Series 953

GEMCO®

INSTALLATION MANUAL

LINEAR DISPLACEMENT TRANSDUCERS

953A VMAX™

Linear Displacement Transducer

ABSOLUTE PROCESS CONTROL
KNOW WHERE YOU ARE... REGARDLESS

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Contents

NOTE: Ametek has checked the accuracy of this manual at the time it was approved for printing. This manual may not provide all possible ways of installing and maintaining the LDT. Any errors or additional possibilities to the installation and maintenance of the LDT will be added in subsequent editions. Comments for the improvement of this manual are welcome.

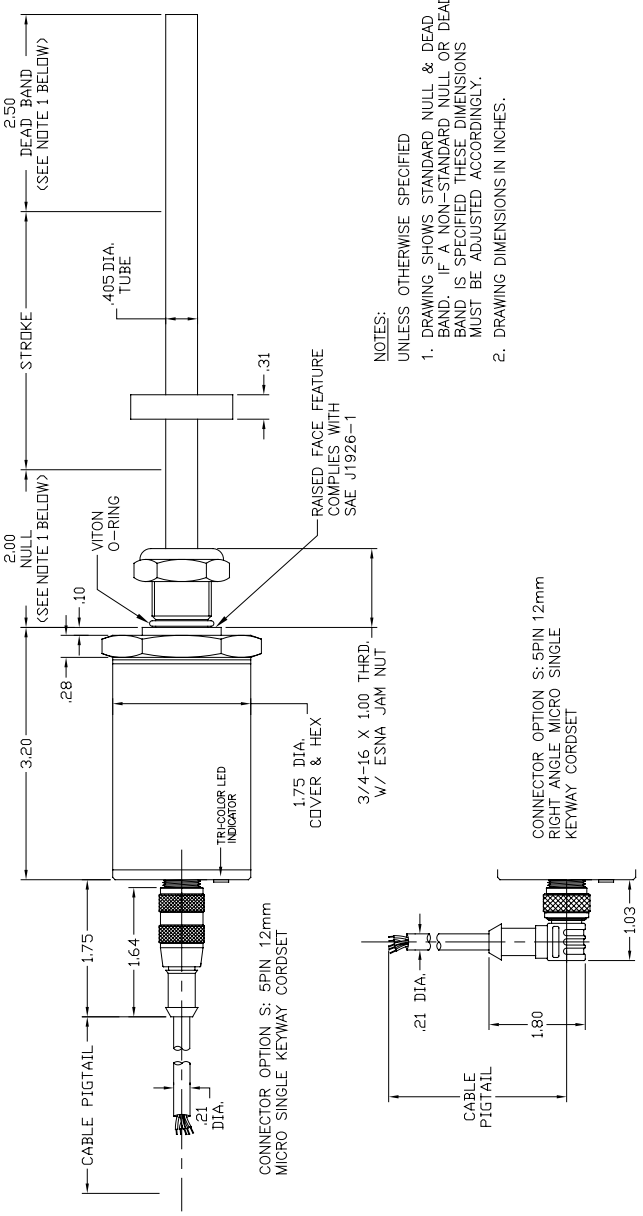

Figure 1-1 953 Dimension Drawing

Chapter 1: 953 Overview

The Gemco 953 VMAX is a Magnetostrictive Linear Displacement Transducer (LDT) for continuous machine positioning in a variety of industrial applications. Each LDT provides highly accurate position sensing.

This sensor is built to withstand the most severe environmental conditions and is completely absolute. Power loss will not cause the unit to lose position information or require re-zeroing. Also, the non-contact design allows this device to be used in highly repetitive applications without mechanical wear.

NOTE: The part number on the LDT is a record of the characteristics that make up your specific unit. For a translation of the part number, see Appendix B.

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Chapter 2: Installing the LDT

If a mounting bracket or other part is used that is made of ferromagnetic material (a material readily magnetized), it should be placed no closer than 0.25" from the LDT's rod end to minimize the effects of magnetic flux distortion. This can cause an inaccurate measurement of the magnet position.

Non-ferrous materials, such as brass, copper, aluminum, non-magnetic stainless steel, or plastics, can be in direct contact with the magnet assembly and rod end without producing any adverse results.

2.1: Installing the LDT to a Mounting Bracket

Parts discussed in this section can be found in Chapter 1, Figure 1-1.

