Type 330SA High-Performance Electric Actuator

The Type 330SA High-Performance Electric Actuator (figure 1) is a high speed, high accuracy actuator that is suited for a wide range of demanding process control applications. Rugged and reliable, the Type 330SA actuation system differentiates itself from more traditional electric actuator technologies by offering these performance features.

- High speed
- High accuracy
- High thrust force
- Long stroke capability
- Spring-fail capability
- High cycle life
- Sliding-stem or rotary-shaft applications
- Third party certification

The Type 330SA actuator uses a brushless servo motor, integrated with an inverted roller screw, to convert rotary torque into linear thrust.

The actuator is used in conjunction with a programmable, microprocessor-based servo drive, which provides the control function to the servo motor. The servo drive is designed to operate brushless DC servo motors, and is tunable to meet the application requirements.

When supplied with performance parameters such as speed, stroke length, and frequency response, Fisher Controls will program the servo drive to meet your application requirements.

Together, the Type 330SA actuator and servo drive compose a programmable, high-performance actuation system for either sliding-stem or rotary-shaft applications.

Should your service requirements change, the system is supplied with software that allows you, using a PC, to modify the servo drive programming.

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Figure 1. *Type 330SA High-Performance Electric Actuator mounted on an* ***easy-e***® *Control Valve*

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D102565X012

Contents

Features

- **High Speed—** The roller screw design allows rotational speeds of up to 5000 rpm. This can produce stroke speeds as fast as 60 milliseconds for 19 mm (0.75-inch) travel.

- **High Accuracy—** Position feedback to the servo drive allows the Type 330SA Electric Actuation System to achieve combined repeatability and hysteresis as low as 0.25%.

- **Long Stroke Capability—** Stroke length in excess of 254 mm (10 inches) is available.

- **Spring-Fail Availability—** Optional spring-fail up or spring-fail down configurations may be specified in place of standard (no spring) constructions. See figure 5.

- **Third Party Certification—** The Type 330SA actuator is CSA certified and the Type VC1000 servo drive is designed to meet CSA certification. See the *Specifications* table on page 8 for details.

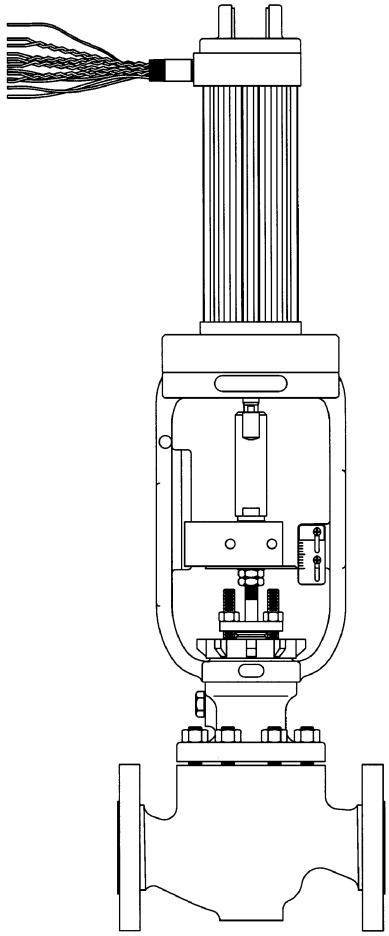


Figure 2. *Type 330SA Size 30 Electric Actuator Mounted on a 2-Inch* ***easy-e*** *Valve*

- **High Thrust Force—** Capable of thrust force up to 44,500 N (10,000 lb) continuous.

- **High Cycle Life—** Linear loads are distributed to the multiple threaded helical rollers in the roller screw assembly. These multiple contact points allow the actuator to achieve cycle life as high as 750 million millimeters (approximately 30 million inches) of travel.

- **High Frequency Response—** Tests have shown frequency response to be as high as 15 Hz when measured at 5% of travel at mid-stroke.

- **Application Versatility—** Compact, integrated design allows use on a variety of sliding-stem and rotary-shaft control valve applications.

