

Mercury™ 1000V: Vacuum Rated Analog Encoder For Customer Interpolation- Resolution to 0.078µm; Rated to 10⁻⁸ Torr

Reflective Linear and Rotary Vacuum Encoders

**Typical
Vacuum Encoder System**

Sensor
the size
of a
Dime

Same sensor
for linear
and rotary
scales

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

Vacuum
10⁻⁸ Torr

The New Mercury 1000V encoder represents the next level of encoder performance. With smallest sensor size, easiest alignment and 10⁻⁸ Torr vacuum rating, the M1000V delivers Best-in-Class performance. Shown with customer-supplied vacuum-wall connectors.

Imagine what you can do with this!

The new Mercury 1000V can reduce the cost and size of your system, and improve its performance all at once! MicroE Systems' Mercury 1000V kit encoders are smaller, higher performance, faster to install, and easier to set up and align than any other encoder. The tiny sensor fits into very tight spaces and works in both linear and rotary applications. The M1000V sensor is vented and constructed with vacuum compatible materials and designed for a 48 hour bake out at 150°C. Color coded bare leads are provided for customer termination.

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
- 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 6 for ordering info.)

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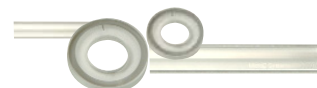
Required accessories

- SmartPrecision Alignment Tool



Optional features

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



- Vacuum cable length of 1.5m or custom
- SmartPrecision Software for set up



System Configurations

Standard and Optional Equipment

Encoder Sensor
Same for linear and rotary scales.

Shielded Vacuum Cable
Supplied with 1.5m standard length and color-coded bare leads for customer termination.



vacuum wall

M1000 Encoder System Standard Equipment

Controller Interface Cable
the cable includes a 15 pin standard D-sub connector with SmartPrecision™ electronics for automatic gain and offset adjustments.

The standard cable is double shielded and 0.5m in length. The cable contains color-coded bare leads for customer termination.



SmartPrecision™ Alignment Tool
Required for set up, the built-in LED indicators make alignment fast and easy, eliminating the need for an oscilloscope. In addition, SmartPrecision gain and offset are automatically adjusted to optimize accuracy.

RS 232 Interface Adaptor
The adaptor provides power to the encoder and connections to a PC and the controller. Included with the Alignment Tool.

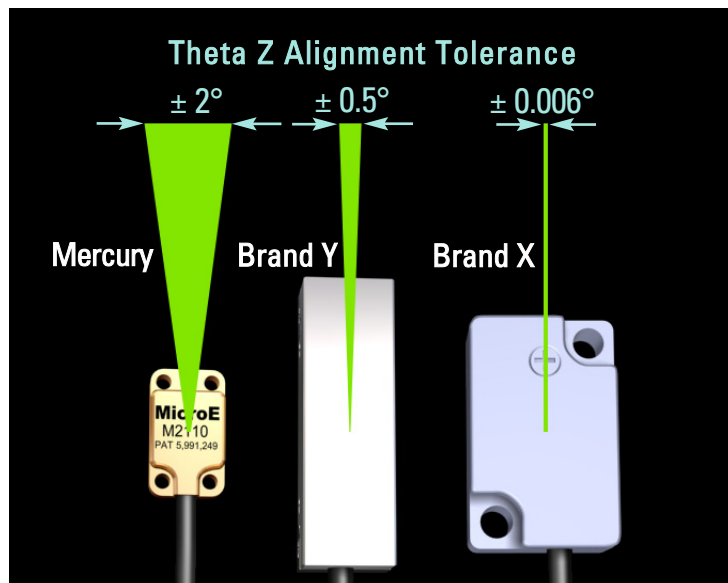
Optional Software



SmartPrecision™ Alignment Software
Optional software lets you view signal strength, Lissajous plots, position data and diagnostics.