1. Unscrew the LDT's jam nut from the threads protruding from the hex mounting base.
2. Insert the LDT's rod end into the mounting bracket's hole. The mounting bracket may contain a 3/4-16 UNF-2B threaded hole. In this case, screw the LDT into this hole using the threads protruding from the hex mounting base.
3. Once the LDT is in place, screw the jam nut back onto the threads of the hex mounting base. Use the 1.75" hex mounting base on the head assembly to tighten the LDT to the bracket.

WARNING: Do not use the blue aluminum cover of the head assembly to tighten the LDT within the bracket (see Figure 2-1). This may damage the LDT and will void your warranty. To tighten the LDT within the bracket, use the 1.75" hex mounting base on the head assembly.

If the length of the LDT's rod end is less than 30", skip to the sub-section: Mounting the Magnet Assembly.

Installing Support Brackets

It is recommended that a support bracket be used with LDTs having a rod 30"-71" in length. Supporting the end of the rod will minimize operational errors and protect against damage due to shock and vibration. If the length of the LDT's rod is 72" or longer, it is recommended that additional support brackets be used. These additional support brackets must be made of a non-ferrous material. Because these additional support brackets will interfere with the magnet's movement, a special split-type magnet assembly must be used. To order a split magnet (part number SD0411200) and support brackets (part number SD0411100), contact the factory.

To install a support bracket for an LDT having a rod 30"-71" in length, perform step 4a. If the rod is longer than 71", perform step 4b.

4a. If the support bracket is made of a ferromagnetic material (material readily magnetized), install the support bracket no closer than 0.25" from where the LDT's dead band ends and the area of stroke begins. Continue to the sub-section: Mounting the Magnet Assembly.

To install two or more support brackets for a LDT having a rod 72" or longer in length, perform the following steps:

4b. Install support brackets at increments of 48" throughout the LDT's rod. Support brackets placed within the null zone and area of stroke or closer than 0.25" to the beginning of these areas must be made of a non-ferrous material.

Mounting the Magnet Assembly

Before mounting the magnet assembly, the following should be considered:

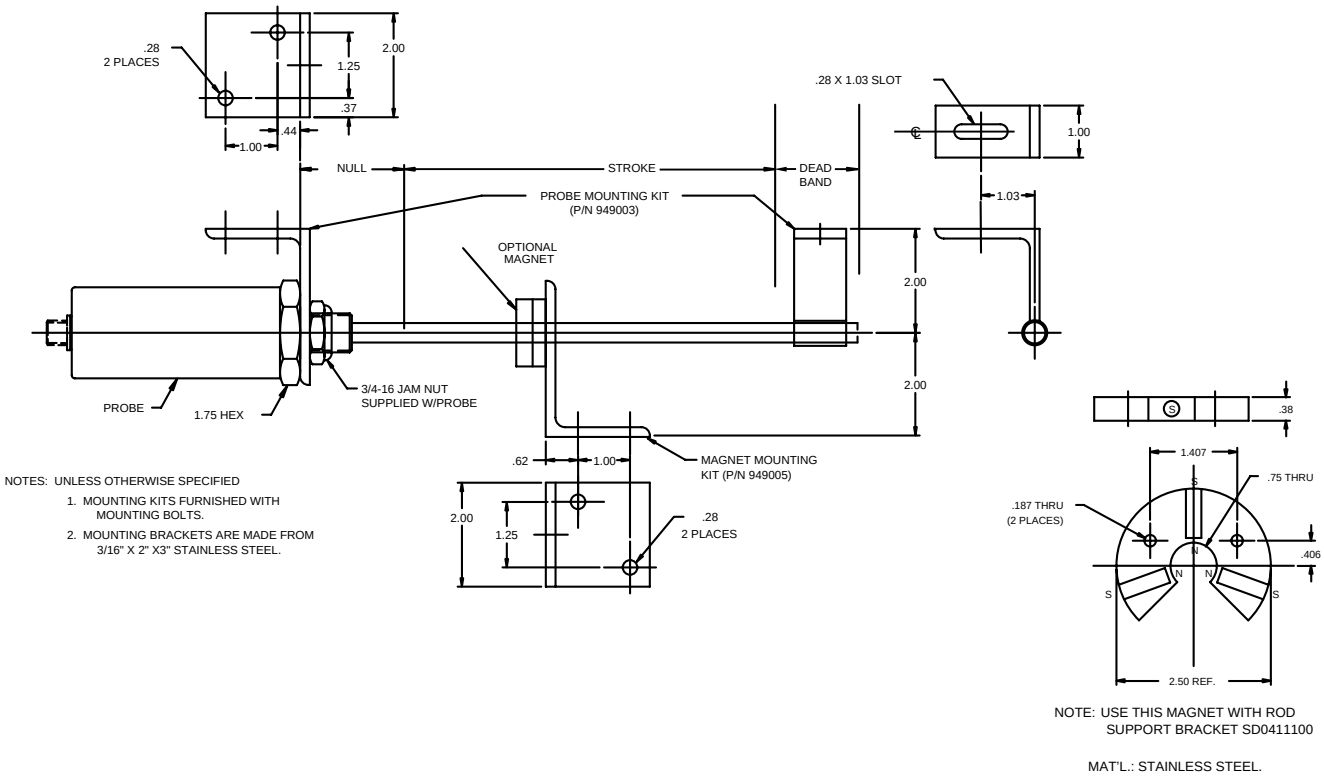

Figure 2-1: Mounting the LDT

- Ferromagnetic material should not be placed closer than 0.25” from the LDT’s magnet assembly or rod end. Failure to do so could cause erratic operations.

- Minimal clearance between the LDT’s rod and the magnet assembly through the full stroke is required. Stress between the magnet and the rod can cause flexing of the mounting brackets. This may result in non-linearity.

- LDTs using a split magnet assembly must keep the diameter of the magnet assembly around the rod throughout the complete stroke. The diameter of this magnet assembly should not be more than 0.2” away from the rod. Split magnet assemblies outside of this range will cause signal loss.

To install the magnet assembly, perform the following steps:

1. Slide the magnet assembly over the LDT rod.
2. Mount the magnet to the non-ferrous, movable portion of the device being controlled using non-ferrous screws.

2.2: Installing the LDT in a Hydraulic Cylinder

Before installing an LDT in a hydraulic cylinder, note the following considerations. Items discussed in this section are found in Figures 1-1 and 2-1.

- A non-ferrous spacer must be used to separate the magnet assembly from the head of the piston rod. See Figure 2-2.

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- The magnet should not be closer than 2.0” from the base of the LDT’s hex head when the piston rod is fully retracted. In instances where space restraints exist, it may be required to countersink the magnet into the piston rod. Two magnets are available for mounting to the piston: the standard 1.29" in diameter (part number SD0400800) four-hole magnet and the 1.0" magnet (part number SD0410300) designed exclusively for countersunk mounting applications. The 1.0" magnet must be secured with a snap ring.

- An O-ring groove is provided at the base of the LDT’s mounting hex for pressure sealing. The O-ring seal was designed to meet Mil-Std-MS33656. Refer to SAE J514 or SAE J1926/1 for machining of mating surfaces.

- A chamfered rod bushing in front of the magnet may be required. It is recommended that a chamfered rod bushing be used with LDTs having a rod 60.0” or longer. This bushing will prevent wear on the magnet assembly (wear occurs as the piston retracts from extended lengths). This rod bushing should be manufactured from a high wear polymer, such as Teflon®.

- It is recommended the bore for the cylinder piston rod have an inside diameter of at least 0.50”. The LDT rod has an outside diameter of 0.405”. Use standard practices for machining and mounting these components. Consult the cylinder manufacturer for details on applicable SAE or military specifications.

It may be necessary to perform machining and mounting operations on the hydraulic cylinder before installing the LDT. Consult the information and specifications provided by the cylinder manufacturer before beginning the following steps:

1. Unscrew the LDT’s jam nut from the threads protruding from the hex mounting base.
2. Position the non-ferrous spacer against the piston face, followed by the magnet, and then the chamfered rod bushing if the LDT’s rod is 60.0” or longer in length.
3. Insert non-ferrous screws through the chamfered rod bushing (if used), magnet, and non-ferrous spacer. Secure items by tightening screws.

   If the leading edge of the magnet will come closer than 2.0” from the base of the LDT’s hex head when the piston rod is fully retracted, it will be necessary to counterbore the magnet assembly into the piston rod. Both the standard 1.29” four-hole magnet assembly (part number SD0400800) and the 1.0” magnet assembly (part number SD0410300) are designed for counterbored mounting applications. If it has a 1.0” magnet assembly, a snap ring will be needed to hold it in place.

