

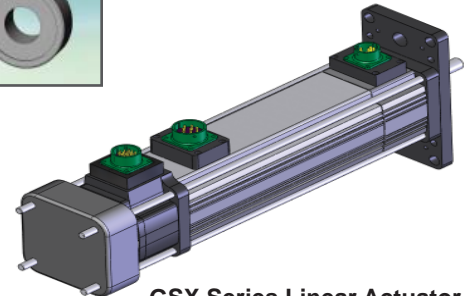
Force Measuring Actuators

Exlar offers select models of its GSX Series and I Series actuators with integral force measuring capability. In both series a load cell is embedded within the actuator allowing it to directly measure the force being applied by the actuator. This option offers a convenient method for obtaining electronic data relating to the force being applied by the actuator. The strain gauge load sensors used to measure applied force are embedded in the actuator's case.

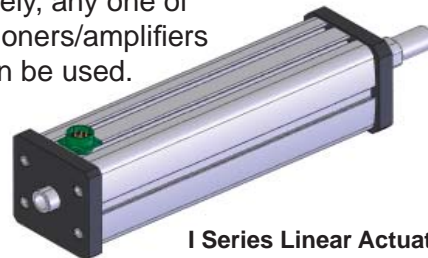
A separate connector is supplied for connecting the internal load sensor to an external strain conditioner/amplifier required to



excite the strain gauge sensor. Exlar offers a rugged strain gauge conditioner to provide a high level signal, either 0 - 10V or 4-20mA output for monitoring the output signal. Alternatively, any one of numerous conditioners/amplifiers on the market can be used.



GSX Series Linear Actuator



I Series Linear Actuator

Integrated Load Cell Option Overview

The integrated load cell option is available on Exlar's GSX30, 40 and 50 models as well as the I 30 and 40 model actuators. The load cell is a strain gauge type, offering you stable and accurate load sensing in both the tension and compression directions, and for static or dynamic loads. The packaging of the strain gauges is integral to the actuator's housing, offering a compact, protected robust design.

Applications

- Fastening and Joining
- Riveting
- Bag Sealing
- Thermoforming
- Injection Molding
- Precision Pressing
- Fillers
- Formers
- Precision Grinders
- Clamping
- Interference detection
- Die Cutters
- Molding
- Welding
- Tube Bending
- Stamping
- Test Stand Lifts
- Tension Control
- Wire Winding
- Parts clamping
- Dispensers
- Circuit Board Testing
- Blood Processing

Features

- Integrated strain gauge load cell
- 10 VDC external excitation
- 2 mV/V sensitivity
- +/- 1% linearity
- +/- 0.5% repeatability
- Hysteresis, 1% nominal
- 250 Hz frequency response
- Factory calibrated
- Compatible with standard gauge monitors and PLC strain gauge input cards
- Requires external excitation
- Totally enclosed within the actuator's sealed housing, and connectorized for ease of use

Achieving Precise Measurement

Frequently industrial applications involving linear actuators require the precise measurement of the load being applied by actuator. Historically these have been accomplished by placing a load cell in the force train between the actuator and the tooling used to hold the workpiece.

This approach is fertile ground for a host of implementation challenges. Load cells need to be sized, selected and ordered. Mechanical linkages and mountings need to be designed, built and assembled. Precise alignment must be maintained to prevent bending moments which can severely degrade the accuracy of any load measurement system using load cells.

Provisions for securing the wires to the load cell need to be designed particularly if the load cell is moving in the process of applying the force on the work piece. Moving wires are extremely prone to failure and consideration must be given to the amount of flexing. Lastly, a strain gauge signal conditioner must be selected, ordered, installed and calibrated.

What seems on the front end to be a simple implementation of a force sensing system frequently turns into a project requiring expertise from both electrical and mechanical personnel. Moreover, it is common to see such projects drag out beyond the completion date as system components are redesigned or reordered.

Exlar's embedded force sensor option eliminates much of the effort and the risk associated with measuring the applied force produced by the actuator. This system will deliver specified performance and allow you to meet target dates as all design work has been done and field-tested by Exlar.

