ATO

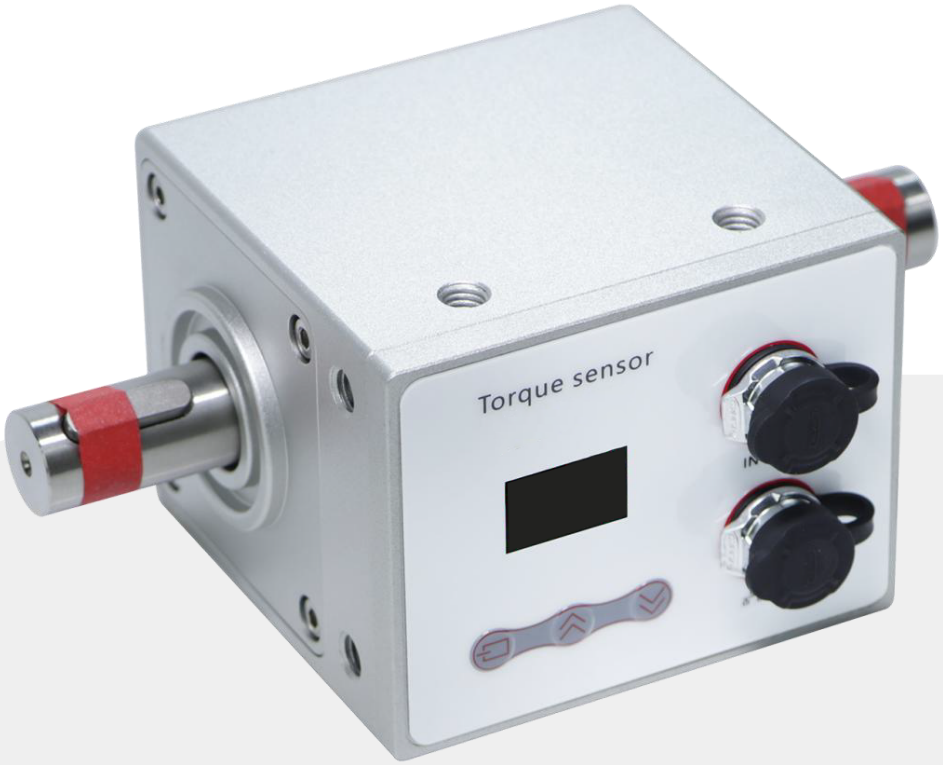
DYN-200 PRO

High-speed dynamic torque sensor

DYN-200 PRO HIGH-SPEED DYNAMIC TORQUE SENSOR SERIES

user's guide

OPERATION INSTRUCTIONS



Catalogue

1. Brief Introduction

This torque sensor series displays torque and rotational speed data on its integrated OLED display, and allows users to adjust specific parameters—such as zero-point and calibration—via dedicated buttons. It enables simple calibration and zeroing operations even in the absence of an instrument panel, making it particularly suitable for industrial production and torque testing applications. The sensor exhibits high stability and adaptability, supporting both transmitter output and RS485 communication. It can actively transmit communication protocols in ASCII or HEX formats, as well as utilize the Modbus-RTU protocol to communicate with torque instruments. The rotational speed is transmitted via a frequency signal directly to the torque instrument, eliminating the need for frequency-to-voltage conversion for all data, which significantly enhances anti-interference performance. Additionally, it ensures the stability and real-time responsiveness of data transmission.

2. Key Features and Functions

- The currently measured torque value and rotational speed value are displayed in real time, with a refresh rate of 15 updates per second.
- The current power value can be directly calculated and displayed.
- Supports RS485 communication, supports proactive upload protocols, and achieves a maximum communication rate of up to 6,400 transactions per second.
- Using a 120-line code disk at a rotational speed of above 12.5 RPM, the acquisition rate is 25 samples per second.
- The rotational speed can directly output a frequency signal, with a maximum speed of 8,000 RPM.
- This sensor supports Ethernet output and the Modbus TCP protocol.
- The sensor features an integrated OLED display with a resolution of 128×64.
- Simple operations such as calibration, zeroing, and filtering can be performed.
- Sensor overload up to 200% is permitted.
- It achieves a precision exceeding 1/1000 and exhibits excellent zero-point stability.
- Contactless operation, requires no maintenance, contains no wear parts, and has no service life limitations.

3. Qualification

Project		Dpecifications
Measurement Performance		24 AD acquisition channels, acquisition rate: 6,400 samples/second
show	Torque display range	-99999-99999
	Speed display range	0-99999
communication		RS485 Communication: RS485 supports the Modbus RTU protocol or the ASCII/HEX active upload protocols. Ethernet communication: supports the Modbus TCP protocol and custom active upload protocols.
key		Operated via three independent buttons
source		DC 24 V (±10%), 0.2 A; maximum voltage: 27.5 V; minimum start-up voltage: 12 V
Speed output		120,60 pulses
work environment		Ambient temperature: -20–70 °C; relative humidity: ≤85% RH; avoid exposure to strongly corrosive gases

Output method and maximum output speed

	MODBUS TCP (Ethernet)	HEX Active Upload	MODBUS RTU (RS485)	HEX Active Upload	ASCII Active Upload (RS485)

		(Ethernet)		(RS485)	
Torque output	100 Hz	6400 Hz	30 times per second	2,000 times per second	2,000 times per second
Speed output	100 Hz	6400 Hz	30 times per second	2,000 times per second	nonsupport
power output	100 Hz	nonsupport	30 times per second	nonsupport	nonsupport

(Note: For protocols without power output, the customer may calculate the required values based on torque and rotational speed.)

(Note: The above speeds refer to communication transmission speeds.)

4. Parameter Declaration

4. 1. Primary filtering

The torque data from this sensor undergoes a first-stage filtering process before being output; this first-stage filtering employs Gaussian filtering and clipping filtering, with filter levels ranging from 1 to 99. A higher filter level provides superior disturbance rejection, but also results in greater latency in data response. If a faster torque signal response is required, the first-stage filter level can be set to 1, in which case no additional filtering is applied to the torque data within the first-stage filter.

4. 2. Secondary filtering

After the torque data undergoes primary filtering, if the secondary filtering is disabled, the torque signal is not further filtered within the secondary filter; otherwise, the torque data is passed through the secondary filter. The secondary filter is a digital low-pass filter with a cutoff range of 20 Hz to 0.05 Hz, where this range indicates the cutoff frequency of the torque signal. A lower cutoff frequency corresponds to slower variations in the torque signal; for example, during torque sensor calibration or metrology, the secondary filter can be set to 0.1 Hz or 0.05 Hz, resulting in a slower torque signal response, which facilitates operator readability of torque readings. The default setting for the secondary filter at the factory is "OFF".

4. 3. Rotational speed filtering

The rotational speed data from this sensor is output after passing through a filter, with the filter grade also ranging from 1 to 99. The raw rotational speed signal of this sensor is a frequency signal, and the acquisition methods for this frequency signal include the "pulse counting method" and the "period measurement method"; the former is suitable for applications requiring high rotational speeds and low response speeds, while the latter is suitable for applications requiring low rotational speeds and high response speeds. Customers may freely select either of these two methods. When the rotational speed filter grade is set to 1–98, the "period measurement method" is used for signal acquisition; when the filter grade is set to 99, the "pulse counting method" is used. After changing the signal acquisition method, the sensor must be powered on again for the new setting to take effect.

4. 4. Number of decimal places

During the factory commissioning phase of this sensor, technicians will adjust the data resolution based on the sensor's measurement range and/or customer requirements, and then adjust the decimal places according to the relationship between the selected data resolution and the actual measured data. The decimal places for torque are intended solely for display purposes; adjusting them will not enhance the torque output resolution. In contrast, adjusting the decimal places for rotational speed and power will affect the output accuracy of those respective data parameters.

4. 5. Data unit

The torque, rotational speed, and power data correspond to their respective units, which can be modified. When the units for torque or rotational speed are changed, the power calculation will be adjusted accordingly; the power value will then be computed based on the selected torque and rotational speed units, along with the number of decimal places.

1. 1. Power-on reset

The customer can enable the torque data zeroing function upon power-on; when activated, this function will automatically reset the torque zero point during subsequent power-on cycles. All torque output data will then be referenced against this zero point.

4. 6. Reset rotational speed

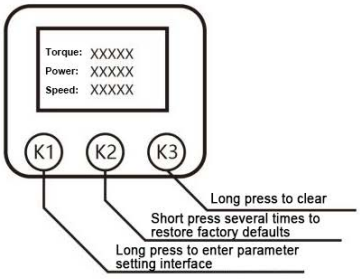
The speed signal of this sensor is a frequency signal; when the sensor operates at a lower speed, the speed frequency decreases accordingly, and its speed sampling rate also decreases. This can result in slower response speeds for speed data during low-speed operation or when the speed reaches zero, thereby compromising the real-time correspondence between torque and power. The "Speed Zeroing" parameter can be set within the range of 9.9–0.1 RPM; this setting causes the speed data to automatically reset to zero when the actual speed falls below this threshold. If the customer requires high real-time performance for speed data during low-speed operation or stall testing, the "Speed Zeroing" parameter value can be increased, which will enable faster response speeds during both zeroing and low-speed operation. Conversely, if the measurement target is speeds below 1.0 RPM, the "Speed Zeroing" parameter value should be reduced to below 1.0 RPM to ensure continuous speed sampling.

