

# BB1 & BB2 INSTALLATION & MAINTENANCE INSTRUCTIONS

#### **DESCRIPTION / IDENTIFICATION**

The BB series valve uses Proportion- Air closed loop technology for pressure control. It gives an output pressure proportional to an electrical command signal input.

The BB1 is a complete closed loop servo system consisting of valves, manifold, housing and electronic controls. Pressure is controlled by the use of two solenoid valves. One valve functions as inlet control, the other as exhaust. The pressure output is measured by a pressure transducer internal to the BB1 and provides a feedback signal to the electronic controls. This feedback signal is compared with the command signal input. A difference between the two signals causes one of the solenoid valves to open, allowing flow in or out of the system. Accurate pressure is maintained by controlling these two valves.

The BB2 is similar to the BB1 but uses a double loop control scheme. In addition to the internal pressure transducer, the BB2 receives an electrical signal from an external sensing device that is provided with the valve. This primary feedback signal is compared against the command signal input. This comparison is then summed with the internal pressure transducer signal. The gain of the circuit is such that priority is given to the external feedback signal. A difference between the command signal and the feedback signal causes one of the solenoid valves to be activated.

A monitor output is available as an option to monitor system pressure. The BB1 monitor output is an amplified signal from the internal pressure transducer. The BB2 monitor output is a buffered signal from the external transducer connected to the BB2.

For BB valves with model number FEE or FIE the monitor output is voltage. For valves with model number FEC or FIC, the monitor output is current. See ordering information for further details.

## **SPECIFICATIONS**

of Echileminons	
<b>ELECTRICAL</b>	
	15-24 VDC
	250mA req'd.
COMMAND SIGNAL	
VOLTAGE	0-10 VDC
CURRENT	4-20mA Sinking
CURRENT (S19	91/S143)4-20mA Differential
COMMAND SIGNAL II	
VOLTAGE	4230 to 5170 $\Omega$
CURRENT	420 to 520 $\Omega$
CURRENT (S19	91)100 $\Omega$
	43)25.5 Ω
ANALOG MONITOR S	IGNAL
VOLTAGE	0-10 VDC @ 10mA max
	4-20mA sinking
	16)4-20mA sourcing
TTL MONITOR OUTPU	JT0-5Vdc @20mA
	AL2.5-24Vdc@1mA
	Ξ200 μs
DIGITAL LATCH LOG	ICLatched-High
	8
<b>MECHANICAL</b>	
PRESSURE RANGES†.	29.9 in. Hg (vac) - 500 psig
	(760 mmHg (vac) - 34.47 BAR)
FLOW RATE	1.2 SCFM max @ 100 psig inlet
	(34L/min @ 6.89 BAR)
	3.5 SCFM max @ 100 psig inlet
	(99L/min @ 6.89 BAR)
	0.04
Cv CAPACITY (81)	0.13
	DLUME1 in <sup>3</sup>
	MENDED40 micron nominal
	SIS<±0.15% F.S. BFSL
REPEATABILITY	±0.02% F.S.
ACCURACY	±0.2% F.S.
WETTED PARTS‡	Elastomers - Fluorocarbon
	Manifold - Brass
	Valves - Nickel plate brass
	P.Transducer - Silicon, Aluminum

#### **PHYSICAL**

OPERATING TEMPERATURE	32-158°F [0-70°C]
WEIGHT	1.02 lb [0.50 Kg]
PROTECTION RATING	NEMA 1 (IP50)
HOUSING	Anodized Aluminum
FINISH	Black Anodized

<sup>†</sup> Pressure ranges are customer specified.

<sup>‡</sup> Others available

# INSTALLATION See FIGURE 1 for ports location

CAUTION: USE ONLY THE THREAD SEALANT PRO-VIDED. OTHER SEALANTS SUCH AS PTFE TAPE AND PIPE DOPE CAN MIGRATE INTO THE FLUID SYSTEM CAUSING FAIL-URES.

