# RAA35T6  Series
# RAA46T6 Series
# Absolute Encoder

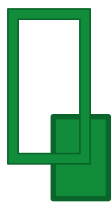**Changchun Rongde Optics Co.,Ltd**
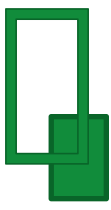
www.roundssencoder.com

info@roundss.net

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## Safety Precautions

When using this product, be sure to observe the following important precautions in order to prevent product failure and malfunction. Please use this product after fully understanding the following.

## Precautions for storage, transportation, and installation

Do not store and set up in the following environments.·Places exposed to direct sunlight · Places with ambient temperature exceeding the storage and installation temperature conditions ·Places with relative humidity exceeding storage and installation humidity conditions ·Places with rapid temperature changes and easy condensation ·Corrosive gases*1 (hydrogen sulfide, sulfurous acid, Places close to flammable gases such as chlorine, ammonia, etc. ·If it is installed in other special gas environments, it needs to be inspected by the customer before use. This product is not guaranteed for use in special gas environments.

·A radiation environment or a place exposed to radiation ·A place where there is a lot of dust, dust, salt, and metal dust

※1. Please note that in addition to the normal surrounding environment, corrosive gas may be generated due to the volatilization of components such as grease around the encoder.

## Installation Precautions

·When installing, follow the instruction manual for assembly and adjustment.

·Please pay sufficient attention to the installation environment to prevent oil, foreign matter, etc. from entering the inside of the encoder.

·Please loosen the screws and bolts used for fixing the encoder.

·Please take measures against static electricity in the installation environment, etc., to prevent electrical parts from being subjected to overvoltage, etc.

·If the encoder is subjected to vibration or shock, it may malfunction or malfunction. Please check the installation environment carefully.

·Do not apply external force such as knocking to the encoder.

·For the encoder cable and the connection part between the cable and the cover, please fix it so that it will not be subjected to loads such as pulling and bending. Otherwise, the problem of falling off and pulling out the cable may occur.

·The interference received by the encoder may cause malfunction. Please pay attention to the installation environment such as the method of installing the encoder case and the method of connecting the motor cable.
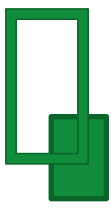
※1. Please use metal products that can shield electromagnetic and keep stable potential for the encoder housing. At this time, please ensure sufficient space distance from the electrical components in the circuit board. If the encoder will be affected by the magnetic field generated by the nearby motor and the welding current, please use soft magnetic material (such as soft iron, etc.) for the encoder housing.

※2. Do not place the motor power cable close to the encoder.

※3. Make sure to ground the FG wire of the motor and the FG of the mechanical device.

·After installing the encoder, the user is requested to conduct a sufficient system evaluation in advance.

·Do not perform withstand voltage test and insulation resistance test on the encoder.

## Wiring Precautions
・Please perform wiring correctly and securely.
・When wiring, please turn off the power.
・Please use the specified power supply voltage. Also, pay attention to the drop in the power supply voltage due to the wiring length.
・Do not use the encoder wiring and other power lines in the same pipe or bundle them in parallel.
・Use twisted pair cables for encoder wiring for signal cables and power cables.
・Use braided shielded cables for encoder wiring. Also, make sure to ground the shielded wires at the encoder and the other side (controller side).

## Operation Precautions
・Please fully study and confirm the safety design of the device against encoder failure and malfunction before using it.
・When an alarm occurs, remove the cause and ensure safety before resetting the alarm and restarting the operation.
・Do not apply excessive force to the cable, otherwise it may cause disconnection.
・Do not apply overvoltage or reverse voltage exceeding the absolute maximum ratings, otherwise the components may be damaged or even fire may occur.

