Resolver-to-Encoder Converter

Model RTE-0x

User Manual

1999

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1.0 Basic features:

Incremental encoder emulation
Differential input
12-bit resolution
Settling time
- 1^{o} typical 2 msec (max 7 msec)
- 179^{o} max 20 msec

Angular Accuracy max +/-10.6 arc min
Repeatability max 1 LSB
Analog Velocity Output (optional)
Configuration of 1, 2, 3 and 4 axes

2.0 Description:

The converter accepts input signals in the range 500Hz – 20 kHz on the SIN, COS and REF inputs. A Type II servo loop is employed to track the inputs and convert the input SIN and COS information into a digital representation of the input angle. The bandwith of the converter is set internally at 1 kHz. Maximum tracking rate is 500 rps at 12-bit resolution. The converters are available in configurations of 1, 2, 3 or 4 axes.

Angular position is available in a form of incremental A quad B. The encoder emulation outputs A, B and Index continuously produce signals equivalent to a 1024 line (4096 quadrature counts) encoder.

An analog velocity output signal provides an accurate representation of input angular velocity of the input signals, in either a clockwise or counterclockwise direction. The analog velocity output is scaled to produce 150 rps/V dc +/- 15% and its maximum value is equivalent to +/- 375 rps.

3.0 Board I/O signals:

Resolver signals:
SIN LO – SIN channel inverting input connected to resolver SIN LO
SIN – SIN channel non-inverting input connected to resolver SIN HI
AGND – analog ground, REF ground
COS - COS channel non-inverting input connected to resolver COS HI
COS LO – COS channel inverting input connected to resolver COS LO
REF – converter reference input connected to resolver primary excitation. Phase shift with reference to COS and SIN $+/-10^{o}$ max.

Power supply signals:
$\mathbf{V_{SS}}$ – digital negative power supply, -5V dc +/- 5%

V_{DD} – digital positive power supply, +5V dc +/- 5%
AGND – analog ground
V_{ASS} – analog negative power supply, -12V dc +/- 2V
V_{ADD} – analog positive power supply, +12V dc +/- 2V
DGND – digital ground
Encoder outputs:
CH. A – encoder A output. A leads B for increasing angular rotation.
CH. B – encoder B output.
INDEX – index signal – 90° wide (one per revolution)

4.0 Board connectors

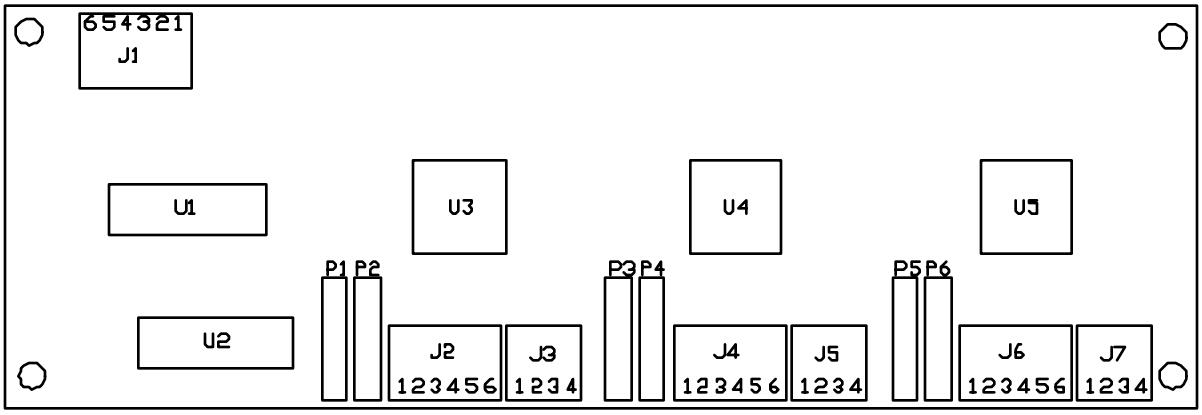

Figure 1. Board elements locations

J1 – Power signals connector

Pin	Signal name	Description
1	V2DD	+5 VDC +/-5% power supply signal
2	DGND	Digital ground connected to AGND (analog ground)
3	V2SS	-5 VDC +/-5% power supply signal
4	V1DD	+12 VDC power supply signal (not exceeding)
5	AGND	Analog ground connected to DGND (digital ground)
6	V1SS	-12 VDC power supply signal (not exceeding)

J2, J4, J6, J8 – Encoder signals connector

Pin	Signal name	Description
1	DGND	Digital ground
2	CH. A	encoder A output. A leads B for increasing angular rotation
3	CH. B	encoder B output
4	INDEX	index signal – 90^{o} wide (one per revolution)
5	DIR	Indicates direction of rotation Logic HI – increasing angular rotation Logic LO - decreasing angular rotation
6	VEL	Indicates angular velocity of input signals. Positive voltage with respect to ANGD indicates increasing angle. Scaled 150rps/V. FSD = 375 rps.

