

## 1. P48 Incremental Optical Encoder (Hollow Shaft)

### 1.1 Introduction:

P48 with its unique through-shaft concentric locking device, single-bearing ultra-thin design, mechanical hard connection, multiple electrical interfaces, and no dust protection, can solve the installation problem of low space restrictions.

### 1.2 Feature:

- Encoder external diameter  $\varnothing 48\text{mm}$ , thickness min 11mm, diameter of shaft up to  $\varnothing 14\text{mm}$ ;
- Adopt non-contact photoelectric principle;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 5000PPR.

### 1.3 Application:

Servo motor, robot and automation control fields.

### 1.4 Connection:

- Radial socket (8P & 14P)
- Radial cable (standard length 1.0M)

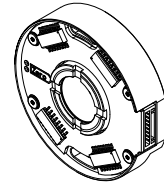
### 1.5 Protection:

None

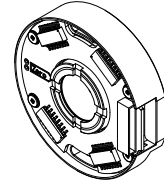
### 1.6 Weight:

About 60g

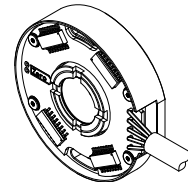
P48-E



P48-S

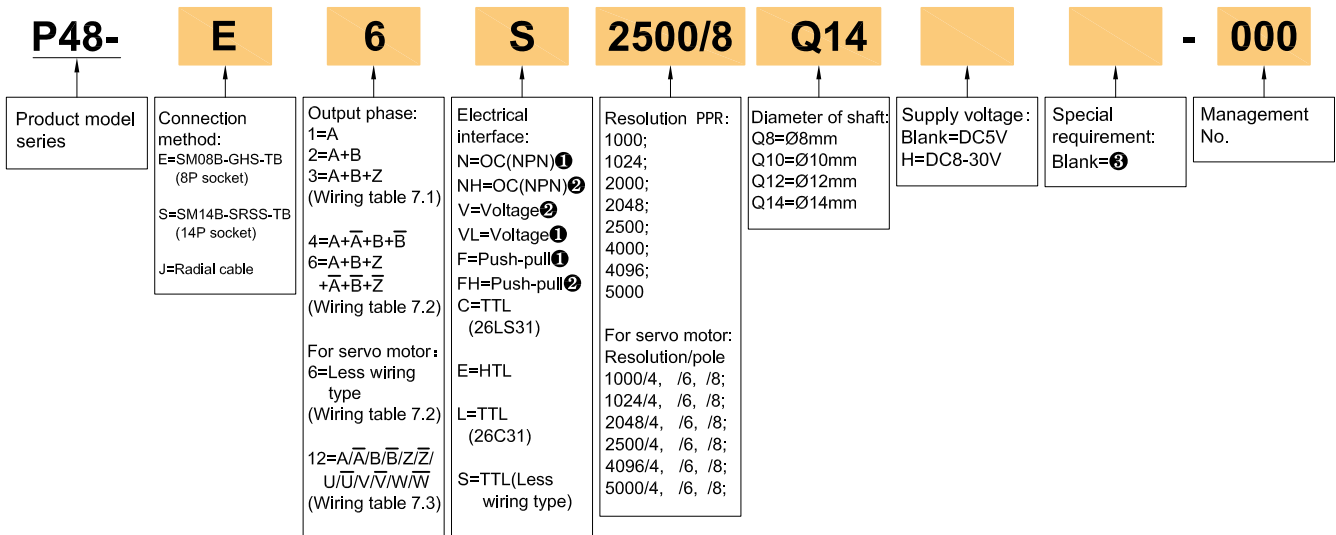


P48-J



## 2. Model Selection Guide

### 2.1 Model composition(select parameters)



### 2.2 Note

- Z signal is low level active.
- Z signal is high level active.
- Blank means IP00, cable length is 1.0M, if need to change the length C+number, the longest is 100M (expressed by C100). For the specific length of use, pls refer to page P2 -P3 of the provision of output circuit.

