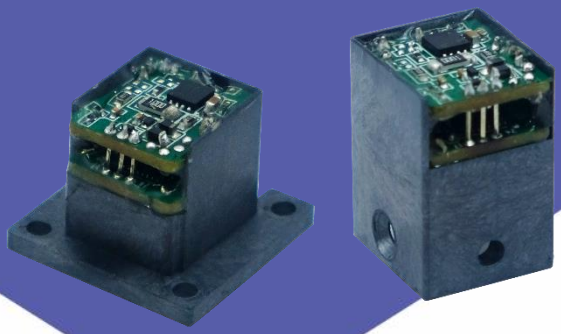
锐鹰传感
REAGLE SENSING

# Ultra-small single-turn absolute rotary encode

# SROA13-17Bit-SYD-W0.5-5V

# SROA20-17Bit-SYD-W0.5-5V

# SPECIFICATION

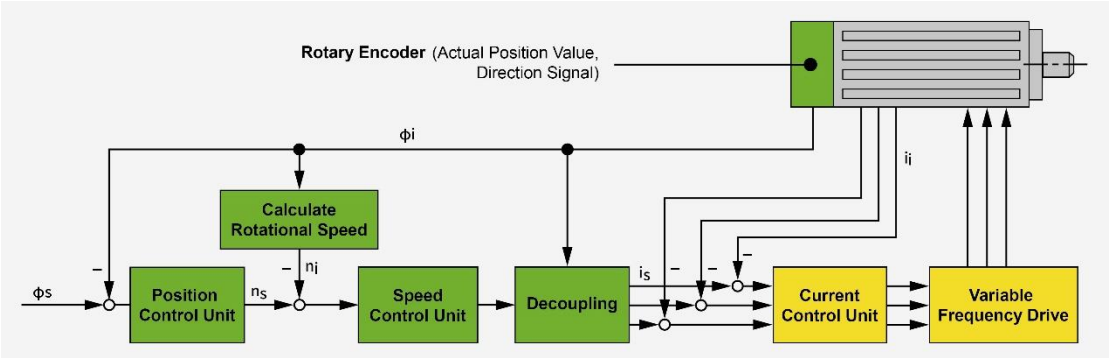


浙江锐鹰传感技术股份有限公司
ZHEJIANG REAGLE SENSING TECHNOLOGY INCORPORATED

# Contents

# 1. Summary Info

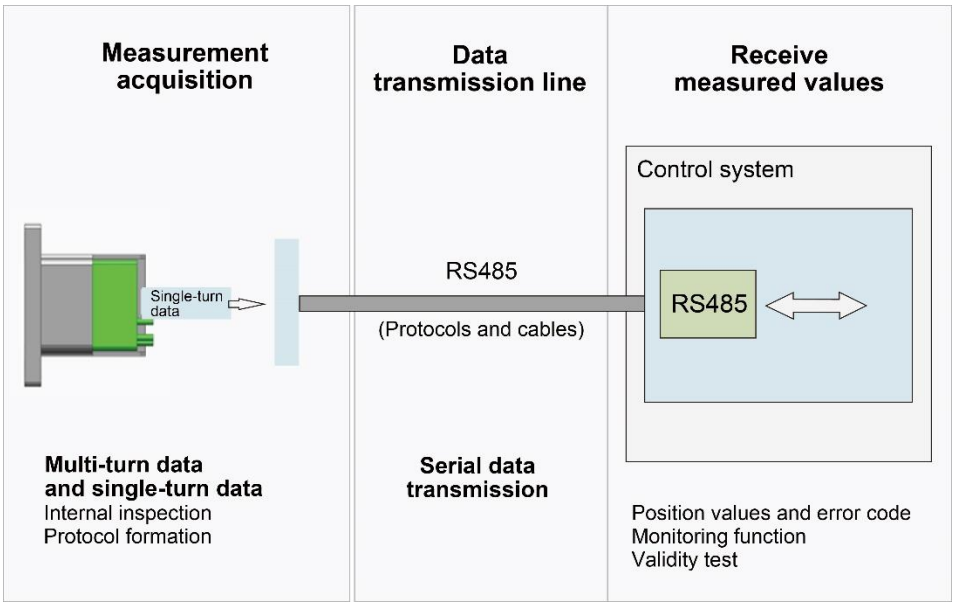
This manual primarily describes how to use the Ultra-small single-turn absolute rotary series SROA13 and SROA20 encoder from Reagle Sensing. This product is mainly used in servo-driven control systems, providing the feedback information required for accurate position and speed control units.




