MicroE Systems®

Mercury II™ 6000 Family

High Performance Encoders with Digital Output

High Resolution and Accuracy with Tape or Glass, Linear or Rotary Scales

The new Mercury II 6000 (MII6000) Family of Encoders represents a breakthrough in performance, offering class-leading resolution and accuracy, digital output, the smallest sensor size, unmatched versatility, robustness, smart programmable features, and easy installation.

System Features at a Glance

- Mercury II 6000 Family of Encoders consists of:
  - MII6500/6700/6800 - A-quad-B Outputs
  - MII6800Si/Pa (Pa - Panasonic) - High Speed Serial Interfaces
- Serial interface for Panasonic MINAS A4 and A5 series servo drives (for use with linear axes)
- High-resolution interpolated digital output directly from the sensor; resolution from 5µm to 1.22nm
- Extremely low cyclical error - only ± 20nm - provides smooth velocity control
- Small sensor - 8.2 mm tall sensor fits tight spaces
- Faster - up to 5m/s at 0.1µm resolution (MII6000). Up to 10 m/s at 1.22nm resolution (MII6800Si/Pa)
- Smarter - programmable resolution in integer steps for MII6000; in binary steps for MII6800Si/Pa
- Cut-to-length Marker and Laser tape scale come in dispensers up to 30m
- Linear glass scales for high accuracy
- Built-in and Stick-on optical index and left/right limits
- Bi-directional optical index is repeatable to 1LSB
- Low power consumption, low heat generation at the sensor

RoHS
CE

Mercury II: The Next Generation

High Resolution Digital Output

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 Systems 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.

Specifications

Resolution	Linear: 5µm to 1.22nm Rotary: 20k to 268M CPR*
Linearity	Tape Scale: ≤ ± 5µm/m**
Accuracy	Glass Scales: Linear: ± 1µm available ± 1.5µm to ± 5µm standard Rotary: Up to ± 2.1 arc-sec
Outputs	A-quad-B, Index Pulse, Dual Limits, and Alarm (MII6500/6700/6800) High Speed Serial Word in two serial interfaces (MII6800Si/Pa)
Scales	Same Sensor for Tape or Glass, Linear or Rotary

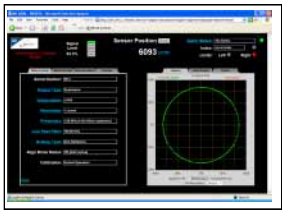
* More is possible with custom diameter grating

**Over any one meter of travel after slope correction in customer's controller

- Broadest alignment tolerances and pushbutton setup with LEDs
- Differential outputs for high reliability in high EMI environments
- Software for setup, programmable features, 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 sizes. Rotary diameters from 44mm to 121mm or custom sizes.
- Sensor cable length of 1m, 3m, 5m, or custom lengths
- SmartPrecision™ II Software



High-Performance Encoders

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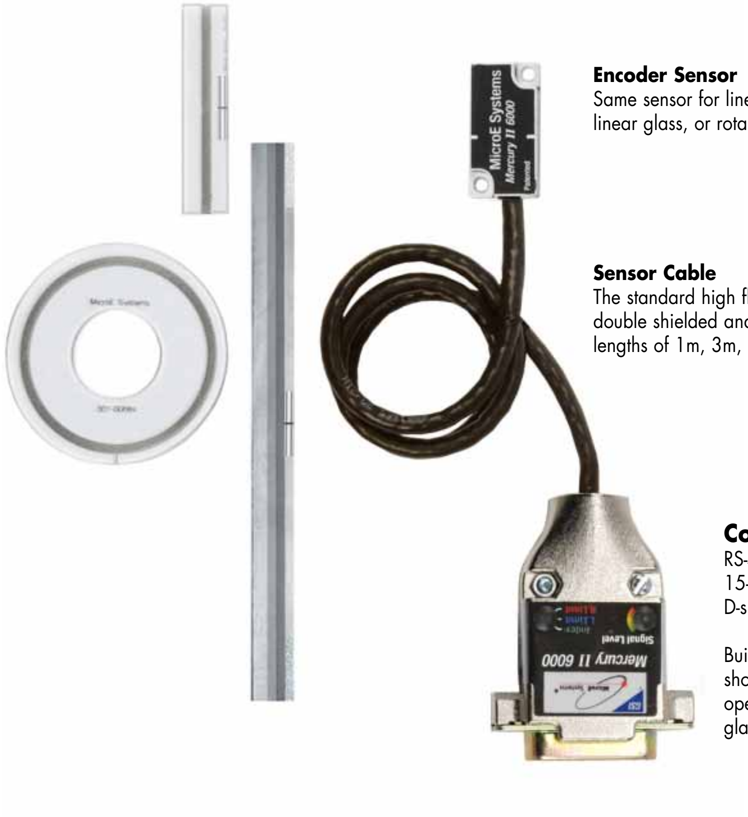
System Configurations

Standard and Optional Equipment

RoHS
CE

Mercury II 6000 Family of Smart Encoder Systems

Standard Equipment


MicroE Systems
Mercury II 6000
Patented
Mercury II 6000
Signal Level
Index
L Limit
R Limit

Encoder Sensor
Same sensor for linear tape, linear glass, or rotary glass scales.

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

Built-in status LEDs show the encoder's operational status at a glance, at all times.

SmartPrecision™ Alignment Tool for Setup - ATMII5000

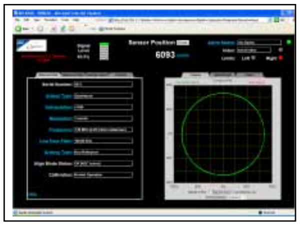
- Provides fast and easy sensor alignment, index setup, and limit setup.
- Status and setup LEDs: red/yellow/green signal strength LEDs assist during setup and provide diagnostics at a glance; status LEDs for both limits; power-indicating LED.
- Includes AC/DC power supply (not shown).
- Use pushbutton or software for setup.
- Built-in SmartPrecision II Software for setup and diagnostics; only a web browser is needed (use of software is optional).
- Ethernet software connectivity supports remote connection to the Alignment Tool and MII6000 Family of Encoders and multiple encoders/computers.

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

MII 5000 Encoder
GSI
MicroE Systems
5VDC
Mercury II 5000
Alignment Tool
Adapter
Alignment Tool
GSI
MicroE Systems
Mercury II 5000
SmartPrecision
Alignment Tool
Power/Cal.
Signal
L Limit
R Limit
Cal.

Mercury II 6000 Family

Optional Equipment



SmartPrecision II™ Software
The software performs setup 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 12 for details. Requires Ethernet cable.

Mercury II 6000 Family

Installation Accessories

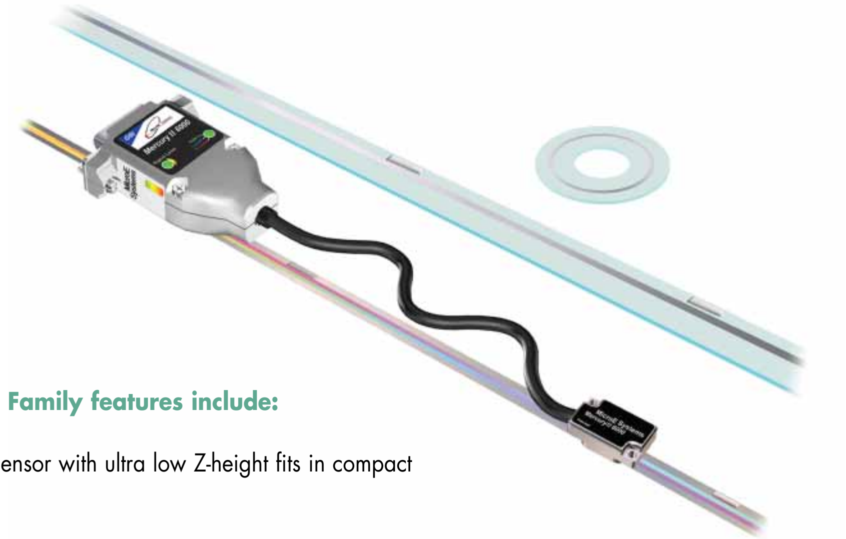
MicroE Systems

Tape Scale Applicator Tool

Tape Scale Shears

MII6000 Family System Features at a Glance

The Mercury II 6000 Family of Encoders 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.

