

ONO SOKKI

TS-2700

TORQUE CONVERTER

INSTRUCTION MANUAL

ONO SOKKI CO., LTD.

FOREWORDS

Thank you for your selecting the ONO SOKKI TS-2700 Torque Converter.

This document is the instruction manual of the TS-2700 Torque Converter. It describes the functions, specifications, connecting procedure, and operational precautions of the TS-2700 Torque Converter.

To ensure proper operation of your TS-2700 Torque Converter, please read this manual carefully before use.

In particular, the precautions described in this manual include “dangers which may lead to damage to property.” Be sure to follow the instructions and operating procedures described in this manual when operating the product.

- | | |
|--------|---|
| NOTICE | <ol style="list-style-type: none">1. The TS-2700 has been tested under strict inspections for normal operation before shipment.2. 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.3. 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. |
|--------|---|

For Your Safety



To ensure safe and proper use of the TS-2700, please read this document and the product instruction manual.

ONO SOKKI, Ltd. bears no responsibility for any warranty regarding damages, failures, or injury resulting from failure to follow directions given in this document.

Meaning of WARNINGS, CAUTIONS, and Symbols

● 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.

	(WARNING)	This symbol is used to indicate precaution where there is a risk of death or serious personal injury to the operator if the product is handled incorrectly.
	(CAUTION)	This symbol is used to indicate precaution 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.


BEFORE USING




(WARNING)

- **Operate the instrument on the specified voltage.** The standard power voltage is 100 to 240VAC. The use of power other than that specified may damage to the instrument. Before turning on the power, make sure that the power voltage is appropriate.
- **Do not operate the instrument in locations where there is gas or steam.** Using this instrument where there is steam or combustible or explosive gas may cause an explosion.
- **Avoid using the instrument in locations with high temperature because there is a risk of fire.** Avoid using it in locations with extremely high temperature. Using this instrument in locations having a temperature exceeding the specified operating temperature range may cause the instrument to catch on fire.
- **Do not block the heat radiation system because there is a risk of fire if heat builds up inside the instrument.** Place the instrument away from the wall in locations with the best ventilation possible.
- **Never dismantle or disassemble the instrument.** Use of this instrument without its casing or while taken apart may cause damage to the equipment or electric shock. When internal adjustment, inspection or repairs are required, contact your dealer or ONO SOKKI sales office nearby.
- **Do not splash or spill water on the instrument** because there is a risk of fire or electric shock because of short-circuit or heat development. If you get water inside the instrument, unplug the power cord immediately and call your dealer or ONO SOKKI sales office nearby as soon as possible.
- **Use the equipment within the operating temperature range (0 to +40°C).** Storage or use of the equipment in locations with rapid temperature variation may cause drops of water inside the unit resulting in failure.


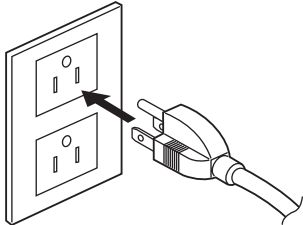
PRECAUTIONS ON ELECTRIC SHOCK

 <p>(WARNING)</p>	<ul style="list-style-type: none">• Never cut the internal or external ground wire of a product or disconnect the wire connected to the protective ground terminal of the instrument because there is a risk of electric shock or damage to the instrument.• Before connecting the instrument to the device under measurement or external control circuit, make sure that protective earth is securely made and that the power is OFF. Connecting to external equipment without protective earth or while the power is still ON may cause electric shock.• Before touching parts of the instrument where voltage is output or circuits connected to parts where voltage is output, make sure that the power is OFF. Touching such parts without turning the power OFF may cause electric shock.• Be sure that the power always meets specified voltage/frequency requirements. Use of power other than that specified may cause electric shock, fire, or damage to the instrument.• If you hear thunder, do not touch any metal parts of the instrument or the plug because there is a risk of electric shock from conducted lighting. Do not use this instrument outdoors if you hear thunder.
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ABOUT THE POWER CORD

 <p>(WARNING)</p>	<ul style="list-style-type: none">• The power cord can be plugged and unplugged. The power is turned off when it is unplugged.• Power Cord for power supply To prevent electric shock, always off the power switch (switch to “O”) for the power supply before attaching or detaching the power cord. Use one of the power cords specified below. Use of an improper power cord can result in fire or other hazard. Also note that the power supply is classified as subject to protection class I against electric shock. Therefore, be sure to connect it to a protective ground terminal Using units in areas where the supply voltage is AC100 to 120V UL Listed detachable power cord set, 3 conductor grounding Type SVT, No.18 AWG, 3m long maximum, rated at 125VAC minimum. Using units in areas where the supply voltage is AC220 to 240V Approved according to EU/EN standards, 3 conductor grounding Type H03VV-F 1.0mm², 3m long maximum, rated at 250VAC minimum.
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ABOUT PROTECTIVE GROUND

 <p>(WARNING)</p>	<ul style="list-style-type: none">• To ensure safety and eliminate noise, be sure to connect the instrument to a good ground. Failure to provide protective earth may cause electric shock. If protective earth is not performed or may not be performed securely, do not turn on the power. Perform protective earth with the following method:<ul style="list-style-type: none">* Using a three-pronged power cord Plug the supplied three-pronged AC power cord into a three-pronged outlet. 
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IF A PROBLEM OCCURS

 <p>(WARNING)</p>	<ul style="list-style-type: none">• If any metal, water, or foreign object should fall inside, unplug the instrument immediately. Using the instrument after metal, water, or foreign object has fallen inside may cause fire or electric shock. Unplug the instrument immediately, then contact your dealer or ONO SOKKI sales office nearby as soon as possible.• 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.
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ABOUT INSTALLATION AND CONNECTIONS

 <p>(CAUTION)</p>	<ul style="list-style-type: none">• Do not install the instrument on unstable locations. If the instrument should fall it may cause injury or damage to the equipment.• Do not place large or heavy objects on top of the instrument. If an object on top of the instrument should fall it may cause injury or damage to the equipment.• 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 oil, water vapor, or dust resulting in fire or electric shock.• Do not install the instrument in locations subject to extremely high temperature or direct sunlight because there is a risk of fire.• When attaching the instrument to a panel rack, use such a structure that supports the weight of the TS-2700 unit on its bottom surface.
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ABOUT THE POWER CORD

 <p>(CAUTION)</p>	<ul style="list-style-type: none">• Be sure to hold onto the plug portion when plugging in or unplugging the power cord. Pulling on the cord may damage or break the cord possibly resulting in fire or electric shock.• Do not plug in or unplug the power cord while your hands are wet.• Keep the power cord away from heaters or appliances which generate high temperature as the cord casing may melt resulting in fire or electric shock.
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ABOUT MEASUREMENT

 <p>(CAUTION)</p>	<ul style="list-style-type: none">• Do not connect or disconnect any I/O connector during measurement because there is a risk of damage to external equipment.• Do not turn the power OFF during measurement because there is a risk of damage to external equipment.• To perform correct measurement, be sure to set specific values for the torque detector according to 3, “Operations.”• When using the instrument for feedback signal for control, perform interlocking using the READY signal output from the REMOTE connector.• Observe the voltage output for rotary encoder. The REV IN connector on the rear panel outputs the +12V power voltage for rotary encoder (pin C) and therefore do not short this connector. If it is shorted, the fuse blows.• Do not short the analog voltage output. Do not short + and - of the TRQ OUT connector or REV OUT connector on the rear panel because there is a risk of damage to the equipment.• Be sure to use the dedicated cable supplied with the torque detector. Using other cable affects the precision.
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CLEANING

 <p>(CAUTION)</p>	<ul style="list-style-type: none">• Dirt on the unit should be wiped off with a soft, dry cloth. For heavy dirt, dip a cloth in a neutral detergent and wring it tight before wiping. Don not use organic solvent (e.g., alcohol, ether, paint thinner) as these may change the shape or color of the unit.
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- Certification and identification label the following label is affixed on the control unit.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two Conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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1. Overview

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1.1 Overview

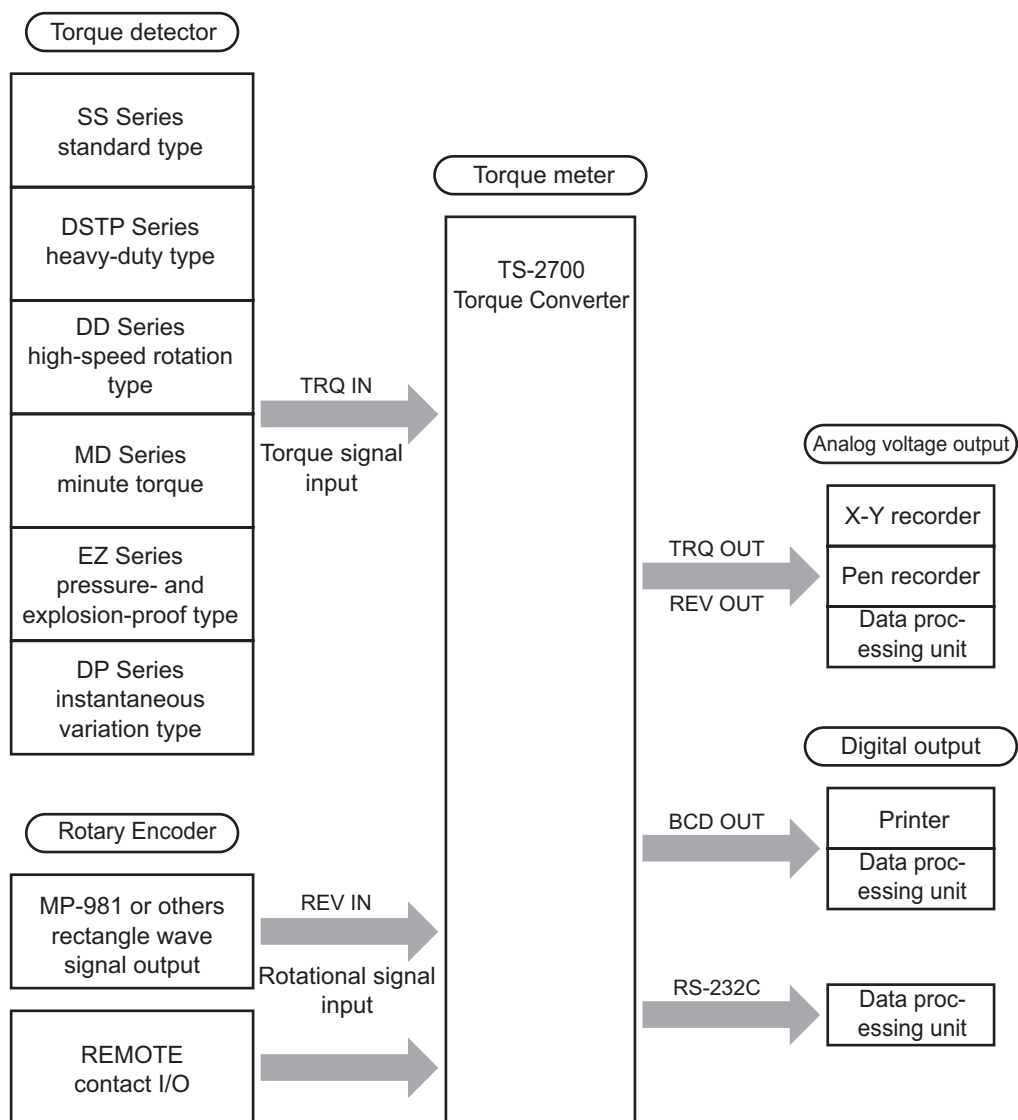
The TS-2700 is used together with the SS Series or other phase difference torque detector from ONO SOKKI to convert the detected phase difference signal into the torque value. Digital processing in the signal processing circuit enables torque measurement with high stability, reproducibility, and linearity.

Since the TS-2700 is provided with analog voltage outputs as standard, it can be connected to an X-Y recorder or pen recorder to perform continuous recording of measurement values. It is also equipped with digital outputs for connection with a printer or data processing unit.

1.2 Features

- Compact size: 76(W) × 142(H) × 302(D) mm
- Operates on a voltage from 100VA to 240VAC, without power supply changeover between the 100V and 200V lines.
- Connects to ONO SOKKI SS/DD/DSTP/MD/DP/EZ Series torque detectors.
- The isolated analog output make it easier to connect to a control system, recorder, or data processing unit.
- Easy external recording due to two external equipment interfaces: BCD output and RS-232C.
- A safe torque measurement system can be built through the combination with the operation alarm unit.

1.3 System Configuration



1.4 Checking the Accessories

When unpacking the unit, make sure that you have all the parts shown below.

If any part is missing or damaged, contact your dealer or ONO SOKKI sale office nearby.

