VEGA
MODEL 2790501

INDUCTOSYN TO ENCODER CONVERTER FOR MACHINE TOOL, POSITIONING, AND COORDINATE MEASURING MACHINES

*** APPLICATIONS ***

- ➤ **Ideal For Closed Loop Positioning Systems**
- ➤ **Machine Tools**
- ➤ **Coordinate Measuring Machines**
- ➤ **PLC Positioning Control**
- ➤ **Index/Rotary Tables**
- ➤ **Tracking/Telescope/Telemetry Systems**
- ➤ **Transfer Lines**
- ➤ **Positioning Systems**
- ➤ **Robotic Applications**
- ➤ **Dispensing Systems**

INDUCTOSYN TO DIGITAL INTERFACE

- ➤ **Hiedenhain, Farrand, G&L and Mitsubishi Linear and Rotary Inductosyn Scales**
- ➤ **Incremental encoder output signals**
- ➤ **Makes Inductosyn Scales as easy to use as encoders**
- ➤ **Jumper Selectable line counts 1000, 1024, 2000, 2048, 4000, 4096, 8000, and 8192 A-quad-B with Index and complements**
- ➤ **Jumper Selectable Excitation Frequency including 2.5, 5.0, and 10 kHz**

With the VEGA 2790501 converter you can have both the precision of an Inductosyn scale and the digital simplicity of an encoder interface. The 2790501 can be used with almost any Inductosyn style scale. The INDEX/MARKER pulse (Channel Z) will occur once per transducer cycle at the zero degree position.

*** ADVANCED FEATURES ***

- ➤ **Easy to Use and Easy to Set Up**
- ➤ **Simplify Retrofits**
- ➤ **Panel Mount or DIN Rail Option**
- ➤ **Non-Phase Locked Loop Design for Faster Loop Closure (Less than 50 uSec @ 10 kHz)**
- ➤ **Highly Accurate**
- ➤ **Tuned Filter for Noise Immunity**
- ➤ **A-Quad-B, Index and Complements**
- ➤ **TTL/Line Driver Outputs**
- ➤ **Quadrature encoder signals to 4 mHz**
- ➤ **Single +5 vDC Supply Operation**
- ➤ **Loss of Phase Detection**
- ➤ **Fault Signal Output (Line Driver, and Active Pull-Up)**
- ➤ **Status LED's for Power, A, B, Z, Signal HI, Signal MID, and Fault**
- ➤ **Configurable Fault signal conditioning for Fail-Safe operations**
- ➤ **Compact Design and Easy to Install**

* Tracking limited to +/- 0.25 Inductosyn cycle with power off

2790501 SPECIFICATIONS

Excitation 2 Phase:	2.5, 5, or 10 kHz
Input:	0.8 to 18 vpp
Power Requirements:	5 vDC @ 2.5 Amps
Drive Capacity:	2.25 Amps
Mechanical:	2.825 x 5.25 x 1.00
Accuracy:	+/- 3 arc minutes
Weight:	80 grams (148 grams w/DIN)

CONVERTER ACCURACY AND TRACKING RATE

The tracking rate is a function of the excitation frequency and quadrature counts. With a 2.5 kHz excitation and 4000 quadrature counts the tracking rate would be 9,600 transducer cycles per minute. With a 10.0 kHz excitation and 4000 quadrature counts the tracking rate would be 38,400 transducer cycles per minute. Reducing the counts will increase the tracking rate proportionately.

PRICING AND DELIVERY

Model	Description
2790501	Inductosyn to Digital
2790DIN	DIN Rail Kit
2790CK1	Solder Connector Kit
2790CK2	Crimp Connector Kit
2789500	2.5 kHz Pre-Amp
2789503	10 kHz Pre-Amp
2789DIN	DIN Rail Kit for Pre-Amp

RoHS Compliant

2790501_Rev. E

VEGA 2790501 INDUCTOSYN TO ENCODER SPECIFICATIONS AND CONNECTIONS

P1 INDUCTOSYN CONNECTOR

PIN#	FUNCTION	COLOR
1	Sine HI	Red
2	Sine LO	Black
3	Sine Shield	SHLD
4	Cosine HI	Yellow
5	Cosine LO	Blue
6	Cosine Shield	SHLD
7	Feedback HI	Red/Wht
8	Feedback LO	Yel/Wht
9	Feedback Shield	SHLD
10	+5 vDC (*External)	N/A

