# Briterencoder Absolute Rotary Encoder

## SSI Interface Communication Protocol

### 1. Product Model Description

BRT=BriterEncoder:
BRT25=OD.25mm,4mm shaft
BRT27=27*27mm,6mm shaft
BRT38=OD.39mm, 6mm shaft
BRT38B=OD.39mm, 8mm hoop blind hole
BRT38M=OD.39mm,8mm blind hole
BRT42=OD.42mm, 6mm shaft
BRT50=OD.50mm, 8mm shaft
BRT58=OD.58mm, 10mm shaft

Resolution:
1024=10bit
4096=12bit
16384=14bit
32768=15bit
16bit =65536
17bit =131072
.....
21bit=2097152

RT1=Side Outlet
AT1=Tail Outlet
(Default Cable Length 1~1.2M)

IP54:Normal
IP65:Waterproof
IP68:Waterproof and dustproof
(Usable 1m underwater)
EX:Explosion-proof

BRT38 — R0M — 1024 — D24 — RT1 — IP68 — X3

**Communication Protocal:**

| | |
|---|---|
| R0M=RS485 (Modbus RTU) | A0M=4~20mA |
| R2M=RS232(Modbus RTU) | V5M=0~5V |
| R4M=RS422(Modbus RTU) | V10M=0~10V |
| T0M=TTL(Modbus RTU) | R0&A0M=RS485&4~20mA |
| C0M=CANbus | R0&V5M=RS48580~5V |
| C2M=CANopen | R0&V10M=RS485&0~10V |
| S0M=SPI | |
| S1M=SSI | |
| S2M=BISS-C | |

**Turns:**
1, 16, 24, 32, 50, 64, 99, 100, 200, 400, 600, 800, 1800, 5400, 10800, 21600, 34891, 69782 turns
(Customizable)
D1 = Single turn
D16 = 16 turns

Internal Identification Code

Note 1: For photoelectric types, add P before the communication interface, e.g., photoelectric RS485 = PROM.

Note 2: For high-speed RS485 communication interfaces compatible with Tamagawa models, add HS before the communication interface, e.g., high-speed RS485 = HSR0M.

Note 3: For analog speed models, note the maximum speed RPM after the model, e.g., BRT38 - A0M1024 - RT1 - IP68(1000RPM).

**Model Description:**
1.Model:e.g., BRT25 indicates an outer diameter of 25mm and an output shaft of 4mm.
2.Communication interface: e.g., R0M means the electrical interface is RS485 and the communication protocol is Modbus RTU.
3.Resolution: It refers to the single - turn resolution, which has nothing to do with the subsequent number of turns. e.g., with a 10 - bit resolution, 2 to the power of 10 equals 1024. That is, the 360° full circle is divided into 1024 parts, and the minimum angular resolution is 360°/1024 = 0.38°.
4.Turns:It represents the power-off memory range, rather than the mechanical rotation turns of the encoder. The power-off memory of a single-turn encoder is limited to one turn, while a multi-turn encoder can record and restore multi-turn position information. Both types of encoders can perform infinite mechanical rotations.
5.Blind holes are mainly used to provide space for fixed threaded connections, while hoop blind hole are mainly used to fix and connect components. In practical applications, it is more recommended to use hoop blind hole for encoders.
6.Inventory: Some randomly combined models may be out of stock. Please consult in advance to ensure that the selected model is available.



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## 2. Wiring Definition and connection

| | | |
|---|---|---|
| Red wire | Power Supply | DC 5V~24V |
| Black wire | 0V (GND) | - |
| Green wire | CLOCK+ | - |
| Brown wire | CLOCK- | - |
| White wire | DATA+ | - |
| Grey wire | DATA- | - |
| Yellow wire | Function line | 1. It serves for encoder zero position setting.<br>2. During normal encoder operation, keep the yellow wire suspended and disconnected. |
| Orange wire | Function line | 1. 1.It serves for encoder setting direction and midpoint.<br>2. During normal encoder operation, keep the yellow wire suspended and disconnected. |