4. Insert the LDT’s rod into the hole of the hydraulic cylinder’s mounting bracket.

   The protective Plug may need to be removed from the hydraulic cylinder before inserting the LDT. The end cap should contain a 3/4-16 UNF-2B threaded hole. Screw the LDT into this hole using the threads protruding from the LDT’s hex mounting base.

WARNING: Do not use the blue aluminum cover of the head assembly to tighten the LDT within the bracket (see Figure 2-1). This may damage the LDT and will void your warranty. To tighten the LDT within the bracket, use the 1.75" hex mounting base on the head assembly.

With the LDT properly installed inside the hydraulic cylinder, it may be necessary to assemble parts of the hydraulic cylinder. For assistance in this task, refer to the information provided by the cylinder manufacturer.

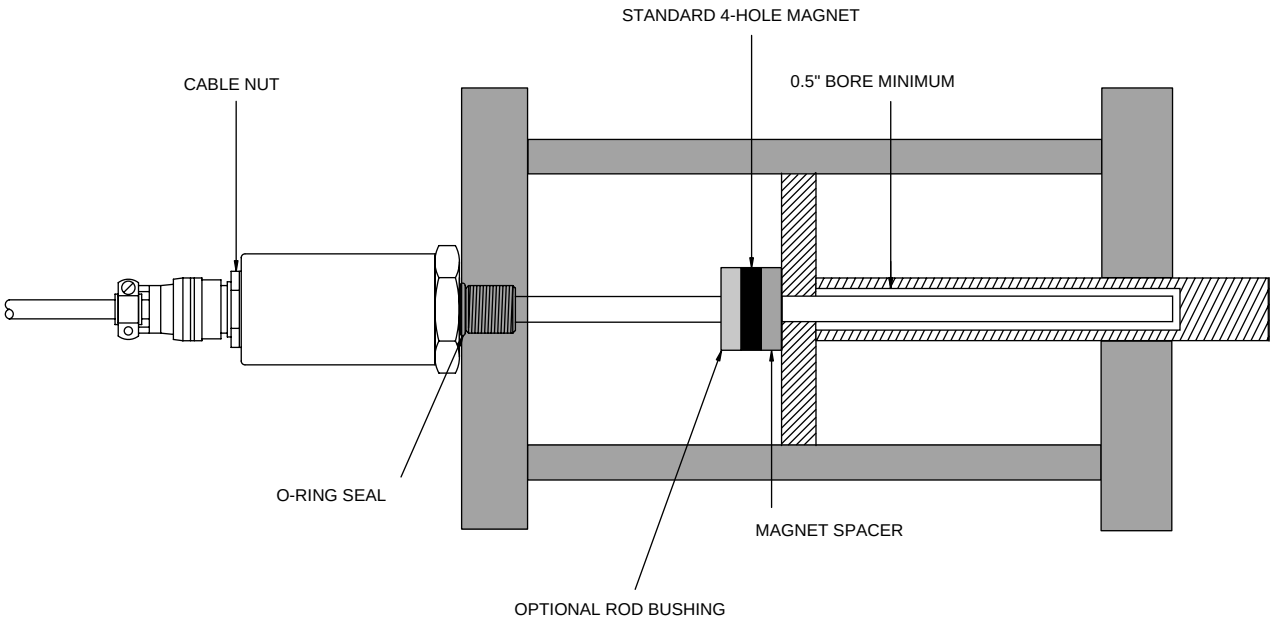

Figure 2-2: Mounting LDT in a Hydraulic Cylinder

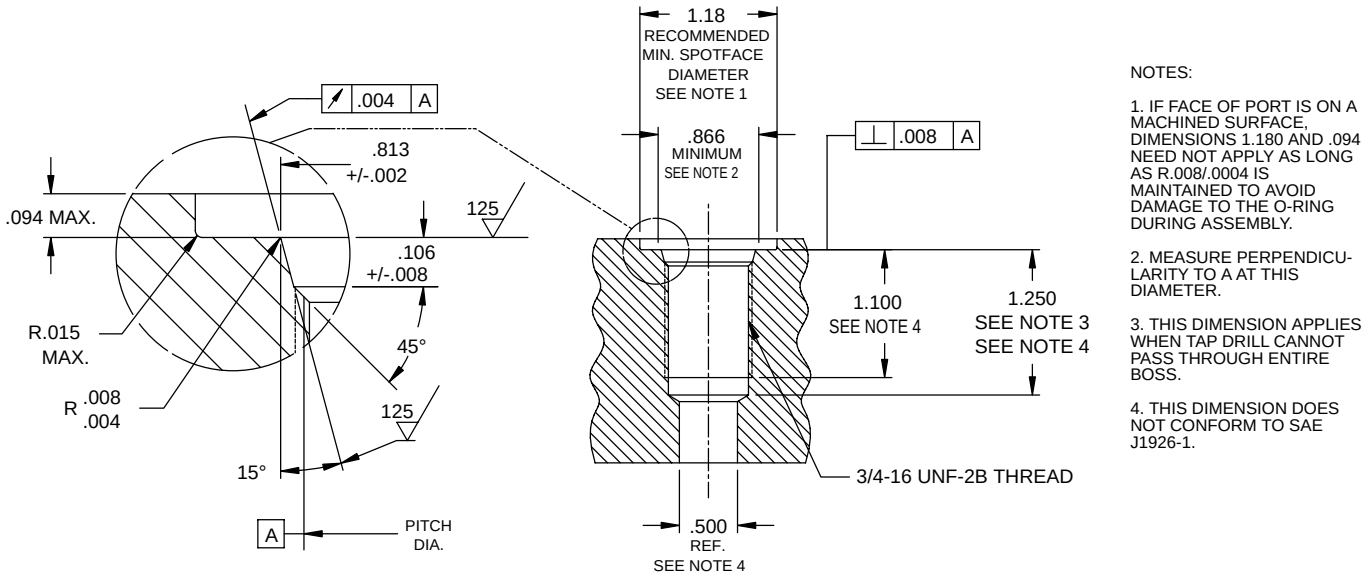

Figure 2-3: Port Detail (SAE J1926/1)

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Chapter 3: Wiring

Once the LDT has been installed, wiring connections can be made. There are two groups of connections that will need to be made. They are as follows:

- Power Supply Connections (including grounding and shielding)
- LDT Input/Output Connections

Power Supply/Ground Connections

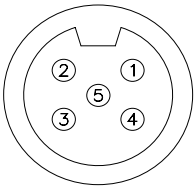
The 953 VMAX LDT uses an industry standard 5 pin 12mm Euro style cordset with a shield. To reduce electrical noise, the shield must be properly used. Connect the cable's shield to the controller system GND. The cable shield is NOT connected at the transducer rod. Always observe proper grounding techniques such as single point grounding and isolating high voltage (i.e. 120/240 VAC) from low voltage (7 - 30 VDC cables).

