

# Digital Torque Meters

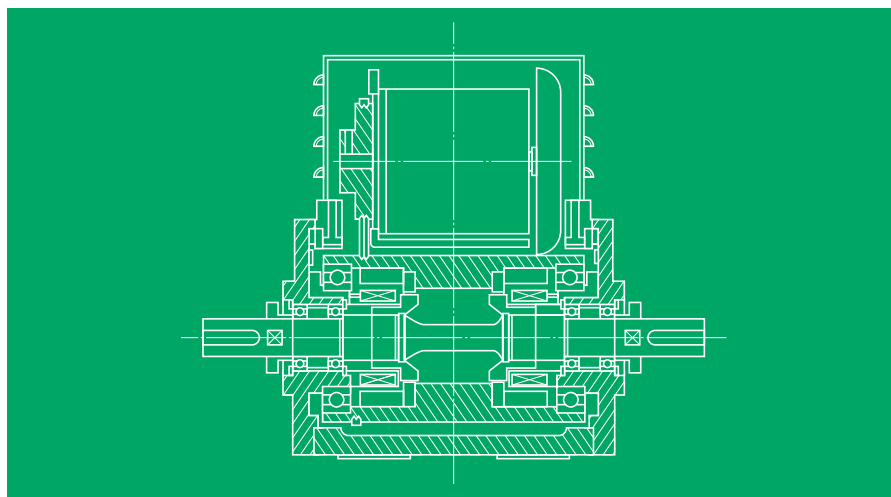
## SELECTION GUIDE



Ono Sokki Torque Meters adopt the original phase difference method to achieve highly accurate and repeatable torque measurements and cover a wide range of applications from mechanical load measurements to torque revolution characteristics measurement of driving motors.

**ONOSOKKI**

# Torque Measurement Demand Quality and Durability in All Environments. Advanced Technology Provides the Solutions.



**Ono Sokki Covers the Full Range of Torque Measurement, from mN·m to kN·m, from Stationary Shafts to Ultra-High-Speed Revolution, Aiming for the Unvarying Maximum in Efficiency, Performance and Reliability.**

## Digital Torque Detector & Digital Torque Meter with Arithmetic Operation Display Features

### ■ Outstanding durability under extremely high load

The detector shaft will not be damaged even if a load that is 400% of the rated torque is applied. Moreover, when combined with a display unit, continuous display up to 180% of the rated torque is enabled.\*1

### ■ High accuracy and stability

The accuracy is 0.1% FS, and the precision is 0.04% FS. Processing errors are negligible since the measurement is digital, and the reproducibility characteristic is extraordinarily high.

### ■ Long service life, easy maintenance

The signal is detected without contacting the shaft. As there are no slip rings or brushes that need to be replaced, the detector has a long, easy-maintenance service life.

### ■ Wide revolution range

Ono Sokki has long years of experience in manufacturing torque detectors with an revolution range from 0 to 100,000r/min. Please consult us if you need high-speed detectors.

### ■ Dual signal output

Since both digital output (BCD, RS-232C) and analog output (voltage) can be specified connection to control systems, recording instruments, panel meters, and personal computers is also facilitated.\*2

### ■ GP-IB connection

Connection via a GP-IB interface enables the CPU to be used for data processing and the control of torque meters, as well as greatly expanding unattended and automated measurement applications.\*2

### ■ Remote functions

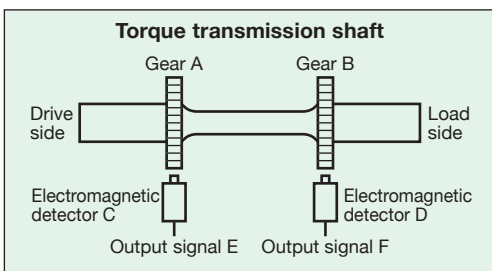
There are several convenient input and output functions for safety and control such as the synchronized driving of torque arithmetic operation display units, zero hold, and measurement preparation output.\*2

\*1) The guaranteed accuracy range is up to 100% of the rated torque. With 10 V as the upper limit of the analog output of display units, there are some models where output exceeding 100% is not possible.

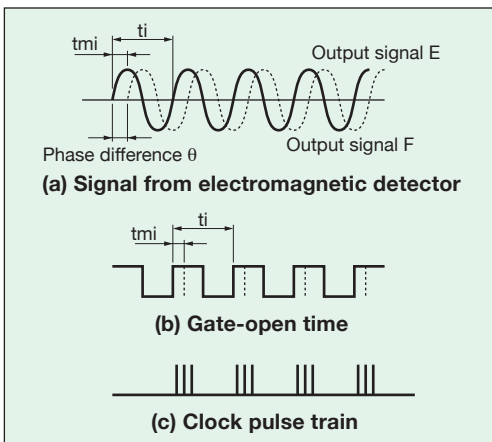
\*2) Varies according to the model.

# Digital Torque Meter Principle

When power is transmitted by a shaft, the shaft undergoes a torsional twisting through an angle which is proportional to the transmitted torque. A digital torque meter coupled to non-contact type electromagnetic detectors facing gears mounted at two points on the shaft detects the torsion angle as the phase difference between two AC signal voltages. Some subtle digital processing, referenced to a highly accurate and stable crystal oscillator, converts the phase difference into a measurement of the transmitted torque. The torsion angle can be detected by inserting a torque detector at a point on the torque transmission shaft.

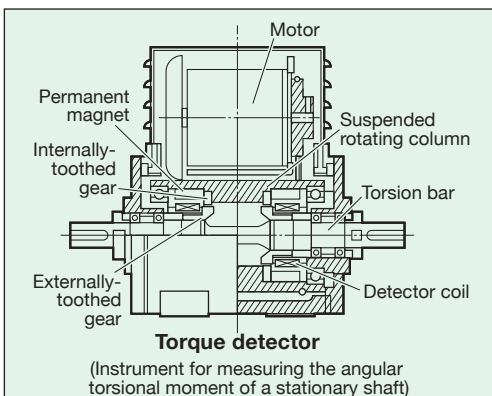


The torque transmission shaft twists through an angle proportional to the size of the applied torque, so the teeth of gears A and B are displaced in relative position by an amount equal to the torsional angle. Since detectors C and D generate AC voltages with waveforms that track the rotation of gears A and B, the phase difference between the output signals varies in proportion to the torsional angle.



The torque can, therefore, be found by measuring the phase difference between the two AC voltages. A gate is opened for a time ( $t_{mi}$ ) equal to the phase difference between the two AC waveforms, creating an intermittent train of clock pulses from a crystal oscillator. Although the pulse train is not uniformly spaced, it forms a type of periodic signal having a frequency which is proportional to the phase difference (torque).

Counting the pulses in the pulse train yields the average value of the torque, and an F-V conversion is used to derive an analog output. Calculation of the phase ratio ( $t_{mi}/t_i$ ) in each period gives the transient torque in the interval equal to the spacing of the teeth.



Torque applied to a stationary shaft can also be measured. A motor rotates the suspended column of the torque detector and the internally-toothed gear coupled to it, so even when the shaft (externally toothed gear) is stationary, there is a speed differential between the two gears. The magnetic flux in the coil therefore fluctuates as the internally-toothed gear turns through its circular pitch, generating an AC voltage with a sine waveform.

## List of Detection Range

Detecting method	Model name	Feature	Reference Page	2 mN·m	5 mN·m	10 mN·m	20 mN·m	50 mN·m	100 mN·m	200 mN·m	500 mN·m	1 N·m	2 N·m	5 N·m	10 N·m	20 N·m	50 N·m	100 N·m	200 N·m	500 N·m	1 kN·m	2 kN·m	5 kN·m	10 kN·m	20 kN·m	50 kN·m	100 kN·m
			8	10	20	20	20				20	20	20														
SS type (Phase difference method using gears)	MD series	Micro torque measurement	8	10	20	20	20																				
	SS series	Standard and general use	7						6	6	6	6	6	8	8	6	6	6	6	5	5						
	DSTP series	High rigidity and durability	9																			4	3	2	1.5	1	
	DD series	High rotation speed measurement	10						30	30	30	30	30	30	13	13	13	10	10	10	6	4					
TH type (Phase difference method using electromagnetic induction theory)	TH-1000 series	Standard and general use	6									6	6	8	8	6	6	6	6								
	TH-2000 series	High rotation speed measurement	6									20	20	20	20												
	TH-3000 series	Micro torque measurement	6				15	15	15																		
	TH-3000H series	Micro torque and high rotation speed measurement	6				25	25	25																		

