Mercury™ 1000 Analog Output Encoder Systems
For Customer Interpolation- Resolution to 0.078μm

Reflective Linear and Rotary Encoders

The Mercury 1000 encoder system includes the sensor, double shielded cable, connector, and either a linear or rotary glass scale. Mercury’s space-saving, integrated configuration gives OEM system designers a breakthrough in performance.

Imagine what you can do with this!
Reduce the cost and size of your system, and increase its performance all at once. MicroE Systems’ Mercury 1000 kit encoders are smaller, higher performance, faster to install, and easier to use than any other encoder. Advanced features include SmartPrecision™ automatic offset and gain adjustments during set up to optimize accuracy. No manual adjustments are needed. The tiny sensor fits into very tight spaces, has broad alignment tolerances for fast and easy setup and works in both linear and rotary applications. The entire Mercury 1000 encoder system is EMI shielded for use in the toughest environments. With standard analog sine/cosine output, use your interpolation electronics to achieve the resolution required by your application.

Standard features
- Small sensor with ultra-low Z height; flush screw mounting
- Sensor is 8.4mm (H) x 12.7mm (W) x 20.6mm (L) and weighs 1.6g
- SmartPrecision automatic offset and gain set up
- Analog Sine/Cosine output and Index window
- Fundamental resolution: Linear 20μm; Rotary 2,500 - 16,384 CPR Interpolated resolution determined by customer electronics: Linear: 20μm - 0.078μm; rotary: 2,500 to 4.2M CPR
- Entire system is EMI shielded
- Bi-directional index signal
- Index mark at the center or end of the glass scale (linear)
- Alignment Tool enables fast set up (Required, see pg 2)

Optional features
- Glass scale length or diameter:
  - Linear lengths from 5mm to 2m
  - Rotary diameters from 12mm to 108mm
- Cable length of 0.5m, 1m, 2m or custom
- SmartPrecision Software for set up

Table of Contents
- System & Sensor pg 4
- Scales pg 5-6
- Ordering Information pg 6

Resolution
Determined by Customer Electronics
- Linear: 20μm to 0.078μm
- Rotary: 2,500 to 4.2M CPR

Accuracy
- Linear: ± 1μm available
- ± 3μm to ± 5μm standard
- Rotary: Up to ± 2.1 arc-sec

Output
- Analog Sine/Cosine and Digital Index Window
Optional software lets you view signal strength, Lissajous plots, position data and diagnostics.
Eliminate the Frustration of Touchy Encoder Alignment

**Mercury Solves this Problem for Good**

Fussy alignment is no longer a concern. With Mercury’s patented PurePrecision™ optics, advanced SmartPrecision™ electronics and LED alignment indicators, you can push the sensor against your reference surface, tighten the screws and you’re finished. Try that with brand X or Y.

This performance is possible thanks to relaxed alignment tolerances, particularly in the theta Z axis. Mercury offers a ±2° sweet spot— that’s a 300% improvement over the best competitive encoder. And that will result in dramatic savings in manufacturing costs.

No other commercially available encoder is easier to align, easier to use, or easier to integrate into your designs.

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**Alignment Tolerance Comparison**

<table>
<thead>
<tr>
<th></th>
<th>Mercury</th>
<th>Brand X</th>
<th>Brand Y</th>
<th>Mercury vs. Best Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z Standoff</td>
<td>± 0.15mm</td>
<td>± 0.1mm</td>
<td>± 0.1mm</td>
<td>Mercury is 50% better</td>
</tr>
<tr>
<td>Y</td>
<td>± 0.20mm for linear</td>
<td>± 0.1mm</td>
<td>unspecified</td>
<td>Mercury is 100% better</td>
</tr>
<tr>
<td></td>
<td>± 0.10mm for rotary ≥19mm dia.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>theta X</td>
<td>± 1.0°</td>
<td>unspecified</td>
<td>± 1.0°</td>
<td>Mercury is 100% better</td>
</tr>
<tr>
<td>theta Y</td>
<td>± 2.0°</td>
<td>± 0.1°</td>
<td>± 1.0°</td>
<td>Mercury is 100% better</td>
</tr>
<tr>
<td>theta Z</td>
<td>± 2.0°</td>
<td>± 0.006°</td>
<td>± 0.5°</td>
<td>Mercury is 300% better</td>
</tr>
</tbody>
</table>

*Measured at a constant temperature for one axis at a time with all other axes at their ideal positions.