AC power cable	SDS4-SB303 SVT3 × AWG18-2M	1
Connector	R03-PB8M (for remote)	1
Indication unit label		1
Rubber foot	With four screws (M3 × 12)	4
Instruction manual		1

1.5 Notes on Wiring Work for Torque Meter

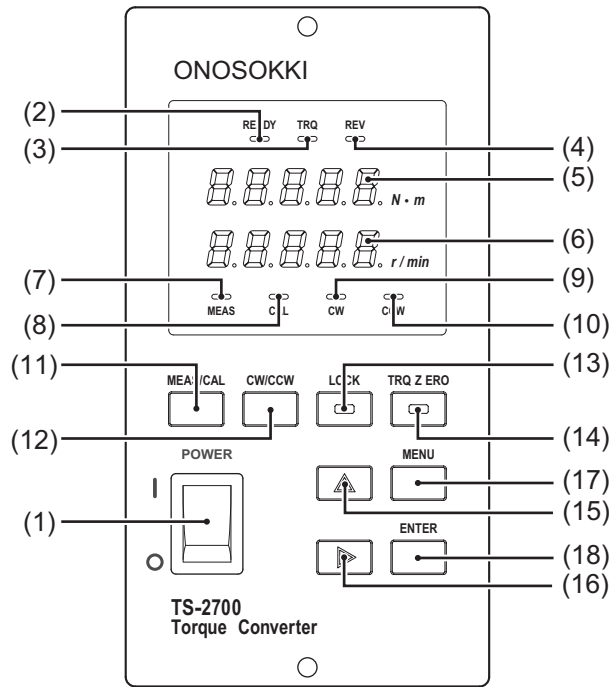
In recent years, there have been increasing number of test instruments which use or measure an inverter. Because of the operating principle, the inverter may generate noise affecting instruments nearby. Torque meter is not an exception, either. The degree of influence depends on the amount of noise generated from the inverter, signal line installation conditions, inverter installation conditions, and distance from installed instrument to the inverter. If the following notes on wiring work are observed, trouble caused by noise generated from the inverter can be reduced. It is recommended that the notes be observed for electrical installation as well as inverter noise measures.

- (1) Take measures against radiation noise on the side of the inverter unit and motor.
- (2) Separate the inverter main circuit I/O wire from the power line and signal line of the torque meter (cable for torque meter and cable for rotary encoder).
The rough standard separation distance is 300 mm or longer. If separation is difficult or ineffective, lead the power line and signal line of torque meter through a metal conduit and connect one side of the metal to a good ground.
- (3) Use the supplied cable for the power line and signal line of the torque meter.
- (4) Connect the rack for the torque detector to a good ground.
- (5) Use separate power supplies for the torque meter and inverter. If any effect cannot be seen, install a noise-cut transformer for EMI measures.

2. Name and Function of Each Section

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2.1 Front Panel



(1) POWER switch

Main power switch of the TS-2700.

Press the upper side of this switch to turn the power on.

(2) READY LED indicator

The green LED indicator lights up in the measurement mode.

The LED indicator lights up when all the following conditions are met.

- The TRQ LED indicator (3) lights up.
- (When the torque detector type setting is DP, the TRQ LED indicator may be off.)
- The MEAS LED indicator (7) lights up.
- CLR IN of REMOTE (21) is open.

(3) TRQ LED indicator

When both measurement signals SIG1 and SIG2 are input from the torque detector, the green LED indicator lights up.

(4) REV LED indicator

When the signal is input from the MP-981 or other rotary encoder, the green LED indicator lights up.

(5) Torque indicator

Displays the torque data with the green 7-segment LED indicator, 4-digit number, 1-digit sign, decimal point, and a unit of Nm. For other units, stick the supplied indication unit label.

(6) Rpm indicator

Displays the rpm data with the green 7-segment LED indicator, 5-digit number, and a unit of r/min. The number blinks at the time of over-scale.

For other units, stick the supplied indication unit label.

(7) MEAS LED indicator

Lights up when the MEAS/CAL switch (11) is set to the measurement mode (MEAS).

(8) CAL LED indicator

Lights up when the MEAS/CAL switch (11) is set to the calibration mode (CAL).

(9) CW LED indicator

When the external input for the rotational direction in 3.6, “Setting Rotational Direction (CW/CCW)” is OFF, this LED indicator lights up if the CCW switch (12) is set to CW. When it is ON, the LED indicator lights up if the CW/CCW input of REMOTE (21) is open.

(10) CCW LED indicator

When the external input for the rotational direction in 3.6, “Setting Rotational Direction (CW/CCW)” is OFF, this LED indicator lights up if the CCW switch (12) is set to CCW. When it is ON, the LED indicator lights up if the CW/CCW input of REMOTE (21) is closed.

(11) MEAS/CAL switch

This switch is used to change the mode between the measurement mode (MEAS) and the calibration mode (CAL).

Press and hold this switch for several seconds to change the mode.

When you calibrate the analog output, select CAL; otherwise, select MEAS.

(12) CW/CCW switch

This switch is used to change the rotational direction between CW and CCW.

Press and hold this switch for several seconds to change the setting.

Change the torque zero correction value depending on the rotational direction to be measured.

Enabled when the LED indicator of the LOCK switch (13) is OFF and the external input of the rotational direction in 3.6, “Setting Rotational Direction (CW/CCW)” is OFF.

(13) LOCK switch

This switch is used to protect TRQ ZERO and CW/CCW operations. When pressed, the operations are locked and the LED indicator lights up. When pressed again, they are unlocked and the LED indicator goes off.

While the LED indicator of this switch is lit, the TRQ ZERO switch (14) is disabled and the torque zero correction value is not updated. When the CW/CCW parameter setting is INT, the CW/CCW switch (12) is disabled.

(14) TRQ ZERO switch

This switch is used to perform torque zero correction for the rotational direction selected by CW/CCW. When you press this switch for several seconds, the green LED indicator lights up and the correction operation starts. When the operation is completed, the LED indicator goes off automatically. Enabled when the LED indicator of the LOCK switch is OFF. The torque zero correction value is memorized in the backup memory.

(15) ^ key

When entering a setting, this key is used to change the current setting.

(16) > key

When entering a setting, this key is used to move the input position horizontally.

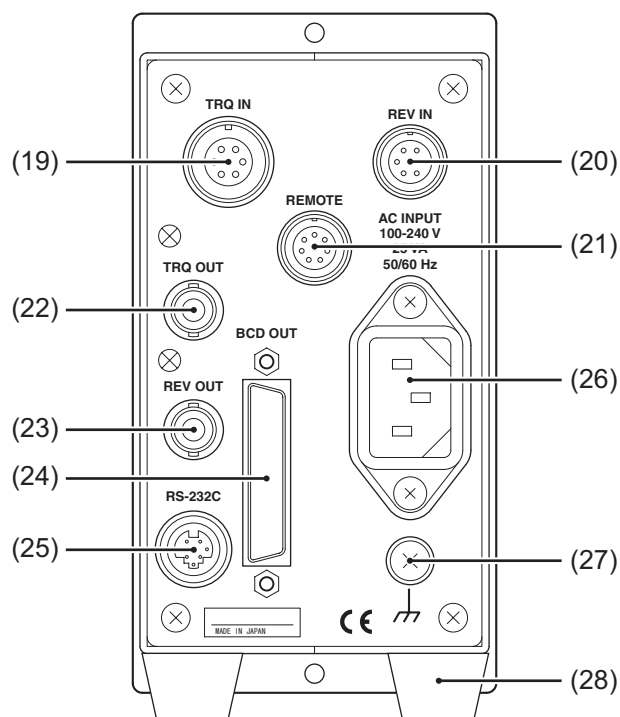
(17) MENU key

This key is used to enter the setting mode. Press and hold this key for two seconds to enter the setting mode. (To terminate the mode, press the MEAS switch (11).)

(18) ENTER key

When entering a setting, this key is used to establish the current setting and proceed with the next one.

2.2 Rear Panel



(19) TRQ IN

This connector is used to input signal from the torque detector.

Applicable connector: TRC116-12A10-7M10.5 (Tajimi Electronics)

Pin assignment

Pin	Signal Name
A	SIG1
B	SIG2
C	SIG1 COM
D	SIG2 COM
E	NC
F	SIG COM
G	NC

2. Name and Function of Each Section

(20) REV IN

This connector is used to input signal from the rotary encoder.



Do not short pin C.
If it is shorted, the power fuse for the rotary encoder blows.

Applicable connector: R03-PB6M (Tajimi Electronics)

Pin assignment

Pin	Signal Name
A	SIG
B	NC
C	12 V
D	GND
E	SIG COM
F	12 V COM

(21) REMOTE

This connector is used for I/O of external control signal.

Applicable connector: R03-PB8M (Tajimi Electronics)

Pin assignment

Pin	Signal Name	Remarks
A	CLR IN	Non-voltage contact input (Same COMMON)
B	TRIG IN	
C	CW/CCW changeover	
D	COM	
E	READY OUT	Non-voltage contact output (Different COMMON)
F	Same as above. COM-1	
G	TRIG OUT	
H	Same as above. COM-2	

(22) TRQ OUT

This connector is used for analog voltage output of torque data.

Applicable connector: C02 type (BNC) connector

(23) REV OUT

This connector is used for analog voltage output of rpm data.

Applicable connector: C02 type (BNC) connector

(24) BCD OUT

This connector is used for BCD output of torque/rpm data.

For details, refer to 5, "Using BCD Output."

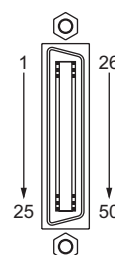
Applicable plug : DX40-50P (Hirose Electric)

Plug cover : DX-50-CV1 (Hirose Electric)

Pin No.	Signal Name	Pin No.	Signal Name
1	Data output 1×10^0	26	Data output 2×10^1
2	(Torque section) 2×10^0	27	(Rpm section) 4×10^1
3	4×10^0	28	8×10^1
4	8×10^0	29	1×10^2
5	1×10^1	30	2×10^2
6	2×10^1	31	4×10^2
7	4×10^1	32	8×10^2
8	8×10^1	33	1×10^3
9	1×10^2	34	2×10^3
10	2×10^2	35	4×10^3
11	4×10^2	36	8×10^3
12	8×10^2	37	1×10^4
13	1×10^3	38	2×10^4
14	2×10^3	39	4×10^4
15	4×10^3	40	8×10^4
16	8×10^3	41	NC
17	NC	42	Torque polarity output "-"
18	NC	43	Torque polarity output "+"
19	NC	44	NC
20	NC	45	NC
21	Data output 1×10^0	46	NC
22	(Rpm section) 2×10^0	47	Hold input
23	4×10^0	48	Busy input
24	8×10^0	49	Print command output
25	1×10^1	50	Common

* The bar over the signal name indicates the negative logic I/O.

* NC indicates "Not connected."



2. Name and Function of Each Section

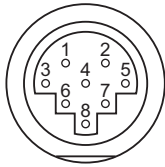
(25) RS232C

This connector is used for the RS-232C interface.

Applicable cable : AX-5022 (ONO SOKKI) 2m

Applicable connector : HR212-10P8PSAT3042 (Hirose Electric)

Pin assignment



Pin No.	Signal Name	Function	I/O
1	FG (AA)	Non Connect	–
2	RxD (BB)	Receive data	Input
3	TxD (BA)	Transmit data	Output
4	CTS (CB)	Clear to send	Input
5	RTS (CA)	Request to send	Output
6	–	Non Connect	–
7	SG (AB)	Signal ground	
8	–	Non Connect	–

(26) AC INPUT

This connector is used to input the AC power.

Applicable cable: SDS4-SB303 SVT3 × AWG18-2M (3P-3P)

(27) Functional ground terminal

Functional ground terminal.

If there is noise problem at the time of measurement, connect this terminal to the ground line.

(28) Rubber foot

Not attached at the time of shipment but included in accessories.

When the unit is placed on a desk, attach on the bottom of the unit using screws.

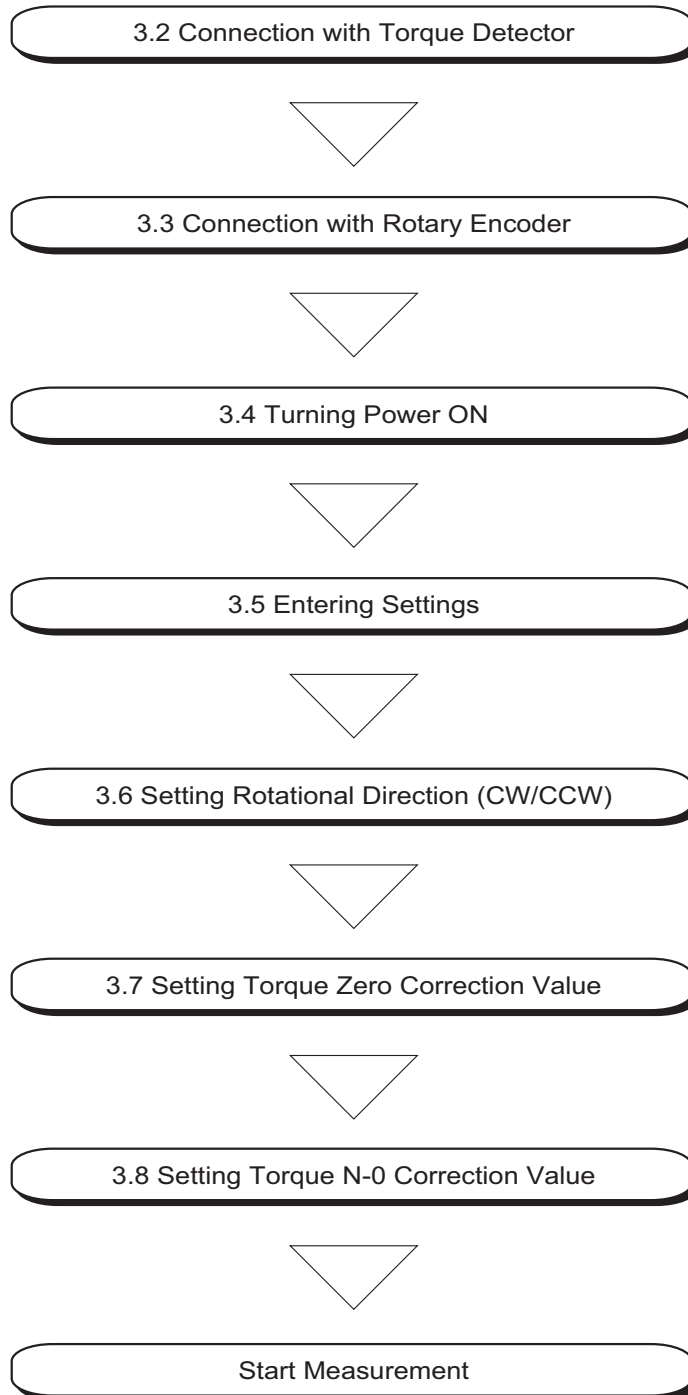
3. Operation



When you use the TS-2700 for the first time, the operation described in 3.5, "Entering Settings" is required before starting measurement.