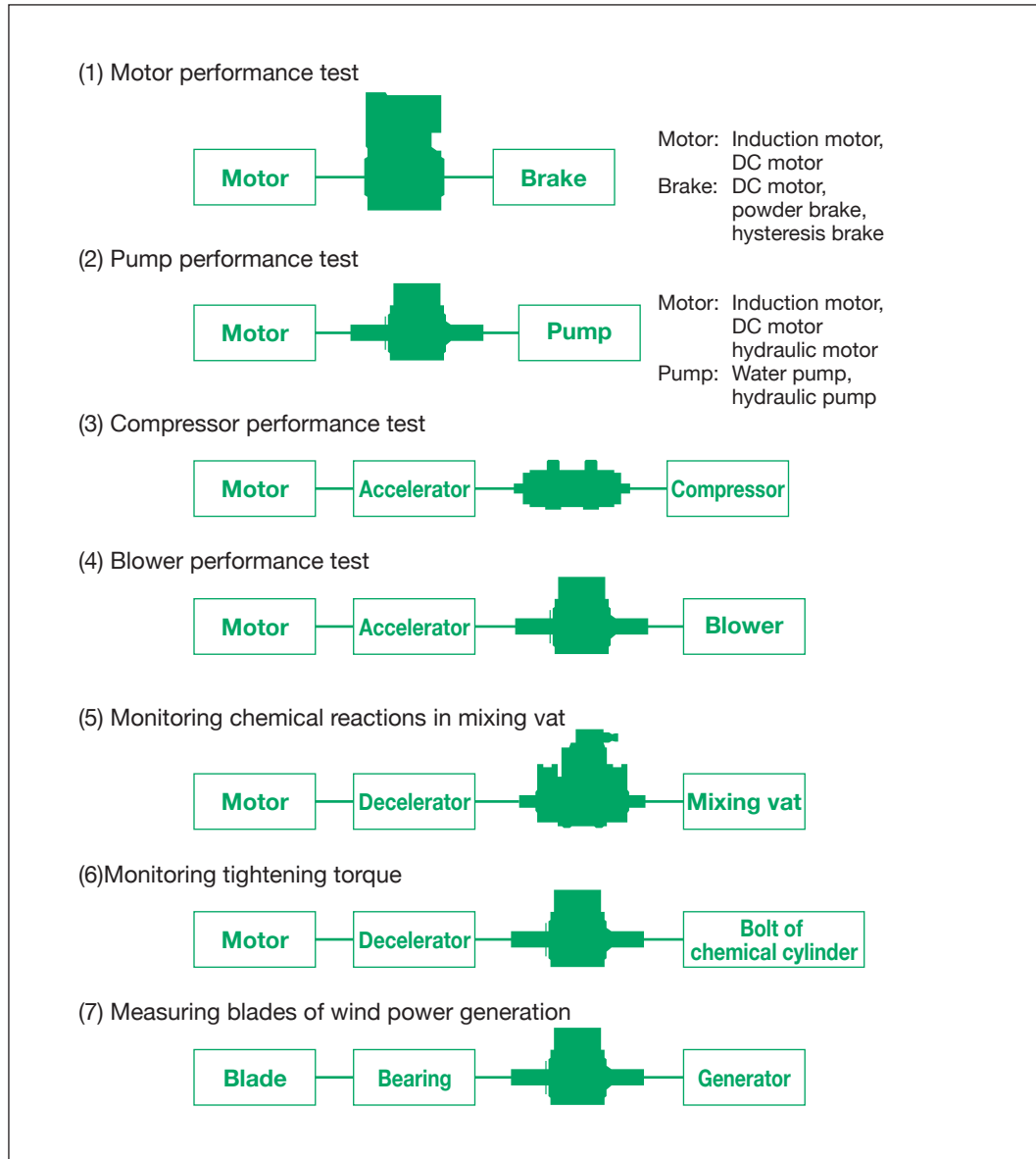
## Comparison Table in specification of Digital Torque Meter

Specification		TS-2800	TS-3200A	Remarks	
Reference page		12, 13	14, 15		
Applicable torque detector		All torque detectors by Ono Sokki excluding TQ series.	All torque detectors by Ono Sokki excluding TQ and TH series.		
Measurement item		Torque, revolution speed	Torque, revolution speed, output*	*Calculated value	
Measurement unit	Torque	mN·m, N·m, kN·m	mN·m, N·m, kN·m		
	Revolution speed	r/min	r/min, r/s		
	Output	—	mW, W, kW, PS		
Digital display	No. of display digit	5-digit*/4-digit	5-digit	*5-digit: When the TH series torque detector is used.	
	Display method	LCD	LCD		
	Display update interval	1s, 10s, EXT	1 to 10.0s, EXT		
	Measurement display accuracy (at reference time (1-second))	Torque	±0.1% / FS.* / ±0.2% / FS.	±0.2% / FS.	*±0.1%: When the TH series torque detector is used.
		Revolution speed	±0.02% / FS.*	±0.05% / FS.*	*FS. is selectable.
	Absolute value display	—	Available		
Data hold function	—	Max. value, Min. value, Peak-to-Peak value			
Detector's parameter setting memory		1 model	10 models		
Revolution input		Provided	Provided		
Comparator function		—	4 channels (option)		
Analog output	Response time (Time constant)	TH type: 1.6 ms, 16 ms, 63 ms, 500 ms* SS type: 63 ms, 500 ms*	16 ms to 64 s*	*Higher speeds are available as an option	
	Output level	±10 V / FS.	±10 V / FS.		
	No. of outputs	1-channel each for torque and revolution speed	2-channel*	*3-channel is possible as an option	
	Accuracy	Torque	±0.1% / FS. / ±0.2% / FS.	±0.2% / FS.	1-s average
		Revolution speed	±0.1% / FS.	±0.1% / FS.	
Output attenuator	2V, 2.5V, 3.3V, 5V, 6.67V	0.01V step		TS-2800: torque only	
Interface		BCD*/RS-232C	BCD*/GPIB*/RS-233C*	* Available as an option. Only either one of GPIB or RS-232C can be installed to the TH-3200A.	
Dimensions (mm) W x H x D		76 x 142 x 262	360 x 99 x 301	Not including protruded section.	
Weight		Approx. 2 kg	Approx. 5 kg		
Panel mounting fixture		—*	Provided as an option	*Fixing bracket for main unit is required. (user preparation)	

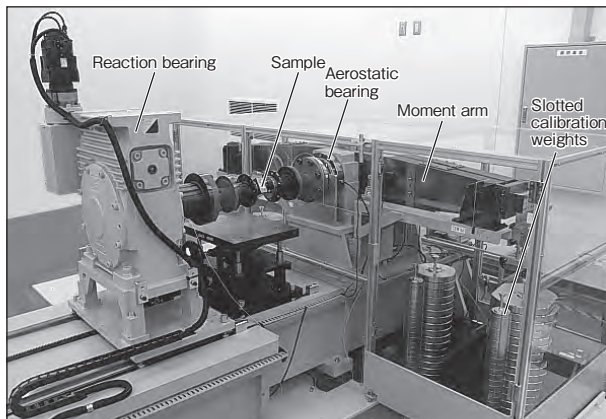


# Torque Measurement: Ono Sokki's Proven Record and Extensive Product Lineup Tell the Whole Story.

## ● Examples of Digital Torque Meter Applications



## ● Calibration of Torque Detector





# SS Series: Torque Detectors for Rotating and Stationary Shafts

Wide measurement range, from Stationary to High-Speed



The SS Series has a long performance sales record in a wide variety of applications, including performance tests of motors, pumps, compressors, blowers, boring machines, and gears. Thanks to the economics of mass production, these detectors are as inexpensive as strain gauge types and they are stocked for immediately delivery. High rigidity results from the unitized cast-casing construction. Combining high performance with ease of use, these standard-type torque detectors require no maintenance or replacement of parts. This series features 13 models, covering the range from 0.2N·m to 2000N·m.

## Notes:

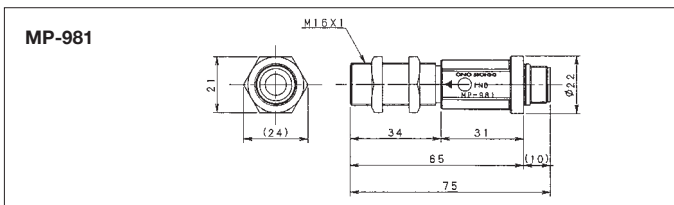
- (1) SS Series torque detectors can be connected to any models of TS Series digital torque meters except the TS-7700 Torque Station Pro.
- (2) The standard cable length for torque signal cable is 5 meter and can be extended on request with extra charge when ordering.
- (3) Recommended coupling  
Model SS-002 to SS-100: Micro coupling  
Model SS-200 to SS-202: Form-flex coupling  
(Please refer to the page 16 in details.)

