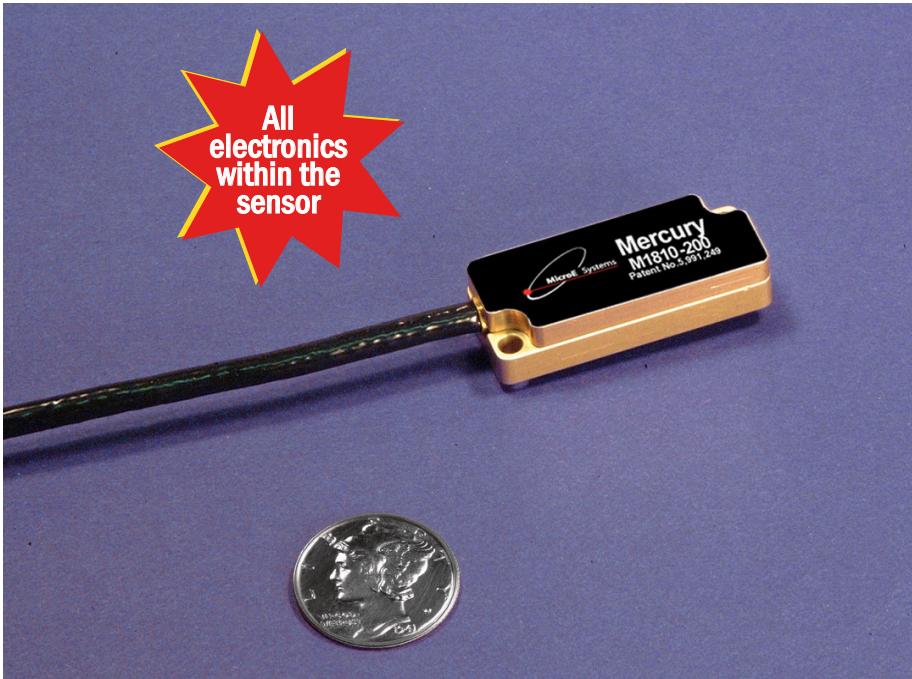


Mercury™ 1800 Digital Output Encoder Systems

Factory Set Resolution to 50 nanometers or 100 nanometers

Reflective Linear and Rotary Encoders



Resolution

Factory Set:
x200 or x400

Linear: 100 nm or 50 nm

Rotary: 330,000 to
6,553,600 CPR

Accuracy

Linear: $\pm 1\mu\text{m}$ available
 $\pm 3\mu\text{m}$ to $\pm 5\mu\text{m}$ standard

Rotary: Up to ± 2.1 arc-sec

Output

A-quad-B and Index Pulse

The Mercury 1800 is the smallest encoder system to provide 50 or 100 nanometer resolution with all electronics inside the sensor body. Its 1 LSB bidirectional index allows startup or recovery at full encoder resolution.

The M1800 is the only digital encoder to provide 50nm resolution with all electronics in the sensor

Add performance, simplicity and robustness to your designs with the Mercury™ 1800 kit encoder. The sensor is 8.9mm tall and contains all system electronics. That makes the M1800 the world's smallest encoder to provide resolutions of 50 or 100 nanometers, linear or up to 6.5 million CPR, rotary, directly from the sensor. Additionally, the 1 LSB bidirectional optical index allows system startup and recovery at full encoder resolution. The index is built into the scale and requires no installation unlike Hall sensor indexes. And, the same sensor operates in both linear and rotary applications. Like other Mercury™ encoders, the M1800 features wide alignment tolerances that allow setup in under 30 seconds with the SmartPrecision™ Alignment Tool. A-quad-B output is standard and is RS-422 compatible.

