File name: ShaftEncodeModBus01.doc

Rev 1.01 Date 10/25/2017

User Manual

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Rotary Encoder

Absolute – Single Turn – Resolution 4096

Interface: RS485

Protocol: ModBus RTU

Manufacturer: **Shanghai QIYI Electrical & Mechanical Equipment Co., Ltd**

Brand: CALT

Part# CAS60R12E10RMB

Introduction

At the center of this “Rotary Encoder” is a rotary shaft. As this shaft is turned the encoder continuously tracks the current angle of that shaft and allows for a PC, or PLC, to query the angular position.

Connecting the encoder to a PC, or PLC, is through a RS485 hardware interface in conjunction with a ModBus RT compliant protocol where the Encoder acts as a ModBus slave. RS485 interfaces are known to function well for distances of up to 0.5 miles and beyond.

Angular resolution

The factory default value for the resolution of model CAS60R12E10RMB is 4096 positions per revolution. This encoder is user programmable, a feature which allows for a custom resolution to be programmed into the encoder. Custom resolutions must never exceed the maximum of 4096 positions. When queried, those Encoders that have never been programmed by the user return a number of 4000 hex, the equivalent of decimal 4096 positions.

User Programming

Users may program the Encoder to suit their particular requirements. Programming of the Encoder requires the use of ModBus RT compliant commands and a RS485 interface, special hardware or software is not required.

Programmable Features

1.	Bus address	1 to 255
2.	Baud rate	4800, 9600, 19200, 38400, 115200
3.	Resolution	1 to 4096 steps per revolution
4.	Position increments	in CW or CCW direction

Mode Settings

Blue wire:	Mode:	Encoder function(s):
Ground	Position Mode	Sending of a Position Report when queried
+24V	Programming Mode	Reading and writing of Programmable Settings

Power On Test:

Prior to powering up an Encoder for the first time Users should wire the Encoder for Position Mode and refrain from using Programming Mode. It seems best to repeatedly query the Encoder in Position Mode until it responds to every query with a viable Position Report. For the Encoder to respond with a Position Report the query must comply with the following Factory Default settings:

ModBus addr.	01h
Baud rate	9,600 Baud
Data bits	8
Parity	even
Stop bits	1

Furthermore, queries should follow the example of a ModBus RT compliant command named “Read Encoder Position”; the details of that command are explained later in this document.

Position Mode: (the blue wire must be connect to Ground)

The encoder will respond to a query with a Position Report, typical response times are <=40mS. Possible causes for missing position reports are:

A: The query does not use the Factory Defaults as shown above

B: The query addresses registers, or coils, that are nonexistent

C: The query uses an incorrect CRC code

D: RS485 lines A and B are wired incorrectly

Programming Mode: (when the blue wire is connect to +24V)

When in “Programming mode” the encoder recognizes two commands:

- “Read Encoder Configuration”, and
- “Write Encoder Configuration”

As long as the Encoder is hard wired to “Programming Mode” it responds only to:

ModBus addr.	01h
Baud rate	19,200
Data bits	8
Parity	even
Stop bits	1

Read Encoder Configuration

This command queries the Encoder to verify previous attempts by the user to program particular settings. Details of that command are explained later in this document.

Write Encoder Configuration

This command permanently customizes ModBus address, Baud rate, and Resolution.
Details of that command are explained later in this document.

It should be noted here that responses from the Encoder are suppressed when the ModBus Master mistakenly addresses nonexistent Encoder Registers or Coils.

User Programmable Parameters

The "Read Encoder Configuration" and "Write Encoder Configuration" commands use identical parameter sets. Encoders with a factory default setting respond to a "Read Encoder Configuration" command with a numeric value of: 01 26 40 00 This 32 bit hex value can be decoded as follows:

01 xx xx xx	A ModBus **Slave Address** in the range of 00h to FFh
	A **Baud rate** setting for:
xx 1x xx xx	4800
xx 2x xx xx	9600
xx 3x xx xx	19200
xx 4x xx xx	38400
xx 5x xx xx	115200
	Positional changes cause a numerical increase in:
xx x6 xx xx	CW direction (Clock Wise)
xx x7 xx xx	CCW direction (Counter Clock wise)
	Encoder Resolution
xx xx 40 00	= 4096 in decimal (the factory default setting)
xx xx 20 00	= 8,192 in decimal (a custom setting)
xx xx 10 00	= 4,096 in decimal (a custom setting)
xx xx 27 10	= 10,000 in decimal (a custom setting) etc.