WARNING: Do not use molded cordsets with LEDs!

It is preferable that the cable between the LDT and the interface device be one continuous run. If you are using a junction box, it is highly recommended that the splice junction box be free of AC and/or DC transient-producing lines. The shield should be carried through the splice and terminated at the interface device end.

NOTE: When grounding the LDT, a single earth ground should be connected to the power supply common (circuit ground). The LDT power supply common (Pin 3) should be connected to the power supply common (-) terminal. Pin 1 should be connected to the power supply positive terminal (+). The LDT cable shield should be tied to earth ground at the power supply. The LDT analog common should not be connected to earth ground and should be used for connection to interface devices only. For assistance, refer to your LDT's wiring drawing in this chapter.

Wiring



LDT Connector View

Pin #	Wire Color	Function
1	Brown	Customer Supplied Power (+VDC)
2	White	Program Input
3	Blue	Power Supply Common
4	Black	Position Output
5	Gray	Position Common

WARNING: Do not route the VMAX cable near high voltage sources.

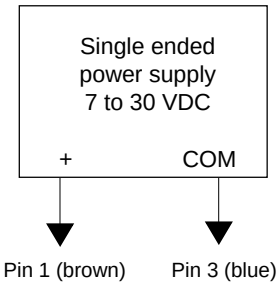


Figure 3-1: Power Supply Wiring

Wiring

In order for the 953 VMAX to operate properly, the LDT's external power supply must provide a voltage between 7 to 30 VDC. The power supply must be rated at one watt minimum. The power supply should provide less than 1% ripple with 10% regulation.