Exlar's design includes a precision strain gauge load cell mounted securely inside the actuator's case. Side loads are eliminated because the rigid case assures concentric alignment of all force bearing components.

Flexing cables are not necessary. The actuator typically does not move as it applies force. The force signal cable can be run alongside the actuator's central and power cables. And, the force sensor carries the same IP rating of the actuator since it is located inside the actuator's case.

Typically the load cell's rating is matched to full load capacity of the actuator. Over-load capacity of a minimum of 2x rating is provided to reduce the possibility of inadvertent load damage due on occasions when higher than planned high peak forces are applied.

Configuration

The load cell is factory preloaded to approximately 10,000 pounds. This preload will vary with time and temperature. This preload can be measured by applying the 10V excitation and reading the mV output, and scaling the output by the calibration factor.

"Load cell amplifiers" commonly used with load cells contain power, excitation, and signal conditioning.

These modules will typically amplify the output signal to volts rather than milli-volts. These types of devices may be stand-alone devices made for mounting in an electrical panel, incorporated into panel meters with digital displays, or integral to a PLC or other control device.

The mechanical efficiency of the entire system that a load measuring device is mounted into is important to the overall accuracy of the measurement. The more mechanically efficient the system is, the more accurate the load sensing will be. So, it is important to take care in the mounting of the actuator, and the design of the overall system to minimize unnecessary friction and other inefficiencies.

Unlike competitive products, the integration of the load cell in Exlar's GSX and I Series actuators allows precise measurement of force in the compression and tension directions.

The entire actuator assembly is preloaded and factory calibrated, providing you the information needed to set up your measuring system.

These robust and convenient packages offer +/- 1% linearity of the load cell output signal, and +/- 0.5 repeatability.

Operation

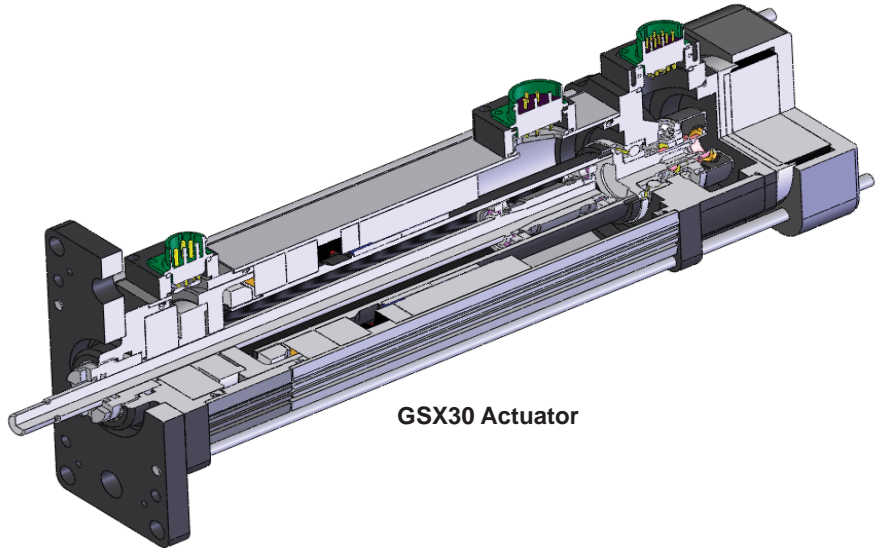
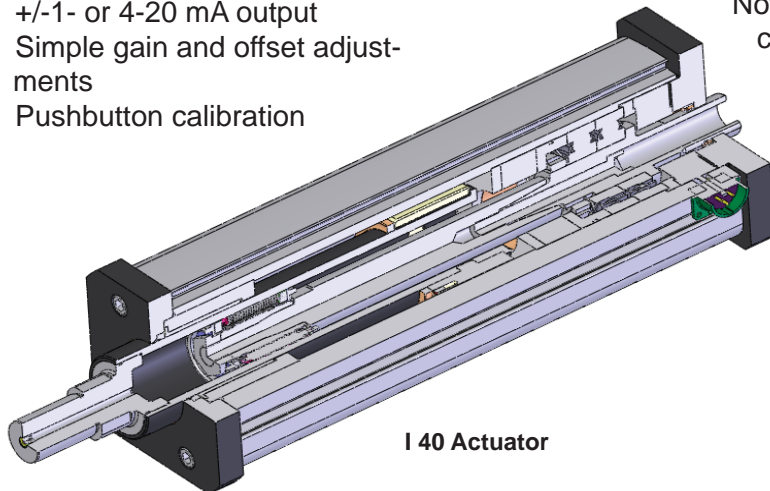
All Exlar precision load sensing designs are incremental in nature. By this it is intended that force measurements always be conducted as the change in the signal output between the start of a load producing motion and its completion. The force sensing option is not intended to be used as an absolute measurement of force being applied.

