

Bettis™ EHO Electro-Hydraulic Operator

The Bettis EHO is a self-contained, quarter-turn, valve actuator that combines proven technologies from Emerson's Actuation Technologies. The actuator has been designed for critical shutdown applications where reliability is crucial. The EHO utilizes a dependable spring-return actuator for the fail-safe stroke combined with an integral hydraulic power pack and electronic control module.

The EHO accepts a wide range of single-phase, three-phase or DC power sources. Solar panel systems are available for areas without electrical power. A hydraulic handpump can be used to stroke the actuator during commissioning or in the event of an emergency power loss.

Electronic modules are contained within an explosion proof, IP68 enclosure and all electronic components are isolated from the customer connection terminals.

Both spring-return and double-acting configurations are available with torque outputs up to 2,761,461 lbf-in. The EHO provides a compact design with actuator and control components that have been field proven for decades in critical service applications.

The EHO comes in two versions: the Standard EHO and the Smart EHO. The Standard EHO is designed for on/off ESD applications, while the Smart EHO is designed for modulating ESD applications and comes with alert, alarm, diagnostic, and self-calibration features.



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Product Attributes

- Easy Installation – Bettis™ EHO actuator is a totally self-contained system and designed for compactness and adaptable to new or existing valves
- Bettis™ G-Series hydraulic double-acting or spring-return, fail-safe actuator
- Shafer™ hydraulic control technology
- EIM™ electronics and communication technology
- Multiple input power options
- Local lockable Remote/Local/Offline selector switch
- Local open/Close selector knob
- Fast speed of operation to fail-safe position if required
- Emergency shutdown – independent safety circuits and solenoid valve
- Dual sealed Separate Terminal Chamber, allows installation wiring to be performed or fuses to be replaced without exposing control components to hostile environmental conditions
- Control enclosure is made of low-copper aluminum alloy and rated for IP68 ingress protection
- Hydraulic handpump manual override
- Optional hydraulic back-up accumulator
- Operating pressures up to 3000 psi with standard components
- Easy control over actuator stroking speeds – The stroking speed is controlled through adjustable hydraulic flow control valves. This enables field personnel to easily adjust actuator stroking speed to comply with field requirements
- (Smart) Communication support through Modbus, HART and Foundation Fieldbus (FF)
- (Smart) Modulating through 4 - 20 mA analog input
- (Smart) Over 25 alerts and alarms
- (Smart) Diagnostics and self-calibration features
- (Smart) Partial stroke testing

General Specifications

Input Power (AC)

- Three-phase 50 Hz
 - 220, 230, 240, 380, 400, 440, 460, 480, 500, 550, 575, 600 volts
- Three-phase 60 Hz
 - 208, 220, 230, 380, 440, 460, 480, 575, 600 volts
- Single-phase 50 Hz
 - 110, 115, 220, 230, 240 volts
- Single-phase 60 Hz
 - 115, 120, 208, 220, 230 volts

(DC)

- 24 volts

Note: The nominal operating voltage must be specified at time of order. Published actuator performance data is for power supply variations of a $\pm 10\%$ voltage and a $\pm 5\text{Hz}$ frequency. If power supply variations are outside these limits, please consult Actuation Technologies to ensure that actuator performance meets your requirements.

Conduit Entry Sizes

- Three 1" NPT
- One 1.5" NPT entry

Local Operation and Display

- Open/Close/Stop pushbuttons
- (Smart) Open/Close selector knob
- Local/Off/Remote lockable selector switch
- (Smart) 2-digit LED display
- (Smart) LED alarm and alerts display
- Local/Off/Remote position indicator LEDs
- Hydraulic handpump manual override

Remote Operation (Inputs)

- Discrete Open/Close/Stop/ESD signals
- (Smart) Discrete PST signal
- (Smart) 4 - 20 mA positioning (1% accuracy)

(Outputs)

- Discrete open/close limits
- 4 - 20 mA hydraulic pressure feedback
- (Smart) 4 configurable relays
- (Smart) 1 ESD monitor relay
- (Smart) 4 - 20 mA position feedback

General Specifications (continuation)

Operating Temperature

- -20 °F to +140 °F (-29 °C to +60 °C)
- -40 °F to +140 °F (-40 °C to +60 °C) optional

Hydraulic Fluid

- CONOCO Megaflow®AW HVI 22
For temperatures down to -20 °F (-29 °C)
- EXXON Univis HVI 13
For temperatures down to -40 °F (-40 °C)

Ingress Protection

- Control enclosure: IP68
- Hydraulic actuator: IP67M
- Motor: IP68

Hazardous Area Classification and SIL Certification

- CSA, Canadian Standard Association Certification
 - Class I, Division I, Groups C and D
 - Group B configuration upon request
- FM, Factory Mutual Certification
 - Class I, II, and III, Groups C, D, E, F, G, Division I, T4
 - Group B configuration upon request
- ATEX Directive
 - EExd IIB T4
- IECEx Certificate of Conformity
 - Ex d IIB T4
- RoHS Directive

Note: This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

- SIL-2 Certification (Standard EHO Spring-Return)
- SIL-3 Certification (Smart EHO Spring-Return)

Torque Output Data (Spring-Return, Fail-Safe Actuator)

Spring-Return Model	EHO MOP (psig)	Actuator DISPL (in3)	Spring Cycle (lbf-in)			Power Cycle @ 2500 psig (lbf-in) or designated pressure			Power Cycle @ 3000 psig (lbf-in) or designated pressure		
			Spring ETC (lbf-in)	Spring RUN (lbf-in)	Spring BTC (lbf-in)	Pressure BTO @ 2500 psig (lbf-in)	Pressure @ 2500 psig RUN (lbf-in)	Pressure ETO @ 2500 psig (lbf-in)	Pressure BTO @ 3000 psig (lbf-in)	Pressure @ 3000 psig RUN (lbf-in)	Pressure ETO @ 3000 psig (lbf-in)
E35 DSRH-100	2000	5.7	1,530	1,060	2,730	2,121 @ 800 psig	765 @ 800 psig	921 @ 800 psig	3,034 @ 1,000 psig	1,221 @ 1,000 psig	1,834 @ 1,000 psig
E50 DSRH-100	2000	22.1	5,700	3,870	9,770	8,440 @ 800 psig	4,370 @ 800 psig	3,200 @ 800 psig	11,977 @ 1,000 psig	4,965 @ 1,000 psig	7,907 @ 1,000 psig
E60 DSRH-100	2000	38.9	9,420	6,440	16,300	12,200 @ 1,000 psig	4,630 @ 1,000 psig	5,280 @ 1,000 psig	16,500 @ 1,200 psig	6,519 @ 1,200 psig	9,626 @ 1,200 psig
G01002.0-SR4	3000	11.2	8,989	5,314	10,618	11,961	6,188	10,331	16,421	8,589	14,786
G01002.0-SR2	3000	11.2	12,046	7,139	14,578	8,902	4,330	6,375	13,361	6,739	10,830
G2002.2-SR4	3000	18.3	15,624	9,715	20,783	19,797	9,423	14,639	27,231	13,414	22,066
G2002.2-SR2	3000	18.3	20,394	12,378	26,199	15,024	6,714	9,227	22,457	10,726	16,655
G3002.5-SR4	3000	25.8	26,651	16,481	35,418	23,073	10,286	14,312	33,508	15,918	24,742
G3003.0-SR2	2853	41	35,011	21,557	46,409	46,545	21,993	35,147	58,455 ¹	28,346 ¹	47,051 ¹
G4003.0-SR4	3000	45	47,059	29,953	66,583	41,244	17,043	21,738	59,550	26,990	40,031
G4003.5-SR2	3000	66.8	66,841	42,765	96,220	67,403	28,075	38,044	94,970	42,938	65,592
G5004.5-SR4	3000	140	92,647	63,247	149,712	191,652	86,787	134,573	249,377	117,695	192,279
G5005.0-SR2	2940	181	131,189	92,045	224,615	240,344	101,889	146,913	303,563 ¹	135,853 ¹	210,110 ¹
G7005.0-SR4	3000	211	183,781	126,295	303,286	247,335	98,171	127,844	334,745	169,064	258,829
G7005.0-SR3	3000	211	217,623	149,987	362,244	259,328	96,715	114,733	300,895	119,696	156,289
G7006.0-SR1	3000	328	295,399	204,800	498,483	384,491	145,511	181,436	521,824	220,192	318,734
G8007.0-SR3	3000	521	353,543	223,309	500,131	730,888	347,616	584,266	949,661	463,521	803,007
G8007.0-SR2	3000	521	417,822	263,542	591,226	666,599	306,200	493,184	885,372	422,319	711,925
G10009.0-SR4	2840	1162	582,143	408,224	999,882	1,853,688 @ 2,000 psig	865,944 @ 2,000 psig	1,435,763 @ 2,000 psig	2,186,099 @ 2,500 psig	1,042,225 @ 2,500 psig	1,768,101 @ 2,500 psig
G10009.0-SR3	2840	1162	695,311	499,282	1,250,605	1,740,495 @ 2,000 psig	766,409 @ 2,000 psig	1,185,094 @ 2,000 psig	2,072,906 @ 2,500 psig	943,584 @ 2,500 psig	1,517,433 @ 2,500 psig