3. Output Mode

3.1 Incremental signal

| Electrical interface                             | Output circuit | Output wave form                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>OC<br/>NPN<br/>open collector circuit</p>     |                | <p> <math>a.b.c.d = \frac{T}{4} \pm 8</math><br/>             Phase A is ahead of B by <math>\frac{T}{4} \pm 8</math>, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings)<br/>             CCW direction <math>\rightarrow</math><br/>             Z signal is low level active         </p>  |
| <p>Voltage</p>                                   |                | <p> <math>a.b.c.d = \frac{T}{4} \pm 8</math><br/>             Phase A is ahead of B by <math>\frac{T}{4} \pm 8</math>, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings)<br/>             CCW direction <math>\rightarrow</math><br/>             Z signal is high level active         </p> |
| <p>Push-pull</p>                                 |                | <p> <math>a.b.c.d = \frac{T}{4} \pm 8</math><br/>             Phase A is ahead of B by <math>\frac{T}{4} \pm 8</math>, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings)<br/>             CW direction <math>\rightarrow</math> </p>                                                         |
| <p>TTL<br/>(DC5V)<br/><br/>HTL<br/>(DC8-30V)</p> |                | <p> <math>a.b.c.d = \frac{T}{4} \pm 8</math><br/>             Phase A is ahead of B by <math>\frac{T}{4} \pm 8</math>, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings)<br/>             CW direction <math>\rightarrow</math> </p>                                                         |

3.2 For servo motor(with UVW)

| Electrical interface                         | Output circuit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Output wave form |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|-----------|--|--|---|---|---|---|-------|----|---|---|---|-------------|----|-----------|-----------|---|-------|----|---|---|---|-------------|----|-----------|-----------|---|--------|----|---|---|---|--------------|----|-----------|-----------|---|-----|-------|--|--|---|-------|----|--|--|---|-----------|-----|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|---|---|------------------|-------------|---|------------------|-------------|---|------------------|------------|
| <p>TTL<br/>(DC5V)</p>                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| <p>TTL<br/>(DC5V)<br/>(Less wiring type)</p> | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>26LS31, 26C31<br/>Transmission distance 200m Max</p> <p><b>Symbol signification</b></p> <ul style="list-style-type: none"> <li>★: indicate position of UVW channel</li> <li>☆: position to start counting ABZ channel</li> <li>□: non-using zone</li> <li>HZ: high impedance</li> </ul> </div> <div style="width: 50%;"> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">No.</th> <th rowspan="2">Function<br/>Color</th> <th colspan="3">Mode</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>white</td> <td>HZ</td> <td>U</td> <td>A</td> </tr> <tr> <td>2</td> <td>white/black</td> <td>HZ</td> <td><math>\bar{U}</math></td> <td><math>\bar{A}</math></td> </tr> <tr> <td>3</td> <td>green</td> <td>HZ</td> <td>V</td> <td>B</td> </tr> <tr> <td>4</td> <td>green/black</td> <td>HZ</td> <td><math>\bar{V}</math></td> <td><math>\bar{B}</math></td> </tr> <tr> <td>5</td> <td>yellow</td> <td>HZ</td> <td>W</td> <td>Z</td> </tr> <tr> <td>6</td> <td>yellow/black</td> <td>HZ</td> <td><math>\bar{W}</math></td> <td><math>\bar{Z}</math></td> </tr> <tr> <td>7</td> <td>red</td> <td colspan="3">DC+5V</td> </tr> <tr> <td>8</td> <td>black</td> <td colspan="3">OV</td> </tr> <tr> <td>0</td> <td>shielding</td> <td colspan="3">GND</td> </tr> </tbody> </table> </div> </div> | No.              | Function<br>Color | Mode      |  |  | 1 | 2 | 3 | 1 | white | HZ | U | A | 2 | white/black | HZ | $\bar{U}$ | $\bar{A}$ | 3 | green | HZ | V | B | 4 | green/black | HZ | $\bar{V}$ | $\bar{B}$ | 5 | yellow | HZ | W | Z | 6 | yellow/black | HZ | $\bar{W}$ | $\bar{Z}$ | 7 | red | DC+5V |  |  | 8 | black | OV |  |  | 0 | shielding | GND |  |  | <p>Reverse signal not shown</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>pole</th> <th>g.h.j.k.m.n</th> <th>r</th> </tr> </thead> <tbody> <tr> <td>4</td> <td><math>30 \pm 1^\circ</math></td> <td><math>180^\circ</math></td> </tr> <tr> <td>6</td> <td><math>20 \pm 1^\circ</math></td> <td><math>120^\circ</math></td> </tr> <tr> <td>8</td> <td><math>15 \pm 1^\circ</math></td> <td><math>90^\circ</math></td> </tr> </tbody> </table> <p>a.b.c.d = <math>\frac{T}{4} \pm \frac{T}{8}</math><br/> e = <math>T \pm \frac{T}{2}</math><br/> f: center of phase Z to rise point of phase U, that is <math>\pm 1^\circ</math></p> <p>CW direction <math>\rightarrow</math></p> <p>Viewed from encoder front side direction is clockwise rotation.<br/>(See dimensional drawings)</p> | pole | g.h.j.k.m.n | r | 4 | $30 \pm 1^\circ$ | $180^\circ$ | 6 | $20 \pm 1^\circ$ | $120^\circ$ | 8 | $15 \pm 1^\circ$ | $90^\circ$ |
| No.                                          | Function<br>Color                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                   | Mode      |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1                | 2                 | 3         |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 1                                            | white                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | HZ               | U                 | A         |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 2                                            | white/black                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HZ               | $\bar{U}$         | $\bar{A}$ |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 3                                            | green                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | HZ               | V                 | B         |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 4                                            | green/black                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HZ               | $\bar{V}$         | $\bar{B}$ |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 5                                            | yellow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | HZ               | W                 | Z         |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 6                                            | yellow/black                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | HZ               | $\bar{W}$         | $\bar{Z}$ |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 7                                            | red                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | DC+5V            |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 8                                            | black                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | OV               |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 0                                            | shielding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GND              |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| pole                                         | g.h.j.k.m.n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | r                |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 4                                            | $30 \pm 1^\circ$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $180^\circ$      |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 6                                            | $20 \pm 1^\circ$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $120^\circ$      |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| 8                                            | $15 \pm 1^\circ$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $90^\circ$       |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |
| <p><b>Timing Chart</b></p>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                   |           |  |  |   |   |   |   |       |    |   |   |   |             |    |           |           |   |       |    |   |   |   |             |    |           |           |   |        |    |   |   |   |              |    |           |           |   |     |       |  |  |   |       |    |  |  |   |           |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |   |   |                  |             |   |                  |             |   |                  |            |

