Preliminary

Mercury™ 3000Si Dual Axis Averager

Motion Control Feedback Using Averaging of Two Sensors

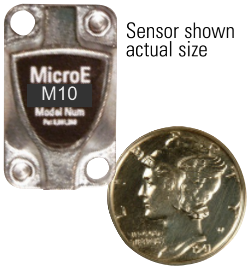
Installation Manual
and Reference Guide

GSI MicroE Systems®

Enabling Technology™

Manual No. IM-M3000SiDAA Rev S4

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



Sensor shown actual size

Table Of Contents

Precautions

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

Safety Information

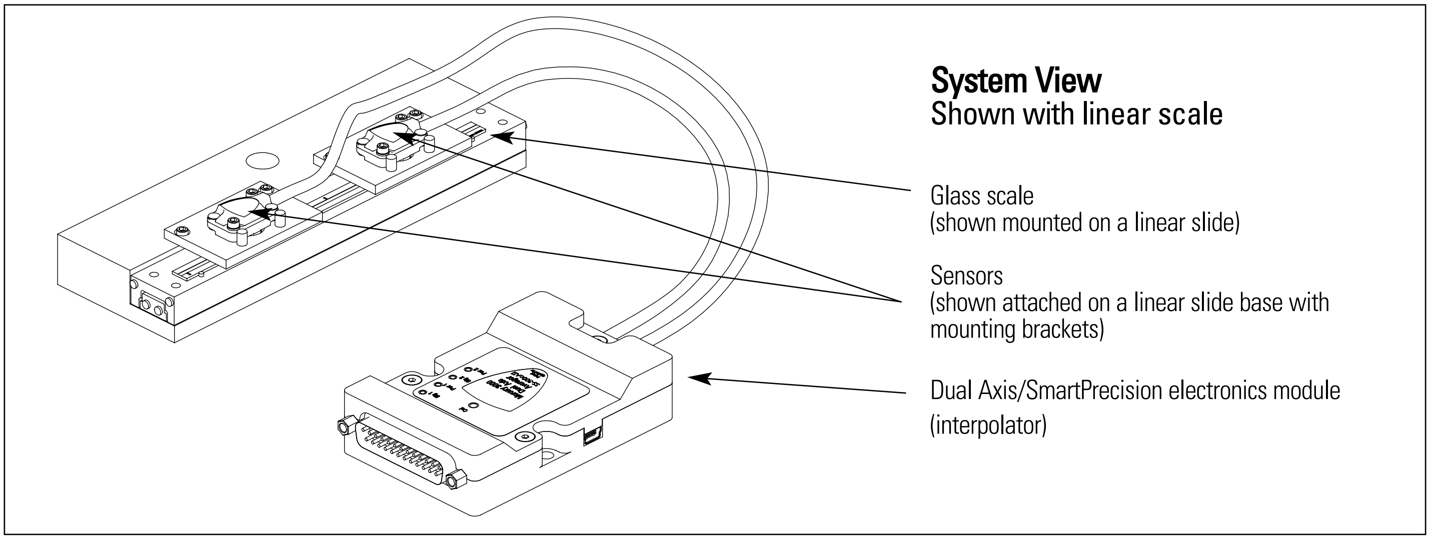
MicroE Systems Mercury series reflective encoders are classified as CDRH Class I and IEC Class 1M laser products.
- Invisible laser radiation (wavelength: 850 nm). Max power 1.5 mW CW.
- This product conforms to all applicable standards under 21 CFR Ch. I 1040.10.
- CDRH Class I level of laser radiation is not considered to be hazardous.
- CAUTION - The use of optical instruments with this product will increase eye hazard.

- DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MICROSCOPES, EYE LOUPES OR MAGNIFIERS)
- CLASS 1M LASER PRODUCT
- IEC 60825-1 (2001)

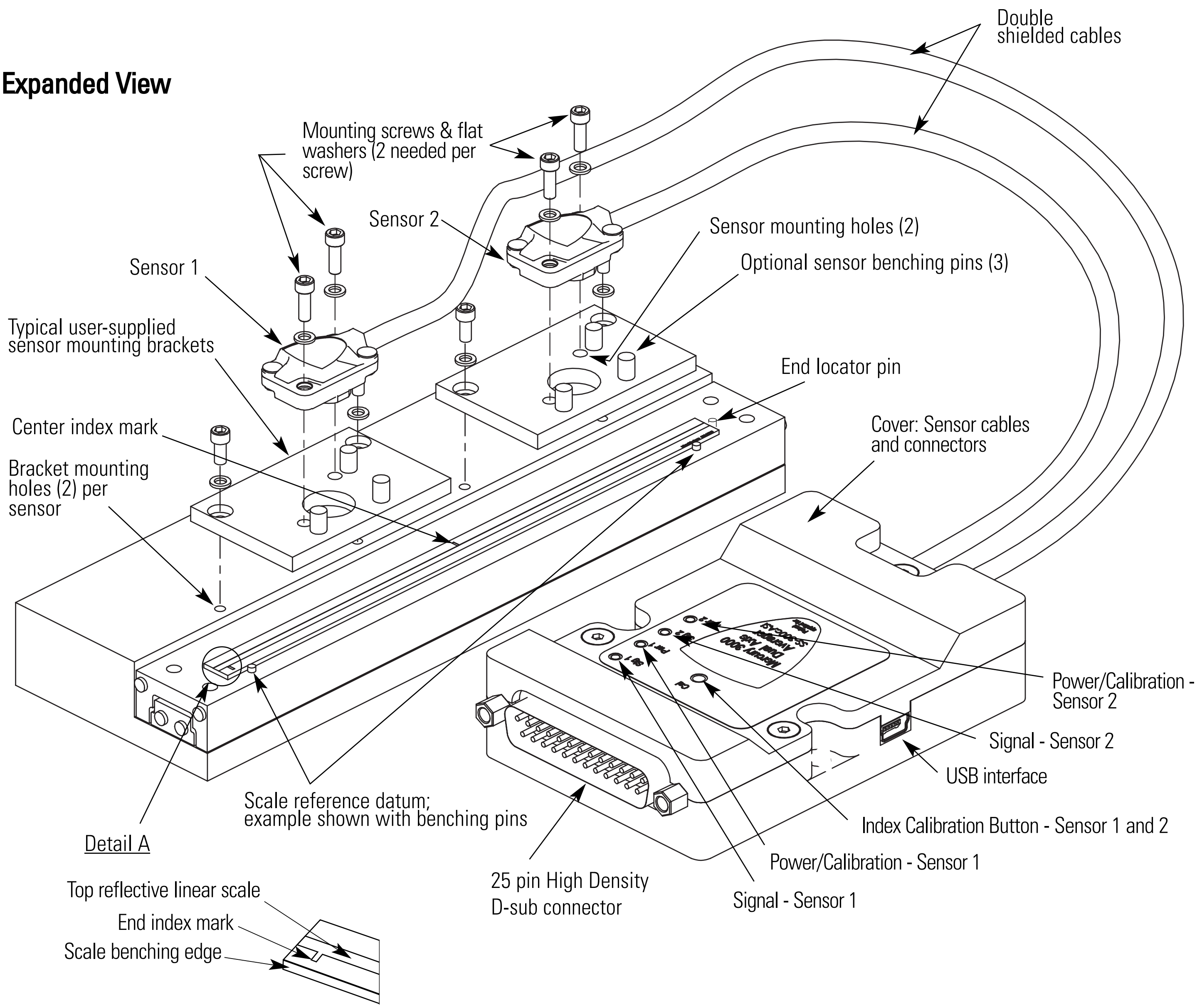
Patents

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

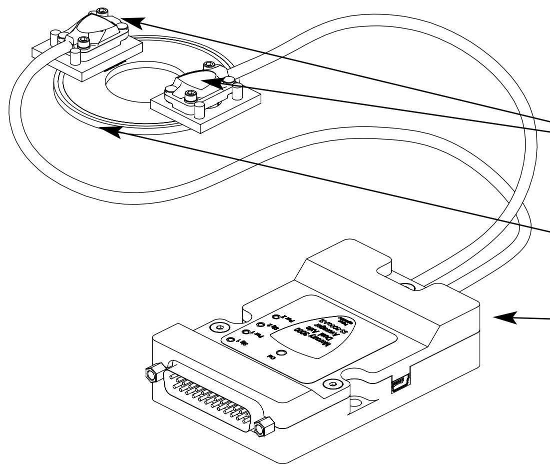
Mercury 3000Si Encoder System
with Linear scale

