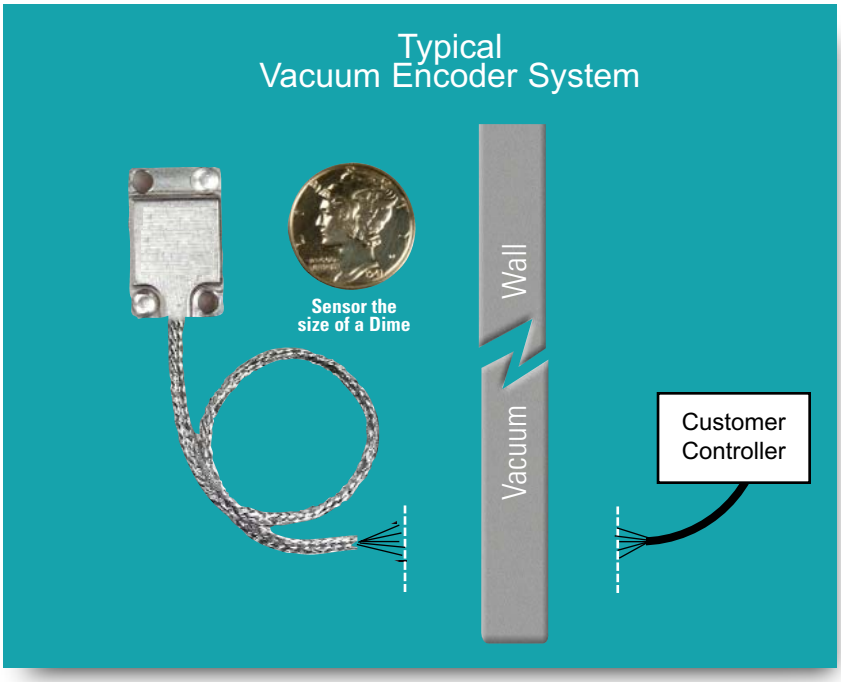
목록

Mercury™ 1500V Vacuum Rated Digital Output Encoders

Factory Set Resolution to 0.50µm

Reflective Linear and Rotary Vacuum Encoders Systems



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-quad-B and
Digital Index Window

Vacuum
10^{-8} Torr

The 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 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-quad-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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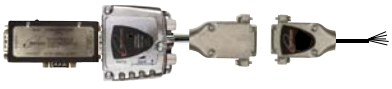
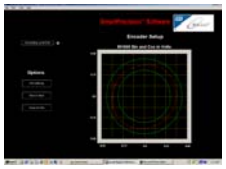
Optional Features & Accessories

- *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

Encoder Sensor
Same for linear and rotary scales.

Shielded Vacuum Cable
Supplied with 5m length and bare color-coded leads for customer termination.

Mercury 1500V Standard Equipment

Optional Shielded Atmospheric Cable - M1500V-AC

0.5m length

Flying leads for customer termination

15 pin standard D-sub connector

Mercury 1500V Optional Equipment

SmartPrecision™ Alignment Tool - SSAT1500S

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

The RS232 Interface Adapter provides power to the encoder and connections to a PC. This is included with the Alignment Tool.

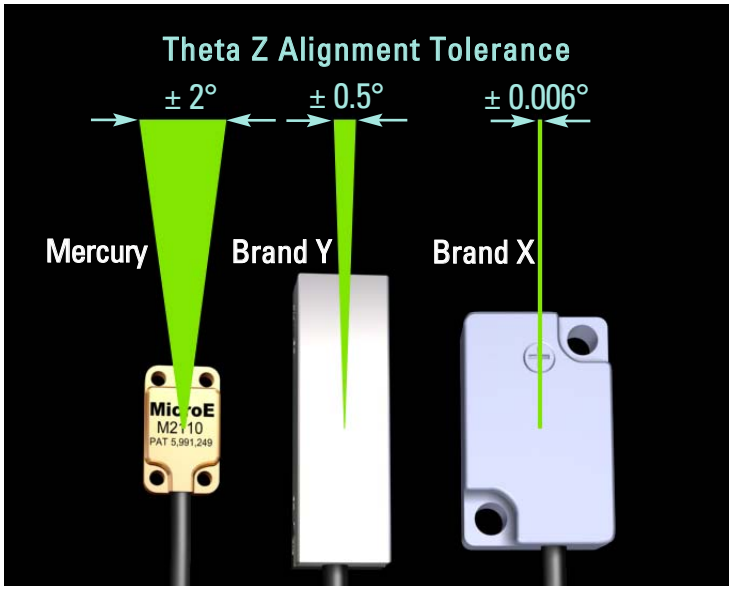
Optional Software

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 ± 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

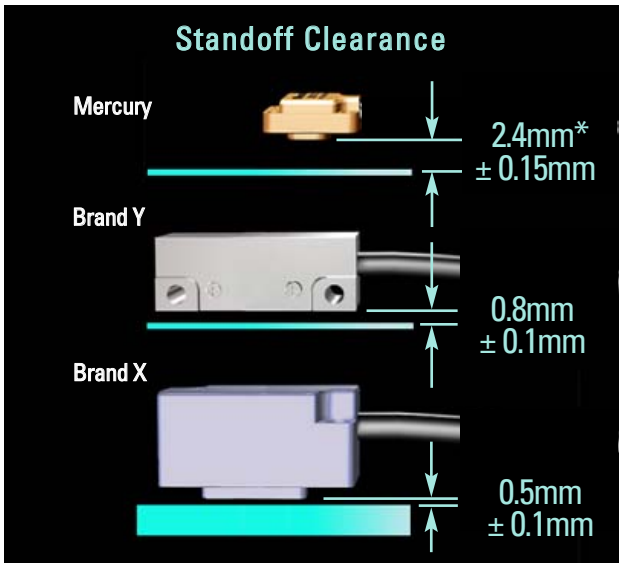
Mercury Can Reduce System Size and Cost

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 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.

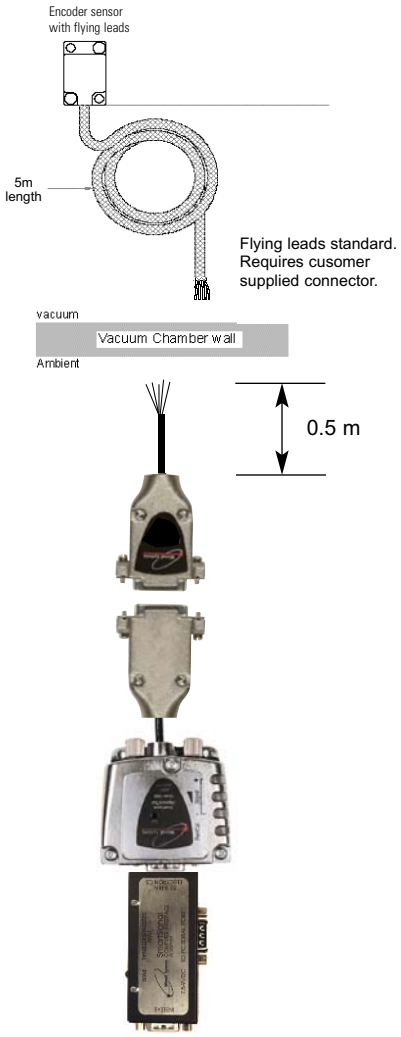
Sensor Size

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

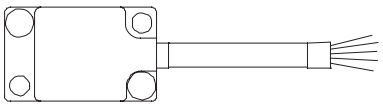
Operating and Electrical Specifications

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.

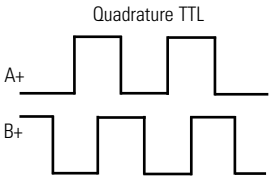
Vacuum Encoder System



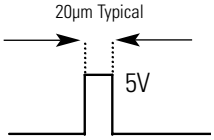
Mechanical and Electrical Information - Sensor

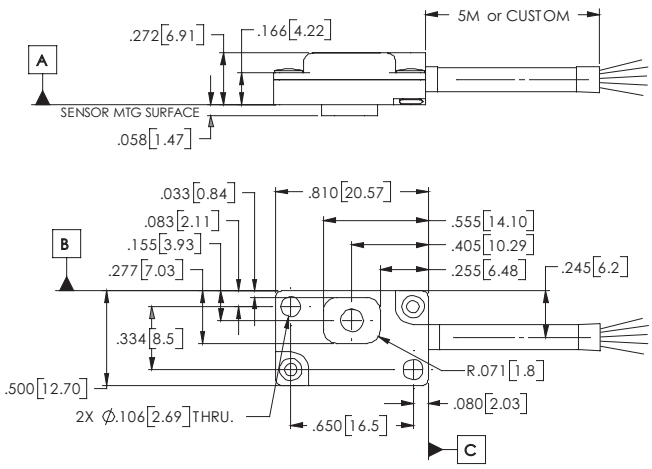


Output Signals



Index Window





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 0.85V_{PP} with 1.7V offset.

SmartPrecision Alignment Tool, Model SSAT1500S, Pin Assigments

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-

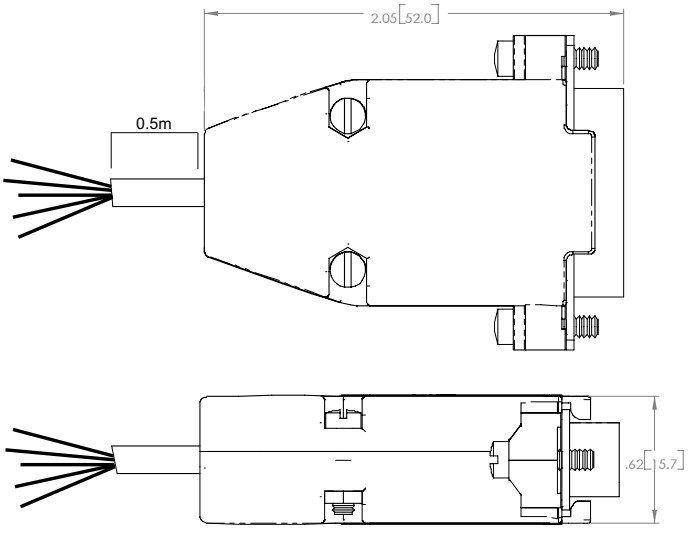
*** Analog outputs are for sensor alignment only and are nominally 0.85V_{PP} with 1.7V offset.

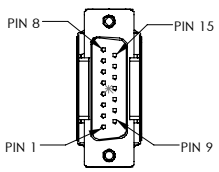
Atmospheric Cable, Model M1500-AC

M1500V-AC can be ordered for use with M1550V units (one M1500V-AC per encoder) or for use with SSAT1500S.

