# ROTARY ENCODERS

## TRD-NA Series Absolute Encoders

**Features**

- Small body with ø50 mm diameter and 35 mm depth
- Dust and splash proofed with reinforced aluminum diecast casing
- ø8 mm thick reinforced stainless steel shaft
- Accurate Gray code
- Metal slit with shock resistance of 980 m/s$^2$

## List of Model Numbers
## NPN Output

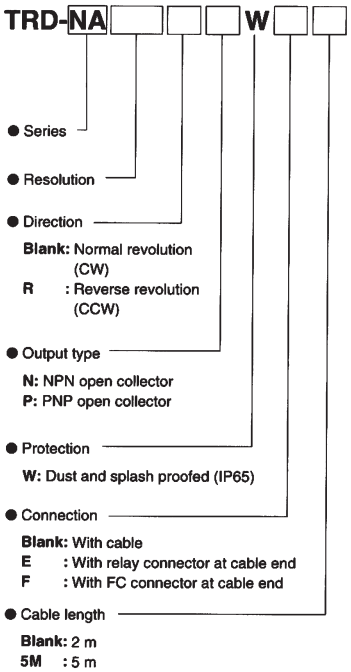
| Resolution | Direction | With cable | | With relay connector | With FC connector* | |
|---|---|---|---|---|---|---|
| | | Cable length 2 m | Cable length 5 m | Cable length 2 m | Cable length 2 m | Cable length 5 m |
| 32 | CW | TRD-NA32NW | TRD-NA32NW5M | TRD-NA32NWE | - | - |
| (5 bit) | CCW | TRD-NA32RNW | TRD-NA32RNW5M | TRD-NA32RNWE | - | - |
| 64 | CW | TRD-NA64NW | TRD-NA64NW5M | TRD-NA64NWE | - | - |
| (6 bit) | CCW | TRD-NA64RNW | TRD-NA64RNW5M | TRD-NA64RNWE | - | - |
| 128 | CW | TRD-NA128NW | TRD-NA128NW5M | TRD-NA128NWE | - | - |
| (7 bit) | CCW | TRD-NA128RNW | TRD-NA128RNW5M | TRD-NA128RNWE | - | - |
| 180 | CW | TRD-NA180NW | TRD-NA180NW5M | TRD-NA180NWE | - | - |
| (8 bit) | CCW | TRD-NA180RNW | TRD-NA180RNW5M | TRD-NA180RNWE | - | - |
| 256 | CW | TRD-NA256NW | TRD-NA256NW5M | TRD-NA256NWE | - | - |
| (8 bit) | CCW | TRD-NA256RNW | TRD-NA256RNW5M | TRD-NA256RNWE | - | - |
| 360 | CW | TRD-NA360NW | TRD-NA360NW5M | TRD-NA360NWE | TRD-NA360NWF | TRD-NA360NWF5M |
| (9 bit) | CCW | TRD-NA360RNW | TRD-NA360RNW5M | TRD-NA360RNWE | - | - |
| 512 | CW | TRD-NA512NW | TRD-NA512NW5M | TRD-NA512NWE | - | - |
| (9 bit) | CCW | TRD-NA512RNW | TRD-NA512RNW5M | TRD-NA512RNWE | - | - |
| 720 | CW | TRD-NA720NW | TRD-NA720NW5M | TRD-NA720NWE | TRD-NA720NWF | TRD-NA720NWF5M |
| (10 bit) | CCW | TRD-NA720RNW | TRD-NA720RNW5M | TRD-NA720RNWE | - | - |
| 1024 | CW | TRD-NA1024NW | TRD-NA1024NW5M | TRD-NA1024NWE | - | - |
| (10 bit) | CCW | TRD-NA1024RNW | TRD-NA1024RNW5M | TRD-NA1024RNWE | - | - |

