

UTMIII ROTATING TORQUE METER

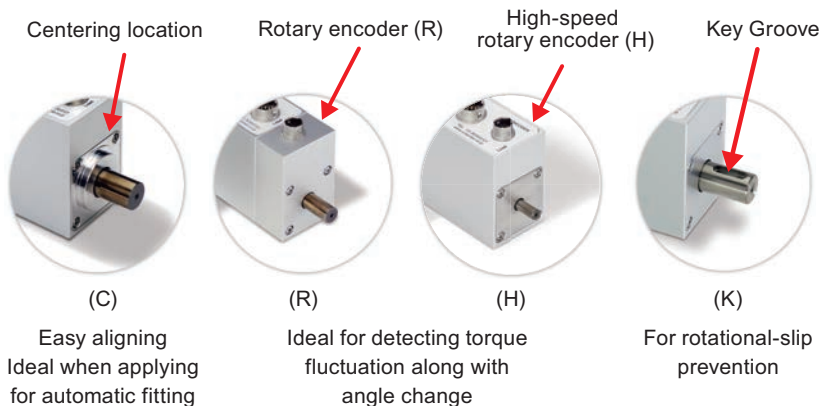


RoHS2

Added 5kHz high-speed response & noise-insensitive digital output!

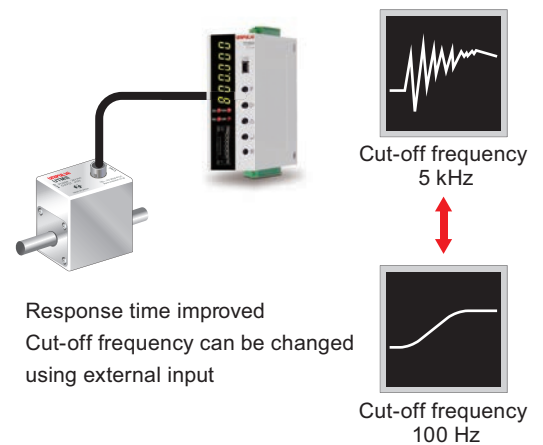
- Compared to UTM II, disturbances on accuracy by radial and thrust loads and during high-speed rotation were dramatically reduced
- Maximum rotational speed 40000 rpm ^{*1}
- Available in 17 different capacities ranging from 0.05 to 10000 N m
- Analog bandwidth 5 kHz with high-speed sampling rate of 20 kHz
- Safe overload of 500%
- ± 10 V of analog output Full Scale
- Digital output via RS-485
- The shaft can be changed to a hollow shaft.(0.5 to 10 N m)
- No need to exchange torque meter! Range-switching method capable of measuring two capacities(option)
 - 2 N m $\leftrightarrow$ 0.1 N m • 10 N m $\leftrightarrow$ 0.5 N m
 - 5 N m $\leftrightarrow$ 0.25 N m
- Digital zero function via external signal
- Equipped with pulse output for rotation detection (4 pulses per 1 rotation)

Abundant options available

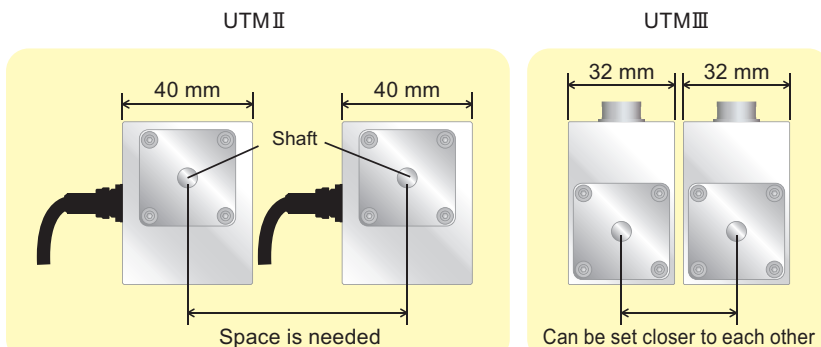


* Please check P.9 for details on centering location (C), P.8 for details on rotary encoder (R)(H) and key groove (K).

Frequency bandwidth of 5 kHz, variable filter



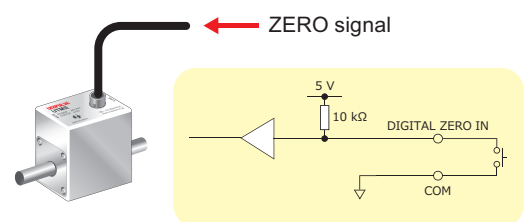
More compact for side-by-side measurement



* Dimensions above are for 0.05 to 2 N m capacity type.

Slimmed down body and repositioned connector allow shafts to be setup closer from each other.

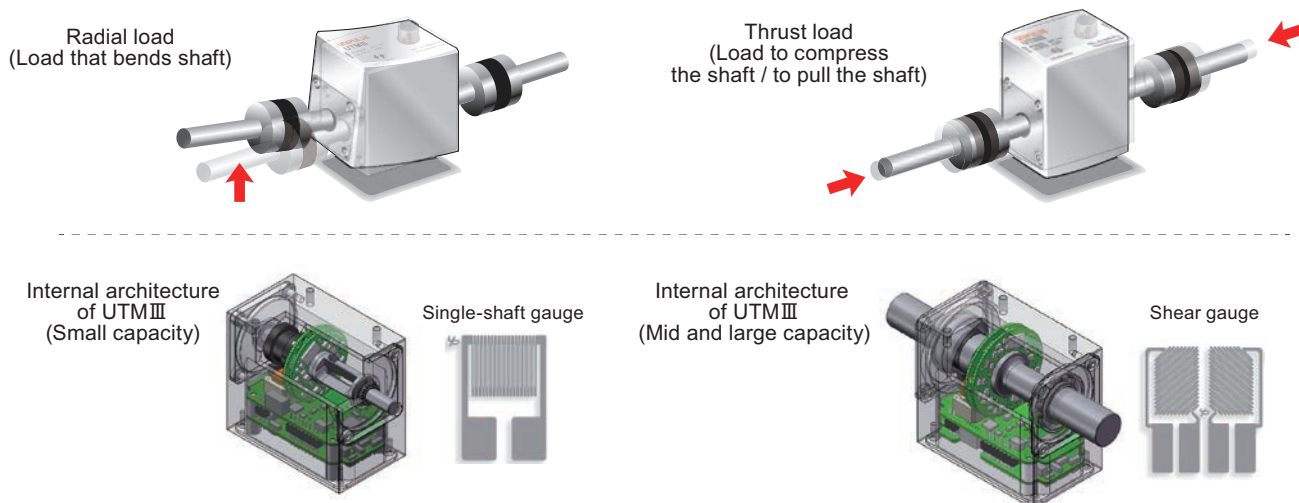
Added zero correction function with external signal