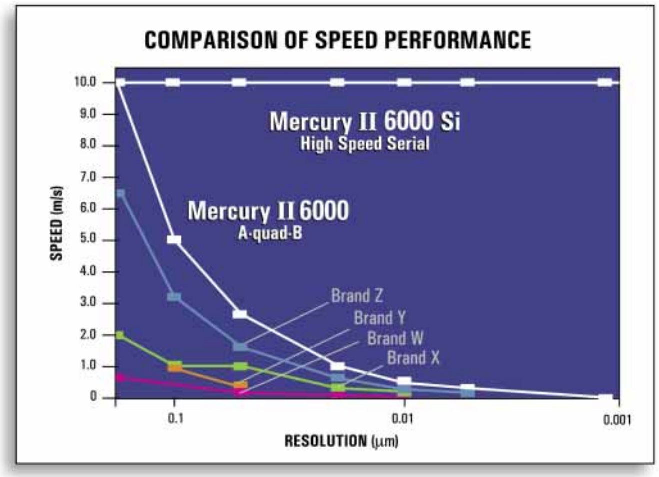


Mercury II 6000 Family features include:

- Small, low-mass sensor with ultra low Z-height fits in compact motion systems.

- Superior resolution and accuracy - resolutions up to 1.22nm (linear), 268M CPR (rotary); cyclic error of ± 20nm typical (linear glass scales); long range accuracy up to ± 1µm (linear glass scales up to 130mm long).

- High-speed operation - 5m/s at 0.1µm resolution (Quadrature Output); 10m/s at 1.22nm resolution (Serial Output).



- Versatility - one sensor works with 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.

- Low sensor power consumption and heat generation – electronics in the sensor are minimized to achieve the lowest possible power consumption and associated heat generation, making the motion stage more thermally stable. Sensor power consumption is just 50mA at 5V DC. Power supply: for quadrature output, 180mA with A, B, L, LL, and RL outputs terminated for the whole encoder system; for serial output, 172mA system total with all outputs terminated.

- 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 required, are easy to apply, and require no adjustment; markers work on both laser tape and linear glass scales.

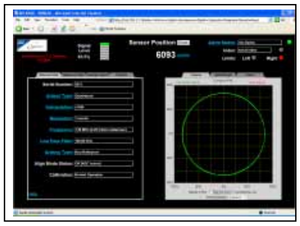
- Status LEDs in the connector show encoder signal strength and limit status at a glance.

- 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 ensures encoder operation even with fingerprints, oil, dust and other forms of contamination.

- Fail-safe dual optical limits have differential outputs (LVTTL) and reduce motion system cabling; index and limit markers fit right on the 6mm wide tape scale for maximum space savings.

- Optional MIIA-OCL Adapter converts LVTTL limit signals to open-collector.

- Included software makes setup and diagnostics easy; Ethernet connectivity allows you to use any computer.



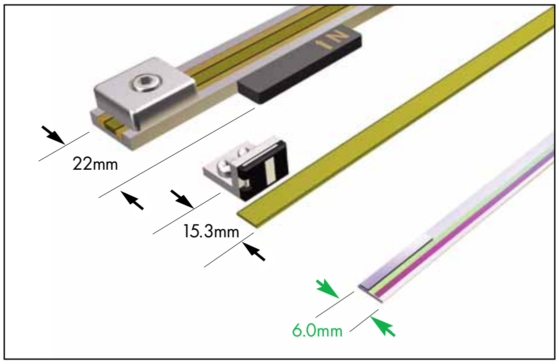
Smallest Sensor, Lowest System Height, Smallest Tape Scale System, Broader Alignment Tolerances, and More

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

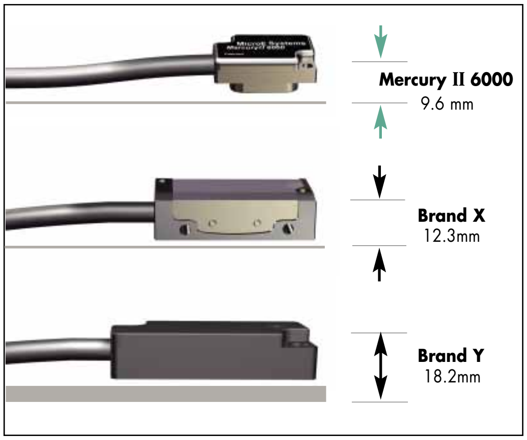
Mercury II Can Reduce System Size and Cost

Mercury II 6000 Family system height with tape scale is 28% shorter than competitive encoders, 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 6000 Family 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.

Smallest Tape Scale System



Lowest System Height



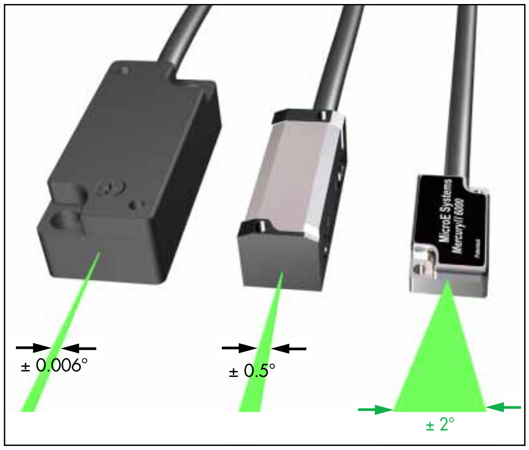
Mechanical Dimension Comparison*

	Mercury II 6000 with Tape Scale	Brand X	Brand Y	Mercury II vs. Best Competitor
System height	9.6mm	12.3mm	18.2mm	28% better
Sensor Z height	8.2mm	10mm	12.0mm	22% better
Standoff tolerance	± 0.15mm	± 0.15mm	± 0.1mm	
Tape scale width**	6.0mm	13.5mm	21.0mm	125% better

*Based on published specifications for encoders with digital output

**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 – 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.

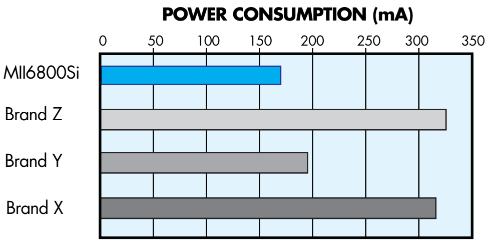
Alignment Tolerance Comparison*

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

*Based on published specifications for encoders with digital output

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

Lowest Power Consumption



Note: MII6800Si shown with all signals terminated. Brands X, Y and Z shown with A, B, and I terminated.

The MII6000 Family uses advanced electronics, giving MII6000s 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

MII6000 Family System Specifications

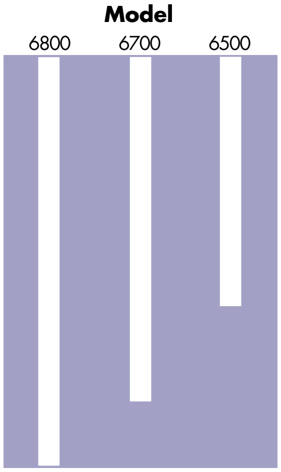
RoHS

Resolution and Maximum Speed Tables - Quadrature Output

Mercury II 6000 systems (models 6500/6700/6800) have programmable interpolation from x4 to x16384 in integer steps. Below are tables of sample values. For applications requiring up to 10m/s at full resolution, use the MII6800Si/Pa with high speed serial interface.

Linear - 20µm grating pitch

Maximum Interpolation	Resolution	Maximum Speed*
x 4	5.000µm/count	10000mm/sec
x 10	2.000µm/count	10000mm/sec
x 20	1.000µm/count	10000mm/sec
x 40	0.500µm/count	10000mm/sec
x 80	0.250µm/count	10000mm/sec
x 100	0.200µm/count	10000mm/sec
x 200	0.100µm/count	5000mm/sec
x 400	0.050µm/count	2500mm/sec
x 1000	20.0nm/count	1000mm/sec
x 2000	10.0nm/count	500mm/sec
x 4000	5.00nm/count	250mm/sec
x 8000	2.50nm/count	125mm/sec
x 16384	1.22nm/count†	61mm/sec

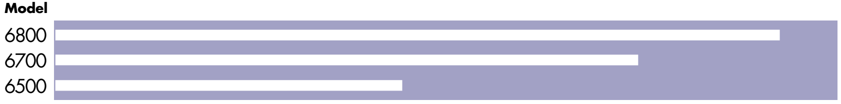


†Value rounded for readability; use the formula [20µm/interpolation multiplier] to calculate the exact resolution in units of µm/count.