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

## PNP Output

| Resolution | Direction | With cable | | With relay connector |
|---|---|---|---|---|
| | | Cable length 2 m | Cable length 5 m | Cable length 2 m |
| 32 | CW | TRD-NA32PW | TRD-NA32PW5M | TRD-NA32PWE |
| (5 bit) | CCW | TRD-NA32RPW | TRD-NA32RPW5M | TRD-NA32RPWE |
| 64 | CW | TRD-NA64PW | TRD-NA64PW5M | TRD-NA64PWE |
| (6 bit) | CCW | TRD-NA64RPW | TRD-NA64RPW5M | TRD-NA64RPWE |
| 128 | CW | TRD-NA128PW | TRD-NA128PW5M | TRD-NA128PWE |
| (7 bit) | CCW | TRD-NA128RPW | TRD-NA128RPW5M | TRD-NA128RPWE |
| 180 | CW | TRD-NA180PW | TRD-NA180PW5M | TRD-NA180PWE |
| (8 bit) | CCW | TRD-NA180RPW | TRD-NA180RPW5M | TRD-NA180RPWE |
| 256 | CW | TRD-NA256PW | TRD-NA256PW5M | TRD-NA256PWE |
| (8 bit) | CCW | TRD-NA256RPW | TRD-NA256RPW5M | TRD-NA256RPWE |
| 360 | CW | TRD-NA360PW | TRD-NA360PW5M | TRD-NA360PWE |
| (9 bit) | CCW | TRD-NA360RPW | TRD-NA360RPW5M | TRD-NA360RPWE |
| 512 | CW | TRD-NA512PW | TRD-NA512PW5M | TRD-NA512PWE |
| (9 bit) | CCW | TRD-NA512RPW | TRD-NA512RPW5M | TRD-NA512RPWE |
| 720 | CW | TRD-NA720PW | TRD-NA720PW5M | TRD-NA720PWE |
| (10 bit) | CCW | TRD-NA720RPW | TRD-NA720RPW5M | TRD-NA720RPWE |
| 1024 | CW | TRD-NA1024PW | TRD-NA1024PW5M | TRD-NA1024PWE |
| (10 bit) | CCW | TRD-NA1024RPW | TRD-NA1024RPW5M | TRD-NA1024RPWE |

## Composition of Model Number



## TRD-NA Series

### Electrical Specifications

| Model Number | | TRD-NA□□NW | | TRD-NA□□PW |
|---|---|---|---|---|
| Power voltage | Power source | 10.8 to 26.4 VDC | | ← |
| | Allowable ripple | 3% rms max. | | ← |
| | Current consumption | 70 mA max. | | 100 mA max. |
| Output code | | Gray binary* 1 | | ← |
| Max. response frequency | | 20 kHz* 2 | | ← |
| Precision | | (360 / resolution x 2)° | | ← |
| Direction | | Normal (CW) or reverse (CCW)* 3 | | ← |
| Output | Output type | Open collector NPN Output | | Open collector PNP Output |
| | Output logic | Negative (low active) | | Positive (high active) |
| | Residual voltage | 0.4 V max. | 1.5 V max. | 0.5 V max. |
| | Inflow current | 16 mA | 32 mA | 30 mA |
| | Load power voltage | 30 VDC max. | | ← |
| Rise / Fall time | | 2.0 μs (at 1 kΩ load resistance) max. | | 3.0 μs (at 1 kΩ load resistance) max. |

*1 38 Gray codes at 180 resolution, 76 Gray codes at 360 resolution, and 152 Gray codes at 720 resolution
*2 Maximum revolution speed = (Maximum response frequency / Resolution) x 60 The encoder does not respond to revolution faster than the maximum speed.
*3 When viewed from the shaft, CW is clockwise direction and CCW is anti-clockwise direction.

### Mechanical Specifications

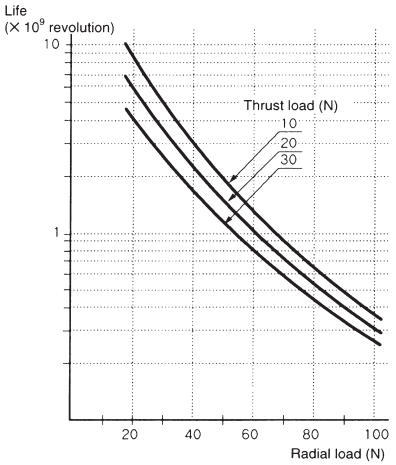
| | |
|---|---|
| Initial torque | 0.03N•m (+20°C) max. |
| Moment of inertia | 2 x $10^{-6}$kg•m$^2$ |
| Allowable load | Radial: 50N |
| | Thrust: 30N |
| Maximum allowable speed (Note 1) | 3000 rpm (continuous) |
| | 5000 rpm (instantaneous) |
| Cable | External diameter ø7 mm |
| | 12-core oil-proofed shielded vinyl chloride cable |
| | Nominal section area of core: 0.14 mm$^2$ |
| Weight | Approx. 300 g (with 2m cable) |