Notes:

1. Torques are calculated at MOP.
2. If accumulator is required, please consult factory before selecting an actuator size.

Torque Output Data (Double-Acting Actuator)

Counterclockwise to Open

G-Series Double-Acting Model	EHO MOP (psig)	Outboard DISPL (In ³)	Outboard BTO and ETO Torque Expression (lbf-in/psig)	Torque Outboard BTO and ETO @ 1,500 psig (lbf-in)	Torque Outboard RUN @ 1,500 psig (lbf-in)	Torque Outboard BTO and ETO @ 2,000 psig or MOP (lbf-in)	Torque Outboard RUN @ 2,000 psig or MOP (lbf-in)	Torque Outboard BTO and ETO @ 3,000 psig or MOP (lbf-in)	Torque Outboard RUN @ 3,000 psig or MOP (lbf-in)
G01002.0	3,000	14.9	13.43	18,448	9,924	24,810	13,306	37,378	20,015
G2002.2	2,916	22.8	16.99	22,336	12,011	30,040	16,105	45,256 ¹	24,227 ¹
G3003.0	2,358	49.5	44.53	63,009	33,517	84,446	44,840	99,716 ¹	52,920 ¹
G4003.0	3,000	60	54.07	76,200	40,615	102,097	54,327	153,395	81,578
G4004.0	2,184	107	96.13	137,831	73,027	184,382	97,582	201,452 ¹	106,597 ¹
G5004.0	3,000	138	157.45	176,914	93,966	236,449	141,186	354,389	188,125
G5005.0	2,469	216	194.38	279,646	147,946	373,518	197,491	461,118 ¹	243,806 ¹
G7005.0	3,000	265	238.56	343,128	181,687	458,340	242,542	687,073	363,660
G7008.0	1,532	679	610.72	890,012	469,167	909,062 ¹	479,198 ¹	N/A	N/A
G8008.0	2,072	804	723.82	1,053,431	555,357	1,405,002	740,624	1,455,495 ¹	767,257 ¹
G10008.0	3,000	1056	950.02	1,382,462	729,214	1,843,934	972,512	2,761,461	1,457,219

Clockwise to Close

G-Series Double-Acting Model	EHO MOP (psig)	Inboard DISPL (In ³)	Inboard BTC and ETC Torque Expression (lbf-in/psig)	Torque Inboard BTC and ETC @ 1,500 psig (lbf-in)	Torque Inboard RUN @ 1,500 psig (lbf-in)	Torque Inboard BTC and ETC @ 2,000 psig or MOP (lbf-in)	Torque Inboard RUN @ 2,000 psig or MOP (lbf-in)	Torque Inboard BTC and ETC @ 3,000 psig or MOP (lbf-in)	Torque Inboard RUN @ 3,000 psig or MOP (lbf-in)
G01002.0	3,000	11.2	10.07	13,450	7,307	18,147	9,818	27,382	14,783
G2002.2	2,916	18.3	13.64	16,285	8,845	21,971	11,883	33,153 ¹	17,893 ¹
G3003.0	2,358	41	36.80	51,506	27,500	69,108	36,818	81,634 ¹	43,462 ¹
G4003.0	3,000	45	40.55	56,072	30,084	75,259	40,285	113,139	60,515
G4004.0	2,184	91.8	82.61	117,714	62,502	157,559	83,548	172,162 ¹	91,272 ¹
G5004.0	3,000	104	93.30	130,667	69,772	174,786	93,226	261,884	139,736
G5005.0	2,469	181	163.28	233,383	123,744	311,835	165,221	384,971 ¹	203,969 ¹
G7005.0	3,000	211	190.25	271,210	144,046	362,449	192,354	543,237	288,378
G7008.0	1,532	625	562.41	818,094	431,526	835,610 ¹	440,754 ¹	N/A	N/A
G8008.0	2,072	709	638.29	926,163	488,762	1,235,311	651,831	1,279,883 ¹	675,267 ¹
G10008.0	3,000	881	793.23	1,148,968	607,007	1,532,608	809,570	2,294,472	1,212,806

Notes:

1. Torques are calculated at MOP.
2. If accumulator is required, please consult factory before selecting an actuator size.

Stroking Time Data (Spring-Return, Fail-Safe Actuator)

Spring-Return Model	EHO MOP (psig)	Actuator DISPL (in ³)	Power Cycle				Spring Cycle		
			Stroke Time Power Cycle (seconds) AC 3-Phase ^{1,2,5}	Stroke Time Power Cycle (seconds) AC 1-Phase ^{1,2,5}	Motor HP Required	Stroke Time Power Cycle (seconds) 1/2 HP DC Motor ^{1,2}	Fastest Stroke Time with Accumulator (seconds) ^{1,4}	Fastest SR Stroke Time to Fail Position (seconds)	Slowest Recommended SR Stroke Time to Fail Position (seconds)
E35 DSRH-100	2,000	5.7	4	4	1.0	8	1	1.0	30
E50 DSRH-100	2,000	22.1	14	14	1.0	28	4	3.5	60
E60 DSRH-100	2,000	38.9	17	17	1.0	34	6	4.0	60
G01002.0-SR4	3,000	11.2	7	7	1.0	14	2	1.2	60
G01002.0-SR2	3,000	11.2	7	7	1.0	14	2	1.2	60
G2002.2-SR4	3,000	18.3	12	12	1.0	24	3	1.7	60
G2002.2-SR2	3,000	18.3	12	12	1.0	24	3	1.7	60
G3002.5-SR4	3,000	25.8	19	19	1.0	38	4	2.4	90
G3003.0-SR2	2,853	41	26	26	1.0	52	7	3.8	90
G4003.0-SR4	3,000	45	29	29	1.0	58	7	4.2	90
G4003.5-SR2	3,000	66.8	45	45	1.0	90	11	6.2	90
G5004.5-SR4	3,000	140	57	85.5	1.5 ⁴	114	23	13	120
G5005.0-SR2	2,940	181	70	105	1.5 ⁴	140	30	17	120
G7005.0-SR4	3,000	211	81	121.5	1.5 ⁴	C/F	35	20	120
G7005.0-SR3	3,000	211	81	121.5	1.5 ⁴	C/F	35	20	120
G7006.0-SR1	3,000	328	126	189	1.5 ⁴	C/F	54	30	120
G8007.0-SR3	3,000	521	190	285	1.5 ⁴	N/A	N/A	48	120
G8007.0-SR2	3,000	521	190	285	1.5 ⁴	N/A	N/A	48	120
G10009.0-SR4	2,840	1,162	400	600	1.5 ⁴	N/A	N/A	106	120
G10009.0-SR3	2,840	1,162	400	600	1.5 ⁴	N/A	N/A	106	120

