

# Mercury II™ 5800Si

**High Performance Encoders with Digital Output from the Sensor**  
High Resolution and Accuracy with Tape or Glass, Linear or Rotary Scales



## Resolution

Linear: 5µm to 1.22nm  
Rotary: 20k to 268M CPR

## Accuracy

Tape Scale: ± 5µm/m  
Glass Scales:  
Linear: ± 1µm available  
± 1.5µm to ± 5µm standard  
Rotary: Up to ± 2.1 arc-sec

## Outputs

High Speed Serial Word in  
SPI Format

## Scales

Same Sensor for Tape or Glass,  
Linear or Rotary

The new Mercury II 5800Si Encoder represents a breakthrough in performance, offering class-leading resolution and accuracy, digital output from the sensor, the smallest sensor size, unmatched versatility, robustness, smart programmable features, and easy installation.

## Mercury II: The Next Generation

High-Resolution Serial Word Output Directly from the Sensor

MicroE Systems revolutionized encoder technology with the original Mercury encoder family. Smaller, faster, and smarter than anything before, it set the standard for innovation. Now Mercury II, MicroE System's newest family of reflective incremental encoders, takes another giant step forward by giving you "best-in-class" performance, unparalleled versatility, superior robustness, and unmatched ease of use. You get all of this from a single encoder system.

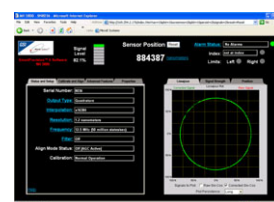
### System Features at a Glance

- High-resolution interpolated digital output directly from the sensor; resolution from 5µm to 1.2nm
- Small sensor - 11mm tall sensor fits tight spaces
- Faster - 10m/s at 1.2nm resolution
- Smarter - programmable filter and other features
- Cut-to-length laser tape scale comes in dispensers up to 30m
- Linear glass scales for high accuracy
- Stick-on optical index and left / right limits
- Bi-directional optical index is repeatable to 1LSB

- Low power consumption
- High tolerance to scale contamination
- Broadest alignment tolerances and pushbutton setup with LEDs
- Differential outputs for high reliability in high EMI environments
- Software for setup, programmable features, monitoring and diagnostics
- RoHS and CE compliant

### Optional Features

- Tape scale length - up to 30m per dispenser
- Glass scale length or diameter:  
Linear lengths from 10mm to 1m or custom  
Rotary diameters from 44mm to 121mm or custom
- Sensor cable length of 1m, 3m, 5m, or custom (up to 10m)
- Accessory Kits for scale installations
- SmartPrecision™ II Software



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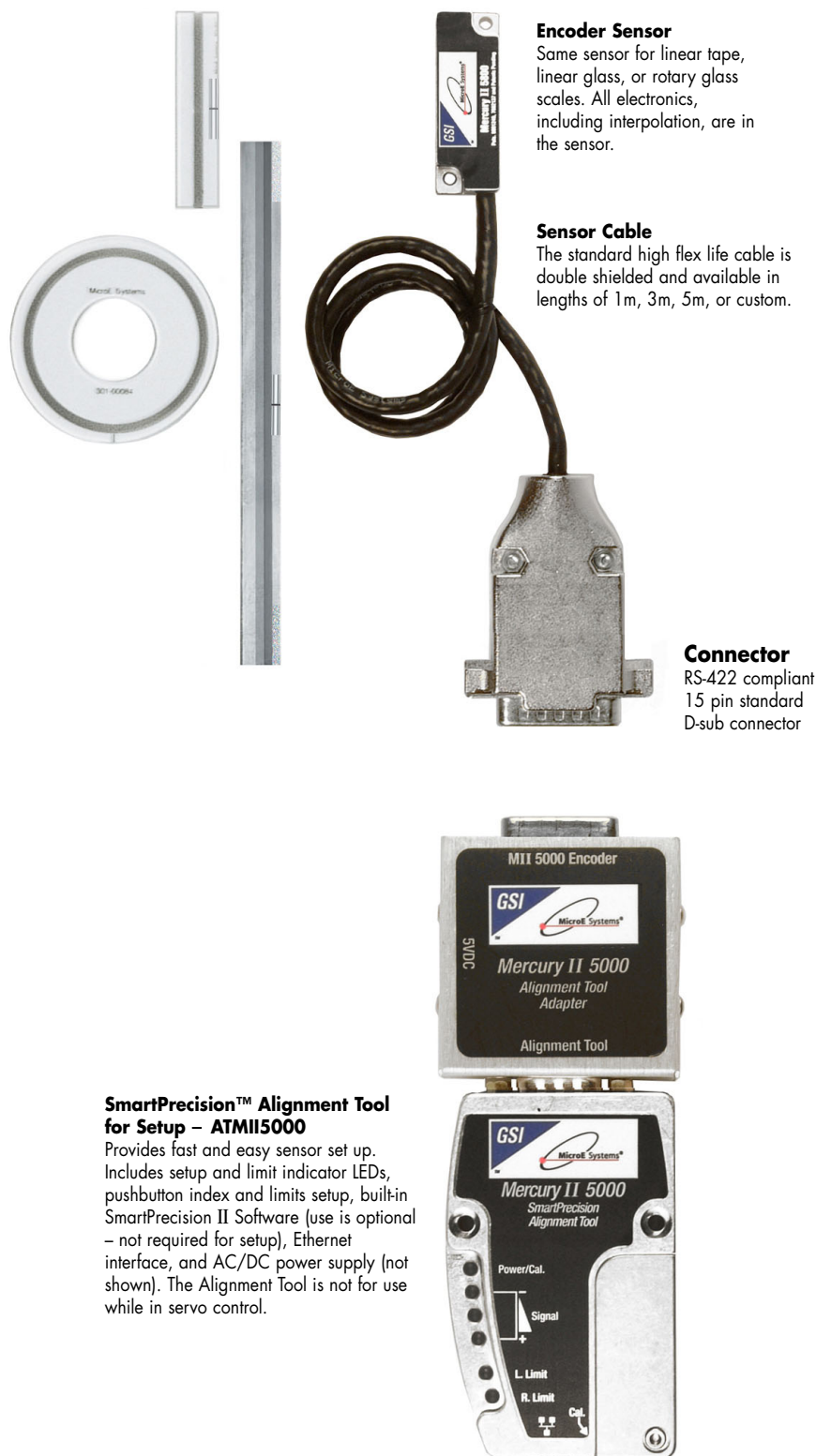
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# System Configurations

## Standard and Optional Equipment

### Mercury II™ 5800Si Smart Encoder Systems

#### Standard Equipment



#### Encoder Sensor

Same sensor for linear tape, linear glass, or rotary glass scales. All electronics, including interpolation, are in the sensor.

#### Sensor Cable

The standard high flex life cable is double shielded and available in lengths of 1m, 3m, 5m, or custom.

#### Connector

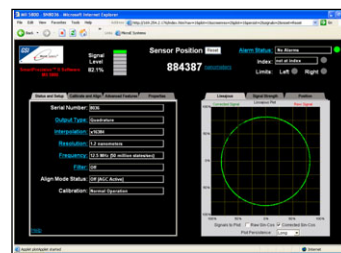
RS-422 compliant  
15 pin standard  
D-sub connector

#### SmartPrecision™ Alignment Tool for Setup – ATMII5000

Provides fast and easy sensor set up. Includes setup and limit indicator LEDs, pushbutton index and limits setup, built-in SmartPrecision II Software (use is optional – not required for setup), Ethernet interface, and AC/DC power supply (not shown). The Alignment Tool is not for use while in servo control.