1. 2. Torque direction

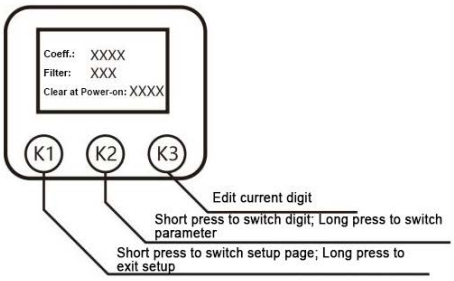
If a customer needs to toggle between positive and negative torque values, they can modify the "Torque Direction" parameter, which can be set to 0 or 1 to correspond to the torque direction and the sign of the torque values, respectively.

5. Operation Declaration

Main Display Screen Schematic Diagram



Parameter Modification Interface Diagram



5. 1. Parameter Modification

When the main interface is displayed, long-pressing the K1 button will bring up the parameter modification interface. This interface displays three groups of parameters, and the cursor defaults to the first parameter row. You can long-press the K2 button to move the cursor to the next parameter row in the current interface. A short press of the K2 button allows the cursor to cycle through the data bits of the current parameter. A short press of the K3 button increments the selected bit of the current parameter. Parameter modification is automatically saved. To return to the main interface, simply long-press the K1 button again.

5. 2. Data displayed independently

Due to display size limitations, the data on the main interface appears small, making it difficult to observe. To address this, you can briefly press the K1 button while on the main interface to cycle through independent display interfaces. Each independent display interface will show specific data—such as "torque," "rotational speed," and "power" —with the data rendered in a larger font size.

5. 3. Adjust zero point

When the main interface is displayed, long-press the K3 button to reset the current torque data and set the current torque zero point.

5. 4. Factory data reset

On the main display interface, hold down the K2 button continuously, then press it rapidly five or more times to restore the current parameters to their factory defaults.

6. Parameter List

Parameter Name	Span	Default value	Mailing address	Supporting Instruction	Explain
Primary filtering	1 ~ 99	50	0X08	03H, 10H	Regarding the first-order filter gain for torque data, a higher value indicates greater stability of the torque data, but also results in slower variations of the torque signal.
Secondary filtering	20 ~ 0.05Hz	OFF	0X3E	03H, 10H	Indicates the cutoff frequency of the torque signal output; the default setting is OFF. 0: indicates OFF state. 1: indicates 20 Hz. 2: Indicates 10 Hz. 3: Indicates 5 Hz. 4: Indicates 2 Hz. 5: Indicates 1 Hz. 4: Indicates 2 Hz. 5: Indicates 1 Hz. 6: Indicates 0.5 Hz. 7: Indicates 0.2 Hz. 8: Indicates 0.1 Hz. 9: Indicates 0.05 Hz.
Rotational speed filtering	1 ~ 99	50	0X2A	03H, 10H	Filter gain for speed data. The higher the value, the more stable the speed data will be, but the speed signal will change more slowly.
Torque value	0 ~ 4	/	0X26	03H, 10H	The torque data shall correspond to the number of decimal places used in the power calculation; this data may not be altered by non-authorized personnel of our company.
Rotational speed decimal	0 ~ 3	/	0X2C	03H, 10H	The rotational speed data indicates the number of decimal places used in the power calculation.
Power fraction	0 ~ 3	/	0X3A	03H, 10H	The power data displays a number of decimal places.
Torque unit	Nm ~ KNm	/	0X34	03H, 10H	Units for torque data. 0: denotes Nm. 1: denotes mNm. 2: representation KNm.
Rotational speed unit	RPM	/	0X36	03H, 10H	Unit for rotational speed data. 0: indicates RPM.
power unit	W ~ KW	/	0X38	03H, 10H	Power data units. 0: denotes W. 1: denotes kW.
display mode	0 ~ 99	/	0X44	03H, 10H	A units digit of 0 indicates Chinese display; a units digit of 1 indicates English display.
Power-on reset	0 ~ 1	1	0X0A	03H, 10H	0: Torque does not reset upon power-on; 1: Torque resets upon power-on
Reset rotational speed	9.9 ~ 0.1	1.0	0X2E	03H, 10H	When the rotational speed data falls below this threshold (in RPM), the rotational speed data is reset to zero.
Torque direction	0 ~ 1	0	0X28	03H, 10H	0: Default torque direction; 1: Opposite torque direction
Single-cycle pulse	/	/	0X3C	03H, 10H	The number of speed pulses output per full rotation of the sensor shaft is hardware-dependent and cannot be modified. 0: indicates 10 pulses. 1: indicates 60 pulses. 2: Indicates 120 pulses.
Torque range	/	/	0X1C	03H, 10H	This pertains to the hardware; it must not be modified by non-technical personnel of our company.
IP1 address	0 ~ 255	192	0X0C	03H, 10H	Splitting an IPv4 address into bytes (Part 1).
IP2 address	0 ~ 255	168	0X0E	03H, 10H	Splitting an IPv4 address into bytes (Part 2).
IP3 address	0 ~ 255	1	0X10	03H, 10H	Split an IPv4 address into 3 bytes.
IP address prefix of class 4	0 ~ 255	160	0X12	03H, 10H	Split an IPv4 address into 4 bytes.
MAC1 address	0 ~ 0XFFFF	/	0X14	03H, 10H	Segment the physical address of this device into segments 1.
MAC2 address	0 ~ 0XFFFF	/	0X16	03H, 10H	Segmentation of the physical address of this device: 2.
MAC3 address	0 ~ 0XFFFF	/	0X18	03H, 10H	Segment the physical address of this device into three parts.
Port number	0 ~ 65535	502	0X1A	03H, 10H	The TCP protocol port: modifying the port number can affect the interval at which the Ethernet proactive upload protocol transmits data packets; for further details, refer to the "Ethernet Proactive Upload Protocol" section.
TCPprotocol	0 ~ 2	1	0X40	03H, 10H	Set the parameters for the Ethernet-based communication protocol. 0: HEX-6 active upload 1: MODBUS TCP 2: HEX-8 Active Upload

traffic rate	0 ~ 230400	19200	0X1E	03H, 10H	Selection of RS485 communication baud rate.
Communication mode	0 ~ 3	1	0X20	03H, 10H	Set the parameters for the RS485 communication protocol. 0: Active upload of HEX-6 bytes 1：MODBUS RTU 2: ASCII Active Upload 3: Proactively upload HEX-8 bytes
mailing address	0 ~ 255	1	0X22	03H, 10H	MODBUS-RTU slave device protocol, sensor address code.
communication mode	N81,N82,O91 O92,E91,E92	N81	0X24	03H, 10H	0：N81, 1：N82, 2：O91, 3：O92, 4：E91, 5：E92
Prioritize high and low	4321 ~ 1234	4321	0X42	03H, 10H	Indicates the byte order for Modbus RTU communication data. 0: Indicates that the byte order of the Modbus RTU communication data is 4321. 1: Indicates that the byte order for Modbus RTU communication data is 3412. 2: Indicates that the byte order for Modbus RTU communication data is 2143. 3: Indicates that the byte order of the Modbus RTU communication data is 1234.
Reset torque	/	/	0X30	05H, 10H	Establish a new torque zero point.
Reset to factory settings	/	/	0X32	05H, 10H	Clear user-modified data and restore data to factory settings.
real-time data					
Torque value	99999～ -99999	/	0X00	03H	Real-time torque.
Rotational speed	+99999～ 0	/	0X02	03H	Real-time RPM.
magnitude of power	+99999～ 0	/	0X04	03H	Real-time power.

(If the current register address cannot be used, you may add 4000 or a multiple of 4000 to the communication address.)

Under the (10H) command, perform reset and factory reset by writing 00 00 00 01 to d1−d4.

(All parameters are `int` type variables, each occupying 4 bytes)

7. RS485 Communication Specifications

This torque sensor supports RS-485 communication, as well as MODBUS-RTU and active upload protocols. There are four available communication modes: Communication Mode 0, Communication Mode 1, Communication Mode 2, and Communication Mode 3. Communication Modes 0 and 3 are protocols for communication with our company's proprietary software and instruments. Communication Mode 1 follows the standard MODBUS-RTU protocol. Communication Mode 2 utilizes the ASCII active upload protocol. The specific communication formats for each of these four protocols are described below. (Note: The checksum method used on this device is CRC16.)

7.1. HEX-6 Byte Active Upload Protocol (Communication Mode 0)

Relationship between baud rate and transmission rate

	9600bps	14400bps	19200bps	38400bps	57600bps
Transmission speed	50 Hz	50 Hz	100 Hz	200 times per second	500 Hz
Frame interval	20ms	20ms	10ms	5ms	2ms

	115200bps	230400bps
Transmission speed	1,000 times per second	2,000 times per second
Frame interval	1ms	0.5ms

(Change the baud rate; the data transmission speed adjusts automatically without requiring modifications to other parameters.)

If you are equipped with a torque display instrument featuring this torque sensor or with our company's custom host computer, please set the communication mode to 0 or 3 while simultaneously transmitting torque data and rotational speed data. When the DYN200 torque sensor is set to communication mode 0, it actively uploads six bytes of data, and each transmitted data sequence must unde**Example of** validation. This transmission method employs scheduled transmission.