(Double-Acting Actuator)

G-Series Double-Acting Model	EHO MOP (psig)	Outboard DISPL (In ³)	Counterclockwise to Open				Clockwise to Close					Motor HP Required
			Stroke Time Power Cycle (seconds) AC 3-Phase ^{1,2,5}	Stroke Time Power Cycle (seconds) AC 1-Phase ^{1,2,5}	Stroke Time Power Cycle (seconds) 1/2 HP DC Motor ^{1,2}	Fastest Stroke Time with Accumulator (seconds) ^{1,4}	Inboard DISPL (In ³)	Stroke Time Power Cycle (seconds) AC 3-Phase ¹	Stroke Time Power Cycle (seconds) AC 1-Phase ¹	Stroke Time Power Cycle (seconds) 1/2 HP DC Motor ^{1,2}	Fastest Stroke Time with Accumulator (seconds) ^{1,4}	
G01002.0	3,000	14.9	8	8	18	2.5	11.2	6	6	18	1.8	1.0
G2002.2	2,916	22.8	12	12	27	3.7	18.3	10	10	27	3.0	1.0
G3003.0	2,358	49.5	26	26	58	8	41	22	22	58	7	1.0
G4003.0	3,000	60	31	31	71	10	45	24	24	71	7	1.0
G4004.0	2,184	107	56	56	126	18	92	51	51	126	15	1.0
G5004.0	3,000	138	48	72	163	23	104	36	54	163	17	1.5 ⁴
G5005.0	2,469	216	75	112	C/F	36	181	63	95	C/F	30	1.5 ⁴
G7005.0	3,000	265	92	138	C/F	44	211	73	110	C/F	35	1.5 ⁴
G7008.0	1,532	679	235	353	N/A	112	625	216	324	N/A	103	1.5 ⁴
G8008.0	2,072	804	278	418	N/A	132	709	245	368	N/A	117	1.5 ⁴
G10008.0	3,000	1,056	366	549	N/A	174	881	305	458	N/A	145	1.5 ⁴

Notes:

1. Stroking speeds are estimates which may vary based on model configuration, temperature, and hydraulic fluid viscosity changes. Consult factory when sizing an actuator for processes with critical stroking speed requirements.
2. For stroking speed requirements less than the illustrated Power Cycle, consult factory for additional hydraulic accumulator to decrease opening stroke times.
3. If slower stroke time is required please consult factory.
4. Single phase motors will be 1 HP only.
5. If accumulator is required, please consult factory before selecting an actuator size.
6. Estimated AC Power Cycle speeds consider a 60 Hz power supply. For 50 Hz power supplies, multiply the listed speed by 0.833.

Model Code Information

Standard Spring-Return EHO

Code	Product Description	
EHO	Standard Self-Contained Electro-Hydraulic Actuator	
Code	Actuator Size	
	Spring-Return Actuator Model	
E35D-SRH100		
G01001.5-SR9		
E50D-SRH100		
G01002.0-SR5		
E60D-SRH100		
G01002.0-SR4		
G01002.0-SR2		
G2002.2-SR4		
G2002.2-SR2		
G3002.5-SR4		
G3003.0-SR2		
G4003.0-SR4		
G4003.5-SR2		
G5004.5-SR4		
G5005.0-SR2		
G7005.0-SR4		
G7005.0-SR3		
G7006.0-SR1		
G8007.0-SR3		
G8007.0-SR2		
G10009.0-SR4		
G10009.0-SR3		
Code	Temperature Rating	
A	-20 °F (-29 °C)	
B	-40 °F (-40 °C)	
Code	Valve Rotation Direction	
0	Clockwise to close	
1	Counterclockwise to close	
Code	Actuator Function	
A	On/Off	
Code	Fail Function	
	Loss of Power	Loss of ESD Signal
0	Stay put (No ESD)	N/A
1	Stay put	Close
2	Close	Close
3	Stay put	Open
4	Open	Open
5	Close (No ESD)	N/A
6	Open (No ESD)	N/A
Code	ESD Solenoid Valve	
X	No ESD Solenoid Valve (Fail Function Code 0 only)	
N	Internally Powered ESD Solenoid Valve, No ESD Signal (Fail Function Codes 5 and 6 only, If Low Wattage Required Add -S)	
S	Internal Standard Solenoid Valve, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
R	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
L	External Low Wattage Solenoid Valve (down to -36C), 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
D	Dual ESD Solenoid Valves, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
T	Internal Standard Solenoid Valve, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
P	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
K	External Low Wattage Solenoid Valve (down to -36C), 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
E	Dual ESD Solenoid Valves, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
U	Internal Standard Solenoid Valve, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Q	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
J	External Low Wattage Solenoid Valve (down to -36C), Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
F	Dual ESD Solenoid Valves, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Code	Remote Control	
0	Discrete	

Model Code Information

Standard Spring-Return EHO (continuation)

Code		Limit Switches		
A		2 SPDT		
B		4 SPDT		
Code		Output		
0		None		
1		Internal pressure transmitter with 4 - 20 mA output for hydraulic pressure monitoring		
2		Internal pressure switch for low pressure alarm		
3		Internal pressure switch for low pressure alarm (accumulator)		
Code		Power Supply		
		Volts	Phase	Hz
1		208	AC	3
2		230	AC	3
3		460	AC	3
T		460	AC	3
4		575	AC	3
5		380	AC	3
N		380	AC	3
6		115	AC	1
7		208	AC	1
8		230	AC	1
9		415	AC	3
K		220	AC	1
P		220	AC	3
L		115	AC	1
R		550	AC	3
S		660	AC	3
A		400	AC	3
V		690	AC	3
W		690	AC	3
F		24	DC	-
Code		Orientation (Operator to Pipeline)		
		Pipeline Orientation	Valve Stem Orientation	Actuator Cylinder Orientation
1		Horizontal	Vertical	Parallel to pipeline
2		Horizontal	Vertical	Perpendicular to pipeline
3		Horizontal	Horizontal	Parallel to pipeline
4		Horizontal	Horizontal	Perpendicular to pipeline
5		Vertical	Horizontal	Perpendicular to pipeline
6		Vertical	Horizontal	Parallel to pipeline
Code		Valve Mounting		
MN		No Valve Mounting Adaptor		
MA		Valve mounting Adaptor		
Code		Options (Multiple Choices)		
AX		Accumulator for X strokes, for example, A1 means accumulator for 1 stroke		
CB		Close coupled circuit breaker		
PC		Customer specified paint		
PS		Bettis standard paint		
RB		Remote mounted circuit breaker		
RD		Remote display module		
SP		Solar panel and battery (only 24 V DC model)		
SW		Level Switch		
Code		Certificates (Multiple Choices)		
AX		ATEX Eexd IIB T4		
CS*		CSA Class I Div. I Group C, D		
FM*		FM Class I Div. I Group C, D		
IE		IECEX		
S2		SIL-2		
Code		Special Configuration		
S		Special Configuration		

Notes:

* CSA and FM group B certification available as a special configuration upon request.