P2 POWER CONNECTOR

PIN#	FUNCTION	COLOR
*1	+5 vDC	Red
*2	DC Ground	Black

P3 ENCODER CONNECTOR

| PIN#	FUNCTION	COLOR
1	DC Ground	Black
2	Channel A+	Grey
3	Channel B+	Yellow
4	Channel Z+	Blue
5	Reserved	N/A
6	Reserved	N/A
7	Reserved	N/A
8	Fault (TTL)	Blu/Red
9	Reserved	N/A
10	+5 vDC (*External)	Red
11	Reserved	N/A
12	Reserved	N/A
13	Reserved	N/A
14	Channel A-	Violet
15	Channel B-	Orange
16	Channel Z-	Green
17	Reserved	N/A
18	Reserved	N/A
19	!Fault (Active Pull-Up)	Red/Blk
20	!Fault (TTL)	Blu/Blk
21	Reserved	N/A
22	Reserved	N/A
23	Reserved	N/A
24	Reserved	N/A
25	Active Pull-Up vDC	Blu/Wht

QUADRATURE OUTPUT

The VEGA 2790 series of converter boards use RS-422-A differential drivers to provide 40 mA into a 100 ohm differential load. These outputs are also TTL compatible.

The output latency is dependent on the excitation frequency. At 2.5 kHz the response will be less than 200 uSec and at 10.0 kHz the response will be less than 50 uSec.

Quadrature is provided via Channel A+, Channel A-, Channel B+ and Channel B-. A count is considered to occur whenever there is a transition in either the Channel A or Channel B output signals. The Channel Z (Index) occurs once per resolver cycle. The phase relationship of the two signals indicates the direction of motion as shown in the figure below.

QUADRATURE OUTPUT FORMAT
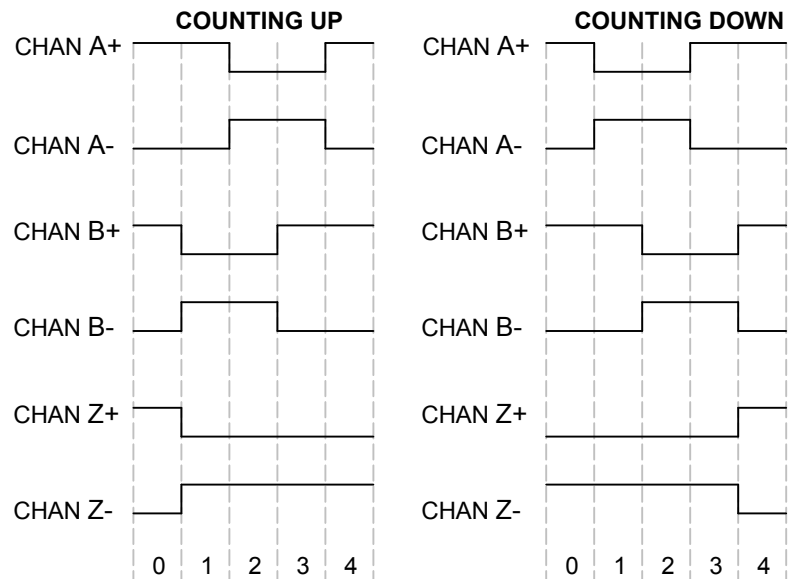
FREQUENCY SELECTION (B1-B2)
The 2790 series of converters provide selectable excitation frequencies via SWB1 jumpers B1 and B2. Most Inductosyn applications are tuned to 2.5 kHZ.

The 2790 also provides jumper selection of the active filter network for the return signal to provide the maximum noise immunity at the selected frequency. For the typical Inductosyn application operating at 2.5 kHZ both J10 and J11 jumpers should be installed. For excitation frequencies above 2.5 kHZ both jumpers should be removed. For low level signal condition at 2.5 kHZ J10 can be removed to achieve a x4 internal gain.