- **Spring-Fail Failure Mode—** “Lock In Last Position” is available on the non-explosion proof version as an optional internal brake.

Table 1. *Servo Drive Specifications*

SERVO DRIVE MODEL	OPERATING VOLTAGE	ACTUATOR SIZE				POSITION FEEDBACK	CONTINUOUS OUTPUT CURRENT	PEAK OUTPUT CURRENT	MAXIMUM CONTINUOUS POWER(1)
		20	30	45	60		Amps	Amps	Watts
VC1000	125 VDC	X	X	X		4-20 mA	20	40	2000
VC1000	220 VAC-single phase	X	X	X		4-20 mA	8	16	2000
FX-490	220 VAC-3 phase			X		2-10 VDC	14	28	2480
FX-8500	460 VAC-3 phase				X	2-10 VDC	25	50	10,600

1. The actuator will draw its required power, but the Servo Drive must be connected to a power source capable of delivering Maximum Continuous Power, as specified in this table.

Table 2. *Additional Specifications*

ACTUATOR SIZE	MAXIMUM CONTINUOUS THRUST(1)		MAXIMUM STROKE SPEED		MAXIMUM STROKE		LEAD SCREW PITCH	
	N	lbf	mm/sec	inch/sec	mm	Inch	mm/revolution	Inch/revolution
20	667	150	406	16	88.9	3.5	5.1	0.2
	1330	300	203	8	88.9	3.5	2.5	0.1
30	2450	550	254	10	146	5.75	5.1	0.2
45	11,100	2500	203	8	254	10	5.1	0.2
	22,200	5000	102	4	254	10	2.5	0.1
60	44,500	10,000	254	10	254	10	6.4	0.25

1. Slight derating may be required in the case of elevated ambient temperatures. Refer to Type 330SA Catalog 14 sizing pages for further information.