Shifted output due to setup conditions can be set to zero with external signal.

Increased resistance to radial & thrust load

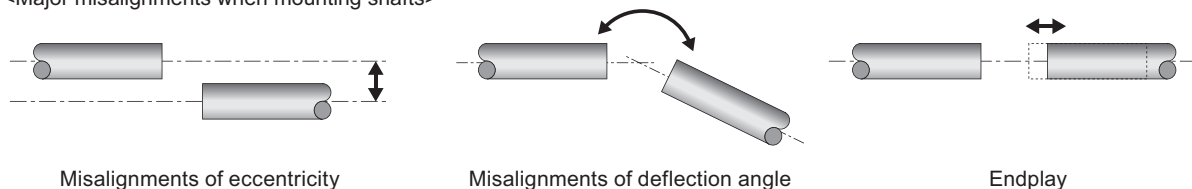
Influences that radial and thrust loads exert on effective accuracy were dramatically reduced.



■ Why is load other than torque applied at torque meter?

For torque measurement, when interlocking shafts, misalignments on shaft center as illustrated below occur by all means. The devices that absorb radial and thrust loads caused by such misalignments are couplings. However, even the couplings cannot completely absorb such radial and thrust loads, resulting in an impact on torque measurement.

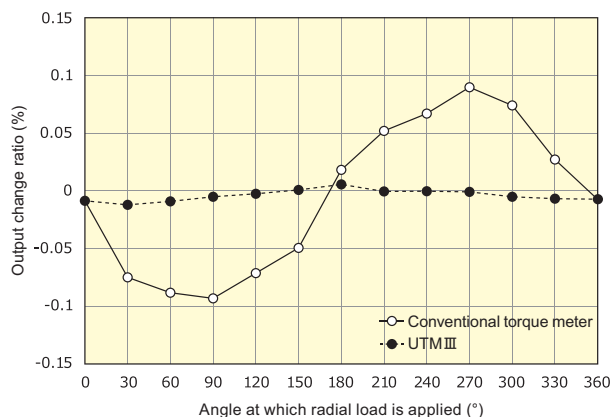
<Major misalignments when mounting shafts>



■ Experimental data

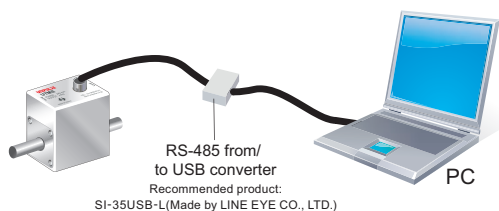
The right figure shows the change in output when one shaft end of a torque meter with a rated torque of 2 N·m is fixed and a 7 N radial load is applied to the other shaft end via a bearing. Output changes depending on rotation angle. While output value changes 0.1% at maximum with conventional torque meter, output value changes less than 0.01% with UTMIII.

The table on P.7 standardizes the allowable shaft end load. UTMIII releases your concern about accuracy due to misalignment.



Digital output via RS-485

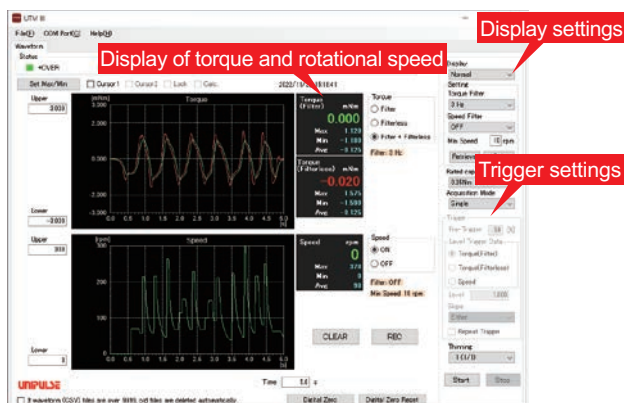
Enable to retrieve the digital signal to PC.



■ Application software for RS-485

Two type torque waveforms, before and after the filter are displayed, allowing you to check whether the filter settings are appropriate.