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

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



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 $\pm 2^\circ$ 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	$\pm 0.15\text{mm}$	$\pm 0.1\text{mm}$	$\pm 0.1\text{mm}$	Mercury is 50% better
Y	$\pm 0.20\text{mm}$ for linear $\pm 0.10\text{mm}$ for rotary $\geq 19\text{mm}$ dia.	$\pm 0.1\text{mm}$	unspecified	Mercury is 100% better
theta X	$\pm 1.0^\circ$	unspecified	$\pm 1.0^\circ$	
theta Y	$\pm 2.0^\circ$	$\pm 0.1^\circ$	$\pm 1.0^\circ$	Mercury is 100% better
theta Z	$\pm 2.0^\circ$	$\pm 0.006^\circ$	$\pm 0.5^\circ$	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

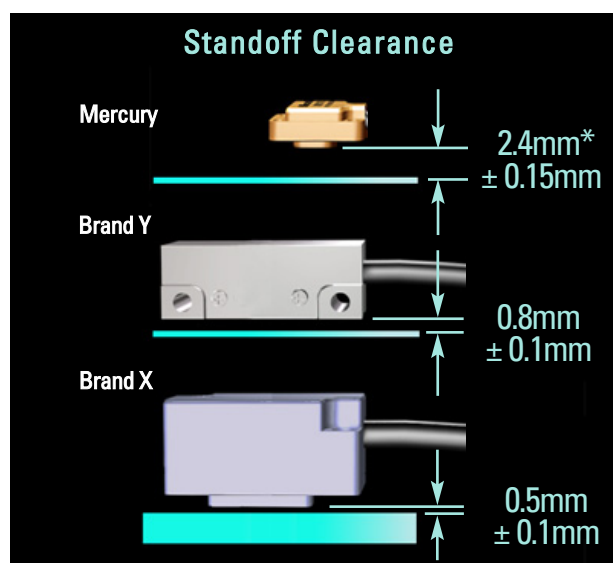
Mercury's sensor height is 44% shorter than competitive encoders, making it easy to fit into your design. This reduction can also cut total system weight and cost by allowing the use of smaller motors and stages. Safe system operation is also enhanced thanks to Mercury's generous standoff clearance— 200% greater than other encoders. And its 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	$\pm 0.15\text{mm}$	$\pm 0.1\text{mm}$	$\pm 0.1\text{mm}$	50% better
System height	11.7mm	28.5mm	15.8mm	26% better

**Based on published specifications



* 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 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
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*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:	20.57mm	0.810"
H:	8.38mm	0.330"

Operating and Electrical Specifications

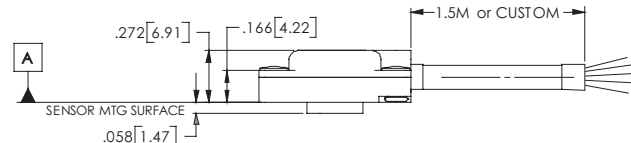
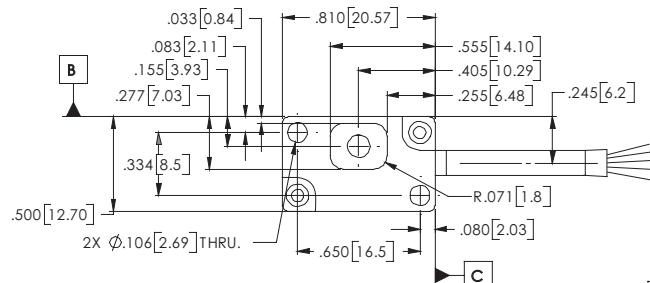
Vacuum	10 ⁻⁸ Torr, negligible outgassing
Bake Out	Up to 150°C; up to 48 hours, non-operating
Power Supply	5VDC ±5% @ 60mA
Temperature	
Operating:	Sensor: 0 to 70°C
Storage:	-20 to 70°C
Humidity:	10 - 90% RH non-condensing
Shock:	1500G 0.5ms half sine
Sensor Weight:	2.7g (Sensor without cable)
Cable:	The 1.5m vacuum-compatible cable is EMI shielded and comes standard with bare leads for customer termination within the vacuum bulkhead. Custom cable lengths and connectors are available.