Standard features

- Small sensor with ultra-low Z height; flush screw mounting
- Sensor is 8.9mm (H) x 12.7mm (W) x 32.6mm (L) and weighs 10.8 g
- Available with 26 pin high density D-sub connector or micro-connector
- A-quad-B output and Index pulse
- Factory set interpolation x200 or x400 for resolutions of 100nm and 50nm (linear); 330,000 CPR to 6,553,600 CPR (rotary)
- Entire system is EMI shielded
- 1 Least Significant Bit (LSB) Bi-directional index signal
- Index mark at the center or end of the glass scale (linear)
- Alignment Tool enables fast set up

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System & Sensor pg. 2-6

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Optional Features & Accessories

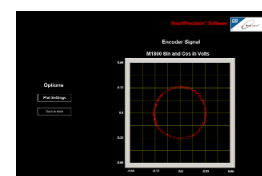
- SmartPrecision™ Alignment Tool (needed for setup)



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



- Cable length of 1m, 2m or custom
- SmartPrecision Software for set up



System Configurations

Standard and Optional Equipment

M1800S Encoder System Standard Equipment



Encoder Sensor
Same for linear and rotary scales.

M1800S
RS-422 compatible
26 pin high density
D-sub connector

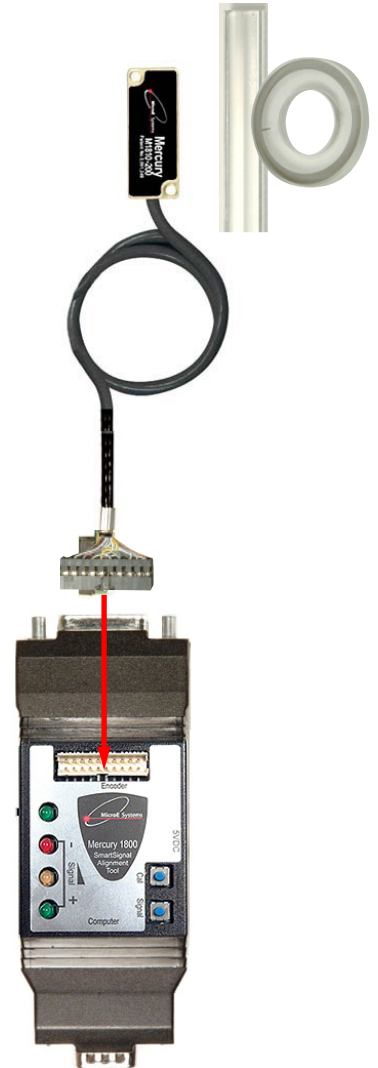
(Only 8 pins are required with either connector for motion control I/O)

SmartPrecision™
Alignment Tool - SSAT1800
(required for setup)

Provides fast set up; the built-in LED indicators make alignment fast and easy, eliminating the need for an oscilloscope. Performs encoder calibration and index setup.

Includes a power supply to power the encoder.

M1800H Encoder System Standard Equipment

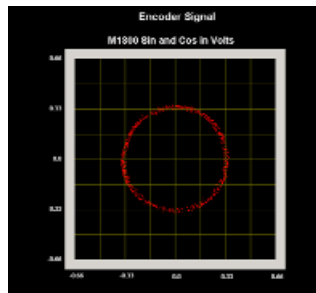


Encoder Sensor
Same for linear and rotary scales.