4. Electrical Parameters

| Parameter / Item            | Output type    | OC                                 | Voltage | Push-pull              | TTL                                                                           | TTL (Less wiring type) | HTL        |
|-----------------------------|----------------|------------------------------------|---------|------------------------|-------------------------------------------------------------------------------|------------------------|------------|
| Supply voltage              |                | DC+5V±5%; DC8V-30V±5%              |         |                        | DC+5V±5%                                                                      |                        | DC8-30V±5% |
| Consumption current         |                | 100mA Max                          |         |                        | 120mA Max                                                                     |                        |            |
| Allowable ripple            |                | ≤3%rms                             |         |                        |                                                                               |                        |            |
| Top response frequency      |                | 100KHz                             |         |                        | 300KHz                                                                        |                        | 500KHz     |
| Output capacity             | Output current | Input                              | ≤30mA   | Load resistance 2.2K   | ≤30mA                                                                         | ≤±20mA                 | ≤±50mA     |
|                             |                | Output                             | —       |                        | ≤10mA                                                                         |                        |            |
|                             | Output voltage | "H"                                | —       | —                      | ≥ $\left[ \begin{matrix} \text{Supply voltage} \\ -2.5V \end{matrix} \right]$ | ≥2.5V                  | ≥Vcc-3 Vbc |
|                             |                | "L"                                | ≤0.4V   | ≤0.7V (less than 20mA) | ≤0.4V(30mA)                                                                   | ≤0.5V                  | ≤ 1V Vbc   |
| Load voltage                |                | ≤DC30V                             | —       |                        | —                                                                             |                        |            |
| Rise & Fall time            |                | Less than 2us(cable length: 2m)    |         |                        | Less than 1us(Cable length: 2m)                                               |                        |            |
| Insulation strength         |                | AC500V 60s                         |         |                        |                                                                               |                        |            |
| Insulation resistance       |                | 10MΩ                               |         |                        |                                                                               |                        |            |
| Mark to space ratio         |                | 45% to 55%                         |         |                        |                                                                               |                        |            |
| Reverse polarity protection |                | ✓                                  |         |                        |                                                                               |                        |            |
| Short-circuit protection    |                | —                                  |         |                        | ✓❶                                                                            |                        |            |
| Phase shift between A & B   |                | 90°±10° ( frequency in low speed)  |         |                        |                                                                               |                        |            |
|                             |                | 90°±20° ( frequency in high speed) |         |                        |                                                                               |                        |            |
| Delay motion time ❷         |                | —                                  |         |                        |                                                                               | 510±220ms              | —          |
| GND                         |                | Not connect to encoder             |         |                        |                                                                               |                        |            |

❶ Short-circuit to another channel or GND permitted for max.30s.

