Minebea

Torque Transducer
*TMRS-*NM*

Instruction Manual

EN294-2053A

Introduction

Thank you for purchasing our TMRS-*NM Torque Transducer.

This instruction manual describes how to operate the device, as well as noteworthy points. Note that handling or operating the device incorrectly may result in malfunctions. Read this manual thoroughly before use for safety and optimal results.

Keep this instruction manual in a location where it is readily accessible to end users.

Overview

This product is a low-capacity torque transducer that combines a shaft calibrated by attaching a strain gage and an optical transformer that acquires signals optically, without making contact with the rotor. It measures both static and dynamic torque using a strain gage, and features high precision and long-term consistency.

It produces a voltage output calibrated at a rated torque and a pulse signal for rotation detection.

Pictograms and Conventions Used in This Manual

This manual uses the following pictograms to indicate actions to avoid at all times, aspects requiring caution, and other noteworthy matters.

Be sure to read the descriptions provided alongside these pictograms.

WARNING

This indicates circumstances in which incorrect handling may result in death or serious injury to users.
Avoid the actions described here at all times.

CAUTION

This indicates circumstances in which incorrect handling may result in injury to users or damage to property.

This indicates operating or procedural precautions or restrictions.
Be sure to read the details provided here to avoid incorrect operations.

Safety Precautions

Please be sure to read this manual before attempting to use the equipment.

WARNING

- **Be sure to use the equipment within its rated operating capacity range. Failure to do so may damage the equipment or affect other connected devices.**
- **Impact loads or vibrations will subject the torque transducer to dynamic loads consisting of the static load multiplied by the acceleration. Make sure the value (taking acceleration into account) does not exceed the rated capacity of the torque transducer.**
- **Install safety devices to prevent damage if excessive loads on the torque transducer are likely.**
- **This is a rotating part. Keep a protective cover fitted at all times to keep materials from flying out.**
- **To avoid injuries, do not touch the torque transducer in operation. Also, do not touch the non-rotating parts while the torque transducer is rotating. There is a risk that your fingers, hands, or clothing may be caught. Install safety devices to prevent injuries if there is a risk of touching the moving parts.**
- **Contact us before using the equipment in a special environment.**
- **Confirm that the wiring is correctly connected before attempting to use the equipment. Incorrect wiring of the equipment may lead to incorrect measurements, equipment malfunctions, damage to peripheral equipment, and serious accidents.**
- **Use the following bolts.**
  - **Strength: JIS B 1051 strength classification of at least 12.9**
  - **Type, size: As indicated in specifications**
- **Install the equipment within the allowable tolerance. Otherwise, it may affect the equipment or the devices connected to it.**
- **As any imbalance caused by the installation of the coupling may result in vibration, adjust the overall dynamic balance after combining the torque transducer and the coupling.**
- **Confirm that the connections are secure before attempting to start operation.**
- **Do not exceed the maximum rotating speed. There is a risk of abnormal heat generation or damage.**
- **Turn off the power immediately if smoke or fire occurs during operation.**
- **Failure to use the equipment in the manner specified in this manual may impair the protection performance.**
- **Do not continue using the equipment if it has a failure.**
- **Do not disassemble the equipment.**

CAUTION

- **Avoid bending excessively or pulling the cable outlet with excessive force.**
  Do not hang the stator by grasping the cable when carrying it.
- **If used where vibrations occur, secure the cable near the cable outlet to prevent vibrations.**
- **In environments where the screws may loosen, either make sure the screws are retightened periodically or take appropriate locking precautions.**
- **Protect the equipment from impact or shock—for example, impact or shock caused by striking against other objects.**
  Impact or shock may damage the product and lead to failures in the electrical circuits.
- **If an unreasonable load is applied to the main unit or shaft in the radial and thrust directions, it may cause insufficient accuracy or abnormal heat generation of the bearing, and affect the durability performance. Take great care to avoid such consequences when installing the equipment.**
  Ensure that the shaft is not overloaded when mounting and removing the equipment.
- **Make sure that the heat generated by other devices is not directly conveyed to the shaft.**
- **Be careful to avoid trapping debris and foreign matter inside when mounting.**