M1800H
RS-422 compatible
10 x 2 header
Micro-connector

Optional SmartPrecision™ software package

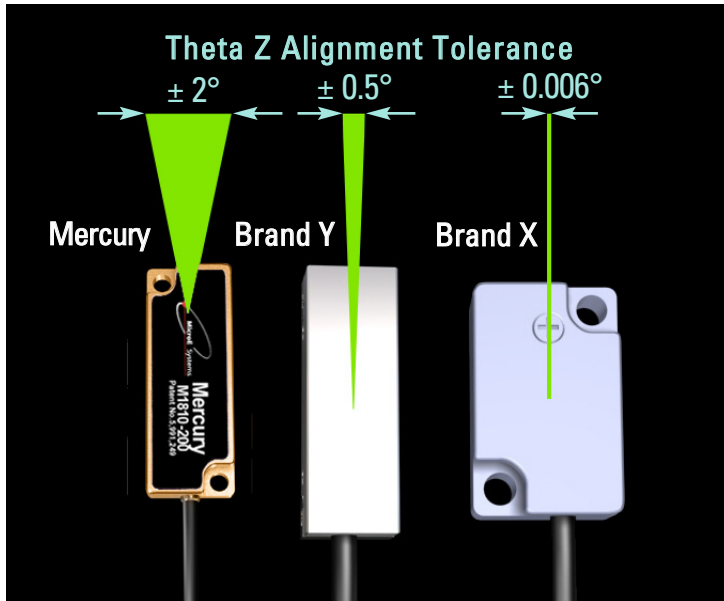
Interface Module



Optional SmartPrecision software lets you view signal strength, Lissajous plots, position data and diagnostics. See www.microesys.com to view the software data sheet for details.

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 ± 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

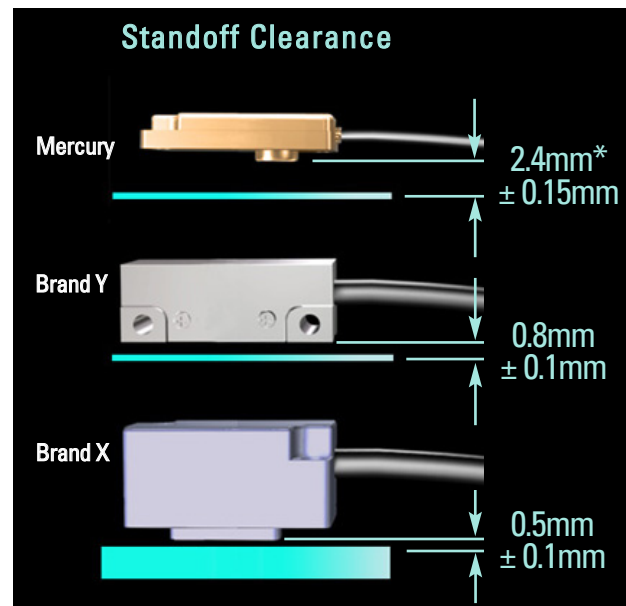
Mercury's sensor height is 44% shorter than competitive encoders, making it easy to fit into your design. This reduction can also cut total system weight and cost by allowing the use of smaller motors and stages. Safe system operation is also enhanced thanks to Mercury's generous standoff clearance— 200% greater than other encoders. And 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	± 0.15mm	± 0.1mm	± 0.1mm	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

Resolution and Maximum Speed

Mercury 1800 systems have factory set interpolation: x200 and x400. Below is the table of available resolutions.

Linear - 20µm grating pitch

Interpolation	Resolution	Maximum Speed
x200	100nm/count	500 mm/sec
x400	50nm/count	250 mm/sec

Rotary - 20µm grating pitch

Rotary Glass Scale Diameter Fundamental Resolution Interpolation
Below is a table of the available resolutions.

Rotary Glass Scale Diameter	Fundamental Resolution	Interpolation	x200	x400
0.472" [12.00mm]	1650 CPR			
		interpolated resolution (CPR)	330,000	660,000
		interpolated resolution (arc-sec/count)*	3.92	1.96
		interpolated resolution (µrad/count)*	19.03	9.52
		maximum speed (RPM)	910	455
0.750" [19.05mm]	2500 CPR			
		interpolated resolution (CPR)	500,000	1,000,000
		interpolated resolution (arc-sec/count)*	2.59	1.30
		interpolated resolution (µrad/count)*	12.58	6.28
		maximum speed (RPM)	600	300
1.250" [31.75mm]	4096 CPR			
		interpolated resolution (CPR)	819,200	1,638,400
		interpolated resolution (arc-sec/count)*	1.58	0.79
		interpolated resolution (µrad/count)*	7.66	3.83
		maximum speed (RPM)	366	183
2.250" [57.15mm]	8192 CPR			
		interpolated resolution (CPR)	1,638,400	3,276,800
		interpolated resolution (arc-sec/count)*	0.79	0.40
		interpolated resolution (µrad/count)*	3.83	1.92
		maximum speed (RPM)	183	92
4.250" [107.95mm]	16384 CPR			
		interpolated resolution (CPR)	3,276,800	6,553,600
		interpolated resolution (arc-sec/count)*	0.40	0.20
		interpolated resolution (µrad/count)*	1.92	0.96
		maximum speed (RPM)	92	46

