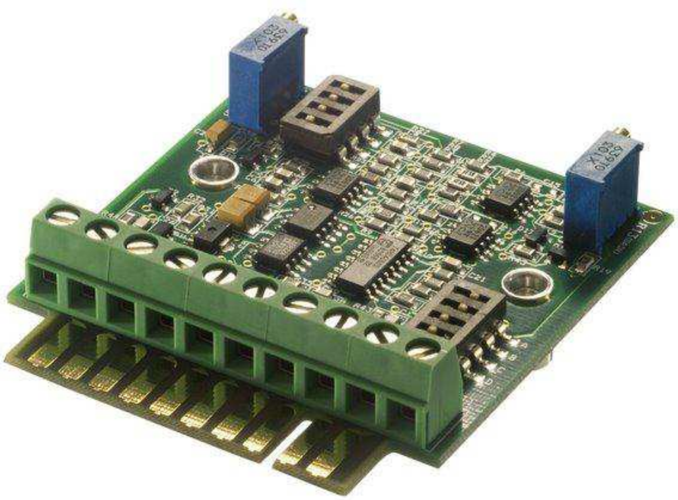
OPERATION MANUAL
LVM-110 Signal Conditioner

With DC Voltage Output



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1. Introduction

The LVM-110 is an LVDT/RVDT (Linear or Rotary Variable Differential Transformer) signal conditioning board with DC voltage 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-PSI0006.html

ELECTRICAL SPECIFICATIONS	
Supply voltage	±12VDC or ±15VDC, ±10% (Note; ±15VDC required for ±10VDC output)
Supply current	±50mA maximum
Output voltage ranges	±5VDC, ±10VDC, 0 to +5VDC, 0 to +10VDC *(DIP switch selectable)*
Temperature coefficient of output	±0.02% of FSO per ºF [±0.036% of FSO per ºC] over operating temperature range
Output current	5mA maximum
Output noise and ripple	15mV RMS maximum
Output impedance	1Ω maximum
Frequency response	250Hz @ -3 dB, 3-pole Butterworth filter
Non-linearity	±0.05% of FSO maximum
Stability	±0.05% of FSO maximum *(after 15 minute warm-up)*
Zero suppression	±6VDC total
Transducer excitation	
Voltage	3VRMS ±10%, sine wave
Current	20mA RMS maximum
Frequency	2.5, 5, 8 or 10KHz *(DIP switch selectable)*
Transducer requirements	
Transducer type	LVDT or RVDT with 5 or 6 electrical connections
LVDT/RVDT input impedance	150Ω minimum
LVDT/RVDT output range	0.1 to 5.6 VRMS for ±10VDC signal conditioner output

ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS	
Operating temperature range	30°F to +130°F [-1°C to 55°C]
Storage temperature range	-40°F to +257°F [-40°C to 125°C]
Zero and gain adjustments	20-turn potentiometers
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 sensor.

