# TRD-N/NH Series Incremental Encoders

## ■ Features

- Shaft and Hollow Shaft type are available.
- Compact body with 50mm diameter and 35mm depth.
- Wide range of resolution from 1 to 2,500P/R.
- Protection degree IP50 (dust proof) or IP65(Dust and splash prrof).
- Wide voltage ranging from 4.75 to 30VDC.
- Servo mounting is available for easy installation

## ■ List of model numbers

| Type | Appearance | Model number | Output | Pulse/revolution |
|---|---|---|---|---|
| **Dust proofed** ABS plastic cover |  | **TRD-N□-S** | One-phase | 1, 3, 4, 5, 10, 20, 30, 60, 100, 120, 200, 300, 360, 500, 600, 1000 |
| | | **TRD-N□-RZ** | Two-phase with home position in normal operation ⎍⎍ | 3, 4, 5, 10, 20, 30, 40, 50, 60, 100, 120, 200, 240, 250, 300, 360, 400, 480, 500, 600, 750, 1000, 1200, 2000, 2500 |
| | | **TRD-N□-RZL** | Two-phase with home position in reverse operation ⎎⎎ | |
| | | **TRD-N□-RZV** | Two-phase with home position in normal operation ⎍⎍ | |
| **Dust and splash proofed** Aluminium die-cast cover |  | **TRD-N□-SW** | One-phase | 1, 3, 4, 5, 10, 20, 30, 60, 100, 120, 200, 300, 360, 500, 600, 1000 |
| | | **TRD-N□-RZW** | Two-phase with home position in normal operation ⎍⎍ | 3, 4, 5, 10, 20, 30, 40, 50, 60, 100, 120, 200, 240, 250, 300, 360, 400, 480, 500, 600, 750, 1000, 1200, 2000, 2500 |
| | | **TRD-N□-RZWL** | Two-phase with home position in reverse operation ⎎⎎ | |
| | | **TRD-N□-RZVW** | Two-phase with home position in normal operation ⎍⎍ | |
| **Dust proof hollow shaft** ABS plastic cover |  | **TRD-NH□-S** | One-phase | 1, 3, 4, 5, 10, 20, 30, 60, 100, 120, 200, 300, 360, 500, 600, 1000 |
| | | **TRD-NH□-RZ** | Two-phase with home position in normal operation ⎍⎍ | 3, 4, 5, 10, 20, 30, 40, 50, 60, 100, 120, 200, 240, 250, 300, 360, 400, 480, 500, 600, 750, 1000, 1200, 2000, 2500 |
| | | **TRD-NH□-RZL** | Two-phase with home position in reverse operation ⎎⎎ | |
| | | **TRD-NH□-RZV** | Two-phase with home position in normal operation ⎍⎍ | |
| **Dust and splash proof Hollow shaft** Aluminium die-cast cover |  | **TRD-NH□-SW** | One-phase | 1, 3, 4, 5, 10, 20, 30, 60, 100, 120, 200, 300, 360, 500, 600, 1000 |
| | | **TRD-NH□-RZW** | Two-phase with home position in normal operation ⎍⎍ | 3, 4, 5, 10, 20, 30, 40, 50, 60, 100, 120, 200, 240, 250, 300, 360, 400, 480, 500, 600, 750, 1000, 1200, 2000, 2500 |
| | | **TRD-NH□-RZWL** | Two-phase with home position in reverse operation ⎎⎎ | |
| | | **TRD-NH□-RZVW** | Two-phase with home position in normal operation ⎍⎍ | |

## ■ Model numbering system

**TRD-N□-RZWL-□**

- Series
  - **N** : Shaft
  - **NH** : Hollow shaft
- Pulse/revolution
- Output signal
  - **S** : One-phase
  - **RZ** : Two-phase with home position in normal operation
  - **RZV** : Line driver output
- Protection
  - Blank : Dust proofed (IP50)
  - **W** : Dust and splash proofed (IP65)
- Home position reverse operation symbol
  If output signal is RZ, model numbers with "L" are home position reverse operation type.
- (Available options)

