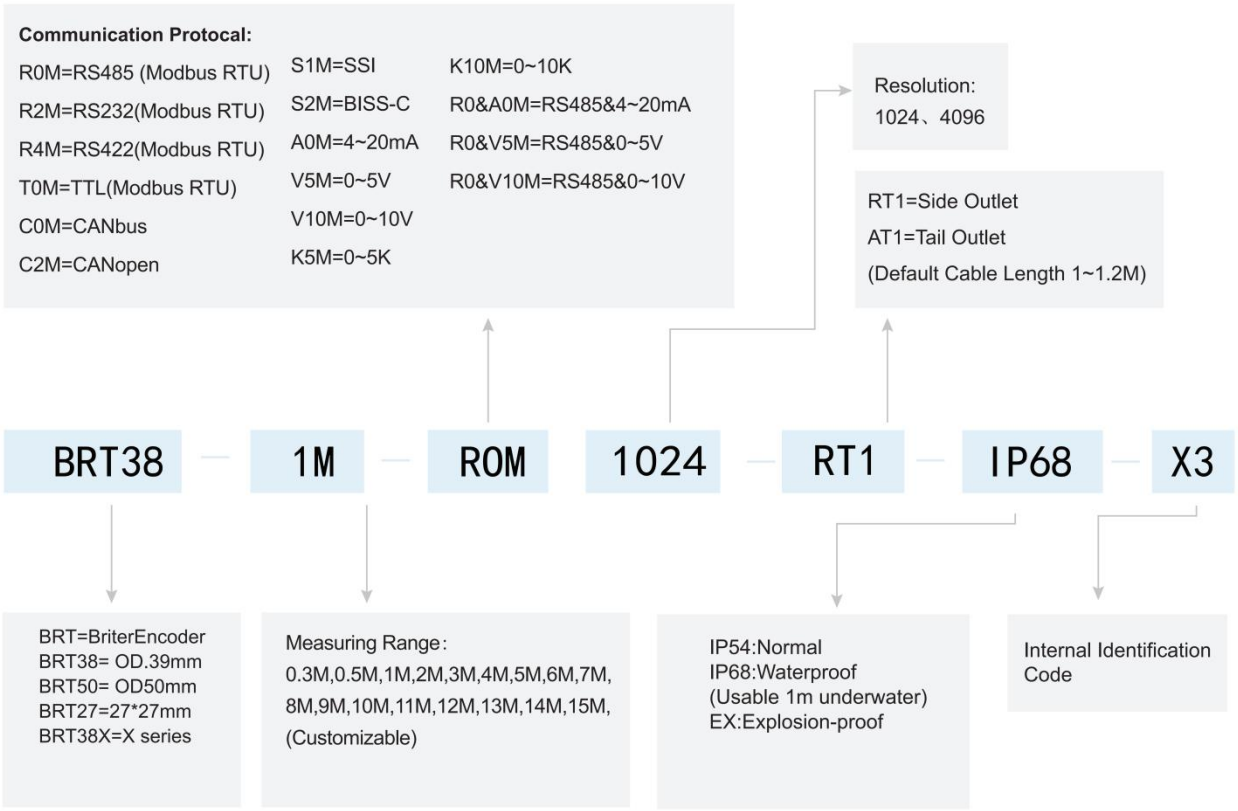
Briterencoder Linear Wire Displacement Sensor

SPI Interface User Manual V202508

1. Product Model Description



Model description:

1.Structural form of the encoder: e.g., BRT38 indicates an outer diameter of 38mm.

2.Measuring range: e.g., 1M indicates a measuring stroke range of 0 - 1000mm.

3.Communication interface: e.g., R0M indicates an electrical interface of RS485 and the communication protocol is Modbus RTU.

4.Resolution: e.g., 1024 means that the internal encoder and the winding wheel feed back 1024 data when rotating one circle. For a 1 - meter stroke, referring to the corresponding table parameters, if the diameter of the internal winding wheel is 100mm, it means that the encoder feeds back 1024 data when moving 100mm. The minimum displacement resolution: 100mm / 1024 = 0.098mm. That is, the displacement resolution of 1024 is 0.098mm.

5.Inventory: Some randomly combined models may be out of stock. Please consult in advance to ensure that the selected model is available.