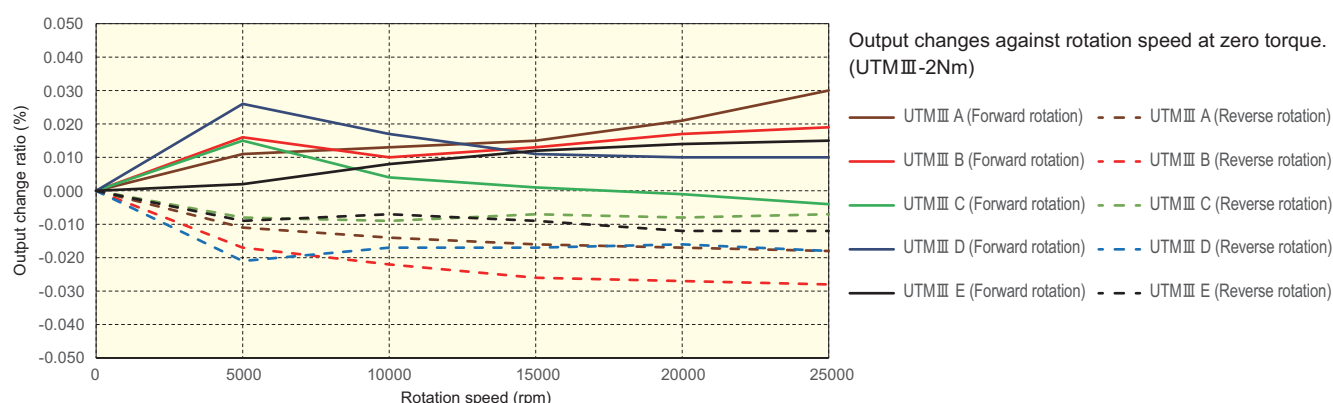
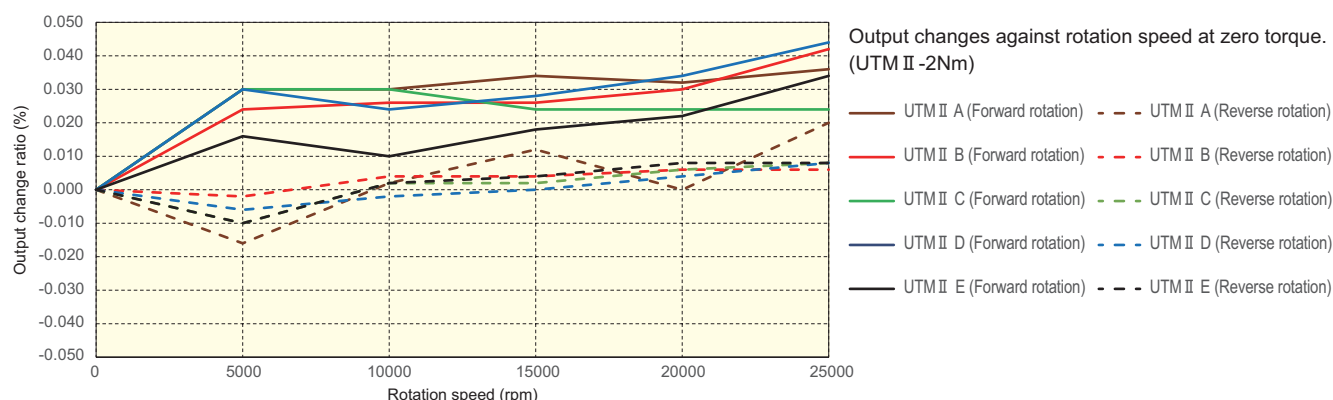
- Display waveforms of torque and rotational speed
- Waveform can be saved in CSV format
- Data of time, torque, and rotational speed can be saved.



Application software can be downloaded from our official website. The dedicated software can be run multiply, and it is possible to connect multiple UTMIII's with one PC.

At high rotation speeds, the output of a rotating torque meter changes due to the rolling friction of the load-side bearing and the centrifugal force.

The figures below show the output changes against the rotation speed for the five sets of UTMII-2Nm (Upper) and UTMIII-2Nm (Lower).



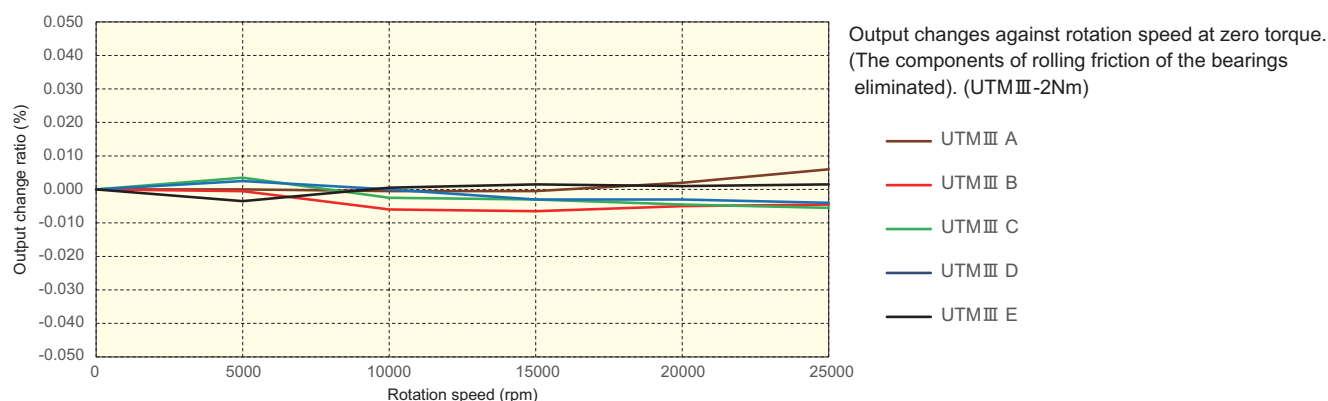
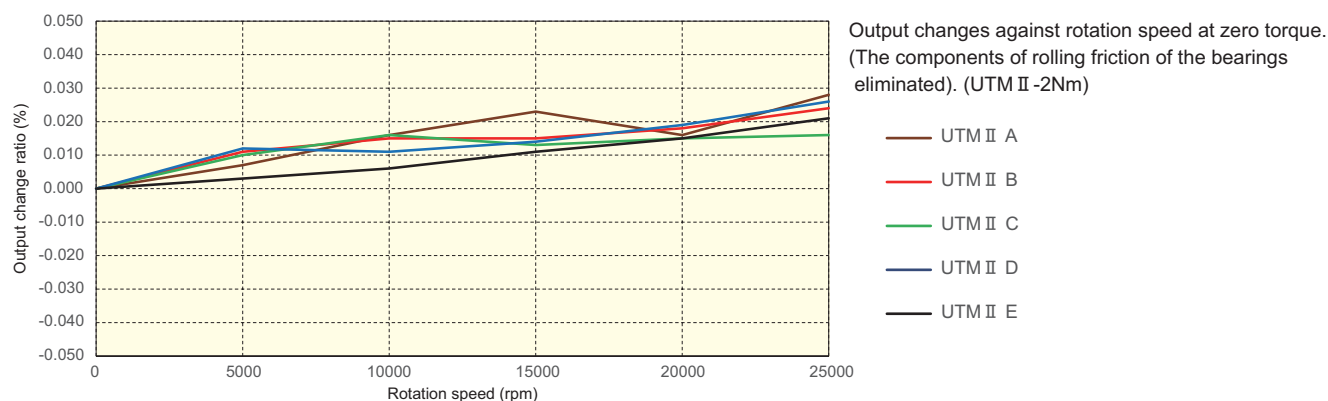
The sign of the output changes due to the rolling friction changes if the rotational direction changes, but the sign of the output due to the centrifugal force does not change.