#### **WORK PORT:**

- Remove the cap from the work port located at the bottom of the BB valve.
- Connect device being controlled to work port of the BB valve.
- 3. The bottom fitting has an o-ring seal between itself and the BB valve. If you remove the bottom fitting, DO NOT damage the o-ring that seals the bottom fitting to the BB control valve.
- 4. The valve can be mounted in any position without affecting performance. Mounting bracket BKT-01 (ordered separately) can be used to attach valve to a panel or wall surface.
- 5. Proceed with electrical connections.

#### INLET PORT:

- 1. The pressure inlet port is located on the side of the BB valve.
- A white warning sticker is placed over the inlet port of the BB valve to keep contamination out during shipping. Remove this sticker to expose the inlet port.
- 3. Apply a small amount of anaerobic sealant (provided) to the male threads of the in-line filter supplied with valve.
- 4. Install the in-line filter into the inlet port on BB valve.
- 5. Connect supply line to the in-line filter port not to exceed rated supply pressure. (TABLE 1)

#### LED LIGHTS:

The RED LED on top of the unit illuminates showing that power is supplied to the unit. Models with monitor optional or TTL signal have a GREEN LED in addition to the RED LED. The GREEN LED illuminates when the device is satisfied, output is within 1% of the set point. The unit may pulsate while "settling in" due to the compressibility of the media and the pneumatic circuit. This is normal under static conditions.

#### TABLE 1

#### RATED INLET PRESSURE FOR STANDARD BB VALVES

For valves ordered with MAX. calibrated	Max. inlet pressure is:
pressure of:	1
	Onnerell forton
Vacuum up to 10 psig (0.69 bar)	Consult factory
10.1 up to 30 psig (0.70 up to 2 bar)	35 psig (2.4 bar)
· · · · · · · · · · · · · · · · · · ·	1 7 7 3 ( 11 )
24 to 400 main (0.4 to 7 han)	440 (7.0)
31 up to 100 psig (2.1 up to 7 bar)	110 psig (7.6 bar)
101 up to 175 psig (7 up to 12 bar)	190 psig (13 bar)
· · · · · · · · · · · · · · · · · · ·	
176 up to 300 psig (12.1 up to 20.7 bar)	330 psig (22.8 bar)
170 up to 300 psig (12.1 up to 20.7 bar)	330 psig (22.0 bai)
301 up to 500 psig (20.8 to 34.5 bar)	550 psig (37.9 bar)

NOTE: Valves with options S67, S91, or S106 can handle higher inlet pressures. Inlet pressures are not the same for valves mounted to volume boosters. Consult factory for further information.

# Work Port 1/4" NPT Male Work Port 1/4" NPT Male Exhaust Port (not

threaded)

Option # S3 for threaded

Exhaust Port 10-32 UNF

FIGURE 1

#### ELECTRICAL CONNECTIONS

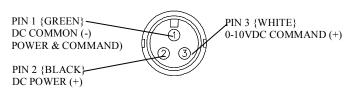
- 1. Turn off all power to valve.
- 2. Identify the valve's command input and analog output using the calibration card included in the package and the ordering information section on the last page of this sheet.
- 3. Proceed to the appropriate section corresponding to the type of valve being installed.

NOTE: ALL COLOR CODES RELATE TO BB'S POWER CORDS (see ordering information for a complete list of available cords).

#### 3 PIN BB VALVES

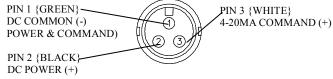
#### Voltage command valves, 3 PIN

All voltage command BB's use common mode voltage, meaning the DC Common pin (Pin 1) is the common reference for both power and command. Pin 1 is used as both the command signal common and power supply common. The following diagram shows the proper connections.



