# VEGA MODEL 2785500

# RESOLVER TO ENCODER CONVERTER FOR MACHINE TOOL, POSITIONING, AND TRANSFER APPLICATIONS


## RESOLVER TO DIGITAL INTERFACE

- **Works with R11, R25, or most any Synchro/Resolver**
- **Incremental encoder output signals**
- **Makes resolvers as easy to use as an encoder**
- **Jumper Selectable 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 2785502 converter you can have both the ruggedness of a resolver and the digital simplicity of an encoder interface. The 2785502 can be used with almost any resolver. The INDEX/MARKER pulse (Channel Z) will occur once per transducer cycle at the zero degree position.

## 2785500 SPECIFICATIONS

| | |
|---|---|
| Excitation: | 2.5, 5, or 10 kHz |
| Max Load: | 250 mA |
| Resolver Input: | 0.8 to 10 Vrms |
| Power Requirements: | 5 vDC @ 300 mA |
| Drive Capacity: | 200 mA |
| 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**
- **Servo Motor Control**
- **Spindle Motor Control**
- **PLC Positioning Control**
- **Index/Rotary Tables**
- **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**
- **Fast 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 Signal 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**

## PRICING AND DELIVERY

| Model | Description | Price | Delivery |
|---|---|---|---|
| 2785500 | Resolver to Digital | $475.00 | 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 |

PEOPLE IN CONTROL OF MOTION

# VEGA 2785500 RESOLVER TO ENCODER SPECIFICATIONS AND CONNECTIONS

## P1 RESOLVER 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

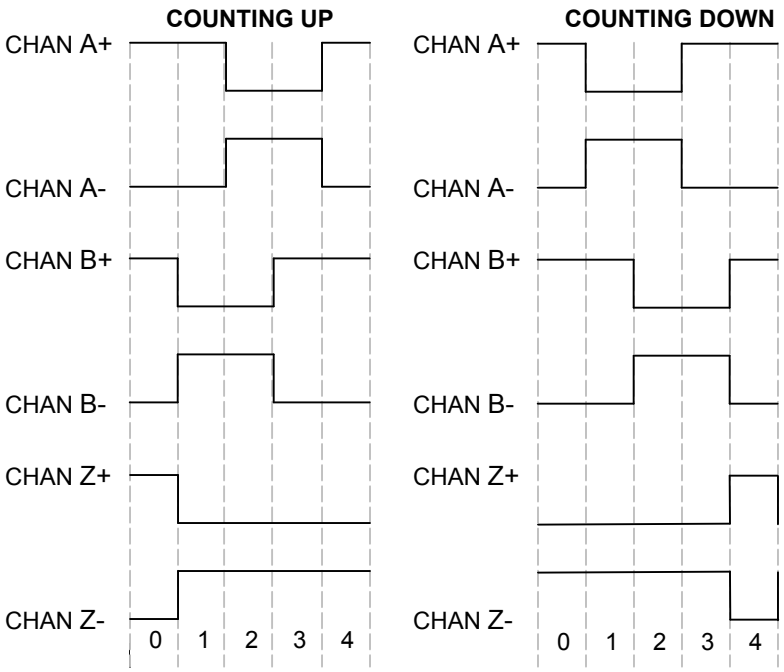
| PIN# | FUNCTION | COLOR |
|---|---|---|
| 1 | DC Ground | Black |
| 2 | Channel A+ | Grey |
| 3 | Channel B+ | Yellow |
| 4 | Channel Z+ | Blue |
| 5 | DC Ground | Black |
| 6 | DC Ground | Black |
| 7 | DC Ground | Black |
| 8 | Fault (TTL) | Blu/Red |
| 9 | DC Ground | Black |
| 10 | +5 vDC (*External) | Red |
| 11 | 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 | +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 | Reserved | N/A |
| 25 | Active Pull-Up vDC | Blu/Wht |

## 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

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# JUMPER SETTINGS

## FREQUENCY SELECTION

The 2785 series of converters provide selectable excitation frequencies via SWB1 jumpers B1 and B2. Most Resolver 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 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 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 counts in x4 quadrature mode. Removing jumper B3 selects the decimal counting mode to provide selection between 1000, 2000, 4000, and 8000 counts in x4 quadrature mode.

