

SMARTLINK® DS Intelligent Control Actuator

TECHNICAL CATALOG

PRODUCT DESCRIPTION

The SMARTLINK® DS Intelligent Control Actuator provides highly accurate positioning, with continuous duty, maintenance-free operation. The actuator offers a wide range of customizable features making it a highly scalable and flexible control valve. The wide operating temperature range and Class I, Division 2 ratings make it suitable for the most demanding installations.

FEATURES AND BENEFITS

- The SMARTLINK® DS offers many advantages and flexible feature configurations making it well suited for a myriad of industrial applications. It is a general purpose control actuator designed for the precise control of air, fuel, gas, steam, chemicals and liquids for industrial combustion applications, as well as for general industrial process control applications.
- Standard torque options are either 300 in-lb (33.9 N.m) or 900 in-lb (101.7 N.m) actuator.
- Optional upgrades of 2-line back-lit LCD display, AC or DC power, brake, and hazardous location rating.
- Valve commissioning accomplished with simple to understand graphical user interface via on-board LCD display, via commissioning PC software or via DCS direct programming.
- The electronic shaft brake provides the capability to limit shaft movement of the actuator in the event of a loss of AC or DC power input to the actuator or if the rated torque capability of the actuator is exceeded.
- Optional hazardous location ratings are available and the standard general purpose NEMA 4x offering is rated for wash-down/exterior applications and performs under a wide temperature range, making it well suited for the most extreme installations.
- Available as stand-alone unit or direct coupled with MAXON's line of butterfly and ball valves. Also separate linkages and couplings are available to support integration to other valves.
- Wide range of butterfly and ball valve body connections and body materials of construction: cast iron, carbon steel, brass, stainless steel as well as internal trim seal sets compatible with oxygen, natural gas, propane gas, digester gas, butane gas, coke oven gas, manufactured gas, landfill gas and a wide range of chemical compatibilities.
- Industry standard communications protocols; analog 4-20 mA and Modbus digital for input and output of valve position confirmation as well as valve status, diagnostics, historical performance, and health reporting.
- Built-in, on-line diagnostics to continuously assess the health and performance of the actuator. Alarm and lockout detection algorithms are performed every 50 milliseconds. Any alarm or lockout event that occurs can be externally detected by monitoring an alarm relay contact or viewing the local display at about a 1 second sampling interval.
- Simple to install, wire and configure with AC and DC power input options and dual NPT conduit ports for separate power and low voltage control wiring.
- Rugged, small footprint extruded and cast aluminum housing with impact, UV and chemical resistant powder coating. Flexible industrial design for reliable, long-life operation and mounting in any orientation.
- The permanently lubricated planetary gears are precision machined from hardened alloy steels minimizing any slip or hysteresis providing efficient, smooth, quiet, and controlled positioning. This precise mechanism enables continuous rotation of valves to positions within $\pm 0.1^\circ$ accuracy and 1000 positions over a full 100 degrees of rotation with a long service life of over 100 million re-positions.
- Operates with a temperature range of -40°C to $+70^\circ\text{C}$ (-40°F to $+158^\circ\text{F}$) enabling the units to operate in a wide variety of installations and regions. Actuators have on-board temperature sensors to monitor internal operating temperatures preventing overheating of the actuator and tracking and reporting temperature alarms.
- Option available for direct coupling to several popular MAXON burner products, providing fully integrated burner and actuator configuration for easy installation and operation.



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APPLICATIONS

The SMARTLINK® DS is designed for applications where very tight control of valve positioning is critical for system operations. Typical applications include:

- Ovens - curing, baking, heating, drying, oxidizer
- Boilers - water, steam
- Furnace - air exchange
- Water/waste water treatment
- Metals and mining - heat treating, metal finishing
- Oil and gas refineries (petroleum processing)
- Agricultural
- Chemical refineries
- Pulp and paper
- HVAC, heat exchange, general air dampeners
- Gas powered electrical power generation plants
- EPC - Engineering, Procurement and Construction firms

Approvals

Factory Mutual Global (File No. 3046182 & 3041711)	Non-incendive Class I, Division 2, Groups A, B, C and D; Dust-ignition proof Class II, III, Division 1 & 2, Groups E, F and G Hazardous Locations NEMA 4X and IP67
	CAN/CSA C22.2 No. 0-M91, No. 142-M1987, No. 213-M1987, No. 157-92, 1010.1, No. 94-M91, ANSI/IEC60529, ANSI / NEMA 250
	ANSI / ISA 61010-1 Safety Requirements for Electrical Equipment
	ATEX Certificate No. FM13ATEX0020: Equipment Group II, Category 3, Gas atmosphere Explosion Protected type “n”, gas group IIC, Temperature class T4 and Equipment Group IIC, Category 3D, Dust atmosphere Explosion Protected type “t”, group IIIC, Temperature class 135°C hazardous locations; EN60079-0:2012 + A 11: 2013, EN60079-15:2010, EN60079-31:2009, EN60529:2000
	IECEx Certification Reference No. US/FMG/ExTR13.0011/0: Explosion Protected type “n”, gas group IIC, Temperature class T4 and Dust Ignition Pro- tected by enclosure type “t”, equipment group IIIC, T=135°C hazardous locations. IEC60079-0:2011, IEC60079-15:2010, IEC60079-31:2008, EN60529:2013
	Safety Feedback Relay Outputs: Performance Level: (PL) of “e” in a Category 4, as calcu- lated per EN/ISO 13849-1
Underwriters Laboratories, Inc. (File No. MH49631)	UL 353 - Standard for Safety for Limit Controls
	UL 1998 - Standard for Safety, Software in Programmable Components
MAXON - Self Declaration	Compliance with European CE requirements defined by:
	- EMC Directive 2004/108/EC
	- Low Voltage Directive 2006/95/EC



SMARTLINK® DS 1” butterfly valve



SMARTLINK® DS 10” butterfly valve

SMARTLINK® DS ball valve with optional
flanges and AC/DC power supply

Model Number

Butterfly valves

Configured item number				Valve body					Actuator						Fluid
Size	Flow capacity	Series		Body connection	Body seals	Body material	Body internals		Torque rating	Power input	Brake	Area classification	Display/keypad		
0100	S	DSCV	-	A	A	1	1	-	C	A	0	0	1	-	I

Size

0000 - Actuator only
 0100 - 1"
 0125 - 1-1/4"
 0150 - 1-1/2"
 0200 - 2"
 0250 - 2-1/2"
 0300 - 3"
 0400 - 4"
 0600 - 6"
 0800 - 8"
 1000 - 10"
 1200 - 12"
 1400 - 14"
 1600 - 16"
 1800 - 18"

Flow capacity

S - Standard

Series

DSCV - SMARTLINK® DS
 (Butterfly) Control Valve

Body connection

A - ANSI flange
 M - "M" style flange
 X - Special
 U - Actuator only

Body seals [1]

A - Buna-N
 B - Viton
 X - Special
 U - Actuator only

Body material

1 - Cast iron
 2 - Carbon steel
 3 - Brass
 5 - Stainless steel
 X - Special
 U - Actuator only

Body internals [2]

1 - Trim package 1
 2 - Trim package 1, oxy clean
 5 - Trim package 2
 6 - Trim package 2, oxy clean
 X - Special
 U - Actuator only

Torque rating

C - 300 in-lbs (33 N.m)
 D - 900 in-lbs (101 N.m)
 X - Special
 U - Valve body only

Power input

A - 100-240 VAC
 B - 24VDC
 U - Valve body only

Brake

0 - No brake
 1 - Brake
 U - Valve body only

Area classification

0 - General purpose
 1 - Hazardous location
 U - Valve body only

Display / keypad

0 - No display / keypad
 1 - Display / keypad
 U - Valve body only

Fluid

A - 158F/70C max air
 B - 350F/177C max air
 C - 400F/204C max air
 D - Butane gas
 E - Coke oven gas
 F - Digester gas
 G - Landfill gas
 H - Manufactured gas
 I - Natural gas
 J - Oxygen
 K - Propane gas
 L - Propane/butane blend gas
 M - Refinery gas
 N - Sour natural gas
 O - Town gas
 U - Actuator only
 X - Special

[1] Buna-N used with cast iron and carbon steel bodies.
 Viton used with brass bodies.

[2] Trim package 1 used with cast iron and carbon steel bodies. Trim package 1, oxy cleaned used with brass bodies.

Ball valves

Configured item number				Valve body					Actuator						Fluid
Size	Flow capacity	Series		Body connection	Body seals	Body material	Body internals		Torque rating	Power input	Brake	Area classification	Display/keypad		
0100	1	DSBV	-	A	E	2	1	-	C	B	0	0	0	-	I

Size

0000 - Actuator only
 0050 - 1/2"
 0075 - 3/4"
 0100 - 1"
 0125 - 1-1/4"
 0150 - 1-1/2"
 0200 - 2"

Flow capacity

1 - 1/32" slot
 2 - 1/16" slot
 3 - 1/8" slot
 4 - 3/16" slot
 5 - 1/4" slot
 6 - 30 deg V
 7 - 60 deg V
 8 - 90 deg V (1" through 2")
 9 - Round port

Series

DSBV - SMARTLINK® DS
 Ball Valve

Body connection

A - ANSI flanged 150#
 B - ANSI threaded
 C - ANSI flanged 150# MAR spl
 X - Special
 U - Actuator only

Body seals

E - Teflon
 X - Special
 U - Actuator only

Body material

2 - Carbon steel
 5 - Stainless steel
 X - Special
 U - Actuator only

Body internals

1 - Trim package 1
 X - Special
 U - Actuator only

Torque rating

C - 300 in-lbs (33 N.m)
 D - 900 in-lbs (101 N.m)
 X - Special
 U - Valve body only

Power input

A - 100-240 VAC
 B - 24VDC
 U - Valve body only

Brake

0 - No brake
 U - Valve body only

Area classification

0 - General purpose
 1 - Hazardous location
 U - Valve body only

Display / keypad

0 - No display / keypad
 1 - Display / keypad
 U - Valve body only

Fluid

A - Air
 D - Butane
 I - Natural gas
 K - Propane
 L - Butane/propane blend
 U - Actuator only
 X - Special

Control actuator- coupling only

Configured item number		Connection		Actuator				
Series		Connection		Torque rating	Power input	Brake	Area classification	Display / keypad
DS CA	-	K1	-	C	A	0	0	1

Series

DS CA - SMARTLINK® DS
Control Actuator

Connection

K1 - 1/2" keyed output shaft
K2 - 17mm keyed output shaft
L1 - Linkage arm
S1 - 1/2" square output shaft
S2 - 3/4" square output shaft

Torque rating

C - 300 in-lbs (33 N.m)
D - 900 in-lbs (101 N.m)
X - Special
U - Valve body only

Power input

A - 100-240 VAC
B - 24VDC
U - Valve body only

Brake

0 - No brake
1 - Brake
U - Valve body only

Area classification

0 - General purpose
1 - Hazardous location
U - Valve body only

Display / keypad

0 - No display / keypad
1 - Display / keypad
U - Valve body only

Spare actuator

Configured item number		Actuator				
Series		Torque rating	Power input	Brake	Area classification	Display / keypad
DS SA	-	C	A	0	0	1

Series

DS SA - SMARTLINK® DS
Spare Actuator

Torque rating

C - 300 in-lbs (33 N.m)
D - 900 in-lbs (101 N.m)
X - Special
U - Valve body only

Power input

A - 100-240 VAC
B - 24VDC
U - Valve body only

Brake

0 - No brake
1 - Brake
U - Valve body only

Area classification

0 - General purpose
1 - Hazardous location
U - Valve body only

Display / keypad

0 - No display / keypad
1 - Display / keypad
U - Valve body only

SPECIFICATIONS

Actuator specifications

SMARTLINK® DS Actuator	300 in-lb torque actuator		900 in-lb torque actuator	
	AC	DC	AC	DC
Size	152 mm x 112 mm x 240 mm	102 mm x 112 mm x 240 mm	152 mm x 112 mm x 292 mm	102 mm x 112 mm x 292 mm
Weight	6.8 kg	6.7 kg	7.3 kg	7 kg
Torque rating in Nm	33 Nm		101 Nm	
Torque rating in ft-lb	25 ft-lb		75 ft-lb	
Power train stepper motor	Continuous duty, permanently lubricated planetary gear set			
Full travel	With no valve option, maximum full travel span: 100 degrees			
Resolution	0.1 degrees or a maximum of 1000 position points over the full range of operation (with no valve option)			
Torque travel timing	15 seconds (100° degree travel)		45 seconds (100° degree travel)	
Overhung shaft load	340 kg			
Optional features				
Actuator size with brake option	152 mm x 112 mm x 292 mm	102 mm x 112 mm x 292 mm	152 mm x 112 mm x 292 mm	102 mm x 112 mm x 292 mm
Brake functionality	Brake is applied (de-energized) within 10 milliseconds of either event: 1) Loss of input AC or DC power, OR 2) Rated torque is exceeded and subsequent loss of motor synchronization occurs			
Display option - 2 x 16 digit backlit LCD	Actuator status, user settings, actuator history - full commissioning at the unit. 2 LED's to indicate manual mode and alarm / lock-out conditions			
Hazardous Location ratings	Non-incendive for Class I, Division 2, Groups A, B, C and D Dust-protected for Class II, III, Division 2, Groups E, F and G Hazardous (classified) Locations			
Mounting bracket shaft configura- tion options	1/2" keyed output, linkage arm, 1/2" square output, 3/4" square output		17mm keyed output, 1/2" square output, 3/4" square output	
Configuration options	Order as a stand-alone actuator only (DSSA), as a stand-alone actuator with valve mounting bracket (DSCA), as an actuator coupled to a butterfly valve (DSCV), or as an actuator coupled to a ball valve (DSBV)			
Standard features				
4-20 mA input	100 Ohms; isolated input			
4-20 mA ouput	275 Ohms (maximum, including DC resistance in cable)			
F-Terminal input	When this terminal is connected to the 4-20 mA input (-) terminal, the actuator shaft will move to a user selected position; Function is disabled (default) when unit is shipped			
RS-485 Modbus interface	Needed to configure actuator when no display option is ordered. MAXON PC-based configuration software and RS-485 cable required.			
Diagnostics via Modbus	Alarm-lockout, communication, and move (repositioning) diagnostic counters Loss-of-motor sync, position control, position (feedback), temperature, and hardware alarms Alarm-lockout event history, position move histogram			
Reverse direction	User selectable clockwise or counter-clockwise movement			
Wiring connections	Accessible high and low voltage terminal connections without opening valve housing			
Supply voltage	100-240 VAC ± 10% 50/60 Hz (0.2 A rms @ 120 VAC)	24VDC +5%/-20% (1.1A max)	100-240 VAC ± 10% 50/60 Hz (0.2 A rms @ 120 VAC)	24VDC +5%/-20% (1.1A max)
Average power	19 watts	17 watts	19 watts	17 watts
Output relay contacts	5A @ 120VAC, 3A @ 250VAC/24VDC (resistive) (general purpose, non-safety ratings) 1.5A @ 120VAC, 250 VAC, 24VDC (for safety applications/200,000 minimum opera- tions)			
Control deadband (mA input)	User selectable: ±0.1, ±0.2, ±0.3, ±0.4, ±0.5 degrees			

SMARTLINK® DS Actuator	300 in-lb torque actuator		900 in-lb torque actuator	
	AC	DC	AC	DC
Linearity	±0.5 degree (max)			
Shaft configurations when no valve is selected	1/2” keyed output shaft w/ 1/8” sq key		17mm keyed output shaft w/ 5mm sq key	
Operating temperature	-40°C to +70°C (-40°F to +158°F) [1]			
Storage temperature	-40°C to +80°C (-40°F to +176°F)			
Vibration	Honeywell V2 test specification; 3 axes: 2-hour performance/resonant detection sweep: vibration sinusoidal: 5 Hz - 30 Hz; amplitude: 0.012 mil pk/pk 75 mm, vibration sinusoidal: 30 Hz - 300 Hz at 0.6G Endurance: 1.1G for 2 hours at resonant frequencies			
EMC	EN61000-6-2 Heavy Industrial Immunity FCC Part 15 and EN55022, Class A Emissions			
Enclosure contamination rating	NEMA 4, 4X, IP67			
Housing materials	Extruded aluminum housing and gear train mounting plate. Coated with scratch and chemical resistant powder coating.			
Life expectancy	10,000,000 repositions over 10-degree span or 100,000,000 repositions over entire 100-degree span			

[1] LCD is not readable below -20°C (-4°F)

Valve capacities

Butterfly valves - 1" through 4"

Size	Minimum controllable Cv rating	Maximum Cv rating	Maximum inlet pressure (bar)	Maximum body pressure (bar)
1"	0.50	27	6.21	6.21
1.25"	0.60	70	6.21	6.21
1.5"	0.70	105	6.21	6.21
2"	1.30	190	6.21	6.21
2.5"	2.40	260	5.59	6.21
3"	3.00	360	3.73	6.21
4"	5.00	750	1.86	6.21

Fluid	Gas code	Suggested material options			Maximum fluid temperature rating	Maximum ambient temperature rating
		Body seals	Body material	Body internals		
158°F/70°C Max Air	A	A, B	1, 2, 3, 5	1, 5	70°C	70°C
Butane Gas	D	A, B	1, 2, 3, 5	1, 5	70°C	70°C
Coke Oven Gas	E	B	1, 2, 5	1, 5	70°C	70°C
Digester Gas	F	B	5	5	70°C	70°C
Landfill Gas	G	B	5	5	70°C	70°C
Manufactured Gas	H	B	5	5	70°C	70°C
Natural Gas	I	A, B	1, 2, 3, 5	1, 5	70°C	70°C
Oxygen	J	B	3, 5	2, 6	70°C	70°C
Propane Gas	K	A, B	1, 2, 3, 5	1, 5	70°C	70°C
Propane/Butane Blend Gas	L	A, B	1, 2, 3, 5	1, 5	70°C	70°C
Refinery Gas	M	B	5	5	70°C	70°C
Sour Natural Gas	N	B	5	5	70°C	70°C
Town Gas	O	A, B	5	5	70°C	70°C

Body seals

A - Buna-N
B - Viton

Body material

1 - Cast iron
2 - Carbon steel
3 - Brass
5 - Stainless steel

Body internals

1 - Trim package 1
2 - Trim package 1, oxy clean
5 - Trim package 2
6 - Trim package 2, oxy clean

Butterfly valves - 6” through 18”

Size	Minimum controllable Cv rating	Maximum Cv rating	Maximum inlet pressure (bar)	Maximum body pressure (bar)
6”	12.5	1425	0.31	6.21
8”	22	2500	0.31	6.21
10”	35	4500	0.31	6.21
12”	50	6400	0.31	6.21
14”	67	8800	0.31	6.21
16”	88	11700	0.31	6.21
18”	214	18000	0.31	6.21

Fluid	Gas code	Suggested material options				Maximum fluid temperature rating	Maximum ambient temperature rating
		Body seals	Body material	Body internals	Gasket material		
158°F/70°C max air	A	A, B	1	1	NEOP, FIBR	70°C	70°C
350°F/177°C max air	B	B	1	1	FIBR	177°C	70°C
400°F/204°C max air	C	B	1	1	FIBR	204°C	60°C
Natural gas	I	A, B	1	1	NEOP, FIBR	70°C	70°C

Body seals

A - Buna-N
B - Viton

Body material

1 - Cast iron

Body internals

1 - Trim package 1

Gasket material

FIBR - Hi temp fiber
NEOP - Neoprene

Ball valves

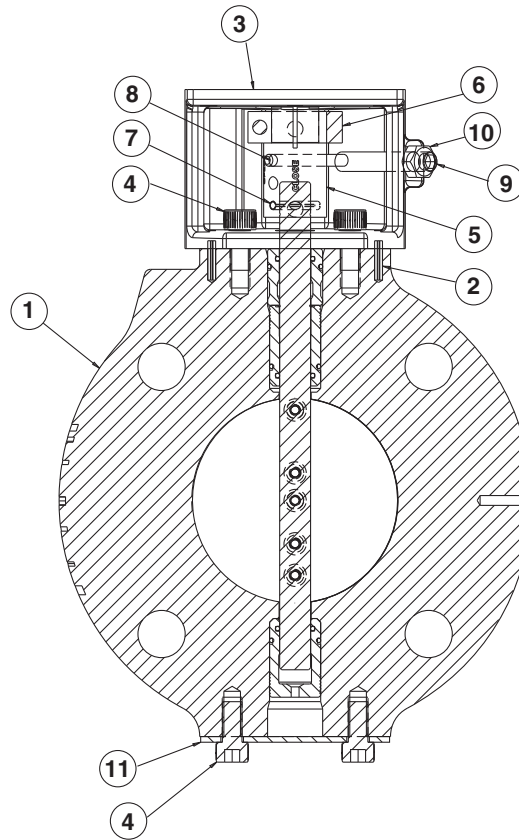
Flow Coefficient - Cv vs. % open											
Size	Insert	0.0%	11.1%	22.2%*	33.3%	44.4%	55.6%	66.7%	77.8%	88.9%	100%
0.5"	1/32" Slot	0.00	0.00	0.03	0.07	0.12	0.16	0.20	0.24	0.28	0.32
	1/16" Slot	0.00	0.01	0.07	0.20	0.33	0.46	0.60	0.73	0.86	1.00
	1/8" Slot	0.00	0.01	0.10	0.36	0.61	0.86	1.10	1.40	1.60	1.80
	30°V	0.00	0.01	0.11	0.24	0.36	0.56	0.84	1.10	1.60	2.10
	60°V	0.00	0.01	0.12	0.33	0.60	0.84	1.40	2.00	3.10	4.40
	Round Port	0.00	0.15	0.29	0.46	0.70	1.10	1.80	2.60	4.30	6.40
0.75"	1/16" Slot	0.00	0.01	0.06	0.24	0.40	0.56	0.73	0.90	1.00	1.20
	1/8" Slot	0.00	0.01	0.14	0.39	0.65	0.90	1.20	1.40	1.70	1.90
	30°V	0.00	0.01	0.11	0.24	0.41	0.67	1.00	1.40	1.90	2.60
	60°V	0.00	0.01	0.13	0.36	0.55	1.00	1.50	2.30	3.60	5.00
	Round Port	0.00	0.21	0.43	0.70	1.10	1.60	2.60	4.00	6.40	9.60
1"	1/16" Slot	0.00	0.03	0.10	0.40	0.67	0.94	1.20	1.50	1.70	1.90
	3/16" Slot	0.00	0.03	0.22	0.82	1.40	1.90	2.50	3.10	3.50	4.00
	30°V	0.00	0.03	0.21	0.56	1.00	1.60	2.40	3.40	4.60	6.20
	60°V	0.00	0.03	0.30	0.78	1.20	2.30	3.60	5.30	8.30	11.60
	90°V	0.00	0.03	0.48	1.20	2.30	3.50	5.40	7.70	10.80	12.10
	Round Port	0.00	0.58	1.20	1.90	2.80	4.30	7.00	10.50	17.00	26.00
1.25"	3/16" Slot	0.00	0.05	0.38	1.40	2.40	3.40	4.40	5.40	6.20	6.90
	30°V	0.00	0.05	0.39	1.00	1.80	2.90	4.40	6.40	8.60	11.40
	60°V	0.00	0.06	0.48	1.30	2.00	3.70	5.80	8.50	13.40	18.70
	90°V	0.00	0.06	0.78	2.00	3.70	5.70	8.80	12.50	17.50	19.70
	Round Port	0.00	0.91	1.80	3.00	4.40	6.70	10.90	16.40	26.60	40.60
1.5"	3/16" Slot	0.00	0.05	0.47	1.80	3.00	4.20	5.40	6.80	7.70	8.60
	30°V	0.00	0.05	0.41	1.20	2.10	3.50	5.20	7.60	10.30	13.70
	60°V	0.00	0.06	0.57	1.70	3.00	5.60	9.10	13.20	19.80	28.40
	90°V	0.00	0.06	1.00	2.80	4.50	8.10	13.40	19.70	30.90	47.10
	Round Port	0.00	1.50	3.00	4.80	7.20	11.00	18.00	27.00	44.00	65.50
2"	1/4" Slot	0.00	0.05	0.75	2.90	4.80	6.80	8.70	10.80	12.30	13.80
	30°V	0.00	0.05	0.55	1.70	3.40	5.70	8.30	12.10	16.60	22.20
	60°V	0.00	0.06	0.70	2.60	4.90	9.30	15.50	22.20	32.10	47.20
	90°V	0.00	0.06	0.88	3.30	6.10	11.70	19.40	27.50	40.10	59.00
	Round Port	0.00	2.20	4.30	7.00	10.50	16.20	26.40	39.60	64.00	96.00

*Select valves for minimum controllable Cv at 22°. Errors may become substantial below this point.