Flying Leads

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-





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 0.85V_{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:

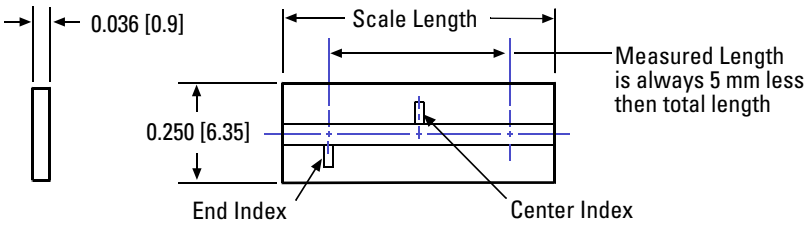
- *Standard linear:* 18mm - 2m
- *Standard rotary:* 12mm - 107.95mm diameter, with or without hubs
- *Custom linear*:* special lengths, widths, thickness, index mark locations and special low CTE materials
- *Custom rotary*:* special ID's, OD's (up to 304.8mm), index mark outside the main track and special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

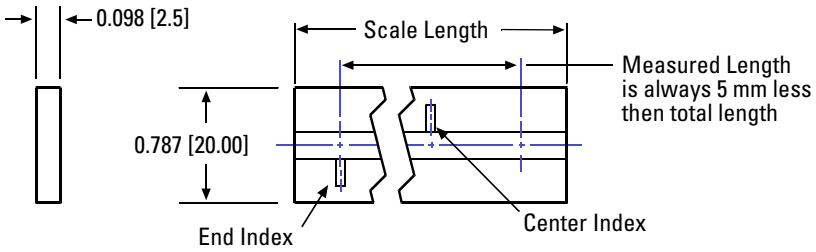
Model	L18	L30	L55	L80	L105	L130
Scale Length	0.709 [18]	1.181 [30]	2.165 [55]	3.150 [80]	4.134 [105]	5.118 [130]
Measured Length	0.512 [13]	0.984 [25]	1.969 [50]	2.953 [75]	3.937 [100]	4.921 [125]

Custom scales available

Standard Long Linear Scales

155mm and Longer

Key: inches[mm]

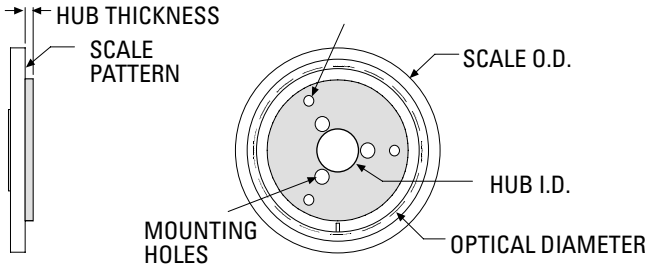


Specifications	
Accuracy	±5 µm <1m ±5 µm/m >1m
Material	Soda lime glass
Typical CTE	8ppm/°C
Index	Center or End

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 **[781] 266-5700.**

Example (Linear Encoder): M1550V-8-L55-C1 Example (Rotary Encoder): M1550V-40-R1910-HA

M1550V – Interpolation – Scale Model – Scale Mounting

Interpolation	Scale Model	Scale Mounting
4 = 4x 8 = 8x 20 = 20x 40 = 40x	Lxxx or Rxxxx	For linear scales: 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

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 M1550V units (one M1500V-AC per encoder) or for use with SSAT1500S.

M1500V-AC

Atmospheric cable, 0.5m long, flying leads/15-pin standard D-sub connector

How to Order SmartPrecision Alignment Tool

Example: Alignment Tool for Mercury 1500V encoder, 120 VAC = SSAT1500S-120

NOTE:
The M1500V-AC Atmospheric cable is recommended when purchasing an SSAT1500S Alignment Tool.

SSAT1500S – 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 SSAT1500 Alignment Tool

SmartPrecision Software

SSWA-AT = SmartPrecision software on CD

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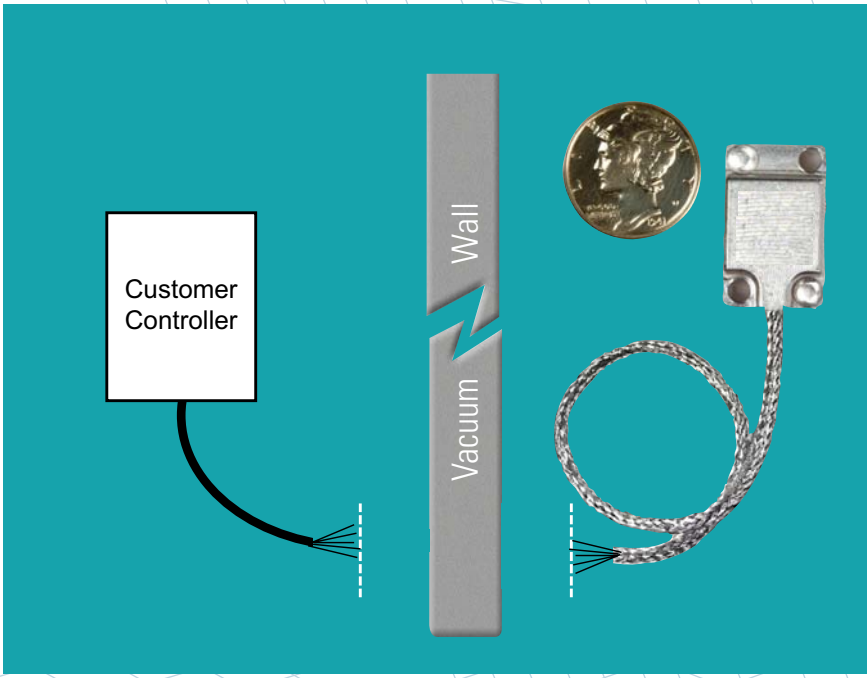
Preliminary 8/20/2008

Mercury™ 1500V - Vacuum Rated

Digital Output Encoder System

Installation Manual and Reference Guide



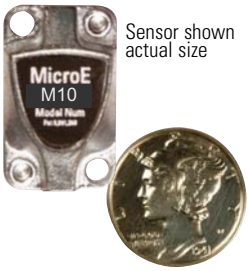
GSI MicroE Systems®

Enabling Technology™

Manual No. IM-M1500V Rev S7

Introduction

MicroE Systems was founded to advance encoder technology to a level never before achieved. Our objective was to design encoder systems that would be small enough to fit into densely packed OEM equipment designs, affordable enough for cost-sensitive applications and easy enough to enable installation, setup and alignment by assemblers with little training. We are pleased to say that all of these goals have been realized with the introduction of the Mercury family of encoders.



Sensor shown actual size

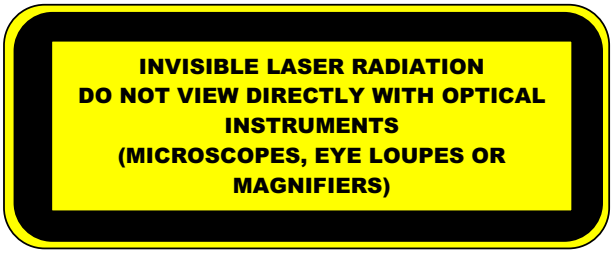
Precautions

1. Follow standard ESD precautions. Turn power off before connecting the sensor. Do not touch the electrical pins without static protection such as a grounded wrist strap.
2. Do not touch the glass scale unless you are wearing talc-free gloves or finger cots. Please read this installation manual for full instructions.

LASER SAFETY INFORMATION: Mercury & ChipEncoder

This product is sold solely for use as a component (or replacement) in an electronic product; therefore it is not required to, and does not comply with, 21 CFR 1040.10 and 1040.11 which pertain to complete laser products. The manufacturer of the complete system-level electronic product is responsible for complying with 21 CFR 1040.10 and 1040.11 and for providing the user with all necessary safety warnings and information.

MicroE encoders contain an infrared laser diode or diodes. Emitted invisible laser radiation levels have been measured to be within the CDRH Class 1 range, which is not considered hazardous; however, to minimize exposure to the diverging beam, the encoder sensor should be installed in its operational configuration in close proximity to the encoder scale before power is applied.



- Invisible laser radiation; wavelength: 850 nm
- Max power 2.4 mW CW (4.8 mW CW for Mercury II™)
- CAUTION – The use of optical instruments with this product will increase eye hazard. DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MICROSCOPES, EYE LOUPES OR MAGNIFIERS).
- All maintenance procedures such as cleaning must be performed with the MicroE encoder turned off.
- Do not insert any reflective surface into the beam path when the encoder is powered.
- Do not attempt to service the MicroE encoder.

Patents

Covered by the following patents: US 5,991,249; EP 895,239; JP 3,025,237; US 6,897,435; and EP 1,451,933. Additional patents and patents pending may apply.

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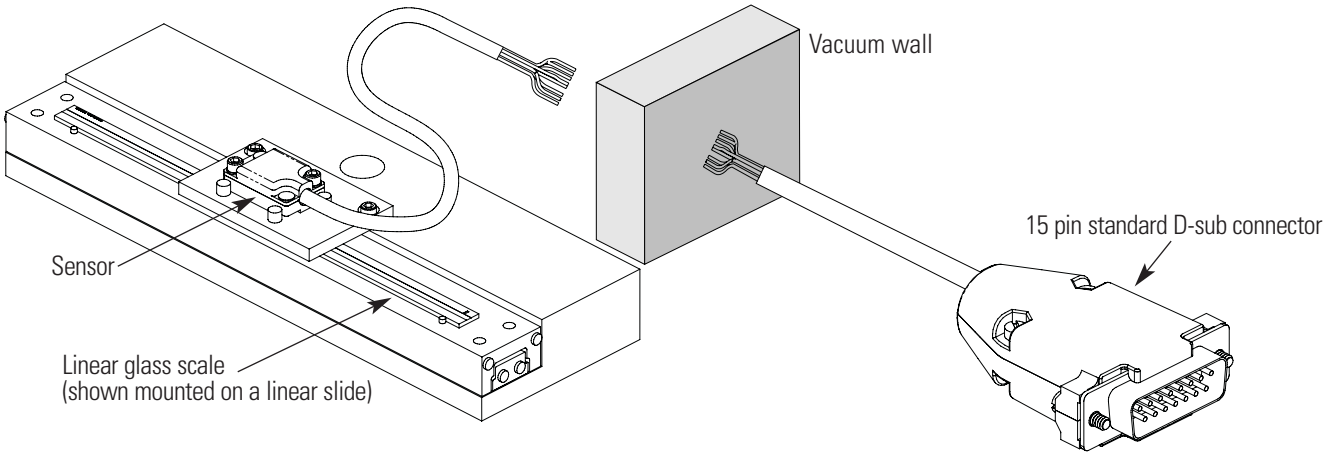
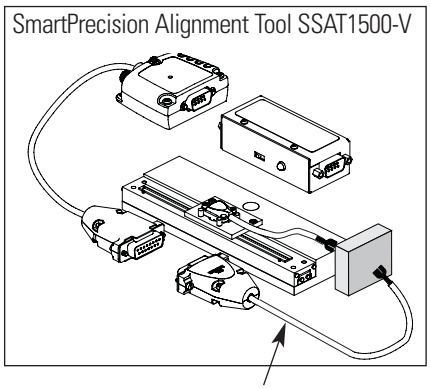
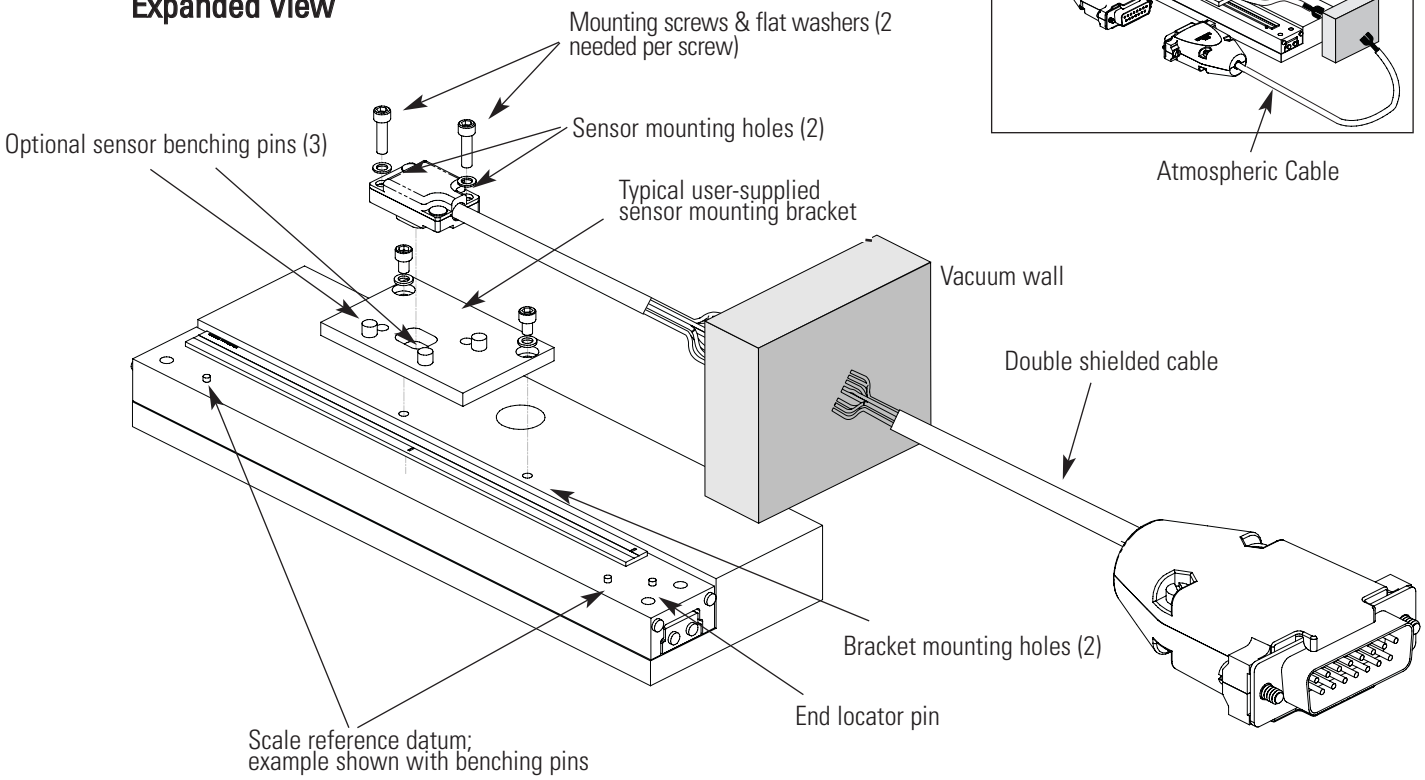
Mercury™ 1500V Encoder System
with Linear scale