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3.1 Operation Flow



3.2 Connection with Torque Detector



With the DSTP/EZ/DP Series torque detectors with two signal output connectors (SIG1 and SIG2) on the detector side, if cable connection is made inversely with SIG1 and SIG2, the display value becomes quite different from the actual value. In this case, however, neither the detector nor the circuit of the TS-2700 will fail.

- (1) Connect the TS-2700 and torque detector using the signal cable supplied with the torque detector. Connect the cable to the TRQ IN connector on the rear panel.
- (2) Set the switches of the torque detector according to the rotational direction of the shaft under measurement.

3.3 Connection with Rotary Encoder

■ Rpm Measurement Using REV IN Signal

Connect a rotary encoder to the TS-2700.

When using a rotary encoder which outputs rectangle wave, such as the MP-981, connect the cable to the REV IN connector on the rear panel. Use the optional MX-800 Series cable (in the case of the MP-981).

■ Rpm Measurement Using TRQ SIG2 Signal

The torque detected signal can be used as a rotational signal depending on setting.

However, there is an offset and therefore the display and output values become larger by the offset both when the shaft is stopped and when it is rotating.

- (1) Note that the amount of offset is different from detector to detector and varies with time.
- (2) If the motor supplied with the torque detector is not operated, there is no offset but lower rpm cannot be measured.

3.4 Turning the Power ON



Before turning the power ON, be sure to connect the TS-2700 unit to a good ground, referencing “For Your Safety.”

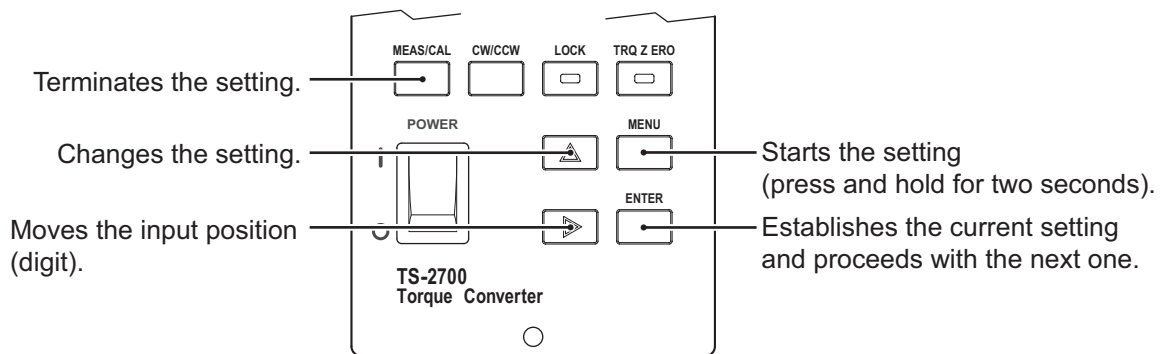
- (1) Make sure that the TS-2700, torque detector, and rotary encoder are connected.
- (2) Using the supplied AC power cable, connect the AC INPUT connector on the rear panel to the AC power.
- (3) Turn on the power of the torque detector.
- (4) Press the upper side of the POWER switch on the front panel to turn on the power. Then, perform aging for 15 to 30 minutes (for stabilization of the analog output).
- (5) When you use the TS-2700 for the first time, make setting referencing 3.5, “Entering Settings.”

3.5 Entering Settings



When you use the TS-2700 for the first time, the operation described in 3.5, "Entering Settings" is required before starting measurement.

■ Operation from Front Panel



- **MENU key** : Press and hold for two seconds to enter the setting mode.
- **MEAS switch** : Terminates the setting mode and enters the measurement mode.
- **ENTER key** : In the setting mode, establishes the current setting and proceeds with the next one.
- **^ key** : Changes the current setting.
- **> key** : Moves the input position (digit).



Selection item changes each time you press the ^ key. Digit selection by the > key is not used.

■ Settings

When the setting mode is entered, setting (1) appears first.

For detailed operation, refer to “■ Setting Details and Operating Procedures.”

(1) Torque capacity



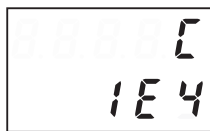
- Input the value of the name plate of the torque detector.
- For unit indication, stick the supplied indication unit label on the panel.
- Selection: 1-9999

(2) Torque factor



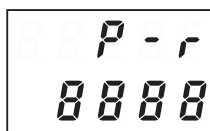
- Input the value of the name plate of the torque detector.
- Selection: 1-63535

(3) Rotational capacity



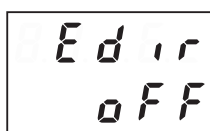
- Select the rpm scale of the analog output.
When IE4 is selected: 0-10,000 r/min/0-10V
When IE5 selected: 0-100,000 r/min/0-10V
- Selection: IE4 or IE5

(4) Number of pulses for rotational signal



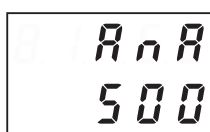
- Set the number of output pulses per rotation for the rotary encoder.
- Selection: 1-9999 (60 for the SS type)

(5) External input for rotational direction



- Set to OFF when the CW/CCW switch on the front panel is used or ON when the rotational direction is indicated with the remote input.
- Selection: OFF or ON

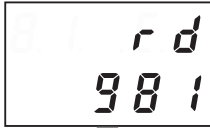
(6) Time constant for analog output



- Switch between 500 ms and 63ms.
- Selection: 500 or 63



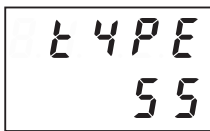
(7) Selection of rotary encoder



- Select the rotary encoder to be used. 981 denotes the MP-981 and INT the torque signal.
- Selection: 981 or INT



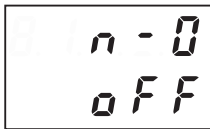
(8) Torque detector type



- Select SS except for the DP Series detector.
- Selection: SS or DP



(9) Torque N-0 correction



- For N-0 setting
- Setting is enabled when set to ON.
- Selection: OFF or ON (usually OFF)



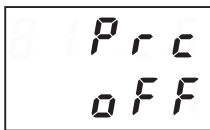
(10) Gate time



- Select the changeover time of display and BCD output from 1s, 10s, and external input.
- Selection: 1, 10, or E (EXT)



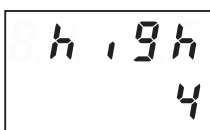
(11) Print command setting



- print command type for BCD output
- When ON, print command is synchronized with the gate time; when OFF, it is synchronized with the HOLD input signal.
- Selection: OFF or ON



(12) Option setting



- Displayed only when an option is mounted.
- Usually select 4. Select 1 when an option is used.
- Selection: 1 or 4

■ Detailed Settings and Operating Procedures

Sample name plate (SS-050)



FACTOR.....8086
CAPACITY.....5

(1) Torque capacity (CAPACITY)

Set the specific value (CAPACITY) printed on the name plate of the torque detector.

When it is less than 1, perform unit conversion to convert it to an integer.

When using the TS-2700 together with the SS Series, reference the following table to select the capacity.

With the sample name plate shown above, the capacity is 5 and 5000 can be selected. When 5000 is selected, stick the indication unit label of mNm on the unit indicator.

Example of capacity settings for SS Series torque detector

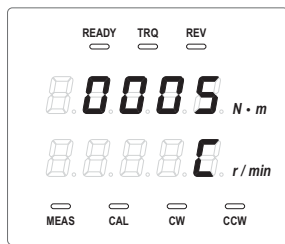
SS Series	Torque Capacity Nm	Capacity and Unit		
		N·m	mN·m	kN·m
002	0.2	–	200.0	–
005	0.5	–	500.0	–
010	1	1.000	1000	–
020	2	2.000	2000	–
050	5	5.000	5000	–
100	10	10.00	–	–
200	20	20.00	–	–
500	50	50.00	–	–
101	100	100.0	–	–
201	200	200.0	–	–
501	500	500.0	–	–
102	1000	1000	–	1.000
202	2000	2000	–	2.000

* Sticking the indication unit label

When a unit other than N·m is used, stick the supplied indication unit label.

* With the MD Series and other detectors, select a numeric value from 1 to 9999 referencing the table above.

Press and hold the MENU key for two seconds to enter the setting mode.

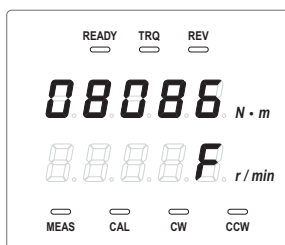


- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the setting using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.
- Example: 0005 N·m

(2) Torque factor (FACTOR)

Set the value printed as FACTOR on the name plate of the torque detector.

FACTOR is a numeric form of torque detector characteristic and different from detector to detector.



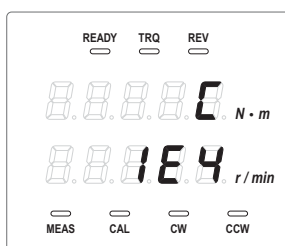
- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the setting using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.
- Example: 8086

(3) Rotational capacity

Reflects the scale of the rpm analog output.

When IE4 selected : 0-10,000 r/min/0-10V

When IE5 selected : 0-100,000 r/min/0-10V



- Display IE4/IE5 alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

(4) Number of pulses for rotational signal (P/R)

Set the number of the pulses output from the rotary encoder when the shaft makes one rotation.

For rotary encoding as the standard option of the torque detector, refer to 1 and 2 below.

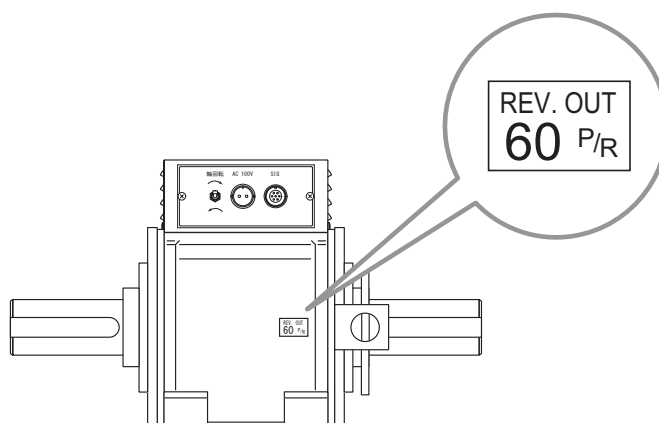
For other cases, check and set the specifications of the rotary encoder.

1. With the SS, DSTP, and MD Series torque detectors, set the number of pulses in the following table.

This applies to the case when the rotary encoding mechanism attached at the shaft of the torque detector is used.

Series	Number of pulses for rotary encoding
SS Series	60
MD Series	120

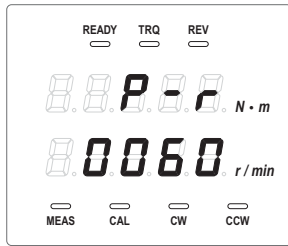
2. With the DD and EZ Series torque detectors with special specifications, set the number of pulses printed on the name plate stuck near the rotary encoder.



3. With the DP Series torque detector, set the number of pulses in the following table.

Since rotational measurement is performed using SIG2 of the torque detector, select INT as (7) Rotary encoder selection.

Model	Number of pulses for rotary encoding	Model	Number of pulse for rotary encoding
DP-002	120	DP-101	120
DP-005	120	DP-201	120
DP-010	120	DP-501	120
DP-020	120	DP-102	180
DP-050	120	DP-202	180
DP-100	120	DP-502	180
DP-200	120	DP-103	180
DP-500	120	DP-203	300

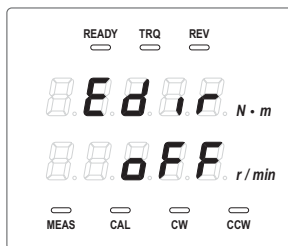


- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the setting using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

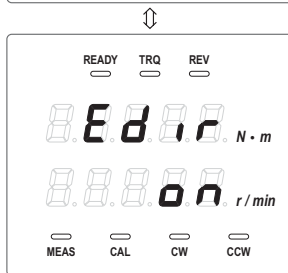
(5) External input for rotational direction

Set to ON when the rotational direction under measurement is selected with the input signal to the remote input terminal or OFF when it is selected with the CW/CCW switch on the front panel.