## General Notes
・These specifications are subject to change without prior notice due to product improvement and technological transformation. Please inquire about the latest specifications and confirm the application before actual use.
・Please note that this product is intended for use in a part of general electronic equipment (OA equipment, communication equipment, home appliances, entertainment equipment, measurement equipment, general industrial equipment, etc.). It is not intended for applications requiring extremely high reliability and safety (transportation equipment, aerospace equipment, atomic force control systems, medical equipment for life support, etc.).
・Our company strives to improve quality and reliability, but in general, malfunctions and failures of semiconductor products cannot be completely avoided. Therefore, when using this product, please take safety measures in order to avoid accidents by considering the possible influences such as malfunction of this product. When the life or property of others is damaged or adversely affected due to the malfunction, failure, or life of this product, or when the installation and use of this product results in failure of the equipment, facilities or machinery used, regardless of the degree How, the company is not responsible. Users are responsible for the system security design by themselves.
The company is responsible for free repair or replacement for the failure of the product due to manufacturing reasons within 18 months of leaving the factory.
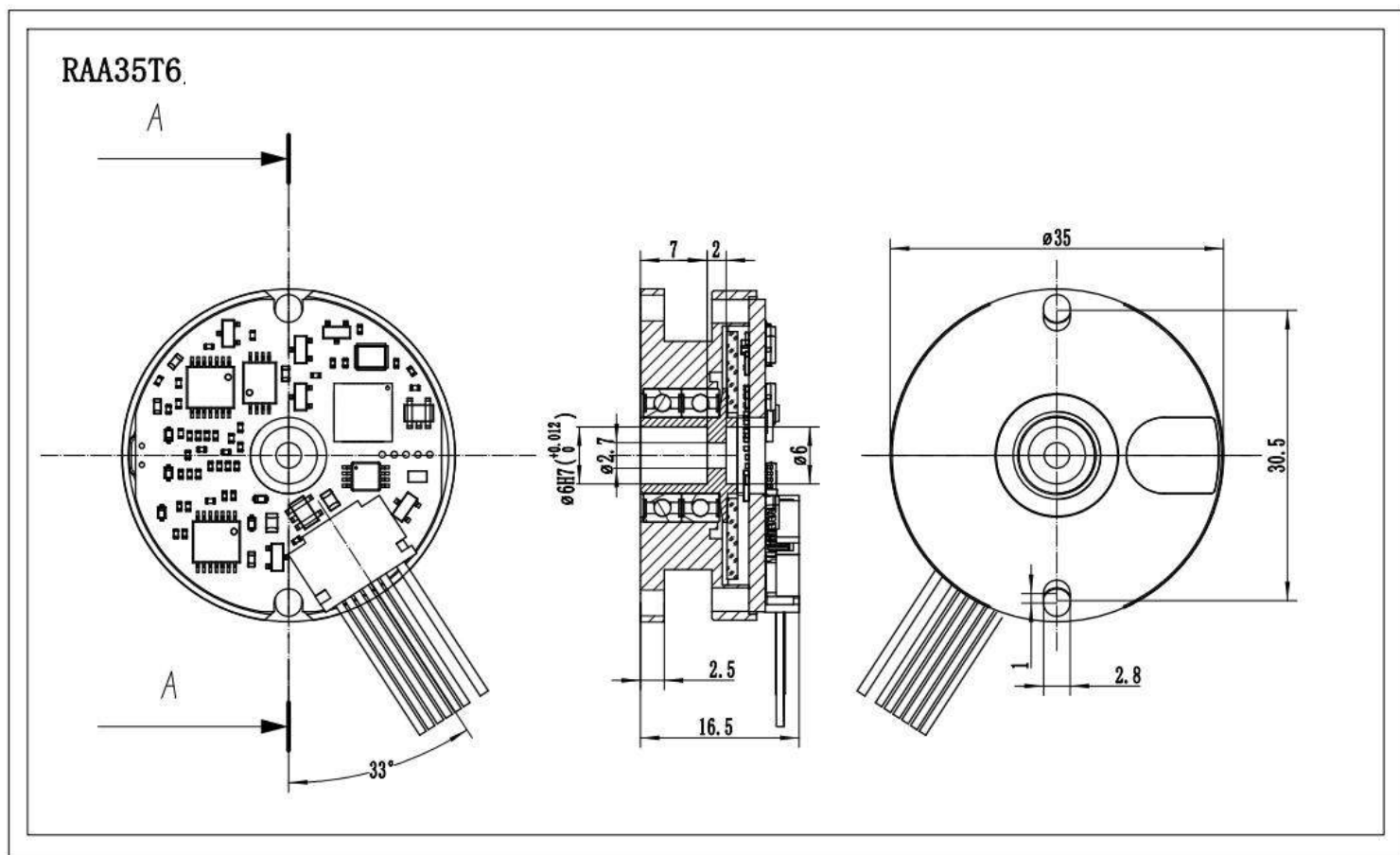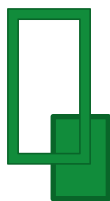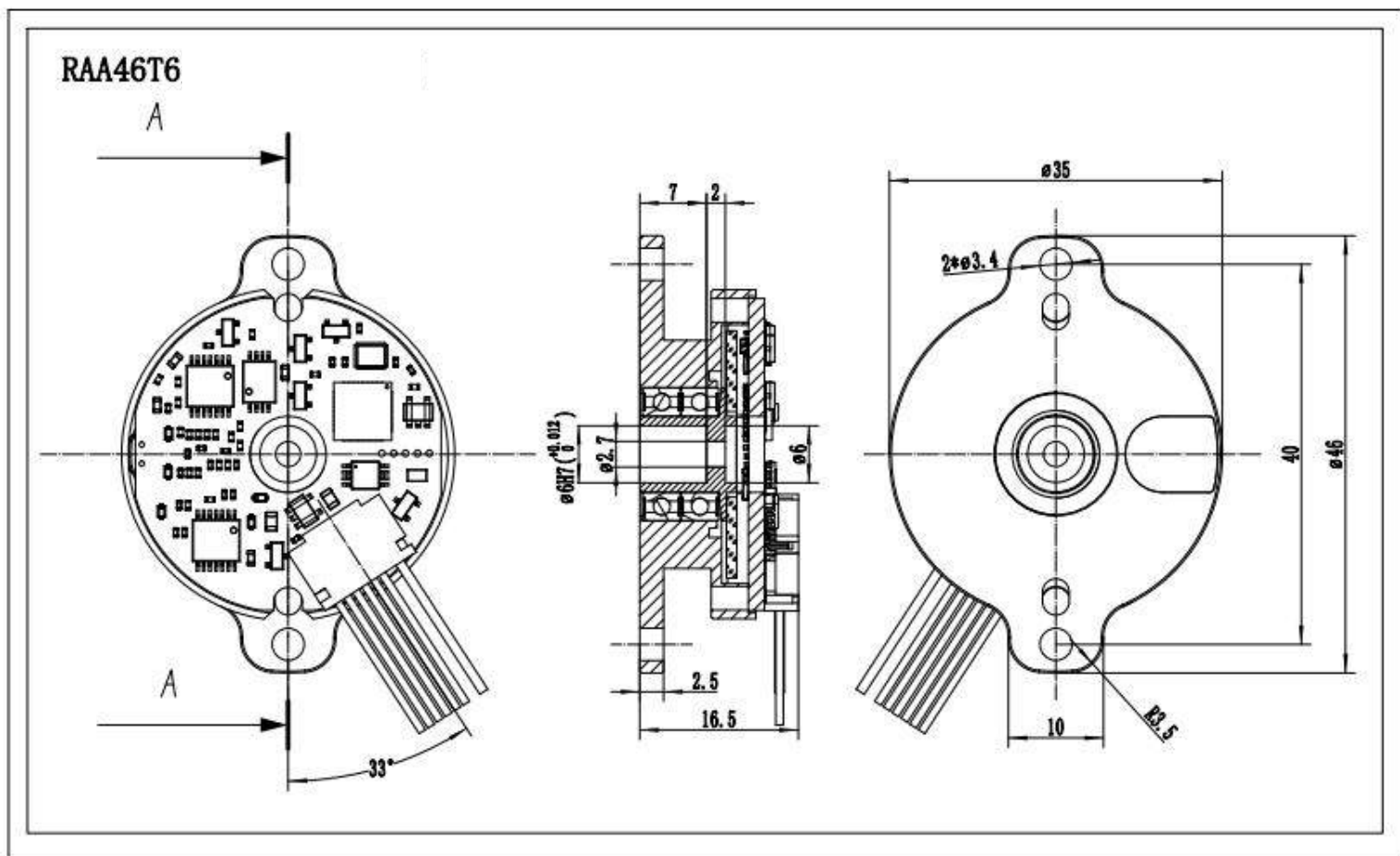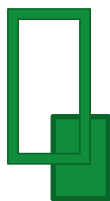
RAA35T6