1. Installation Location

WARNING

- **Install in a location where temperature and humidity conditions are within the rated ranges.**
- **To minimize the risk of unforeseen accidents, avoid installing the equipment in the following locations.**
  - Avoid use in locations outdoors or exposed to direct sunlight.
  - Avoid use in damp locations.
  - Do not install in locations with weak floor strength. Vibration may cause damage.
  - Avoid use where the atmosphere contains excessive dust, sands, particles or metal powders.
  - Avoid use where the atmosphere contains corrosive or inflammable gases, salt, oil or inert liquid.
  - Do not install in locations subject to sudden temperature, humidity or pressure fluctuations.
  - Avoid use in environments where condensation or freezing may occur.
  - Do not install close to equipment that generates magnetic or electromagnetic radiation. Electromagnetic inference may result in noise.
  - Take shielding measures to protect the equipment and cables when using in such locations.
  - Do not install in locations subject to the effects of radioactivity or radiation.
  - Do not install in locations where there is a risk of chemical reactions.

2. Power Supply

WARNING

- **Turn off power before connecting or disconnecting cables.**
  Connecting/disconnecting cables while power is on may result in electric shock or equipment damage.
- **Before turning on power, confirm that the power supply meets equipment specifications.**
  Contact us if the specifications do not match. Using an unconfirmed power supply may result in electric shock or equipment damage.
- **Always ground the equipment using the screw hole of the case. Failure to ground the equipment may result in failures caused by static electricity.**

CAUTION

- **Do not apply voltages exceeding the maximum applied voltage to the input voltage.**
  Do not reverse the polarity. Doing so may cause accidents.
- **Always ground motors and motor controlling devices. We recommend directly grounding motors to the main unit. Failure to do so may superimpose noise on the output voltage.**
- **Separate the cables from power lines for motors or similar equipment.**
- **Improper cable routing may cause electrostatic charge to build up in the cables. In this case, the electronic parts in the equipment may be damaged.**
- **Ensure that the shaft and case of the equipment are not energized. Take measures to prevent current from flowing to the shaft.**
- **Insulate the terminals of unused cables.**

3. Compatible standards

This equipment conforms to the following standards:

- EN61326-2-3:2021
- RoHS directive compliance

⚠ CAUTION

- **The equipment conforms to EN61326-2-3 when the following conditions are met.**
  - **Shielding**
    Use a dedicated cable and ground the shield.
  - **Grounding**
    Ground the equipment based on Type D single grounding using the screw hole of the case.

Revision History

Date	Manual No.	Revision reason (details)
April 2024	EN294-2053	NEW
August 2025	EN294-2053A	ECN No.FN25-0182 Correction of errors 5-2. Mechanical characteristics (rotor) [Before the change] Moment of inertia (kg·cm^2) Torsional rigidity (kN·m/red) [After the change] Moment of inertia (kg·mm^2) Torsional rigidity (N·m/rad)

