

SL Series

Linear Position Sensors

SL0390
SL1200
SL1290
SL1390
SL1400
SL1490



User Manual



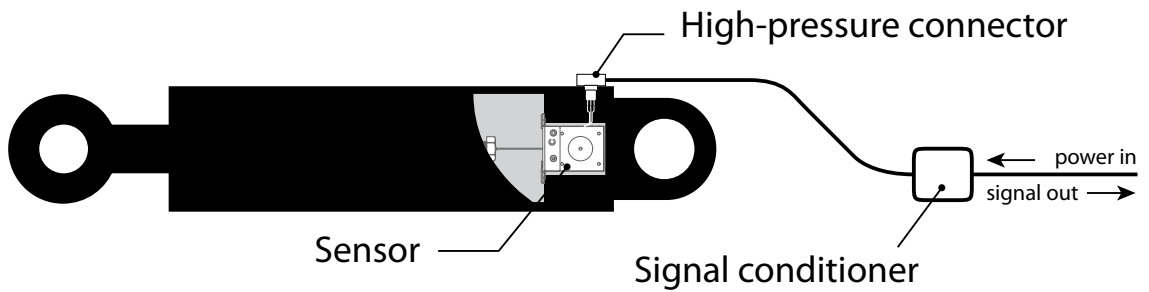
HANDLING PRECAUTIONS

All SL Series Sensors are precision instruments and must be handled accordingly. If the following rules are observed, users and installers will benefit from long-term reliable sensor operation:

- **Avoid manual operation of the sensor;** under no circumstances should the cable be pulled out and released, causing the connector bolt to retract freely.
- **For Piston Accumulator installation:** DO NOT move piston using COMPRESSED GAS.
It is recommended that the oil side be filled first when moving the piston for setup or calibration with the sensor installed.
- If the cable is nicked, kinked, or damaged in any way, the factory warranty is void. In the event of a damaged cable, the sensor can be reworked. A minimum rework charge of \$250 will apply.
- Great care has been taken to strain relieve the very small gauge LVDT signal wires on the basic sensor. Avoid contact with this part of the assembly.
- The basic sensor is completely vented, however when first installed, gradual complete air displacement is recommended. On initial cylinder start-up, move the cylinder slowly to allow complete air evacuation within and around the sensor.

The SL Series System

Internal Mount



External Mount

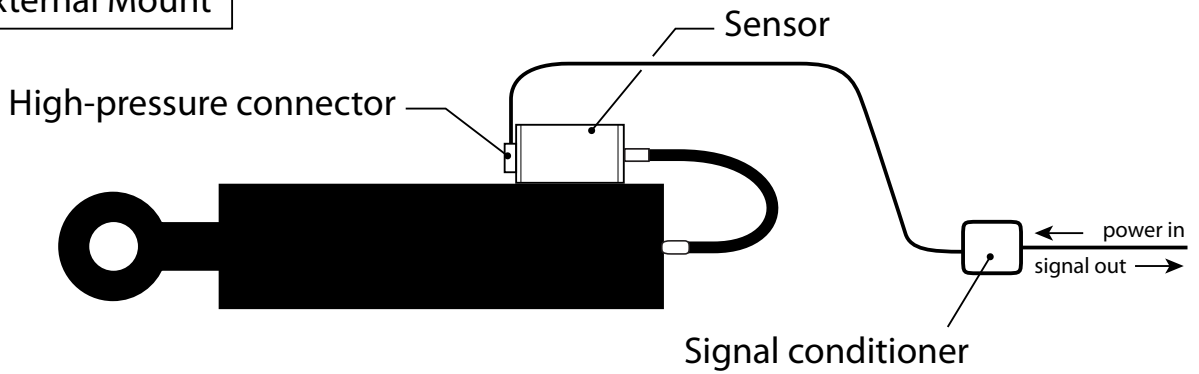


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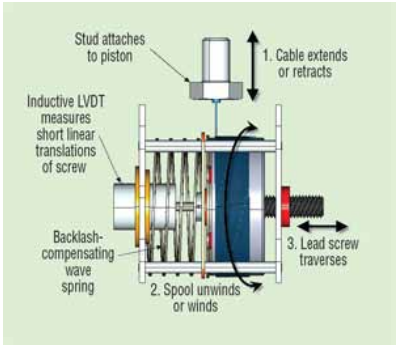
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General Description