### Mercury II 5800Si

#### Optional Equipment

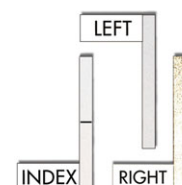


#### SmartPrecision II Software

The software performs setup, monitoring and diagnostics, includes displays for encoder output, multiple data plots, and is used for programmable functions. It is built into the ATMII5000 Alignment Tool; use is optional. See Page 9 for details. Requires Ethernet cable.

### Mercury II 5800Si

#### Installation Accessories



Index and Limit Marker Set



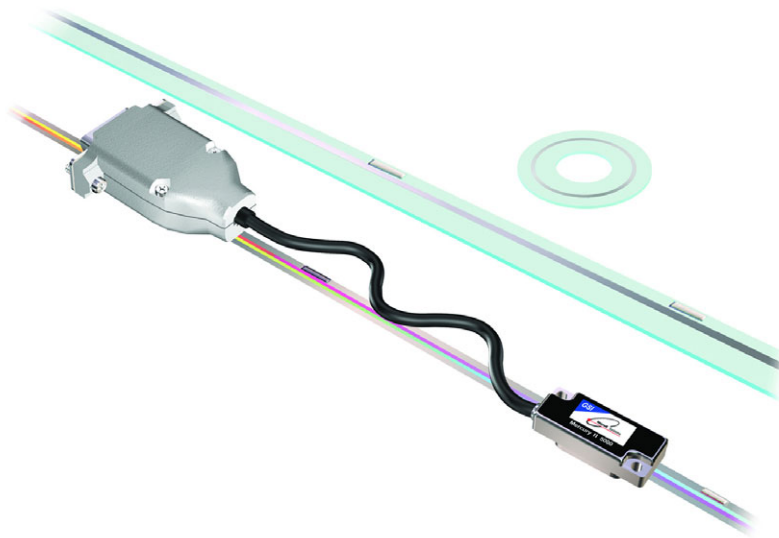
Tape Scale Applicator Tool



Tape Scale Shears

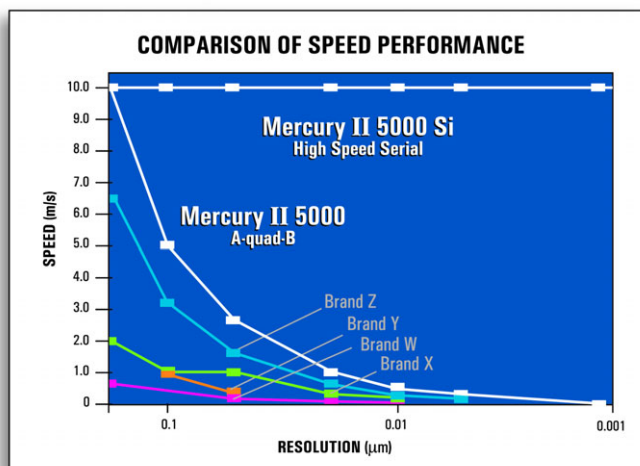
# MII 5800Si System Features at a Glance

The Mercury II™ 5800Si is built on the field-proven Mercury technology platform. Known for being smaller, smarter and faster, Mercury II builds on the original Mercury™ series and adds increased performance, versatility, robustness, and ease-of-use.



## Mercury II 5800Si's features include:

- Small, low-mass sensor with ultra low Z-height fits in compact motion systems
- All electronics are in the sensor for maximum space savings, system reliability and ease of integration; a variety of connector options are possible, including use of your own connector
- Superior resolution and accuracy - resolutions up to 1.22nm (linear), 268M CPR (rotary); short-travel accuracy of  $\pm 20$ nm typical (linear glass scales); up to  $\pm 1\mu\text{m}$  (linear glass scales up to 130mm long)

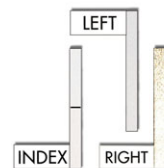


- High-speed operation - 10m/s at 1.2m resolution
- Versatility - one sensor works with laser tape or glass scales, linear or rotary
- Broad sensor alignment tolerances, and the alignment tool's built-in red/yellow/green setup LEDs and pushbutton setup, make setup fast and eliminate ancillary setup instruments

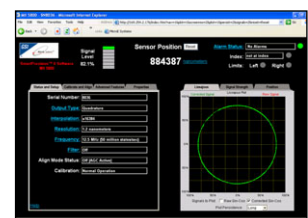
- Adhesive-mount laser tape scale supplied in continuous lengths for cut-to-length convenience and inventory savings; mounts on virtually any surface - metals, granite, glass, composites, or ceramics



- Stick-on optical index and limit markers can be placed anywhere they are required, are easy to apply, and require no adjustment; markers work on both laser tape and linear glass scales



- Convenient tape scale applicator tool insures consistency and speeds installation
- Low power consumption - only 172mA with all outputs terminated
- Robustness features include all differential digital outputs, all digital signals from the sensor, and double-shielded cabling for superior EMI/RFI immunity; scale contamination resistance insures encoder operation even with fingerprints, oil, dust and other forms of contamination
- Fail-safe dual optical limits have differential outputs and reduce motion system cabling; limit markers fit right on the 6mm wide laser tape scale for maximum space savings
- Included software makes setup, motoring and diagnostics easy; Ethernet connectivity allows you to use any computer



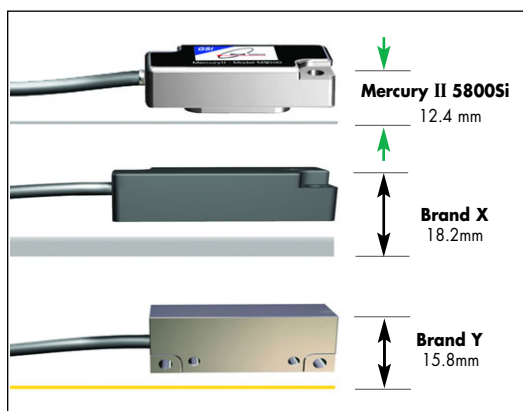
# Smallest Sensor, Lowest System Height, Smallest Tape Scale System, Broader Alignment Tolerances, and More

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

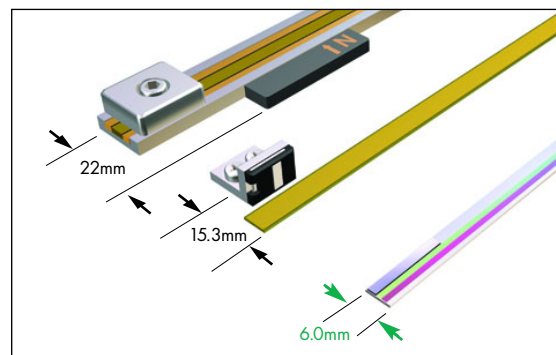
## Mercury II Can Reduce System Size and Cost

Mercury II 5800Si's system height with tape scale is 22% shorter than competitive encoders with digital output from the sensor, making it easier to fit into your design. This reduction can also cut motion system weight and cost by allowing the use of smaller motors and stages. Mercury II 5800Si's optical index and limit markers are placed within the 6mm width of the tape scale, saving even more space by eliminating external index and limit magnets.