Rotary - 20µm grating pitch

Rotary Glass Scale Diameter | **Fundamental Resolution** | **Interpolation**

Note: The range of available values is x4 to x16384 in integer steps; sample values below.



Rotary Glass Scale Diameter	Fundamental Resolution	x4	x20	x40	x400	x1000	x4000	x16384
44.45mm	**5000 CPR**	**x4**	**x20**	**x40**	**x400**	**x1000**	**x4000**	**x16384**
	interpolated resolution (CPR)	20000	100000	200000	2000000	5000000	20000000	81920000
	interpolated resolution (arc-sec/count)**	64.8	12.96	6.48	0.648	0.259	0.0648	0.01582
	interpolated resolution (µrad/count)**	314	62.8	31.4	3.14	1.257	0.314	0.0767
	maximum speed* (RPM)	6000	6000	6000	1500	600	150	36.6
63.50mm	**8192 CPR**	**x4**	**x20**	**x40**	**x400**	**x1000**	**x4000**	**x16384**
	interpolated resolution (CPR)	32768	163840	327680	3276800	8192000	32768000	134217728
	interpolated resolution (arc-sec/count)**	39.6	7.91	3.96	0.396	0.1582	0.0396	0.00966
	interpolated resolution (µrad/count)**	191.7	38.3	19.17	1.917	0.767	0.1917	0.0468
	maximum speed* (RPM)	3660	3660	3660	915	366	91.5	22.3
120.65mm	**16384 CPR**	**x4**	**x20**	**x40**	**x400**	**x1000**	**x4000**	**x16384**
	interpolated resolution (CPR)	65536	327680	655360	6553600	16384000	65536000	268435456
	interpolated resolution (arc-sec/count)**	19.78	3.96	1.978	0.1978	0.0791	0.01978	0.00483
	interpolated resolution (µrad/count)**	95.9	19.17	9.59	0.959	0.383	0.0959	0.0234
	maximum speed* (RPM)	1830	1830	1830	457	183.1	45.7	11.17

*Maximum speed produces an encoder quadrature output of 50 million states per second (12.5MHz). See page 9 for additional output frequencies. Maximum speeds shown above will be reduced if a lower quadrature output frequency is selected.

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

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

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

MII6000 Family System Specifications

Resolution and Maximum Speed Tables - Serial Output

Mercury II 6800Si/Pa systems have programmable interpolation from x4 to x16384 in binary steps. Below is a table of examples. Unlike A-quad-B encoders, the MII6800Si/Pa 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; sample values below.			
44.45mm	**5000 CPR**	**x4**	**x1024**	**x4096**	**x16384**
	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
63.50mm	**8192 CPR**	**x4**	**x1024**	**x4096**	**x16384**
	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
120.65mm	**16384 CPR**	**x4**	**x1024**	**x4096**	**x16384**
	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.

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

MII6000 Family System Specifications

System

Scales:

- PurePrecision Marker Tape or Laser Tape scales - 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 [20µm/interpolation multiplier] to calculate the exact resolution in units of µm/count.

Note: MII6800Pa resolution is fixed at 1.22nm.

Cyclical Error	
Tape Scales:	± 30nm typical over any 20µm movement
Glass Scales:	± 20nm typical over any 20µm movement

Tape Scale Linearity ≤ ± 5µm/m

Glass Scale Accuracy	
High accuracy grade:	≤ ±1µm for scales up to 130mm
	≤ ±2µm for scales from 130mm to 1m
Standard accuracy grade:	≤ ±1.5µm for scales up to 130mm
	≤ ±5µm for scales from 130mm to 1m

Note: Accuracy is the 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	± 38	± 7.8
	63.50mm	± 19	± 3.9
	120.65mm	± 10	± 2.1

*Based on ideal scale mounting concentricity.

Index: Built-in or stick-on; bi-directional, full speed. Note: After power up, the index mark must be passed once at ≤ 1 m/s for proper operation.

Limits: Separate built-in or stick-on left and right limits.

Laser-written embedded index and limits available. Contact MicroE.

Sensor Size

H:	8.23mm
W:	12.70mm
L:	22.61mm

Operating and Electrical Specifications

Agency Standards Conformance: In accordance with Electromagnetic Compatibility Directive 2004/108/EC:

EN 55011:2007

EN 61000-4-2, -3, -6

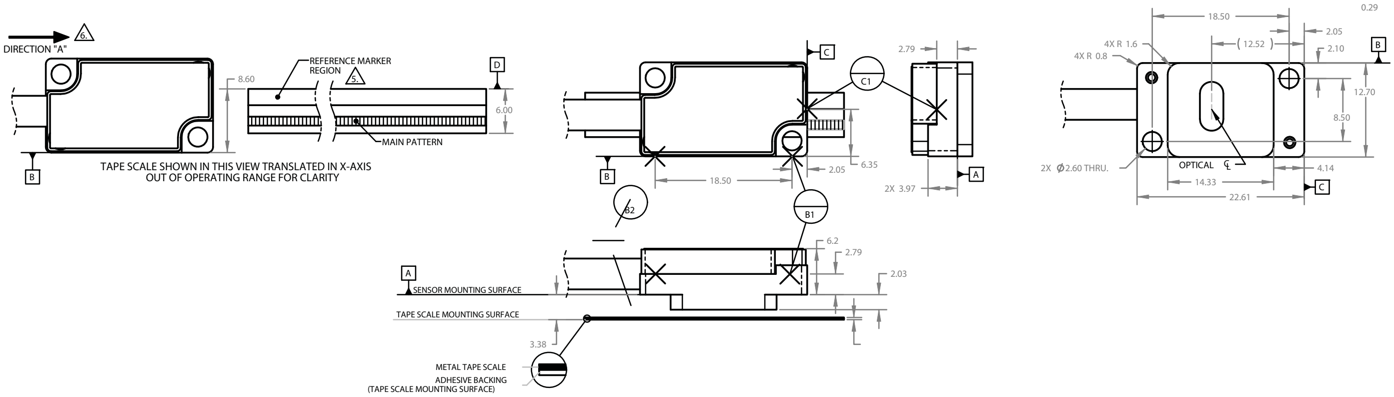
SPI Interface Clock Speed
Clock Speed: 25MHz - 50MHz
Maximum Sample Rate: 227,272 position reads/sec with 50MHz clock

Power Supply:	5VDC ±5%	@ 140mA (no outputs terminated) @ 180mA (A, B, I, and both limits terminated); 50mA at the sensor (MII6500/6700/6800) @ 172mA (all serial I/O connections terminated); 50mA at the sensor (MII6800Si/Pa)

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:	3g (Sensor without cable)
Cable:	Double Shield Maximum length: 10m (contact MicroE Systems for applications >5m) Diameter: 4.2mm Flex Life: 20 x 10^6 cycles @ 20mm bending radius

Reliability Information

5 Year Expected Reliability: >99.8% under normal operating conditions


DIRECTION "A"
6.
REFERENCE MARKER REGION
5.
D
8.60
6.00
MAIN PATTERN
B
TAPE SCALE SHOWN IN THIS VIEW TRANSLATED IN X-AXIS OUT OF OPERATING RANGE FOR CLARITY
C
C1
2.79
2.05
6.35
18.50
2X 3.97
A
B2
B1
6.2
2.79
2.03
SENSOR MOUNTING SURFACE
TAPE SCALE MOUNTING SURFACE
3.38
METAL TAPE SCALE
ADHESIVE BACKING
(TAPE SCALE MOUNTING SURFACE)
0.29
18.50
2.05
4X R 1.6
4X R 0.8
(12.52)
2.10
12.70
8.50
2X Ø2.60 THRU.
OPTICAL ℄
4.14
14.33
22.61

Note: Sensor shown with tape scale Refer to the Mercury II 6000/6800Si interface drawings for additional dimensional details and important notes.