For details, refer to 3.6, "Setting Rotational Direction (CW/CCW)" and 6, "Using Remote Functions."



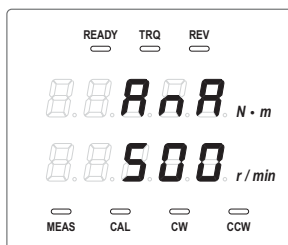
- Display OFF/ON alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.



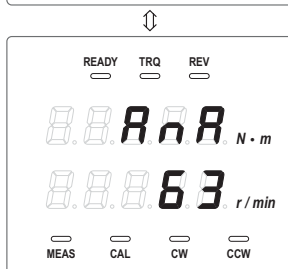
(6) Time constant for analog output

Select the time constant for analog output.

For the time constant, refer to 4.3, "Time Constant."



- Display 500/63 alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.



(7) Rotary encoder selection

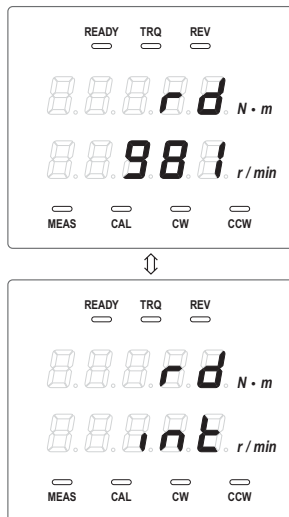
981: Select when the MP-981 rotary encoder is used.

When rotational measurement is performed using the signal input to REV IN on the rear panel

INT: Select when rotational measurement is performed using SIG2 of the torque detector.

In this case, the setting of (4) Number of pulses for rotary encoding is the numeric value of P/R on the name plate of the torque detector.

For details, refer to 3.3, "Connection with Rotary Encoder."



- Display 981/INT alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

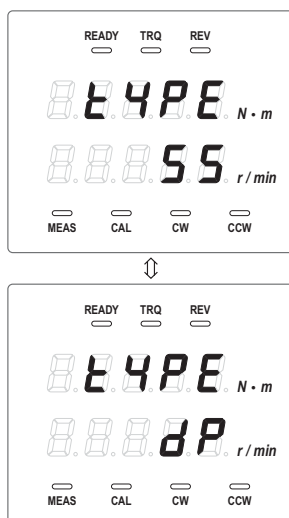
(8) Torque detector type

SS : SS Series, DD Series, DSTP Series, and MD Series

DP : DP Series

The DP Series does not output signal while the shaft is not rotating. When DP is selected, the presence/absence of the torque signal input is excluded from the READY output condition.

For details, refer to 6, "Using Remote Functions."

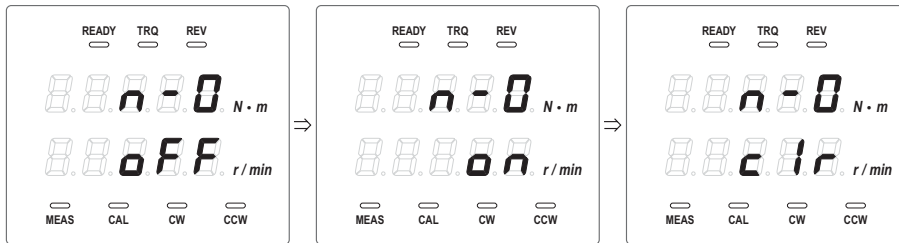


- Display SS/DP alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

(9) Torque N-0 correction

Usually, set to OFF.

For details on this function, refer to 3.8, “Torque N-0 Correction.”



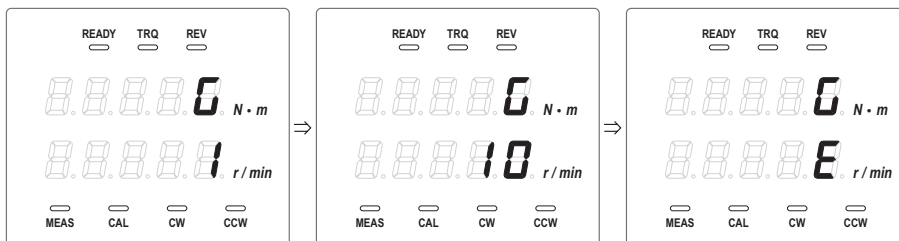
- Display OFF/ON/CLR alternately using the \wedge key.
- Select OFF and then press the ENTER key.
- Select CLR and then press the ENTER key to clear N-0 correction values in memory to zero.

(10) Gate time

Select the display changeover time and BCD output update time.

Select 1 second, 10 seconds, or external input (EXT).

When external input (EXT) is used, display changeover and output update are performed with the input interval of the TRIG IN signal in 6, “Using Remote Functions.”



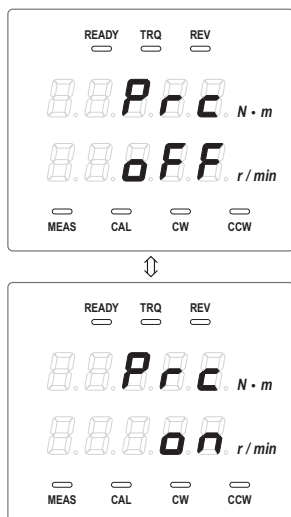
- Display 1/10/E (EXT) alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

(11) Print command setting

For commands, refer to 5, "Using BCD Output."

OFF : Outputs the print command only at the time of HOLD signal input.

ON : Outputs the print command at each gate time (setting (10)).

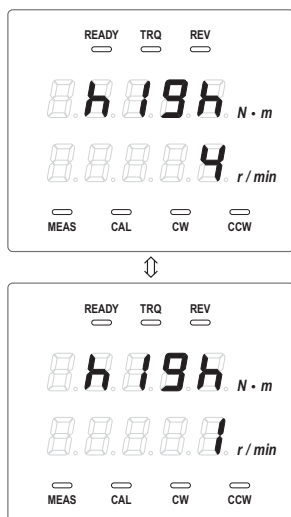


- Display OFF/ON alternately using the \wedge key.
- Press the ENTER key to establish the setting and proceed with the next one.

(12) Option setting

Displayed only when an option is loaded.

Usually (standard specification), select 4. When enabling the option function, select 1.



- Display 4/1 using the \wedge key.
- Press the ENTER key to establish the setting and proceed with setting (1).

3.6 Setting Rotational Direction (CW/CCW)

Change the setting of the TS-2700 in terms of the rotational direction of the shaft under measurement. There are two different change procedures.

- (1) Using the CW/CCW switch on the front panel

Set external input for rotational direction (setting (5)) to OFF in 3.5, “Entering Settings.”

- (2) Using remote input

Set external input for rotational direction (setting (5)) to ON in 3.5, “Entering Settings.”

When pins C and D of the REMOTE terminal on the rear panel are open, CW is selected; when closed, CCW is selected.

■ Changing Rotational Direction to be Measured

If the rotational direction of the shaft under measurement is changed, the torque zero correction value and N-0 correction value change. In order to change the rotational direction, it is necessary to set the torque zero correction value and N-0 correction value for each of the CW and CCW directions.

For the setting procedure, refer to 3.7, “Setting Torque Zero Correction Value” and 3.8, “Setting Torque N-0 Correction Value.”

Once the torque zero correction value and N-0 correction value are set, they are memorized in the backup memory.

At the time of measurement, change the rotational direction of the motor supplied with the detector as well as the CW/CCW setting of the TS-2700.

3.7 Setting Torque Zero Correction Value

- (1) Put the shaft of the torque detector in no-load condition and then turn ON the power. (The no-load condition is a condition in which coupling connection of one shaft or both shafts of the torque detector is dislocated.)
- (2) The TRQ LED indicator on the front panel lights up. Make sure that the signal is input from the torque detector.
- (3) Change the CW/CCW switch according to the rotational direction to be measured.
- (4) When the LOCK switch lights up, press to turn it off.
- (5) Press and hold TRQ ZERO switch until the LED indicator lights up. When correction operation is completed, the LED indicator goes off automatically and the torque display becomes 0. It may not become 0 because of variation within the accuracy range.
- (6) To prevent incorrect operation during measurement, press the LOCK switch to turn on the LED indicator before starting measurement.



When the CLR IN input of the REMOTE function is closed, torque zero correction is not performed.
When you use the TS-2700 for the first time, enter settings described in 3.5, "Entering Settings" and then perform torque zero correction. If a setting is changed, perform torque zero correction again.

3.8 Setting Torque N-0 Correction Value

Because of the frequency characteristic of the detector, the measured torque value may appear even if the shaft is rotating in the no-load condition. Since this value is reproducible, it is possible to perform high-precision measurement by setting correction value for each rpm.



CAUTION

It is necessary to obtain and enter correction value separately for CW and CCW. The direction selected with the CW/CCW selector switch on the front panel can be corrected. First, check the setting of the rotational direction.

■ Obtaining N-0 Correction Value

1. Specify settings (1) to (8) correctly and then enter the measurement mode.
Refer to 3.7, "Setting Torque Zero Correction Value."
2. Put the detection shaft in the no-load condition (in which nothing is attached to the shaft on one side) and then rotate it using a motor.
3. Change the rpm within the rpm range used and then record the indicated torque value at each rpm.

Use the following table in which the rpm in the measurement range is described.

Rpm (r/min)	0	1000	2000	3000	4000	5000
Torque count						

Note 1: In the Torque count column, enter numbers ignoring the decimal point display.

Example: For 1.234, enter 1234. For -0.20, enter -20.

Note 2: Torque count refers to the torque display value with the decimal point ignored.

Up to five points can be stored in the TS-2700. Input points can be approximated with a straight line to perform correction of other than input points. It is also possible to coarsely record data in regions with small variation by shortening the interval of rpm in regions with large numeric variation.

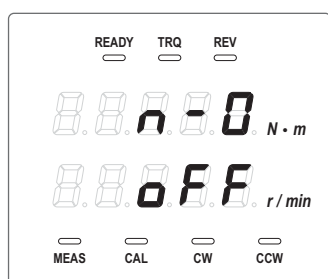
Example: Rpm → 200, 500, 1000, 2000, 5000

4. Entering N-0 Correction Value

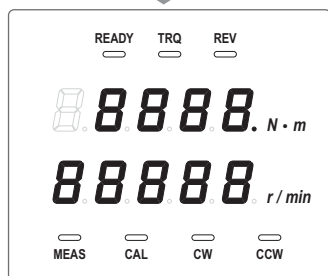
Open the settings in 3.8, “Setting Torque N-0 Correction Value” referencing “■ Setting Details and Operating Procedures” in 3.5, “Entering Settings.”



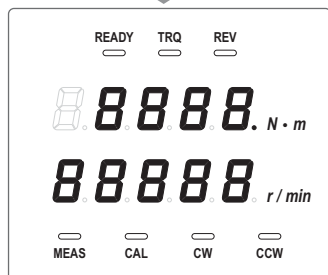
1. Set correction value in ascending order of rpm.
2. As torque value, enter count value with the decimal point ignored.
3. Torque values exceeding the torque capacity cannot be entered.
4. As rpm, up to 99,999 r/min can be entered regardless of the rpm capacity setting.



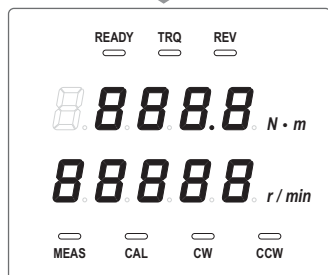
ENTER



ENTER



ENTER



ENTER

- Correction value can be entered by pressing the > key from the initial display of torque N-0 correction.
- Correction value can be entered also by pressing the > key from the ON and CLR display.
- Previous input value can be overwritten.
- The upper row is the torque value and the lower row rpm.

Torque correction value input at the first point is enabled.

The decimal point at the first digit indicating the first point goes on.

- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the setting using the ^ key. “-” can be displayed using the MENU key.
- Press the ENTER key to establish the setting and proceed with the next one.

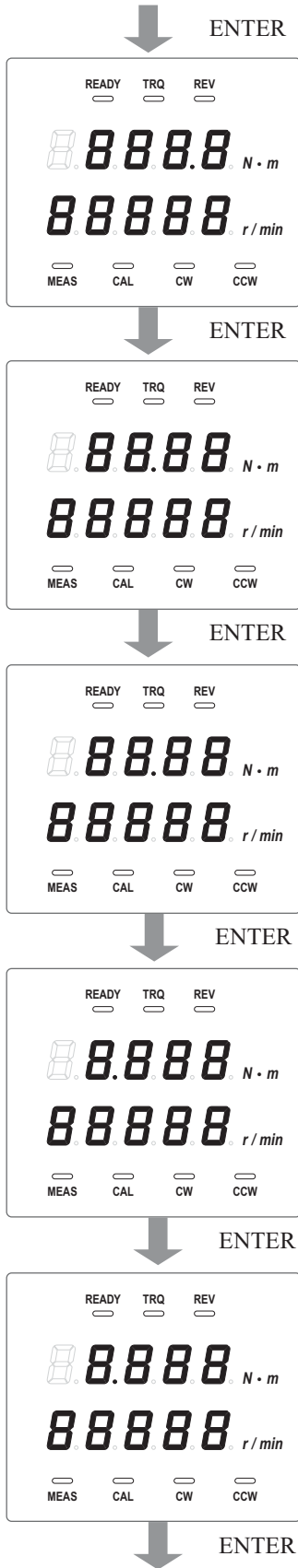
Rpm value input at the first point is enabled.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

Torque correction value input at the second point is enabled.