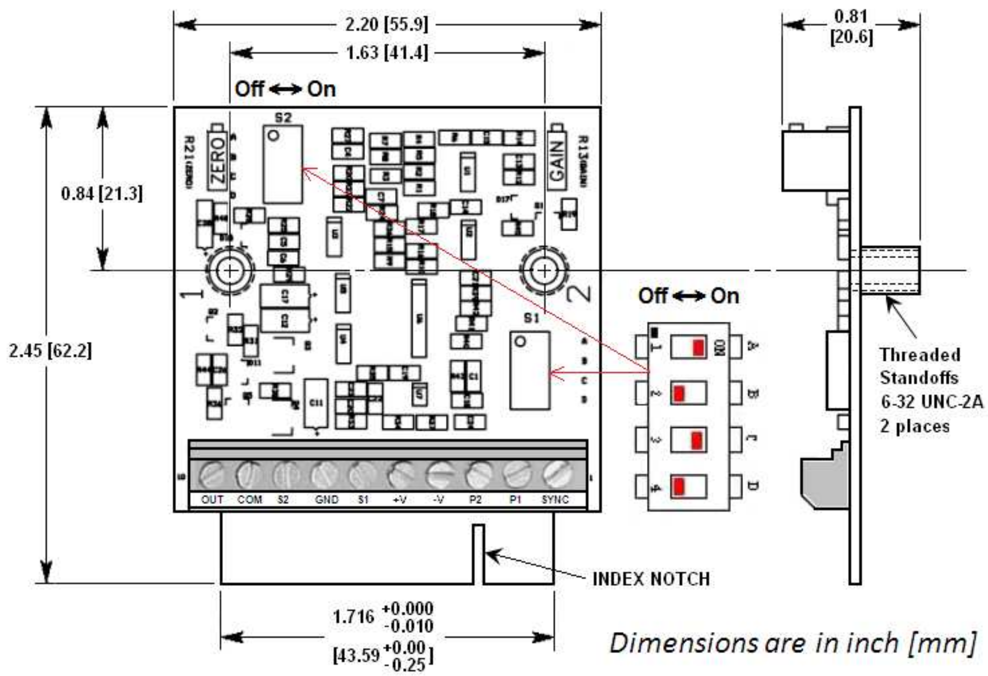
DIP switches are provided to allow selection of four transducer excitation frequencies, from 2.5 to 10 kHz. Switches are also provided to select six coarse gain ranges, two zero offsets, and master/slave or standalone operation.

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

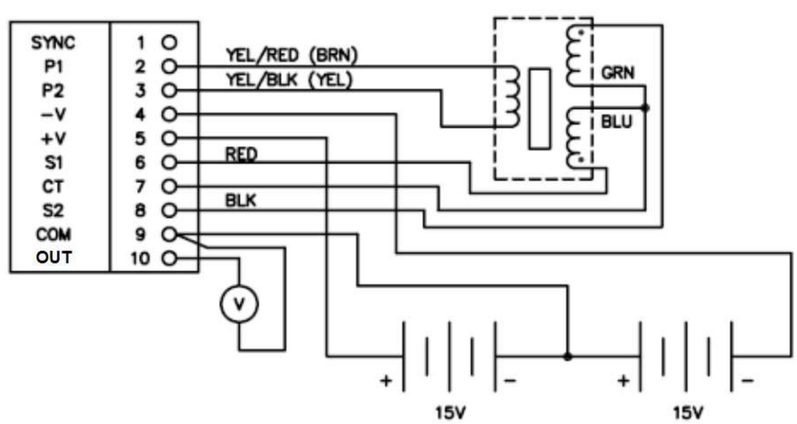
The next few pages will take you, step by step, through the simple set-up and calibration process. This device may be set-up for several different full scale analog outputs; some of the potential configurations are listed below:

- ±10 VDC output
- ±5 VDC output
- 0 to 10 VDC output
- Standalone operation
- Master/slave operation

4. Circuit Top View



5. Connection Diagram



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 LVM-110 conditioning board. The information may be obtained from the sensor calibration sheet, catalog literature, or datasheet. The list below is the minimum information required to perform a successful calibration:

- Recommended operating frequency
- Sensitivity at that frequency
- Primary (input) impedance at that frequency
- The ± full scale (inch or degree) you intend to calibrate over
- Analog output signal required by your application

6.1. Oscillator Frequency

Once you have established the proper excitation frequency for your transducer, refer to the table below and the DIP switch locations on the Circuit Top View (in this manual) to set the LVM-110 oscillator frequency:

Oscillator Frequency	S1-C	S1-D
2.5 KHZ	OFF	OFF
5 KHZ	ON	OFF
8 KHZ	OFF	ON
10 KHZ	ON	ON

(Refer to Circuit Top View in this manual for ON/OFF positions)

6.2. Oscillator Mode

The Oscillator mode setting depends on the number of LVM-110's and LVDT/RVDTs in your system. For a single LVDT or RVDT system, run the LVM-110 in the stand alone (master) mode. For multi sensor systems, it is best to master and slave the LVM-110 oscillators to prevent beat frequencies and crosstalk between amplifiers and LVDTs. Select one LVM-110 to serve as the master oscillator, and setup the balance in the slave mode.

