Single-turn Absolute Rotary Encoder User Manual

For RS485(Modbus RTU) Interface

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BriterEncoder.com

Product Advantages

●RS485 digital communication signal output, digital output encoder absolute position value.

● Adopt standard ModBus-RTU communication protocol, support Kingview, Intouch, FIX, synall and other popular software, and can realize data communication with equipment and systems of international famous brands such as AB, Siemens, Schneider, and GE.

● If the power always keeps on, the single-turn encoder can be used as an electronic multi-turn encoder (but this function do not have the power-off memory feature), the total turns can be counted up to one million turns or more. Now that it has 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 movement after power break, 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 through the RS485 communication of the computer, and the zero point can be set at any position. Therefore, when the encoder is installed, the device can be left at any position, and the connecting shaft can be fixed without considering the rotation position of the encoder. After power-on, it can be automatically corrected by performing a zero-setting operation at the external lead or through RS485 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.

Electrical Characteristics

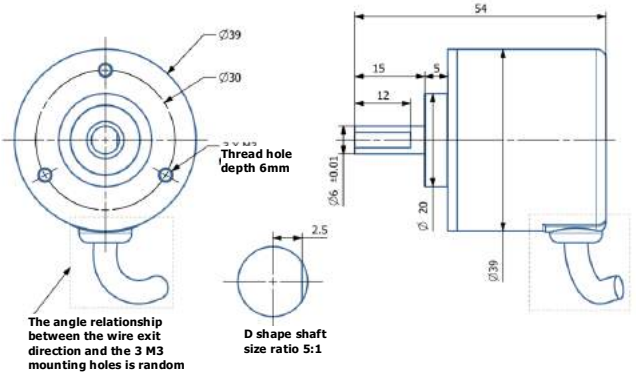
Electrical Parameters			
Working Voltage	5V, 24V(9~30V)	Baud rate	9600~115200(default 9600)
Working Current	50mA	Station address	1~127（default 1）
Linearity	0.1%	TCP	Refer to the Attachment
Kernel refresh cycle	50uS	Electrical life	> 100000 h

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）

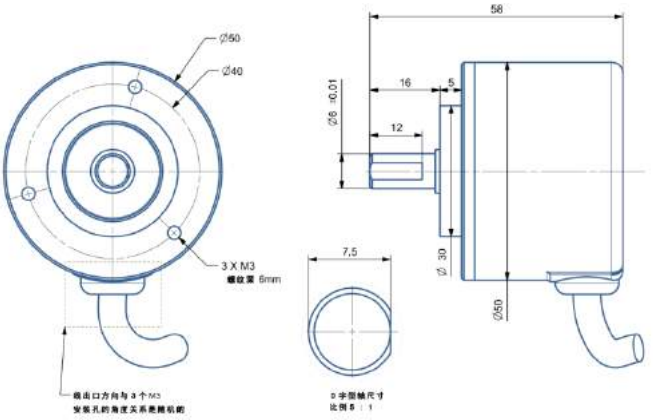
Environment Parameters	
Operating temperature	-40 ~ +85°C
Storage temperature	-40 ~ +85 ℃
Humidity	98 % (No condensation)
Standard Waterproof Level	Shell: IP54; Shaft , Bearing: IP65
Highest Waterproof Level	IP67 / IP68 waterproof for the entire body

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	（ZR）	1. When the zero-setting wire is grounded for more than 100ms, the encoder position value returns to zero. 2. Restore the factory setting function: after power off, connect the yellow wire to ground (black wire). Power on again, hold for 2minutes, it can be reset after 2 minutes, and separate the two wires after reset.
Green	RS485B	
White	RS485A	