Materials of construction

Butterfly valves

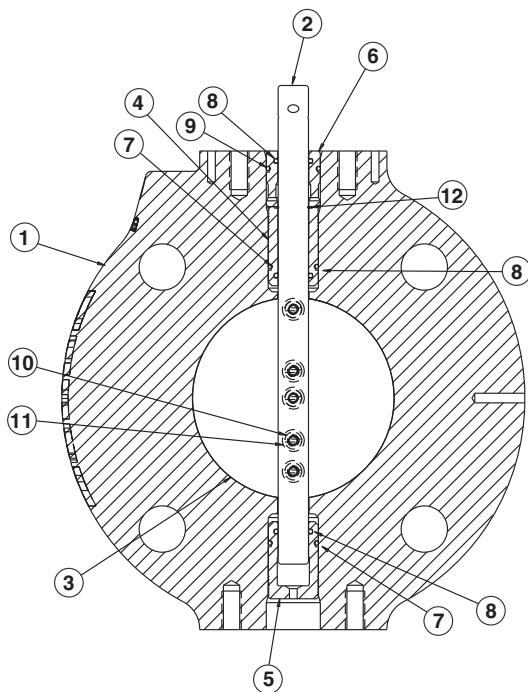
Butterfly valve body assembly - all sizes



Item number	Description	Material specifications
1	Valve body sub-assembly	See pages 12 and 13
2	Locating spring pin	Zinc plated carbon steel
3	Adapter bracket	ASTM B179 T6 aluminum
4 [1]	Socket head cap screw	Zinc plated carbon steel
5	Coupling	ASTM A582 type 303 stainless steel
6	Locking collar	Zinc plated alloy steel
7	Spring pin	Zinc plated carbon steel
8	Dowel pin	303 stainless steel
9	Hard stop screw	18-8 stainless steel
10	Hard stop nut	Stainless steel
11 [1]	Cover plate	Aluminum

[2] These items used only on sizes 1" through 4"

Butterfly valve body sub-assembly - sizes 1” through 4”

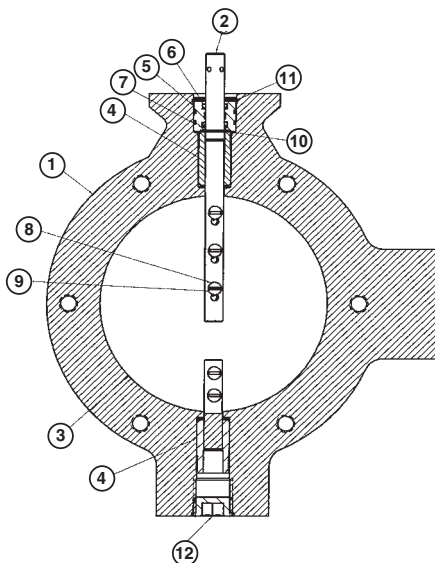


Body Materials					
Item No.	Description	Material Code			
		1	2	3	5
1	Valve Body	Cast Iron ASTM A159 Gr. 3000	Carbon Steel ASTM A216 Gr. WCB	Brass ASTM B62 UNS No. C83600	Stainless Steel ASTM A351 Gr. CF8M

Body Seals		
Item No.	Description	Material
7	O-Ring	Standard material options are Buna-N and Viton
8	O-Ring	
9	O-Ring	

Trim Package Materials			
Item No.	Description	Internal Trim Package	
		1	2
2	Valve Stem	303 Stainless Steel, ASTM A157 Gr. G3000	
3	Butterfly Disc	304 Stainless Steel (1.4301), ASTM A240 Type 304 UNS No. S30400	
4	Top Bushing	Bronze ASTM B271, B505 and B584 UNS No. C93200	PEEK
5	Bottom Bushing		
6	Top Shim Bushing		
10	Screw	18-8 Stainless Steel	
11	Washer	304 Stainless Steel (1.4301)	
12	Retaining Ring	316 Stainless Steel	

Butterfly valve body sub-assembly - sizes 6" through 18"

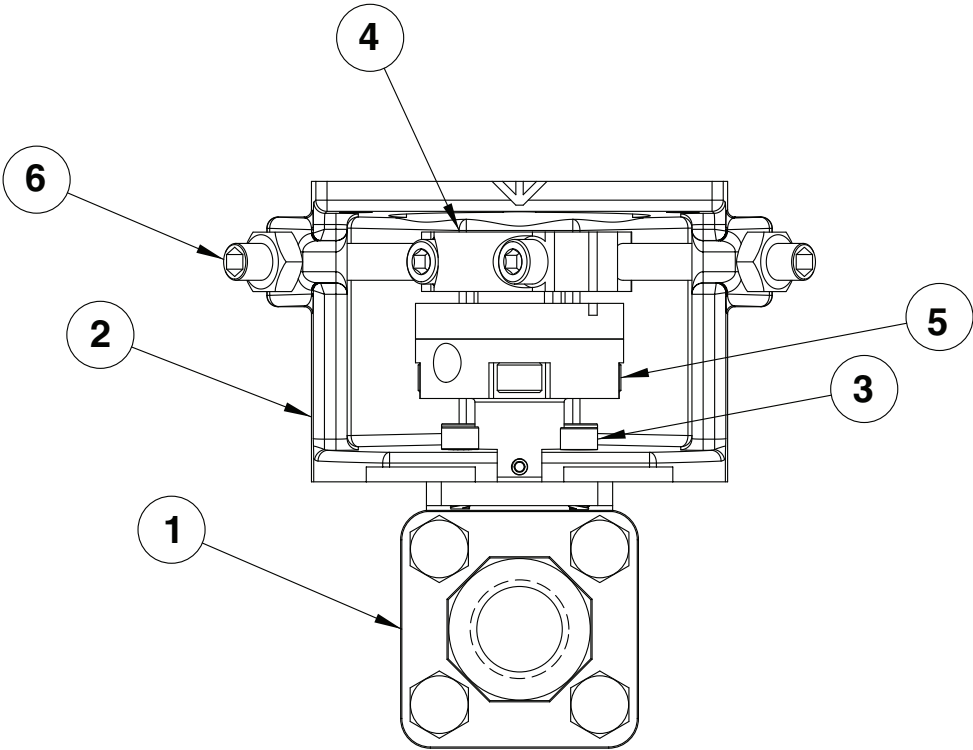


Body Materials		
Item No.	Description	Material Code
		1
1	Valve Body	Cast Iron ASTM A159 Gr. 3000

Body Seals		
Item No.	Description	Material
6	O-Ring	Standard material option is Buna-N
7	O-Ring	

Trim Package Materials			
Item No.	Description	Internal Trim Package	
		1	
Valve Size		6" & 8"	10" through 18"
2	Valve Stem	316 Stainless Steel, ASTM A276	
3	Butterfly Disc	304 Stainless Steel (1.4301) ASTM A167 UNS No. S30400	Carbon Steel ASTM A108 UNS No. G10180
4	Top & Bottom Bushing	Bronze ASTM B271, B505 and B584 UNS No. C93200	
5	Shim Bushing		
8	Screw	304 Stainless Steel (1.4301)	Zinc Plated Carbon Steel
9	Washer	316 Stainless Steel	Zinc Plated Carbon Steel
10	Retaining Ring	Carbon Steel SAE 1060-1090 UNS No. G10600-G10900	
11	Retaining Ring		
12	Pipe Plug	Alloy Steel, ASTM A322 UNS G40370	

Ball valves



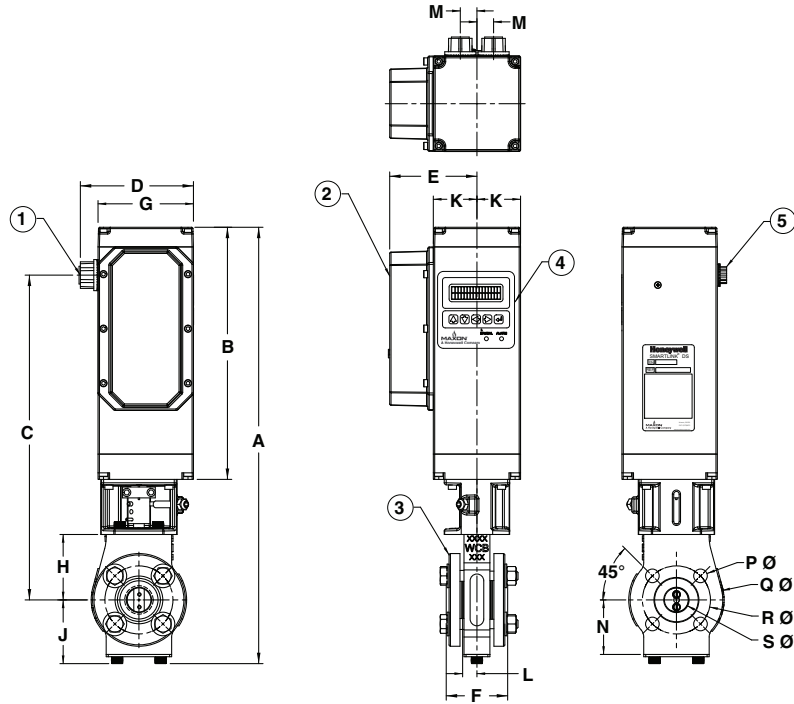
Item number	Description	Material specification
1	Valve Body Sub-assembly	Based on selection on page 10-2.4-4
2	Bracket	A356 T6 aluminum alloy ASTM B179
3	Socket Head Screw	18-8 (type 303) stainless steel
4	Actuator Coupling	Grade 17-4PH (630) stainless steel
5	Valve Coupling	Grade 17-4PH (630) stainless steel
6	Hard Stop Hexagon Socket Set Screw	18-8 (type 303) stainless steel

DIMENSIONS

Butterfly valves

1" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



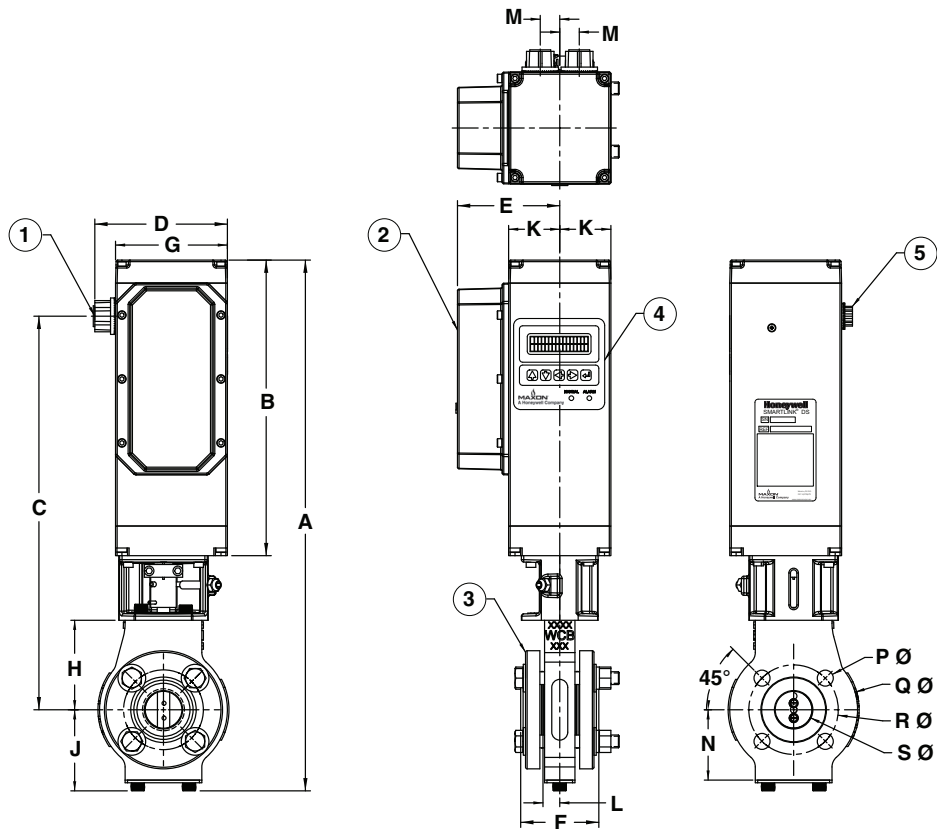
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	457	244	328	112	102
300 in-lb hazardous location	457	244	328	132	102
300 in-lb general purpose with brake	508	295	378	112	102
300 in-lb hazardous location with brake	508	295	378	132	102
900 in-lb general purpose with or without brake	508	295	378	112	102
900 in-lb hazardous location with or without brake	508	295	378	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	72
Steel	Threaded	72
Steel	Socket welded	72
Brass	Threaded	72

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	76	74	51	17	19	64	16	108	79	28

1.25" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



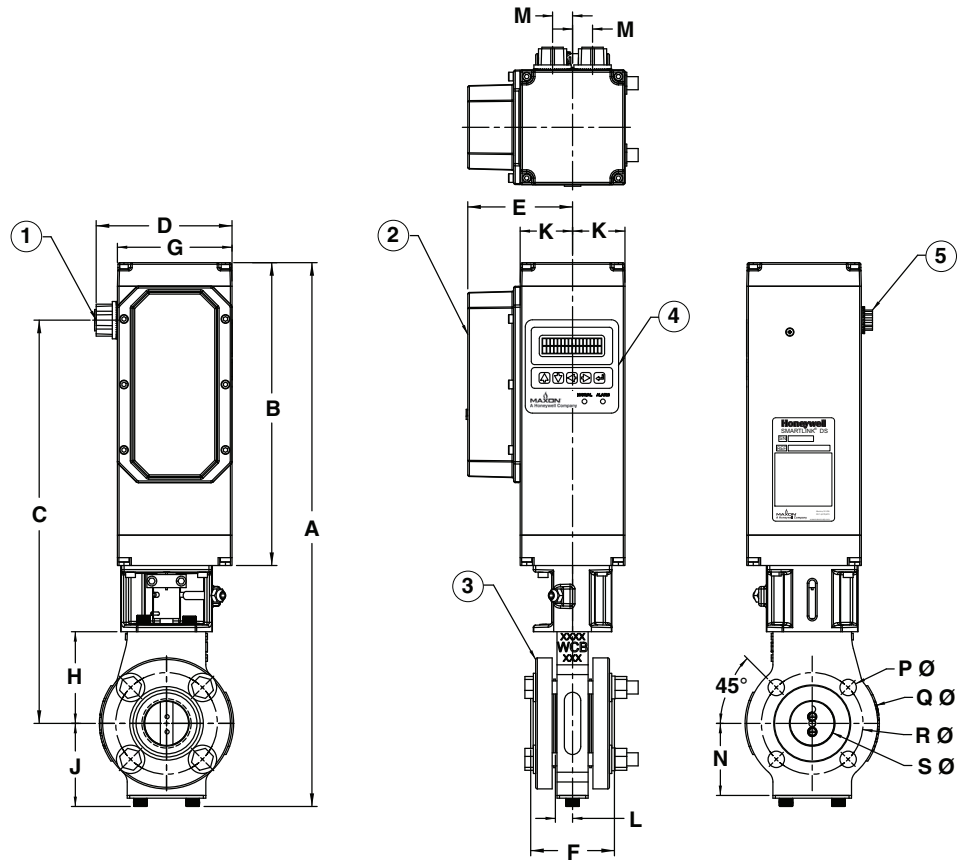
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	478	244	340	112	102
300 in-lb hazardous location	478	244	340	132	102
300 in-lb general purpose with brake	528	295	391	112	102
300 in-lb hazardous location with brake	528	295	391	132	102
900 in-lb general purpose with or without brake	528	295	391	112	102
900 in-lb hazardous location with or without brake	528	295	391	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	78
Steel	Threaded	77
Steel	Socket welded	77
Brass	Threaded	78

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	89	81	51	17	19	71	16	127	89	36

1.5" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



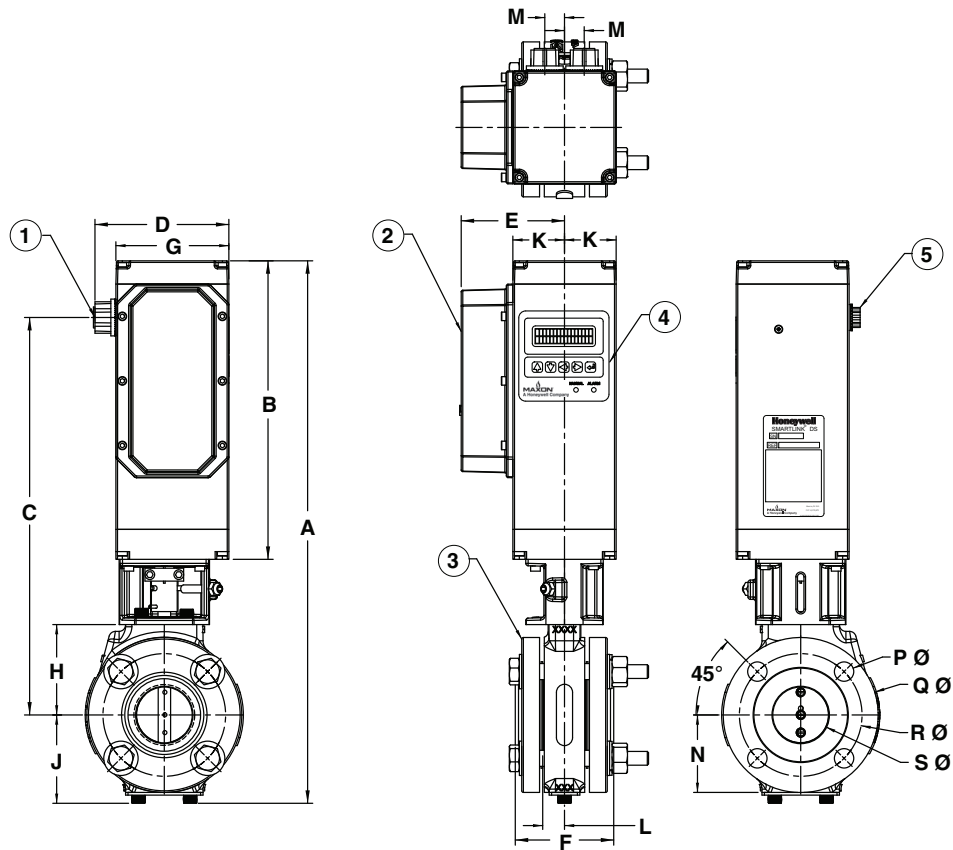
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	478	244	340	112	102
300 in-lb hazardous location	478	244	340	132	102
300 in-lb general purpose with brake	528	295	391	112	102
300 in-lb hazardous location with brake	528	295	391	132	102
900 in-lb general purpose with or without brake	528	295	391	112	102
900 in-lb hazardous location with or without brake	528	295	391	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	80
Steel	Threaded	81
Steel	Socket welded	81
Brass	Threaded	80

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	89	81	51	17	19	70	16	127	99	43

2" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



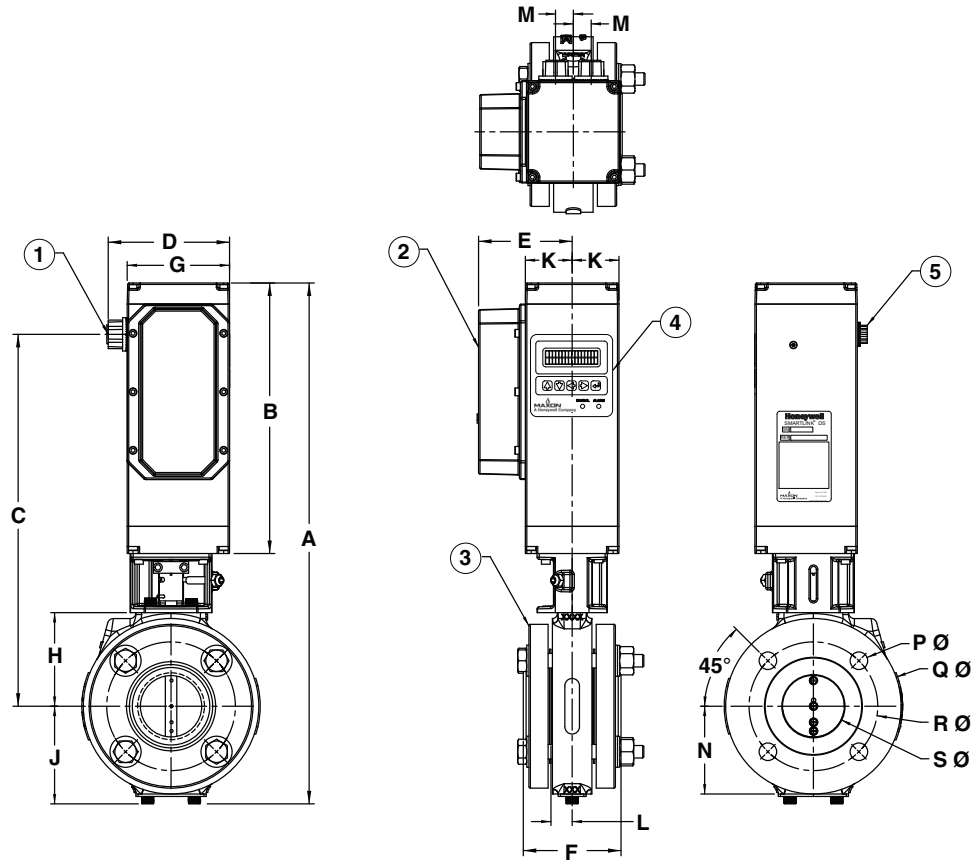
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	483	244	340	112	102
300 in-lb hazardous location	483	244	340	132	102
300 in-lb general purpose with brake	533	295	391	112	102
300 in-lb hazardous location with brake	533	295	391	132	102
900 in-lb general purpose with or without brake	533	295	391	112	102
900 in-lb hazardous location with or without brake	533	295	391	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	96
Steel	Threaded	97
Steel	Socket welded	97
Brass	Threaded	96

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	89	86	51	21	19	76	19	152	121	56

