### 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

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### Model TR2 Tru-Trac™ Ordering Guide

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

#### Mechanical

<table>
<thead>
<tr>
<th>Model</th>
<th>TR2 - D1</th>
<th>TR2 - R4</th>
<th>TR2 - N0800</th>
<th>TR2 - V1</th>
<th>TR2 - A0</th>
<th>TR2 - OC0</th>
<th>TR2 - F00</th>
<th>Optional Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR2 Tru-Trac™</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### Electrical

<table>
<thead>
<tr>
<th>Cycles per Revolution</th>
<th>Input Voltage</th>
<th>Output Type</th>
<th>Operating Temperature</th>
<th>Maximum Frequency</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Resolution Chart</td>
<td>V1 5 to 28 VDC</td>
<td>Open Collector</td>
<td>-20° to 85° C Std</td>
<td>Standard</td>
<td>F00 18&quot; Cable</td>
</tr>
<tr>
<td>Below Price adder &gt;1999</td>
<td></td>
<td>Line Driver</td>
<td>-40° to 85° C (Std)</td>
<td>F01 12&quot; Cable</td>
<td>F06 24&quot; Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Line Driver</td>
<td>-20° to 100° C</td>
<td>F02 36&quot; Cable</td>
<td>F03 36&quot; Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pull-Up Resistor</td>
<td></td>
<td>F00 18&quot; Cable with 5-pin M12</td>
<td>M00 2M Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open Collector with Differential Outputs</td>
<td></td>
<td>J00 18&quot; Cable with 5-pin M12</td>
<td>K00 18&quot; Cable with 8-pin M12</td>
</tr>
</tbody>
</table>

**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.

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### Model TR2 Tru-Trac™ CPR Options

<table>
<thead>
<tr>
<th>Number of Channels</th>
<th>CPR Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Channel A</td>
</tr>
<tr>
<td>B</td>
<td>Channel B</td>
</tr>
<tr>
<td>Q</td>
<td>Quadrature A &amp; B</td>
</tr>
<tr>
<td>R</td>
<td>Quadrature A &amp; B with Index</td>
</tr>
<tr>
<td>K</td>
<td>Reverse Quadrature A &amp; B</td>
</tr>
<tr>
<td>D</td>
<td>Reverse Quadrature A &amp; B with Index</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 VDC max for temperatures up to 85°C.
- Input Current: 10 mA max (65 mA typical) with no load.
- Output Format: Incremental – Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the wheel side. See Waveform Diagram.
- Output Types: Open Collector - 20 mA max per channel.
- Pull-Up – 20 mA max per channel.
- Pull-Up – Open Collector with 2.2K ohm internal resistor, 20 mA max per channel.
- Line Driver – 20 mA max per channel (Meets RS 422 at 5 VDC supply).

**Index**
- Incremental – Once per revolution.
- 0190 to 10,000 CPR: Gated to output A.
- 0001 to 0189 CPR: Ungated. See Waveform Diagram.

**Waveform Geometry**
- Output Format: Incremental.
- Accuracy: ±0.002 inch/inch max accumulated error.

**Max Linear Speed**
- 800 revolutions/minute may be achievable, contact Customer Service.

**Sealing**
- 80 g @ 11 ms duration.
- 10 g @ 58 to 500 Hz.

**Shock**
- 80 g @ 11 ms duration.
- 10 g @ 58 to 500 Hz.

**Humidity**
- 80% RH non-condensing.

**Storage Temp**
- 25°C to 85°C.

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

**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 typical.

**Environmental**
- 54° electrical minimum at temperatures > 99°C.

**NOTE:** All degree references are electrical degrees.

**COMMUTATION SIGNALS**
3.00 TYP. SPACING

**OUTPUT A**
- Output to Line Driver – 20 mA max per channel.
- **OUTPUT B**
- Open Collector – 20 mA max per channel.
- **OUTPUT U**
- Line Driver – 20 mA max per channel.
- **OUTPUT V**
- Open Collector – 20 mA max per channel.
- **OUTPUT W**
- Line Driver – 20 mA max per channel.

**PITCH LINE**
- For 20° pressure angle pinion.
- 6-32 UNC-2B THRU 0.475 UNLESS OTHERWISE NOTED.
- 0.125 FACE WIDTH PINION FOR FLEXIBLE RACK.

**TORQUE ADJUSTMENT UNDER RUBBER CAP**
- 0.175 [4.44] INCH.

**RESOLUTIONS – English Units**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Pulse per Inch</th>
<th>Pulses per mm</th>
<th>Disc Cycles per Revolution</th>
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</thead>
<tbody>
<tr>
<td>mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.01</td>
<td>100</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>0.005</td>
<td>200</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>0.004</td>
<td>250</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>0.002</td>
<td>500</td>
<td>2000</td>
<td></td>
</tr>
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<td>8000</td>
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<td>2500</td>
<td>10000</td>
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</tr>
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<td>0.0002</td>
<td>5000</td>
<td>20000</td>
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<tr>
<td>0.0001</td>
<td>10,000</td>
<td>40000</td>
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**RESOLUTIONS – Metric Units**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Pulse per Revolution</th>
</tr>
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<tbody>
<tr>
<td>mm</td>
<td>Revolution</td>
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<tr>
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<td>0.0002</td>
<td>5000</td>
</tr>
<tr>
<td>0.0001</td>
<td>10,000</td>
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</table>

**Pinion Gear for Flexible Rack**

**Pinion Gear for Stainless Steel Rack**

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

<table>
<thead>
<tr>
<th>Gland Cable</th>
<th>Wire Color</th>
<th>5-pin M12*</th>
<th>8-pin M12*</th>
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</thead>
<tbody>
<tr>
<td>In.</td>
<td>mm</td>
<td></td>
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</tr>
<tr>
<td>Com</td>
<td>Black</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>+VDC</td>
<td>White</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>Brown</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>A’</td>
<td>Yellow</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Red</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>B’</td>
<td>Green</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>Orange</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Z’</td>
<td>Blue</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Shield</td>
<td>Blue</td>
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</tr>
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</table>

**NOTE:** Cable shield (bare wire) is connected to internal case. Standard cable is 24 AWG conductors with foil and braid shield.

****CE Option:** Use cable cordset with shield connected to M12 connector coupling nut.

**WAVEFORM DIAGRAM**
Incremental Signals

**OUTPUT A**
- Output to Line Driver – 20 mA max per channel.
- **OUTPUT B**
- Open Collector – 20 mA max per channel.
- **OUTPUT U**
- Line Driver – 20 mA max per channel.
- **OUTPUT V**
- Open Collector – 20 mA max per channel.
- **OUTPUT W**
- Line Driver – 20 mA max per channel.

**Output Format:** Incremental.
- Accuracy: ±0.002 inch/inch max accumulated error.

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

**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.

**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: ±0.005 inch/inch max accumulated error.
- Repeatability: ±0.001 inch.

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

**Environmental**
- 98% RH non-condensing.
- 80% RH non-condensing.
- 10 g @ 58 to 500 Hz.
- 80 g @ 11 ms duration.
- IP50 standard; IP65 or IP66 available.

**SCALE:** DWG. NO. DRAWN B REV. C NAME AND TITLE

**DIMENSIONS ARE IN INCHES**

**REV.**

**ISSUE DATE**

**NOTE:** ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.