D1 D2		D3 D4		D5 D6	
0X**	0X**	0X**	0X**	0X**	0X**

The data format is as follows: D1 and D2 represent the current torque values, with a maximum value of 65535; D3 and D4 represent the current rotational speed values, with a maximum value of 32767; D5 and D6 are CRC check bits, where the most significant bit of D3 indicates the sign of the torque value—when this bit is set to 1, the torque value is negative. The checksum algorithm used is CRC16.

7.2. HEX-8 Byte Active Upload Protocol (Communication Mode 3)

This communication protocol serves as a supplement to the HEX6 byte active upload protocol; it can be used for HEX communication when the rotational speed data exceeds 32767 or the torque data exceeds 65535. This transmission method employs timed transmission.

Example of

D1 D2 D3			D4 D5 D6			D7 D8	
0X**	0X**	0X**	0X**	0X**	0X**	0X**	0X**

The data format is as follows: D1 and D2 represent the current torque values, with a maximum value of 0x7FFFFF; when the torque is negative, the most significant bit of D1 is set to 1—for example, if the torque data is 0xFF 0xFF 0xFE, it indicates a torque value of-2. D4, D5, and D6 represent the current rotational speed values, with a maximum value of 0xFFFFFF. D7 and D8 are CRC check bits, and the checksum algorithm used is CRC16.

7. 3. ASCII Active Upload Protocol (Communication Mode 2)

Relationship between Baud Rate and Transmission Rate

	9600bps	14400bps	19200bps	38400bps
Transmission speed	50 Hz	50 Hz	100 Hz	200 times per second
Frame interval	20ms	20ms	10ms	5ms
	57600bps	**115200bps**	**230400bps**	
Transmission speed	500 Hz	1,000 times per second	2,000 times per second	
Frame interval	2ms	1ms	0.5ms	

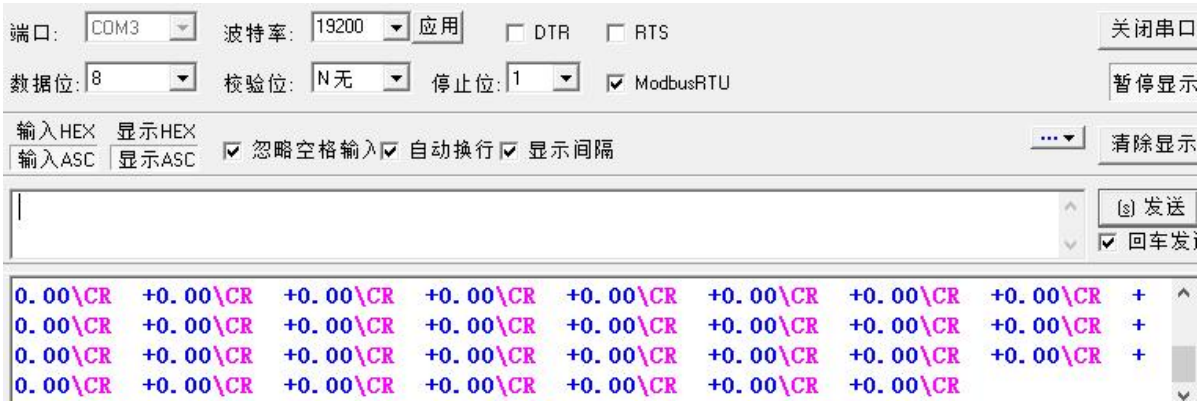
(Change the baud rate; the data transmission speed adjusts automatically without requiring modifications to other parameters.)

If you are using ASCII active upload, please set the communication mode to 2. If you need to change the transmission rate, simply adjust the baud rate. To ensure speed and stability, ASCII active upload transmits only real-time torque data.

One data segment has the following format: 2B 30 2E 30 30 30 31 0D

When converted using an ASCII code table, the resulting data is: +0.0 0 0 1\CR

The data received from the host computer are as follows:



7. 4. MODBUS_RTU Protocol (Communication Mode 1)

(Note: XXH denotes hexadecimal; 10H converts to 16 in decimal.)

Sensor code	The sensor operates in slave mode, with a default device ID of 01H.
Baud rate	When using MODBUS_RTU communication, it is recommended to use a baud rate below 19200, as higher baud rates can lead to an increased error rate.
stop bit	The stop positions are one bit and two bits, with two-bit stop positions being the default.
03H Command	It can read the current rotational speed, torque, and power values, among others.
05H Command	You can perform a factory reset to restore the device to its factory settings.
10H Command	You can modify coefficients, apply filtering, adjust the decimal point, and more.
Communication Example	01: Machine code; crc0: lower byte of the CRC check value; crc1: upper byte of the CRC check value. The Commix software can automatically calculate the checksum, and most PLCs already incorporate built-in data validation capabilities.

03H Functional Code Examples

send

01	03	00 00	00 02	C4 0B	Read the torque measurement value (long)
Machine code	read command	start address	Number of reads	check code	

retur

01	03	04	d1 d2 d3 d4	crc0 crc1	(d1–d4: torque measurement data; d1 is the most significant bit, and d4 is the least significant bit)
Machine code	read command	Byte count	measured value	check code	

Note: Each register contains a 16-bit hexadecimal value, with every four bytes constituting a complete data unit. By default, the data is ordered with the most significant byte first and the least significant byte last; the data format is an integer type, stored in two's complement, representing signed integers.

Note: For data such as torque and rotational speed that includes decimal places, the raw readings should be rounded to the nearest integer; then, dividing this rounded value by 10^(number of decimal places) yields the correct data value. For example, if the decimal place precision of torque is 2 and the raw reading is 241, the actual torque value is 2.41 Nm.

for instance:

00000000H represents 0; 00000001H represents 1; FFFFFFFFH represents-1; FFFFFFFEH represents-2.

05H Functional Code Examples

send

01	05	00 00	ff 00	8C 3A	(Zeroing operation)
Machine code				check code	

retur

01	05	00 00	ff 00	8C 3A
Machine code				check code

10H Function Code Examples

send

		00 06	00 02 04	d1 d2 d3 d4	8C 3A	(Modified filtering) d1–d4 represent the filter values, with the
Machine	Write a comman	address	register	Filter value	check code	

retur

01	10	00 06	00 02	A1 C9
Machine code	Write a command	address	register	check code

Under the (10H) command, perform reset and factory reset by writing 00 00 00 01 to d1–d4.

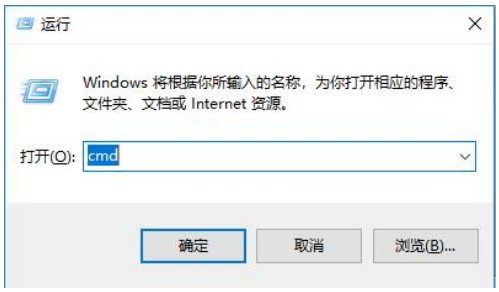
8. Ethernet Communication Guidelines

This sensor comes standard with Ethernet communication support. It utilizes the Modbus TCP protocol to communicate with a host computer or a PLC, and employs a custom protocol (i.e., Ethernet active upload mode) to communicate with our proprietary host computer. The Modbus TCP protocol of this sensor supports operation commands 03H and 10H; for detailed Modbus-RTU protocol specifications, please refer to the official Modbus TCP standard documentation, as this document will not cover those details. The total length of transmitted and received data packets shall not exceed 30 bytes. If high-speed torque acquisition is required, you may directly utilize the Ethernet active upload mode, enabling data to be packetized and transmitted.

Preparation

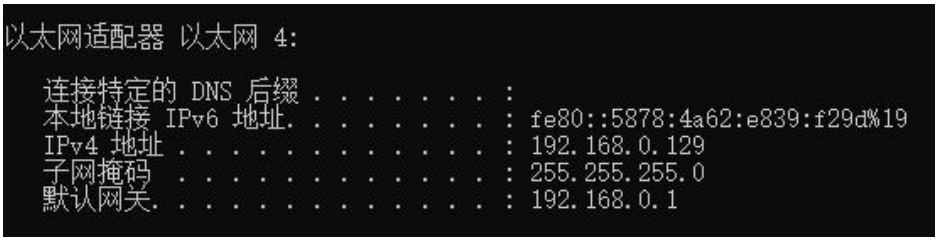
Connect the RJ45 connector of the sensor to the switch, router, and PC.

In Windows, press Win+R on your desktop, then type "cmd" in the pop-up dialog box.



After pressing the OK button, type "ipconfig" in the pop-up black window, then press the Enter key.

Find the IP address and the default gateway of this machine's Ethernet connection.



Next, proceed to the parameter configuration section to set the IP address of the instrument. The first three octets of the instrument's IP address must match the first three octets of the gateway's IP address; for example, if the gateway address is 192.168.0.1, the instrument address must be 192.168.0.x. Additionally, the instrument's IP address must be distinct from other IP addresses within the local area network (LAN). Once the sensor's IP address and port number have been configured, restart the sensor to establish normal communication. After modifying the Ethernet parameters, the sensor must be restarted to resume normal communication.

8. 1. MODBUS TCP Protocol (TCP Communication Mode 1)

Modbus-TCP supports the 0x03 read command and the 0x10 write command; below is the basic command format.

0x03 Read Command

Send command:

00 00 00 00 00 06 01 03 00 00 00 02

00 02: Read number of registers
00 00: Register start address
03: Refers to the 03 command
01: Machine Code
00 06: indicates that there are 6 bytes following it.
00 00: Protocol identifier; 00 00 indicates that this command is a modbusTCP command.
00 00: Communication transaction processing identifier; the same value is used for both the send and return operations, serving to mark that the send and return commands are one-to-one corresponding.