## ■ Pulse and frequencies

| Pulse/revolution | | 1 | 3 | 4 | 5 | 10 | 30 | 40 | 50 | 60 | 100 | 120 | 200 | 240 | 250 | 300 | 360 | 400 | 480 | 500 | 600 | 750 | 1000 | 1200 | 2000 | 2500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. response frequency (kHz) | | 0.08 | 0.25 | 0.33 | 0.41 | 0.8 | 2.5 | 3.3 | 4.1 | 4.9 | 8.3 | 9.9 | 16 | 19 | 20 | 24 | 29 | 33 | 39 | 41 | 49 | 62 | 83 | 100 | 100 | 100 |
| Applicable models | TRD-N□-S□ | ● | ● | ● | ● | ● | ● | | | ● | ● | ● | ● | | | ● | ● | | | ● | ● | | ● | | | |
| | TRD-NH□-S□ | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TRD-N□-RZ□ | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | TRD-NH□-RZ□ | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TRD-N□-RZ□L | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | TRD-NH□-RZ□L | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TRD-N□-RZV□ | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | TRD-NH□-RZV□ | | | | | | | | | | | | | | | | | | | | | | | | | |

* Maximum response frequency is defined by the following formula:
Maximum revolution speed = (Maximum response frequency/Pulse) × 60
The encoder does not respond to revolution faster than the maximum speed.

## ■ Specifications

| Model number | | | TRD-N□-S□<br>TRD-NH□-S□ | TRD-N□-RZV□<br>TRD-NH□-RZV□ | TRD-N□-RZ□/TRD-N□-RZ□L<br>TRD-NH□-RZ□/TRD-NH□-RZ□L |
|---|---|---|---|---|---|
| Power source | Power source voltage | | 4.75 to 30 VDC | 4.75 to 5.25 VDC | 4.75 to 30 VDC |
| | Allowable ripple | | 3% rms max. | 3% rms max. | 3% rms max. |
| | Current consumption (no load) | | 40 mA max. | 60 mA max. | 60 mA max. |
| Output wave form | Output signal type | | One-phase | Two-phase + home position | Two-phase + home position |
| | Duty ratio | | 50 ± 25% (square wave) | 50 ± 25% (square wave) | 50 ± 25% (square wave) |
| | Signal width at home position | | — | 100 ± 50% | 100 ± 50% |
| | Rise/Fall time | | 3 μs max. | 2 μs max. | 3 μs max. |
| Output | Output type | | Totem-pole | Line driver output | Totem-pole |
| | Output current | Outflow "H" | 10 mA max. | — | 10 mA max. |
| | | Inflow "L" | 30 mA max. | — | 30 mA max. |
| | Output voltage | "H" | [(Load power voltage) – 2.5 V] min. | 2.5V min. | [(Load power voltage) – 2.5 V] min. |
| | | "L" | 0.4 V max. | 0.5V max. | 0.4 V max. |
| | Load power voltage | | 35 VDC max. | — | 35 VDC max. |

## ■ Mechanical specifications

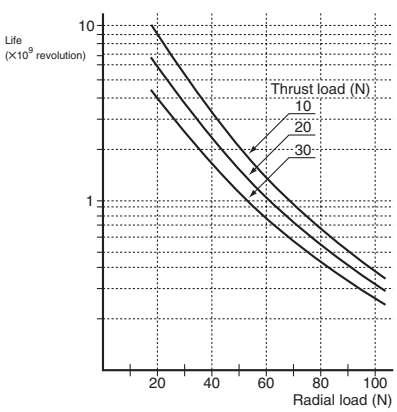
| | |
|---|---|
| Initial torque | Dust proof: 0.003 N•m max. (+20°C), Dust and splash proof: 0.02 N•m max. (+20°C), Hollow shaft: 0.05 N•m max. (+20°C) |
| Moment of inertia | $2\times10^{-6}$kg•m$^2$ |
| Allowable load | Radial: 50 N |
| | Thrust: 30 N |
| Maximum allowable speed (Note 1) | 5000 rpm (Dust and splash proofed: Continuous: 3000 rpm, Instantaneous: 5000 rpm) |
| Cable | External diameter: ø6 mm<br>5-wire oil resistant PVC cable<br>Nominal section area of core: 0.3 mm$^2$ (Line driver output : 8 cores , 0.14mm$^2$) |
| Weight | Approx. 150 g (Dust and splash proofed: Approx. 200 g) |