The power supply should be dedicated to the LDT to prevent noise and external loads from affecting the 953 VMAX. When powering up more than one 953 VMAX on a single power supply, each 953 VMAX will draw no more than one watt.

3.1: V0/V1 (Voltage)

The LDT generates a voltage output based on position. The 953 VMAX offers 16 Bits of resolution and is fully programmable over the entire active stroke length. Keep in mind that there is a 2" Null Zone at the connector end of the LDT and a 2.5" Dead Band at the other end of the LDT that the magnet must stay out of at all times. The units come fully programmed from the factory and do not require re-programming unless desired. The units are 100% absolute and will retain programmed parameters on power loss.

The analog output is referenced to the analog common terminal and should not be referenced to any of the other common terminals. For wiring, see Figure 3-2. For programming Zero and Span, See Section 3.3.

3.2: C4/C2 (Current)

The LDT generates a current output based on position. The 953 VMAX offers 16 Bits of resolution and is fully programmable over the entire active stroke length of the LDT. Keep in mind that there is a 2” Null Zone at the connector end of the LDT and a 2.5” Dead Band at the other end of the LDT that the magnet must stay out of at all times. The units come fully programmed from the factory and do not require re-programming on power loss.

The analog output is referenced to the analog common terminal and should not be referenced to any of the other common terminals. To wire, see Figure 3-2. For programming Zero and Span, refer to Section 3.3.

NOTE: Current sourcing allows the current to flow from the LDT into the user’s equipment.

3.3: Setting Zero & Span Position

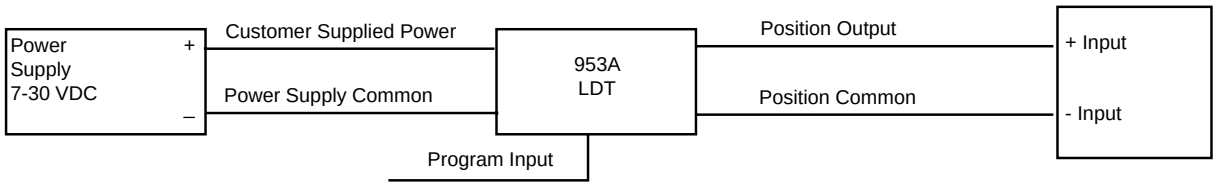
The units come fully programmed from the factory and do not require re-programming unless desired. The units are 100% absolute and will not lose programmed parameters on power loss.

To set the Zero and Span position for the LDT follow these steps:

1. Apply power to the LDT.
2. Place magnet assembly where Zero is to be located, but within the active region of the probe.
3. Momentarily short the program input pin to the power supply common.
4. Place magnet assembly where Span is to be located, but within the active region of the probe.
5. Momentarily short the program input pin to the power supply + pin (the maximum distance must be within the active stroke range).

This completes the programming process.

Differential Input



Single Ended Input

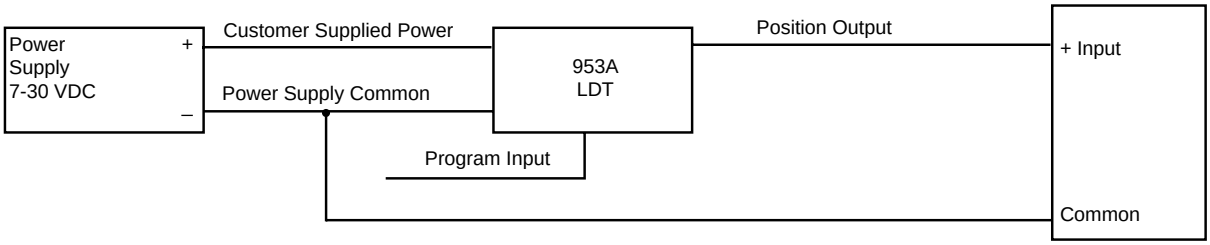


Figure 3-2: Current Sourcing

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Appendix A: Troubleshooting

If a problem exists after reading this section, please contact our technical support department. Troubleshooting is divided into the following two groups:

- General Checks
- Power Supply Checks

General Checks

Make sure that the magnet is located within the LDT's active stroke area. Keep in mind that the LDT is programmable over the entire active stroke area. Captive magnet assemblies should be positioned so that they can move freely over the entire area of the active stroke without binding or pushing on the rod end. Non-captive magnet assemblies should be situated so that the magnet is no farther than 0.2" from the rod at any point in the magnet assembly's movement.