DECIMAL/BINARY SELECTION (B3)
The 2790 converter card provides both decimal and binary counting modes. Installing SWB1 jumper B3 selects binary counting mode to provide selection between 256, 512, 1024, and 2048 line counts. Removing jumper B3 selects the decimal counting mode to provide selection between 250, 500, 1000, and 2000 line counts.

LINE COUNT SELECTION (B4-B5)
The 2790 converter board provides 8 jumper selectable line counts. Binary counts are selected by installing SWB1 jumper B3 and installing the appropriate combination of jumpers B4 and B5. Most systems using encoder style feedback are set to the x4 quadrature counting mode so that the effective quadrature counts are 4 times greater than the physical line count of the encoder.

RESERVED (B6-B9)
On the 2790 converter board Jumpers B6-B9 are reserved and should have all jumpers removed

See Figure 1.0 for SWB1 Jumper Chart.

CHANNEL Z NORMAL/INVERTED SELECTION (J2)
The 2790 converter board provides jumper selectable inversion of the Z Channel (Index) for systems requiring an active low signal. Jumper J2 pins 2-3 select the channel Z Normal mode and pins 1-2 select the Channel Z Inverted mode.

FAULT MODE OUTPUT SELECTION
The 2790 converter board provides several methods of interface for fail safe fault detection.

DIFFERENTIAL FAULT SIGNAL SET-UP (J4)
Installing a jumper on J4 pins 1-2 enables the RS-422-A differential drivers and provide up to 40 mA into a 100 ohm differential load. These outputs are also TTL compatible and are located on pins 8 and 20 of the P3 connector.


TTL OR LINE DRIVER INTERFACE
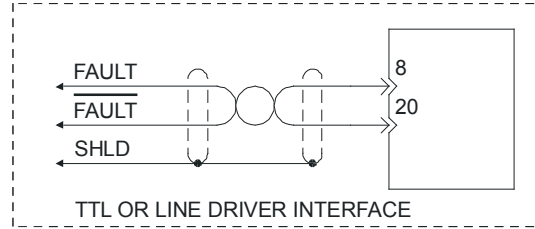
TRI-STATE A-QUAD-B FAULT SIGNAL SET-UP (J4)
Install a jumper on J4 pins 2-3. The 2790 board will Tri-State the A-Quad-B signals as well as the Z Channel during a Fault condition. The +/- Fault TTL signals located on P3 pins 8 and 20 are also Tri-Stated and are NOT a valid interface with this set-up. This interface will allow an immediate Fault sense by equipment with loss of signal detection.

ACTIVE PULL-UP FAULT SIGNAL SET-UP
The active pull-up interface is a fail-safe design so that in a loss of power condition the 2790 will still drop the fault signal on Pin 19 of the P3 connector. Pin 19 will be the source voltage with no fault present and can drive up to 600 mA. The source voltage for the Pull-up must be provided on Pin 25 of the P3 connector and can range from 5-40 vDC.

ACTIVE PULL-UP INTERFACE
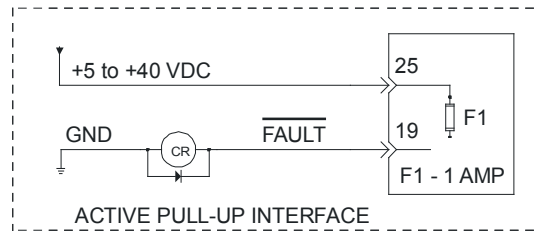
FUNCTION	B1	B2	B3	B4	B5	B6	B7	B8	B9	Quadrature Counts
2.5 kHZ	0	0								
5.0 kHZ	1	0								
10.0 kHZ	0	1								
Reserved	1	1								
Decimal Count			0							
Binary Count			1							
250/256 Lines				0	0					1000 Decimal/1024 Binary
500/512 Lines				1	0					2000 Decimal/4048 Binary
1000/1024 Lines				0	1					4000 Decimal/4096 Binary
2000/2048 Lines				1	1					8000 Decimal/8192 Binary
Default						0	0	0	0	
Reserved						1				
Reserved							1			
Reserved								1		
Reserved									1	

- Figure 1.0 -

1 Indicates installed jumper   **Indicates default setting**

1) Install the 2790 board as described in the application drawing 2790501.

