

Digital Tachometer

TM-3100 Series

Instruction Manual (specifications)

This manual describes functions, specifications, setup procedures, precautions, etc. for use of the TM-3100 Series Digital Tachometer. To ensure proper use of the TM-3100 Series Digital Tachometer, please thoroughly read this manual. After reading this manual, keep it carefully.

Warnings and Cautions
 In this document precautions are classified into two categories: **WARNING** and **CAUTION**. This depends on the degree of danger or damage possible if the precaution is ignored and the product is used incorrectly.

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

- The TM-3100 Series Digital Tachometer has been tested under strict inspections for normal operation before shipment.
- When unpacking the unit, make sure that none of the parts have been damaged during transportation and that the product operates normally referencing this manual.
- If any part is damaged or the product does not operate as described in this manual, contact your dealer or Ono Sokki sales office nearby.

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Notice
 When you export or bring abroad Ono Sokki products (including services), it is required to get the export license and others from your government in compliance with the export control law in your country.

Warranty conditions

- This product is covered by a warranty for a period of one year from the date of shipment from manufacturer.
 - This warranty covers free-of-charge repair during the warranty period for defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
 - For free-of-charge repair during the warranty period, contact your dealer or your nearest Ono Sokki sales office nearby.
 - Even during the warranty period, the following failures will be handled on a fee basis.
 - Failures or damages occurring through misuse, misoperation, or modification.
 - Failures or damages occurring through mishandling (dropping) during transportation after shipment.
 - Failures or damages occurring through natural calamities (fires, earthquakes, flooding, and lightning), environmental disruption, or abnormal voltage.
 - Replenishment of expendable supplies, spare parts, and accessories.
- * This warranty does not limit any legal rights of customers.
 * For repairs after the warranty period expired, contact your dealer. If the function of the product could be maintained through repair, it will be handled on a fee basis.
 * This warranty covers only the product itself; it does not cover any damages resulting from failures of the product.



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Observe the Following Points before Use

WARNINGS

- Warnings on installation**
- Do not operate the instrument in locations where there is gas or steam. Using the instrument where there is steam or combustible or explosive gas may cause an explosion.
 - Using this instrument in a location where the temperature exceeds the specified operating temperature range may cause fire.
 - Do not block the heat radiation system. There is a risk of fire if heat builds up inside the instrument. Place the instrument away from the wall on locations with the best ventilation possible.
 - Do not splash or spill water on the instrument. There is a risk of fire or electric shock due to short or increased heat. If you get water inside the instrument, turn OFF the power immediately and contact your dealer or Ono Sokki sales office nearby as soon as possible.

Warnings on wiring

- Do not disassemble the instrument. Use of the instrument without its casing or while taken apart may result in damage to instrument or electric shock. When internal adjustment, inspection or repairs are required, contact your dealer or Ono Sokki sales office nearby.
- Be sure that the power supply meets specified voltage and frequency requirements. Using power supply with other voltage or frequency requirements may result in electric shock, fire, or damage to the instrument.
- Before touching parts of voltage/current output section or circuits connected thereto, make sure that the power is OFF. Touching such circuits without turning the power OFF may result in electric shock. In addition, be sure to insulate the circuit to withstand the output voltage and current.
- When the power supply terminal block and the comparator output inserted into the A slot are used, be sure to attach the supplied terminal block cover because there is a risk of electric shock. Do not touch a terminal when the power is ON.

Warnings on activation and maintenance

- If you hear thunder, do not touch any metal parts of the instrument or the plug. There is a risk of electric shock from conducted lightning.
- If you perceive smoke, noise, or abnormal odor coming from the instrument or if you accidentally drop or damage it, unplug the instrument immediately. Using the instrument under such conditions may cause fire or electric shock. Contact your dealer or Ono Sokki sales office nearby as soon as possible.