The decimal point at the second digit indicating the second point goes on.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.



Rpm value input at the second point is enabled.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

Torque correction value input at the third point is enabled.

The decimal point at the third digit indicating the third point goes on.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

Rpm value input at the third point is enabled.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

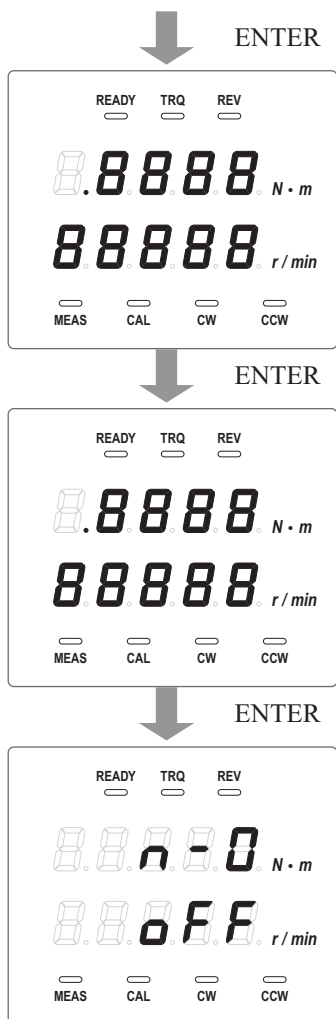
Torque correction value input at the fourth point is enabled.

The decimal point at the fourth digit indicating the fourth point goes on.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

Rpm value input at the fourth point is enabled.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.



Torque correction value input at the fifth point is enabled.

The decimal point at the fifth digit indicating the fifth point goes on.

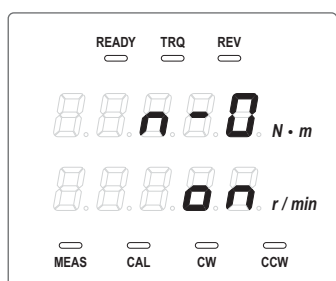
- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

Rpm value input at the fifth point is enabled.

- The operating procedure is the same as that of torque correction value input at the first point. Hereafter, description of the operating procedure is omitted.

When you press the ENTER key after rpm input display at the fifth point, the first screen of N-0 correction appears.

■ Enabling N-0 Correction



- When you press the \wedge key, display changes to OFF, ON, and CLR in this order.
- Select ON. Then, press the ENTER key to establish the setting and proceed with the next one.

4. Analog Outputs

4.1	Voltage Output for Torque	36
	■ Calibration of Voltage Output for Torque	36
4.2	Voltage Output for Rpm	38
	■ Calibration of Voltage Output for Rpm.....	38
4.3	Time Constant	40

4.1 Voltage Output for Torque

The analog voltage for torque is output from the TRQ OUT connector on the rear panel.

Usually, when the capacity value of the torque detector set in 3.5, “Entering Settings” is reached, the output voltage becomes $\pm 10V$.

Output voltage	$\pm 10V$ (maximum output)
Output connector	C02 type (BNC) connector
Appropriate load	10k Ω or more
Time constant	63 ms/500 ms changeover

At the time of shipment, the time constant is set to 500 ms.

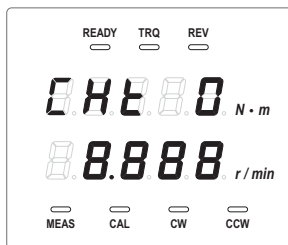
When the time constant for analog output (setting (6) in 3.5, “Entering Settings”) can be changed to 63 ms.

■ Calibration of Voltage Output for Torque

Prepare a digital voltmeter. Calibration is performed monitoring the indication of the digital voltmeter.

- (1) Connect the TRQ OUT connector on the rear panel and the digital voltmeter.
- (2) Press and hold the MEAS/CAL switch for several seconds to turn on the CAL LED indicator.

The zero adjustment screen of the voltage output of torque appears.



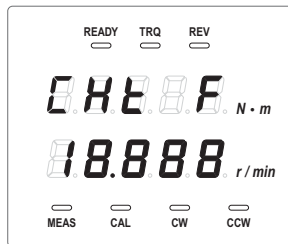
- In this case, the voltage for zero value is output.

- (3) Measure the output voltage using the digital voltmeter and then perform zero adjustment by setting the value in the TS-2700 in unit of V.

Setting range: 0 to ± 0.999

- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the numeric value using the \wedge key. “-” is displayed with the MENU key.

- (4) When you establish the setting using the ENTER key, the full voltage adjustment screen appears.



- In this case, the voltage for the full-scale value is output.

- (5) Measure the output voltage using the digital voltmeter and then adjust it to the full voltage by setting the value in the TS-2700 in unit of V.

Setting range: 9.000 to 10.999

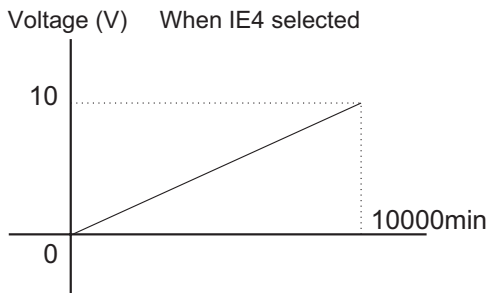
- The LED indicator of the input position blinks.
 - Move the input position (digit) using the > key.
 - Change the numeric value using the ^ key.
 - Only 9 or 10 is displayed at the fourth and fifth digits. Each time you press the ^ key at the fourth digit, 9 and 10 are displayed alternately.
- (6) Press the ENTER key to establish the setting.
- (7) Press the MEAS/CAL switch to turn on the MEAS LED indicator.
- (8) Start measurement.

4.2 Voltage Output for Rpm



The lower limit frequency (1Hz) is converted to 1 r/min at the time of 60 P/R.
Accuracy guaranteed from 10Hz.

The analog voltage for rpm is output from the REV OUT connector on the rear panel.
Set the number of pulses for rotational signal (setting (4) in 3.5, “Entering Settings”) according to the number of teeth of the rotary encoding gear.

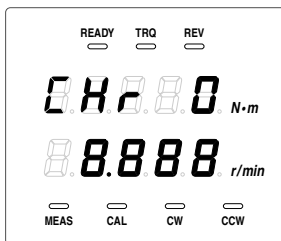


Input frequency range	1Hz to 100kHz
Output connector	C02 type (BNC) connector
Appropriate load	10kΩ or more
Time constant	63 ms

■ Calibration of Voltage Output for Rpm

Prepare a digital voltmeter, Calibration is performed monitoring the indication of the digital voltmeter.

- (1) Connect the REV OUT connector on the rear panel and the digital voltmeter.
- (2) Press and hold the MEAS/CAL switch for several seconds to turn on the CAL LED indicator.
- (3) When you press the ENTER key twice, the zero adjustment screen for voltage output for rpm appears.



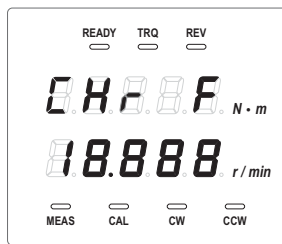
- In this case, the voltage for zero value is output.

- (4) Measure the output voltage using the digital voltmeter and then perform zero adjustment by setting the value in the TS-2700 in unit of V.

Setting range: 0 to ±0.999

- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the numeric value using the ^ key. “-” is displayed with the MENU key.

(5) When you establish the setting using the ENTER key, the full voltage adjustment screen appears.



- In this case, the voltage for the full-scale value is output.

(6) Measure the output voltage using the digital voltmeter and then adjust it to the full voltage by setting the value in the TS-2700 in unit of V.

Setting range: 9.000 to 10.999

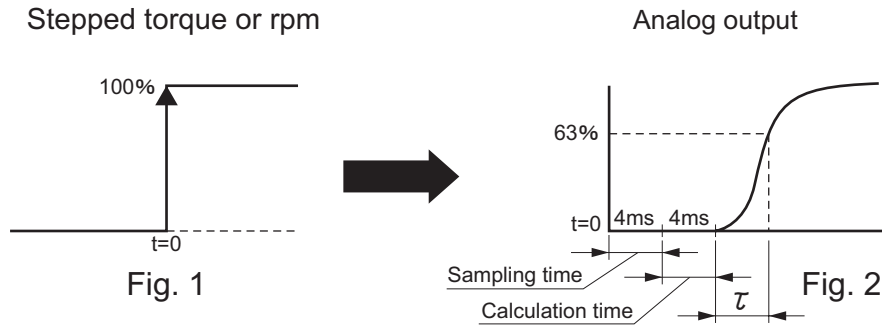
- The LED indicator of the input position blinks.
- Move the input position (digit) using the > key.
- Change the numeric value using the ^ key.
- Only 9 or 10 is displayed at the fourth and fifth digits. Each time you press the ^ key at the fourth digit, 9 and 10 are displayed alternately.

(7) Press the ENTER key to establish the setting.

(8) Press the MEAS/CAL switch to turn on the MEAS LED indicator.

(9) Start measurement.

4.3 Time Constant



As mentioned above, when a stepped torque is applied to the torque detector, the analog output becomes as shown in Fig. 2. In this case, the time duration necessary to reach 63% of the output voltage is referred to as time constant τ .

For example, when the time constant is set to 500 ms ($\tau=500$ ms) and a stepped power is applied as shown above, the time to reach 63% is 500 ms.

The time constant is obtained through digital filter processing using the exponential averaging method.

Exponential average: $A_n = A_{n-1} + (M_n - A_{n-1})/K$

The n-th analog output A_n is obtained by subtracting analog value A_{n-1} which is the exponential average of 1st to (n-1)-th measurement values from the n-th measurement value M_n , dividing the result by K (average coefficient), then adding the result and analog value A_{n-1} .

M_n is obtained at 4-ms sampling intervals.

$K=125$ when the time constant $\tau = 500$ ms and $K=16$ when $\tau=63$ ms.

The relationship between the cutoff frequency f_c (as general filter characteristic) and time constant τ is $\tau \cong 1 / (2\pi f_c)$.

For example, $f_c \cong 0.32$ Hz when $\tau =500$ ms.

The average processing by exponential averaging has the 1st order low-pass characteristic as used in the field of filter.



<< CAUTION >> Calculating procedures for digital display and analog output are shown below.

- Digital display value
Simple average of high-speed sampled torque and rpm for each gate
- Analog output value
Exponential average (with specified time constant) of high-speed sampled torque and rpm

5. Using BCD Output

The BCD output and print command output of the TS-2700 are all open-collector outputs. The following explains the BCD output and print command output as a logic recognized by the external device side, assuming that they are connected to external devices through the recommended interface.



Make the total length of the cables connected to BCD OUT 5m or less and perform shield processing as required.

- 5.1 Description of Each Signal 42
- 5.2 Recommended Interfaces 43
- 5.3 Timing Chart 44

5.1 Description of Each Signal

For pin assignment, refer to (24), “BCD OUT” on page 18.

(1) BCD output

Torque data Pins 1-16 : Output 4-digit display value. The decimal point is not output.

Rpm data Pins 21-40 : Output 5-digit display value.

Positive logic parallel output

Open-collector output

(2) Torque data polarity output

Pins 2 (- output)/43 (+ output)

Open-collector output

When measurement value is positive (+): Pin 42(- output): Lo (ON)/Pin 43 (+ output): Hi (OFF)

When measurement value is negative (-): Pin 42(- output): Hi (OFF)/Pin 43 (+ output): Lo (ON)

(3) Print command output

Pin 49

Open-collector output

When the hold signal or busy signal is input and the BCD output is held, the print command signal with negative logic pulse is output. (Refer to 5.3, “Timing Chart.”)

(4) Hold input

Pin 47

When the voltage signal with the Lo level (contact closed) is input, the BCD output data is held and the print command signal is output. The hold state is retained while this signal is at the Lo level (contact closed).

During the hold state, the counter circuit performs count operation according to the input signal from the torque sensor. When the hold state is canceled, the BCD data and output data are changed to measurement values at that timing.