## Magneto-electric rotation detector MP-981(option)



### Specification

Measurement range : 1 to 20,000 r/min  
(60 P/R)  
Measurement accuracy :  $\pm 0.02\%$  / F.S.  
at reference time  
(1 second) of TS Series  
Operating temperature : -10 to +70°C  
Weight : Approx. 80 g



## Dimensions

SS	A	B	C	D	E	F	øG	H	I	J	K	L	øM	Np <sup>g</sup>	O	Weight (kg)
002, 005, 010, 020, 050	200	104	70	130	105	167	8 <sup>h6</sup>	17	32	50 <sup>0</sup> <sub>-0.2</sub>	25	15	10	-	-	5
100, 200	220	104	70	130	105	167	14 <sup>h6</sup>	27	32	50 <sup>0</sup> <sub>-0.2</sub>	25	15	10	5	3 <sup>+0.1</sup> <sub>0</sub>	5.5
500, 101	300	150	115	200	170	230	25 <sup>h6</sup>	45	35	80 <sup>0</sup> <sub>-0.5</sub>	40	20	14	8	4 <sup>+0.2</sup> <sub>0</sub>	14
201, 501	350	150	115	200	170	230	36 <sup>h6</sup>	70	35	80 <sup>0</sup> <sub>-0.5</sub>	40	20	14	10	5 <sup>+0.2</sup> <sub>0</sub>	15
102, 202	430	150	115	230	200	245	55 <sup>h6</sup>	110	35	90 <sup>0</sup> <sub>-0.5</sub>	55	25	14	16	6 <sup>+0.2</sup> <sub>0</sub>	23

\*Please refer to the page 11 for the dimensions of the detector shaft ends.

Model SS	Measurement range (N·m)	Minimum resolution (mN·m)	Revolution range (r/min)	Inertia moment (kgm <sup>2</sup> )	Spring constant (N·m/rad)
002	0.2	0.1	0 to 6000	4.25 x 10 <sup>-5</sup>	1.67 x 10
005	0.5	0.1	0 to 6000	4.25 x 10 <sup>-5</sup>	4.12 x 10
010	1	1	0 to 6000	4.25 x 10 <sup>-5</sup>	8.24 x 10
020	2	1	0 to 6000	4.25 x 10 <sup>-5</sup>	1.67 x 10 <sup>2</sup>
050	5	1	0 to 6000	4.25 x 10 <sup>-5</sup>	4.12 x 10 <sup>2</sup>
100	10	10	0 to 8000	5.00 x 10 <sup>-5</sup>	7.75 x 10 <sup>2</sup>
200	20	10	0 to 8000	5.00 x 10 <sup>-5</sup>	1.57 x 10 <sup>3</sup>
500	50	10	0 to 6000	1.30 x 10 <sup>-3</sup>	6.18 x 10 <sup>3</sup>
101	100	100	0 to 6000	1.30 x 10 <sup>-3</sup>	1.27 x 10 <sup>4</sup>
201	200	100	0 to 6000	1.45 x 10 <sup>-3</sup>	2.54 x 10 <sup>4</sup>
501	500	100	0 to 6000	1.50 x 10 <sup>-3</sup>	6.18 x 10 <sup>4</sup>
102	1000	1000	0 to 5000	5.00 x 10 <sup>-3</sup>	1.67 x 10 <sup>5</sup>
202	2000	1000	0 to 5000	5.25 x 10 <sup>-3</sup>	3.43 x 10 <sup>5</sup>

## Specification

Accuracy :  $\pm 0.2\%$ /F.S. (when combined with model TS-2800/TS-3200A on N-0 compensation.)

Temperature effect on : +0.03%/F.S./°C  
the sensitivity

Operating temperature : 0 to +40°C

Storage temperature : -20 to +60°C

Operating humidity : 85% maximum

Vibration resistance : Within 50m/s<sup>2</sup>

Applicable connector : TRC116-12A10-7M10.5

Rotation detecting gear : Provided as standard (60 P/R)

Power requirement : 100/VAC\*, 50/60Hz

SS-002 to 200: 35VA

SS-500 to 202: 50VA

Accessory : Power cable (2.4 m)

Torque signal cable (5 m)

Instruction manual

Test certificate

Key of the detector shaft ends (SS-100 to SS-202 only)

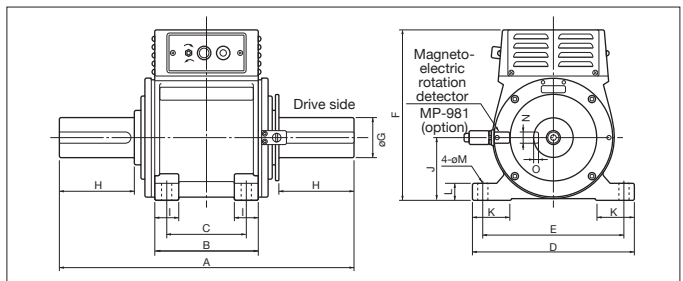
Option (sold separately) : Magneto-electric rotation detector (MP-981)

Rotation signal cable (MX-8105, 5 m)

Rotation direction external selection function (SS-0004)

- The cable (5 m) is provided as standard, the selector switch is sold separately.

\*The change of voltage: Available as an option.



# MD Series: Low-Capacity Torque Detectors for Rotating and Stationary Shafts

High accurate measurement for micro torque with the compact size



Small electric motors drive many of the common machines used in everyday life and business, including digital video camera, DVD player/recorder, and other audio visual equipment and the various tools of office automation: printer, disk drivers, etc. and the parts which are built in the automobiles.

The torque detectors in the MD Series measure the torque output from these compact, precision motors to the mechanisms.

By using phase differential principle, the measurement is possible by the unit of 0.001mNm (with MD-501C).

MD Series torque detectors are built into the MT Series of small torque measurement systems, where they have established a track record of outstanding reliability in small-motor performance tests.

## Notes:

- (1) The MD Series should be used with the model TS-2800/TS-3200A digital torque meter.
- (2) Please refer to the below right drawing when the rotation detector is mounted.
- (3) The rotation detector can be mounted on either one of drive or load side. (It is mounted on drive side if there is no request.)
- (4) Please consult us for details if the optional high speed revolution range as above table is required.

Model MD	Measurement range (mN·m)	Minimum resolution (mN·m)	Standard revolution range (r/min)	Optional high speed revolution range (r/min)	Inertia moment (kgm <sup>2</sup> )	Spring constant (N·m/rad)
201C	2	0.001	0 to 10,000	0 to 10,000	$1.9 \times 10^{-7}$	$8.24 \times 10^{-2}$
501C	5	0.001	0 to 10,000	0 to 20,000	$1.9 \times 10^{-7}$	$2.06 \times 10^{-1}$
102C	10	0.01	0 to 10,000	0 to 20,000	$1.9 \times 10^{-7}$	$4.12 \times 10^{-1}$
202C	20	0.01	0 to 10,000	0 to 20,000	$1.9 \times 10^{-7}$	$8.24 \times 10^{-1}$
503C	500	0.1	0 to 10,000	0 to 20,000	$1.45 \times 10^{-6}$	$3.14 \times 10$
104C	1000	1	0 to 10,000	0 to 20,000	$1.45 \times 10^{-6}$	$6.18 \times 10$
204C	2000	1	0 to 10,000	0 to 20,000	$1.45 \times 10^{-6}$	$1.27 \times 10^2$

## Specification

Accuracy :  $\pm 0.2\%$ /F.S.  
(when combined with model TS-2800/TS-3200A on N-0 compensation.)

Temperature effect on the sensitivity :  $+0.03\%$ /F.S./°C

Operating temperature : 0 to  $+50^\circ\text{C}$

Storage temperature :  $-20$  to  $+60^\circ\text{C}$

Operating humidity : 85% maximum

Vibration resistance : Within  $50\text{m/s}^2$

Applicable connector : TRC116-12A10-7M10.5

Power requirement : 100/VAC\*, 50/60Hz, 10VA

Accessory : Power cable (2.4 m)

Torque signal cable (5 m)

Instruction manual

Test certificate

Option (sold separately) : Rotation detector (120 P/R)

Model name	Applicable detector
MD-0113	MD-201C/501C/102C/202C
MD-0118	MD-503C/104C/204C

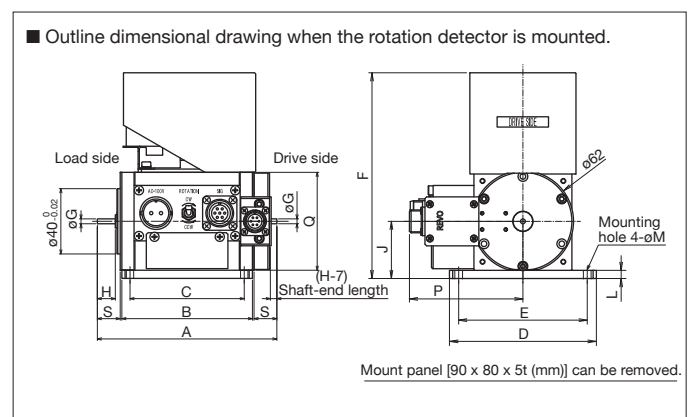
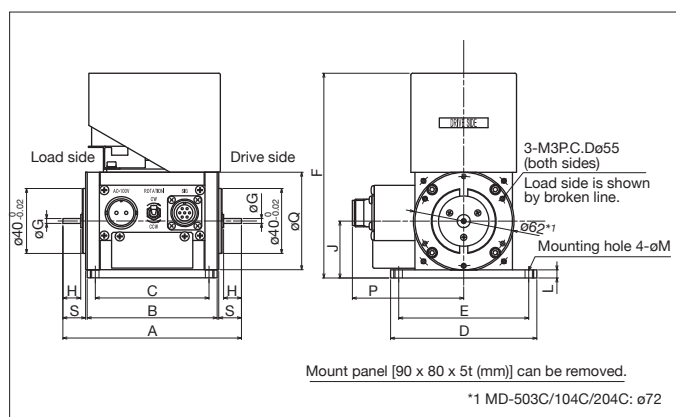
Rotation signal cable

(Model MX-8105, 5m/MX-8110, 10m/MX-8120, 20m)

Rotation direction external selection function (MD-0004)

- The cable (5m) is provided as standard, selector switch is sold separately.