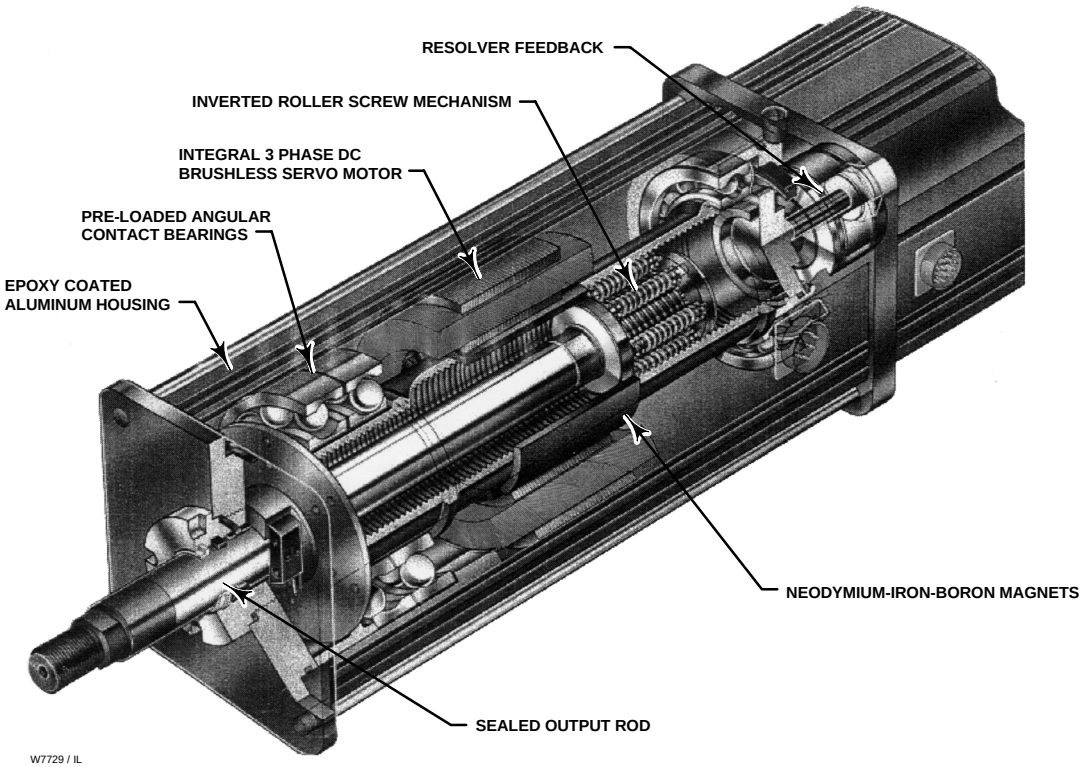


Figure 3. *Type 330SA Electric Actuator Design*

Principle of Operation

This high-performance actuator system combines the Type 330SA electric actuator and a servo drive assembly. These two components work together to provide you with a highly accurate, high speed actuation system.

The Type 330SA actuator uses a patented inverted roller screw technology. It has the low friction commonly associated with ball screws, but without the recirculating ball bearings. The roller screw can be operated at much higher speeds without sacrificing operating life. The brushless DC servo motor has been built around the roller screw mechanism, resulting in a compact, highly reliable, linear actuator.

Because there are no brushes, the motor commutation is accomplished electronically. The motor is driven by a servo drive which uses an integrated resolver as the motor shaft position feedback device (see table 1). This resolver is a rugged, motor-like device, attached to the servo motor shaft. When used in combination with the microprocessor inside the servo drive, the result is a versatile position control system.

The servo drive control program was developed especially for Fisher Controls to perform the demanding valve control function required in the process control industry. Program input parameters can be changed in the field to fine tune the system as process conditions change.

Figure 4 shows a typical Type 330SA actuator system.

Failure Modes

Your Type 330SA actuation system can be configured with two failure modes scenarios.

- **Loss of command signal—** The versatility of the Type 330SA actuator allows you to configure the servo drive to position the valve to any position desired upon loss of command signal (open, close, “lock in last position”, or anything in between).

- **Loss of power—** If fail open or fail close action upon loss of power is desired, then the spring return actuator construction is required. *Be aware that the addition of a spring will increase the size of the actuator required.*

“Lock in last position” capability is available with the addition of an internal brake. Note that this option is not available with CSA explosion proof or CENELEC certification.

Mounting Configurations

The Type 330SA electric actuator can be mounted to a wide range of sliding-stem and rotary valves. See table 3 for sliding-stem valve mounting information. Contact your Fisher Controls sales office for further information on rotary valve mounting configurations.