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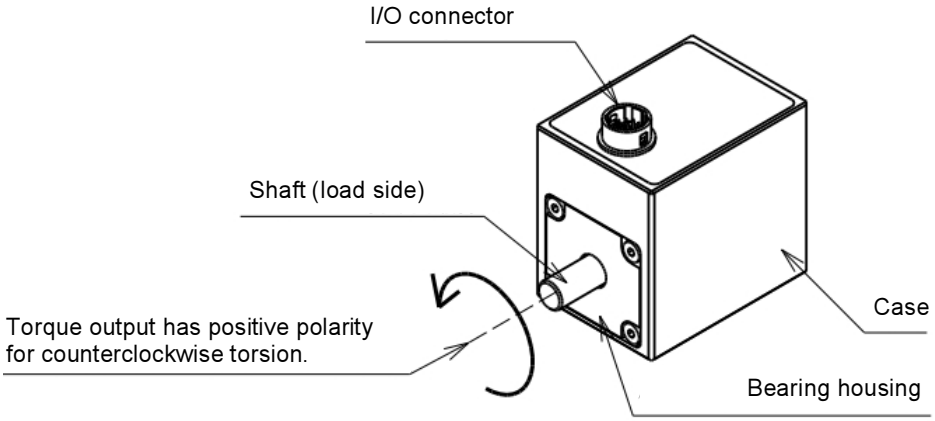
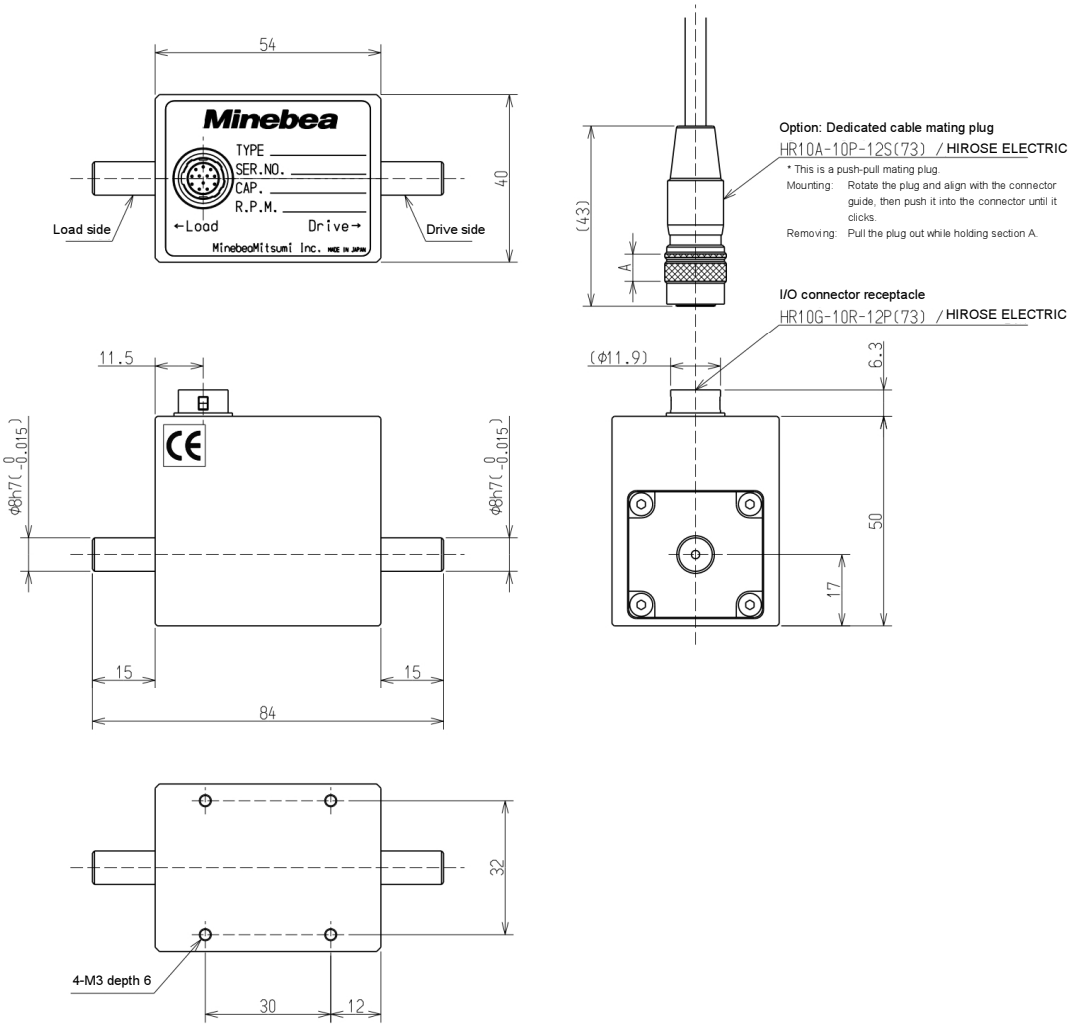
1. Part Names and Functions