SL Series Sensors are linear displacement transducers (LDT) based on a patented linear to rotary to linear mechanism utilizing a linear variable differential transformer (LVDT) as its core sensor. LVDTs are a mature class of sensors, extremely accurate and widely used in hydraulic systems. Also referred to as a draw wire sensor, the hub of the SL's retract mechanism is coupled with the LVDT core which translates axially as the cable pool rotates.

The SL0390, SL1200 and SL1400 are configured for remote installation with hydraulic cylinders and accumulators, minimizing equipment modifications. The wire passes through a conduit made from standard hydraulic hose, which attaches to a standard #8 SAE O-ring port; the cable connector screws into a 7/16-20 blind hole in your piston rod or accumulator piston.

The SL1290, SL1390 and SL1490 provide a flange-mount for installation within hydraulic cylinders and accumulators. Typical cylinder installation embeds the sensor within the end cap. The flange rests on a step within the endcap, and the cable connector screws into a 7/16-20 blind hole in the piston rod or accumulator piston. LVDT signal wire sockets plug into the SC451 high pressure connector or customer supplied high pressure interconnect.



1. Installation Basics

Three Attachment Types

Specially designed connections provide engagement with the piston and allow for free rotation and shock protection. The external connections are tightened by way of a slotted 7/32 hex wrench (provided with sensors)