**Recommended screws for installation (screws are not included)**

| Name | Dimensions | Standard | Class | QTY |
|------|-----------|----------|-------|-----|
| Hexagon socket head screws | M2.5×8 | GB/T818-2016 | A2-70 | 3 |

**In order to prevent failures caused by loose screws, it is recommended to use screws with coating.**

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**Recommended screws for installation (screws are not included)**

| Name | Dimensions | Standard | Class | QTY |
|---|---|---|---|---|
| Hexagon socket head screws | M2.5×8 | GB/T818-2016 | A2-70 | 1 |
| Hexagon socket head screws | M3×8 | GB/T818-2016 | A2-70 | 2 |

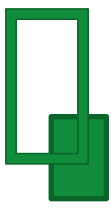**In order to prevent failures caused by loose screws, it is recommended to use screws with coating.**

# Installation design recommendation (subject to actual needs)
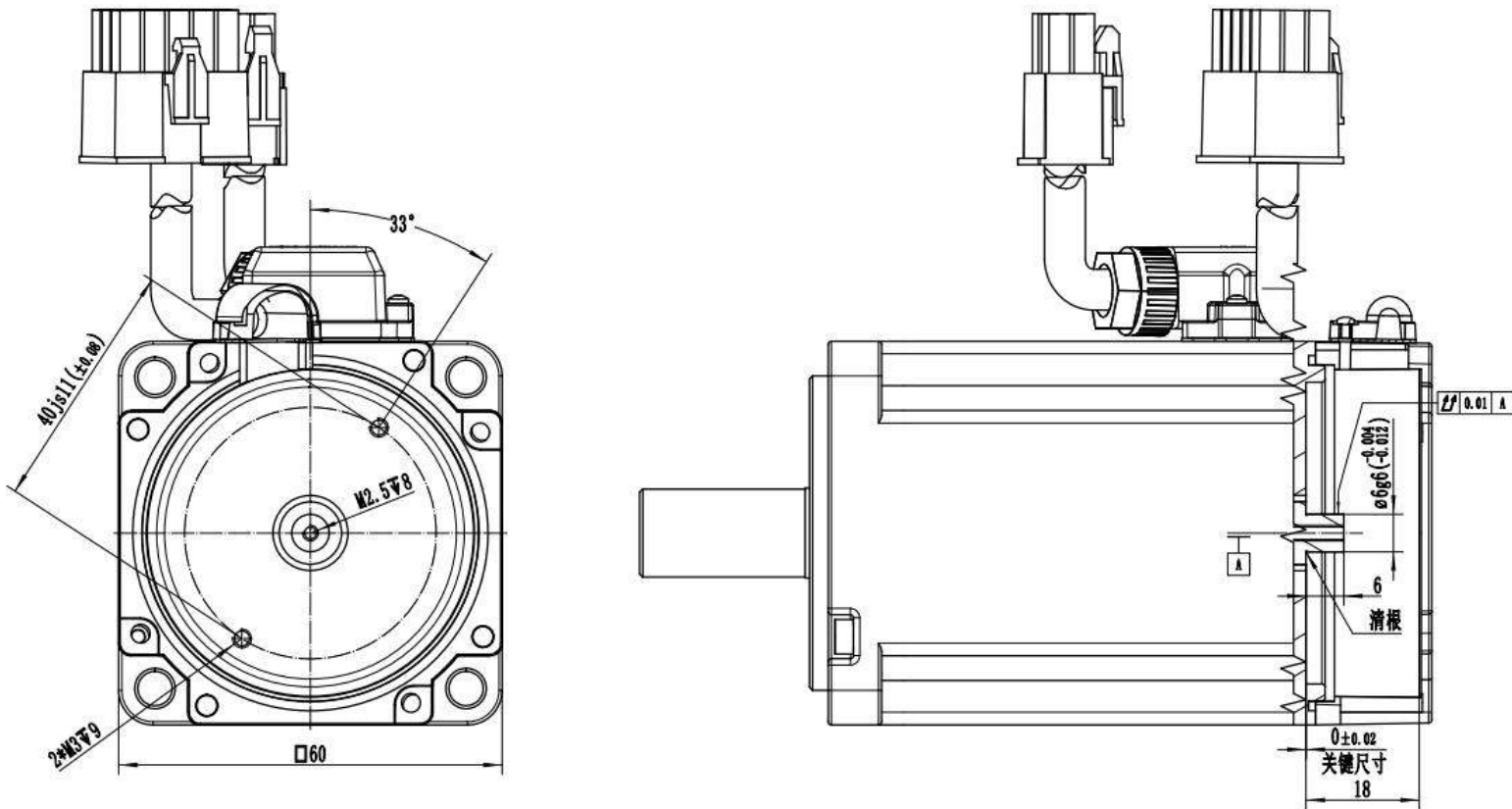


**60 Motor Recommended Design**

If the critical dimension machining accuracy is out of the allowable range, use a shim to correct the machining accuracy.

