



PRESSURE SWITCH & TRANSDUCER



주식회사 플루마

Fluma Co., Ltd.

HYDRAULIC, PNEUMATIC AND ELECTRIC TECHNOLOGY

Compact Pressure Switch

Series 7000

Features

- ▶ Compact size
- ▶ Multiple electrical connections
- ▶ SPDT snap action micro-switch
- ▶ NEMA 1 or 4 (depending on electrical connection)
- ▶ Factory preset or field adjustable
- ▶ Available in stainless steel

Applications

- ▶ Air proving in HVAC systems
- ▶ Engine monitoring
- ▶ Hydraulic power units
- ▶ Mobile hydraulics
- ▶ Pump or compressor control
- ▶ Hydraulic and pneumatic braking systems



General Specifications*

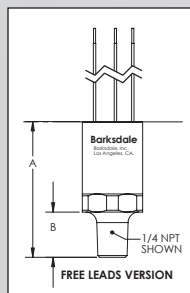
Electrical Characteristics:	All models incorporate Underwriters' Laboratories, Inc. and CSA Listed single pole double throw snap-action switching elements.
Accuracy:	±8% typical
Switch:	SPDT snap action; single circuit
Wetted Parts:	
Diaphragm type: (ranges 2, 3)	300 series stainless steel fitting and Buna-N diaphragm.
Piston type: (ranges 4, 5, 6, 7)	300 series stainless steel fitting.
Electrical Connection:	See product configurator for electrical connection options.
Enclosure Ratings:	NEMA 1; NEMA 4
Pressure Connection:	1/4" NPT (standard)

* See product configurator for additional options.

Approvals:	
UL:	Recognized components per UL 508 standard, industrial control equipment.
CSA:	Listed per CSA Guide 380-W1.16 class 3231
PED (European):	Compliant to PED 97/23/EC standard
Temperature Range:	
Operating:	-40° to +180°F - piston type 0° to 180°F - diaphragm type
Storage:	-40° to +200°F
EMI/RFI:	
Vibration:	10 g's per MIL-STD 202, method 204, condition A
Shock:	50 g's per MIL-STD 202, method 213, condition A
Adjustment Instructions:	
Pressure Setpoint:	Turn adjustment screw clockwise to increase pressure; counterclockwise to decrease pressure.
Shipping Weight:	Stainless steel: approximate .25 lbs.

SS Fitting Dimension

FITTING	DIMENSION 'A'	DIMENSION 'B'
1/4 NPT	2.25 [57.15]	.75 [19.05]
1/8 NPT	2.62 [66.55]	1.10 [27.94]
* 7/16 NPT	2.25 [57.15]	.75 [19.05]
* G 1/4	2.25 [57.15]	.75 [19.05]



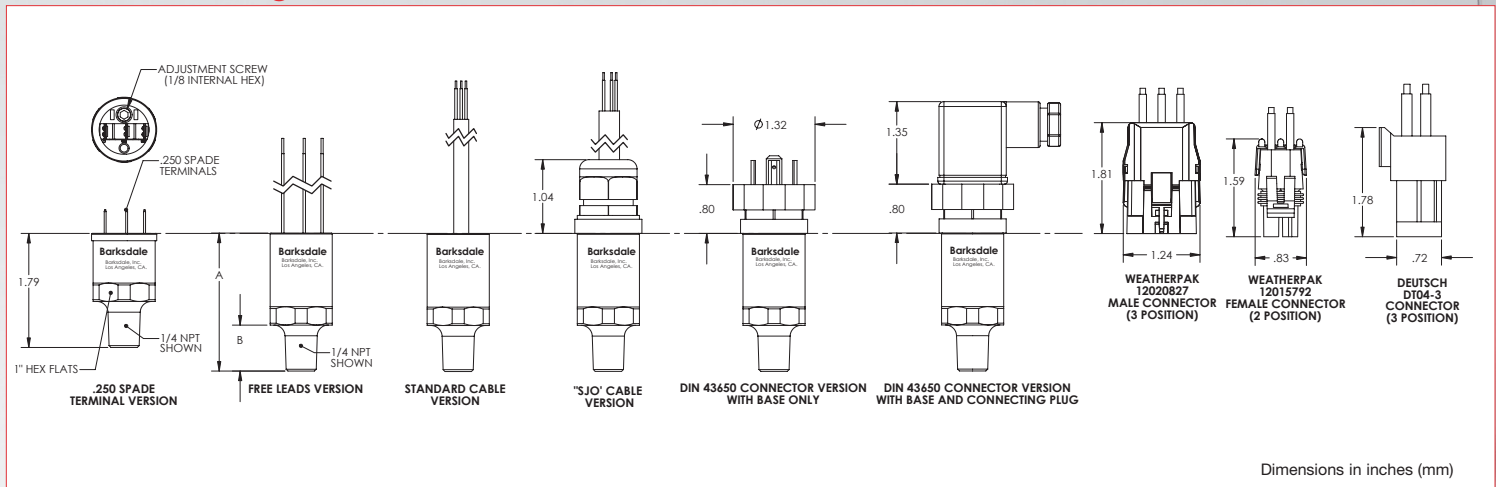
Wiring Code

CONTACT	FREE LEADS	PVC GRAY CABLE	TYPE 'SJO' CABLE	DIN 43650 TYPE CONNECTOR
COMMON	PURPLE	WHITE	WHITE	POSITION 1
NORMALLY OPEN	RED	RED	GREEN	POSITION 3
NORMALLY CLOSED	BLUE	BLACK	BLACK	POSITION 2

