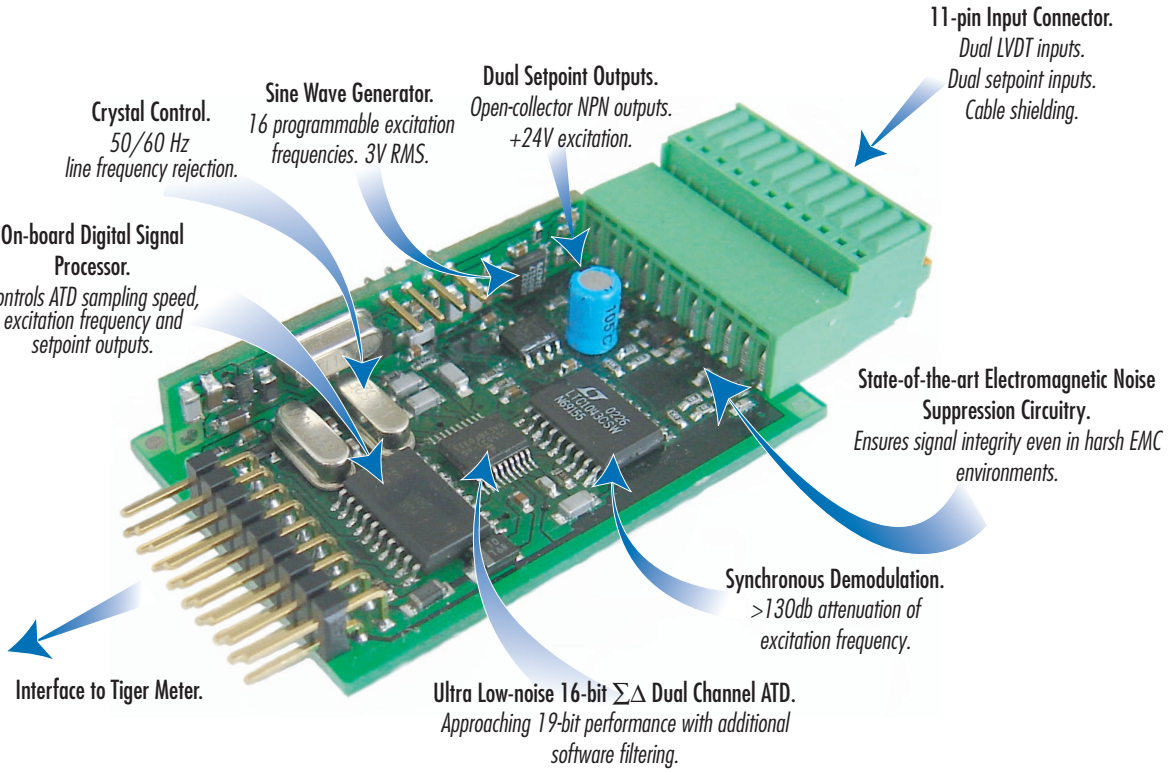
TEXMATE INC

Fits Tiger 320 Series

SMART DUAL LVDT INPUT

DUAL LVDT INPUT



A high performance dual channel LVDT input module.

A dual LVDT signal conditioning input module interfaced to the Tiger 320 Series Operating System provides programmable excitation frequency, ATD sampling and averaging rate, and high-speed setpoint outputs. Synchronous demodulation at multiples of line frequency ensures high frequency response applications unhindered by carrier noise.

Input Module Order Code Suffix

ISL1 (50 Hz Rejection)

ISL2 (60 Hz Rejection)

Hardware Module Specifications	
Excitation Voltage	3 V RMS sine wave, Zero DC component
	THD < 2% (1.2 kHz).
Excitation Frequency	x 16 available (1.2 kHz to 11.52 kHz)
	as multiples of 50/60 Hz line frequency.
	Crystal locked, software driven.
Temperature Coefficient	± 50 ppm /°C full scale (typical).
Dual LVDT Inputs	30 kΩ input impedance.
	Synchronous demodulation of excitation carrier.
	> 130 dB rejection of excitation carrier.
Frequency Response	500 Hz (–3 dB) low-pass filter.
Analog to Digital	Dual channel ΣΔ A/D convertor approaching
	19-bit resolution. Ratiometric operation relative
	to excitation voltage magnitude.
High-speed Control Outputs	Dual high speed open collector transistor outputs 600 mA max.
	under setpoint control (SP5 / SP6).