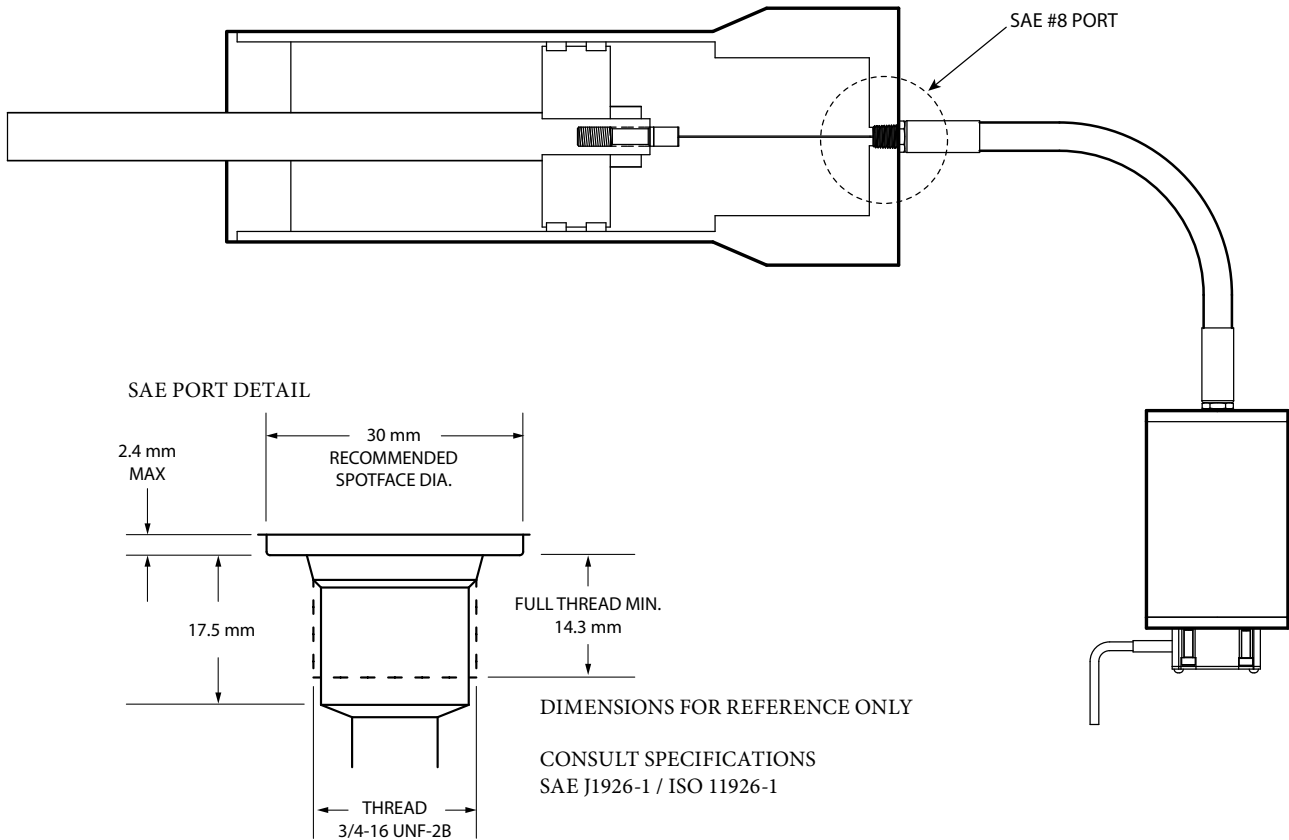


1. Installation Basics (cont'd)

1.1 Port Configurations

1.1.a External Mount Sensors

SL0390 / SL1200 / SL1400



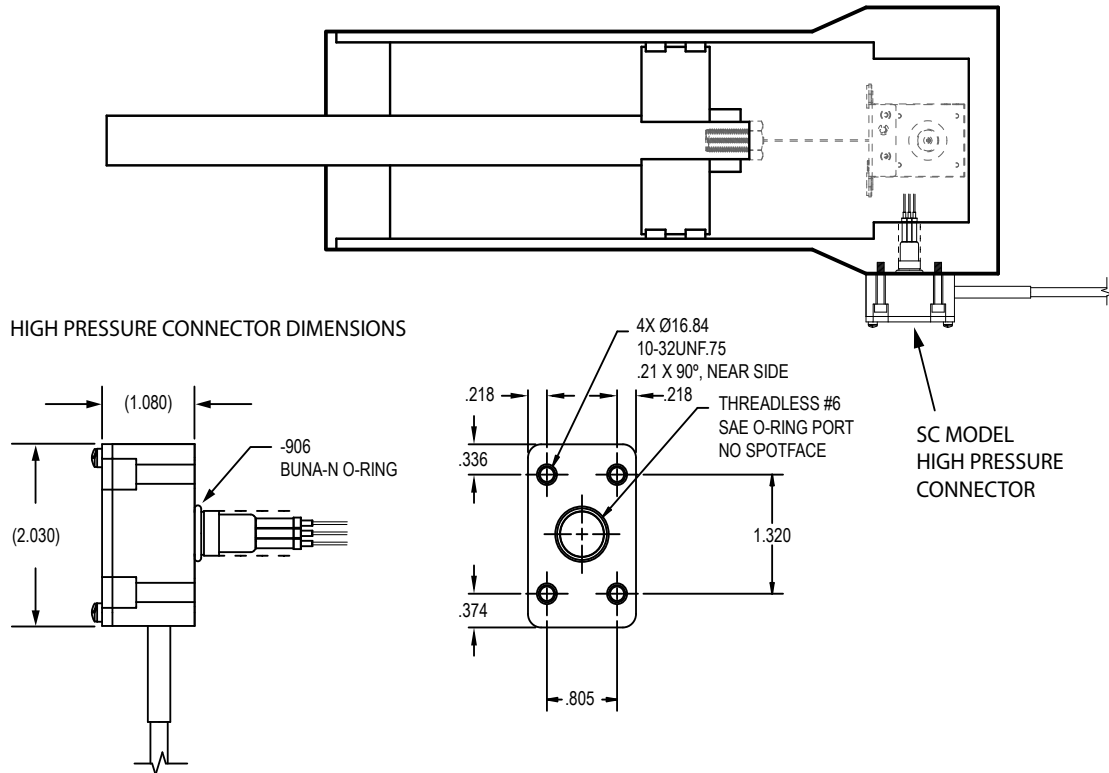
External-mount sensors interface with the cylinder end cap through an SAE #8 port.