(5) Busy input

Pin 48

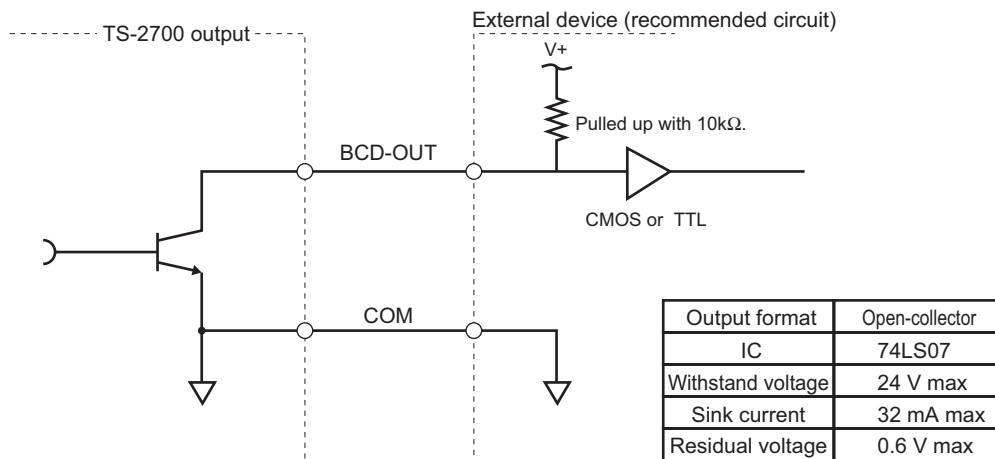
When the printer is used, this pin inputs the busy signal from the printer which received print command during printing.

During printer busy, input the Lo level (contact closed).

5.2 Recommended Interfaces

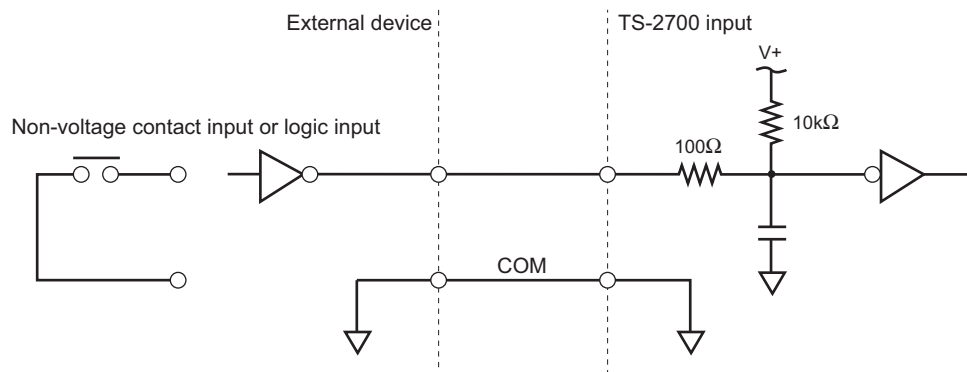
Recommended interface circuits are shown below.

(1) BCD output/Polar output/Print command output



(2) Hold input/Busy input

7- Input a signal without chattering.



Contact input

Load voltage	5 Vdcmin
Load current	100 mA min
ON resistance	10 Ωmax
OFF resistance	500 kΩmin

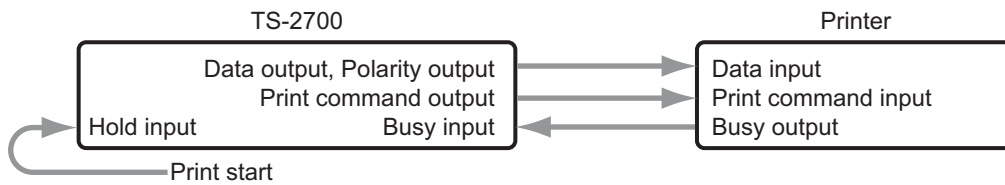
Logic input

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

5.3 Timing Chart

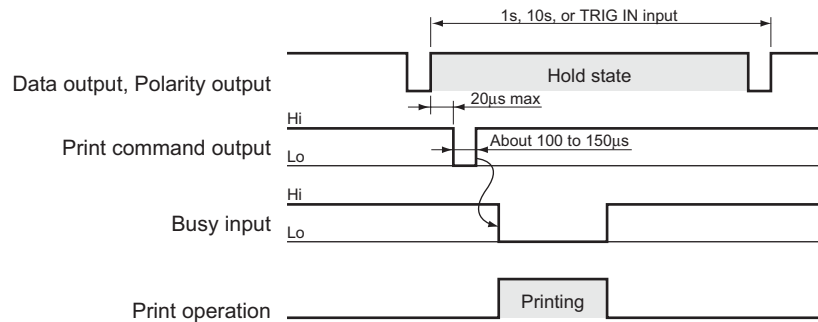


Make setting of print command/hold input as described in 3.5, “Entering Settings.” When the hold input is used, the data/polarity output is counted at one-second intervals (or 10-second intervals when the gate time (setting (10) is set to 10). Therefore, the data may not be updated even if the hold signal is canceled and then held again within one second (or 10 seconds).



■ When Hold Input is Not Used (Repetition of Following Pattern)

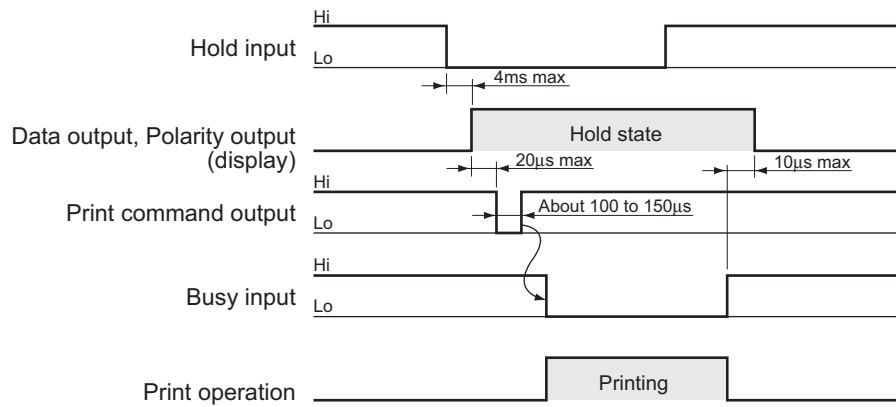
When the print command (setting (11)) is set to ON, the print command is output at intervals of the gate time (setting (10): 1 second, 10 seconds, or TRIG IN).



■ When Hold Input is Used

Set the print command (setting (11)) to OFF.

The print command is output only when the hold signal is input to pin 47 of the connector for BCD OUT.



6. Using Remote Functions



Make the total length of the cables connected to the REMOTE connector 5m or less and perform shield processing as required.

- 6.1 Inputs (Non-Voltage Contact Inputs) 48
 - Function..... 48
- 6.2 Outputs (Non-Voltage Contact Outputs)..... 49
 - Function..... 49
- 6.3 Synchronous Operation..... 50

6.1 Inputs (Non-Voltage Contact Inputs)

■ Function

CW/CCW selection : For CW/CCW selection from external

Refer to 3.6, “Setting Rotational Direction (CW/CCW).”

(Enabled when external input for rotational direction (setting (5) in the 3.5, “Entering Settings”) is set to ON.)

Contact input CW when open or CCW when Close

Logic input CW when Hi or CCW when Lo

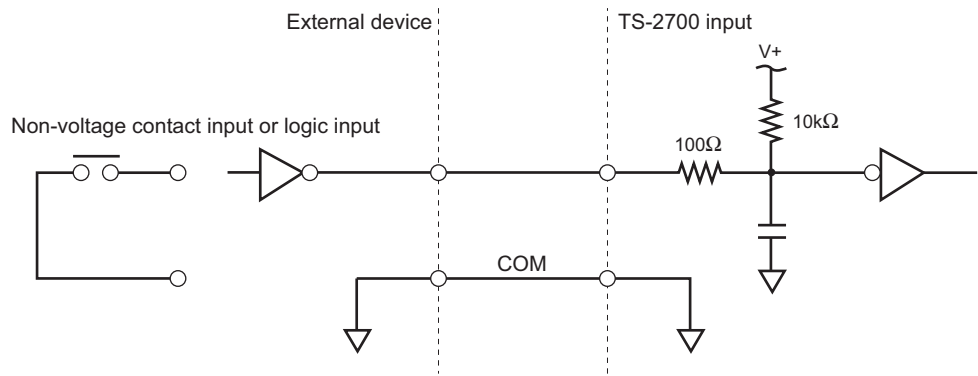
CLR IN : Both analog and digital outputs are forcibly set to 0 while the contact input is closed (logic input Lo).

Torque zero correction is not performed, either. Refer to 3.7, “Setting Torque Zero Correction Value.”

TRIG IN : (Enabled when the gate time (setting (10) in 3.5, “Entering Settings”) is set to EXT.) The display/BCD data is updated in synchronization with this signal.

The data is changed when the input to TRIG IN changes from contact-open to contact-closed (from logic Hi to Lo).

Input interval: 100 ms to 32 s



Contact input

Load voltage	5 V _{DC} min
Load current	100 mA min
ON resistance	10 Ωmax
OFF resistance	500 kΩmin

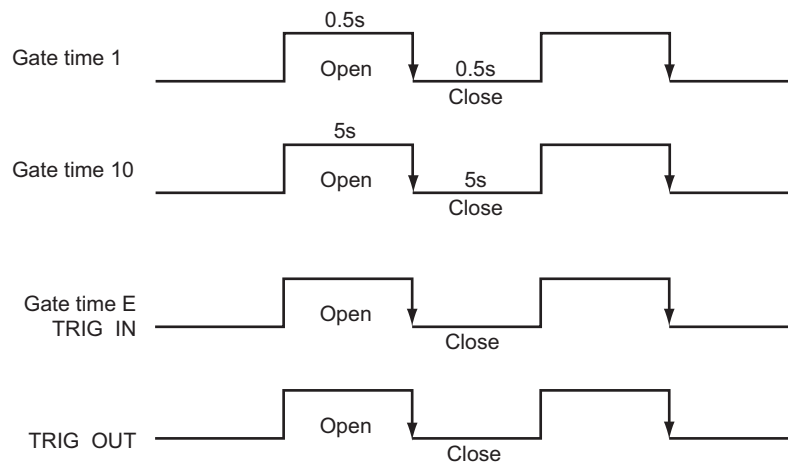
Logic input

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

6.2 Outputs (Non-Voltage Contact Outputs)

■ Function

TRIG OUT : This output signal synchronizes with the gate time (setting (10) in 3.5, “Entering Settings”).



The display and BCD change at the edge shown by ↓.

TRIG OUT is output in synchronization with TRIG IN.

READY OUT : The contact closes in the measurement mode. When using other signal outputs of the TS-2700 for as feedback signal for control, use this READY OUT signal to perform interlocking to ensure safety.

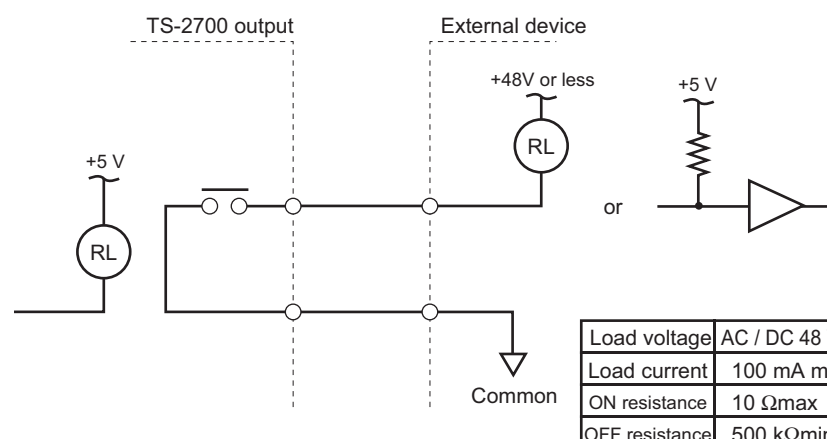
When the following conditions are met, the measurement mode is entered.

Conditions

- (1) MEAS is selected as the MEAS/CAL setting.
- (2) TRQ LED indicator lights up.

(When DP is selected as the torque detector type, this is not included in conditions.)

- (3) CLR IN of REMOTE is open.



6.3 Synchronous Operation

Synchronous operation with synchronized gate time (display/BCD changeover timing) of multiple TS-2700s is possible. The display value equals the average value from TRIG IN to the next TRIG IN.

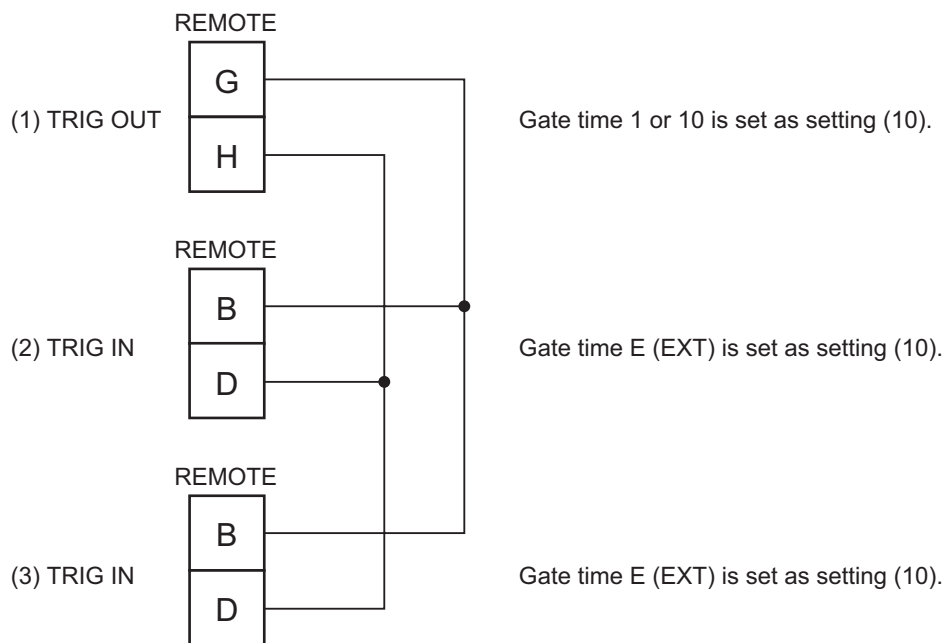
● Example

When installing three torque detectors, connecting the TS-2700 to each of them, and synchronizing the gate time, connect the TRIG OUT connector and TRIG IN connector on the rear panel as shown below.