Position and velocity control system

The performance of the encoder has a decisive impact on the essential characteristics of the motor, such as:

- Positioning accuracy
- Speed stability
- Bandwidth, determining the response speed to drive command signals and resistance to interference
- Motor size
- Noise




RS485 Communication Encoder

## 2．Technical Specifications

| Model | SROA13-17Bit-SYD-W0.5-5V<br>SROA20-17Bit-SYD-W0.5-5V |
|---|---|
| Resolution | Supports up to 131072（17bit） |
| Auxiliary Functions | Fault Warning<br>* Electromagnetic Environment Warning |
| Communication Interface | RS485 |
| Communication frequency | ⩽16kHz |
| Baud rate | 2.5Mbps |
| Input shaft allowable deviation | Axial：±0.1mm　　Axial play：＜0.1mm<br>Radial：±0.1mm　　Radial play：＜0.01mm<br>Tilt：＜0.1° |
| Main shaft speed | ⩽5000rpm |
| shaft diameter | straight shaft Ø4mm |
| moment of inertia | 0.003kg·mm$^2$ |
| weight | ≈0.003kg（without cables） |
| rotational angular acceleration | ⩽80000rad/s$^2$ |
| Vibration | Between 10 and 55Hz, maintain amplitude of 1.5mm.<br>Between 55 and 2000Hz, acceleration is 98m/s².<br>2 hours per axis for XYZ, totaling 6 hours. |
| Mechanical shock | Shock acceleration of 980m/s², 11 milliseconds.<br>3 impacts per direction, totaling 18 impacts. |
| Operating Temperature | -10℃~105℃ |
| Relative Humidity | ≤90% (40°C/21 days, based on EN 60068-2-78); No condensation |
| Enclosure Protection Rating | —（Motor Rear Case Protection）<br>Avoid dust, moisture, oil, and other contaminants during operation and use. |

## 3. Electrical Parameters

| Items | | T=25℃ | | |
|---|---|---|---|---|
| | | Min. | Typ. | Max. |
| Main power supply voltage | | 4.75 V | 5V | 5.25V |
| Main power supply Current (Typ) | | -- | 140mA | -- |
| Differential Level | High | 3.5V | -- | -- |
| | Low | -- | -- | 1.7V |
| Edge Change Time | | -- | -- | 100ns |
| Insulation resistance | | 50MΩ | -- | -- |

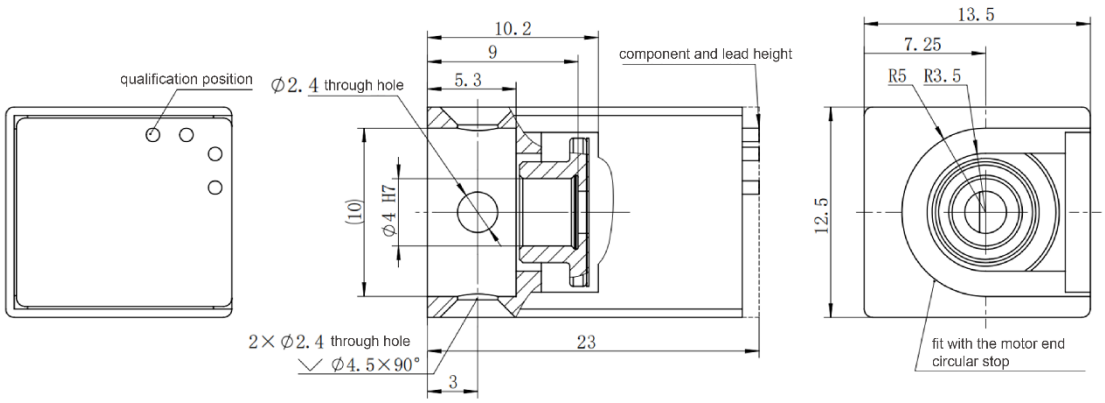
## 4. Cable Definition

| Cable color | Definition |
|---|---|
| Red | 5V |
| Black | GND |
| Blue | 485+ |
| Yellow | 485- |