How to Specify Your Type 330SA Actuator System

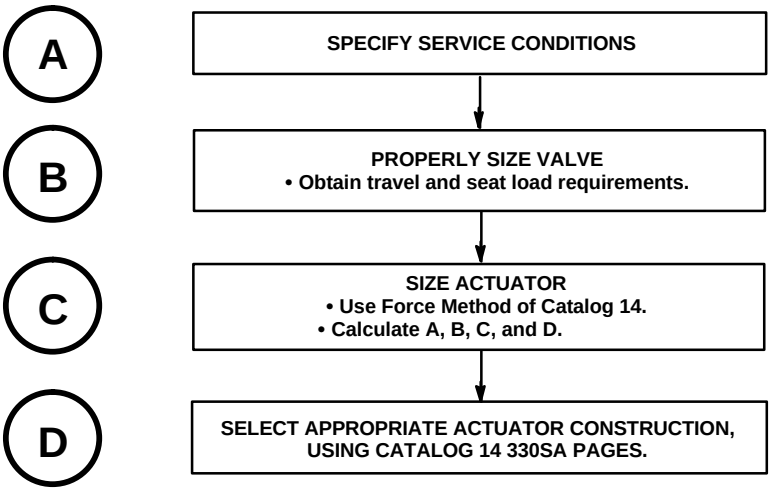


Table 3. *Sliding-Stem Mounting Configurations*

ACTUATOR STYLE	SIZE	MAXIMUM CONTINUOUS THRUST		YOKE BOSS SIZE		MAXIMUM TRAVEL		STEM DIAMETER	
		N	lb	mm	Inch	mm	Inch	mm	Inch
No Spring	20	1330(1)	300(1)	54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
	30	2450(1)	550(1)	54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
				90	3-9/16	102	4	19.1	3/4
	45	22,200(1)	5000(1)	71	2-13/16	51	2	12.7	1/2
				90	3-9/16	102	4	19.1	3/4
				127	5, 5H	102	4	25.4	1
								31.8	1-1/4
	60	44,500(1)	10,000(1)	127	5, 5H	102	4	25.4	1
								31.8	1-1/4
Spring-Fail Up	20	Contact your Fisher Controls sales office.		54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
	30			54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
				90	3-9/16	76	3	25.4	1
						102	4	31.8	1-1/4
	45			71	2-13/16	51	2	12.7	1/2
				90	3-9/16	76	3	25.4	1
						102	4	31.8	1-1/4
				127	5	76	3	25.4	1
								31.8	1-1/4
						102	4	25.4	1
								31.8	1-1/4
				127	5H	102	4	31.8	1-1/4
	60			127	5H	102	4	31.8	1-1/4
Spring-Fail Down	20	Contact your Fisher Controls sales office.		54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
	30			54	2-1/8	29	1-1/8	9.5	3/8
				71	2-13/16	51	2	12.7	1/2
				90	3-9/16	76	3	25.4	1
						102	4	31.8	1-1/4
	45			71	2-13/16	51	2	12.7	1/2
				90	3-9/16	76	3	25.4	1
						102	4	31.8	1-1/4
				127	5	76	3	25.4	1
								31.8	1-1/4
						102	4	25.4	1
								31.8	1-1/4
				127	5H	102	4	31.8	1-1/4
	60			127	5H	102	4	31.8	1-1/4

1. Thrust is dependent on lead screw pitch. Values shown are for a lead screw pitch of 2.5 mm/revolution (0.1 inches/revolution). For a lead screw pitch of 5.1 mm/revolution (0.2 inches/revolution) the available thrust is half that shown in this table. See thrust values in table 2.