Software Module Specifications	
Dual Output Rates	Rapid & average response outputs.
	1 Hz, 4 Hz, 10 Hz, 20 Hz, averaged.
Single Fast Output	Single channel, increased signal to noise.
	4 Hz, 10 Hz, 20 Hz, 40 Hz, averaged.
Excitation Frequency	16 selectable frequencies.
Line Frequency Rejection	50 / 60 Hz noise rejection.
High-speed Control Outputs	Choice of logic modes to control
	high speed setpoints.

Connector Pinouts

ISL1 / ISL2 configured for dual input LVDTs.

Fast setpoint control outputs activate a status LED (SP5) and a +24 V relay coil (SP6).

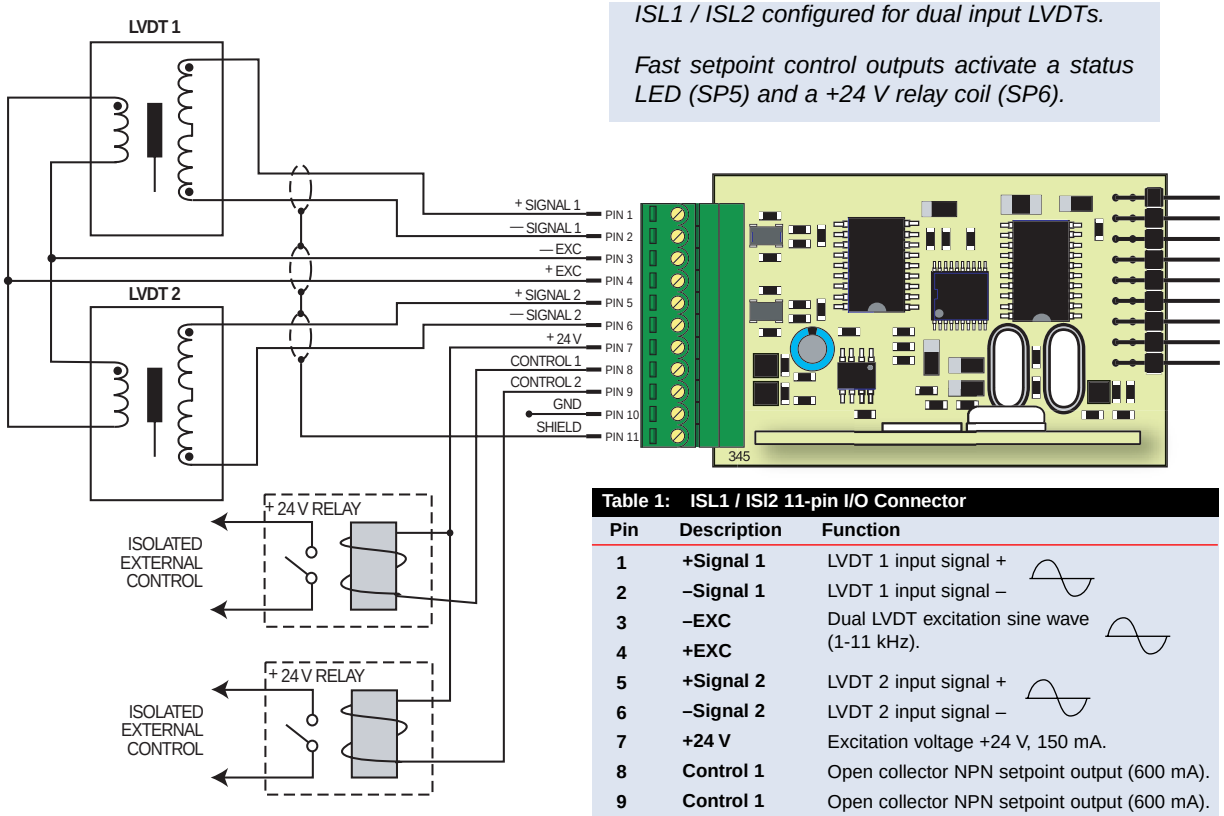


Figure 1 – ISL1 / ISL2 Configured for Dual LVDT Inputs

Table 1: ISL1 / ISl2 11-pin I/O Connector

Pin	Description	Function
1	**+Signal 1**	LVDT 1 input signal +
2	**–Signal 1**	LVDT 1 input signal –
3	**–EXC**	Dual LVDT excitation sine wave (1-11 kHz).
4	**+EXC**	
5	**+Signal 2**	LVDT 2 input signal +
6	**–Signal 2**	LVDT 2 input signal –
7	**+24 V**	Excitation voltage +24 V, 150 mA.
8	**Control 1**	Open collector NPN setpoint output (600 mA).
9	**Control 1**	Open collector NPN setpoint output (600 mA).
10	**Ground**	0 V.
11	**Shield**	Cable shield, 3 V common mode.

