VEGA

MODEL 2785501

INDUCTOSYN TO ENCODER CONVERTER FOR MACHINE TOOL, POSITIONING AND TRACKING APPLICATIONS

INDUCTOSYN TO DIGITAL INTERFACE

- **Hiedenhain, Farrand and G&L 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 2785501 converter you can have both the ruggedness of an Inductosyn scale and the digital simplicity of an encoder interface. The 2785501 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.

2785501 SPECIFICATIONS

Excitation:	2.5, 5, or 10 kHz
Max Load:	2.5 Amps
Inductosyn Input:	0.4 to 10.0 Vrms (0.6-28.0 vDC Peak to Peak)
Power Requirements:	5 vDC @ 2.5 Amps
Drive Capacity:	2.25 Amps
Mechanical:	2.825 x 4.75 x 1.00
Accuracy:	+/- 2 arc minutes

CONVERTER ACCURACY AND TRACKING RATE

The 2785 board was designed for high speed applications. The standard converter accuracy is +/- 2 arc minutes. When using 4000 counts per excitation phase, with one phase = .1000 inch and x4 quadrature, the resolution will be .000025 inch per count with 1200 IPM the maximum tracking rate.

*** 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**

*** ADVANCED FEATURES ***

- **Easy to Use and Easy to Set Up**
- **Simplify Retrofits**
- **Panel Mount or DIN Rail Option**
- **Non-Phase Locked Loop Design (No Lag)**
- **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, Open Collector, 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**

PRE-AMP INTERFACE

The 2785501 Inductosyn to Digital Converter can use the existing Pre-Amp or choose the VEGA 2782500 single +5 vDC supply Pre-Amp for an easy interface. The 2785501 converter card can handle return excitation signals from 0.6 to 28.0 vDC peak to peak.

PRICING AND DELIVERY

Model	Description	Price	Delivery
2785501	Inductosyn to Digital	$1,125.00	In Stock
2785DIN	DIN Rail Kit	$ 24.00	In Stock
2785CK1	Solder Connector Kit	$ 17.00	In Stock
2785CK2	Crimp Connector Kit	$ 27.00	In Stock
2789500	Inductosyn Pre-Amp	$ 225.00	In Stock

VISIT US ON
THE WEB AT
VEGACNC.COM

PEOPLE IN CONTROL OF MOTION

VEGA 2785501 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	DC Ground	Black
6	DC Ground	Black
7	DC Ground	Black
8	Fault (TTL)	Blu/Red
9	DC Ground	Black
10	+5 vDC (*External)	Red
11	Hall A	N/A
12	Hall B	N/A
13	DC Ground	Black
14	Channel A-	Violet
15	Channel B-	Orange
16	Channel Z-	Green
17	+5 vDC (*External)	Red
18	+5 vDC (*External)	Red
19	!Fault (Configurable)	Red/Blk
20	!Fault (TTL)	Blu/Blk
21	Reserved	N/A
22	Reserved	N/A
23	Reserved	N/A
24	Hall C	N/A
25	Active Pull-Up vDC	Blu/Wht

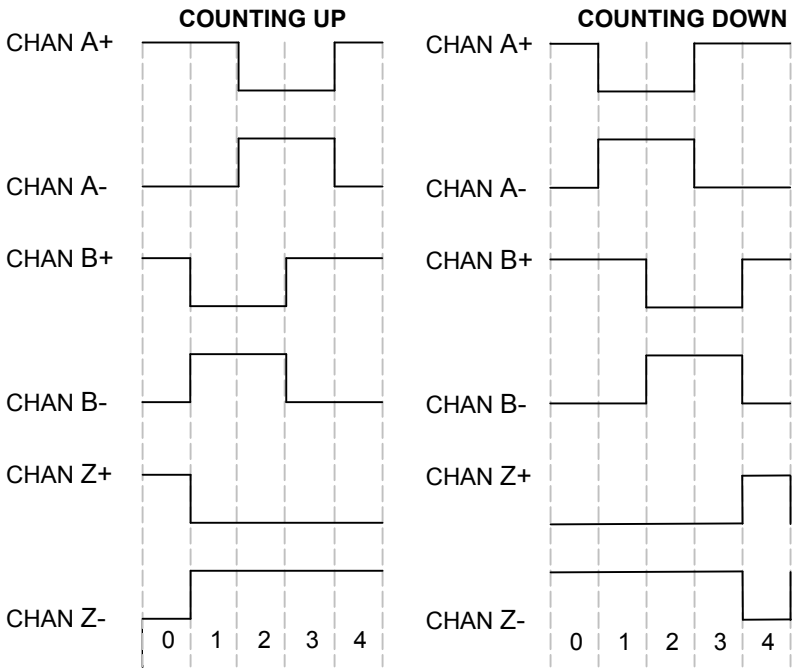
VEGA
1270 Souter Blvd.
Troy, MI 48083
(248) 585-3600

QUADRATURE OUTPUT

The VEGA 2785 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.

