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Single-turn Absolute Rotary Encoder User Manual

For CANbus Interface



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Product Advantages

●The CAN interface has real-time two-way communication capabilities, and the CAN interface rotary encoder is compatible with CAN2.0 electrical specifications. Users can set the encoder ID address, zero point, data transmission mode and other parameters through commands. It is currently the friendliest intelligent rotary encoder.

● If the power keeps on, the single-turn encoder can be used as an electronic multi-turn encoder (this function do not have the power-off memory feature), the total turns can be counted up to one million turns or more, what's it increases the measuring speed function, which is easy for users to calculate; any position within the measuring range is unique, even if there is interference or power-off movement, the position information will not be lost.

● The resolution of the single-turn absolute encoders are 10bit (1024P/R), 12bit(4096P/R), 14bit(16384P/R) and 15bit(32768P/R), and the resolution of 0.01 degree can be achieved within the range.

● All parameters can be set via CAN bus communication, and the zero point can be set at any position. Therefore, when the encoder is installed, the device can be left at any position, without considering the rotation position of the encoder, and the connecting shaft can be fixed and powered on. Afterwards, it can be automatically corrected by performing a zero-setting operation at the external lead or through CAN bus communication.

●It is especially suitable for tower cranes, mining cranes, construction lifts, machine tools, 3D printers, automatic assembly lines, industrial robots, printing machinery, packaging machinery, logistics machinery, mobile advertising screen slides and other equipment height, stroke, angle and speed reliable / accurate measurement.

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[redacted] Electrical Characteristics

Electrical Parameters			
Working Voltage	5V, 24V(9~30V)	Baud rate	100k-1M(default 500k)
Working Current	50mA	Station ID	1~255（default 1）
Linearity	0.1%	TCP	Refer to the Attachment
Kernel refresh cycle	50uS	Electrical life	> 100000 h
Resolution/turn	10bit(1024P/R), 12bit(4096P/R), 14bit(16384P/R), 15bit(32768P/R)		

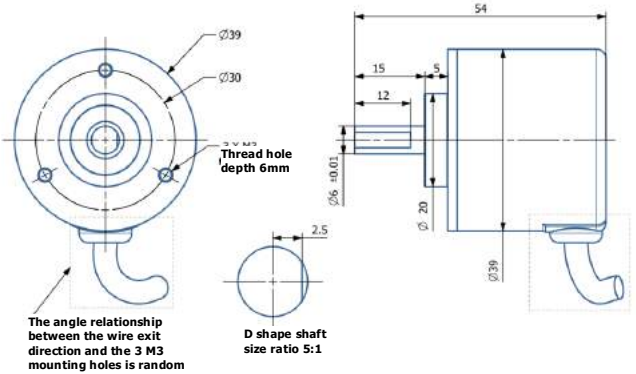
Mechanical parameters	
Shell/ flange material	Zinc-nickel coated steel/ Aerospace aluminum
Shaft material	Stainless steel
Bearing material	Bearing steel
Maximum load of the Shaft	Axial 20 N, Radial 80 N
Maximum mechanical speed	1000RPM
Starting torque	0.006Nm
Weight	150 g（include 1.2meter shielded wire）

Environment Parameters	
Operating temperature	-40 ~ + 85°C
Storage temperature	-40 ~ + 85 °C
Humidity	98 % (No condensation)
Standard Waterproof Level	Shell: IP54; Shaft , Bearing: IP65
Highest Waterproof Level	IP67 waterproof for the entire body

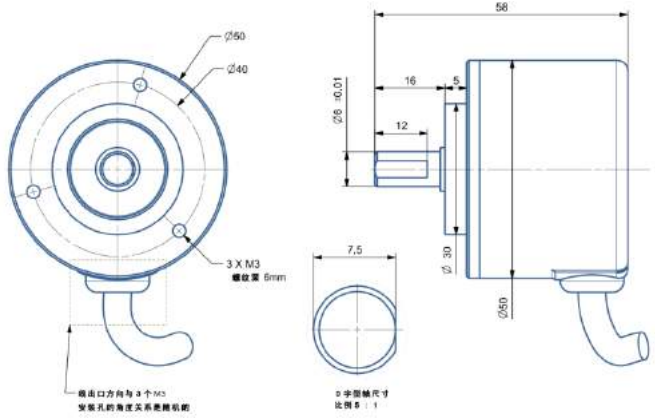
Wiring Methods		
Red	Positive power supply（5V、9~30V）	Please pay attention to the voltage value on the encoder label before power on.
Black	Ground（GND）	
Yellow	NC	1. Set zero position: connect yellow wire to ground (black wire). 2. Restore the factory setting function: after power off, connect yellow wire to ground (black wire). Power on again, hold for 2 minutes, it can be reset after 2 minutes, separate the two wires after reset.
Green	CANH	
White	CANL	