2. Wiring Definition and connection

Red wire	Power Supply	DC 5V
Black wire	0V (GND)	-
Yellow wire	CS (Chip Select)	-
Green Wire	CLK (Clock)	-
White Wire	DO (Data Output)	-

3. Product Parameters

Measuring Range	Interface	Pull Rope Tension	Resolution 1024PPR	Resolution 4096PPR	Winding wheel diameter(mm)
0~650mm	BRT27 Series	3.5N	0.0586mm	0.0146mm	60mm
500mm	BRT38 Series	3~4N	0.098mm	0.0244mm	100mm
1000mm			0.098mm	0.0244mm	100mm
2000mm		2.5N	0.146mm	0.0366mm	150mm
3000mm		3~4N	0.195mm	0.0488mm	200mm
4000mm			0.244mm	0.061mm	250mm
5000mm		5~6N	0.244mm	0.061mm	250mm
6000mm			0.220mm	0.0549mm	225mm
7000mm		7~8N	0.220mm	0.0549mm	225mm
8000mm		8~9N	0.332mm	0.0830mm	340mm
9000mm		9~10N	0.332mm	0.0830mm	340mm
10000mm			0.332mm	0.0830mm	340mm
11M~15M		20~25N	0.341mm	0.0854mm	350mm
16M~20M		25~30N	0.341mm	0.0854mm	350mm
500mm	BRT38X Series	2N	0.126mm	0.031mm	130mm
1000mm			0.126mm	0.031mm	130mm
2000mm		3N	0.175mm	0.043mm	180mm
3000mm		6N	0.224mm	0.056mm	230mm
4000mm		4~5N	0.292mm	0.073mm	300mm
5000mm		9N	0.375mm	0.093mm	385mm

BRT27

BRT38

BRT38X

Service times	>5million times	Working temp.	-40~+85°C

Body Material	Aluminum alloy housing with anti-static surface, tainless steel puller, IP68-rated encoder in stainless iron.	Drawstring diameter	0.8mm
Max. Working Speed	1m/s	Pull rope material	steel wire, outer nylon coating
Protection Grade	IP54, IP68waterproof, Explosion proof	Cable Length	1-1.2meters
Working voltage	5V	Linearity Accuracy	±0.1% of Full Scale
Working current	100mA	Node number	1-255 (default1)
Kernel refresh cycle	50uS	Electrical life	> 100000 h
Resolution	1024, 4096 (default)		

4. How to calculate the displacement length

Firstly, it is necessary to determine the inner wheel perimeter and resolution of the sensor you purchased; When using, the position values feedback by the sensor before and after pull the rope are X2 and X1.

Method 1: For the rope sensor you purchased with a range of Part No. BRT38-0.5M with 500mm and a resolution of 4096ppr, referring to the corresponding wheel diameter of 100mm in the table, the displacement calculation formula is: Length = (X2 - X1) * 100 / 4096 mm.

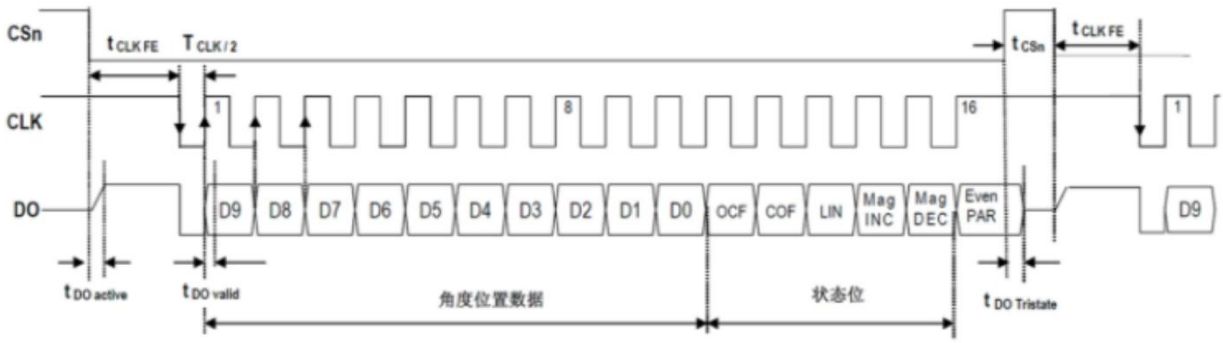
Part No.	Measuring Range	Interface	Linear accuracy	Resolution 1024PPR	Resolution 4096PPR	Winding wheel diameter(mm)
BRT38-0.5M	500mm	SPI	±0.1%	0.098mm	0.0244mm	100

Method 2: For the rope sensor you purchased with a range of Part No. BRT38-0.5M with 500mm and a resolution of 4096ppr, according to the table, the actual resolution is 0.0244mm, so the displacement calculation formula is: Length = (X2 - X1) * 0.0244 mm.

Note: When X1 displays a large value, it is caused by the principle of multi-turn absolute encoder used in the draw-wire displacement sensor. Therefore, moving backward from the zero position results in a large numerical value.
To address this situation, simply preset the initial value of X1 to 1000 (this can be modified via the PC software or by sending a command), which can effectively solve the problem.

5. SPI Core Code

The Serial Peripheral Interface (SPI) is a synchronous serial communication protocol used primarily for short-distance communication between a master device, like a microcontroller, and one or more slave devices. It features full-duplex communication, utilizing four main signal lines: MOSI, MISO, SCLK, and CS/SS, allowing flexible and high-speed data exchange. SPI is favored in embedded systems for its simplicity and efficiency, commonly applied in scenarios such as interfacing with sensors, memory devices, and displays.



