

Mercury™ 1500V Vacuum Rated Digital Output Encoders

Factory Set Resolution to 0.50µm

Reflective Linear and Rotary Vacuum Encoders Systems

Typical
Vacuum Encoder System

Resolution
Factory Set:
x4, x8, x20, or x40
Linear: 5µm, 2.5µm, 1.0µm,
or 0.50µm
Rotary: 6,600 to 655,000 CPR

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

Output
A-quadr-B and
Digital Index Window

Vacuum
10⁻⁸ Torr

The New Mercury 1500V Digital Output Vacuum Encoder is a cost effective solution with high immunity to EMI noise and all digital outputs straight from the sensor.

Imagine what you can do with this!

The New Mercury 1500V Digital Output Vacuum Encoder delivers unmatched performance at a lower cost for your vacuum application. With all digital signals directly from the sensor the M1500V has high immunity to EMI noise and includes a 5m vacuum-rated cable. The sensor is vented and constructed with vacuum compatible materials rated up to 10⁻⁸ Torr and is designed for a 48 hour bake out at 150° C. The tiny sensor is easy to align and fits into very tight spaces and works in both linear and rotary applications. Color coded bare leads are provided for customer termination.

Standard features

- Digital A-quadr-B output and Index window
- Vacuum rating : 10⁻⁸ Torr ; bake out - 48 hours at 150° C (non-operating)
- Smallest sensor with ultra-low Z height
- Factory set interpolation x4, x8, x20, x40 for resolutions of 5µm to 0.50µm (linear); 6,600 CPR to 655,000 CPR (rotary)
- Bi-directional index signal
- Index mark at the center or end of the glass scale (linear)
- 5m vacuum cable with flying leads
- Alignment Tool enables fast set up (see pg 2)

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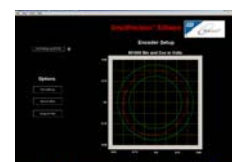
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Optional Features & Accessories