Model Code Information

Standard Double-Acting EHO

Code	Product Description	
EHO	Standard Self-Contained Electro-Hydraulic Actuator	
Code	Actuator Size	
	Double-Acting Actuator Model	
G01002.0		
G2002.2		
G3003.0		
G4003.0		
G4004.0		
G5004.0		
G5005.0		
G7005.0		
G7008.0		
G8008.0		
G10008.0		
Code	Temperature Rating	
A	-20 °F (-29 °C)	
B	-40 °F (-40 °C)	
Code	Valve Rotation Direction	
0	Clockwise to close	
1	Counterclockwise to close	
Code	Actuator Function	
A	On/Off	
Code	Fail Function	
	Loss of Power	Loss of ESD Signal
0	Stay put (No ESD)	N/A
1	Stay put	Close
2	Close	Close
3	Stay put	Open
4	Open	Open
5	Close (No ESD)	N/A
6	Open (No ESD)	N/A
Code	ESD Solenoid Valve	
X	No ESD Solenoid Valve (Fail Function Code 0 only)	
N	Internally Powered ESD Solenoid Valve, No ESD Signal (Fail Function Codes 5 and 6 only, If Low Wattage Required Add -S)	
S	Internal Standard Solenoid Valve, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
R	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
L	External Low Wattage Solenoid Valve (down to -36C), 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
D	Dual ESD Solenoid Valves, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
T	Internal Standard Solenoid Valve, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
P	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
K	External Low Wattage Solenoid Valve (down to -36C), 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
E	Dual ESD Solenoid Valves, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
U	Internal Standard Solenoid Valve, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Q	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
J	External Low Wattage Solenoid Valve (down to -36C), Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
F	Dual ESD Solenoid Valves, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Code	Remote Control	
0	Discrete	

Model Code Information

Standard Double-Acting EHO (continuation)

Code		Limit Switches			
A		2 SPDT			
B		4 SPDT			
Code		Output			
0		None			
1		Pressure transmitter with 4 - 20 mA output for hydraulic pressure monitoring			
2		Internal pressure switch for low pressure alarm			
3		Internal pressure switch for low pressure alarm (accumulator)			
Code		Power Supply			
		Volts		Phase	Hz
1		208	AC	3	60
2		230	AC	3	60
3		460	AC	3	60
T		460	AC	3	50
4		575	AC	3	60
5		380	AC	3	50
N		380	AC	3	60
6		115	AC	1	60
7		208	AC	1	60
8		230	AC	1	60
9		415	AC	3	50
K		220	AC	1	50
P		220	AC	3	50
L		115	AC	1	50
R		550	AC	3	50
S		660	AC	3	60
A		400	AC	3	50
V		690	AC	3	50
W		690	AC	3	60
F		24	DC	-	-
Code		Orientation (Operator to Pipeline)			
		Pipeline Orientation	Valve Stem Orientation	Actuator Cylinder Orientation	
1		Horizontal	Vertical	Parallel to pipeline	
2		Horizontal	Vertical	Perpendicular to pipeline	
3		Horizontal	Horizontal	Parallel to pipeline	
4		Horizontal	Horizontal	Perpendicular to pipeline	
5		Vertical	Horizontal	Perpendicular to pipeline	
6		Vertical	Horizontal	Parallel to pipeline	
Code		Valve Mounting			
MN		No Valve Mounting Adaptor			
MA		Valve Mounting adaptor			
Code		Options (Multiple Choices)			
AX		Accumulator for X strokes, for example, A1 means accumulator for 1 stroke			
CB		Close coupled circuit breaker			
PC		Customer specified paint			
PS		Bettis standard paint			
RB		Remote mounted circuit breaker			
RD		Remote display module			
SP		Solar panel and battery (only 24 V DC model)			
SW		Level Switch			
Code		Certificates (Multiple Choices)			
AX		ATEX Eexd IIB T4			
CS*		CSA Class I Div. I Group C, D			
FM*		FM Class I Div. I Group C, D			
IE		IECEX			
Code		Special Configuration			
S		Special Configuration			

Notes:

* CSA and FM group B certification available as a special configuration upon request.

Model Code Information

Smart Spring-Return EHO

Code	Product Description	
SEHO	Smart Self-Contained Electro-Hydraulic Actuator	
Code	Actuator Size	
	Spring-Return Actuator Model	
E35D-SRH100		
G01001.5-SR9		
E50D-SRH100		
G01002.0-SR5		
E60D-SRH100		
G01002.0-SR4		
G01002.0-SR2		
G2002.2-SR4		
G2002.2-SR2		
G3002.5-SR4		
G3003.0-SR2		
G4003.0-SR4		
G4003.5-SR2		
G5004.5-SR4		
G5005.0-SR2		
G7005.0-SR4		
G7005.0-SR3		
G7006.0-SR1		
G8007.0-SR3		
G8007.0-SR2		
G10009.0-SR4		
G10009.0-SR3		
Code	Temperature Rating	
A	-20 °F (-29 °C)	
B	-40 °F (-40 °C)	
Code	Valve Rotation Direction	
0	Clockwise to close	
1	Counterclockwise to close	
Code	Actuator Function	
B	On/Off or Intermittent Positioning	
C	Modulating	
Code	Fail Function	
	Loss of Power	Loss of ESD Signal
0	Stay put (No ESD)	N/A
1	Stay put	Close
2	Close	Close
3	Stay put	Open
4	Open	Open
5	Close (No ESD)	N/A
6	Open (No ESD)	N/A
Code	ESD Solenoid Valve	
X	No ESD Solenoid Valve (Fail Function Code 0 only)	
N	Internally Powered ESD Solenoid Valve, No ESD Signal (Fail Function Codes 5 and 6 only, If Low Wattage Required Add -S)	
S	Internal Standard Solenoid Valve, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
R	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
L	External Low Wattage Solenoid Valve (down to -36C), 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
D	Dual ESD Solenoid Valves, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
T	Internal Standard Solenoid Valve, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
P	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
K	External Low Wattage Solenoid Valve (down to -36C), 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
E	Dual ESD Solenoid Valves, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
U	Internal Standard Solenoid Valve, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Q	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
J	External Low Wattage Solenoid Valve (down to -36C), Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
F	Dual ESD Solenoid Valves, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	

Model Code Information

Smart Spring-Return EHO (continuation)

Code		Communication Protocols		
0	No communication protocol			
1	Modbus (CAM05)			
2	HART (CAM16)			
3	Foundation Fieldbus (CAM228)			
Code		Limit Switches		
N	No Limit Switches			
A	2 SPDT			
B	4 SPDT			
Code		Power Supply		
	Volts		Phase	Hz
1	208	AC	3	60
2	230	AC	3	60
3	460	AC	3	60
T	460	AC	3	50
4	575	AC	3	60
5	380	AC	3	50
N	380	AC	3	60
6	115	AC	1	60
7	208	AC	1	60
8	230	AC	1	60
9	415	AC	3	50
K	220	AC	1	50
P	220	AC	3	50
L	115	AC	1	50
R	550	AC	3	50
S	660	AC	3	60
A	400	AC	3	50
V	690	AC	3	50
W	690	AC	3	60
F	24	DC	-	-
Code		Orientation (Operator to Pipeline)		
	Pipeline Orientation	Valve Stem Orientation	Actuator Cylinder Orientation	
1	Horizontal	Vertical	Parallel to pipeline	
2	Horizontal	Vertical	Perpendicular to pipeline	
3	Horizontal	Horizontal	Parallel to pipeline	
4	Horizontal	Horizontal	Perpendicular to pipeline	
5	Vertical	Horizontal	Perpendicular to pipeline	
6	Vertical	Horizontal	Parallel to pipeline	
Code		Valve Mounting		
MN	No Valve Mounting Adaptor			
MA	Valve mounting Adaptor			
Code		Options (Multiple Choices)		
AX	Accumulator for X strokes, for example, A1 means accumulator for 1 stroke			
CB	Close coupled circuit breaker			
PC	Customer specified paint			
PS	Bettis standard paint			
RB	Remote mounted circuit breaker			
SP	Solar panel and battery (only 24 V DC model)			
SW	Level Switch			
Code		Certificates (Multiple Choices)		
AX	ATEX Eexd IIB T4			
CS*	CSA Class I Div. I Group C,D			
FM*	FM Class I Div. I Group C, D			
IE	IECEX			
S3	SIL 3			
Code		Special Configuration		
S	Special Configuration			

Notes:

* CSA and FM group B certification available as a special configuration upon request.

