Demod-DIGITAL

Displacement Signal Conditioner

LORD Sensing Linear Variable Differential Transducer (LVDT) systems enable precise micro-position measurement for a wide variety of applications. From slow, slight movements over time to high frequency vibration, the LVDT system provides accurate, repeatable measurement.

Within this system, LORD Sensing Demod signal conditioners provide a precision excitation source for the LVDT as well as filtering and buffering of the output signal. The Demod-DIGITAL uniquely stores specific calibration values in an internal lookup table and provides a highly accurate displacement output on both digital serial and analog output channels.

Each system includes a sensor, cable, and signal conditioning module calibrated as one unit to ensure accuracy.

NOTE: Designed for use with LORD Sensing DVRT sensors. With a Demod-DIGITAL purchase, current LORD Sensing customers may return sensors for calibration free of charge.

Item	Description	Qty.
A	Demod-DIGITAL Signal Conditioner	1
B	LEMO Sensor Cable (4-pin to 4-pin mini, 6.5 feet)	1
C	Optional Analog Output Cable (HD-BNC to BNC, 3 feet)	1
D	Power supply with plug adapter kit	1
E	Digital Output Cable (Micro DB9 to DB9) (RS232 / RS 485 Serial)	1
--	Sensor and Calibration Certificate	1

Table 1. Signal Conditioner Components

Indicator	Behavior	Power Status
Power indicator	OFF	Module is powered off
	ON Blinking Blue	Module is powered on and ready to use

Table 2. Interface and Indicators

1. Demod-DIGITAL Connections

Perform the following to establish a connection:

1. Connect a LORD Sensing LVDT (shown in Figure 3) to the 4-pin LEMO sensor cable.
2. Align the 4-pin LEMO sensing connector to the M8 port on the Demod-DIGITAL and attach by hand.
3. Connect the 12V power source with Wall Adapter to the Demod-DIGITAL barrel jack.

NOTE: To ensure system stabilization and measurement accuracy, allow the devices to warm-up for five minutes after power-up before taking measurements.

To access the output, the Demod-DIGITAL can be connected to a digital system, analog system, or both.

Digital - Use a flat-head screwdriver to attach the Micro DB9 connector to the Demod-DIGITAL. Connect the DB9 Serial port to a computer or tablet (may require a USB adapter).

Analog - Connect the optional analog cable to the Demod-DIGITAL mini-BNC, and the BNC connector to the customer supplied Data Acquisition System.

Figure 1. System Connections (refer to Table 1 for definitions)

2. Demod-DIGITAL Tare Button Behavior

The Tare button on the Demod-DIGITAL is used to enable/disable Tare Mode and select a baud rate. The operating mode, Tare value, and the baud rate is stored in non-volatile memory.

Modes of operation

- Tare Mode - Output is adjusted for the position where the tare was enabled.
- Absolute Mode - Output is not adjusted.

Tare Status Indicate

1. Press and release the Tare button. The Tare status is indicated by:
   - Solid Green LED - Tare Mode enabled (Absolute Mode is disabled)
   - Solid Red LED - Absolute Mode enabled (Tare Mode is disabled)

Tare Mode Toggle

1. Press and hold the Tare button.

   a. Wait for solid blue, then blinking blue, then release the Tare button.

2. A press and release toggles the current Tare mode.

   a. If the node is in Absolute Mode, the Tare value locks in and the mode changes to Tare Mode.

   b. If the node is in Tare Mode, the mode changes to Absolute Mode.

   c. The mode is set and indicated after the button is released.

   d. After the indication, the status LED returns to the previous behavior.

3. To cancel the Tare setting press and hold the Tare button until the solid blue indicator illuminates.

Baud Rate Select

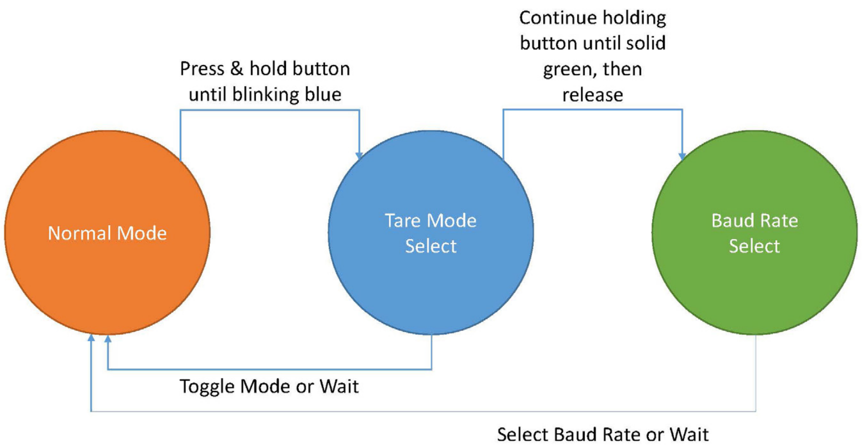
1. Press and hold the Tare button. Wait for the solid blue indicator, then the blinking blue, then the solid green (approximately 10s), then release.