Mercury II 6000 Family Electronics

RoHS
CE

MicroE Systems
Mercury II 6000

The Mercury II 6000 Family of Encoders is optimized to achieve the smallest sensor with the lowest power consumption, while delivering high resolution and accuracy. This compact, versatile system 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
- A-quad-B tri-state output alarm for low signal. Alarm on output pin (and 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
- Status LEDs in the connector show the encoder's operational status at a glance

Programmable Interpolation

For the Mercury II 6000 family of encoders, the sensor has programmable interpolation that is selectable over the range x4 to x16,384 in integer steps (depending on model), providing output resolutions that can be matched to your application requirements. This feature allows customers to reduce inventory and field spare parts costs since one electronics module can be programmed for many different resolution requirements and different motion axes. Motion system development engineers also benefit from the flexibility of programmable interpolation by allowing them to vary the encoder's resolution during motion system loop tuning and optimization. Linear resolutions can range from 5μm to 1.22nm in convenient increments and rotary resolutions from 20k CPR to 268 million CPR. Specify the interpolation value at the time of ordering or select the interpolation at your site using SmartPrecision II Software.

Programmable Maximum Output Frequency

For the Mercury II 6000 Family of Encoders applications combining high resolution and high speed, the sensor supports up to 50 million quadrature state changes per second.* By specifying the maximum output frequency to match your controller's capability - ranging from approximately 0.098 to 50 million quadrature state changes per second - the Mercury II encoder system will never produce encoder counts faster than your controller can read them. Specify the encoder's maximum output frequency at the time of ordering or select the setting at your site using MicroE's SmartPrecision II Software.

* "Quadrature state changes per second" is the reciprocal of "dwell time" or "edge separation." For example, 50 million states per second = 0.02 μsec dwell time.

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 6800Si. 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 6800Si, encoder position values are sent directly into the controller's DSP. Limitations of encoders with A-quad-B output are completely eliminated. Standard features include:

- Very high motion speed with high encoder resolution - up to 10m/s movements with 1.22nm** resolution.
- 50MHz maximum input clock frequency/Sample rate of 227,272 position reads/sec with 50MHz clock.
- RS422 voltage levels are resistant to electromagnetic 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 11 for software features.

*Mercury II 6000 family of encoders supports Panasonic serial interface.

**Resolution values shown are approximate - see pages 5 and 6 for exact values.

Dual limits

Mercury II includes electrically fail-safe independent left and right limits with differential outputs. The limit outputs are non-latching. The output for limits is active-low, making them electrically fail-safe. Limit outputs can be configured for active-low or active-high at the time of ordering, or by the customer using SmartPrecision II Software, to match your controller's requirement.

Programmable Low Pass Filter

The Mercury II 6000 family has a programmable low-pass input filter for enhanced performance in low speed applications. The filter can be disabled for full bandwidth or set from 0.01 - 100kHz in steps of 0.01kHz for MII6500/6700/6800 (from 0.01% - 40% of the sample rate in steps of 0.01% for MII6800Si/Pa) where the frequency is -3dB output roll-off.

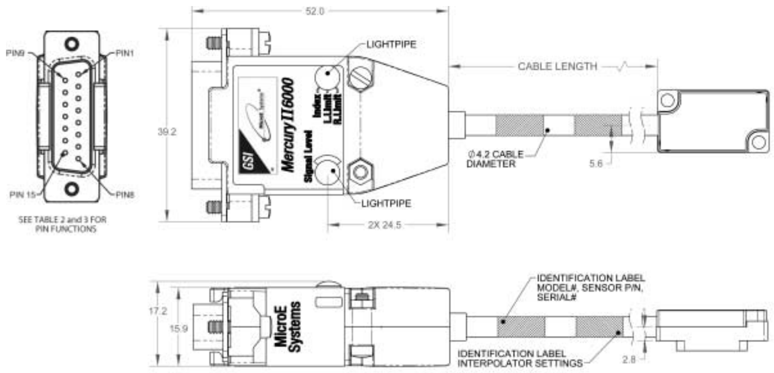
Mercury II 6000 Family Inputs and Outputs

Quadrature Inputs/Outputs

15-pin standard Male D-sub connector

PIN	Function
1	Right Limit+
2	Ground
3	Right Limit–
4	Index–
5	B–
6	A–
7	+5V
8	+5V
9	Ground
10	Left Limit+
11	Left Limit-
12	Index+
13	B+
14	A+
15	Alarm

Mechanical Information - 15 pin Connector


PIN9
PIN1
PIN 15
PIN8
SEE TABLE 2 and 3 FOR PIN FUNCTIONS
52.0
39.2
LIGHTPIPE
LIGHTPIPE
CABLE LENGTH
Ø4.2 CABLE DIAMETER
5.6
2X 24.5
GSI
Mercury II 6000
Index
L.Limit
R.Limit
Signal Level
17.2
15.9
MicroE Systems
IDENTIFICATION LABEL MODEL#, SENSOR P/N, SERIAL#
IDENTIFICATION LABEL INTERPOLATOR SETTINGS
2.8

Note: Tri-state alarm - A and B are tri-stated if the encoder signal becomes too low for reliable operation.

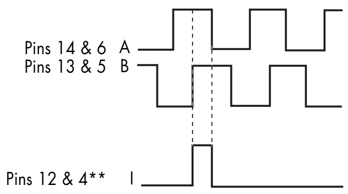
Maximum Quadrature Output Frequency

Output Frequency (MHz)	A-Quad-B Output Rate (millions of states/sec)	Dwell Time (or edge separation) (μsec)
12.50	50.00	0.02
6.25	25.00	0.04
3.125	12.50	0.08
1.563	6.25	0.16
0.781	3.125	0.32
0.391	1.5625	0.64
0.195	0.78125	1.28
0.098	0.390625	2.56
0.049	0.1953125	5.12
0.024	0.09765625	10.24

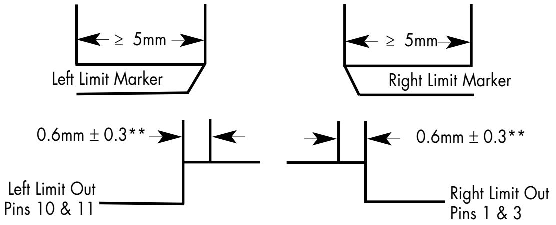
*Values shown are approximate. Exact values may be calculated as follows: Output Frequency = 12.5MHz / 2^n where n = number of steps below 12.5MHz, or Output Rate = 50 / 2^n where n = number of steps below 50 million states per second.

Output Signals

Quadrature*


Pins 14 & 6 A
Pins 13 & 5 B
Pins 12 & 4** I

Limits*

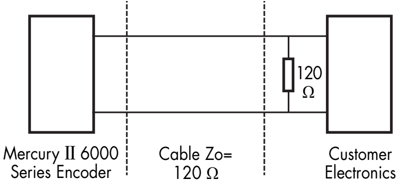

≥ 5mm
Left Limit Marker
≥ 5mm
Right Limit Marker
0.6mm ± 0.3**
0.6mm ± 0.3**
Left Limit Out
Pins 10 & 11
Right Limit Out
Pins 1 & 3

*Output signals are IEEE 422 compliant, 3.3V differential logic.