2.5" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



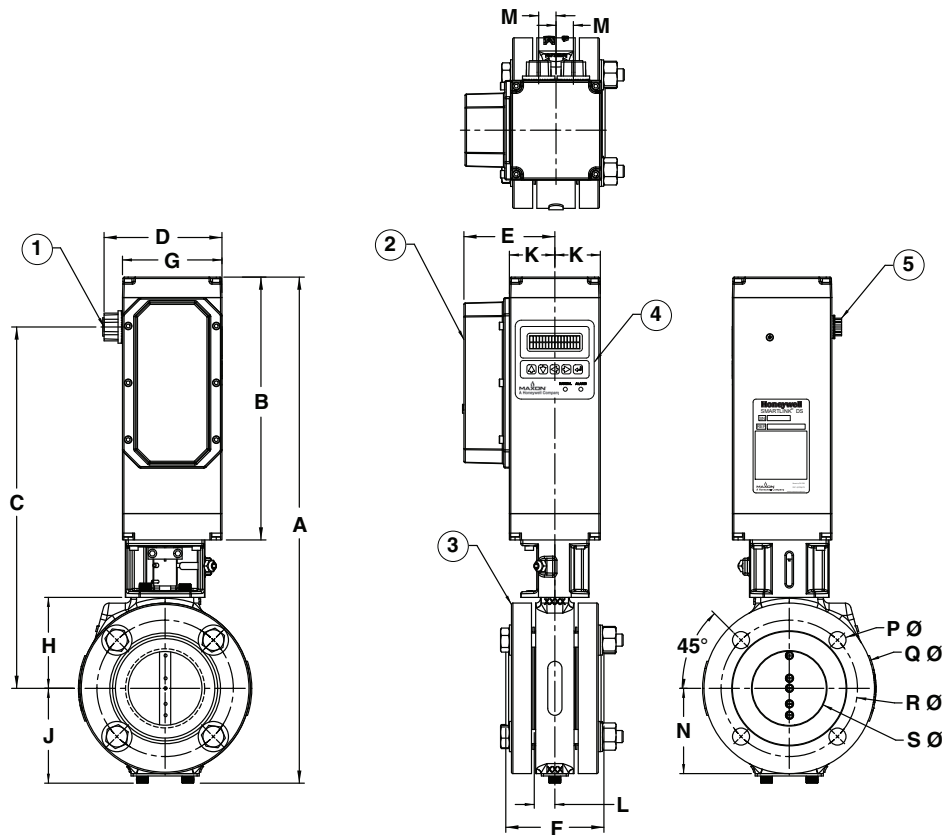
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	516	244	353	112	102
300 in-lb hazardous location	516	244	353	132	102
300 in-lb general purpose with brake	566	295	404	112	102
300 in-lb hazardous location with brake	566	295	404	132	102
900 in-lb general purpose with or without brake	566	295	404	112	102
900 in-lb hazardous location with or without brake	566	295	404	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	107
Steel	Threaded	106
Steel	Socket welded	106
Brass	Threaded	107

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	102	107	51	23	19	97	19	191	140	66

3" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



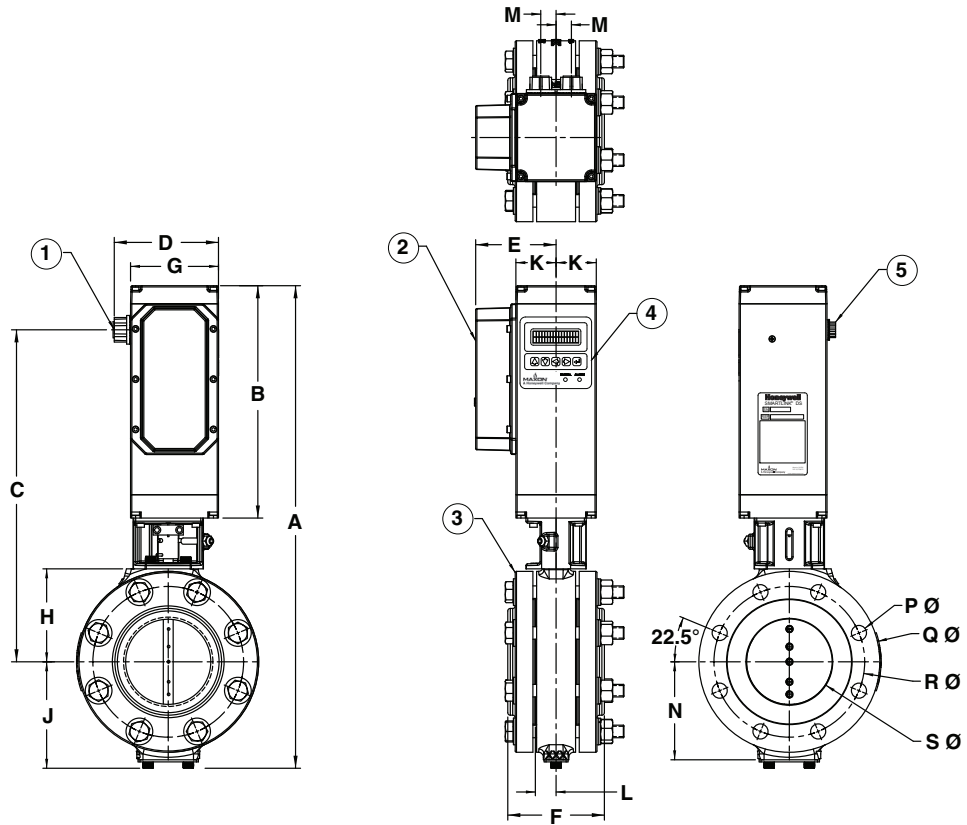
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	516	244	353	112	102
300 in-lb hazardous location	516	244	353	132	102
300 in-lb general purpose with brake	566	295	404	112	102
300 in-lb hazardous location with brake	566	295	404	132	102
900 in-lb general purpose with or without brake	566	295	404	112	102
900 in-lb hazardous location with or without brake	566	295	404	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	109
Steel	Threaded	110
Steel	Socket welded	110
Brass	Threaded	109

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	102	107	51	23	19	97	19	191	152	84

4" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



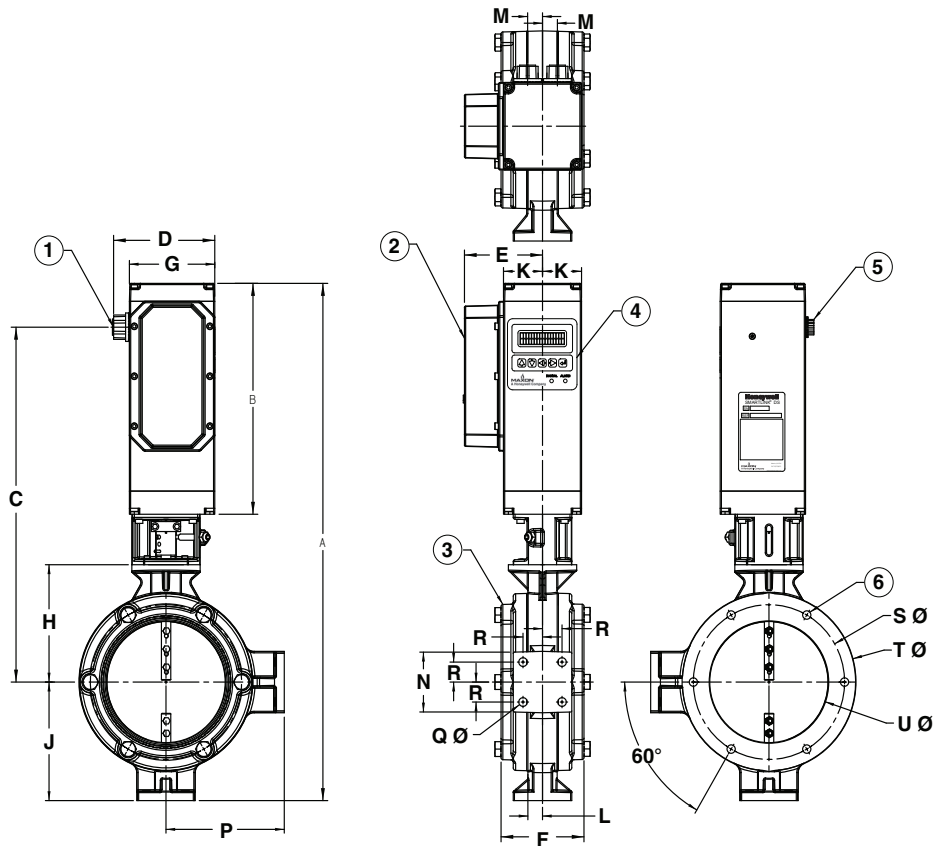
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	559	244	368	112	102
300 in-lb hazardous location	559	244	368	132	102
300 in-lb general purpose with brake	610	295	419	112	102
300 in-lb hazardous location with brake	610	295	419	132	102
900 in-lb general purpose with or without brake	610	295	419	112	102
900 in-lb hazardous location with or without brake	610	295	419	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	121
Steel	Threaded	122
Steel	Socket welded	122

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N	P Ø	Q Ø	R Ø	S Ø
112	117	135	51	26	19	124	19	229	191	109

6” SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2”-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2” conduit
entrance
- 6) 1/2 - 13 UNC



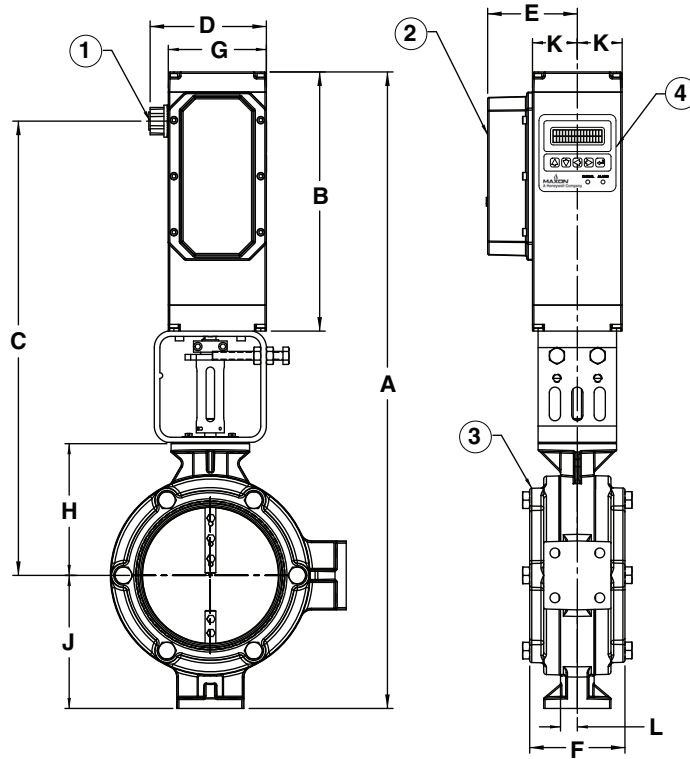
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	608	244	401	112	102
300 in-lb hazardous location	608	244	401	132	102
300 in-lb general purpose with brake	658	295	452	112	102
300 in-lb hazardous location with brake	658	295	452	132	102
900 in-lb general purpose with or without brake	658	295	452	112	102
900 in-lb hazardous location with or without brake	658	295	452	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	108
Steel	Socket welded	120

Dimensions in mm unless stated otherwise												
G	H	J	K	L	M	N sq.	P	Q Ø	R	S Ø	T Ø	U Ø
112	150	150	51	19	19	76	155	11	25	197	226	155

6" SMARTLINK® DS butterfly valve - high temperature configuration

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)



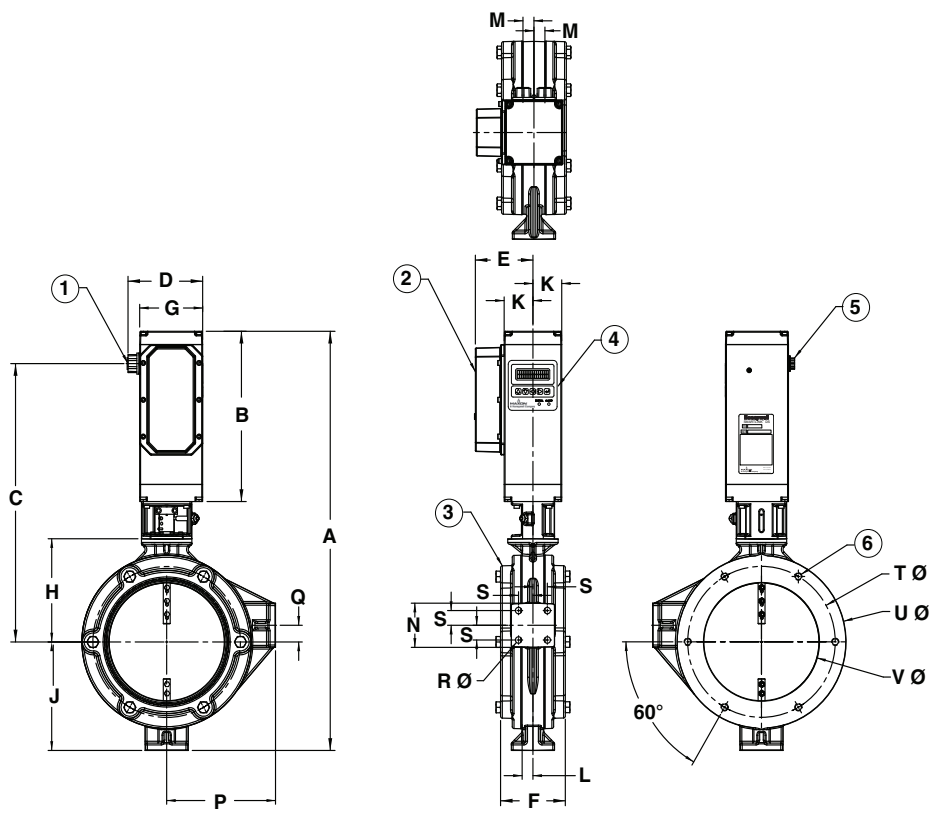
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	671	244	465	112	102
300 in-lb hazardous location	671	244	465	132	102
300 in-lb general purpose with brake	721	295	516	112	102
300 in-lb hazardous location with brake	721	295	516	132	102
900 in-lb general purpose with or without brake	721	295	516	112	102
900 in-lb hazardous location with or without brake	721	295	516	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	108
Steel	Socket welded	120

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	144	144	51	19

8" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance
- 6) 1/2 - 13 UNC

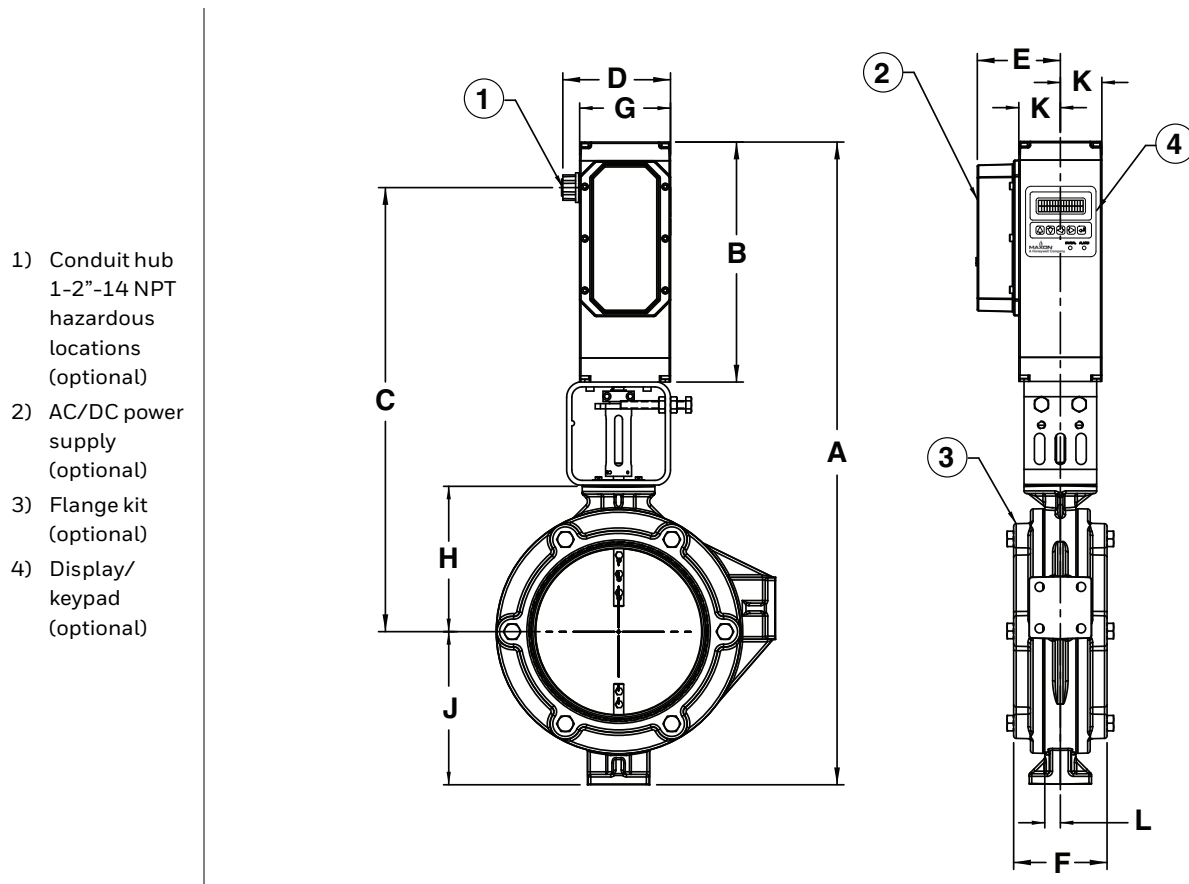


Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	673	244	429	112	102
300 in-lb hazardous location	673	244	429	132	102
300 in-lb general purpose with brake	724	295	480	112	102
300 in-lb hazardous location with brake	724	295	480	132	102
900 in-lb general purpose with or without brake	724	295	480	112	102
900 in-lb hazardous location with or without brake	724	295	480	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	114
Steel	Socket welded	130

Dimensions in mm unless stated otherwise													
G	H	J	K	L	M	N sq.	P	Q	R Ø	S	T Ø	U Ø	V Ø
112	178	188	51	19	19	76	193	28	11	25	260	300	203

8" SMARTLINK® DS butterfly valve - high temperature configuration



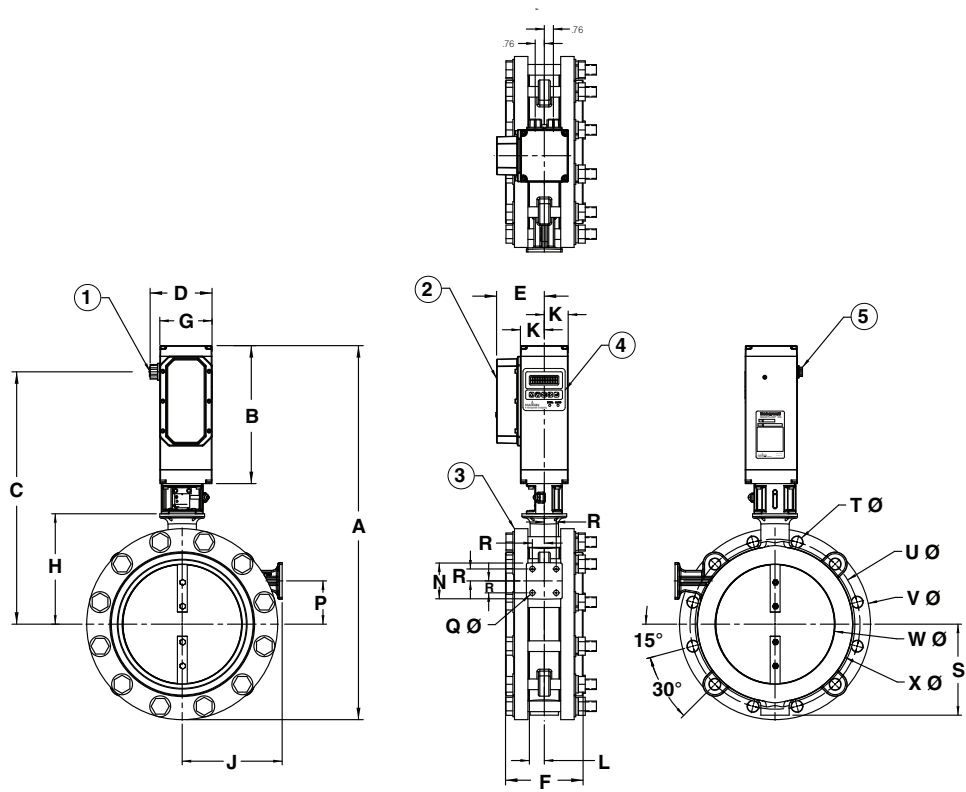
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	734	244	493	112	102
300 in-lb hazardous location	734	244	493	132	102
300 in-lb general purpose with brake	785	295	544	112	102
300 in-lb hazardous location with brake	785	295	544	132	102
900 in-lb general purpose with or without brake	785	295	544	112	102
900 in-lb hazardous location with or without brake	785	295	544	132	102

Valve flange style (optional)		F Flange to flange
Cast iron	Threaded	114
Steel	Socket welded	130

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	178	188	51	19

10" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



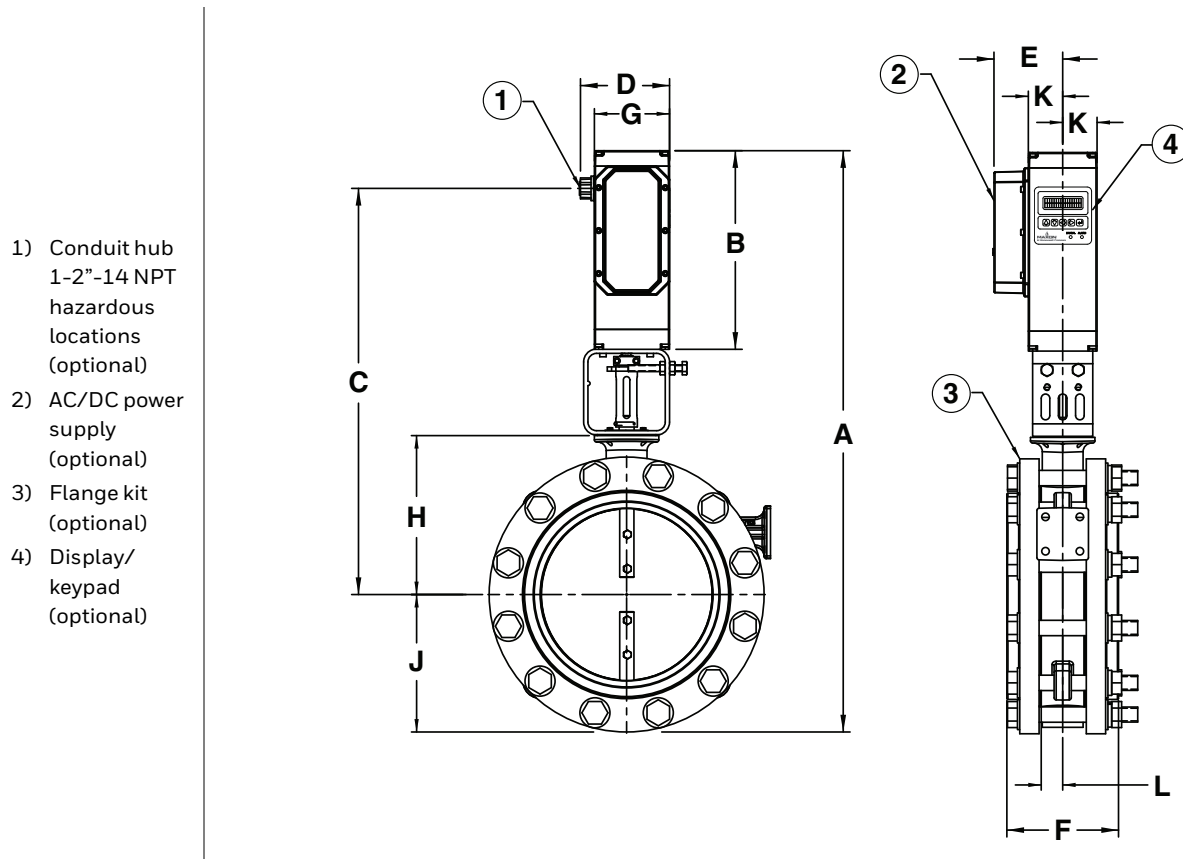
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	744	244	485	112	102
300 in-lb hazardous location	744	244	485	132	102
300 in-lb general purpose with brake	795	295	536	112	102
300 in-lb hazardous location with brake	795	295	536	132	102
900 in-lb general purpose with or without brake	795	295	536	112	102
900 in-lb hazardous location with or without brake	795	295	536	132	102

Valve flange style (optional)	F Flange to flange
Steel	165

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N sq.	P	Q Ø	R	S
112	234	213	51	32	19	76	91	11	25	193