2. The green indicator flashes at a speed relative to the six supported baud rate settings:

a. 9600	**b. 19200**
c. 115200 (Default)	**d. 230400**
e. 460800	**f. 921600**

3. Each press and release of the Tare button cycles to the next baud rate setting. The sequence always begins at 9600. Cycle through the baud rates as many times as desired.

4. Select the appropriate baud rate, then press and hold the Tare button until the solid green indicator illuminates. Release the button. A blue-green indicator verifies the baud rate has been set.



3. Output with SensorConnect

LORD's SensorConnect Software is the easiest method to directly access a displacement output in millimeters. Use the following procedure to acquire and use SensorConnect.

Download and install SensorConnect from the LORD MicroStrain website: https://www.microstrain.com/software/sensorconnect.

To Manually add the Demod-DIGITAL perform the following:

1. Find the COM PORT (Device Manager)
2. Add Device in Lower Left Corner
3. Change to Serial Connection
4. Enter COM Port # and Baud Rate of 115200

Use the Devices Tab to Start or Resume Sampling. Use the Data Tab to add a Widget and select the device.

4. Sensor Types

There are many sizes of sensors available and mounting options for each. The two basic types of LORD LVDT displacement sensors are contacting and non-contacting (Figure 2 and 3). Contact sensors have a sliding core that moves in and out of the sensor body. These are available as a non-Gauging type with a free floating removable core and no contact ball on the tip. The Gauging option has a captive spring loaded core with a ball contact tip. Non-Contact (NC) sensors do not have a core, and sense the distance to a metallic target. NC sensors work with ferrous and non-ferrous conductive target material.

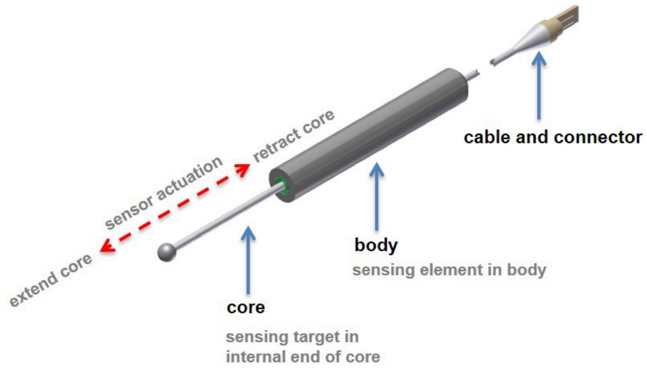


Figure 2. Contact-type Sensor Actuation

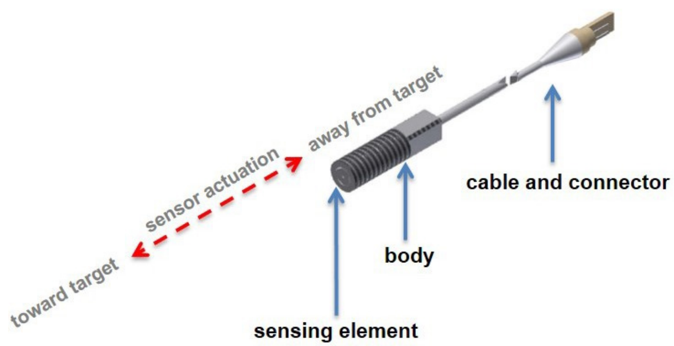


Figure 3. Non-Contact Sensor Actuation

5. Test the System

Once the signal conditioner is plugged in, the system is operating. The measurement device will display the current output based on the position of the sensor core within the sensor body (for contact-type sensors) or distance to the sensing target (non-contact sensors) and will change as the sensing element is actuated. Actuate the sensor and verify the analog output voltage changes.

6. Determine the Sensor Position Range for Installation

Contact-type sensors

Slowly actuate the core (or the target material for Non-Contact sensors) towards the sensor, reaching the following values in order.

This test should be run over the specified stroke length, for example moving an HSG-6, 6mm should change the output from -4.5V to +4.5V, or from -3.00mm to +3.00mm

Install the sensor body and core fixturing so that the position range is maximized within the calibration range but not directly on the endpoints. The certificate of calibration for each system shows the actual endpoint voltages, which will vary from nominal.

Description	Digital	Example	Analog
Core Inserted	Less than ½ * Negative Stroke Length	-3.21 mm	0.0V
Start of Linear Range	½ Negative Stroke Length	-3.00 mm	+0.5V*
Midpoint of Linear Range	Zero	0.00 mm	+5.0V
End of Linear Range	½ Positive Stroke Length	+3.00 mm	+9.5V*