The figures below (Upper for UTMII-2Nm and Lower for UTMIII-2Nm) are plots of the values obtained by subtracting the reverse rotation values from the forward rotation values.

For UTMII, the output changes upward according to the rotation speed, whereas for UTMIII, the output changes are very small.

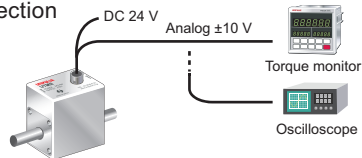
In bearingless UTMIII, in principle, any rolling friction does not occur.

In UTMIII, the output changes due to the centrifugal force are tiny, so it can accurately measure rotating torque at high rotation speed.

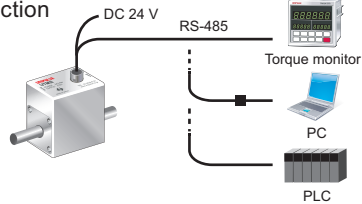


Connection example

Analog connection

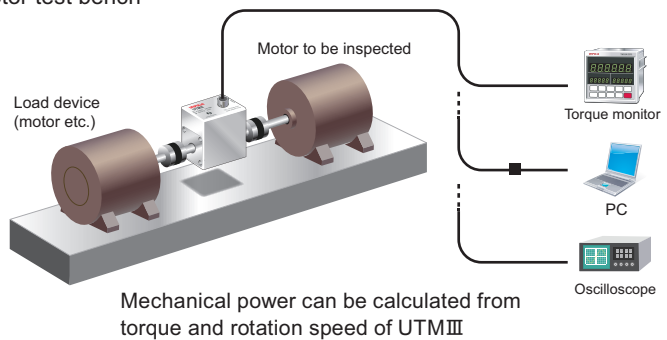


Digital connection



Sample application

Motor test bench



Specifications

Measurement range	±0.05 N m	±0.1 N m	±0.2 N m	±0.5 N m	±1 N m	±2 N m ^{*1}	±5 N m ^{*1}	±10 N m ^{*1}	±20 N m	±50 N m	±100 N m	±200 N m	±500 N m	±1000 N m	±2000 N m	±5000 N m	±10000 N m
Power supply	DC 24 V ±15%																
Consumption current	100 mA or less																
Output range	±10 V DC Load resistance must be more than 5 kΩ																
Responsivity	5 kHz																
Rotation signal	4 pulses per 1 rotation Open collector Max. ratings 30 V, 10 mA																
Digital filter	1 Hz to 1 kHz (Depending on settings) PASS 5 kHz																
Safe overload	500% FS (300% FS for key groove option)																
Non-linearity	0.03% FS or less																
Hysteresis	0.03% FS or less																
Repeatability	0.03% FS or less																
Operation temperature	-10 to +50°C																
Temperature effect on zero	0.01% FS/°C or below																
Temperature effect on span	0.01% FS/°C or below																
Maximum rotation speed	25000 rpm ^{*2}																
Torsional spring constant (N m/rad)	5.67	11.57	26.10	93.1	188	414	691	1851	5386	8428	17.3×10 ³	41.7×10 ³	117×10 ³	377×10 ³	717×10 ³	1649×10 ³	3255×10 ³
Maximum torsional angle (rad)	8.81×10 ⁻³ (0.505°)	8.64×10 ⁻³ (0.495°)	7.66×10 ⁻³ (0.439°)	5.37×10 ⁻³ (0.308°)	5.32×10 ⁻³ (0.305°)	4.83×10 ⁻³ (0.277°)	7.24×10 ⁻³ (0.415°)	5.40×10 ⁻³ (0.310°)	3.71×10 ⁻³ (0.213°)	5.93×10 ⁻³ (0.340°)	5.78×10 ⁻³ (0.331°)	4.79×10 ⁻³ (0.275°)	4.28×10 ⁻³ (0.246°)	2.65×10 ⁻³ (0.152°)	2.79×10 ⁻³ (0.160°)	3.03×10 ⁻³ (0.174°)	3.07×10 ⁻³ (0.176°)
Inertia moment (kg m ²)	8.48×10 ⁻⁷	8.58×10 ⁻⁷	8.70×10 ⁻⁷	1.46×10 ⁻⁶	1.49×10 ⁻⁶	1.39×10 ⁻⁶	3.56×10 ⁻⁶	3.66×10 ⁻⁶	2.59×10 ⁻⁶	2.66×10 ⁻⁶	6.59×10 ⁻⁶	1.40×10 ⁻⁴	4.70×10 ⁻⁴	2.90×10 ⁻³	5.89×10 ⁻³	2.01×10 ⁻²	5.16×10 ⁻²
Permissible shaft end load ^{*3}	Radial	0.12 N	0.25 N	0.3 N	0.5 N	1 N	8 N	15 N	20 N	23 N	60 N	90 N	160 N	300 N	400 N	500 N	1000 N
	Thrust	3 N	4 N	5 N	6 N	8 N	30 N	40 N	100 N	360 N	400 N	500 N	800 N	1800 N	3000 N	4500 N	7000 N
	Radial (R, RC, RK, RCK)	0.07 N	0.14 N	0.17 N	0.3 N	0.6 N	5 N	7 N	13 N	20 N	25 N	60 N	100 N	200 N	400 (H) only	500 (H) only	1000 (H) only
	Thrust (R, RC, RK, RCK)	3 N	4 N	5 N	6 N	8 N	30 N	40 N	100 N	360 N	400 N	500 N	800 N	1800 N	3000 (H) only	4500 (H) only	7000 (H) only
Dimension (case size) W×H×D (mm)	54×49×32																
Total length	74 mm																
Shaft diameter	φ 5 mm																
Approx. weight	140 g																
Supplied cable	12-conductor flexible cable (2 m) Cable end: 13 wires → Cable length is switchable to 5 m (Option: UTMIII-L5)																
Optionally available cable	CATM351: 12-conductor flexible cable (5 m) Cable end: 13 wires CATM312: 12-conductor flexible cable (10 m) Cable end: 13 wires																
Option	Key groove																
	Rotary encoder	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Key groove & Rotary encoder																
	Centering location	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Key groove & Centering location																
	Rotary encoder & Centering location	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

