**MODEL TR2 – LINEAR SOLUTION ENCODER**

**FEATURES**
Encoder with Rack-and-Pinion Gear Integrated into One Compact Unit
Easily Installed in a Vertical, Horizontal or Upside Down Orientation
Operates at speeds up to 400 Feet per Minute
Spring Loaded Torsion Arm Eliminates Gear Backlash
Integrated Module Simplifies Your System Design

The TR2 Tru-Trac™ is a versatile solution for tracking velocity, position, or distance in almost any application and features an integrated encoder with a rack-and-pinion gear assembly. Using the rack-and-pinion gear system, encoder readings can be obtained with repeatable positioning, providing excellent accuracy. Racks can be ordered in varying lengths, and with the accessory spacer block, multiple lengths of rack can be joined for easy installation. The spring loaded torsion arm provides easily adjustable torsion load, giving the TR2 all the flexibility and maneuverability of the original TR1 Tru-Trac™. It can be installed in a horizontal, vertical, or upside down position. The threaded shaft on the TR2’s pivot axis is field reversible, providing mounting access from either side. And the durable conductive composite housing material reduces static build up.

**COMMON APPLICATIONS**

---

**MODEL TR2 TRU-TRAC™ ORDERING GUIDE**
Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

<table>
<thead>
<tr>
<th>Mechanical</th>
<th>Electrical</th>
<th>Optional Features</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR2</td>
<td>D1</td>
<td>R4</td>
<td>Leave Blank for Standard Options</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>V1</td>
<td>-20° to 85°C Std</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>OC</td>
<td>IP65 Std</td>
</tr>
<tr>
<td></td>
<td>F00</td>
<td></td>
<td>None Std</td>
</tr>
</tbody>
</table>

**Pivot Shaft Mounting**
- R4: Right side 1/4-20 thread
- L4: Left side 1/4-20 thread
- R5: Right side M6 thread
- L6: Left side M6 thread

**Pinion Gear**
- D1: 40 Tooth Pinion Gear for Stainless Steel Rack
- D2: 40 Tooth Pinion Gear for Flexible Rack
- 19: No Pinion, 1/4” Shaft
- 20: No Pinion, 6 mm Shaft

**Cycles Per Revolution**
See Resolution Chart Below
Price adder >1999

**Input Voltage**
V1: 5 to 28 VDC

**Output Type**
- OC: Open Collector
- PP: Push-Pull
- HV: Line Driver
- PU: Pull-Up Resistor
- OD: Open Collector with Differential Outputs

**Operating Temperature**
- -20° to 85°C (Std)
- -20° to 100°C
- -40° to 85°C
- T1: -40° to 85°C
- T2: -20° to 100°C

**Maximum Frequency**
- Standard: F3
- Extended: See Specifications

**Connector Type**
- F00: 18” Cable (Std)
- F01: 12” Cable
- F02: 24” Cable
- F03: 36” Cable
- M00: 2M Cable
- J00: 18” Cable with 5-pin M12
- K00: 18” Cable with 8-pin M12

**Certification**
- None (Std)
- CE: CE Marked

**NOTES:**
1. See mechanical drawing. Shaft is reversible in the field.
2. Contact Customer Service for non-standard index gating or phase relationship options.
3. Reverse Quadrature not available with Pull-Up Resistor Output Type.
5. With input voltage above 16 VDC, operating temperature is limited to 85°C.
6. For mating connectors, cables, and cordsets see *Accessories* at encoder.com. For Connector Pin Configuration Diagrams, see Technical Information or see *Connector Pin Configuration Diagrams* at encoder.com.
7. For non-standard English cable lengths enter ‘F’ plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
8. For non-standard metric cable lengths enter ‘M’ plus cable length expressed in meters. Example: M06 = 6 meters of cable.

---

**MODEL TR2 TRU-TRAC™ CPR OPTIONS**

<table>
<thead>
<tr>
<th>CPR</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001 thru 0189</td>
<td>0198</td>
</tr>
<tr>
<td>0200</td>
<td>0250</td>
</tr>
<tr>
<td>0256</td>
<td>0300</td>
</tr>
<tr>
<td>0315</td>
<td>0360</td>
</tr>
<tr>
<td>0400</td>
<td>0500</td>
</tr>
<tr>
<td>0512</td>
<td>0580</td>
</tr>
<tr>
<td>0600</td>
<td>0600</td>
</tr>
<tr>
<td>0750</td>
<td>0800</td>
</tr>
<tr>
<td>1000</td>
<td>1024</td>
</tr>
<tr>
<td>1200</td>
<td>1250</td>
</tr>
<tr>
<td>1500</td>
<td>1800</td>
</tr>
<tr>
<td>2000</td>
<td>2048</td>
</tr>
<tr>
<td>2500</td>
<td>2540</td>
</tr>
<tr>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>3600</td>
<td>4000</td>
</tr>
<tr>
<td>4096</td>
<td>5000</td>
</tr>
<tr>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>7200</td>
<td>8192</td>
</tr>
<tr>
<td>10,000</td>
<td></td>
</tr>
</tbody>
</table>

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one time NRE fee.
**MODEL TR2 TRU-TRAC™ SPECIFICATIONS**

**Electrical**

Input Voltage............. 4.75 to 28 V DC max for temperatures up to 85° C. 4.75 to 24 VDC for temperatures between 85° C to 100° C.

Input Current............. 100 mA max (65 mA typical) with no output load

Output Format............. Incremental – Two square waves in quadrature with channel A leading by 90° clockwise shaft rotation, as viewed from the wheel side. See Waveform Diagram.