Model Code Information

Smart Double-Acting EHO

Code	Product Description	
SEHO	Smart Self-Contained Electro-Hydraulic Actuator	
Code	Actuator	
	Double-Acting Actuator Model	
G01002.0		
G2002.2		
G3003.0		
G4003.0		
G4004.0		
G5004.0		
G5005.0		
G7005.0		
G7008.0		
G8008.0		
G10008.0		
Code	Temperature Rating	
A	-20 °F (-29 °C)	
B	-40 °F (-40 °C)	
Code	Valve Rotation Direction	
0	Clockwise to close	
1	Counterclockwise to close	
Code	Actuator Function	
B	On/Off or Intermittent Positioning	
C	Modulating	
Code	Fail Function	
	Loss of Power	
	Loss of ESD Signal	
0	Stay put (No ESD)	N/A
1	Stay put	Close
2	Close	Close
3	Stay put	Open
4	Open	Open
5	Close (No ESD)	N/A
6	Open (No ESD)	N/A
Code	ESD Solenoid Valve	
X	No ESD Solenoid Valve (Fail Function Code 0 only)	
N	Internally Powered ESD Solenoid Valve, No ESD Signal (Fail Function Codes 5 and 6 only, If Low Wattage Required Add -S)	
S	Internal Standard Solenoid Valve, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
R	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
L	External Low Wattage Solenoid Valve (down to -36C), 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
D	Dual ESD Solenoid Valves, 24 V DC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
T	Internal Standard Solenoid Valve, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4) - Common	
P	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
K	External Low Wattage Solenoid Valve (down to -36C), 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
E	Dual ESD Solenoid Valves, 120 V AC SIGNAL (Fail Function Codes 1, 2, 3, and 4)	
U	Internal Standard Solenoid Valve, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Q	Internal Standard Solenoid Valve with External Manual Reset Pushbutton Box, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
J	External Low Wattage Solenoid Valve (down to -36C), Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
F	Dual ESD Solenoid Valves, Non-standard Signal Voltage Specified in -S (Fail Function Codes 1, 2, 3, and 4) - Uncommon	
Code	Communication Protocols	
0	No communication protocol	
1	Modbus (CAM05)	
2	HART (CAM16)	
3	Foundation Fieldbus (CAM228)	

Model Code Information

Smart Double-Acting EHO (continuation)

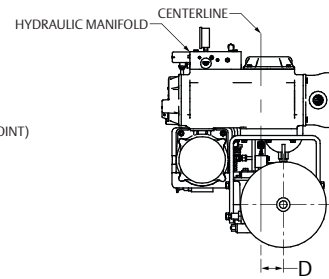
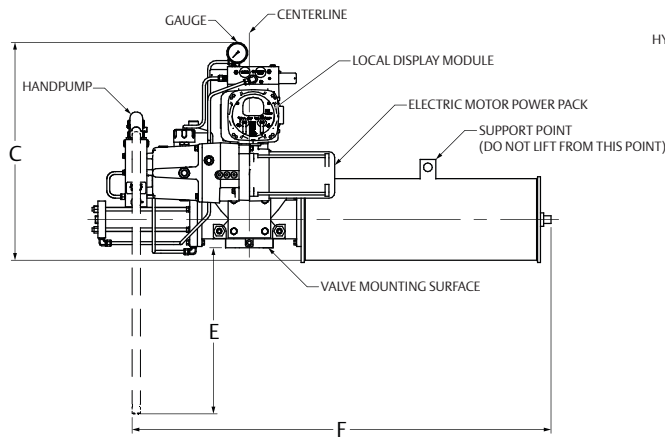
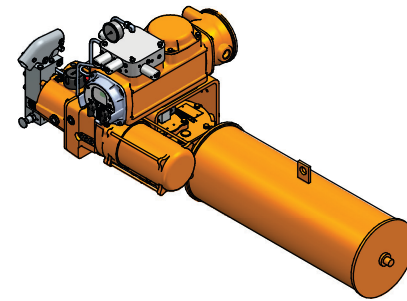
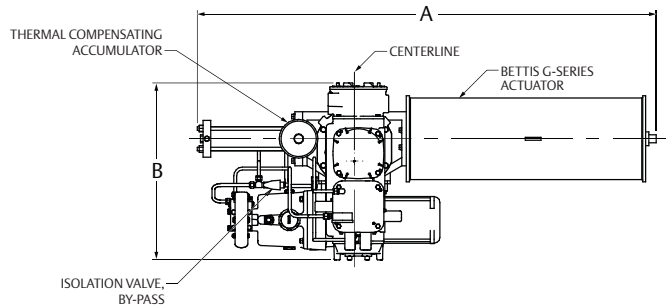
Code		Limit Switches		
N	No Limit Switches			
A	2 SPDT			
B	4 SPDT			
Code		Output		
0	None			
1	Internal pressure transmitter with 4 - 20 mA output for hydraulic pressure monitoring			
2	Internal pressure switch for low pressure alarm			
Code		Power Supply		
	Volts		Phase	Hz
1	208	AC	3	60
2	230	AC	3	60
3	460	AC	3	60
T	460	AC	3	50
4	575	AC	3	60
5	380	AC	3	50
N	380	AC	3	60
6	115	AC	1	60
7	208	AC	1	60
8	230	AC	1	60
9	415	AC	3	50
K	220	AC	1	50
P	220	AC	3	50
L	115	AC	1	50
R	550	AC	3	50
S	660	AC	3	60
A	400	AC	3	50
V	690	AC	3	50
W	690	AC	3	60
F	24	DC	-	-
Code		Orientation (Operator to Pipeline)		
	Pipeline Orientation	Valve Stem Orientation	Actuator Cylinder Orientation	
1	Horizontal	Vertical	Parallel to pipeline	
2	Horizontal	Vertical	Perpendicular to pipeline	
3	Horizontal	Horizontal	Parallel to pipeline	
4	Horizontal	Horizontal	Perpendicular to pipeline	
5	Vertical	Horizontal	Perpendicular to pipeline	
6	Vertical	Horizontal	Parallel to pipeline	
Code		Valve Mounting		
MN	No Valve Mounting Adaptor			
MA	Valve mounting Adaptor			
Code		Options (Multiple Choices)		
AX	Accumulator for X strokes, for example, A1 means accumulator for 1 stroke			
CB	Close coupled circuit breaker			
PC	Customer specified paint			
PS	Bettis standard paint			
RB	Remote mounted circuit breaker			
SP	Solar panel and battery (only 24 V DC model)			
SW	Level Switch			
Code		Certificates (Multiple Choices)		
AX	ATEX Eexd IIB T4			
CS*	CSA Class I Div. I Group C, D			
FM*	FM Class I Div. I Group C, D			
IE	IECEX			
Code		Special Configuration		
S	Special Configuration			

Notes:

* CSA and FM group B certification available as a special configuration upon request.