2) Select the fault signal conditioning method by setting the JB4 jumper as described in the JUMPER SETTINGS section based on the application requirements.

3) Select the Z Channel inverted option by setting J2 to short pins 1 and 2. The DEFAULT is non-inverting and having pins 2 and 3 shorted on J2.

4) Select the excitation frequency by JB1-2 of SWB1 (see jumper table Fig. 1.0). 2.5 kHZ is the DEFAULT setting with both jumpers removed.

5) Select the passive filter setting by J11 for the corresponding frequency setting. The DEFAULT setting is for a board set to 2.5 kHZ and J11 is installed.

6) Select the counting style of Binary or Decimal by JB3 of SWB1 (see jumper table Fig. 1.0). Decimal is the DEFAULT setting with JB3 removed.

7) Select the line count per revolution by setting JB4-5 of SWB1 (see jumper table Fig. 1.0). 1000 lines per revolution (4000 quadrature counts per cycle) is the DEFAULT setting with JB4 removed and JB5 installed.

8) Jumpers JB6-8 are reserved for the 2790501 and should be removed.

9) Adjust the Pre-Amp to achieve 2.5 volts peak to peak on the SIG test point. If you are using the VEGA Pre-Amp MN#2789500 turn the pre-amps Gain pot so that the MID led is illuminated and the HI and LO led's are extinguished.

10) J10 selects in the input course gain range and allows for interface to a broad range of resolver transformation ratios. Installing a jumper on pins 1 and 2 sets the gain to 0.25 (gain of ¼). Installing a jumper on pins 2 and 3 sets the gain to 1.0 (Default) and removing the jumpers completely sets the gain to 4.0.

11) Turn the gain potentiometer fully counter-clockwise. Then turn the gain potentiometer clock-wise until the MID LED comes on. The signal return on "ST1" test point should now be 3.8 volts peak to peak. Phase the position loop if necessary by reversing the Sine HI and Sine LO wires to reverse the count direction. At this point the basic set-up is complete and the position loop can now be closed. Set the position loop gain of the servo system and then continue to Step 12.

12) After the position loop has been closed the phase balance of the 2790 board can be adjusted. To adjust the phase balance of the 2790 board, observe the excitation return on the "ST1" test point. Adjust the oscilloscope to 100 mvDC per division and offset the signal so that just the peak of the signal is visible. Jog the axis at 30% of its feedrate. If the phase is unbalanced the peak of the sine wave will bounce and become blurred. Adjust the balance pot (BAL) on the 2790 to achieve 20 mvDC or less bounce.

LED STATUS INDICATORS

CHA = Channel A State Indicator
CHB = Channel B State Indicator
CHZ = Channel Z (Index/Marker) Indicator
PWR = Power Status Indicator