## 5. Structural Dimensions

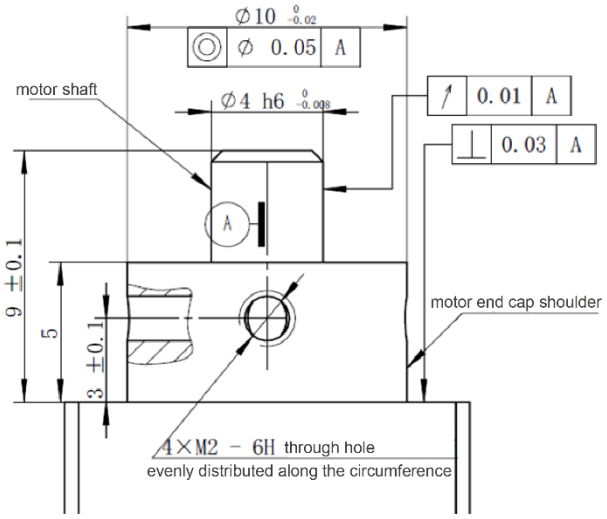
### 5.1 SROA13 Series

✧ Product Structure Dimension Diagram



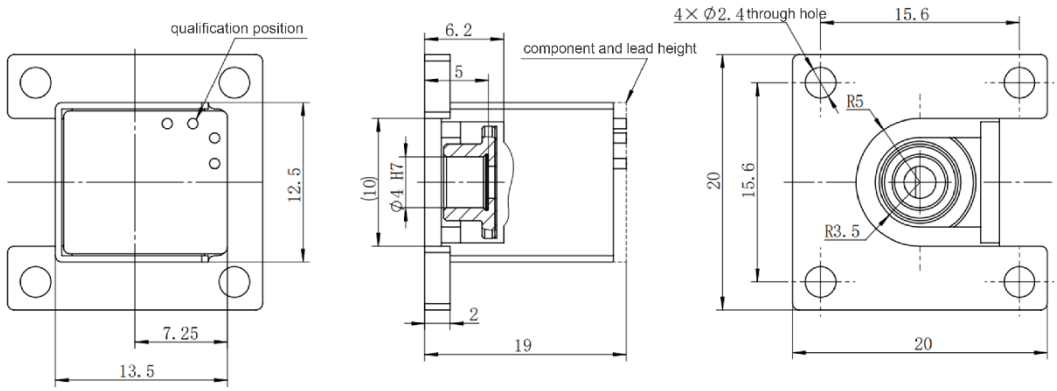

【Note】6.0mm Lead-out with a flexible wire, length 0.5m, outer diameter 6.0mm.

✧ Recommended Motor End Design Dimensions



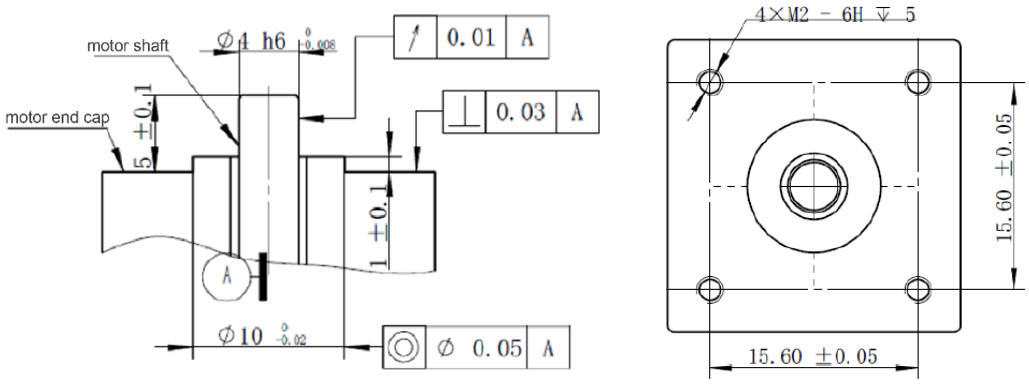

## 5.2 SROA20 Series

✧ Product Structure Dimension Diagram




【Note】6.0mm Lead-out with a flexible wire, length 0.5m, outer diameter 6.0mm.