Table 3. Linear Range Setpoints

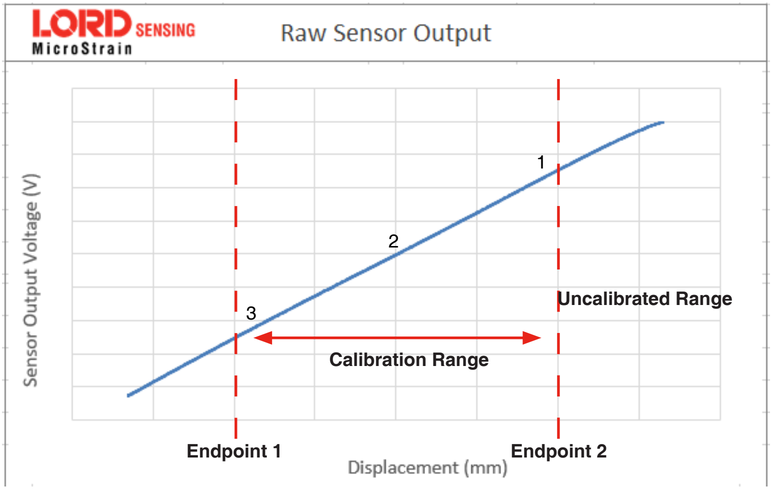


Figure 4. Example Contact-type Sensor Range and Zero Position

The zero position is the customer determined reference position from which the LVDT will sense changes in position.

1. For applications in which the core will only be extending from the zero position, mount the zero position near the maximum end of the linear range (just less than actual endpoint voltages, nominally +½ Stroke Length mm; +9.5 V).
2. For applications in which the core will be both extending and retracting, mount the home position near the center of the linear range (nominally 0 mm; 5.0 Volts).
3. For applications in which the core will only be retracting from the home position, mount the home position near the minimum end of the linear range (just greater than the actual endpoint voltages, nominally -½ Stroke Length mm; +0.5V).

After the home position has been determined, build sufficient fixturing using a polymer or 300 series stainless steel, to maintain a valid calibration. For additional support, contact a LORD Sensing support engineer.

NOTE: For the calibration to remain valid during operation for contact type sensors, the fixture material must be a non-magnetic material. For non-contact type sensors, the fixture material must be non-magnetic and non-conductive.

Non-contact sensors

Observe the output voltage as the sensor is actuated. Start with the sensor body directly coupled to the external sensing target, and move it away slowly. Depending on the type of sensing material used, the initial voltage may be at either the minimum or maximum end of the output range. Find both ends.

Mount the sensor so the travel to the target is fully within the sensing range but not directly on the endpoints. The calibration sheet for each system shows the actual endpoint voltages, which will vary from the nominal.

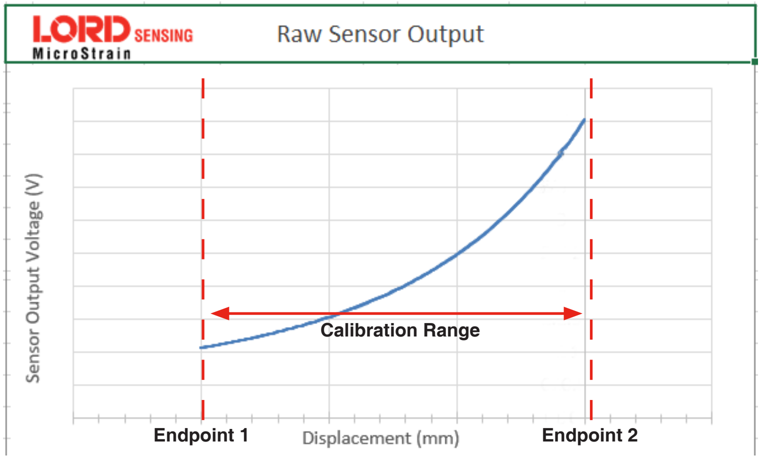


Figure 5. Non-contact Sensor Output Range

NOTE: The sensing target for non-contact sensors must be metallic. For accurate measurements ensure there is not other metal, such as sensor mounting hardware, that could cause sensing interference. The target material must be known at the time of factory calibration in order to apply the appropriate model and may require a material sample in sensitive applications.

7. Scale Volts to Displacement

The Demod-DIGITAL stores specific calibration values in an internal lookup table and provides a highly accurate displacement output on both digital serial and analog output channels. Digital position is output in engineering units as shown in Table 4.

The analog output linear fit converts the filtered digital output into analog voltage (Table 4).

Use the Analog Output formula to calculate the installation offset in mm.

The calibration values are specific to each system and are provided in the calibration reports.

8. Calibration Formulas

Displacement Da = Dm – O	**Dm** = measured displacement (mm)
	Da = actual displacement (mm)
	O = installation offset (mm)
Least squares linear fit Dm = mx + b	**x** = sensor output voltage (V)
	m = slope (mm/V)*
	b = calibration offset *

*values from the calibration report

Table 4. Calibration Formulas

Support

Sales Support

Products can be ordered directly from the LORD Sensing website by navigating to the product page and using the Buy feature.

http://www.microstrain.com/displacement

For further assistance, our sales team is available to help with product selection, ordering options, and questions.

sensing_sales@LORD.com

Phone: 802-862-6629

9:00 AM to 5:00 PM (Eastern Time US & Canada)

Technical Support

There are many resources for product support found on the LORD Sensing website including technical notes, FAQs, and product manuals.

https://www.microstrain.com/contact-support

For further assistance our technical support engineers are available to help with technical and applications questions.

sensing_support@LORD.com

Phone: 802-862-6629

Live Chat is available from the website during business hours:8:00 AM to 4:30 PM (Eastern Time US & Canada)

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