#### **Current command valves, 3 PIN (standard Sinking input)**

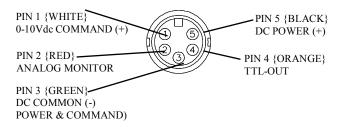
Use the following wiring diagram for BB valves with a sinking command input



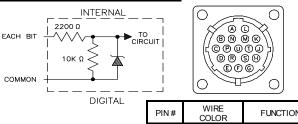
#### **5 PIN BB VALVES**

#### Voltage command valves, 5 PIN

All voltage command BB's use common mode voltage, meaning the DC Common pin (Pin 3) is the common reference for both power and command. Pin 3 is used as both the command signal common and power supply common. The following diagram shows the proper connections.



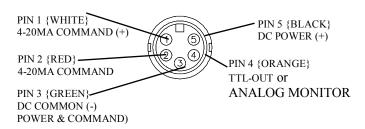
#### Digital command valves, 13 PIN



PIN#	COLOR	FUNCTION
Α	PINK	BIT 1 (MSB)
В	GRAY	BIT2
С	VIOLET	BIT3
D	BROWN	BIT4
R	BLUE	BIT 5
Р	YELLOW	BIT 6
N	WHITE	BIT 7
L	TAN	BIT 8 (LSB)
M	ORANGE	TTL-OUT
U	RED	ANALOG OUT
к	GREEN	(-) DC COMMON
G	BLACK	(+) POWER
J	RED/YELLOW	LATCH

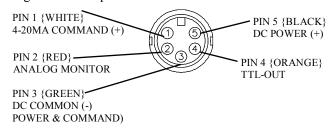
# <u>Current command valves (S143, S191 differential input ontion)</u>

BB's with S191 use a differential current loop scheme (not isolated), meaning current flow is from Pin 1 to Pin 2 on the BB valve. Some applications may require the common of the power supply that provides loop power for the 4-20mA command to be tied to power supply common. The following diagram shows the correct connection for conventional current flow.



## Current command valves, 5 PIN (standard Sinking input)

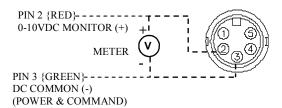
Use the following wiring diagram for BB valves with a sinking command input



#### ANALGO MONITOR OPTION

#### Voltage monitor (FEE or FIE)

Use the following wiring diagram for BB valves with a voltage monitor output.



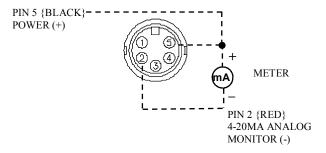
#### TTL-output

BB valves with analog monitor option have an additional outual line. The TTL signal is a conditional ON/OFF signal to use for diagnostic purposes. The signal is LOW when the pressure is within 1% of final setting.



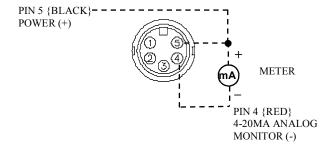
#### **Current monitor (FEC or FIC)**

Use the following wiring diagram for BB valves with a current sinking monitor output.



#### **Current monitor (S143 or S191 option)**

Use the following wiring diagram for BB valves with a current sinking monitor output.

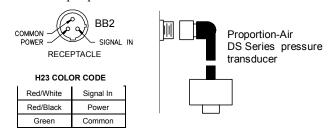


# **BB2 SECOND LOOP CONNECTIONS**

Each BB2 valve comes with a matched pressure transducer for second loop feedback input unless an S59 option (no external pressure transducer) is ordered with the valve. 0-10Vdc BB2 valves are designed to accept a 0-10 volt second loop input signal, 4-20mA command units accept a 2 to 9 Vdc second loop signal (DSZ Series), unless ordered with special option code S143 or S191 differential command input. Valves with S230 option accept a 4-20mA second loop input. See wiring below.

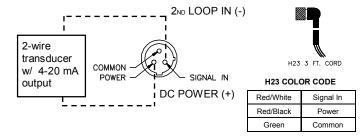
## **BB2-Standard valves**

Second loop input is 0-10Vdc.