T Ø	U Ø	V Ø	W Ø	X Ø
25	361	406	254	330

10" SMARTLINK® DS butterfly valve - high temperature configuration



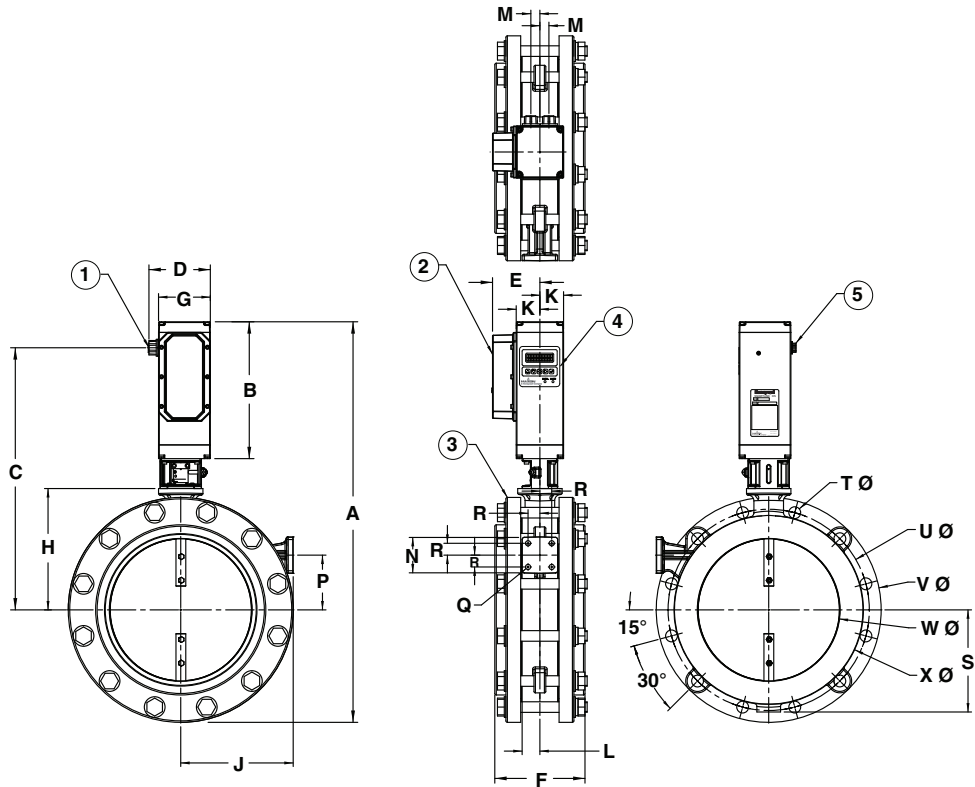
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	808	244	549	112	102
300 in-lb hazardous location	808	244	549	132	102
300 in-lb general purpose with brake	859	295	599	112	102
300 in-lb hazardous location with brake	859	295	599	132	102
900 in-lb general purpose with or without brake	859	295	599	112	102
900 in-lb hazardous location with or without brake	859	295	599	132	102

Valve flange style (optional)		F Flange to flange
Steel	Socket welded	165

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	234	203	51	32

12" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



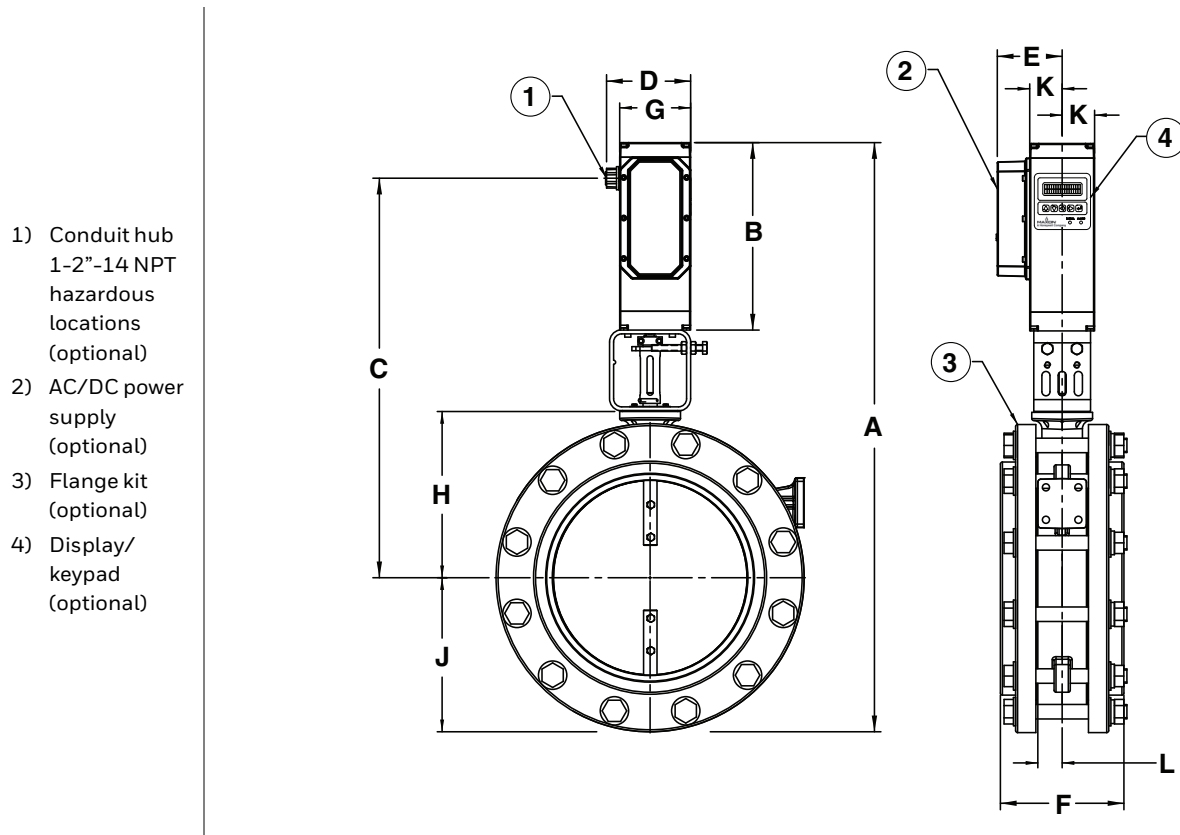
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	808	244	511	112	102
300 in-lb hazardous location	808	244	511	132	102
300 in-lb general purpose with brake	859	295	561	112	102
300 in-lb hazardous location with brake	859	295	561	132	102
900 in-lb general purpose with or without brake	859	295	561	112	102
900 in-lb hazardous location with or without brake	859	295	561	132	102

Valve flange style (optional)		F Flange to flange
Steel	Socket welded	193

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N sq.	P	Q Ø	R	S
112	259	241	51	38	19	76	117	11	25	218

T Ø	U Ø	V Ø	W Ø	X Ø
25	432	483	305	406

12" SMARTLINK® DS butterfly valve - high temperature configuration



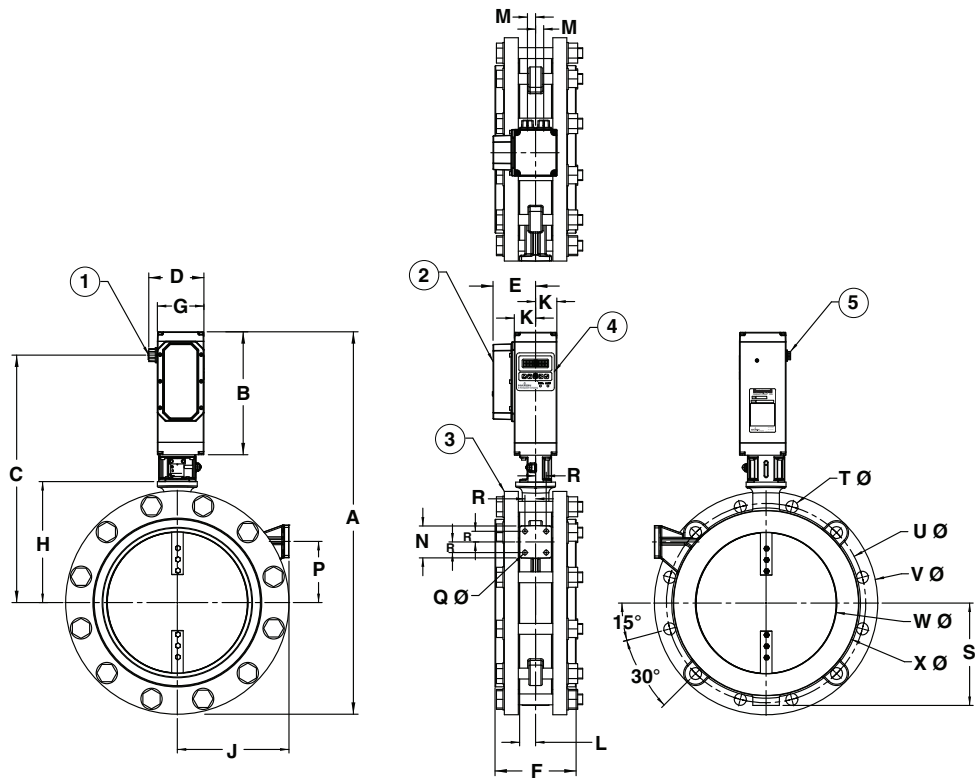
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	871	244	574	112	102
300 in-lb hazardous location	871	244	574	132	102
300 in-lb general purpose with brake	922	295	625	112	102
300 in-lb hazardous location with brake	922	295	625	132	102
900 in-lb general purpose with or without brake	922	295	625	112	102
900 in-lb hazardous location with or without brake	922	295	625	132	102

Valve flange style (optional)		F Flange to flange
Steel	Socket welded	193

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	259	241	51	38

14" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	861	244	541	112	102
300 in-lb hazardous location	861	244	541	132	102
300 in-lb general purpose with brake	912	295	592	112	102
300 in-lb hazardous location with brake	912	295	592	132	102
900 in-lb general purpose with or without brake	912	295	592	112	102
900 in-lb hazardous location with or without brake	912	295	592	132	102

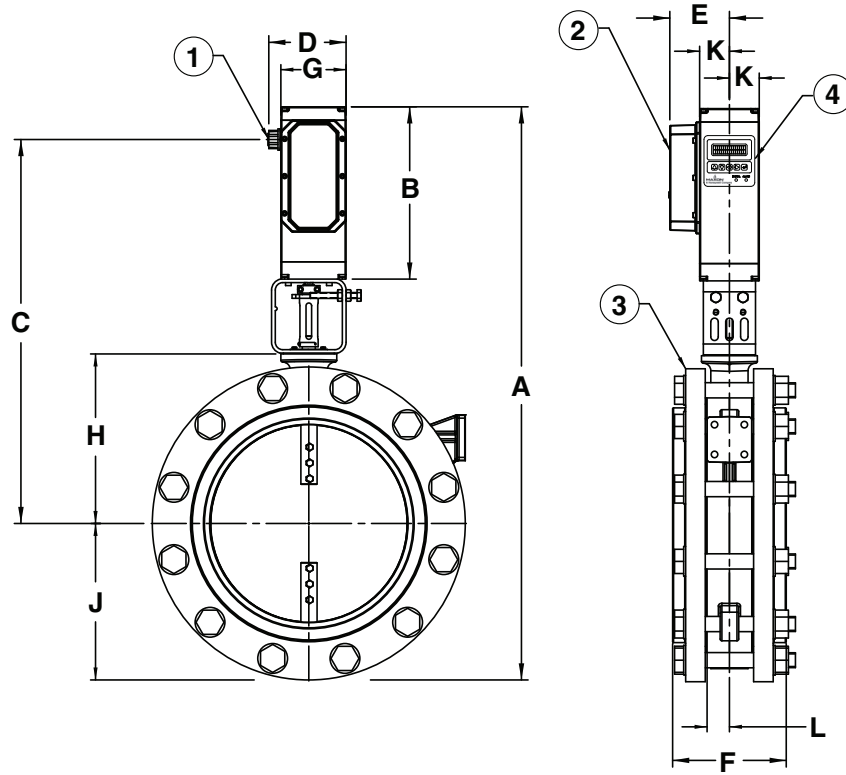
Valve flange style (optional)		F Flange to flange
Steel	Socket welded	193

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N sq.	P	Q Ø	R	S
112	290	267	51	38	19	76	147	11	25	244

T Ø	U Ø	V Ø	W Ø	X Ø
28	478	533	338	445

14" SMARTLINK® DS butterfly valve - high temperature configuration

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)



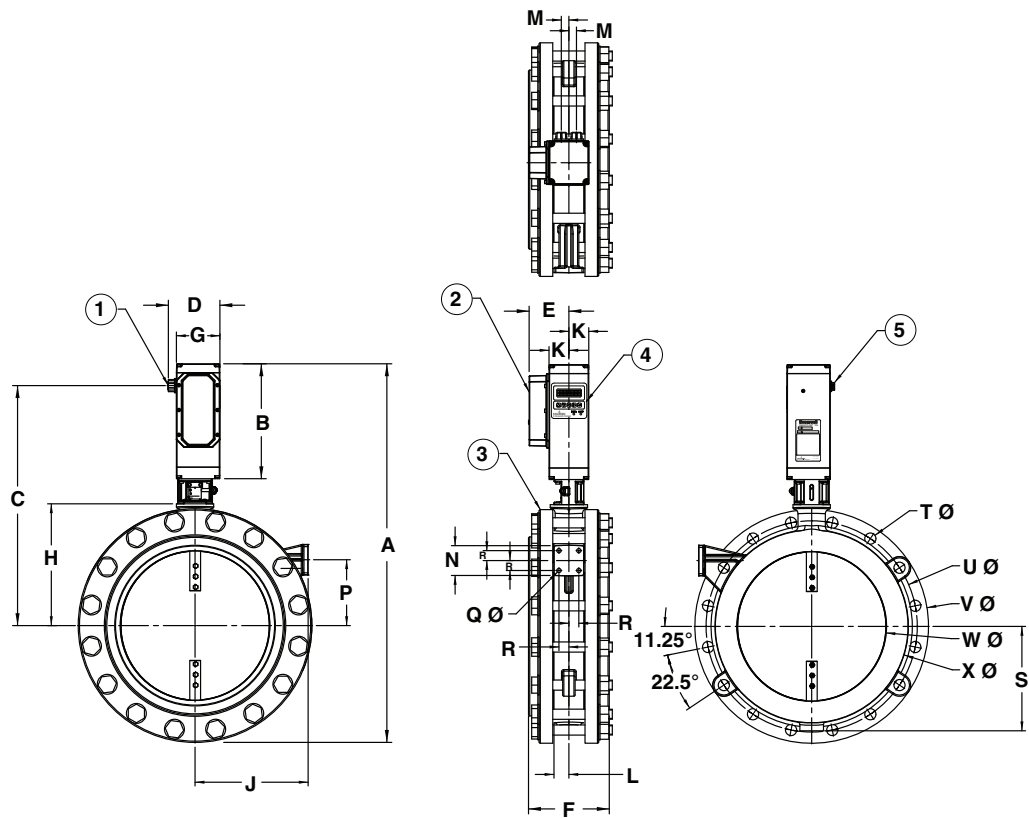
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	927	244	605	112	102
300 in-lb hazardous location	927	244	605	132	102
300 in-lb general purpose with brake	978	295	655	112	102
300 in-lb hazardous location with brake	978	295	655	132	102
900 in-lb general purpose with or without brake	978	295	655	112	102
900 in-lb hazardous location with or without brake	978	295	655	132	102

Valve flange style (optional)		F Flange to flange
Steel	Socket welded	193

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	290	267	51	38

16” SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2”-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2” conduit
entrance



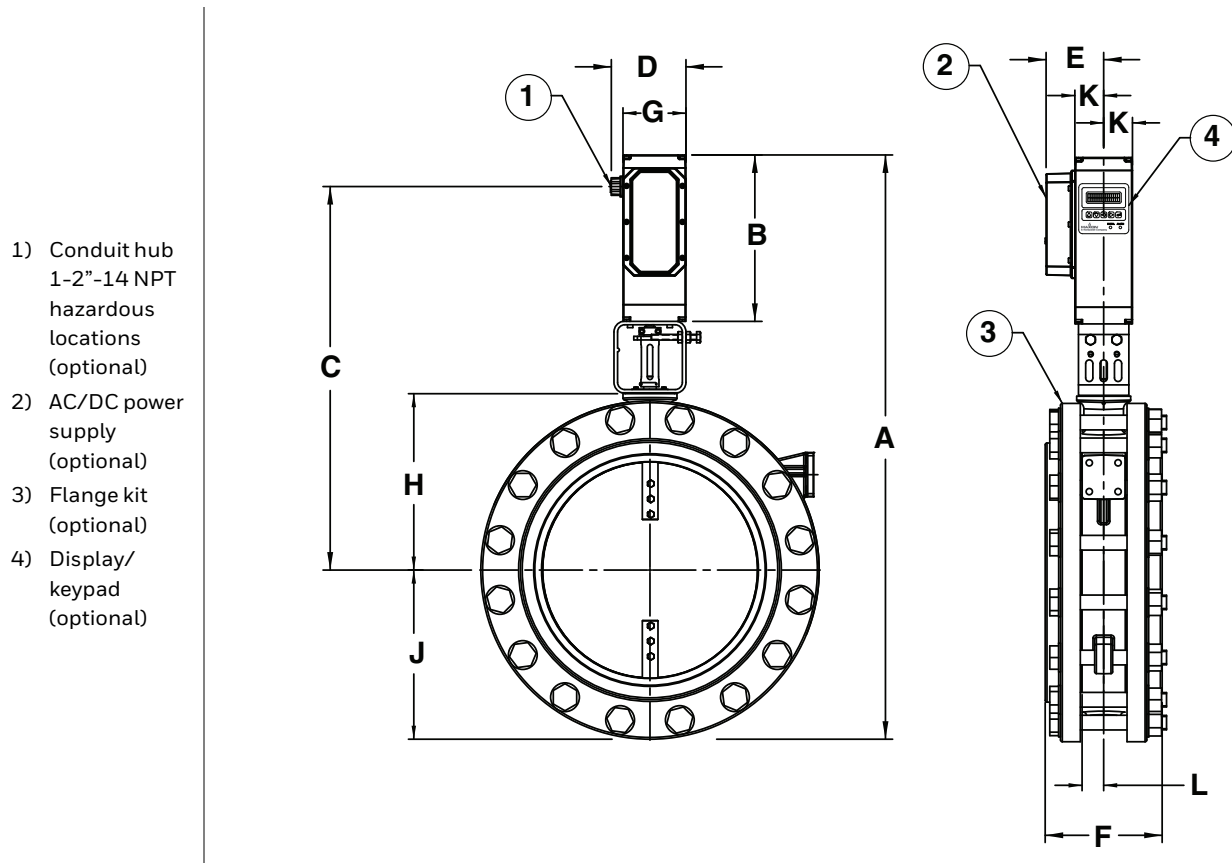
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	917	244	561	112	102
300 in-lb hazardous location	917	244	561	132	102
300 in-lb general purpose with brake	968	295	612	112	102
300 in-lb hazardous location with brake	968	295	612	132	102
900 in-lb general purpose with or without brake	968	295	612	112	102
900 in-lb hazardous location with or without brake	968	295	612	132	102

Valve flange style (optional)		F Flange to flange
Steel	Socket welded	206

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N sq.	P	Q Ø	R	S
112	310	290	51	38	19	76	168	11	25	267

T Ø	U Ø	V Ø	W Ø	X Ø
28	538	597	381	495

16" SMARTLINK® DS butterfly valve - high temperature configuration



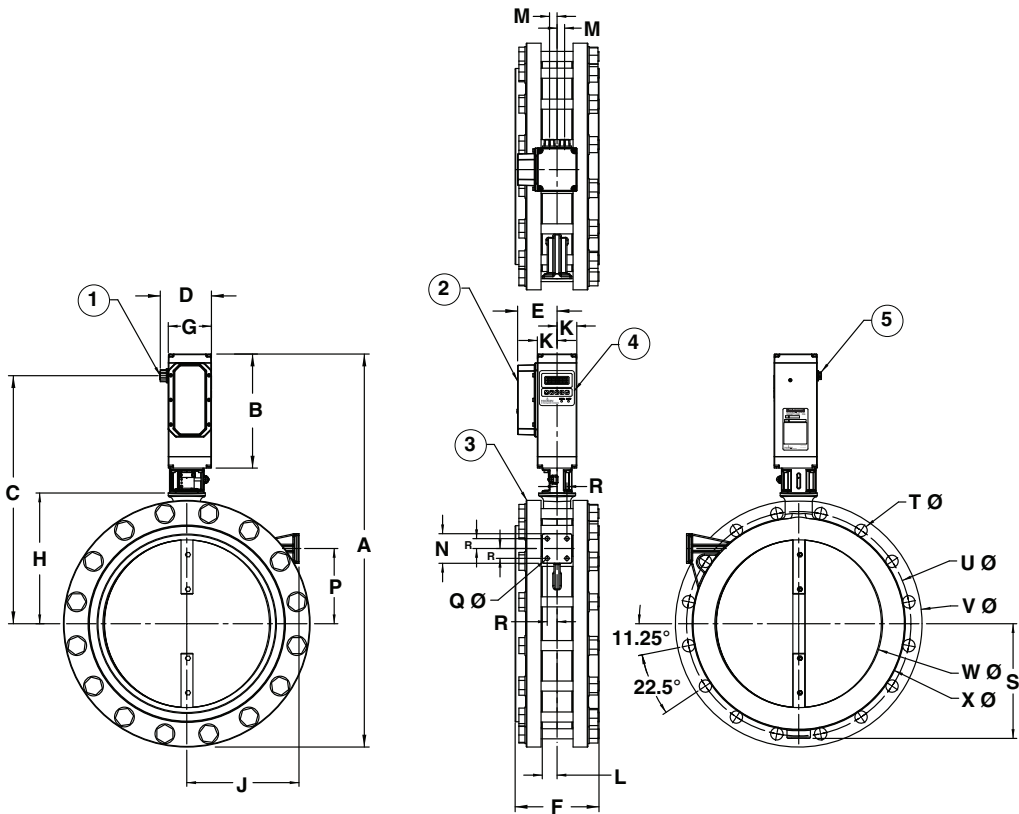
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	980	244	625	112	102
300 in-lb hazardous location	980	244	625	132	102
300 in-lb general purpose with brake	1031	295	676	112	102
300 in-lb hazardous location with brake	1031	295	676	132	102
900 in-lb general purpose with or without brake	1031	295	676	112	102
900 in-lb hazardous location with or without brake	1031	295	676	132	102

Valve flange style (optional)	F Flange to flange
Steel	206
Socket welded	

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	310	300	51	38

18" SMARTLINK® DS butterfly valve

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)
- 5) Standard
shipping
caplug with
gasket. (2) 22
mm dia. holes
in housing for
1/2" conduit
entrance



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
900 in-lb general purpose with or without brake	1011	295	638	112	102
900 in-lb hazardous location with or without brake	1011	295	638	132	102