NOTE: Ferromagnetic material (material readily magnetized) should be located no closer than 0.25" from the magnet or LDT rod end. This includes mounting brackets, magnet spacers, magnet brackets, and mounting screws. Ferromagnetic material can distort the magnetic field, causing adverse operation or failure of the LDT.

Check all LDT wires for continuity and/or shorts. It is preferable that the cable between the LDT and the interface device be one continuous run. If you are using a junction box, it is highly recommended that the splice junction box be free of AC and/or DC transient-producing lines. The shield should be carried through the splice and terminated at the interface device end.

Power Supply Check

This section will help you to determine if your power supply is adequate for the LDT to operate properly, or if the LDT's cable has a short or open.

In order for the 953 VMAX to operate properly, the external power supply must provide a level between 7 to 30 VDC. A power supply providing voltage above this specified range may damage the LDT. A power supply providing power below this specifed range will not be sufficient to power the LDT. When powering more than one 953 VMAX on a single power supply, remember that each 953 VMAX requires one watt of power. The amount of current draw will vary based on the input voltage used. To calculate the current draw for a particular LDT, divide the LDT wattage by the input voltage. For example, 1 watt divided by 24 VDC equals 41.6mA.

If the LDT is not operating properly, the LDT's cable may have an open or short, or the power supply is not supplying sufficient power. To verify this:

1. Turn the power supply off.
2. Remove the mating connector from the LDT.
3. Turn the power supply on.
4. Using a digital voltmeter, check across power supply common and customer supplied power (+VDC) on the mating end of the cable for a level between 7 and 30 VDC.

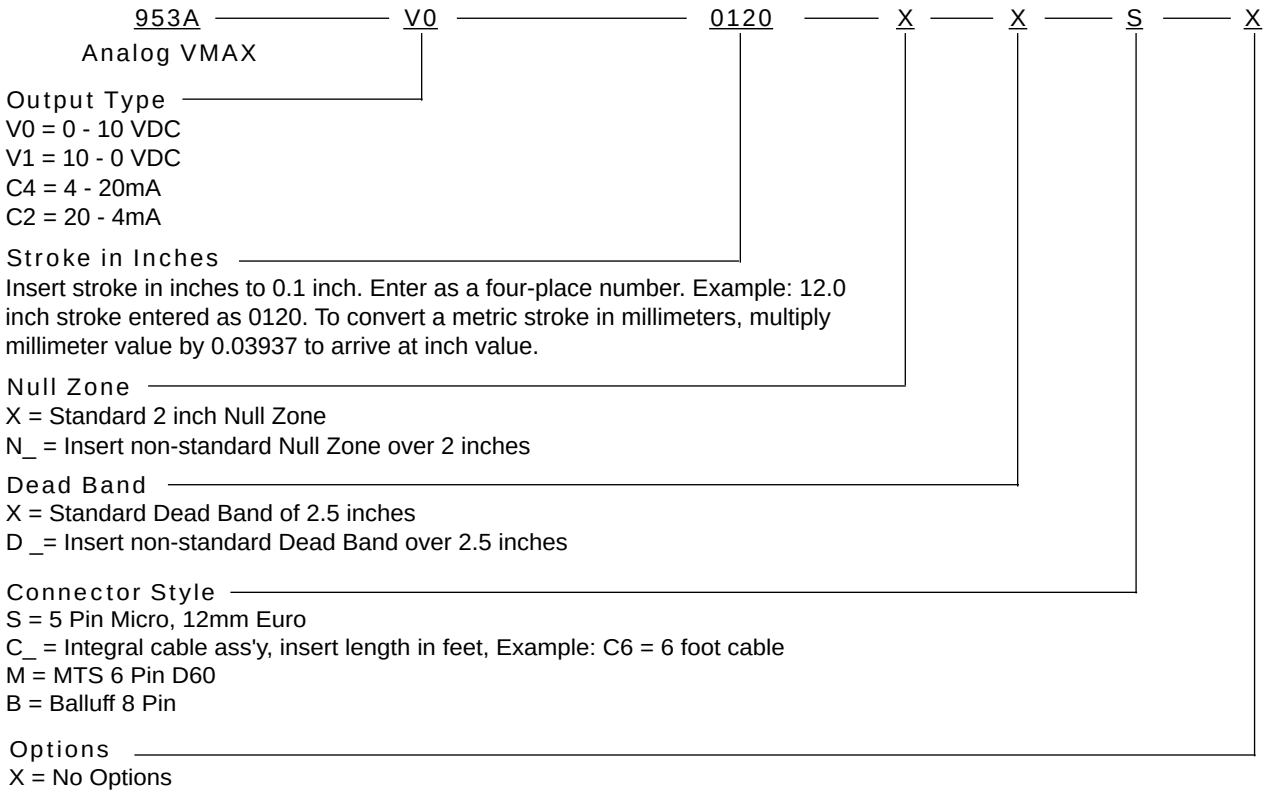
NOTE: LDT's with potted cable assemblies should be checked for proper voltage at the power supply terminals. This cable assembly cannot be removed from the LDT.