✧ Recommended Motor End Design Dimensions



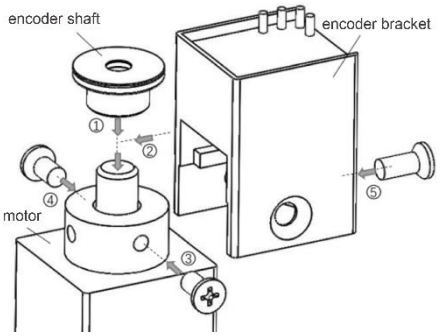
# 6．Mounting Procedure

## 6.1 SROA13 Series

### 6.1.1 Installation Accessories

- Cross Head Torque Screwdriver

### 6.1.2 Installation Sequence




① Assemble the encoder shaft onto the motor shaft using structural adhesive (recommend using anaerobic adhesives like Loctite 638/648). Ensure that the end face of the motor shaft is flush with the end face of the encoder's inner hole, and make sure no adhesive overflows onto the code disk surface；

② Slide the encoder bracket assembly radially over the encoder shaft (note: during the insertion process, ensure that the bracket notch aligns with the code disk height to avoid collision and friction). After the bracket contacts the motor end cover stop, place it downward so that the inner circular stop of the bracket aligns with the motor end cover stop;

③ Tighten one side screw using a cross-bit torque screwdriver;

④ Tighten the other side screw using a cross-bit torque screwdriver;

⑤ Tighten the third screw using a cross-bit torque screwdriver (this can be done simultaneously with the motor rear cover);

⑥ Complete the encoder installation and perform installation testing using the specialized Eagle Sensor workstation.

【Note】：

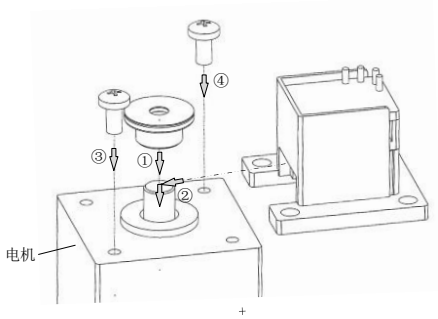
1. It is recommended that users protect the motor rear cover to prevent contamination of the code disk and electronic components. The screw at position ⑤ can be installed after coordinating with the motor rear cover;
2. To prevent loosening of the above screws, you can either apply thread locker to the threaded holes in advance or use screws with pre-applied thread locker. It is recommended to use a tightening torque of 2.0 ± 0.2 kgf·cm for the screws;
3. The screws at positions ③ and ④ should be countersunk screws, and the screw at position ⑤ must be equipped with a flat washer

## 6.2 SROA20 Series

### 6.2.1 Installation Accessories

- Cross Head Torque Screwdriver

### 6.2.2 Installation Sequence




① Assemble the encoder shaft into the motor shaft and secure it using structural adhesive (recommended to use anaerobic adhesive such as Loctite 638/648). During assembly, ensure that the end face of the motor shaft is flush with the end face of the encoder inner bore, and make sure there is no adhesive overflow contaminating the code disk surface;

② Pass the main body of the encoder bracket radially over the encoder shaft (note: during the insertion process, ensure that the bracket's notch aligns with the height of the code disk to avoid contact and friction with the code disk). Once the bracket touches the motor end cover stop, place it downward so that the inner stop of the bracket aligns with the stop on the motor end cover;

③ Use a crosshead screwdriver to tighten a screw on one side;

④ Use a crosshead screwdriver to tighten the screw on the other side;

⑤ Complete the encoder installation and use the SharpEagle sensor-specific workstation for installation verification;

【Note】：

1. It is recommended to protect the motor’s rear cover to prevent contamination of the code disk and electronic components.
2. The screws mentioned in notes ③ and ④ must have flat washers. To prevent loosening, apply thread-locking adhesive to the threaded holes beforehand or use screws pre-coated with thread-locking adhesive. Recommended screw tightening torque is 2.0±0.2 kgf·cm.

