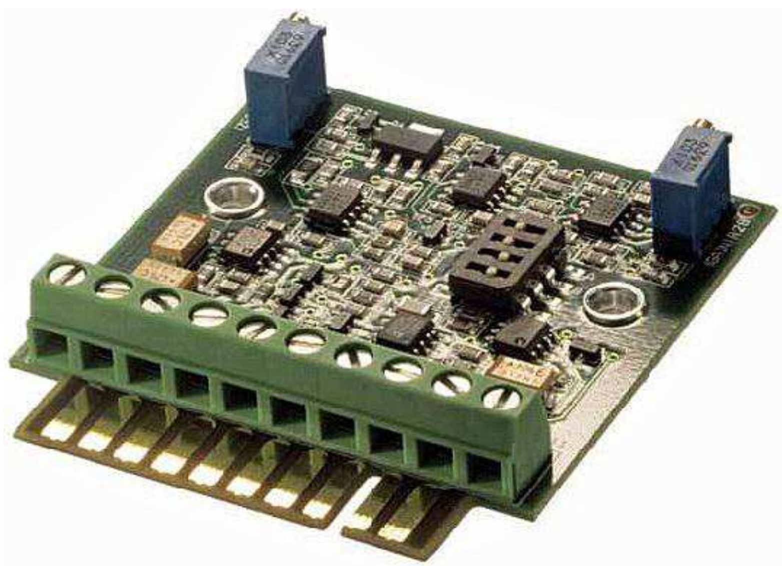
OPERATION MANUAL
LiM-420 Signal Conditioner

With 4 to 20mA current output



Contents

1. Introduction

The LiM-420 is an LVDT/RVDT (Linear or Rotary Variable Differential Transformer) signal conditioning board with 4 to 20mA DC output, primarily designed for OEM process automation applications. The design has been optimized to provide maximum versatility while offering good performance at a moderate cost.

2. Product Specifications

For complete specifications and ordering information, please refer to the datasheet at:

http://www.te.com/usa-en/product-CAT-PSI0005.html

ELECTRICAL SPECIFICATIONS	
Supply voltage	18 to 30VDC (unipolar)
Supply current	50mA maximum
Output range	4 to 20mA DC
Temperature coefficient of output	±0.02% of FSO per ºF [±0.036% of FSO per ºC] over operating temperature range
Maximum loop resistance	500Ω *(with 24VDC supply)*
Output noise and ripple	25µA RMS maximum
Frequency response	50Hz @ -3 dB
Non-linearity	±0.05% of FSO
Stability	±0.05% of FSO maximum *(after 30 minute warm-up)*
Zero adjustment range	±2.5mA
Transducer Excitation	
Voltage	3.5 VRMS ±10%, sine wave
Current	20mA RMS maximum
Frequency	2.5kHz
Transducer requirements	
Transducer type	LVDT or RVDT with 5 or 6 electrical connections
LVDT/RVDT input impedance	175Ω minimum
LVDT/RVDT output range	0.1 to 5.6 VRMS for 20mA full scale output

ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS	
Operating temperature range	-13°F to +185°F [-25°C to 85°C]
Storage temperature range	-40°F to +257°F [-40°C to 125°C]
Gain adjustment	6 DIP switch selectable ranges; 20-turn fine adjustment potentiometer
Zero adjustment	20-turn fine adjustment potentiometer
Electrical connections	PC board edge (to backplane-type connector) or barrier terminal strip (accepts AWG 14 to 30 wire sizes)
Mounting	Use the attached threaded standoffs or card-edge guides

Notes:

- *All values are nominal unless otherwise noted*
- *FSO (Full Scale Output) is the largest absolute value of the outputs measured at the range ends*