Return command:

00 00 00 00 00 07 01 03 04 00 01 00 02

00 01 00 02: Value of the read register
04: Next, the byte length
03: Function code, consistent with the sent command
01: Machine code, consistent with the command sent
00 07: Next data length
00 00: Protocol identifier, consistent with the command being sent
00 00: Communication transaction processing identifier, consistent with the sent command

Write command 0x10

Send command:

00 FF 00 00 00 0B 01 10 00 06 00 02 04 00 00 00 0B

00 00 00 0B: Write parameters
04: The following byte count
00 02: Number of registers
00 06: Register start address
10: Refers to the Ten Commandments
01: Machine Code
00 0B: Next byte length
00 00: Protocol identifier; 00 00 indicates that this command is a modbusTCP command.
00 FF: Communication transaction processing identifier; the same value is used for both the send and return operations, serving to mark that the send and return commands are one-to-one corresponding.

return command

00 FF 00 00 00 06 01 10 00 06 00 02

00 02: Number of registers to write to
00 06: Register start address
10: Function code, consistent with the sent command
01: Machine code, consistent with the command sent
00 06: Next byte length
00 00: Protocol identifier; 00 00 indicates that this command is a modbusTCP command.
00 FF: Communication transaction processing identifier, consistent with the sent command

8. 2. Ethernet HEX-6 Active Upload Protocol (TCP Communication Mode 0)

This protocol is relatively simple. When the PC and the sensor are connected via the same gateway or are linked by a network cable, the PC establishes a connection with the sensor using the TCP protocol. Given that TCP provides reliable transmission, the data packets transmitted do not include header, footer, or checksum fields. By default, the system transmits approximately 53 packets per second, each packet containing 480 bytes, with four bytes per packet representing torque and rotational speed data. The packet size may vary depending on the port number. The format of a single data packet is as follows:

D1 D2		D3 D4	
0X**	0X**	0X**	0X**

D1 and D2 represent the current torque values, with a maximum value of 65535; D3 and D4 represent the current rotational speeds, with a maximum value of 32767. The most significant bit of D3 indicates the sign of the torque value: if this bit is set to 1, the torque value is negative. This transmission method employs timed transmission.

Impact of port number configuration on the size and transmission rate of actively sent data packets

For example, if the port number is set to 502 or is not one of the following addresses, it indicates that the packet size of the Ethernet Active Upload Protocol is 480 bytes, with approximately 53 packets transmitted per second.

When the port number is set to 503, the packet size of the Ethernet Active Upload Protocol is 240 bytes, and approximately 10^7 packets are transmitted per second.

When the port number is set to 504, the packet size of the Ethernet active upload protocol is 120 bytes, and approximately 213 packets are transmitted per second.

When the port number is set to 505, the packet size for the Ethernet Active Upload Protocol is 72 bytes, and

approximately 355 packets are transmitted per second.

port number	Data size per package	Number of data entries per package	Package interval	Total number of data transmissions
1~502，506~65535	480 bytes	120	18.75MS	6400
503	240 bytes	60	9.37MS	6400
504	120 bytes	30	4.68MS	6400
505	72 bytes	18	2.81MS	6400

(After modifying the port, the system must be restarted; the data packet transmission speed will be automatically adjusted.)

8. 3. Ethernet HEX-8 Active Upload Protocol (TCP Communication Mode 2)

This agreement is an upgraded version of the HEX-6 active upload protocol. The primary difference is that the number of bytes has been increased, with data now transmitted in 6-byte chunks; however, the number of data packets per transmission remains unchanged. The format of a single data segment is as follows:

D1 D2 D3			D4 D5 D6		
0X**	0X**	0X**	0X**	0X**	0X**

Data fields D1, D2, and D3 represent the current torque values, while data fields D4, D5, and D6 represent the current rotational speed values; this transmission method employs periodic transmission.

Impact of port number configuration on the size and transmission rate of actively sent data packets

port number	Data size per package	Number of data entries per package	Package interval	Total number of data transmissions
1~502，506~65535	720 bytes	120	18.75MS	6400
503	360 bytes	60	9.37MS	6400
504	180 bytes	30	4.68MS	6400
505	108 bytes	18	2.81MS	6400

(After modifying the port, the system must be restarted; the data packet transmission speed will be automatically adjusted.)

9. Speed Output

	60 pulses	2000 pulses
Detectable speed range	20000RPM	3000RPM
output	monopulse	A.B.ZXiang
Differentiate between forward and reverse rotation	deny	yes
Output rise time (5V)	12us	1us
output form	Open-collector (OC)	NPN transistor with open-collector configuration PNP collector open-circuit NPN voltage output (default)
OC pull-up voltage	5-30V	/

9. 1. Rotational speed acquisition method

This torque sensor employs two speed acquisition methods: the "pulse counting method" and the "periodic measurement method." When the "speed filtering" parameter is set to 1–98, the periodic measurement method is used, which ensures the accuracy and real-time performance of speed data at

low speeds; however, this approach results in a partial positive correlation between the speed acquisition rate and the actual speed value. When the "speed filtering" parameter is set to 99, the "pulse counting method" is utilized; this method guarantees data stability and accuracy at high speeds, albeit with reduced real-time performance. After modifying the speed acquisition method, the sensor must be powered up again for the new configuration to take effect.

9. 2. Rotation speed acquisition rate

The speed of speed acquisition is influenced by the speed acquisition method. When using the "periodic measurement method" with a 60-pulse code disk, if the rotational speed exceeds 25 PRM, the speed of speed acquisition is 25 cycles per second. When using the "pulse counting method," the speed of speed acquisition is 1 cycle per second, regardless of the number of pulses on the speed code disk.

9. 3. Rotational speed filtering

When the speed fluctuation of the motor is significant, you may adjust the "Speed Filtering" parameter; a higher speed filtering value results in more stable speed data, but at the cost of slower response speed for the speed data. When the speed filtering value is between 1 and 98, the "periodic measurement method" is used for speed acquisition; when the speed filtering value is 99, the "pulse counting method" is used for speed acquisition.

9. 4. Rotational speed decimal

When the rotational speed ranges from 1–100 RPM, the minimum resolution of the rotational speed is 0.001 RPM, and the decimal places for the rotational speed are set to 3. To ensure real-time performance, when the rotational speed is below 2.000 RPM, the rotational speed data is output directly without filtering.

Within the speed range of 1–1000 RPM, the minimum speed resolution is 0.01 RPM, and the speed resolution decimal places are set to 2. To ensure real-time performance, when the speed is below 20.00 RPM, the speed data is output directly without filtering.

Within the speed range of 1–10,000 RPM, the minimum speed resolution is 0.1 RPM, and the decimal place for speed is set to 1. To ensure real-time performance, when the speed is below 200.0 RPM, the speed data is output directly without filtering.

Within the speed range of 1–20,000 RPM, the minimum speed resolution is 1 RPM, and the speed decimal place is set to 0. To ensure real-time performance, when the speed is below 200 RPM, the speed data is output directly without filtering.

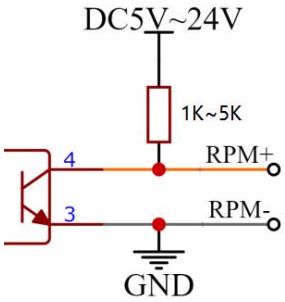
9. 5. Speed zeroing threshold

When performing a motor locked-rotor test or low-speed measurement, the larger the value set for the "Speed Zeroing" parameter, the faster the speed will be reset to zero. If low-speed measurement is required—such as testing at 0.5 RPM—the "Speed Zeroing" parameter can be set to 0.2 to ensure the stability and continuity of low-speed data acquisition.

9. 6. Standard output configuration for rotational speed

By default, this torque sensor outputs 60 Hz per revolution; for customized configurations, the maximum measurable speed can be set to 15,000 RPM for torque up to 100 N·m, or 120 Hz for maximum measurable speed up to 8,000 RPM. All three configurations utilize the OC output mode, i.e., the open-collector output mode. When using this output, a pull-up resistor must be connected to the collector; the pull-up resistor should be selected from the range of 1 kΩ to 5 kΩ, with 2 kΩ being the

commonly chosen value. The resistor value must neither be too large nor too small, as this could distort the output frequency and narrow the output frequency range.



Example: Connect the RPM+ pin to a 2K pull-up resistor to 24 V, connect the RPM-pin to ground, and connect the output signal to RPM+. In this configuration, the output signal will be a square wave representing the rotational speed frequency with an amplitude of 24 V.

