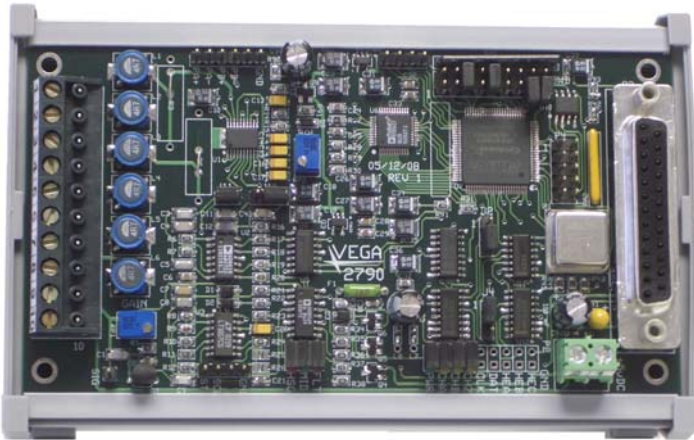


# VEGA

## MODEL 2790514

## INDUCTOSYN TO ABSOLUTE ENCODER CONVERTER with SSI INTERFACE



### RESOLVER TO DIGITAL INTERFACE

- Hiedenhain, Farrand, G&L and Mitsubishi Linear and Rotary Inductosyn Scales
- 25 Bit SSI (Synchronous Serial Interface with Fault status bit)
- Makes Inductosyn Scales as easy to use as encoders
- Jumper Selectable quadrature 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 2790514 converter you can have both the precision of an Inductosyn and the digital simplicity of a SSI interface. The 2790514 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.

### 2790514 SPECIFICATIONS

Excitation 2 Phase:	2.5, 5, or 10 kHz @ 3.6 vpp
Resolver Input:	0.8 to 18 vpp
Power Requirements:	5 vDC @ 2.5 Amps
Drive Capacity:	2.25 Amps
Mechanical:	2.825 x 4.75 x 1.00
Accuracy:	+/- 3 arc minutes

### 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 rpm. With a 10.0 kHz excitation and 4000 quadrature counts the tracking rate would be 38,400 rpm. Reducing the counts will increase the tracking rate proportionately.

### \*\*\* APPLICATIONS \*\*\*

- Ideal For Closed Loop Positioning Systems
- Machine Tools
- Servo Motor Control
- PLC Positioning Control
- Index/Rotary Tables
- Laboratory Equipment
- Positioning Systems
- Robotic Applications
- Nuclear Applications



### \*\*\* ADVANCED FEATURES \*\*\*

- Easy to Use and Easy to Set Up
- \*Absolute Multi-Turn Position Feedback
- Position recovery after Power Fail
- Counter Reset Input
- Compatible with Galil Controllers
- Not Sensitive to Controller Reset
- Non-Phase Locked Loop Design for Faster Loop Closure (Less than 50 uSec @ 10 kHz)
- Highly Accurate
- Tuned Filter for Noise Immunity
- Single +5 vDC Supply Operation
- Loss of Signal Detection
- Status LED's for Power, A, B, Z, Signal HI, Signal MID, and Fault
- Configurable Fault signal conditioning for Fail-Safe operations

- \* Tracking limited to +/- 0.25 inductosyn cycle with power off
- \* Absolute Multi-Turn position on SSI interface only

### SSI (Synchronous Serial Interface)

The 2790514 Inductosyn to Digital Converter has a differential SSI interface for applications requiring serial interface. This makes the 2790514 IDEAL for applications where absolute multi-turn inductosyn feedback is required.