CAUTIONS

Cautions on installation

- Be sure to built this product in a metal panel.
- Make sure that none of screws of the terminal block on the rear panel is loose.
- Make sure that cable coating is neither torn nor damaged (particularly in the case of a long cable).
- Make sure that the input signal maintains the initial signal level.
- When installing the instrument in a panel, make arrangements so that the temperature around the instrument, not around the panel, exceeds the rated temperature range (+50°C).
- When multiple Digital Tachometers are attached on a panel, refer to the panel cut-dimensions.

Overview

1.Overview
 The TM-3100 Series Digital Tachometer, a rotational display unit of the DIN specification size, makes it possible to select a desired input pulse and display directly read values in relation to detectors.

- 2.Features**
- Input frequency range 0.1Hz to 100kHz
 - A fluorescence indicator tube of the display has better visibility.
 - DIN specification size (96 x 48 mm)
 - Direct read value conversion function
 - Output method selection
 - TM-3110 : Basic type
 - TM-3120 : With the BCD(open collector) output function
 - TM-3130 : With the analog output function
 - TM-3140 : With the comparator output function

3. Product configuration (including accessories)

When unpacking the unit, make sure you have all the following parts:

① Main unit (TM-3100 Series)	: 1 piece
② Attachment fitting	: 1 set (= 2 pieces)
③ Instruction manual Specification/ basic operation editions	: 2 copies (1 copy for each)

- Do not install the instrument in locations where there is oily smoke or steam or where there is high humidity or lots of dust. Electricity could conduct through the oil, water vapor, or dust resulting in fire or electric shock.
- Do not install the instrument in locations where the temperature is extremely high or locations subject to direct sunlight. There is a risk of fire.

CAUTIONS

Cautions on wiring

- For the terminal block and connector, correctly make wiring while checking the name and polarity.
 - When using a solderless terminal, select a M3 terminal having a coated clamp section and a width of 5.8mm or less.
 - Fasten screws of the power supply input terminal and function terminal block with the specified torque.
- Insufficient fastening may cause short circuit, fire, or malfunction.

Power supply terminal block fastening torque	: 0.5N · m
Power cable thickness	: AWG18 or higher (UL-approved product)
Power cable length	: 1 m or less 10
RS gate terminal block fastening torque	: 0.22 to 0.25N · m
RS gate cable thickness	: AWG26 to AWG18

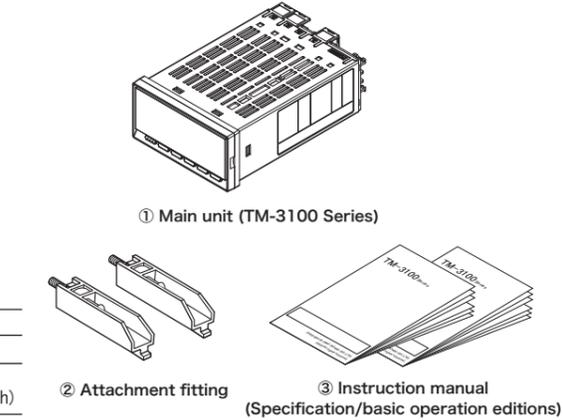
Cautions on activation and maintenance

- When the power is turned on, perform a warm-up operation for at least 15 minutes.
- Never remove or replace a slot board, or never add a board to an empty slot.

Cautions on installation for CE marking and EMC compatibility

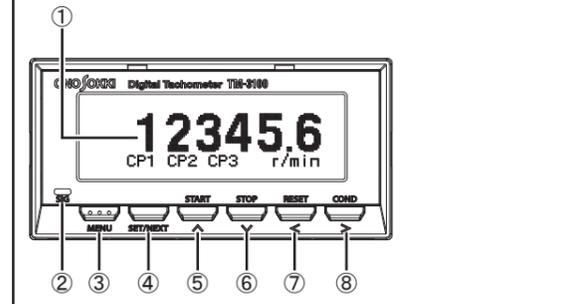
- Supply the power to the instrument from a line separated from other power equipment.
- Be sure to use a power cable with a length of 1 m or less (AWG18 or higher, UL-approved product).
- Do not supply the power to the instrument from a line in parallel with or in combination with a power line.
- Separate the power cable as much as possible from the signal cable.
- Do not extend the signal cable more than necessary.
- Use a shielded cable as the signal cable.
- Separate the instrument as much as possible from an apparatus which generates strong high frequency or surge, and use a surge killer and a line filter.
- Separate the instrument from an apparatus which generates a strong electric or magnetic field.
- After grounding the shielding wire of the Digital Tachometer to the panel, connect the metal panel to a good ground.
- ⊕ indicates the function grounding.
- If measures of noise are required, be sure to connect the instrument to a good ground.