Compact Pressure Switch

Series 7000

Technical Drawing



Product Configurator

Example **72 4 S -2 4 -1 B**

Basic Configuration

71	Factory set & permanently locked
72	Field adjustable
73	Field adjustable with factory pre-set

* Highlighted options represent those most frequently used. Select these common options for improved availability. (5/21)

Pressure Range

Range	Adjustable Range				Approx. Deadband (Actuation Value) psi	*Operating Pressure (Max) psi	Max. Proof Pressure psi
	Decreasing - psi		Increasing - psi				
	Min	Max	Min	Max			
2	6	35	8	50	2 - 15	80	100
3	30	90	40	120	5 - 30	130	140
4	150	700	250	1000	30 - 300	4000	6000
5	500	2300	600	3000	100 - 800	4000	6000

* Operating pressure is defined as the maximum pressure at which the pressure switch can maintain set point accuracy.

Fitting Material

S	300 series stainless steel
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Limit Switch

-1	SPDT, snap-action switch, 5 Amps @ 125/250 VAC (silver contacts)
-2	SPDT, snap-action switch, 0.1 Amps @ 125/250 VAC (gold contacts)
-4	SPST, N.O., snap-action switch, 5 Amps @ 125/250 VAC (silver contacts)
-5	SPST, N.C., snap-action switch, 5 Amps @ 125/250 VAC (silver contacts)
-6	SPST, N.O., snap-action switch, 0.1 Amps @ 125/250 VAC (gold contacts)
-7	SPST, N.C., snap-action switch, 0.1 Amps @ 125/250 VAC (gold contacts)

Options

-Wxxx	Extra wire length (XXX = inches)
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Set Point

-XXX	Set point (not required for field adjustable)
R	Rising pressure
F	Falling pressure

Wetted Material

B	Buna-N
N	Neoprene (all except -4 and -5 pressure range codes)
V	Viton® Diaphragm
D	Disogrin O-ring (available in piston models only)

Process Connection ³

-1	1/8" NPTM
-2	1/4" NPTM
-3	7/16-20 with O-ring seal
-4	G1/4

Electrical Connection

1	.250 x .032 male spade quick disconnects (NEMA 1), not available with brass
2	.110 x .020 male spade quick disconnects (NEMA 1), not available with brass, only SPDT
3	Free leads. 18 gauge, 18" long (NEMA 1)
4	Unshielded PVC jacketed cable, 18 AWG, 18" long (NEMA 4)
5 ²	DIN 43650-type connector - base only (available only with stainless steel & factory set models - NEMA 4)
6 ²	DIN 43650-type connector - with base & plug (available with factory set models - NEMA 4)
7 ²	SJO type cable, 3 wire, 18 AWG, 18" long (available only with factory set models - NEMA 4)
8 ^{1,3}	Weatherpak connector, female, 2-position, two 18" free wires, for normally closed circuits
9 ^{1,3}	Weatherpak connector, female, 2-position, two 18" free wires, for normally open circuits
10 ^{1,3}	Weatherpak, connector, male, 3-position, three 18" free wires, used only with SPDT limit switches
11 ^{1,3}	Deutsch connector, female, 3-position, three 18" free wires, used only with SPDT limit switches

NOTES:

- Not UL/CSA certified
- Available only with factory set & locked models
- Minimum quantities may be required.

Compact Pressure Switch

Series 9000

Features

- ▶ Compact design as compared to Series 8000
- ▶ Long pressure spring (enhanced adjustment)
- ▶ Captive set screw
- ▶ Standard DIN 43650 electrical connector
- ▶ NEMA 4 / IP65

Applications

- ▶ OEM applications
- ▶ Hydraulic power units
- ▶ Test equipment
- ▶ Heavy industry
- ▶ Mobile and stationary hydraulics
- ▶ Press Equipment



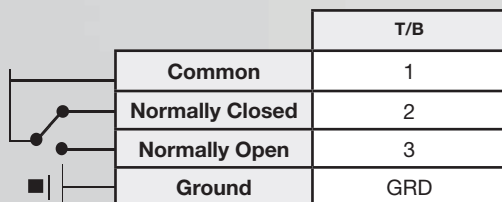
General Specifications*

Repeatability:	±2% (typical)
Microswitch: Type: Rating:	SPDT contact Silver contacts: 10A @ 250 VAC 6A @ 24 VDC
Switching Frequency:	Max. 60/min.
Wetted Parts: Dynamic Seal:	Buna-N (NBR) Viton® (FKM) EPDM (EPR)
Fitting: Piston:	Stainless Steel / Aluminum Steel
Electrical Connection:	DIN 43650 (EN 175301-8013-A plug)
Adjustment Ranges:	90 to 5800 psi (6 to 400 bar)
Ambient Temperature Range: Storage: Ambient/Media:	-40 °F to +176 °F (-40 °C to +80 °C) -4 °F to +176 °F (-20 °C to +80 °C)