Note 1: Highest speed that can support mechanical integrity of the encoder

## ■ Environmental requirements

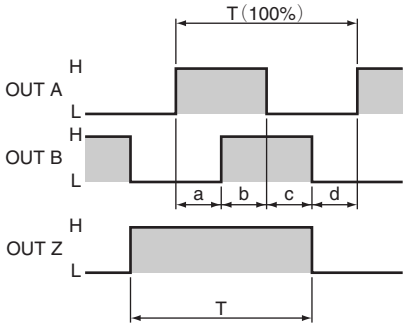
| | |
|---|---|
| Ambient temperature | –10 to +70°C |
| Storage temperature | –25 to +85°C |
| Operating humidity | 35 to 85% RH (with no condensation) |
| Voltage withstand | 500 VAC at 50/60 Hz for 1 min (Excluding shield between power supply, signal cable, and case.) |
| Insulation resistance | 50 MΩ min. |
| Vibration resistance | Durable for one hour along three axes at 10 to 55 Hz with 0.75 mm amplitude |
| Shock resistance | Metal slit plate at 500 P/R or less: 11 ms with 981 m/s$^2$<br>Glass slit plate at 600 P/R or more: 11 ms with 490 m/s$^2$<br>Applied three times along three axes |
| Protection | IP50: Dust proofed<br>IP65: Dust and splash proofed |

● Life of bearing



## ■ Channel timing chart

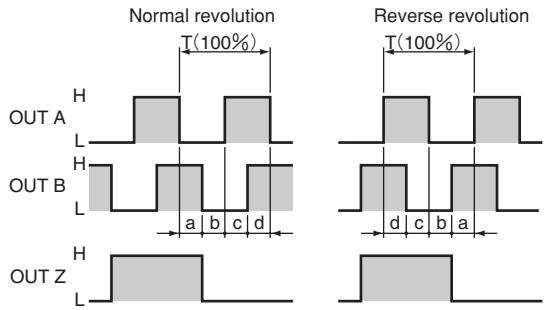
Totem-pole output




a, b, c, d =1/4T±1/8T
50% ≤ T ≤ 150%

The above waveforms apply to normal (clockwise) revolution viewed from the shaft. OUT Z phase is reversed on the RZL and RZWL models.

Line driver output

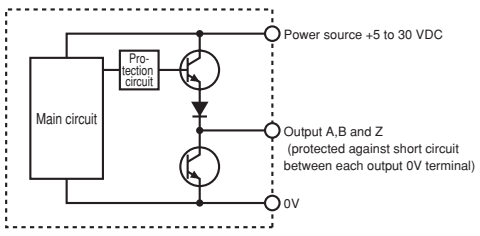



a,b,c,d=1/4T±1/8T
50%≦T≦150%

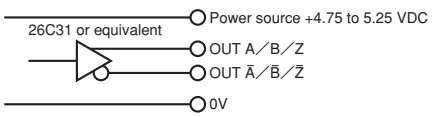
The above waveforms apply to normal (clockwise) revolution viewed from the shaft.