❷ Phase A.B.Z are back of phase U.V.W when power on.

## 5. Mechanical Specifications

|                   |                                                            |
|-------------------|------------------------------------------------------------|
| Diameter of shaft | Ø8mm; Ø10mm; Ø12mm; Ø14mm(optional)                        |
| Starting torque   | Less than $9.8 \times 10^{-3} \text{N}\cdot\text{m}$       |
| Inertia moment    | Less than $6.5 \times 10^{-6} \text{kg}\cdot\text{m}^2$    |
| Shaft load        | Radial 20N; Axial 10N                                      |
| Slew speed        | ≤5000 rpm                                                  |
| Bearing Life      | $1.5 \times 10^9$ revs at rated load(100000hrs at 2500RPM) |
| Material          | Base: Die cast aluminum                                    |
| Weight            | About 60g                                                  |

## 6. Environmental Parameters





|                           |                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Environmental temperature | Operating: $-20 \sim +85^\circ\text{C}$ (repeatable winding cable: $-10^\circ\text{C}$ ); Storage: $-20 \sim +90^\circ\text{C}$ |
| Environmental humidity    | Operating and storage: 35~85%RH(noncondensing)                                                                                  |
| Vibration(Endurance)      | Amplitude 0.75mm,5~55Hz,2h for X,Y,Z direction individually                                                                     |
| Shock(Endurance)          | $490\text{m/s}^2$ 11ms three times for X,Y,Z direction individually                                                             |
| Protection                | None                                                                                                                            |

### 7. Wiring Table

#### 7.1 OC / Voltage








| Socket pin No. | Incremental signal |   |       |   |        |   | Supply voltage |       |
|----------------|--------------------|---|-------|---|--------|---|----------------|-------|
|                | 1                  | 2 | 3     | 4 | 5      | 6 | 7              | 8     |
| Wire color     | White              | - | Green | - | Yellow | - | Red            | Black |
| Function       | A                  | - | B     | - | Z      | - | Up             | 0V    |

#### 7.2 TTL / HTL / Push-pull / Less wiring type

| Socket pin No.       | Incremental signal                                                                |          |                                                                                   |          |                                                                                    |           | Supply voltage                                                                      |       |
|----------------------|-----------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|-------|
|                      | 1                                                                                 | 2        | 3                                                                                 | 4        | 5                                                                                  | 6         | 7                                                                                   | 8     |
| Wire color           | White                                                                             | White/BK | Green                                                                             | Green/BK | Yellow                                                                             | Yellow/BK | Red                                                                                 | Black |
| Function             | A+ (U+)*                                                                          | A- (U-)* | B+ (V+)*                                                                          | B- (V-)* | Z+ (W+)*                                                                           | Z- (W-)*  | Up                                                                                  | 0V    |
| Twisted-paired cable |  |          |  |          |  |           |  |       |

\* For the functional status in less wiring mode, refer to the functional mode wiring table for output circuit on page3.