J3, J5, J7, J9 – Resolver signals connector

Pin	Signal name	Description
1	REF LO	REF Low (analog ground)
2	REF	converter reference input connected to resolver primary excitation. Phase shift with reference to COS and SIN +/- 10^{o} max.
3	AGND	analog ground used to connect cable shield
4	COS	COS channel non-inverting input connected to resolver COS HI
5	COS LO	COS channel inverting input connected to resolver COS LO
6	SIN	SIN channel non-inverting input connected to resolver SIN HI
7	SIN LO	SIN channel inverting input connected to resolver SIN LO

5.0 Installation:

The converter board is already preset according to the customer's resolver specifications. It requires two symmetrical power supplies +/-5 Vdc and +/-12 Vdc that share common ground on the board. After connecting resolver and encoder cables the board is ready to operate.

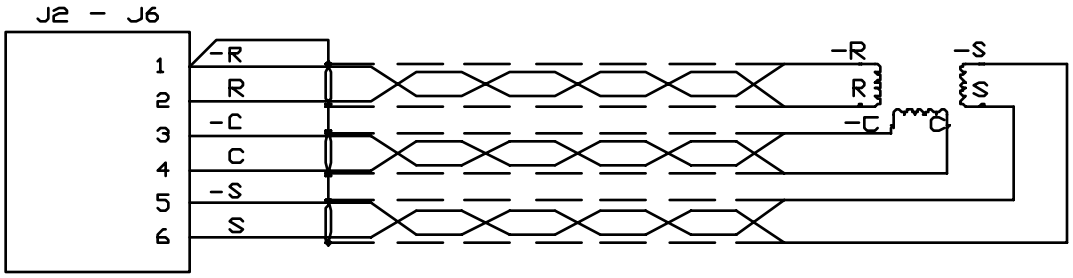

Figure 2. Connecting the RTE to a resolver

6.0 Adjustment

The boards leaving the factory are adjusted accordingly to the specified resolver transformation ratio provided by the customer. In case of changing a resolver type new adjustment needs to be done. In order to make adjustment an oscilloscope is needed.

Before any adjustment is done the board has to be disconnected from the power supply otherwise a damage to the circuits can occur.

All the measurements described below are performed on a selected axis and one of the signals: SIN or COS at a time. Then the following measurement can be done on the next resolver signal. There is no a particular sequence of signals adjustment.

6.1 Unknown resolver transformation ratio:

If a resolver transformation ration between stator and rotor windings is unknown the jumpers Z1 – Z10 should be removed. The resolver and power supply cables remain connected. At this point the power supply can be turned on and the incoming SIN and COS signals from the resolver stator winding can be measured on the jumper pin 2.

The output oscillator signal connecting to the REF resolver winding (rotor) should be adjusted to its nominal value. Maximum level of the oscillator signal generated by the converter is 2.5 Vrms. By turning a trimpot wiper it can be decreased to the resolver spec requirements. The REF signal can be measured at the middle pin of the trimpots P2, P5, P8 and P11.

The resolver SIN and COS signals have modulated amplitude by resolver shaft angular position. While turning the resolver shaft the amplitude of the measured signal should captured at its maximum level and kept at this position while other adjustments will be performed. Now, by turning a wiper of trimpots P3, P4, P6, P7, P9, P10, P12 and P13, and probing the incoming signal from the resolver on the jumper pin 2 the Vrms level should be adjusted to 2V rms. Exceeding this value can damage the converter circuit and it is user's responsibility to carefully follow these requirement.

6.2 Known resolver transformation ratio:
Assuming that the analog supply voltage is +/-12V (connector J1 – pins 4 and 6), thus a maximum voltage level of reference signal powering the resolver is 2.5 Vrms. This signal should be adjusted to resolver nominal value of the REF signal (rotor winding) using trimpots P2, P5, P8 and P11. Multiplying the REF signal Vrms value by a transformation ratio of the resolver we obtain a voltage level of the COS and SIN signals from the resolver.

Using P3, P4, P6, P7, P9, P10, P12 and P13 10kΩ trimpots of a selected axis the resistance measured between the ground and the middle pin should be adjusted to such a value that divides the amplitudes of COS and SIN signals to maximum 2V (**not exceeding!**).

Example:

REF signal Vrms level:	2.5 V
Resolver transformation ratio	1:2
Trimpots resistance	10kΩ
Required SIN and COS amplitude	2V

To calculate the trimpots resistance between the ground and the middle pin use the following formula:

$$\frac{2V * 10k\Omega}{(2.5\ V * 2)}$$

ATTENEDUM

CCW – decreasing resolver SIN & COS signals amplitude (P3, P4, P6, P7, P9, P10, P12, P13)
CW – decreasing resolver REF signal amplitude (P2, P5, P8, P11)