The flexible cable and threaded connector are passed through this port and threads into the piston.

Both the piston connection and SAE port must be positioned concentric to the piston/cylinder (unless the piston does not rotate).

1. Installation Basics (cont'd)

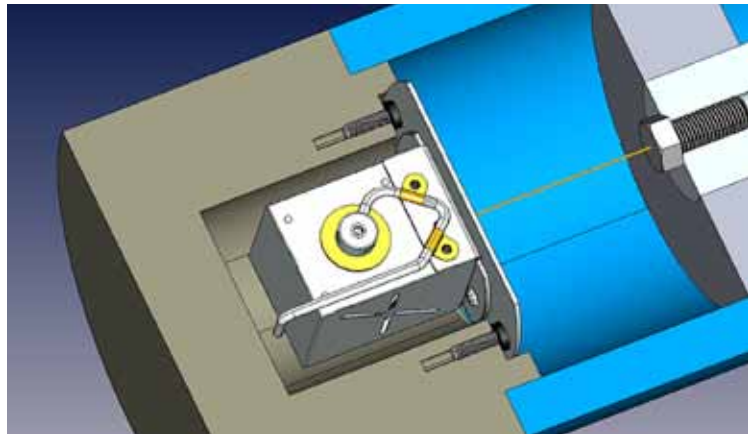
1.1.b Internal Mount Sensors SL1390 / SL1290 / SL1490



These open-chassis sensors present robust mounting flanges leaving cylinder configuration open to the designer. Below is a depiction of the SL1390 where the sensor is mounted to the customer-configured plate which resides on a step within the cylinder.

Please refer to product installation drawings for complete product envelope and mounting flange dimensions.

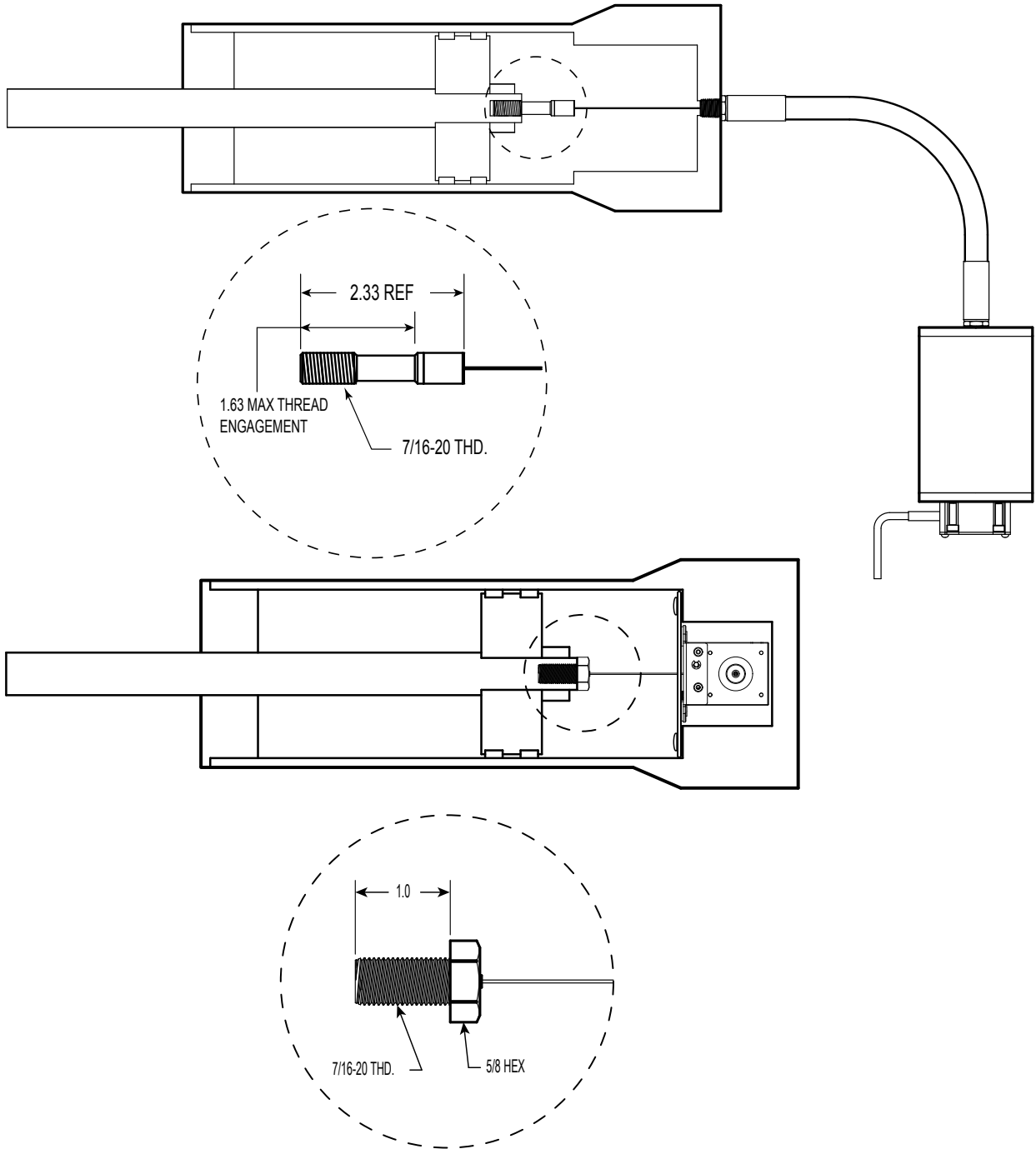
Control Products' engineering is available to consult on sensor installation / integration.