* Resolution values shown are approximate. To calculate exact resolution values, convert from CPR (Counts Per Revolution) to the desired units.

Note: Specifications assume XOR function which is available in all standard controllers.

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

System Specifications

System

Grating Period	20 μ m
System Resolution	100nm or 50nm (linear)
Linear Accuracy*	Better than $\pm 1\mu$ m available; contact MicroE Better than $\pm 3\mu$ m up to 130mm, $\pm 5\mu$ m from 155mm to 1m, $\pm 5\mu$ m 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.

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

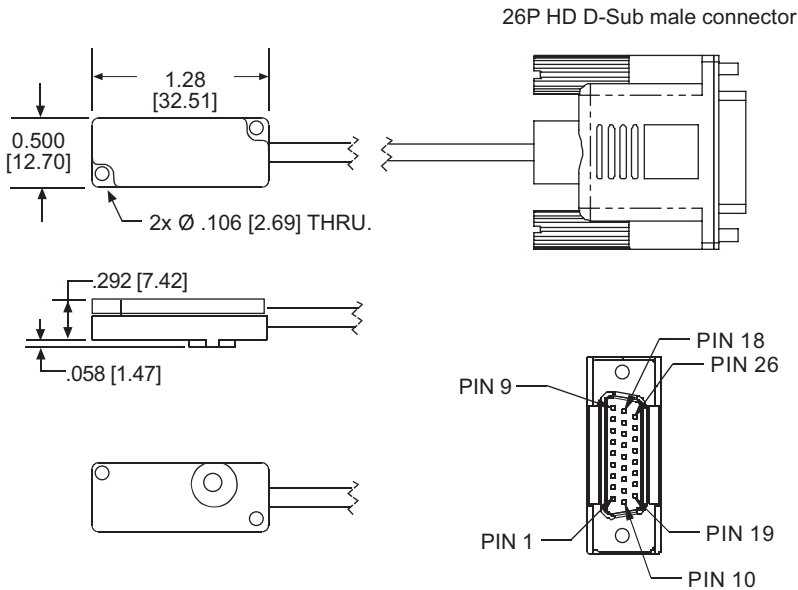
Sensor Size

W:	12.70mm	0.50"
L:	32.6mm	1.28"
H:	8.9mm	0.35"

Operating and Electrical Specifications

Power Supply	5VDC $\pm 5\%$ @ 100mA
Temperature	
Operating:	0 to 70°C
Storage:	-20 to 70°C
Humidity:	10 - 90% RH non-condensing
EMI:	M1800S: Entire system is EMI/RFI protected M1800H: Customer provides shielding at cable termination
Shock:	1500G 0.5 ms half sine (Sensor)
Sensor Weight:	10.8 g(Sensor without cable)
Cable:	Double Shield. Diameter: 3.6mm (0.142") Flex Life: 20 x 10 ⁶ cycles @ 20mm bending radius

Mechanical Information - Sensor with High Density D-sub Connector



Note: See Interface Drawings of the M1800S and M1800H for complete mechanical and alignment information, and see User Manual for guidelines on cable strain relief and grounding.