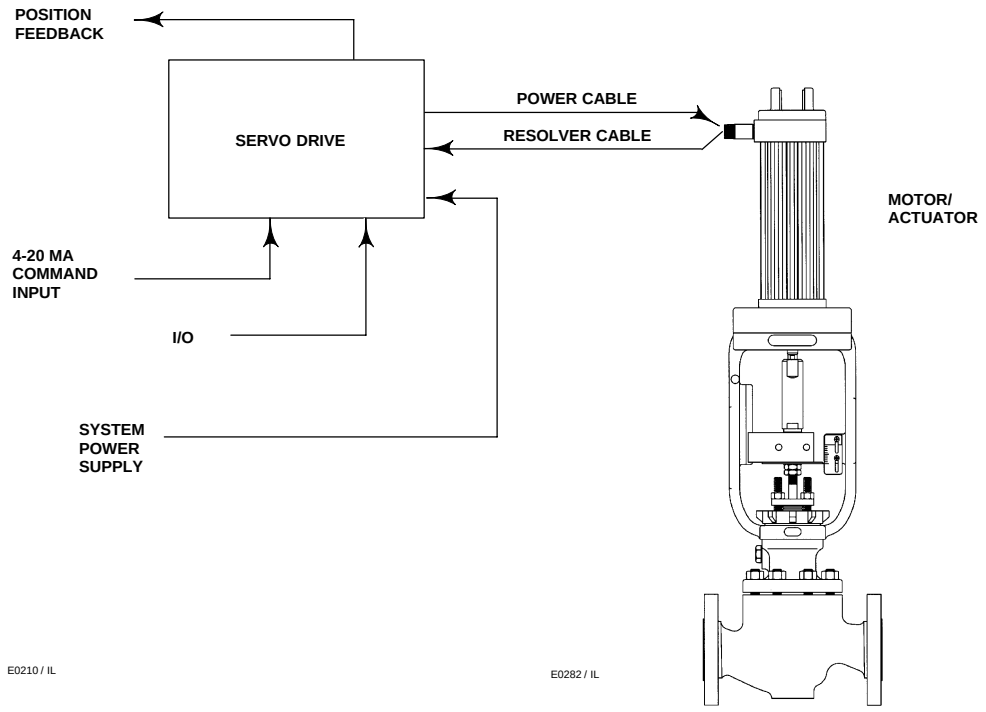


Figure 4. *Typical Type 330SA Actuator System Including the Actuator Motor, Mounting, and Servo Drive*

Servo Drive Electrical Connections

The **system power supply** provides electrical power to the servo drive. A **4-20 mA command input** signal is sent from the control room to the servo drive. The servo drive then sends required power to the actuator via the **power cable**. Actuator position feedback is sent back to the servo drive via the **resolver cable**. The servo drive then controls power to the actuator to make the “actual” position equal to the “commanded” position. The servo drive also sends this position signal back to the control room via the **position feedback** cable. Alarms and digital information are relayed back and forth to the control room via optically isolated **I/O** lines.

Power

A terminal block with screw terminals is provided on the servo drive for power connections. The terminals are rated at 30 Amps and accommodate wire size ranges from 24 to 10 AWG.

I/O

Optically isolated inputs and outputs are provided. Inputs can be programmed for functions such as *Enable Drive*, *Remote Reset*, etc. The outputs can be connected for *Loss of Command Signal*, *General Fault Alarm*, etc.

Resolver

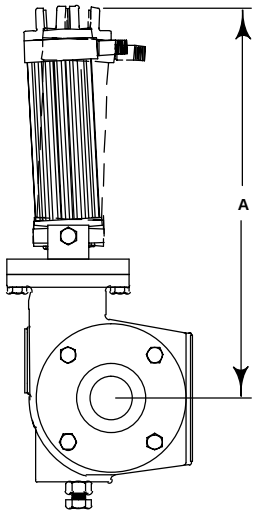
A 9-pin D-shell connector is provided for interfacing the resolver cable from the Type 330SA actuator to the servo drive.

Serial

A 9-pin D-shell connector is provided for interfacing to the serial port of a PC running the installed software for tuning and monitoring the servo drive.

ACTUATOR SIZE	TYPICAL ACTUATOR TO MATCHLINE DISTANCE(1)		
	A	B	C
	mm		
20	555.8	416.1	633.5
30	581.2	574.8	879.6
45	749.3	865.1	1190.8
60	896.9	1044.5	1358.9
	Inches		
20	21.88	16.38	24.94
30	22.88	22.63	34.63
45	29.50	34.06	46.88
60	35.31	41.12	53.50

1. These are typical measurements. Matchline distances will vary with regard to yoke boss size and actuator construction. Contact your Fisher Controls sales office for specific matchline measurements.



TYPICAL ROTARY VALVE/ACTUATOR CONSTRUCTION

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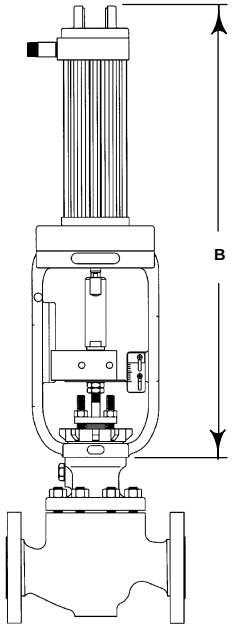