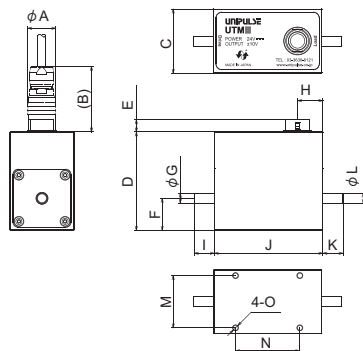
*1 The measurement range can be changed to the dual-range specification of 20% FS. Please consult with us for capacities other than 2, 5 and 10 N m.

*2 0.05 to 10 N m can be changed to a maximum rotation speed of 40000 rpm.

*3 The allowable shaft end load (N) for radial and thrust is the value that guarantees that the torque output will not be affected by 0.03% FS or less when these loads are applied.

*4 The shaft can be changed to a hollow shaft. Contact us for more details.

External dimension

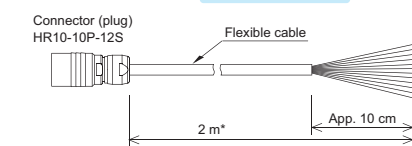


Unit: mm

Measurement range (N m)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0.05															
0.1							5h7		10		10	5h7			
0.2								12		54					
0.5							8h7		15		15	8h7		32	M3 Depth 5
1															
2															
5															
10															
20	14	31.5				18.5	12h7	13.5	20	57	20	12h7	30		
50															
100						47	63	6.1	24	20h7	23	40	50	40	M3 Depth 6
200						56	63.5		28	25h7	55	55	25h7	46	38
500						61	68		30	30h7	18.5	60	67	60	30h7
1000						71	78		35	40h7	75	75	40h7	63	30
2000						98	103		49	60h7	28	100	86	100	60h7
5000						111	119		57.5	70h7	110	110	70h7	100	69
10000						137	141		68.5	90h7	133	145	90h7	124	72
						162	166		81	110h7	162	172	110h7	144	76

Supplied cable

Flexible cable



2 PWR (0 V), 4 SIG GND & 6 PULSE OUT - are separate isolated ground.
2 PWR (0 V) & 12 COM are connected internally.

- 1 : Red PWR (+24 V)
- 2 : Black PWR (0 V)
- 3 : Green SIG OUT (±10 V)
- 4 : White SIG GND
- 5 : Yellow PULSE OUT +
- 6 : Brown PULSE OUT -
- 7 : Orange DIGITAL ZERO IN
- 8 : Purple RS-485 TX +
- 9 : Gray RS-485 TX -
- 10 : Pink RS-485 RX +
- 11 : Light blue RS-485 RX -
- 12 : Blue COM

Full of measuring instruments dedicated for UTMIII

TM320

High-speed sampling Torque, rotation speed, and power are displayed simultaneously.

More details: P.27

TM380

High-speed sampling Torque, rotation speed, and angle are displayed simultaneously.

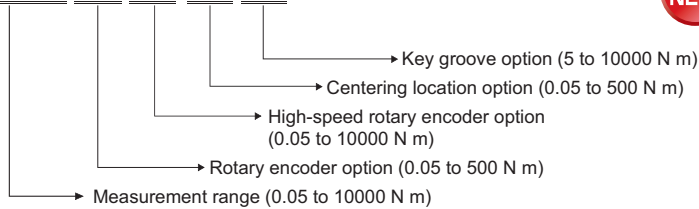
More details: P.28

TC80

High-speed sampling Torque, rotation speed, and torque-angle curve can be monitored.

More details: P.29

UTM III -0.05Nm (R) (H) (C) (K)

UNIPULSE
NEW!

**New release! 1000 to 10000Nm joined
High-speed rotary encoder option!**

* For 0.05 to 500 N m, a rotary encoder option and centering location option can be added.
Model numbers are UTM III - ONm(RC) respectively.

* You can add both rotary encoder and key groove options for 5 to 500 N m capacity type.
Model numbers are UTM III - ONm(RK) respectively.

* You can add both centering location and key groove options for 20 to 500 N m capacity type.
Model numbers are UTM III - ONm(CK) respectively.

* For 20 to 500 N m, a rotary encoder option, centering location option and key groove option can be added.
Model numbers are UTM III - ONm(RCK) respectively.