CAUTION **Attempting to synchronize two LVM-110 set as masters may damage one or both units.**

Connecting Pin-1 (Sync) of the barrier strip, from unit to unit, will complete the sync bus circuit. The power common serves as the return line. Use the table below to configure your oscillator mode:

S1-B	Mode
OFF	SLAVE
ON	MASTER

6.3. Oscillator Drive Capability

To ensure LVDT/RVDT compatibility with the LVM-110 you must know the transducer current draw. The LVM-110 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 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 150 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.

7. 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 VRMS for the LVM-110)
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 x 1 = 1.17 VRMS full scale output or 1.17 VRMS at ± 1 inch

Using the Gain Selection Table below, select the coarse gain settings (S1 and S2 DIP switches for the two amplification stages) for the range the full scale output falls into. In our example, you would use the x0.2 HIGH, or the x0.5 LOW settings; either will work, due to range overlap. The gain selections are for a ±10 VDC LVM-110 full scale output.

To calibrate the LVM-110 with your LVDT or RVDT for a ±5 VDC output, double the result of your full scale output calculation, prior to consulting the gain table. This will result in you selecting half the normal gain, therefore half the normal DC output.

Gain Selection Table:

First Stage			Second Stage		LVDT Full Scale Output
Gain	**S2-A**	**S2-B**	**Gain Lo/Hi**	**S1-A**	for ±10VDC output
x0.2	OFF	OFF	LOW	ON	2.10 to 5.55 VRMS
x0.2	OFF	OFF	HIGH	OFF	1.00 to 2.64 VRMS
x0.5	ON	OFF	LOW	ON	0.84 to 2.22 VRMS
x0.5	ON	OFF	HIGH	OFF	0.40 to 1.00 VRMS
x2	OFF	ON	LOW	ON	0.21 to 0.55 VRMS
x2	OFF	ON	HIGH	OFF	0.10 to 0.26 VRMS

8. Calibration Procedure (for +/-10 and +/-5VDC Output)

Using the Connection Diagram in this manual, connect the LVDT or the RVDT, a DC voltmeter, and a bipolar power supply to the LVM-110. Turn power on and allow 15 minute warm-up.

Note: Changing coarse gain settings (DIP switches) after Step 6 below may result in a zero 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 LVM-110 input)

Step 3: Adjust the ZERO potentiometer for zero volt DC output, between terminals 9 (GND) and 10 (OUT)

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 to the transducer null (as close as possible to zero VDC output between pins 9 and 10)

Step 6: Using the ZERO potentiometer, adjust out any remaining output signal, due to positioning difficulty

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 (positive DC voltage between pins 9 and 10) 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 for the required positive full scale DC output (5 or 10VDC) between pins 9 and 10

Step 9: Return to the original zero position to re-check your null DC voltage between pins 9 and 10

Step 10: Displace the LVDT core or rotate the RVDT shaft to the negative full scale position (negative DC voltage between pins 9 and 10). You should measure approximately the same DC voltage (except negative) at this location as at the positive full scale position.

9. Zero Suppression Calibration (for 0 to 10 VDC Output)

To perform a 0 to 10 VDC calibration, follow the instructions for the ±5 VDC calibration, then displace the LVDT core or the RVDT shaft to the minus full scale position (-5VDC output between pins 9 and 10). Using the table below, select a +4 Volt offset:

S2-C	S2-D	Offset
OFF	OFF	None
ON	OFF	-4VDC
OFF	ON	+4VDC

After zero switches are set, the output at the minus full scale position should have changed to –1VDC approximately.

Using the ZERO potentiometer, adjust the DC output until it changes to zero VDC, from the original -1VDC. Return to the original zero (mid) position; you should now read +5 Volts DC instead of zero. Continue in the same direction up to the original positive full scale position; the reading should be +10 VDC. The output was shifted by +5VDC; your calibration is now complete for a 0 to 10VDC output range.

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

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