\*The change of voltage: Available as an option.



## Dimensions

MD	A	B	C	D	E	F	øG	H	J=0.5	L	øM	P	Q	S	Weight (kg)
201C, 501C, 102C, 202C	110	80	70	90	80	126	$3_{-0.01}^0$	11	35	5	4.5	70	60	14	1.5
503C, 104C, 204C	120	80	70	90	80	136	$8_{-0.01}^0$	16	40	5	4.5	75	70	19	1.8

\*Please refer to the page 11 for the dimensions of the detector shaft ends.



# DSTP Series: Large-Capacity Torque Detectors for Rotating and Stationary Shafts

## Outstanding Rigidity and Durability with Covering Large Torque Capacity



The DSTP Series cover the large-capacity range of torque measurement from stationary to high speed. This series have rigid and durable structure, their outstanding capabilities have made them a popular choice in wide variety applications for many years.

### Notes:

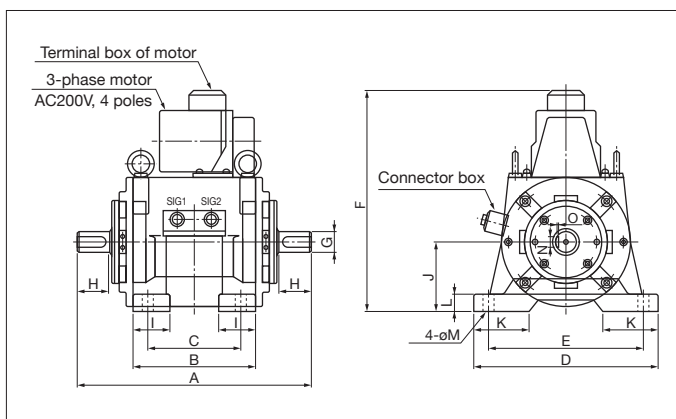
- (1) DSTP Series torque detectors can be connected to any models of TS Series digital torque meters except the TS-7700 Torque Station Pro.
- (2) The DSTP Series are semi-standard models manufactured on order. They are designed for use in high-speed and large torque measurement. Owing to coupling balance and critical speed problem being raised at high speed, please check the rate of revolution before ordering. Please consult us for details.

Model DSTP	Measurement range (N·m)	Minimum resolution (mN·m)	Revolution range (r/min)	Inertia moment (kgm <sup>2</sup> )	Spring constant (N·m/rad)
500	5000	1000	0 to 4000	$3.74 \times 10^{-2}$	$4.81 \times 10^5$
1000	10,000	10,000	0 to 3000	$9.69 \times 10^{-2}$	$9.71 \times 10^5$
2000	20,000	10,000	0 to 2000	$3.32 \times 10^{-1}$	$3.04 \times 10^6$
5000	50,000	10,000	0 to 1500	$8.53 \times 10^{-1}$	$7.06 \times 10^6$
10000	100,000	100,000	0 to 1000	4.175	$1.40 \times 10^7$

### Specification

Accuracy	: $\pm 0.2\%$ /F.S. (when combined with model TS-2800/TS-3200A on N-0 compensation.)
Temperature effect on the sensitivity	: $+0.03\%$ /F.S./°C
Operating temperature	: 0 to $+50^\circ\text{C}$ (DSTP-500/1000) 0 to $+45^\circ\text{C}$ (DSTP-2000/5000/10000)
Storage temperature	: $-20$ to $+60^\circ\text{C}$
Operating humidity	: 85% maximum
Vibration resistance	: Within $50\text{m/s}^2$
Applicable connector	: 12P2B
Power requirement	: 200VAC*, 50/60Hz, 3-phase
Accessory	: Torque signal cable (5 m) Power cable (5 m) Instruction manual Test certificate
Option (sold separately)	: Magneto-electric rotation detector (MP-981) Rotation detecting gear Rotation signal cable (Model MX-8105, 5m)

\*The change of voltage: Available as an option.



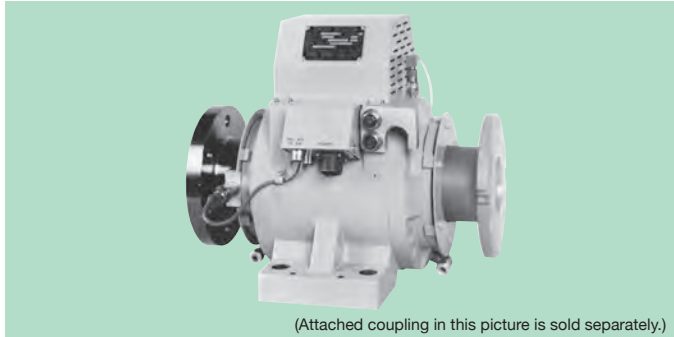
### Dimensions

DSTP	A	B	C	D	E	F	øG	H	I	J	K	L	øM	N <sup>ø</sup>	O	Weight (kg)
500	640	320	250	370	310	390	85 <sup>h6</sup>	120	100	125 <sup>0 -0.5</sup>	125	40	27	25	9 <sup>+0.2 0</sup>	120
1000	700	320	250	370	310	390	110 <sup>h6</sup>	140	100	125 <sup>0 -0.5</sup>	125	40	27	28	10 <sup>+0.2 0</sup>	140
2000	900	360	280	520	450	540	140 <sup>h6</sup>	220	120	200 <sup>0 -0.5</sup>	150	55	33	36	12 <sup>+0.3 0</sup>	330
5000	1100	360	280	520	450	540	170 <sup>h6</sup>	300	120	200 <sup>0 -0.5</sup>	150	55	33	45	15 <sup>+0.3 0</sup>	450
10000	1500	490	400	700	620	748	220 <sup>h6</sup>	330	160	280 <sup>0 -1</sup>	200	90	45	50	17 <sup>+0.3 0</sup>	1500

\*When the rotation detecting gear (option) is mounted, the dimensions of "H" is different from the above table. Please check it when ordering.

# DD Series: Torque Detectors for Rotating and Stationary Shafts

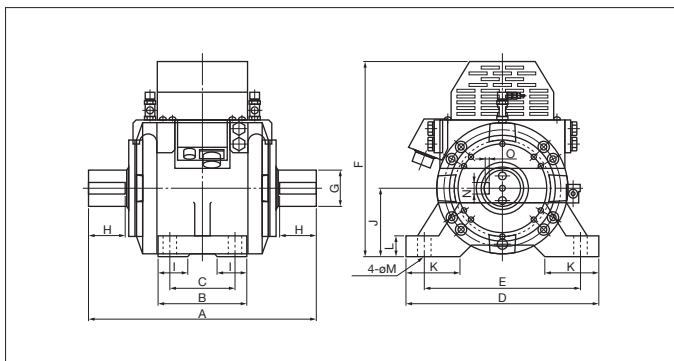
## Heavy Duty Type with Double Bearings to Withstand Thrust and Radial Loads Fluctuation



The DD Series is high performance of SS Series, which can measure the larger capacity torque at higher speed. Model DD-505 to DD-108 are mostly suitable for the torque measurement with heavy load. The double bearings provide three to five times the strength of the DSTP Series under radial and thrust load. Further, it can be connected directly with propeller shaft which does not need the intermediate coupling and save space as well. Oil drop lubrication unit is required.

### Notes:

- (1) Radial loads are recovery forces caused by eccentricity and miscentering of the coupling when the shaft rotates. The load specifications are limit values. Loads of these values would affect vibration performance and service life.
- (2) Please consult us for details if the optional high speed revolution range as above table is required.
- (3) Interference-fit coupling is recommended.
- (4) Please consult us concerning the weight of the coupling.
- (5) A rotation detector can not be attached with the main body of DD Series detector. If it is required to measure the revolution, please consult us for details.
- (6) Spindle oil (ISO VG22) should be used for lubrication at a rate of 20 to 30 drops per minute.
- (7) Grease lubrication type is also manufactured depending on the specification. Please consult us for details.