Refer to the Noise measures installation diagram (Fig. 1) on the back.



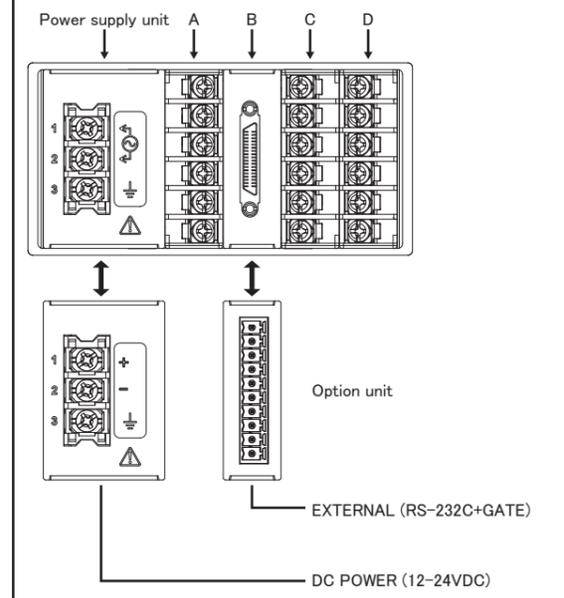
Name and Function of Each Section

1.Front panel



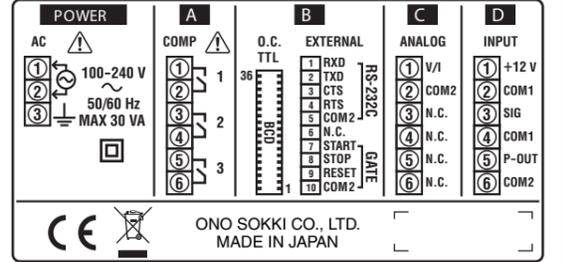
- Display device: This fluorescence indicator tube displays various measurement values and setup conditions.
- SIG: This green LED indicates the state of a signal input from the SIG IN terminal block. Blinks (lights up) each time a signal is input.
- MENU: This switch selects the measurement mode or setup mode. When pressed in the setup mode, the measurement mode or setup mode main menu is selected. When pressed for 2 seconds or longer in the setup mode, the measurement mode is selected.

2.Rear panel



POWER	Power supply unit
Slot	Standard : 100V to 240VAC Option : 12 to 24VDC (TM-0301)
Slot A	Comparator output function(TM-3140 or option/TM-0340) 3 outputs for 6-digit upper- and lower-limit settings
Slot B	External output function (TM-3120 or option) <ul style="list-style-type: none"> TM-3120 : BCD open-collector 6-digit parallel output Applicable connector ; HDRA-E36MA+ (connector) HDRA-E36LPTH (case) TM-0321(option) : BCD-TTL 6-digit parallel output Applicable connector ; HDRA-E36MA+ (connector) HDRA-E36LPTH (case) TM-0350(option): EXTERNAL (RS-232C+GATE) Applicable connector ; MC1, 5/10-ST3.5
Slot C	Analog output function(TM-3130 or option/TM-0330) Voltage/current selection Output voltage range : 0 to 10V, 0 to 5V, 1 to 5V Output current range : 4 to 20mA, 0 to 16mA
Slot D	Signal input function (common to the TM-3100 Series) AC/DC amplification selection Voltage/non-voltage input, open collector Applicable detector : MP, LG, and RP Series