Technical Description

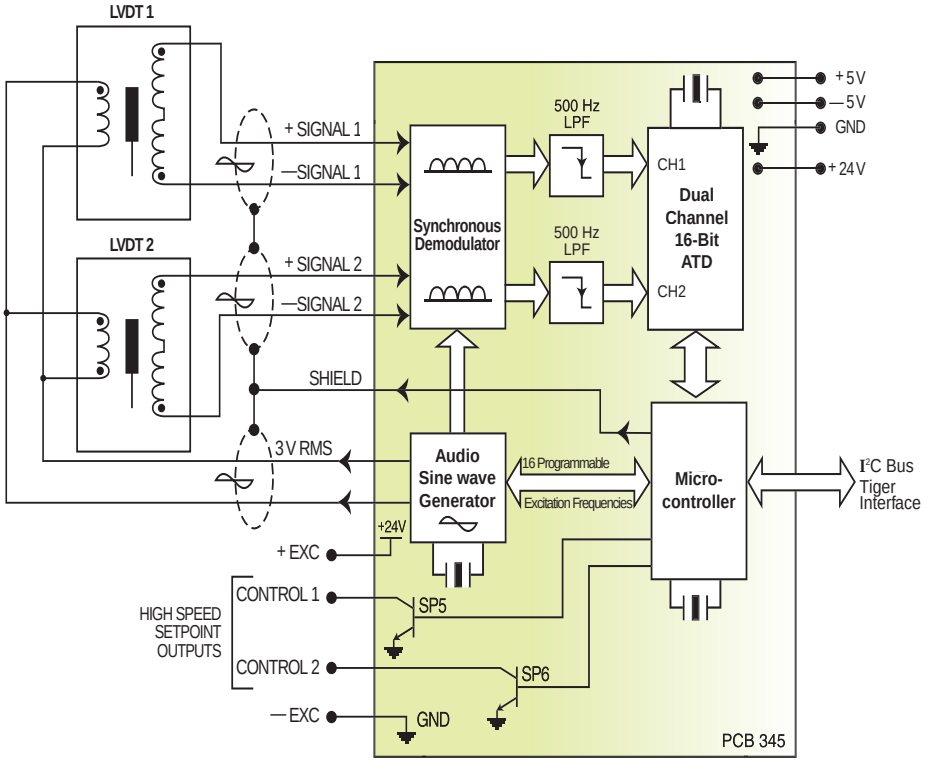


Figure 2 – ISL1 / ISL2 LVDT Functional Schematic

ISL1 / ISL2 is a smart input module designed to drive and condition the signals from two LVDT transducers. The module contains two high-speed microcontrollers and a $\Sigma\,\Delta$ 16-bit dual channel A/D convertor. It communicates with the selected Tiger controller via the I^2C data bus. One of the microcontrollers generates the sine wave for the LVDT excitation frequency. These frequencies are produced as multiples of the line frequency (either 50 Hz or 60 Hz). Up to 16 frequencies are available and are selected using the Tiger controller setup.

The output to the primary coil of both LVDTs is a 3 V RMS sine wave. The received LVDT signals are synchronously demodulated and filtered to remove the carrier frequency. The $\Sigma\,\Delta$ 16-bit A/D convertor has over 130 dB noise rejection at the excitation frequencies and is capable of 40 Hz averaged output on 45 samples.

Two open collector NPN transistors are available as high-speed controlled outputs. Tiger controller setpoint SP5 controls output CONTROL 1 and SP6 and controls output CONTROL 2.