## ■ Output circuit

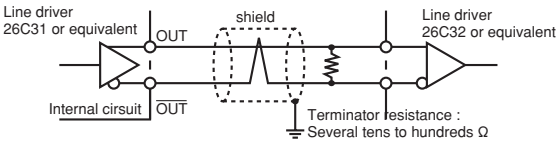
Totem-pole output



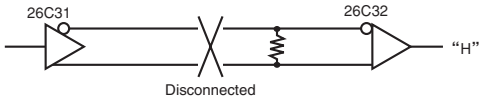

Line driver output



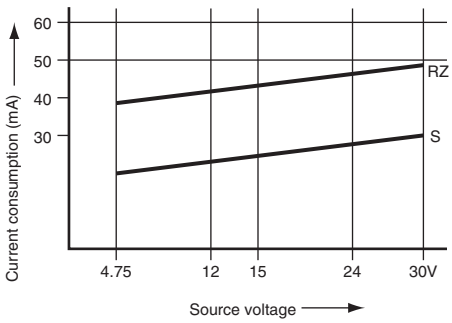

●The line driver can use a RS-422A compliant twisted pair cable of up to 1,200m.




●Output signal turns to "H" level when the cable or connector is disconnected.



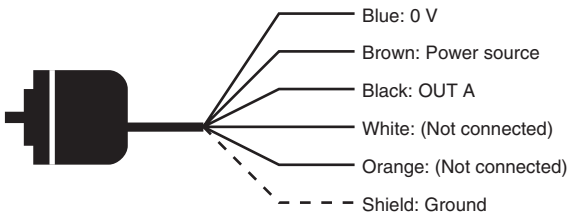

## ■ Electrical characteristics (typical)



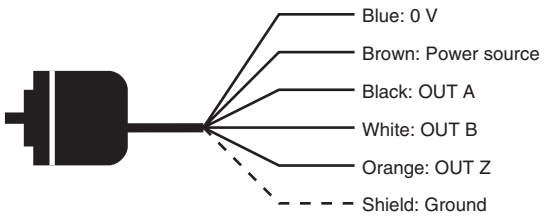

## ■ Terminal assignment

Shielded cable is not connected to the encoder body.

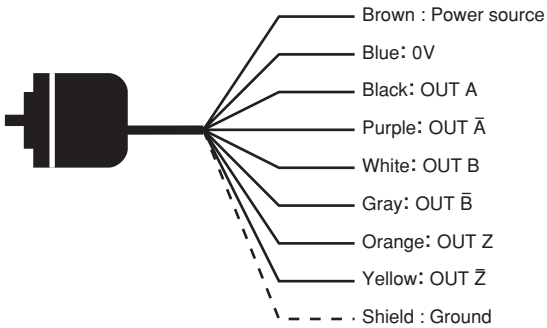
**One-phase: TRD-N□-S□**
**: TRD-NH□-S□**