The model EMG2 amplifier provides a convenient method for accurately and reliably measuring the resistance change of the strain gauge load cell embedded in either a GSX or I series actuator. The unit measures the minute resistant changes of the wheatstone bridge, then converts and amplifies that signal to provide a 0-10 volt and 4-20 mA signal which is proportional to the load or tension being applied by the actuator.

The model EMG2 strain gauge amplifier is designed to be mounted on a standard din rail.

Conditioner Specifications:

- 24 VDC power (2.5N)
- +/-1- or 4-20 mA output
- Simple gain and offset adjustments
- Pushbutton calibration



Operation Example

Operational Example: If the calibration factor is 1.656 mV/V at full load, and the excitation supply is 10 Volts, and the output signal is .894 mV, then without any external load on the actuator, the preload is:

$$Q = .894 \times 20000 / (1.656 \times 10) = 1079 \text{ pounds}$$

At application of load, sample the signal and compare to unloaded value. The result is the load.

Example: Given the preload Q of 1079 pounds, and the signal after a load is applied is .338 mV, what is the load?

$$P = (.894 - .338) \times 20000 / (1.656 \times 10) = 671 \text{ lbs.}$$

Note a positive value indicates the load is a compressive load on the actuator rod and a negative value indicates a tensile load on the rod actuator.

Performance Specifications

	GS Series	I Series
Linearity (% of full actuator max load)	+/- 1%	+/- 1%
Repeatability	+/- 0.5%	+/- 0.5%
Hysteresis	1% Nominal	1% Nominal
Frequency Response*	>250 Hz	>250 Hz
Overload Capability	2x Full Scale	3x Full Scale
Sensitivity (nominal)	2 mV/V	2mV/V
Bridge Resistance	350 Ohm	350 Ohm
Excitation	10 VDC	10 VDC
Input Impedance	352 Ohms	352 Ohms
Output Impedance	353 Ohms	353 Ohms
Electrical Leakage	Infinite Meg Ohm	

*Note: This is the frequency response of a "locked rotor" load cell actuator. Frequency response of the load cell/actuator system will depend on total system inertia and the motor and drive amplifier powering the system.

Standard Strain Gauge Connector Wiring Information

Pin	Function	
A	(+) Excitation	10V
B	(-) Excitation	
C	(-) Output	
D	(+) Output	
E		
F	Shield	
G		
H		

Example Calibration and Load Information

Model	GSX40 Actuator with Load Cell
Serial No	6090825
Type	Tension and Compression Load Cell
Calibration Factor	2.1809 mV/V Full Scale
Calibration Full Scale Load	20,000 Pounds
Excitation Voltage	10V
Linearity	98% at Max Load
Max Load	4500 Pounds
See Operation Manual for wiring and operation instructions	

Load Sensing Actuator Range/Capacity

Frame	30	40	50
GSX Series Force/Tension Measurement Range/Capacity lbf (kN)	50-1300 (0.2-5.78)	100-4000 (0.4 - 17.8)	250-9000 (1.1 -4.0)
I Series Force/Tension Measurement Range/Capacity lbf (kN)	50 - 1306 (0.2 - 5.78)	100-4000 (.4 - 17.8)	NA