1. Installation Basics (cont'd)

1.2 Cable Connection

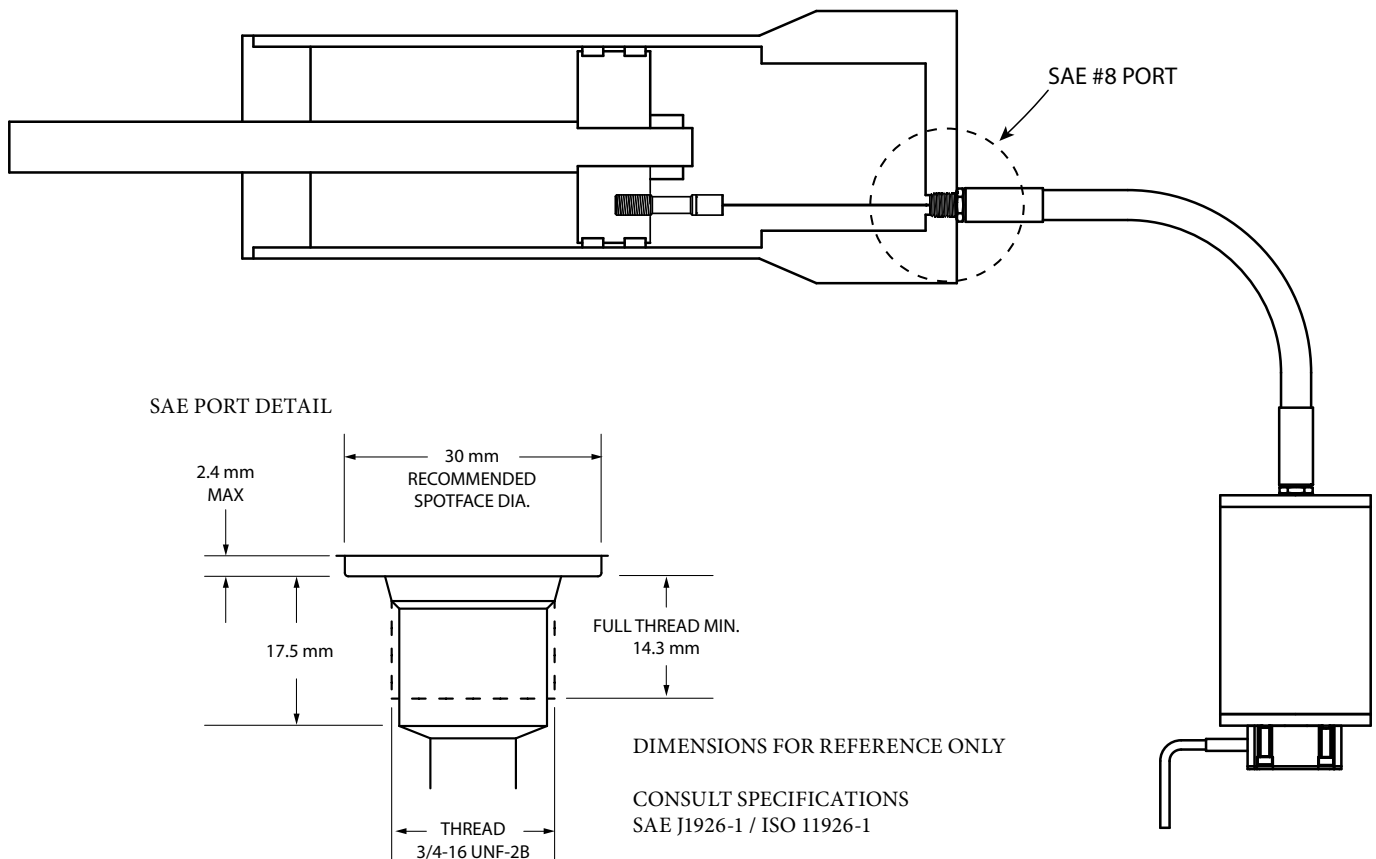
1.2.a Center - External & Internal Mount Sensors (blind hole depicted in the rod)