Connecting procedure

The following indicates that three TS-2700s are (1), (2), and (3), and that (2) and (3) are synchronized with TRIG OUT of (1) determined in 6.2, “Outputs.”

Setting of related settings in 3.5, “Entering Settings” is required.



7. RS-232C

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7.1 Overview

The RS-232C interface is a serial communication interface standardized by EIA (Electronic Industries Association). The RS-232C interface of the TS-2700 enables data read operation and N-0 correction value write operation through the use of an appropriate program for personal computers. If you have a personal computer which supports terminal emulator or VT-100 terminal emulator function, the zero correction value and torque N-0 correction value can be stored in the terminal mode of the TS-2700.



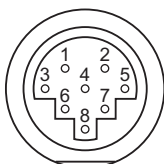
Turn on the power of the TS-2700 after activating the OS of the personal computer.

7.2 Specifications

Standard	Conforms to EIA and JIS X5101.
Communication mode	Asynchronous full-duplex mode
Transmission rate (baud rate)	9600 bps
Character length	8 bits
Parity check	None
Stop bit length	1 bit
X parameter control	Hardware control
Terminator	CR+LF

7.3 Connector Connections

Connector : HR12-10R-8SD (Hirose Electric)



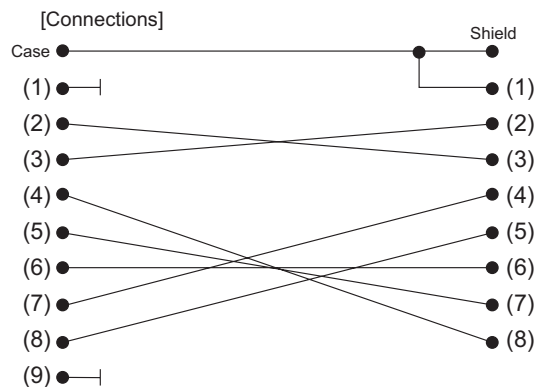
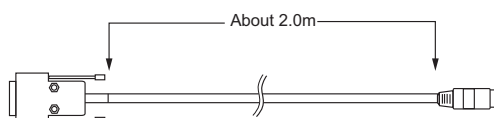
Pin No.	Signal Name	Function	I/O
1	FG (AA)	Non Connect	–
2	RxD (BB)	Receive data	Input
3	TxD (BA)	Transmit data	Output
4	CTS (CB)	Clear to send	Input
5	RTS (CA)	Request to send	Output
6	–	Non Connect	–
7	SG (AB)	Signal ground	
8	–	Non Connect	–

Applicable connector : HR212-10P8PSAT3042 (Hirose Electric)

Applicable cable : AX-5022 (D-sub 9-pin type) 2m (ONO SOKKI)

RS-232C option cable for PC/AT compatibles

HDEB-9S	(Connector: Hirose Electric)
HDE-CHT-1 (4-40)	(Case: Hirose Electric)
HR-212-10P8PSAT3042	(Hirose Electric)



7.4 Terminal Mode

```

<<< TS-2700 DIGITAL TORQUE CONVERTER TERMINAL UTILITY >>>
Ver.0.92      Copyright(C) 2003 ONO SOKKI Co.,Ltd

MODE:MEASURE      CONDITION SETTING

TORQUE  0.000      ZERO CW      10000      TRQ.CAPA      5
              ZERO CCW      10000      TRQ.FACT      8000
REVO      0      N-0
              CW      R      T
READY  OFF      1      0      +0      DET.TYPE      0 (0:SS 1:DP)
TRQ SIG OFF      2      0      +0      ANALOG TAU      1 (0:63 1:500)
REV SIG OFF      3      0      +0      (0:OFF 1:80)
IN TRG OFF      4      0      +0      ROT.SET      1 (0:EXT 1:INT)
HOLD  OFF      5      0      +0      GATE-1      0 (0:1s 1:10s)
CCW      CCW      R      T      GATE-2      0 (0:INT 1:EXT)
UNLOCK      1      0      +0      PRN.CMND      0 (0:HOLD 1:GATE)
              2      0      +0      REV.SIG      1 (0:INT 1:981)
              3      0      +0
              4      0      +0
              5      0      +0

[ESC] -> END UTILITY  [S] -> SET MODE  [Z] -> AUTO ZERO

```

The VT-100 terminal unit from DEC is supported by many personal computers as a standard terminal. The TS-2700 becomes the full-screen terminal mode using the escape sequences which can be used by the VT-100 terminal.

■ Activating Terminal Mode

It is necessary to activate the VT-100 (hyper terminal) implemented in the personal computer and then make setting to enable communication with the TS-2700 through the RS-232C interface.

Upon completion of setting, enable communication between the TS-2700 and the hyper terminal, enter "TRM" (half-size characters, not displayed on the screen), then press the return key. The terminal mode screen appears.

■ Functions and Operable Keys

There are two terminal modes: the monitor mode and the set mode. In the monitor mode, torque for each gate time, rpm display value, and switch statuses are displayed. In the set mode, the torque zero correction value and N-0 correction value can be set.

For the N-0 correction value, refer to (9), “Torque N-0 correction” in 3.5, “Entering Settings.”

Operable keys and functions are shown below.

(1) Monitor mode

- “ESC” : Terminates the terminal mode.
- “S” : Enters the set mode.

(2) Set mode

- “ESC” : Terminates the set mode and returns to the monitor mode.
- “BS” : Deletes one character.
- “+”, “-” : Sign input (Effective only at the time of N-0 correction value setting.)
- “0” to “9” : Numeric input
- “ENTER” : Establishes the current setting and proceeds with the next one.
If you enter a wrong value, you need to press and hold the “ENTER” key to circulate the setting.
- “!” : Sorts the N-0 setting (in order of rpm), calculates the table, then memorizes the result in the backup memory. (Correction becomes effective if the parameter setting is set to ON.)
At this time, the torque zero correction value is also stored in the backup memory.

(3) Key operation common to both modes

- “CTRL” + “L” : Refreshes the screen.
(Press “L” while holding down the “CTRL” key.)

■ Entering N-0 Correction Value

Obtain the N-0 correction value referencing 3.8, “Setting Torque N-0 Correction Value” and then enter the numeric value.

In the terminal screen, R denotes the rpm and T the torque value.

- (1) Press “S” to enter the set mode.
- (2) Enter the rpm and torque values while selecting settings with the “ENTER” key.
- (3) Press “!” to memorize the setting in the backup memory.

7.5 Command List

The command terminator is CR (0DH) + LF (0AH). CR+LF is added to the output from the TS-2700. As for setup commands, if the value in [] is omitted, the command works as a readout command. In actual setting, [] is not necessary.

■ Measurement Commands (Succeeded from TS-2600)

RTD Reads the torque display value.

<u>Setup parameter</u>	None
<u>Read data</u>	Torque display value (upper display value)
	No unit data
	Left-justified
	No space
	Minus sign

RRD Displays the rpm display value.

<u>Setup parameter</u>	None
<u>Read data</u>	Rpm display value (lower display value)
	No unit data
	Left-justified
	No space

RDD Outputs the torque and rpm display values delimited with a comma.

<u>Setup parameter</u>	None
<u>Read data</u>	Torque and rpm display values
	No unit data
	Left-justified
	No space

RLO Outputs the torque and rpm display values, delimited with a comma, for each gate time until the RLF command is received.

<u>Setup parameter</u>	None
<u>Read data</u>	Same as the read data of the RDD command.
<u>Description</u>	EXT trigger
	Data is output for each trigger input and clear input.
	During clear input, data is not output even if trigger input is present.
	INT trigger
	Data is output at each gate time and clear input.

RLF Stops continuous output by the RLO command.

Setup parameter None

Read data None

■ Setup Commands (Succeeded from TS-2600)

STZn[,d] Sets the torque zero value.

Setup parameter

n = 0 : CW
1 : CCW
d = 0 to 99999
-1 : Auto

Read data Zero value for specified rotational direction
No unit data

Description Same as DTZ in “Torque Setting.”
For Auto, can be set only for the current rotational direction.
LED lights up during execution.

STNn (r1,t1,...,[r5,t5]) Sets the N-0 value of torque detector.

Setup parameter

n = 0 : CW
1 : CCW
r = 0 to 99999 : Rpm data for each point
t = 0 to ±99999: Torque data for each point (decimal point ignored)

Read data (r1,t1,...,[r5,t5])

r = 0 to 99999 : Rpm data for each point
t = 0 to ±99999: Torque data for each point (decimal point ignored)

■ Parameter Setup Commands

LDG [t] Sets the gate time.

Setup parameter

t = 0 : 1s
1 : 10s
2 : EXT

Read data Returns the gate time code (0/1/2).

PRN [d] Sets the print command.

Setup parameter

d = 0 : Hold used.
1 : Hold not used. (Synchronized gate time)

Read data Returns the print command code (0/1).

■ Torque Setup Commands

DTR [d] Sets the rotational direction of torque detector.

Setup parameter

d = 0 : EXT
1 : INT CW
2 : INT CCW

Read data

0 : EXT
1 : INT CW
2 : INT CCW

DTZn[d] Sets the zero value of torque detector.

Description Same as STZ in “Setup Commands.”

DTF [d] Sets the factor value of torque detector.

Setup parameter

d : 1 to 65535

Read data Factor value

DTC [d] Sets the capacity value of torque detector.

Setup parameter

d : 1 to 99999

Read data Capacity value

DTNn [r,t] Sets the N-0 value.

Description Same as STZ in “Setup Commands.”

DNSn[f] Sets the N-0 value of torque detector.

Setup parameter

n = 0 : CW
1 : CCW
f = 0 : OFF
1 : ON
2 : CLR

Read data

0 : OFF
1 : ON

DTT [d] Sets the detector type.

Setup parameter

d = 0 : SS

1 : DP

Read data Detector type code (0 or 1)

■ Rpm Setup Commands

DRC [d] Changes the capacity value of rotary encoder.

Setup parameter

d = 0 : 10000 (IE4)
1 : 100000 (IE5)

Read data Returns the rotational capacity code.

DRP [d] Sets the number of teeth of rotary encoder.

Setup parameter

d = Number of teeth: 1 to 9999

Read data Returns the number of teeth of rotary encoder.

DRS [d] Sets the signal source of rotary encoder.

Setup parameter

d = 0 : INT (SIG2 of torque detector)
2 : MP981

Read data Returns the signal source code of rotary encoder.

0 : INT (SIG2 of torque detector)
2 : MP981

■ Analog Output Setup Commands

DAT1[.d] Sets the time constant for torque analog output.

Setup parameter

d	CH1	Without high-speed option	High-speed option mounted
		3 : 63 ms	0 : OFF
		6 : 500 ms	1 : ON (80Hz filter)

Read data Returns the time constant code setting (3 or 6, 0 or 1 when the high-speed option is mounted).

■ Mode Commands

EMS Enters the measurement mode.

Setup parameter None

Read data None

CLCn Clears the control command. (Same operation as CLR IN of the REMOTE function.)

Setup parameter

 n = 0 : CLR OFF

 1 : CLR ON

Read data None

RMD [d] Sets the operation mode.

Setup parameter

 d = 0 : MEAS

 1 : CAL

 2 : TEST

 3 : -

Read data Returns the operation mode value.

RCD Reads the status setting.

Setup parameter None

Read data a,b,c,d,e,f

 a : READY 0:OFF 1:ON

 b : TRQ SIG0:OFF 1:ON

 c : REV SIG0:OFF 1:ON

 d : CLR 0:OFF 1:ON

 e : TRIG 0:OFF 1:ON

 f : W/CCW 0:CCW 1:CCW

8. Troubleshooting

8. Troubleshooting

If a failure is assumed, check the following points.

If the TS-2700 does not operate normally after check, contact your dealer or ONO SOKKI sales office nearby.