The axial displacement of the motor rotor must be controlled within ±0.02mm.

The measurement accuracy of the encoder depends on the machining accuracy of the motor. Be sure to confirm whether the machining accuracy meets the requirements before installation.

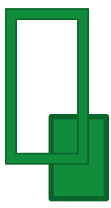# Installation design recommendation (subject to actual needs)
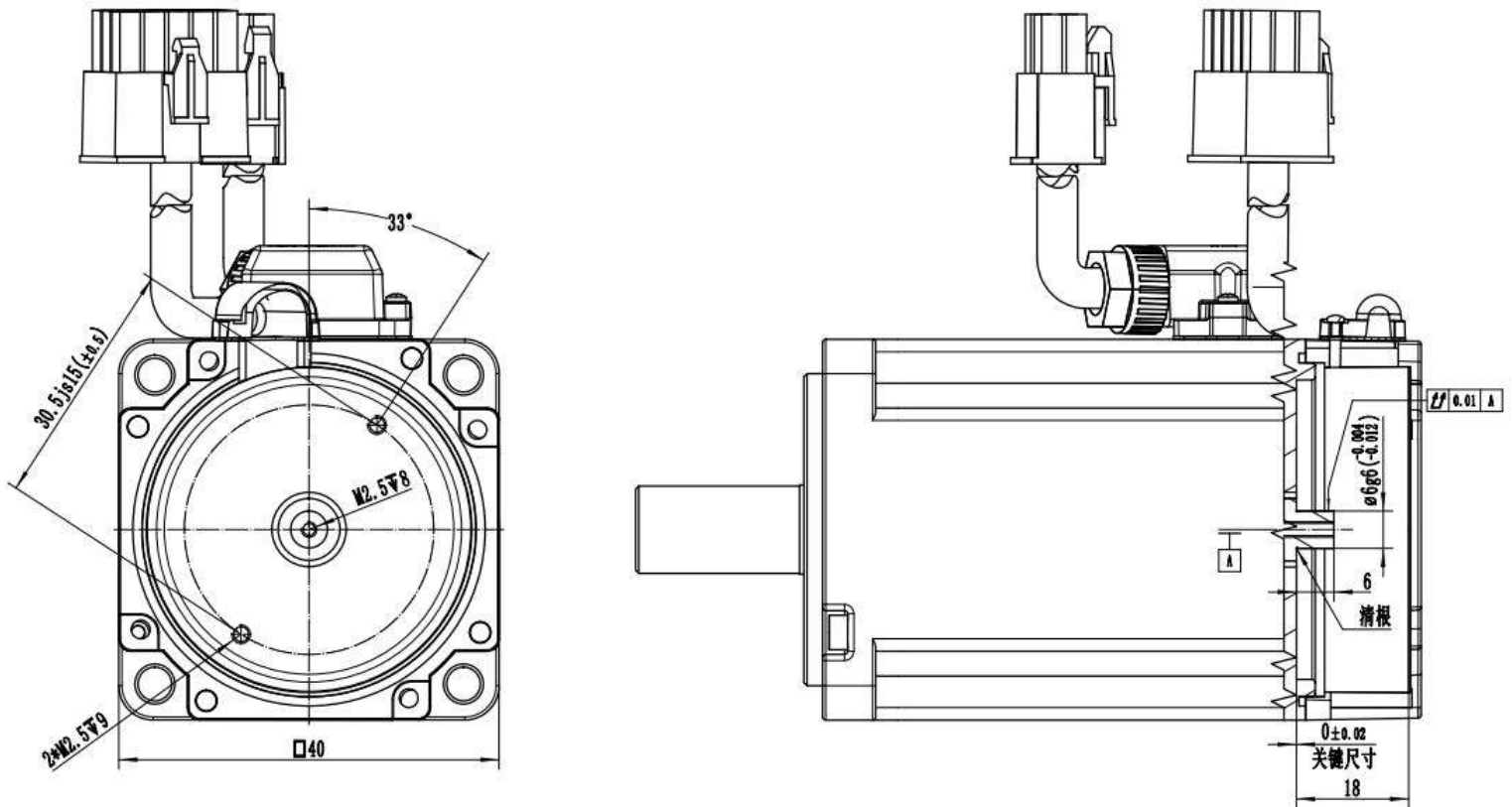


**40 Motor Recommended Design**
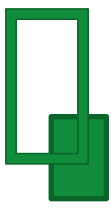
If the critical dimension machining accuracy is out of the allowable range, use a shim to correct the machining accuracy.

The axial displacement of the motor rotor must be controlled within ±0.02mm.

The measurement accuracy of the encoder depends on the machining accuracy of the motor. Be sure to confirm whether the machining accuracy meets the requirements before installation.