- SET/NEXT: This switch is used to apply a setup item or select a following setup item during parameter setup.
- START/^: This switch starts start-stop (SS) measurement (MANUAL), setup for start-stop (SS) measurement (AUTO), reached speed time measurement (A.TIME), and section data memory (P.MEM) measurement; and performs addition during parameter setup.
- STOP/v: This switch stops start-stop (SS) measurement (MANUAL), setup for start-stop (SS) measurement (AUTO), reached speed time measurement (A.TIME), and section data memory (P.MEM) measurement; and performs subtraction during parameter setup.
- RESET/<: This switch recovers the comparator; resets the maximum, minimum, and average values; and moves the cursor to the left during parameter setup.
- COND/>: This switch checks setup parameters and data; and moves the cursor to the right during parameter setup. Pressing the "SET/NEXT" switch during check operation selects a following check item. Pressing this switch for 2 seconds or longer locks the keys. In the keylock mode, if you perform a key operation during keylock, "K.P." (Key Protect) is displayed at the bottom center of the display unit.



BCD pin assignment

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

Specifications

Common specification

1. Input unit

① Input amplification format	AC/DC coupling selectable
② AC amplifier	Signal wave: Sine wave 0.2 to 45 Vrms Signal voltage range: Square wave 0.6 to 63 Vp-p Signal frequency range: 1Hz to 100kHz
③ DC amplifier	Signal wave: Rectangle wave having a pulse width of 5μs or more Signal voltage range: Hi level ; +4 to +30 V Lo level ; -1 to +1 V Signal frequency range: 0.1Hz to 100kHz Time measurement: 10ms to 3600s
④ Input impedance	10kΩ or higher
⑤ Input format	Voltage/non-voltage input Open collector
⑥ Low-pass filter	OFF/100Hz/20kHz selectable
⑦ Input connector	Terminal block

2. Function calculation method

① Calculation method	Periodic calculation method
② Time base device	Crystal oscillator (20 MHz)
③ Rotational speed measurement accuracy	Display value x (±0.01%)±1 count or less * The display value indicates the count value except the decimal point.
④ Measurement time	10ms + 1 period time (Periodic calculation method)
⑤ Auto zero	OFF, 0.5 to 10 s (1s as factory setting) OFF, 0.5s, 1.0s, 2.0s, 3.0s, 4.0s, 5.0s, 6.0s, 7.0s, 8.0s, 9.0s, 10.0s Except the setup time, the display value is zeroed if a signal is not input for 11 seconds or longer. In passage time measurement, a measurement error results if a signal is not input for 3600 seconds or longer.
⑥ Rapid deceleration follow-up function	If the input signal rapidly decreases and an input signal is not input for about 1 second or longer, measurement automatically decelerates with this function and then zeroed in about 11 seconds later.
⑦ Moving average	OFF (factory setting), 2, 4, 8, 16, 32, 64, 128 times
⑧ Peak-hold function	OFF (factory setting), average, maximum, minimum
Section data	Holds the peak value between start and stop commands.

3. Setup section

① Panel condition memory	Holds setup conditions. Memorizes the measurement conditions at power ON/OFF and 4 other kinds of measurement conditions.
② Pulse setup	1 to 999999 P/R
③ Roller diameter setup	0.1 to 99999.9 mm
④ Distance between pulses	0.1 to 99999.9 mm
⑤ Processing time	0.1 to 99999.9 mm
⑥ Factor	9.99999 x 10E(-3 to 3) EU/PULS

4. Display section

① Display unit	Fluorescence indicator tube
② Refresh time	Average display 0.2s (factory setting), 0.4s, 0.5s, 0.6s, 0.8s, 1.0s to 10s (in 1.0-s steps)
③ Unit display	(A) Rotational speed (ROTATION) : r/s, r/min, r/h (B) Circumferential speed (L.SPEED) : mm/s, m/s, mm/min, m/min (C) Moving speed (VELOCITY) : mm/s, m/s, mm/min, m/min, km/min, mm/h, m/h, km/h (D) Period (PERIOD) : s, min (E) 1/s (number of times) (TIMES) : 1/s, 1/min, 1/h (F) Frequency (FREQ) : Hz, kHz (G) Flow rate (FLOW) : ml/s, ml/min, ml/h, l/s, l/min, l/h (H) Passage time (P.TIME) : s, min (I) User-defined engineering unit (OTHER) : EU/s, EU/min, EU/h
④ Number of decimal points	OFF (factory setting) Number of decimal points below data (1, 2, 3)
⑤ Number of zero-fixed digits	OFF (factory setting), minimum digits (1, 2)
⑥ SIG indicator	Blinks in synchronization with the input signal.
⑦ Error indication	Backup memory error, board error, input frequency over, display digit over, memory full error, setup value error
⑧ Brightness selection	LOW, MID, HI