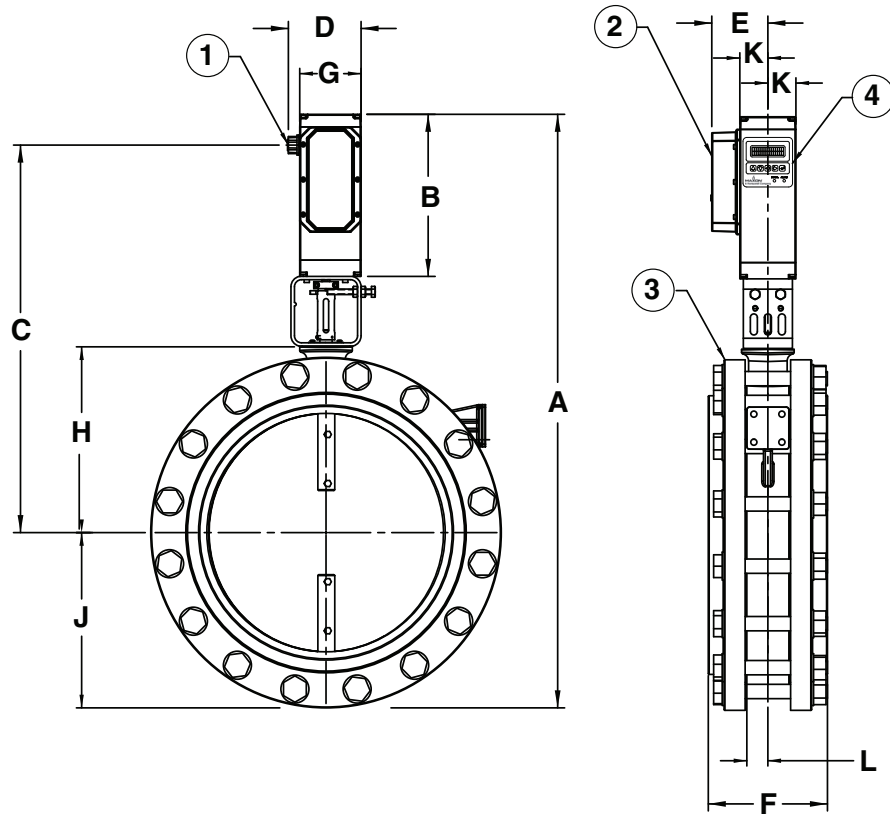
Valve flange style (optional)	F Flange to flange
Steel	Socket welded
	216

Dimensions in mm unless stated otherwise										
G	H	J	K	L	M	N sq.	P	Q Ø	R	S
112	335	290	51	38	19	76	193	11	25	295

T Ø	U Ø	V Ø	W Ø	X Ø
30.4	578	635	432	546

18" SMARTLINK® DS butterfly valve - high temperature configuration

- 1) Conduit hub
1-2"-14 NPT
hazardous
locations
(optional)
- 2) AC/DC power
supply
(optional)
- 3) Flange kit
(optional)
- 4) Display/
keypad
(optional)



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
900 in-lb general purpose with or without brake	1074	295	701	112	102
900 in-lb hazardous location with or without brake	1074	295	701	132	102

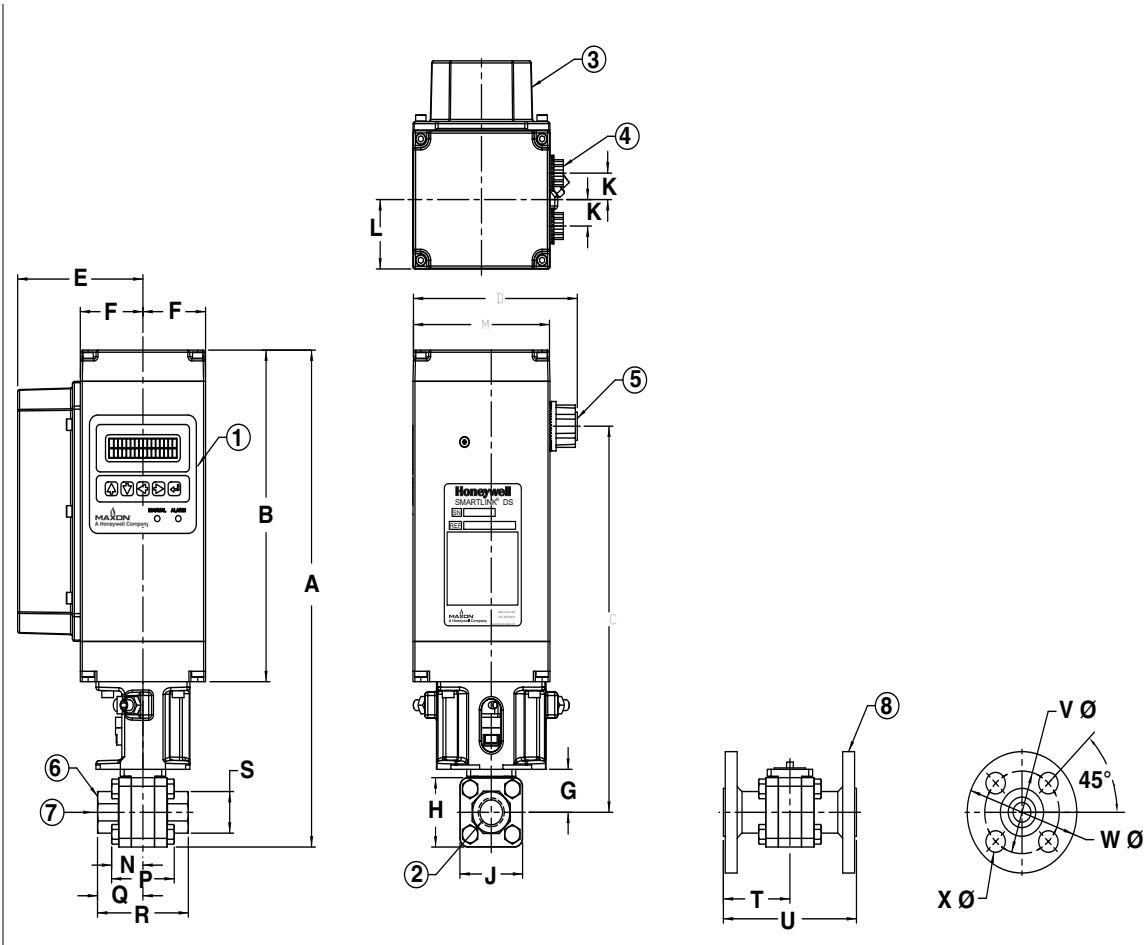
Valve flange style (optional)	F Flange to flange
Steel	216
Socket welded	

Dimensions in mm unless stated otherwise				
G	H	J	K	L
112	335	318	51	38

Ball valves

.5" SMARTLINK® DS ball valve

- 1) Display/ keypad (optional)
- 2) 1/2-14 NPT
- 3) AC/DC power supply (optional)
- 4) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2" conduit entrance
- 5) Conduit hub 1/2"-14 NPT hazardous locations (optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



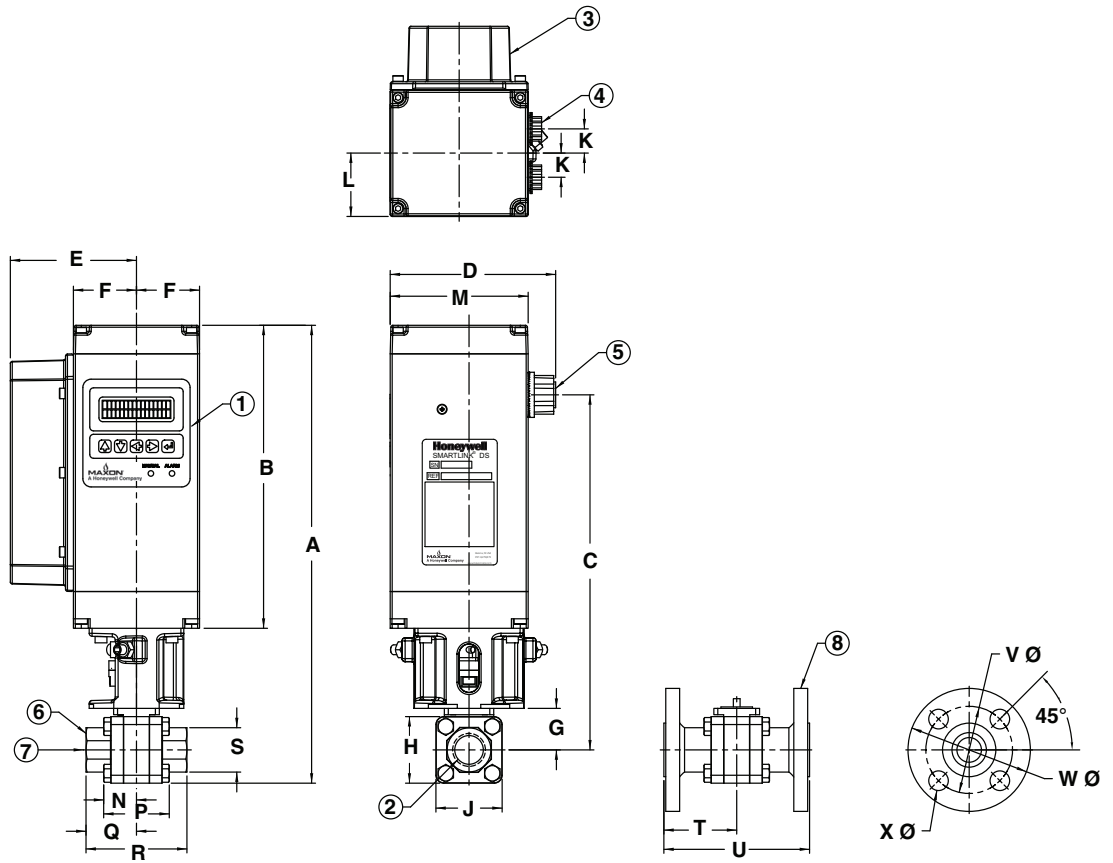
Actuator type	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	112	102
300 in-lb hazardous location	132	102

Dimensions in mm unless stated otherwise										
A	B	C	F	G	H	J	K	L	M	N
363	244	282	51	32	51	51	19	50	112	25

P	Q	R	S oct.	T	U	V Ø	W Ø	X Ø
51	37	74	30.5	54	108	60	89	16

.75" SMARTLINK® DS ball valve

- 1) Display/ keypad (optional)
- 2) 3/4 -14 NPT
- 3) AC/DC power supply (optional)
- 4) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2" conduit entrance
- 5) Conduit hub 1/2"-14 NPT hazardous locations (optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



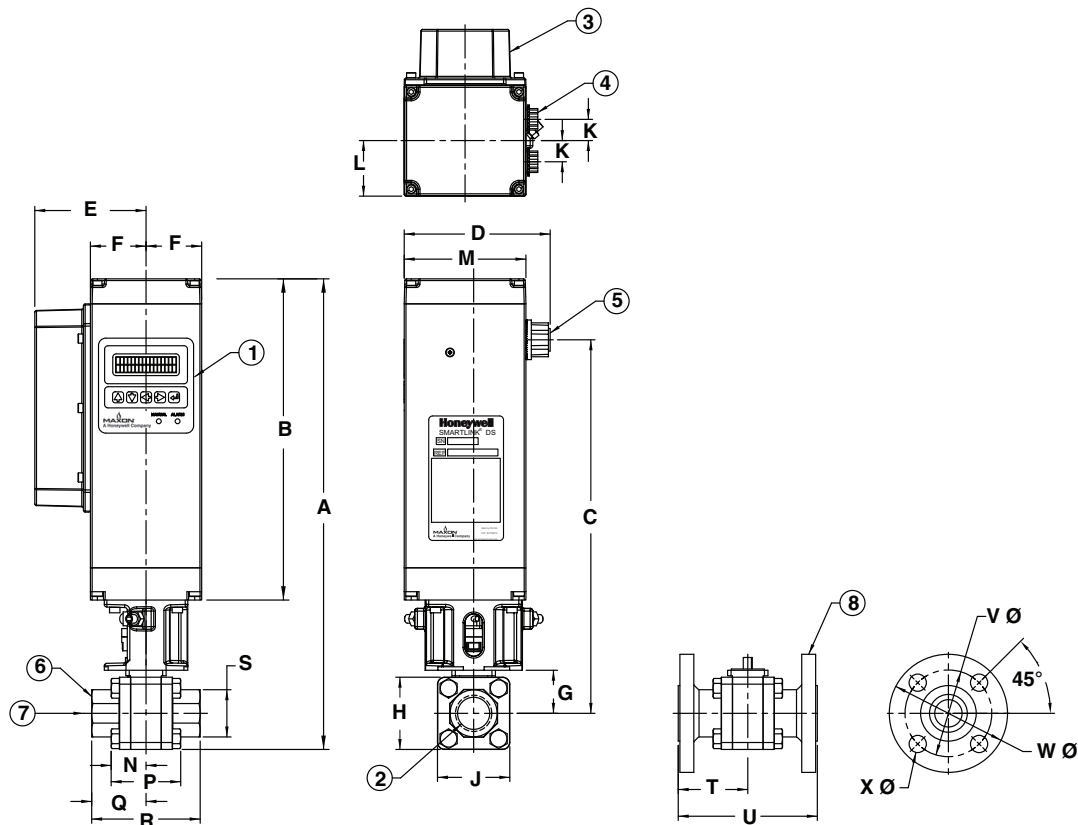
Actuator type	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	112	102
300 in-lb hazardous location	132	102

Dimensions in mm unless stated otherwise										
A	B	C	F	G	H	J	K	L	M	N
366	244	284	51	33	53	53	19	50	112	26

P	Q	R	S oct.	T	U	V Ø	W Ø	X Ø
53	41	81	36	59	117	70	99	16

1” SMARTLINK® DS ball valve

- 1) Display/ keypad (optional)
- 2) 1 - 11-1/2 NPT
- 3) AC/DC power supply (optional)
- 4) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2” conduit entrance
- 5) Conduit hub 1/2”-14 NPT hazardous locations (optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



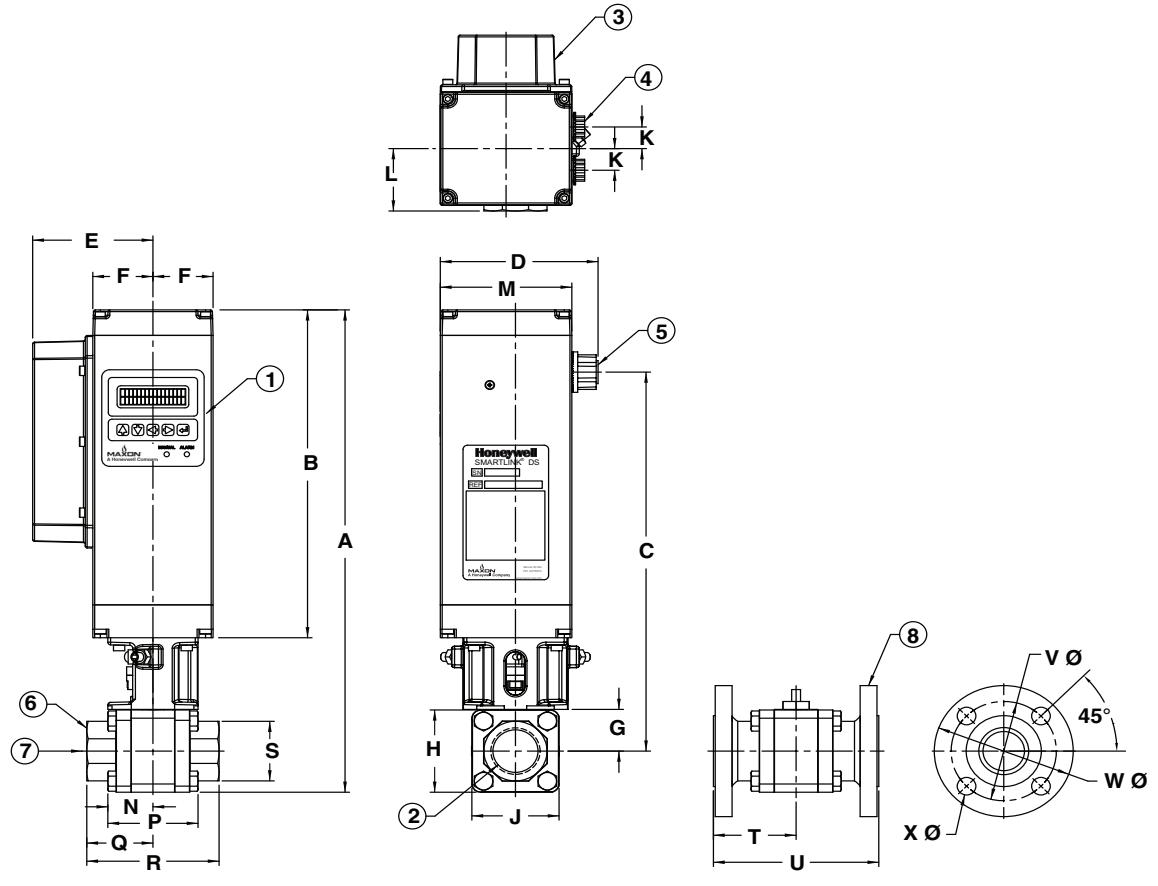
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	378	244	290	112	102
300 in-lb hazardous location	378	244	290	132	102
900 in-lb general purpose	429	295	340	112	102
900 in-lb hazardous location	429	295	340	132	102

Dimensions in mm unless stated otherwise											
F	G	H	J	K	L	M	N	P	Q	R	
51	39	66	66	19	50	112	32	64	50	99	

S oct.	T	U	V Ø	W Ø	X Ø
43	64	127	79	108	16

1.25" SMARTLINK® DS ball valve

- 1) Display/
keypad
(optional)
- 2) 1-1/4 - 11-1/
2 NPT
- 3) AC/DC power
supply
(optional)
- 4) Standard
shipping
caplug with
gasket. (2) Ø
22 mm holes
in housing for
1/2" conduit
entrance
- 5) Conduit hub
1/2"-14 NPT
hazardous
locations
(optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



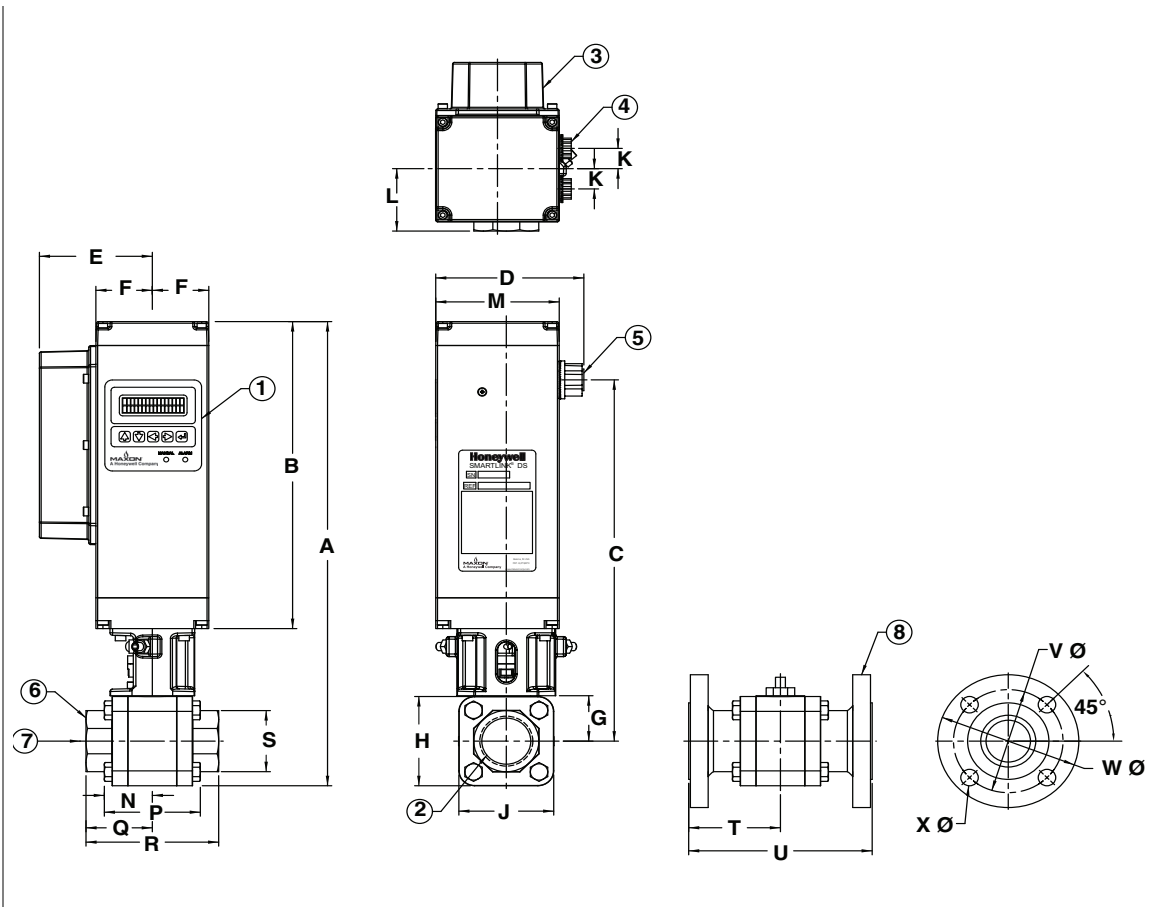
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	381	244	290	112	102
300 in-lb hazardous location	381	244	290	132	102
900 in-lb general purpose	432	295	340	112	102
900 in-lb hazardous location	432	295	340	132	102

Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R
51	37	74	74	19	56	112	38	76	56	112

S oct.	T	U	V Ø	W Ø	X Ø
53	70	140	89	117	16

1.5” SMARTLINK® DS ball valve

- 1) Display/ keypad (optional)
- 2) 1-1/2 - 11-1/2 NPT
- 3) AC/DC power supply (optional)
- 4) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2” conduit entrance
- 5) Conduit hub 1/2”-14 NPT hazardous locations (optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



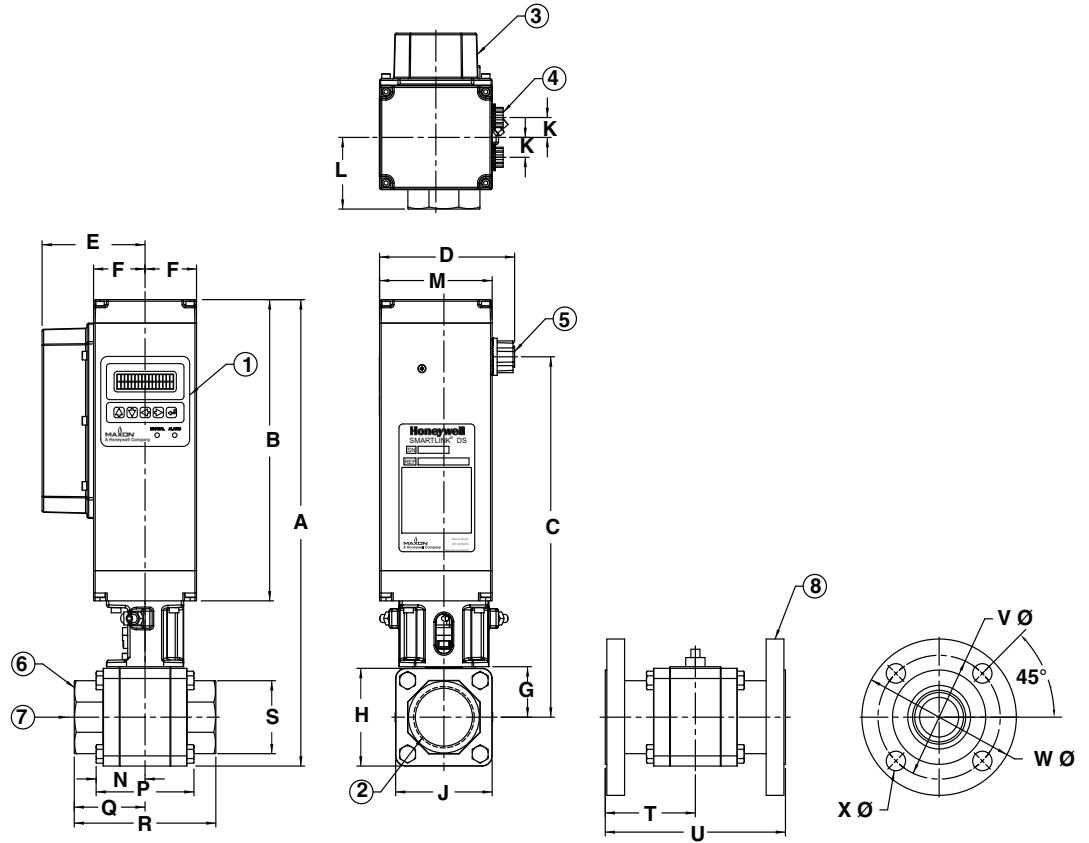
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	394	244	294	112	102
300 in-lb hazardous location	394	244	294	132	102
900 in-lb general purpose	444	295	345	112	102
900 in-lb hazardous location	444	295	345	132	102

Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R
51	43	85	85	19	60	112	43	86	60	119

S oct.	T	U	V Ø	W Ø	X Ø
38	83	165	99	127	16

2" SMARTLINK® DS ball valve

- 1) Display/ keypad (optional)
- 2) 2 - 11-1/2 NPT
- 3) AC/DC power supply (optional)
- 4) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2" conduit entrance
- 5) Conduit hub 1/2"-14 NPT hazardous locations (optional)
- 6) Inlet end
- 7) Flow direction
- 8) 150# flange



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	404	244	300	112	102
300 in-lb hazardous location	404	244	300	132	102
900 in-lb general purpose	454	295	350	112	102
900 in-lb hazardous location	454	295	350	132	102

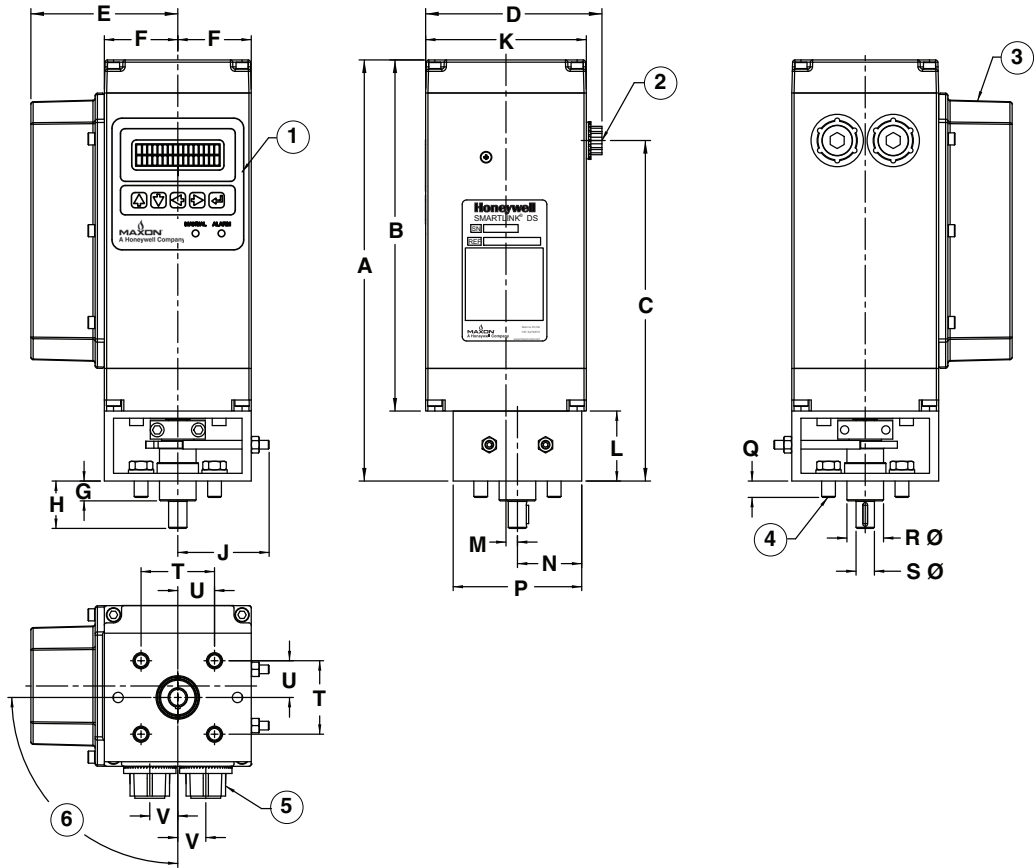
Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R
51	49	95	95	19	70	112	48	97	70	140

S oct.	T	U	V Ø	W Ø	X Ø
77	89	178	121	152	19

Control actuator

1/2” keyed output

- 1) Display/ keypad (optional)
- 2) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2” conduit entrance
- 3) AC/DC power supply (optional)
- 4) 4 x 3/8-16 UNC
- 5) Conduit hub 1/2”-14 NPT hazardous locations (optional)
- 6) Shaft rotation quadrant



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	292	244	236	112	102
300 in-lb hazardous location	292	244	236	132	102
300 in-lb general purpose with brake	343	295	287	112	102
300 in-lb hazardous location with brake	343	295	287	132	102

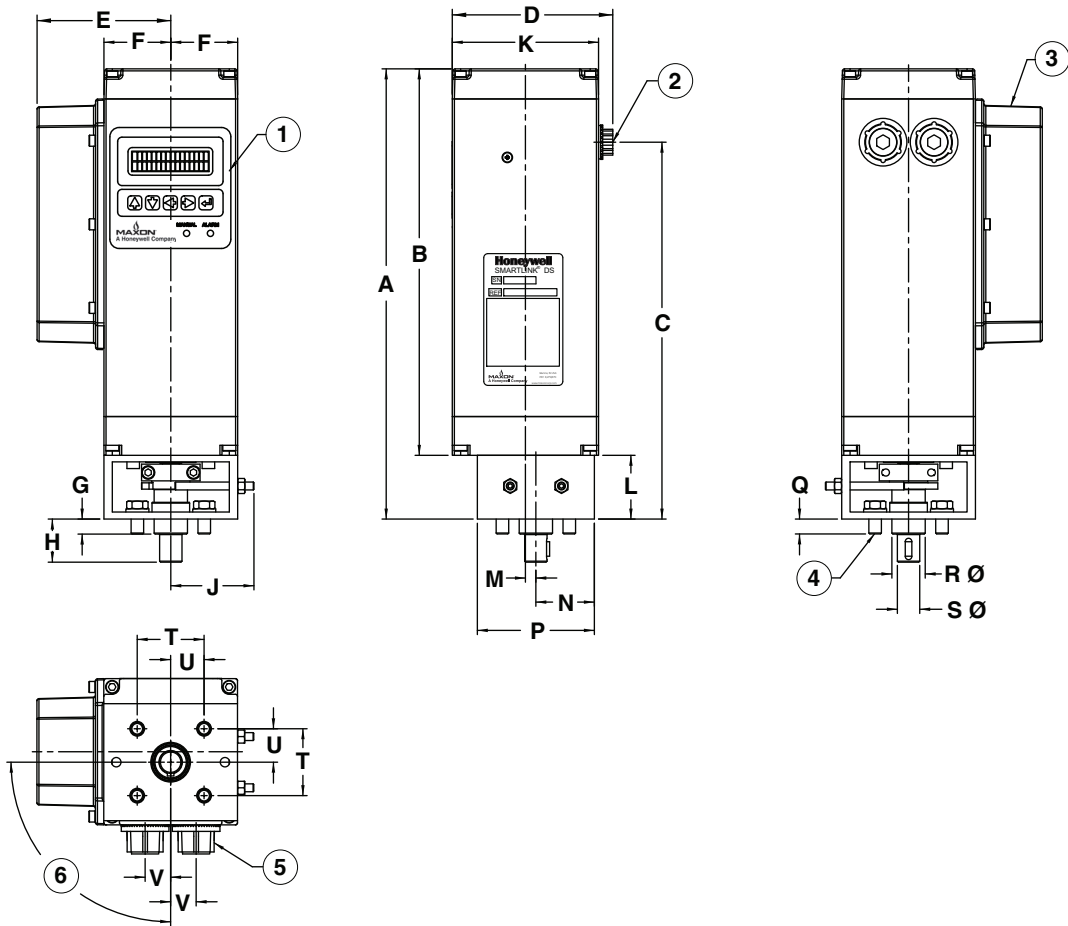
Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R Ø
51	14	33	64	112	48	8	44	89	11	25

S Ø [1]	T	U	V
13	51	25	19

[1] with 1/8” square key

17mm keyed output

- 1) Display/ keypad (optional)
- 2) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2" conduit entrance
- 3) AC/DC power supply (optional)
- 4) 4 x 3/8-16 UNC
- 5) Conduit hub 1/2"-14 NPT hazardous locations (optional)
- 6) Shaft rotation quadrant



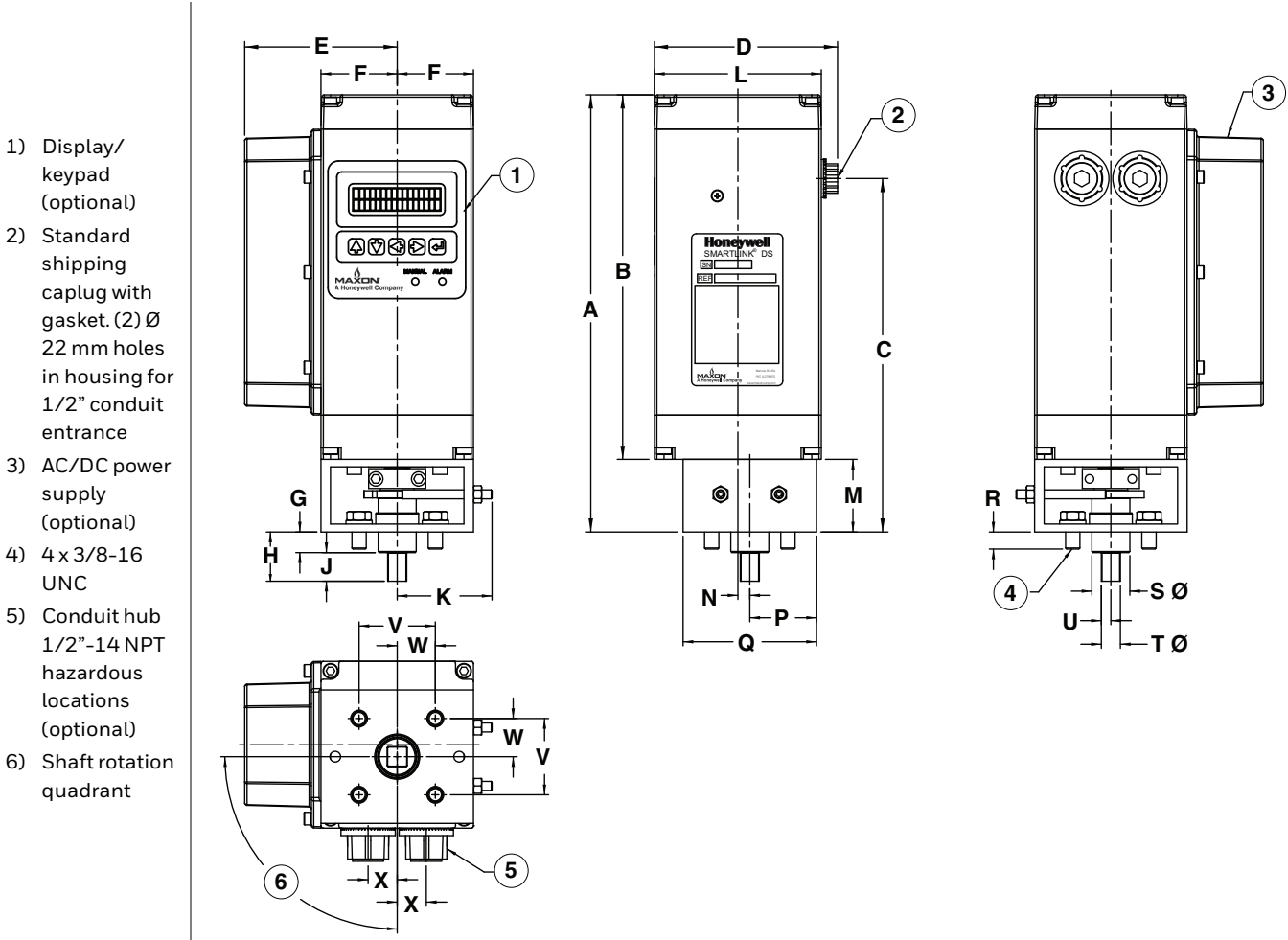
Actuator type	D Conduit entrance	E Over optional power supply
900 in-lb general purpose with or without brake	112	102
900 in-lb hazardous location with or without brake	132	102

A	B	C	F	G	H	J	K	L	M	N
343	295	287	51	11	33	64	112	48	8	44

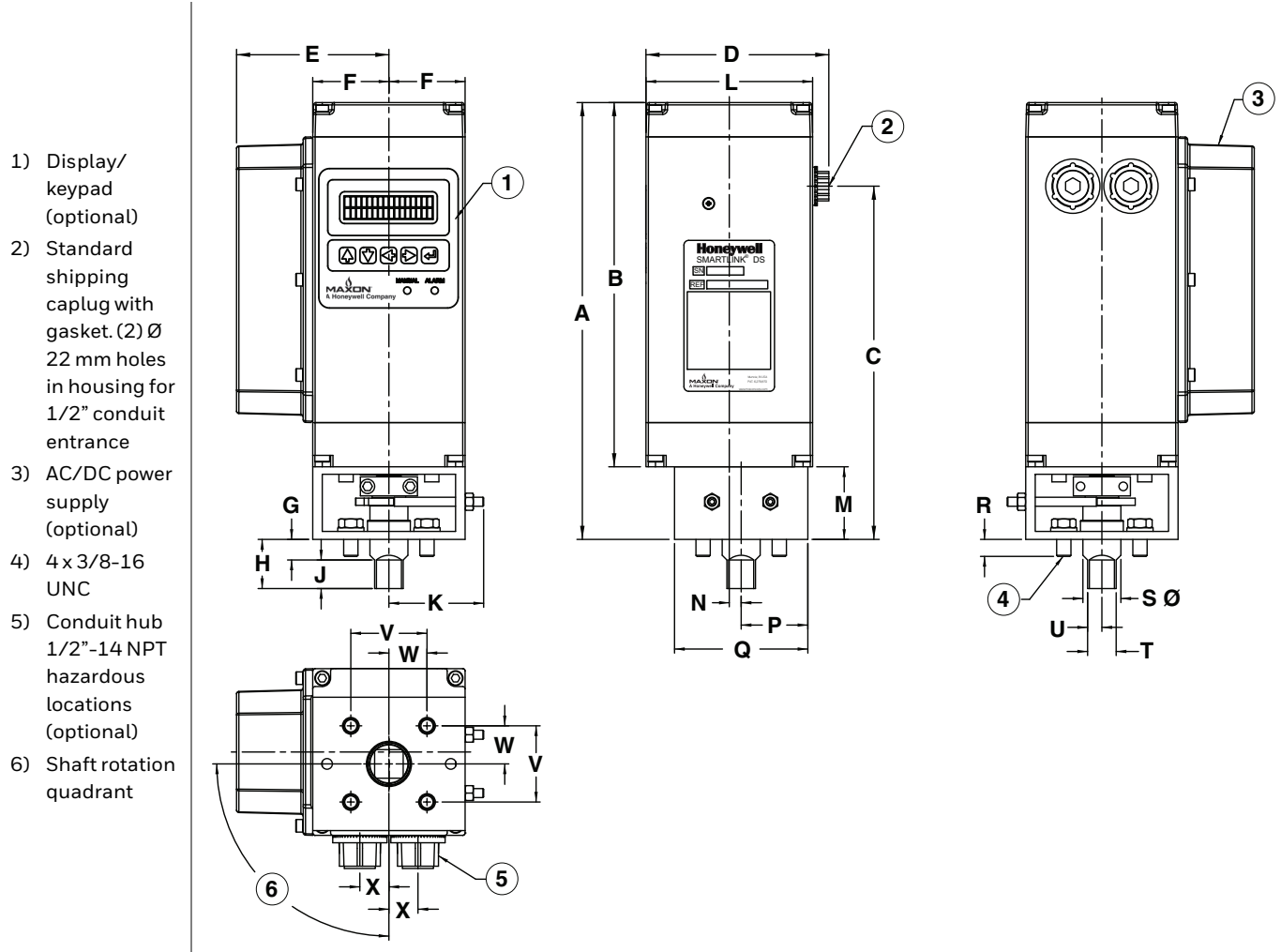
P	Q	R Ø	S Ø [1]	T	U	V
89	11.4	25	17	51	25	19

[1] With 5mm square key

1/2” square output



3/4" square output



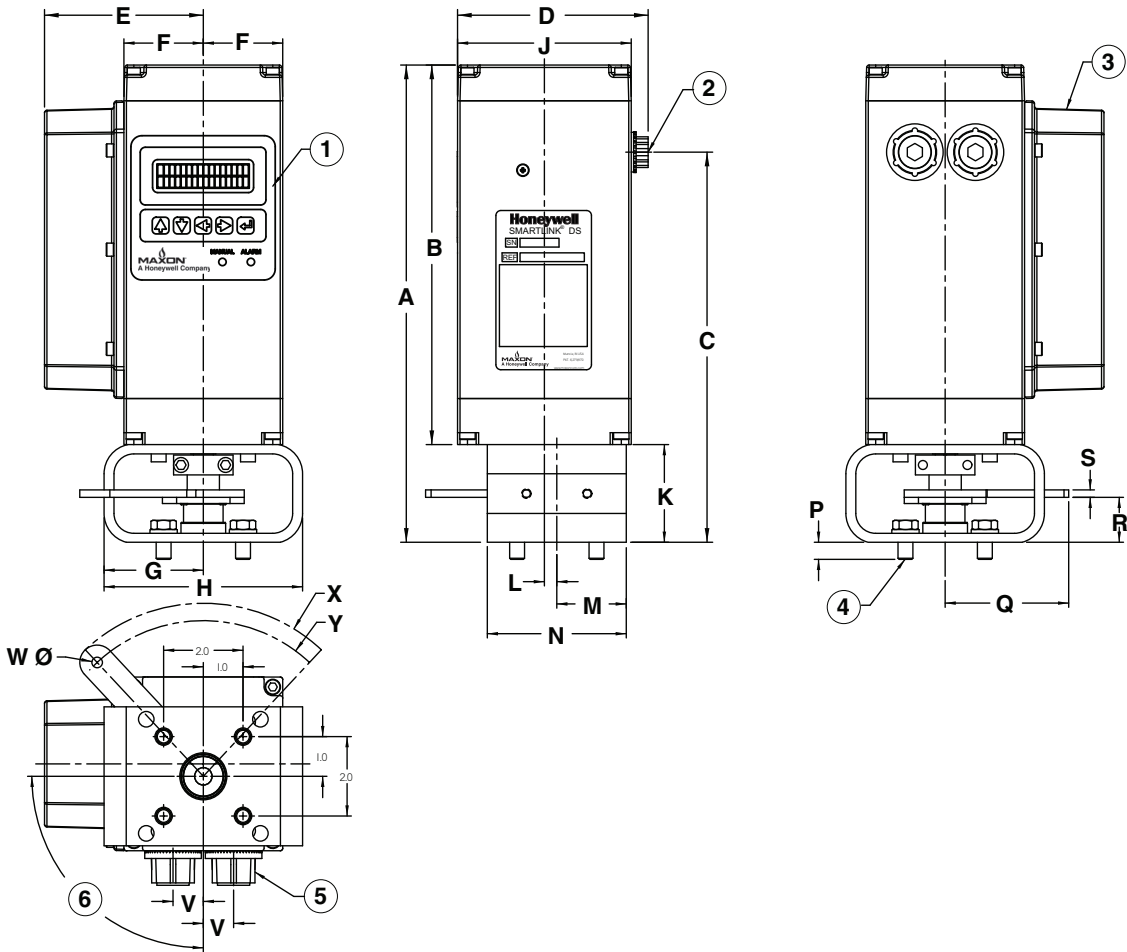
Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	292	244	236	112	102
300 in-lb hazardous location	292	244	236	132	102
300 in-lb general purpose with brake	343	295	287	112	102
300 in-lb hazardous location with brake	343	295	287	132	102
900 in-lb general purpose with or without brake	343	295	287	112	102
900 in-lb hazardous location with or without brake	343	295	287	132	102

Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R
51	14	33	19	64	112	48	8	44	89	11

S Ø	T	U	V	W	X
25	19	10	51	25	19

Linkage arm

- 1) Display/ keypad (optional)
- 2) Standard shipping caplug with gasket. (2) Ø 22 mm holes in housing for 1/2" conduit entrance
- 3) AC/DC power supply (optional)
- 4) 4 x 3/8-16 UNC
- 5) Conduit hub 1/2"-14 NPT hazardous locations (optional)
- 6) Shaft rotation quadrant



Actuator type	A Overall height	B Actuator height	C Orifice to conduit centerline	D Conduit entrance	E Over optional power supply
300 in-lb general purpose	305	244	249	112	102
300 in-lb hazardous location	305	244	249	132	102
300 in-lb general purpose with brake	356	295	300	112	102
300 in-lb hazardous location with brake	356	295	300	132	102

Dimensions in mm unless stated otherwise										
F	G	H	J	K	L	M	N	P	Q	R Ø
51	64	127	112	64	8	44	89	11	79	29

S	T	U	V	W	X rad.	Y rad.
5	51	25	19	7	111	100

INSTALLATION INSTRUCTIONS



Please read the operating and mounting instructions before using the equipment. Install the equipment in compliance with the prevailing regulations.

Bedrijfs- en montagehandleiding voor gebruik goed lezen! Apparaat moet volgens de geldende voorschriften worden geïnstalleerd.

Lire les instructions de montage et de service avant utilisation! L'appareil doit impérativement être installé selon les réglementations en vigueur.

Betriebs- und Montageanleitung vor Gebrauch lesen! Gerät muß nach den geltenden Vorschriften installiert werden.

MANUFACTURER AND IMPORTER ADDRESSES

Below are the addresses and contact information for the Honeywell – Maxon manufacturing location and European sales office. The European sales office serves as the importer and EU manufacturer's representative under the EU New Legislative Framework (NLF).

MUNCIE, INDIANA, USA – MANUFACTURER

201 East 18th Street

P.O. Box 2068

Muncie, IN 47307-0068

Tel: 765.284.3304

Fax: 765.286.8394

EUROPEAN SALES OFFICE – IMPORTER

BELGIUM

Maxon International BVBA

Luchthavenlaan 16-18

1800 Vilvoorde, Belgium

Tel: 32.2.255.09.09

Fax: 32.2.251.82.41

Safety requirements



The SMARTLINK® DS actuator has been independently evaluated by Underwriters Laboratories to provide fail-safe high and low position proven and alarm relay outputs with a maximum safety position error of 2 degrees and a declared maximum detection/annunciation time of 2 seconds. The safety of the overall system, however, is ultimately the responsibility of: 1) The upstream safety control that commands and monitors the SMARTLINK® DS actuator, and 2) the trained commissioning engineer that configures the unit for system operation.

The SMARTLINK® DS actuator is shipped with the high/low position proven relay outputs disabled (or de-energized). It is the responsibility of the commissioning engineer to setup the position proven thresholds (or trip levels) and the minimum and maximum travel positions of the actuator for safe system operation.

The SMARTLINK® DS actuator is designed to operate the high and low position proven relays and alarm relay in a fail safe mode, disabling (or de-energizing) the relay outputs when an internal potentiometer, electronic relay drive component, or software fault is detected.

The 4-20 mA position feedback or digital, RS-485 serial feedback information provided by this product can be used in safety applications if the upstream safety control complies with software/functional safety requirements such as ANSI/UL 1998 Software Class 2, UL/IEC 60730-1 Software Class C appropriate for the safety requirements of the end application, and when used in one of the following (or equivalent) configurations:

- The upstream safety control compares its commanded actuator position with the 4-20 mA actuator position feedback from the SMARTLINK® DS while also monitoring the alarm relay output. In this

configuration, if the alarm output becomes de-energized for more than 2 seconds, the upstream control should command other external hardware to achieve a safe system state.

- The upstream safety control compares its commanded actuator position with the digital, RS-485-based position information contained within the Feedback Safety Data (FSD) packet while also monitoring the alarm output and/or the state of this relay output (also contained within the FSD packet). If this RS-485 data is used for position feedback confirmation and alarm relay status fault monitoring, the upstream safety control must “validate” the Feedback Safety Data packet as follows: 1) verify the source of the information by testing for the correct actuator ID and data type ID, 2) ensure the information is current by verifying the packet counter is being incremented, and 3) verify the data is not corrupted by testing the CRC value of each communications packet and the CRC value of each FSD packet. In addition, a safety communications timeout period appropriate for the end application should be implemented to detect loss of communication between the upstream safety control and the actuator. Refer to the SMARTLINK® DS Modbus User Manual for more detailed information on the Feedback Safety Data packet.