The Tiger meter uses three smart setup registers to configure all smart input modules. ISL1 / ISL2 requires only **smart register 1** (SMT1) and **smart register 2** (SMT2) to be configured. See Figure 3.

SMT1 configures both LVDT1 and LVDT2 input signals for line frequency, excitation frequency, and output rate. SMT2 allows LVDT1 and LVDT2 to be selected as a high-speed setpoint outputs, CONTROL 1 from setpoint 5 and CONTROL 2 from setpoint 6.

ISL1 / ISL2 produces the following four output registers:

- The averaged response signal output from LVDT 1.
- The averaged response signal output from LVDT 2.
- The rapid response signal output from LVDT 1.

One of these registers can be transferred to Channel 1 (CH1) via Code 2, the same or another register to CH2 via Code 4, the same or another register to CH3 via Code 5, and the same or another register to CH4 via Code 6,

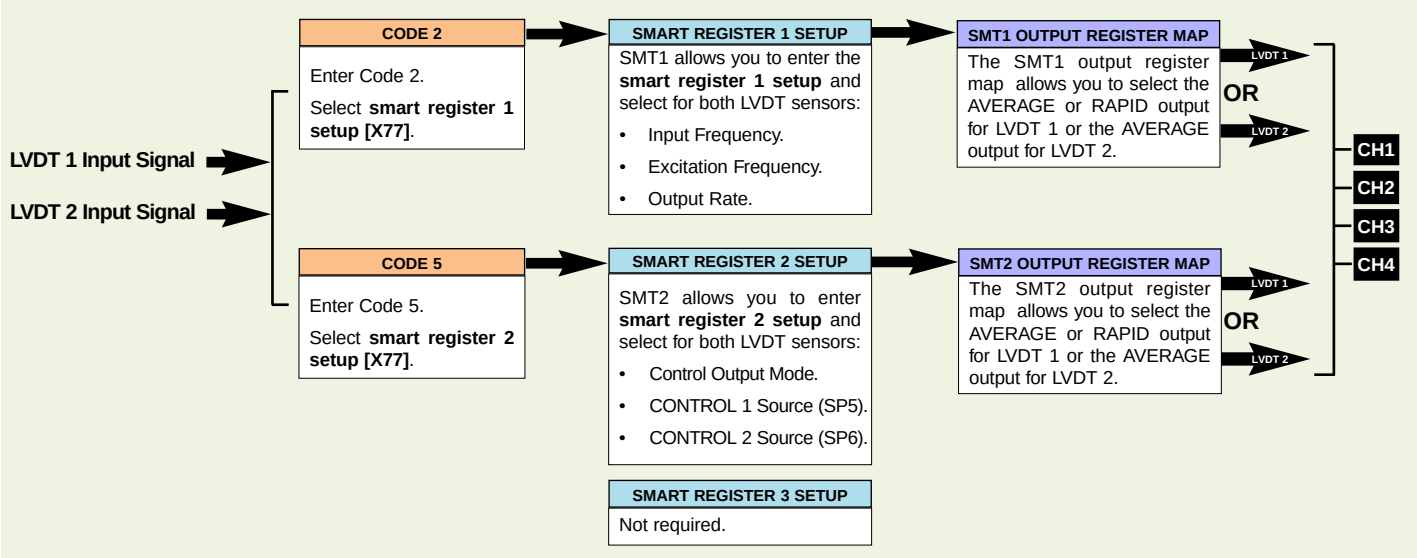


Figure 3 – ISL1 / ISL2 Smart Setup Registers Operational Flow Diagram

Programming Procedures

The following programming procedures cover all the steps required to configure smart input module ISL1 / ISL2. Steps **1** to **6** describe how to select the **line frequency**, **excitation frequency**, and **output rate** through SMT1. Steps **7** to **12** describe how to select the **control output mode**, **control 1** and **control 2 source** through SMT2.

Steps **13** to **18** describe how to select the output registers for channels 1, 2, 3, or 4 as required.

1 Press the [P] and [⬆] buttons at the same time to enter the main programming mode.

2 Press the [P] button three times to enter Code 2. Set Code 2 to [X77].

This setting enters the **smart register 1** code setup menu.