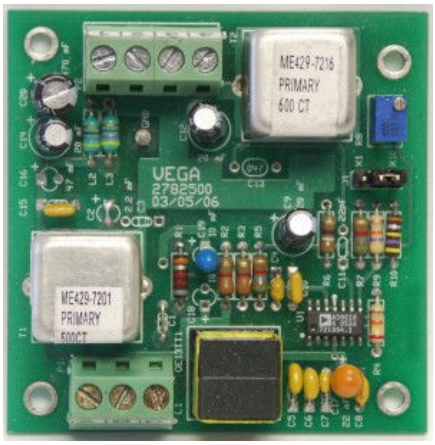
The quadrature (Channel A+ and Channel A-, Channel B+ and Channel B-) is the default configuration of the 2785 series of boards. A count is considered to occur whenever there is a transition in either the Channel A or Channel B output signals. The phase relationship of the two signals indicates the direction of motion as shown in the figure below.

QUADRATURE OUTPUT FORMAT



PRE-AMP OPTIONS

The 2785501 can accept input signals from Pre-Amps in the range of 0.6 – 28.0 vDC peak to peak. In retrofit conditions where the existing Pre-Amps can be adjusted to this level can be used with the 2785501. The compact 2789500 Pre-Amp requires a single +5 vDC supply. The onboard tuned filter provides excellent noise rejection required in industrial Inductosyn applications. The 2789500 Pre-Amp includes jumper selectable gain settings of x1 and x10 as well as a gain potentiometer for easy set-up.



JUMPER SETTINGS

FREQUENCY SELECTION

The 2785 series of converters provide selectable excitation frequencies via SWB1 jumpers B1 and B2. Most inductosyn applications are tuned to 2.5 kHZ.

The 2785 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 J11 jumper should be installed. For excitation frequencies above 2.5 kHZ J11 jumper should be removed.

INTERNAL GAIN SELECTION

The 2785 series of converters provide selectable gain selection via J10 jumper. Installing a jumper on J10 pins 1-2 selects a gain of x1. Installing a jumper on J10 pins 2-3 selects a gain of x0.25 and removing the jumper on J10 provides a gain of x4.

DECIMAL/BINARY SELECTION

The 2785 converter card provides both decimal and binary counting modes. Installing SWB1 jumper B3 selects binary counting mode to provide selection between 1024, 2048, 4096, and 8192 quadrature counts. Removing jumper B3 selects the decimal counting mode to provide selection between 1000, 2000, 4000, and 8000 quadrature counts.

CHANNEL Z NORMAL/INVERTED SELECTION

The 2785 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 2785 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 quadratue counts are 4 times greater than the physical line count of the encoder.

HIGH/LOW SPEED INTERPOLATION

The 2785 converter board provides jumper selectable interpolation rates for the A quad B signals. Installing SWB1 jumper B6 selects the high speed interpolation. For positioning systems with the maximum feedrate of less than 1200 IPM the LS INTERP should be selected. For high speed positioning systems with feedrates greater than 1200 IPM the HS INTERP should be selected.

FAULT MODE OUTPUT SELECTION

The 2785 converter board provides several methods of interface for fail safe fault detection. Pins 8 and 20 on the P3 connector provide a differential fault signal interface. Pin 19 on the P3 connector provides the open collector or active pull-up method of fault signal interface. The A quad B signals can also be tri-stated during a fault condition for interface to systems with quadrature fault detection.

DIFFERENTIAL FAULT SIGNAL SET-UP

Install J4 on pins 2-3. The jumper setting on J3 does not affect the differential signals and can be removed.