### Dimensions

DD	A	B	C	D	E	F	øG	H	I	J <sub>-0.5</sub>	K	L	øM	N <sup>ø9</sup>	O	Weight (kg)
503, 104, 204	185	75	50	180	150	215	8 <sup>h5</sup>	16	-	65	60	20	12	-	-	20
504	185	75	50	180	150	215	8 <sup>h5</sup>	16	-	65	60	20	12	3	1.8 <sup>+0.1 0</sup>	20
105, 205	230	100	70	200	170	240	14 <sup>h5</sup>	20	-	80	60	20	12	5	3 <sup>+0.1 0</sup>	25
505, 106, 206	320	125	90	240	200	280	36 <sup>js6</sup>	40	-	85	80	30	19	10	5 <sup>+0.2 0</sup>	40
1506B, 1107B, 1207B	380	135	90	280	240	318	60 <sup>js6</sup>	65	-	95	90	30	23	18	7 <sup>+0.2 0</sup>	53
507	600	230	180	410	345	420	85 <sup>js6</sup>	105	80	150	105	40	26	25	9 <sup>+0.2 0</sup>	180
108	680	230	180	410	345	420	110 <sup>js6</sup>	130	80	150	105	40	26	28	10 <sup>+0.2 0</sup>	210

\*Please refer to page 11 for the key dimensions.

Model DD	Measurement range (N·m)	Minimum resolution (mN·m)	Standard revolution range (r/min)	Optional high speed revolution range (r/min)	Inertia moment (kgm <sup>2</sup> )	Spring constant (N·m/rad)	Load value	
							radial (N)	Thrust (N)
503	0.5	0.1	0 to 20,000	0 to 30,000	1.00 x 10 <sup>-5</sup>	3.82 x 10	-	-
104	1	1	0 to 20,000	0 to 30,000	1.00 x 10 <sup>-5</sup>	7.26 x 10	-	-
204	2	1	0 to 20,000	0 to 30,000	1.00 x 10 <sup>-5</sup>	1.32 x 10 <sup>2</sup>	-	-
504	5	1	0 to 20,000	0 to 30,000	1.00 x 10 <sup>-5</sup>	2.62 x 10 <sup>2</sup>	-	-
105	10	10	0 to 20,000	0 to 30,000	5.93 x 10 <sup>-5</sup>	6.18 x 10 <sup>2</sup>	-	-
205	20	10	0 to 20,000	0 to 30,000	5.95 x 10 <sup>-5</sup>	1.11 x 10 <sup>3</sup>	-	-
505	50	10	0 to 10,000	0 to 13,000	1.5 x 10 <sup>-3</sup>	3.63 x 10 <sup>3</sup>	300	1500
106	100	100	0 to 10,000	0 to 13,000	1.5 x 10 <sup>-3</sup>	7.06 x 10 <sup>3</sup>	300	1500
206	200	100	0 to 10,000	0 to 13,000	1.5 x 10 <sup>-3</sup>	1.37 x 10 <sup>4</sup>	300	1500
1506B	500	100	0 to 8000	0 to 10,000	8.6 x 10 <sup>-3</sup>	5.30 x 10 <sup>4</sup>	400	2000
1107B	1000	1000	0 to 8000	0 to 10,000	8.6 x 10 <sup>-3</sup>	9.90 x 10 <sup>4</sup>	400	2000
1207B	2000	1000	0 to 8000	0 to 10,000	8.7 x 10 <sup>-3</sup>	1.77 x 10 <sup>5</sup>	400	2000
507	5000	1000	0 to 6000	0 to 6000	4.8 x 10 <sup>-2</sup>	5.36 x 10 <sup>5</sup>	600	2000
108	10,000	10,000	0 to 4000	0 to 4000	1.43 x 10 <sup>-1</sup>	1.23 x 10 <sup>6</sup>	800	2000

Remarks

- Drip-feed lubrication system is standard at DD Series.
- The above revolution speed ranges are the values for the detector alone, and vary depending on the load balance of the coupling connected to the shaft ends and the mounting method of the coupling.

### Specification

- Accuracy : ±0.2%/F.S.  
(when combined with model TS-2800/TS-3200A on N-0 compensation.)
- Temperature effect on : +0.03%/F.S./°C  
the sensitivity
- Operating temperature : 0 to +50°C  
Storage temperature : -20 to +60°C  
Operating humidity : 85% maximum  
Vibration resistance : Within 50m/s<sup>2</sup>  
Applicable connector : TRC116-12A10-7M10.5  
Power requirement : 200VAC\*, 50/60Hz, 3-phase  
Accessory : Torque signal cable (5 m)  
Power cable (5 m)  
Instruction manual  
Test certificate
- Option (sold separately) : Drip-feed lubrication unit (DD-0101, DD-0102)  
Rotation detector  
Main shaft bearing temperature alarm unit  
(Available from DD-505 to 108)

\*The change of voltage: Available as an option.

# Torque Detector Shaft End and Attached Motor Specification

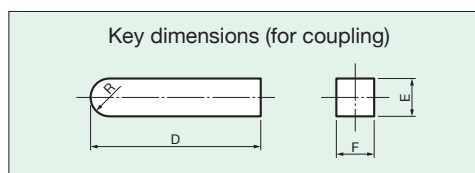
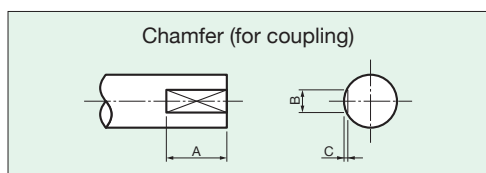
## Phase difference method using electromagnetic induction theory

Model name		Chamfer			Key dimensions				
		A	B	C	D	E <sub>h9</sub>	F	R	
TH-1000	1204, 1504	17	4	0.5					
	1105, 1205				25	5	5 <sup>0</sup> <sub>-0.03</sub>	2.5	
	1505, 1106				40	8	7 <sup>0</sup> <sub>-0.09</sub>	4	
	1206, 1506				65	10	8 <sup>0</sup> <sub>-0.09</sub>	5	
TH-2000	2204, 2504	17	4	0.5					
	2105, 2205				25	5	5 <sup>0</sup> <sub>-0.03</sub>	2.5	
TH-3000	3502, 3502H	10	3	0.5					
	3103, 3013H								
	3203, 3203H								

## Phase difference method using gears

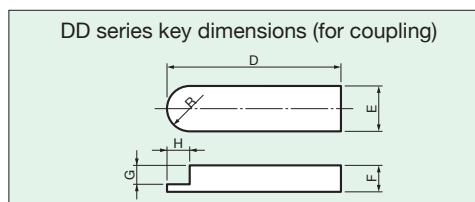
Model name		Chamfer			Key dimensions				Attached motor specification		
		A	B	C	D	E <sub>h9</sub>	F	R	Power requirement*1	No. of poles	Consumption power (VA)
MD	201C to 202C	Without chamfer			No using of key				100/VAC	Single-phase 2 poles	10
	502C to 203C	10	3	0.5							
	503C to 204C	15	4	0.5							
SS	002, 005, 010, 020, 050	17	4	0.5					100/VAC	Single-phase 4 poles	35
	100, 200				25	5	5 <sup>0</sup> <sub>-0.03</sub>	2.5			
	500, 101				40	8	7 <sup>0</sup> <sub>-0.09</sub>	4			
	201, 501				65	10	8 <sup>0</sup> <sub>-0.09</sub>	5			
DSTP	102, 202				105	16	10 <sup>0</sup> <sub>-0.09</sub>	8	200VAC	3-phase 4 poles	120
	500				118	25	14 <sup>0</sup> <sub>-0.11</sub>	12.5			
	1000				137	28	16 <sup>0</sup> <sub>-0.11</sub>	14			
	2000				215	36	20 <sup>0</sup> <sub>-0.13</sub>	18			
	5000				294	45	25 <sup>0</sup> <sub>-0.13</sub>	22.5			
DD	10000				355	50	28 <sup>0</sup> <sub>-0.13</sub>	25	200VAC	3-phase 4 poles	460
	*2 503, 104, 204	15	4	0.5							
	504				15	3	3 <sup>0</sup> <sub>-0.025</sub>	1.5			
	105, 205				22.5	5	5 <sup>0</sup> <sub>-0.03</sub>	2.5			
	505, 106, 206				39	10	8 <sup>0</sup> <sub>-0.09</sub>	5			
	1506B, 1107B, 1207B				70	18	11 <sup>0</sup> <sub>-0.11</sub>	9			
	507				113	25	14 <sup>0</sup> <sub>-0.11</sub>	12.5			
108				137	28	16 <sup>0</sup> <sub>-0.11</sub>	14				

\*1 The change of voltage: Available as an option.