#### 7.3 For servo motor

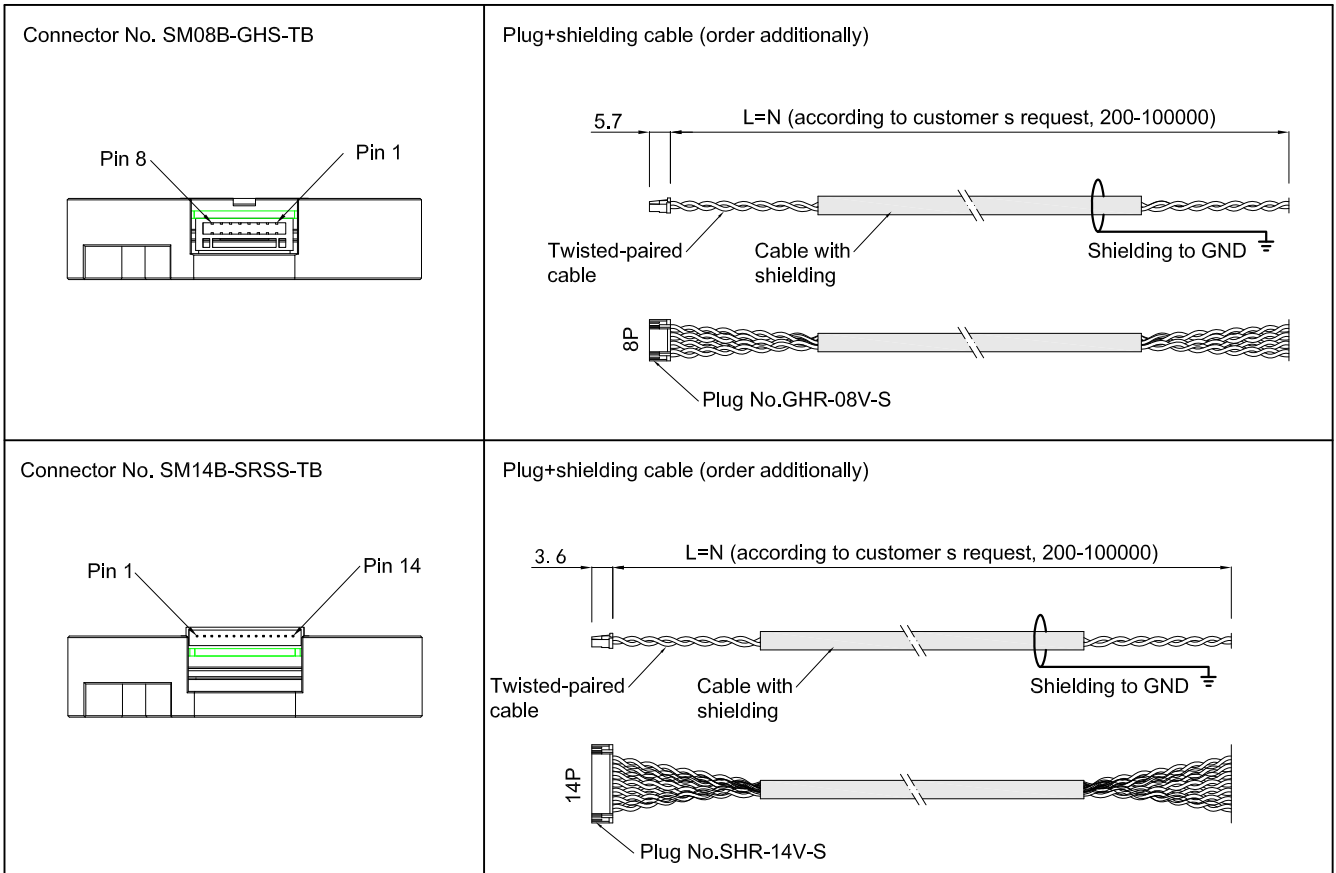
| Socket pin No.       | Incremental signal                                                                  |         |                                                                                     |         |                                                                                     |         |                                                                                     |           |                                                                                      |          |                                                                                       |          | Supply voltage                                                                        |     |
|----------------------|-------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|-----|
|                      | 1                                                                                   | 2       | 3                                                                                   | 4       | 5                                                                                   | 6       | 7                                                                                   | 8         | 9                                                                                    | 10       | 11                                                                                    | 12       | 13                                                                                    | 14  |
| Wire color           | Blue                                                                                | Blue/Bk | Grey                                                                                | Grey/Bk | Pink                                                                                | Pink/Bk | Yellow                                                                              | Yellow/BK | Green                                                                                | Green/BK | White                                                                                 | White/BK | Black                                                                                 | Red |
| Function             | U+                                                                                  | U-      | V+                                                                                  | V-      | W+                                                                                  | W-      | Z+                                                                                  | Z-        | B+                                                                                   | B-       | A+                                                                                    | A-       | 0V                                                                                    | Up  |
| Twisted-paired cable |  |         |  |         |  |         |  |           |  |          |  |          |  |     |

Up=Supply voltage.

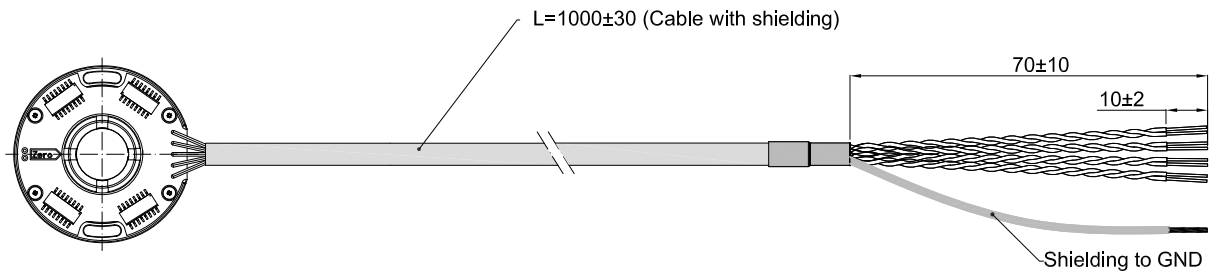
Shield wire is not connected to the internal circuit of encoder.