## 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 | | | |
| **Resolver** | | | | | | | 0 | 0 | |
| **Reserved** | | | | | | | 1 | 0 | |
| **Reserved** | | | | | | | 0 | 1 | |
| **Reserved** | | | | | | | 1 | 1 | |

- Figure 1.0 -

## RESOLVER SET-UP PROCEDURE

1) Install the 2785 board as described in the application drawing 2785500.

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 for resolver applications and should be removed (see jumper table Fig. 1.0).

10) 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 11.

11) 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 Indicator
**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 (1.4-18.0 vDC Peak to Peak)
**STG1** = Stage 1 Signal (3.8 vDC Peak to Peak)
**SCL** = Tracking Clock

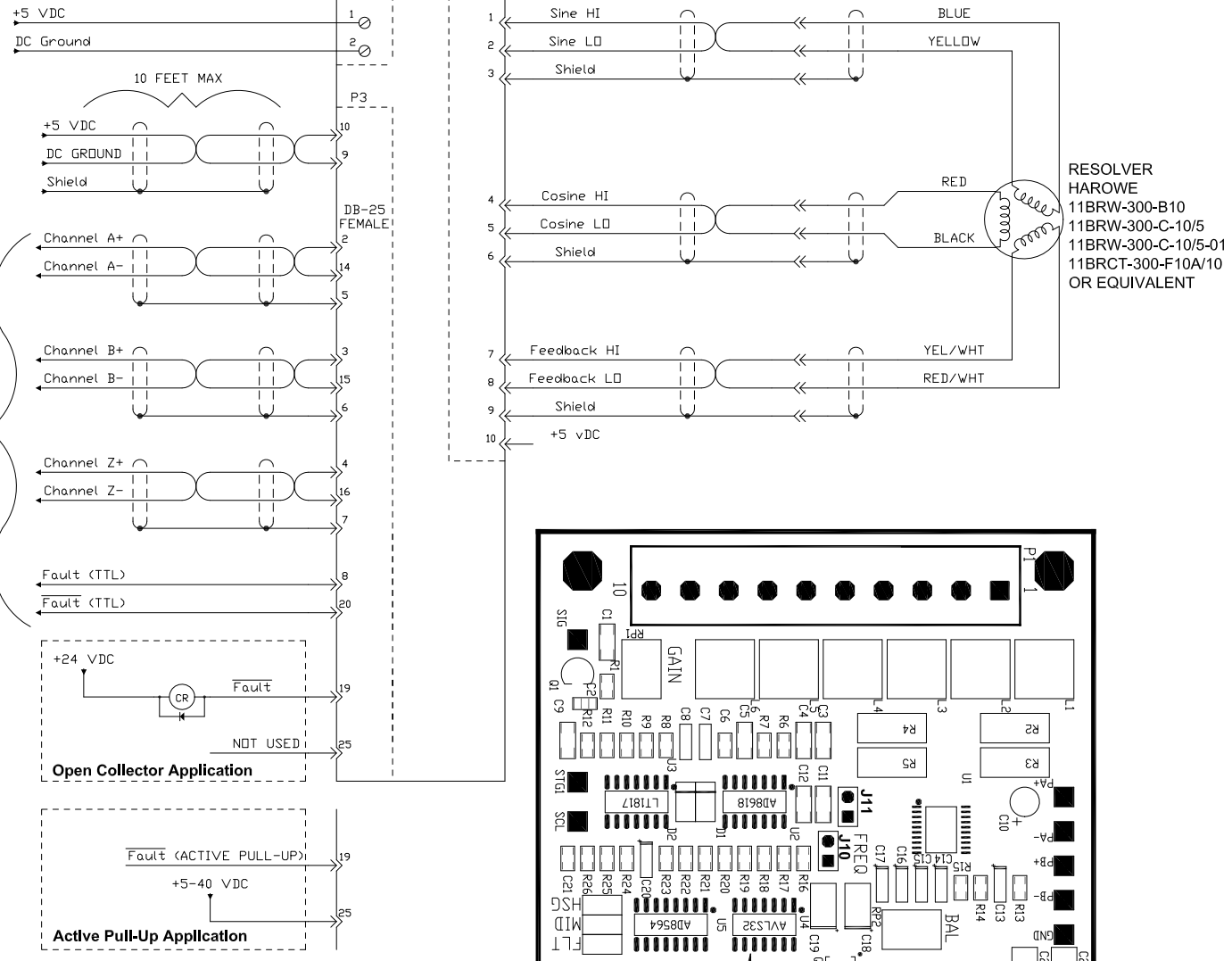
| SYMPTOM | CHECKS | SOLUTION |
|---|---|---|
| No Power LED | Check +5 vDC | +5 vDC Present → Board Failure – Replace board |
| Fault LED (Low Signal) Continuous | Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value. | Resistance values are less than 30 ohms – 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 "STG1" test point for 3.8 volts peak to peak | Repeat Step 10 of the Resolver Set-Up Procedure |
| 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 resolver windings – Replace resolver or cables |
| | Remove power and ohm between "PA+" and "PA-" note value. Ohm between "PB+" and "PB-" note value. | Resistance values are less than 30 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 11 of the Resolver 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 30 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 resolver windings – Replace resolver 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 of the Resolver 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 11 of the Resolver Set-Up Procedure |
| Feedback Polarity is Reversed | None | Swapping the Sine HI with the Sine LO wires will reverse the feedback polarity |