ModBus RT compliant commands

All numbers are presented in hex

Read Encoder Position:

Host Command		Slave Response	
01	Slave Address	01	Slave Address
04	Read Command	04	Read Command
00	Register Address Hi	04	Byte Count
01	Register Address Low	00	Read Data 1 Hi (MSB)
00	Word Count Hi	00	Read Data 1 Low
02	Word Count Low	01	Read Data 2 Hi
20	CRC-A	00	Read Data 2 Low (LSB)
0B	CRC-B	FA	CRC-A
		14	CRC-B

Read Encoder Configuration: (The Blue wire must be connected to +24V)

Host Command		Slave Response	
01	Slave Address	01	Slave Address
03	Read Command	03	Read Command
00	Register Address Hi	04	Byte Count
44	Register Address Lo	00	Read Data 1 Hi (MSB)
00	Word Count Hi	00	Read Data 1 Lo
02	Word Count Lo	00	Read Data 2 Hi
84	CRC-A	00	Read Data 2 Lo (LSB)
1E	CRC-B	FB	CRC-A
		84	CRC-B

Write Encoder Configuration: (The Blue wire must be connected to +24V)

Host Command		Slave Response	
01	Slave Address	01	Slave Address
10	Write Command	10	Write Command
00	Register Address Hi	00	Data 1 Hi (MSB)
44	Register Address Lo	04	Data 1 Lo (LSB)
00	Word Cnt Hi	00	Byte Count
02	Word Cnt Lo	02	Byte Count
04	Byte count	01	CRC-A
00	See note 1 - ModBus Slave Addr.	DD	CRC-B
00	See note 1 - Baud / Direction		
00	See note 1 - Encoder resolution, high byte		
00	See note 1 - Encoder resolution, low byte		
F6	CRC-A		
6C	CRC-B		

Note 1: Refer to section “User Programmable Parameters” for details

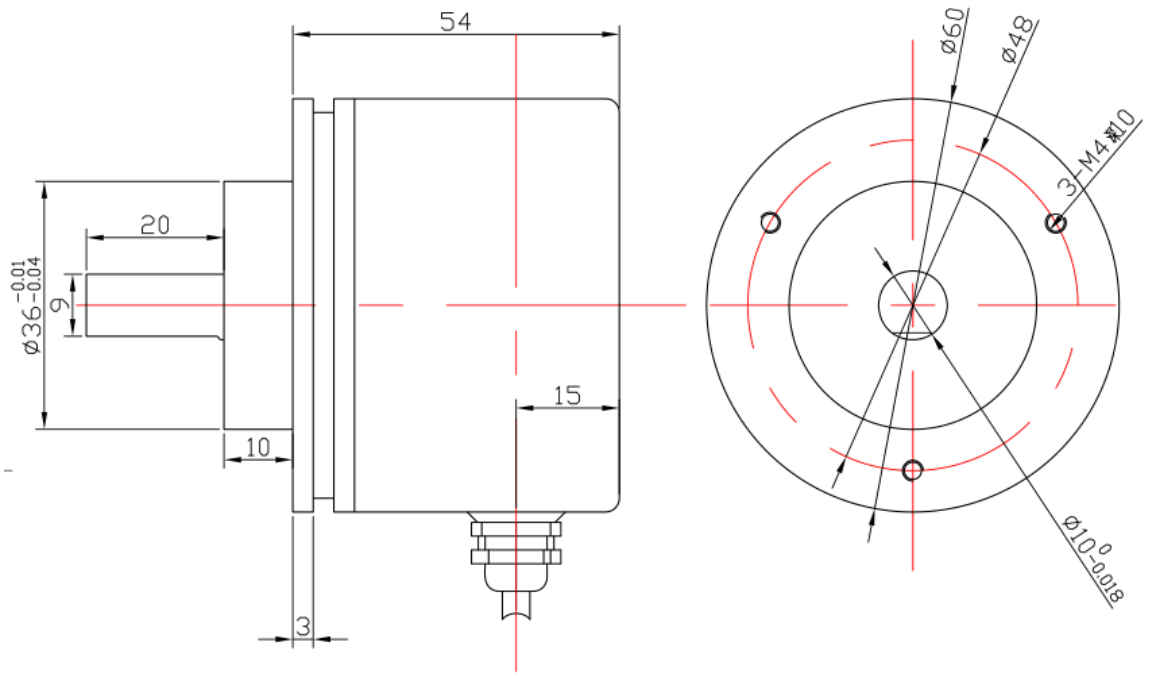
Connections

Wire color:	Signal name:
Brown	+24V power
White	Ground
Green	RS485-A
Yellow	RS485-B
Red	Shield
Gray	Ground = Normal operation +24V = Force position counter to zero
Blue	Ground = Read Encoder Position +24V = Read/Write Encoder Configuration

Technical specifications

Supply voltage	+24V nominal, range 10 to 30 Volt
Current consumption	<110mA at +24V
Line protocol	ModBus RT compliant
Interface	RS485
Cable length	3 ft
Connector	None
Maximum resolution	4096
Angular tolerance	+/- 1/16384
Rotational speed max.	2400 rpm
Response time	<40mS, varies with Baud rate
Operating temperature	-40 to +80˚C
Storage temperature	-40 to +80˚C
Protection class	Housing IP67, Shaft IP65 or IP67 optional
Vibration & shock	20g at 10-2000Hz, 100g for 6mS

Mechanical specifications (unit: mm)


54
20
9
Ø36 -0.01 -0.04
10
15
3
Ø60
Ø48
3-M4↧10
Ø10 0 -0.018