

ATO-TQS-D03

Digital Rotary Torque Sensor

User Manual



Overview

The ATO-TQS-D03 series digital torque sensors can display the torque, speed and power value on its own LCD display. And the parameters can be setting by the keys, such as zero setting and calibration. Digital torque sensor has strong stability and adaptability. It supports analog transmission output and RS485 communication, uses the active transmission communication protocol and Modbus RTC protocol to communicate with the torque meter. And the speed is transformed to frequency signal and transmitted to the torque meter, which greatly improves anti-interference performance. It also guarantees the stability and real-time nature of the transmitted data.

I. Feature:

- Display the measured torque value and speed value in real time.
- The current power value can be calculated directly.
- Support RS485 communication, and actively upload communication protocol.
- Support current and voltage output signals.
- The resolution of LCD display is 128 * 64.
- It can perform simple operations, such as calibration, clearing, filtering, etc.
- Ultimate overload: 200%FS.
- Accuracy reaches 1/1000, excellent zero point stability.
- Non-contact, no maintenance, no service life limit.

II. Specification:

SKU	ATO-TQS-D03
Model	ATO-TQS-DYN-200
Shipping weight	7~18kg
Capacity range	0-0.1 Nm ~ 0-10000 Nm
	Note: When selecting the capacity of 0.1~5 Nm, remark the shaft diameter by email.
Display	LCD display (show torque/speed/power value)
Non-linearity	0.1%FS
Hysteresis	0.03%FS
Repeatability	0.03%FS
Temperature drift on zero	<0.01%FS/°C
Temperature effect on output	<0.01%FS/°C
Power supply	DC 24V
Consumption current	<150mA
Load resistance	≥2kΩ
Output torque	±5V, 0-10V, 4-20mA
Output speed	60 pulse per revolution

Response performance	1kHz
Signal delay	0.6ms
Ultimate overload	200%FS
Rated speed	10000rpm
Maximum speed	15000rpm
Maximum Deformation	0.149° / 1Nm at 2.60*10rad
Inertia moment	0.38kg • cm
Natural vibration frequency	19.4kHz
Torsion constant	3.85*10Nm/rad
Elastic element material	17-4 stainless steel
Operating temperature	-10°C~+50°C (14~122°F)
Humidity	0~85%RH
Electrical connection	7 pin waterproof circular connector
Cable length	3m (Φ 5mm)
Pin definition	1: Red, PWR (+24V)
	2: Black, PWR (0V)
	3: Green, SIG OUT ($\pm 5V/\pm 10V/4-20mA$)
	4: White, SIG GND
	5: Yellow, RS485 A
	6: Blue, RS485 B
	7: Orange, RPM+
	8: Gray, RPM-
	9: Braided wire, shielded line (It can't be connected to torque sensor housing.)

III. Working Principle:

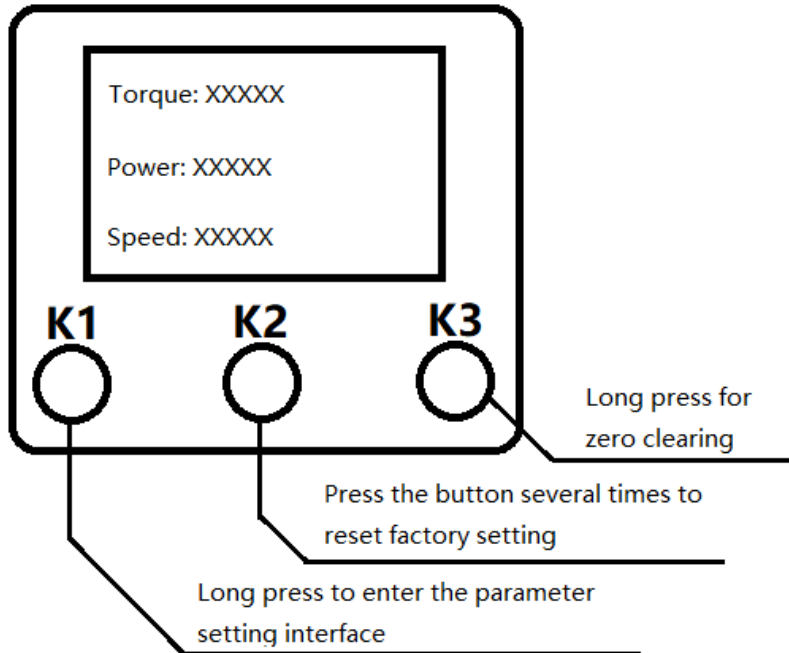
1. Manual reset: Press K3 key to reset the current data and establish a new zero point. Or modify the zero-clearing parameters after power-on, and the zero point will be established automatically after power-on.
2. Digital filtering: Take multiple data to accumulate. Take the average value, the digital filtering level is 0-100. It has a certain anti-interference performance, but it will cause the data change to be lagging behind.
3. Object approach calibration method: The current actual torque value and the displayed torque value are simply calculated, and the result is entered into the torque sensor. Then the current weight value can be simply calibrated.
4. Transmission output: Optional voltage output or current output, which essentially uses a microcontroller to amplify the torque sensor data and output a large voltage or current change for customer use.
5. Speed output: The current speed is sent in pulses. The torque sensor shaft rotates a circle to output 60 pulses, and the maximum speed output is 11000rpm. The PLC can collect this frequency signal.
6. Power-on zero setting: The customer can set the power-on zero clearing function, and