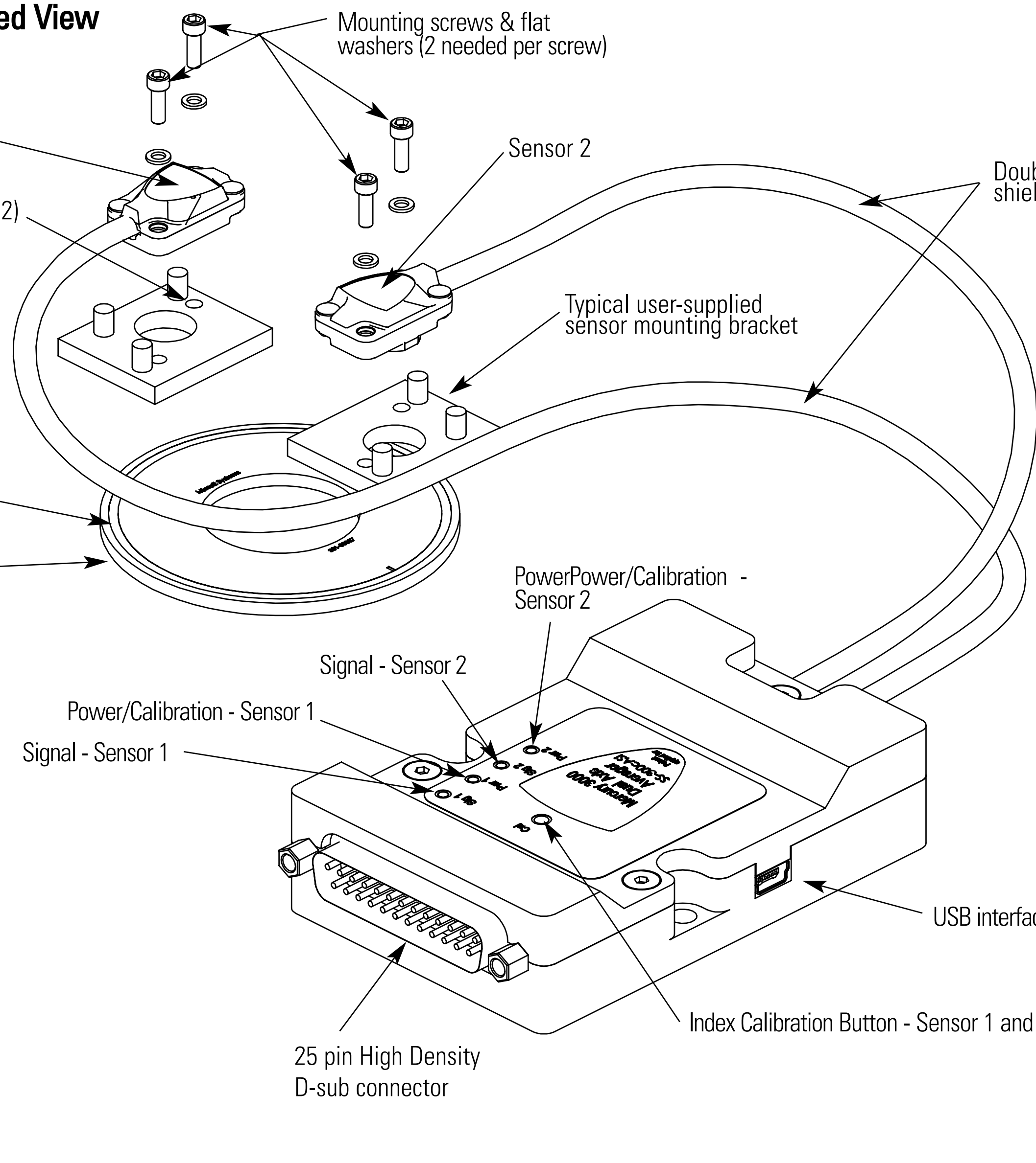


Expanded View



Mercury 3000Si Encoder System
with Rotary scale





Installation Instructions
Linear Encoders - Mounting

1

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

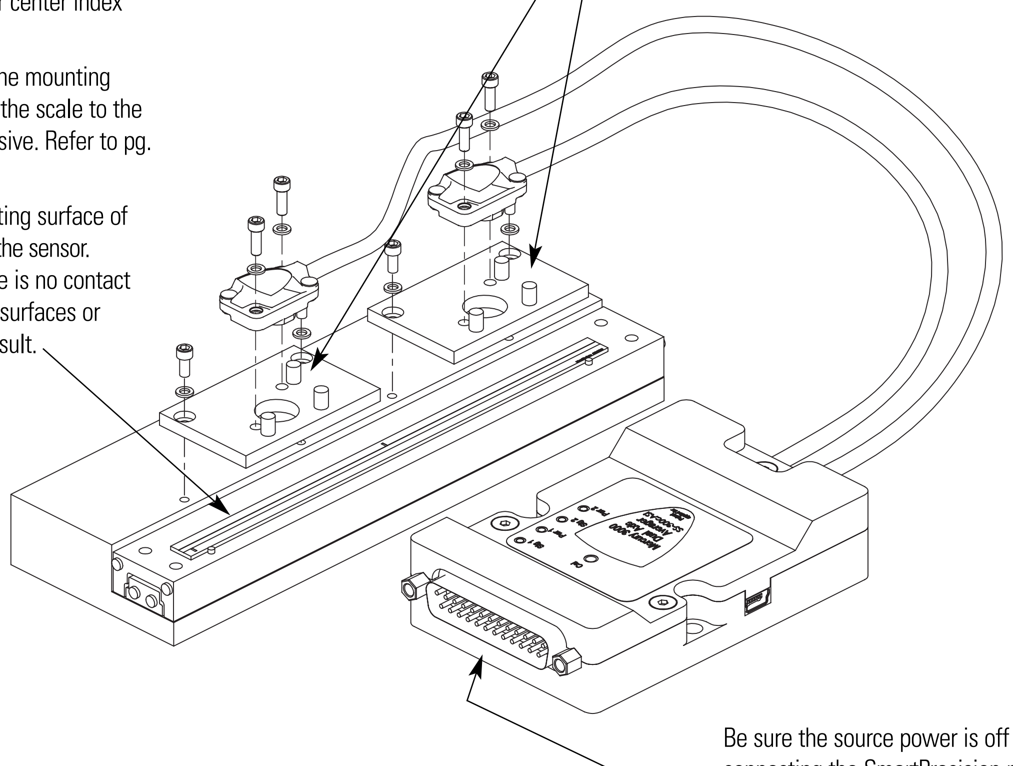
Depending on the mounting method, attach the scale to the slide with adhesive. Refer to pg. 8 for details.

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

2

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

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



4

Be sure the source power is off before connecting the SmartPrecision plug.

Connect the SmartPrecision electronics to the controller using the pinout diagram described on the interface drawing.

Insure proper system grounding. Refer to the procedure on pg 9.

Tighten the thumb screws.

Power up the system. The Power and Signal indicators for both sensors will illuminate.

CAUTION: observe precautions for handling electrostatic sensitive devices.

Route the sensor cables through your equipment to the Dual Axis SmartPrecision electronics module.

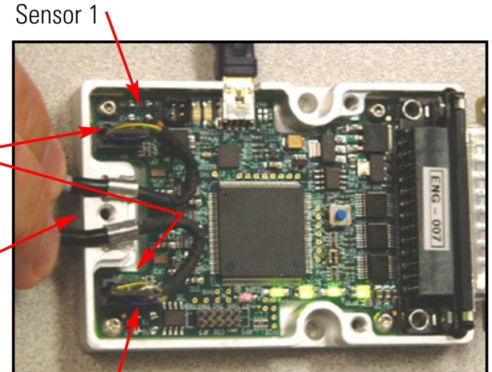
3

A) Remove the three cover screws and the top half of the connector housing. Do not pull on the 25-pin D-sub connector or the circuit board under the insulation layer.

B) Attach each sensor's 5 X 2 connector to the mating 5 X 2 connector on the circuit board.

C) Route the sensor cables through their channels in the center of the connector body and place the cable's hex sleeves in the matching recesses. Attach the top half of the connector housing to the bottom half using the three cover screws.

Sensor 1



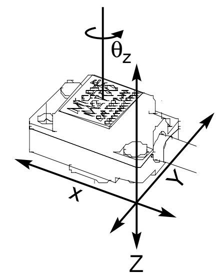
Sensor 2

5

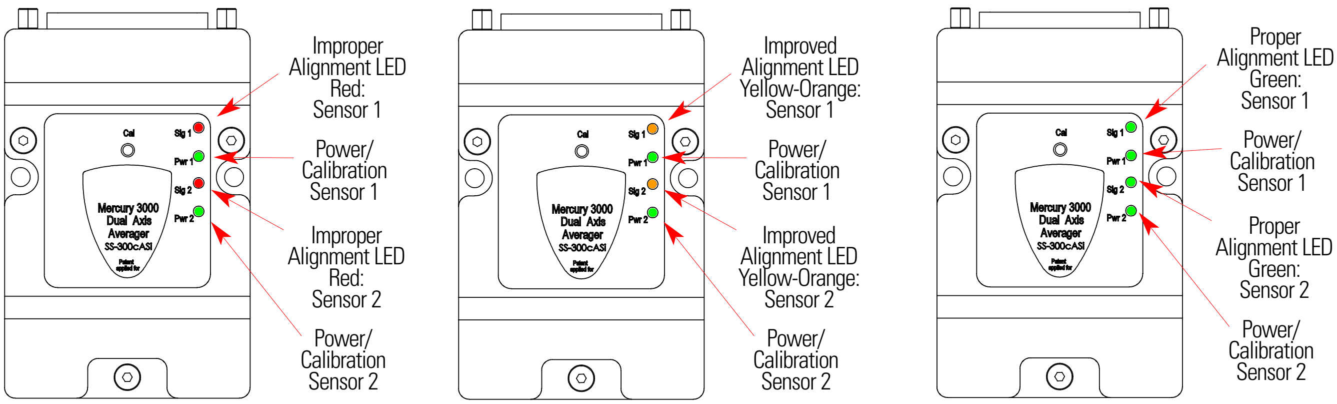
If benching dimensions cannot be provided, proper sensor alignment may require minor adjustments to each sensor's position with respect to the scale. This can be performed easily using the LED alignment indicators, as illustrated below.

For sensor 1, the Sig 1 multicolor LED will turn from red to yellow-orange to green depending on sensor alignment. Slowly move the sensor by allowing it to slide on the mounting surface until the Sig 1 multicolor LED turns green. Optimal alignment will be displayed as a "Bright Green" LED. Repeat the last step, using sensor 2 and the Sig 2 multicolor LED, to align sensor 2.

IMPORTANT: Confirm that the Proper Alignment LED blinks when passing over the index. If not, readjust the sensor in the Y direction and repeat the above procedure. When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).