8. Socket & Cable

8.1 Socket pin definition



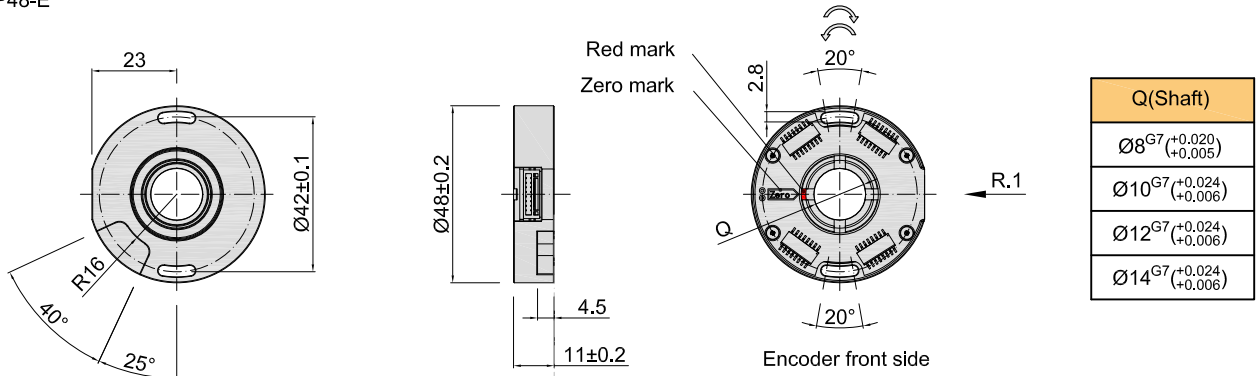
8.2 Radial Cable Schematic



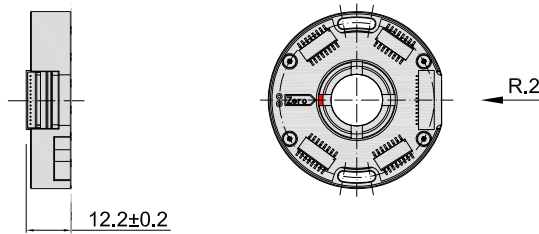
Unit: mm

9. Basic Dimension

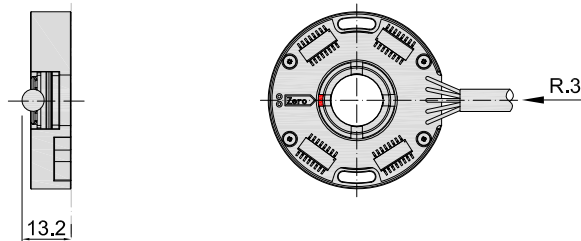
9.1 P48-E



9.2 P48-S (other dimension are the same as P48-E)

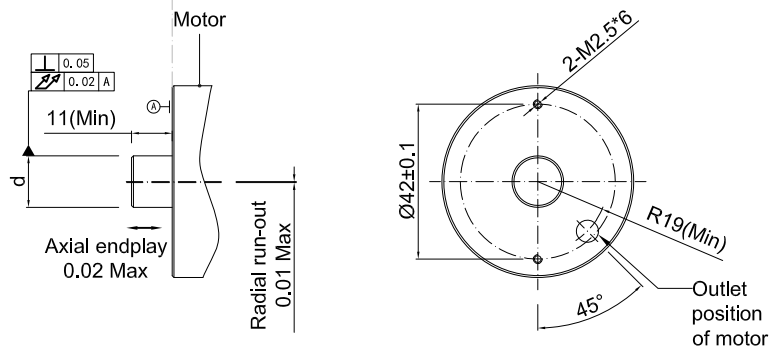


9.3 P48-J (other dimension are the same as P48-E)

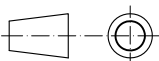


9.4 Installation shaft specification

| d(motor shaft)                               | Mounting screws                                           |
|----------------------------------------------|-----------------------------------------------------------|
| Ø8 <sub>g4</sub> <sup>(-0.005/-0.009)</sup>  | Inner hexagon bolt +flat washer<br>Specification: M2.5*12 |
| Ø10 <sub>g4</sub> <sup>(-0.006/-0.011)</sup> |                                                           |
| Ø12 <sub>g4</sub> <sup>(-0.006/-0.011)</sup> | Material: stainless steel<br>Quantity: 2                  |
| Ø14 <sub>g4</sub> <sup>(-0.006/-0.011)</sup> |                                                           |