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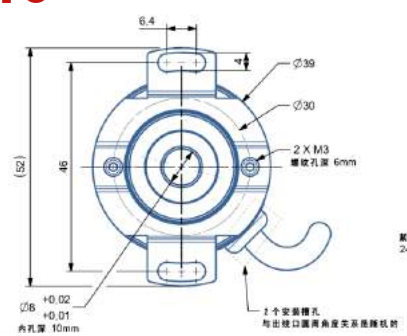
[redacted] Mechanical Size



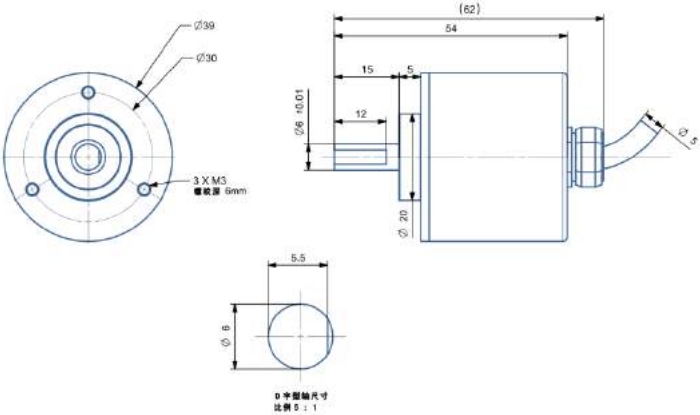
Drawing 1: 6mm solid shaft, IP54



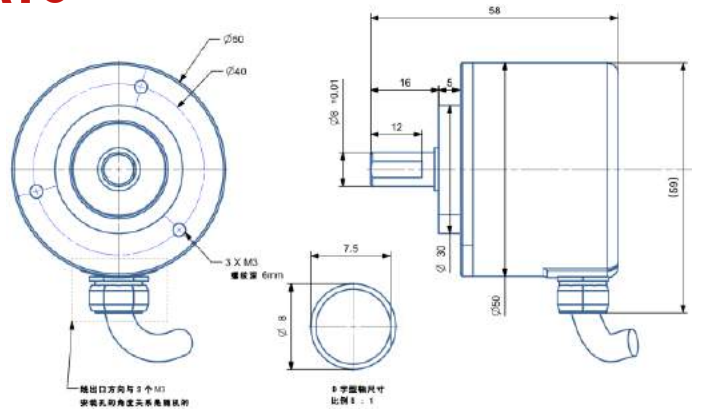
Drawing 2: 8mm solid shaft, IP54



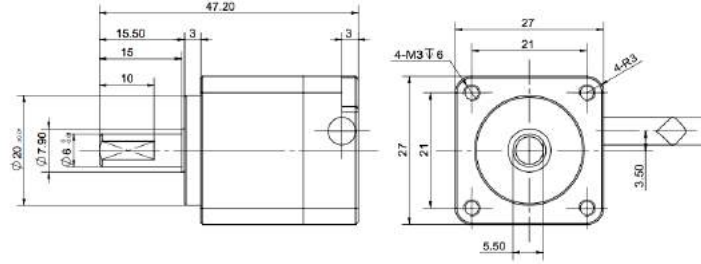
Drawing 3: 8mm blind hole, IP54



Drawing 4: 6mm solid shaft, IP67 waterproof encoder



Drawing 5: 8mm solid shaft, IP67 waterproof encoder



Drawing 6: 6mm solid shaft, IP68 waterproof encoder

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[redacted] Precautions for installation and use

● The encoder is a precision instrument. Please handle it with care and use it carefully, especially for the encoder shaft, please do not knock, hit or pull hard.

● Flexible connectors or elastic supports should be used for the connection between the encoder and the machine, and the rigid damage caused by the non-concentricity of the rigid connection should be avoided.