**Note: At some interpolation values, the index pulse may be aligned with states of A or B other than the ones shown.

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

Signal Termination for A-quad-B, Index, and Limits


120 Ω
Mercury II 6000 Series Encoder
Cable Zo= 120 Ω
Customer Electronics

Mercury II 6000 Family Inputs and Outputs

RoHS
CE

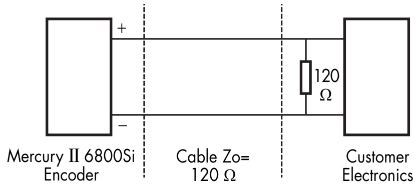
Serial Inputs/Outputs

15-pin standard Male D-sub connector

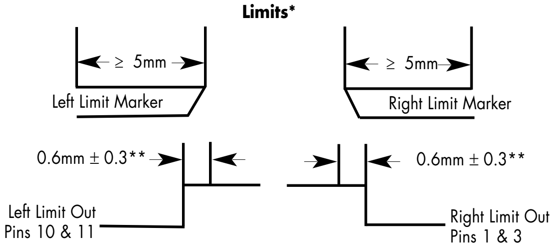
Pin	Name	Direction	Description
1	nCS+	Input	
2	GND*		
3	nCS-	Input	Negative True Chip Select (Capture Start)
4	Reserved - do not connect		Must be floating at host
5	SCLOCK_OUT-	Output	
6	SDATA_OUT-	Output	
7	+5V*		
8	+5V*		
9	GND*		
10	SCLOCK_IN+*	Input	Serial Clock from Host to Sensor
11	SCLOCK_IN-*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

Note*: The following are pinouts for MII6800Pa (Panasonic):
Pins 2,7,8,9 are same for both MII6800Si/Pa
Pin 10 = REQ_SD+, Pin 11 = REQ_SD-
(REQ = Request, SD = Serial Data)
All other pins are NC (no connect)

Signal Termination for Serial I/O Connections

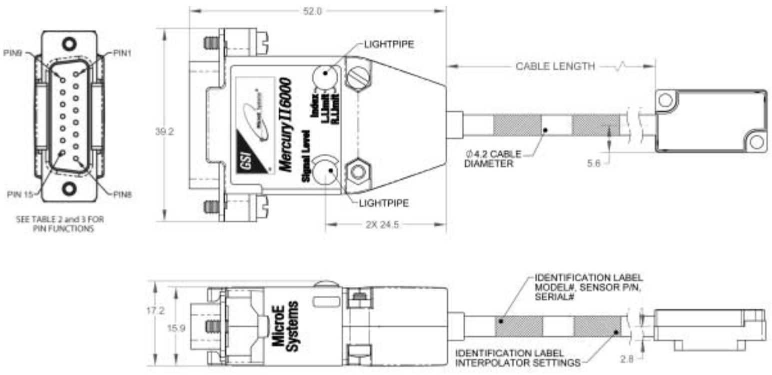

+
–
120 Ω
Mercury II 6800Si Encoder
Cable Zo= 120 Ω
Customer Electronics

Limit Marker Positioning


Limits*
≥ 5mm
Left Limit Marker
≥ 5mm
Right Limit Marker
0.6mm ± 0.3**
0.6mm ± 0.3**
Left Limit Out
Pins 10 & 11
Right Limit Out
Pins 1 & 3

*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


52.0
PIN9
PIN1
PIN 15
PIN8
SEE TABLE 2 and 3 FOR PIN FUNCTIONS
39.2
LIGHTPIPE
LIGHTPIPE
CABLE LENGTH
Ø4.2 CABLE DIAMETER
5.6
2X 24.5
GSI
Mercury II 6000
Signal Level
Index
L.Limit
R.Limit
17.2
15.9
MicroE Systems
IDENTIFICATION LABEL MODEL#, SENSOR P/N, SERIAL#
IDENTIFICATION LABEL INTERPOLATOR SETTINGS
2.8

Serial Word Data Format*

The SPI serial interface to the MII6800Si 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.

*For Mercury II 6800Si only. MII6800Pa Panasonic serial interface supported.

58 Bit Data Word

Start 4 bits	Position 4-35 bits	Status 9 bits	CRC 6 bits	Stop 4 bits

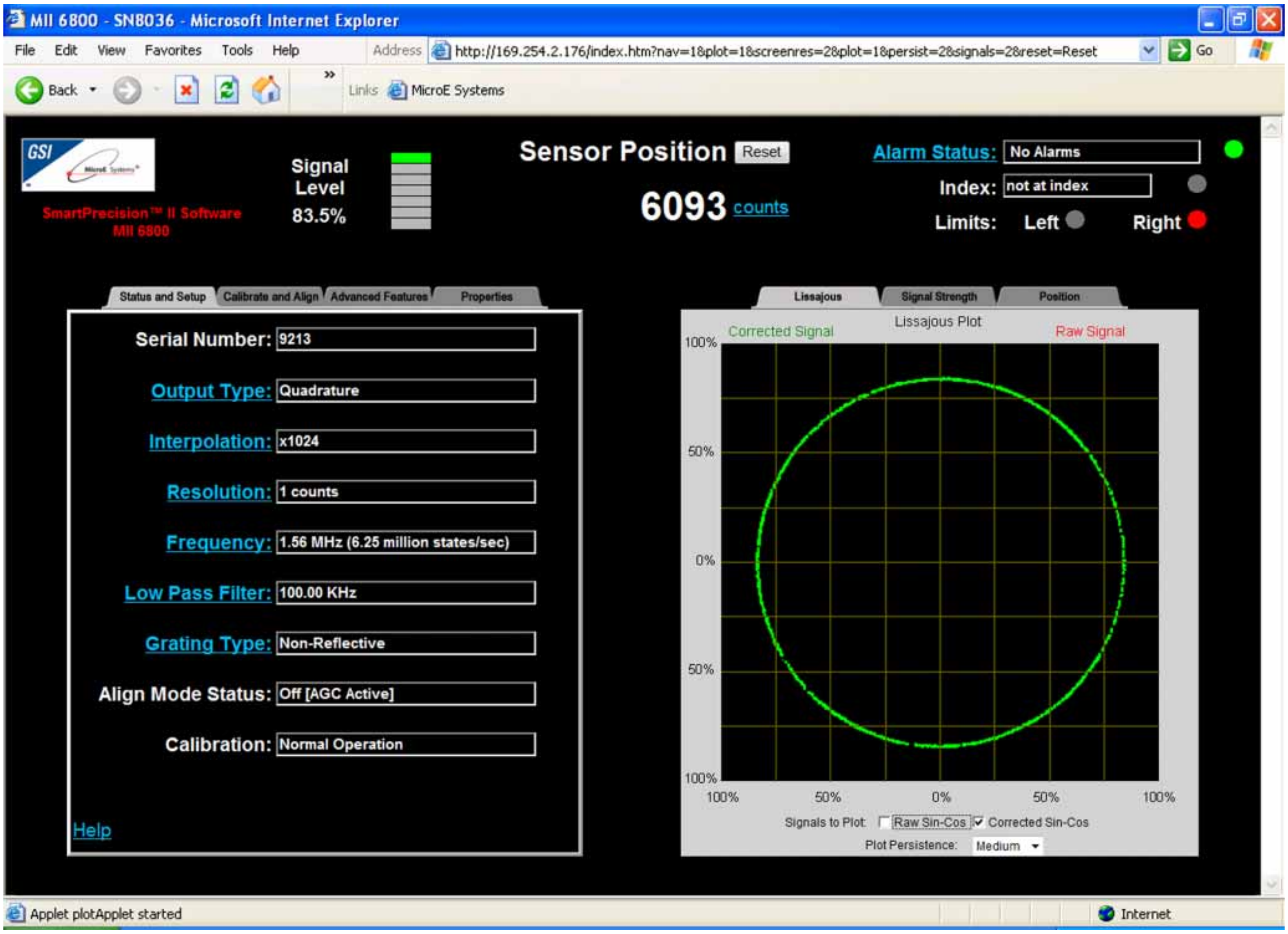
The data word length is up to 58 bits. The data word consists of four start bits, a position word of 4 to 35 bits (35 bits is full interpolation depth), nine bits of status, a 6-bit cyclic redundancy check (CRC) to provide data communication error detection, and four stop bits. This position word is 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 (for example: 14 bits = x16384 interpolation; see pages 5 and 6 for tables of output resolutions). Fringe count bits determine the maximum number of 20μm fringes that can be counted in the position word (for 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 6000 Installation Manual.

SmartPrecision II Software


MII 6800 - SN8036 - Microsoft Internet Explorer
File
Edit
View
Favorites
Tools
Help
Address
Go
Back
Links
MicroE Systems
GSI
SmartPrecision™ II Software
MII 6800
Reset
Status and Setup
Calibrate and Align
Advanced Features
Properties
Lissajous
Signal Strength
Position
Lissajous Plot
Corrected Signal
Raw Signal
100%
50%
0%
50%
100%
100%
50%
0%
50%
100%
Help
Applet plotApplet started
Internet

http://169.254.2.176/index.htm?nav=1&plot=1&screenres=2&plot=1&persist=2&signals=2&reset=Reset

Signal Level 83.5%

Sensor Position 6093 counts

Alarm Status: No Alarms

Index: not at index

Limits: Left ● Right ●

Serial Number: 9213

Output Type: Quadrature

Interpolation: x1024

Resolution: 1 counts

Frequency: 1.56 MHz (6.25 million states/sec)

Low Pass Filter: 100.00 KHz

Grating Type: Non-Reflective

Align Mode Status: Off [AGC Active]

Calibration: Normal Operation

Signals to Plot ☐ Raw Sin-Cos ☑ Corrected Sin-Cos

Plot Persistence: Medium

Why use software with an encoder?