Dimension

Spring-Return, Fail-Safe Actuator

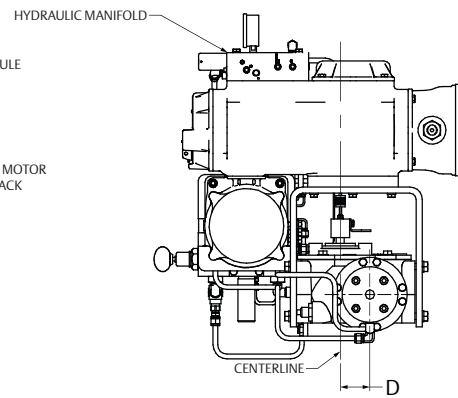
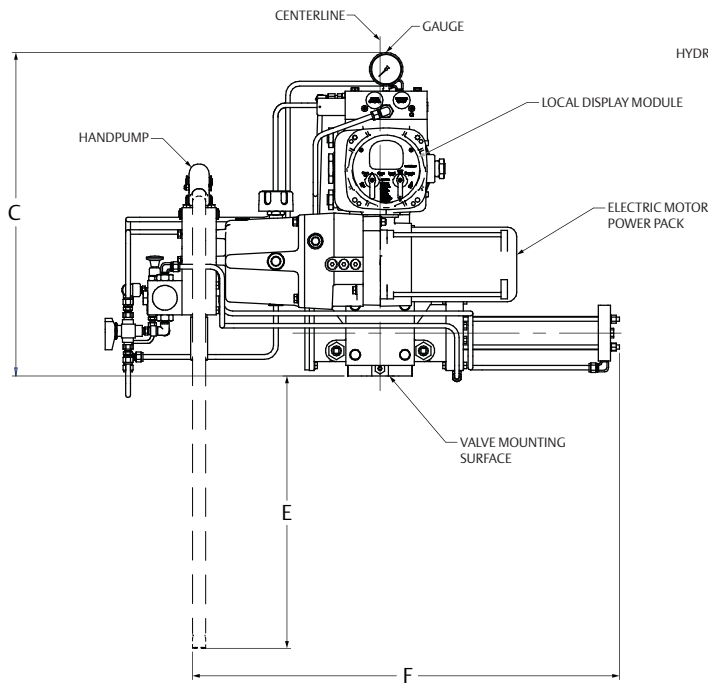
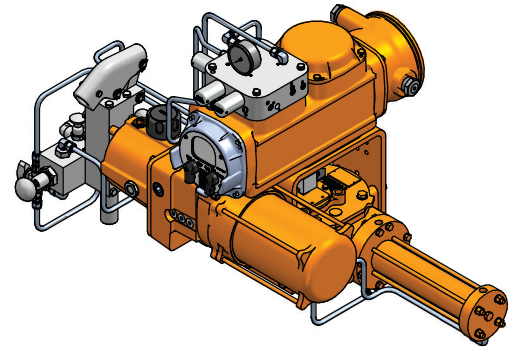
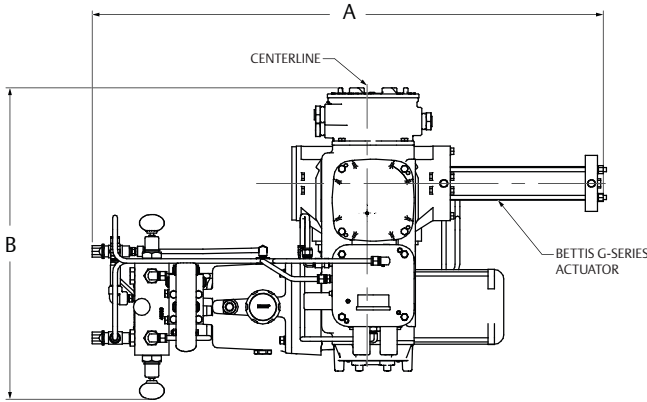


OUTLINE DIMENSION AND DETAILS

Actuator	A		B		C		D		E		F		Approximate Weight	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg
E35D-SRH100	32.00	81.30	22.6	57.40	28.10	71.40	1.40	3.50	22.8	57.91	25.0	63.50	515	234
E50D-SRH100	48.50	123.20	22.6	57.40	28.10	71.40	2.20	5.60	20.2	51.31	30.0	76.20	565	259
E60D-SRH100	54.00	137.20	22.6	57.40	30.10	76.50	2.40	6.10	18.4	46.74	30.9	78.49	625	284
G01002.0-SR2-CW	54.0	137.16	22.6	57.40	28.1	71.37	2.4	6.10	21.9	55.63	34.4	87.38	669	303
G01002.0-SR4-CW	54.0	137.16	22.6	57.40	28.1	71.37	2.4	6.10	21.9	55.63	34.4	87.38	655	297
G2002.2-SR2-CW	57.8	146.81	22.6	57.40	28.1	71.37	2.9	7.37	21.4	54.36	54.0	137.16	774	351
G2002.2-SR4-CW	57.8	146.81	22.6	57.40	28.1	71.37	2.9	7.37	21.4	54.36	54.0	137.16	759	344
G3002.5-SR4-CW	65.5	166.37	22.6	57.40	32.1	81.53	3.5	8.89	17.9	45.47	57.1	145.03	916	415
G3003.0-SR2-CW	65.5	166.37	22.6	57.40	32.1	81.53	3.5	8.89	17.9	45.47	57.1	145.03	945	429
G4003.0-SR4-CW	76.2	193.55	27.7	70.36	31.7	80.52	4.3	10.92	16.4	41.66	62.6	159.00	1229	557
G4003.5-SR2-CW	76.2	193.55	27.7	70.36	31.7	80.52	4.3	10.92	16.4	41.66	62.6	159.00	1313	596
G5004.5-SR4-CW	89.0	226.06	31.1	78.99	35.9	91.19	5.5	13.97	13.3	33.78	69.3	176.02	1970	894
G5005.0-SR2-CW	89.0	226.06	31.1	78.99	35.9	91.19	5.5	13.97	13.3	33.78	69.3	176.02	2099	952
G7005.0-SR3-CW	105.6	268.22	35.7	90.68	42.4	107.70	6.8	17.27	10.3	26.16	91.8	233.17	3238	1469
G7005.0-SR4-CW	105.6	268.22	35.7	90.68	42.4	107.70	6.8	17.27	10.3	26.16	91.8	233.17	3325	1508
G7006.0-SR4-CW	105.6	268.22	35.7	90.68	42.4	107.70	6.8	17.27	10.3	26.16	91.8	233.17	3312	1502
G8007.0-SR2-CW	139.7	354.84	36.9	93.73	43.1	109.47	8.0	20.32	9.2	23.37	111.2	282.45	5447	2471
G8007.0-SR3-CW	139.7	354.84	36.9	93.73	43.1	109.47	8.0	20.32	9.2	23.37	111.2	282.45	5427	2462
G10009.0-SR4-CW	168.6	428.24	39.4	100.08	45.3	115.06	10.5	154.94	7.2	18.29	127.0	322.58	7497	3401