## 3. Product Parameters

| | | | |
|---|---|---|---|
| Multi-turns | Singleturn、16、25、32、50、64、100、400、1800、5400、10800、21600turns(Customizable) | | |
| Resolution | 10bit、12bit、13bit、14bit、15bit、16bit | | |
| Supply Voltage | 5~24V | Linearity | 0.1% |
| Kernel Refresh Period | 50uS | Electrical lifespan | > 100000 h |
| Working Current | 100mA | Code System | Binary / Gray Code (Default: Binary) |
| Shell/ Flange Material | Galvanized steel / Aluminum alloy IP68/EX Stainless Steel | Clock Frequency | 50 kHz - 5 MHz |
| Shaft Material | Stainless Steel(Customizable) | Maximum mechanical speed | Single turn 8000RPM<br>Multi-turn 6000PRM |
| Bearing material | Bearing Steel | Starting Torque | 0.006Nm |
| Maximum load on the shaft | Axial 20 N, Radial 80 N | Weight | 86~200 g |
| Working temperature | -40 ~ + 85 ℃ | Humidity | 98 % ( No condensation) |
| Storage temperature | -40 ~ +85°C | Protection Level | IP54、IP68、EX |

### Three simple ways to set absolute encoder to zero position?

- ✧ Method 1. Connect yellow wire to ground (black wire) more than 100mS. After set zero, please separate the yellow and black wire.
- ✧ Method 2. After right connected the wires according to the wiring definition. send set zero position command according to the user manual.
- ✧ Method 3. Use the upper computer provided by our company (BriterEncoder).

### How to set directions of encoder rotation?

- ✧ Step 1: After power off, connect the orange wire to the black wire.
- ✧ Step 2: Power on and hold for two minutes.
- ✧ Step 3: Power off, then separate the orange wire from the black wire. The rotary encoder has now switched direction.

### How to set midpoint of encoder?

Setting the absolute encoder to the midpoint position. Connect the orange wire to ground (black wire) for more than 100 milliseconds. After setting, please separate the orange and black wires.

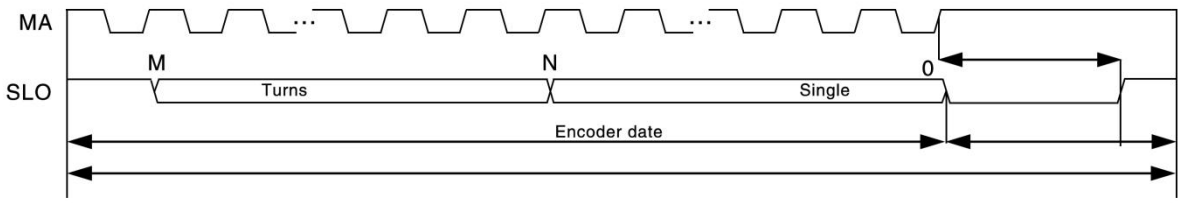
## 4. SSI communication protocol

SSI communication protocol, abbreviated as Synchronous Serial Interface, uses RS422 as the physical interface and is divided into two parts: clock pulse and data. The receiving device sends a series of clock pulses to the encoder, and the encoder outputs encoder values bit by bit based on the number of clock pulse bits, including angle position, calibration signal, or encoder working status, upon receiving synchronization of the clock pulses. SSI is a widely used position sensor.

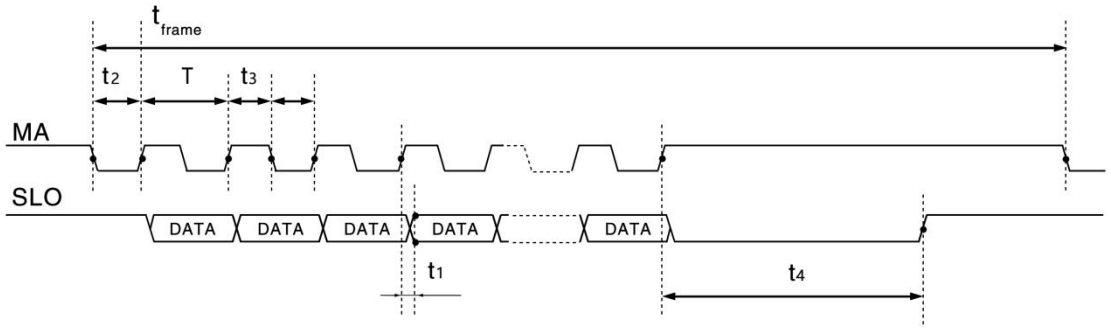
The SSI interface encoder only requires two signals: clock and data, which are independent of the encoder's accuracy. The data reading speed of the encoder depends on the clock frequency given by the host, and the encoder emits real-time data based on the clock pulses given by the host. In order to enhance anti-interference ability and long-distance transmission, the SSI interface adopts RS422 level, a pair of differential clock signals, and a pair of differential data signals.

