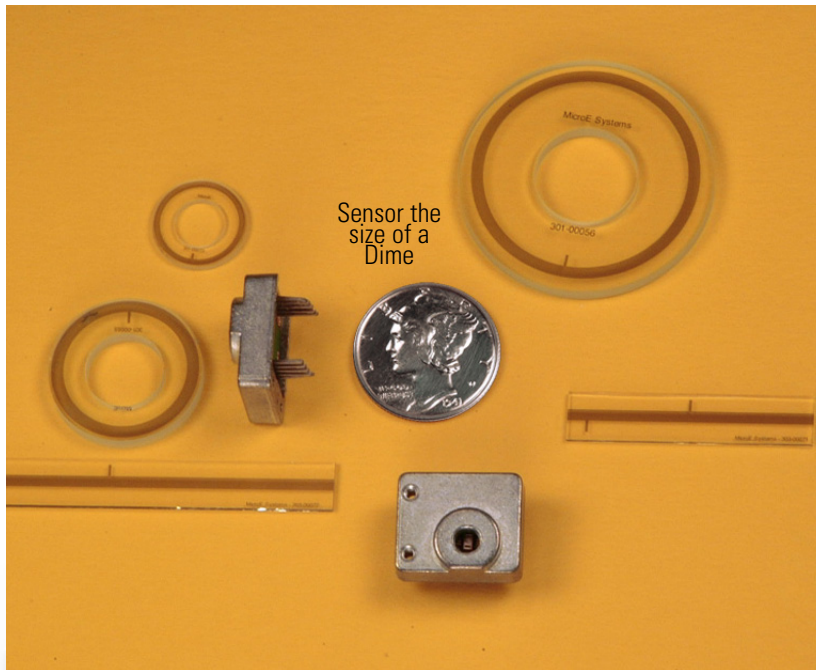**GSI** MicroE Systems ®

Enabling Technology ™

# *Mercury* ™ *1200* PCB-Mount Analog Encoders
## *For Customer Interpolation- Resolution to 0.078µm*

Reflective Linear and Rotary Encoders

Sensor the size of a Dime

## 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 Index Window

The Mercury 1200 encoder is an analog output system. Designed for PC board mounting, it is available with linear or rotary scales. Mercury's space-saving, integrated configuration gives OEM system designers a breakthrough in performance.

## Imagine what you can do with this!

OEMs can now use encoders for closed loop control where it was previously not possible or cost effective. Using your interpolation electronics, engineers can achieve dramatic improvements in system speed, throughput, and reliability, while reducing cost, size and weight. The Mercury 1200 series kit encoders make it all possible. The analog output sensors can mount directly on your printed circuit board within an EMI shielded module. The low Z height of the sensor, only 5.6mm, opens up exciting design possibilities.

OEMs that want to incorporate our interpolation electronics can contact MicroE for chip set or daughterboard solutions.

## Standard Features
- *Small PCB mount sensor*
- *Sensor is 5.6mm (H) x 11.9mm (W) x 14.9mm (L) and weighs 1.2g*
- *Fundamental resolution: Linear 20µm; Rotary 2,500 - 16,384 CPR*
  *Interpolated linear resolution up to 0.078µm;*
  *Rotary resolution 2,500 CPR to 4.2M CPR*
- *Analog output: sine/cosine and Index window*
- *Bi-directional Index window signal*
- *Index mark at the center or end of the glass scale (linear)*

## Table of Contents

**Optional features**
- *Glass scale length or diameter:*
  *Linear lengths from 5mm to 2m*
  *Rotary diameters from 12mm to 108mm*