- SmartPrecision Alignment Tool

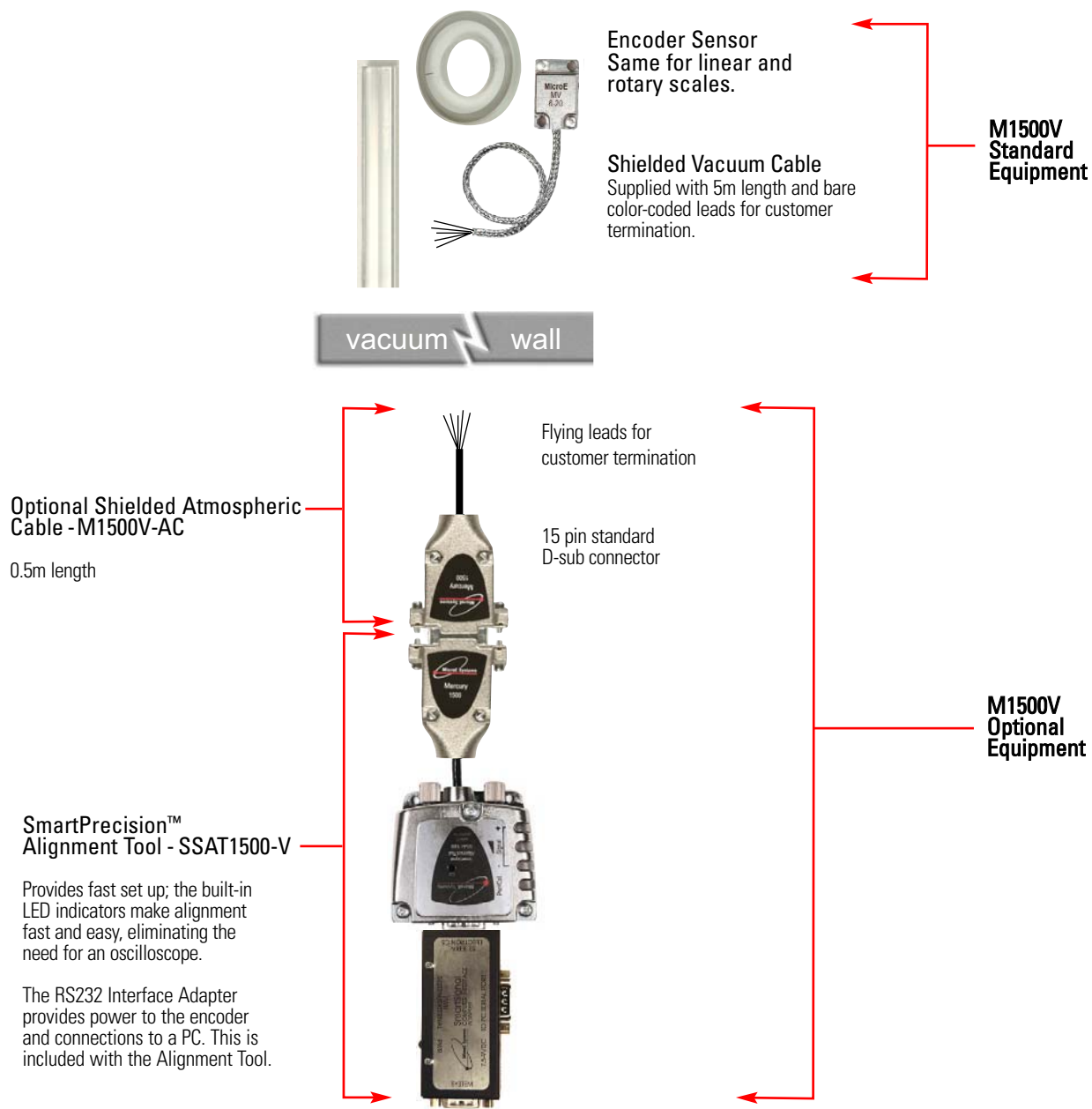


- 0.5m, atmospheric, double shielded cable with 15 pin D-sub connector
- Glass scale length or diameter:
Linear lengths from 5mm to 2m
Rotary diameters from 12mm to 108mm
- Vacuum-rated cable length of 5m or custom
- SmartPrecision Software for set up and monitoring



System Configurations

Standard and Optional Equipment



Optional Software

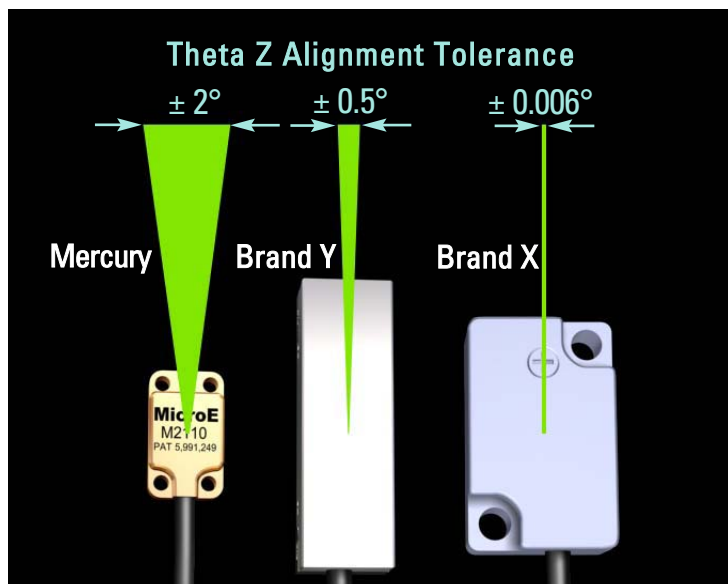
SmartPrecision™ Software



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

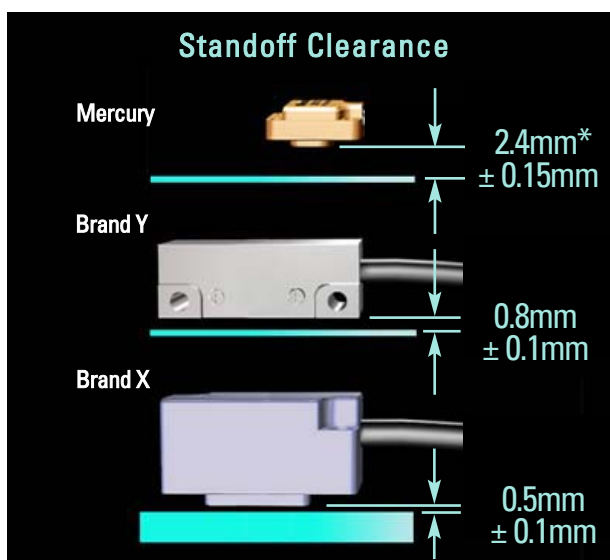
Mercury's sensor height is 44% shorter than competitive encoders, making it easy to fit into your design. This reduction can also cut total system weight and cost by allowing the use of smaller motors and stages. Safe system operation is also enhanced thanks to Mercury's generous standoff clearance—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

Resolution and Maximum Speed

Mercury 1500 systems have factory set interpolation: x4, x8, x20, x40. Below is the table of available resolutions.