**Two-phase with home position: TRD-N□-RZ□/RZ□L**
**: TRD-NH□-RZ□/RZ□L**



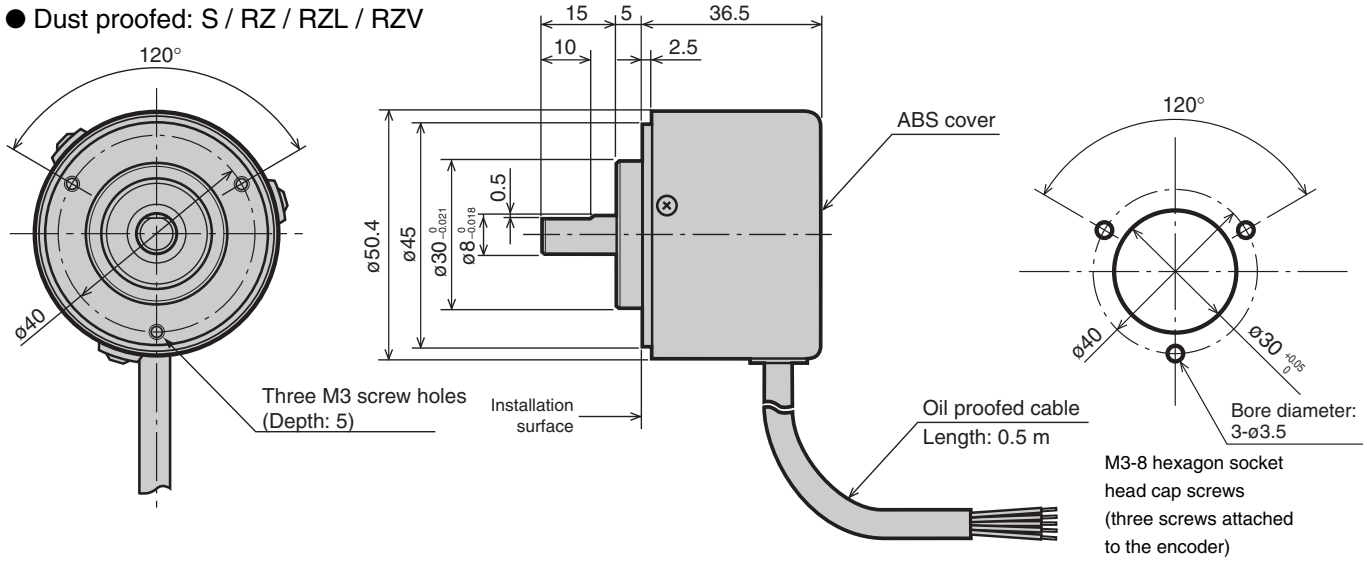

Line driver output **:TRD-N□-RZV□**
**:TRD-NH□-RZV□**



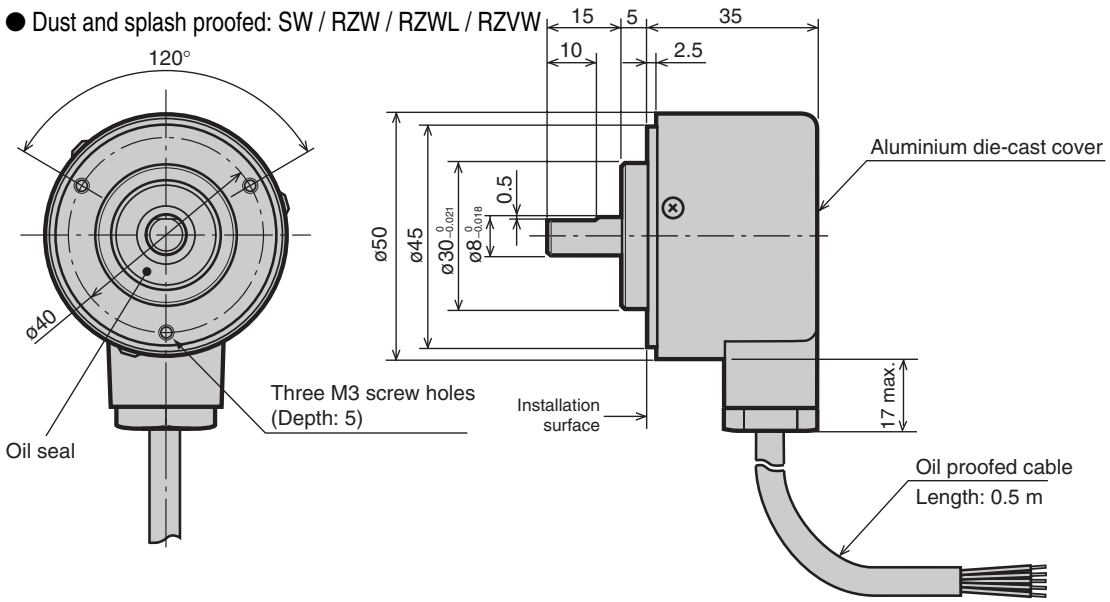
# Dimensions TRD-N Series (shaft type)