Mercury II 6000 Family 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:

- Observe 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 6000 Family Alignment Tool, SmartPrecision II Software can perform setup 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

RoHS
CE

Program Mercury II 6000 Family Encoder Electronics

- Set interpolation in integer steps and filter roll-off frequency (quadrature output frequency) for MII6000 or in binary steps from x4 to x16,384 for MII6800Si/Pa
- Set maximum output frequency to match your controller
- Disable/enable low-pass filter and set filter roll-off frequency
- Set limit logic when necessary to match your controller's requirements
- Set grating type
- Set index mode

Install Mercury II 6000 Family 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
- Calibration

Monitor Mercury II 6000 Family Encoder Operation

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

Diagnose Mercury II 6000 Family 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 ATMII5000 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 an ATMII5000 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 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 Runtime Environment installed and enabled
- Ethernet connection to a computer, LAN, WAN or router

How To Order

SmartPrecision II Software is included with all ATMII5000 Alignment Tools and does not require any installation - just access it using your computer's web browser.

PurePrecision Marker and Laser Tape Scales

RoHS
CE

The Best Tape Scale Solutions Available

Mercury II PurePrecision Marker Tape and Laser Tape scales are fast and easy to install, provide excellent accuracy and take up less space than any encoder in this class because index and limit marks are contained within the tape's 6mm width. They mount using permanent pressure-sensitive adhesive. Thermal expansion of the substrate is matched by anchoring the ends of the tape scale using epoxy.

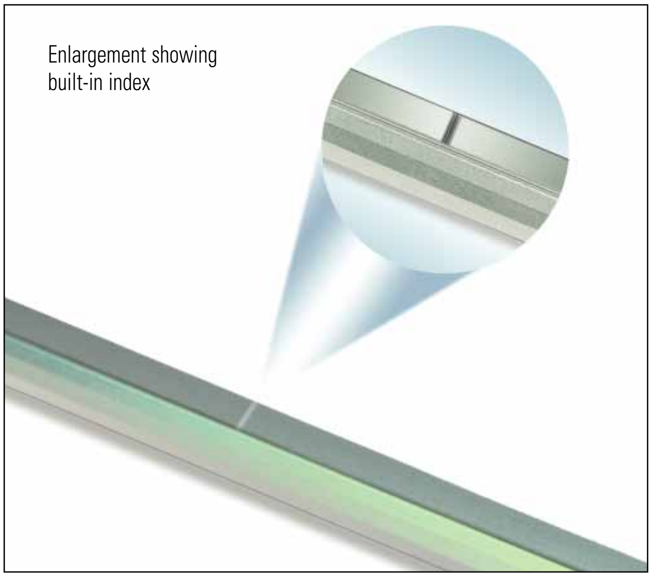
Marker Tape and Laser Tape scales are supplied in dispensers of lengths up to 30m so that they can be cut to any length required for your application, minimizing inventory costs. They may also be ordered pre-cut to any length you specify for high-volume OEM applications.

Left
MicroE Systems
194-00018
Right

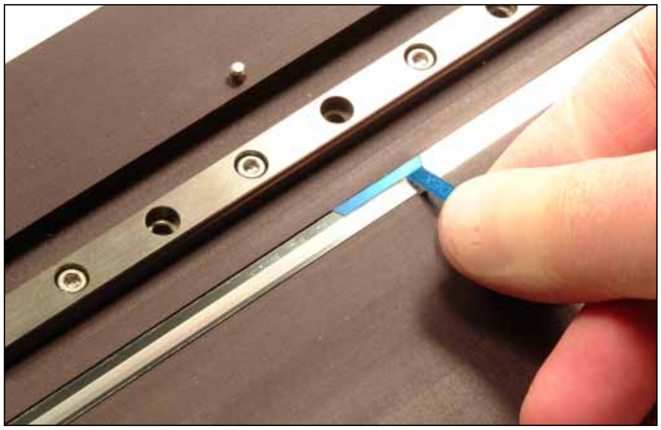
Installation for a wide range of lengths is fast and easy using MicroE Systems' tape applicator tool, or without a tool by hand. When using the installation tool, released paper is automatically removed from the tape. The tape's location on the mounting surface is set by a reference edge that is either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

PurePrecision Marker Tape

PurePrecision Marker Tape has built-in index and limit marks to speed installation. Manufactured into the tape scale to your specifications using a laser etch process, installation of the tape scale is reduced to one simple step: just apply the adhesive-mount tape scale to your system's mounting surface and you are done. There is no need to mount index or limit markers or magnets. The laser-written marks are placed in the exact locations you specify – index location, number of index marks, and limit mark lengths can be specified at the time of ordering. PurePrecision Marker Tape may be ordered in pre-cut lengths for the fastest installation, or in continuous form for cutting at your site.


Enlargement showing built-in index

PurePrecision Laser Tape with Stick-On Index and Limits



PurePrecision Laser Tape has the same high performance Inconel scale as PurePrecision Marker Tape, but without the factory written index/limit markers. Laser Tape provides the ultimate in flexibility and productivity by using stick-on index and limit markers so that you can cut the tape scale to any length you need.

The stick-on (adhesive-mount) optical index and limit markers are mounted on the tape in seconds 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.

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

PurePrecision Marker Tape Scale

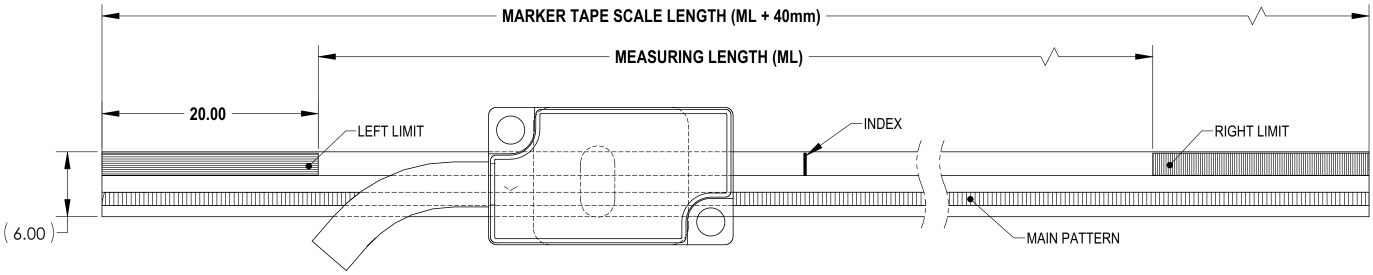
The Marker Tape scale length that you specify for your application must be calculated as follows. This calculation applies when using 20mm end limits. Note that 5mm at each end of the tape scale is not to be used for encoder feedback.

Tape Scale Length = Measuring Length + 40mm*

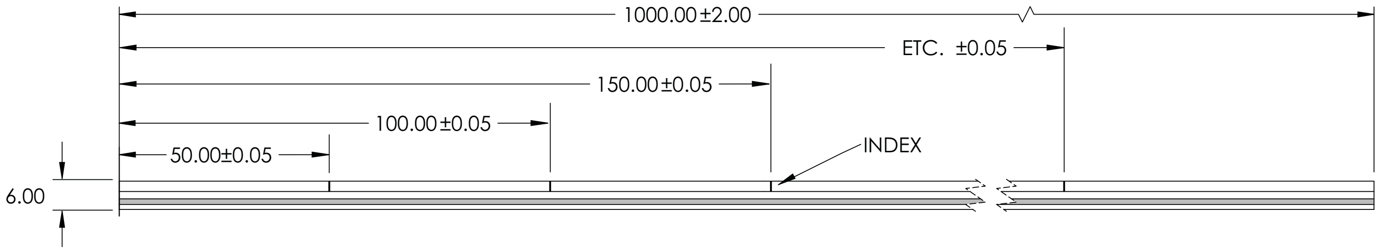
For Example: Measuring Length of 800mm is required, limits will be used at the end of the tape scale and end caps will not be used. The Tape Scale Length = 800mm + 40mm = 840mm.