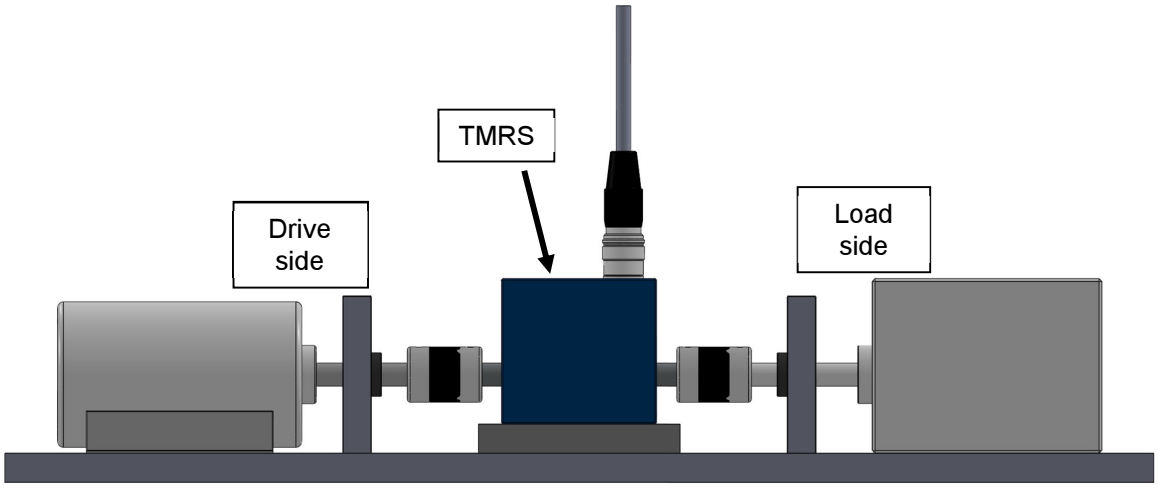




Name	Function
I/O connector	I/O connector for connecting power, a digital multimeter, and so on. Connector: HR10G-10R-12P(73) (HIROSE ELECTRIC) Mating plug: HR10A-10P-12S(73) (HIROSE ELECTRIC)
Load side shaft	Shaft on the load side. It is connected to the load of which torque is to be measured. It is linked with the shaft on the drive side internally.
Drive side shaft	Shaft on the drive side. It is connected to the drive unit that rotates the shaft. It is linked with the shaft on the load side internally.
Case	Main unit of the torque transducer. There are screw holes on the bottom used to secure the case in place. Use 6 mm long M3 screws.
Direction of polarity	Rotate the shaft counterclockwise, as viewed from the load side, to produce a positive polarity torque.

2. Mounting Procedure

2-1. Typical mounting configuration



(1) We recommend connecting both ends using flexible couplings.

(2) Prepare suitable couplings for the shaft diameter. The couplings should be lightweight and have good rotation balance.

- Compatible coupling examples: XGT-10C, XGT-25C (Nabeya Bi-tech)

(3) Attach the equipment so that the "←Load" side on the nameplate is at the load side. If it is attached in the opposite direction, the inertia of the internal transmission circuit components will affect output signals.

(4) Ensure that the centering accuracy matches the value recommended by the coupling manufacturer.

2-2. Mounting procedure and precautions

The equipment can be used in both horizontal and vertical directions.

In the typical mounting configuration, both ends of the equipment are connected using flexible couplings.

If bearings are contained in both drive and load units, the bearing structure shown in the figure is not required.

Secure the equipment to a rigid urethane resin plate to prevent the main unit from rotating.

We recommend lightly attaching the equipment to the rigid urethane resin plate via four anti-rotation screw holes of the main unit to reduce vibrations.

Take great care to avoid shaft misalignment when tightening bolts.

⚠ CAUTION

- **If an unreasonable load is applied to the main unit or shaft in the radial or thrust directions, it may cause insufficient accuracy or abnormal heat generation of the bearing, and affect the durability performance. Take great care to avoid such consequences.**
- **As this product is a low-capacity torque transducer, ensure that the shaft is not overloaded when mounting and removing the equipment.**
- **Make sure that the heat generated by other devices is not directly conveyed to the shaft.**
- **Secure the equipment when placing it on either side.**
  Make sure the length of the threaded screw shaft is at least equal to the nominal screw diameter.
- **Make sure that the flat rigid urethane resin plate is level.**
- **Be careful to avoid trapping debris and foreign matter inside when mounting.**