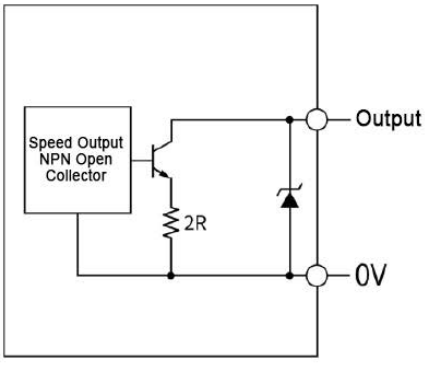
9. 7. Encoder output mode

Relationship between encoder parameters and sensor measurement range

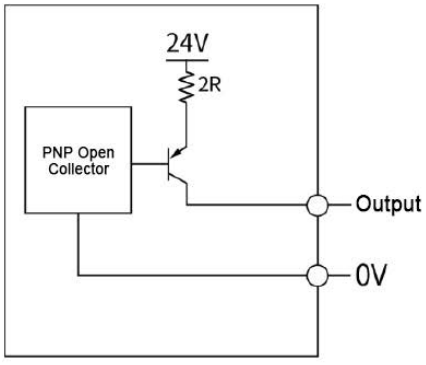
Sensor measurement range (N•m)	Diameter of axle(mm)	Encoder number of lines	Signal output
0.1-5	10	2000	ABZ
0.1-100	18	2000	ABZ
200-300	28	not have	not have
500-800	38	2050	ABZ
1000-5000	60	1600	AB
10000-20000	98	4700	AB

If you have higher requirements for rotational speed sampling speed and accuracy, you may optionally select the built-in encoder output mode, in which the encoder is integrated within the sensor. The overall dimensions of the sensor remain unchanged, enhancing its adaptability. This encoder draws power directly from the sensor's 24 V supply, eliminating the need for an external power supply; however, if differential signal output is required, custom configuration is necessary. Three output modes are available; the following sections describe the internal circuitry and wiring definitions for each of these modes.

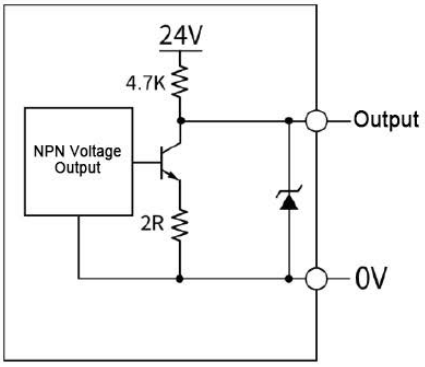
NPN collector open-circuit output



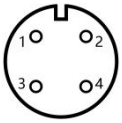
PNP collector open-circuit output



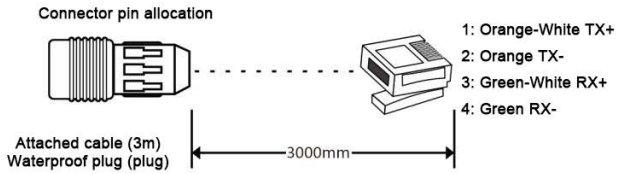
NPN voltage output

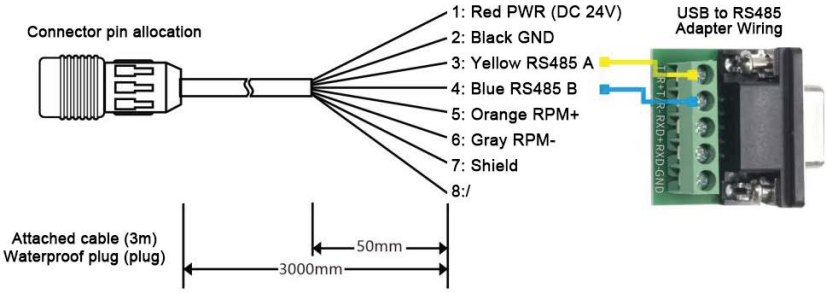


10. Wiring Definition

Type		Pin numbering	Cable color	Signal name
4-pin aviation connector 		1	Orange-White	TX+
		2	Citrus sinensis	TX-
		3	Green and white	RX+
		4	Green	RX-
8-pin aviation connector 	Source	1	red	PWR(DC 24V)
		2	black	GND
	RS485 interface	3	Huang	RS485 A
		5	Lan	RS485 B
	Speed	6	Citrus sinensis	RPM+
		7	Gray	RPM-
		8	shield line	Connect to the instrument housing
		4	reserve	

10. 1. Jack pin distribution





11. Performance Parameters Table

rated capacity	±20000N.m	nolinear	0.1%FS
power input	DC24V	repetitiveness	0.03%FS
Current consumption	Below 200 mA	lag	0.03%FS
Torque output	RS485 and Ethernet	Effect of temperature on the torque zero point	0.01%FS/℃
Speed output	120 / 60 pulses per revolution; RS485 and Ethernet interfaces	Effect of temperature on rotational speed output	0.01%FS/℃

Response performance	6.4kHz	rated speed	3000-8000rpm
load resistance	Above 2 kΩ	Maximum rotational speed	15,000 rpm (customizable up to ≤ 100 N·m)
Signal delay	2.6ms	Maximum torsional angle	2.60x10rad (0.149°)
Overload permitted	150%FS	moment of inertia	0.38x10-4-0.35x10-3kgcm²
Extreme overload	200%FS	Natural frequency of vibration (rotor portion)	19.4kHz
Operating temperature range	-10~+ 50℃	torsional constant	3.85x10Nm/rad

12. Relationship between maximum rotational speed and torque range of the product

Sensor measurement range (N•m)	diameter of axle(mm)	weight(KG)	Default rated speed (RPM)
0.1-5	10	1.3	8000
0.1-100	18	1.5	8000
200-300	28	1.9	7000
500-800	38	3.5	6000
1000-5000	60	8.0	4000
10000-20000	98	38	3000

13. Torque conversion relationship (to prevent sensor overload)

13. 1. Calculation formula

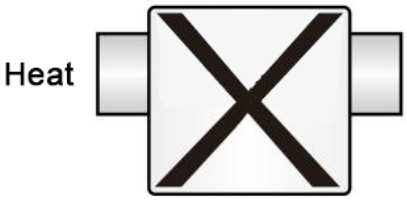
T (torque) = 9550 × P (power) / n (rotational speed)	T – Torque, Nm; P – Power, kW; n – Speed, r/min; 9550 – Coefficient

After installation, rotate the product at low speed to verify its output.

Rotation start/stop conditions and torque: During design and operation, ensure that the torque applied to this product when starting or stopping rotation does not exceed its rated value.

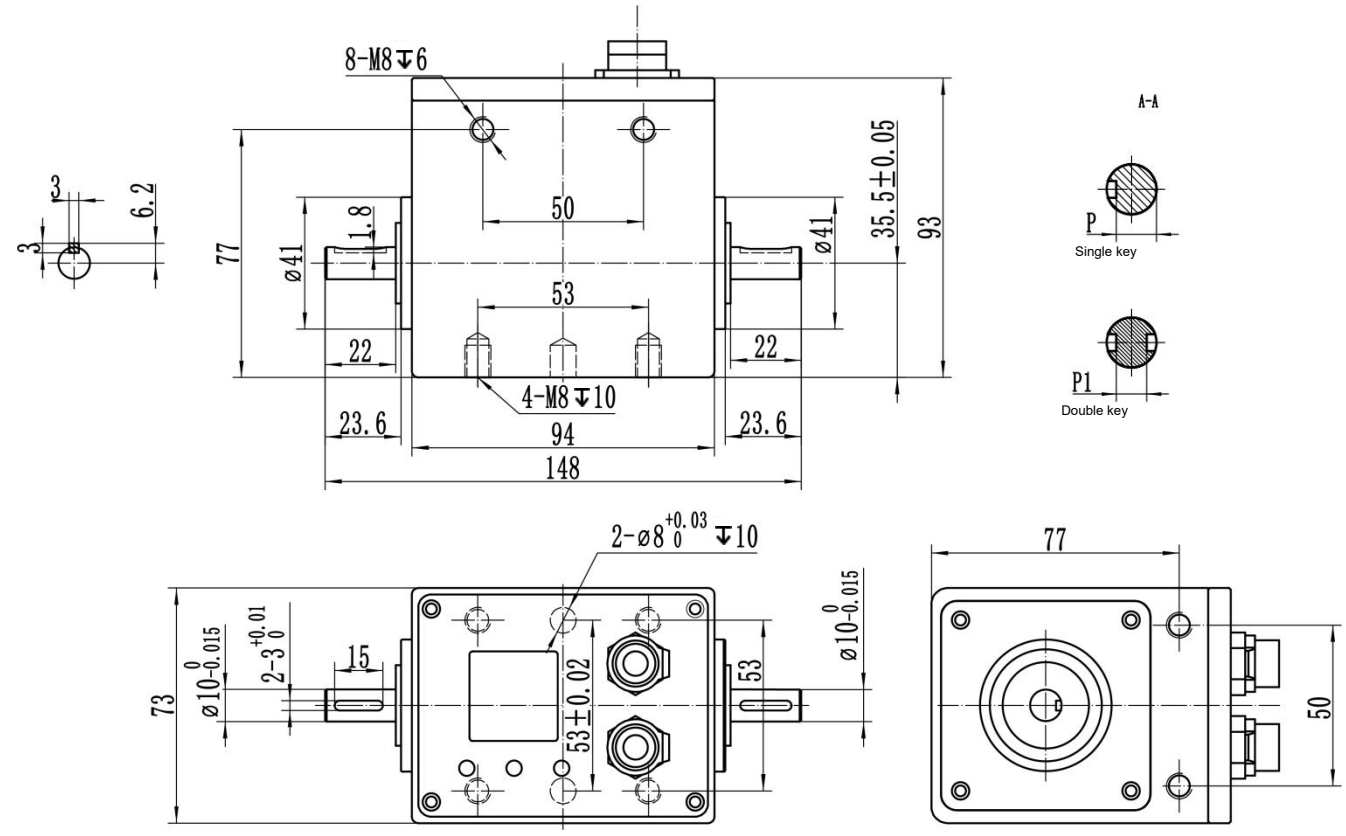
Temperature gradient: During installation, take care to avoid creating a temperature gradient along the shaft. Prevent direct heat transfer from other components to the shaft. High-speed rotation of the shaft may cause bearing overheating. Implement appropriate cooling measures, such as ventilation, as required.