## Lowest System Height



## Smallest Tape Scale System



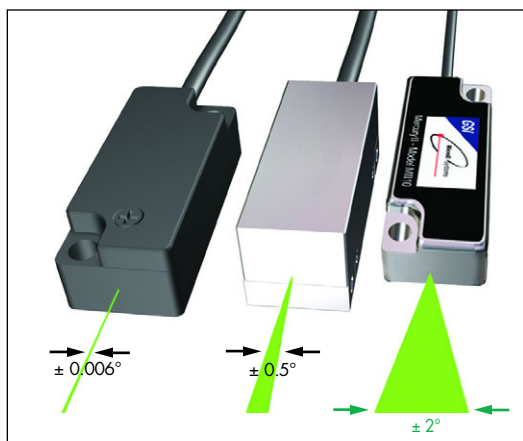
## Mechanical Dimension Comparison\*

	Mercury II 5800Si with Tape Scale	Brand X	Brand Y	Mercury II vs. Best Competitor
System height	12.4mm	18.2mm	15.8mm	22% better
Sensor Z height	11.0mm	12mm	14.8mm	9% better
Standoff tolerance	± 0.15mm	± 0.1mm	± 0.1mm	50% better
Tape scale width**	6.0mm	22.0mm	15.3mm	155% better

\*Based on published specifications for encoders with digital output from the sensor

\*\*Tape scale system width including index and limits

## Theta Z Alignment Tolerance



## Eliminate the Frustration of Touchy Encoder Alignment

With Mercury's patented PurePrecision™ optics, 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 II 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.

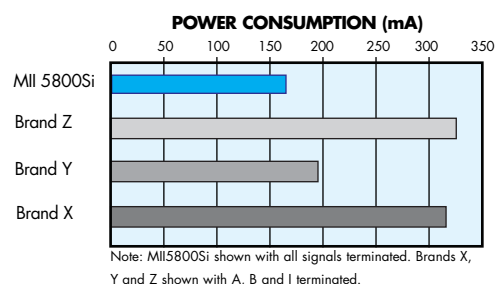
## Alignment Tolerance Comparison\*

	Mercury II***	Brand X	Brand Y	Mercury II vs. Best Competitor
theta Z	± 2.0°	± 0.006°	± 0.5°	Mercury is 300% better
theta Y	± 1.0°	unspecified	± 1.0°	
theta X	± 1.0°	± 0.1°	± 1.0°	

\*Based on published specifications for encoders with digital output from the sensor

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

## Lowest Power Consumption



MII 5800Si uses advanced electronics that are 100% in the sensor, giving MII 5800Si the lowest power consumption of any high-performance digital-output encoder:

- Lowest heat generation / dissipation
- Cost and size savings in the controls / drives
- More system design flexibility

# MII 5800Si System Specifications

## Resolution and Maximum Speed Tables

Mercury II™ 5800Si systems have programmable interpolation from x4 to x16384 in binary steps. Below is a table of examples. Unlike A-quadrant encoders, the MII5800Si's resolution does not drop off with speed.

### Linear - 20µm grating pitch

Interpolation Multiplier	Interpolation Bits	Resolution	Maximum Speed
x 4	2	5.000µm/count	10000mm/sec
x 8	3	2.500µm/count	10000mm/sec
x 16	4	1.250µm/count	10000mm/sec
x 32	5	0.6250µm/count	10000mm/sec
x 64	6	0.3125µm/count	10000mm/sec
x 128	7	0.15625µm/count	10000mm/sec
x 256	8	0.078125µm/count	10000mm/sec
x 512	9	0.0390625µm/count	10000mm/sec
x 1024	10	19.53125nm/count	10000mm/sec
x 2048	11	9.765625nm/count	10000mm/sec
x 4096	12	4.8828125nm/count	10000mm/sec
x 8192	13	2.44140625nm/count	10000mm/sec
x 16384	14	1.220703125nm/count	10000mm/sec

### Rotary - 20µm grating pitch

Rotary Glass Scale Diameter	Fundamental Resolution	Interpolation			
		Note: The range of available values is x4 to x16384 in binary steps; example values below.			
<b>44.45mm</b>	<b>5000 CPR</b>	<b>x4</b>	<b>x1024</b>	<b>x4096</b>	<b>x16384</b>
	interpolated resolution (CPR)	20000	5120000	20480000	81920000
	interpolated resolution (arc-sec/count)*	64.8	0.253	0.0630	0.01582
	interpolated resolution (µrad/count)*	314	1.23	0.306	0.0767
	maximum speed (RPM)	6000	6000	6000	6000
<b>63.50mm</b>	<b>8192 CPR</b>	<b>x4</b>	<b>x1024</b>	<b>x4096</b>	<b>x16384</b>
	interpolated resolution (CPR)	32768	8388608	33554432	134217728
	interpolated resolution (arc-sec/count)*	39.6	0.154	0.038	0.00966
	interpolated resolution (µrad/count)*	191.7	0.749	0.187	0.0468
	maximum speed (RPM)	3660	3660	3660	3660
<b>120.65mm</b>	<b>16384 CPR</b>	<b>x4</b>	<b>x1024</b>	<b>x4096</b>	<b>x16384</b>
	interpolated resolution (CPR)	65536	16777216	67108864	268435456
	interpolated resolution (arc-sec/count)*	19.78	0.0772	0.01978	0.00481
	interpolated resolution (µrad/count)*	95.9	0.375	0.0937	0.0234
	maximum speed (RPM)	1830	1830	1830	1830

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

To calculate desired rotary interpolation multiplier, use the following equation:  
Interpolation Multiplier = Desired Resolution (CPR)/Fundamental Scale Resolution (CPR).



# MII 5800Si System Specifications

## System

Scales:

- Cut-to-length PurePrecision™ laser tape scale - available in continuous lengths up to 30m
- Linear glass scales for high accuracy
- Rotary glass scales for rotary applications

Grating Period	20µm
Signal Period	20µm
System Resolution	5µm - 0.00122µm* in integer interpolation steps (factory set or user programmed using included SmartPrecision™ II Software)

\*Value rounded for readability; use the formula  $[20\mu\text{m}/\text{interpolation multiplier}]$  to calculate the exact resolution in units of  $\mu\text{m}/\text{count}$ .

Linear accuracy\*\*

	Laser Tape Scale	Glass Scales
Short-travel Accuracy	$\pm 30\text{nm}$ typical over any 20µm movement	$\pm 20\text{nm}$ typical over any 20µm movement
Long-travel Accuracy	$\pm 5\mu\text{m}/\text{m}$ after two-point linearization in the customer's controller	High accuracy grade: $\leq \pm 1\mu\text{m}$ for scales up to 130mm $\leq \pm 2\mu\text{m}$ for scales from 130mm to 1m  Standard accuracy grade: $\leq \pm 1.5\mu\text{m}$ for scales up to 130mm $\leq \pm 5\mu\text{m}$ for scales from 130mm to 1m

\*\*Maximum 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
	44.45mm	$\pm 38$	$\pm 7.8$
	63.50mm	$\pm 19$	$\pm 3.9$
	120.65mm	$\pm 10$	$\pm 2.1$

\*Based on ideal scale mounting concentricity

Index: stick-on optical marker can be placed anywhere; bi-directional, full speed. Note: after power up, the index mark must be passed once at  $\leq 1 \text{ m/s}$  for proper operation.