GLOBE VALVE/ACTUATOR STANDARD CONSTRUCTION

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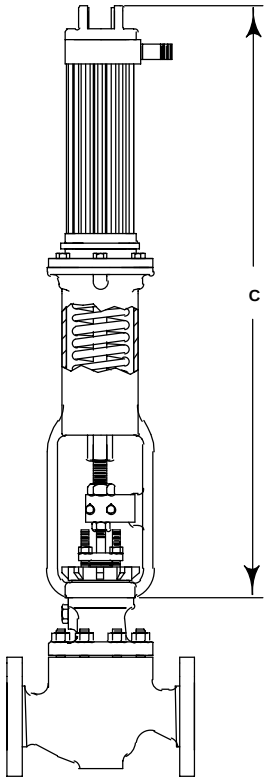

OPTIONAL SPRING-FAIL CONSTRUCTION

Figure 5. *Dimensions*

Programming and Tuning

The actuation system is shipped preprogrammed by Fisher Controls. Programming modifications may be done onsite with menu-driven software, which sets up and tunes the drive through the serial interface. There are no jumpers, potentiometers or switches to set. Parameters are stored in non-volatile RAM. Traditional tuning parameters of Proportional and Integral gains are used to adjust the control loop to desired performance. Other parameters are available for adjusting thrust, velocity, and position limits.

Specifications

Actuator Specifications

Available Configurations and Mountings

Available with either spring-return or no spring configurations for sliding-stem (table 3) and rotary-shaft applications. Contact your Fisher Controls sales office for information on rotary-shaft applications.

Construction

Canadian Standards Approved for Explosion Proof Class I, Division 1, Groups B, C, & D
Size 30: Standard
Sizes 20, 45, & 60: Contact your Fisher Controls sales office for availability

CENELEC Approved for Flame Proof Zone 1, Eexd IIC, IIB, and IIA
Size 30: Standard
Sizes 20, 45, & 60: Contact your Fisher Controls sales office for availability

Optional Internal Brake: All sizes

Note

The optional internal brake is not available with CSA explosion proof or CENELEC certification.

Stroke: See table 2
Stroking Speed: See table 2. The servo drive is configured with acceleration and deceleration parameters at each end of travel.
Thrust Output: See table 2. The maximum continuous thrust output may require derating in the case of elevated ambient temperatures. See Type 330SA Catalog 14 pages for further information.

Motor Specifications

Environment: Sealed against dust and water jets (IP rating 65)
Operating Temperature: –29 to 127°C (–20 to 260°F)
Relative Humidity: 0 to 100%
Storage Temperature: –40 to 127°C (–40 to 260°F)

Electrical Interfaces

Actuator Power Connection
Size 20, 30, and 45: 1/2-inch NPT, free leads 1.8 meters (6 feet) long
Size 60: 3/4-inch NPT, free leads 1.8 meters (6 feet) long
Actuator Feedback Connection: 1/2-inch NPT, free leads 1.8 meters (6 feet) long
Maximum cable length: 76 meters (250 feet)

Materials

Motor housing: 6063 Aluminum
Output Shaft: 440 series Stainless Steel

Servo drive Specifications

Models Available: See table 1
Control Signal: 4-20 mA
Position Feedback: 0-10 VDC or 4-20 mA. See table 1

Environment

FX-Series Servo Drive
Operating Temperature: 0 to 45°C (32 to 113°F)
Relative Humidity: 0 to 95%, non condensing
Storage Temperature: –40 to 85°C (–40 to 185°F)

VC1000 Servo Drive
Operating Temperature: –10 to 60°C (14 to 140°F)
Relative Humidity: 0 to 95%, non condensing
Storage Temperature: –40 to 85°C (–40 to 185°F)

VC1000 Servo Drive Approvals

Designed to Meet Canadian Standards Approval for: Explosion Proof: Class I, Division 2, Groups C & D, Temperature Code Rating T3

Electrical Interfaces

Power to Servo drive: Screw Terminals
4-20 mA Command: Screw terminals
Position Feedback: Screw Terminals
Actuator Power Connection: Screw Terminals
Actuator Feedback Connection: 9 pin “D” female connector

For information, contact Fisher Controls:
Marshalltown, Iowa 50158 USA
Cernay 68700 France
Sao Paulo 05424 Brazil
Singapore 128461

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