1. Installation Basics (cont'd)

1.2.b Off-Center - External Mount Sensors Only (blind hole depicted in the piston)

PLEASE NOTE THAT OFF-CENTER INSTALLATIONS ONLY WORK IN APPLICATIONS WHERE THE PISTON DOES NOT ROTATE



1.2.c Magnetostrictive Replacement

External-mount sensors can be supplied with a special non-threaded attachment suitable for installation in gun-drilled rods as a replacement for magnetostrictive sensors.

The attachment is simply placed within the bore and expanded to grip the inner bore wall using the supplied 7/32 hex wrench. For a brief demonstration of how this attachment works, please visit our website:

<http://www.cpi-nj.com/resources/videos/magnetostrictive-replacement-attachment-animation>

1. Installation Basics (cont'd)

1.3 Conduit Length / Bend SL0390 / SL1200 / SL1490

The external mount SL Series sensors afford tremendous flexibility for equipment designers, as the sensor can be located away from space constrained areas where there may be moving structures. The conduit (hydraulic hose) length can be specified by the designer, however the maximum length is subject to the demands of the application. Additionally, while there is a minimum bend radius for the flexible conduit for each sensor, again, the system operating characteristics must be accounted for. For example, in a high velocity application where the sensor is run dry, the concerns are:

1. Reduced velocity due to drag, which is increased with conduit length and bends in the conduit
2. Wear in the conduit liner

The above is an extreme example. Generally, as long as the sensor is run in a pressurized hydraulic environment (i.e. lubricated), both of the above concerns are substantially reduced.