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

### Environmental Requirements

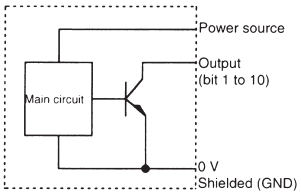
| | |
|---|---|
| Ambient temperature | Operating temperature: -10 to +60°C Storage temperature: -25 to +85°C |
| Operating / Storage humidity | 25 to +85%RH (with no condensation) |
| Withstand voltage | Removed for capacitor earth |
| Insulation resistance | 10 MΩmin. |
| Vibration resistance | Durable for 1 hour along 3 axes at 10 to 55 Hz with 0.75mm amplitudes |
| Shock resistance | 11 ms with 980 m/s$^2$ applied 3 times along 3 axes |
| Protection | IP65: Dust and splash proofed |

### Service Life of Bearing

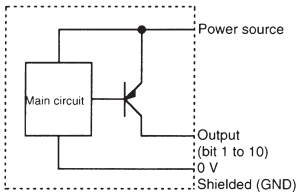



### Output Circuit

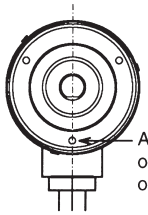
**TRD-NA□□NW**(NPN 出力)




**TRD-NA□□PW**(PNP 出力)




### Home Position



Align the downward notch of the shaft with the hole on the cable side.

### Terminal Assignment

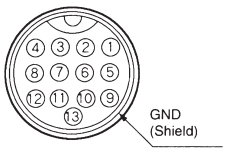
GND (shielded cable) is not connected to the encoder body. The enclosure is grounded through 0 V line.

| Color of core cable | Connector pin number | 1024/720 Resolution | 512/360 Resolution | 256/180 Resolution | 128 Resolution | 64 Resolution | 32 Resolution |
|---|---|---|---|---|---|---|---|
| Blue | 1 | 0V | ← | ← | ← | ← | ← |
| Brown | 2 | +12 / 24V | ← | ← | ← | ← | ← |
| Black | 3 | bit 1 ($2^0$) | Not connected | ← | ← | ← | ← |
| Red | 4 | bit 2 ($2^1$) | bit 1 ($2^0$) | Not connected | ← | ← | ← |
| Orange | 5 | bit 3 ($2^2$) | bit 2 ($2^1$) | bit 1 ($2^0$) | Not connected | ← | ← |
| Yellow | 6 | bit 4 ($2^3$) | bit 3 ($2^2$) | bit 2 ($2^1$) | bit 1 ($2^0$) | Not connected | ← |
| Green | 7 | bit 5 ($2^4$) | bit 4 ($2^3$) | bit 3 ($2^2$) | bit 2 ($2^1$) | bit 1 ($2^0$) | Not connected |
| Purple | 8 | bit 6 ($2^5$) | bit 5 ($2^4$) | bit 4 ($2^3$) | bit 3 ($2^2$) | bit 2 ($2^1$) | bit 1 ($2^0$) |
| Gray | 9 | bit 7 ($2^6$) | bit 6 ($2^5$) | bit 5 ($2^4$) | bit 4 ($2^3$) | bit 3 ($2^2$) | bit 2 ($2^1$) |
| White | 10 | bit 8 ($2^7$) | bit 7 ($2^6$) | bit 6 ($2^5$) | bit 5 ($2^4$) | bit 4 ($2^3$) | bit 3 ($2^2$) |
| Black / White | 11 | bit 9 ($2^8$) | bit 8 ($2^7$) | bit 7 ($2^6$) | bit 6 ($2^5$) | bit 5 ($2^4$) | bit 4 ($2^3$) |
| Red / White | 12 | bit 10 ($2^9$) | bit 9 ($2^8$) | bit 8 ($2^7$) | bit 7 ($2^6$) | bit 6 ($2^5$) | bit 5 ($2^4$) |
| - | 13 | Not connected | ← | ← | ← | ← | ← |
| Shield | - | GND | ← | ← | ← | ← | ← |

*() In parenthese is the bit corresponding to binary code.