System View
Shown with linear scale



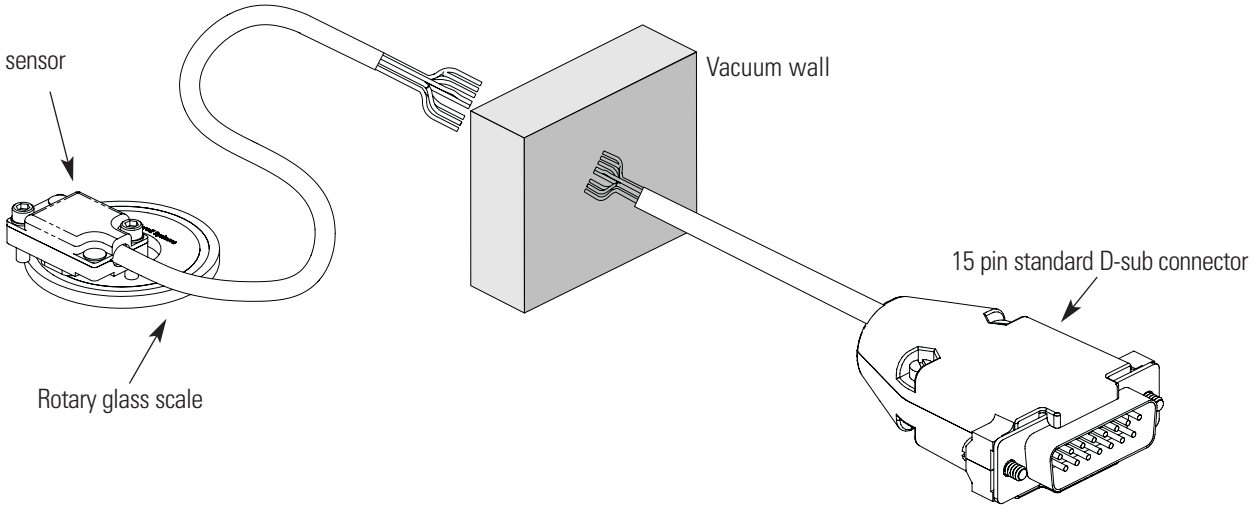


Expanded View

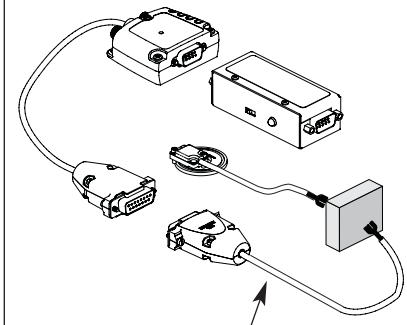


Mercury 1500V Encoder System
with Rotary scale

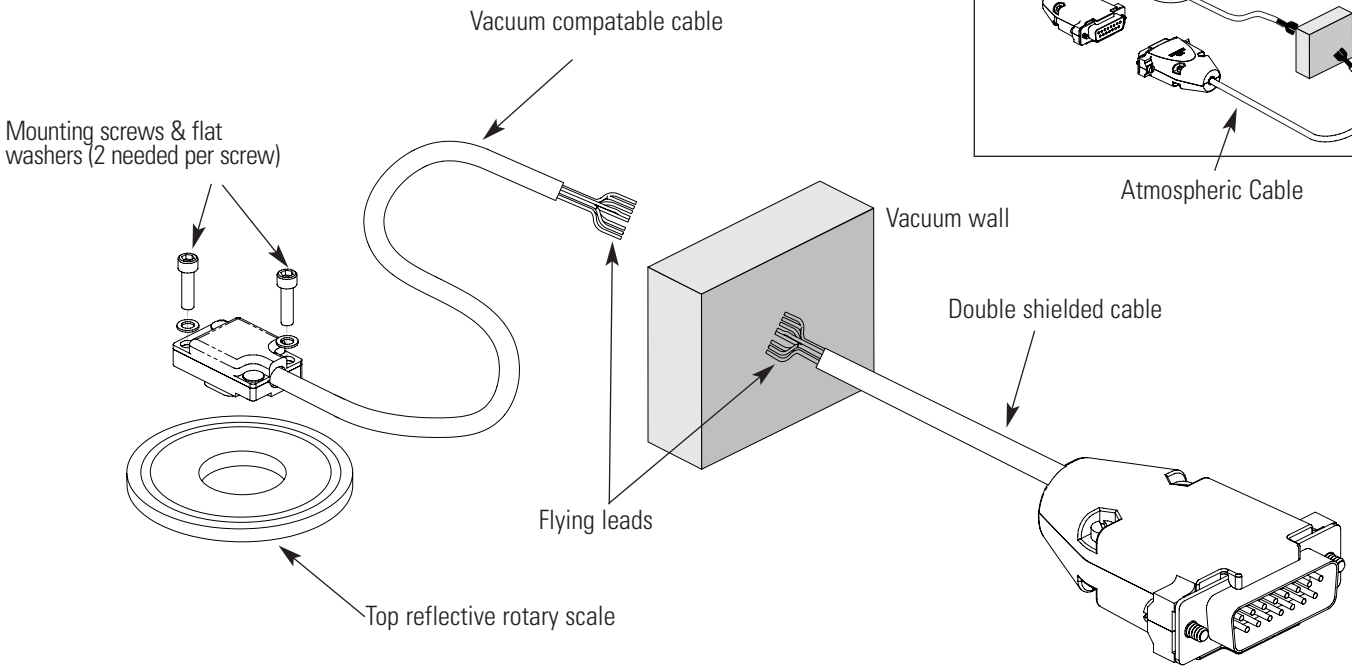
System View
Shown with rotary scale



SmartPrecision Alignment Tool SSAT1500-V



Expanded View



Installation Instructions
Linear Encoders - Using Alignment Tool - Mounting

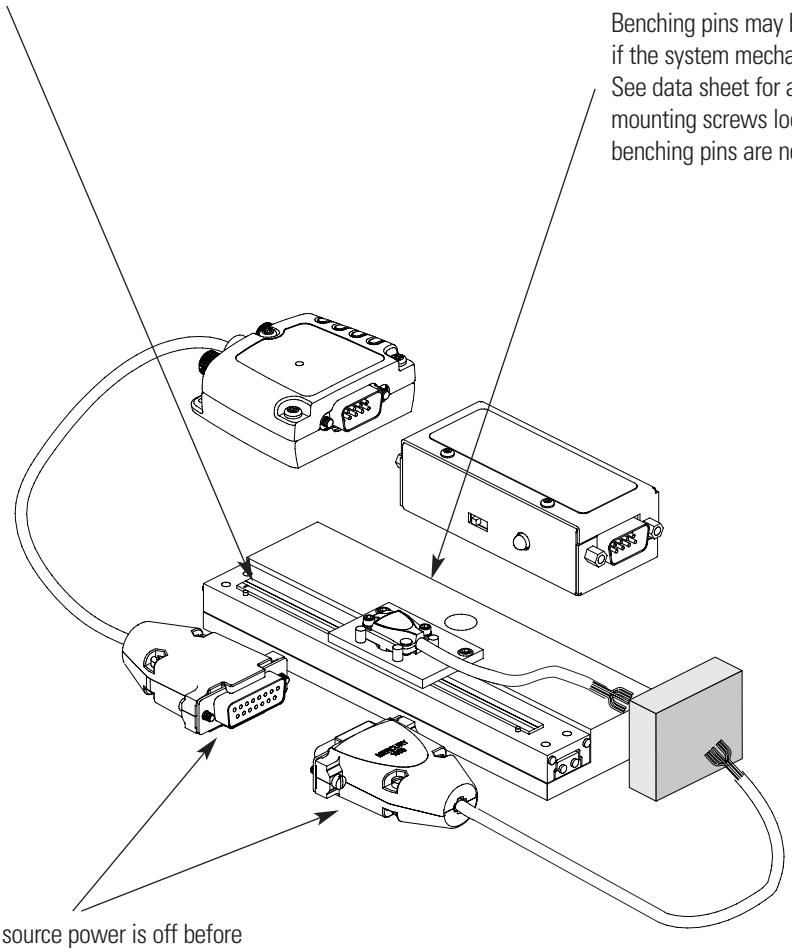
1 Attach the scale to the base slide. Reference the preferred datum on the interface drawing for either end or center index orientation.

Depending on the mounting method, attach the scale to the slide with adhesive. Refer to pg. 12 for details.

Be sure the grating surface of the scale faces the sensor. Insure that there is no contact between these surfaces or damage may result.

2 Install the sensor on your mounting surface referencing the appropriate datum surface as shown on the interface drawing. Use 2 washers per mounting screw.

Benching pins may be used to locate the sensor if the system mechanical tolerances are adequate. See data sheet for alignment tolerances, or keep mounting screws loose for sensor alignment if benching pins are not used.



3 Be sure the source power is off before connecting the SmartPrecision™ II Alignment Tool.

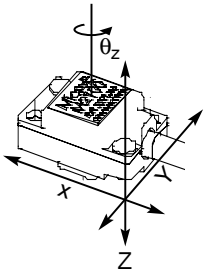
Connect the M1500V to the SmartPrecision II Alignment Tool. (The M1500V-AC Atmospheric Cable shown in the illustration above is optional. A customer-supplied cable may be used.)

4 Connect the Alignment Tool to the Computer Interface Adapter. Turn on the power.

5 Proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed easily using the SmartPrecision Alignment Tool as illustrated below.

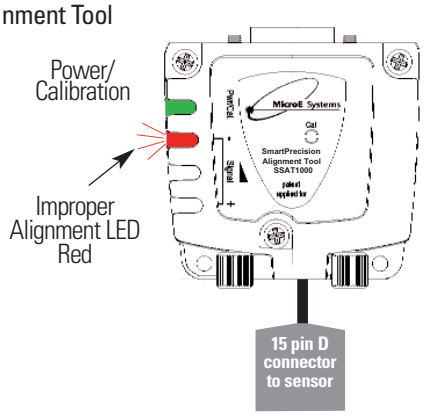
The red, yellow, or green LED will light depending on sensor alignment. Slowly move the sensor by allowing it to slide on the mounting surface until the green LED, is illuminated. Optimal alignment will be displayed as a "Bright Green" LED.