Linear - 20µm grating pitch

Interpolation	Resolution	Maximum Speed
x4	5.000µm/count	7200mm/s
x8	2.500µm/count	7200mm/s
x20	1.000µm/count	7200mm/s
x40	0.500µm/count	7200mm/s

Rotary - 20µm grating pitch

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

0.472" [12.00mm]	1650 CPR	x4	x8	x20	x40
	interpolated resolution (CPR)	6,600	13,200	33,000	66,000
	interpolated resolution (arc-sec/count)*	196.4	98.2	39.2	19.64
	interpolated resolution (µrad/count)*	952	476	190.3	95.2
	maximum speed (RPM)	13090	13090	13090	13090
0.750" [19.05mm]	2500 CPR	x4	x8	x20	x40
	interpolated resolution (CPR)	10,000	20,000	50,000	100,000
	interpolated resolution (arc-sec/count)*	129.6	64.8	25.9	12.96
	interpolated resolution (µrad/count)*	628	314	125.6	62.8
	maximum speed (RPM)	8640	8640	8640	8640
1.250" [31.75mm]	4096 CPR	x4	x8	x20	x40
	interpolated resolution (CPR)	16,384	32,768	81,920	163,840
	interpolated resolution (arc-sec/count)*	79.1	39.6	15.82	7.91
	interpolated resolution (µrad/count)*	383	191.7	76.6	38.3
	maximum speed (RPM)	5273	5273	5273	5273
2.250" [57.15mm]	8192 CPR	x4	x8	x20	x40
	interpolated resolution (CPR)	32,768	65,536	163,840	327,680
	interpolated resolution (arc-sec/count)*	39.6	19.78	7.92	3.96
	interpolated resolution (µrad/count)*	191.7	95.8	38.3	19.17
	maximum speed (RPM)	2637	2637	2637	2637
4.250" [107.95mm]	16384 CPR	x4	x8	x20	x40
	interpolated resolution (CPR)	65,536	131,072	327,680	655,360
	interpolated resolution (arc-sec/count)*	19.78	9.89	3.96	1.978
	interpolated resolution (µrad/count)*	95.8	47.9	19.16	9.58
	maximum speed (RPM)	1318	1318	1318	1318

* 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	20µm
System Resolution	5µm, 2.5µm, 1.00µm, or 0.50µm (linear)
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.

**Or +/- one quadrature count, whichever error value is greater.

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

**Or +/- one quadrature count, whichever error value is greater.

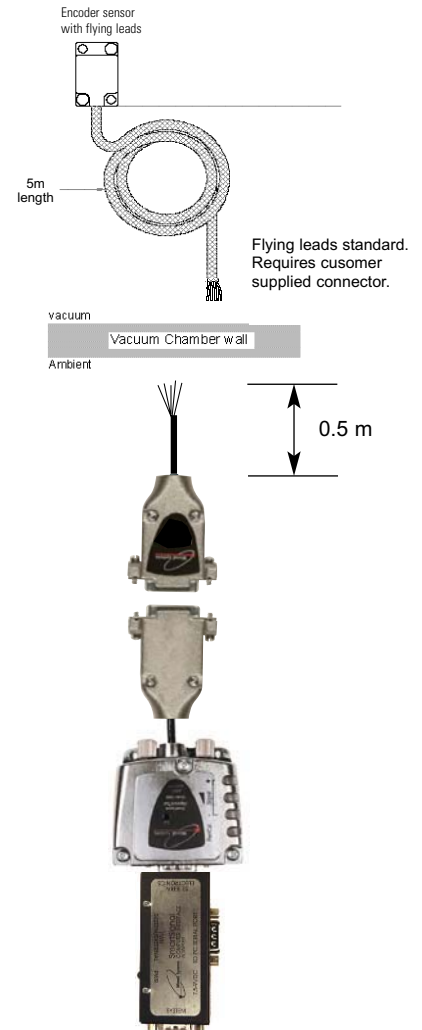
Sensor Size

W:	12.70mm	0.500"
L:	20.57mm	0.810"
H:	8.38mm	0.330"

Operating and Electrical Specifications

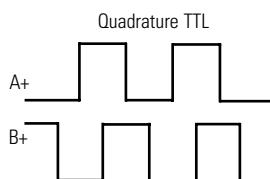
Vacuum	10 ⁻⁸ Torr, negligible outgassing
Bake Out	Up to 150°C; up to 48 hours, non-operating
Power Supply	5VDC ±5% @ 60mA
Temperature	
Operating:	Sensor: 0 to 70°C
Storage:	-20 to 70°C
Humidity:	10 - 90% RH non-condensing
Shock:	1500G 0.5 ms half sine
Sensor Weight:	2.7g (Sensor without cable)
Cable: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