Less temperature gradient

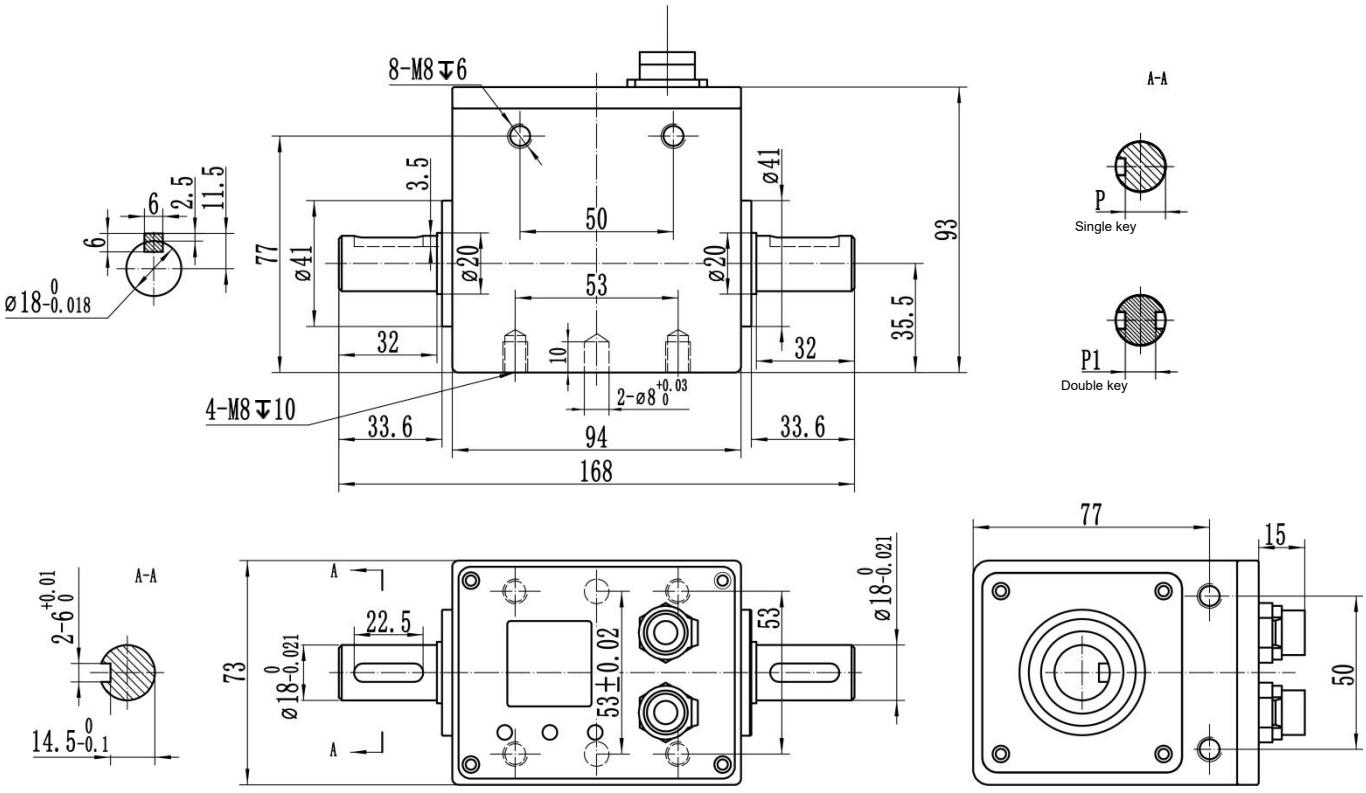


Creates a temperature gradient

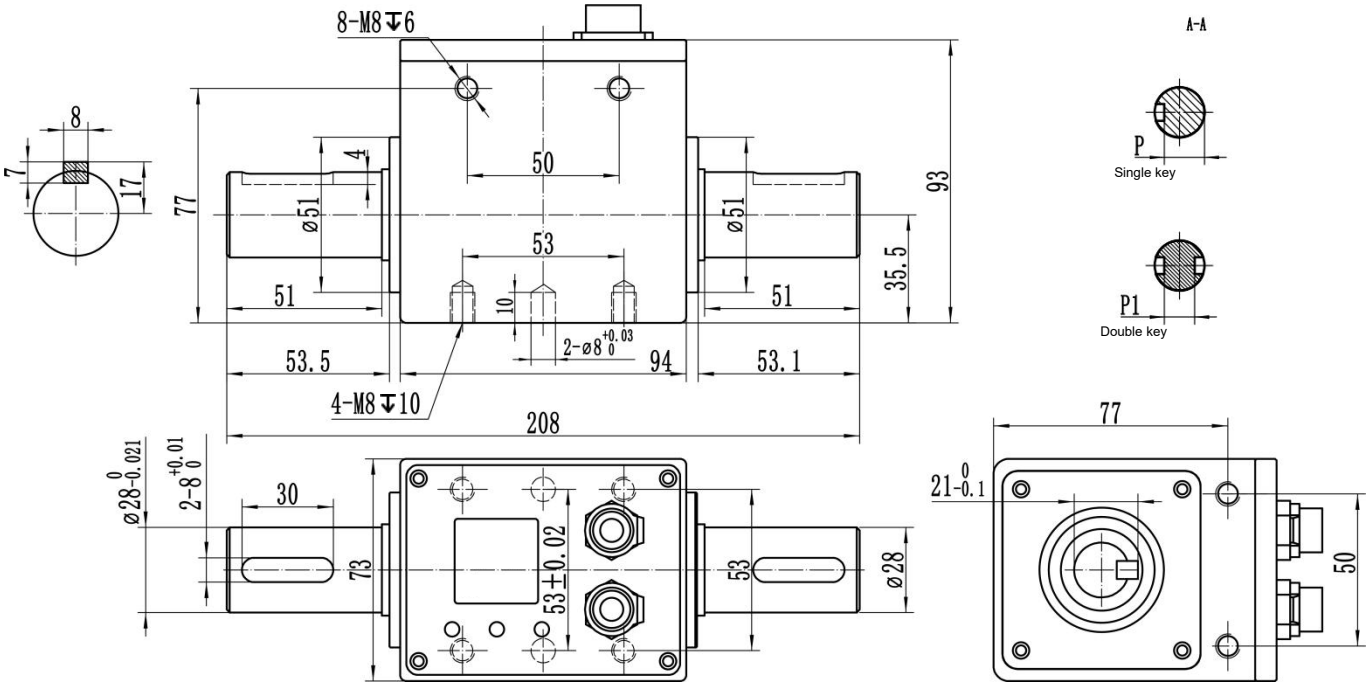
14. product size



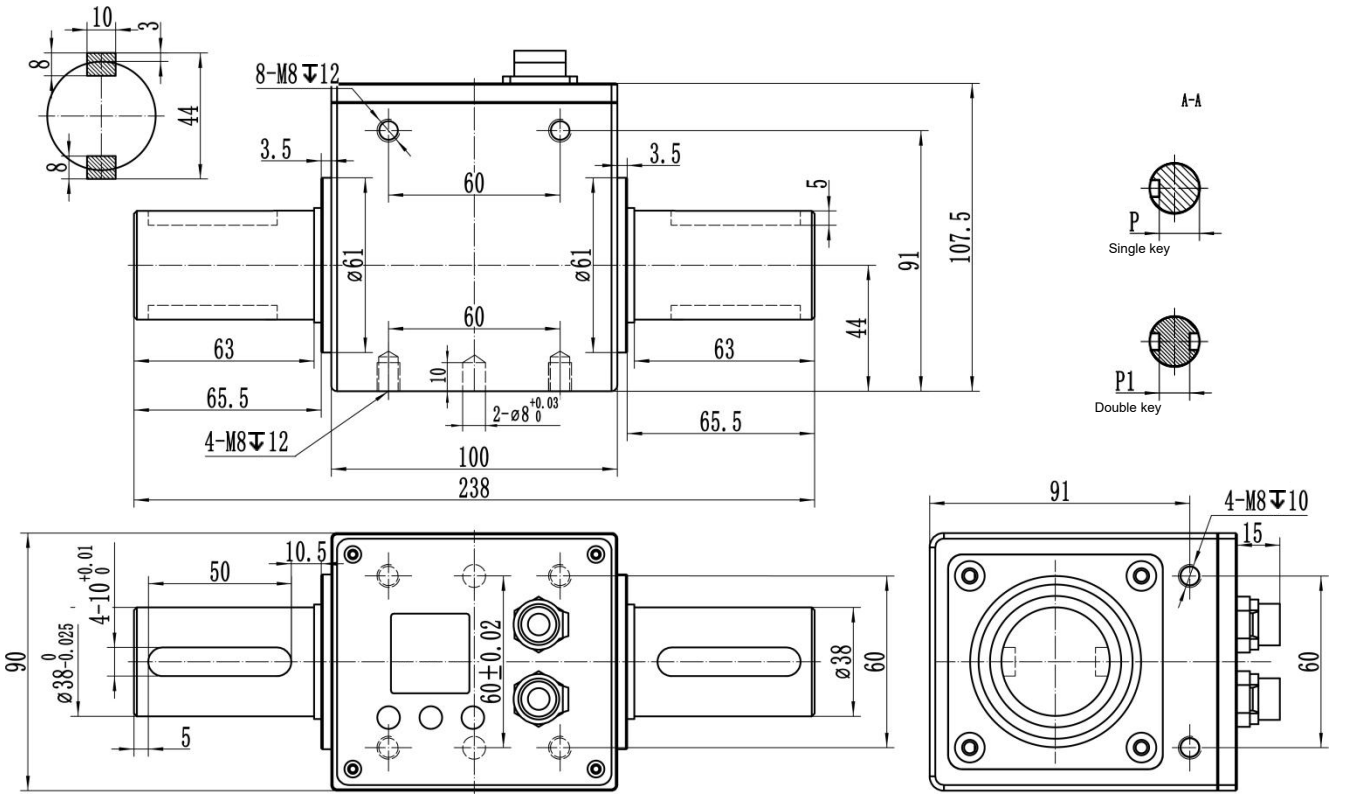
0.1-5NM



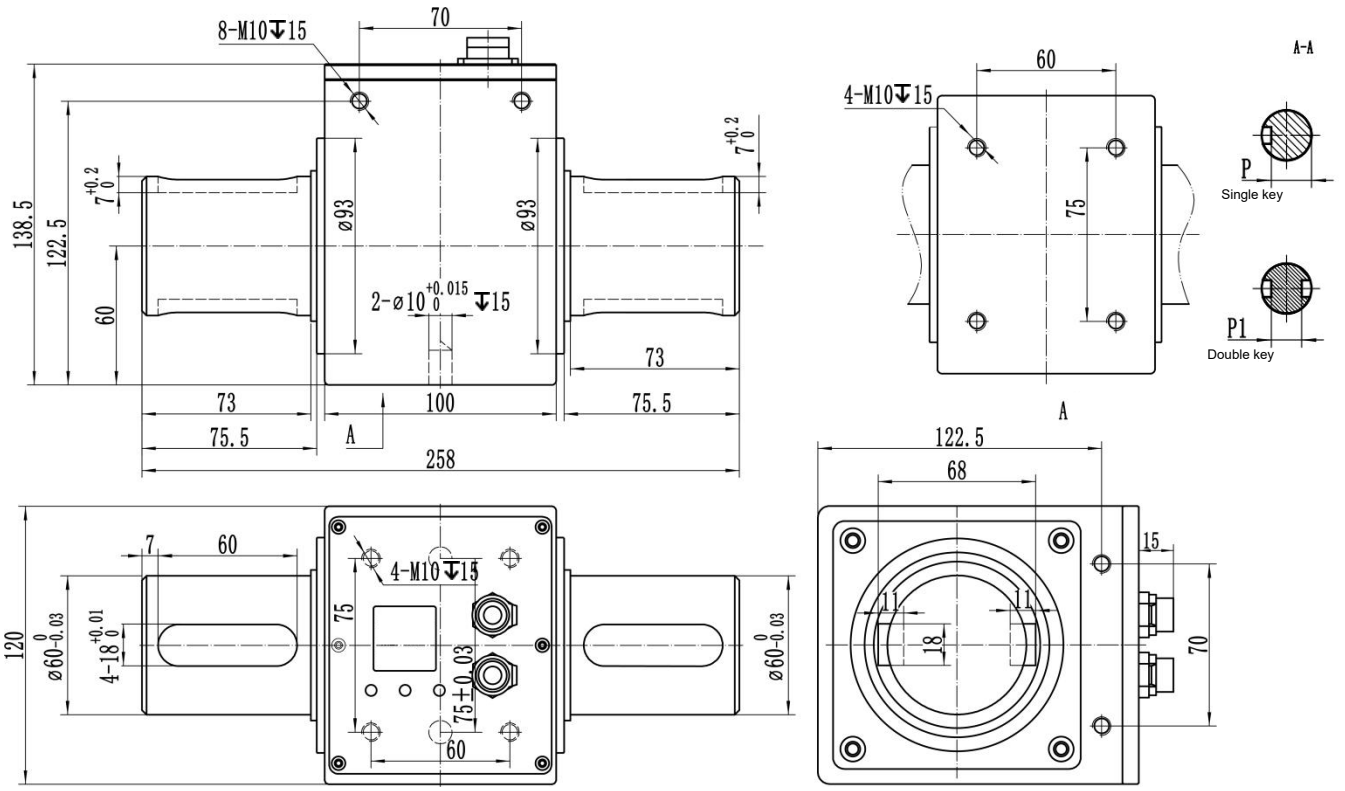
10-100NM



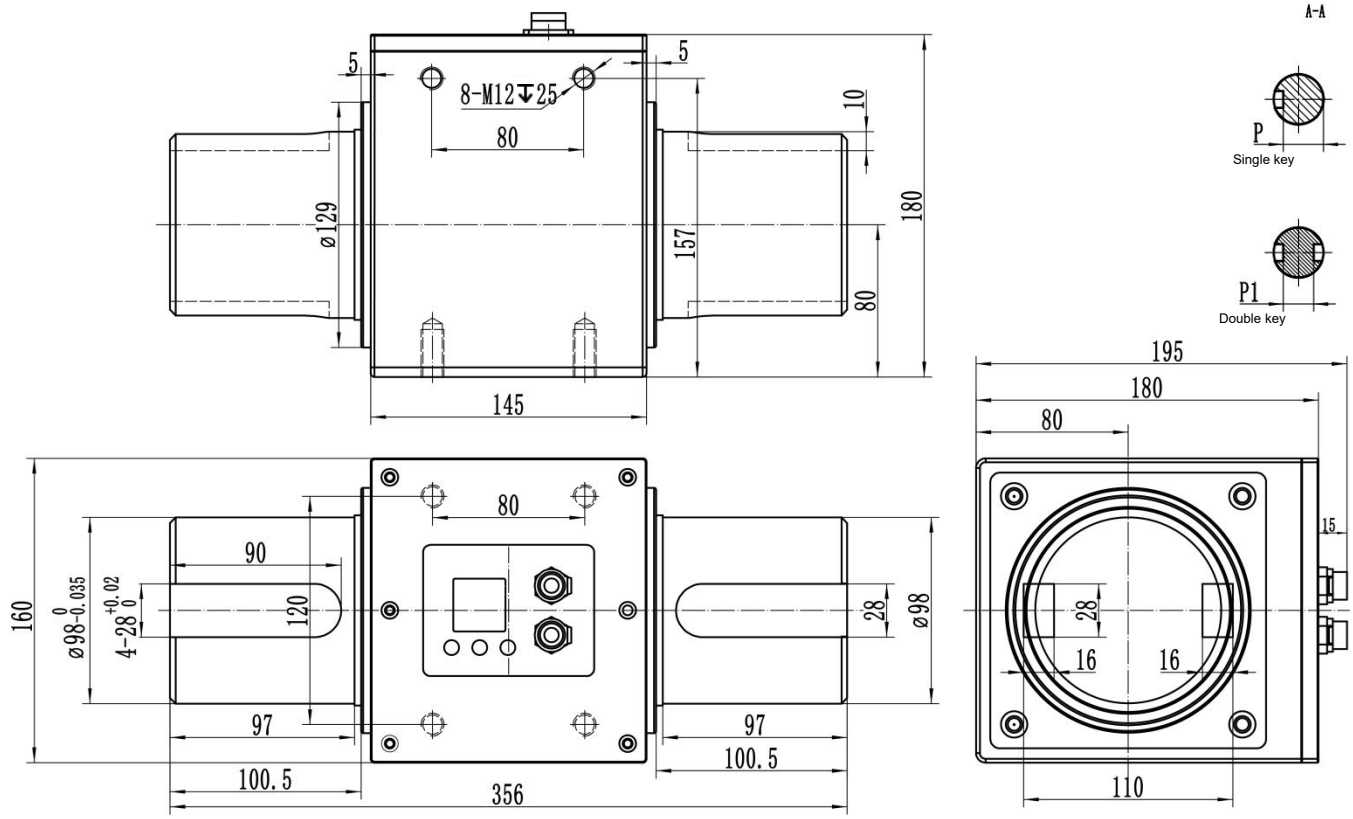
200-300NM



500-800NM



1000-5000NM



10,000–20,000 NM

15. Precautions for Use

Prohibited operations and prohibited behaviors during operations

- Disassembly of this product is prohibited.
- Do not allow this product to fall or be subjected to a strong impact.
- Do not use this product for any purpose other than torque measurement.

warn **Improper operation may result in personal injury or damage to property.**

Design Warning

- To ensure that the entire system continues to operate safely in the event of failure or erroneous operation of this product, please install a safety circuit externally to this product.

- If you intend to use this product for any of the following purposes, please consult our sales representatives before use.

  When used in environments not specified in the user manual

  When used in applications—such as medical equipment, transport equipment, weapons, entertainment equipment, and installation devices—that pose significant risks to personal safety and property.

- During operation, do not touch this product with your hands or fingers, as this may cause injury or result in your clothing being caught by the product. To prevent hazards, be sure to install the safety guard cap or other safety devices so that the device will automatically stop if the rotating parts are accidentally touched.