【Precautions】：

1. This encoder has a split design, with the encoder shaft (including the code disk) separate from the main structure. The encoder shaft and motor shaft need to be exposed to air during installation, so please assemble in a clean, dust-free environment.
2. Before installation, clean and degrease the motor shaft to avoid affecting the encoder shaft's fastening or contaminating the code disk.

3. During installation, avoid contaminating the code disk surface, as fingerprints, oil, and dust can cause signal abnormalities.
4. If contamination occurs after installation, gently wipe with a lint-free cloth moistened with alcohol. Avoid excessive force or using hard materials, as this could damage the code disk.
5. Do not apply excessive tension to the encoder cable to prevent deformation of the encoder or damage to the cable, which could affect the encoder's signal output.

# 7. Communication Specifications

## 7.1 Overview

| Items | Description | Remarks |
|---|---|---|
| Communication Code System | Binary | -- |
| Communication Circuit | Differential Drive | RS485 |
| Data Transmission Content | Single-Turn Position Information | 17 bit |
| Communication Rate | 2.5 Mbps | -- |

## 7.2 E²PROM Communication Specifications

| Items | Address | Description | Remarks |
|---|---|---|---|
| Readable and Writable User Parameter Address Range | 0~0x7E* page8 | User Parameter Domain | This address domain can be used to store user parameters. The partial area on page 8 is reserved and not recommended for customer use. |
| Page Address | 0x7F | 0~7 | Within this range |
| Maximum Number of Erase Cycles | 100000 次 | | Executable Operation Count |

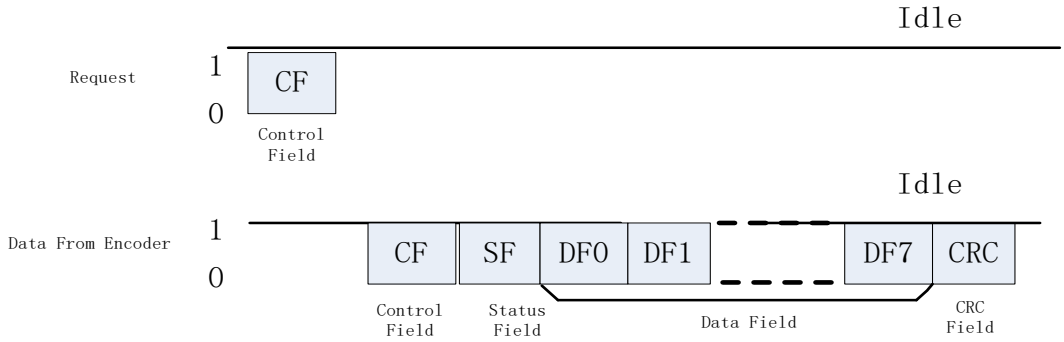
## 7.3 Frame Format

Each data frame is divided into several data words. Each data word is transmitted and received with 1 start bit, 8 data bits, and 1 stop bit, with the least significant bit first and the most significant bit last.

In the data frame transmission, the following terms are used:

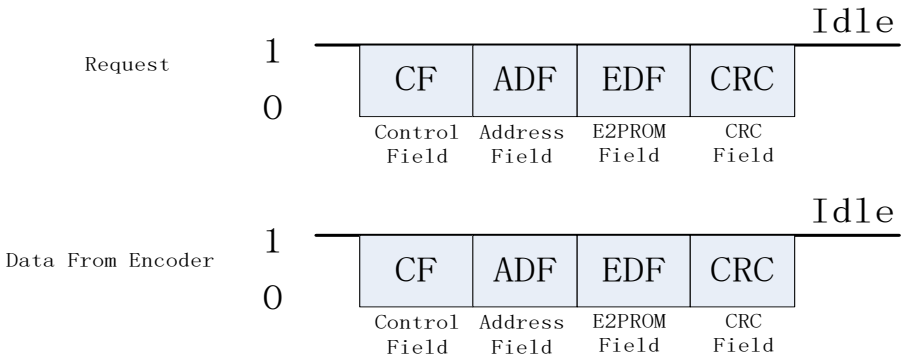
| Items | Description | Remarks |
|---|---|---|
| CF | Control Field | Identifies different command types. |
| SF | Status Field | Provides information on the encoder's status |
| DF | Data Field | Encoder Position Data |
| ADF | Address Field | Accessible Encoder Address |
| EDF | E2PROM Field | The content at the specified address |
| CRC | CRC 校验 | Polynomial: x8+1 (XOR all data except CRC) |

