Briterencoder Linear Wire Displacement Sensor

BRT38X Series CANbus Interface User Manual V202407

1. Product Model Description

Communication Protocal:

R0M=RS485 (Modbus RTU)
R2M=RS232(Modbus RTU)
R4M=RS422(Modbus RTU)
T0M=TTL(Modbus RTU)
C0M=CANbus
C2M=CANopen

S1M=SSI
S2M=BISS-C
A0M=4~20mA
V5M=0~5V
V10M=0~10V
K5M=0~5K

K10M=0~10K
R0&A0M=RS485&4~20mA
R0&V5M=RS485&0~5V
R0&V10M=RS485&0~10V

Resolution:
1024、4096

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

BRT38X	1M	ROM	1024	RT1	IP68

BRT=BriterEncoder
BRT38= OD.39mm
BRT50= OD50mm
BRT27=27*27mm
BRT38X=X series

Measuring range:0.3M、0.5M、1M、2M、3M、4M、5M、6M、7M、8M、9M、10M、11M、12M、13M、14M、15M、(Customizable)

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

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~24V
Black wire	0V (GND)	-
Green wire	CANH	-
White wire	CANL	-
Yellow wire	Function line	1. It serves for encoder zero position setting and factory settings restoration. 2. During normal encoder operation, keep the yellow wire suspended and disconnected.

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 restore the absolute encoder to factory settings?

- Step 1, After power off, connect the yellow wire to the black wire.
- Step 2, power on, and hold for two minutes.
- Step 3, power off, then separate the yellow wire from the black wire. now the rotary encoder had been restored to factory settings.

3. Product Parameters

Measuring Range	Interface	Linear accuracy	Resolution 1024PPR	Resolution 4096PPR	Winding wheel diameter(mm)
500mm	CANbus	±0.1%	0.126mm	0.031mm	130
1000mm		±0.1%	0.126mm	0.031mm	130
2000mm		±0.1%	0.175mm	0.043mm	180
3000mm		±0.1%	0.224mm	0.056mm	230
4000mm		±0.1%	0.292mm	0.073mm	300
5000mm		±0.1%	0.375mm	0.093mm	385
Service times	>5million times		Working temp.	-40~+85°C	
Pull Tension	2~3N		Resolution	1024(10bit), 4096(12bit)	
Max. Working Speed	1m/s		Pull rope material	Stranded steel wire	
Protection Grade	IP54, IP68waterproof, Explosion proof		Drawstring diameter	0.6mm	
Cable Length	1-1.2meters		Electrical life	> 100000 h	
Working voltage	5~24V		Kernel refresh cycle	50uS	
Working current	100mA		Address	1-255 (default 1)	
Baud rate	100K~1M(Default 500K)				
Body material	Aluminum alloy (anti-static), stainless steel head; IP68/ex-proof encoder in stainless steel.				

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	RS485	±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. CANbus communication protocol

1) 6.1. Application CAN and encoder communication

Open the CAN device

Set the baud rate.
The host should be set to the same baud rate as the encoder;
The encoder factory default baud rate is 500kbps.
Note: To connect the CAN device to the encoder, at least one 120 Ω terminal resistor needs to be added, and a second resistor should be added according to the actual situation.

Frame information setting

(1) Select standard frames instead of extended frames;
(2) Select data frames instead of remote frames;
(3) Calculate the length of the data field, including all content in the data field, with a maximum value of "8".

Data transmission

According to the encoder's protocol, fill in the data field content. When the content of the data field is multi byte, the low byte comes first.
For example, the host sends command to encoder 1: "Read encoder value", data field length 4;
Data field: 0x04 (data length) + 0x01 (encoder address) + 0x01 (instruction code) + 0x00 (data 1)

Identifier 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)Identifier 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	——

2) BriterEncoder CAN instruction set. V2.3

CAN Protocol

(1) Adopting CAN2.0B standard frame communication protocol.
(2) Communication rate: 1Mbps、500kbps、250kbps、125kbps、100kbps are settable.
500kbps is the default baud rate.