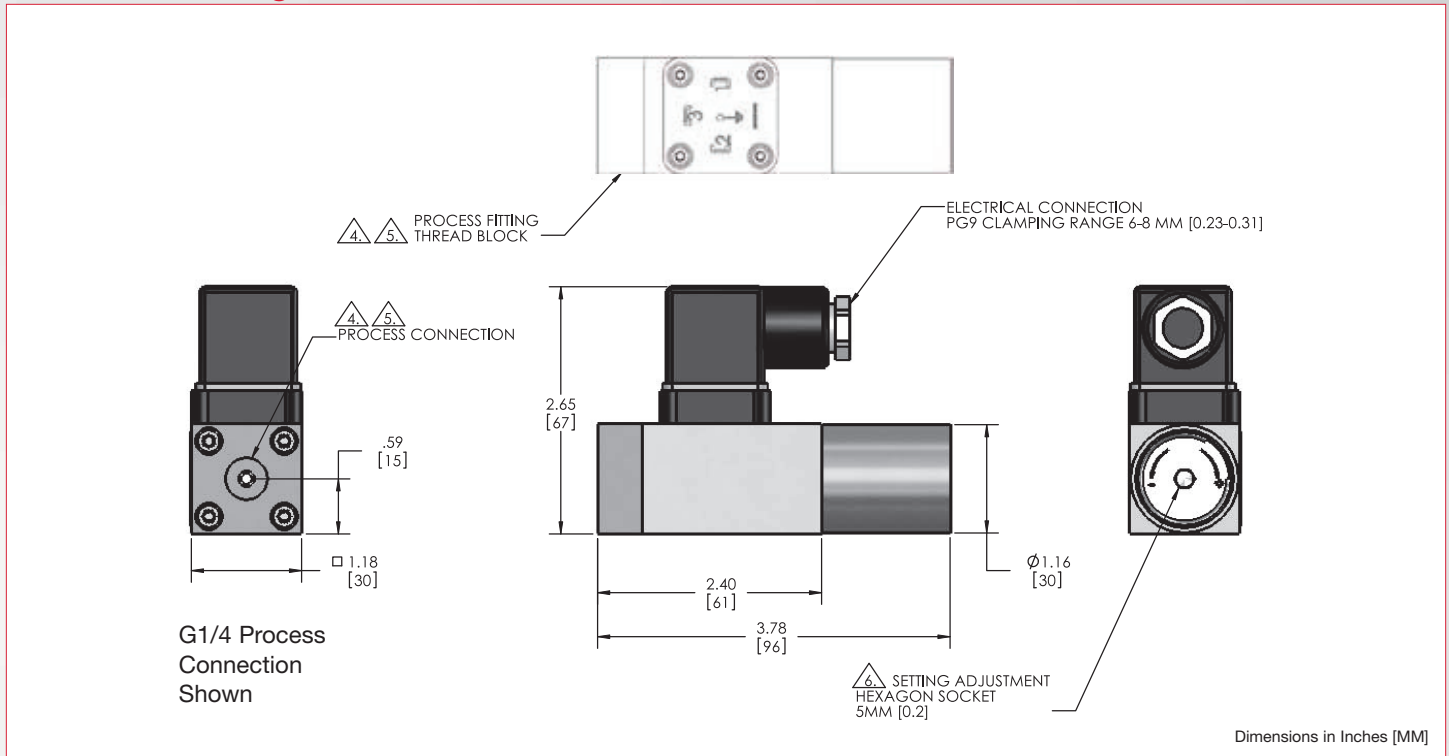
Enclosure Rating:	IP65 / NEMA 4
Material: Housing: Electrical plug: Adjustment screw:	Standard: Aluminum Optional: Stainless steel (1.4305) / AISI 303, Version - VA Polyamide Standard: Aluminum Optional: Stainless steel, 1.4305 / AISI 303 (SW5), captive
Process Connection (female):	1/4" NPT; G1/4 7/16 - 20 UNF SAE 4
Adjustment Instructions: Setpoint Adjustment:	Turn adjustment screw clockwise to increase pressure; counterclockwise to decrease pressure.
Weight:	0.39 lbs (175 g)

* See Product Configurator for additional options.