(in mm)

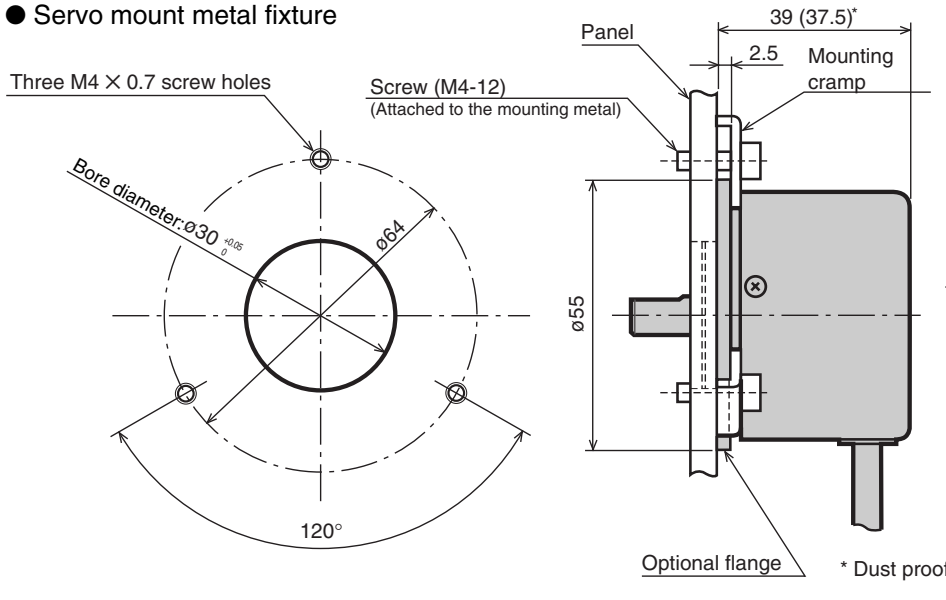
● Dust proofed: S / RZ / RZL / RZV



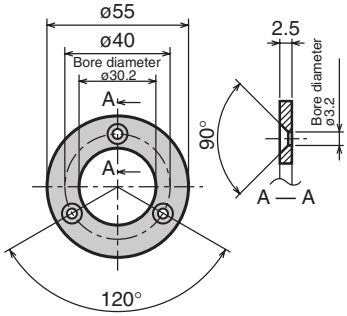

● Dust and splash proofed: SW / RZW / RZWL / RZVW




● Servo mount metal fixture

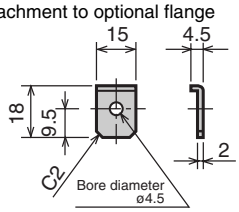



Flange **NF-55** (Option)