Minimum Bend Radius

SL0390: 6 inches

SL1200: 6 inches

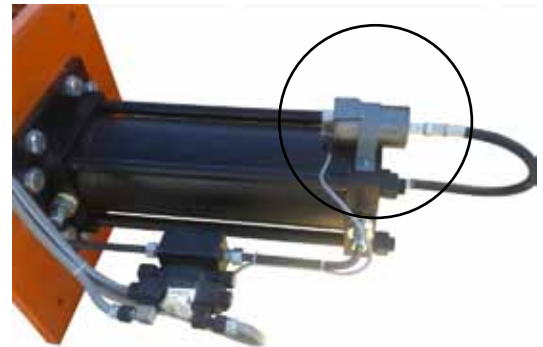
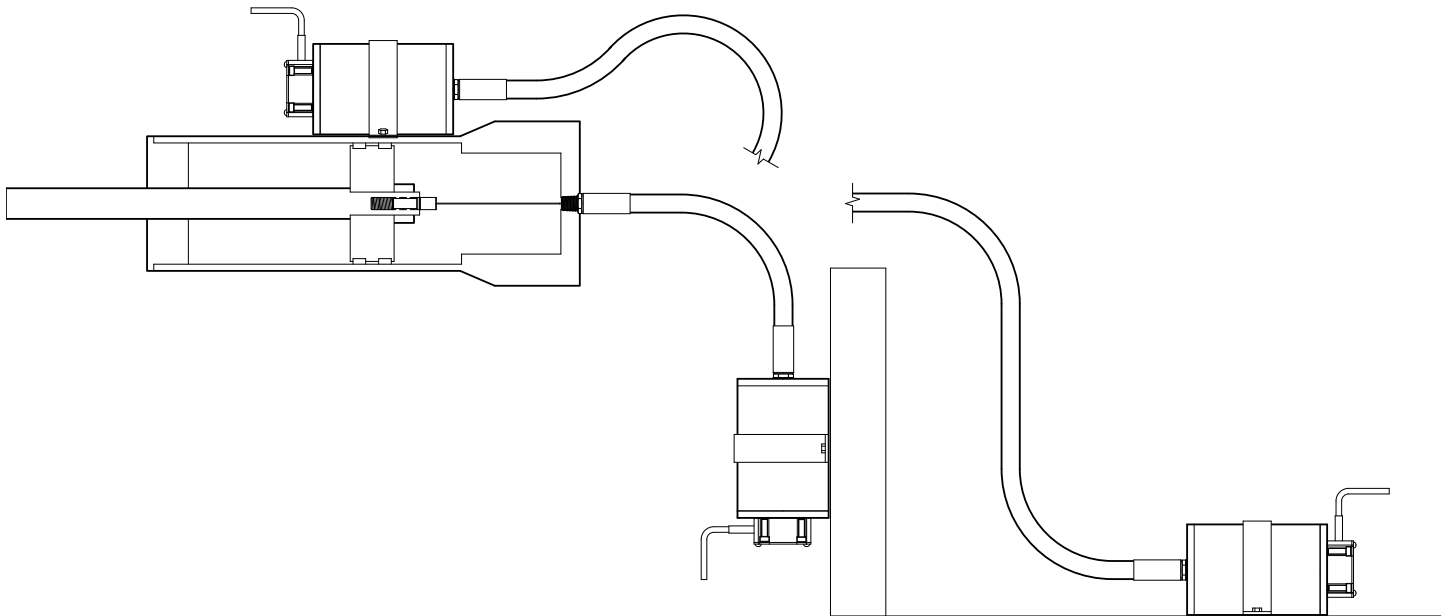
SL1400: 6 inches



1. Installation Basics (cont'd)

1.4 Mounting (brackets, concepts)

Control Products offers design support to customers to ensure successful deployment of SL Series sensors. We have found that no two applications are alike and this especially holds true for sensor mounting requirements.



Our SL0390 shown mounted in the field using a customer-designed bracket.

Please feel free to contact the factory to discuss your sensor mounting challenges

2. Environmental Specifications

2.1 Temperature

SL SERIES SENSORS WILL NOT OPERATE IN FROZEN MEDIA.

Operating Temperature

sensor: -40°F (unfrozen media) to 300°F / -40°C (unfrozen media) to 105°C
(standard range; higher available)
signal conditioner: signal conditioner dependent

2.2 EMI / RFI

Please contact us with your application requirements.

2.3 System Pressure

2.3.a Enclosure: 5000psi maximum working pressure

2.3.b High-pressure Connector: 5000psi maximum working pressure

2.3.c Conduit: 3500psi maximum working pressure

Consult factory for higher pressure applications.