FIRST DIGIT
TIGER PROCESSING RATE
0 10 Hz
1 10 Hz
2 100 Hz
3 100 Hz

SECOND DIGIT	
MEASUREMENT TASK	
0	**Voltage, Current**
1	TC (3rd digit selects type of TC)
2	RTD 3-wire (3rd digit selects type of RTD)
3	RTD 2- or 4-wire (3rd digit selects type of RTD)
4	Frequency
5	Period
6	Counter
7	Smart Input Module

THIRD DIGIT	
SMT1 OUTPUT REGISTER MAP	
0	**LVDT1 Average Output**
1	LVDT1 Rapid Output
2	LVDT2 Average Output
3	-
4	-
5	-
6	-
7	Smart input module register 1 code setup

Note the output registers in the 3rd digit are specific to the ISL1 / ISL2 input module. These registers vary for each different smart input module.

3 Press the P button.

SMt1 000 →

This menu provides settings unique to **smart register 1** of input module ISL1.

FIRST DIGIT
LINE FREQUENCY SELECT
0 60 Hz rejection
1 -
2 50 Hz rejection
3 -

SECOND DIGIT		
EXCITATION FREQUENCY 50/60 Hz		
0	**50 Hz 1.2 kHz**	**60 Hz 1.44 kHz**
1	50 Hz 1.6 kHz	60 Hz 1.92 kHz
2	50 Hz 2.4 kHz	60 Hz 2.88 kHz
3	50 Hz 3.2 kHz	60 Hz 3.84 kHz
4	50 Hz 4.8 kHz	60 Hz 5.76 kHz
5	50 Hz 6.4 kHz	60 Hz 7.68 kHz
6	50 Hz 8.0 kHz	60 Hz 9.60 kHz
7	50 Hz 9.6 kHz	60 Hz 11.52 kHz

THIRD DIGIT	
OUTPUT RATE	
0	**1 Hz average, 50/60 Hz sample**
1	4 Hz average, 200/240 Hz sample
2	10 Hz average, 400/480 Hz sample
3	20 Hz average, 800/960 Hz sample
4	4 Hz average, 200/240 Hz sample*
5	10 Hz average, 400/480 Hz sample*
6	20 Hz average, 800/960 Hz sample*
7	40 Hz average, 1600/1920 Hz sample*

*** Single fast LVDT 1 (LVDT 2 is disabled) (improved signal-to- noise).**

4 Using the ↑ ↓ buttons, select:

- **1st Digit**: **50 Hz line frequency rejection** for 50 Hz power supply areas, or **60 Hz line frequency rejection** for 60 Hz power supply areas.
- **2nd Digit**: The **excitation frequency**.
- **3rd Digit**: The **output rate**.

5 Press the P button. The display returns to [Cod_2] [X77]. Cod_2 X77

6 Using the ↓ button, reset the 3rd digit to zero [X70] to leave the smart register 1 menu. Cod_2 X70

Note, leaving the 3rd digit as 7 means the display constantly cycles between [Cod_2] and [SMt1].

7 Press the P button three times to enter Code 5. Set Code 5 to [X77]. Cod_5 X77

Cod_5 X77 →

FIRST DIGIT
TIGER PROCESSING RATE
0 Direct Display of Input (no processing)
1 Square Root of Channel 3
2 Inverse of Channel 3
3 **Meters with 4 kB memory** NO Linearization **Meters with 32 kB memory** 32-point Linearization of CH3 using Table 3
Note: All linearization tables are set up in the Calibration Mode [24X].

SECOND DIGIT
MEASUREMENT TASK
0 No Function
1 Voltage, Current
2 TC (3rd digit selects type of TC)
3 RTD/Resistance (3rd digit selects type)
4 Real-time Clock & Timer (3rd digit selects type)
5 -
6 -
7 Smart Input Module

THIRD DIGIT
SMT2 OUTPUT REGISTER MAP
0 LVDT1 Average Output
1 LVDT1 Rapid Output
2 LVDT2 Average Output
3 -
4 -
5 -
6 -
7 Smart input module register 1 code setup

Note, the output registers in the 3rd digit are specific to the ISL1 / ISL2 input module. These registers vary for each different smart input module.

8 Press the P button.

This setting enters the **smart register 2** code setup menu. This menu configures the two high-speed setpoint outputs.