Servo mount metal fixture **NM-9**

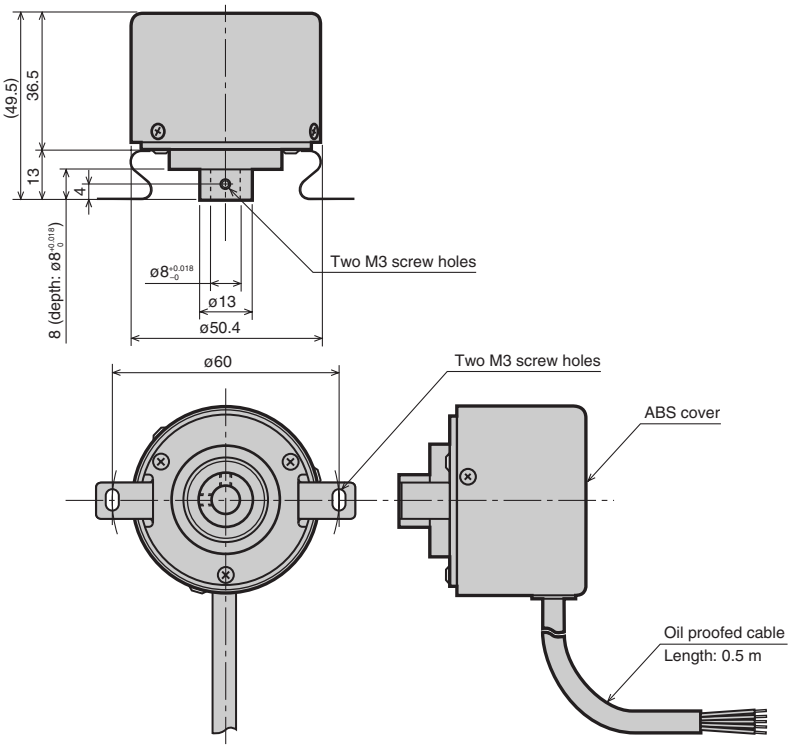
Attachment to optional flange



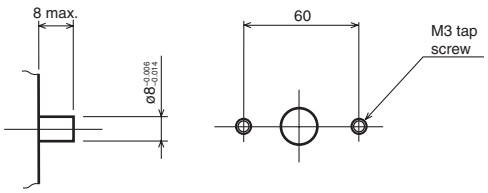
# Dimensions TRD-NH Series (hollow shaft)

in: mm

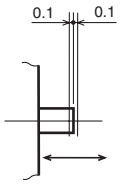
● Dust proofed : **S / RZ / RZL / RZV**



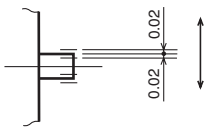

Mounting part



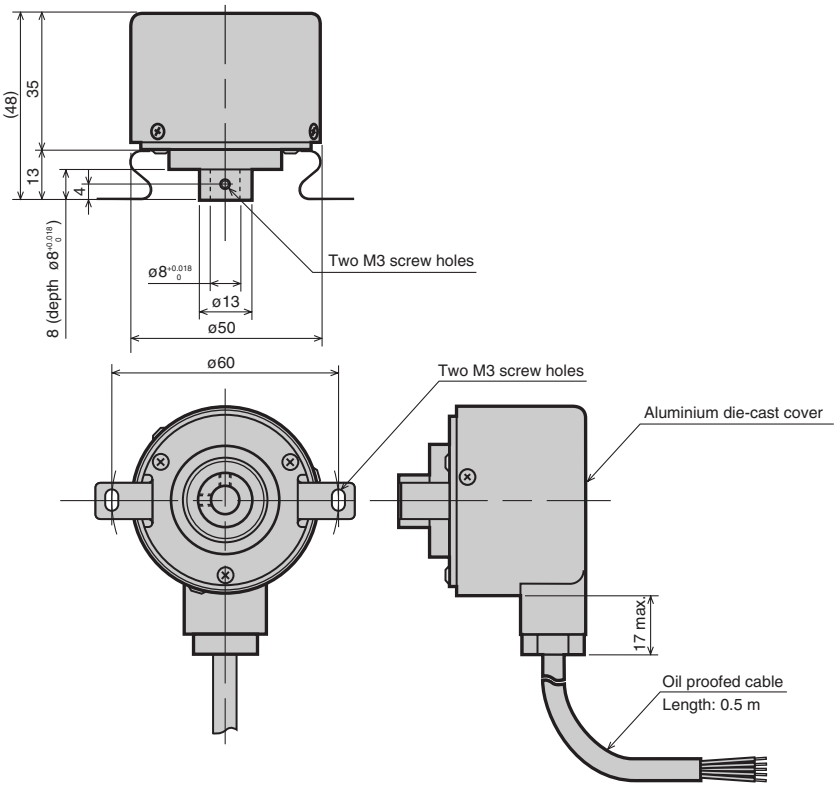

Shaft direction variation




Shaft angle direction variation




● Dust and splash proofed : **SW / RZW / RZWL / RZVW**




Degree of mounting surface angle over shaft.