Unit: mm



↻ = Rotate direction of incremental TTL & HTL signal output shaft

↻ = Rotate direction of OC signal output shaft

R1 = Radial socket 8P (SM08B-GHS-TB).

R2 = Radial socket 14P (SM14B-SRSS-TB).

R3 = Radial cable(standard length 1M).



### 10. Assembly Steps

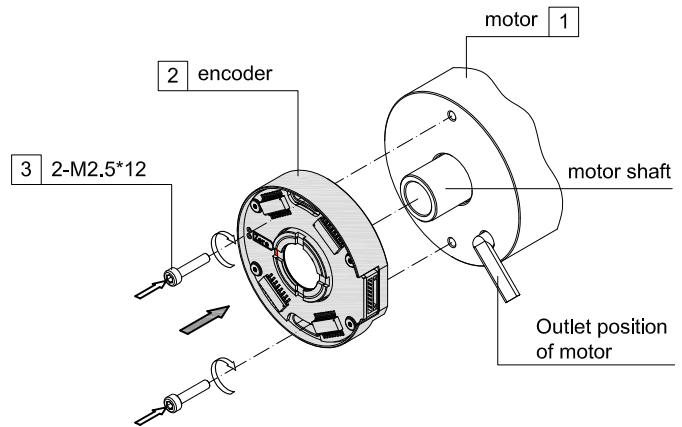
#### 10.1 Assembling steps for encoder with UVW

**Step 1**

- a. Before installing the encoder, first to confirm the starting zero position of the motor and lock it tightly to ensure that the motor shaft is not moving until the encoder is finished installation, otherwise the encoder and the motor's zero position cannot be aligned.
- b. Put the encoder (2) directly on the motor shaft and gently push it to the motor platform by hand.
- c. Screwed the two M2.5\*12 bolts (3) at the same time, but do not tighten, just enough to rotate the encoder by hand.

**Note:**

Please refer to page 8 for the matching tolerance of the encoder shaft sleeve and the motor shaft.

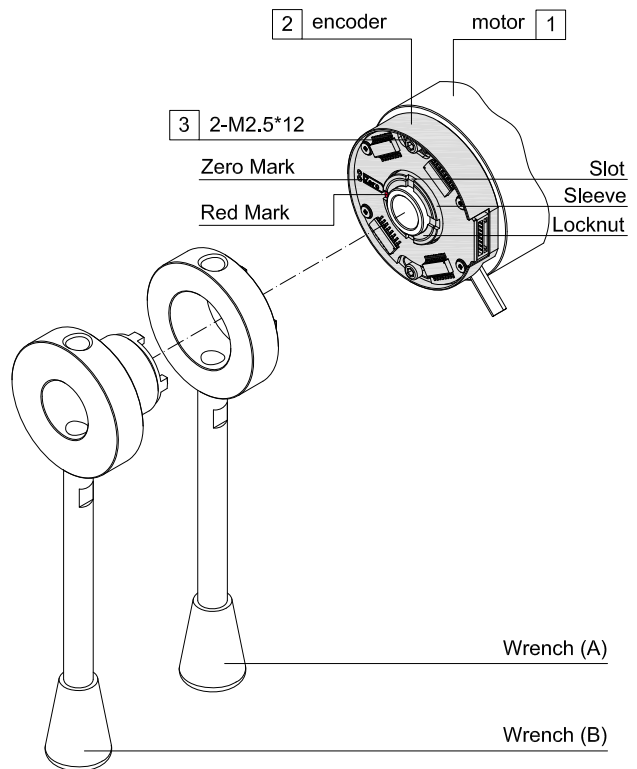


**Step 2**

- a. Fix the spanner (A) on the slot of the encoder shaft sleeve (outer ring) and then use the spanner (B) to tighten the lock nut (recommended tightening force is 8-13nm).
- b. Pls refer to the cable connection table on page 6-7, power on after checking all are correct, please confirm again that the motor is in the zero locked state, and then turn the encoder (2) left and right by hand, make sure the zero signal between encoder and motor is aligned, then screwed two M2.5 bolts(3).