### PRICING AND DELIVERY

Model	Description	Price	Delivery
2790514	Inductosyn to SSI	\$1,125.00	In Stock
2790DIN	DIN Rail Kit	\$ 24.00	In Stock
2790CK1	Solder Connector Kit	\$ 17.00	In Stock
2790CK2	Crimp Connector Kit	\$ 27.00	In Stock
2789500	2.5 kHz Pre-Amp	\$ 225.00	In Stock
2789503	10 kHz Pre-Amp	\$ 225.00	In Stock
2789DIN	DIN Rail Kit for Pre-Amp	\$24.00	In stock

2790514 Rev. 2

# PEOPLE IN CONTROL OF MOTION

# VEGA 2790514 INDUCTOSYN TO SSI 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 INDUCTOSYN CONNECTOR

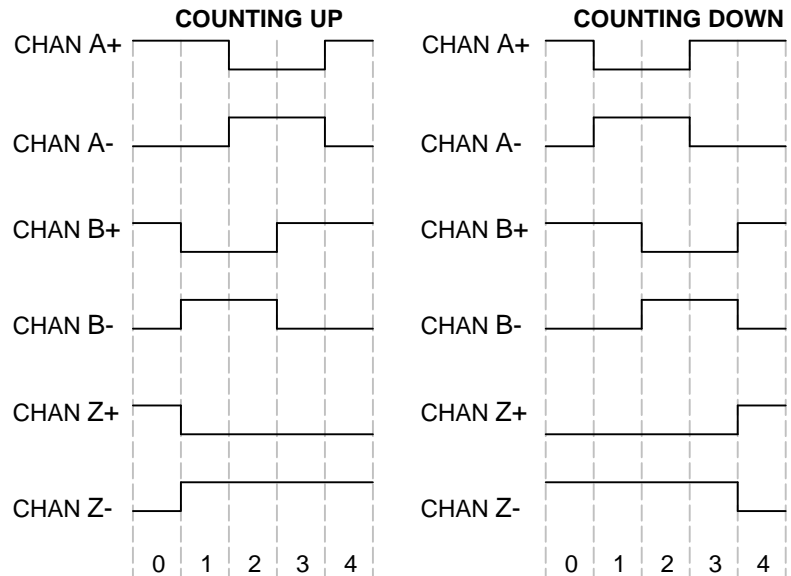
PIN#	FUNCTION	COLOR
1	DC Ground	Black
2	Channel A+	Grey
3	Channel B+	Yellow
4	Channel Z+	Blue
5	SSI Data-	Grn/Blk
6	SSI Data+	Grn/Wht
7	DC Ground	Black
8	Fault (TTL)	Blu/Red
9	DC Ground	Black
10	+5 vDC (*External)	Red
11	Reserved	N/A
12	Reserved	N/A
13	DC Ground	Black
14	Channel A-	Violet
15	Channel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

## QUADRATURE OUTPUT

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

The quadrature (Channel A+ and Channel A-, Channel B+ and Channel B-) is the default configuration of the 2790 series of boards. A count is considered to occur whenever there is a transition in either the Channel A or Channel B output signals. The phase relationship of the two signals indicates the direction of motion as shown in the figure below.

### QUADRATURE OUTPUT FORMAT

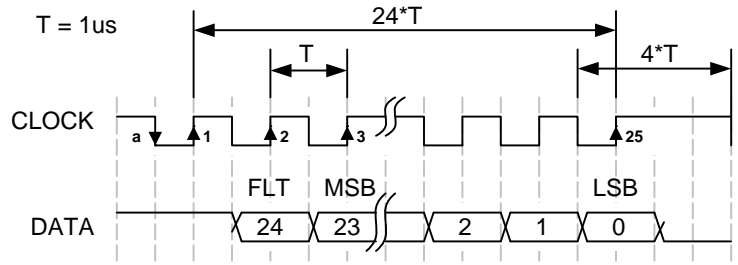


## SSI (Synchronous Serial Interface) OUTPUT

The 2790 board's SSI interface provides serial transmission of absolute position data in binary form from the resolver based on a timed clock pulse train from the host device. The SSI differential interface provides a high degree of noise immunity. For each sequential clock pulse from the host device, the 2790 board transmits one data bit from the shift registers of the tracking circuit.

Grounding Pin 18 of P3 will reset the SSI counter to the absolute position from the NULL reference position of the resolver.