then it will automatically set zero point after power-on.

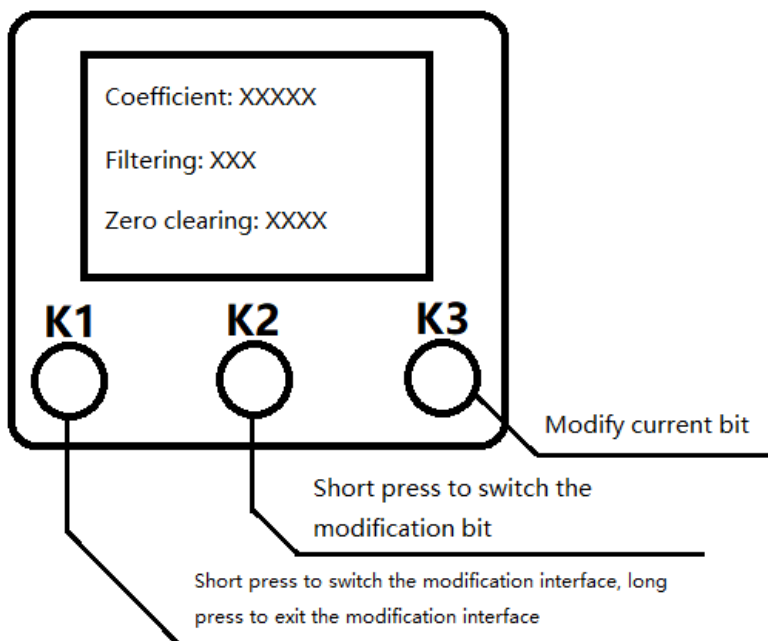
7. Communication output: RS485 communication output port outputs the current torque sensor data value, which is sent to the torque meter or PLC by Modbus RTU protocol and active transmission protocol. The higher the baud rate setting, the more data will be sent within a fixed time.

IV. Operation

Main interface:



Parameter setting interface:



1. **Parameter setting:** When the main interface is displayed, press and hold K1 for two seconds and then release. The system enters the parameter setting interface and displays the parameter setting interface 1. Short press K1 in interface 1 and the interface cycles through the four parameter setting interfaces. If you need to return to the main interface, long press K1 again for more than two seconds to exit.
2. **Modify the zero point:** When the main interface displays, long press the K3 to clear the current parameter. Set the current zero point.
3. **Object approach calibration:** Apply a known torque (set to X), after stabilization, record the meter display value (set to Y), find the "coefficient" in interface 1, move by short press K2 key and modify number by K3 key, modify the parameter value to $(Z * Y / X)$: The displayed weight is divided by the actual weight and multiplied by the "coefficient". Directly press and hold K1 to exit the parameter setting interface to save value.
4. **Modify the filter:** Press and hold the K1 key in the main interface to enter the parameter setting interface 1, short press the K1 in the interface 1, select the filter coefficient, short press the K2 to move the currently selected data bit backward, and press K3 to modify the value of the bit.
5. **Modify the baud rate and machine code:** Long press K1 key on the main interface to enter interface 1, short press K1 key twice on interface 1, enter interface 3, long press K2 on interface 3, select the communication rate or communication code, short press K2 and K3 to modify the current parameters.
6. **Restore factory settings:** Press the K2 key continuously in the main interface, and press it more than five times within four seconds to reset the current parameters to the factory settings.