Limits: separate left and right limits with stick-on markers

## Sensor Size

H: 11.03mm

W: 13.50mm

L: 38.50mm

## Operating and Electrical Specifications

SPI Interface Clock Speed

Maximum: 50MHz (results in 227,272 position reads/sec 220 clock cycles/position reads at 1.2nm resolution)

Minimum: 30MHz

Power Supply: 5VDC  $\pm 5\%$  @ 140mA (no outputs terminated)  
@ 172mA (all serial I/O connections terminated)

Temperature

Operating: 0 to 70°C

Storage: -20 to 85°C

Humidity: 10 - 90% RH non-condensing

EMI: CE Compliant

Shock: 300G 0.5 ms half sine (Sensor)

Vibration: 30G @ 17Hz

Sensor Weight: 8 g (Sensor without cable)

Cable: Double Shield

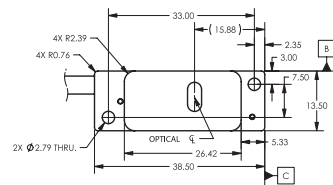
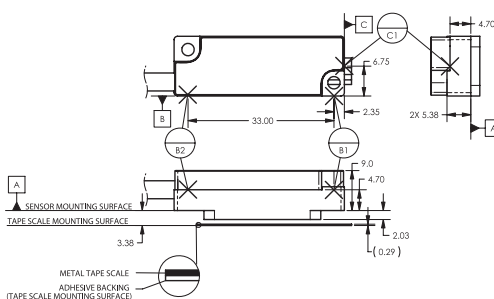
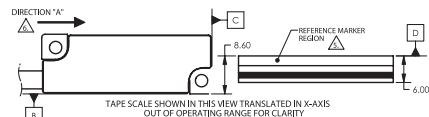
Maximum length: 10m (contact MicroE Systems for applications >5m)

Diameter: 4.2mm

Flex Life: 20 x 10<sup>6</sup> cycles @ 20mm bending radius

## Reliability Information

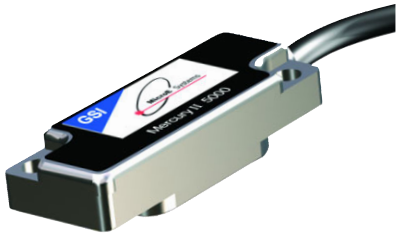
5 year Expected Reliability: >99.8% under normal operating conditions.



NOTE:

Sensor shown with tape scale Refer to the Mercury II™ 5800Si interface drawings for additional dimensional details and important notes.

# Mercury II™ 5800Si Sensor Electronics



The Mercury II™ 5800Si encoders have all electronics, including interpolation, built into the sensor. This compact, versatile sensor includes the following features:

- Programmable interpolation level and low-pass filter
- Accuracy optimization - sensor signals are automatically optimized to improve system accuracy and maximize repeatability
- Bi-directional index with repeatability of 1LSB
- Alarm bit (in serial word) for low signal
- All settings and setup parameters are stored in non-volatile memory
- Superior EMI/RFI immunity - CE compliant, and all outputs are differential and RS422 compatible

## High Speed Serial Interface

Motion system engineers who are optimizing their system can boost its performance by interfacing their SPI-compatible controller with the Mercury II 5800Si. Its industry standard SPI high-speed serial data interface is supported by multiple DSP chip manufacturers, including TI, Motorola and Analog Devices, and provides a robust connection that is ideal for encoder interfacing. With the Mercury II 5800Si, encoder position values are sent directly into the controller's DSP. Limitations of encoders with A-quadr-B output are completely eliminated. Standard features include:

- Very high motion speed with high encoder resolution - up to 10m/s movements with 1.2nm\* resolution
- 50MHz max. input clock frequency / 250kHz position word sample rate
- RS422 voltage levels are resistant to Electro Magnetic Interference and support long cable runs
- Two index modes:

Mode 0: Zeros the position value at power up, without reference to the index mark. No changes are made to the position word at the index mark.

Mode 1: Zeros the position value at every encounter with the index mark.

The index mode can be factory set or selected by the customer using SmartPrecision II Software - see page 9 for software features.

\* Resolution values shown are approximate - see p. 4 for exact values.

## Dual limits

Mercury II includes optically fail-safe independent left and right limits. The limits are momentary. Full reflectivity on the optical limit track is the normal operating condition; loss of signal on the optical limit track triggers a limit output, making them optically fail-safe.

## Programmable Low Pass Filter

The Mercury II 5800Si has a programmable low-pass output filter for enhanced performance in low speed applications. The filter can be disabled for full bandwidth or set from 0.01% - 40% of the sample rate in steps of 0.01%, where the frequency is -3dB output roll off.

## Alignment Tool



## Alignment Tool Features

- Provides fast and easy sensor alignment, index setup and limit setup
- Status and setup LED's: red / yellow / green signal strength LED's assist during setup and provide diagnostics at a glance; status LED's for both limits; power-indicating LED
- Includes AC/DC power supply
- Use pushbutton or software for setup
- Built-in SmartPrecision II Software for setup, monitoring, and diagnostics; only a web browser is needed (use of software is optional)
- Ethernet software connectivity supports remote connection to the Alignment Tool and MII5000 encoder, and multiple encoders / computers

Note: Alignment Tool and software not for use while in servo control

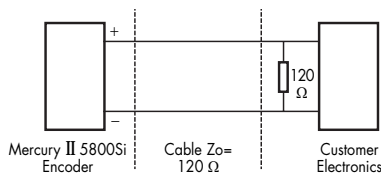
# Mercury II™ 5800Si Inputs & Outputs

## Mercury II 5800Si I/O:

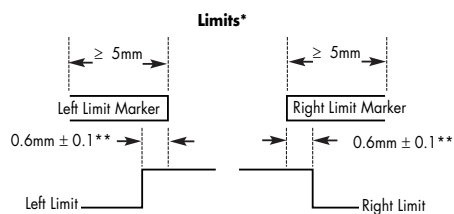
15-pin standard Male D-sub connector

Pin	Name	Direction	Description
1	nCS+	Input	
2	GND		
3	nCS-	Input	Negative True Chip Select (Capture Start)
4	Reserved - do not connect		Must be floating at host
5	SCLOCK_OUT-	Output	
6	SDATA_OUT-	Output	
7	+5V		
8	+5V		
9	GND		
10	SCLOCK_IN+	Input	Serial Clock from Host to Sensor
11	SCLOCK_IN-	Input	
12	Reserved - do not connect		Must be floating at host
13	SCLOCK_OUT+	Output	Serial Clock from Sensor to Host
14	SDATA_OUT+	Output	Serial Data from Sensor to Host
15	Do Not Connect		

## Signal Termination for Serial I/O Connections



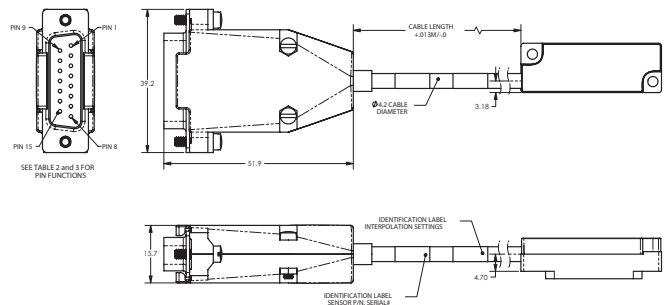
## Limit Marker Positioning



\*Output signals are differential. Inverse signals are not shown for clarity.

\*\*Above are with reference to the sensor's optical centerline (see interface drawings).

## Mechanical Information - 15 pin Connector



## Serial Word Data Format

The serial interface to the MII 5800Si allows a serial host to receive position and status information from the sensor at up to 250,000 position reads / sec. This supports applications up to 10m/s with 1.2nm resolution in servo control, and applications where a device such as a laser or camera must be triggered from the encoder at a particular position.

## 58 bit Data Word

Start 4 bits	Position 4-35 bits	Status 9 bits	CRC 6 bits	Stop 4 bits
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The data word length is up to 58 bits. The data word consists of start bits, a position word of 4 to 35 bits, 9 bits of status, a 6-bit cyclic redundancy check (CRC) to provide data communication error detection, and stop bits. This position word is large enough to keep track of a measurement length of 41.9 meters.