Suitable for motion controllers, PLCs with SSI interfaces, or for simulating SSI host acquisition through a microcontroller.

**SSI Protocol Frame Structure Diagram:**




**SSI Timing Requirements:**




**Timing Description:**

| Bit | Identifier | Description |
|---|---|---|
| M~N bit | Turns | Multi-turn value |
| N~0 bit | Single | Single-turn value |
| M~0 bit | Encoder date | Encoder output value |

As shown in the above figure, the absolute position value of the encoder is emitted by the host's clock signal, starting from the binary high bit (MSB) and outputting a serial signal synchronized with the clock signal. The clock is emitted from the host device and outputs N pulses in the total number of bits of the encoder. When the signal is not transmitted, both the clock and data bits are high. At the first falling edge of the clock signal, the current value begins to be stored. From the rising edge of the clock signal, the data signal begins to be transmitted, and one clock pulse synchronizes one bit of data.

T=500ns ~ 10us; t2=t3=1/2T; t1 < 1us; t4 > 20us(Dead Time).

## 5. Precautions and warranty

● Encoders belong to precision instruments. Please handle them with care and use them with care, especially do not knock, hit, or forcefully pull the encoder shaft.
● The encoder and mechanical connection should use flexible connectors or elastic brackets to avoid hard damage caused by non concentric rigid connections.
● Although the encoder itself does not lose the number of turns in interference environments, it can cause interference to the data during transmission. Therefore, when there is a motor or strong electromagnetic interference environment in the system, an isolated power supply should be used to power the encoder. And when there's external extended communication lines, it is best to use double shielded cables.
● The encoder casing and shielding wire should be well grounded to prevent damage to the encoder circuit caused by lightning strikes or high-voltage static electricity
● The product is guaranteed for two 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).

## 6. Encoder Indicator Lights Description

1. Default indication status: Status light flashing (flashing color varies by model), indicating normal power supply to the encoder;

2. Other work status indications:
(1) -SSI reading encoder data status: green light flashes quickly at 0.5s intervals;
(2) - Yellow wire power-on reset, yellow wire zero-point setting status: Orange light flashes quickly at 0.5s intervals;
(3) - Orange wire power-on direction switch, orange wire midpoint setting status: Purple light flashes quickly at 0.5s intervals;
(4) - Normal working status upon power-on: Stop 4s, flash slowly 3 times at 1s intervals, stop 2s, flash slowly 3 times at 1s intervals, stop 2s, flash slowly 3 times at 1s intervals, where the combination of three flashes forms a quaternary number that can be converted into the corresponding multi-turn number and single-turn accuracy digits of the encoder, the last flash color defines the output mode, 0 for SSI.

Table 5: Color and Numerical Value Definitions

| **Color** | Blue | Cyan | Orange | Purple | Green | Red |
|---|---|---|---|---|---|---|
| **Value** | 0 | 1 | 2 | 3 | 4 | 5 |

Table 6:Definition and Examples of Status Light Blinking

| | | Segment 1: Multi-Turn Bit Count | | | | Segment 2: Single-Turn Resolution | | | | Segment 3: Output Interface |
|---|---|---|---|---|---|---|---|---|---|---|
| LED State | OFF | ON | ON | ON | OFF | ON | ON | ON | OFF | ON |
| Duration | 4s | 1s | 1s | 1s | 2s | 1s | 1s | 1s | 2s | 1s |
| State Example | - | Blue | Purple | Orange | - | Cyan | Blue | Blue | - | Blue |
| Corresponding Digit | - | 0 | 3 | 2 | - | 1 | 0 | 0 | - | 0 |
| State Decoding | - | $0*4^2 + 3*4^1 + 2*4^0 = 14$ | | | | $1*4^2 + 0*4^1 + 0*4^0 = 16$ | | | | SSI |
| State Meaning | - | Multi-Turn 14 bits | | | | Single-Turn 16 bits | | | | SSI |

## 7. Contact us and technology support

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### 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.**