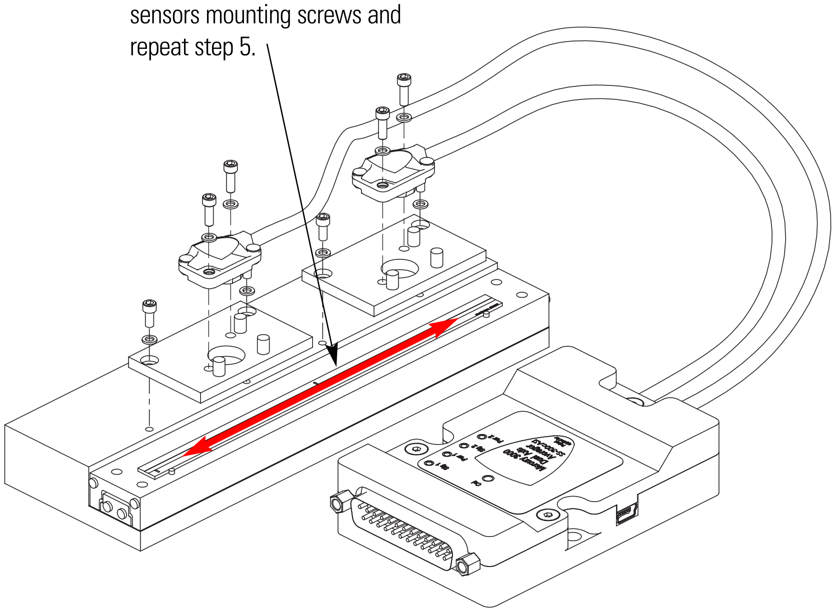


To align the sensor, move it in the Y or θ_z directions.



6

Confirm proper alignment over the full range of motion. The "Proper Alignment" LED must remain green over the entire range for both sensors. If not aligned over the entire range of motion, loosen the sensors mounting screws and repeat step 5.



7

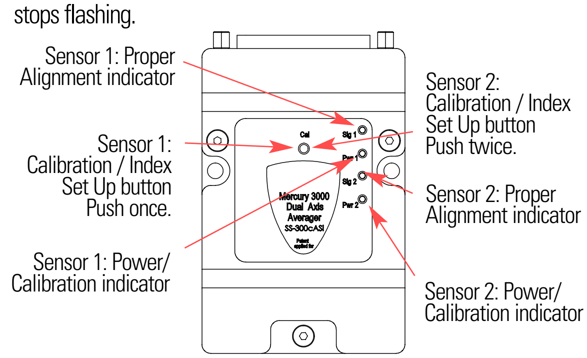
IMPORTANT

OUTPUT CALIBRATION PROCEDURE

This procedure must be completed for proper system operation each time the sensors are aligned or if the SmartPrecision electronics module is replaced

Position each sensor at least 7mm (1/4") away from the index mark on the scale. Next, for sensor 1, push the Index/Calibration button inside the module just once. The Power/Calibration indicator for sensor 1, will flash continuously. Move the scale past sensor 1 in both directions so that the index mark passes under sensor 1. When the calibration procedure is complete, the Power/Calibration indicator for sensor 1 stops flashing.

To calibrate sensor 2, push the Index/Calibration button twice. The Power/Calibration indicator for sensor 2 will flash continuously. Move the scale past sensor 2 in both directions so that the index mark passes under sensor 2. When the calibration procedure is complete, the Power/Calibration indicator for sensor 2 stops flashing.

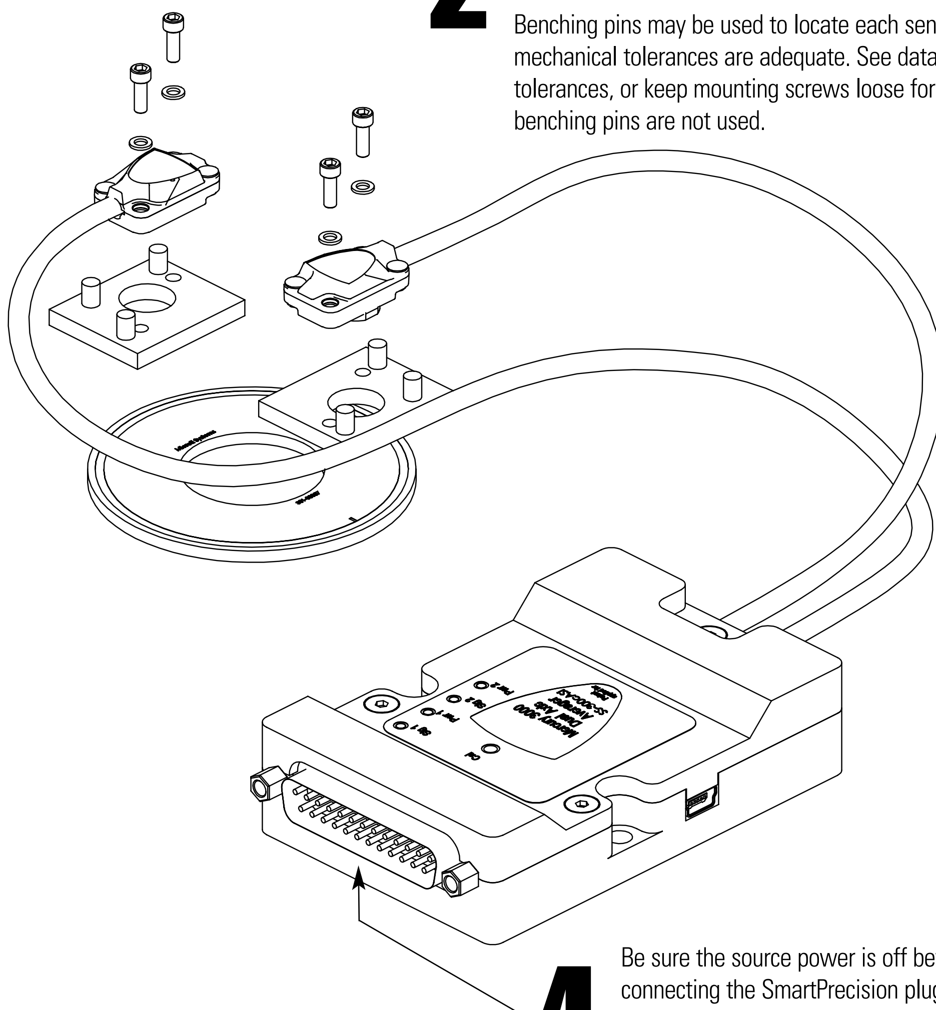


Installation Instructions
Rotary Encoders - Mounting

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

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

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



4 Be sure the source power is off before connecting the SmartPrecision plug.

Connect the SmartPrecision electronics to the controller using the pinout diagram described on the interface drawing.

Insure proper system grounding. Refer to the procedure on pg 9.

Power up the system. The Power and Signal indicators for both sensors will illuminate.

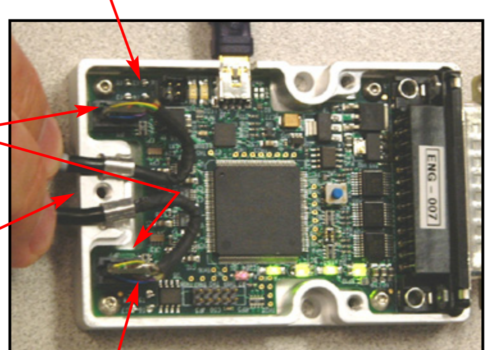
3 CAUTION: observe precautions for handling electrostatic sensitive devices.

Route the sensor cables through your equipment to the Dual Axis SmartPrecision electronics module.

A) Remove the three cover screws and the top half of the connector housing. Do not pull on the 25-pin D-sub connector or the circuit board under the insulation layer.

B) Attach each sensor's 5 X 2 connector to the mating 5 X 2 connector on the circuit board.

C) Route the sensor cables through their channels in the center of the connector body and place the cable's hex sleeves in the matching recesses. Attach the top half of the connector housing to the bottom half using the three cover screws.



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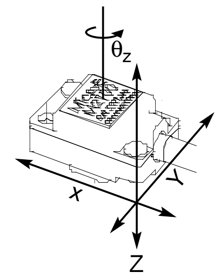
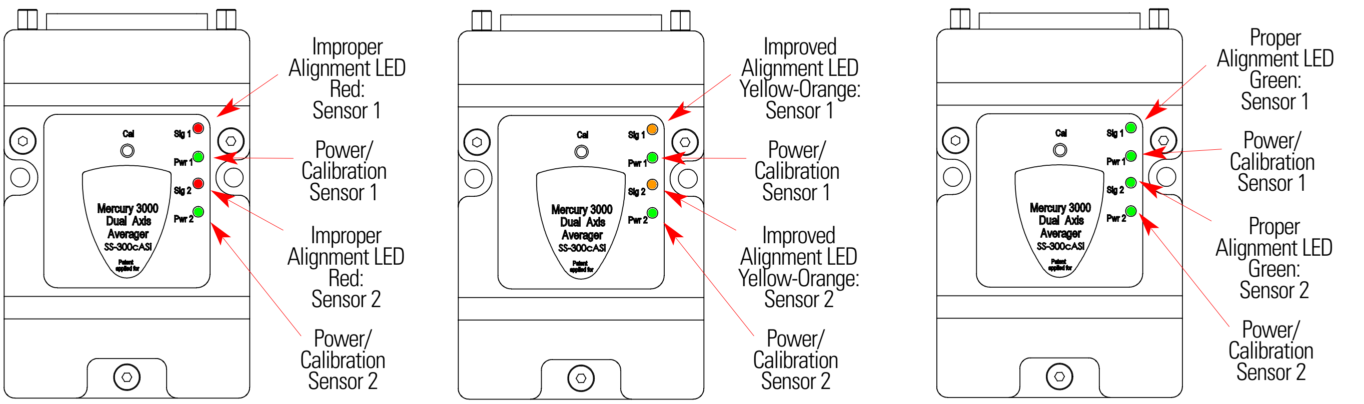
For sensor 1, the Sig 1 multicolor LED will turn from red to yellow-orange to green depending on sensor alignment. Slowly move the sensor by allowing it to slide on the mounting surface until the Sig 1 multicolor LED turns green. Optimal alignment will be displayed as a "Bright Green" LED. Repeat the last step, using sensor 2 and the Sig 2 multicolor LED, to align sensor 2.

IMPORTANT: Confirm that the Proper Alignment LED blinks when passing over the index. If not, readjust the sensor in the Y direction and repeat the above procedure. When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).