Parameter List

Code	Name	Value range	Description
01	Current coefficient	100~32700	The result of the object approach calibration and it is not recommended to modify.
02	Digital filtering	1 ~ 100	The larger the filter value, the more stable the data, but the change is slower.
03	Decimal point	0 ~ 4	Display decimal point, default value is 2.
04	Zero reset when power on	0 ~ 1	0: Do not clear 1: Clear
05	Transmitting zero	0 ~ 16384	Zero voltage output
06	Transmitting full range	0 ~ 16384	Rated transmission full range is 16384
07	Transmitting range	100 ~ 30000	Input torque sensor range
08	Communication rate	9600 ~ 38400	Communication baud rate selection, default 38400
09	Communication mode	0 ~ 1	0: Actively upload; 1: MODBUS RTU
10	Communication key	0 ~ 120	Address code of the current torque sensor
11	Communication stop bit	0 ~ 1	0: 2 stop bits; 1: 1 stop bit
12	Torque direction	0 ~ 1	0: Default torque direction; 1: Inverse torque direction

V. Communication

Digital torque sensor supports RS485 communication. It uses Modbus RTU protocol to communicate with PLC, and uses a custom protocol to communicate with the torque meter. The module's Modbus-RTU protocol supports 3 operating instructions such as 03H, 05H, and 10H. The detailed protocol can refer to the standard text of Modbus, which will not be repeated here. The total length of sending and receiving data packets cannot exceed 30 bytes.

(Note: XXH means hexadecimal, 10H converts to decimal is 16.)

- Meter code: The meter is in slave mode, and the default code is 01H.
- Baud rate: The baud rate is from 9600 to 38400, and the data format can also be set.
- Stop position: The default value is one bit, and it can be changed to two bits.
- 03H command: Read the current speed value, torque value and power value.
- 05H command: Zero clearing and factory data reset.
- 10H command: Modify the coefficient, filter, decimal point, etc.
- Communication example: nn is the machine code, crc0 is the low bit of CRC check, crc1 is the high bit of CRC check. The check code can be calculated automatically using Commix software.

03H function code example

Send: nn 03 00 00 00 02 crc0 crc1 read torque measuring value (long)

Return: nn 03 04 d1 d2 d3 d4 crc0 crc1 (d1-d4 torque measurement data)

05H function code example

Send: nn 05 00 00 ff 00 crc0 crc1 (zero clearing operation)

Returns: nn 05 00 00 ff 00 crc0 crc1

10H function code example

Send: nn 10 00 06 00 02 04 d1 d2 d3 d4 crc0 crc1 (modify the filter) d1-d4 are the fixed value, 4 bytes, high bit first.


Returns: nn 10 00 06 00 02 crc0 crc1

(Under the 10H command, zero clearing and factory data reset, just write d1-d4 to 00 00 00 01.)

Address	Parameter name	Support instruction	Description
06H	Digital filtering	03H,10H	The larger the filter value, the more stable the data, but the change is slower.
08H	Decimal point	03H,10H	Display decimal point, default value is 2.
0AH	Zero reset when power on	03H,10H	0: Do not clear 1: Clear
0CH	Transmit zero	03H,10H	Transmit hardware zero output

0EH	Transmitting full range	03H,10H	Transmit full range hardware output value
10H	Transmitting range	03H,10H	Torque sensor range input
12H	Torque direction	03H,10H	Change of torque direction
14H	Communication rate	03H,10H	Baud rate, 1--9600, 2--14400, 3--19200, 4--38400
16H	Communication machine code	03H,10H	The initial value is 1, modify according to demand
18H	Stop bit	03H,10H	0: 2 stop bits; 1: 1 stop bit
1AH	coefficient	03H,10H	The result of the object approach calibration and it is not recommended to modify.
00H	Zero clearing	05H,10H	Create a new zero
02H	Factory data reset	05H,10H	Clear user modified data
00H	Torque value	03H	Current output torque in Nm
02H	Speed	03H	Current speed in rpm
04H	Power / 10W	03H	Current output power in kW

VI. Connection

Pin configuration	Number	Color	Pin description
	1	Red	PWR (+24V)
	2	Black	PWR (0V)
	3	Green	SIG OUT ($\pm 5V/\pm 10V/4-20mA$)
	4	White	SIG GND
	5	Yellow	RS485 A
	6	Blue	RS485 B
	7	Orange	RPM+
	8	Gray	RPM-
	9	Braided wire	Shielded line (It can't be connected to torque sensor housing.)

Pin Definition