● Encoder waterproof grade IP54, IP67, IP68, such as the choice of IP54 encoder, shaft protection grade is IP65, should avoid shaft upward installation or soaking in water, otherwise, please use waterproof shield and other measures; IP67/ IP68 waterproof encoder was tested in one-meter depth of water for 48 hours. Please rest assured to use in outdoor conditions.

● Although the encoder itself will not lose the number of turns in the interference environment, it will cause interference to the data in the transmission process, so when there is a motor in the system or a very strong electromagnetic interference environment, the encoder power supply should use an isolated power supply and external extension It is best to use double-shielded cables and other measures for the communication wire.

● The outer shell of the encoder shell and shielded cable should be well grounded to prevent damage to the encoder circuit due to lightning strikes or high-voltage static electricity!

● Except for the above zero-setting (yellow wire) allows grounding, any other signal wires of the encoder are forbidden to be short-circuited with each other. After power-on, avoid accidentally touching the signal wires, otherwise it may cause permanent damage to the circuit!

[redacted] Product warranty and disclaimer

● 1. The product is guaranteed for one year free of charge when used correctly.

● 2. When exceed the warranty period, or the product is damaged due to improper use, the product can be sent back to the original factory for repair (only raw material cost is required when repair).

Encoder CAN protocol specification

1. Introduction to CAN

CAN is called Controller Area Network. It was first proposed by Bosch Company in Germany and is one of the most widely used field buses in the world.

2. CAN application layer protocol

Frame information setting:

1. Choose standard frames instead of extended frames
2. Select data frame instead of remote frame
3. Data field length (without identifier)

Application layer protocol:

Data length	Encoder address	Command FUNC	Data
1 byte	1 byte	1 byte	0~4 bytes

The CAN communication protocol of the encoder adopts a master and multiple slaves.

2.1 About identifiers

CAN2.0B stipulates that the standard data frame has an 11-bit identifier, which is defined as the target address of the call in this protocol.

Data range: 0～255.

2.2 About the data field

The master station and the slave station transmit data through the data domain. Regarding the 8-byte data field content, the format defined by this agreement:

[Data Length] + [Encoder Address] + [Command FUNC] + [Data DATA]:

(1) Data length: 1 byte, data range 0~8, including the total number of bytes of itself, encoder address, command FUNC, and data DATA. Note: This data length is different from the data length of the frame information;

(2) Encoder address: the CAN node address of the encoder, 1 byte;

(3) Command FUNC: communication function code, 1 byte;

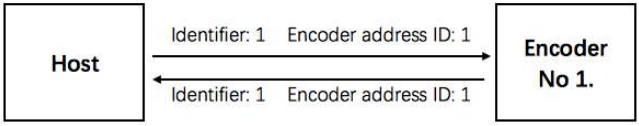
(4) Data DATA: The data carried by the instruction, 0~4 bytes.

2.3 About identifier ID and encoder address

When the host calls the encoder, the identifier represents the node address of the target encoder;

When the encoder responds to the host, the identifier indicates the node address of the return encoder;

For example, the communication between the host and encoder No.1:



3. Application of CAN and encoder communication:

3.1. Turn on the CAN device

(1) Set the baud rate. The host should be set to the same baud rate as the encoder, and the factory default rate of the encoder is 500kbps;

3.2. Frame information setting

(1) Choose standard frames instead of extended frames;

(2) Choose data frame instead of remote frame;

(3) Calculate the length of the data field, including all content in the data field, the maximum value is "8".

3.3. Data transmission

Fill in the content of the data field according to the protocol of the encoder. When the content of the data field is multi-byte, the low byte is in front.

For example: A. The host sends an instruction to Encoder 1: "Read encoder value", the data field length is 4;

Data field: 0x04 (data length) + 0x01 (encoder address) + 0x01 (instruction code) + 0x00 (data 1)

ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0X01	0x04	0x01	0x01	0x00	——	——	——	——

Returned data: data field length 7;

Data field: 0X07 (data length) + 0X01 (encoder address) + 0X01 (instruction code) + 0x00012345(data)

ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0X01	0x07	0x01	0x01	0x45	0x23	0x01	0x00	——

4. BriterEncoder CAN instruction set V2.1

4.1. CAN protocol

(1) Adopt CAN2.0B standard frame communication protocol,

(2) Communication rate: 1Mbps, 500kbps, 250kbps, 125kbps, 100kbps can be set. 500kbps is the default communication rate setting.