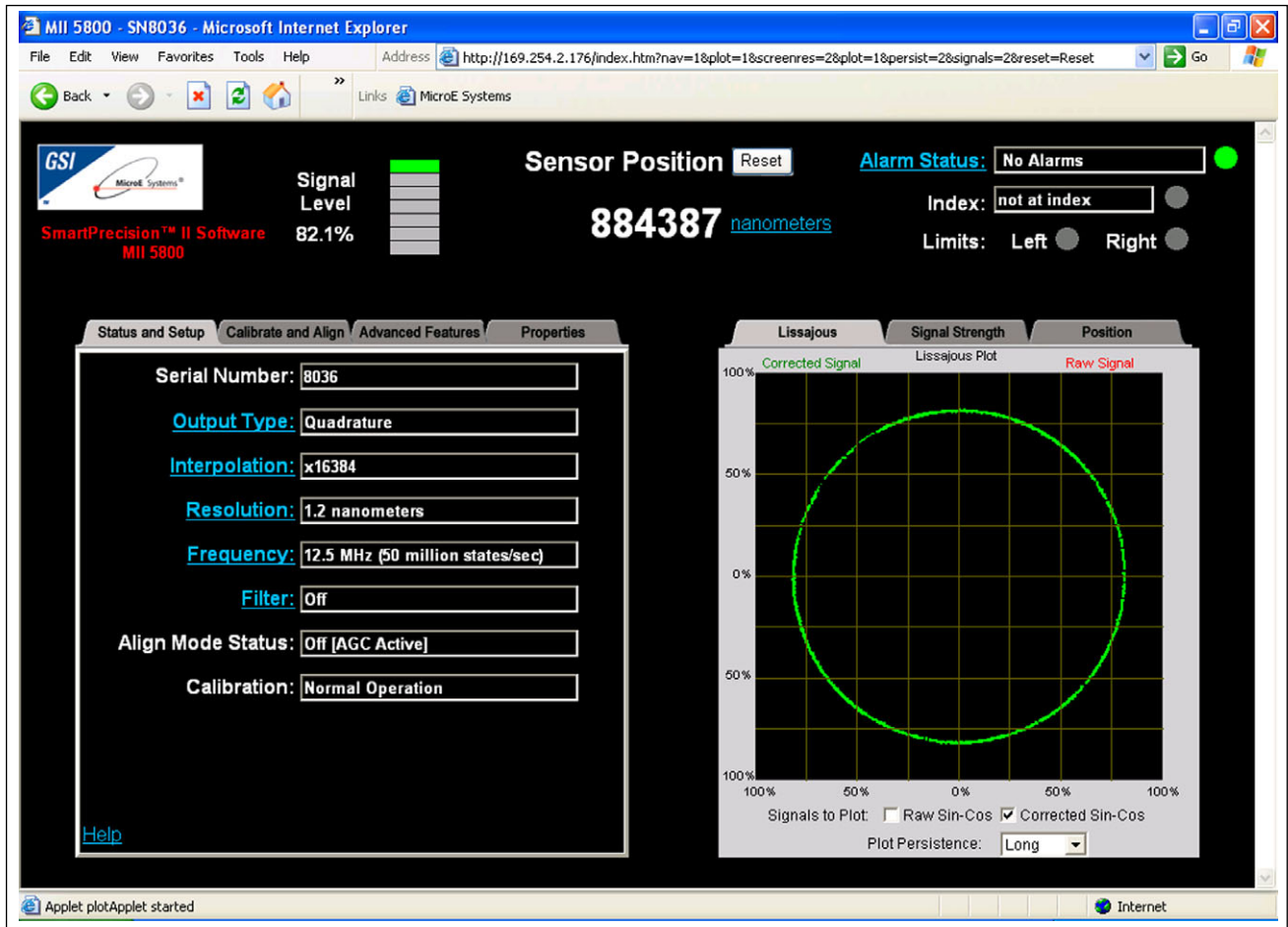
The number of position bits is determined by adding the number of interpolation bits (valid range: 2-14) and the number of fringe count bits (valid range: 2-21). Interpolation bits determine the interpolation multiplier (example: 14 bits = x16384 interpolation; see p. 5 for a table of output resolutions). Fringe count bits determine the maximum number of 20µm fringes that can be counted in the position word (example: 21 bits = 2097152 fringes = 41.9 meters). Most applications can use 14 interpolation bits and 21 fringe count bits. Use fewer interpolation or fringe count bits if your motion controller requires a shorter data word for faster transfer rates than can be achieved with the maximum data word of 58 bits. The number of interpolation and fringe count bits is specified at the time of ordering, but may be changed using SmartPrecision II Software.

The status bits include index window, left limit, right limit, and signal level alarms.

Important controller interfacing information such as a timing diagram, signal descriptions and the CRC formula are in the Mercury II Family Installation Manual.



# SmartPrecision™ II Software



## Why use software with an encoder?

Mercury II™ 5800Si's Alignment Tool includes built-in SmartPrecision II Software. The Alignment Tool's pushbutton setup process does not require use of the software, however SmartPrecision II Software adds unique functionality:

- Monitor encoder operation using digital readouts and data plots such as Lissajous
- Get support from trained MicroE Systems' support personnel for diagnosing customer equipment, no matter where the equipment is located throughout the world
- Use Mercury II's programmable features for more rapid integration and motion system optimization
- Perform encoder setup with the convenience and step-by-step prompts of a software interface

Included with every Mercury II 5800Si Alignment Tool, SmartPrecision II Software can perform setup, monitoring, and diagnostic functions locally or remotely across a LAN or WAN. It operates from the encoder using simple Java commands and thus does not require any software to be installed on the computer other than a standard web browser (such as Internet Explorer). Compatible with numerous web browsers and operating systems, its features include simultaneous displays of:

- Position in engineering units
- Lissajous plot
- Encoder signal level
- Status of software alarms, index and limits
- Status of programmable encoder settings
- Encoder serial number

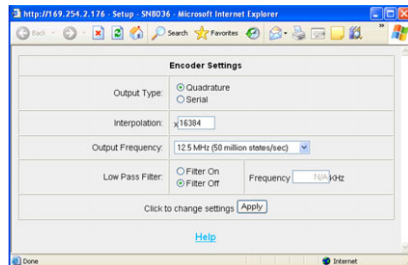
# SmartPrecision™ II Software

## Functions:

- Setting of programmable features, including interpolation in integer steps and filter rolloff frequency
- Encoder Calibration
- View the Software Alarm Details

## Program Mercury II™ Encoder Electronics

- Set interpolation in binary steps from x4 to x16,384
- Disable / enable low-pass filter and set filter roll-off frequency
- Set index mode

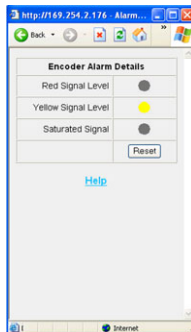


## Install Mercury II 5800Si Encoders

- Align sensor using Signal Level display and Lissajous data plot
- Locate index and see when sensor is over the scale's index mark
- Verify sensor output over length of scale using the Signal Strength plot

## Monitor Mercury II 5800Si Encoder Operation

- Read encoder position in engineering units of your choice
- View data plots (software not for use while using Mercury II 5800Si in servo control)
- Monitor software alarms and programmable settings



## Diagnose Mercury II 5800Si Encoder Performance

- Capture signal data and email it to MicroE for rapid diagnostic support
- View software alarms and programmable settings

## Ethernet Connectivity Features

The software resides in the Mercury II 5800Si Alignment Tool as a 'web server' and is accessed using an Ethernet connection. The computer does not need any special software to be installed, so virtually any computer can connect instantly to a Mercury II 5800Si Alignment Tool. Ethernet connectivity advantages include:

- High speed, network data connection supports many configurations:
  - one encoder with one computer
  - many encoders with one computer
  - several computers and one encoder
  - multiple encoders and multiple computers
  - one-to-one (no network), LAN, WAN, or router
- Securely connect to the encoder remotely for monitoring and field support through your company's Virtual Private Network
- The software's web server architecture can respond to a variety of requests (html pages, data requests, java plots, etc.)
  - take requests from most operating systems
  - take requests from a variety of sources (user with web browser, user-software, scripts, controller, etc.)
- Program your controller to communicate with the encoder using simple HTML web commands for 'observer' position data feedback or encoder status, including calibration, alarms, and limits
- Computer operating system independence and flexibility of interfacing to your own software without needing any dlls, drivers or any specific hardware or software configuration

