INDUCTOSYN™ TO DIGITAL CONVERTER

MODEL 2796501

RESOLVER TO SSI INTERFACE

- **Hiedenhain, Farrand, G&L and Mitsubishi Linear and Rotary Inductosyn Scales**
- **Makes Inductosyn as easy to use as an encoder**
- **Jumper Selectable Excitation Frequency including 2.5, 5.0, and 10 kHz**
- **Removable Screw Terminals**

With the VEGA 2796501 converter you can have both the ruggedness of a Inductosyn and the digital simplicity of an SSI interface. The 2796501 can be used with almost any Inductosyn scale.

CONVERTER ACCURACY AND TRACKING RATE

The tracking rate is a function of the excitation frequency. With a 2.5 kHz excitation the tracking rate would be 9,600 transducer cycles per minute. With a 10.0 kHz excitation the tracking rate would be 38,400 transducer cycles per minute.

2796501 SPECIFICATIONS

Excitation:	2.5, 5, or 10 kHz @ 3.6 vpp
Resolver Input:	0.8 to 18 vpp
Power Requirements:	5 vDC @ 2 Amps (2796513.05)
	24 vDC @ 500 mA (2796513.24)
Drive Capacity:	1.5 Amps Peak
Mechanical:	4.10 x 0.75 x 5.00
Accuracy:	+/- 3 arc minutes typical.

*** APPLICATIONS ***

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

*** ADVANCED FEATURES ***

- **Incremental Encoder Output (*Absolute within 1 Transducer cycle)**
- **High Resolution and Highly Accurate**
- **Tuned Filter for Noise Immunity**
- **TTL/Line Driver Outputs**
- **Single vDC Supply Operation**
- **Loss of Phase Detection**
- **Fault Signal Output (Tri-State Quadrature, and SSR Output)**
- **Status LED's for Power, Signal HI, Signal MID, and Fault**
- **Compact Design Only 17.5 mm wide**

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

PART NUMBER AND DESCRIPTION

Model	Description
2796501.05	+5 vDC Inductosyn to Digital Converter
2796501.24	+24 vDC Inductosyn to Digital Converter
2789500	2.5 kHz Pre-Amp
2789503	10 kHz Pre-Amp
2789DIN	DIN Rail Kit for Pre-Amp

VEGA
12974 Jewell Circle NE
Blaine, MN 55449
248.585.3600

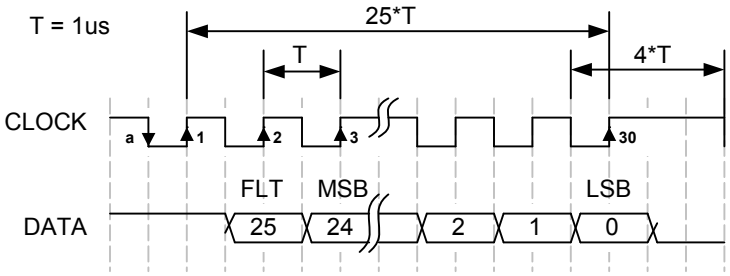
2796513_Rev. 3W

SSI (Synchronous Serial Interface) OUTPUT

The 2796513 board's SSI interface provides serial transmission of absolute position data in binary form from the inductosyn 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 2796 board transmits one data bit from the shift registers of the tracking circuit.

Applying 5-25 vDC to P3-9 will preset the SSI turn counter to 1024 and the low order data will reflect the current transducer position of the inductosyn.

SSI TIMING DIAGRAM



1) The 2796513 SSI Format is set up for 25 bit transfers.
2) The 2796513 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. The contacts of the solid state relay between P1-8 and P1-9 will also be opened.
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 2796513 is normally interrogated 1000 times/sec.
5) The Galil motion control board setup string would be: **SIX=1,25,13,-1<-10>1**.
6) The Galil command **MG_SIX** will sample the Fault status bit.