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

Command 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 consist16 bit data， The low byte comes first; 4 bytes make up 32-bit data, and the low byte comes first.

CAN command data list. V2.3

CAN Command	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 integer. Numerical range: 0~X (X For single turn resolution*Multiturns-1) Encoder current multi turn angle= Encoder value*360/ single turn resolution. e.g. reading the encoder value is 4000, the single turn resolution is 1024 (10bit). then the encoder current multi turn angle= 4000*360/1024=1406.25°	Issue: [0x04][0x01][0x01][0x00] Return: [0x07][0x01][0x01][0x45][0x23][0x01][0x00] Encoder value: 0X00012345 (Decimal: 74565)
0x02	Set the encoder ID, Numerical range: 1~255 (8-bit unsigned integer) The default node address is 1(0x01) Send data: 8-bit unsigned integer. Return data: 8-bit unsigned integer. 0: Set successfully other: Error code Effective immediately after successful setting	Issue: [0x04][0x01][0x02][0x08] Return: [0x04][0x08][0x02][0x00] Set address: 0X08 After successful setup, the slave responds with a new address
0x03	Set CAN baud rate: Numerical range: 0~4 (8-bit unsigned integer) Send data: 8-bit unsigned integer. Return data: 8-bit unsigned integer. 0: Set successfully， other: Error code 0x00: 500K (default) ； 0x01:1M 0x02: 250K； 0x03:125K; 0x04: 100K； Effective immediately after successful setting	Issue: [0x04][0x01][0x03][0x01] Return: [0x04][0x01][0x03][0x00] Set baud rate: 1M
0x04	Set the encoder mode: 0x00: query mode，(default) 0x01: Automatically return encoder angular velocity value, 0xAA: Automatically return encoder value, Effective immediately after successful setting	Issue: [0x04][0x01][0x04][0xAA] Return: [0x04][0x01][0x04][0x00] Setting mode: 0xAA (automatic return mode), After setting the automatic mode, the encoder position or angular velocity will be periodically and actively transmitted back. The transmission cycle is determined by the encoder's automatic transmission time.
0x05	Set the automatic return time of the encoder (microseconds), Numerical range: 50~65535 (16-bit unsigned integer) Effective immediately after successful setting	Issue: [0x05][0x01][0x05][0xE8][0x03] Return: [0x04][0x01][0x05][0x00] Set automatic return time: 0X03E8 (1000ms)
Note: Setting too short a return time and then setting other parameters through the encoder upper computer can easily fail. Use with caution!		