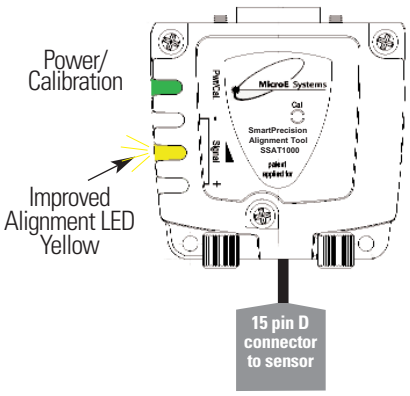
IMPORTANT: Confirm that the green LED blinks when passing over the index. If not, readjust the sensor in the Y direction and repeat the above procedure. When alignment is completed, tighten the sensor mounting screws.

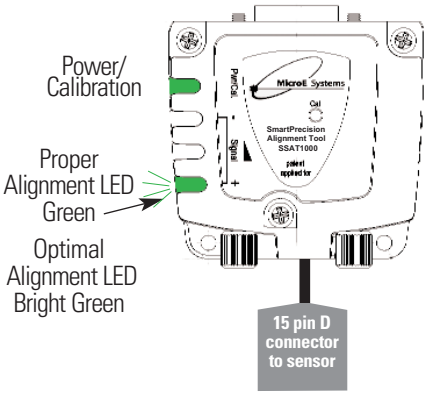


To align the sensor, move it in the Y or θ_Z directions.

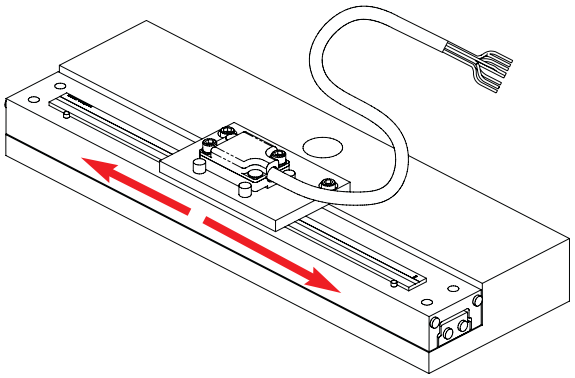
SmartPrecision Alignment Tool







6 Confirm green over the full range of motion by sliding the scale past the sensor. The "green" LED must remain on over the entire range. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat step 5.

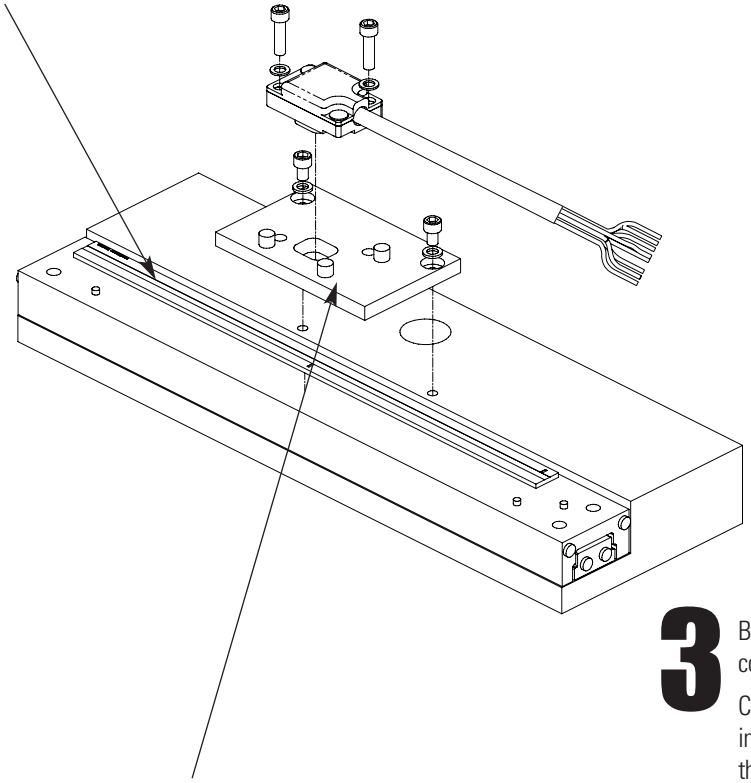


Installation Instructions
Linear Encoders - Using Sin/Cos Signals - Mounting

1 Attach the scale to the base slide. Reference the preferred datum on the interface drawing for either end or center index orientation.

Depending on the mounting method, attach the scale to the slide with adhesive. Refer to pg. 12 for details.

Be sure the grating surface of the scale faces the sensor. Insure that there is no contact between these surfaces or damage may result.



2 Install the sensor on your mounting surface referencing the appropriate datum surface as shown on the interface drawing. Use 2 washers per mounting screw.

Benching pins may be used to locate the sensor if the system mechanical tolerances are adequate. See data sheet for alignment tolerances, or keep mounting screws loose for sensor alignment if benching pins are not used.

3 Be sure power is off before connecting the sensor.

Connect the M1500V to your interface electronics using the wire color/signal assigments described on the interface drawing.

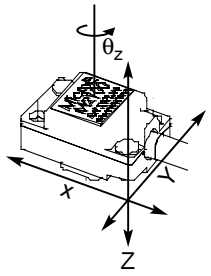
Tighten the connector screws.

Power up the system.

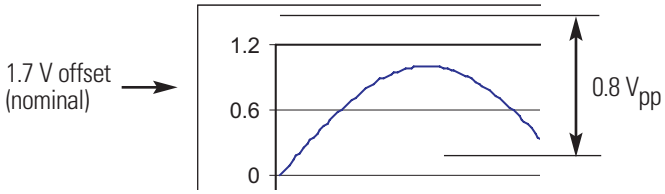
4 MAIN TRACK ALIGNMENT

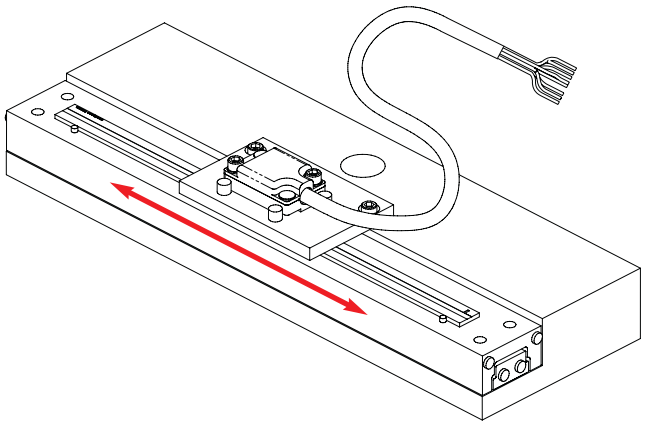
If benching dimensions cannot be provided, proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed by maximizing the sine signal from the M1500V.

Using an oscilloscope, monitor the sine or cosine signal (refer to the interface drawing for pinouts) while moving the sensor over the scale. Align the sensor until 0.8 volts peak-to-peak +/- 25% is obtained. When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).



To align the sensor, move it in the Y or θ_Z directions.





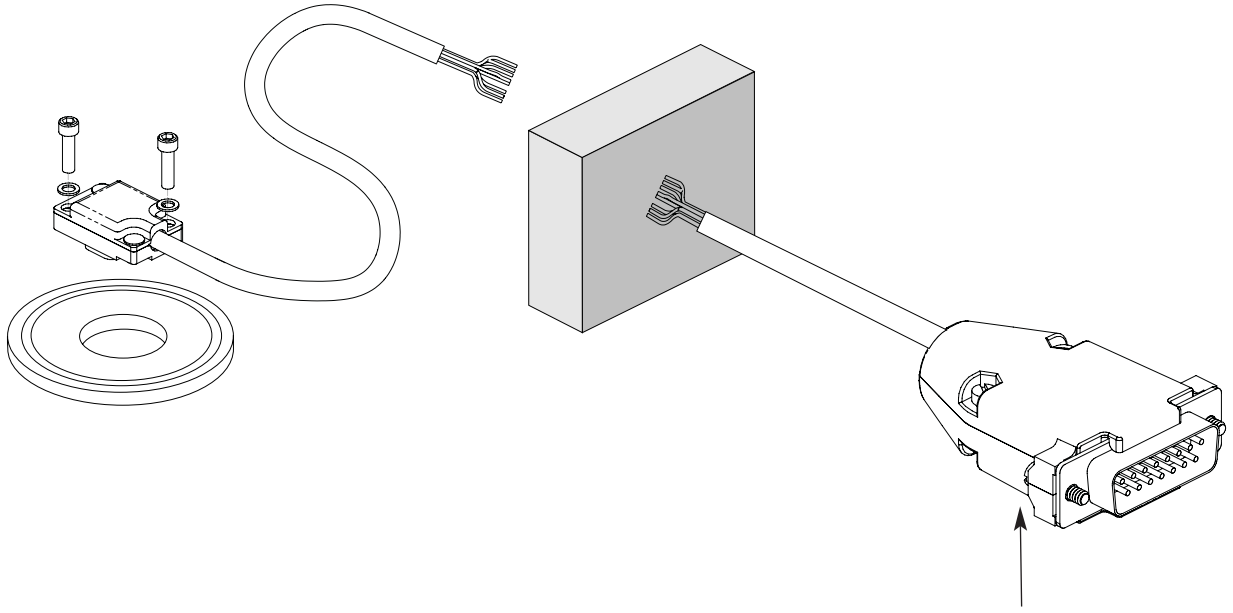
5 INDEX TRACK ALIGNMENT

The M1500V must be aligned for both the main and index tracks. When properly aligned, the sensor will produce an index window as the sensor passes over the index mark. The index window is approximately one fringe wide (20µm). To verify proper index track alignment, use a digital oscilloscope triggered on the index window. Refer to the interface drawing for the index window pinout.

Confirm proper alignment of the main track over the full range of motion. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat steps 4 and 5.

Installation Instructions
Rotary Encoders - Using Alignment Tool - Mounting

1 Attach your hub/scale assembly to the rotary device. Refer to the interface drawing. The reflective surface of the scale must face the sensor.



3 Be sure the source power is off before connecting the SmartPrecision Alignment Tool. (The M1500V-AC Atmospheric Cable shown above is optional. A customer-supplied cable may be used.)

Connect the M1500V encoder to the SmartPrecision Alignment Tool.

2 Install the sensor on your mounting surface referencing the appropriate datum surface as shown on the interface drawing. Use 2 washers per mounting screw.

Benching pins may be used to locate the sensor if the system mechanical tolerances are adequate. See data sheet for alignment tolerances, or keep mounting screws loose for sensor alignment if benching pins are not used.

To Power Supply

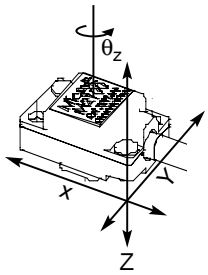
4 Connect the Alignment Tool to the Computer Interface Adapter. Turn on the power.

To M1500V encoder

5 Proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed easily using the SmartPrecision Alignment Tool as illustrated below.

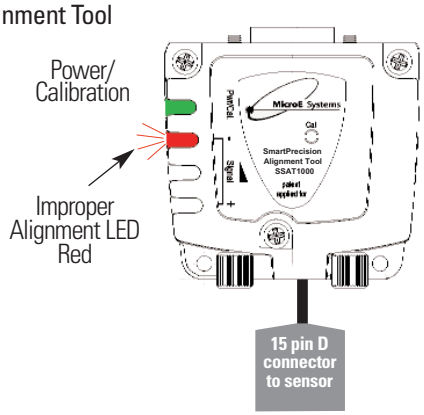
The red, yellow, or green LED will light depending on sensor alignment. Slowly move the sensor by allowing it to slide on the mounting surface until the green LED, is illuminated. Optimal alignment will be displayed as a "Bright Green" LED.