SMt2 000 →

This menu provides settings unique to **smart register 2** of input module ISL1.

FIRST DIGIT
CONTROL OUTPUT MODE
0 Control 1 & 2 (Normally OFF)
1 Control 1 inverted (Normally ON)
2 Control 2 inverted (Normally ON)
3 Control 1 & 2 inverted (Normally ON)

SECOND DIGIT
CONTROL 2 SOURCE (SP6)
0 LVDT 1 average
1 LVDT 1 rapid
2 LVDT 2 average
3 -
4 -
5 -
6 -
7 -

THIRD DIGIT
CONTROL 1 SOURCE (SP5)
0 LVDT 1 average
1 LVDT 1 rapid
2 LVDT 2 average
3 -
4 -
5 -
6 -
7 -

9 Select the following control output settings:

- **1st Digit:** Control output mode for the open-collector transistors.
- **2nd Digit**: Control output source for CONTROL 2 (SP6).
- **3rd Digit**: Control output source for CONTROL 1 (SP5).

10 Press the [P] button to save the settings. The display returns to [Cod_5] [X77].

11 Using the [⇩] button, reset the 3rd digit to zero [X70] to leave the smart register 1 menu.
Note, leaving the 3rd digit as 7 means the display constantly cycles between [Cod_5] and [SMt2].

12 Press the [P] and [⇧] buttons at the same time to return to the operational display.

Select a Channel

Select the output register for the required channels

13 Press the [P] and [⇧] buttons at the same time again to re-enter the main programming mode, then press the [P] button three times to enter Code 2.

14 Set Code 2 to [X7X]. Select the required processing rate for **CH1** in the 1st digit and the required register map settings in the 3rd digit.

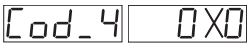
CH1 

FIRST DIGIT
TIGER PROCESSING RATE
0 10 Hz
1 10 Hz
2 100 Hz
3 100 Hz

Note the output register map is different for each smart input module type.

THIRD DIGIT
SMT1 OUTPUT REGISTER MAP
0 LVDT1 Average Output
1 LVDT1 Rapid Output
2 LVDT2 Average Output
3 -
4 -
5 -
6 -
7 Smart input module register 1 code setup

15 Set Code 4 to [0X0]. Select the required register map settings for **CH2** in the 2nd digit.

CH2 

FIRST DIGIT
MEASUREMENT TASK
0 Voltage, Current
1 TC (type as per 2nd digit)
2 RTD (type as per 2nd digit)
3 Second Digital Input Channel (type as per 2nd digit)

SECOND DIGIT	
FOR VOLTAGE & CURRENT	
0 Channel 2 Disabled	
1 Direct (no post processing)	
2 Square Root of Channel 2	
3 Inverse of Channel 2	
4 Output Register 1 (smart module)*	
5 Output Register 2 (smart module)*	
6 Output Register 3 (smart module)*	
7 Output Register 4 (smart module)*	

Note:
The logic for CH2 is not the same as CH1, CH3, or CH4. The 1st and 3rd digits must both be set to 0. Selecting 040 or 050 in the 2nd digit of Code 4 directly selects one of the following settings in the output register map (3rd digit):

2nd Digit	SMT1 Output Register Map
4 selects	**LVDT1 Average Output**
5 selects	LVDT1 Rapid Output
6 selects	LVDT2 Average Output
7 selects	-

16 If required enter Code 5 and select the required register map settings for **CH3** in the 3rd digit.

CH3 

FIRST DIGIT
CH3 POST PROCESSING
0 Direct Display of Input (no processing)
1 Square Root of Channel 3
2 Inverse of Channel 3
3 **Meters with 4 kB memory** NO Linearization **Meters with 32 kB memory** 32-point Linearization of CH3 using Table 3

Note:
All linearization tables are set up in the Calibration Mode [24X].

THIRD DIGIT
SMT1 OUTPUT REGISTER MAP
0 LVDT1 Average Output
1 LVDT1 Rapid Output
2 LVDT2 Average Output
3 -
4 -
5 -
6 -
7 Smart input module register 1 code setup

Note the output register map is different for each smart input module type.