Maximum Speed

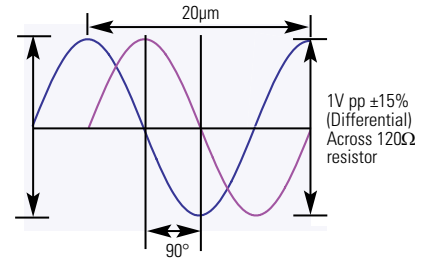
	Scale Length/Diameter	Maximum Speed*
Linear	All Lengths	7200mm/s
Rotary	0.75"	8640 RPM
	1.25"	5272 RPM
	2.25"	2637 RPM
	4.25"	1318 RPM

*Assumes customer electronics have adequate bandwidth

Mechanical Information - Sensor



Analog Output Pins 7,8,14 and 15

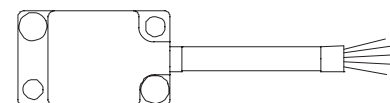
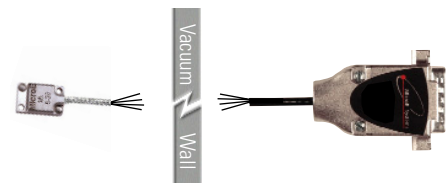
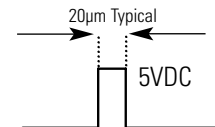


Mercury 1000V Outputs

15-pin Standard Male D connector

PIN	FUNCTION
1	Index Window-
2	Index Window+
3	Reserved - do not connect
4	Reserved - do not connect
5	Reserved - do not connect
6	Reserved - do not connect
7	Cosine+
8	Sine+
9	Reserved - do not connect
10	Reserved - do not connect
11	Reserved - do not connect
12	+5V
13	Ground
14	Cosine-
15	Sine -

Index Window Pin 2



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:

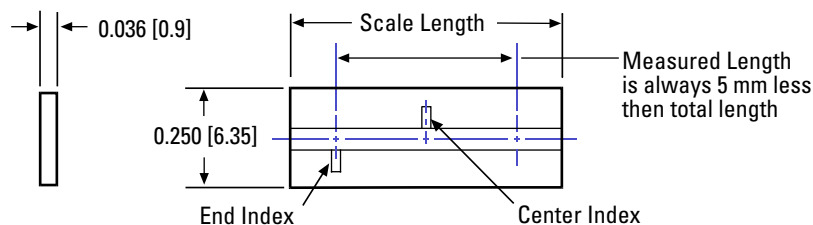
- *Standard linear*: 18mm - 2m
- *Standard rotary*: 12mm - 107.95mm diameter, with or without hubs
- *Custom linear**: special lengths, widths, thickness, index mark locations and special low CTE materials
- *Custom rotary**: special ID's, OD's (up to 304.8mm), index mark outside the main track and special 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

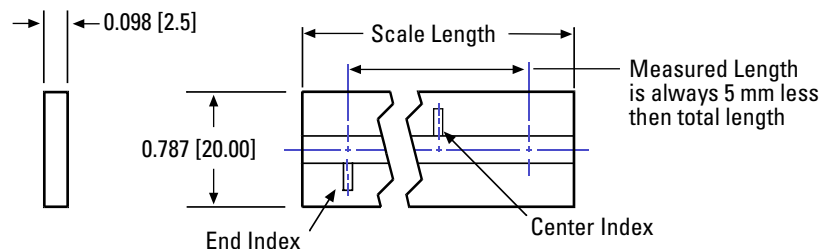
Model	L18	L30	L55	L80	L105	L130
Scale Length	0.709 [18]	1.181 [30]	2.165 [55]	3.150 [80]	4.134 [105]	5.118 [130]
Measured Length	0.512 [13]	0.984 [25]	1.969 [50]	2.953 [75]	3.937 [100]	4.921 [125]

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

Technical drawing of a scale assembly. The left side shows a side view of the scale pattern with labels for 'HUB THICKNESS' and 'SCALE PATTERN'. The right side shows a top view of the scale assembly with labels for 'SCALE O.D.', 'HUB I.D.', 'MOUNTING HOLES', and 'OPTICAL DIAMETER'.

Material	Soda lime glass
Typical CTE	8ppm/°C

Model No.	Scale Outer Diameter	Scale Inner Diameter	Optical Diameter	Hub Inner Diameter +0.0005/-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