#### **BB2-S230 option valves**

Second loop input is 4-20mA. To facilitate wiring between the BB2 and the 4-20mA external pressure transducer, an auxiliary adaptor cord, H23, should be ordered.



#### RE-CALIBRATION PROCEDURE

Each control valve or transducer is hand built to your requirements and custom calibrated by trained personnel using precision calibration equipment. Each product contains a precision electronic pressure sensor has a typical drift less than 1% over the life of the product. If your product appears to be out of calibration by more than 1%, it is not likely that the product is faulty. Check the system for adequate supply pressure, wiring and electronic signal levels. Verify the accuracy of your measuring equipment before re-calibrating. Consult factory if you have any questions or require assistance.

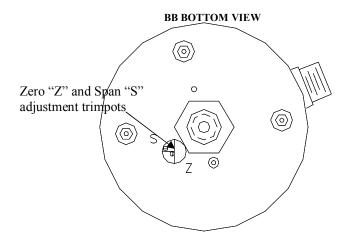
#### BB1 VALVES

- Identify the inputs and outputs of the valve using the model number of the valve, calibration card included with the valve, and the information provided in this sheet.
- Connect a precision measuring gage or pressure transducer to the OUT port of the BB.
   NOTE: THERE MUST BE A CLOSED VOLUME OF AT LEAST 1 CU. IN. (17 CC) BETWEEN THE VALVE OUTLET AND THE MEASURING DEVICE FOR THE VALVE TO BE STABLE.
- 3. Connect the correct supply source to the IN port of the BB, making sure the pressure does not exceed the rating for the valve (See Table 1).
- 4. Locate the calibration access hole at the bottom of the BB valve. There are two adjustment trimpots, Zero "Z" and Span "S". See figure 1 for pot locations.
- 5. NOTE: Only use this step if your device is totally out of calibration. If it is slightly out of calibration, omit this step and move on to paragraph 6. Using a small screwdriver, turn both trimpots 15 turns clockwise. Then turn both trimpots 7 turns counterclockwise. This will put the BB roughly at mid-scale.
- Make correct electrical connections per "ELECTRICAL CONNECCTIONS". Make sure there is a proper meter in place to measure the command input to the BB.
- 7. Set the electrical command input to MAXIMUM value.
- Adjust the SPAN pot until MAXIMUM desired pressure is reached.
- Set the electrical command input to 10 percent of full valve (1Vdc for 0-10Vdc valves or 5.6mA for 4-20mA valves).
- 10. Adjust the ZERO pot until 10 percent of maximum desired pressure is reached.
- 11. Repeat ZERO and SPAN adjustments, which interact slightly, until BB1 valve is calibrated back to proper range. Step 7-10.
- 12. Verify calibration at several setpoints across the operating range (25%, 50%, 75%, 100% and 0%) to ensure that the unit's output is linear. It is important to verify that the unit goes to 0 command. Adjust zero potentiometer slightly counterclockwise until there is no pressure output. Verify calibration across the full range once again and make adjustments as necessary.

#### **BB2 VALVES**

All BB2 valves come with a matched DS Series pressure transducer for second loop feedback input. This section assumes that the transducer is a properly scaled and calibrated. For information on recalibrating Proportion-Air DS series pressure transducers see sheet BRDS-WT.

- 1. Follow, in order, steps 1-5 as noted in the section titled BB1 VALVES.
- 2. Make correct electrical connections as noted. Make sure there is a proper meter in place to measure the command input to the BB2. Make sure the 2nd loop signal is connected.
- 3. Set the electrical command input to MAXIMUM value.
- 4. Adjust the SPAN pot until MAXIMUM desired pressure is reached.
- 5. Set the electrical command input to 10 percent of full valve (1Vdc for 0-10Vdc valves or 5.6mA for 4-20mA valves).
- 6. Repeat ZERO and SPAN adjustments, which interact slightly, until BB2 valve is calibrated back to proper range. Steps 3 5.
- 7. Verify calibration at several setpoints across the operating range (25%, 50%, 75%, 100% and 0%) to ensure that the unit's output is linear. It is important to verify that the unit goes to 0 command, adjust zero potentiometer slightly counterclockwise until there is no pressure output. Verify calibration across the full range once again and make adjustments as necessary.