# Installation Instructions
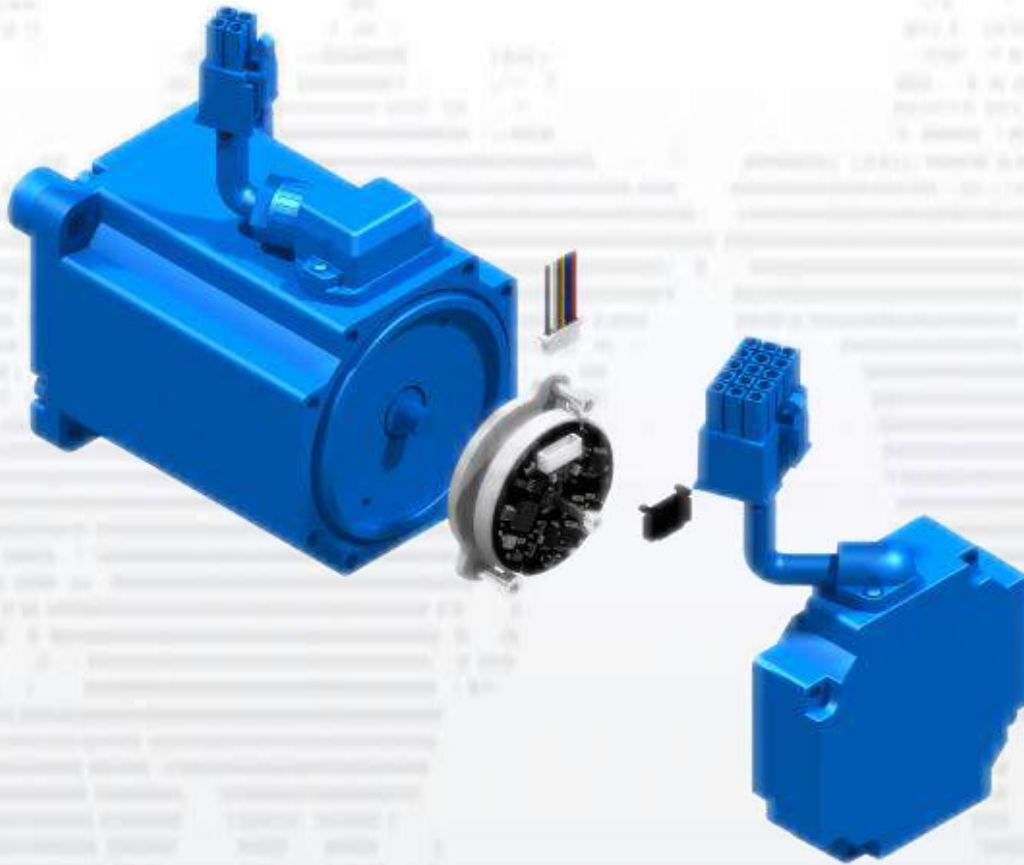
## Installation steps

- Fit the encoder on the motor shaft
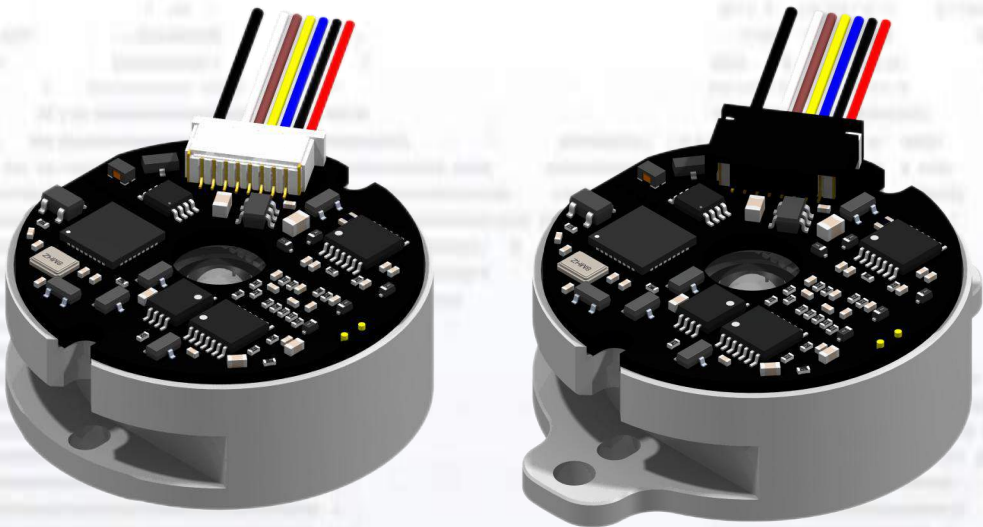- Tighten the fixing screw of encoder stator
- Tighten the fixing screw of encoder rotor
- Plug-in Terminals
- Install the terminal anti-tripping clip
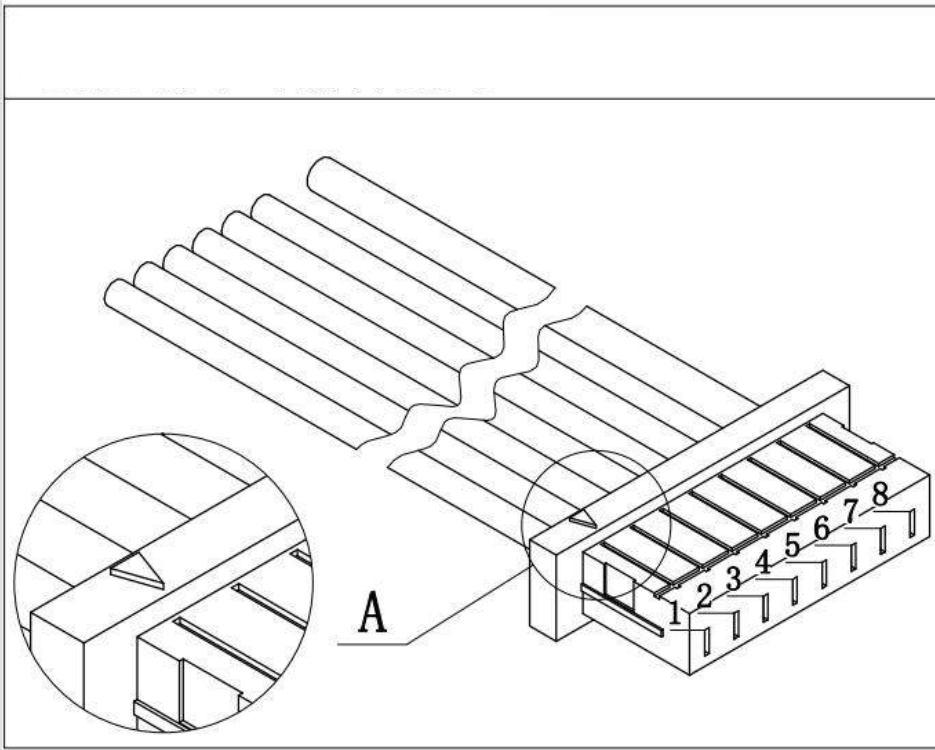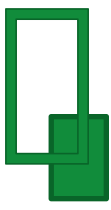- Install the motor back cover