*See Interface Drawings for other configurations.

Index and Limit Marker Locations



Marker Tape with index and limit marks



Marker Tape with periodic index marks

Note: Configurations above are only examples. For other limit lengths or index configurations, contact MicroE Systems.

Specifications

Accuracy	≤ ±5μm over any one meter of travel after slope correction 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 less than the Tape Scale Length. PurePrecision Marker 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 the model number configuration in the How to Order section at the end of this document.

PurePrecision Laser Tape Scale with Stick-On Index and Limits

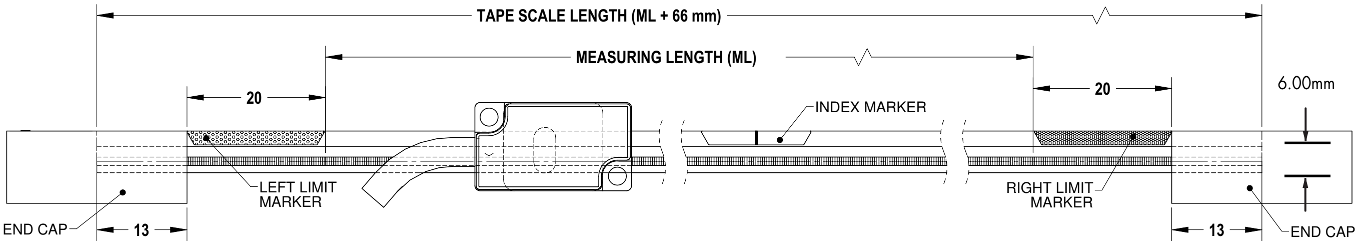
The laser scale length that you specify for your application must be calculated as follows. This calculation applies whether your application requires end limits or not. 20mm at each end of the tape scale are not to be used for encoder feedback.

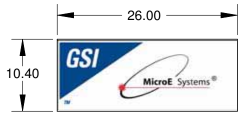
Tape Scale Length = Measuring Length + 40mm*

For 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.

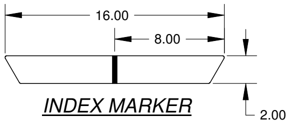
*When the end limits are at the ends of the tape scale and end caps are not used. The Tape Scale Length must be increased further if the limit markers are applied at a distance from the ends of the tape scale.

Index and Limit Marker Locations

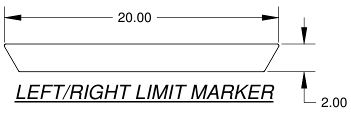




END CAP



INDEX MARKER



LEFT/RIGHT LIMIT MARKER

Specifications

Linearity	≤ ± 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 less than the Tape Scale Length depending on limits and use of end caps. PurePrecision laser tape scale is shipped in tubes for lengths from 40mm - 500mm and in dispensers for lengths greater than 500mm.

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 for the highest accuracy.

Glass Scale Options

- Standard linear: 10mm - 1m (contact 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 IDs, ODs (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 (embedded index only).

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

If your application requires end limits

*Glass Scale Length = Measuring Length + 40mm**

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

If your application does not require end limits

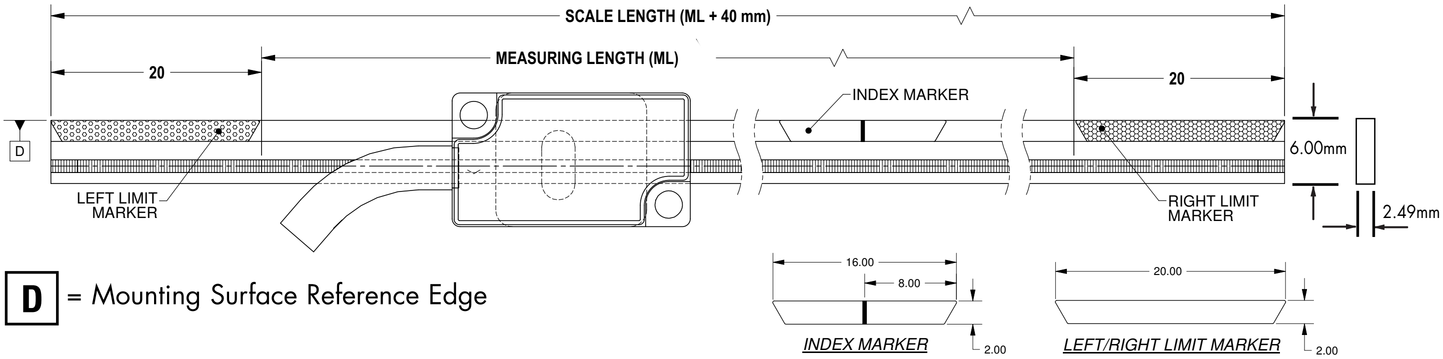
Glass Scale Length = Measuring Length + 5mm

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.

Order the required Scale Length using model number MIILxxxx where xxxx = Scale length in mm (10mm - 1000mm). Example: (30mm Linear Glass Scale): MIIL30.



D = Mounting Surface Reference Edge

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

Model	MII018	MII030	MII055	MII080	MIIL105	MIIL130
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

Longer scales available; contact MicroE

Linear Glass Scales with Stick-on Index and Limits

Standard Long Linear Scales

131mm and Longer

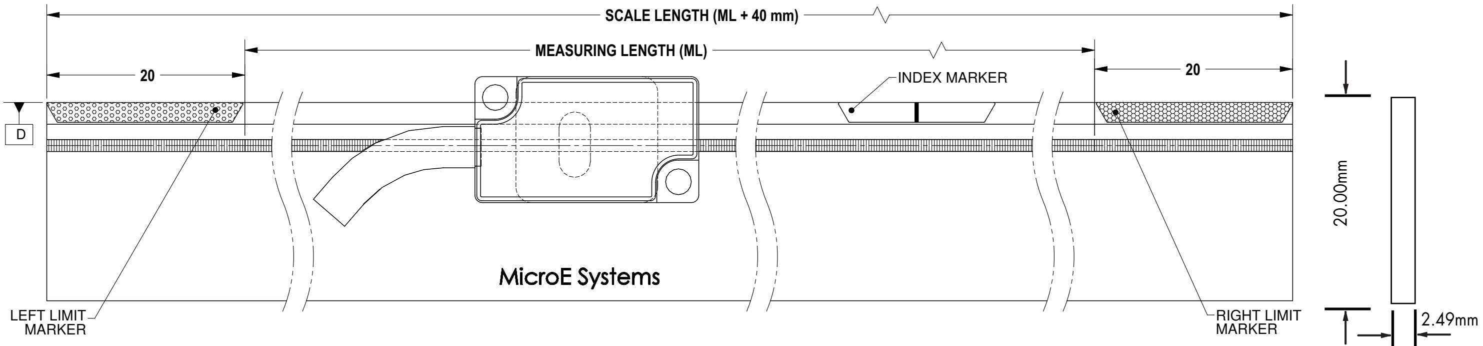
(dimensions in mm)

Specifications

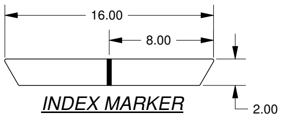
Accuracy	±5µm standard accuracy grade
	±2µm available (high accuracy grade)
Material	Soda lime glass
Typical CTE	8ppm/°C (Ultra-low CTE glass available)

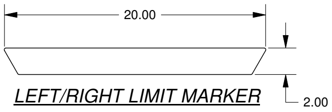
Order the required Scale Length using model number MIILxxxx where xxxx = Scale length in mm (10mm - 1000mm).

Example: (225mm Linear Glass Scale): MIIL225. Contact MicroE Systems for lengths greater than 1m.