Wiring and Connection Diagram



Technical Drawing



Product Configurator

Example 9 A A 1 T V

Series

* Highlighted options represent those most frequently used. Select these common options for improved availability. (5/21)

9 Series 9000

Process Connection

2	G1/4" female
3	G1/4" IG DIN ISO 228-1 with 2 mounting wholes (Ø 5,5mm / 20mm distance)
A	1/4" NPT female
E	7/16-20 UNF (SAE-4) female

Pressure Range

Range	Adjustable Range		Max. Hysteresis at full range max %	Max. Operating Pressure psi (bar)	Proof Pressure psi (bar)
	Decreasing Press. psi (bar)	Increasing Press. psi (bar)			
A	90 - 630 (6 - 44)	145 - 725 (10 - 50)	10%	3620 (250)	4350 (300)
B	220 - 2680 (15-185)	290 - 2900 (20 - 200)		3620 (250)	4350 (300)
C	510 - 5220 (35 - 360)	580 - 5800 (40 - 400)		7250 (500)	8700 (600)

SPDT Contact

1 Silver

Electrical Connection

T	DIN 43650, IP65 (formerly PL1)
B	DIN 43650 without mating plug, IP65

Accessories

/N	DIN 43650 type A connector with molded cable, 6.56 feet (2 meters)
/O	DIN 43650 type A connector with molded cable, 16.40 feet (5 meters)

Options

XXXXR*	Factory setpoint rising (standard)
XXXXF*	Factory setpoint falling

*Example: if setpoint is 2000 rising, order 2000R
If setpoint is 500 falling, order 0500F

Seals

B	BUNA-N (NBR)
V	Viton® (FKM)
E	EPDM (EPR)

Electr. Dual Pressure Switch

BPS3000

Features

- ▶ Measuring ranges: 0 ... -1 bar to 0 ... 600 bar gauge
- ▶ Max. 2 switch points
- ▶ Analog output 4 - 20 mA or 0 - 10 V
- ▶ Rotatable 320° display & electrical connection
- ▶ Menu navigation refers to VDMA standard
- ▶ IO-Link communication interface

Applications

- ▶ Pressure control for:
 - Hydraulics & Pneumatics
 - Lubrication system
 - Cooling



Technical Data

Sensor element:	Ceramic sensor optional: piezoresistive sensor
Materials:	
Wetted parts:	Stainless steel, mat. no. 1.4301, brass MS58*
Electronics housing:	Stainless steel, mat. no. V2A, PA / PC
Seals:	FKM, EPDM
Operating elements:	3 easy-response pushbuttons
System of protection:	IP65, IP67
Protection class:	III
Electrical connection:	Plug M12 x 1, 4-pin / 5-pin (depending on output code)
Process connection:	see order code
Dimensions:	110 x 41 mm (without plug connector)
Weight:	approx. 200 g
A/D converter:	
Resolution:	12 bit (4096 steps per measuring span)
Scanning rate:	1000 / s
Linearity error:	< ± 0.5 % v. f. s. at +25 °C
Temperature influence:	TC zero < ±0.2 % FSO / 10K TC span < ±0.3 % FSO / 10K
Compensation range:	-10 °C... +70 °C
Repeatability:	±0.1 % FSO
Temperature range:	
Medium:	-25 °C... +100 °C
Electronics:	-10 °C... +70 °C ¹⁾
Storage:	-30 °C... +80 °C
Power supply:	15... 32 V DC, reversed polarity protected (SELV, PELV)
Digital display:	4-digit 14-segment LED display, red, digit height 9 mm
Error display:	LED red and alphanumeric display
Power consumption:	approx. 50 mA (without load)
Analog output:	
Current output:	4...20 mA
Load:	max. RI = (Ub-12V) / 20 mA RI = 600 Ohm at Ub = 24 V DC
Scanning rate:	2 ms
Voltage output:	0...10 V DC
Rating:	max. 10 mA
Adjustment range:	25 %... 100 % f. s.

Transistor switching outputs / IO-Link:		
Switching function:	Normally open/normally closed, standard / window mode and diagnosis function adjustable	
Adjustment range for switching point and hysteresis:	0 %... 125 % f. s.	
Switching frequency:	max. 100 Hz	
Load:	max. 500 mA, short-circuit proof, IO-Link: max. 250 mA	
Delay:	0.0 s ... 50 s adjustable	
Status display(s):	LED(s) red	
Interfaces		
Communication interface:	IO-Link	
Transmission type:	COM2 (38,4 kBaud)	
IO-Link revision:	1.1	
SDCI standard:	IEC 61131-9	
Profiles:	Smart Sensor	
SIO mode:	yes	
Device type:	Class A	
Process data variable:	1	
Binary data channel:	2	
Min. process cycle time [ms]	2.5	
Device ID:	0x011...	
EMV /ESD	EN 61000-4-2 ESD	4 kV CD / 8 kV AD
	EN 61000-4-3 HF radiated	10 V/m
	EN 61000-4-4 Burst	2 kV
	EN 61000-4-5-Surge	1/2 kV
	EN 61000-4-6 HF conducted	10 V
Shock resistance	DIN EN 60028-2-27	50 g (11 ms)
Vibrations resistance	DIN EN 60028-2-26	20 g (10...2000 Hz)
Approvals:	BV-50018/A1 ^{2),3)} , cULus 1) - E42816	

* In the pressure inlet a damping screw made of brass is mounted. This screw can be removed if required, e.g. in case of soiled medium or material incompatibility, using a slotted screw driver (max. width 3 mm). The pressure switch is less resistant to pressure peaks when the damping screw has been removed.

¹⁾ Conditions of use with cULus: 60 °C max. ambient, power supply max. 28 V DC

²⁾ BV approval only with output code 1-5

³⁾ Direct electromagnetic fields can interfere the LED display, at some frequencies. This does not lead to an impairment of the performance.