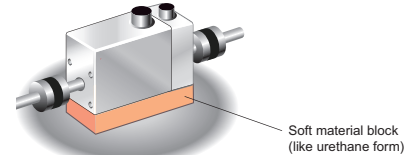
* Centering location option and key groove option cannot be added to high-speed rotary encoder option.

(R) Rotary encoder option: 0.05 to 500 N m, (H) High speed rotary encoder option: 0.05 to 10000 N m

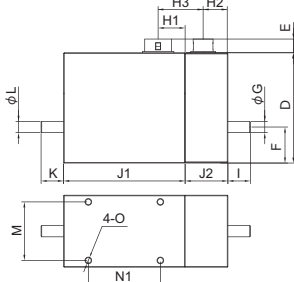
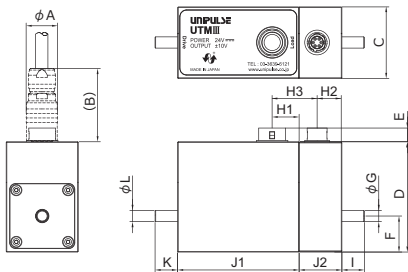


RoHS2

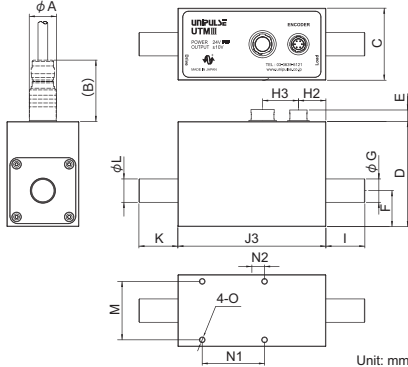
- Optical encoder
- Ideal for detecting torque versus angle
- Mounting instruction
Fix the main unit to prevent it from moving in rotational direction.
- Torque signal (analog ± 10 V) and rotation angle signals (A and B phase line driver outputs) are outputted.



- UTM III -0.05Nm(R) to 500Nm(R)
- UTM III -1000Nm(H) to 10000Nm(H)



- UTM III -0.05Nm(H) to 500Nm(H)



- Supplied cable Flexible cable

Connector (plug)
HR10-7P-6S

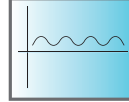
2 m*

App. 10 cm

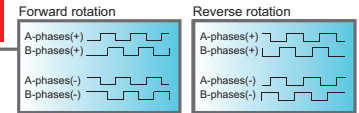
- 1: Red PWR (+5 to +24 V)
 2: Black PWR GND
 3: Green Line driver output B-phase (+)
 4: White Line driver output B-phase (-)
 5: Yellow Line driver output A-phase (+)
 6: Brown Line driver output A-phase (-)
 7: Shield

* Cable length is switchable to 5 m (Option: UTM III-R5)

Torque value is outputted within ± 10 V



Pulses are outputted (A and B-phases) in accordance with rotation angles



Measurement range (N m)	Pulses per rev.		Maximum measurable rotation speed (rpm)		Torsional spring constant (N m/rad)		Maximum torsional angle (rad)		Inertia moment (kg m ²)		Approx. weight (g)	
	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)
0.05					5.55		$9.01 \times 10^{-3} (0.516^\circ)$		1.39×10^{-6}	1.26×10^{-6}		
0.1					11.08		$9.02 \times 10^{-3} (0.517^\circ)$		1.40×10^{-6}	1.27×10^{-6}	190	185
0.2					23.73		$8.43 \times 10^{-3} (0.483^\circ)$		1.41×10^{-6}	1.28×10^{-6}		
0.5					88.32		$5.66 \times 10^{-3} (0.324^\circ)$		1.90×10^{-6}	1.81×10^{-6}		
1					169.41		$5.90 \times 10^{-3} (0.338^\circ)$		1.93×10^{-6}	1.84×10^{-6}	210	207
2					333.57		$6.00 \times 10^{-3} (0.344^\circ)$		1.83×10^{-6}	1.74×10^{-6}		
5					831		$6.02 \times 10^{-3} (0.345^\circ)$		4.18×10^{-6}	4.16×10^{-6}	320	306
10					1492		$6.70 \times 10^{-3} (0.384^\circ)$		4.28×10^{-6}			
20					4390		$4.56 \times 10^{-3} (0.261^\circ)$		2.85×10^{-5}	3.03×10^{-5}	780	765
50					7578		$6.60 \times 10^{-3} (0.378^\circ)$		2.92×10^{-5}	3.10×10^{-5}		
100					15000	15.9×10^3	$6.28 \times 10^{-3} (0.36^\circ)$		7.49×10^{-5}	1.11×10^{-4}	1.2 k	1.2 k
200					12000	37.6×10^3	$5.32 \times 10^{-3} (0.305^\circ)$		1.55×10^{-4}	1.54×10^{-4}	1.7 k	1.6 k
500					10000	106×10^3	$4.71 \times 10^{-3} (0.27^\circ)$		5.10×10^{-4}	5.16×10^{-4}	2.9 k	2.8 k
1000					7000	377×10^3	$2.65 \times 10^{-3} (0.152^\circ)$		2.95×10^{-3}	2.95×10^{-3}	7.6 k	7.6 k
2000					6000	717×10^3	$2.79 \times 10^{-3} (0.160^\circ)$		5.92×10^{-3}	5.92×10^{-3}	11 k	11 k
5000					5000	1649×10^3	$3.03 \times 10^{-3} (0.174^\circ)$		2.01×10^{-2}	2.01×10^{-2}	22 k	22 k
10000					4000	3255×10^3	$3.07 \times 10^{-3} (0.176^\circ)$		5.24×10^{-2}	5.24×10^{-2}	37 k	37 k

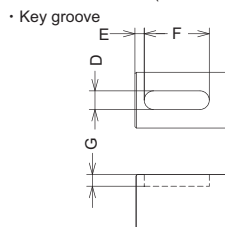
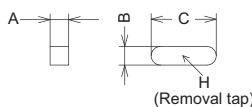
Measurement range (N m)	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O	
	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)	(R)	(H)
0.05																														
0.1																														
0.2																														
0.5																														
1																														
2																														
5																														
10																														
20																														
50																														
100																														
200																														
500																														
1000 (H) only																														
2000 (H) only																														
5000 (H) only																														
10000 (H) only																														

(K) Key groove option: 5 to 10000 N m

- UTM III -5Nm(K) to 10000Nm(K)

Due to the strength of the key, the safe overload is 300% FS.