3. Wiring

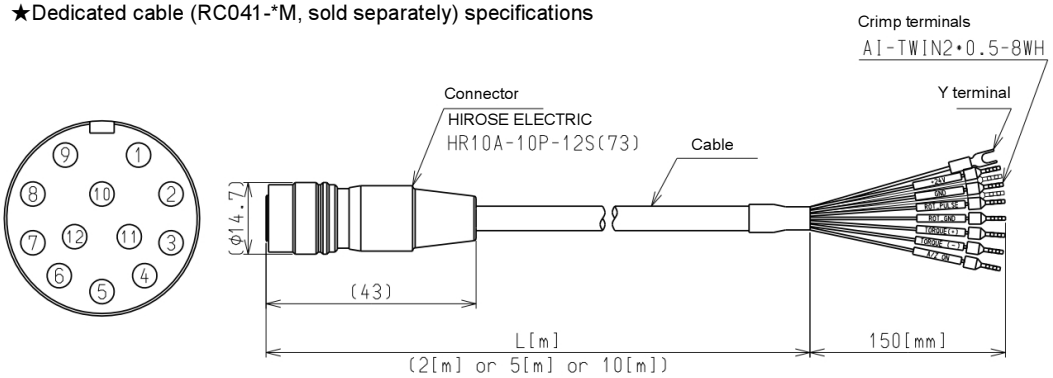
3-1. Wiring precautions

CAUTION

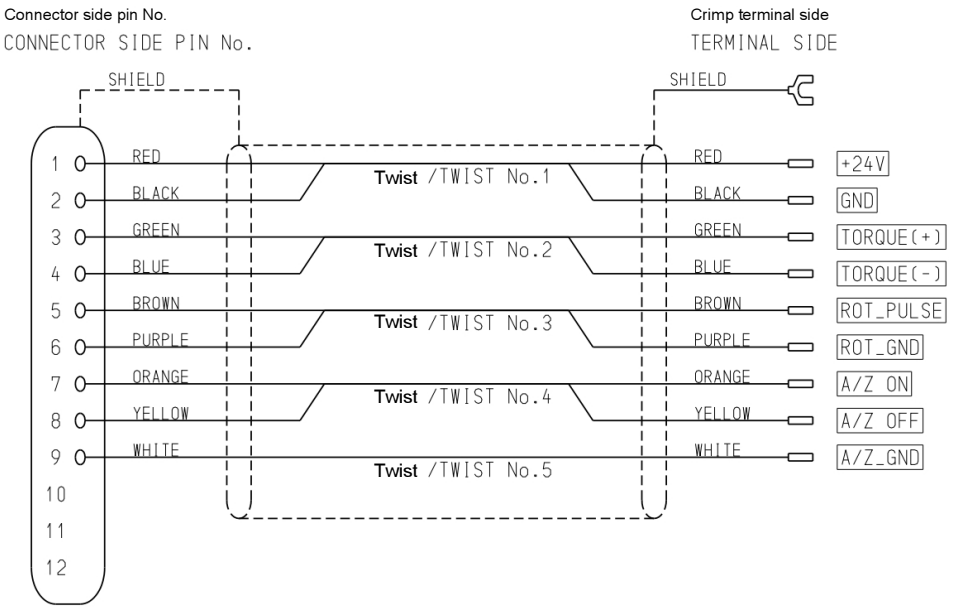
- **Always turn off power before connecting or disconnecting the equipment.**
- **Do not turn on power until all installation work is complete.**
- **There is no ON/OFF switch on the unit itself.**
- **Keep cables connected to the unit as far away as possible from sources of noise such as power lines or control interfaces.**
- **The conduit should house exclusively cables connected to the equipment itself. Avoid joint use with other lines in the conduit.**
- **Always ground the equipment. Use Type D single grounding. Do not share a ground with the power supply system.**

3-2. Dedicated cable (RC041-*M, sold separately)

★Dedicated cable (RC041-*M, sold separately) specifications



★Dedicated cable (RC041-*M, sold separately) pin layout and wiring diagram



Always use the dedicated cable to connect the equipment to the torque transducer. To avoid increased sensitivity to external noise and loss of accuracy, do not connect an extension cable to the connector board. If the standard cable is too short, contact our sales office or dealer.