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



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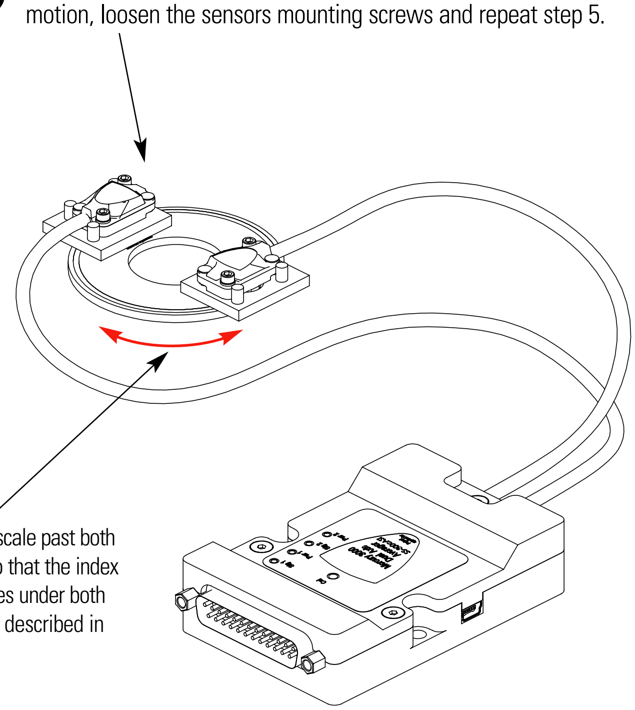


Move the scale past both sensor s so that the index mark passes under both sensors as described in step 7.

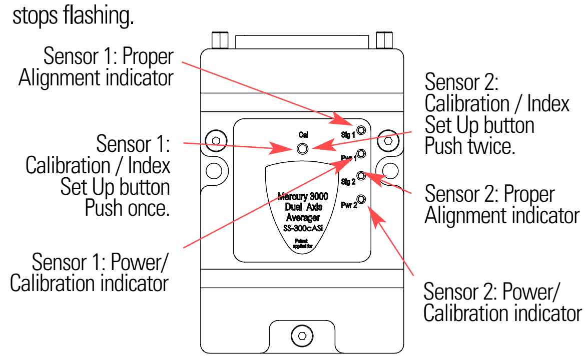
7

IMPORTANT
OUTPUT CALIBRATION PROCEDURE

This procedure must be completed for proper system operation each time the sensors are aligned or if the SmartPrecision electronics module is replaced

Position each sensor at least 7mm (1/4") away from the index mark on the scale. Next, for sensor 1, push the Index/Calibration button inside the module just once. The Power/Calibration indicator for sensor 1, will flash continuously. Move the scale past sensor 1 in both directions so that the index mark passes under sensor 1. When the calibration procedure is complete, the Power/Calibration indicator for sensor 1 stops flashing.

To calibrate sensor 2, push the Index/Calibration button twice. The Power/Calibration indicator for sensor 2 will flash continuously. Move the scale past sensor 2 in both directions so that the index mark passes under sensor 2. When the calibration procedure is complete, the Power/Calibration indicator for sensor 2 stops flashing.



Reference Section

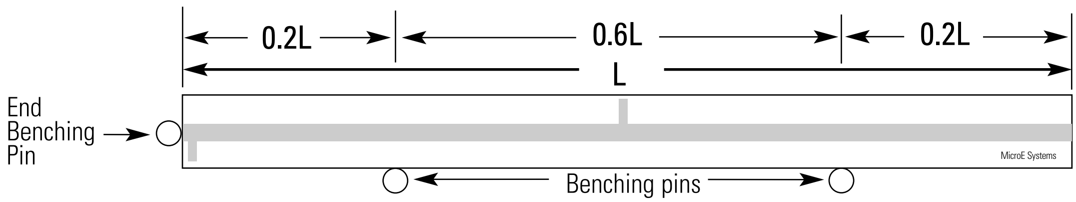
Installation of Linear Scales

Positioning the Scale

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

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

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



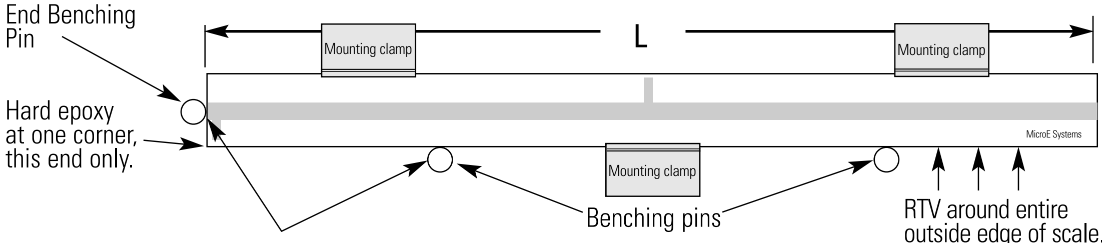
Mounting the Scale

MicroE Systems' linear scales should be affixed to the mounting surface. Two different approaches are described below:

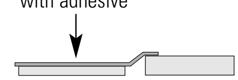
Epoxy and RTV Mounting (Recommended for best accuracy)

1 Make sure the mounting surface is clean and dry.

3 Optionally, scale clamps may be used to secure the scale while the adhesive cures. Avoid damage to the top surface.



Scale clamp with adhesive



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

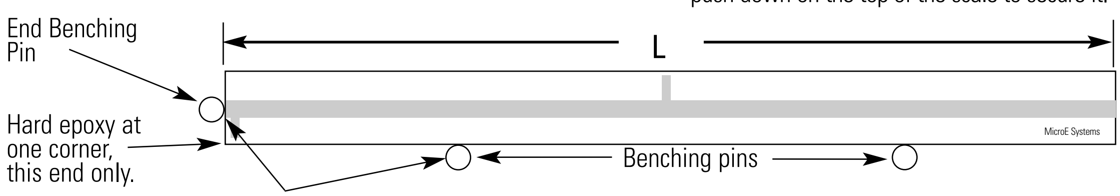
2 Align the scale by placing the edges against the benching pins.

4 Apply a hard epoxy, such as Tra-Con's Tra-Bond 2116, to the end of the scale at the end benching pin. Apply 100% Silicone RTV adhesive around the edges of the scale. This method allows thermal expansion from the benched end of the scale. After adhesive curing, remove the scale mounting clamps or, if permanently installing clamps, make sure they do not interfere with the sensor or sensor mount.

Two Sided Adhesive Tape Mounting

1 Make sure the mounting surface is clean and dry. Peel the cover paper off and place the scale above the final location.

3 Gently place the scale on the mounting surface. Positioning adjustments can be made until the scale is firmly pressed down. After final positioning, push down on the top of the scale to secure it.



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

Grounding Instructions for Mercury 3000Si Dual Axis Encoder Systems

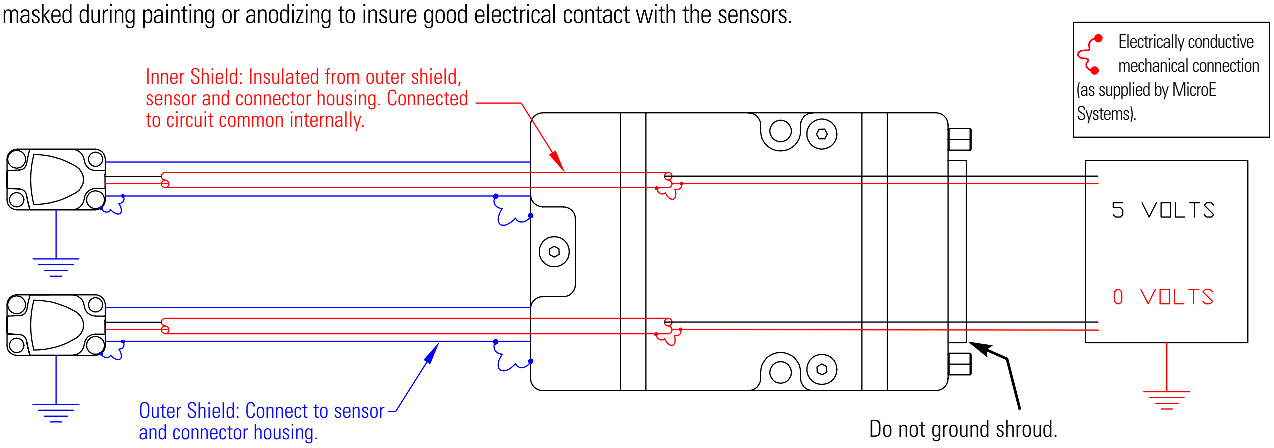
For Mercury 3000Si Dual Axis Averager encoder systems to operate reliably, it is essential that the sensor and cable shield are grounded properly according to the following instructions. The diagrams below show how to make the connections when the encoder's connector is plugged into the customer's controller chassis. If a customer-supplied extension cable is used, it should be a double shielded cable with conductive connector shells and must provide complete shielding over the conductors contained within it over its entire length. Furthermore, the shields should be grounded at the connection to the controller chassis the same way as the encoder connectors in the diagrams below.

Note: For best performance, isolate encoder shield from motor cable shields and separate encoder cable as far possible from motor cables.

Sensors mounted with good electrical contact to a well-grounded surfaces (preferred)

1. 25-pin D-sub connector grounding: The encoder's connector shell must be in intimate, electrically conductive contact with the customer-supplied mating connector, which must be isolated from the controller's ground. If a customer-supplied shielded cable connects the encoder to the controller, then the shielding on the customer-supplied cable must be isolated from the controller's ground.

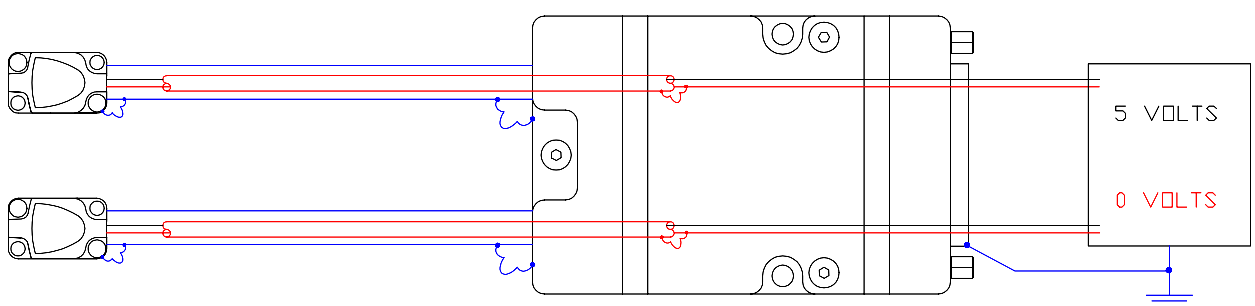
2. The sensors' mounting surfaces must have a low impedance (DC/AC) connection to ground. The encoder sensors' mounting surfaces may have to be masked during painting or anodizing to insure good electrical contact with the sensors.