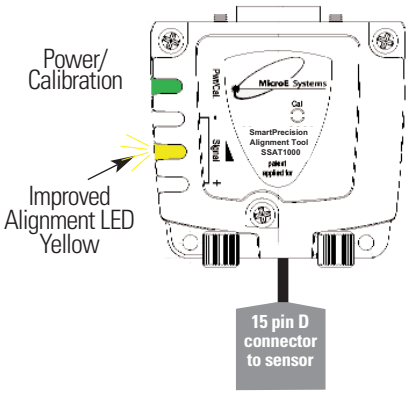
IMPORTANT: Confirm that the green LED blinks when passing over the index. If not, readjust the sensor in the Y direction and repeat the above procedure. When alignment is completed, tighten the sensor mounting screws.

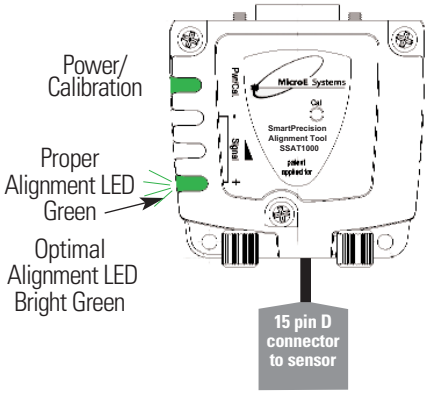


To align the sensor, move it in the Y or θ_Z directions.

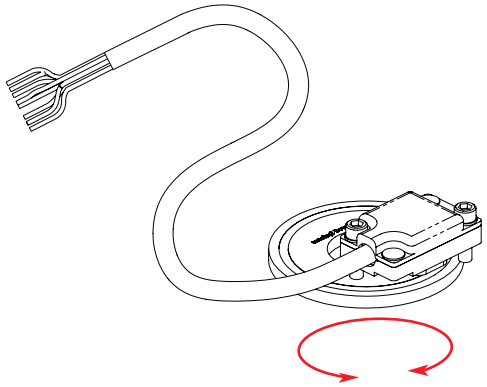
SmartPrecision Alignment Tool





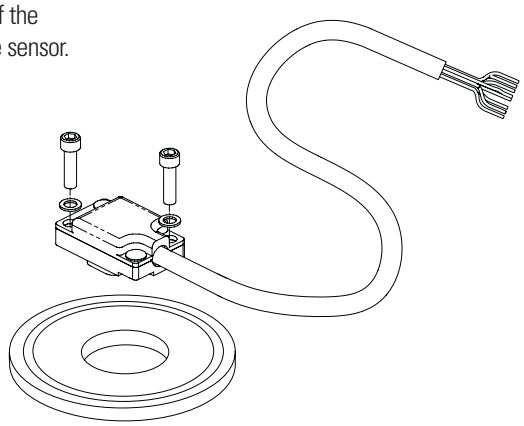


6 Confirm green over the full range of motion by sliding the scale past the sensor. The "green" LED must remain on over the entire range. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat step 5.



Installation Instructions
Rotary Encoders - Using Sin/Cos Signals - Mounting

1 Attach your hub/scale assembly to the rotary device. Refer to the interface drawing. The reflective surface of the scale must face the sensor.



2 Install the sensor on your mounting surface referencing the appropriate datum surface as shown on the interface drawing. Use 2 washers per mounting screw.

Benching pins may be used to locate the sensor if the system mechanical tolerances are adequate. See data sheet for alignment tolerances, or keep mounting screws loose for sensor alignment if benching pins are not used.

3 Be sure power is off before connecting the sensor.

Connect the M1500V to your interface electronics using the wire color/signal assignments described on the interface drawing.

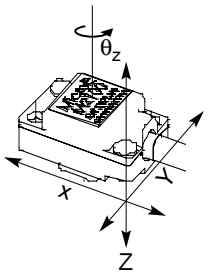
Tighten the connector screws.

Power up the system.

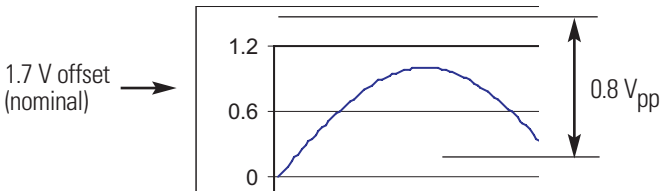
4 MAIN TRACK ALIGNMENT

If benching dimensions cannot be provided, proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed by maximizing the sine signal from the M1500V.

Using an oscilloscope, monitor the sine or cosine signal (refer to the interface drawing for pinouts) while moving the sensor over the scale. Align the sensor until 0.8 volts peak-to-peak +/- 25% is obtained. When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).



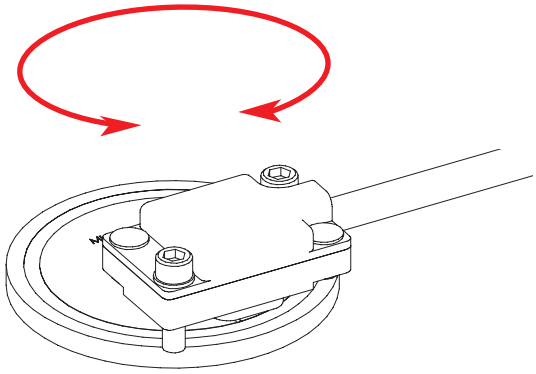
To align the sensor, move it in the Y or θ_Z directions.



5 INDEX TRACK ALIGNMENT

The M1500V must be aligned for both the main and index tracks. When properly aligned, the sensor will produce an index window as the sensor passes over the index mark. The index window is approximately one fringe wide (20µm). To verify proper index track alignment, use a digital oscilloscope triggered on the index window. Refer to the interface drawing for the index window pinout.

Confirm proper alignment of the main track over the full range of motion. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat steps 4 and 5.



Reference Section

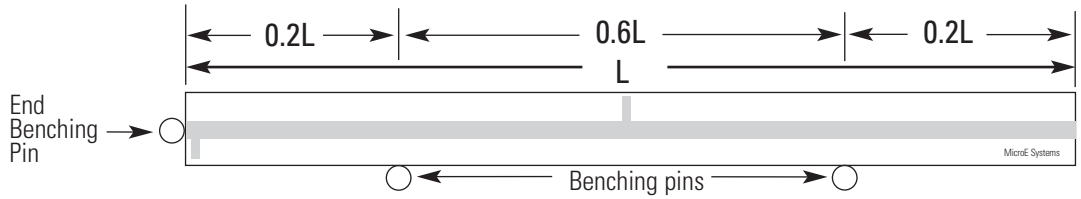
Installation of Linear Scales

Positioning the Scale

Note: Before beginning mounting procedure, use talc-free gloves or finger cots to handle the scales. Also use vacuum compatible handling procedures and materials . "Benching" the scale to the system means aligning the scale by means of benching pins. Pin locations are described on the appropriate interface drawing. Two benching pins are recommended on the long side of the scale and one at the end as shown . This is marked datum A on the interface drawing.

1 Position the benching pins in from either end. 20% of the overall scale length is the recommended location from the edge.

2 Be sure the benching pins do not extend too high in the Z direction to prevent mechanical interference with the sensor or sensor mount.

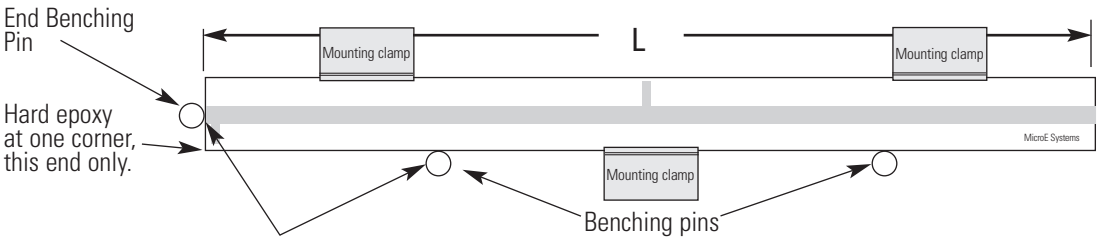


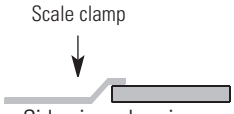
Mounting the Scale

Suggested Epoxy and Clamp Mounting

1 Make sure the mounting surface is clean and dry.

3 Scale clamps (customer supplied) may be used to mechanically secure the scale. The clamps should allow for thermal expansion of the scale and mounting surface. Make sure that the clamps do not interfere with the sensor or sensor mount. Note: adhesive used on clamps supplied by MicroE is not vacuum rated.





Side view showing suggested scale clamps and scale. Space clamps every 75mm on scales over 150 mm in length.

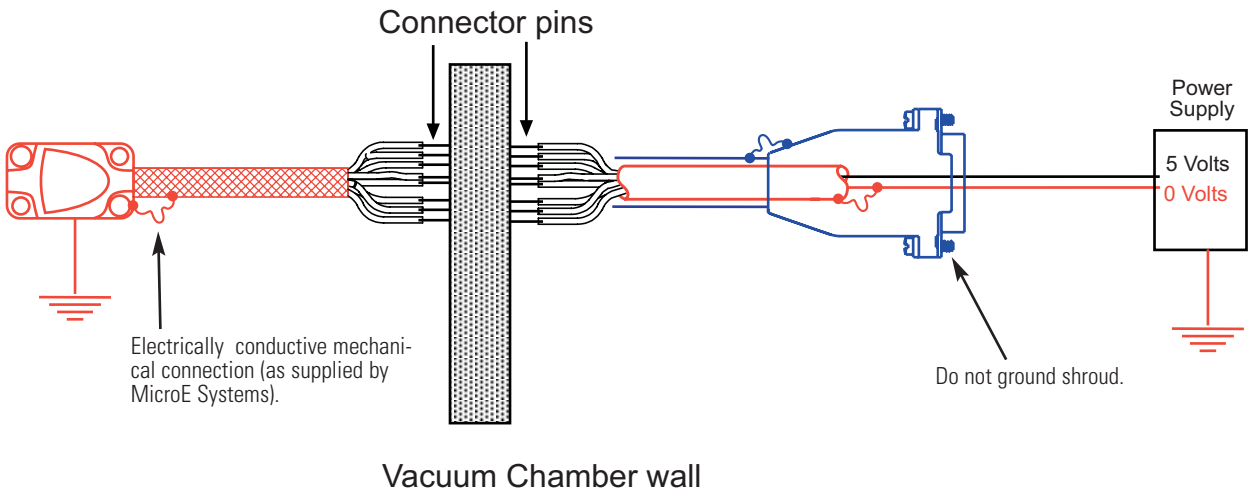
2 Align the scale by placing the edges against the benching pins.

4 Apply a hard, vacuum compatible epoxy to the end of the scale at the end benching pin.

Grounding Instructions for Mercury 1500V Encoder Systems

Correct grounding can be implemented in several ways depending on how the customer implements the connections through the vacuum chamber wall. The diagram below is suitable where:

- The outer cable shields are electrically isolated from each other at the vacuum chamber wall.
- The sensor is mounted with good electrical contact to a well-grounded surface. (Note that an electrical path through bearings will not result in a well-grounded sensor.)



Note: specific applications may require a different grounding scheme. Contact MicroE Systems for applications support.

Shielding Instructions

Customer-installed connectors at the vacuum chamber wall must electrically shield the signal wires from Electro Magnetic Interference, Radio Frequency Interference and Electro Static Discharge. The connectors' shielding must completely surround the wires with no gaps, including intimate electrical contact 360 degrees around the outer cable shields at the ends of the cables supplied with flying leads. The inner shield of the cable that is attached to the SmartPrecision electronics module must be electrically isolated from the outer shield.

Important Note

MicroE Systems recommends testing the motion subsystem after the Mercury 1500V encoders are installed using your vacuum through-wall connectors. The testing should prove that the motion system has sufficient immunity to Electro Magnetic Interference, Radio Frequency Interference and Electro Static Discharge according to the application requirements.