OPEN COLLECTOR FAULT SIGNAL SET-UP

Remove jumper J3. The jumper on J4 does not effect the open collector signal but does effect the A quad B signals. If the system interfacing to the 2785 board does not have quadrature fault detection the J4 jumper should be installed on pins 2-3. The open collector device is capable of sinking up to 40 vDC @ 600 mA

ACTIVE PULL-UP FAULT SIGNAL SET-UP

Install jumper J3. The active pull-up interface is a fail-safe design so that in a loss of power condition the 2785 will still drop the fault signal on Pin 19 of the P3 connector. The source voltage for the Pull-up must be provided on Pin 25 of the P3 connector and can range from 5-40 vDC. The jumper on J4 does not effect the active pull-up signal but does effect the A quad B signals. If the system interfacing to the 2785 board does not have quadrature fault detection the J4 jumper should be installed on pins 2-3.

TRI-STATE A-QUAD-B FAULT SIGNAL SET-UP

Install a jumper on J4 pins 1-2. The 2785 board will Tri-State the A-Quad-B signals as well as the Z Channel (Index/Marker Pulse) 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 with out the need for additional Fault detection circuitry.

FUNCTION	B1	B2	B3	B4	B5	B6	B7	B8	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
Low Speed Interp						0			
High Speed Interp						1			
Inductosyn							0	0	
Reserved							1	0	
Reserved							0	1	
Reserved							1	1	

- Figure 1.0 -

INDUCTOSYN SET-UP PROCEDURE

1) Install the 2785 board as described in the application drawing 2785501.

2) Select the fault signal conditioning method by setting the JB2 and JB3 jumpers as described in the JUMPER SETTINGS section and the jumper table (Fig. 1.0) based on the application requirements.

3) Select the Z Channel inverted option by setting J2 to short pins 2 and 3. The DEFAULT is non-inverting and having pins 1 and 2 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 JB4 of SWB1 (see jumper table Fig. 1.0). Decimal is the DEFAULT setting with the jumper 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 revolution) is the DEFAULT setting with JB4 installed and JB5 removed.

8) Select the interpolation rate of the A-Quad-B signals by setting JB6 of SWB1 (see jumper table Fig. 1.0). High Speed Interpolation is the DEFAULT setting with JB6 installed.

9) Jumpers JB7-8 are reserved on the 2785501 Inductosyn to Digital converters. The DEFAULT setting is having both jumpers removed.Apply power to the 2785 board and observe the signal return on the “SIG” test point.

10) Adjust the Pre-Amp gain to achieve 3.8 volts peak to peak at the “SIG” test point. The sine wave should be clean from noise and not clipped. For low level signal conditioning or frequencies above 2.5 kHZ remove jumper J10 to provide a x4 internal gain and proceed to Step 11.

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 “STG1” 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 2785 board can be adjusted. To adjust the phase balance of the 2785 board, observe the excitation return on the “STG1” 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 on the 2785 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