- In the event that this product becomes damaged, the drive assembly and the load assembly may completely separate. To prevent potential hazards, it is essential to install safety protective devices, such as a safety brake.

Installation warnings

- Please do not install in the following environments.

  In environments containing corrosive or flammable gases

  Areas where water, oil, or chemicals may splash

- When installing a square-end shaft with a recessed-end coupling, if the shaft is misaligned or bent, it may not only fail to meet product performance requirements but also lead to damage of the product due to rotational vibration; in the worst-case scenario, the product could disintegrate, posing a serious safety hazard. During the shaft centering operation, the product must be rotated at low speed to verify that it operates smoothly and exhibits no vibration before commencing operation. When installing this product on the equipment, ensure that the installation deviation remains within the permissible limits. Using this product outside these permissible limits may result in damage to the product itself or adversely affect the equipment on which it is installed.

- Do not apply voltage to the shaft or housing of this product. Additionally, implement protective measures on the exterior of the product to prevent leakage current from entering the shaft.

Warning on the wiring

- Do not connect this product directly to a commercial power supply.

- Before performing the following operations, please ensure that this product is not powered on.

  Unplug the plug

  Cable routing and connection

- Insulate the ends of unused cables to prevent contact with other metal parts or live parts.

- Before connecting the power supply, carefully verify the wiring and other related components.

Warning on the wiring

- Please do not attempt to repair, inspect the internal components of, or modify this product without authorization. Failure to do so may result in fire or electric shock. If repair is necessary, please entrust the repair work to our company.
- Before starting, be sure to verify that the fixed components are securely fastened.

Startup maintenance warning

- Please do not attempt to repair, inspect the internal components of, or modify this product without authorization. Failure to do so may result in fire or electric shock. If repair is necessary, please entrust the repair work to our company.
- Before starting, be sure to verify that the fixed components are securely fastened.

Warning during operation

- When in use, ensure that the supply voltage and load remain within the specified and rated limits. Operating the product beyond these limits may not only cause damage to the product but also adversely affect the equipment used to install it.
- Opening the outer cover of the main unit may result in electric shock or entrapment in rotating parts inside the product.
- If you notice signs such as smoking, burning, or unusual odors, immediately disconnect the power supply.
- Do not touch the rotating or non-rotating parts of this product with your hands while it is rotating. Please be careful not to allow your fingers or clothing to become caught in this product.
- Operating beyond the maximum rotational speed may increase vibration; in severe cases, this can lead to product damage, detachment of components, or even ejection of parts, posing serious hazards. Please strictly adhere to the maximum speed limit. Additionally, even when operating within this limit, take precautions to avoid vibration caused by installation-related dimensional deviations or other factors.
- If operated while the connection is loosely fastened, it may lead to slipping, abnormal overheating, damage, and adversely affect the equipment on which this product is installed. Please ensure that this product is used only when the fastening components are fully tightened. Additionally, it is mandatory to install safety protection devices, such as a safety brake.

⚠Pay attention to

Improper operation may result in personal injury or damage to property.

Installation Notes

● Please do not install in the following environments.

Locations where temperature and humidity exceed the specified ranges
Areas subject to rapid temperature fluctuations, or where freezing or condensation may occur
The region where a temperature difference arises between the drive section and the load section
outdoor
Areas exposed to direct sunlight
Areas with high dust levels
Areas with poor ventilation
Areas with high concentrations of salt and metal chips
The point of direct impact on the subject

● When using the equipment in the following locations, adequate shielding measures, including for cables, shall be implemented.

Near electrical wires
A region where strong electric and magnetic fields are generated
Areas where static electricity and relays, among other devices, generate interference

● During installation, keep the equipment as far away as possible from devices that generate high-frequency signals, high voltages, large currents, or surges. Additionally, when routing cables, ensure that they are separated from these power lines. Do not use parallel routing or routing within the same conduit.

● When connecting the motor as the drive source, follow the user manuals of the variable frequency drive and the servo amplifier, and ensure that the motor housing is properly grounded.

● Do not use until the malfunction has been resolved.

● Do not use screws other than those specified by our company.

Notes on wiring

● During operation, cables may generate static electricity, which could damage the semiconductors within the device.

● Please use a stable DC 24V power supply.

● Please use shielded cables.

● When extending the cable, use a cable with a wire gauge of AWG26 (0.13 mm^2) or larger, and a length not exceeding 10 m.

● To prevent faults caused by static electricity, please ground the housing using its threaded holes.

Startup Maintenance Notes

● If not used according to the specified instructions, the protective performance of this product may be compromised.

● cleaning

When performing a cleaning procedure, please disconnect the power supply.

Do not use a wet cloth. If the stains are severe, soak the cloth in a low-concentration neutral cleaning solution, wring it out, wipe the area, and then dry it thoroughly with a dry, soft cloth.

Precautions for disposal

● When disposing of this product, please treat it as industrial waste.

16. Debugging

Q. No output torque signal is present.

A. 1) Please verify the power supply voltage. Confirm that the power supply voltage is DC 24V.

2) After setting the wiring other than the power supply to an open state, apply torque, and then measure the voltage between SIG and OUT, as well as between SIG and GND.

If no output voltage is present in this state, it can be inferred that the product has failed.

If a voltage is outputted in this state, it can be inferred that there is an issue with the connection method.

Q. A torque signal is being output even in the no-load state.

A. Remove the product from the mounting device so that it is in a no-load condition. If, under these conditions, the output exceeds the sensor's specified range, it can be inferred that the product is faulty. This may be due to zero-point drift caused by abrupt temperature changes or overload. Please verify whether there are any issues with the specifications of the mounting device or its operating procedures.

Q. The product is experiencing abnormal high temperatures.

A. When the power is applied and the shaft is not rotating, the temperature rise shall be approximately +10 °C relative to the ambient temperature. Even when the shaft is rotating, in the

absence of any external load beyond the specified limits, the temperature rise shall be approximately +15 °C (at 15,000 rpm).

If the temperature of this product exhibits significant deviations compared to the aforementioned conditions, the following causes may be inferred.

1) Please confirm whether heat from any other heat sources is being transferred to the shaft.

2) Please verify that the power supply voltage is DC 24 V ± 10%.

3) If the temperature of this product remains high while the power supply is functioning normally and no rotation is occurring, it can be inferred that a fault has occurred.

4) If the temperature rises abnormally while the power supply is operating normally and the shaft is rotating, it can be inferred that an out-of-specification load (radial or axial load) has been applied to the shaft, or that the bearing has reached the end of its service life due to wear.

Q. The output fluctuates with rotation.

A. Please verify the output fluctuations when operating this product independently. If the shaft jams during rotation or exhibits poor rotation performance, this may indicate bearing wear and that the bearing has reached the end of its service life. If output fluctuations occur during rotation while the product is in its assembled state, please verify whether the installation tolerances are adequate; such fluctuations may be caused by deformation of the measured shaft, among other factors.

Q. Under a given load, the output is unstable.

A. 1) Confirm that the measurement object, this product, and the entire device exhibit no vibration.

2) Please confirm whether there are strong alternating magnetic fields in the vicinity, or whether the temperature fluctuates frequently.

3) Confirm whether the shaft is energized, or whether leakage current has entered the shaft.

If none of the above conditions apply, it can be inferred that the product is faulty.

17. Common Issues and Solutions

1. What should I do if the data settings are incorrect, rendering the system unusable, or if the torque values are inaccurate?

Answer: Restoring to factory settings can generally resolve issues related to incorrect parameter configurations. When the main interface is displayed, if the K2 button is pressed five times within four seconds and the screen flashes once, this indicates that the device has been restored to its factory settings.

2. What should be done if the sensor cannot communicate via MODBUS?

Answer: Change the communication mode to 2, then test whether the communication line is functioning properly and whether correct data can be received. Once the communication line is confirmed to be operational, send the command 010300000002C40B and check whether the torque value is returned.

3. When using the active transmission mode, how is the rotational speed read?

Answer: To ensure speed, only torque is actively transmitted; the rotational speed can be determined via frequency detection. For specific detection methods, refer to Section 7 of the user manual.

18. Statement

Exceeding the specified operating environmental conditions can adversely affect the sensor's measurement performance and service life; in severe cases, it may lead to permanent damage to the sensor!

The installation, commissioning, and maintenance of this product shall be performed by qualified engineering and technical personnel.

The Company shall not be liable for any direct or indirect losses other than those arising from the products themselves.

The Company reserves the right to amend the product manual without prior notice.

19. Warranty Statement

From the date of sale, the entire unit is covered by a one-year warranty and lifetime after-sales service. During the warranty period, if any malfunction of the product is detected, you shall promptly contact our company; you shall not disassemble the product on your own, otherwise our company reserves the right to deny the warranty claim.

1. Repair services shall be subject to a fee if any of the following conditions apply:

2. Products whose warranty period has expired.

3. Damage resulting from improper transportation or storage, or damage resulting from failure to operate in accordance with the instructions provided.

4. Products that have been disassembled by the user or repaired at non-authorized service centers of this Company.

5. Products without a product number, or where the product number on the warranty card does not match the product number of the unit being serviced, or where the product number has been altered.

6. During the warranty period, any damage not caused by product defects shall result in the repair costs being borne by the user.

Version Update Notes

date	edition	change
	1.4	