3-3. Stator connector pin assignment

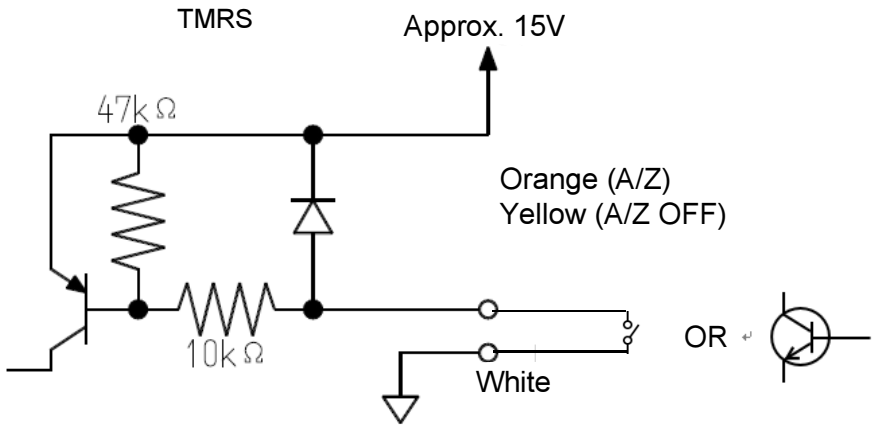
Pin layout

Pin No.	Cable color	Signal	Type
1	Red	+24 V	Connect the 24 V supply voltage.
2	Black	GND	Connect the 0 V supply voltage.
3	Green	TORQUE(+)	Torque voltage output terminal. ±10 V output.
4	Blue	TORQUE(-)	
5	Brown	ROT_PULSE	Rotary pulse output terminal. It produces four pulse signals per rotation. Open collector output.
6	Purple	ROT_GND	
7	Orange	A/Z_ON	When the torque voltage output is within 10 % of the rating, you can re-adjust the zero-point by short-circuiting it to A/Z_GND without affecting the span point.
8	Yellow	A/Z_OFF	When A/Z is enabled, you can disable the auto zero function by short-circuiting it to A/Z_GND.
9	White	A/Z_GND	Auto zero common.
Shield	-	-.	Shield wire.

3-4. External control input connections

A/Z functions can be controlled externally via the external control input connectors.

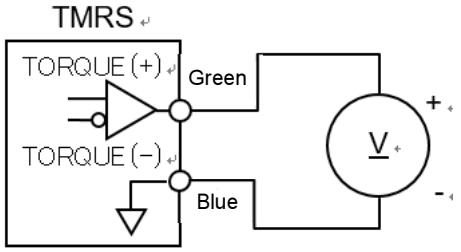
External control input is performed by shorting the corresponding inputs to A/Z GND using contacts or an open collector after wiring the connectors.



- **The A/Z and A/Z OFF inputs are operated after shorting for at least approximately 100 ms.**
- **No A/Z operations are performed when the torque output is greater than 10 % of the rating.**

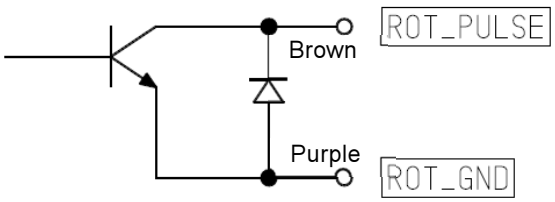
3-5. Torque voltage output connections

Voltage output for torque is produced by the torque voltage output terminal.



To a digital multimeter, PLC, or similar device
Load resistance: 2 kΩ or more
Capacitance load: 0.1 μF or less

3-6. Rotary pulse output connections



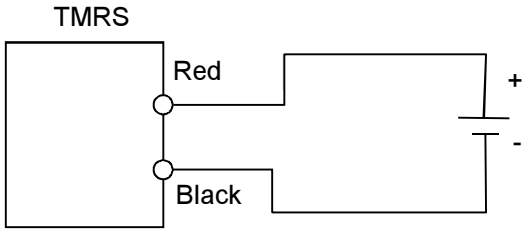
Open collector output
- Rated voltage: 30 V DC
- Rated current: 10 mA DC

* Insulated by photocoupler from internal circuit.

3-7. Connecting the power supply

Connect the power supply as shown in the following figure. Use Type D single grounding.

24 V DC (permissible fluctuation range: ±15 %)



CAUTION

Connect the power supply correctly, as shown in the diagram, and use within the rated power supply range.

Use Type D single grounding for the equipment. If not, the equipment may be susceptible to noise from other devices, resulting in malfunctions.

4. Measurement

4-1. Checking output

The zero and span have been properly adjusted for this torque transducer.

If zero and span adjustment is required after installation, perform adjustment on the device that receives voltage output.

Confirm that the output changes when a torque load is applied. Note that rotating the shaft on the load side counterclockwise produces a positive output for torque.