Sensors mounted to a surfaces that are grounded through bearings or poorly-grounded surfaces, or non-conducting surfaces

1. 25-pin D-sub connector grounding: The encoder's connector shell must be in intimate, electrically conductive contact with the customer-supplied mating connector, which must be connected to the controller's ground. If a customer-supplied shielded cable connects the encoder to the controller, then the shielding on the customer-supplied cable must be connected to the controller's ground. The controller must be grounded to earth at the point of installation.

2. The encoder sensors must be mounted so that they are electrically isolated from ground.



Recommendations for Power

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

Customer Interface Cable Requirements

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

- Twisted pair signal wiring.
- Characteristic impedance of 100-120 ohms.
- Sufficient wire gauge to meet the minimum voltage requirement at the encoder, for example 24AWG gauge wire for a 2m length cable. Examples of acceptable cables with 24 AWG gauge wire and 5 twisted pairs are Belden 9832, 8105 or other manufacturer's equivalents.
- Single shield cable with a minimum of 90% coverage. Note that a double shielded cable may be required in high-noise applications.

Signal Wiring:

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

Mercury 3000SiDAA

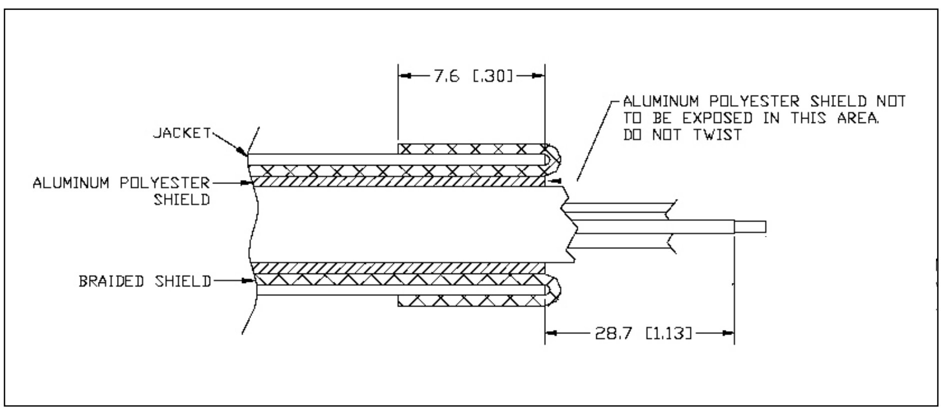
Signal	Twisted Pair
SD0+ SD0-	Pair 1
Trigger+ Trigger-	Pair 2*
SCK+ SCK-	Pair 3
N_CS+ N_CS-	Pair 4
+5V GND	Pair 5

* For synchronous system connection only.

Revision pending.

Shield Termination:

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



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

Introduction

Historically, the method of choice for many optical position feedback systems has been A quad B (Quadrature) output. The limitation of this method is output speed, especially when the interpolation level is high. When the optical sensor speed and/or the interpolation multiplier is set high, the Quadrature output frequencies will be extremely high and out of the range of the Quadrature counters of most standard motion controllers.

This limitation can be avoided by sending the position information in parallel format or in a serial word format. The parallel formats are cumbersome to cable (especially wide word lengths) and are more susceptible to noise interference. Therefore, a serial data word format is the data communication method of choice.

The Mercury 3000Si Dual Axis Averager Interpolator has the ability to output a position word in a serialized format. This allows very fast communication between an interpolator and customer application. The speed limitation of the Quadrature format is thus eliminated.

Signal Description

The interface from your electronics to the Mercury 3000SiDAA interpolator uses four signals, n_spiEnable (n_CS), spiDataOut (SDO), spiClock (SCK), and optional spiTrigger (TRIG). Each signal is differential and RS-422 compatible. See table for interpolator signal names, pin names, and pin locations:

Signal Description

Signal name	Pin Name	Function	I/O Interpolator Referenced	15 pin HD Connector
n_spiEnable	n_CS+	Chip Select+	Input	7
	n_CS-	Chip Select-	Input	8
spiClock	SCK+	Serial Clock+	Input	14
	SCK-	Serial Clock-	Input	15
spiDataOut	SDO+	Serial Data Out+	Output	5
	SDO-	Serial Data Out-	Output	4
spiTrigger	TRIG+	External Trigger+	Input	10
	TRIG-	External Trigger-	Input	9

Revision pending.

Index Processing

A unique physical position is referenced on all gratings and is called an index position. The value of this position is determined during an index capture routine initiated by a button press or the SmartPrecision Software and is permanently stored for use after power cycling. The index value has the same resolution as the interpolated position.

The M3000SiDAA has four modes of operation that use the index position to generate a physical reference position. The position word calculated by the M3000SiDAA electronics is a 28-bit number, which includes 18 fringe counter bits and 10 sub-fringe interpolation bits. The fringe counter keeps track of the number of electrical cycles encountered caused by a grating moving past a sensor and can be reset. The sub-fringe position is absolute because the voltage relationship between sine and cosine are fixed electrically and therefore cannot be reset or cleared.

A physical mark on the grating called an index window is used to generate an accurate index position. The index window is approximately one fringe wide. By monitoring the edges of the window with respect to the absolute sub-fringe position during the index capture mode, an accurate index position is calculated and stored.

At power up the encoder is in an undefined position relative to the outside world. By traveling past the index mark on the scale and knowing where the index is relative to the outside world the encoder position becomes defined. The M3000SiDAA supports the following index processing modes:

No Index: No changes are made to the position word at the index mark.

Mode 1: Zeros the fringe counter at the first encounter with index mark after power up.

Mode 2: Zeros the fringe counter at every encounter with index mark.

Mode 3: Zeros the fringe counter at the first encounter with index mark after power up and subtracts the index position from the calculated position making the index mark the zero position of the encoder.

Mode 4: Zeros the fringe counter at every encounter with index mark after power up and subtracts the index position from the calculated position making the index mark the zero position of the encoder.

The Index mode can be factory set or selected by the customer using the optional SmartPrecision software.

Optional SmartPrecision Software Installation Instructions

Hardware Requirements:

SmartPrecision Software for M3000SiDAA requires a PC with the following minimum specifications:

- · Windows 2000 or XP operating systems
- · 300MHz
- · 32Mb RAM
- · 1024 x 768 or higher screen resolution with High Color (16 bit color)
- · 20Mb free disk space
- · One USB port (Version 1.1 or higher)

MicroE SS300cDI SmartPrecision Software (Preliminary)

Software Notes:

1) This is Preliminary Software - Functionality not comprehensively tested and some limitations exist.
2) Intended for use on Windows 2000 or XP systems, with display resolution of at least 1024x768 (1024x768 is optimal).

Installing the Software:

1) IMPORTANT - INSTALL SOFTWARE BEFORE CONNECTING ELECTRONICS - this will allow the proper driver files to be copied to the PC.
2) Insert Install CD - if setup does not automatically start - navigate to CD folder and run 'setup.exe'
3) To start the software - Click on 'Start>Programs>MicroE SmartPrecision for SS300cDI>SS300cDI Software' in the Start Menu.

Installing the USB Driver:

USB Driver Installation Windows 2000:

1) Connect the USB cable between the host computer and the M3000SiDAA.
2) When the electronics are on, Windows will notify you it has found new hardware prompting you with a "Found New Hardware" wizard. Press the Next button.
3) Select "Search for a suitable driver for my device (recommended)" and press the Next button.
4) Select "Specify a location" under "Optional search locations:" and press the Next button.
5) Press the Browse button to locate the SiF32X_USB.inf driver Installation file. SiF32X_USB.inf is located in "Install Directory\Driver" under the directory where the software was installed. The default install directory is ..Program Files\MicroE Systems\ss300cDI.

Once this file is selected press the OK button.

6) Verify that the correct path and filename are shown and press the Next button.
7) Press the Finish button.

USB Driver Installation Windows XP:

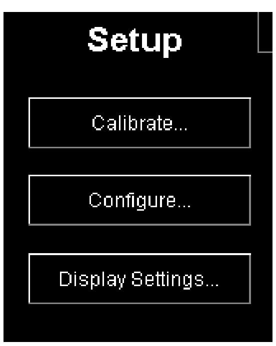
1) Connect the USB cable between the host computer and the M3000SiDAA.
2) When the electronics are on,, Windows will notify you it has found new hardware prompting you with a "Found New Hardware" wizard.
3) Select "Install from a list or specific location(Advanced)" and press the Next button.
4) Select "Include this location in the search". Press the Browse button to locate the SiF32X_USB.inf driver installation file. SiF32X_USB.inf is located in "Install Directory\Driver" under the directory where the software was installed. The default install directory is ..Program Files\MicroE Systems\ss300cDI. Once this file is selected press the OK button.
5) Verify that the correct path and filename are shown and press the Next button.
6) Press the Finish button.

Configuration and Setup - SmartPrecision Software

The M3000SiDAA interpolator module can be configured quickly and easily using the SmartPrecision Software. The M3000SiDAA interpolator will accept input from two separate encoders. The M3000SiDAA has three output channels. These can be configured to output the following: Channel 1, Channel 2, Average ((Ch1+Ch2)/2), and/or Difference (Ch1-Ch2). The main screen shows Encoder Position, Signal Level, Alarm Status, Data Plots, and Setup.

Encoder Position:
The Encoder Position box displays the current position data for each of the three output channels.
Each output can be reset or zeroed independently. The units can be changed from encoder counts, to any number of linear or rotary units.