5. Output section

① Pulse output	(A) Output voltage: Hi (+4.5 V or higher), Lo (+0.5 V or lower) (B) Output logic: Negative logic (C) Load resistance: 100kΩ or higher
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6. Power supply section for detector

① Output voltage	12VDC±10%
② Maximum output current	100 mA

7. General specifications

① Equipment type	Built-in type
② Power rating	100 to 240VAC, 50/60Hz, 30 VA max.
③ Power consumption	11 to 19VA (TM-3110) 13 to 21VA (TM-3120)/ 16 to 5VA (TM-3130) 12 to 21VA (TM-3140)/ 20 to 30VA (ANALOG, BCD, COMP)
④ Safety	Overvoltage category II Insulation Double insulation structure Dielectric strength 1500VAC (between AC line and FG) Insulation resistance More than 10M ohms (500VDC)
⑤ Operating environment	Indoor use only Operating temperature and humidity 0 to +50°C 30 to 80%RH (without condensation) Storage temperature and humidity -10 to +60°C 30 to 85%RH (without condensation) Pollution degree 2 Altitude 2000 m max.
⑥ Outer dimensions	96(W) x 48(H) x 140(D) mm or less
⑦ Weight	About 340g (ANALOG, BCD, COMP)
⑧ Applicable standard	CE marking • EN61010-1:2001 (2nd) • EN61326-1:2006
⑨ Mark	CE: This mark is the EC command compatibility declaration mark.  ; This mark indicates the double insulation structure.

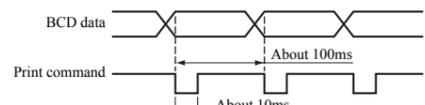
8. Accessories

- Instruction manual (Specifications, Basic Operations Reference: × 1 each)
- Attachment fitting (× 2)

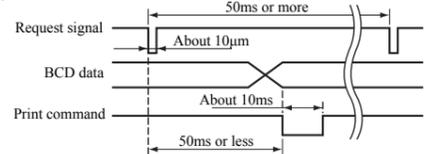
TM-3120 (with BCD/open collector output function) specifications

① Mode	(A) Normal mode: Continuously outputs the print command at every approx. 100ms. (B) Request mode: Outputs data for each request signal. Outputs data and the print command within at least 50ms after reception of a request signal.
② Output signal	(A) BCD output (a) Output mode: 6-digit parallel output (b) Output format: Open collector (c) Maximum sink current: 32 mA max. (d) Output withstand voltage: 24 V max. (e) Output logic: Positive logic (f) Data refresh time: 100ms or less

Normal (CONTINUE) mode



Request mode



③ Input signal	(A) Request signal (a) Input mode: Negative logic (with a pulse width of 10μs) (b) Operating edge: Falling edge (c) Input voltage: TTL (B) Gate function Start, stop, reset
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TM-3130 (with analogue output function) specifications

① Output signal (voltage/current selection)	(a) Output method: 12-bit D/A conversion method The resolution may decrease depending on the setup value. (b) Output voltage range: 0 to 10V, 0 to 5V, 1 to 5V (c) Output current range: 4 to 20 mA, 0 to 16 mA
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② Load resistance	(a) Voltage output: 100kΩ or higher (b) Current output: 500Ω or less
③ Linearity	±0.3%/F.S
④ Analog output adjustment	(a) Voltage output: ±5%/F.S. or higher (b) Current output: ±3%/F.S. or higher
⑤ Zero drift	±0.05%/F.S./°C
⑥ Span drift	±0.05%/F.S./°C
⑦ Output refresh time	10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s