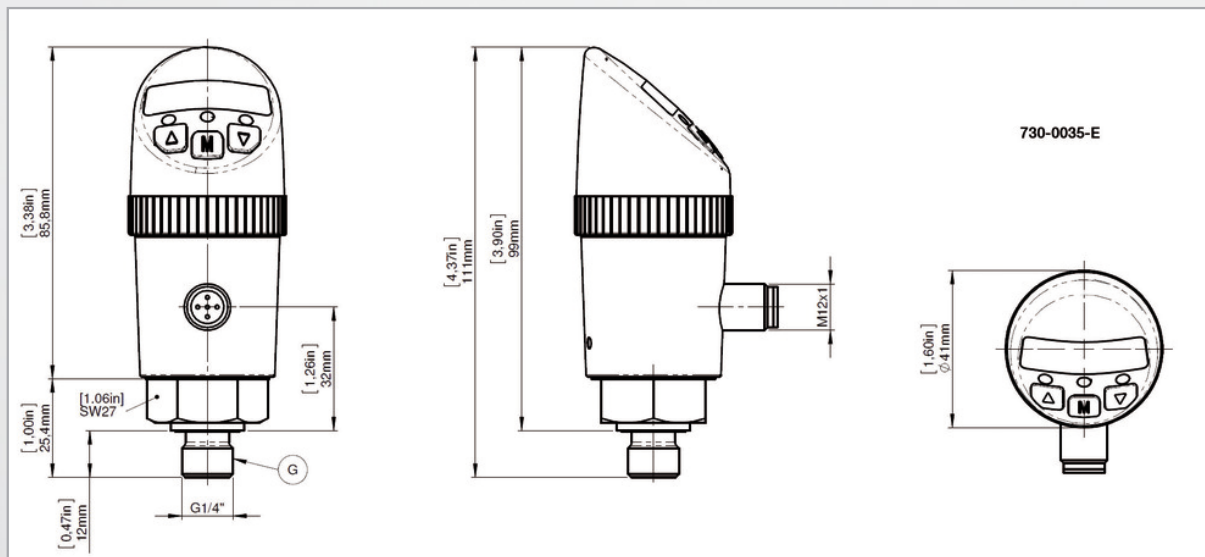
Electr. Dual Pressure Switch

BPS3000

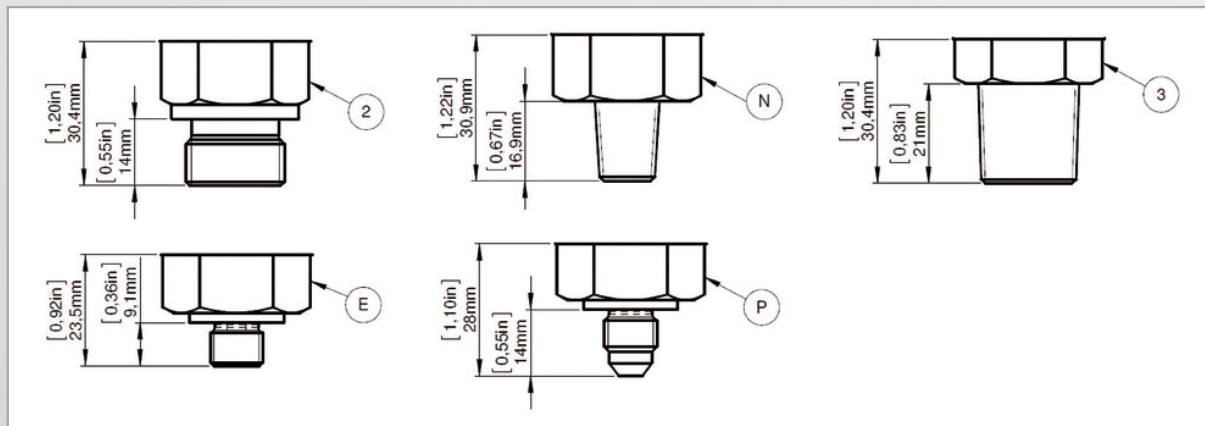
Accessories

Order Number	Description
907-0357	Plug connector M12 x 1, 4-pin, with screw terminals, angled (IP65)
907-0185	Plug connector M12 x 1, 5-pin, with screw terminals, angled (IP65)
908-0361	Plug connector M12 x 1, 5-pin, with sharped cable (IP67)

Dimensions (mm / inch)



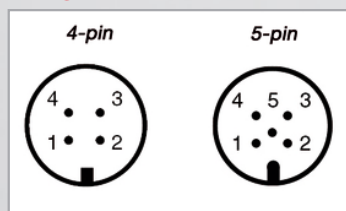
Process connection



Legend

G	G1/4" Ceramic
N	1/4" NPT Ceramic
2	G1/2" flush diaphragm
3	1/2" NPT flush diaphragm
E	7/16-20 UNF (SAE)
P	7/16-20 UNF (JIC)