\*2

Model name	Key dimensions	
	G	H
504	—	—
105, 205	2.5	2.5
505, 106, 206	—	—
1506B, 1107B, 1207B	7	7
507	7	9
108	9	8



# Digital Torque Meter **TS-2800**

*Compact and space-saving design with high accuracy and high response for all of phase difference type torque detectors by Ono Sokki*



The TS-2800 performs calculation, display and output of torque and revolution speed by using signals from torque detector and rotation detector.

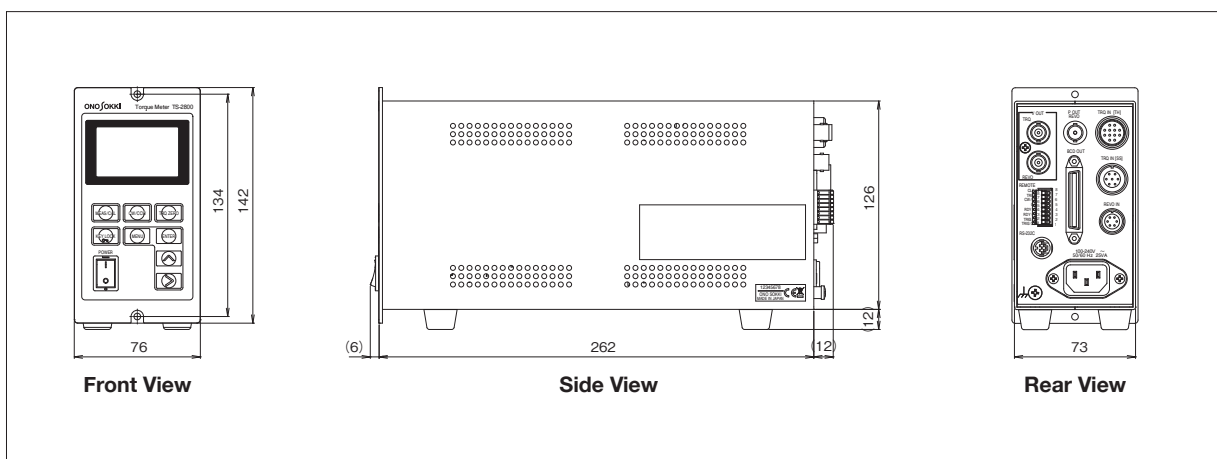
Can be used with our long-selling torque detectors MD/SS/DD/DSTP series (Phase difference method using gears) and TH series (Phase difference method using electromagnetic induction theory).

### Notes:

- (1) The exclusive power cable (sold separately) is required when the TS-2800 is used on the voltage over 125V. (The withstand voltage of the cable provided as standard:125V)
- (2) Set up the time constant value of the analog output 63 ms or more when the TS-2800 is used with MD, SS series detectors.
- (3) Please connect either one of SS type or TH type torque detector.

### Option:

- **TS-0281** High-speed response output function for TH series:
  - Adds three more selections of the response setup (0.8ms, 0.4ms or 0.16ms)
  - Adds low-pass filter function (option only for the TH series)
- **TS-0282** Time constant change function for DD series:
  - Replace the response setup to 63ms/16ms. (option only for the DD series)
- **TS-0283** BCD output function:
  - Output digital data every second
- **TS-0284** Rotation pulse output function:
  - Synchronously output 0-5V signal after waveform-shaping from a rotation detector



## Specification

### ■ Applicable detector

Torque detector  
 : TH type (Phase difference method using electromagnetic induction theory: TH series)  
 SS type (Phase difference method using gears: MD,SS, DD, DSTP Series)

### Rotation detector

: Magneto-electric rotation detector (MP-981/9820)  
 Optical rotation detector (MD-0100series)

### ■ Display

Display : LCD  
 Display contents : torque, revolution speed  
 Condition display : Sensor mode, measurement ready, torque signal input, revolution signal input, revolution direction, analog output scale setting value  
 Display update interval : Measurement value; 1s/10s/external Condition display; 0.5s

### ■ Torque measurement

Number of display digits (with polarity)  
 : TH type: 4/5-digit selectable  
 Other than TH type: 4-digit

Measurement unit : mN·m, N·m, kN·m

Measurement accuracy :  $\pm 0.1\%$  /F.S. or  $\pm 0.2\%$  /F.S. (depending on the accuracy of detector connected)

Compensation range of torque factor : 0.8000 to 1.2000

N-0 compensation : 5 points for each direction of CW/CCW

### Other functions

: Zero setting, analog output calibration

### ■ Torque analog output

Output : Voltage (Signal commons of torque output and revolution speed output are isolated from main circuit of TS-2800. However, both commons are connected each other.)

Output voltage : 0 to  $\pm 10\text{V}$  / F.S.

Voltage selection : Selectable from 2V, 2.5V, 3.33V, 5V, 6.67V, 10V

### Time constant

: TH type; 500ms, 63ms, 16ms, 1.6ms (standard)  
 0.8ms, 0.4ms, 0.16ms (added optionally)  
 SS type; 500ms and 63ms (standard)  
 63ms and 16ms (selectable either one of the pair optionally)

### Low pass filter

: Available only TH type: 50Hz, 100Hz, 500Hz, 1kHz, 5kHz (added optionally)

### Output accuracy

:  $\pm 0.1\%$  /F.S. or  $\pm 0.2\%$  /F.S. (depending on the accuracy of detector connected)

### Applicable connector

: C02 type (BNC) plug

### ■ Revolution speed measurement

Number of display digits : 5-digit (0 to 99,999 r/min)

Measurement accuracy :  $\pm 0.02\%$  /F.S.  $\pm 1$  count (10 Hz or more, 1-s average)

F.S. range : 200 to 100,000 r/min  
 Pulsation range of rotation detector : 1 to 9999 P/R

### Other function

: Analog output calibration

### Applicable connector

: R03-PB6M

### ■ Revolution speed analog output

Output : Voltage (Signal commons of torque output and revolution speed output are isolated from main circuit of TS-2800. However, both commons are connected each other.)

Output voltage : 0 to  $\pm 10\text{V}$  / F.S.

Time constant : TH type; 0.16 ms

SS type; 63 ms

### Output accuracy

:  $\pm 0.1\%$  /F.S.

### Applicable connector

: C02 type (BNC) plug

### ■ Revolution pulse output (added optionally)

#### Number of output pulses

: Same as the input pulse

Output level : Lo;  $+0.5\text{V}$  or less, Hi;  $\pm 5\pm 0.5\text{V}$

#### Applicable connector

: C02 type (BNC) plug

### ■ Remote function

Input signal : CW/CCW changeover, display/output clear, display/BCD trigger

#### Output signal

: Trigger output (synchronous updating), measurement ready

#### Signal format

: See page 15

#### Applicable connector

: FK-MC0.5/8-ST-2.5 (Made by Phoenix Contact) provided as standard

### ■ RS-232C

Function : Readout of measurement value and setting condition, setting of zero value, N-0 value, readout of other functions

Baud rate : 9600 bps (fixed)

Applicable cable : AX-5022 (2m) with D-sub 9-pins one of the cable ends

### ■ BCD output (added optionally)

Function : Output of torque/revolution speed

#### Output update

: Every display update time

#### Signal format

: See [BCD Pin assignment] on this page

#### Applicable connector

: DX40-50P or DX30-50P (Made by HIROSE)

### ■ General specification

Power supply voltage : AC 100 to 240 V, 50/60 Hz

Power consumption : 28 VA

Operating temperature range : 0 to  $+40\text{ }^\circ\text{C}$

Weight : Approx. 2 kg

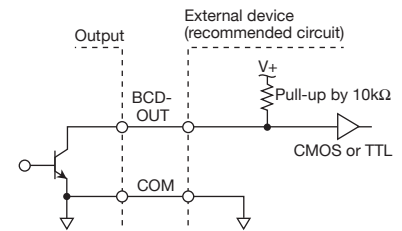
Conforming standard : CE marking, Low Voltage Directive, EMC directive

### Accessory

: Remote terminal connector  
 Rubber foot x 4  
 Power cable (1.9 m)  
 Instruction manual

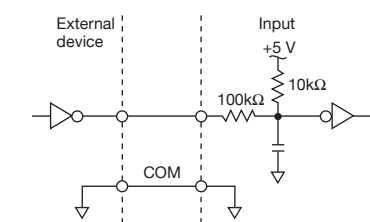
### ■ Recommended Interface for BCD

#### ① BCD output, polarity output, print command output



Output format	Open collector
IC	74LS07
Withstand voltage	24 V max.
Sink current	32mA max.
Remained voltage	0.6 V max.