- Key (Included in (K) option)



Measurement range (N m)	A	B	C	D	E	F	G	H
5	$4^{+0.03}_{-0.03}$	$4h9^{+0.03}_{-0.03}$	$14^{+0.18}_{-0.18}$	$4^{+0.012}_{-0.012}$	2	$14^{+0.3}_{-0.3}$	$2.5^{+0.1}_{-0.1}$	—
10								
20	$6^{+0.03}_{-0.03}$	$6h9^{+0.03}_{-0.03}$	$32^{+0.25}_{-0.25}$	$6^{+0.012}_{-0.012}$		$32^{+0.3}_{-0.3}$	$3.5^{+0.1}_{-0.1}$	
50			$38^{+0.25}_{-0.25}$			$38^{+0.3}_{-0.3}$		
100			$48^{+0.25}_{-0.25}$			$48^{+0.3}_{-0.3}$		
200	$7^{+0.036}_{-0.036}$	$8h9^{+0.036}_{-0.036}$	$53^{+0.25}_{-0.25}$	$8^{+0.015}_{-0.015}$		$53^{+0.3}_{-0.3}$	$4^{+0.2}_{-0.2}$	
500	$8^{+0.09}_{-0.09}$	$12h9^{+0.043}_{-0.043}$	$62^{+0.3}_{-0.3}$	$12^{+0.018}_{-0.018}$		$62^{+0.3}_{-0.3}$	$5^{+0.2}_{-0.2}$	
1000	$11^{+0.11}_{-0.11}$	$18h9^{+0.043}_{-0.043}$	$90^{+0.35}_{-0.35}$	$18^{+0.018}_{-0.018}$		$90^{+0.3}_{-0.3}$	$7^{+0.2}_{-0.2}$	
2000	$12^{+0.11}_{-0.11}$	$20h9^{+0.052}_{-0.052}$	$100^{+0.35}_{-0.35}$	$20^{+0.022}_{-0.022}$		$100^{+0.3}_{-0.3}$	$7.5^{+0.2}_{-0.2}$	
5000	$14^{+0.11}_{-0.11}$	$25h9^{+0.052}_{-0.052}$	$135^{+0.4}_{-0.4}$	$25^{+0.022}_{-0.022}$		$135^{+0.3}_{-0.3}$	$9^{+0.2}_{-0.2}$	
10000	$18^{+0.11}_{-0.11}$	$32h9^{+0.062}_{-0.062}$	$162^{+0.4}_{-0.4}$	$32^{+0.028}_{-0.028}$		$162^{+0.5}_{-0.5}$	$11^{+0.3}_{-0.3}$	

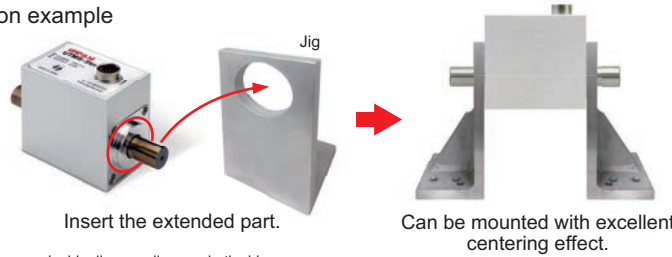
* During high-speed rotation, consider the imbalance caused by the key and adjust the rotation balance of the entire device.

Unit: mm

Centering location type suitable for mounting a main unit

- In a scene like this...
- Wants center point of axis as reference for installation
 - Wants to stop vibration & fix main unit

Installation example



Insert the extended part.

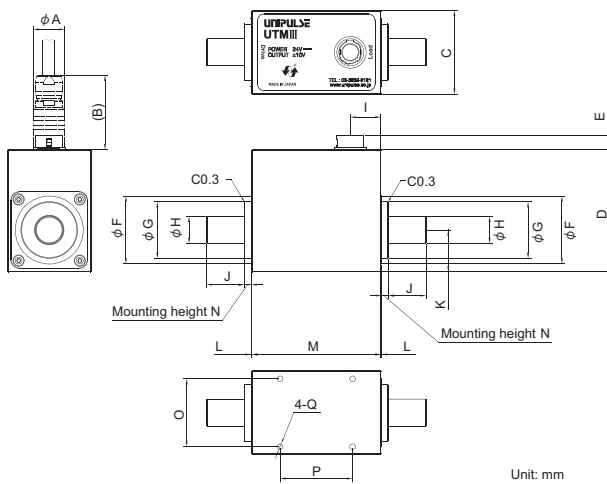
Can be mounted with excellent centering effect.

RHS2

- * For this setup use double disc couplings on both sides.
 * If the main unit rotates, please install a stopper to avoid excessive force on the main unit.
 * Jig is not included. Please prepare an installation jig that fits the convex part of UTM III.