FLT = Loss of Signal Indicator
MID = Return Signal Proper Indicator
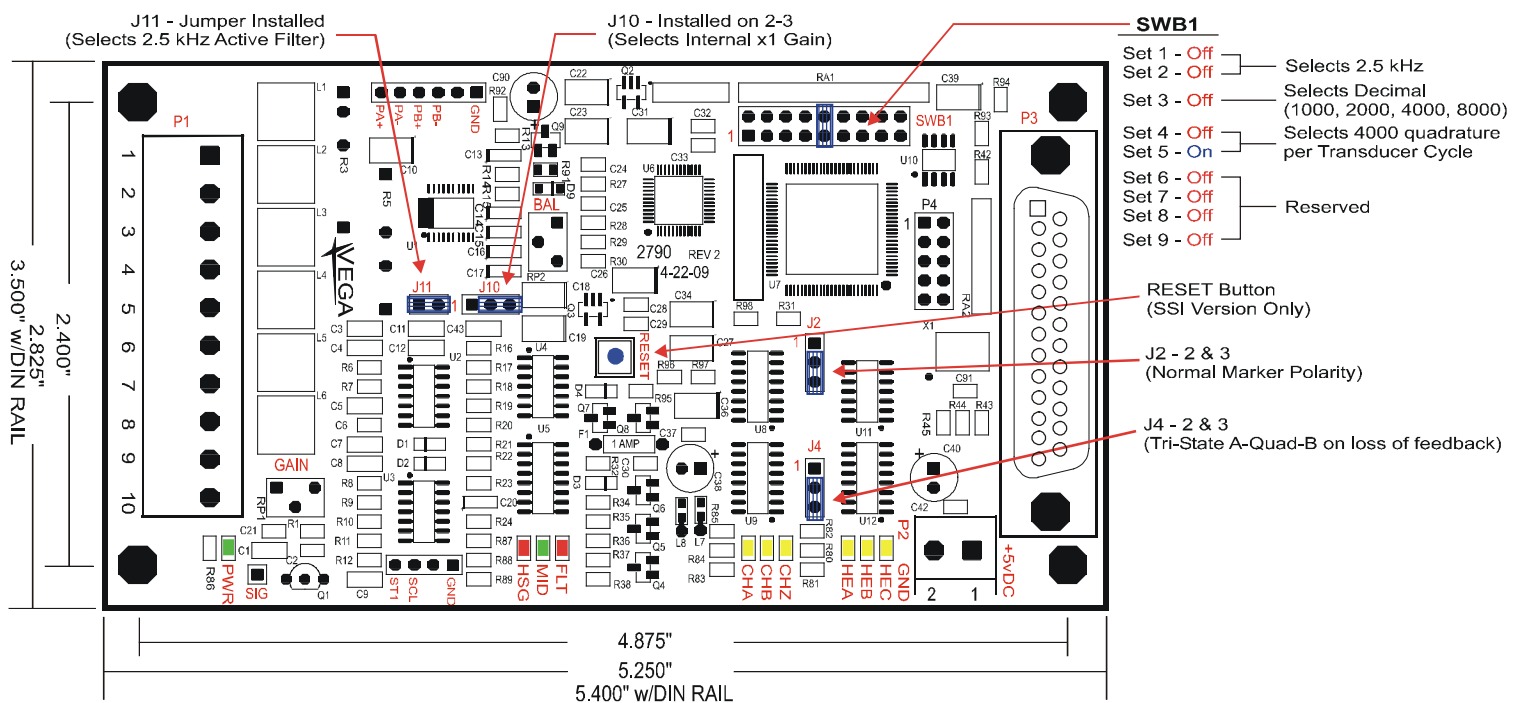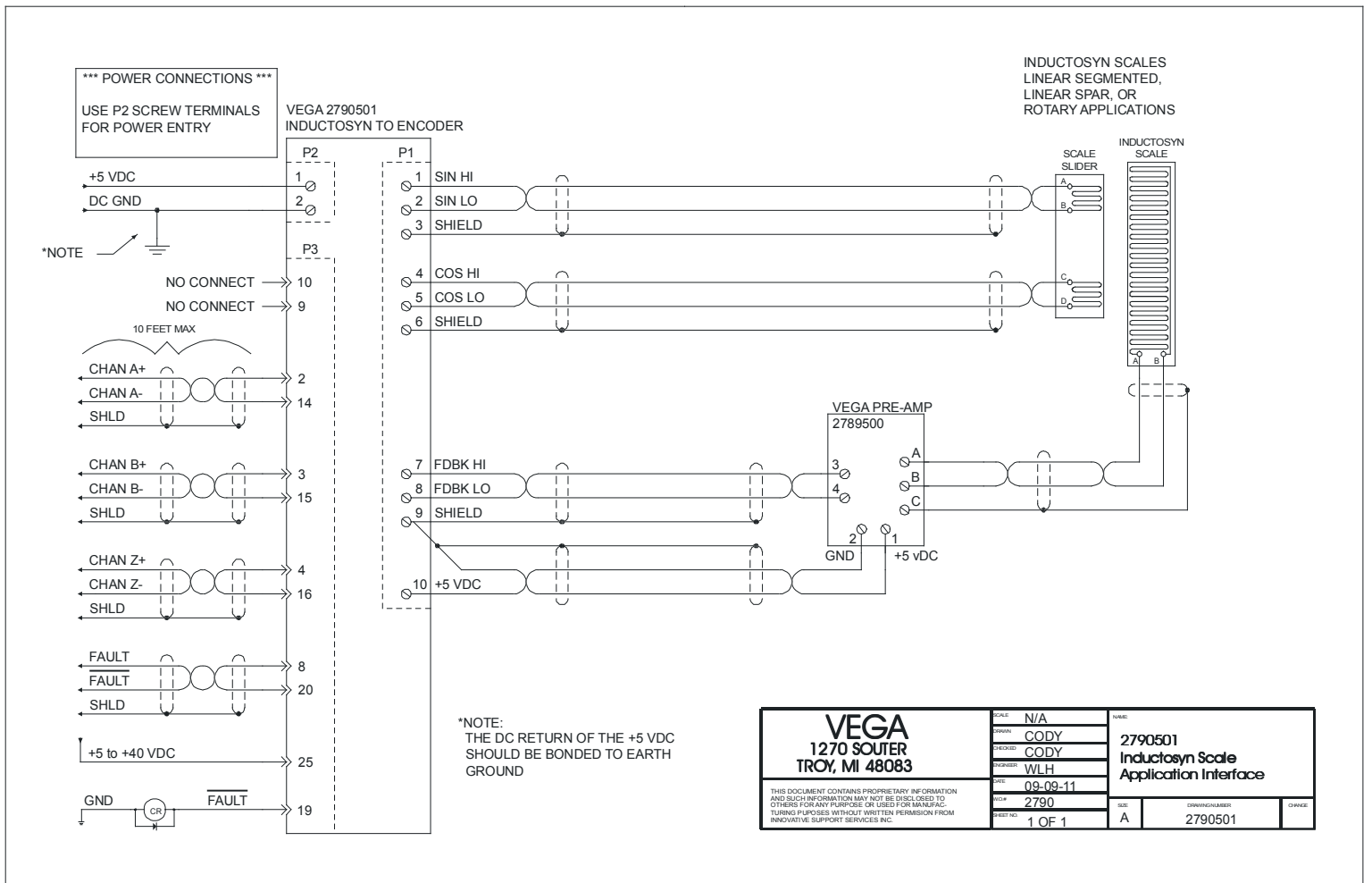**HSG** = High Signal Indicator