#### ② Hold input, busy input



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

### ■ BCD Pin Assignments

Pin No.	Signal name	Pin No.	Signal name
1	Data output (torque) $1 \times 10^0$	26	Data output (revolution) $2 \times 10^1$
2	$2 \times 10^0$	27	$4 \times 10^1$
3	$4 \times 10^0$	28	$8 \times 10^1$
4	$8 \times 10^0$	29	$1 \times 10^2$
5	$1 \times 10^1$	30	$2 \times 10^2$
6	$2 \times 10^1$	31	$4 \times 10^2$
7	$4 \times 10^1$	32	$8 \times 10^2$
8	$8 \times 10^1$	33	$1 \times 10^3$
9	$1 \times 10^2$	34	$2 \times 10^3$
10	$2 \times 10^2$	35	$4 \times 10^3$
11	$4 \times 10^2$	36	$8 \times 10^3$
12	$8 \times 10^2$	37	$1 \times 10^4$
13	$1 \times 10^3$	38	$2 \times 10^4$
14	$2 \times 10^3$	39	$4 \times 10^4$
15	$4 \times 10^3$	40	$8 \times 10^4$
16	$8 \times 10^3$	41	N.C. (not connected)
17	$1 \times 10^4$	42	Torque polarity output "-"
18	$2 \times 10^4$	43	Torque polarity output "+"
19	$4 \times 10^4$	44	N.C. (not connected)
20	$8 \times 10^4$	45	N.C. (not connected)
21	Data output (revolution) $1 \times 10^0$	46	N.C. (not connected)
22	$2 \times 10^0$	47	Hold input
23	$4 \times 10^0$	48	Busy input
24	$8 \times 10^0$	49	Print command output
25	$1 \times 10^1$	50	Common

### ■ RS-232C Pin Assignments

Pin No.	Signal name	Pin No.	Signal name
1	-	5	RST (Transmission request)
2	RxD (Data reception)	6	-
3	TxD (Data transmission)	7	SG (Signal ground)
4	CTS (Clear to transmission)	8	-



# Digital Torque Meter with Arithmetic Operation Display **TS-3200A**

*Advanced Model with an Easy-to-use LCD and a Range of Optional Interfaces to Utilize the Full Potential of High-accurate Digital Data*



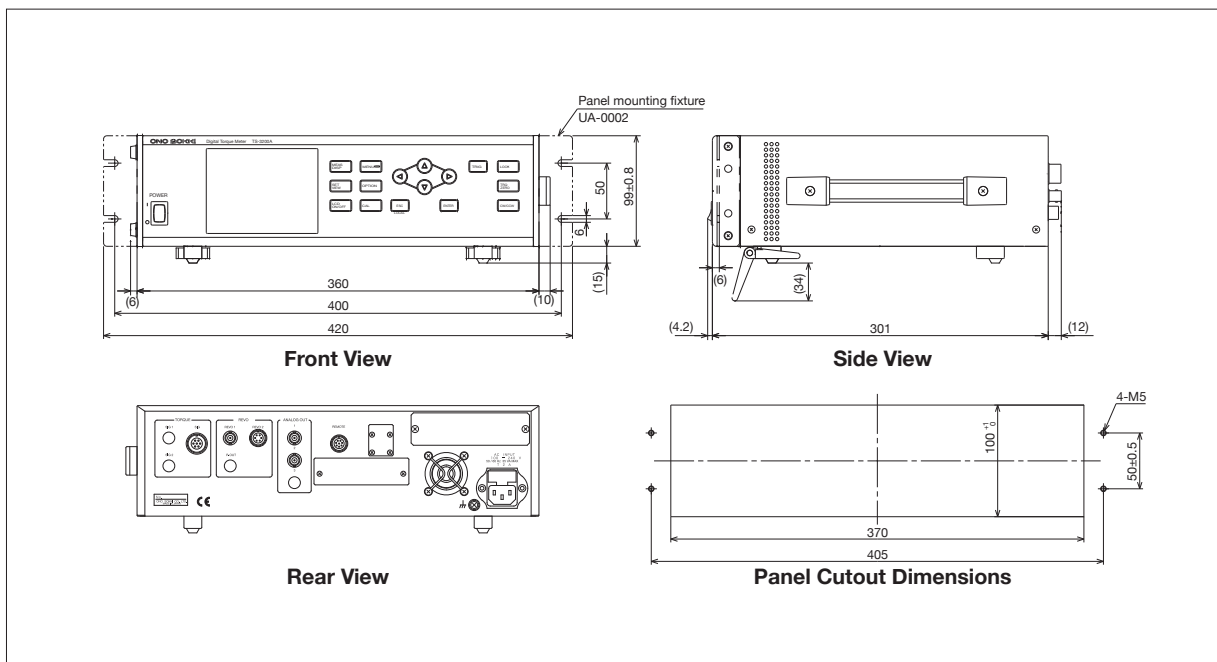
The TS-3200A uses an LCD display for setting measurement condition and displaying the measurement data. Settings are easy to make, and different numerical display formats can be selected to suit various applications. Ten torque detection settings can be stored in memory, which is a very convenient function when you have several torque detectors.

### Notes:

- (1) The exclusive power cable (sold separately) is required when the TS-3200A is used on the voltage over 125V. (The withstand voltage of the cable provided as standard: 125V)
- (2) Set up the time constant value of the analog output 63 ms or more when the TS-2800 is used with MD, SS Series detectors.

### Option:

- **TS-0321A** Analog output high-speed response (1ms)
- **TS-0322A** Comparator output
- **TS-0323** BCD output
- **TS-0325** RS-232C Interface
- **TS-0326** GPIB Interface
- **TS-0327** Rotation pulse output
- **TS-0328** Analog output 1ch addition



## Specification

### Torque Measurement Section

#### Input Section

Input signal : Signal detected by Phase-difference type detectors of Ono Sokki

Applicable connector : TRC-116-12A10-7M10.5

#### Setting Section

Unit : mN·m, N·m, kN·m

Zero compensation : 1 point each for CW and CCW; manual and automatic

N-0 compensation : 10 points each for CW and CCW; manual and automatic

#### Display Section

Number of digits displayed : Polarity indication + 4-digit, Polarity indication + 5-digit, selectable

Display update interval : 1 to 10s (in 1-s increments), or external input signal

Accuracy : With N-0 compensation; (1-s average)  $\pm 0.2\%/F.S. \pm 1$  count

Measurement item : MAX, MIN, P-P and RIPPLE factor

### Revolution Measurement Section

#### Input Section

1. REVO1.....For sinewave input signal detected by an electromagnetic rotation detector such as Ono Sokki's MP-9100

Input frequency range : 10Hz to 100kHz

Applicable connector : C02 type (BNC) plug

2. REVO2.....For squarewave input signal detected an magneto-electric rotation detector such as Ono Sokki's MP-981/MP-9820

Input frequency range : 1Hz to 200kHz

Applicable connector : R03-PB6M

#### Setting Section

Unit : r/min, r/s, Hz

Number of pulses : 1 to 99999 P/R

Gear ratio :  $\pm 1$  to 9999/1 to 9999 (Display is possible of the revolution prior to the speed change.)

Offset :  $\pm 1$  to 9999 (Only when the unit is r/min.)  
Measured value = actual - offset

#### Display Section

Number of display digits : 5-digit

Display resolution : 0.001, 0.01, 0.1, 1, selectable from the capacity (full scale) setting

Display update interval : Same as the torque section

Accuracy :  $\pm 0.05\%/F.S.$  (1-s average)

### Output (Power) Processing Section

#### Processing Method

Output (W) = torque (N·m) x revolution (r/min) x  $2\pi/60$   
Output (PS) = 0.7355kW

#### Display Section

Number of display digits : Polarity indication + 5-digit

Unit : mW, W, kW, PS

Accuracy : Torque display accuracy plus revolution speed display accuracy

### Interface Section

Only either one of the TS-0325 or TS-0326 can be installed.

#### Analog output

Analog output format

: Voltage output

Number of output

: 2ch (standard)

One analog output channel is added by the TS-0328 (sold separately)

Output item : Selectable from torque, revolution speed or output (POWER)

Time constant: 16 ms to 64s

Scale : Voltage of the full scale can be set from 0.1V to 10V in 0.1V steps.

Accuracy : Torque;  $\pm 0.2\%/F.S.$  (at N-0 (Average value compensation)

of one second) Revolution;  $\pm 0.1\%/F.S.$

Output (POWER); Torque output accuracy + revolution speed output accuracy

Applicable connector : C02 type (BNC) plug

#### TS-0321A Analog output high-speed response (sold separately)

Analog voltage output up to 1 ms can be added by this optional function.

Channel : 2ch

Output : Output from terminal of analog voltage output

Restriction : No comparator output  
Fixed analog output time constant.  
SS and MD Series torque detectors cannot be used with.