Recommendations for Power

Mercury encoders require a minimum of 4.75V DC continuously. When designing circuits and extension cables to use Mercury encoders, be sure to account for voltage loss over distance and tolerances from the nominal supply voltage so that at least 4.75V DC is available to the Mercury encoder under all operating conditions. The input voltage should not exceed 5.25V DC.

Customer Interface Cable Requirements

Customer cables that interface to Mercury series encoders must have the following characteristics:

- Twisted pair signal wiring.
- Characteristic impedance of 100-120 ohms.
- Sufficient wire gauge to meet the minimum voltage requirement at the encoder, for example 24AWG gauge wire for a 2m length cable. Examples of acceptable cables with 24 AWG gauge wire and 4 twisted pairs are Belden 9831, 8104, and 9844 or other manufacturer's equivalents.
- Single shield cable with a minimum of 90% coverage. Note that a double shielded cable may be required in high-noise applications.

Signal Wiring:

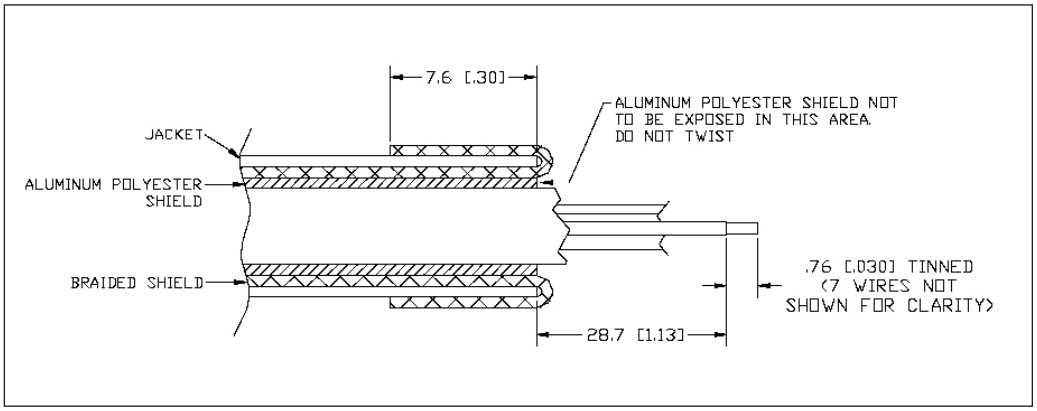
Each differential signal should be connected to a corresponding twisted pair as follows:

Mercury 1500V

Signal	Twisted Pair
A+ A-	Pair 1
B+ B-	Pair 2
Index+ Index-	Pair 3
+5V GND	Pair 4

Shield Termination:

The customer's cable shield should be in 360° contact with the connector shroud and the connector shell to provide complete shielding. The connector shell should be metal with conductive surfaces. Suggested metal connector shells for use with Mercury 3500, 3000, 3000Si, and 2000 encoders: AMP 748676-1 or equivalent; for Mercury 1000 and 1500V encoders: AMP 745172-3, -2, or -1 where the dash number is dependent on the customer's outside cable diameter. The shield should be terminated as illustrated in the following diagram.

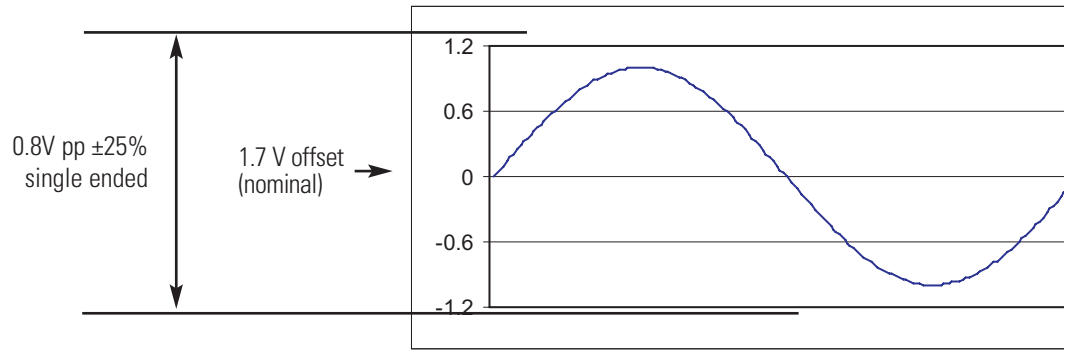


Fold braided shield back over jacket. Example shows double-shielded cable. Dimensions shown are for illustration only.

Output Signal Description

SINE+/COSINE+

Analog signal with nominal peak to peak amplitude of 0.8V. The output signal has a source impedance of 1KΩ. This signal is only used to align the sensor using an oscilloscope and is not suitable for feedback in a control system.



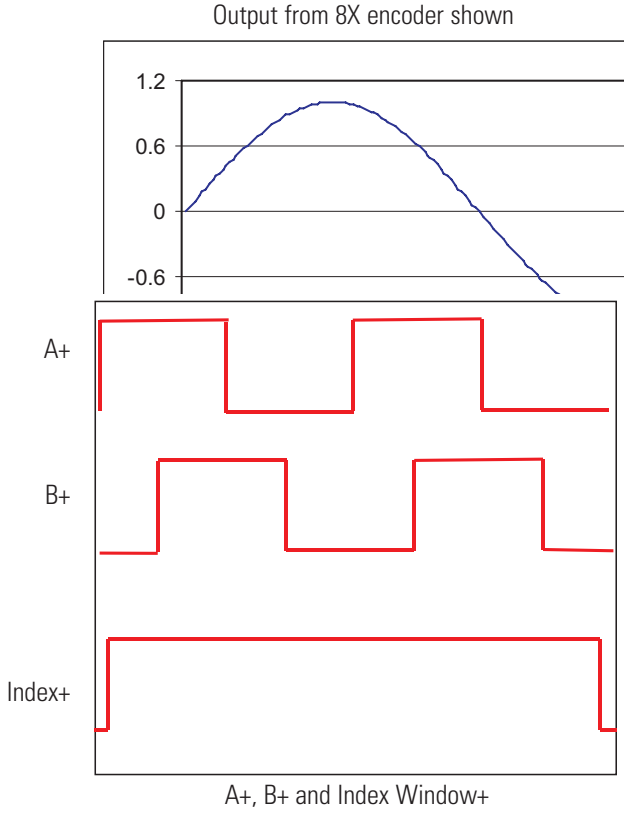
Output Signal Description

A+/A- Digital Quadrature output. Signal is a RS-422 compatible square wave. Pulses are 90° out of phase with B+/B- outputs. Please see below.

B+/B- Digital Quadrature output. Signal is a RS-422 compatible square wave. Pulses are 90° out of phase with A+/A- outputs. Please see below.

Index Window

The Index Window defines one particular fringe on the grating.



Troubleshooting

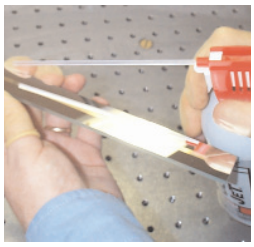
Problem
The Power/Calibration indicator will not come on.

Solution
- Make sure the M1500V 15-pin D connector is fully seated and connected.
- Confirm that +5 Volts DC is being applied to pin 12 on the M1500V 15-pin D connector and that pin 13 is connected to ground.

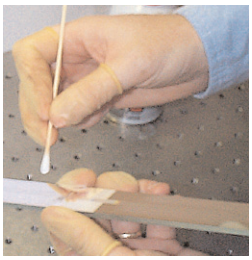
Problem
Can't get the SmartPrecision Alignment Tool "Signal" LEDs better than red or yellow; or the green, " green" indicator doesn't stay illuminated over the full length of the scale.

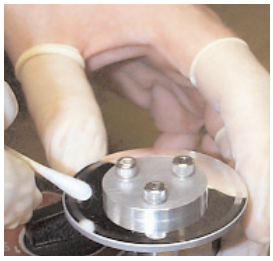
Solution
- Verify that the sensor has been aligned to the scale and that the mounting screws are tight. Check the dimensions for the mechanical mounting holes (and clamps if any) to make sure that the sensor is correctly located over the scale. Refer to the appropriate interface drawing.
- Check that the scale is firmly mounted and can't jiggle or move in other than the intended direction.
- Make sure that the scale is clean over its entire length or circumference. Use the recommended Cleaning Scales procedure.

Cleaning Scales



General Particle Removal
Blow off the contamination with nitrogen, clean air, or a similar gas.





Contamination Removal
Use a lint-free cleanroom wipe or cotton swab dampened with isopropyl alcohol or acetone only to wipe the surface clean. Handle the scale by the edges. Do not scrub the scale.

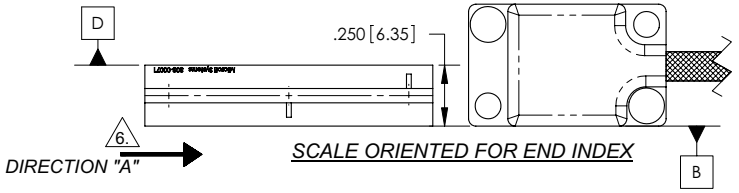
Contact MicroE Systems

Thank you for purchasing a MicroE Systems product. You should expect the highest level of quality and support from MicroE. If you want to download the Mercury Encoder Installation Manual, Data Sheet or Interface Drawing, browse www.microesys.com and click on the Mercury Encoders button.

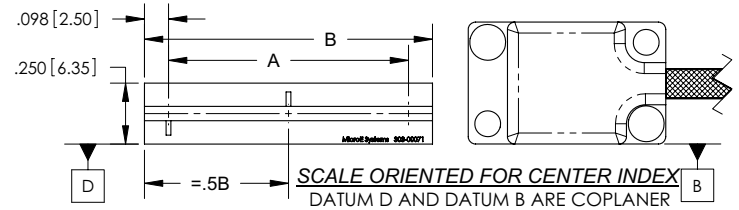
World Headquarters: 125 Middlesex Turnpike • Bedford • MA 01730 USA
www.microesys.com • info@microesys.com • T. [781] 266-5700 • F. [781] 266-5112

Mercury 1500V Encoder System
Interface Drawing: Short Linear Scales

REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APP'D
S1	---	INITIAL	9/26/05	MF
A	1702	CHANGED ADAPTER CABLE, REMOVED NOTE 2, RELEASED TO PRODUCTION	11/16/06	MF
B	2102	Changed note 6, Incorrect Pin call out for Signal B+ in Directionality note.	11/16/06	MF



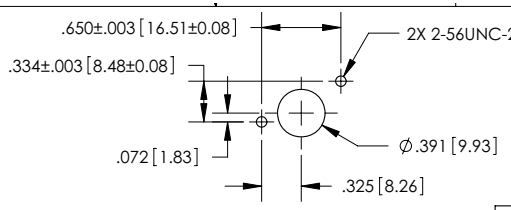
SCALE ORIENTED FOR END INDEX



SCALE ORIENTED FOR CENTER INDEX

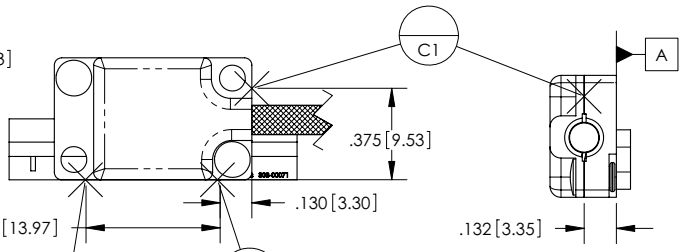
DATUM D AND DATUM B ARE COPLANER AND MUST BE MAINTAINED WITHIN ±.005

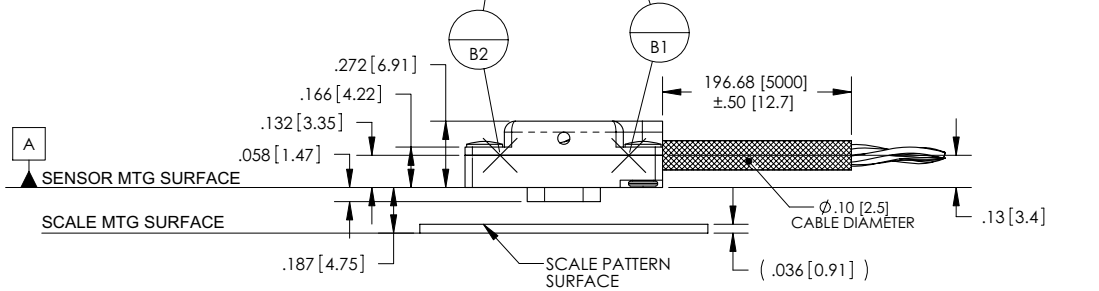
SCALES SHOWN IN THIS VIEW TRANSLATED IN X AXIS OUT OF OPERATING RANGE FOR CLARITY