P1 POWER CONNECTOR

PIN#	FUNCTION	COLOR
1	+5 vDC IN (2796513-05 Only)	RED
2	DC Ground	BLK
3	Shield In	SHLD
4	No Connection	N/A
5	No Connection	N/A
6	No Connection	N/A
7	No Connection	N/A
8	!Fault Output	ORG
9	I/O vDC IN	BLU/WHT
10	+24 vDC IN (2796513-24 Only)	BLU

P3 SSI CONNECTOR

PIN#	FUNCTION	COLOR
1	No Connection	N/A
2	No Connection	N/A
3	Shield Out	SHLD
4	DC Ground OUT	N/A
5	SSI Clock-	RED/WHT
6	SSI Clock+	RED
7	SSI Data-	BLUE/WHT
8	SSI Data+	BLUE
9	SSI Preset	YELLOW

P4 RESOLVER CONNECTOR

PIN#	FUNCTION	COLOR
1	Feedback LO	YEL/WHT
2	Feedback HI	RED/WHT
3	Shield Out	SHLD
4	Sine LO	BLACK
5	Sine HI	RED
6	Shield Out	SHLD
7	Cosine HI	YELLOW
8	Cosine LO	BLUE
9	Shield Out	SHLD
10	DC Ground OUT	N/A
11	+5 vDC OUT	N/A

JUMPER SETTINGS (JB1)

FREQUENCY SELECTION (JB1-1 & JB1-2)

The 2796 converters provide selectable excitation frequencies of 2.5, 5.0 and 10.0 kHz via JB1-1 and JB1-2 jumpers.

RESERVED (JB1-6 thru JB1-9)

On the 2796513 converter board Jumpers JB1-6 thru JB1-9 are reserved and should have all jumpers removed

ACTIVE FILTER SELECTION (JB1-10)

The 2796 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 JB1-10 jumper should be installed. For excitation frequencies above 2.5 kHZ JB1-10 jumper should be removed.

INTERNAL GAIN SELECTION (JB1-11 & 12)

The 2796 series of converters provide selectable gain selection via JB1 jumpers 11 and 12. Installing a jumper on JB1-11 selects a gain of x0.25 Installing a jumper on JB1-12 selects a gain of x1.0 and removing the jumpers JB1-11 and JB1-12 selects a gain of x4.0

See Figure 1.0 for JB1 Jumper Chart Below.

FAULT SIGNAL INTERFACE

The return signal level is monitored for high signal level (HI LED), and low signal level (LO LED). During a low level detection or loss of power to the board the fault relay contacts will open (P1-8 and P1-9). The relay can drive 600 mAmps. The source voltage must be provided on P1-9 and can range from 5-25 vDC.

During fault detection the SSI fault bit will be set to a high level.

TEST POINTS

ACOM = 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)

FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12	QUADRATURE COUNTS
2.5 kHz Excitation	0	0											
5 kHz Excitation	1	0											
10 kHz Excitation	0	1											
Reserved	1	1											
Decimal Count			0										
Binary Count			1										
250/256 Lines				0	0								1000/1024 Counts
500/512 Lines				1	0								2000/2048 Counts
1000/1024 Lines				0	1								4000/4096 Counts
2000/2048 Lines				1	1								8000/8192 Counts
Reserved						0	0	0	0				
10.0 kHz LPF										0			
2.5-5.0 kHz LPF										1			
x 4.0 Gain Select											0	0	
x 0.25 Gain Select											1	0	
x 1.0 Gain Select											0	1	
Reserved											1	1	

Figure 1.0

Indicates Default

THEROY OF OPERATION

The return signal level is monitored for high signal level (HSG LED), and low signal level (FLT LED). During a low level detection or loss of power to the board the fault relay contacts will open (connector P2 terminal 8 and 9). The A-Quad-B outputs will be tri-stated during a fault detection.

The Z channel (Marker Pulse) will occur once per transducer cycle and will occur around 90 degrees from the sine excitation.

POWER UP SEQUENCE

1) The 2796 allows 50 mSec for the power to stabilize
2) The 2796 then starts the Sine and Cosine excitations with the sine being in sync with the command square wave
3) The 2796513 will then restores the turn count from the powered down position and ready the SSI position register for reading.

LED STATUS INDICATORS

PWR = Power Status Indicator

FLT = 1 Flash = Low Signal Continuous
2 Flash = High Signal Continuous
3 Flash 2796512 Only
PUPV Fault (Power Up Position Valid)
Power up position detected +/- 15 Counts of Error
4 Flash = Low Signal Intermittent
5 Flash = High Signal Intermittent