0x06	Set the current position value to zero, Send data: 8-bit unsigned integer. Return data: 8-bit unsigned integer. 0: Set successfully，other: Error code Effective immediately after successful setting	Issue: [0x04][0x01][0x06][0x00] Return: [0x04][0x01][0x06][0x00] Set the position value to zero, and after setting, the current encoder value is 0.
0x07	Set encoder value increment direction: 0x00: Clockwise, 0x01: Counterclockwise Effective immediately after successful setting	Issue: [0x04][0x01][0x07][0x01] Return: [0x04][0x01][0x07][0x00] Set direction: 0x01 (Counterclockwise)
0x0A	Read encoder angular velocity value. Return data: 32-Bit signed integer. Numerical range: -2147483648~2147483647 Encoder rotation speed= Encoder angular velocity value/ single turn resolution/ Speed calculation time (Unit: rpm) e.g. The encoder angular velocity value is returned as 1000，single turn resolution is 32768 (15bit)，Speed calculation time is 100ms (0.1/60min) Encoder rotation speed= 1000/32768/(0.1/60) = 1000*0.0183 = 18.31rpm.	Issue: [0x04][0x01][0x0A][0x00] Return: [0x07][0x01][0x0A][0x45][0x23][0x01][0x00] The encoder angular velocity value: 0X00012345 (Decimal: 74565)
0x0B	Set encoder angular velocity calculation time (power off memory，unit: ms) Numerical range: 0~65535 (16-bit unsigned integer) Effective immediately after successful setting	Issue: [0x05][0x01][0x0B][0x03][0xE8] Return: [0x04][0x01][0x0B][0x00] Set encoder angular velocity calculation time: 0X03E8 (1000 ms)
0x0C	Set encoder midpoint, Send data: 8-bit unsigned integer. Return data: 8 -bit unsigned integer. 0: Set successfully，other: Error code Effective immediately after successful setting	Issue: [0x04][0x01][0x0C][0x01] Return: [0x04][0x01][0x0C][0x00] Set the encoder to use the current position value as the midpoint value. Set the current encoder value to M (M is single turn resolution*turns/2)
0x0D	Set the current position value of the encoder. Numerical range: 0~X (X is for the single turn resolution*turns-1) Send data: 32 -bit unsigned integer. Return data: 8 -bit unsigned integer. 0: Set successfully，other: Error code Effective immediately after successful setting	Issue: [0x07][0x01][0x0D][0x00][0x01][0x23][0x45] Return: [0x04][0x01][0x0D][0x00] Set encoder value: 0X00012345 (Decimal: 74565)
0x0F	Sets the encoder current value to 5 turns. Send data: 8-bit unsigned integer. Return data: 8 -bit unsigned integer. 0: Set successfully，other: Error code Effective immediately after successful setting.	Issue: [0x04][0x01][0x0F][0x01] Return: [0x04][0x01][0x0F][0x00] Set the encoder to the current position value of 5 turns. That is, the current encoder value is Z (Z is the single turn resolution*5)

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).

7. Indicator Lights Description

1) The default state consists of 5 flashing statuses in the following sequence: “Blue -> Blue -> Blue -> Cyan -> Blue” with a slow flash every 1 second, indicating normal power supply to the encoder.

2) Other operational status indications
a. Query encoder data status: Green light flashing quickly every 0.5 seconds.
b. Setting the zero point for the yellow line: Orange light flashing quickly every 0.5 seconds.
c. Power-on reset status for the yellow line: Purple light flashing quickly every 0.5 seconds.
d. Encoder data automatic return status: Pause for 1 second, slow flash, interval of 0.5 seconds fast flash, blinking 5 times, defined with reference to the first item.
e. The red light indicates encoder malfunction.

3) When the encoder’s ID and baud rate are changed, the colors of the flashing lights will correspondingly change. Here is the color reference table for the status lights and their meanings:

Table 1 Color and Numerical Definition Relationship

Color	Blue	Cyan	Orange	Purple	Green	Red
Numerical Value	0	1	2	3	4	5

Table 2 CANbus Baud Rate and Numerical Definition Relationship

Baud Rate	500K	1M	250K	200K	100K
Numerical Value	0	1	2	3	4

(1) Upon power-on in normal operation:
a. There is a 4-second pause followed by 5 slow flashes with a 1-second interval.
b. The colors of the first 4 flashes form a quaternary (base-4) data that corresponds to the encoder ID number.
c. The color of the last flash defines the baud rate.

(2) For example: Orange -> Cyan -> Purple -> Orange -> Blue. Referring to Table 1 and Table 2, we can determine the corresponding numbers: 21320. The last digit is 0, according to Table 2, which corresponds to a baud rate of 9600. The first four digits form the quaternary number 2132, which converts to decimal ID: 2 * 4^3 + 1 * 4^2 + 3 * 4^1 + 2 * 4^0 = 158 (Encoder ID).

Table 3 Status LED Blinking Definitions and Examples

		Section 1 Encoder ID				Section 2 Baud Rate	
LED Status	OFF	ON	ON	ON	ON	ON	OFF
Hold Time	4s	1s	1s	1s	1s	1s	4s
Status Color	-	orange	blue-green	purple	orange	blue	-

Number	-	2	1	3	2	0	-
Status Analysis	-	2*4^3+ 1*4^2 + 3*4^1 + 2*4^0 = 158				Baud rate is 500K	-
Status Meaning	-	Encoder ID				Baud Rate	-

8. 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:
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