Operating Conditions:

(Tamb = -40°C to +125°C, VDD5V = 3.0 to 3.6V (3V operation) VDD5V = 4.5 to 5.5V (5V operation), unless otherwise specified)

Parameter	Symbol	Min	Max	Unit	Notes
Data Output Activation (logic high level)	t_DO_active	/	100	ns	Time between CSn falling edge and data output
First Data Shift to Output Register	t_CLK_FE	500	/	ns	Each rising edge of CLK shifts out one bit
Start Data Output	T_CLK/2	500	/	ns	Each rising edge of CLK shifts out one bit
Data Output Valid	t_DO_valid	375	394	ns	Time between CLK rising edge and data output becoming valid
Data Output Tristate	t_DO_tristate	/	100	ns	Time when the DO pin returns to "tristate" after the last bit
CSn Pulse Width	t_CSn	500	/	ns	CSn = high level, prepare to start the next angle position read operation
Readout Frequency	f_CLK	>0	1	MHz	Clock frequency for reading out serial data

1) Core code for 10bit(1024)

```markdown
// The following routine: PA0 connects to DO, PA1 connects to CLK, and PA2 connects to the CS pin.
// When using, please initialize the ports according to the microcontroller type and make any other necessary modifications.

#define CS_H  GPIOA->ODR|=(1<<2);
#define CS_L  GPIOA->ODR&=~(1<<2);
#define CLK_H  GPIOA->ODR|=(1<<1);
#define CLK_L  GPIOA->ODR&=~(1<<1);

void Delay_SPI(__IO uint32_t nCount)
{
  for(; nCount != 0; nCount--);
}

int SPI_RW()
{
        int i=0;
        int     wdata=0;
        CS_H;
        Delay_SPI(0xF); // The routine assumes a 72M clock. Please adjust the delay according to the actual clock of the microcontroller.

        CS_L;
        Delay_SPI(0xF);
        for(i=0; i<16; i++)
        {
                CLK_H;
                Delay_SPI(0xF);
                if((GPIOA->IDR&0x00000001)>0)wdata|=1;  // Please modify this according to the pin connected to DO.
                wdata<<=1;
                CLK_L;
                Delay_SPI(0xF);
```

```
        }
        return(wdata>>7);  // Returns the absolute position value of the encoder.
}
```

2) Core code for 12bit(4096)

```
// The following routine: PA0 is connected to DO, PA1 is connected to CLK, and PA2 is connected to the CS pin.
// When using, please initialize the ports and make other modifications according to the specific microcontroller type.
#define CS_H  GPIOA->ODR |= (1 << 2);
#define CS_L  GPIOA->ODR &= ~(1 << 2);
#define CLK_H  GPIOA->ODR |= (1 << 1);
#define CLK_L  GPIOA->ODR &= ~(1 << 1);
void Delay_SPI(__IO uint32_t nCount)
{
  for(; nCount != 0; nCount--);
}
int SPI_RW()
{
    int i = 0;
    int wdata = 0;
    CS_H;
    Delay_SPI(0xF); // For 72M clock routine, please adjust the delay accordingly according to the actual clock of the microcontroller.
    CS_L;
    Delay_SPI(0xF);
    for(i = 0; i < 18; i++)
    {
        CLK_H;
        Delay_SPI(0xF);
        if((GPIOA->IDR & 0x00000001) > 0) wdata |= 1;  // Please make corresponding modifications according to the pin connected to DO.
```

```
        wdata <<= 1;
        CLK_L;
        Delay_SPI(0xF); //
    }
    return (wdata >> 7);  // Return the absolute position value of the encoder.
}
```

6. Precautions and warranty

● The displacement sensor of the pull rope is installed in a fixed position, and when the pull head is pulled out, it is strictly prohibited to let go and allow the pull rope to retract instantly.
● Movement needs to be kept unobstructed, and the cable should be pulled out vertically during installation.
● Non technical personnel are strictly prohibited from disassembling. If necessary, please disassemble and reassemble under the guidance of technical personnel;
● When installing the stainless steel ropes, attention should be paid to angle control. If necessary, pulleys can be added appropriately to change direction to ensure measurement accuracy and the service life of the steel rope, and to avoid friction between the wire and the outlet.
● Please confirm the power is turned off when wiring, and be aware that incorrect wiring may cause the encoder main board to burn out.
● The product is guaranteed for one year free of charge when used correctly.
● 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).

8.Contact us and technology support

WhatsApp：+86 15183276844
Phone/Wechat: +86 17665280977
Email: brt@briterencoder.com

Technical documentation

Detailed version of the instruction manual;
PC software;
2D drawings and 3D model files;
Additional Video Tutorials;

For more details, please visit our website:
www.briterencoder.com.

WhatsApp

WeChat