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

INDUCTOSYN SET-UP PROCEDURE

1) With the power turned off. Install the 2796 board as described in the application drawing and complete the following steps.
2) Select the excitation frequency by setting JB1-1 and JB-2 jumpers as described in the JUMPER SETTINGS (see jumper table Fig. 1.0). 10.0 kHZ is the DEFAULT setting with Jumper JB1-1 removed and JB1-2 installed.
3) Jumpers JB1-3 through JB1-9 are reserved on the 2796514 board and should be removed
4) Select the passive filter setting by JB1-10 for the corresponding frequency setting. The DEFAULT setting is set to 10.0 kHZ and JB1-10 is removed.
5) Select the Internal Gain Selection by setting the JB1-11 and JB1-12 jumpers as described in the JUMPER SETTINGS section. The DEFAULT setting is for a board set to x1 Gain JB1-12 installed (See step 8 for detailed set-up instructions).
6) 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 OR 2789503 turn the pre-amps Gain pot so that the MID led is illuminated and the HI and LO led's are extinguished.
7) Starting with the JB1-11 jumper removed and the JB1-12 jumper installed (x1.0 Gain Selection). Turn the ADJ Potentiometer fully counter-clockwise (12 turn Pot). Observing the LO, MID and HI LEDs apply power to the board.

   NOTE: If the MID or HE LEDs are turned on, remove JB1-12 and install JB1-11 (x0.25 Gain Selection).
8) Turn the ADJ potentiometer clock-wise until the (Green) MID LED turns on and the LO LED turns off. Continue turning the ADJ clock-wise until the HI LED turns on. Now turn the ADJ potentiometer counter-clockwise to position the ADJ in the middle of the MID LED band.

   NOTE: If you are unable to get the MID or HI LED to turn on, remove both JB1-11 and JB1-12 jumpers (x4.0 Gain Selection).
9) Turn the ADJ potentiometer clock-wise until the (Green) MID LED turns on and the LO LED turns off. Continue turning the ADJ clock-wise until the HI LED turns on. Now turn the ADJ potentiometer counter-clockwise to position the ADJ in the middle of the MID LED band.

   NOTE: If you are unable to get the MID or HI LED to turn on, remove both JB1-11 and JB1-12 jumpers (x4.0 Gain Selection).

   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.
10) The amplitude balance of the Sine and Cosine excitations, have been factory set and should not require adjustment. To adjust the phase balance of the 2796 board, observe the excitation return on the "ST1" test point. Adjust the oscilloscope to 50 mvDC per division and offset the signal so that just the peak of the signal is visible. Rotate the resolver at 500-600 rpm. If the phase is unbalanced the peak of the sine wave will bounce and become blurred. Adjust the balance pot on the 2796 to achieve 20 mvDC or less bounce.

ELECTRICAL

POWER REQUIREMENTS

The 2796501-05 converter requires +5 vDC supply @ 2 Amp2 for operation. The 2796501-24 converter requires +24 vDC supply @ 500 mAmp for operation. The supplied power should have less than 50 mVolts of noise and drift.

Recommended Power Supplys (If Required)

TDK DSP30-5 (+5 vDC @ 3 Amps)
TDK DSP60-24 (+24 vDC @ 2.5 Amps)

CABLE SPECIFICATIONS

The 2796 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 (3) Twisted Pair with Drain Wire
Belden #8103 or equivalent

REPAIR and TECHNICAL SUPPORT

VEGA
12974 Jewell Circle NE
Blaine, MN 55449
248.585.3600

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

DISASEMBLY

Firmly press the center of the latch hook down and slide towards the center of the enclosure.

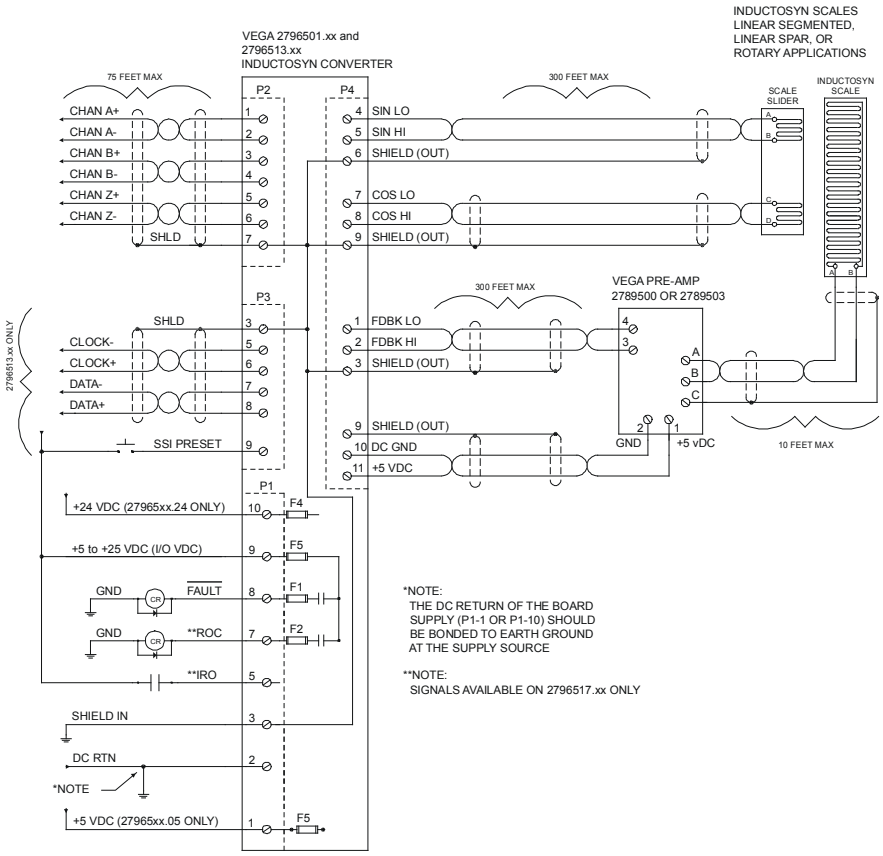
NOTE: Use caution not to drop the spring under the latch hook.

