>7</td><td>Yellow</td><td>COM</td><td>-SIGZ</td></tr> <tr><td>8</td><td>Red</td><td>DC+</td><td>DC+</td></tr> <tr><td>9</td><td>Brown</td><td>DC-</td><td>DC-</td></tr> <tr><td>10</td><td>Unused</td><td>COM</td><td>COM</td></tr> <tr><td>Shell</td><td>Shield</td><td>Folding shield</td><td>Folding shield</td></tr> </tbody> </table>	Encoder Connector	Color of Code	Encoder output Signal		Totem pole, Collector, Open collector	Line driver	1	Blue	SIGA	SIGA	2	White	SIGB	SIGB	3	Orange	SIGZ	SIGZ	4	Green	COM	-SIGA	5	Gray	COM	-SIGB	6	Unused	COM	COM	7	Yellow	COM	-SIGZ	8	Red	DC+	DC+	9	Brown	DC-	DC-	10	Unused	COM	COM	Shell	Shield	Folding shield	Folding shield
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13	RP-1700 series (AC power supply)	20276-VSV-4P	PE3534954 (PS-D11146) 5 m	 <p>M3x7 (for AC power supply) Ferrule terminal x7 (for AC power supply)</p>	TM-4200/4300 series	TM-4100 series	<table border="1"> <thead> <tr> <th rowspan="2">Encoder terminal block</th> <th rowspan="2">Color of Code</th> <th colspan="2">Encoder output Signal</th> </tr> <tr> <th>Totem pole, Collector, Open collector</th> <th>Line driver</th> </tr> </thead> <tbody> <tr><td>1</td><td>Blue</td><td>SIGA</td><td>SIGA</td></tr> <tr><td>2</td><td>Green</td><td>SIGM</td><td>-SIGA</td></tr> <tr><td>3</td><td>White</td><td>SIGB</td><td>-SIGB</td></tr> <tr><td>4</td><td>Gray</td><td>COM</td><td>-SIGB</td></tr> <tr><td>5</td><td>Brown</td><td>COM</td><td>COM</td></tr> <tr><td>6</td><td>Orange</td><td>SIGZ</td><td>SIGZ</td></tr> <tr><td>7</td><td>Yellow</td><td>COM</td><td>-SIGZ</td></tr> <tr><td>8</td><td>Unused</td><td>COM</td><td>COM</td></tr> <tr><td>9</td><td>Unused*</td><td>AC</td><td>AC</td></tr> <tr><td>10</td><td>Unused*</td><td>AC</td><td>AC</td></tr> </tbody> </table> <p>* Encoder terminal block: Power cable (RP-0151/0152/0153) is required separately for 9-pin, 10-pin.</p>	Encoder terminal block	Color of Code	Encoder output Signal		Totem pole, Collector, Open collector	Line driver	1	Blue	SIGA	SIGA	2	Green	SIGM	-SIGA	3	White	SIGB	-SIGB	4	Gray	COM	-SIGB	5	Brown	COM	COM	6	Orange	SIGZ	SIGZ	7	Yellow	COM	-SIGZ	8	Unused	COM	COM	9	Unused*	AC	AC	10	Unused*	AC	AC				
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14	RP-1700 series (DC power supply)	20276-VSV-4P	PE3534955 (PS-D11147) 5 m	 <p>M3x8 (for DC power supply) Ferrule terminal x8 (for DC power supply)</p>	TM-4200/4300 series	TM-4100 series	<table border="1"> <thead> <tr> <th rowspan="2">Encoder terminal block</th> <th rowspan="2">Color of Code</th> <th colspan="2">Encoder output Signal</th> </tr> <tr> <th>Totem pole, Collector, Open collector</th> <th>Line driver</th> </tr> </thead> <tbody> <tr><td>1</td><td>Blue</td><td>SIGA</td><td>SIGA</td></tr> <tr><td>2</td><td>Green</td><td>COM</td><td>-SIGA</td></tr> <tr><td>3</td><td>White</td><td>SIGB</td><td>-SIGB</td></tr> <tr><td>4</td><td>Gray</td><td>COM</td><td>-SIGB</td></tr> <tr><td>5</td><td>Unused</td><td>COM</td><td>COM</td></tr> <tr><td>6</td><td>Orange</td><td>SIGZ</td><td>SIGZ</td></tr> <tr><td>7</td><td>Yellow</td><td>COM</td><td>-SIGZ</td></tr> <tr><td>8</td><td>Unused</td><td>COM</td><td>COM</td></tr> <tr><td>9</td><td>Red</td><td>DC+</td><td>DC+</td></tr> <tr><td>10</td><td>Brown</td><td>DC-</td><td>DC-</td></tr> </tbody> </table>	Encoder terminal block	Color of Code	Encoder output Signal		Totem pole, Collector, Open collector	Line driver	1	Blue	SIGA	SIGA	2	Green	COM	-SIGA	3	White	SIGB	-SIGB	4	Gray	COM	-SIGB	5	Unused	COM	COM	6	Orange	SIGZ	SIGZ	7	Yellow	COM	-SIGZ	8	Unused	COM	COM	9	Red	DC+	DC+	10	Brown	DC-	DC-				
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1	MX-000 series cable 100 "	3D-2V (2-core outer shield cable)	MX-603 0.3 m	 <p>C02 type (BNC) (jack) TM1.25-3.5S</p>	FV-1500 PA-150 TM-4100 series 	TM-4200/4300/4400 series	<table border="1"> <thead> <tr> <th>Connector</th> <th>Color of Code</th> <th>Signal</th> </tr> </thead> <tbody> <tr><td>Center contact</td><td>White</td><td>SIG</td></tr> <tr><td>Shell</td><td>Green</td><td>COM</td></tr> <tr><td>Shell</td><td>Shield</td><td>Case Ground</td></tr> </tbody> </table>	Connector	Color of Code	Signal	Center contact	White	SIG	Shell	Green	COM	Shell	Shield	Case Ground																																						
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	TM-4100 series	30AWG×18P BIOS-E-3018-E	AA-8207 3 m	 <p>One-end open</p>	<ul style="list-style-type: none"> When several counters are connected to one detector, it is convenient to use BNC-JPJ connector. 																																																				
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	TM-4100/4200/4300/4400 series	Universal power cable	AX-2050N AC100 V 3 m	 <p>Crimped terminal AC plug 3P</p>	 <p>Example of using C02 type (BNC)-JPJ</p>																																																				
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	TM-4100/4200/4300/4400 series	R-OKTP-E5-P-SASB	AX-6103 3 m AX-6105 5 m	 <p>IX30G-A-10S-CV (7.0) RJ45</p>	 <p>BNCTAJPJ Coaxial connector (PE1507010)</p>  <p>BNCTAJJJ Coaxial connector (PE1507025)</p>																																																				
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	TM-4100/4200/4300/4400 series	R6 (3 twisted pairs with 2 shield cables)	PE3532908 (PS-D10502) 2m	 <p>MC1,5/10-ST3.5 D-sub9PIN</p>																																																					

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

URL: <https://www.onosokki.co.jp/English/english.htm>



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