TM-3140 (with comparator output function) specifications

① UPPER setup function	6-digit setup The relay turns ON when UPPER ≤ Indicated value.
② LOWER setup function	6-digit setup The relay turns ON when LOWER > Indicated value.
③ OK setup function	The relay turns ON when UPPER or LOWER is OFF.
④ ERROR setup function	The relay turns ON only when an error other than RS communication occurs.
⑤ Output format	1-make contact output3 outputs (COMP1, COMP2, and COMP3) (UPPER, LOWER, OK, and ERROR for each)
⑥ Measurement mode	Selection of comparator operation mode (A) Automatic recover mode: The comparator automatically recovers when the rotational speed returns within a setup range. Comparator hysteresis: Adds hysteresis to the setup value when the comparator recovers. (B) Hold mode: Holds the state even if the rotational speed returns within a setup range. (C) Shot output function: Holds the comparator output time for a fixed time duration.OFF (factory setting), 10 to 2000ms in 10-ms steps
⑦ COMP delay function	The comparator operates when the setup value is continuously exceeded for setup time.0 to 1000ms in 50ms steps
⑧ Reset function	Returns to the comparator hold mode.
⑨ Maximum contact capacity	30VDC/1A, 250VAC/1A
⑩ Output format	Terminal block
⑪ Output refresh time	About 10ms

TM-3100 Series option

1. DC power requirements (TM-0301)

① Power voltage	12 to 24VDC
② Power consumption	7VA (TM-3110) 7VA (TM-3120) 9VA (TM-3130) 7VA (TM-3140) 15VA (ANALOG, BCD, COMP)

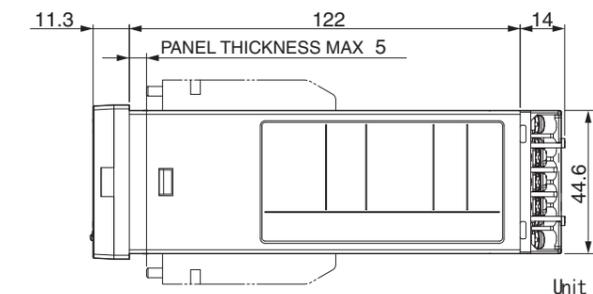
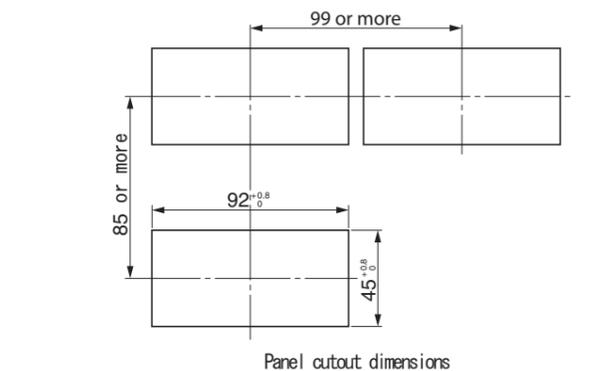
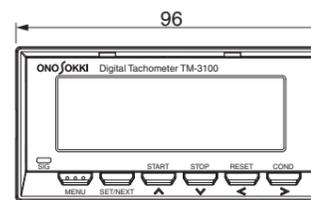
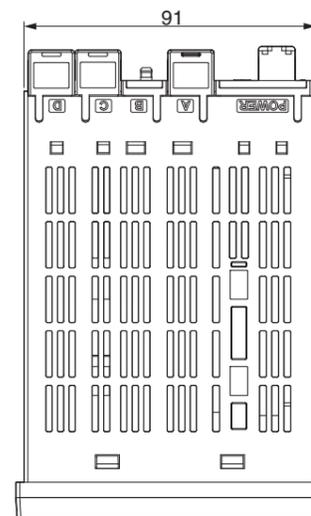
2. BCD-TTL output specifications (TM-0321)

① Function	Same as TM-3120 BCD output specifications except for ②-(A)-(b).
② Output format	TTL
③ Output level	Hi level +3.8 to +5.25 V Lo level 0 to +0.4 V
④ Output current	4 mA max.