#### Remote function

Input signal : CW/CCW, clear input, trigger input.  
Non-voltage contact or voltage (Hi +4 to 5.25V, Lo 0 to +1V)

Output signal : Trigger output, ready output, PhotoMOS relay (max. load: DC30 V, 0.1 A)

Applicable connector : R03-PB8M (provided as standard)

#### TS-0322A Comparator output (sold separately)

Channels : 4ch

Item : Upper or lower level limit setting of the torque, revolution speed, and output (Power)

Output update : At the specified interval (0.004 to 10s, External)

Reference comparison : Average value at each specified time

Output format : PhotoMOS relay (max. load: DC30 V, 0.1 A)

Applicable connector : RM12BPG-6S (provided as standard)

#### TS-0323 BCD output (sold separately)

Channels : 2ch

Item : Two items selectable from torque, revolution speed, and output (Power)

Output update : At each gate time set (0.1 to 10s, External) or at each sampling interval

Output format : Positive logic open collector output

Applicable connector : 57-30500 Amphenol full pitch, 50-pin

#### TS-0325 RS-232C (sold separately)

Standard : Conforms to EIA and JISX5101

Baud rate (bps) : 1200, 2400, 4800, 9600, 19200

Applicable connector : D-sub 9-pin, female

#### TS-0326 GPIB (sold separately)

Electrical and mechanical specification : Conform to IEEE 488-1978

#### TS-0327 Rotation pulse output (sold separately)

Channel : 1ch

Number of output pulse : Same as number of input pulse

Output format : TTL level

Applicable connector : C02 type (BNC) plug

### General Specification

Power supply voltage : 100 to 240VAC  $\pm 10\%$ , 50/60Hz

Power consumption : 75VA max.

Operating temperature range : 0 to +40°C

Storage temperature range : -10 to +55°C

Weight : Approx. 5kg

Accessory : Instruction manual  
Power cable (1.9 m)  
Applicable connector for remote control

### Option (sold separately)

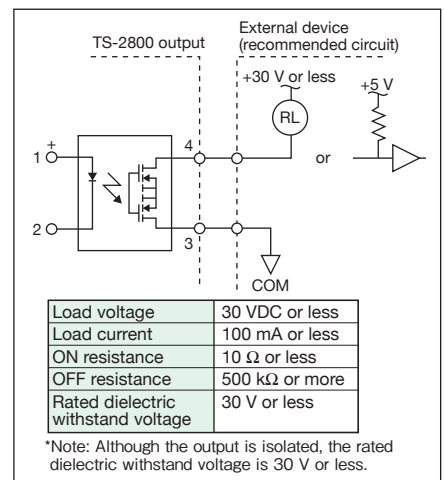
#### Panel mounting fixture

UA-0001 For 480-mm width racks  
UA-0002 For mounting in a panel cutout of the same width as the TS-3200A

### Pin Assignments of Remote Function TS-2800/3200A

TS-2800	TS-3200A	Signal name	Remarks
8	A	CLR IN	Contact input (Common is common.)
7	B	TRIG IN	
6	C	CW/CCW Switch	
5	D	GND	No-voltage contact output (Common is separate.)
4	E	READY OUT	
3	F	READY OUT COM-1	
2	G	TRIG OUT	
1	H	TRIG OUT COM-2	

### Recommended Interface for remote function

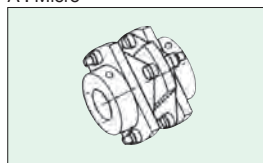


# Recommended Couplings for Torque Detection

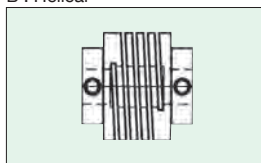
	Micro	Helical	NSO Diaphragm	Form-flex
Recommended torque detector	SS-002 to SS-100	Low-capacity models	High-capacity models	SS-200 to SS-202
Maximum revolution	20,000r/min / 10N-m	25,000r/min / 2.5N-m	23,000r/min / 1,090N-m	19,000r/min / 1,300N-m
Transmitted torque capacity	10N-m max.	2.5N-m max.	200 to 38,140N-m	20 to 181,500N-m
Features	<ol style="list-style-type: none"> <li>1. No backlash</li> <li>2. Large torsional rigidity</li> <li>3. Non-magnetic material</li> <li>4. Easy maintenance</li> <li>5. Eccentric, angle of deviation absorption</li> <li>6. Low inertia moment</li> <li>7. Water-resistant, chemical-resistant, oil-resistant</li> </ol>	<ol style="list-style-type: none"> <li>1. No backlash</li> <li>2. Small-format, lightweight</li> <li>3. Ideal for use with micro precision devices</li> <li>4. Easy maintenance</li> <li>5. Eccentric, angle of deviation absorption</li> <li>6. Low inertia moment</li> <li>7. Duralmin material (non-magnetic material) and stainless, two types</li> </ol>	<ol style="list-style-type: none"> <li>1. No backlash</li> <li>2. Large torsional rigidity</li> <li>3. Large allowable eccentric, angle of deviation tolerance</li> <li>4. Lightweight, easy attachment and removal</li> <li>5. High-speed revolution enabled</li> <li>6. Easy maintenance</li> <li>7. Water-resistant, chemical-resistant, oil-resistant</li> <li>8. Fail-safe structure</li> </ol>	<ol style="list-style-type: none"> <li>1. No backlash</li> <li>2. Large torsional rigidity</li> <li>3. Large allowable eccentric, angle of deviation tolerance</li> <li>4. Lightweight, easy attachment and removal</li> <li>5. High-speed revolution enabled</li> <li>6. Easy maintenance</li> <li>7. Water-resistant, chemical-resistant, oil-resistant</li> <li>8. Fail-safe structure</li> </ol>
Weight	280 (g) (At 10N-m transmitted torque)	38 (g) (Duralmin) (At 2.3N-m transmitted torque)	4 (kg) (At 200N-m transmitted torque)	3.7 (kg) (At 250N-m transmitted torque)
Usage methods	<ol style="list-style-type: none"> <li>1. Extend the cores of the torque detector and the target measurement object shafts, and then attach the flanges, plate springs and spacers.</li> <li>2. Move the devices in the axial direction to attach and remove the couplings.</li> <li>3. Eccentricity and angle deviation are exceedingly small at high revolutions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Extend the cores of both shafts, and then move the devices in the axial direction to connect the couplings to the shafts.</li> <li>2. Move the devices in the axial direction to attach and remove the couplings.</li> <li>3. At 25,000r/min, Core extension 0.1mm max. Angle of deviation 0.5° max.</li> </ol>	<ol style="list-style-type: none"> <li>1. Attach flanges to both devices, extend the cores, and then insert the flexible units.</li> <li>2. The couplings can be attached or removed without any need to move the devices in the axial direction.</li> </ol>	<ol style="list-style-type: none"> <li>1. Attach hubs to both devices, extend the cores, and then insert the element spacers.</li> <li>2. The couplings can be attached or removed without any need to move the devices in the axial direction.</li> </ol>
Operating temperature range	-30 to +100°C	-40 to +150°C	-100 to +320°C 120 to 150°C (heating temperature for heat shrinking)	-30 to +100°C 90 to 120°C (heating temperature for heat shrinking)
Applicable torque	10N-m max.	2N-m max.	200 to 30,000N-m	34 to 100,000N-m
Configuration (see diagrams below)	A	B	C	D

## ■ Coupling Figure

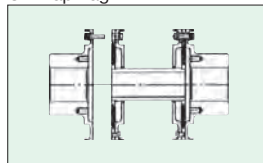
A : Micro



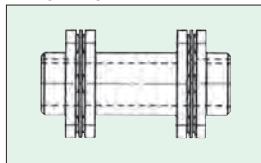
B : Helical



C : Diaphragm

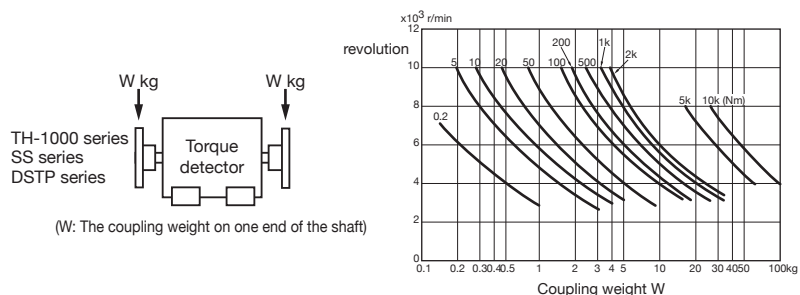


D : Form-flex



## ■ Revolution and Coupling Weight

The weight of the coupling that can be attached to the torque detector is determined by the maximum revolution used. Please refer to the following chart for details.



## ■ Alignment

Allowable alignment should be less than 0.05mm (depending on the revolution). No abnormal noise or vibration should not be caused.

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