**Mercury Can Reduce System Size and Cost**

Mercury’s sensor height is 44% shorter than competitive encoders, making it easy to fit into your design. This reduction can also cut total system weight and cost by allowing the use of smaller motors and stages. Safe system operation is also enhanced thanks to Mercury’s generous standoff clearance— 200% greater than other encoders. And its standoff tolerance is 50% greater than the best alternative.

This significantly relaxes mechanical system tolerances, while reducing system costs.

**Mechanical Dimension Comparison**

<table>
<thead>
<tr>
<th></th>
<th>Mercury</th>
<th>Brand X</th>
<th>Brand Y</th>
<th>Mercury vs. Best Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Z height</td>
<td>8.4mm</td>
<td>23mm</td>
<td>15mm</td>
<td>44% better</td>
</tr>
<tr>
<td>Standoff clearance</td>
<td>2.4mm</td>
<td>0.5mm</td>
<td>0.8mm</td>
<td>200% better</td>
</tr>
<tr>
<td>Standoff tolerance</td>
<td>± 0.15mm</td>
<td>± 0.1mm</td>
<td>± 0.1mm</td>
<td>50% better</td>
</tr>
<tr>
<td>System height</td>
<td>11.7mm</td>
<td>28.5mm</td>
<td>15.8mm</td>
<td>26% better</td>
</tr>
</tbody>
</table>

* Dimensions shown illustrate encoder system standoff clearance; see Mercury Encoder Interface Drawings for correct design reference surfaces.

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**System Specifications**

**System**
- Grating Period: 20µm
- Signal Period: 20µm
- System Resolution:
  - Fundamental resolution: Linear 20µm; Rotary 2500 - 16,384 CPR
  - Interpolated resolution determined by customer electronics:
    - Linear: 20µm - 0.078µm; rotary: 2,500 to 4.2M CPR
- Linear Accuracy*
  - Better than ±1µm available; contact MicroE
  - Better than ±3µm up to 130mm, ±5µm from 155mm to 1m, ±5µm per meter from 1m to 2m
  - *Maximum peak to peak error over the specified movement when compared to a NIST-traceable laser interferometer standard, used at room temperature and with MicroE interpolation electronics.

**Rotary Accuracy***

<table>
<thead>
<tr>
<th>Scale O.D.</th>
<th>Microradians</th>
<th>Arc-Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00mm</td>
<td>±100</td>
<td>±21</td>
</tr>
<tr>
<td>19.05mm</td>
<td>±63</td>
<td>±13</td>
</tr>
<tr>
<td>31.75mm</td>
<td>±38</td>
<td>±7.8</td>
</tr>
<tr>
<td>57.15mm</td>
<td>±19</td>
<td>±3.9</td>
</tr>
<tr>
<td>107.95mm</td>
<td>±10</td>
<td>±2.1</td>
</tr>
</tbody>
</table>

*Based on ideal scale mounting concentricity

**Sensor Size**
- W: 12.70mm 0.500*
- L: 20.57mm 0.810*
- H: 8.38mm 0.330*

**Operating and Electrical Specifications**
- Power Supply: 5VDC ±5% @ 60mA
- Operating Temperature: 0 to 70°C
- Storage Temperature: -20 to 70°C
- Humidity: 10 - 90% RH non-condensing
- EMI: Entire system is EMI/RFI protected
- Shock: 1500G 0.5ms half sine (Sensor)
- Sensor Weight: 2.7g (Sensor without cable)
- Cable: Double Shield, Diameter: 3.6mm (0.142“) Flex Life: 20 x 10³ cycles @ 20mm bending radius