### SSI TIMING DIAGRAM



- 1) The 2790 SSI Format is set up for 25 bit transfers.
- 2) The 2790 uses the least significant 13 bits for positional data (8192 counts per cycle), and the next 11 most significant bits are used for the turn counter. The most significant bit is the Fault status bit and will be set to 1 to indicate a fault has occurred.
- 3) Data is available less than 100ns after the down clock transition and well ahead of the up clock transition at 1mhz clock frequency. The data should be sampled at the up transition of the clock.
- 4) The 2790 is normally interrogated 1000 times/sec.
- 5) The Galil motion control board setup string would be:  
**SIX=1,25,12,-1<-10>1.**
- 6) The Galil command **MG SIX** will sample the Fault status bit.



# JUMPER SETTINGS

## FREQUENCY SELECTION

The 2790 series of converters provide selectable excitation frequencies via SWB1 jumpers B1 and B2. Most Resolver 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 Resolver 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

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.

## CHANNEL Z NORMAL/INVERTED SELECTION

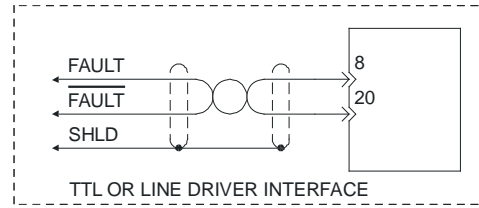
The 2790 converter board provides jumper selectable inversion of the Z Channel (Index) for systems requiring an active low signal. Jumper J2 pins 2-3 select the channel Z Normal mode and pins 1-2 select the Channel Z Inverted mode.

## LINE COUNT SELECTION

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.

## 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.

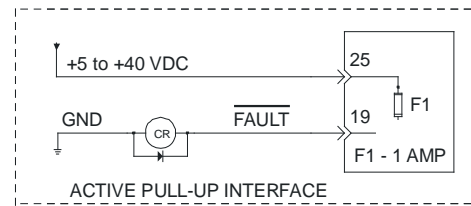


## TRI-STATE A-QUAD-B FAULT SIGNAL SET-UP (J4)

Install a jumper on J4 pins 2-3. The 2790 board will Tri-State the A-Quad-B signals during a Fault condition. The Differential Fault signals are also Tri-States 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

This interface is a fail-safe design so that in a loss of power condition the fault signal on Pin 19 of the P3 connector will be 0 vDC. Pin 19 will be the source voltage with no fault present and can drive up to 600mA. The source voltage for the Pull-up must be provided on Pin 25 of the P3 connector and can range from 5-40 vDC.



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 2790514.
- 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). 10 kHz is the DEFAULT setting with JB1 removed and JB2 installed.
- 5) Select the passive filter setting by J11 for the corresponding frequency setting. The DEFAULT setting is for a board set to 10 kHz and J11 is removed.
- 6) Select the counting style of Binary or Decimal by JB3 of SWB1 (see jumper table Fig. 1.0). Binary is the DEFAULT setting for SSI applications with the jumper installed.
- 7) Select the line count per revolution by setting JB4-5 of SWB1 (see jumper table Fig. 1.0). 1024 lines per revolution (8192 quadrature counts per cycle) is the DEFAULT setting with JB4 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