Vacuum Encoder System

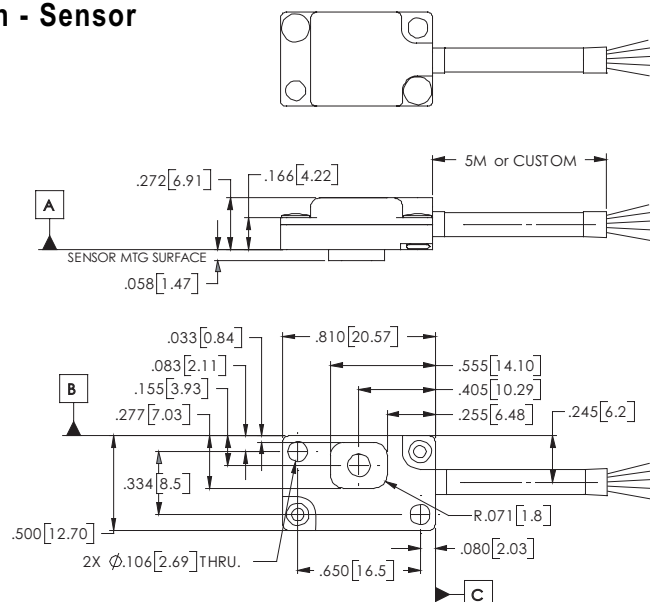
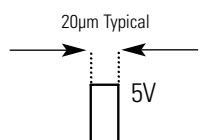


Mechanical and Electrical Information - Sensor

Output Signals



Index Window



Mechanical and Electrical Information

Mercury™ 1500V Flying Leads Color Code Signal Chart

Sensor Wires

COLOR	FUNCTION
Orange	A - quadrature
Brown	A + quadrature
Yellow	Sine+***
Green	Cosine+***
White	B- quadrature
Grey	B+ quadrature
Red	+5VDC
Black	Ground
Violet	Index Window+
Blue	Index Window-

*** Analog outputs are for sensor alignment only and are nominally 0.85Vpp with 1.7V offset.

SmartPrecision Alignment Tool, Model SSAT1500-V, Pin Assignments

15-pin Standard Female D-sub connector

PIN	FUNCTION
1	
2	
3	
4	A - quadrature
5	A + quadrature
6	
7	Sine+***
8	Cosine+***
9	B- quadrature
10	B+ quadrature
11	
12	+5VDC
13	Ground
14	Index Window+
15	Index Window-

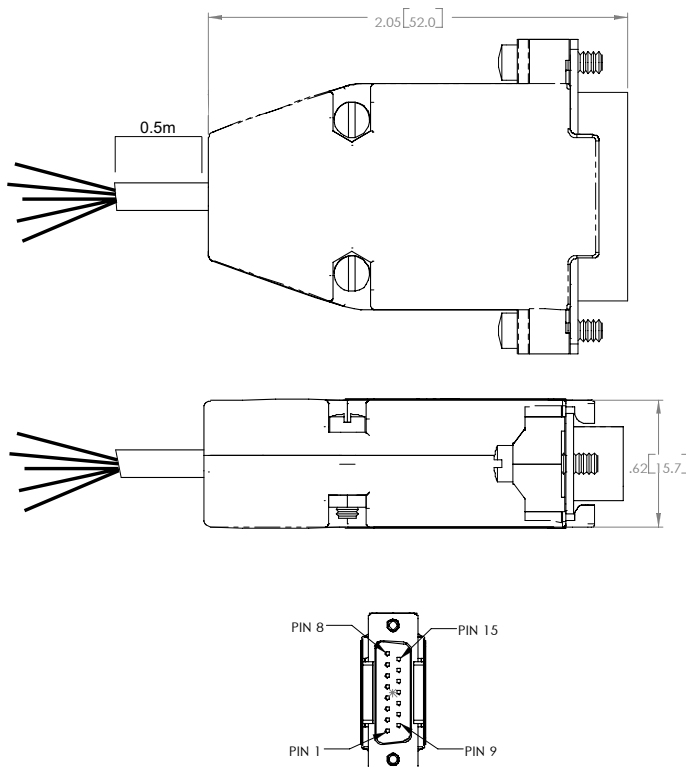
*** Analog outputs are for sensor alignment only and are nominally 0.85Vpp with 1.7V offset.

Atmospheric Cable, Model M1500-AC

M1500V-AC can be ordered for use with M1500V-MV units (one M1500V-AC per encoder) or for use with SSAT1500-V.