MSB

Pin out of connector



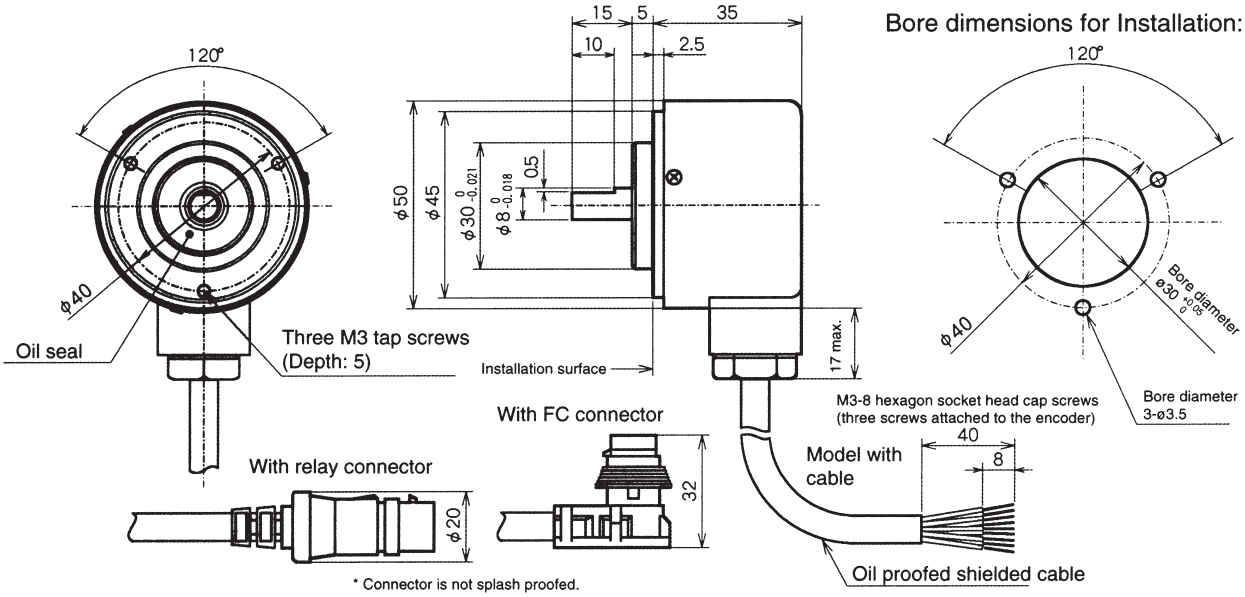

Rear view

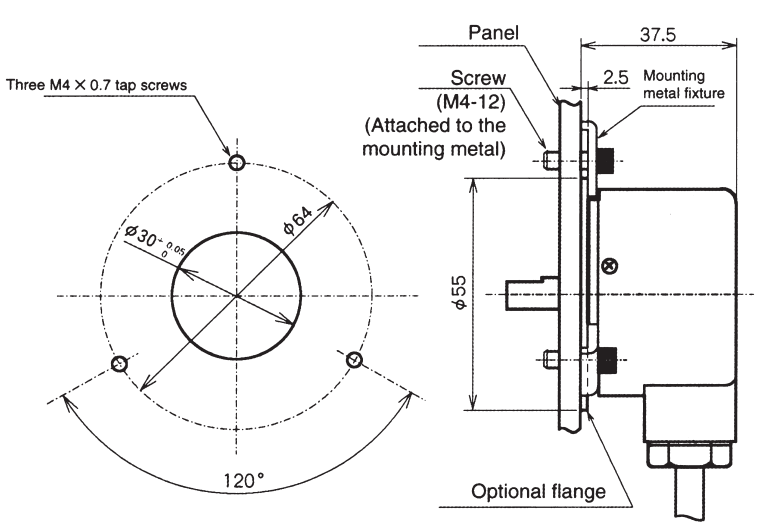
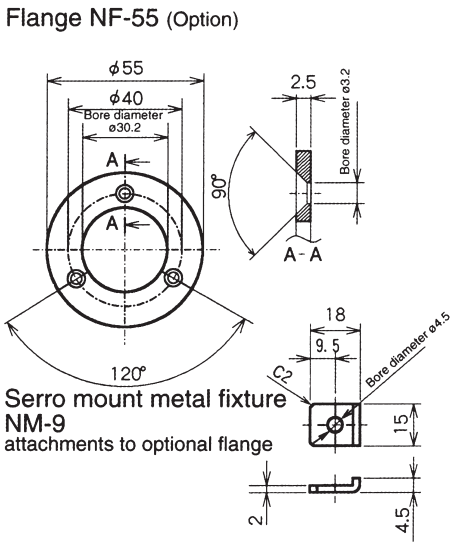
# ROTARY ENCODERS

## TRD-NA Series

### External Dimensions

(in mm)




### Servo Mount Metal Fixture