Plug



Electrical Connection

Pin	Signal Output Code 1,7	Signal Output Code 2, 3	Signal Output Code 4, 5, 8
1	+Ub	+Ub	+Ub
2	SP2	Signal	Signal
3	0V	0V	0V
4	SP1 / IO-Link*	SP1	SP1 / IO-Link*
5	-	-	SP2

* only code 7 and 8

Order Code

BPS3000	
BPS3	Base Model
Output	
1	2 switch points
2	4...20 mA - 1 switch point
3	0...10 V - 1 switch point
4	4...20 mA - 2 switch points
5	0...10 V - 2 switch points
7	IO-Link / 2 switch points (PNP, NPN, PP)
8	IO-Link / 2 switch points (PNP, NPN, PP) / Analog Output
Process Connection	
G	G1/4" ext. thread G1/2" flush diaphr. (requires piezoresistive sensor / code P* /10-600 bar only)
2	
N	1/4"NPT ext. thread 1/2"NPT flush diaphr. (requires piezoresistive sensor / code P* / 10-600 bar only)
3	
1	40x40 Cetop/Manifold - on request
E	7/16-20 UNF (SAE4) ext. thread
P	7/16-20 UNF (37° JIC) ext. thread
Sealing	
V	FKM
E	EPDM
Electrical Connection	
M	M12
Range	
- 1 . 0 B V	-1 ... 0 bar requires piezoresistive sensor / code P)*, IP65 only
0 0 0 1 B V	-1 ... 1 bar requires piezoresistive sensor / code P)*, IP65 only
0 0 0 5 B V	-1 ... 5 bar requires piezoresistive sensor / code P)*, IP65 only
0 0 1 0 B V	-1 ... 10 bar requires piezoresistive sensor / code P)*, IP65 only
0 0 0 1 B A	0 ... 1 bar absolute (requires piezoresistive sensor / code P)*
0 0 0 5 B A	0 ... 5 bar absolute (requires piezoresistive sensor / code P)*
0 0 1 0 B A	0 ... 10 bar absolute (requires piezoresistive sensor / code P)*
0 0 . 2 B	0 ... 0.2 bar (requires piezoresistive sensor / code P)*,IP65 only
0 0 . 5 B	0 ... 0.5 bar (requires piezoresistive sensor / code P)*,IP65 only
0 0 0 1 B	0 ... 1 bar (requires piezoresistive sensor / code P)*,IP65 only
0 0 0 2 B	0 ... 2 bar (requires piezoresistive sensor / code P)*, IP65 only
0 0 0 5 B	0 ... 5 bar (requires piezoresistive sensor / code P)*, IP65 only
0 0 1 0 B	0 ... 10 bar
0 0 5 0 B	0 ... 50 bar
0 1 0 0 B	0 ... 100 bar
0 2 0 0 B	0 ... 200 bar
0 4 0 0 B	0 ... 400 bar
0 6 0 0 B	0 ... 600 bar (requires piezoresistive sensor / code P)*
	Others on request
Sensor	
Blank	Standard ceramic sensor
P	*Piezoresistive sensor
Example:	
BPS3	4 G V M 0 2 0 0 B

Special designs on request

Transducer

OEM Transducer

Series 623, 624, 625, 626, 627

Features

- ▶ UL and cUL approved
- ▶ Compact size
- ▶ Stainless steel construction
- ▶ Ceramic sensor technology
- ▶ Current and voltage outputs
- ▶ 0.5% accuracy


Applications

- ▶ Water irrigation systems
- ▶ Medical gas systems
- ▶ HVAC systems
- ▶ Pumps and compressors
- ▶ Machine tools
- ▶ Hydraulic and pneumatic applications
- ▶ Mobile hydraulics
- ▶ General industrial applications

General Specifications*

Accuracy (LH & R):	±0.5% FSO at 75°F (24°C), typical
Typical Life Cycle:	100 million cycles
Proof Pressure:	2 times rated pressure, except -16 and -18 pressure ranges
Input/Excitation Voltage:	
625 (2-wire):	9 to 28 VDC
623 (3-wire):	9 to 30 VDC
624 (3-wire):	5 VDC (fixed)
626 (3-wire):	14 to 30 VDC
627 (3-wire):	14 to 30 VDC
Output:	
625:	Output: 4 to 20 mA Full scale output: 16 mA ± 1% Zero output: 4 mA ± 2%
623:	Output: 0.5 to 5.5 VDC Full scale output: 5.0 VDC ± 1% Zero output: 0.5 VDC ± 2%
624:	Output: 0.5 to 4.5 VDC ratiometric Full scale output: 4.0 VDC ± 2% Zero output: 0.5 VDC ± 2%
626:	Output: 1 to 11 VDC Full scale output: 10 VDC ± 1% Zero output: 1.0 VDC ± 2%
627:	Output: 0 to 10 VDC Full scale output: 10 VDC ± 1% Zero output: 0 VDC ± 2%
Supply Current:	15 mA maximum (no load)
Wetted Parts:	316 stainless steel, ceramic and Viton® O-ring (standard)
Enclosure**:	NEMA 4X (IP 65)