### 7.3.1 Position Data Reading



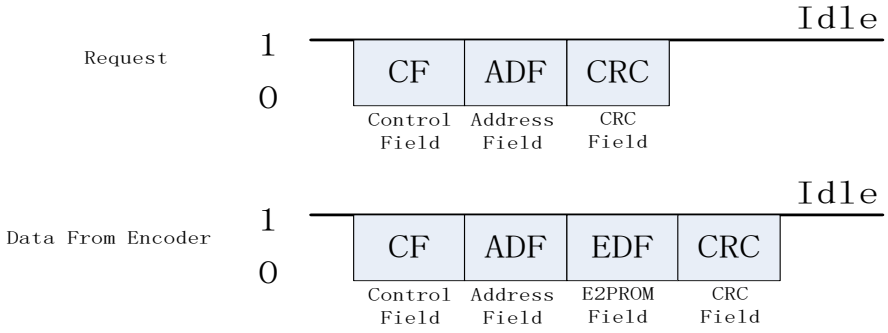

[Note]: The number of DF (Data Frames) varies depending on the CF (Configuration File).

### 7.3.2Write $E^2PROM$




***The request frame and response frame have the same content**

### 7.3.3 Read $E^2PROM$




***The request frame and response frame have the same content**

## 7.4 Detailed Description

### 7.4.1 Control Field（CF）

CF consists of one data word, with categories and contents as shown in the table below:

| Items | CF type | Remarks |
|---|---|---|
| Read data | ID0(0x02) | Single-turn position information reading（CF+SF+ABS+CRC） |
| | ID2(0x92) | Encoder ID Information Read（CF+SF+ENID+CRC） |

| | | |
|---|---|---|
| | ID3(0x1A) | Read All Data（CF+SF+ABS+ENID+ABM+ALMC+CRC） |
| Write $E^2PROM$ | ID6(0x32) | 8-bit 'user data' can be written to the specified address. After the instruction format is sent, the encoder will return data within 20 μs. During this process, please avoid communicating with the encoder. |
| Read $E^2PROM$ | IDD(0xEA) | 8-bit 'user data' can be read from the specified address. After the instruction format is sent, the encoder will return data within 20 μs. During this period, please do not communicate with the encoder. |
| Reset | ID7(0xBA) | The reset command requires sending 10 consecutive instructions with a time interval of no less than 62.5 μs between each, to reset all fault status flags. |
| | ID8(0xC2) | The reset command requires sending 10 consecutive instructions with a time interval of no less than 62.5 μs between each, to reset and zero the current single-turn position. The position data will remain at the reset value even after power is cycled. |

### 7.4.2 Status Field（SF）

SF is composed of one byte, with each bit defined as shown in the table below:

| Bit number | Description | Remarks |
|---|---|---|
| Bit0 | Rsvd | “0” |
| Bit1 | Rsvd | “0” |
| Bit2 | Rsvd | “0” |
| Bit3 | Rsvd | “0” |
| Bit4 | Counting Error | 同 ALMC.Bit2 |
| Bit5 | Rsvd | “0” |
| Bit6 | Rsvd | “0” |
| Bit7 | Rsvd | “0” |

### 7.4.3 Data Field (DF0~DF7)

Depending on the CF type, the DF contains a different number of bytes, as detailed in the table below:

| CF type | DF0 | DF1 | DF2 | DF3 | DF4 | DF5 | DF6 | DF7 |
|---|---|---|---|---|---|---|---|---|
| ID0 (0x02) | ABS0 | ABS1 | ABS2 | | | | | |
| ID2 (0x92) | ENID | | | | | | | |
| ID3 (0x1A) | ABS0 | ABS1 | ABS2 | ENID | 00 | 00 | 00 | ALMC |
| ID7 (0xBA) | ABS0 | ABS1 | ABS2 | | | | | |
| ID8 (0xC2) | ABS0 | ABS1 | ABS2 | | | | | |

【Note】：

1. ABS0~ABS2 represent the low, middle, and high bits of the encoder's single-turn position, where the high 7 bits of ABS2 are zero, and the remaining data forms a 17-bit position information.
2. ABM is always "0".
3. ENID is the encoder ID information, with a default value of 0x11.
4. ALMC is the encoder fault status flag, detailed in Section 7.4.4.