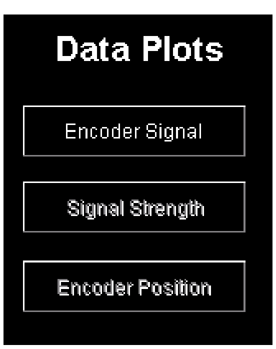
Main Screen



Setup
Calibrate: Starts the calibration routine for the selected channel.

Configure: Allows user to configure the Input and Output Channel settings, Calibration settings, SPI settings, and Hardware/Communication settings

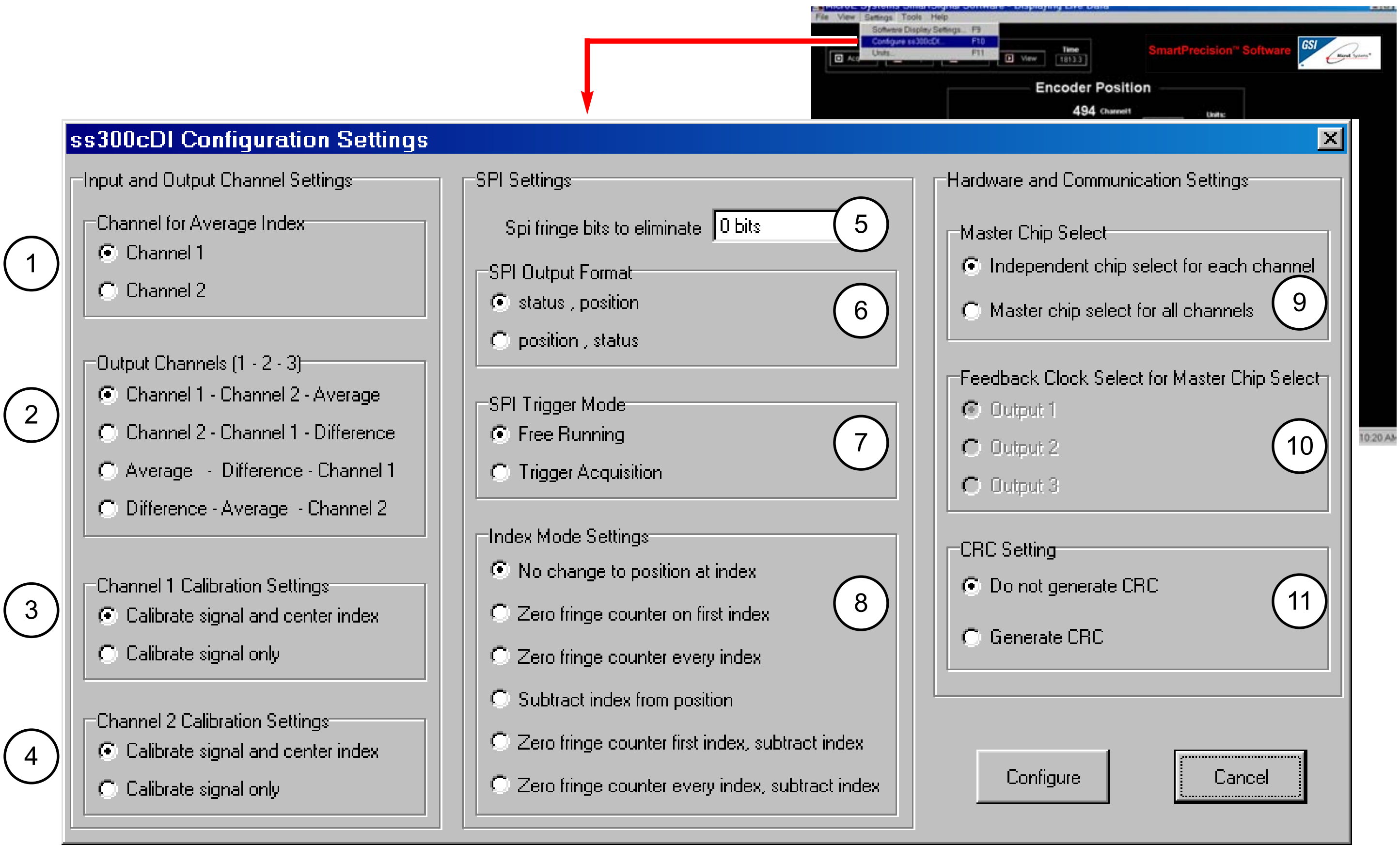
Display Settings: Configures the SmartPrecision Software Display



Data Plots
Encoder Signal: Displays the encoder signal plot for each input channel

Signal Strength: Displays the encoder signal strength for each in out channel.

Encoder Position: Displays the encoder position for each in out channel.



Configurations screen

1 **Channel for Average Index:**
Selects the input channel index that will be used for the Averaged output.
Example shown:
Index for Channel 1 selected

2 **Output Channels [1 - 2 - 3]**:
The Mercury Dual Axis Averager uses two sensors as inputs and has three output channels. Each sensor's signal is processed for accuracy enhancement and interpolated. The signals, or their average or difference, are routed to each of the three output channels. The routing assignments can be changed using SmartPrecision Software in the Configuration Settings dialog box. There are four possible configurations for the output channel assignments as shown in the following table:

Output Configuration	Assignment for Output Channel 1	Assignment for Output Channel 2	Assignment for Output Channel 3
"Channel 1 - Channel 2 - Average"	Sensor 1	Sensor 2	Average of Sensor 1 and Sensor 2
"Channel 2 - Channel 1 - Difference"	Sensor 2	Sensor 1	Difference (Sensor 1 minus Sensor 2)
"Average - Difference - Channel 1"	Average of Sensor 1 and Sensor 2	Difference (Sensor 1 minus Sensor 2)	Sensor 1
"Difference - Average - Channel 2"	Difference (Sensor 1 minus Sensor 2)	Average of Sensor 1 and Sensor 2	Sensor 2

M3000SiDAA Configuration

3
4
Channel 1 & 2 Calibration Settings
If two separate axes are used the recommended setting is "Calibrate signal and center index". For applications where two sensors are used on the same axis or if the index mark is not in the range of motion for one of the encoders, the "Calibrate signal only" will allow proper calibration of the signal.

5
Fringe Counter Size
The M3000SiDAA allows the user to configure the serial word to increase sampling rate. Some applications do not require 18 bits of fringe count. The SPI Settings box allows the user to reduce the fringe counter to suit the application and thereby increasing the maximum sampling rate of the system.

6
SPI Output Format
The format of the SPI output can be configured to have the status word at the beginning or at the end of the serial word.

7
SPI Modes
There are two different SPI modes the users can select from:

Free Running or Standard communication mode latches the output buffer with the current data when the falling edge of Chip Select is asserted.

The Trigger Acquisition mode can be used in applications where synchronization of the position data to an event is required. Often, this mode is used when a fixed latency between a clock signal and the sampled position data is required. If this option is selected a new calculation cycle starts each time the falling edge of Chip Select is asserted. NOTE: This mode is equivalent to the SS-350cSI Trigger line. It use the falling edge of the cs as trigger

8
Index Mode Settings:
Configure how the serial word data is manipulated when encountering the index angle position.

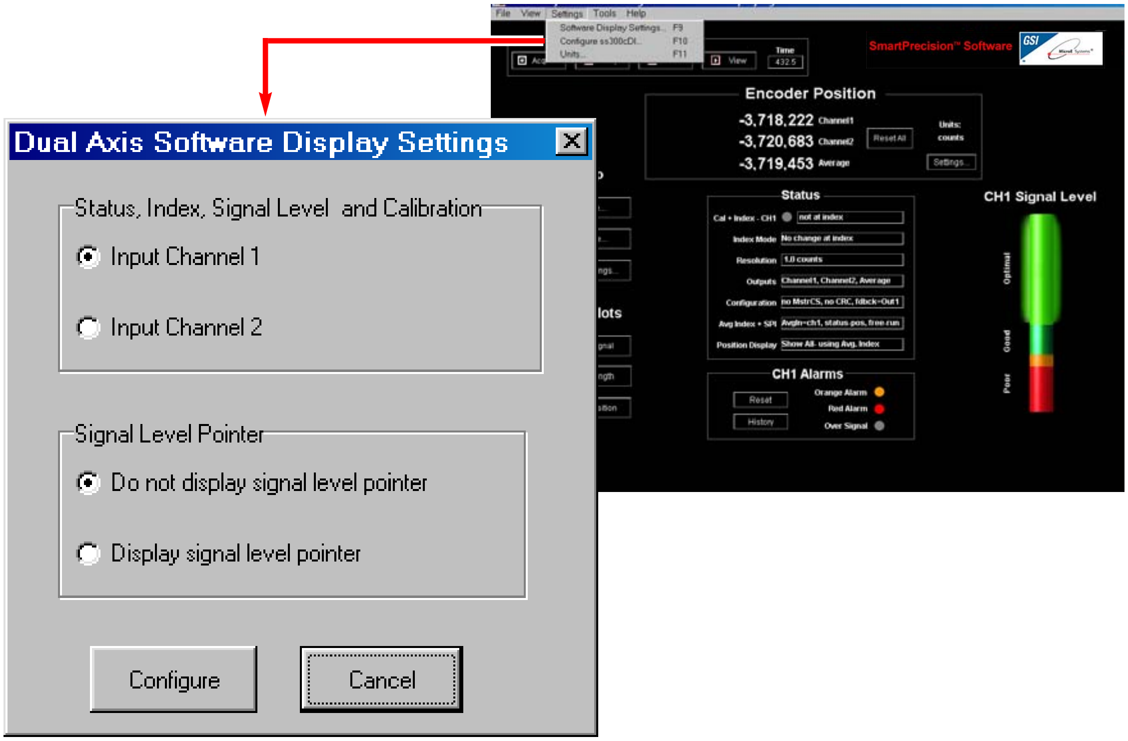
9
Master Chip Select
Allows one hardware Chip Select to be used for all channels to minimize wiring connections.

10
Feedback Clock Select
Allows the user to select the optional Feedback clock. The Feedback clock signal is used to eliminate propagation delays due to long cable lengths.