Pressure Connection:	1/4" NPT standard. Other options available.
Electrical Connection:	PVC jacketed cable standard. Other options available.
Temperature Ranges:	
Operating:	-40°F to +185°F (-40°C to +85°C)
Compensated:	30°F to +130°F (-1°C to +54°C)
Storage:	-40°F to +185°F (-40°C to +85°C)
Temperature Shift:	
Zero and Span:	±0.06% FS/K over operating temperature range
Vibration:	15 g's, 10-2000 Hz, MIL-STD 202
Approval¹:	 UL File E302981, to UL 508, as Industrial Control Equipment (NMTR, NMTR7), and to UL 61010-1, as Process Control Equipment (QUYX, QUYX7).
Shock:	50 g's, 11 ms, MIL-STD 202 Method 213, Cond. G.
Weight:	5.1 oz (145 grams) (typical)
Warranty:	1 year

1. Conditions of Use: Class 2 power source, Type 4X indoor, 122°F (50°C) max. ambient.

Wiring Code

Electrical Termination		Voltage Output	Current Output	Current Output
H3	H4 / T4 / T5	Series 623/624/626/627	Series 625	Series 625-H4 (-Q21)
Red	1	+ Excitation	+ Excitation	Common
Black	2	Common	- Excitation	Not used
White	3	+ Output	Not used	+ Excitation
Drain	4	Case Ground	Case Ground	Case Ground

Pin Out Diagram



* See product configurator for additional options.

** Mating connector must be properly installed to preserve enclosure rating

Barksdale®

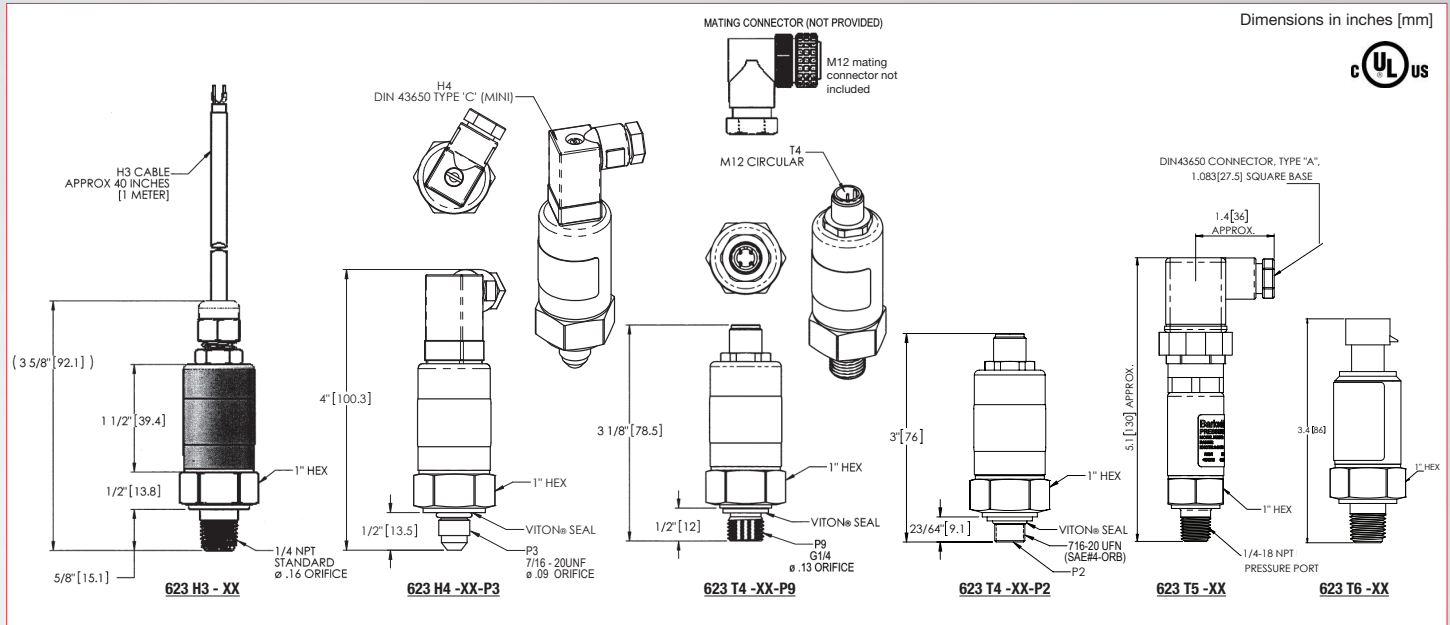
CONTROL PRODUCTS

Barksdale, Inc./Barksdale GmbH
A Subsidiary of Crane Co.