# Broader Alignment Tolerances, Increased Standoff Clearance, Smallest Sensor and More

## Why Mercury Encoders Make It Easier To Design High Performance Into Your Equipment



**Theta Z Alignment Tolerance**

± 2°    ± 0.5°    ± 0.006°

Mercury    Brand Y    Brand X
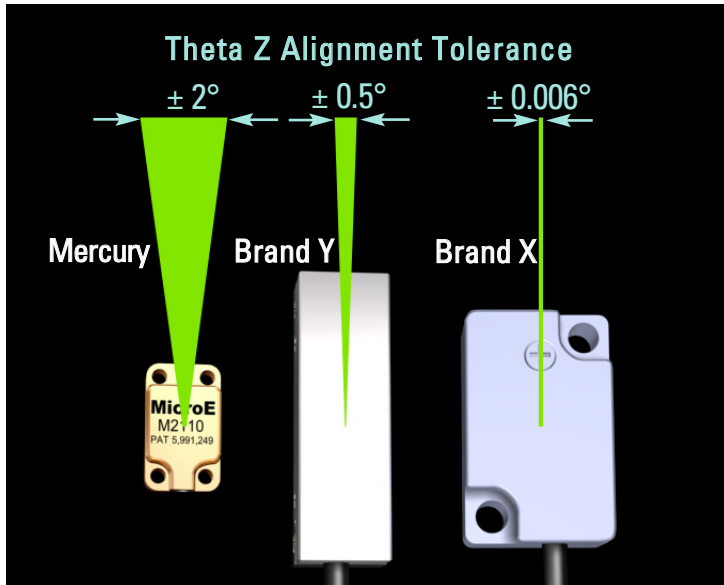
### Eliminate the Frustration of Touchy Encoder Alignment

### 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.

## Alignment Tolerance Comparison**

|  | Mercury* | Brand X | Brand Y | Mercury vs. Best Competitor |
|---|---|---|---|---|
| Z Standoff | ± 0.15mm | ± 0.1mm | ± 0.1mm | Mercury is 50% better |
| Y | ± 0.20mm for linear ± 0.10mm for rotary ≥19mm dia. | ± 0.1mm | unspecified | Mercury is 100% better |
| theta X | ± 1.0° | unspecified | ± 1.0° |  |
| theta Y | ± 2.0° | ± 0.1° | ± 1.0° | Mercury is 100% better |
| theta Z | ± 2.0° | ± 0.006° | ± 0.5° | Mercury is 300% better |

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

**Based on published specifications

### 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 it's standoff tolerance is 50% greater than the best alternative. This significantly relaxes mechanical system tolerances, while reducing system costs.

## Mechanical Dimension Comparison**

|  | Mercury | Brand X | Brand Y | Mercury vs. Best Competitor |
|---|---|---|---|---|
| Sensor Z height | 8.4mm | 23mm | 15mm | 44% better |
| Standoff clearance | 2.4mm | 0.5mm | 0.8mm | 200% better |
| Standoff tolerance | ± 0.15mm | ± 0.1mm | ± 0.1mm | 50% better |
| System height | 11.7mm | 28.5mm | 15.8mm | 26% better |

**Based on published specifications

Note: Mecury 1200 is even smaller at 5.6mm sensor height



**Standoff Clearance**

Mercury    2.4mm* ± 0.15mm

Brand Y    0.8mm ± 0.1mm

Brand X    0.5mm ± 0.1mm
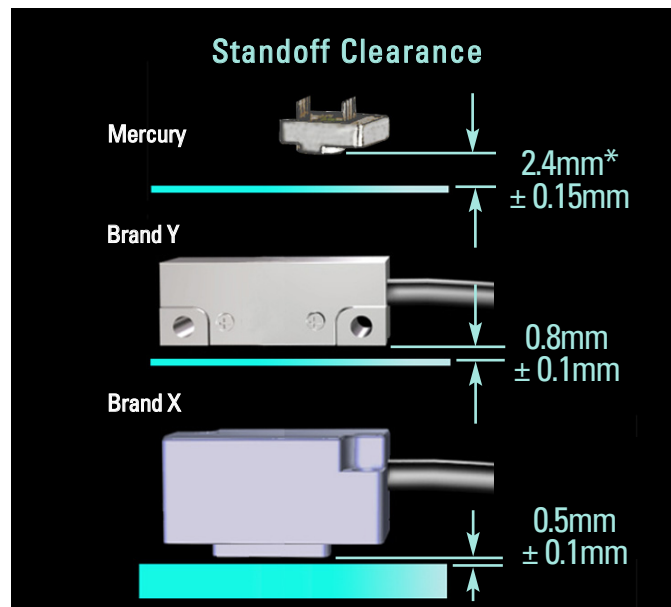
* Dimensions shown illustrate encoder system standoff clearance; see Mercury Encoder Interface Drawings for correct design reference surfaces.