Mercury 1800S Outputs

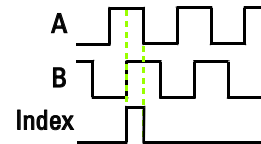
26-pin high density Male D-sub connector
(Only 8 pins are required for motion control I/O)

PIN	FUNCTION
2	Sin (uncorrected)*
7	B-
8	A+
9	Index+
12	+5VDC
13	Ground
17	B+
18	Index-
20	Cos (uncorrected)*
26	A-

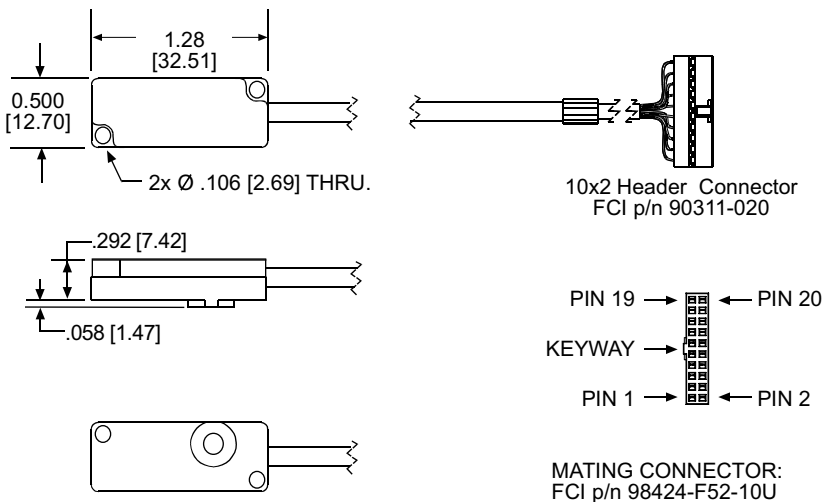
Notes: Pins not listed above are reserved- do not connect. For applications requiring an Index Window (20um nominal signal width) instead of a 1LSB Index, use Pin 25 IW+ and Pin 16 IW-.

* Analog outputs are for sensor alignment only and are optional. They are not required when using the M1800 with an SSAT1800 Alignment Tool. Customers who wish to use an oscilloscope to perform sensor alignment can use the uncorrected Sin and Cos which are nominally 0.85V_{pp} with 1.7V offset.

Output Signals Quadrature TTL



Mechanical Information - Sensor with Micro-connector



Note: See Interface Drawings of the M1800S and M1800H for complete mechanical and alignment information, and see User Manual for guidelines on cable strain relief, shielding and grounding.

Mercury 1800H Outputs

Micro-connector (Female 10 x 2 Header)
(Only 8 pins are required for motion control I/O)

PIN	FUNCTION
4	Ground
8	+5VDC
9	Sin (uncorrected)*
10	Cos (uncorrected)*
15	Index+
16	Index-
17	B+
18	B-
19	A+
20	A-

Notes: Pins not listed above are reserved- do not connect. For applications requiring an Index Window (20um nominal signal width) instead of a 1LSB Index, use Pin 6 IW+ and Pin 2 IW-.

* Analog outputs are for sensor alignment only and are optional. They are not required when using the M1800 with an SSAT1800 Alignment Tool. Customers who wish to use an oscilloscope to perform sensor alignment can use the uncorrected Sin and Cos which are nominally 0.85V_{pp} with 1.7V offset.

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:

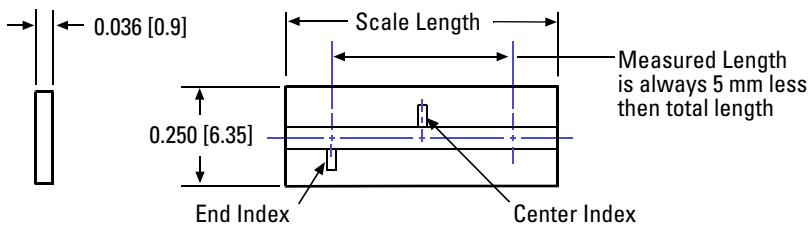
- *Standard linear*: 30mm - 2m
- *Standard rotary*: 12mm - 107.95mm diameter, with or without hubs
- *Custom linear**: special lengths, widths, thickness, index mark locations and special low CTE materials
- *Custom rotary**: special ID's, OD's (up to 304.8mm), index mark outside the main track and special 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