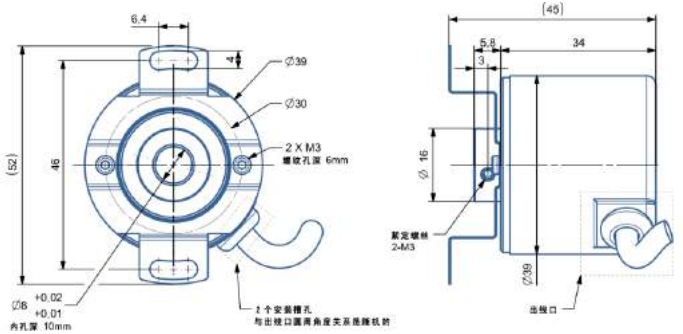
Mechanical Size



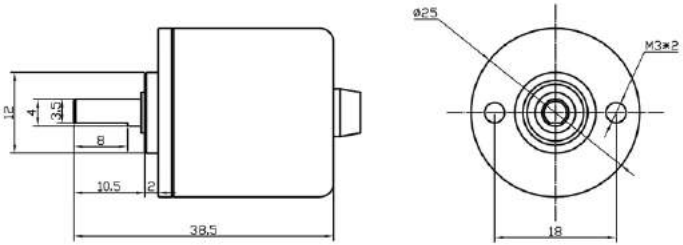
Drawing 1: 6mm solid shaft, IP54



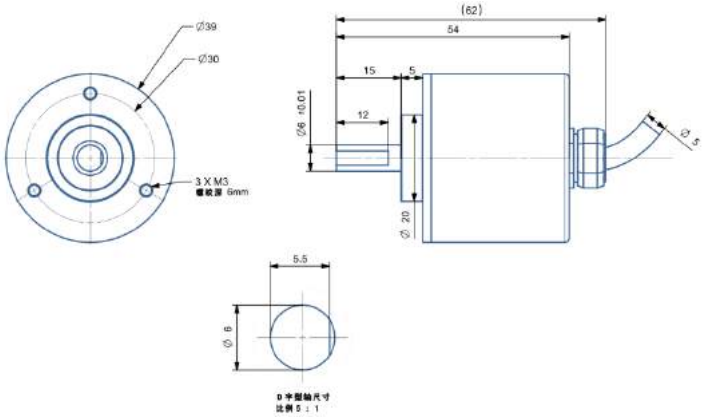
Drawing 2: 8mm solid shaft, IP54



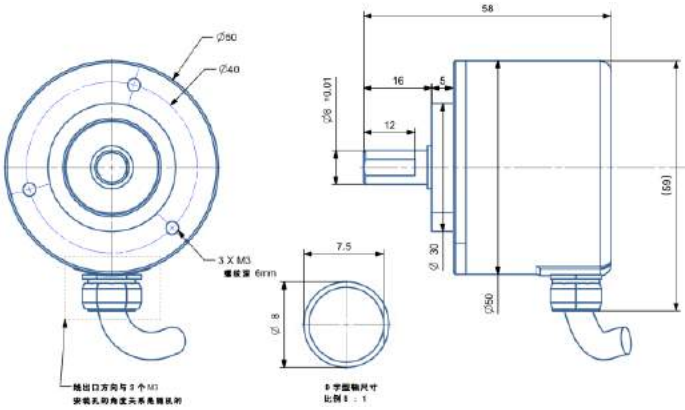
Drawing 3: 8mm blind hole, IP54



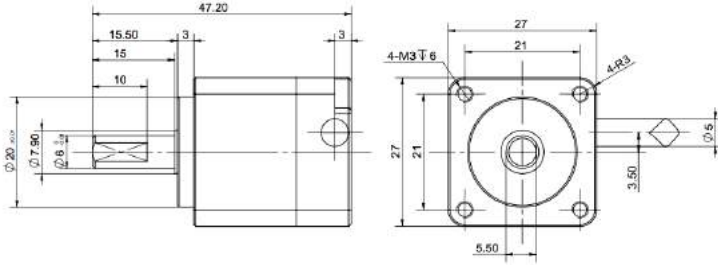
Drawing 4: 4mm solid shaft, IP54



Drawing 5: 6mm solid shaft, IP67 waterproof encoder



Drawing 6: 8mm solid shaft, IP67 waterproof absolute encoder



Drawing 7: 6mm solid shaft, IP68 waterproof absolute encoder

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 two optional, 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 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!

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).

Contact Us

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Store: www.briterencoder.com

Attachment

Encoder RS485 TCP (Standard MODBUS-RTU)

This encoder uses MODBUS-RTU (National Standard GB/T19582-2008) TCP for communication, supports one master station to control multiple slave stations, and 127 slave station addresses can be configured through the built-in host computer. The master station can be a single-chip computer, PLC or PC, etc.

1.1 Communication parameters

The default configuration of the serial port at the factory, the baud rate is 9600bps by default, the data bit is 8, no parity, and the stop bit is 1. The baud rate can be configured in the range of 9600~115200bps, and the encoder default communication address (station number) is 1.