17 If required enter Code 6 and select the required register map settings for **CH4** in the 3rd digit.

CH4 

FIRST DIGIT
CH4 POST PROCESSING
0 Direct Display of Input (no processing)
1 Square Root of Channel 4
2 Inverse of Channel 4
3 **Meters with 4 kB memory** NO Linearization **Meters with 32 kB memory** 32-point Linearization of CH4 using Table 4

Note:
All linearization tables are set up in the Calibration Mode [24X].

Press the [P] button to save the settings.

18 Press the [P] and [⇧] buttons at the same time to return to the operational display.

LVDT sensors can be applied to almost all engineering applications from civil, mechanical, petrochemical, and power generation, to production, aerospace, defense, and much more.

They can be used on production lines to automatically gauge products for quality control and product sorting. In the power generation and petrochemical industries they can be used, for example, as servo position feedback on actuated equipment such as valves and dampers, or for measuring turbine casing expansion. Submersible units can be used in marine and offshore mining applications, and sensors that meet military environmental standards have been applied to defense and aerospace applications.

Dual LVDT smart input module ISL1 / ISL2 is the ideal interface between LVDT sensors and the unrivaled control functionality of the Tiger 320 Series operating system. This combination is ideal for multi-dimensional linear displacement measurement applications. Programmable excitation voltage, ultra-low noise high speed signal processing, and dual control outputs are standard features of this input module.

The following are example applications that show the versatility of the LVDT200 controller.

Example Setup Procedure

An LVDT transducer is fitted to the shaker head of a vibration tester to measure dynamic displacement versus time. The shaker head vibrates at approximately 100 Hz frequency and a 3 mm peak to peak amplitude.

The excitation frequency is set at 2.4 kHz, 24 times greater than the mechanical vibration frequency, and a 50 Hz line frequency rejection (suitable for 50 Hz power supply areas). A single channel fast option with a 40 Hz average and a 1600 Hz sampling speed is selected. If this averaged result exceeds 3.500 mm then CONTROL 1 is activated and a buzzer sounds.

1 **Set up smart register 1 (SMT1) for 50 Hz line rejection, 2.4 kHz excitation frequency, and a 40 Hz averaged output rate:**

In [CODE 2] select [X77] then press the [P] button.

Display toggles between [SMt1] [000]

Set [SMt1] to [227]

2 **Select** LVDT 1 average output **for CH1:**

In [CODE 2] reset to [X70] then press the [P] button.

3 **Set up smart register 2 (SMT2) to activate CONTROL 1 output (SP5) on the LVDT 1 averaged signal:**

In [CODE 5] select [X77] then press the [P] button.

Display toggles between [SMt2] [000]

Set [SMt2] to [0X0]