Scan the QR code on WeChat and watch the GIF installation tutorial
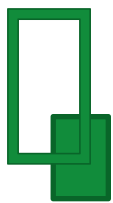
# Connections



| 1 | 5V |
|---|---|
| 2 | 0V |
| 3 | D+ |
| 4 | D- |
| 5 | 3.6V Battery |
| 6 | 0V Battery |
| 7 | Blank |
| 8 | Shield |

# Technical Specifications

| | |
|---|---|
| **Part Number** | RAA35T6-8D1TLKT-23/16B<br>RAA46T6-8D1TLKT-23/16B |
| **Single turn resolution** | 23bit，compatible17bit |
| **Multi turn resolution** | 16bit |
| **Communication Interface** | RS485 |
| **Supply voltage** | 5V±0.25 |
| **Battery voltage** | 3.6V |
| **Battery error generating voltage** | 2.75V（±0.15v） |
| **Battery alarm generating voltage** | 3.1V（±0.15V） |
| **Baud rate** | 2.5MHZ |
| **Refresh rate** | 16K |
| **Output code** | Binary code |
| **Fall time/Rise time** | 100ms |
| **Operating Temp.** | -10℃～90℃ |
| **Operating Humidity** | 90%RH bellow（No condensation） |
| **Storage Temp.** | -20℃～100℃ |
| **Storage humidity** | 95%RH bellow（No condensation） |
| **Shock** | 980m/s²,11ms；3 times for each direction, total 18 times |
| **Vibiration** | 10 to 55Hz，amplitude 1.5mm；55 to 2000Hz，98m/s²；2 hours for each axis, total 6 hours |
| **Rotational speed** | ≤6000rpm |
| **Protection class** | (motor cover protection) |

# Communication Protocol

## 1.1 General Specifications

| Items | Specifications | Remarks |
|---|---|---|
| Communication code | Binary | |
| Transmission type | Differential line driver | RS485 |
| Transmission data | One revolution data | 17 bit(Max 23bit) |
| | multi turn data | 16bit |
| Communication rate | 2.5 Mbps | |

## 1.2 E²PROM

| Items | Address | Description | Remarks |
|---|---|---|---|
| Accessible address | 0~0x7E | User data field | This address field can be used to store user data |
| | 0x7F | Page address 0~2 (total 3 page) | Value can be set |
| Permissible times for writing | 100000 times | | The number of times the operation can be performed |

## 1.3 Frame Format

| Items | Description | Remark |
|---|---|---|
| CF | Control Field | to identify different command types |
| SF | Status Field | Get the encoder status through this part |
| DF | Data Field | Encoder position data |
| ADF | Address Field | Accessible encoder addresses |
| EDF | E2PROM Field | the content of the address |
| CRC | CRC Field | Polynomial: x8+1 (XOR all data except CRC) |

※The name used in data frame transmission are shown in the table above

Each data frame is divided into several bytes, and the transmission and reception of each byte is realized by 1 start bit, 8 data bits and 1 stop bit, the low bit is in front and the high bit is behind.