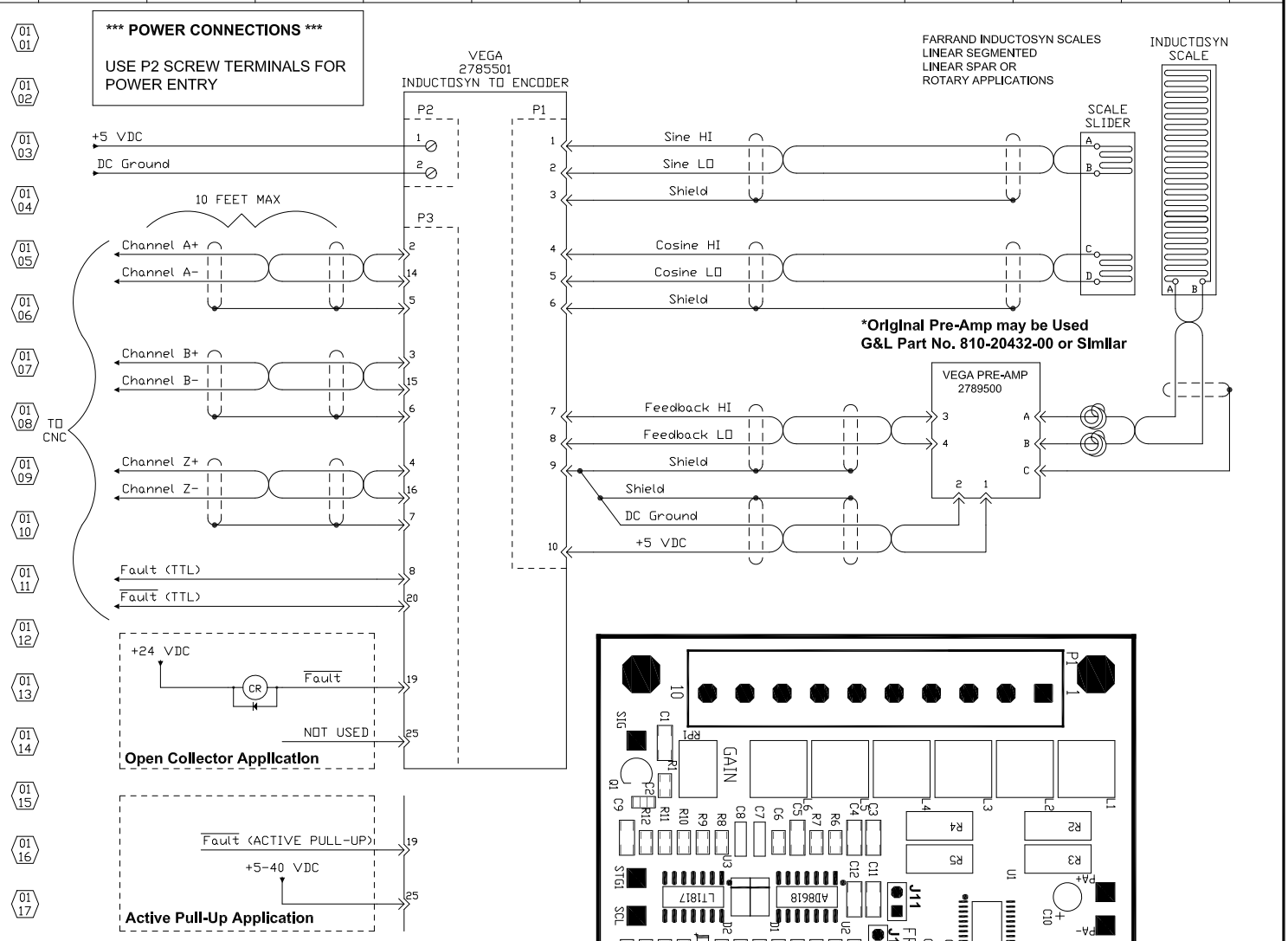
FLT = Loss of Signal Indicator
MID = Return Signal Proper
HSG = High Signal Indicator