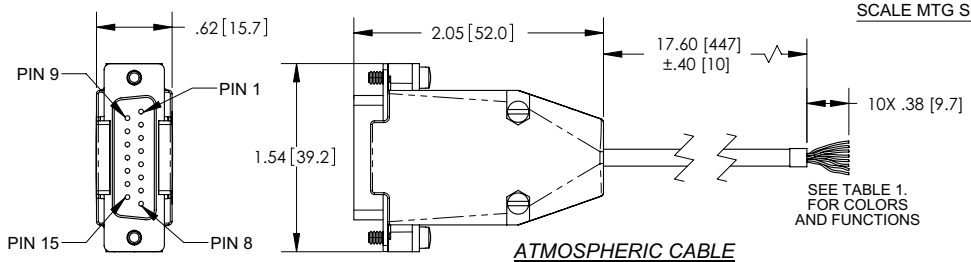


SENSOR MOUNTING PLATE RECOMMENDATION

SCALE: 1:1







ATMOSPHERIC CABLE

M1500V-AC

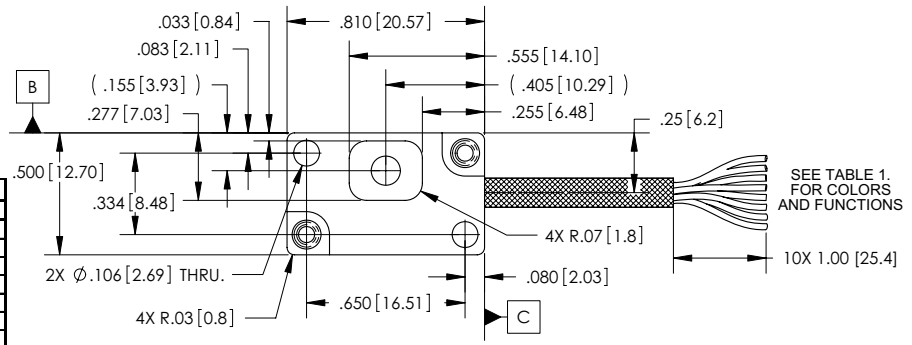


TABLE 1.

	Wiring Diagram		
	Wire Color	***Function***	***Pin (AC)***
Twisted	Black	GND	13
Pair	Red	+5V	12
Twisted	Brown	A+	5
Pair	Orange	A-	4
Twisted	Yellow	SIN+	7
Pair	Green	COS+	8
Twisted	Blue	IW-	15
Pair	Violet	IW+	14
Twisted	Gray	B+	10
Pair	White	B-	9

NOTES:

1. RECOMMENDED MOUNTING HARDWARE:
   2-56 OR M2 SCREWS w/ 4 FLAT WASHERS (2 ON EACH SCREW)
   (OD OF WASHER NOT TO EXCEED .150 [3.81])
2. IF BENCHING PINS ARE TO BE USED, PINS MUST BE PLACED ALONG DATUM EDGES OF BOTH THE SENSOR AND THE SCALE FOR PROPER ALIGNMENT. (REFERENCE DATUMS B1, B2 AND C1 FOR SENSOR BENCHING PINS).
3. HEIGHT OF SENSOR BENCHING PINS MUST BE A MINIMUM OF .170 [4.32] IN HEIGHT FROM DATUM A.
4. HEIGHT OF SCALE BENCHING PINS NOT TO EXCEED THE THICKNESS OF THE SCALE.
5. RECOMMENDED SENSOR MOUNTING PLATE THICKNESS:
   MINIMUM- 4 SCREW THREADS
   MAXIMUM- ALLOW CLEARANCE FOR SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)
6. WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL B+ (GRAY [PIN10]) LEADS OUTPUT SIGNAL A+ (BROWN [PIN 5]).

SCALE IDENTIFICATION AND SIZE.

Scale	Dim A.	Dim B.
Identification #	Measured Length	Scale Length
L**XX**	**XX**mm-5mm	**XX**mm
L30	30mm-5mm = 25mm	30mm
(max) L130	130mm-5mm = 125mm	130mm

UNITS: in. [mm]

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES [MILLIMETERS]
DIM. APPLY AFTER PROCESSING
INTERPRET ALL GEOMETRIC TOLS. PER ANSI Y14.5M-1994
TOLERANCES ARE:
DECIMALS: .XX [.X] ±.01 [.25] .XXX [.XX] ±.005 [.13]
ANGULAR: ±30 MIN.

APPROVALS	DATE
DRAWN S.BUTURLIA	9/20/05
CHECKED	
ENGRG. P.REMILLARD	11/16/06
MFG ENG. T.GARCIA	11/16/06
QA A.VILLARROEL	11/16/06

MicroE Systems
Division of GSI
125 Middlesex Turnpike
Bedford, Ma 01730

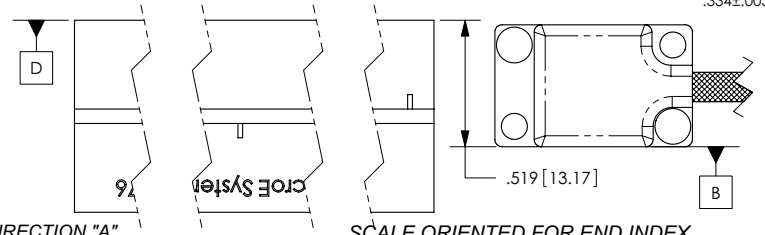
DESCRIPTION:
INTERFACE, ENCODER, 20um, SHORT LINEAR, MERCURY 1500 VACUUM SENSOR

SIZE B | DWG. NO. ID-00322 | REV. B

SCALE: 1:1 | CAD FILE: | 3rd ANGLE PROJECTION | SHEET 1 OF 1

Mercury 1500V Encoder System
Interface Drawing: Long Linear Scales

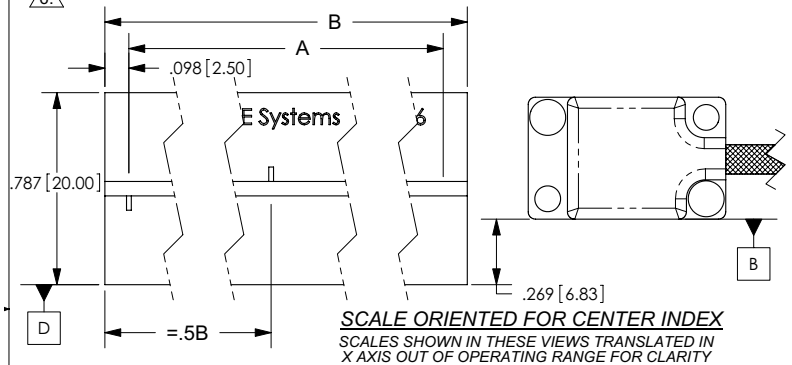
REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APP'D
S1	---	INITIAL	9/26/05	MF
A	1702	CHANGED ADAPTER CABLE, REMOVED NOTE 2. RELEASED TO PRODUCTION	11/17/06	MF
B	2102	Changed note 6, Incorrect Pin call out for Signal B+ in Directionality note	4/24/09	SB



DIRECTION "A"

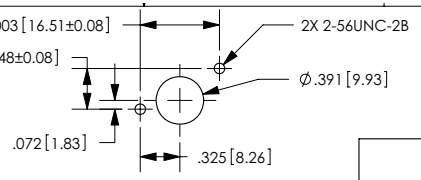
6.

SCALE ORIENTED FOR END INDEX



SCALE ORIENTED FOR CENTER INDEX

SCALES SHOWN IN THESE VIEWS TRANSLATED IN X AXIS OUT OF OPERATING RANGE FOR CLARITY

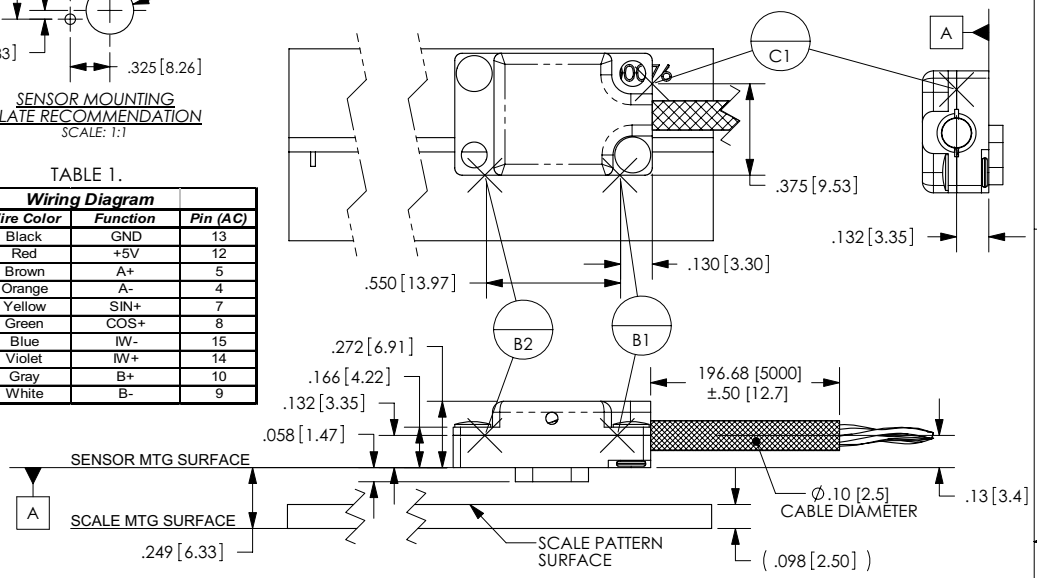


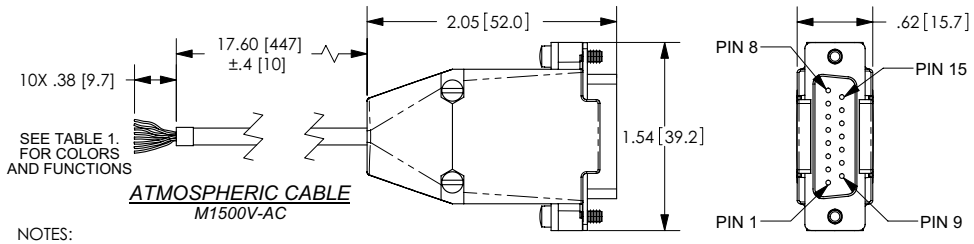
SENSOR MOUNTING PLATE RECOMMENDATION

SCALE: 1:1

TABLE 1.