### 7.4.4 Error Description

ALMC faults are detailed in the table below:

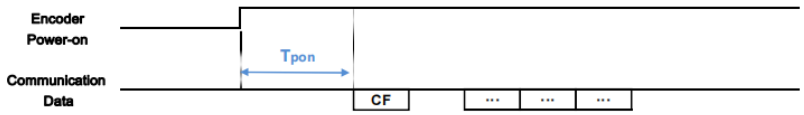
| Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Name | Over-speed | “0” | Counting Error | “0” | “0” | “0” | “0” | “0” |

Descriptions of fault flag bits are as follows:

| Name | Function | Action |
|---|---|---|
| Over-speed | For 5V power mode, when speed exceeds 7200 RPM | Reset Power |
| Counting Error | Single-turn information calculation fault | Reset Power |

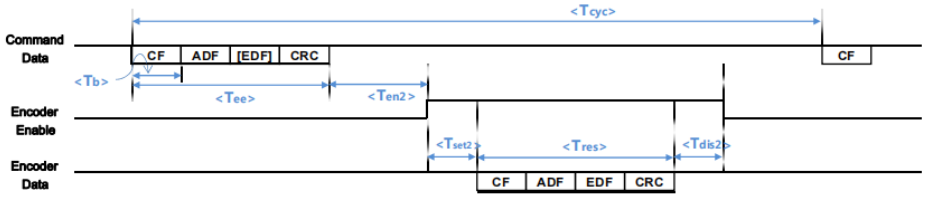
# 8. Timing Description

## 8.1 Timing Diagram




Reagle Power-on Timing Chart


Reagle CF Communication Timing Chart




Reagle EEPROM Communication Timing Chart

## 8.2 Detailed Specifications

| Characteristic | Symbol | Minimum | Default | Maximum | Unit | Note |
|---|---|---|---|---|---|---|
| Power-On time | Tpon | | 450 | 550 | ms | |
| Command cycle period | Tcyc | 62.5 | | | μs | |
| Data byte time | Tb | | 4 | | μs | |
| Encoder enable delay time | Ten1 | 1.5 | | 3.5 | μs | |
| | Ten2 | | 4.5 | | μs | |
| Encoder EEPROM Command time | Tee | | 12 | | μs | Read: 3 bytes data |
| | | | 16 | | μs | Write: 4 bytes data |
| Encoder response time | Tres | | 4*N | | μs | N bytes data |
| Encoder data set-up delay time | Tset1 | 0.8 | | 2 | μs | |
| | Tset2 | 1 | | 1.5 | μs | |
| Encoder disable delay time | Tdis1 | 0.6 | | 1.2 | μs | |
| | Tdis2 | | 1.3 | | μs | |

SROA Timing Characteristics

# Revision History

| Date | Version Number | Modification Details or Changes | |
|---|---|---|---|
| | | Location | Content |
| 20210831 | V1.0 | $E^2PROM$ Communication Specifications | Communication Specifications Change/ Addendum Revision Record |
| 20210302 | V2.0 | Communication Protocol<br><br>Timing | Detailed Communication Protocol Specification<br><br>Add Timing Section |
| 20220407 | V3.0 | Technical Specifications | Modify Allowable Deviation of Output Shaft<br><br>Increase Protection Rating and Operating Environment Description |
| 20220728 | V3.1 | Structural Parameters | Add Installation Details Description |
| 20221220 | V3.2 | Structural Parameters | Encoder Height Adjustment |
| | | | |
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PROMOTE INDUSTRIAL CIVILIZATION

www.reagles.cn sales@reagles.cn 400-636-1110

Fourth Floor, Block B, Building 9, Intelligence Industry