

LVDT SIGNAL CONDITIONING

LVDT Measurement Principle

The LVDT, Linear Variable Differential Transformer is a well established transducer design allowing linear displacements from less than a millimetre to over one metre to be converted into a range of electrical outputs to match different controllers and measuring systems. The outputs are linear and highly reproducible providing accurate position measurement and feedback control signals on a wide range of production machinery and test equipment.

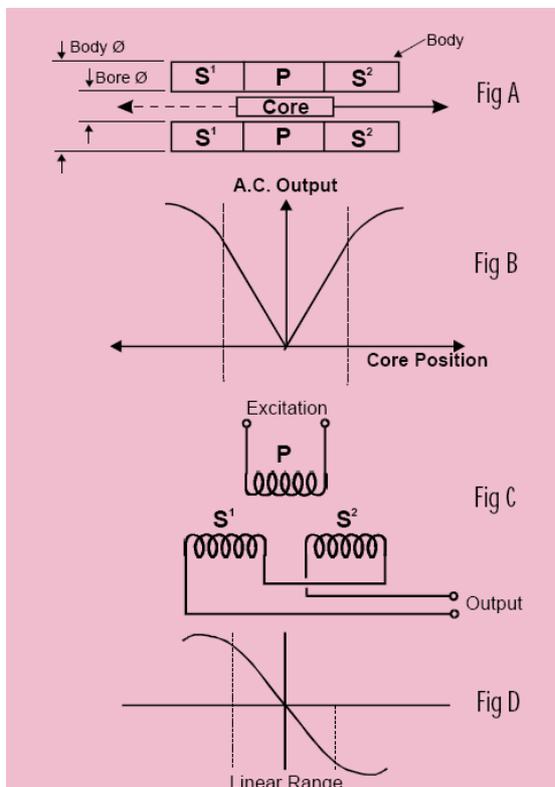
The design consists of a cylindrical array of primary and secondary windings with a separate cylindrical core which passes through the centre.

Movement of the core from this point in either direction causes the signal to increase (Fig C). As the windings are wound in a particular, precise manner the signal output has a linear relationship with the actual mechanical movement of the core.

The secondary output signal is then processed by a phase-sensitive demodulator which is switched at the same frequency as the primary energising supply. This results in a final output which can be rectified and filtered to give DC voltage or 4-20mA current proportional to the core movement and also indicates its direction, positive or negative from the central zero point (Fig D).

The distinct advantage of using an LVDT displacement transducer is that the moving core does not make contact with other electrical components of the assembly and so offers high reliability and long life. Further, the core can be so aligned that an air gap exists around it, ideal for applications where minimum mechanical friction is required.

The LVDT design lends itself for easy modification to fulfill a whole range of different applications in both research and industry. Some typical variations include :- Complete sealing for part or full submersion in liquids and gases, Heavy construction for tough industrial areas, Miniature and low cost models for price-conscious OEM usage, Refer to Monitran's LVDT datasheets for the details of the mechanical design.



The primary windings (P) are energised with a constant amplitude A.C. supply at a frequency of 1 to 10 kHz. This produces an alternating magnetic field in the centre of the transducer which induces a signal into the secondary windings (S¹ & S²) depending on the position of the core.

Movement of the core within this area causes the secondary signal to change (Fig B). As the two secondary windings are positioned and connected in a set arrangement (push-pull mode), when the core is positioned at the centre, a zero signal is derived.

Output Options

AC Option

This is the basic output for operation with the user's own controller.

Input Voltage	5 Vrms @ 3kHz (others available)
Sensitivity	50mV/V/full range output to 460mV/V/full range output Dependent on stroke
Non-Linearity	0.5% or better
Repeatability	Better than 0.1%
Resolution	(Dependent on measuring instrument)
Frequency Response:	3dB @ 180Hz (Dependent on conditioning unit)
Operation Temperature Range:	Normal -30°C to +85°C Extended -30°C to +150°C
Vibration Resistance:	20g up to 2kHz
Shock Resistance	1000g for 10 milliseconds
Output	6 wire (4 wire-Option)

Signal Conditioners

The following signal conditioners can be supplied either built in to the LVDT body in Economy and Industrial Series or externally in an in-line, low cost plastic enclosure or rugged industrial housing for miniature types or where operating conditions or space do not allow internal fitting.

Current Output Option – 4-20mA

Supply	14-24 Volts DC, 40-50mA max
Output	4-20mA, 4mA fully out, 20mA fully in,
Null	12mA at zero set to within 0.5%
Non-Linearity	Better than 0.5%
Temperature Range	-20°C to 95°C
Output Ripple	0.1% at 20mA

Voltage Output Option – Unipolar

Supply	9-24 Volts, governs output. Regulated internally
Current	25mA nominal at 15 Volts input.
Non Linearity	0.5% of full range, higher specification can be achieved at extra cost.
Output Voltage	0-5v dc @ 9-24v dc supply (5V fully in) OR 0-10v dc @ 14-24v dc supply (10V fully in)
Output Ripple	30mV (maximum)
Output Bandwidth	300 Hz
Temperature Coefficients	
Zero	0.01% FS/°C
Span	0.03% FS/°C
Temperature Range	-50°C to + 85°C
Output Impedance	20K Ohms

Voltage Output Option – Bipolar

Supply	12V Supply = +/- 2.5V output 24V Supply = +/-5V output
Polarity	+2.5V when fully in, -2.5V when fully out at 12V supply +5V when fully in, -5V when fully out at 24V supply
Current	35mA nominal at 12 Volts input.
Non Linearity:	0.5% of full range
Output Ripple	30mV (maximum)
Output Bandwidth	300 Hz
Temperature Coefficients	
Zero	0.01% FS/°C
Span	0.03% FS/°C
Temperature Range	-50°C to +85°C



External signal conditioner in robust industrial enclosure with IP66 ingress protection



Spring loaded ±1mm Miniature Series LVDT with external in-line signal conditioner