If the reading is between 7 and 30 VDC, turn power supply off and go to step 7. If the reading is below 7 VDC, either the power supply is not providing enough power or the LDT's cable possibly has a short or open. A reading of no voltage or minimal voltage (less than 5 volts) may be due to a short or open in the cable. If the reading is not between 7 and 30 VDC, go to step 5. If the reading is above 30 VDC, adjust power supply or replace.

5. Turn the power supply off.
6. Check the continuity of the individual wires of the cable between the power supply and the LDT. Check for continuity from one end of the cable to the other. Also, verify that no shorts exist between pins.
7. Reconnect the mating connector to the LDT.

Appendix B: Part Numbering

Part Numbering



NOTE 1: On unsupported stroke lengths greater than 4 feet, rod support bracket(s) and a special magnet should be used.
NOTE 2: Specify magnet as separate line item. Standard magnet is SD0400800.

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Appendix C: Specifications

General Specifications	
Rod End	316 Stainless Steel, 0.405" (10.29 mm) outer diameter
Mounting Hex	316 Stainless Steel, 1.75" (44.45 mm) across flats, IP68
Mounting Threads	3/4" (19.05 mm) x 16 x 1.00" (25.4 mm) with ESNA jam nut and O-ring seal
Head Assembly	Thick wall aluminum cover with Viton O-ring standard, gasket seal at the base and connector exit, IP68 IEC 600529, stainless steel cover optional
Head Enclosure	3.2" (81.3 mm) long with 1.75" (44.45 mm) diameter
Connector	5 pin 12mm Euro/Micro, consult factory for other options
Displacement	Up to 300"
Dead Band	2.50" (63.5 mm) standard (cannot be less than 2.25")
Null Zone	2.00" (50.8 mm) standard (cannot be less than 1.5")
Zero & Span Adjustability	Factory set at Null Zone & Dead Band locations. Field re-settable at any location within active stroke.
Approvals	CE (EMC)

Electrical Specifications	
Input Voltage	7 to 30 VDC
Current Draw	One watt maximum, 40mA at 24 VDC typical
Linearity	Less than +/- 0.01% or +/-0.003", whichever is greater.
Repeatability	Equal to Resolution
Hysteresis	0.001"
Operating Temperature Head (Electronics) Guide Tube	 -40° to 185° F (-40° to 85° C) -40° to 221° F (-40° to 105° C)
Storage Temperature	-40° to 221° F (-40° to 105° C)
Operating Pressure	3,000 psi constant, 8,000 psi spike
Guide Tube Pressure	5,000 psi constant, 10,000 psi spike
Shock & Vibration Shock Vibration	 1000Gs (lab tested) IEC 60068-2-27 30Gs (lab tested) IEC 60068-2-6
Specifications are subject to change and based on a typical 36" stroke length.	

Analog Specifications	
Analog Output	10ppm/Degree F (18ppm/Degree C)
Analog Output Loading	Voltage output minimum load resistance: 2K ohms Current output: Guaranteed 6mA minimum for voltage units Maximum load resistance: 500 ohms
Analog Ripple	<1 mV maximum (position output)
Update Time	<2mS typical
Resolution Internal Output	 0.00006" 16-Bit
Position Output	0 - 10 VDC, 16 Bits (65,535) resolution 4 - 20mA, 16 Bits (65,535) resolution
Output Type Voltage Current	 0V to 10V, 10V to 0V 4mA to 20mA, 20mA to 4mA

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