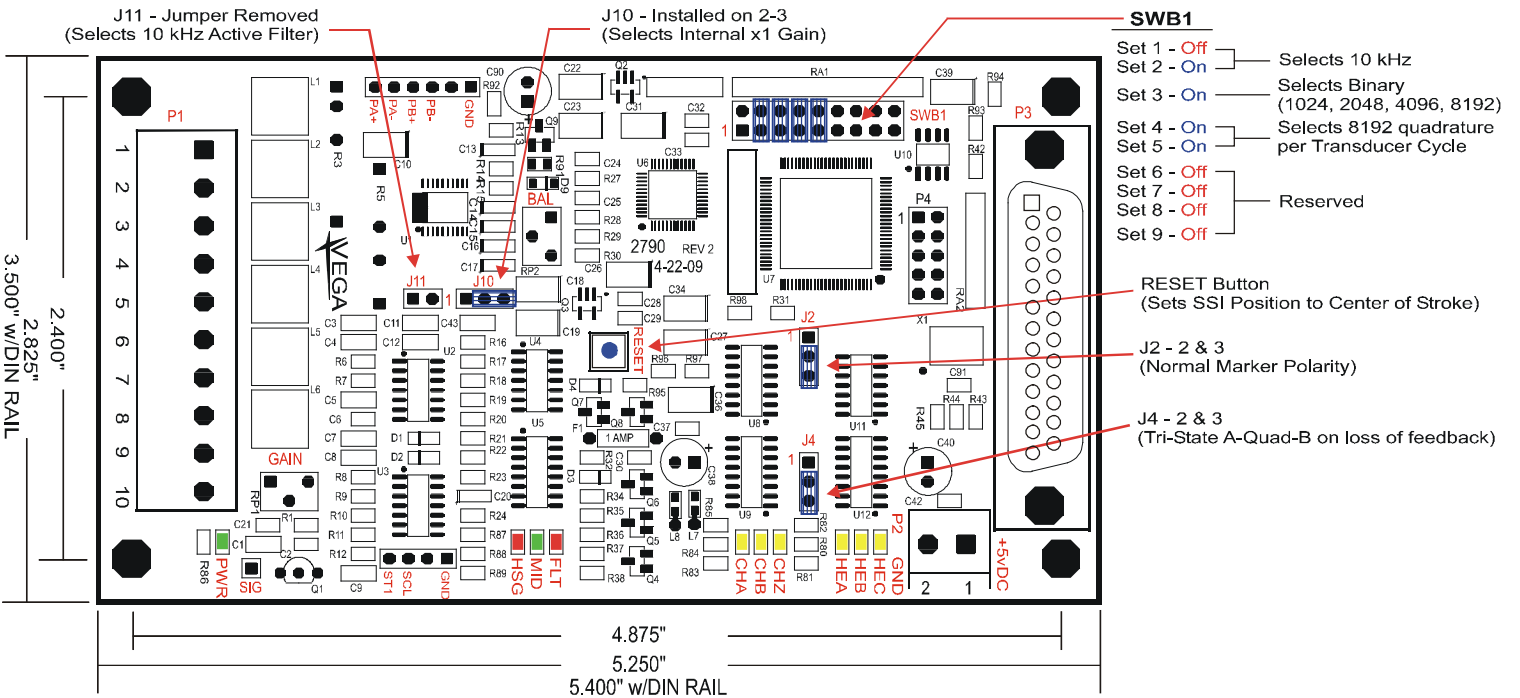
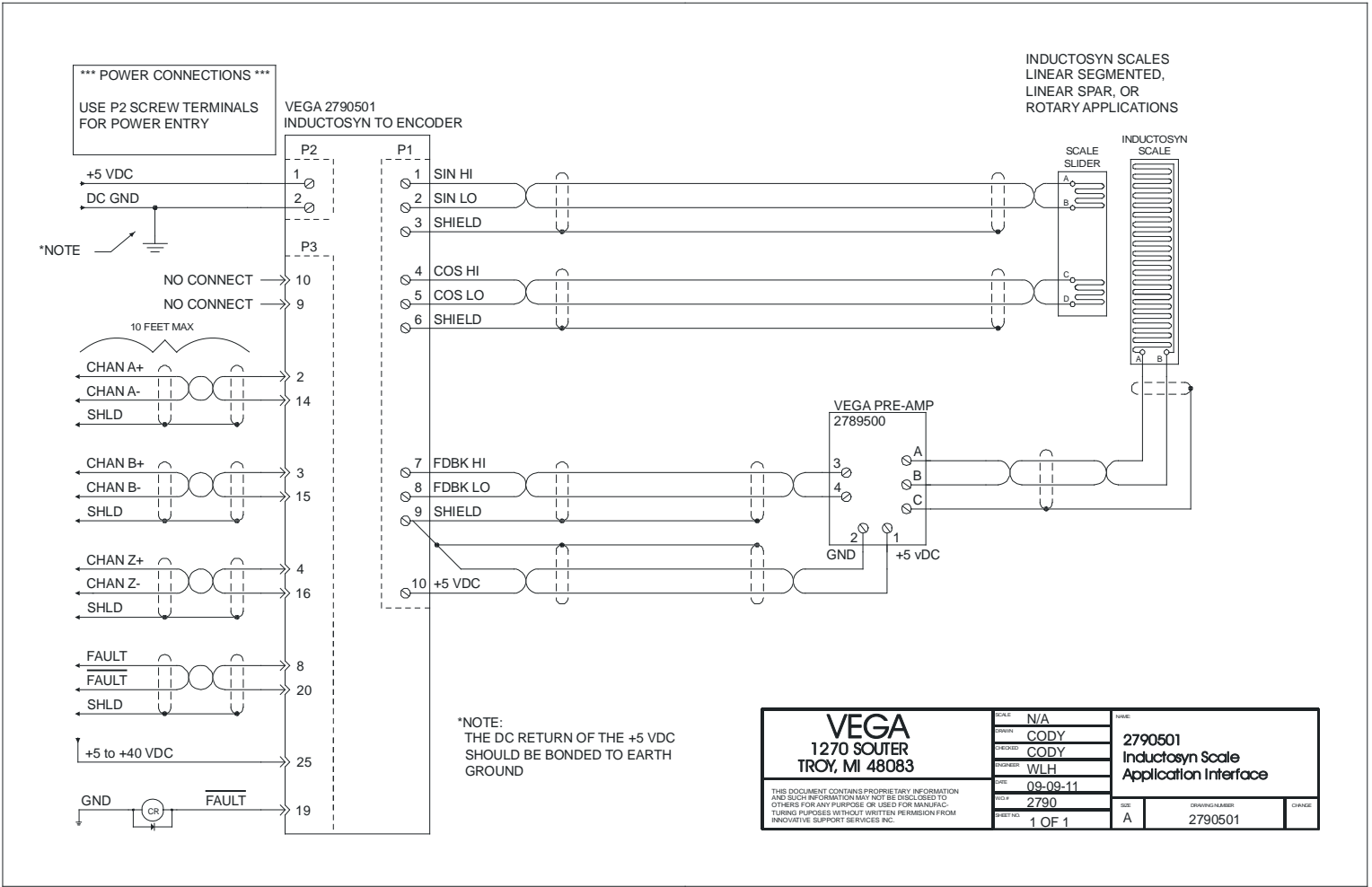
## TEST POINTS