## 1.3.1 Data Readout
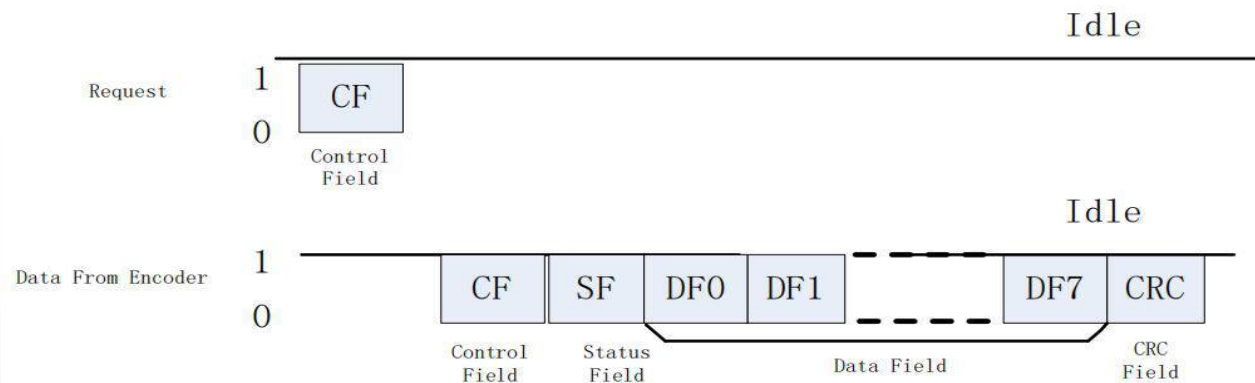


※The number of data in DF depends on different CFs

## 1.3.2 Access (Writing) to E²PROM
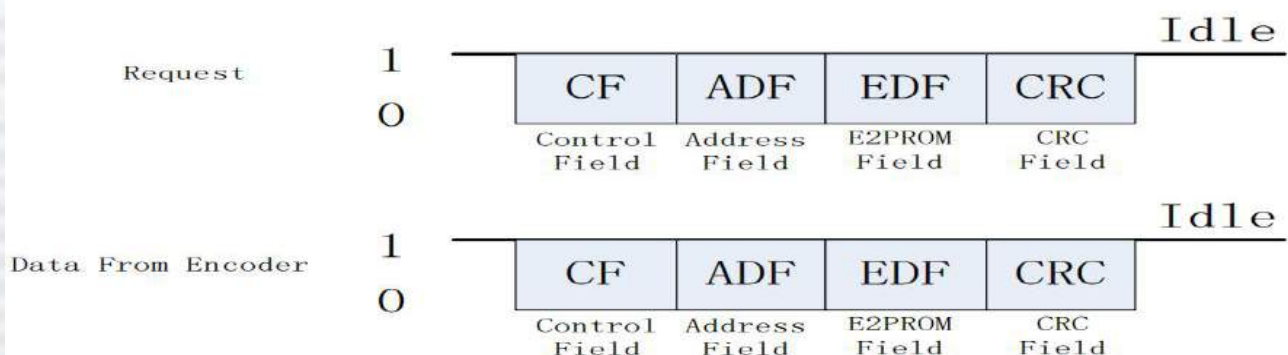


※CF is transmitted as the same content of its request

## 1.3.3 Access (Readout) from E²PROM



※The content of the accessed address is added to the return frame

## 1.4.1 Control Field (CF)

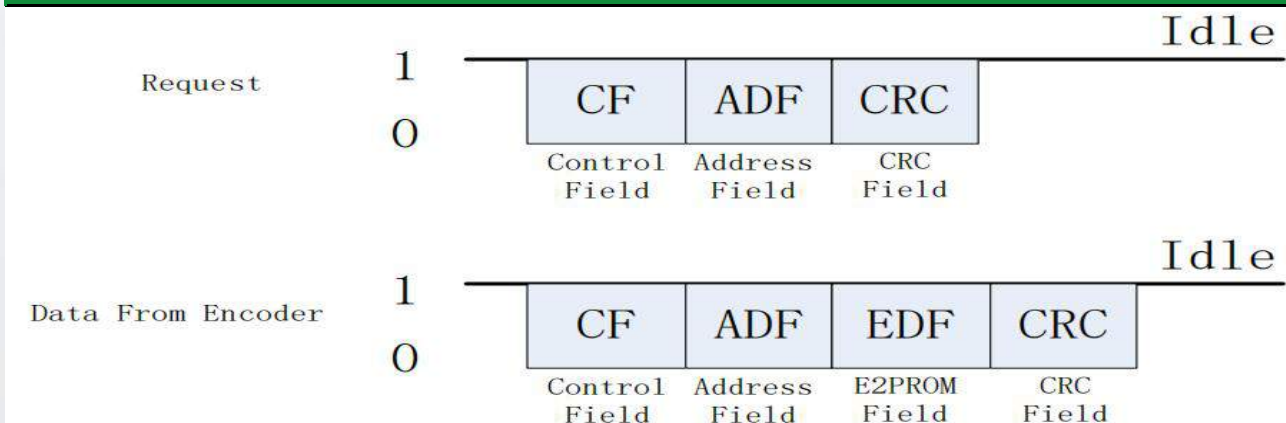| Application | Data ID | Remark |
|---|---|---|
| Data readout | ID0(0x02) | Read absolute position information (CF+SF+ABS+CRC) |
| | ID1(0x8A) | Multi-turn data information reading (CF+ABM+CRC) |
| | ID2(0x92) | Encoder ID information read (CF+ID+CRC) |
| | ID3(0x1A) | Read all data (CF+SF+ABS+ID+ABM+ALMC+CRC) |
| | ID4(0x2B) | Read necessary data (SF+ABS+ABM0+ABM1+ALMC+CRC) |
| Writing to E2PROM | ID6(0x32) | The 8-bit "user data" can be written into the data corresponding to the specified address. Within 20µs after sending according to the command format, the encoder will send back data. Do not communicate with the encoder during this process. |
| Readout from E2PROM | IDD(0xEA) | 8-bit "user data" can be read from the specified address. Within 20µs after sending according to the command format, the encoder will send back data. Do not communicate with the encoder during this process. |
| Reset | ID7(0xBA) | This reset command requires 10 consecutive commands to be sent at a time interval of not less than 62.5us to reset all fault flags. |
| | ID8(0xC2) | This reset command requires 10 consecutive commands to be sent at a time interval of not less than 62.5us to reset any single-turn position to zero. Even if the power is turned on again, the position still retains the position data after reset. |
| | IDC(0x62) | This reset command requires that the command be sent 10 times continuously at a time interval of not less than 62.5us, and the multi-turn data will be reset to zero (single-turn data will not be affected). At the same time reset all fault flags. |

※CF consists of 1 byte, the category and content are shown in the table above

## 1.4.2 Status Field (SF)

| Bit No | Description | Remark |
|---|---|---|
| Bit0 | Rsvd | all are fixed to "0" |
| Bit1 | Rsvd | |
| Bit2 | Rsvd | |
| Bit3 | Rsvd | |
| Bit4 | Counting Error | Logic "1" is transmitted when any error occurs |
| Bit5 | Output multi-turn error, battery error and battery alarm | confirm them in ALMC |
| Bit6 | Rsvd | all are fixed to "0" |
| Bit7 | Rsvd | |