Note: After modifying the communication rate of the encoder, the host should also be modified to the same communication rate!

4.2. Instruction structure

The composition of CAN2.0B instruction code:

[Length LEN] + [Device ID] + [Command FUNC] + [Data DATA]

[Length LEN]: 1 byte, including [Length LEN] + [Device ID] + [Command FUNC] + [Data DATA]

[Device ID]: 1 byte, range 0~255;

[Command]: 1 byte, range 0~255;

[Data]: 0 ~ 4 bytes; 2 bytes form 16-bit data, with low byte first; 4 bytes form 32-bit data, with low byte first;

5. CAN command data table V2.1

CAN	Function description	Example (encoder address ID defaults to 01). Standard frame ID (identifier) is also 01
0x01	Read the encoder value. Return data : 32-bit unsigned number	Issue : [0x04][0x01][0x01][0x00] Return : [0x07][0x01][0x01][0x45][0x23][0x01][0x00] Encoder value : 0X00012345 (decimal : 74565)
0x02	Set the encoder ID , value range : 2~255 Send data : 8bit unsigned number. Return data : 8bit unsigned number. 0 : set successfully , other : error code	Issue : [0x04][0x01][0x02][0x08] Return : [0x04][0x08][0x02][0x00] Set address : 0X08
0x03	Set CAN communication baud rate Send data: 8-bit signed number. Return data: 8-bit signed number. 0: set successfully, other: error code 0x00 : 500K ; 0x01:1M 0x02 : 250K ; 0x03:125K ; 0x04 : 100K	Issue : [0x04][0x01][0x03][0x01] Return : [0x04][0x01][0x03][0x00] Set baud rate : (1M)
0x04	Set the encoder mode: 0x00: query, 0xAA: automatic post back	Issue : [0x04][0x01][0x04][0xAA] Return : [0x04][0x01][0x04][0x00] Setting mode: 0XAA (automatic return)
0x05	Set the automatic return time of the encoder (microseconds), the value range: 50~65535:	Issue : [0x05][0x01][0x05][0xE8][0x03] Return : [0x04][0x01][0x05][0x00] Set the automatic return time of the encoder (microseconds) : 0X03E8 (1000 microseconds)

Note: After setting a too short return time, the encoder will no longer be able to set other parameters, use it with caution!!		
0x06	Set the current position value to zero. Send data: 8-bit unsigned number. Return data: 8-bit unsigned number. 0: set successfully, other: error code	Issue：[0x04][0x01][0x06][0x00] Return：[0x04][0x01][0x06][0x00] Set position value to zero
0x08	Reads the encoder virtual multi-turn value. Return data: 32-bit unsigned number.	Issue：[0x04][0x01][0x08][0x00] Return:[0x07][0x01][0x08][0x45][0x23][0x01][0x00] Encoder value：0X00012345 (decimal:74565)
0x09	Read the encoder virtual number of turns. Return data: 32-bit unsigned number.	Issue：[0x04][0x01][0x09][0x00] Return:[0x07][0x01][0x09][0x45][0x23][0x01][0x00] Encoder value：0X00012345 (decimal:74565)
0x0A	Read the encoder angular velocity value. Return data: 32-bit unsigned number.	Issue：[0x04][0x01][0x0A][0x00] Return: [0x07][0x01][0x0A][0x45][0x23][0x01][0x00] Encoder value：0X00012345 (decimal:74565)
0x0B	Set encoder angular velocity sampling time (milliseconds). Value range: 0~65535:	Issue：[0x05][0x01][0x0B][0xE8][0x03] Return：[0x04][0x01][0x0B][0x00] Set encoder angular velocity sampling time (milliseconds)：0X03E8（1000ms）

5.1 Calculate the rotation speed of the encoder

Encoder rotation speed = encoder angular speed value/ single-turn resolution/ speed calculation time (in rpm).

For example, the angular velocity of the encoder is returned to 1000, the resolution of one turn is 32768, and the sampling time of rotational speed is 100ms (0.1/60min).

Encoder rotation speed= 1000/ 32768/ (0.1/ 60) = 1000* 0.0183 = 18.31 rpm