Dimension

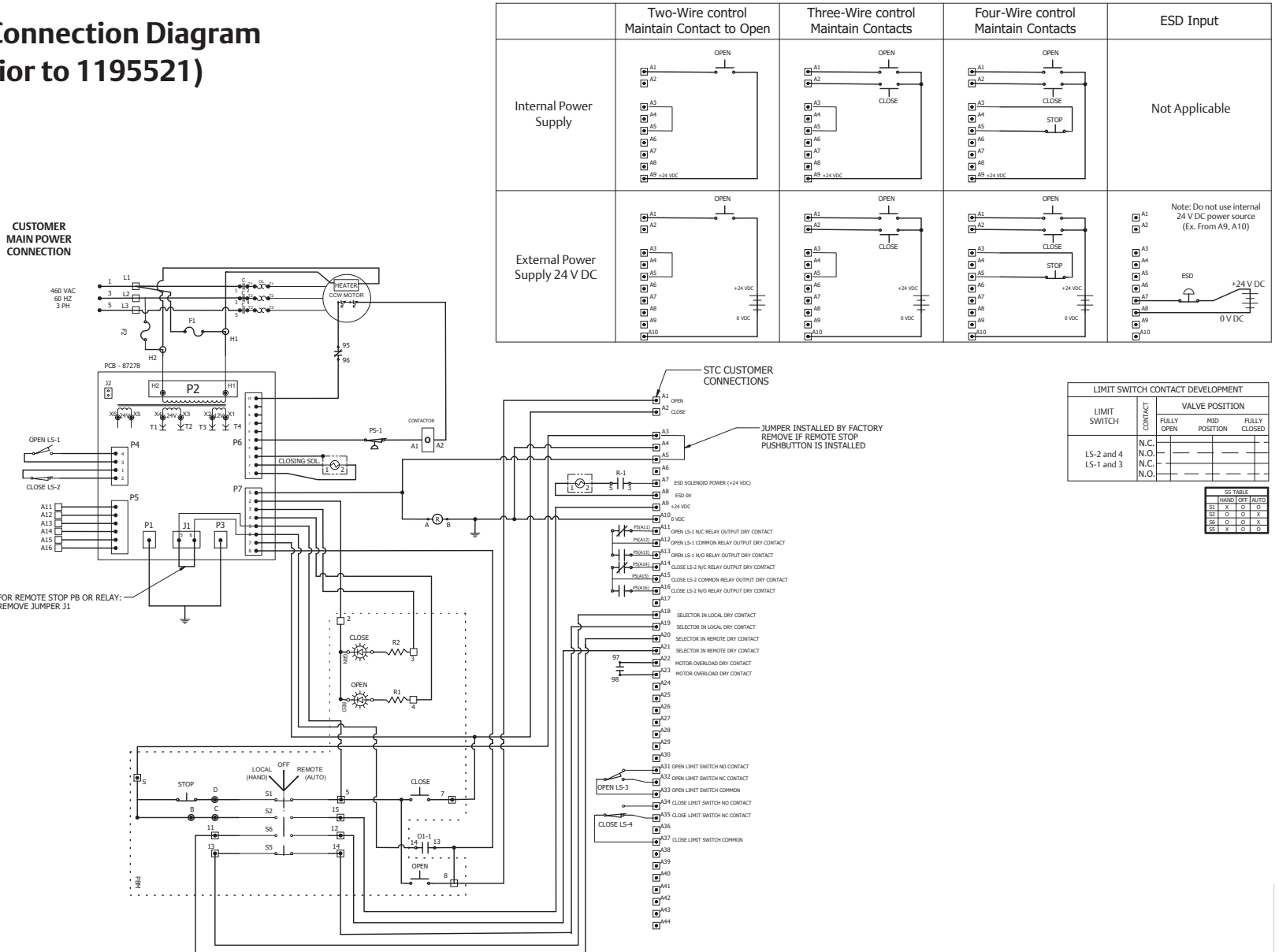
Double-Acting Actuator



OUTLINE DIMENSION AND DETAILS														
Actuator	A		B		C		D		E		F		Approximate Weight	
	inch	cm	inch	cm	inch	cm	inch	cm	inch	cm	inch	cm	lb	kg
G01002.0	41.2	104.65	25.2	64.01	26.5	67.31	2.4	6.10	21.9	55.63	34.4	87.38	669	303
G2002.2	42.4	107.70	25.2	64.01	27.3	69.34	3.0	7.62	24.4	61.98	35.4	89.92	774	351
G3003.0	45.6	115.82	25.2	64.01	31.4	79.76	3.5	8.89	18.0	45.72	38.5	97.79	916	415
G4004.0	55.2	140.21	25.2	64.01	33.0	83.82	4.3	10.92	14.0	35.56	48.0	121.92	1229	557
G5004.0	61.6	156.46	28.5	72.39	35.9	91.19	5.5	13.97	14.2	36.07	54.2	137.67	1970	894
G5005.0	61.6	156.46	28.5	72.39	35.9	91.19	5.5	13.97	14.2	36.07	54.2	137.67	2099	952
G7005.0	65.5	166.37	31.3	79.38	37.5	95.25	6.7	17.02	10.4	26.42	58.5	148.59	3238	1469
G7008.0	65.5	166.37	31.3	79.38	37.5	95.25	6.7	17.02	10.4	26.42	58.5	148.59	3325	1508
G8008.0	71.6	181.86	33.6	85.34	40.2	102.11	8.0	20.32	9.4	23.88	64.6	164.08	5447	2471
G10008.0	83.5	212.09	37.9	96.27	43.2	109.73	10.5	26.67	7.3	18.54	76.5	194.31	7497	3401

Standard EHO

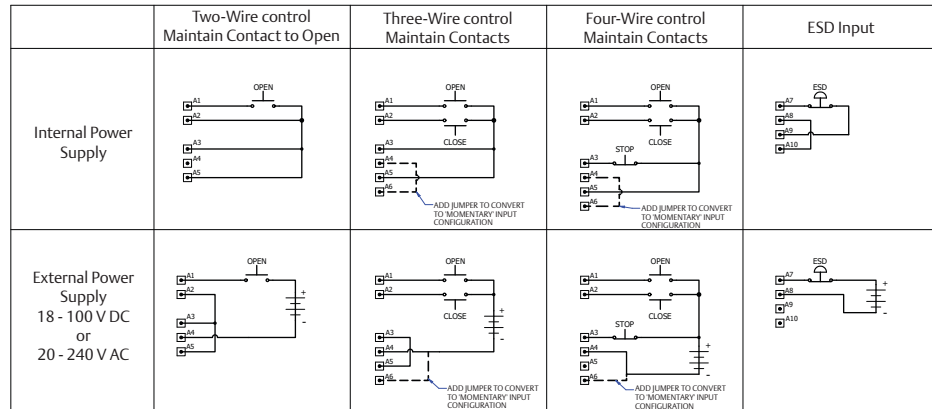
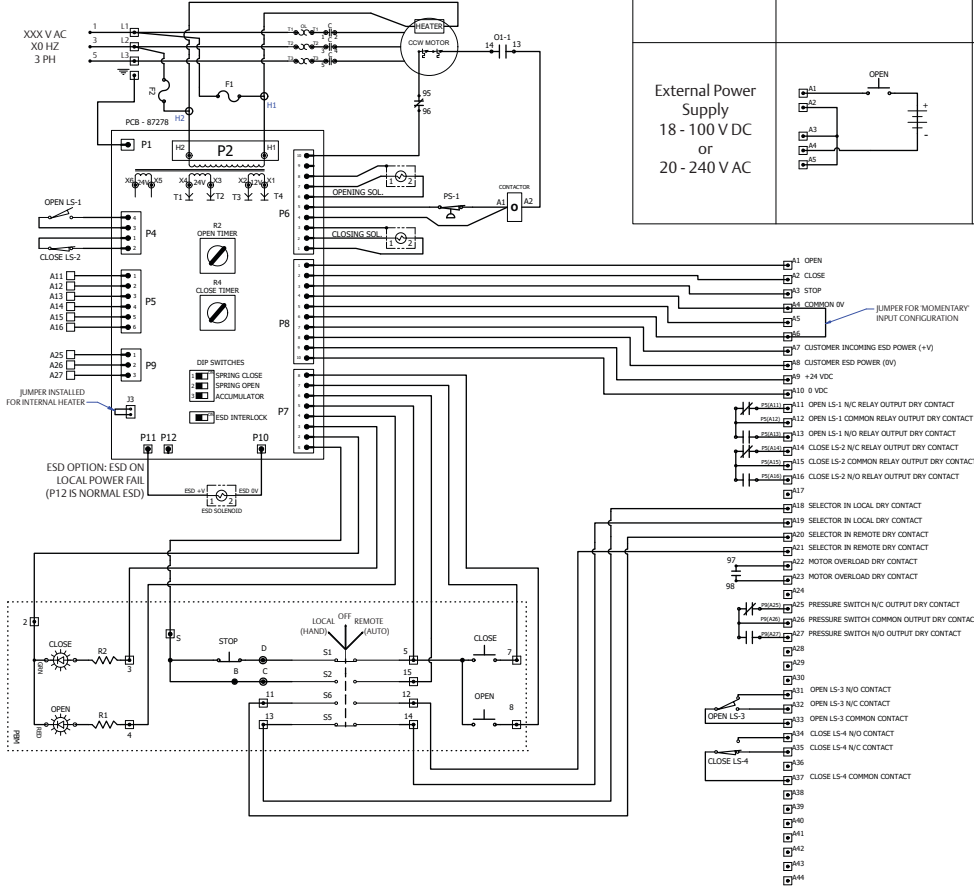
Generic Electrical Connection Diagram (Serial Numbers Prior to 1195521)