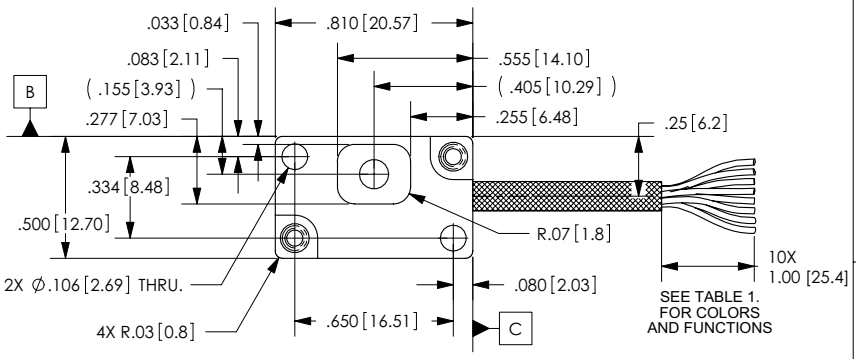
	Wiring Diagram		
	Wire Color	Function	Pin (AC)
Twisted	Black	GND	13
Pair	Red	+5V	12
Twisted	Brown	A+	5
Pair	Orange	A-	4
Twisted	Yellow	SIN+	7
Pair	Green	COS+	8
Twisted	Blue	IW-	15
Pair	Violet	IW+	14
Twisted	Gray	B+	10
Pair	White	B-	9





ATMOSPHERIC CABLE

M1500V-AC



NOTES:

1. RECOMMENDED MOUNTING HARDWARE:
   2-56 OR M2 SCREWS w/ 4 FLAT WASHERS (2 ON EACH SCREW)
   (OD OF WASHER NOT TO EXCEED .150 [3.81])
2. IF BENCHING PINS ARE TO BE USED, PINS MUST BE PLACED ALONG DATUM EDGES OF BOTH THE SENSOR AND THE SCALE FOR PROPER ALIGNMENT. (REFERENCE DATUMS B1, B2 AND C1 FOR SENSOR BENCHING PINS).
3. HEIGHT OF SENSOR BENCHING PINS MUST BE A MINIMUM OF .170 [4.32] IN HEIGHT FROM DATUM A.
4. HEIGHT OF SCALE BENCHING PINS NOT TO EXCEED THE THICKNESS OF THE SCALE.
5. RECOMMENDED SENSOR MOUNTING PLATE THICKNESS:
   MINIMUM- 4 SCREW THREADS
   MAXIMUM- ALLOW CLEARANCE FOR SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)
6. WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL B+ (GRAY [PIN 10)LEADS OUTPUT SIGNAL A+ (BROWN [PIN 5]).

SCALE IDENTIFICATION AND SIZE

Scale Identification #	Dim A. Measured Length	Dim B. Scale Length
L**XX**	**XX**mm-5mm	**XX**mm
L155	155mm-5mm = 150mm	155mm
(max) L2025	2025mm-5mm = 2020mm	2025mm

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES [MILLIMETERS]
DIM. APPLY AFTER PROCESSING
INTERPRET ALL GEOMETRIC TOLS. PER ANSI Y14.5M-1994
TOLERANCES ARE:
DECIMALS: .XX [.X] ±.01 [.25] .XXX [.XX] ±.005 [.13]
ANGULAR: ±30 MIN.

APPROVALS	DATE
DRAWN S.BUTURLIA	9/20/05
CHECKED	
ENGRG. P.REVILLARD	11/16/06
MFG ENG T.GARCIA	11/16/06
QA A.VILLARROEL	11/16/06

UNITS: in. [mm]

MicroE Systems
Division of GSI
125 Middlesex Turnpike
Bedford, Ma 01730

DESCRIPTION:
INTERFACE, ENCODER, 20um, LONG LINEAR, MERCURY 1500 VACUUM SENSOR

SIZE B | DWG. NO. ID-00323 | REV. B

SCALE: 1:1 | CAD FILE: | 3rd ANGLE PROJECTION | SHEET 1 OF 1

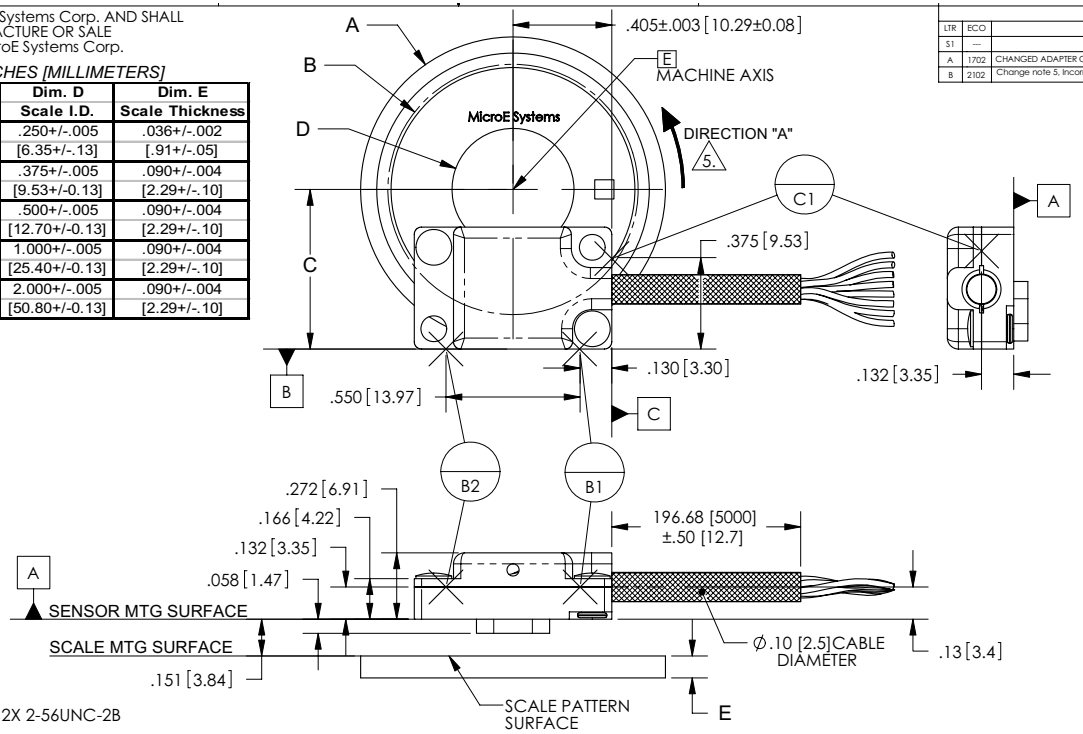
Mercury 1500V Encoder System
Interface Drawing: Rotary Scales

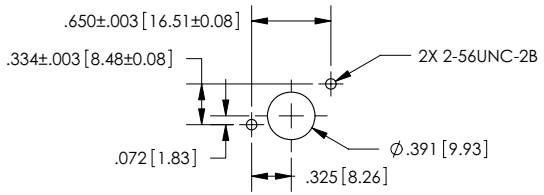
SCALE IDENTIFICATION AND SIZE. DIMENSIONS IN INCHES [MILLIMETERS]

Scale Identification	Counts/ Rev	Dim. A Scale O.D.	Dim. B Optical Dia.	Dim. C Mounting Dim.	Dim. D Scale I.D.	Dim. E Scale Thickness
R1206	1,650	0.472	0.413	0.348+/-.002	.250+/-.005	.036+/-.002
		[12.00]	[10.50]	[8.84+/-.05]	[6.35+/-.13]	[.91+/-.05]
R1910	2,500	0.750	0.627	0.454+/-.002	.375+/-.005	.090+/-.004
		[19.05]	[15.92]	[11.53+/-.05]	[9.53+/-0.13]	[2.29+/-.10]
R3213	4,096	1.250	1.027	0.654+/-.002	.500+/-.005	.090+/-.004
		[31.75]	[26.08]	[16.62+/-.05]	[12.70+/-0.13]	[2.29+/-.10]
R5725	8,192	2.250	2.053	1.168+/-.002	1.000+/-.005	.090+/-.004
		[57.15]	[52.15]	[29.66+/-.05]	[25.40+/-0.13]	[2.29+/-.10]
R10851	16,384	4.250	4.106	2.194+/-.002	2.000+/-.005	.090+/-.004
		[107.95]	[104.30]	[55.73+/-.05]	[50.80+/-0.13]	[2.29+/-.10]

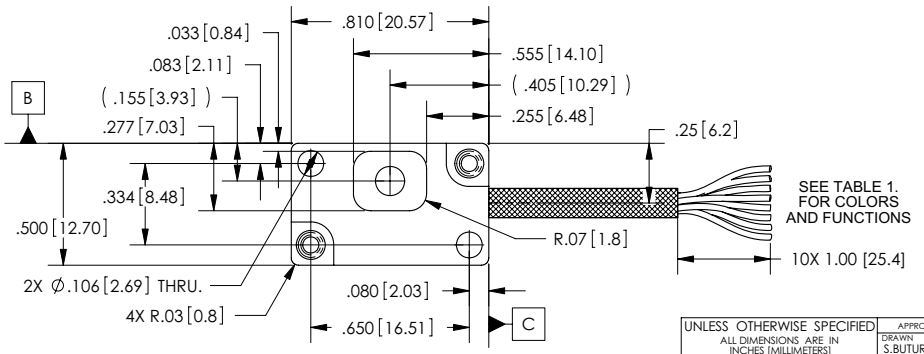
TABLE 1.

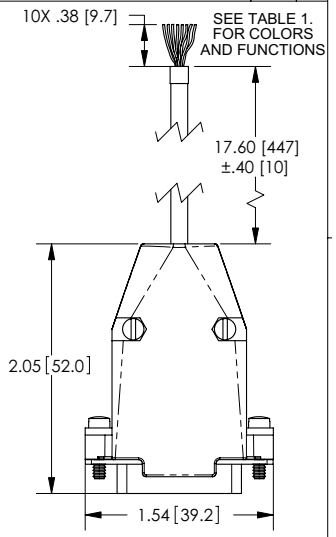
	Wiring Diagram		
	Wire Color	*Function*	*Pin (AC)*
Twisted Pair	Black / Red	GND / +5V	13 / 12
Twisted Pair	Brown / Orange	A+ / A-	5 / 4
Twisted Pair	Yellow / Green	SIN+ / COS+	7 / 8
Twisted Pair	Blue / Violet	IW- / IW+	15 / 14
Twisted Pair	Gray / White	B+ / B-	10 / 9

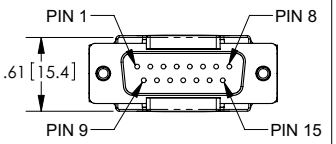




SENSOR MOUNTING PLATE RECOMMENDATION
SCALE: 1:1







ATMOSPHERIC CABLE
M1500V-AC

NOTES:
1. RECOMMENDED MOUNTING HARDWARE:
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   MAXIMUM- ALLOW CLEARANCE FOR SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)

5. WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL B+ (GRAY [PIN 10]) LEADS OUTPUT SIGNAL A+ (BROWN [PIN 5]).

REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APP'D
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A	1702	CHANGED ADAPTER CABLE. REMOVED NOTE 2. RELEASED TO PRODUCTION	11/17/06	MF
B	2102	Change note 5, Incorrect Pin call out for Signal B+ in Directionality note	4/24/09	SB

UNITS: .in [mm]

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES [MILLIMETERS]
DIM. APPLY AFTER PROCESSING
INTERPRET ALL GEOMETRIC TOLS. PER ANSI Y14.5M-1994
TOLERANCES ARE:
DECIMALS: .XX [.X] ±.01 [.25] .XXX [.XX] ±.005 [.13]
ANGULAR: ±30 MIN.

APPROVALS		DATE
DRAWN	S.BUTURLIA	9/20/05
CHECKED		
ENGRG.	P.REMILLARD	11/16/06
MFG ENG	T.GARCIA	11/16/06
QA	A.VILLARROEL	11/16/06

GSI MicroE Systems Division of GSI
125 Middlesex Turnpike
Bedford, Ma 01730

DESCRIPTION:
INTERFACE, ENCODER, 20um, ROTARY, MERCURY 1500 VACUUM SENSOR

SIZE B | DWG. NO. ID-00324 | REV B
SCALE: 1:1 | CAD FILE: | 3rd ANGLE PROJECTION | SHEET 1 OF 1