※CF consists of 1 byte, the category and content are shown in the table above

## 1.4.3 Data Field (DF0~DF7)

| Data ID code | DF0 | DF1 | DF2 | DF3 | DF4 | DF5 | DF6 | DF7 |
|---|---|---|---|---|---|---|---|---|
| ID0 (0x02) | ABS0 | ABS1 | ABS2 | | | | | |
| ID1 (0x8A) | ABM0 | ABM1 | ABM2 | | | | | |
| ID2 (0x92) | ENID | | | | | | | |
| ID3 (0x1A) | ABS0 | ABS1 | ABS2 | ENID | ABM0 | ABM1 | ABM2 | ALMC |
| ID4 (0x2B) | ABS0 | ABS1 | ABS2 | ABM0 | ABM1 | ALMC | | |
| ID7 (0xBA) | ABS0 | ABS1 | ABS2 | | | | | |
| ID8 (0xC2) | ABS0 | ABS1 | ABS2 | | | | | |
| IDC (0x62) | ABS0 | ABS1 | ABS2 | | | | | |

※According to different CF types, there are different number of bytes in DF, as shown in the above table

Note:
1. ABS0~ABS2 are the low, middle and high bits of the absolute position of the encoder.Higher 7 bits of ABS2 are always logic "0", and then the valid data consists of total 17 bits(for a 23-bit encoder, the high 1 bit of ABS2 is 0, and the rest are valid bits).
 2. ABM0~ABM2 are the low, middle and high bits of the multi-turn position of the encoder. ABM2 is always logic "0",and then the valid data consists of total 16 bits.
3. ENID: Encoder ID, =0x11 (17Bit) or 0x17 (23Bit).

# Part Number Defination

RAA | 35 | T6 | - | 8D | 1 | T | L | K | T | - | 23 | / | 16 | B

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
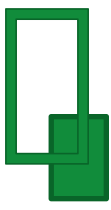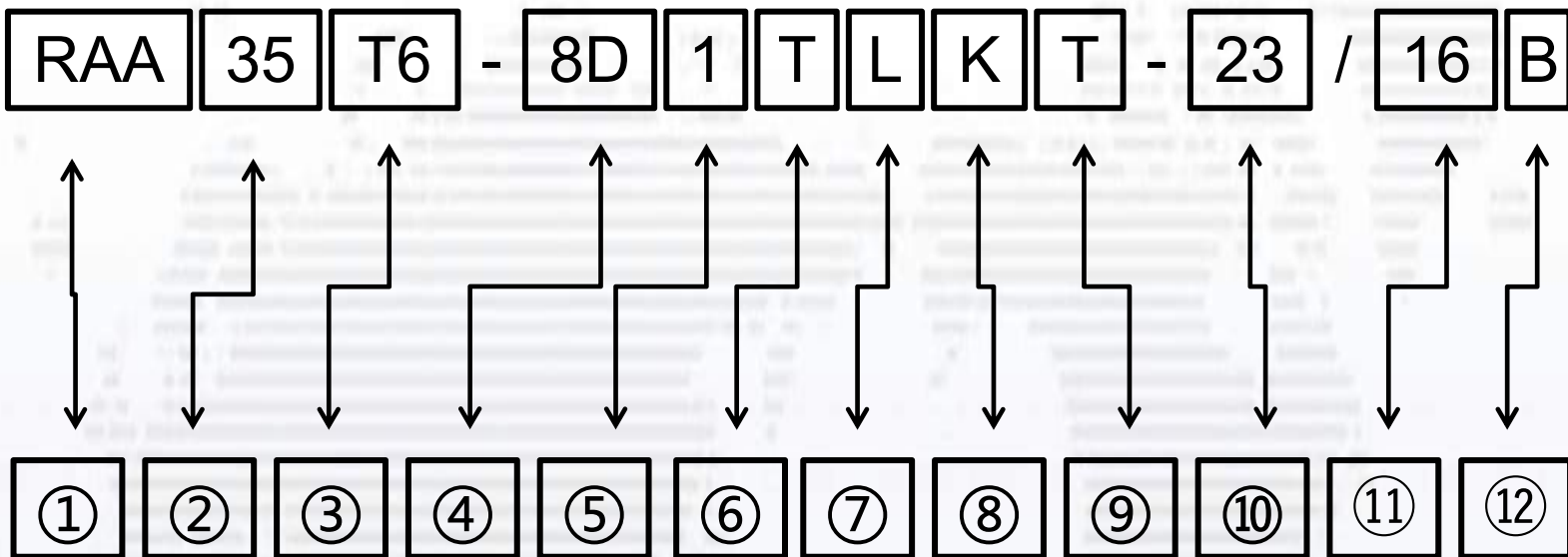
| Items | Defination |
|---|---|
| ① | Main model |
| ② | OD |
| ③ | Shaft ID (End hollow shaft) |
| ④ | 8Pins Terminal outlet |
| ⑤ | Power 5V |
| ⑥ | RS485 |
| ⑦ | 2.5MHz baud rate |
| ⑧ | 16K refresh rate |
| ⑨ | Timing transmission |
| ⑩ | 23bit single turn resolution |
| ⑪ | 16bit multi turn resolution |
| ⑫ | Positive logic binary code |

※As shown in the above: outer diameter 35mm, φ6 mm shaft, 8 pins terminal outlet, 5V voltage, RS485 interface, baud rate 2.5MHz, update rate 16K, communication protocol is timing transmission, single-turn 23-bit, multi-turn 16 bits, positive logic binary code