4-2. Running-in operation

Running-in should be performed to ensure that the specified accuracy is achieved.

Perform running-in operation at a low rotation speed to confirm that there are no abnormal outputs, noise or vibrations before starting measurement.

Wait at least 30 minutes after power startup before performing measurement.

5. Specifications

5-1. Specifications

Model (indicated capacity)	0.5NM	1NM	2NM
Load characteristics			
Rated capacity (R.C.)	±0.5 Nm	±1 Nm	±2 Nm
Safe overload	500 % R.C.		
Torque output (R.O.)	Voltage output ±10 V		
Measurement accuracy (including nonlinearity, hysteresis, and repeatability)	±0.03% R.O.		
Temperature characteristics			
Acceptable temperature range	-20 °C to 60 °C		
Operating temperature range	-10 °C to 50 °C (non-condensing)		
Temp. effect on zero balance	0.1 % R.O./10 °C		
Temp. effect on output	0.1 % load/10 °C		
Rotation characteristics			
Max. rotation speed (rpm)	25,000		
Other characteristics			
Material	Shaft: Stainless steel		
	Bearing housing: Stainless steel		
	Case: Aluminum alloy		
Fatigue life	10^7 cycles under rated load		
Main unit weight	Approx. 240 kg		

5-2. Mechanical characteristics (rotor)

Model (indicated capacity)	0.5NM	1NM	2NM
Response frequency (kHz)	6		
Moment of inertia (kg·mm^2)	1.46	1.48	1.52
Torsional rigidity (N·m/rad)	236	318	531
Torsional angle (10^{-3}rad)	2.12	3.14	3.77
Torsional angle (deg.)	0.121	0.180	0.216
Torsional natural frequency (kHz)	5.01	5.67	6.61
Accurate safe bending load (N)	50	60	70
Accurate safe thrust load (N)	5	10	20

5-3. Power

Rated power supply	24 V DC ±15 %
Current consumed	0.2 A or less

5-4. Output signals (voltage)

Output voltage	±10 V DC
Resistive load	2 kΩ or more
Output capacitance load	0.1 μF or less
Over-range	Approx. ±12 V DC
Output cycles	Approx. 60,000 cycles/s

5-5. Rotary pulse output signals

Output pulse specifications	Four pulse outputs per rotation
Output type	Open collector output
Rated voltage	30 V DC
Rated current	10 mA DC

5-6. Output adjustment function

Zero adjustment range	Approx. ±10% R.O.

5-7. General specifications

Operating temperature/humidity range	Temperature	-10°C to 50°C
	Humidity	Max. 85 %RH (with no condensation)
Acceptable temperature range		-20°C to 60°C

5-8. Accessories

Certificate of analysis	1
Instruction Manual	1

5-9. Options

Name	Model	Notes
Dedicated cable	RC041-*M	Select 2 m, 5 m, or 10 m. Example: RC041-2M (for 2 m cable)

6. Warranty

6-1. Warranty

The warranty for this equipment is valid for a period of one year from the date of delivery.

Please contact our sales office or dealer from which you purchased the product for repairs or service during the warranty period.

6-2. Repairs

Before requesting repairs, double-check that all connections are correct.

In particular, confirm that torque transducer connections are not disconnected.

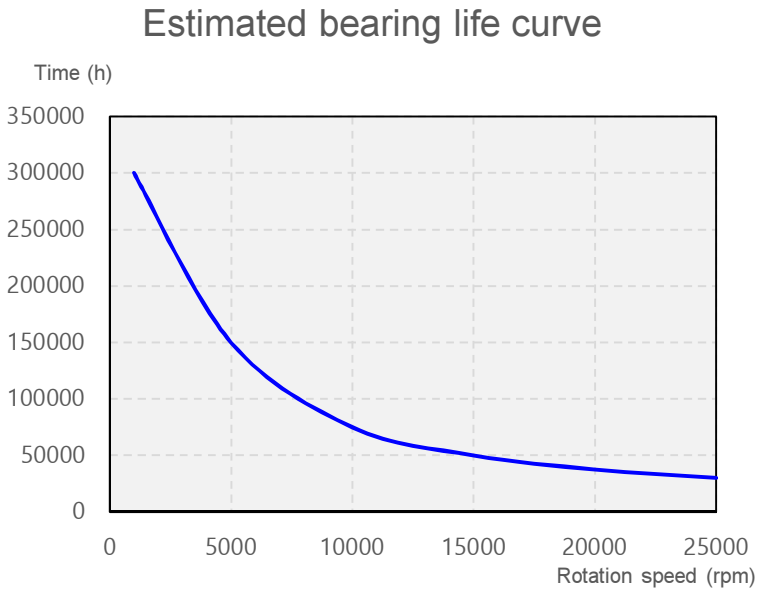
If problems remain after these inspections, contact our sales office or dealer from which you purchased the equipment for repairs.