OEM Transducer

Series 623, 624, 625, 626, 627

Technical Drawings



Product Configurator

Example: **625** **H3** **-05**

Base Model

625	4-20 mA analog output
623	0.5-5.5 VDC analog output
624⁵	0.5-4.5 VDC ratiometric analog output (not agency approved)
626	1-11 VDC analog output
627	0-10 VDC analog output

Highlighted options represent those most frequently used. Select these common options for improved availability. (5/21)

Options

Blank	Standard
-Z1	Cleaned for oxygen service
-Z15 ⁴	Calibrated in 'bar' unit
-Z10	1 to 5 V output (only available on 623)
-Z11	1 to 6 V output (only available on 623)
-Z12	0.5 to 4.5 V output (only available on 623)
-Z19	Built in pressure surge suppressor (0.031" orifice)
-Z21	Built in pressure surge suppressor (0.011" orifice)
-Z22	Combination options: P9 + Z15 + Z19
-Z23	Combination options: P9 + Z15 + Z21
-ZXXY ^{3,7}	Special pressure ranges
-Wxxx	Specify cable length in inches (H3 option)
-Q21	Use with 625H4 only. (See Page 1 for pinout information)

Electrical Connection

H3	PVC Shielded & jacketed #22 AWG cable (1 meter)
H4	Mini-DIN 43650 Type "C" - mating connector included (Industry std-9.4mm)
T4¹	M12 connector (mating connector NOT included)
T5 ⁵	Standard DIN (43650) mating connector included (Not UL approved)
T6 ¹	Delphi Metri-Pack Series 150 (Not UL approved)

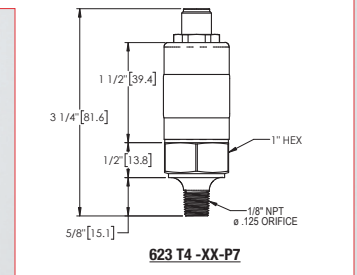
Pressure Range^{2,4}

-21	0-30 PSI (0-2.07 BAR)
-26	0-75 PSI (0-5.17 BAR)
-05	0-150 PSI (0-10.34 BAR)
-07	0-300 PSI (0-20.69 BAR)
-27	0-750 PSI (0-51.71 BAR)
-11	0-1500 PSI (0-103.42 BAR)
-13	0-3000 PSI (0-206.9 BAR)
-16⁸	0-6000 PSI (0-413.7 BAR)
-18 ^{5,6,7,9}	0-8700 PSI (0-600 BAR)

Process Connection

Blank	1/4" NPT male
-P3	7/16-20 UNF male (JIC 37°)
-P9	G1/4 male (gasket seal)
-P2	7/16-20 SAE #4 ORB
-P7 ¹⁰	1/8" NPT male

- Note: 1. Mating connector not included
 2. Other ranges available with the use of -ZXXY Option. Consult factory.
 3. Add suffix ZXXY for special pressure range calibration. XX = significant digits. Y = number of trailing zeros. Example: 130 psi calibration: add -Z131.



Accessories

/A	4 pin M12 female right angle plug molded cable, 3.28 ft. (1 m)
/B	4 pin M12 female right angle plug molded cable, 6.56 ft. (2 m)
/E	4 pin M12 female right angle plug molded cable, 16.40 ft. (5 m)
/F	4 pin M12 female right angle plug molded cable, 32.81 ft. (10 m)
/G	4 pin M12 female straight plug molded cable, 3.28 ft. (1 m)
/H	4 pin M12 female straight plug molded cable, 6.56 ft. (2 m)
/K	4 pin M12 female straight plug molded cable, 16.40 ft. (5 m)
/L	4 pin M12 female straight plug molded cable, 32.81 ft. (10 m)
/M	4 pin M12 female straight connector
/P	4 pin M12 female right angle connector

4. To calibrate unit in 'BAR', select the closest pressure range then add suffix '-Z15' and 'ZXXY'. Example: 15 bar = 625H3-07-Z15-Z150
 5. No agency approvals
 6. Built with 0.011 orifice on pressure port
 7. 8,700 PSI (600 BAR) range is not available with special pressure ranges
 8. Proof pressure is 9000 PSI
 9. Proof pressure is 11,000 PSI
 10. Only up to 3,000 PSI

Barksdale®

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Fluma Co., Ltd.



주식회사 플루마 Fluma Co., Ltd.

(우)50877 경상남도 김해시 주촌면 서부로1499번길22-60(주촌면)

Tel: 055-909-8129 Fax:055-909-8130

22-60, Seobu-ro 1499 beon-gil, Juchon-myeon,
Gimhae-si, Gyeongsangnam -do, Rep. of Korea

영업

심재문 대표

메일 : jmshim@fluma.co.kr, www.fluma.co.kr

전화 : +82 55 909 8129 / 팩스 : +82 55 909 8130

핸드폰 : +82 10 2561 8129

정현성 이사

메일 : hsjung@fluma.co.kr, www.fluma.co.kr

전화 : +82 55 909 8129 / 팩스 : +82 55 909 8130

핸드폰 : +82 10 9525 6263

Sales contact persons

Jae-mun, Shim / President,

E-mail : jmshim@fluma.co.kr, www.fluma.co.kr

Tel. : +82 55 909 8129 / Fax. : +82 55 909 8130

M.P : +82 10 2561 8129

Hyeon-sung, Jung / Director,

E-mail : hsjung@fluma.co.kr, www.fluma.co.kr

Tel. : +82 55 909 8129 / Fax. : +82 55 909 8130

M.P : +82 10 9525 6263