Before operating this product, check all specifications (Page 6 and 7) and safety requirements (Page 47) to ensure the product is suitable and safe for the intended application. In addition, read all installation, commissioning, and operating instructions. The SMARTLINK® DS actuator must be set-up and maintained in the field by qualified personnel. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

Mechanical installation

The valve actuator assembly may be installed in any orientation. Observe good piping practice when installing valves. Do not use valves or actuators to support the weight of the pipe.

Ensure pressures in pipe cannot exceed the rated valve pressure.

Ensure material compatibility of the valve body and trim options in combination with the process media, any possible contaminants, and any possible cleaning materials. Material incompatibility can lead to damage or failure.

If performing a line-breaking operation, relieve pipe pressure and purge any dangerous media prior to valve installation. If the process media poses any risk or hazard, consult the site safety manager prior to proceeding.

Observe national and local regulatory codes when installing on a pipeline.



Maintain the integrity of the enclosure by using NEMA 4X or IP67 rated dust- and water-tight electrical connectors. Use cable-sealing grips and strain-relief loops for any cord or cable. Plug unused conduit holes. Use internal sealing materials on all conduit connections. Moisture can have a harmful effect on device internals if permitted to enter through wiring connectors. **Ensure that the device connection is not at a low point of the conduit to avoid condensation run-off into the housing; install a drip loop if necessary.** Make sure that the access cover plate is in place and securely fastened. All cover screws should be tightened using an alternate cross-corner tightening pattern to the specified torque. Cover screws should be checked periodically to ensure adequate sealing protection.

Ensure the media temperature cannot exceed the valve or actuator ratings. Use a coupling with thermal breaks if required. If the possibility exists for radiant heating (such as a furnace application), install a thermal barrier.

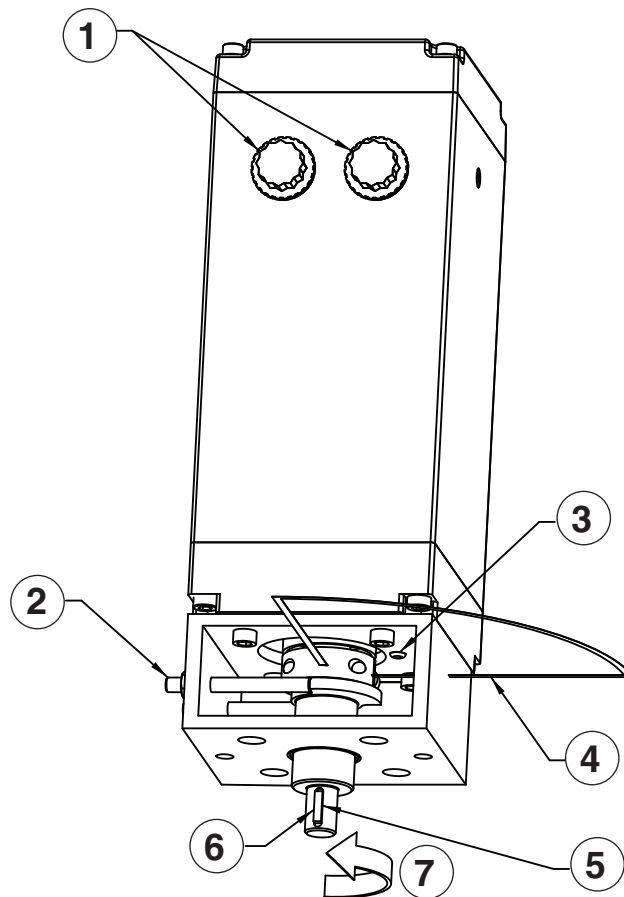
Ensure that pipe and ductwork is free of debris that could impair valve function.

Note that if a brake option is selected, the actuator CANNOT be manually stroked without first powering the unit and disabling the motor and brake. If the unit has no brake, turn off power to the system before actuator replacement or valve body (or damper) servicing is performed to avoid unsafe operating conditions or injury.

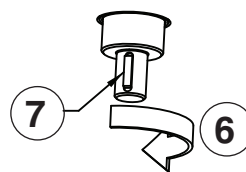
For standalone models, note the quadrant of the keyway and rotation direction as shown in Figure 1.

Figure 1

- 1) Conduit entrance
- 2) Hard stops
- 3) Alignment pin in base of actuator
- 4) Shaft rotation quadrant
- 5) Key in shaft
- 6) Min. (close)
- 7) Max. (open)



Counter-clockwise (CCW-to-close) rotation, default mode (when viewing shaft end)



Clockwise (CW-to-close) rotation (when viewing shaft end)

Ensure a key is installed and fully seated in all keyways; failure to install a key can compromise the safety of some applications. Hand tighten bolts on the mounting bracket and coupling collar and ensure good fit and that the shaft

is centered prior to fully tightening all bolts. Ensure the coupling collar does not bind throughout the full rotation. Ensure coupling collar is tightened to ,19 N.m especially in high-torque applications. Tighten bracket bolts.

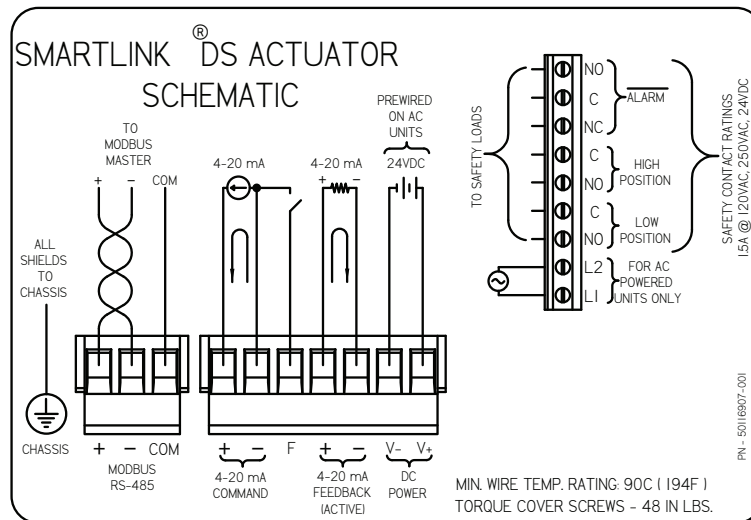
Electrical installation



If the possibility of a hazardous location exists, ensure the area is made safe and disconnect power before removing the actuator cover or conduit fittings.

Wiring terminals

The diagram below indicates each wiring terminal and the following reference table (page 53) identifies each terminal's signal type and function. Many applications will not require connections to all terminals.



To access the field wiring compartment for power and signal connections, remove the 4 bolts and cover from the top of the actuator housing. Pass all customer-supplied wires into the enclosure through the 2 conduit hubs.



To ensure physical protection as well as electromagnetic immunity, the use of flexible, sunlight-resistant, jacketed, metallic, water-tight conduit is required. The conduit should be connected to earth ground on both ends.

One or both conduit holes may be used when wiring an actuator. When AC (mains) voltage is present for either power or relay signals, it is preferable to use a separate conduit for low voltage signal wire to avoid electrical interference.

In addition to a grounded conduit, the use of shielded, twisted-pair cable is strongly recommended for DC power and signal wires. The shield drain wires should be landed to chassis/earth on both ends of the cable, but **ONLY** if a conduit is also grounded on both ends. In other cases, earth the shields at one end only to prevent ground loops.



- For position feedback, wire to the 4-20 mA (+) and (-) terminals. 4mA=0% open 20mA=100% open
- The 4-20 mA output signal is self-powered. DO NOT use an external supply in conjunction with this output.

Input power

Use cable rated for the temperatures, voltages, and currents required by the application. In the case of DC power, use a gauge of wire to minimize voltage loss (droop) over long cable runs, especially at full current load (see specification sheet for maximum current draws and table on page 53 for wire gauge recommendations). Ensure that voltage specifications are met under all conditions.

In the case of AC power, safety ground must be wired to the chassis ground screw.

A fuse or breaker should be installed at the power source. In the case of DC power, if the power supply is not factory-supplied, a SELV (Safety Extra Low Voltage) rated supply with regulated output must be provided. Check table on page 53 for fusing requirements.

If a brake option is not used, eliminate any possibility of externally driving the actuator. If the possibility exists for back-driving, particularly with a large (12" or larger) butterfly valve or damper, use of a battery-backup system is highly recommended to prevent an actuator over-speed condition on power loss. High speed or acceleration will irreparably damage the gearbox and/or motor.



The 4-20 mA output signal is self-powered. DO NOT use an external supply in conjunction with this output.

The output terminals are fully isolated from the power supply, input terminals, and communication signals.

Relay connections

All relay connections are dry (unpowered) and isolated from each other and other signals. All 3 relay loads are de-rated when used in a safety-critical application; see the specification list. In addition, all relays are significantly de-rated if driving an inductive load, such as a motor. Use cable rated for the temperatures, voltages, and currents required by the application.

The low and high position relays are intended to act in the same way as mechanical limit switches. Each will energize and close when the limit threshold is met or exceeded. In addition, a small amount of hysteresis has been designed into these limits to avoid relay chatter. Both relays are guaranteed to open if the actuator becomes un-powered or enters a lockout condition. By default, no thresholds are set; the user must determine the safe limits for a given application.

The alarm relay will energize when the unit is powered and operating normally. By default, the alarm relay will alternately open and close (approximately every 1.5 seconds) when an aberrant (but non-lockout) condition is present, such as excessive temperature; this behavior may be de-activated. The relay is guaranteed to de-energize if the actuator becomes un-powered or enters a lockout condition.

Low voltage inputs

By default, the actuator is controlled by an analog 4-20 mA signal (alternatively, Modbus control is possible; see page 60).

This input is polarity sensitive; observe the polarity shown in the wiring diagram, with current flowing INTO the positive terminal.

The F-terminal is a special command input that will trigger the actuator to move to a pre-defined location. It is active when shorted (via a switch or relay) to the 4-20 mA terminal.

The command input terminals, along with the F-terminal, are fully isolated from the power supply, feedback signal, and communication signals.

Low voltage outputs

The 4-20 mA position feedback signal works similarly to the 4-20 mA input signal. The output is polarity sensitive; observe the polarity shown in the wiring diagram, with the current flowing OUT of the positive terminal.

The alarm relay is intended to operate either as a safety interlock, an interlock with the analog feedback signal, or as a means to drive an external warning light. As an interlock, the normally-open (NO) terminal should be used, since it will be closed only during normal operation. To drive a warning light, the light may be powered through the normally-closed (NC) terminal, since it will be closed only during a fault.

Communication (Modbus over RS-485)

Use appropriate communication cable (see table on page 53). A network will consist of a customer's Modbus master (with termination) and one or more actuator slaves. The recommended network layout for multiple actuators is a "star" topology where each branch/homerun length does not exceed 500 feet in length (2000 feet total); in this case use the termination resistor at each actuator. Multiple actuators may also be connected in a "multi-drop" or "daisy chain" topology as long as the total cable length does not exceed 3000 feet; in this case use the termination resistor at the furthest (end-run) actuator only and remove it from other actuators. Note that while communication and AC power may be daisy-chained, it is recommended that DC power distribution be via the star topology only to limit voltage droop.

Wiring requirement summary

Type	Terminal	Description	Wiring
PE (Protective Earth)	Chassis ground screw	Chassis connection for mains power and shield/drain wires	Follow local codes for safety earth installation. See Electrical installation section for shield drain installation instructions.
Power/ground (AC models only)	L1	AC mains	Use a 3.15A slow-blow fuse. Use 12-22 AWG wire.
	L2	AC mains	
DC power terminals (pre-wired on AC models)	24V+	24VDC positive terminal	Shielded twisted pair cable is recommended. Self-healing 1.8A fuse is provided in all units (AC or DC). If additional fusing protection is required in the DC input cabling, use a 3.15A slow-blow fuse. Required gauges are: Up to 80 ft: 24 AWG Up to 120 ft: 22 AWG Up to 500 ft: 16 AWG Up to 800 ft: 14 AWG Up to 1200 ft: 12 AWG Over 1200 ft: AC powered models are recommended to avoid large voltage drops.
	24V-	24VDC negative terminal	
Low voltage inputs	4-20 In+	Isolated 4-20 mA position command signal (current input)	Shielded twisted pair cable is recommended. Use 12-24 AWG wire.
	4-20 In-	Command signal current return	
	F	F-terminal input (see page 59)	<20 mA current. Use 12-24 AWG wire.
Low voltage outputs	4-20 Out+	Isolated, self-powered 4-20 mA position feedback signal (current output)	Shielded twisted pair cable is recommended. Use 12-24 AWG wire.
	4-20 Out-	Feedback signal current return	
Low voltage communication (Modbus over RS-485)	RS485 In+	Isolated RS-485: positive	Shielded twisted pair cable with a separate common wire is recommended. See Electrical installation section for length limitations. Use 12-24 AWG wire.
	RS485 In-	Isolated RS-485: negative	
	RS485COM	Isolated RS-485: common	
Relay contacts	Alarm RLY NO	Alarm (NOT) indication: CLOSED to COM when powered and no alarm or lockout condition	See specification sheet for current capacity. Use 12-22 AWG wire.
	Alarm COM	Alarm relay common	
	Alarm RLY NC	Alarm (NOT) indication: OPEN to COM when powered and no alarm or lockout condition	
	HIGH POS RLY COM	High position proven (HPP) dry contact return	
	HIGH POS RLY NO	High position proven (HPP) indication CLOSED to COM while user-defined high position condition is achieved	
	LOW POS RLY COM	Low position proven (LPP) dry contact return	
	LOW POS RLY NO	Low position proven (LPP) indication CLOSED to COM while user-defined low position condition is achieved	

OPERATING INSTRUCTIONS

Instructions provided by the company or individual responsible for the manufacture and/or overall installation of a complete system incorporating MAXON equipment take precedence over the installation and

operating instructions provided by MAXON. If any of the instructions provided by MAXON are in conflict with local codes or regulations, please contact MAXON before initial start-up of equipment.



Read the instruction manual carefully before initiating the start-up and adjustment procedure. Verify that all of the equipment associated with and necessary to the safe operation of the system has been installed correctly, that all pre-commissioning checks have been carried out successfully and that all safety-related aspects of the installation are properly addressed.

Overview

SMARTLINK® DS provides multiple methods for actuator commissioning, precise closed-loop valve (or damper) position control, and health monitoring.

- An optional built-in display and keypad can be used to perform commissioning, local valve positioning, and to view status and diagnostic information.
- Position can be commanded by a 4-20 mA input control signal, via Modbus, or through the local display.
- Commissioning is easily accomplished by the optional local display, or PC-based configuration software that communicates to the unit via a RS-485 Modbus interface.
- Although SMARTLINK® DS will operate out of the box, the user can perform field setup of several configuration parameters such as:
 - Rotation,
 - Minimum and maximum positions,
 - High and low position (proven) relay thresholds,
 - Loss-of-signal position and F-terminal positions, and
 - RS-485 Modbus mode and address

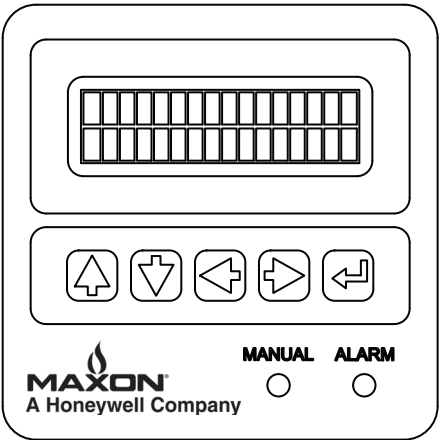
- Field wiring and operational checkout can be easily performed with the PC-based software or the optional display by viewing status information such as position, mA input and output current, and relay output status.
- SMARTLINK® DS includes extensive built-in field diagnostics that can be viewed at the display or by using the PC-based software. Long term, health monitoring of the unit is possible by a user-provided PLC, programmed to periodically poll Modbus registers. These provide information such as real time and historical alarm and lockout data, internal temperature, motor current and voltage, position feedback safety data, and RS-485 Modbus performance.
- SMARTLINK® DS also provides built-in diagnostics which can prevent costly down time and lead to improvements in overall process efficiency, particularly in the area of energy savings for combustion control applications. Specifically, position move counters and positioning histograms can be used to determine problems with valve positioning or upstream temperature control loop tuning.

The following sections provide instructions for the operational capabilities briefly introduced in the list above.

Display and keypad (optional)

A backlit, 2 x 16 LCD (2 rows, each 16 characters long) and an externally mounted keypad provide the user with the ability to configure the actuator and view status without a computer. In addition, two LEDs are provided to indicate when the actuator is in a local manual mode, and when an alarm or lockout condition exists. The manual mode LED is green and the alarm/lockout LED is red. When one or more

alarm conditions exist, the alarm LED will turn on for 2 seconds and off for 2 seconds. When a lockout condition exists, position control is inhibited and the alarm LED will be continuously lit up.



Menu navigation

In the figure above, the four arrow keys on the left and the enter key on the far right are used to select the desired menu display. An explanation of key navigation is summarized in the table below. Pressing the LEFT and UP arrow keys simultaneously forces Menu 1A to be displayed.

Key	Function
 RIGHT	Selects the first display in the “next” menu column (or category). If Menu 1C is displayed and the RIGHT arrow key is pressed, Menu 2A is displayed. When any Menu 4 item is selected and the RIGHT arrow key is pressed, the display will “wrap” to Menu 1A.
 LEFT	Selects the first display menu in its column (or category). If Menu 2E is displayed and the LEFT arrow key is pressed, Menu 2A is displayed. When any Menu 1 item is selected and the LEFT arrow key is pressed, the display will “wrap” to Menu 4A.
 UP	Used to move “up” the menu column to a lower item number. When the first item in a column is selected and the UP arrow is pressed, the display will “wrap” to the last item in the column.
 DOWN	Used to move “down” the menu column to a higher item number. When the last item in a column is selected and the DOWN arrow is pressed, the display will “wrap” to the first item in the column.
 ENTER	Used to perform a user setup function or select an item within a menu item.

Menu structure

As shown in the table below, menus are all numbered and divided into 4 categories.

- Menu 1 provides actuator status information so that field wiring checkout, troubleshooting, and periodic maintenance can be performed. Alarm/lockout, input/output signals, motor, and internal temperature status is made available.
- Menu 2 provides the most common setup functions such as setting minimum and maximum positions and rotation.
- Menu 3 provides less commonly used setup functions such as selecting the mA position output mode or changing the passcode for the “lock” function.
- Menu 4 provides actuator history information such as non-volatile alarm and lockout event logs and counters, actuator run time, and manufacturing data.

Table 1. Menu structure

Actuator status	Unit setup A	Unit setup B	Actuator history
1A Control Mode Position 100.0%	2A Unit Setup A Unlocked ↵ Lock	3A Unit Setup B Unlocked ↵ Lock	4A Run Days-Time D:9999 T:23:59:59
1B Command Input Open 100.0 %	2B Change Mode Control ↵:Manual	3B Change Mode Control ↵:Manual	4B Lockout Log Events: 0 ↵ To ↑↓
1C Position Open 100.0 DEGS	2C Set Position POSxxx.x° ↵ To ↑↓	3C Set Passcode PC: 0000 ↵ To ↑↓	4C Alarm Log Events: 0 ↵ To ↑↓
1D Command Input Open 100.0 DEGS	2D Set LPP Trip LPPxxx.x° ↵ To ↑↓	3D Disable LPP LPPxxx.x° [↵]	4D Lockout Event Counters: ↵ To ↑↓
1E Analog Input Current 20.00 mA	2E Set HPP Trip HPPxxx.x° ↵ To ↑↓	3E Disable HPP HPPxxx.x° [↵]	4E Alarm Event Counters: ↵ To ↑↓
1F Analog Output Current 20.00 mA	2F Set Min Pos MINxxx.x° ↵ To ↑↓	3F Disable LOS LOSxxx.x° [↵]	4F S/W Version 01.002.01.001
1G Lo Pos Proven LPP Relay ON	2G Set Max Pos MAXxxx.x° ↵ To ↑↓	3G Disable F-T F-Txxx.x° [↵]	4G Mfg Min Pos Open 0.0 DEGS
1H Hi Pos Proven HPP Relay OFF	2H Set LOS Pos LOSxxx.x° ↵ To ↑↓	3H mA Deadband 0.20 DEGS ↵ To ↑↓	4H Mfg Max Pos Open 100.0 DEGS
1I Alarm (Not) Alarm/ Relay OFF	2I Set F-T Pos F-Txxx.x° ↵ To ↑↓	3I Ma Out Mode % OF SPAN ↵ To ↑↓	4I Move Counter 123456789
1J Temperature Housing 25.1 C	2J Set Rotation CCW ↵ For CW	3J Alarm Mode LKO+ALM ↵ To ↑↓	4J Move Degrees 1234567.89
1K Motor Sense Current x.xx A	2K Reset Logs ↵ To Clear Logs	3K Brake Enable ENABLED ↵ To ↑↓	4K RS485 Message Counters: ↵ To ↑↓
1L Motor Volts Supply xx.x Vdc	2L Reset Config ↵ For Defaults	3L Command Input 4-20mA ↵ To ↑↓	
1M F-Terminal Input State ON	2M Test Lockout/ ↵ To Lockout (Reset)	3M RS-485 Mode MB 19.2K-e ↵ To ↑↓	
1N 4-20ma LOS Input State OFF	2N Motor Power ON ↵ To Turn Off	3N Modbus Addr ADDR 011: ↵ To ↑↓	
1O RS-485 Status ModBus 19.2K-e	2O Lockout Move POSxxx.x° ↵ To ↑↓	3O Actuator ID ID#: 001 ↵ To ↑↓	

Modes of operation

SMARTLINK® DS has three modes of operation:

- **Control Mode:** In this mode, depending on the user configuration, the shaft position is controlled by either:
 - The 4-20 mA input signal and the Loss-of-Signal and F-terminal functions (if enabled by the user), or
 - Serial Modbus position command registers that specify the setpoint in degrees or percent of full span.

In Control Mode, the user cannot make changes to the actuator setup parameters in Menu 2 and 3 (Table 1), but can monitor the status and history of the actuator (Menu 1 and 4).

- **Manual Mode:** In this mode, the user can modify setup parameters in Menu 2 and 3, as well as monitor the status and history parameters in Menus 1 and 4. The actuator will not respond to a 4-20 mA positioning signal, but the shaft can be moved by keypad commands if the unit is in “unlocked” state.
- **Lockout Mode:** This operational mode is entered after a fault is detected, and position control is then disabled until the user attempts to reset the lockout condition.

Conditions for NOT being able to modify configuration parameters include:

- The unit is in Control Mode and must first be switched to Manual Mode.
- The unit is in a “locked” state and requires the appropriate passcode to be entered. If the passcode is “0” (default), the unit cannot be locked.
- A fault condition was diagnosed and the unit is in Lockout Mode.

Commissioning

The actuator commissioning process is application-specific and will depend on the selected electrical and mechanical interfaces. For a SMARTLINK® DS that is provided as a standalone actuator (without a valve), Figure 2 shows the physical relationship between the full 100-degree positioning span, the actuator mounting plate, and the minimum and maximum positions for Counter Clockwise (CCW-to-close) and Clockwise (CW-to-close) rotation (when viewing from the shaft end). When SMARTLINK® DS is supplied with an integrated MAXON valve, the full travel will be reduced due to the flow characteristics and the mechanical limits of the specific valve assembly.