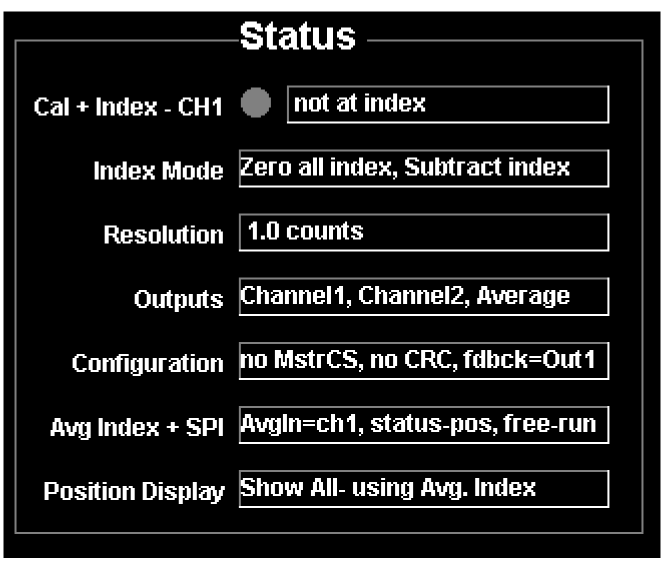
11
CRC Setting
Allows the user to generate a CRC (Cyclic Redundancy Check). The CRC is located within the status word. The CRC is only valid when the status byte is at the end of the serial word (see **SPI Output Format** above) and the wholw fringes (18 bits) are read.

Note: The polynomial used for CRC calculation is 10011. The resulting checksum is 4 bits and performed on the 28 bits position word only, the status bits are not used in the CRC calcualtion.

Warning: Changing configuration settings while in closed loop control is not recommended.

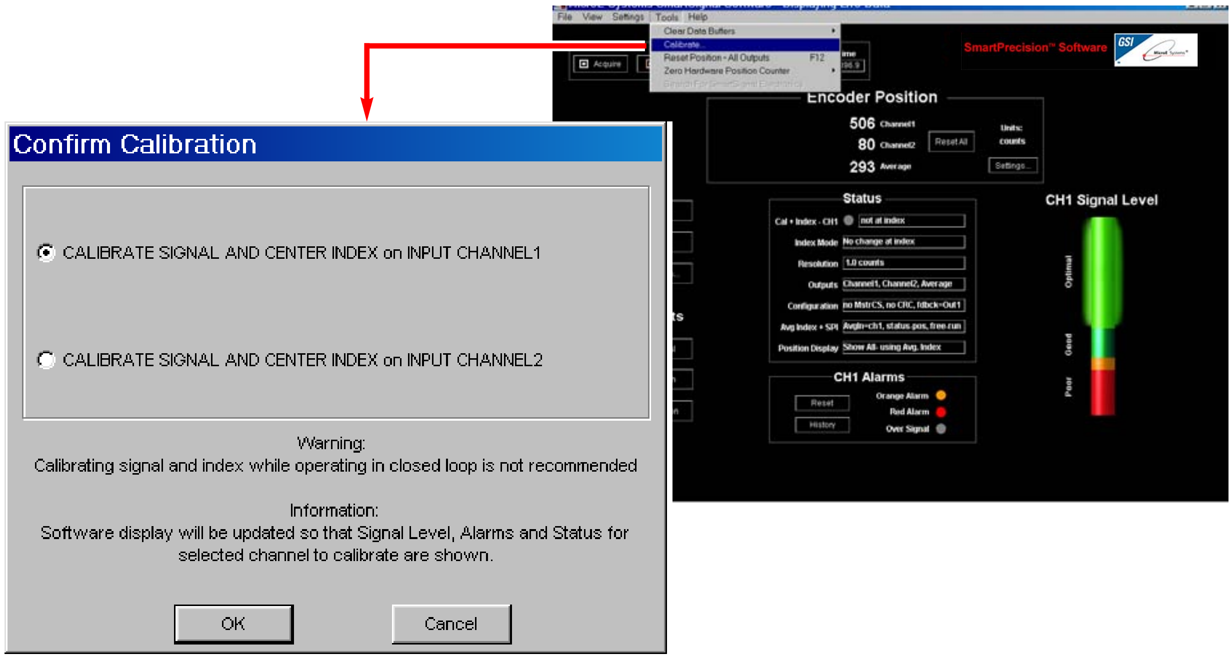


Dual Axis Software Display Settings



The Status Display in the center of the screen gives the user a snapshot of the interpolator configuration as well as Index position indication. The indicator light on the SmartPrecision software mimics the LED on the M3000SiDAA. The indicator will be green as long as the encoder is within the index window.

Calibration - SmartPrecision Software



Confirm Calibration screen

Calibration should be performed only after each of the encoders is aligned properly.

Calibration can be initiated by either the Calibrate button using Smart Signal Software or through the recessed push button switch in the M3000SiDAA.

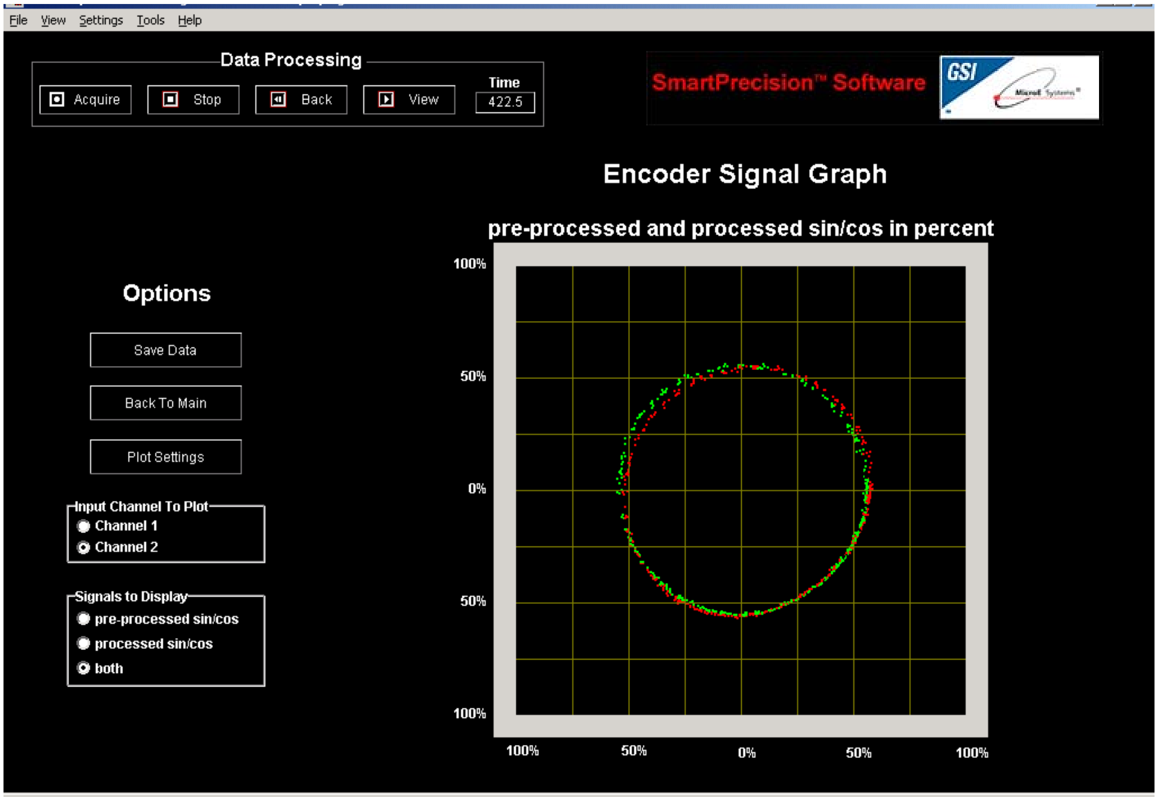
To calibrate Channel 1:
Through Software: Select "CALIBRATE SIGNAL on INPUT CHANNEL 1"
Through Hardware: Push the recessed button once.

The power indication for Channel 1 will rapidly blink until the calibration routine is complete.

To calibrate Channel 2:
Through Software: Select "CALIBRATE SIGNAL on INPUT CHANNEL 1"
Through Hardware: Push the recessed button twice quickly (within 3 sec).

The power indication for Channel 2 will rapidly blink until the calibration routine is complete.

Warning: Changing configuration settings while in closed loop control is not recommended.



Encoder Signal Data Plot showing pre-porcessed and processed data.

The Encoder Signal Graph will plot the encoder signal for Channel 1 or Channel 2. The M3000SiDAA has a USB interface which allows very fast data collection and plotting. The number of data points to be plotted on the graph at one time can be changed using the "Plot Settings" button.

The processed (Green) and/or the pre-processed (Red) signals can be shown on the graph. Plotted data can be saved using the "Save Data" button.

Note:
The calibration routine cannot be initiated through hardware (recessed push button) while the software is in the Encoder Signal Screen.