1.2 MODBUS-RTU Frame format

This encoder supports 0x03 (read holding register), 0x06 (write a single register) function codes of MODBUS。

1.2.1 0x03 Read holding register

Host send :

Byte	1	2	3	4	5	6	7	8
Content	ADR	0x03	Start register high byte	Start register low byte	High byte of register number	Low byte of register number	CRC High byte	CRC low byte

The 1st byte ADR : Slave address code (1～127)

The 2nd byte 0x03 : Read register value function code

The 3rd.、4th. byte : Start address of the register to be read

The 5th.、6th. byte : Number of registers to be read

The 7th.、8th. byte : CRC16 checksum from byte 1 to 6

Return from station :

Byte	1	2	3	4、5	6、7		M-1、M	M+1	M+2
Content	ADR	0x03	Total byte	Register data 1	Register data 2	.....	Register data M	CRC High byte	CRC Low byte

The 1st byte ADR :	Slave address code (1 ~ 127)
The 2nd byte 0x03 :	Return to read function code
The 3rd byte :	The total number of bytes from 4 to M (including 4 and M)
The 4th. ~ M byte :	Register data
The M + 1、 M+2byte :	CRC16 checksum from byte 1 to M

1.2.2 0x06 Write a single register

Host send :

Byte	1	2	3	4	5	6	7	8
content	ADR	0x06	Start register high byte	Start register low byte	High byte of register number	Low byte of register number	CRC High Byte	CRC Low byte

When the slave station receives correctly, the slave station sends back :

Byte	1	2	3	4	5	6	7	8
Content	ADR	0x06	Register high byte	Register low byte	High byte of register number	Low byte of register number	CRC high byte	CRC low byte

1.3 Register definition

1.3.1 Encoder register

Register address	description	Value ranges	Support function code	Remarks
0x0000	Encoder single turn value	0~0xFFFFFFFF (0~4294967295)	0x03	Power break memory function
0x0000 ~0x0001	Encoder virtual multi-turn value	0~0xFFFFFFFF (0~4294967295)	0x03	Return to zero when power break
0x0002	Encoder virtual number of multi-turn	0~0xFFFF (0~65535)	0x03	Return to zero when power break
0x0003	Encoder angular velocity value	0~0xFFFF (0~65535)	0x03	Return to zero when power break
0x0004	Encoder address	1~127	0x06	Default 01
0x0005	Baud rate	0x0000~0x0004	0x06	Default 9600 0x00 : 9600 0x01 : 19200 0x02 : 38400 0x03 : 57600

				0x04：115200
0x0006	Encoder mode	0x0000~0x0001	0x06	0x00：Query mode 0x01: automatic backhaul
0x0007	Automatic return time	0~65535(ms)	0x06	default：20mS
Note: once the automatic return time is set to less than 20 milliseconds, the encoder will not be able to set other parameters, use with caution!				
0x0008	Encoder reset zero mark	0x0001	0x06	Write 0x0001，the encoder takes the current position as the zero point
0x0009	Encoder value increasing direction	0x0000~0x0001	0x06	0x00：clockwise 0x01：counterclockwise
0x000A	Encoder angular velocity sampling time	0~65535(毫秒)	0x06	default：100mS
0x000B	Set the current value of the encoder	0~65535	0x06	Power break memory function
0x000E	Encoder setting midpoint flag bit	0x0001	0x06	Write 0x0001，the encoder takes the current position as the mid-point

1.4 Example of Encoder communication

1.4.1 Read encoder value
Tx: 01 03 00 00 00 01 (84 0A)
Rx: 01 03 02 01 42 (39 E5)
Note: The CRC check digit is in the brackets, and the encoder return data is 01 42 (decimal: 322)

1.4.2 read the virtual multi-turn value of the encoder.
Tx:01 03 00 00 00 02 (C4 0B).
Rx:01 03 04 00 01 76 3B (CC 40).
Note: the CRC parity bits are in parentheses, and the returned data of the encoder value is 00 01 76 3B (decimal: 95803).

1.4.3 read encoder virtual number of turns.
Tx:01 03 00 02 00 01 (25 CA).
Rx:01 03 02 00 08 (59 83).
Note: CRC parity bits are in parentheses, and the returned data of encoder circle value is 0008 (decimal: 8 turns).

1.4.4 read encoder angular velocity.
Tx:01 03 00 03 00 01 (74 0A).
Rx:01 03 02 02 7A (D8 C6).
Note: CRC check bits are in parentheses, and the return data of encoder circle value is 027A (decimal: 634).

1.4.5 set encoder address.
Tx:01 06 00 04 00 02 (49 CA).
Rx:01 06 00 04 00 02 (49 CA).

Note: the CRC check bit is in parentheses, and the set address is 02 (HEX:0x0002).

1.4.6 set encoder baud rate.

Tx:01 06 00 05 00 02 (18 0A).
Rx:01 06 00 05 00 02 (18 0A).
Note: CRC parity bits are in parentheses, and the baud rate set is 38400 (0x02).