Using a small flat head screwdriver release all four of the enclosure cover hooks.

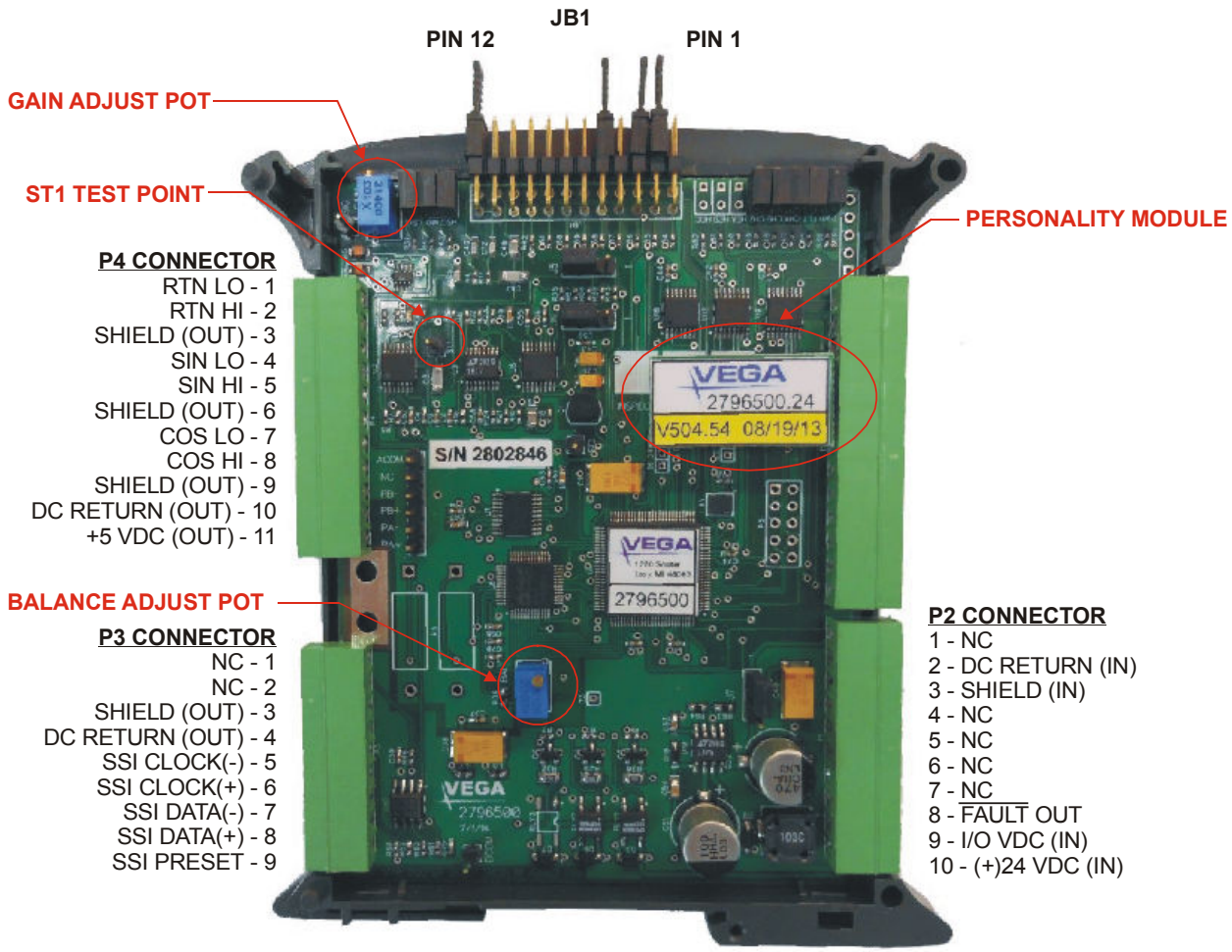
NOTE: Use caution to avoid breaking the cover hooks.