# System Specifications

## System

| | |
|---|---|
| Grating Period | 20µm |
| Signal Period | 20µm |
| System Resolution | 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 |
| 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* | Scale O.D. | Microradians | Arc-Seconds |
|---|---|---|---|
| | 12.00mm | ±100 | ±21 |
| | 19.05mm | ±63 | ±13 |
| | 31.75mm | ±38 | ±7.8 |
| | 57.15mm | ±19 | ±3.9 |
| | 107.95mm | ±10 | ±2.1 |

*Based on ideal scale mounting concentricity

## Sensor Size

| | | |
|---|---|---|
| W: | 12.70mm | 0.500" |
| L: | 15.24mm | 0.600" |
| H: | 5.59mm | 0.220" |

## Operating and Electrical Specifications

| | |
|---|---|
| Power Supply | 5VDC ±5%  @ 33mA |
| Temperature | |
| Operating: | 0 to 70°C |
| Storage: | -20 to 70°C |
| Humidity: | 10 - 90% RH non-condensing |
| Shock: | 1500G 0.5ms half sine |
| Sensor Weight: | 2.6g ( Sensor without cable ) |

## Maximum Speed

| | Scale Length/Diameter | Maximum Speed* |
|---|---|---|
| Linear | All Lengths | 7200mm/s |
| Rotary | 0.75″ | 8640 RPM |
| | 1.25″ | 5273 RPM |
| | 2.25″ | 2637 RPM |
| | 4.25″ | 1318 RPM |

*Assumes customer electronics have adequate bandwidth

## Mechanical Information - Sensor
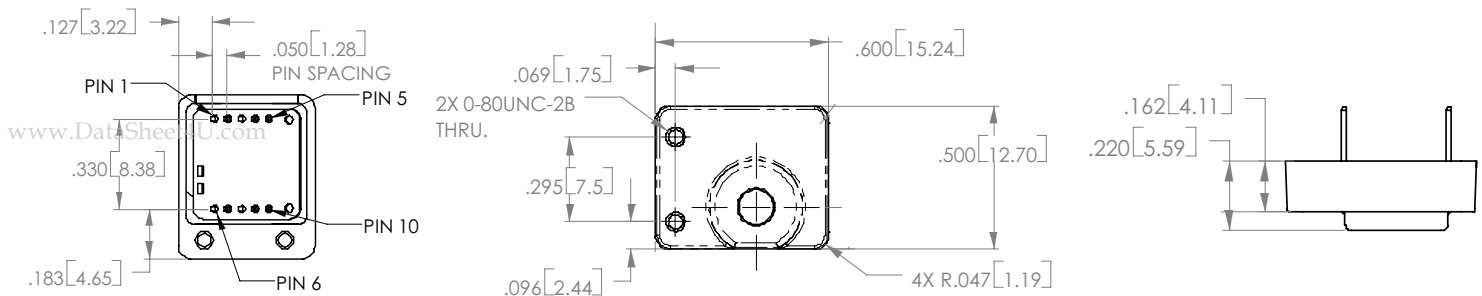


### Analog Output
### Pins 1,2,3 and 4



20µm

1.6 V pp (Differential) Across 2k Ω resistor

90°
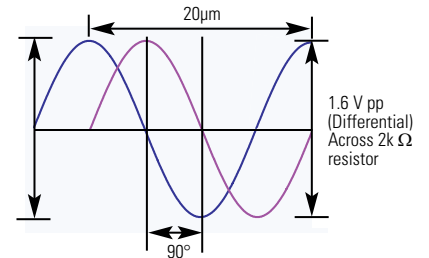
## Mercury 1200 Outputs

10-pin interface

| PIN | FUNCTION |
|---|---|
| 1 | Sine + |
| 2 | Sine - |
| 3 | Cosine + |
| 4 | Cosine - |
| 5 | + 5 V DC |
| 6 | Reserved - Do Not Connect |
| 7 | Reserved - Do Not Connect |
| 8 | Index Window - |
| 9 | Index Window + |
| 10 | Ground |

### Index Window
### Pin 9



20µm Typical

5VDC

All Specifications are subject to change. All data is accurate to the best of our knowledge.
MicroE Systems is not responsible for errors.
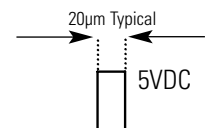
# Scale Specifications
## Standard and Customized Scales