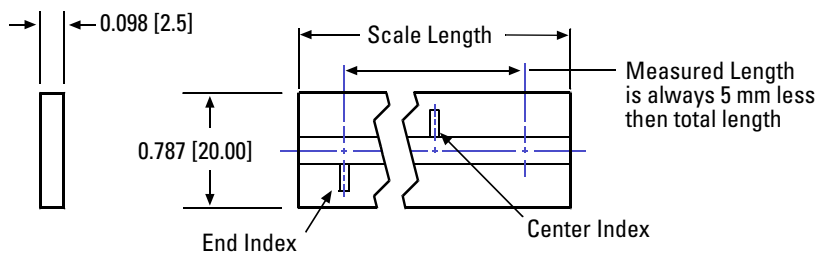
Model	L18	L30	L55	L80	L105	L130
Scale Length	0.709 [18]	1.181 [30]	2.165 [55]	3.150 [80]	4.134 [105]	5.118 [130]
Measured Length	0.512 [13]	0.984 [25]	1.969 [50]	2.953 [75]	3.937 [100]	4.921 [125]

Custom scales available

Standard Long Linear Scales

155mm and Longer

Key: inches[mm]



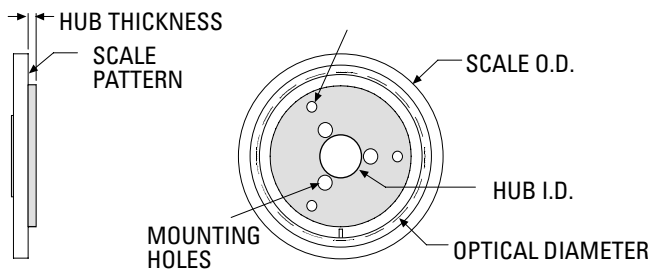
Specifications

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

Standard Rotary Scales



Key: inches[mm]

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

Custom scales available

Specifications

Material	Soda lime glass
Typical CTE	8ppm/°C

How to Order Mercury 1800 Encoder Systems

To specify your Mercury encoder with the desired scale, level of interpolation, alignment tool 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 1 [800] 355-4047

Example (Linear Encoder): M1810-S-200-L55-C1
 (Rotary Encoder): M1810-H-400-R1910-HA

<u>M18XX</u>	–	<u>Connector Type</u>	–	<u>Interpolation</u>	–	<u>Scale Model</u>	–	<u>Scale Mounting</u>
M1810 = 1m cable M1820 = 2m cable		S = Hi Density 26 pin D-sub H = Micro- connector		200 = x200 400 = x400		Lxxx or Rxxxx		For linear scales: T = Tape mounting C1 = 3 scale clamps* C2 = 10 scale clamps**
								Hubs for Rotary Scales: NH = Without Hub HE = for R1206 HA = for R1910 HB = for R3213 HC = for R5725 HD = for R10851

* 3 clamps for linear scales up to 130mm
 ** 10 clamps for linear scales 155mm or longer

How to Order SmartPrecision Alignment Tool (required for setup)

Example: Alignment Tool for Mercury 1800H encoder, 120 VAC = SSAT1800-120

<u>SSAT1800</u>	–	<u>Voltage</u>
		120 = 120 VAC, 60Hz US Std. 2-prong plug 220 = 220 VAC, 50Hz European Std. 2-prong plug

How to Order SmartPrecision Software for M1800 (optional)

Example: SmartPrecision Software for SSAT1800 Alignment Tool = SSWA1800 - 120

<u>SSWA1800</u>	–	<u>Voltage</u>
SmartPrecision software on CD with Interface Module, cable and power adapter		120 = 120 VAC, 60Hz US Std. 2-prong plug 220 = 220 VAC, 50Hz European Std. 2-prong plug

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