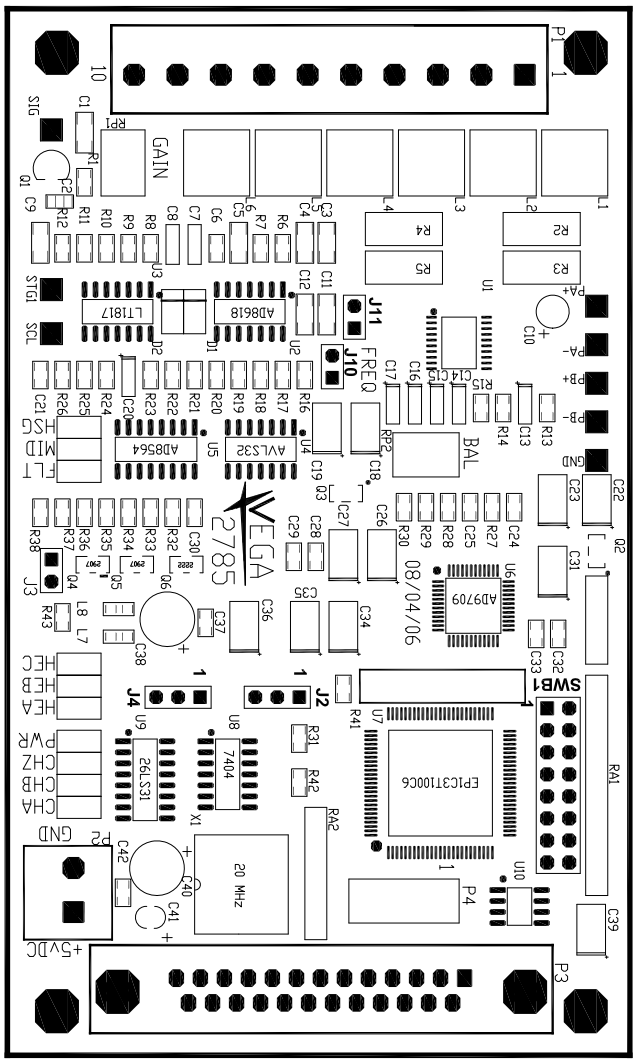
***** POWER CONNECTIONS *****

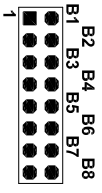
USE P2 SCREW TERMINALS OR
P3 CONNECTOR PINS FOR
POWER ENTRY

VEGA
278550
RESOLVER TO ENCODER

SYNCRO/RESOLVER
APPLICATIONS




***** POWER REQUIRMENTS *****
+5 vDC @ 250 mA 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 2785500**
SINGLE TWISTED PAIR
BELDEN # 8761 OR EQUIVALENT
(4) TWISTED PAIR CABLE
BELDEN # 9728 OR EQUIVALENT