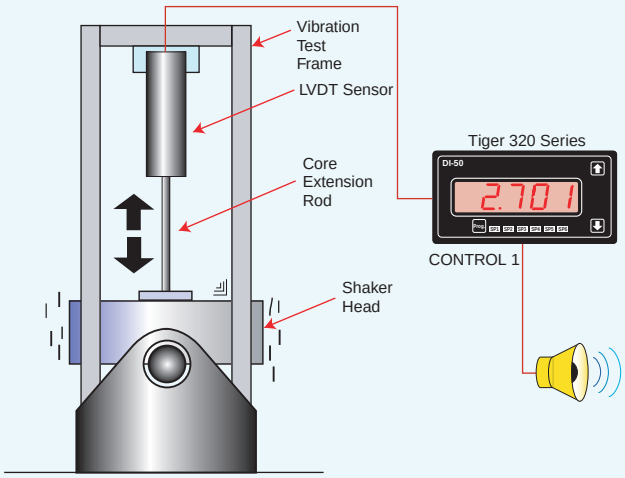


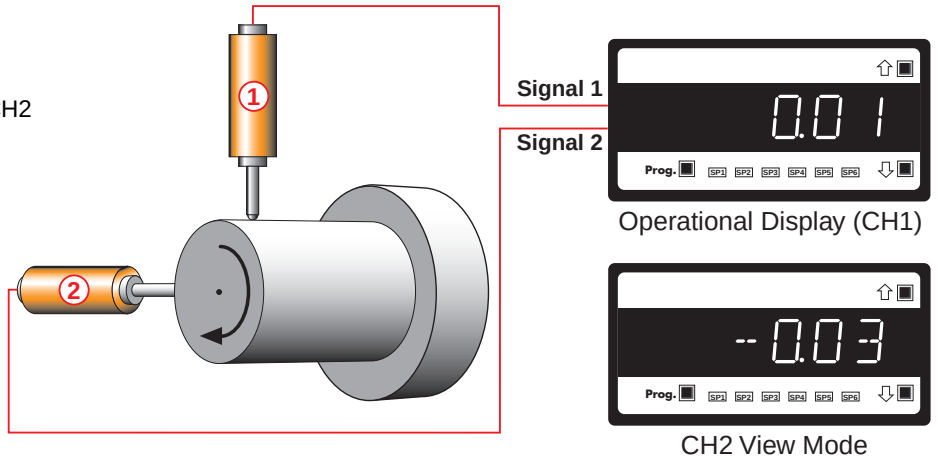
Figure 4 – Example LVDT Application

ALIGNMENT TOOL

Measured using two LVDT sensors at 90°

Signal 1 to CH1 = Shown on Display

Signal 2 to CH2 = Use View Mode to view CH2

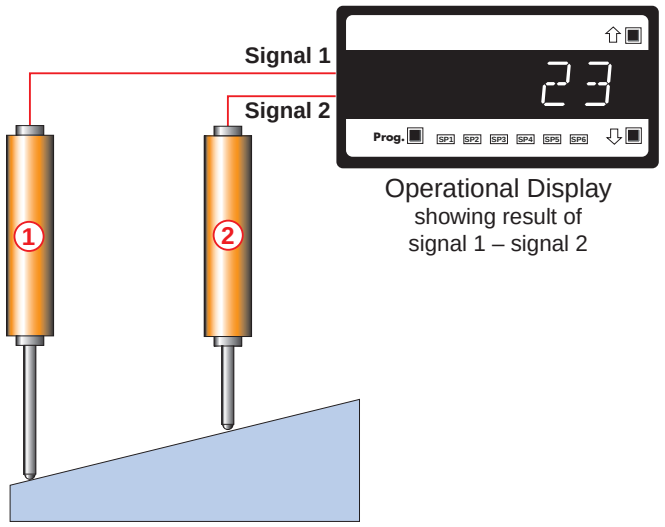


SLOPE INDEXING

Measured using two parallel LVDT sensors (1 – 2)

Signal 1 minus Signal 2 = Displayed Result

Note:
Select [rESLt] as the data source for the display in Code 1 of the main programming mode.

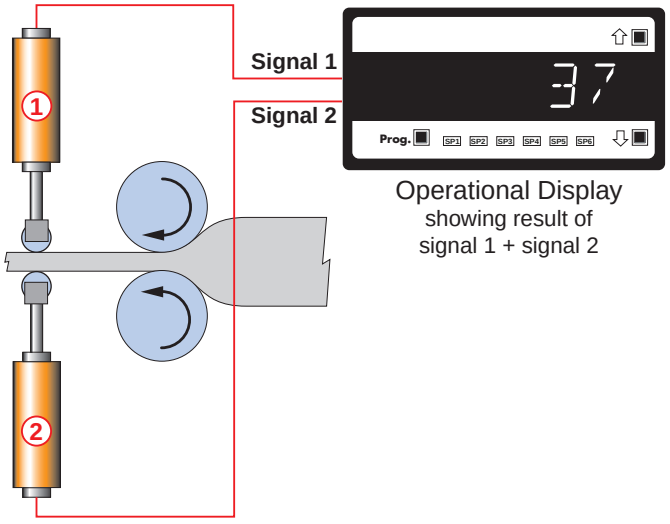


THICKNESS MONITORING

Measured using two opposed LVDT sensors (1 + 2)

Signal 1 plus Signal 2 = Displayed Result

Note:
Select [rESLt] as the data source for the display in Code 1 of the main programming mode.



Note: **The ISL1 / ISL2 dual LVDT smart input module is the standard input module for Texmate's LVDT200 dual input LVDT controller, but can be used in any Tiger 320 Series controller.**

Customer Configuration Settings:

	1st Digit	2nd Digit	3rd Digit
SMt 1			
SMt2			

		1st Digit	2nd Digit	3rd Digit
CH1	Cod_2		7	
CH2	Cod_4	0		0
CH3	Cod_5		7	
CH4	Cod_6		7	

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