SYMPTOM	CHECKS	SOLUTION
No Power LED	Check +5 vDC on 2796513-05 or +24 vDC on 2796513-24	vDC Present → Check Fuses F4 and F5
LO LED (Low Signal) Continuous	Remove power and disconnect P4 from the board. Ohm the wires on P4-1 and P4-2 and note value.	Resistance values are less than 3 ohms – Check for shorts between P4-1 and P4-2 as well as ground.
	Remove power and disconnect P4 from the board. Ohm the wires on P4-4 and P4-5 and note value. Ohm the wires on P4-7 and P4-8 note value.	Resistance values are less than 3 ohms – Check for shorts between P4-4 and P4-5 as well as ground. Check for shorts between P4-7 and P4-8 as well as ground.
	Apply power and measure between P4-4 and P4-5 for 2.9 vRMS	Signal not present → Board Failure – Replace board
	Apply power and measure between P4-7 and P4-8 for 2.9 vRMS	Signal not present → Board Failure – Replace board
	Check “ST1” test point for 3.6 volts peak to peak	Repeat Step 6-9 of the Inductosyn Set-Up Procedure
LO LED (Low Signal) Intermittent	Remove power and disconnect P4 from the board. Ohm the wires on P4-4 and P4-5 and note value. Ohm the wires on P4-7 and P4-8 note value.	Resistance values differ by more than 3 ohms of each other → Check resolver windings – Replace cables and/or resolver
	Check “ST1” test point for bounce	Repeat step 6-9 of the Inductosyn Set-Up Procedure
Cyclic Error	Check “ST1” test point for bounce	Repeat step 6-9 of the Inductosyn Set-Up Procedure
	Remove power and disconnect P4 from the board. Ohm the wires on P4-4 and P4-5 and note value. Ohm the wires on P4-7 and P4-8 note value.	Resistance values are less than 3 ohms – Check for shorts between P4-4 and P4-5 as well as ground. Check for shorts between P4-7 and P4-8 as well as ground.
	Remove power and disconnect P4 from the board. Ohm the wires on P4-4 and P4-5 and note value. Ohm the wires on P4-7 and P4-8 note value.	Resistance values differ by more than 3 ohms of each other → Check resolver windings – Replace cables and/or resolver
HSG LED (High Signal) Continuous	Check “ST1” test point for 3.6 volts peak to peak	Repeat Step 6-9 of the Inductosyn Set-Up Procedure
HSG LED (High Signal) Intermittent	Check “ST1” test point for 3.6 volts peak to peak	Follow procedures described in the LO 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 11 of the Resolver Set-Up Procedure
Feedback Polarity is Reversed	None	Swapping the P4-4 (Sine HI) with the P4-5 (Sine LO) wires will reverse the feedback polarity

APPLICATION INTERFACE



MECHANICAL



P4 CONNECTOR
RTN LO - 1
RTN HI - 2
SHIELD (OUT) - 3
SIN LO - 4
SIN HI - 5
SHIELD (OUT) - 6
COS LO - 7
COS HI - 8
SHIELD (OUT) - 9
DC RETURN (OUT) - 10
+5 VDC (OUT) - 11

P3 CONNECTOR
NC - 1
NC - 2
SHIELD (OUT) - 3
DC RETURN (OUT) - 4
SSI CLOCK(-) - 5
SSI CLOCK(+) - 6
SSI DATA(-) - 7
SSI DATA(+) - 8
SSI PRESET - 9

P2 CONNECTOR
1 - NC
2 - DC RETURN (IN)
3 - SHIELD (IN)
4 - NC
5 - NC
6 - NC
7 - NC
8 - $\overline{\text{FAULT}}$ OUT
9 - I/O VDC (IN)
10 - (+)24 VDC (IN)