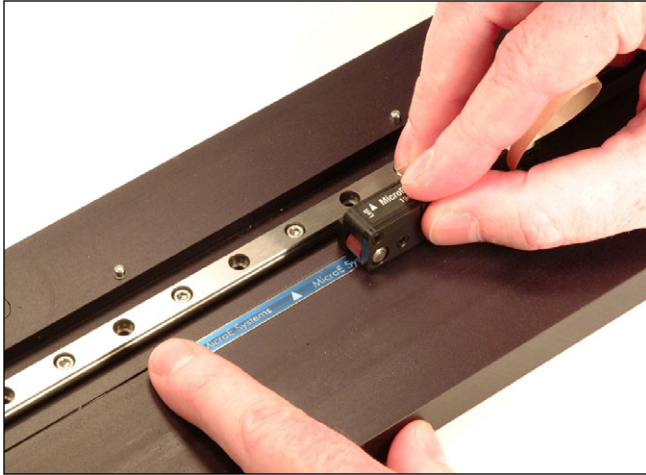
## Computer Requirements

- Any computer with a web browser (such as Internet Explorer) and Java 2.0 installed and enabled
- Ethernet connection to a computer, LAN, WAN or router

## How To Order

SmartPrecision II Software is included with all Mercury II 5800Si Alignment Tools and does not require any installation - just access it using your computer's web browser.

# PurePrecision™ Laser Tape Scale with Stick-On Index and Limits

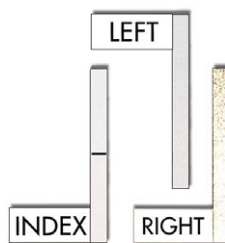
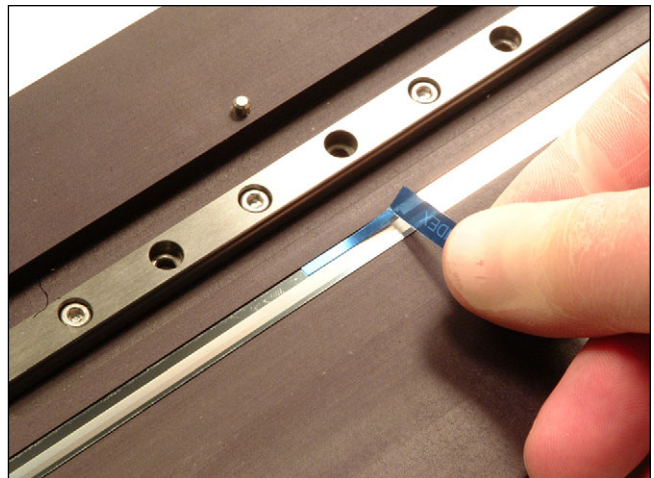
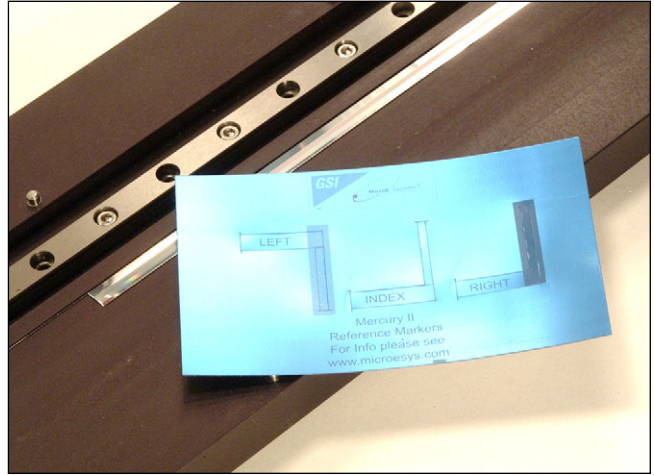


Mercury II™'s PurePrecision laser tape scale is fast and easy to install, provides excellent accuracy and takes less space than any encoder in its class. It mounts using a permanent pressure-sensitive adhesive. Thermal expansion of the substrate is matched by anchoring the ends of the tape scale using epoxy and end caps.



Tape is supplied in a dispenser in lengths up to 30m so that you can cut any length required for your application, minimizing inventory costs, or it may be ordered pre-cut to any length you specify for high-volume OEM applications.

Installation for a wide range of lengths is fast and easy using MicroE Systems' tape applicator tool, or without a tool by hand. When using the installation tool, release paper is automatically removed from the tape. The tape's location on the mounting surface is set by a reference edge that is either machined into the substrate or is put in place temporarily.



The stick-on (adhesive-mount) optical index and limit markers are mounted on the tape in seconds usually using the same reference edge as for the tape scale. This space-saving design keeps the index and limit markers within the 6mm width of the tape, ideal for space-constrained motion systems. The index is bi-directional, operates at all encoder speeds, and is repeatable to 1LSB. View the Tape Scale Installation video at [www.microesys.com/MercuryII](http://www.microesys.com/MercuryII) for a demonstration.

Mercury II PurePrecision tape scale may also be installed using scale applicator tools for 6mm-wide tape from other manufacturers.

# PurePrecision™ Laser Tape Scale with Stick-On Index and Limits

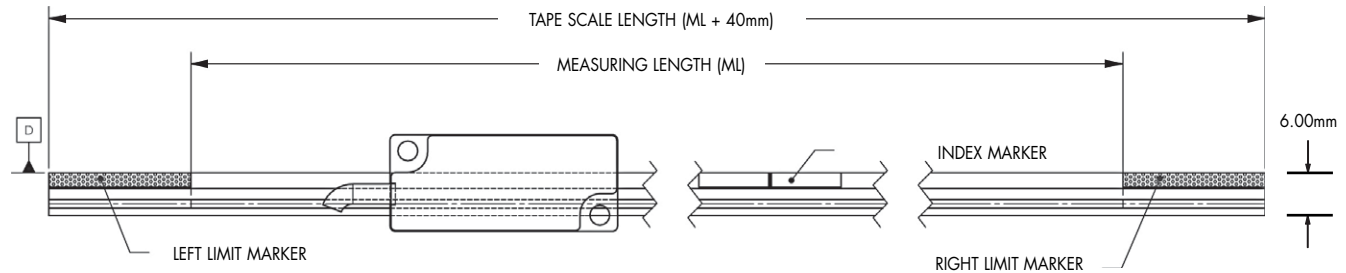
The laser scale length that you specify for your application must be calculated as follows. This calculation applies whether your application requires end limits or not. 20mm at each end of the tape scale are not to be used for encoder feedback.

**Tape Scale Length = Measuring Length + 40mm\***

Example: Measuring Length of 800mm is required, and limits will be used at the end of the tape scale. The Tape Scale Length = 800mm + 40mm = 840mm.

\*When the end limits are at the ends of the tape scale as shown below. The Tape Scale Length must be increased further if the limit markers are applied at a distance from the ends of the tape scale.

## Index and Limit Marker Locations When End Caps Are Not Used



**D** = Mounting Surface Reference Edge

## Specifications

Accuracy	±5µm/m after two-point linearization in the customer's controller
Material	Inconel 625
Typical CTE	13ppm/°C; thermal behavior of the tape scale is typically matched to the substrate using epoxy at the ends of the tape scale

## Available Lengths:

Order as much tape scale as you will require for your production and cut it to length for each job, or order pre-cut lengths to match your application requirements. Note that the Measuring Length for each axis in your equipment will be 40mm less than the Tape Scale Length when end caps are not used. PurePrecision laser tape scale is shipped in tubes for lengths from 40mm - 500mm and in dispensers for lengths greater than 500mm.