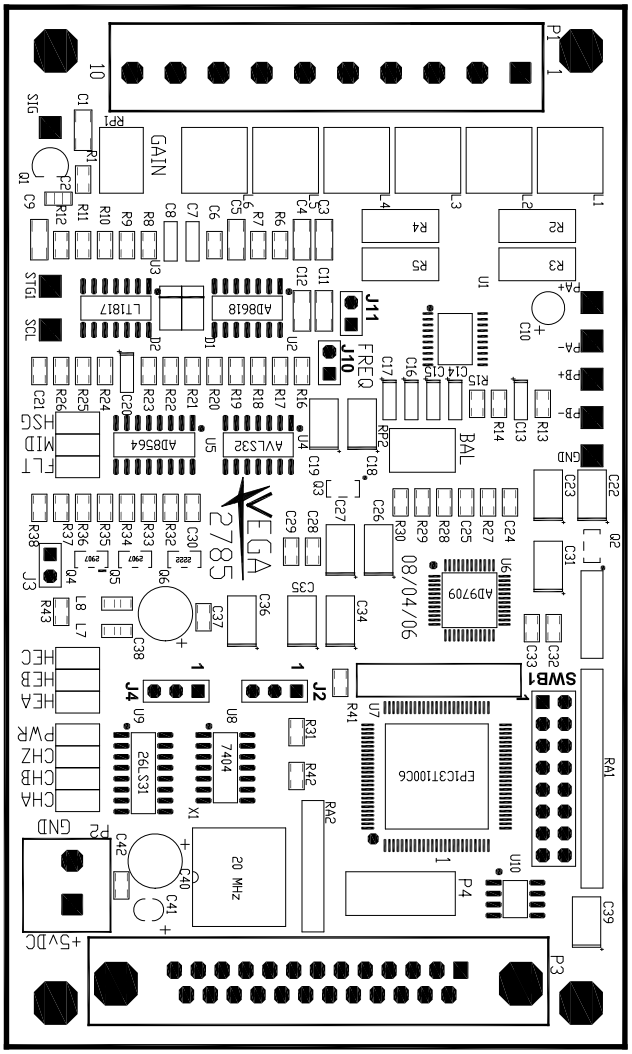
TEST POINTS

GND = Analog Ground
PA+ = Sine HI (2.6 vDC Peak to Peak)
PA- = Sine LO (2.6 vDC Peak to Peak)
PB+ = Cosine HI (2.6 vDC Peak to Peak)
PB- = Cosine LO (2.6 vDC Peak to Peak)

SIG = Signal Return (1.4-15.0 vDC Peak to Peak)
STG1 = 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.	Resistance values are less than 3 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 2.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PA-" and "PB-"test point for 2.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "SIG" test point for 3.8 volts peak to peak	Adjust Pre-Amp to achieve 3.8 volts peak to peak
	Unable to achieve 3.8 volts peak to peak with pre-amp turned all the way up.	Adjust air gap between slider and scale to 0.006 and 0.012 inches. Check scale resistance for open continuity
	Check "STG1" test point for 3.8 volts peak to peak	Repeat Step 10 and 11 of the Inductosyn Set-Up Proceedure
Fault LED (Low Signal) Intermittent	Check "PA+" and "PB+"test point for 2.6 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PA-" and "PB-"test point for 2.6 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.	Resistance values differ by more than 3 ohms of each other → Check slider windings – Replace slider or cables
	Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value.	Resistance values are less than 3 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 "STG1" 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.	Resistance values are less than 3 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.	Resistance values are differ by more than 3 ohms of each other → Check slider windings – Replace slider or cables
	Check "PA+" and "PA-"test point for 4.0 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
	Check "PB+" and "PB-"test point for 4.0 volts peak to peak sine excitation	Signal not present → Board Failure – Replace board
HSG LED (High Signal) Continuous	Check "STG1" test point for 3.8 volts peak to peak	Repeat Step 10 and 11 of the Inductosyn Set-Up Procedure
HSG LED (High Signal) Intermittent	Check "STG1" 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 "STG1" test point for bounce	Repeat step 12 of the Inductosyn Set-Up Procedure
Feedback Polarity is Reversed	None	Swapping the Sine HI and the Sine LO wires will reverse the feedback polarity





***** POWER REQUIRMENTS *****

+5 vDC @ 2.25 Amps per board
Reccomended Power Supplys
Condor HC5-6-0V-A+ (+5 vDC @ 6 Amps)
Condor HN5-9-0V-A+ (+5 vDC @ 9 Amps)
Condor HD5-12-0V-A+ (+5 vDC @ 12 Amps)
Condor HE5-18-0V-A+ (+5 vDC @ 18 Amps)

***** CABLE SPECIFICATIONS *****

CNC to 2785501
SINGLE TWISTED PAIR
BELDEN # 8761 OR EQUIVELANT
(4) TWISTED PAIR CABLE
BELDEN # 9728 OR EQUIVELANT

2785501 to Scale
SINGLE TWISTED PAIR
BELDEN # 8760 OR EQUIVELANT

***** ACCESSORIES *****

KIT # 2785CK1
(1) DB-25 MALE SOLDER CUP
(1) DB-25 HOOD AND HARDWARE
(4) #4-40 Male to Female Standoffs

KIT # 2785CK2
(1) DB-25 MALE CRIMP STYLE
(1) DB-25 HOOD AND HARDWARE
(25) MALE CRIMP-ON PINS
(4) #4-40 Male to Female Standoffs

KIT # 2785DIN
(1) DIN RAIL MOUNT BOARD CARRIER

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS 2 PLACES ±.010 3 PLACES ±.005 ANGLE ±2° BREAK ALL SHARP EDGES .005 REMOVE ALL BURS