Output Types............. Open Collector - 20 mA max per channel
Push-Pull – 20 mA max per channel
Pull-Up – Open Collector with 2.2 k ohm internal resistor, 20 mA max per channel
Line Driver – 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..................... Once per revolution.

Max. Frequency............. Standard Frequency Response is 200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000

Extended Frequency Response (optional) is 300 kHz for CPR 2000, 2488, 2540, & 2540

Electrical Protection . . . Reverse voltage and output short circuit protection. NOTE: Sustained reverse voltage may result in permanent damage.

Noise Immunity............. Tested to BS EN61000-4-2; BS EN61000-4-3;
BS EN61000-4-4; BS EN61000-4-5

QuadraDrive............. 67.5° electrical or better is typical,

Edge Separation........... 54° electrical minimum at temperatures > 99° C

Waveform Symmetry....... 180° electrical (single channel encoder)

Accuracy................. Within 0.017° mechanical or 1 arc-minute from true position (for CPR>189)

**Mechanical**

Radial Shaft Load ....... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^6 revolutions

Axial Shaft Load ......... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^6 revolutions

Starting Torque .......... IP50 0.05 oz-in
IP65 0.4 oz-in
IP66 0.8 oz-in

Housing ................. Stainless steel fibers in a high temperature nylon composite

Weight.................... 5 oz or typical

**Environmental**

Storage Temp............. -25° to 85° C

Humidity................. 98% RH non-condensing

Vibration................. 10 g @ 58 to 500 Hz

Shock...................... 80 g @ 11 ms duration

Sealing................... IP50 standard; IP65 or IP66 available

**Mechanical – Stainless Steel Rack**

Max Linear Speed ......... 400 Feet Per Minute. Speeds over 200 FPM require lubricant, such as MoS2 paste, to reduce gearing wear. Higher speeds may be achievable, contact Customer Service.

Rack Material .......... 303 Stainless Steel

Gearing Tolerance ....... AGMA 10, 20 degree pressure angle teeth

Accuracy................. ±0.0005 inch/inch max accumulated error

Repeatability............. ±0.0010 inch

**Mechanical – Flexible Rack**

Max Linear Speed ......... 200 Feet Per Minute

Rack Material .......... Acetal

Gearing Geometry ........ 20° pressure angle teeth

Accuracy................. ±0.002 inch/inch max accumulated error

Repeatability............. ±0.001 inch for Flexible Rack

**WIRING TABLE**

For EPC-supplied mating cables, refer to wiring table provided with cable.

Trimpack and insulate unused wires.

**RESOLUTIONS – English Units**

<table>
<thead>
<tr>
<th>Inches per Pulse</th>
<th>Pulsess per Inch</th>
<th>Disc Cycles per Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>100</td>
<td>400</td>
</tr>
<tr>
<td>0.005</td>
<td>200</td>
<td>800</td>
</tr>
<tr>
<td>0.004</td>
<td>250</td>
<td>1000</td>
</tr>
<tr>
<td>0.002</td>
<td>500</td>
<td>2000</td>
</tr>
<tr>
<td>0.005</td>
<td>1000</td>
<td>2000†</td>
</tr>
<tr>
<td>0.004</td>
<td>2500</td>
<td>2500‡</td>
</tr>
<tr>
<td>0.002</td>
<td>5000</td>
<td>2500*</td>
</tr>
<tr>
<td>0.001</td>
<td>10,000</td>
<td>2500***</td>
</tr>
</tbody>
</table>

*Requires 2x external quadrature counting.
**Requires 4x external quadrature counting.
†Requires 2x Interpolation.
‡Requires 4x Interpolation.

**RESOLUTIONS – Metric Units**

<table>
<thead>
<tr>
<th>mm per Pulse</th>
<th>Pulsess per mm</th>
<th>Disc Cycles per Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.04</td>
<td>25</td>
<td>2540</td>
</tr>
<tr>
<td>0.02</td>
<td>50</td>
<td>2540*</td>
</tr>
<tr>
<td>0.01</td>
<td>100</td>
<td>2540**</td>
</tr>
</tbody>
</table>

*Requires 2x external quadrature counting.
**Requires 4x external quadrature counting.

**WAVEFORM DIAGRAM**

Incremental Signals

---
PINION GEAR FOR FLEXIBLE RACK

- 0.125 FACE WIDTH PINION FOR FLEXIBLE RACK
- 40 TOOTH, 1/10 CIRCULAR PITCH PINION
- 1.2732 PITCH CIRCLE, 4.000 PITCH CIRCUMFERENCE
- 0.2498 THRU (6.345)

MOLDED FLEXIBLE RACK
FOR 20° PRESSURE ANGLE PINION
1/10 CIRCULAR PITCH

- TOTAL LENGTH +/- 0.5%
- SEE ORDER GUIDE

PINION GEAR FOR STAINLESS STEEL RACK

- 0.125 FACE WIDTH PINION FOR RIGID RACK
- 40 TOOTH, 1/10 CIRCULAR PITCH PINION
- 1.2732 PITCH CIRCLE, 4.000 PITCH CIRCUMFERENCE
- 0.2498 THRU (6.345)

1/10 CIRCULAR PITCH SPACER BLOCK

- SEE ORDERING GUIDE FOR AVAILABLE LENGTHS

TRU-TRAC™ MOUNTING BRACKET

Allows for a variety of mounting positions and makes installation of the Model TR2 even easier.

STOCK #140104