Order the required Tape Scale Length using model number TS-xxxxx (where xxxxx = Tape Scale Length in mm [40mm - 30000mm]). Example (9000mm Tape Scale): TS-09000. Contact MicroE Systems for lengths greater than 30m.

# Linear and Rotary Glass Scales

MicroE Systems offers a wide array of chrome on glass scales. Easy to install, choose from standard linear and rotary scales, or customized linear, rotary, and rotary segment scales where needed. Use linear glass scales when you need the highest accuracy.

## Glass Scale Options

- Standard linear: 10mm - 1m (consult MicroE for longer lengths)
- Standard rotary: 44mm - 121mm diameter, with or without hubs
- Custom linear\*: special lengths, widths, thickness, index mark locations, pre-printed index and limits, and special low CTE materials
- Custom rotary\*: special ID's, OD's (up to 304.8mm), index mark inside 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.

Mercury II linear glass scales 130mm or shorter are only 6mm wide, enabling drop-in replacement of existing 6mm wide tape scale encoders for dramatic improvements in motion system resolution and accuracy.

## Standard Short Linear Scales

130mm and Shorter

Dimensions in mm.

## Specifications

Accuracy	±1.5µm standard accuracy grade ±1µm available (high accuracy grade)
Material	Soda lime glass
Typical CTE	8ppm/°C (Ultra-low CTE glass available)

## Linear Glass Scales

The stick-on (adhesive-mount) optical index and limit markers are mounted on the scale in seconds usually using the same reference edge as for the scale or a metal block. This space-saving design keeps the index and limit markers within the 6mm width of the scale, ideal for space-constrained motion systems. The index is bi-directional, operates at all encoder speeds, and is repeatable to 1LSB.

The scale length that you specify for your application must be calculated as follows.

### When your application requires end limits:

$$\text{Glass Scale Length} = \text{Measuring Length} + 40\text{mm}^*$$

Example: A Measuring Length of 90mm is required, and limits will be used. Scale Length = 90mm + 40mm = 130mm.

\*When the end limits are at the ends of the tape scale

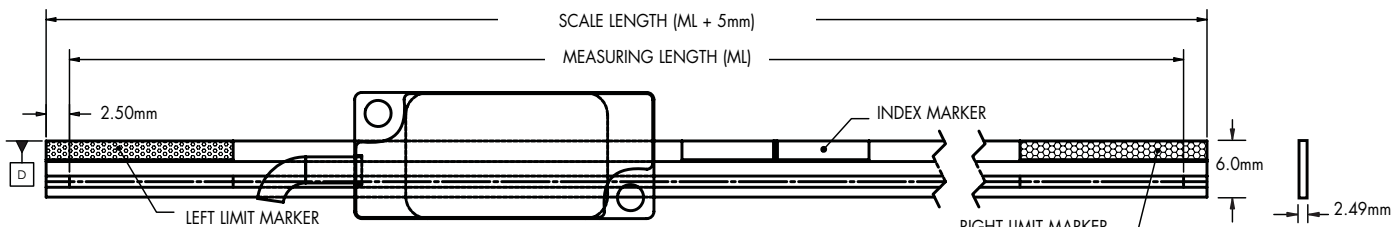
### When your application does not require end limits:

$$\text{Glass Scale Length} = \text{Measuring Length} + 5\text{mm}$$

Example: A Measuring Length of 25mm is required, and limits will not be used. Scale Length = 25mm + 5mm = 30mm.

### Factory cut-to-length flexibility:

Mercury II's stick-on index and limit markers make factory cut-to-length glass scales possible, enabling rapid turnaround for any scale length and helping you exactly match your application requirements. For OEM applications, linear glass scales can be ordered with pre-printed index and limit markers that are optimized for your needs, speeding installation and maximizing motion system performance.



**D** = Mounting Surface Reference Edge

Note: The following are only examples; you can order any size.

Model	MIL18	MIL30	MIL55	MIL80	MIL105	MIL130
Scale Length	18mm	30mm	55mm	80mm	105mm	130mm
Measuring Length - Without Limits	13mm	25mm	50mm	75mm	100mm	125mm
Measuring Length - With Limits	N/A	N/A	15mm	40mm	65mm	90mm

Custom scales available, including scales with pre-printed index and limits



# Linear Glass Scales with Stick-on Index and Limits

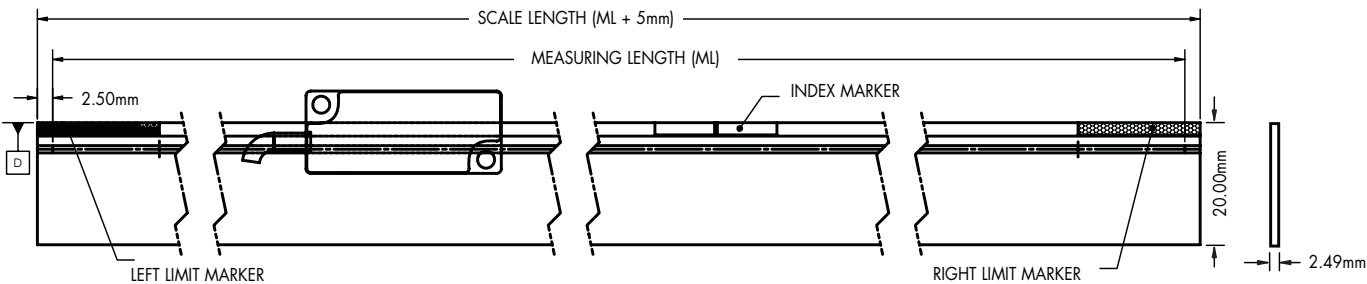
## Standard Long Linear Scales

131mm and Longer (Dimensions in mm.)

### Specifications

Accuracy	±5µm standard accuracy grade
	±2µm available (high accuracy grade)
Material	Soda lime glass
Typical CTE	8ppm/°C (Ultra-low CTE glass available)

Order the required Scale Length using model number MIILxxxx where  
xxxx = Scale length in mm (10mm - 1000mm).  
Example: (225mm Linear Glass Scale): MIIL225. Contact MicroE Systems  
for lengths greater than 1m.



**D** = Mounting Surface Reference Edge

Note: The following are only examples; you can order any size.

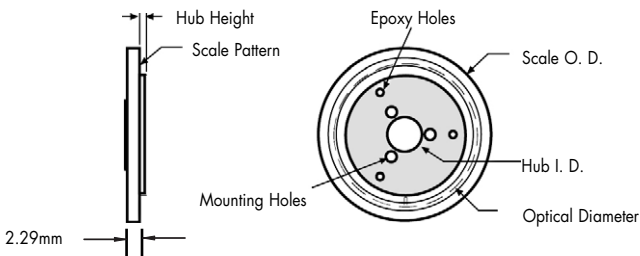
<b>Model</b>	MIIL155	MIIL225	MIIL325	MIIL425	MIIL525	MIIL1000
<b>Scale Length</b>	155mm	225mm	325mm	425mm	525mm	1000mm
<b>Measuring Length - Without Limits</b>	150mm	220mm	320mm	420mm	520mm	995mm
<b>Measuring Length - With Limits</b>	115mm	185mm	285mm	385mm	485mm	960mm

# Rotary Glass Scales with Built-in Index

## Standard Rotary Scales

### Specifications

Material	Soda lime glass
Typical CTE	8ppm/°C



Dimensions in mm

Model No.	Fundamental CPR	Scale Outer Diameter	Scale Inner Diameter	Optical Diameter	Hub Inner Diameter +0.013mm/-0.0000	Hub Height
MIIR4513	5000	44.45mm	12.70mm	31.83mm	6.358mm	1.27mm
MIIR6425	8192	63.50mm	25.40mm	52.15mm	12.708mm	1.52mm
MIIR12151	16384	120.65mm	50.80mm	104.30mm	25.408mm	2.03mm

Custom scales are available including larger diameters

# Installation Accessory Kits



Compatible with all Mercury II™ encoder models, Installation Accessory Kits provide everything you need to install Mercury II encoders. Kits come in “non-consumable” and “consumable” styles. Non-consumable kits are designed for first-time buyers. They include the special tools that you only need to buy once, and add all of the consumables needed for five installations. Consumable kits are for customers to reorder after they have used up the consumable materials in the Non-consumable kits. The Consumables Kits include all materials necessary for 10 installations. All Accessory Kits include both Metric and US Customary sensor mounting screws and hex wrenches, and come packaged in a kit for convenient storage. For instructions about how to use the kits, see the installation manual for Mercury II encoders at [www.microesys.com/MercuryII](http://www.microesys.com/MercuryII).