FINISH

MATERIAL

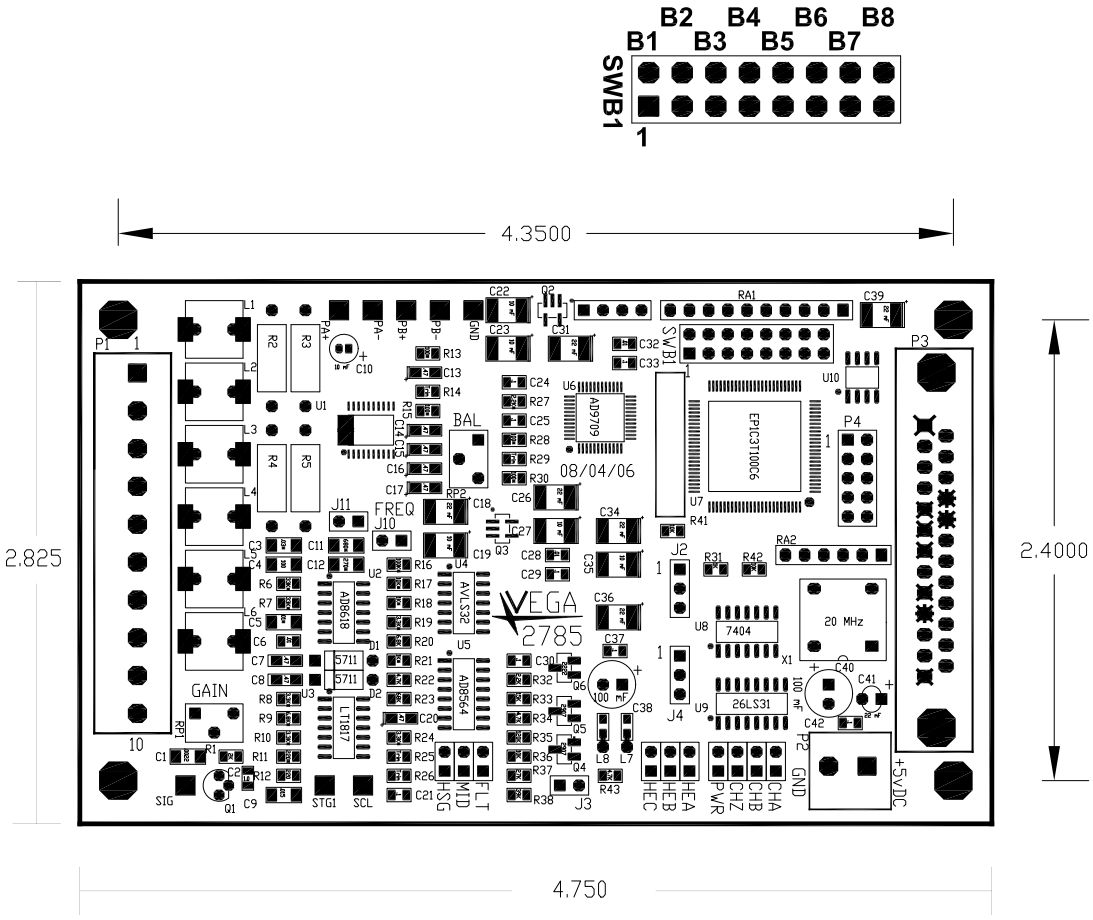
VEGA CNC
1270 SOUTER BLVD.
TROY, MI 48083

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION MAY NOT BE DISCLOSED TO OTHERS FOR ANY PURPOSE OR USED FOR MANUFACTURING PUPOSES WITHOUT WRITTEN PERMISION FROM INNOVATIVE SUPPORT SERVICES INC.