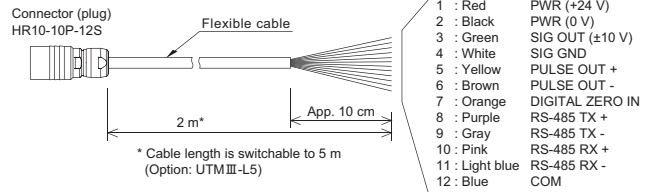
■ UTM III-0.05Nm(C) to 500Nm(C)

Measurement range	±0.05 N m	±0.1 N m	±0.2 N m	±0.5 N 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
Torsional spring constant (N m/rad)	5.67	11.57	26.10	93.1	188	414	691	1851	5386	8428	17.3×10 ³	41.7×10 ³	117×10 ³
Maximum torsional angle (rad)	8.81×10 ⁻³ (0.505°)	8.64×10 ⁻³ (0.495°)	7.66×10 ⁻³ (0.439°)	5.37×10 ⁻³ (0.308°)	5.32×10 ⁻³ (0.305°)	4.83×10 ⁻³ (0.277°)	7.24×10 ⁻³ (0.415°)	5.40×10 ⁻³ (0.310°)	3.71×10 ⁻³ (0.213°)	5.93×10 ⁻³ (0.340°)	5.78×10 ⁻³ (0.331°)	4.79×10 ⁻³ (0.275°)	4.28×10 ⁻³ (0.246°)
Inertia moment (kg m ²)	8.48×10 ⁻⁷	8.58×10 ⁻⁷	8.7×10 ⁻⁷	1.46×10 ⁻⁶	1.49×10 ⁻⁶	1.39×10 ⁻⁶	3.56×10 ⁻⁶	3.66×10 ⁻⁶	2.59×10 ⁻⁵	2.66×10 ⁻⁵	6.59×10 ⁻⁵	1.40×10 ⁻⁴	4.70×10 ⁻⁴
Approx. weight		150 g			170 g		260 g		690 g		1.1 kg	1.5 kg	2.6 kg



Measurement range (N m)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
0.05																	
0.1																	
0.2																	
0.5																	
1																	
2																	
5																	
10																	
20																	
50																	
100																	
200																	
500																	

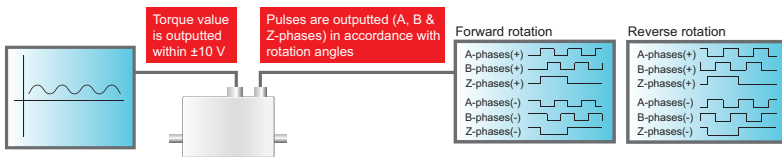
■ Supplied cable (C), (RC) common Flexible cable



- * 2: PWR GND, 4: SIG GND & 6: PULSE GND are separate isolated ground.
 * 2: PWR GND & 12: COM are connected internally.

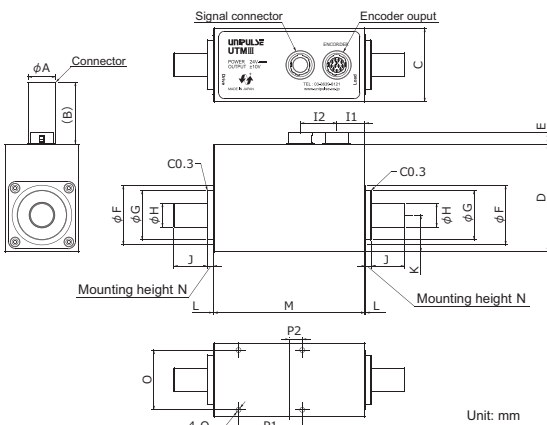
■ UTM III-0.05Nm(RC) to 500Nm(RC)

- Torque signal (analog±10 V) and rotation angle signals (A, B & Z phase line driver outputs) are outputted.



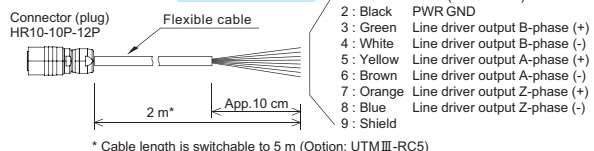
- Angular resolution: 3600 per rotation
- Maximum measurable rotation speed:
5000 rpm (0.05 to 50 N m)
2500 rpm (100, 200, 500 N m)

Measurement range	±0.05 N m	±0.1 N m	±0.2 N m	±0.5 N 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
Torsional spring constant (N m/rad)	5.55	11.08	23.73	88.32	169.41	333.57	831	1492	4390	7578	15.9×10 ³	37.6×10 ³	106×10 ³
Maximum torsional angle (rad)	9.01×10 ⁻³ (0.516°)	9.02×10 ⁻³ (0.517°)	8.43×10 ⁻³ (0.483°)	5.66×10 ⁻³ (0.324°)	5.90×10 ⁻³ (0.338°)	6.00×10 ⁻³ (0.344°)	6.02×10 ⁻³ (0.345°)	6.70×10 ⁻³ (0.384°)	4.56×10 ⁻³ (0.261°)	6.28×10 ⁻³ (0.378°)	5.32×10 ⁻³ (0.306°)	4.71×10 ⁻³ (0.270°)	
Inertia moment (kg m ²)	1.39×10 ⁻⁶	1.40×10 ⁻⁶	1.41×10 ⁻⁶	1.92×10 ⁻⁶	1.95×10 ⁻⁶	1.85×10 ⁻⁶	4.26×10 ⁻⁶	4.36×10 ⁻⁶	2.86×10 ⁻⁵	2.93×10 ⁻⁵	7.56×10 ⁻⁵	1.56×10 ⁻⁴	5.12×10 ⁻⁴
Approx. weight		190 g			210 g		320 g		770 g		1.2 kg	1.6 kg	2.8 kg



Measurement range (N m)	A	B	C	D	E	F	G	H	I1	I2	J	K	L	M	N	O	P1	P2	Q
0.05																			
0.1																			
0.2																			
0.5																			
1																			
2																			
5																			
10																			
20																			
50																			
100																			
200																			
500																			

■ Supplied cable (RC) Flexible cable



* For key and key groove of RCK option, see P.8 for details.

* Cable length is switchable to 5 m (Option: UTM III-RC5)