Flying Leads

COLOR	FUNCTION
Orange	A - quadrature
Brown	A + quadrature
Yellow	Sine+***
Green	Cosine+***
White	B- quadrature
1 Grey	B+ quadrature
Red	+5VDC
Black	Ground
Violet	Index Window+
Blue	Index Window-



15-pin Standard Male D-sub
connector

PIN	FUNCTION
1	
2	
3	
4	A - quadrature
5	A + quadrature
6	
7	Sine+***
8	Cosine+***
9	B- quadrature
10	B+ quadrature
11	
12	+5VDC
13	Ground
14	Index Window+
15	Index Window-

*** Analog outputs are for sensor alignment only and are nominally 0.85Vpp 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:

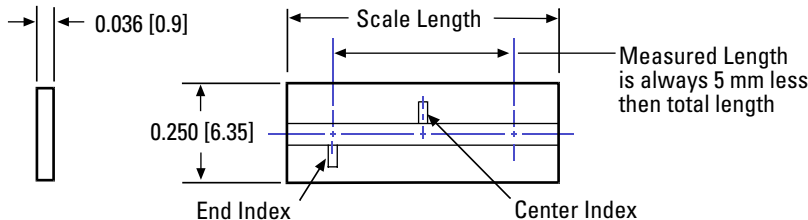
- *Standard linear*: 18mm - 2m
- *Standard rotary*: 12mm - 107.95mm diameter, with or without hubs
- *Custom linear**: special lengths, widths, thickness, index mark locations and special low CTE materials
- *Custom rotary**: special ID's, OD's (up to 304.8mm), index mark outside the main track and special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

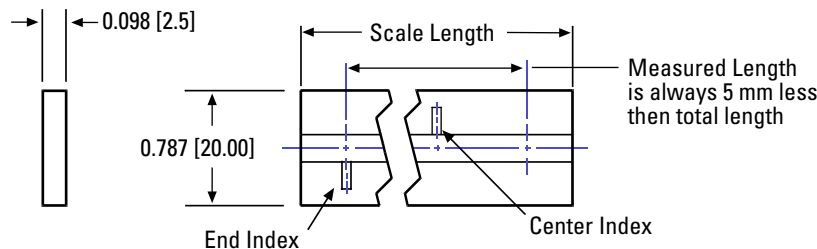
Model	L18	L30	L55	L80	L105	L130
Scale Length	0.709 [18]	1.181 [30]	2.165 [55]	3.150 [80]	4.134 [105]	5.118 [130]
Measured Length	0.512 [13]	0.984 [25]	1.969 [50]	2.953 [75]	3.937 [100]	4.921 [125]

Custom scales available

Standard Long Linear Scales

155mm and Longer

Key: inches[mm]



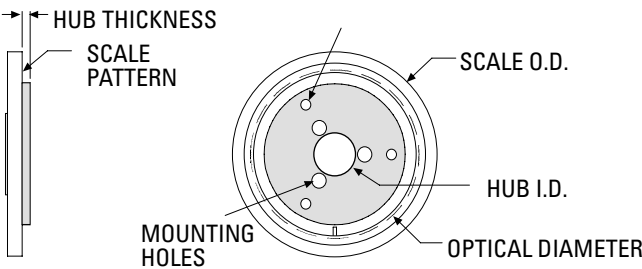
Specifications

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

Standard Rotary Scales



Specifications	
Material	Soda lime glass
Typical CTE	8ppm/°C

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 1500V Encoder Systems

To specify your Mercury encoder with the desired scale, level of interpolation, 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): M1500V-MV-8-L55-C1 Example (Rotary Encoder): M1500V-MV-40-R1910-HA

<u>M1500V-MV</u>	–	<u>Interpolation</u>	–	<u>Scale Model</u>	–	<u>Scale Mounting</u>
		4 = 4x		Lxxx or Rxxxx		For linear scales: C1 = 3 scale clamps* C2 = 10 scale clamps**
		8 = 8x				
		20 = 20x				
		40 = 40x				
						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

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

Note: Scale mounting clamps are not vacuum rated.

How to Order Atmospheric Cable

M1500V-AC can be ordered for use with M1500V-MV units (one M1500V-AC per encoder) or for use with SSAT1500-V.

M1500V-AC

How to Order SmartPrecision Alignment Tool

Example: Alignment Tool for Mercury 1500V encoder, 120 VAC = SSAT1500-V-120

NOTE:

The M1500V-AC Atmospheric cable is recommended when purchasing an SSAT1500-V Alignment Tool.

SSAT1500-V – Voltage

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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 SSAT1500 Alignment Tool

SmartPrecision Software

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SSWA-AT = SmartPrecision software on CD

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