1.4.7 set encoder data mode.

Tx: 01 06 00 06 00 01 (A8 0B).
Rx: 01 06 00 06 00 01 (A8 0B).
Note: CRC check bits are in parentheses, and the current encoder data mode is set to automatic backhaul (default query).

1.4.8 set encoder automatic return time (milliseconds).

Tx: 01 06 00 07 00 64 (39 E0).
Rx: 01 06 00 07 00 64 (39 E0).
Note: the CRC check bit is in parentheses, and the automatic return time is set to 100ms (HEX:0x0064).
Note: once the automatic return time is set to less than 20 milliseconds, the encoder will not be able to set other parameters, use with caution!

1.4.9 set encoder zero.

Tx:01 06 00 08 00 01 (C9 C8).
Rx:01 06 00 08 00 01 (C9 C8).
Note: the CRC check bit is in parentheses, and the current encoder current point is set to zero.

1.4.10 set the encoder value increment direction.

Tx:01 06 00 09 00 01 (98 08).
Rx:01 06 00 09 00 01 (98 08).
Note: the CRC check bit is in parentheses, set the current encoder counterclockwise value to increase (default clockwise).

1.4.11 set the midpoint of the encoder.

Tx:01 06 00 0E 00 01 (29 C9).
Rx:01 06 00 0E 00 01 (29 C9).
Note: the CRC check bit is in parentheses, and the current point of the current encoder is set to the midpoint.

1.4.12 set encoder angular velocity sampling time (milliseconds).

Tx: 01 06 00 A 03 E8 (A9 76).
Rx: 01 06 00 A 03 E8 (A9 76).
Note: the CRC check bit is in parentheses, and the automatic return time is set to 1000 milliseconds (HEX:0x3E8).

1.4.13 set the current position value of the encoder.

Tx 01 06 00 B 03 E8 (F8 B6).
Rx: 01 06 00 B 03 E8 (F8 B6).
Note: the parenthesis is the CRC check bit, and the position set is 1000 (HEX:0x3E8).

1.4.12 calculation of encoder speed:

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.

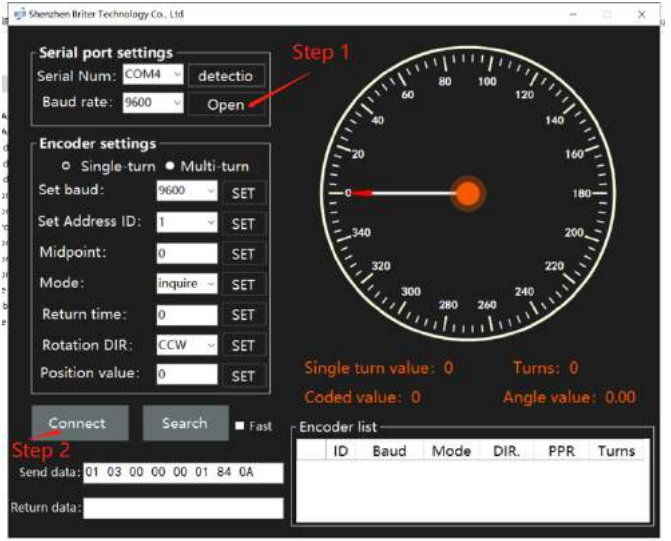
1.5 CRC check function Code reference

unsigned int Crc_Count(unsigned char pbuf[],unsigned char num)

```
{
        int i,j; unsigned int wcrc=0xffff;
        for(i=0;i<num;i++)
        {
                wcrc^=(unsigned int)(pbuf[i]);
                for (j=0;j<8;j++)
                {
                        if(wcrc&0x0001)
                        {
                                wcrc>>=1; wcrc^=0xa001;

                        }
                        else
                                wcrc>>=1;
                }
        }
        return wcrc;
}
```

1.6 BriterEncoder software interface


Shenzhen Briter Technology Co., Ltd
Serial port settings
Serial Num: COM4
detectio
Baud rate: 9600
Open
Step 1
Encoder settings
Single-turn
Multi-turn
Set baud: 9600 SET
Set Address ID: 1 SET
Midpoint: 0 SET
Mode: inquire SET
Return time: 0 SET
Rotation DIR: CCW SET
Position value: 0 SET
Connect
Search
Fast
Step 2
Send data: 01 03 00 00 00 01 84 0A
Return data:
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
Single turn value: 0
Turns: 0
Coded value: 0
Angle value: 0.00
Encoder list
ID
Baud
Mode
DIR.
PPR
Turns