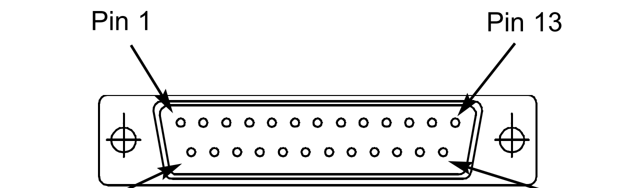
System Specifications

Operating and Electrical Specifications

Maximum Power Supply:	5V+/-5% @ 550mA (including two sensors)
Operating Temperature:	0 to 70 degrees C
Storage Temperature:	-30 to 80 degrees C
Humidity:	10 to 90% RH non-condensing

M3000SiDAA Output Connector Pinout (DB25)

PIN	Function
1	Serial Data Output 1+
2	Serial Data Output 1-
3	Chip Select Input 1+
4	Chip Select Input 1-
5	Serial Clock Input 1+
6	Serial Clock Input 1-
7	Serial Data Output 2+
8	Serial Data Output 2-
9	Chip Select Input 2+
10	Chip Select Input 2-
11	Serial Clock Input 2+
12	Serial Clock Input 2-
13	Serial Data Output 3+
14	Serial Data Output 3-
15	Chip Select Input 3+
16	Chip Select Input 3-
17	Serial Clock Input 3+
18	Serial Clock Input 3-
19	Serial Feedback Clock Output or Trigger input+
20	Serial Feedback Clock Output or Trigger input-
21	Do not connect
22	Do not connect
23	Alarm Output
24	5volt power
25	Ground



M3000SiDAA Male DB25 Connector Front View

Serial Output Specification

The interface to the M3000SiDAA Interpolator uses the following signals to implement serial communication, n_spiEnable (n_CS), spiDataOut (SDO), spiClockIn (SCK), and optionally spiClockOut (SCF). Each signal is differential and RS-422 compatible. See table for interpolator signal names, pin names, and pin locations

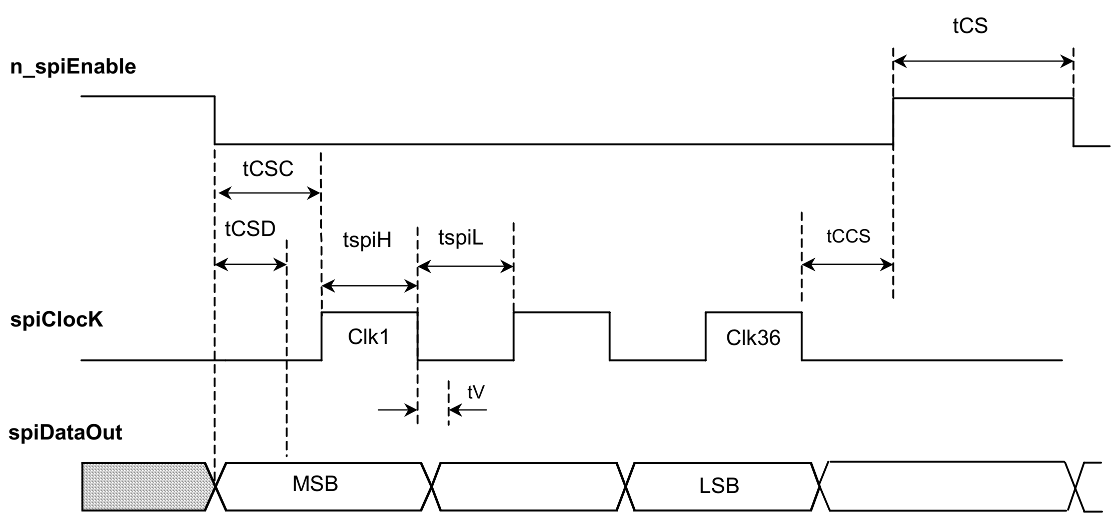
Signal Name	Pin Name	Function	I/O Interpolator Referenced	15 Pin HD Connector Pin Number
n_spiEnable	n_CS+	Chip Select+	Input	7
	n_CS-	Chip Select-	Input	8
spiClockIn	SCK+	Serial Clock+	Input	14
	SCK-	Serial Clock-	Input	15
spiDataOut	SDO+	Serial Data Output+	Output	5
	SDO-	Serial Data Output-	Output	4
spiClockOut	SCF+	Serial Clock Feedback+	Output	10
	SCF-	Serial Clock Feedback-	Output	9

Revision pending.

Operational Modes: Standard Communication Mode

The falling edge of the n_spiEnable signal loads the current data word into the output buffer. The serial data (MSB) is valid 80ns (typical) after the falling edge of n_spiEnable signal. The n_spiEnable signal is kept asserted while spiClock signal shifts out the rest of the data bits. Each serial data bit is valid on the falling edge of the spiClock signal. The n_spiEnable should return to High after the last serial data bit has been shifted out

Communication Mode Timing



Serial Output Specification

Symbol	Parameter	Minimum	Typical	Maximum	Units
tspiH	spiClock High Time	50			ns
tspiL	spiClock Low Time	50			ns
tCSC	↓n_spiEnable to ↑spiClock	0			ns
tCSD	↓n_spiEnable to DataValid		80		ns
tV	↓spiClock to Data Valid		80		ns
tCCS	↓spiClock to ↑n_spiEnable	0			ns
tCS	n_spiEnable High	50			ns

All timing are specified assuming no propagation delay from user's electronics and cabling.

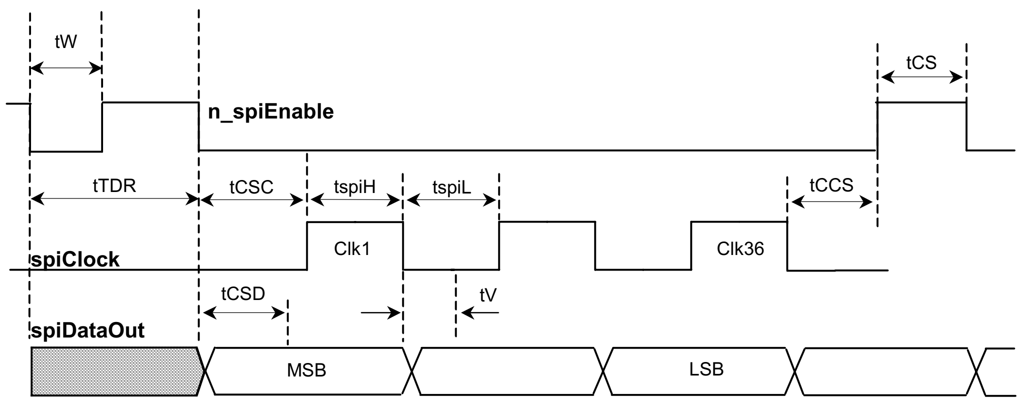
Operational Modes: Trigger Approach Timing Diagram

The Trigger Approach can be used in applications where synchronization of the position data to an event is required. Often, this mode is used when a fixed latency between a clock signal and the sampled position data is required. The customer can choose this mode of operation by using the optional SmartPrecision Software. In this mode, triggering is controlled by the n_spiEnable signal.

The falling edge of n_spiEnable signal starts the process by immediately resetting the internal calculators and acquiring the latest A/D converter information. Old data in the calculation chain is discarded and the initiation of a new position calculation is started. The new data is ready in 1420ns. The n_spiEnable signal for retrieving the data must be asserted within 210ns after the new data is ready or the triggered acquisition will be over written by new data.

Shifting the data out of the interpolator's serial port is accomplished exactly as in the Standard Communication mode of operation. In order to sample the next position, n_spiEnable must be brought high and then reasserted. See the Trigger Approach timing diagram below.

Trigger Approach Timing Diagram

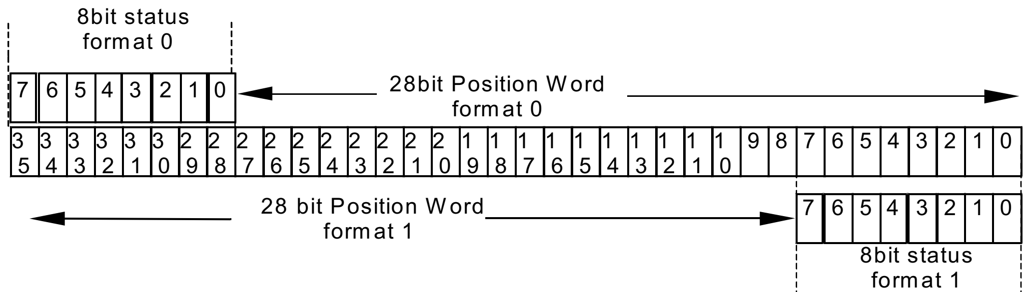


Trigger Approach Timing Diagram

Symbol	Parameter	Minimum	Typical	Maximum	Units
tspiH	spiClock High Time	50			ns
tspiL	spiClock Low Time	50			ns
tTDR	↓n_spiEndable to DataReady	1420		1600	ns
tW	↓n_spiEnable Low for trigger	50			ns
tCSC	n_spiEnable to ↑spiClock	0			
tCSD	↓n_spiEnable to DataValid		80		ns
tV	↓spiClock to Data Valid		80		ns
tCCS	↓spiClock to ↑n_spiEnable	0			ns
tCS	n_spiEnable High	50			ns

Serial Output Specification

Serial Data Format



Troubleshooting

Problem
The Power/Calibration indicator will not come on.

Solution
- Make sure that the SmartPrecision electronics' 25-pin HD connector is fully seated and connected.
- Confirm that +5 Volts DC is being applied to pin 24 on the SmartPrecision electronics' 25-pin HD connector and that pin 25 is connected to ground.

Problem
None of the SmartPrecision electronics' LEDs turn on.

Solution
- Refer to the Grounding Reference Guide on pg. 9.

Problem
Can't get the SmartPrecision electronics' "Signal" LEDs better than red or yellow; or the green, " Proper Alignment" indicators don't stay illuminated over the full length of the scale.

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

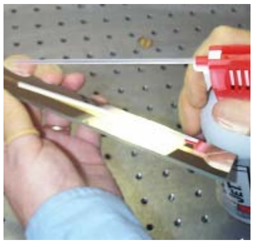
Problem
The green Power/Calibration indicator is flashing unexpectedly.

Solution
- Part of the normal setup procedure is to activate the SmartPrecision electronics' index capture process by pressing the recessed button on the SmartPrecision electronics' connector body, once for sensor 1 and twice for sensor 2. Each Power/Calibration LED will begin to flash until the index mark on the scale passes under each sensor at least one time.

Problem
Can't complete the Capture Index process - the green Power/Calibration indicators don't stop flashing.

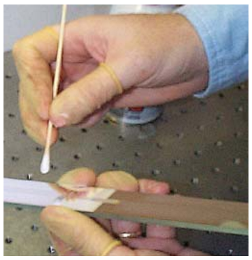
Solution
- Verify that each sensor is mounted in the correct orientation to the scale for the desired index mark. Refer to the interface drawing.
- Refer to step 5 of the installation procedure to insure proper operation.

Cleaning scales




General Particle Removal

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




Contamination Removal

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

Contact MicroE Systems

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

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