**Maximum Speed**

<table>
<thead>
<tr>
<th>Scale Length/Diameter</th>
<th>Maximum Speed*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear All Lengths</td>
<td>7200mm/s</td>
</tr>
<tr>
<td>Rotary 0.75“</td>
<td>8640 RPM</td>
</tr>
<tr>
<td>1.25“</td>
<td>5272 RPM</td>
</tr>
<tr>
<td>2.25“</td>
<td>2637 RPM</td>
</tr>
<tr>
<td>4.25“</td>
<td>1318 RPM</td>
</tr>
</tbody>
</table>

*Assumes customer electronics have adequate bandwidth

**Mechanical Information - Sensor and Connector**

Note: See interface drawing for important sensor mounting information.
Scale Specifications
Standard and Customized Scales

MicroE Systems offers a wide array of chrome on glass scales for the highest accuracy and best thermal stability. Easy to install, standard linear and rotary scales meet most application requirements. Customized linear, rotary, and rotary segment scales are available where needed. All scales include an optical index. Mercury’s glass scales save time by eliminating motion system calibrations or linearity corrections required by other encoders, and provide better thermal stability than metal tape scales.

Options include:
- **Standard linear**: 18mm - 2m
- **Standard rotary**: 12mm - 107.95mm diameter, with or without hubs
- **Custom linear**: special lengths, widths, thickness, index mark locations and special low CTE materials
- **Custom rotary**: special ID’s, OD’s (up to 304.8mm), index mark outside the main track and special low CTE materials
- **Mounting of hubs for rotary scales**: MicroE Systems can mount and align standard, custom, or customer-supplied hubs
- **Rotary segments**: any angle range; wide range of radius values

*Custom scales or rotary segments are available in OEM quantities. Contact your local MicroE Systems sales office.

### Standard Short Linear Scales

**130mm and Shorter**

Key: inches [mm]

![Diagram of short linear scale](2186)

<table>
<thead>
<tr>
<th>Model</th>
<th>L18</th>
<th>L30</th>
<th>L55</th>
<th>L80</th>
<th>L105</th>
<th>L130</th>
</tr>
</thead>
</table>

### Standard Long Linear Scales

**155mm and Longer**

Key: inches [mm]

![Diagram of long linear scale](2186)

<table>
<thead>
<tr>
<th>Model</th>
<th>L155</th>
<th>L225</th>
<th>L325</th>
<th>L425</th>
<th>L525</th>
<th>L1025</th>
<th>L2025</th>
</tr>
</thead>
</table>

Custom scales available
To specify your Mercury encoder with the desired scale, cable length and software, consult the chart below to create the correct part number for your order. Call MicroE Systems’ Rapid Customer Response team for more information [508] 903-5000.

### How to Order Mercury 1000 Encoder Systems

To specify your Mercury encoder with the desired scale, cable length and software, consult the chart below to create the correct part number for your order. Call MicroE Systems’ Rapid Customer Response team for more information [508] 903-5000.

**Example (Linear Encoder): M1000-M05-L55-C1**

**Example (Rotary Encoder): M1000-M10-R1910-HA**

#### Scale Mounting

- **T = Tape mounting**
- **C1 = 3 scale clamps**
- **C2 = 10 scale clamps**

#### Cable Length

- **M05 = 0.5 m**
- **M10 = 1.0 m**
- **M20 = 2.0 m**

#### How to Order SmartPrecision Alignment

Required for M1000 setup

**Example: Alignment Tool for Mercury 1000 encoder, 120 VAC = SSAT1000-120**

**SSAT1000**  –  **Voltage**

- 120 = 120 VAC, 60Hz US Std. 2-prong plug
- 220 = 220 VAC, 50Hz European Std. 2-prong plug

#### How to Order SmartPrecision Software

Optional for SSAT1000 Alignment Tool

**SmartPrecision Software**

- **SSWA-AT = SmartPrecision software on CD**

All Specifications are subject to change. All data is accurate to the best of our knowledge. MicroE Systems is not responsible for errors.