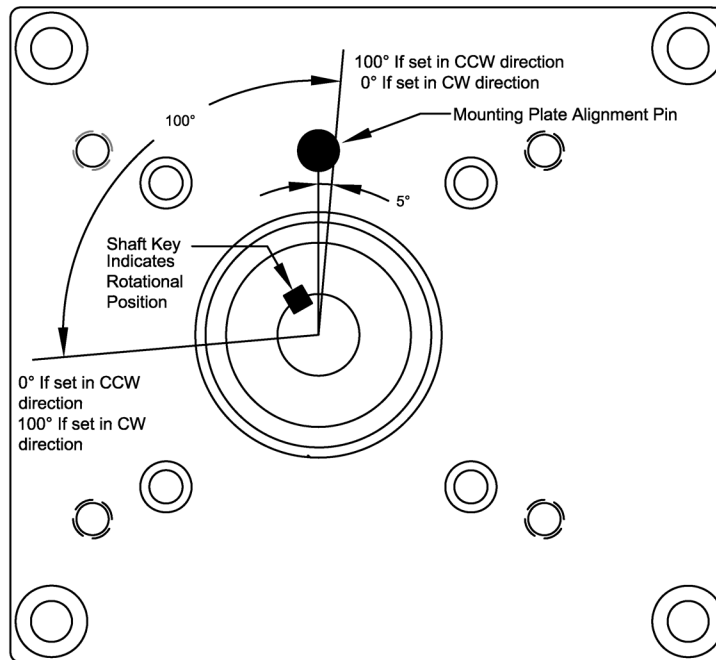


Figure 2: 100-degree span on SMARTLINK® DS actuator mounting plate

The person responsible for SMARTLINK® DS commissioning should consider each of the setup options listed below. **In order to make any configuration change or locally control position, the unit must be in an “unlocked” state and in Manual Mode.** The lock function is disabled when shipped from the factory and therefore, unlocking the unit will NOT be necessary the first time the unit is set-up. SMARTLINK® DS powers up in Control Mode. If the unit is “locked” after power up, all user commands will be disabled. Refer to the Lock Configuration section below to “unlock” the unit. Setting the mode to Manual can be accomplished on the user display with Menu 2B or 3B, Change Mode. All commissioning functions can be accomplished via RS-485 Modbus, with the PC Configuration software. This software can be downloaded from the SMARTLINK® DS product page of the MAXON web site at www.maxoncorp.com.

Manual (local) position control

In many applications, SMARTLINK® DS is provided with a MAXON integrated valve assembly with factory preset minimum and maximum positions. In these applications, it is important to move the valve through its full span to ensure gaskets or other debris do not interfere with valve movement. After the unit is powered, unlocked, and the mode is changed to Manual as described above, Menu 2C can be used to move the valve to its minimum and maximum positions.

Rotation

SMARTLINK® DS can be configured by the user to move in a Counter Clockwise (CCW-to-close) or Clockwise (CW-to-close) rotation. The CCW-to-close and CW-to-close rotation conventions (Figure 1) are defined by the user's view of the shaft end and mounting plate as follows:

- Counter Clockwise (CCW-to-close) Rotation - When viewing the shaft end, the shaft keyway moves counter clockwise towards the defined minimum or “closed” position relative to the mounting plate alignment pin.
- Clockwise (CW-to-close) Rotation - When viewing the shaft end, the shaft keyway moves clockwise towards the defined minimum or “closed” position relative to the mounting plate alignment pin.

Changing the rotation will not physically affect the user commissioned or factory preset position “quadrant”. In other words, the actuator shaft will move through the same full travel span but several previously commissioned parameters will change as follows:

- The new user Minimum Position is set to 100 degrees minus the current user Minimum Position.
- The new user Maximum Position is set to 100 degrees minus the current user Maximum Position.
- The High Position Proven (HPP) and Low Position Proven (LPP) relay functions are disabled and must be re-commissioned, if required by the application.
- The Loss-of-Signal and F-Terminal command functions are disabled and must be re-commissioned if required by the application.

Minimum and maximum positions

The full travel of the actuator can be modified by changing the minimum (0%) and maximum (100%) positions. If SMARTLINK® DS is provided as a standalone actuator, or with a shaft coupling for connection to a customer-provided damper or valve, setting the minimum and maximum positions can be accomplished using Menus 2F and 2G.

SMARTLINK® DS, when provided with a MAXON integrated valve assembly, has a preset minimum (0%) and maximum (100%) position that roughly delivers the full flow capacity of the valve. These factory set positions are displayed in Menus 4G and 4H. **Although the full span of the valve assembly can be customized using Menus 2F and 2G, the minimum and maximum user selected positions CANNOT exceed the position boundaries established at manufacturing.** In other words, the user may reduce the full travel of the integrated MAXON valve assembly, but may NOT decrease the minimum and increase the maximum user positions beyond the manufacturing preset positions.

High and low position proven relays

SMARTLINK® DS provides two relays to prove a high and a low position state with normally open contacts. The operation of both relays is disabled when shipped from the factory. If proving a position is required for the application, the “trip” point (i.e. the position at which the relay contacts close), must be programmed by the commissioning engineer. A trip position for the Low Position Proven (LPP) relay can be set by Menu 2D, and a trip position for the High Position Proven (HPP) relay can be set by Menu 2E. Both display menu items provide the capability to move the shaft to the required position and then save the commissioned trip point. Menus 3D and 3E are provided to disable each relay individually. In the disabled state, the position indicated for LPP is -4.0 degrees and the disabled position for HPP is 104.0 degrees.

After commissioning the LPP relay, the contacts will operate as follows:

- When approaching from a position above the trip point, the initially open LPP contacts will close when the actual position of the shaft becomes less than the programmed trip position plus 0.6 degrees. For example, if the LPP trip position was set for 10.0 degrees and the shaft is starting at 15 degrees, the contacts will close when the actual position becomes less than 10.6 degrees (or $10.0 + 0.6$ degrees).
- When approaching from below the trip point, the initially closed LPP contacts will open when the shaft position becomes greater than the trip position plus 1.1 degrees. For example, if the LPP trip position was set for 10.0 degrees and the shaft is starting at 0 degrees, the contacts will open when the actual position becomes greater than 11.1 degrees (or $10.0 + 1.1$ degrees).

After commissioning the HPP relay, the contacts will operate as follows:

- When approaching from a position below the trip point, the initially open HPP contacts will close when the actual position becomes greater than the programmed trip position minus 0.6 degrees. For example, if the HPP trip position was set to 80.0 degrees and the shaft is starting at 75 degrees, the contacts will close when the actual position becomes greater than 79.4 degrees (80.0 – 0.6 degrees).
- When approaching from a position above the trip point, the initially closed HPP contacts will open when the shaft position becomes less than the trip position minus 1.1 degrees. For example, if the HPP trip position was set for 80.0 degrees and the shaft is starting at 85 degrees, the contacts will open when the actual position becomes less than 78.9 degrees (or 80.0 – 1.1 degrees).

The HPP and LPP relay contact hysteresis of 0.5 degrees (or 1.1 – 0.6 degrees) minimizes contact “chatter” when the actuator is modulating near the position trip level. The 0.6 degree position tolerance permits the user to increase the mA control deadband to its maximum value of 0.5 degrees, without affecting the operation of either relay.

When SMARTLINK® DS is in Lockout Mode, a Safety System alarm exists, or the unit is powered down, both the LPP and HPP contacts will be open. **For safety applications, such as a combustion system requiring a high position purge and a low fire start contact, SMARTLINK® DS has been designed with a highly integrated safety system that permits connecting LPP and HPP directly to the flame safeguard.** This safety feature eliminates crudely commissioned actuator cam switches or limit switches mounted on external linkage that can malfunction in severe industrial outdoor or high vibration environments.

The commissioned LPP and HPP trip positions are independent of the user-configured minimum and maximum positions that establish the full span of SMARTLINK® DS. For example, if the user-configured minimum (0%) position is set to 20 degrees, the LPP trip

position can be commissioned to any position greater than or equal to 20 degrees. However, the selected trip position will be limited to the preset factory position span shown in Menus 4G and 4H.

F-Terminal position

The F-Terminal function is provided to drive the actuator to a user commissioned position. This feature is often used in a single-point combustion control application for the purge position. In this type of application, a UDC (Universal Digital Controller) controls the 4-20 mA command signal, and a flame safeguard provides the F-Terminal dry contact. When the F-Terminal is connected to the 4-20 mA minus (-) terminal through a dry contact, the 4-20 mA signal is ignored and the actuator will move to the commissioned F-Terminal position.

Similar to LPP and HPP, the F-Terminal function is disabled when shipped from the factory or when rotation is changed. Menu 3G is used to disable the function after F-Terminal is commissioned. A position of -4.0 degrees indicates the function is disabled. The user selected position is limited to the preset factory span shown by Menus 4G and 4H.

Loss-of-signal position

The Loss-of-Signal (LOS) function drives the actuator to a user commissioned position when the 4-20 mA command signal is disconnected or driven to 0 mA. This feature is often used in a single-point combustion control application. In this type of application, a UDC controls the 4-20 mA command signal, and a flame safeguard provides the dry contact that breaks the mA current loop and drives the actuator to a light-off position. **If enabled, the F-Terminal function takes priority over an LOS command.**

Similar to F-Terminal, the LOS function is disabled when shipped from the factory or when rotation is changed. Menu 3F is used to disable the function. A position of -4.0 degrees indicates the LOS function is disabled. The user selected position is limited to the preset factory span shown by Menus 4G and 4H.

4-20 mA output mode

The 4-20 mA output signal provides position feedback information every 50 milliseconds. The user can select one of two possible modes of position output: (a) Percent of Span and (b) Degrees. The default mode is Percent of Span and Menu 31 can be used to select either output mode.

POSITION OUTPUT IN PERCENT OF SPAN

When this output mode is selected, 4 mA = 0% and 20 mA = 100%, where percent of span is defined as follows:

$$\text{Position in percent of span} = \frac{\text{Position (Degrees)} - \text{User Minimum Position (Degs)}}{\text{User Maximum (Degs)} - \text{User Minimum (Degs)}} \times 100\%$$

The percent span current output can be calculated as follows:

$$\text{Percent Position Span Current Output (mA)} = (\text{Position \% of Span} \times 16.00 \text{ mA}) + 4.00 \text{ mA}$$

For example, if the user configured minimum and maximum positions are 20.0 and 80.0 degrees, respectively, and the position of the shaft is at 50.0 degrees, the percent of span and mA output are calculated as follows:

$$\text{Position in Percent of Span} = [(50.0 - 20.0 \text{ degs}) / (80.0 - 20.0 \text{ degs})] \times 100\% = 50\%$$

$$\text{Percent Position Span Current Output} = (50\% \times 16.00 \text{ mA}) + 4.00 \text{ mA} = 12.00 \text{ mA}$$

The output range for this mode of operation is: -4.0% (or 3.36 mA) and 104% (or 20.64 mA).

If the position is less than -4.0% or greater than 104% of span, the current output will be set to 2 mA, indicating an out-of-span position.

POSITION OUTPUT IN DEGREES

When this output mode is selected, 4 mA = 0 degrees and 20 mA = 100 degrees. The degree position current output is calculated as follows:

$$\text{Degree Position Current Output} = \frac{\text{Position (Degrees)} - 100.00 \text{ (Degrees)}}{100.00 \text{ (Degrees)}} \times 16.00 \text{ mA} + 4.00 \text{ mA}$$

The range for this mode of operation is: -4.0 degrees (or 3.36 mA) and 104 degrees (or 20.64 mA). If the position is less than -4.0 degrees or greater than 104.0 degrees, the current output will be set to 2 mA, indicating an invalid position.

Alarm relay mode

The Alarm relay can be configured in one of two possible modes: Lockout + Alarm Mode or Lockout Only Mode.

Menu 3J can be used to select either mode. SMARTLINK® DS is shipped from the factory in the default, Lockout + Alarm Mode. In this mode, the relay annunciates both Alarm and Lockout conditions. While an Alarm condition exists, the relay contacts open for 2 seconds and close for 2 seconds, repeatedly. While a Lockout condition exists, the normally open contacts will remain open and the normally closed contacts will remain closed.

The Alarm relay can also be configured in a Lockout Only Mode. In this mode, the relay annunciates only Lockout conditions. The normally open contacts can be used in safety application. For example, in the Lockout Only Mode, the 4-20 mA position output signal can be wired through the normally open contacts of the Alarm. This permits an upstream PLC or DCS to monitor the analog feedback in a fail-safe manner.

RS-485 mode

The serial, RS-485 interface can be configured in one of five possible communication modes:

- Modbus, 19200 Baud, 8 data bits, 1 start bit, 1 stop bit, even parity (Default)
- Modbus, 19200 Baud, 8 data bits, 1 start bit, 1 stop bit, odd parity
- Modbus, 9600 Baud, 8 data bits, 1 start bit, 1 stop bit, even parity
- Modbus, 9600 Baud, 8 data bits, 1 start bit, 1 stop bit, odd parity
- Serial ASCII Manufacturing, 19200 Baud, 8 data bits, 1 start bit, 2 stop bits, no parity (Factory Use ONLY)

To avoid field troubleshooting, it is highly recommended that the default Modbus (19.2Kb, even parity) mode is left unchanged unless the upstream controller cannot be configured for this factory setting.

The RS-485 Mode can be selected using Menu 3M. The custom serial ASCII mode should not be selected and is intended for factory or field service use only.

Detailed information on Modbus is provided in the SMARTLINK® DS Modbus User Guide that can be downloaded from the SMARTLINK® DS product page on the MAXON web site at www.maxoncorp.com.

Modbus address

SMARTLINK® DS is shipped from the factory with a default Modbus address of 11. The address can be changed by the user to any valid Modbus address, 1 to 247. Menu 3N can be used to modify the Modbus address.

Actuator ID

The actuator ID provides the user with a simple 3 digit numeric number to differentiate multiple SMARTLINK® DS actuators. The default ID is 1 and the user selectable range is 1 to 255. Menu 3O can be used to change the actuator ID.

Command input (source)

The analog, 4-20 mA input signal or the serial Modbus interface can be selected as the actuator's position command source. Menu 3L can be used to select either source.

- 4-20 mA Command Source: The factory default configuration is the 4-20 mA input source. For this setting, when the actuator is in Control Mode ONLY, the actuator will move to a setpoint determined by the following:
 - If both the F-Terminal or Loss-of-Signal functions are disabled or NOT active (if commissioned), the position command will be established by the 4-20 mA input current as follows:

$$\text{Position Command (\% of Position Span)} = \frac{(\text{mA Input Current} = 4.00 \text{ mA})}{16.00 \text{ mA}} \times 100\%$$

Position Command (Degs) = [Position Command,% Span X (User Max Position Degs – User Min Position Degs)] + User Min Degs.

- If the F-Terminal function is enabled and active, this function will take precedence over the 4-20 mA current signal and the actuator will move to commissioned position.
 - If the Loss-of-Signal (LOS) function is enabled and 4-20 mA input current is 0, SMARTLINK® DS will move to the commissioned LOS position. If the F-Terminal function is enabled and active, it will take precedence over both the 4-20 mA current signal and the LOS function.
- Serial Modbus Command Source: This setting disables the 4-20 mA input function, the F-Terminal, and Loss-of-Signal functions. Position commands are only accepted via specific Modbus registers. Detailed information on Modbus is provided in the SMARTLINK® DS Modbus User Guide that can be downloaded from the SMARTLINK® DS product page on the MAXON web site at www.maxoncorp.com.

Lock configuration

An electronic “lock” function inhibits all user commands for commissioning, manual control, and diagnostics. It reduces the likelihood of actuator field tampering while the unit is under closed-loop process control. The

SMARTLINK® DS “lock” is disabled when shipped from the factory. **The lock function is disabled when the user passcode is set to 0.** For all other 4-digit passcodes (1-9999), the unit will be locked when powered up, or if the user manually locks the unit using the display or the PC Configuration software.

To enable the lock function, use Menu 3C, Set Passcode. The commissioning engineer should select, enter, and record a 4-digit passcode, other than 0. After entering the new passcode, the unit will remain unlocked for 20 minutes after the last keypad entry.

To “lock” the unit, repower the actuator or use Menu 2A or 3A.

To disable the lock function, the unit must first be “unlocked” and then use Menu 3C to set the passcode to 0.

4–20 mA deadband

The 4–20 mA deadband can be configured to reduce position control loop hunting due to high electromagnetic noise environments. The default factory setting for the 4–20 mA deadband is 0.2 degrees and can be changed in 0.1 degree increments using Menu 3H. The mA deadband prevents a change in the position command until one of the following two conditions are met:

- 1) The input command signal is greater than or equal to the existing position command *PLUS* the deadband, OR
- 2) The input command signal is less than or equal to the existing position command *MINUS* the deadband.

EXAMPLE:

If the existing position command is 50.0 degrees, the mA deadband works as follows for the default 0.2 degree setting with a full position span of 100 degrees:

Current position command: 50.0 degrees = 12.000 mA

To change position, the new command must be

Less than or equal to: 49.8 degrees = 11.988 mA OR

Greater than or equal to: 50.2 degrees = 12.013 mA

As shown in the above example, a small 0.0125 mA change will move the actuator by 0.2 degrees. For this reason, it is highly recommended to review the electrical installation instructions for proper 4–20 mA input cabling before modifying this configuration parameter from its default 0.2 degree setting.

On-line diagnostics

Alarm and lockout event reporting

SMARTLINK® DS provides built-in, on-line diagnostics to continuously assess the health and performance of the actuator. Alarm and lockout detection algorithms are performed every 50 milliseconds. Any alarm or lockout event that occurs can be externally detected by monitoring an alarm relay contact or viewing the local display at about a 1 second sampling interval. All diagnostic health monitoring information described below is available through Modbus registers. These registers can be polled while the actuator performs all position control and local user interface functions. This information is also viewable on the local display or by using the PC-based configuration software.

Several diagnostic features are provided by the SMARTLINK® DS safety system. These include redundant position potentiometers, redundant relay drive circuitry, and dual microprocessors. One of the microprocessors handles all safety functions and the other performs position control, 4–20 mA input/output, serial communication, and user display functions. The safety hardware ensures that the drive signals to the High Position (Proven), Low Position (Proven), and Alarm relays are fail-safe, and will NOT indicate a false position limit or non-alarm operating condition. The two tables below summarize all SMARTLINK® DS alarms and lockout conditions as well as their associated display message and relay output states.

Table 2. SMARTLINK® DS Alarm Events

Alarm Name (Display Message)	Alarm Description	Alarm [2] [3] N.O. Contacts (Alarm LED)	High Position Contacts	Low Position Contacts
Position Feedback “ALARM: Position”	Redundant potentiometer feedback indicates out-of-quadrant position	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Position Control “ALARM: Pos Ctrl”	Commanded position cannot be achieved within +/- 0.1 degrees	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Motor Synchronization “ALARM: Motor Sync”	Loss of brushless DC motor synchronization detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Nonvolatile Memory “ALARM: Memory”	Nonvolatile RAM memory error is detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Control Hardware “ALARM: Ctrl H/W”	Microprocessor or analog-to-digital control hardware failure is detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
DC Voltage [1] “ALARM: 24Vdc”	Less than 18VDC input DC voltage is detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Microprocessor Reset “ALARM: Reset”	Watchdog or software reset is detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Software Execution “ALARM: Software”	Improper software execution is detected	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Internal Temperature “ALARM: Temp”	Internal housing temperature exceeds -40C to 85C range	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Safety System #1 “ALARM: Safety #1”	Safety system detects failure or an input voltage of less than 16Vdc	0.25Hz Open/Close (0.25Hz On-Off)	N/A	N/A
Safety System #2 “ALARM: Safety #2”	Safety system detected a failure in 3 or more consecutive samples	Open	Open	Open
Safety System #3 “ALARM: Safety #3”	Control microprocessor detects loss of safety system communication	Open	Open	Open

[1] Below 16 Vdc, all three output relays are de-energized, similar to Safety System #2 and #3 alarms

[2] Alarm relay contacts open for 2 seconds and close for 2 seconds, continuously; Display alarm LED turns on/off at same rate

[3] 2 second open/close alarm relay function is disabled if configured Alarm Mode is set to “Lockout Only”

Table 3. SMARTLINK® DS Lockout Events

Lockout Name (Display Message)	Lockout Description [1] [2]	Alarm [3] N.O. Contacts (Alarm LED)	High Position Contacts	Low Position Contacts
Position Feedback “LKOUT: Position”	Redundant potentiometer feedback is invalid due to failure or out-of-quadrant position	Open	Open	Open
Position Control “LKOUT: Pos Ctrl”	Commanded position cannot be achieved to within required +/-0.1 degrees after 3 consecutive (different) position commands	Open	Open	Open
Motor Synchronization “LKOUT: Motor Sync”	Loss of brushless DC motor synchronization is detected in 3 consecutive samples	Open	Open	Open
Nonvolatile Memory “LKOUT: Memory”	Nonvolatile memory error is detected in configuration data	Open	Open	Open
Control Hardware “LKOUT: Ctrl H/W”	Permanent microprocessor or analog-to-digital control hardware failure is detected	Open	Open	Open
Safety System “LKOUT: Safety”	Permanent safety system failure is detected	Open	Open	Open
User Lockout Test “LKOUT: User Test”	Lockout test initiated by the user	Open	Open	Open

[1] All lockout conditions force the unit into a Lockout Mode that inhibits closed-loop and manual position control

[2] Shaft position can only be changed in Lockout Mode with a special open-loop, Lockout Move user command

[3] For safety applications, the normally open contacts of the 3 relays should be connected to loads of less than 1.5A

Alarm and lockout event logs and counters

Non-volatile event logs and counters are provided for both alarms and lockouts. These built-in diagnostic features direct the user to the specific problem that affects (or will affect in the long term) proper operation of the actuator. The last 6 alarm events (Menu 4C), the last 6 lockout events (Menu 4B), and a total count of all event types (Menus 4D and 4E) are recorded for use during operation and after unit power cycling. Without continuous PLC monitoring, this capability permits periodic viewing of alarm and lockout events using the display or the PC-based software. With the unit “unlocked”, the user can reset the alarm and lockout logs along with the event counters (Menu 2K).

Actuator life and position diagnostics

Condition-based monitoring of actuator performance is possible with non-volatile, actuator diagnostic data that is stored over the entire life of the actuator. This data is available during operation and after the unit is power cycled. Actuator life and diagnostic data include:

- Total actuator run time (Menu 4A)
- Number of shaft repositions (Menu 4I)
- Total degrees of shaft movement (Menu 4J)
- Position move histogram

This data can be used to assess process control-loop performance and actuator life expectancy. Specifically, upstream temperature control loop performance can minimize temperature control hunting, i.e. the number of actuator repositions within a period of time. With the high resolution (0.1-degree) control of SMARTLINK® DS, energy savings and process benefits can be achieved by using these built-in position diagnostics combined with process control PID adjustments.

Modbus communication diagnostics

During installation or normal actuator operation, Modbus diagnostic counters and an LED inside the housing can be used to troubleshoot and verify communications. The diagnostic counters include:

- Slave message counter: Number of valid messages addressed to the unit
- Bus error counter: Total number of corrupt messages seen on the network “bus”
- Slave message counter: Number of valid messages including those addressed to the unit
- Bus overrun counter: Number of messages with a receiver character overrun error
- Slave exception counter: Number of messages received by the slave with a Modbus exception response
- Slave no response counter: Number of messages received by the slave with no Modbus response

All of the counters described above can be reset to zero by repowering the unit. The communication LED is located on the back of the PCB assembly, behind the 3-pin, Modbus plug-in connector. This LED conveys activity on the Modbus network. A user-provided PLC or the PC-based configuration software can be used to transmit a message to the unit for communication verification in the field. The following LED flashing patterns, with 100 millisecond on-off interval(s), can be used to diagnose communication problems after sending a single command on the Modbus network:

- 1 LED flash: Valid bus message but not addressed to the slave unit
- 2 LED flashes: Valid slave message with a Modbus normal response sent to master
- 4 LED flashes: Valid slave message with a Modbus exception response sent to master
- 10 LED flashes: Overrun, parity, or baud rate error

Modbus safety packets

The safety architecture of SMARTLINK® DS provides “packets” of position feedback data for upstream PLC control in applications that determine position status in a fail-safe manner with ONLY a Modbus interface.

Reference the SMARTLINK® DS Modbus Users Manual for more detailed information on the content of the packets and their proper use in safety critical applications.

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