TEST POINTS

GND = Analog Ground
PA+ = Sine HI (3.6 vDC Peak to Peak)
PA- = Sine LO (3.6 vDC Peak to Peak)
PB+ = Cosine HI (3.6 vDC Peak to Peak)
PB- = Cosine LO (3.6 vDC Peak to Peak)

SIG = Signal Return (0.8-18.0 vDC Peak to Peak)
ST1 = Stage 1 Signal (3.8 vDC Peak to Peak)
SCL = Tracking Clock

SYMPTOM	CHECKS	SOLUTION
No Power LED	Check +5 vDC	+5 vDC Present → Board Failure – Replace board
Fault LED (Low Signal) Continuous	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value.	If resistance values are less than 3.0 ohms – Check for shorts between "PA-" and "PA+" as well as ground. Check for shorts between "PB-" and "PB+" as well as ground.
	Check "PA+" and "PB+"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PA-" and "PB-"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "ST1" test point for 3.8 volts peak to peak	Repeat Step 9-11 of the Inductosyn Set-Up Procedure
Fault LED (Low Signal) Intermittent	Check "PA+" and "PB+"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PA-" and "PB-"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" not value.	If resistance values differ by more than 0.5 ohms of each other → Check Inductosyn connections – Replace slider or cables
	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value.	If resistance values are less than 3.0 ohms – Check for shorts between "PA-" and "PA+" as well as ground. Check for shorts between "PB-" and "PB+" as well as ground.
	Check "ST1" test point for bounce	Repeat step 12 of the Inductosyn Set-Up Procedure
Cyclic Error	Check "ST1" test point for bounce	Repeat step 12 of the Inductosyn Set-Up Procedure
	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value.	If resistance values are less than 3.0 ohms – Check for shorts between "PA-" and "PA+" as well as ground. Check for shorts between "PB-" and "PB+" as well as ground.
	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value.	If resistance values are differ by more than 0.5 ohms of each other → Check Inductosyn connections – Replace slider or cables
	Check "PA+" and "PA-"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PB+" and "PB-"test point for 3.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
HSG LED (High Signal) Continuous	Check "ST1" test point for 3.8 volts peak to peak	Repeat Step 9-11 of the Inductosyn Set-Up Procedure
HSG LED (High Signal) Intermittent	Check "ST1" test point for 3.8 volts peak to peak	Follow procedures described in the Fault LED (Low Signal) Intermittent section
MID LED (Signal Midpoint) Continuous	Signal Proper	No Problem… Life is Good
MID LED (Signal Midpoint) Intermittent	Check "ST1" test point for bounce	Repeat step 12 of the Inductosyn Set-Up Procedure
Feedback Polarity is Reversed	None	Swapping the Sine HI with the Sine LO wires will reverse the counting direction of the A-quad-B