Standard EHO

Generic Electrical Connection Diagram (Serial Numbers After 1195521)

CUSTOMER MAIN POWER CONNECTION



LIMIT SWITCH CONTACT DEVELOPMENT		VALVE POSITION	
LIMIT SWITCH	CONTACT	FULLY OPEN	FULLY CLOSED
LS-2 and 4	N.C.		
LS-1 and 3	N.O.		
	N.C.		
	N.O.		

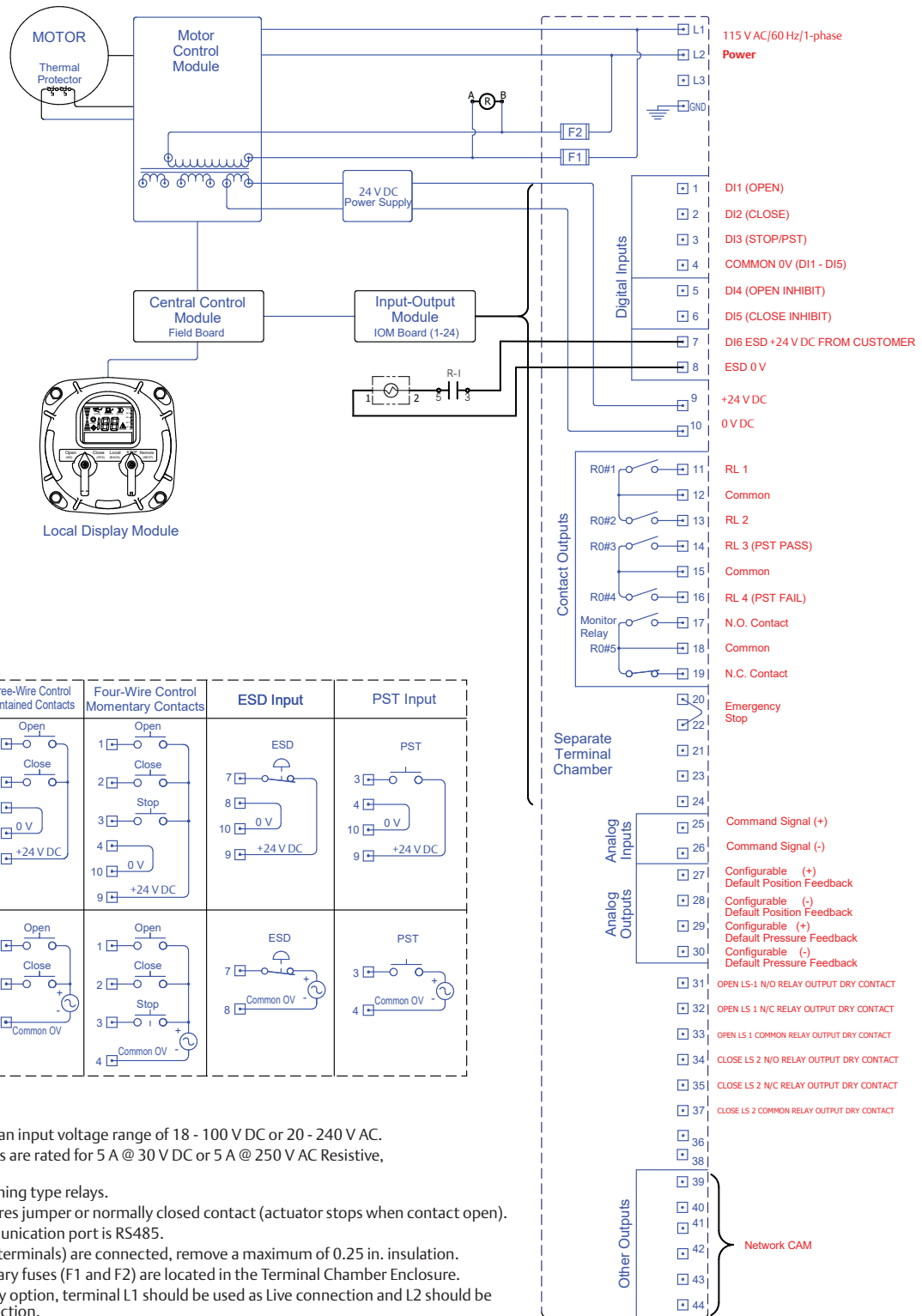
DIP SWITCHES	HAND/OFF/AUTO		
	1	2	3
SR, FAIL	X	O	O
CLOSE, NO ACC			
SR, FAIL, ACC	X	O	X
CLOSE, ACC			
SR, FAIL, OPEN, NO ACC	O	X	O
SR, FAIL, OPEN, ACC	O	X	X
DA, NO ACC	O	O	O
DA, ACC	O	O	X

Notes:

1. All digital inputs have an input voltage range of 18 - 100 V DC or 20 - 240 V AC.
2. All digital relay outputs are rated for 5 A @ 30 V DC or 5 A @ 250 V AC Resistive, 2 A Inductive load.
3. Pressure Switch and Limit Switch relays are non latching type relays.
4. Emergency stop requires jumper or normally closed contact (actuator stops when contact is open).
5. If bare wires (without terminals) are connected, remove a maximum of 0.25 in. insulation.
6. User replaceable primary fuses (F1 and F2) are located in the Terminal Chamber Enclosure.
7. For single phase supply option, terminal L1 should be used as Live connection and L2 should be used as neutral connection.
8. When ESD Interlock Dip Switch is set to ON, motor will not run when ESD signal is lost. ESD Interlock Dip Switch defaults to OFF.
9. Timers provide a 1 to 15 seconds delay in shutting off the solenoid/motor at the end of the stroke. Timers start at a 1 second delay in the full CCW position and adjust at a rate of 1 second per every 1.5 turns to a maximum of 15 seconds.

Smart EHO

Generic Electrical Connection Diagram



	Two-Wire Control Maintain Contact to Open	Three-Wire Control Maintained Contacts	Four-Wire Control Momentary Contacts	ESD Input	PST Input
Internal Power Supply					
External Power Supply (18-100 V DC or 20-240 V AC)					

Notes:

1. All digital inputs have an input voltage range of 18 - 100 V DC or 20 - 240 V AC.
2. All digital relay outputs are rated for 5 A @ 30 V DC or 5 A @ 250 V AC Resistive, 2 A Inductive load.
3. RL1 - RL4 are dual latching type relays.
4. Emergency stop requires jumper or normally closed contact (actuator stops when contact open).
5. Remote display communication port is RS485.
6. If bare wires (without terminals) are connected, remove a maximum of 0.25 in. insulation.
7. User replaceable primary fuses (F1 and F2) are located in the Terminal Chamber Enclosure.
8. For single phase supply option, terminal L1 should be used as Live connection and L2 should be used as Neutral connection.
9. The Shield connections of RS485, Analog input and Analog output lines should be terminated on terminal #24.

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