3. Electrical Connections

To connect the sensor wires to pins on the SC451 high-pressure connector:

1. Match the sensor wire color to the same color pin on the SC451 high-pressure connector
2. Push each wire receptacle fully onto the corresponding color pin
3. Carefully guide the wires into the hole while installing the plug with 4 bolts. Ensure the bolts are tight and the plug is fully seated and flat on the mounting surface.

NOTE:

ALL SURFACES MUST BE CLEAN.

APPLY A SMALL AMOUNT OF OIL TO THE PLUG AND O-RING.

To connect the cable to the signal conditioner:

<u>WIRE COLOR</u>	<u>DESIGNATION</u>	<u>SC240 TERMINAL NUMBER</u>
Black	Secondary 1	Terminal 7
Brown	Secondary 2	Terminal 8
Blue	Primary 1	Terminal 4
White	Primary 2	Terminal 3

4. Fault Indication

All SL Series sensors provide a proportional analog output over their entire stroke length—there is no end-of-stroke dead zone for any of these products. Fault indication is a feature inherent in the various analog outputs available from the signal conditioner (SL240, Macro Sensor LVC4000). In the case of the 0-5V output option, the full span of the sensor is typically defined by 0.5V to 4.5V. If the actual output is outside of these limits, that would indicate a fault condition. If the output drops to zero, for example, that might be an indication of a damaged or broken flexible connector. Other causes of fault conditions include broken LVDT wire(s) internal to the sensor or failed connection elsewhere between the sensor and signal conditioner.

5. MTBF

The SL Series sensor system is comprised of three elements:

- The draw-wire core
- An LVDT (the core sensing technology)
- A signal conditioner

The draw-wire core is a highly integrated mechanical assembly with no electronic elements. As a mechanical assembly, there are many conditions specific to each application which impact its operation. Applying MTBF to the draw-wire core is not meaningful.

The LVDT is the only electronic component to any SL Series sensor. It is a non-contacting technology which will operate for an indefinite period estimated in years.

The signal conditioner converts the standard LVDT output to various proportional analog outputs. An example is CPI P/N SC240, which is manufactured by Macro Sensors, ref. P/N LVC-4000. Please contact the signal conditioner manufacturer for MTBF information

6. Specifications

Resolution:	± .025"	Shock:	50g, 6ms, sawtooth
Repeatability:	.025"	Vibration:	5g, 10Hz to 2kHz
Non-linearity:	2% of full scale output (FSO)	Pressure:	
Hysteresis:	± .010" MAX.	<i>Operating:</i>	5,000psi
Input Voltage:	9-30VDC typical*** (LVC4000)	<i>Spike:</i>	10,000psi
Input Current:	100mA typical @ 24VDC*** (LVC4000)	Endurance:	1 million full-stroke cycles
Output Voltage:	0-5V*** 0-10V 4-20mA Serial RS485	Recommended Cleanliness Level:	ISO-19/18/15
Operating Temperature:		Cold Oil Performance Delo 400 (MIL-PRF-46167):	
<i>Sensor:</i>	-40°C to 105°C (-40°F to 221°F)**	<i>1 ft. retraction:</i>	1/2 second @ 0°F* 3 seconds @ -25°F* 24 seconds @ -50°F*
<i>Signal Conditioner:</i>	signal conditioner dependent		
EMC:			
<i>Emissions:</i>	Please consult factory		
<i>Immunity:</i>	Please consult factory		

* Will not operate in frozen liquid media

** Standard temperature range. Greater temperatures available - please consult factory

*** See MacroSensor LVC4000 User Manual

The SL Family of Linear Position Sensors

1 METER

SL0390

1 Meter Remote



SL1390

1 Meter Internal



3 METERS

SL1200

3 Meters Remote



SL1290

3 Meters Internal



7 METERS

SL1400

7 Meters Remote



SL1490

7 Meters Internal



LONGER STROKES...

Longer stroke sensors available. Please consult the factory for your long-stroke application requirements.