- MIIAK-1** Non-consumables for Tape Scale Installations (includes consumables for five installations)
- MIIAK-2** Consumables for Tape Scale Installations (includes consumables for 10 installations)
- MIIAK-3** Non-consumables for Linear Glass Scale Installations (includes consumables for five installations)
- MIIAK-4** Consumables for Linear Glass Scale Installations (includes consumables for 10 installations)
- MIIAK-5** Non-consumables for Rotary Glass Scale Installations (includes consumables for five installations)
- MIIAK-6** Consumables for Rotary Glass Scale Installations (includes consumables for 10 installations)

	<b>MIIAK-1</b>	<b>MIIAK-2</b>	<b>MIIAK-3</b>	<b>MIIAK-4</b>	<b>MIIAK-5</b>	<b>MIIAK-6</b>
Tape Scale Applicator Tool - for applying tape scale	1					
Tape Scale Shears - for cutting tape scale	1					
Tweezers - plastic with sharp tips	1		1			
Sensor Height Gage - for verifying sensor height	1		1		1	
Index and Limit Marker Set - for tape or linear glass scales	5	10	5	10		
Tape Scale End Caps (two required per tape scale installation)	10	20				
Two-part Epoxy - for mounting scales	5 Packages	10 Packages	5 Packages	10 Packages	5 Packages	10 Packages
Silicone Adhesive - for mounting linear glass scales			1 Tube	1 Tube		
Powder-Free Finger Cots	8	15	8	15	8	15
Scale Cleaning Tissues	8	15	8	15	8	15
Sensor Mounting Screws - M2.5x6mm	10	20	10	20	10	20
Sensor Mounting Screws - 2-56UNCx1/4inch	10	20	10	20	10	20
Hex Wrench for M2.5 Screws	1		1		1	
Hex Wrench for 2-56UNC Screws	1		1		1	

Note: MII5000 sensor height gages and sensor mounting screws are not included in the accessory kits. Contact MicroE Systems for availability.

# How to Order Mercury II™ 5800Si Encoder Systems

To specify your Mercury II 5800Si encoder with the desired encoder model, cable length, level of interpolation, maximum output frequency, and limit logic, order the required quantities for each system model number below. Order scales and additional items using their model number. Call MicroE Systems' Rapid Customer Response team for more information at 781-266-5700.

## MII5800Si, Serial Output with Output Resolution up to 1.2nm

**Example: MII5810-Si-14-21-1-0**

<u>MII58XX</u>	<u>Si</u>	<u>Interpolation Bits</u>	<u>Number of Fringe Count Bits</u>	<u>Index Mode</u>	<u>Low Pass Filter Roll Off Frequency (% of Sample Rate)</u>
MII5810 = 1m cable MII5830 = 3m cable MII5850 = 5m cable	Si = Serial output	2 = 2  3 = 3 ↓ 14 = 14	2 = 2  3 = 3 ↓ 21 = 21	0 = No change to position at index  1 = Position reset at every index	0 = off (full bandwidth)  1 = 1% of sample rate 2 = 2% of sample rate ↓ 40 = 40% of sample rate

# How to Order Mercury II™ Encoder Systems

## How to Order SmartPrecision Alignment Tool

Required for MII5800Si setup. AC / DC Power Supply is included, 100-240 VAC / 50-60 Hz. Model ATMII5000 works with all MII5000 and MII5800Si models.

**Example (Alignment Tool for Mercury II 5000 encoders, Europlug): ATMII5000-S-EU**

<u>ATMII5000</u>	<u>Connector</u>	<u>Plug Type</u>
	S = 15-pin Std. D-sub	US = Power Supply with US Standard 2-prong plug  EU = Power Supply with European Standard 2-prong plug

## PurePrecision™ Laser Tape Scales

**Example (8000mm Tape Scale): TS-08000**

TS-xxxxx Where xxxxx = Tape Scale Length in mm (40mm - 30000mm)

### MS

MS = One set of index and limit markers  
(one index marker, one left limit marker, and one right limit marker)

### EC

EC = One bag of tape scale end caps (10 per bag)  
Note: two end caps are recommended per tape scale installation

# How to Order Mercury II™ Encoder Systems

## PurePrecision Linear Glass Scales

(Standard accuracy grade)

### Example (350mm Linear Glass Scale): MII<sub>L</sub>350

MIILxxxx Where xxxx = Glass Scale Length in mm (10mm - 1000mm)  
(High accuracy grade scales: consult MicroE Systems)

Note: index and limit marker sets must be ordered separately - one set per linear glass scale

## PurePrecision Rotary Glass Scales

### Example (44.45mm OD Rotary Glass Scale with Hub):

#### MIIR4513-HI

<u>MIIRxxxx*</u>	- Hub
MIIR4513	NH = Without Hub
MIIR6425	HI = for R4513
MIIR12151	HJ = for R6425
	HK = for R12151

\*Custom versions are available

Note: rotary glass scales are shipped not mounted to hubs; hub mounting is available from MicroE Systems - contact us for information

## Installation Accessory Kits

### Example (Consumables Kit for Tape Scale Installations): MIIAK-2

<u>MIIAK</u>	- Kit Number
1	= Kit 1, Non-consumables for tape scale installations. Includes consumables for (5) installations.
2	= Kit 2, Consumables for tape scale installations. Includes consumables for (10) installations.
3	= Kit 3, Non-consumables for glass scale installations. Includes consumables for (5) installations.
4	= Kit 4, Consumables for glass scale installations. Includes consumables for (10) installations.
5	= Kit 5, Non-consumables for rotary glass scale installations. Includes consumables for (5) installations.
6	= Kit 6, Consumables for rotary glass scale installations. Includes consumables for (10) installations.

## Mercury II Encoders Are Fully RoHS-Compliant

Mercury II is fully compliant with European Directive 2002/95/EC (Restriction of use of Hazardous Substances, "RoHS"). A Document of Compliance is available upon request. "Mercury™" is a brand name of MicroE Systems; Mercury and Mercury II encoders do not contain any mercury metal.

## Vacuum-Rated and Small Diameter Rotary Encoders

See [www.microesys.com/mercury](http://www.microesys.com/mercury) for Mercury linear and rotary encoders that are vacuum rated up to 10<sup>-8</sup> torr, small-diameter rotary encoders with scale outside diameters from 32mm to 12mm and low-cost PCB mount encoders.

All specifications are subject to change.

**MicroE Systems** - World Headquarters: 125 Middlesex Turnpike, Bedford, MA USA 01730-1409

DS-Mercury II 5800Si Rev. E

[www.microesys.com](http://www.microesys.com)

[info@microesys.com](mailto:info@microesys.com)

T. 781-266-5700

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