*** POWER CONNECTIONS ***

USE P2 SCREW TERMINALS FOR POWER ENTRY

VEGA 2790501
INDUCTOSYN TO ENCODER

INDUCTOSYN SCALES
LINEAR SEGMENTED,
LINEAR SPAR, OR
ROTARY APPLICATIONS

+5 VDC
DC GND

*NOTE

NO CONNECT
NO CONNECT

10 FEET MAX

CHAN A+
CHAN A-
SHLD

CHAN B+
CHAN B-
SHLD

CHAN Z+
CHAN Z-
SHLD

FAULT
FAULT
SHLD

+5 to +40 VDC

GND   FAULT

P1: 1 SIN HI, 2 SIN LO, 3 SHIELD, 4 COS HI, 5 COS LO, 6 SHIELD, 7 FDBK HI, 8 FDBK LO, 9 SHIELD, 10 +5 VDC

VEGA PRE-AMP
2789500

GND   +5 vDC

*NOTE:
THE DC RETURN OF THE +5 VDC SHOULD BE BONDED TO EARTH GROUND

SCALE SLIDER
INDUCTOSYN SCALE

VEGA
1270 SOUTER
TROY, MI 48083

SCALE	N/A	NAME	2790501
DRAWN	CODY		Inductosyn Scale
CHECKED	CODY		Application Interface
ENGINEER	WLH		
DATE	09-09-11		
WO#	2790	SIZE	DRAWING NUMBER	CHANGE
SHEET NO	1 OF 1	A	2790501	

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J11 - Jumper Installed
(Selects 2.5 kHz Active Filter)

J10 - Installed on 2-3
(Selects Internal x1 Gain)

SWB1

Set 1 - Off	Selects 2.5 kHz
Set 2 - Off	
Set 3 - Off	Selects Decimal (1000, 2000, 4000, 8000)
Set 4 - Off	Selects 4000 quadrature
Set 5 - On	per Transducer Cycle
Set 6 - Off	
Set 7 - Off	Reserved
Set 8 - Off	
Set 9 - Off	

RESET Button
(SSI Version Only)

J2 - 2 & 3
(Normal Marker Polarity)

J4 - 2 & 3
(Tri-State A-Quad-B on loss of feedback)

3.500" w/DIN RAIL
2.825"
2.400"

4.875"
5.250"
5.400" w/DIN RAIL

INCH DIMENSIONS

VEGA CNC   1270 Souter Boulevard   Troy, MI 48083   USA   (248) 585-3600

Connector Kits and Mounting Options

KIT #2790CK1
    Includes:
        (1) DB-25 Male Solder Cup Connector
        (1) DB-25 Plastic Hood and Hardware
        (4) #4-40 Male to Female Stand-Offs

KIT #2790CK2
    Includes:
        (1) DB-25 Male Crimp Style Connector
        (25) Gold Male Crimp Pins
        (1) DB-25 Plastic Hood and Hardware
        (4) #4-40 Male to Female Stand-Offs

KIT #2790DIN
    Includes:
        (1) DIN Rail Mount for 2790 boards

REPAIR AND TECHNICAL SUPPORT

VEGA
1270 Souter Blvd.
Troy, MI 48083
(248) 585-3600

Monday-Friday 8:00am to 6:00pm Eastern

VEGA CNC   **1270 Souter Boulevard**   **Troy, MI 48083**   **USA**   **(248) 585-3600**