Symptom	Cause	Check Point	Solution	Page
Power does not turn on	Power switch not set to ON	POWER switch	Turn on POWER switch	6
	AC power cable unplugged	AC power cable connection	Plug AC power cable securely into outlet	9 12
	AC power cable disconnected	Continuity of AC power cable	Replace AC power cable	
	Fuse has blown	All LED indicators are off	Contact dealer or ONO SOKKI sales office	
Minus torque displayed	Wrong setting of torque detector	Rotational direction of motor supplied with torque detector	Change rotational direction of supplied motor	28 29
		Mounting direction of driving side/load side	Re-install torque detector	
	Overload measured	Measurement with light load	Exchange torque detector capacity	
Zero display retained	Torque signal not received	TRQ LED indicator not on	Power of torque detector not turned on rotational direction selector switch of detector to CW/CCW	6 7
Mismatched torque	Wrong setting	Factor of torque detector/ Capacity setting/Unit/Torque zero correction value setting	Reset each item	19 29
Mismatched rpm	Wrong setting	Rotary encoder selector switch/P/R value setting	Reset each item	25 23
Shifted zero point	Torque zero correction value not set	Torque zero correction value setting	Set torque zero correction value	29
	Overloaded measurement performed	Torque zero correction value setting/Torque of object under measurement/Sudden start/ Presence or absence of sudden stop	Contact dealer or ONO SOKKI sales office	29
	Shaft torque applied when stopped	Remove shaft connection and check zero point	If zero point not shifted, change of zero point not necessary	
Unstable zero point	Noise	Review wiring method/earth	Separate from power cable Ground the case Use dedicated cable	4
Analog voltage not output	Minus voltage output with wrong setting of torque detector	Is torque display negative ? Is output negative voltage ?	Refer to symptom "Minus torque displayed"	
	Connection load not appropriate	Is connection load 10kΩ or more ?	Change connection load	36/38
Shifted analog voltage output	Drift caused by temperature	Within measurement accuracy range ?	Refer to "Calibration of Voltage Output for Torque/Rpm"	36/38

9. Specifications

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9.1 Torque Measurement Unit

Input Section

Amplification format	Isolated unbalanced DC amplification
Input signal	Phase-difference converted detector output signal (sine wave)
Input impedance	About 2 k Ω
Input frequency range	200 Hz to 50 kHz
Input signal amplitude range	0.2V _{pp} to 15V _{pp}
Connector	TRC116-23A10-7F (Tajimi Electronics)
Indicator	Green LED indicator lights up at the time of signal input from torque detector.

Setup Section

Capacity	1 to 9999
Factor	1 to 63535
Torque zero correction value	Auto zero by the push button switch CW/CCW Memorizes each point in memory.
Torque zero correction value changeover	Change the CW/CCW switch on the front panel. Selection from external is possible using the remote function.
Setting for calibration	Set the MEAS/CAL switch to CAL. Outputs the full-scale analog data with CAL.

Display Section

Display unit	Green LED indicator, 7-segment, 4-digit number, 1-digit sign, 0 to ± 9999
Unit	N·m (Use the supplied seal when using unit mN·m/kN·m.)
Accuracy	When detectors are combined: 1-second average value N-0 correction OFF: $\pm 0.5\%$ /full-scale ± 1 count N-0 correction ON: $\pm 0.2\%$ /full-scale ± 1 count (When the N-0 correction value has been entered)
Display/output changeover time	1s/10s/EXT (TRIG IN signal)
Decimal point light-up	Automatic (Depends on the capacity setting.)
N-0 correction	ON/OFF (Can be input with front panel switch operation or RS-232C.)

Output Section

Analog	Output format	Isolated voltage output (COMMON common to rpm.)
	Scale	0 to $\pm 10\text{V}$ /full-scale (capacity value)
	Appropriate load	10k Ω or more
	Time constant	63 ms/500 ms changeover
	Accuracy	When detectors are combined: 1-second average value Linearity: N-0 correction OFF: $\pm 0.5\%$ /full-scale N-0 correction ON: $\pm 0.2\%$ /full-scale (When the N-0 correction value has been entered) Temperature drift: $\pm 0.05\%$ /full-scale/ $^{\circ}\text{C}$
	Connector	C02 type (BNC) connector
Digital	Output format	BCD, positive logic open-collector output, 4-digit number, 1-digit sign Withstand voltage: 24VDC max. Sink current: 32mA max. Data changeover time: 1s, 10s, EXT (TRIG IN signal)
	Accuracy	When detectors are combined: 1-second average value N-0 correction OFF: $\pm 0.5\%$ /full-scale ± 1 count N-0 correction ON: $\pm 0.2\%$ /full-scale ± 1 count (When the N-0 correction value has been entered)
	Connector	Common to DX10A-50S (Hirose Electric) for rotation.

9.2 Rpm Measurement Unit

Input Section

Input signal	Rectangle wave input, such as the MP-981, or torque detector
Amplification format	Unbalanced DC amplification (without isolation)
Input impedance	30k Ω or more
Input frequency	1 Hz to 100 kHz (Accuracy guaranteed from 10Hz.) SIG2 of torque detector: 200Hz to 50kHz.
Input signal amplitude	Rectangle wave HIGH level: +4 to +15V LOW level: +0.6V or lower Pulse width: 3 μ s or more
Power supply	12VDC \pm 0.6V, 100mA max.
Power fuse	125mA time-lag fuse
Connector	R03-R6F (Tajimi Electronics)
Indicator	The green LED indicator lights up at the time of signal input from the rotary encoder.

Setup Section

Signal changeover	Selection of MP-981/INT (SIG2 of the torque detector)
P/R changeover	1 to 9999 P/R
Analog output scale	0-10,000r/min/0-10V, 0-100,000r/min/0-10V changeover
Setting for calibration	Change the MEAS/CAL switch to CAL. The full-scale analog data is output with CAL.

Display Section

Display unit	Green LED indicator, 7-segment, 5-digit number, 0 to 99999
Unit	r/min
Accuracy	\pm 0.02%/full-scale \pm 1 count, 1-second average value
Display/output changeover time	Synchronized with torque.

Output Section

Analog	Output format	Isolated voltage output (COMMON common to torque.)
	Scale	0 to +10V/full-scale (10 Ω or more)
		Full scale: 10,000/100,000 r/min changeover
	Appropriate load	10k Ω or more
	Time constant	63 ms
	Linearity	$\pm 0.2\%$ /full-scale, 1-second average value
	Temperature drift	$\pm 0.01\%$ /full-scale/ $^{\circ}\text{C}$
	Connector	C02 type (BNC) connector
Digital	Output format	BCD, positive logic open-collector output, 5 digits Maximum ratings of withstand voltage/sink current/residual voltage are the same as those for torque.
	Accuracy	$\pm 0.02\%$ /full-scale ± 1 count, 1-second average value
	Scale	0 to 99999 counts
	Connector	DX10A-50S (Common to torque.)

9.3 Remote Function

Input	CW/CCW changeover/Clear input/Trigger input
Output	Trigger output/READY output (measurement setup completion signal)

9.4 Other I/Os

Print command output	Open-collector (negative logic), Pulse width from 100 μs to 150 μs
Hold input	Non-voltage contact or TTL level (negative logic)
Busy input	Non-voltage contact or TTL level (negative logic)

9.5 RS-232C

Standard	Conforms to EIA and JIS X5101.
Communication mode	Asynchronous full-duplex mode
Transmission rate	9600 bps
Character length	8 bits
Parity check	None
Stop bit length	1 bit
X parameter	Hardware control
Terminator	Transmit data + CR+LF
Connector	HR12-10R-8SD (Hirose Electric)

9.6 General Specifications

Power rating	100-240VAC, 50/60Hz, 18-26VA
Voltage fluctuation	±10% with respect to the power voltage
Protective ground class	Class I
Altitude	2000m max.
Operating temperature	0 to + 40°C
Operating humidity	30 to + 80%RH (without condensation)
Storage temperature	-10 to + 55°C
Storage humidity	30 to + 80%RH (without condensation)
Degree of pollution	Pollution level 2
Installation category	Category II
Outside dimensions	76(W) × 142(H) × 302(D) mm
Weight	About 1.9 kg

Confirming safety standards

The TS-2700 is designed and tested to comply with the ICE61010-1 part 1(*) standard including US/EN deviations, and also meets the requirements of the EU Low Voltage, EMC Directive and FCC/CANADA EMI regulation. (*Safety standard applied to electrical equipment for measurement, control, and laboratory use.)

FCC 15B, Class A satisfied

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

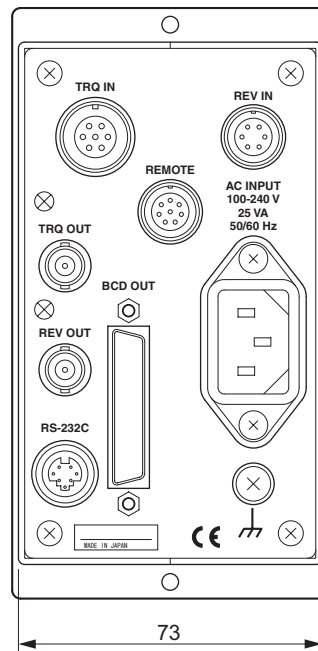
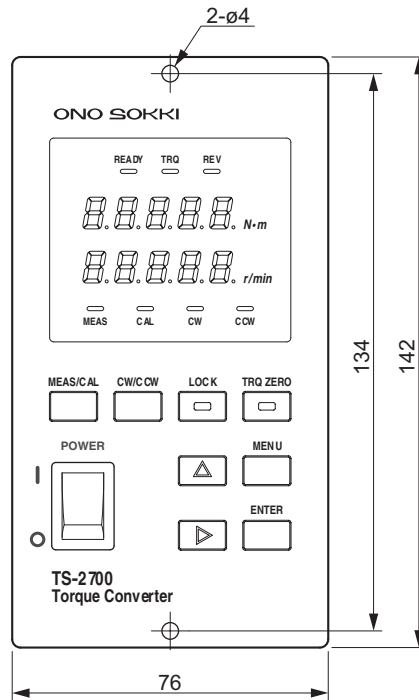
This Class A digital apparatus complies with Canadian ICE-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

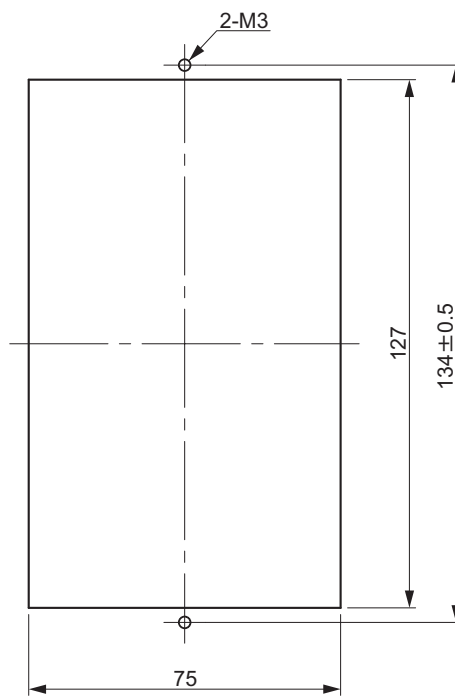
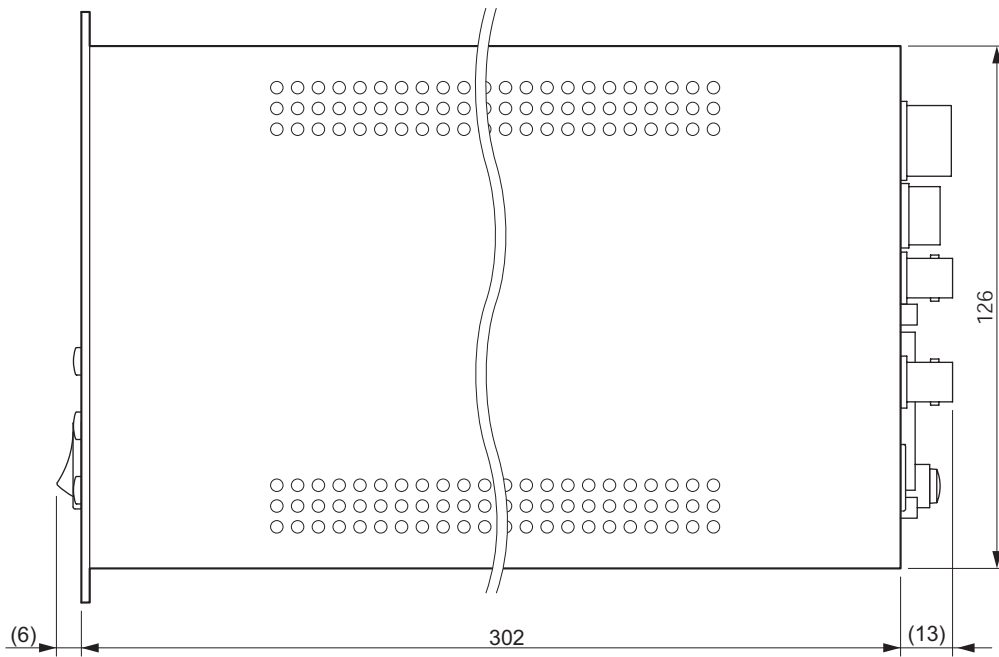
9.7 Accessories

AC power cable	SDS4-SB303 SVT3 × AWG18-2M	1
Connector	R03-PB8M (for remote)	1
Indication unit label		1
Rubber foot	With four screws (M3 × 12)	4
Instruction manual		1

9.8 Outside Dimensions



Rear Panel



Panel cutout dimensions

ONO SOKKI

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*Outer appearance and specifications are subject to change without prior notice.
HOME PAGE: <http://www.onosokki.co.jp/English/english.htm>

WORLDWIDE
Ono Sokki Co., Ltd.
1-16-1 Hakusan, Midori-ku,
Yokohama 226-8507, Japan
Phone:045-935-3976
Fax:045-930-1906
E-mail:overseas@onosokki.co.jp

B00001855/IM04013001(3)045(UT)010