3. RS-232C/gate specifications (TM-0350)

① RS-232C communication	Serial communication (start-stop)
② RS-232C baud rate	9600 bps, 19200 bps
③ RS-232C gate input connector	Connector terminal block
④ Rotation change rate	a) Calculates rotational speed, circumferential speed, moving speed, period, passage time, number of times, and flow rate variation value. b) Calculates variation value for reference data. Reference data ; Section average measurement value, user setup (1 to 999999)
⑤ Measurement accuracy of rotation change rate	(±0.02% x Maximum section variation ±2 count)/(±0.01 x Reference value ±1 count) Maximum section variation = (Maximum or minimum value in measurement section, whichever having a larger difference from reference value) - Reference value
⑥ Section data memory function	Stores the average, maximum value, minimum value, and change rate within setup time for 48 sections.
⑦ Acceleration calculation function	Acceleration of rotational speed, circumferential speed, and moving speed
⑧ Acceleration measurement accuracy	V1-V2 = Speed difference for 1 second ±0.02% x (V1-V2) ±2 count
⑨ Reached speed time function	Measures the time duration until the stop command value is reached from the start command value.
⑩ Gate function	Start, stop, reset

Outside dimensions

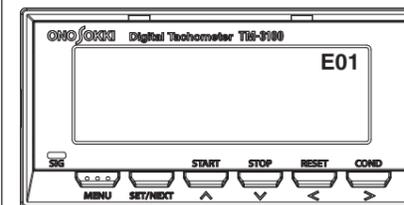


Unit : mm

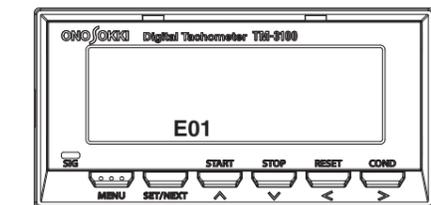
Error indication

Error No.	Name	Description
E01	Backup memory error	The backup memory have failed. If the error is not canceled, contact your dealer or Ono Sokki sales office nearby.
E02	Board error	The optional board currently used cannot be recognized correctly. Contact your dealer or Ono Sokki sales office nearby.
E11	Input frequency over	Displayed if the input frequency exceeds 100kHz.
E12	Number of display digits exceeded	Displayed if the result of display value calculation exceeds 9999999.
E13	Memory full error	Displayed if the storage memory becomes full while the section data memory function is operating in the memory full mode. Use the function after clearing the storage memory.
E15	Setup value error	Indicates an inconsistent state as a setup value during setup related to multiple setup items such as upper- and lower-limit settings of the comparator. Check the settings before use.

Error display position during "1LINE" display



Error display position during "2LINES" display



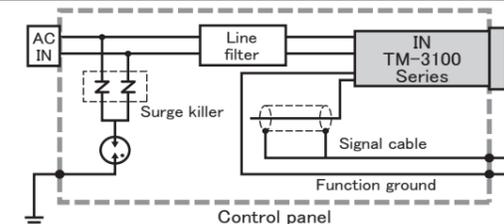
Noise measures installation diagram (Fig. 1)

Parts list

Part name	Manufacturer	Model name
Line filter	TDK	ZHC2203-11
Surge killer	Phoenix Contact	F-MS 12ST
Surge killer	Phoenix Contact	VAL-MS 230ST
Surge killer	Phoenix Contact	VAL-MS 230ST
Base for surge killer	Phoenix Contact	VAL-MS-BE

※ For details, refer to the Installation Manual (download version) on our site (<http://www.onosokki.co.jp>).

• Contact your agent or nearest Ono Sokki sales office for the details of the above parts (line filter, surge killer, base for surge killer etc.).



※ Make the signal cable as short as possible. Keep the negative side of surge within 50 cm. To shield all input and output signal cables, connect both ends to the ground terminal of the panel for grounding.