**Note:**

- \*. The red mark on the shaft sleeve is always aligned with the zero point.
- \*. After making sure that the lock nut has been tightened, put thread glue on the inner thread of the slot to prevent the screw from loosening.
- \*. Because the width of the zero signal is relatively narrow, it is easy to cause displacement during the tightening process. please be patient to debug.



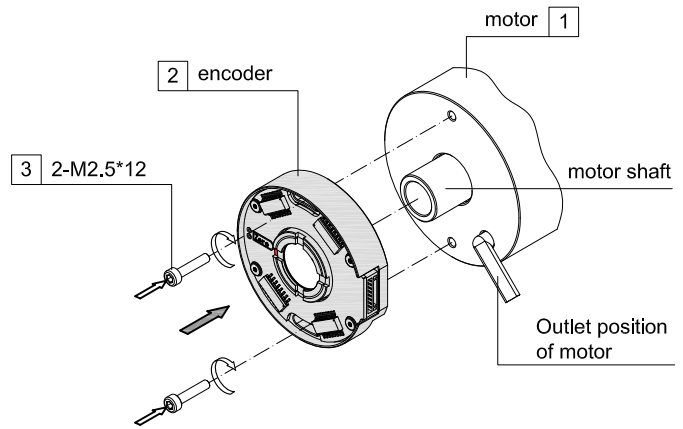
10.2 Assembling steps for encoder without UVW

Step 1

Put the encoder (2) directly on the motor shaft (1) and gently push it to the motor platform, then tighten the two M2.5\*12 bolts (3) at the same time.

Note:

Please refer to page 8 for the matching tolerance of the encoder shaft sleeve and the motor shaft.

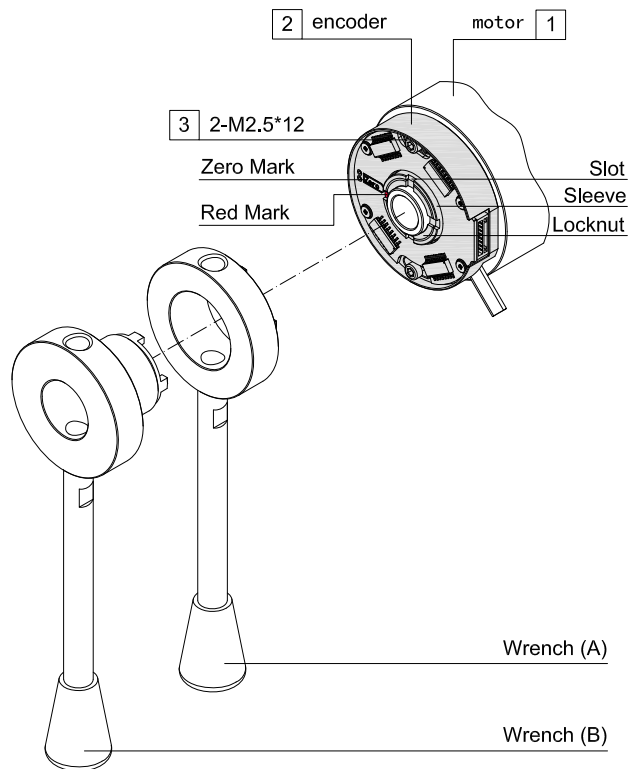


Step 2

Put the wrench (A) on the slot of the encoder sleeve (outer ring), and then use the wrench (B) to tighten the nut to ensure tightness (the recommended tightening force is 8-13N.m).

Note:

\*. After ensuring that the locking nut is tightened, apply thread glue to the internal threads of the slot to prevent the threads from loosening.



## 11. Caution

### 11.1 About vibration

Vibration act on encoder always cause wrong pulse, so we should pay attention to working place. More pulse per revolution, narrower groovy spacing of grating, more effect to encoder by vibration, when rev is low or stop, vibration act on shaft or main body would cause grating vibrating, so encoder might make wrong pulse.

### 11.2 Caution for wiring

- Use the encoder under the specified supply voltage. Please note that the supply voltage range may drop due to the wiring length.
- Do not put the encoder wiring and other power lines through the same duct, and do not use them by bundling in parallel.
- Please do not apply excessive force to the cable of encoder, or it will may be damaged.