7. Component Service Lives

This equipment uses a bearing. The bearing service life ends when the grease exchange limit is reached.

The grease exchange limit varies depending on the number of rotations used. Refer to the following table.

Contact us if the service life ends and the bearing needs to be replaced or repaired.



8. Troubleshooting

If readings are unstable or abnormal, confirm that connections with other instruments are correct and that usage precautions are observed, then inspect the torque transducer as described below.

(1) Confirm that the output changes when you twist the shaft by hand.
(2) Confirm that the output (zero balance) with no load is not significantly shifted.

If the equipment is subjected to overloading or excessive rotating speeds or if the equipment is subjected to overloading in the bending/thrust directions, remove the load and record the difference from the zero output value of the state before subjected to the load.

Contact us if you encounter abnormalities or if you have any questions.

The information provided in this manual is subject to change without notice.

9. Technical Information

9-1. EMC Information

The equipment complies with the following EMC (electromagnetic compatibility) standards.

⚠ CAUTION

- **The equipment is intended for use in industrial environments.**
- **The equipment is not intended for use in non-industrial environments such as in homes, where electromagnetic emissions may affect other devices.**
- **Special caution is required regarding EMC when using the product. It must be used in accordance with the following EMC information.**

Electromagnetic emissions (EMI: Electromagnetic interference)			
Test item	**Standard No.**	**Compatibility**	**Guidance**
Radiated interference waves Conducted interference	CISPR11	Group 1 Class A	If used under conditions that deviate from the usage conditions to ensure compliance, electromagnetic emissions may exceed the levels specified by the standards. For information on the usage conditions to ensure compliance with standards, see “3. Compatible standards”.
Harmonic currents	IEC 61000-3-2	Not applicable *1	–
Voltage variations, voltage fluctuations, and flicker	IEC 61000-3-3	Not applicable *1	–

*1 Not applicable, as the equipment is for use in industrial environments.

Electromagnetic immunity (EMS: Electromagnetic susceptibility)			
Test item	**Standard No. (standard)**	**Compliance level**	**Guidance**
Electrostatic discharge	IEC 61000-4-2 (Criterion B)	±4 kV contact/indirect ±2 kV, ±4 kV, ±8 kV in air	If used under conditions that deviate from the usage conditions to ensure compliance, the equipment may not meet compliance levels. For information on the usage conditions to ensure compliance with standards, see “3. Compatible standards”.
Radiated RF electromagnetic interference	IEC 61000-4-3 (Criterion A)	80 to 1,000 MHz (10 V/m) 1.4 to 6.0 GHz (3 V/m)	
Electrical fast transient/burst	IEC 61000-4-4 (Criterion B)	±2.0 kV (DC power supply port) ±1.0 kV (signal port)	
Surge	IEC 61000-4-5 (Criterion B)	Not applicable *2	
Conducted interference induced by RF electromagnetic fields	IEC 61000-4-6 (Criterion A)	0.15 to 80 MHz, 10 V (DC power supply port, signal port)	
Power supply frequency magnetic field	IEC 61000-4-8 (Criterion B)	50/60 Hz, 30 A/m	
Voltage dip, power outage, voltage fluctuations	IEC 61000-4-11 (Criterion B)	Not applicable *3	
Performance criteria A: While disturbances are applied, variations in measured values are within specifications. B: Variations in measured values exceeding specifications during disturbances are permitted. However, the normal state must be restored automatically after the disturbance. C: Loss of functions during and after disturbances is permitted. However, operators should be able to intervene and restore to the normal state after the disturbance.			

*2 Not applicable, as the signal cable is not a long‐distance cable.
*3 Not applicable, as the DC power supply is used.

●The contents of this manual may subject to change without notice.

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HOMEPAGE ADDRESS

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