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]
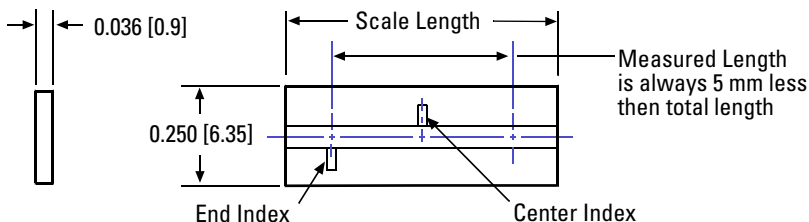
**Specifications**

| Accuracy | ±3µm standard |
| --- | --- |
| | ±1µm available |
| Material | Soda lime glass |
| Typical CTE | 8ppm/°C |
| Index | Center or End |

| Model | L18 | L30 | L55 | L80 | L105 | L130 |
| --- | --- | --- | --- | --- | --- | --- |
| Scale Length | 0.709 [18] | 1.181 [30] | 2.165 [55] | 3.150 [80] | 4.134 [105] | 5.118 [130] |
| Measured Length | 0.512 [13] | 0.984 [25] | 1.969 [50] | 2.953 [75] | 3.937 [100] | 4.921 [125] |

Custom scales available

## Standard Long Linear Scales
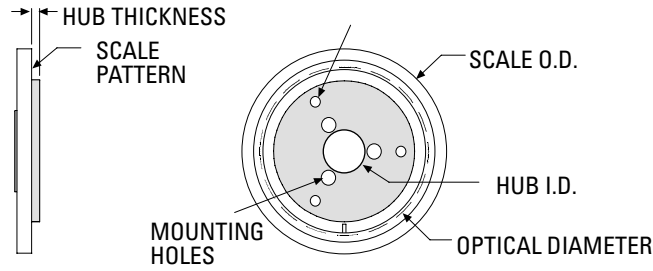### 155mm and Longer

Key: inches[mm]

**Specifications**

| Accuracy | ±5 µm <1m |
| --- | --- |
| | ±5 µm/m >1m |
| Material | Soda lime glass |
| Typical CTE | 8ppm/°C |
| Index | Center or End |

| Model | L155 | L225 | L325 | L425 | L525 | L1025 | L2025 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Scale length | 6.102 [155] | 8.858 [225] | 12.795 [325] | 16.732 [425] | 20.669 [525] | 40.354 [1025] | 79.724 [2025] |
| Measured length | 5.906 [150] | 8.661 [220] | 12.598 [320] | 16.535 [420] | 20.472 [520] | 40.157 [1020] | 79.528 [2020] |

Custom scales available

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

## *Standard Rotary Scales*

HUB THICKNESS
SCALE PATTERN
SCALE O.D.
HUB I.D.
MOUNTING HOLES
OPTICAL DIAMETER

Key: inches[mm]

| Model No. | Scale Outer Diameter | Scale Inner Diameter | Optical Diameter | Hub Inner Diameter +.0005/-0.0000 | Hub Thickness | Fundamental CPR |
|---|---|---|---|---|---|---|
| R1206 | 0.472 [12.00] | 0.250 [6.35] | 0.413 [10.50] | 0.1253 [3.18] | 0.040 [1.02] | 1650 |
| R1910 | 0.750 [19.05] | 0.375 [9.52] | 0.627 [15.92] | 0.1253 [3.183] | 0.040 [1.02] | 2500 |
| R3213 | 1.250 [31.75] | 0.500 [12.70] | 1.027 [26.08] | 0.2503 [6.358] | 0.050 [1.27] | 4096 |
| R5725 | 2.250 [57.15] | 1.000 [25.40] | 2.053 [52.15] | 0.5003 [12.708] | 0.060 [1.52] | 8192 |
| R10851 | 4.250 [107.95] | 2.000 [50.80] | 4.106 [104.30] | 1.0003 [25.408] | 0.080 [2.03] | 16384 |

Custom scales available

# How to Order Mercury 1200 Encoder Systems

To specify your Mercury encoder with the desired scale, 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): M1200-L55-C1   (Rotary): M1200-R3213-HB

| M1200 | – | Scale Model | – | Scale Mounting |
|---|---|---|---|---|
| M1200 | | Lxxx or Rxxxx | | For Linear Scales: T = Tape Mounting C1 = 3 scale clamps* C2 = 10 scale clamps** |

Hubs for Rotary Scales:
NH = No hub
HE = for R1206
HA = for R1910
HB = for R3213
HC = for R5725
HD = for R10851

\* 3 clamps come standard with linear scales up to 130mm
\*\*10 clamps come standard with linear scales 155mm or longer

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**GSI** MicroE Systems®

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