SCALE LENGTH (ML + 40 mm)
MEASURING LENGTH (ML)
20
20
INDEX MARKER
D
20.00mm
MicroE Systems
LEFT LIMIT MARKER
RIGHT LIMIT MARKER
2.49mm

D = Mounting Surface Reference Edge


16.00
8.00
2.00
INDEX MARKER


20.00
2.00
LEFT/RIGHT LIMIT MARKER

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

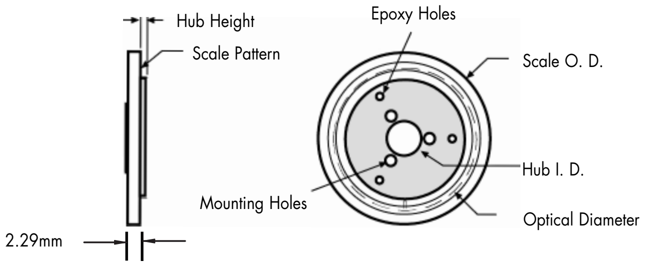
Model	MIIL155	MIIL225	MIIL325	MIIL425	MIIL525	MIIL1000
Scale Length	155mm	225mm	325mm	425mm	525mm	1000mm
Measuring Length - Without Limits	150mm	220mm	320mm	420mm	520mm	995mm
Measuring Length - With Limits	115mm	185mm	285mm	385mm	485mm	960mm

Rotary Glass Scales with Built-in Index

Standard Rotary Scales

Specifications

Material	Soda lime glass
Typical CTE	8ppm/°C


Hub Height
Scale Pattern
Epoxy Holes
Scale O. D.
Hub I. D.
Mounting Holes
Optical Diameter
2.29mm

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

Note: MII6800Pa is for linear axes only.

How to Order Mercury II 6000 Encoder Systems

To specify your Mercury II 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.

MII6800, A-quad-B Output, with Output Resolution from 5µm to 1.22nm

Example: MII6810-AB-16384-1-1-0

MII68XX	AB	Interpolation (Integer Steps)	Maximum Output Frequency	Limit Logic	Low Pass Filter Roll Off Frequency (kHz)
MII6810 = 1m cable	AB = A-quad-B output	4 = x4	1 = 12.50 MHz	1 = active low (fail safe)	0 = off (full bandwidth)
		5 = x5	2 = 6.25 MHz	2 = active high	1 = 1kHz
MII6830 = 3m cable		↓	3 = 3.125 MHz		2 = 2kHz
			4 = 1.563 MHz		↓
MII6850 = 5m cable			5 = 0.781 MHz		
			6 = 0.391 MHz		
		16384 = x16384	7 = 0.195 MHz		
			8 = 0.098 MHz		100 = 100kHz
			9 = 0.049 MHz		
			10 = 0.024 MHz		

MII6700, A-quad-B Output, with Output Resolution from 5µm to 5nm

Example: MII6710-AB-4000-1-1-0

MII67XX	AB	Interpolation (Integer Steps)	Maximum Output Frequency	Limit Logic	Low Pass Filter Roll Off Frequency (kHz)
MII6710 = 1m cable	AB = A-quad-B output	4 = x4	1 = 12.50 MHz	1 = active low (fail safe)	0 = off (full bandwidth)
		5 = x5	2 = 6.25 MHz	2 = active high	1 = 1kHz
MII6730 = 3m cable		↓	3 = 3.125 MHz		2 = 2kHz
			4 = 1.563 MHz		↓
MII6750 = 5m cable			5 = 0.781 MHz		
			6 = 0.391 MHz		
		4000 = x4000	7 = 0.195 MHz		
			8 = 0.098 MHz		100 = 100kHz
			9 = 0.049 MHz		
			10 = 0.024 MHz		

MII6500, A-quad-B Output, with Output Resolution from 5µm to 50nm

Example: MII6510-AB-400-1-1-0

MII65XX	AB	Interpolation (Integer Steps)	Maximum Output Frequency	Limit Logic	Low Pass Filter Roll Off Frequency (kHz)
MII6510 = 1m cable	AB = A-quad-B output	4 = x4	1 = 12.5MHz	1 = active low (fail safe)	0 = off (full bandwidth)
		5 = x5	2 = 6.25 MHz	2 = active high	1 = 1kHz
MII6530 = 3m cable		↓	3 = 3.125 MHz		2 = 2kHz
			4 = 1.563 MHz		↓
MII6550 = 5m cable			5 = 0.781 MHz		
			6 = 0.391 MHz		
		400 = x400	7 = 0.195 MHz		
			8 = 0.098 MHz		100 = 100kHz
			9 = 0.049 MHz		
			10 = 0.024 MHz		

How to Order Mercury II™ 6000 Family Encoder Systems

RoHS CE

MII6800Si, Serial Output with Output Resolution up to 1.22nm

Example: MII6810-Si-14-21-1-0

MII68XX	Si	Interpolation Bits	Number of Fringe Count Bits	Index Mode	Low Pass Filter Roll Off Frequency (% of Sample Rate)
MII6810 = 1m cable	Si = Serial interface	2 = 2	2 = 2	0 = No change to position at index	0 = off (full bandwidth)
MII6830 = 3m cable					
MII6850 = 5m cable		3 = 3	3 = 3	1 = Position reset at at every index	1 = 1% of sample rate
					2 = 2% of sample rate
		↓	↓		↓
		14 = 14	21 = 21		40 = 40% of sample rate

Note: Interpolation bits + fringe count bits must be ≤ 35 bits.

MII6800Pa, Panasonic Serial Output with Output Resolution up to 1.22nm

Example: MII6810-Pa-14-10-0-0

MII68XX	Pa	Interpolation Bits	Number of Fringe Count Bits	Index Mode	Low Pass Filter Roll Off Frequency (kHz)
MII6810 = 1m cable	Pa = Panasonic serial interface	2 = 2	2 = 2	0 = Default (no option)	0 = off (full bandwidth) 1 = 1kHz 2 = 2kHz ↓
MII6830 = 3m cable					
MII6850 = 5m cable		3 = 3	3 = 3		100 = 100kHz
		↓	↓		
		14 = 14	21 = 21		

Note: Interpolation bits + fringe count bits must be ≤ 24 bits.

How to Order Mercury II™ Encoder Systems

RoHS
CE

Sensor Installation Tools

ATMII5000 **-US** **-EU**	*Alignment Tool Kit for MII6000 encoders includes Alignment Tool, SmartPrecision II™ Software, USB Cable, Power Supply (100V-240VAC/50-60Hz) US = Power Supply with US std 2-prong plug EU = Power Supply with European std 2-prong plug
ZG-PP3	Z-Height Gauge, PurePrecision™ Tape Scales
ZG-GS3	Z-Height Gauge, Glass Scales

*Required for MII6000 Family setup. Works with all MII5000, MII6000, and MII6800Si/Pa models.

End Cap Kit, PurePrecision™ Tape Scales

EC	Optional Tape Scale End Caps

Adaptor for Open Collector Limit Outputs

MIIA-OCL	Small DB15 adaptor to convert 3.3V left and right limit output signals to open collector type (7407)

Tape Scale Applicator Tools (use for lengths >300mm)

TSAT-PPT	Tape Applicator Tool for applying tape scale

All specifications are subject to change.

Scales

PurePrecision™ Marker Tape II

HPMT – N – A – L – 9999 – I

I = Individual Lengths
C = Continuous reel with index and cut marks (unless otherwise specified)

Length in mm (40mm - 9,999mm)
For length >10,000mm, contact MicroE for custom P/N.

A = Adhesive

L = Center Index and End Limits
I = Center Index Only
C = Custom

PurePrecision™ Laser Tape II

HPTS –30000

Length in mm (40mm - 30,000mm)

PurePrecision™ Linear Glass Scales

(Standard accuracy grade)

MIIL-100

Length in mm (10mm - 1000mm)

For high accuracy grade scales, contact MicroE.

Note: Index and limit markers must be ordered separately.

Stick-on Index and Limit Markers (for Laser Tape II and Performance and Value Linear Glass Scales)

NRIMS	Qty 8 Stick-On Index Markers
NRLMS	Qty 4 Stick-On Left Limit Markers and Qty 4 Stick-On Right Limit Markers

Note: To use NRIMS/LMS, MII6000 must be configured for NR.

PurePrecision™ Rotary Glass Scales

MIIRxxxx* – Hub

NH = Without Hub
HI = for R4513
HJ = for R6425
HK = for R12151

MIIR4513
MIIR6425
MIIR12151

*Custom Versions are available.

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

Note: MII6800Pa is for linear axes only.

Mercury II Encoders Are Fully RoHS-Compliant

RoHS
CE

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.microesystems.com/products for Mercury linear and rotary encoders that are vacuum rated up to 10^{-8} torr, small-diameter rotary encoders with scale outside diameters from 32mm to 12mm, and low-cost PCB mount encoders.

MicroE Systems®