**2785500 to Resolver**
SINGLE TWISTED PAIR
BELDEN # 8760 OR EQUIVALENT

***** 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

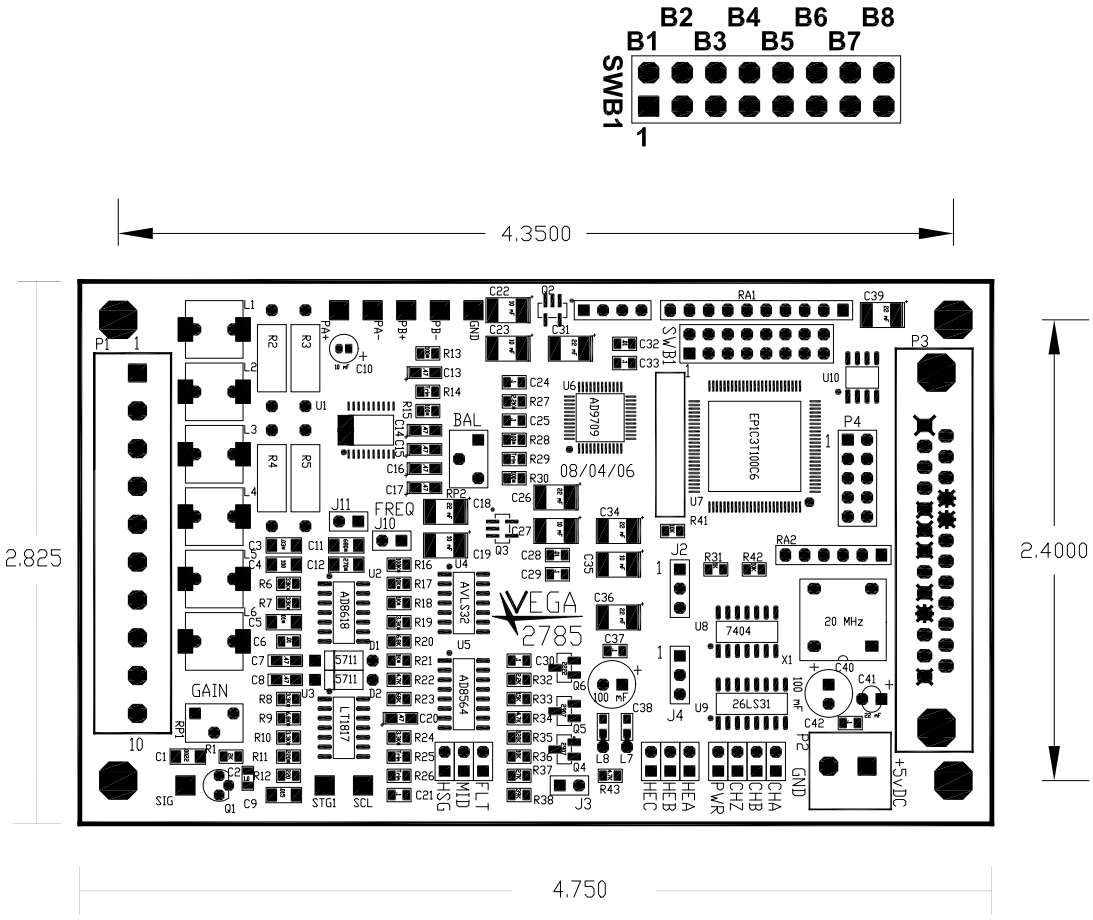
VEGA CNC
1270 SOUTER BLVD.
TROY, MI 48083



| | |
|---|---|
| SCALE | N/A |
| DRAWN | WLH |
| CHECKED | CODY |
| ENGINEER | WLH |
| DATE | 10-21-06 |
| W.O.# | 2785 |
| SHEET NO. | 1 OF 1 |

NAME: 2785500 Syncro/Resolver Application

| SIZE | DRAWING NUMBER | CHANGE |
|---|---|---|
| A | 2785500 | 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<br>1270 SOUTER BLVD.<br>TROY, MI 48083 | SCALE N/A<br>DRAWN WLH<br>CHECKED CODY<br>ENGINEER WLH<br>DATE 08-02-06<br>W.O.# 2785<br>SHEET NO. 1 OF 1 | NAME:<br>2785<br>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<br>DRAWING NUMBER 2785200<br>CHANGE |