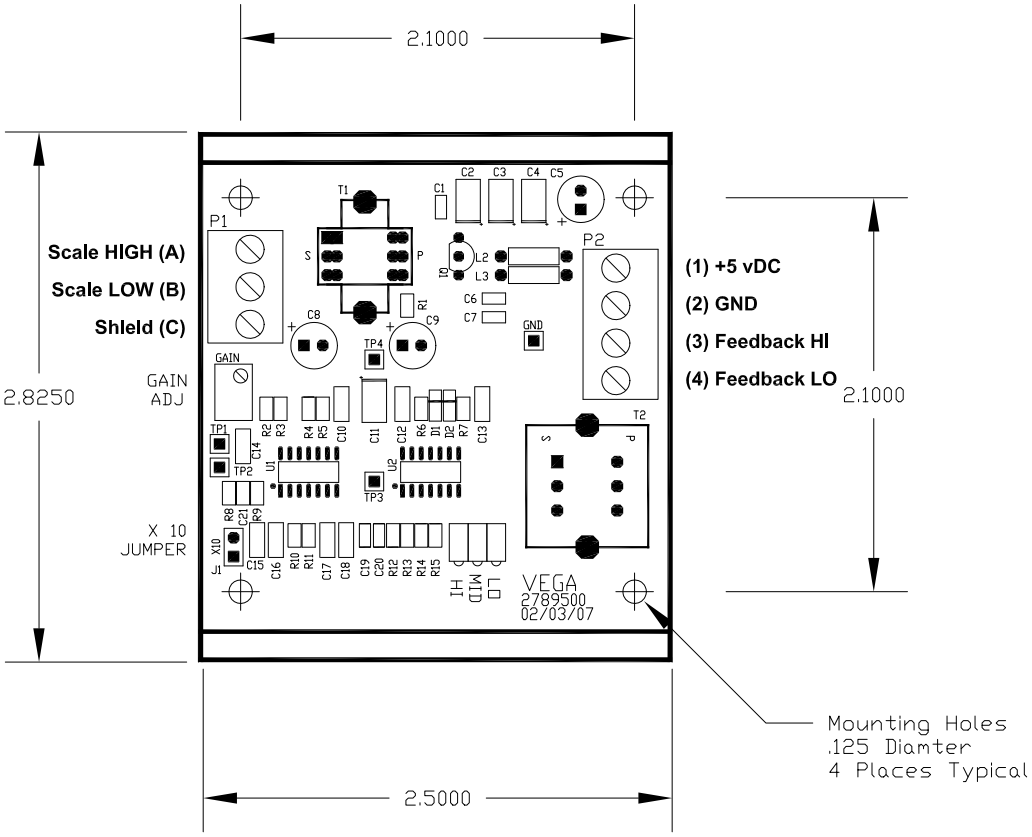
SCALE	N/A
DRAWN	WLH
CHECKED	CODY
ENGINEER	WLH
DATE	09-21-06
W.O.#	2785
SHEET NO.	1 OF 1

NAME: 2785501 Inductosyn Scale Application with 2789500 Pre-Amp

SIZE	DRAWING NUMBER	CHANGE
A	2785501	00



UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS 2 PLACES ±.010 3 PLACES ±.005 ANGLE ±2° BREAK ALL SHARP EDGES .005 REMOVE ALL BURS	VEGA CNC 1270 SOUTER BLVD. TROY, MI 48083	SCALE N/A DRAWN WLH CHECKED CODY ENGINEER WLH DATE 08-02-06 W.O.# 2785 SHEET NO. 1 OF 1	NAME: 2785 Resolver/Inductosyn to Digital Converter
FINISH			
MATERIAL	THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION MAY NOT BE DISCLOSED TO OTHERS FOR ANY PURPOSE OR USED FOR MANUFACTURING PUPOSES WITHOUT WRITTEN PERMISION FROM INNOVATIVE SUPPORT SERVICES INC.		SIZE A DRAWING NUMBER 2785200 CHANGE



***** J1 GAIN MULTIPLIER *****
J1 Removed = x10 Gain (Default)
J1 Installed = x1 Gain

***** Gain Adjust *****
Adjust Gain Pot to achieve 2.5 volts peak to peak

1) Turn Gain Pot fully CCW until just the LO LED comes ON.
2) Adjust the Gain Pot CW until the the LO LED goes out and the MID LED is ON.

Turn the Gain POT CCW if the HI LED comes on until only the MID LED is ON.

***** Electrical Requirments *****
+5 vDC @ 50 mA

***** Accessories *****
2789-DIN DIN Rail Mounting Option

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS 2 PLACES ±.010 3 PLACES ±.005 ANGLE ±2° BREAK ALL SHARP EDGES .005 REMOVE ALL BURS

FINISH

MATERIAL

VEGA CNC
1270 SOUTER BLVD.
TROY, MI 48083

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION MAY NOT BE DISCLOSED TO OTHERS FOR ANY PURPOSE OR USED FOR MANUFACTURING PUPOSES WITHOUT WRITTEN PERMISION FROM INNOVATIVE SUPPORT SERVICES INC.

SCALE	N/A
DRAWN	WLH
CHECKED	CODY
ENGINEER	WLH
DATE	02-05-08
W.O.#	2789
SHEET NO.	1 OF 1

NAME:
2789500
Inductosyn Pre-Amp

SIZE	DRAWING NUMBER	CHANGE
A	2789200	