**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

## TROUBLE SHOOTING

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-” note 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.
Cyclic Error	Check “ST1” test point for bounce	Repeat step 12 of the Inductosyn Set-Up Procedure
	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
Counting Polarity is Reversed	None	Swapping the Sine HI with the Sine LO wires will reverse the counting direction
No SSI Data is transferred	None	Swap the Clock+ and Clock- wires

# MECHANICAL AND APPLICATION DRAWINGS



**POWER REQUIREMENTS**

The 2790514 converter requires +5 vDC supply @ 2 amps for operation. The supplied power should have less than 50 mVolts of noise and drift.

**Recommended Power Supplies (If Required)**

Mean Well MDR-20-5 (+5 vDC @ 3 Amps)

Mean Well MDR-40-5 (+5 vDC @ 6 Amps)

**CABLE SPECIFICATIONS**

The 2790 series of converters provide stable and precise sine and cosine excitations. These signals and the return signal are analog and proper routing and shielding techniques should be observed. Shielded twisted pair cables should be used for all interface signals.

**Recommended Cable**

Shielded Twisted Pair with Drain Wire

Belden #8103 or equivalent

**Connector Kits and Mounting Options**

KIT #2790CK1

Includes:

(1) DB-25 Male Solder Cup Connector

(1) DB-25 Plastic Hood and Hardware

KIT #2790CK2

Includes:

(1) DB-25 Male Crimp Style Connector

(25) Gold Male Crimp Pins

(1) DB-25 Plastic Hood and Hardware

\* Use Molex Crimper HTR2445A or similar

KIT #2790DIN

Includes:

(1) DIN Rail Mount for 2790 boards

**REPAIR AND TECHNICAL SUPPORT**

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