3. Product Description

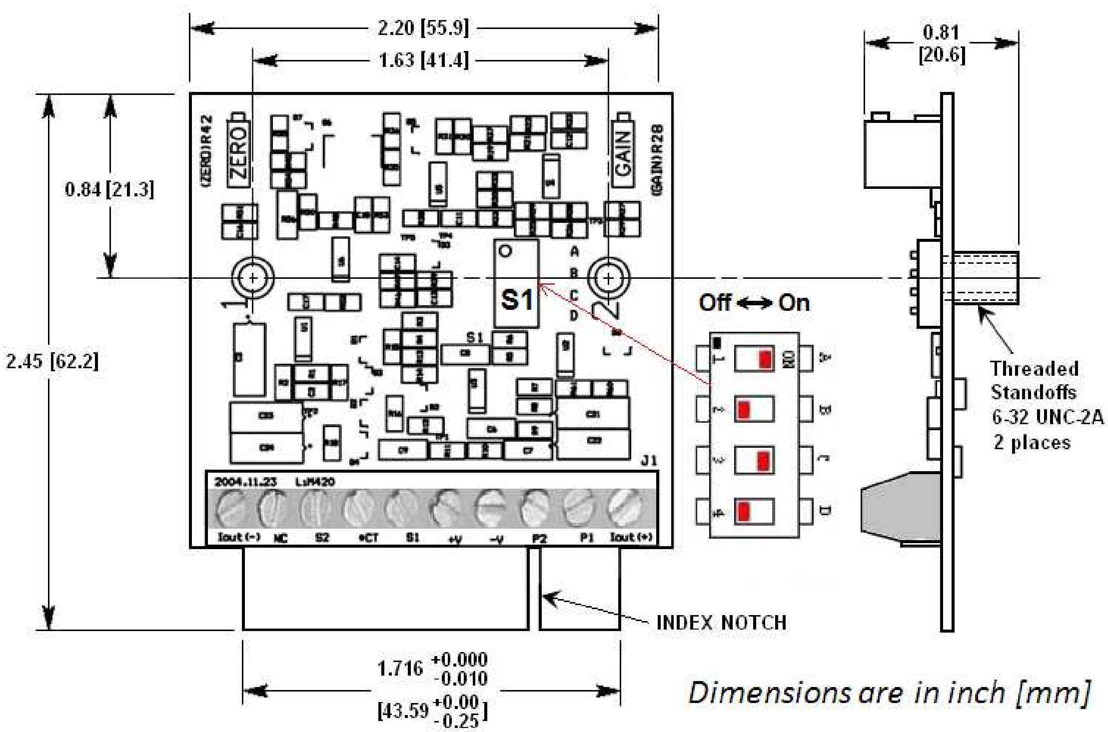
This device is compatible with most, but NOT all, 5 and 6 wire LVDT and RVDT type transducers. Please consult the product specification to ensure compatibility with your particular transducer.

DIP switches are provided to allow selection of six course gain ranges to match the full scale output of the LVDT or RVDT. The excitation voltage and frequency are fixed (3.5 VRMS, 2500 Hertz). A board mounted gain control potentiometer with a 2.5 to 1 ratio is provided. A zero control potentiometer, also board mounted, provides ±2.5mA offset adjustment.

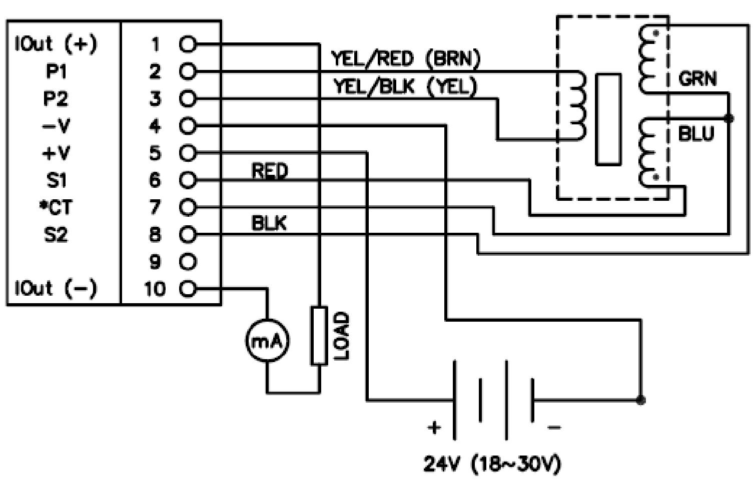
Installation may be accomplished by use of the card-edge connector or threaded stand-offs and screw-lock barrier strip connections.

The next few pages will take you, step by step, through the simple set-up and calibration process.

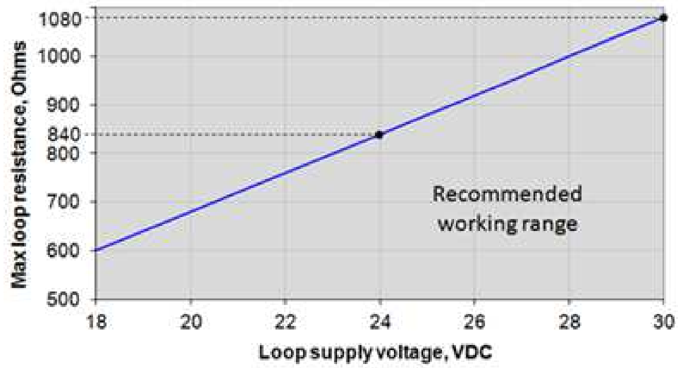
4. Circuit Top View



5 Connection Diagram



5. Maximum Loop Resistance (load) Function of Supply Voltage



6. Initial Setup

In order to begin this process, you must first know a few basic characteristics about the LVDT or RVDT you intend to use with the LiM-420 conditioning board. The information may be obtained from the transducer calibration sheet, catalog literature, or datasheet. The list below is the minimum information required to perform a successful calibration:

- Sensitivity at 2500 Hertz
- Primary (input) impedance at that frequency
- The ± full scale (inch or degree) you intend to calibrate over

6.1 Oscillator Drive Capability

To ensure LVDT/RVDT compatibility with the LiM-420 you must know the transducer current draw. The LiM-420 is designed with a robust sine wave oscillator; it is rated for a maximum drive current of 20mA RMS with a fixed amplitude of 3.5 VRMS. To ensure compatibility, you will need to know the LVDT/RVDT input impedance for the frequency at which you intend to operate it. The transducer input impedance must be equal to or greater than 175 Ohms, which will result in current draw of 20mA or less. The input impedance information is available on the datasheets for all our LVDTs and RVDTs.

6.2 Setting the Amplifier Gain

Calculate the LVDT or RVDT full scale output, using the simple formula below:

LVDT/RVDT* sensitivity *(in V/V/inch or V/V/degree), at the selected frequency
multiplied with
The excitation voltage, (3.5 VRMS for the LiM-420)
multiplied with
The full scale of the LVDT in inches (or RVDT in degrees)

As an example, the calculation for an HR1000 LVDT (±1 inch range; 1 inch full scale), with a sensitivity of 0.39V/V/inch at 2.5KHZ, would be done as follows: *0.39 x 3.5 x 1 = 1.365 VRMS full scale output or 1.365 VRMS at ± 1 inch*

Using the Gain Selection Table below, select the coarse gain settings (for the two amplification stages) for the range the full scale output falls into. In our example, use the x0.4 HIGH, or the x1 LOW settings; either will work, due to range overlap.

First Stage			Second Stage		LVDT Full Scale Output
Gain	S1-A	S1-B	Gain Lo/Hi	S1-C	for 4-20mA DC output
x0.4	OFF	OFF	LOW	ON	2.10 to 5.55 VRMS
x0.4	OFF	OFF	HIGH	OFF	1.00 to 2.64 VRMS
X1	ON	OFF	LOW	ON	0.84 to 2.22 VRMS
X1	ON	OFF	HIGH	OFF	0.40 to 1.00 VRMS
X4	OFF	ON	LOW	ON	0.21 to 0.55 VRMS
X4	OFF	ON	HIGH	OFF	0.10 to 0.26 VRMS

7. Calibration Procedure (for 4-20mA DC Output)

Using the Connection Diagram in this manual, connect the LVDT or the RVDT, a DC Ammeter, a load (loop resistance), and a 24 VDC power supply to the LiM-420. Turn power on and allow 15 minute warm-up.

Note: Changing coarse gain settings (DIP switches) after Step 6 below may result in an offset shift. Should you find it necessary to change the gain, you should repeat steps 1 through 6.

Step 1: Disconnect the LVDT/RVDT secondary lead-wire (black) from terminal 8

Step 2: Place a temporary shorting jumper across terminals 6 and 8 (to short the LiM-420 input)

Step 3: Turn the ZERO potentiometer to obtain an output of 12mA on the Ammeter

Step 4: Remove shorting jumper and reconnect the black wire to terminal 8

Step 5: Move the LVDT core or rotate the RVDT shaft to the approximate center of the mechanical range, then keep moving/turning until you get as close as possible to the 12mA output position (this is the LVDT/RVDT null position)

Step 6: Using the ZERO potentiometer, adjust the output signal to 12mA, if needed

Step 7: Using a gage block micrometer or other precision positioning device, displace the LVDT core or rotate the RVDT shaft in a positive direction (increasing mA output) to the full scale position used in your calculation (see "Setting the Amplifier Gain"; +1 inch in our HR1000 LVDT example)

Step 8: Adjust the GAIN potentiometer until the output reads 20mA DC

Step 9: Displace the LVDT core or rotate the RVDT shaft to the negative full scale position (-1 inch in our HR1000 LVDT example). You should measure approximately 4mA at this location.

Your calibration is now complete for a 4 to 20mA output range.

Other custom mA DC output ranges can be achieved by using different switch settings and/or potentiometer adjustments.

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