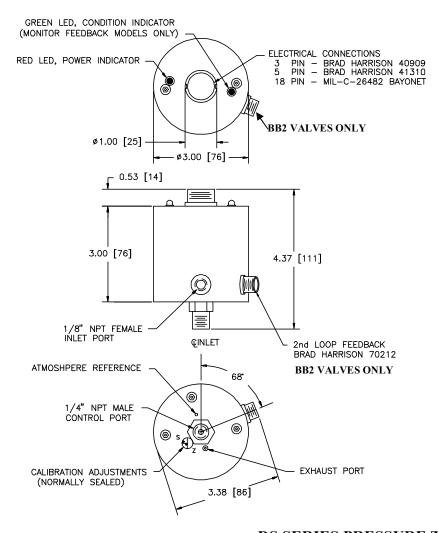


# TRUTH TABLE FOR DIGITAL BB VALVES

DIN #	01	UTPUT	DIN #	01	UTPUT	DIN #	OI	JTPUT	DIN #	OI	UTPUT
PIN# ABCDRPNL	% of	VDC	PIN# ABCDRPNL	% of	VDC	PIN# ABCDRPNL	% of	VDC	PIN# ABCDRPNL	% of	VDC
I D C D K I N L	Scale	1,50	I D C D K I N L	Scale	100	A D C D KI N L	Scale	100	11 D C D K I N L	Scale	100
00000000		0.10	0.1.0.0.0.0.0		2.56	1000000		5.02	1100000		7.40
0000000	0.00	0.10	0100000	25.10	2.56	1000000	50.20	5.02	11000000	75.29	7.48
00000001	0.39	0.14	01000001	25.49	2.60	10000001	50.59	5.06	11000001	75.69	7.52
00000010	0.78	0.18	01000010	25.88	2.64	10000010	50.98	5.10	11000010	76.08	7.56
00000011	1.18	0.22	01000011	26.27	2.67	10000011	51.37	5.13	11000011	76.47	7.59
00000100	1.57	0.25	01000100	26.67	2.71	10000100	51.76 52.16	5.17 5.21	1 1 0 0 0 1 0 0	76.86 77.25	7.63
00000101	2.35	0.29	01000101	27.45	2.79	10000101	52.55	5.25	11000101	77.65	7.71
00000110	2.75	0.37	01000110	27.84	2.82	10000110	52.94	5.29	11000110	78.04	7.75
00000111	3.14	0.41	01000111	28.24	2.87	1000100	53.33	5.33	11001000	78.43	7.79
00001001	3.53	0.45	01001001	28.63	2.91	10001001	53.73	5.37	11001001	78.82	7.82
00001010	3.92	0.48	01001010	29.02	2.94	10001010	54.12	5.40	11001010	79.22	7.86
00001011	4.31	0.52	01001011	29.41	2.98	10001011	54.51	5.44	11001011	79.61	7.90
00001100	4.71	0.56	01001100	29.80	3.02	10001100	54.90	5.48	11001100	80.00	7.94
00001101	5.10	0.60	01001101	30.20	3.06	10001101	55.29	5.52	11001101	80.39	7.98
00001110	5.49	0.64	01001110	30.59	3.10	10001110	55.69	5.56	11001110	80.87	8.02
00001111	5.88	0.68	0 1 00 1 1 1 1	30.98	3.14	10001111	56.08	5.60	11001111	81.18	8.06
00010000	6.27	0.71	01010000	31.37	3.17	10010000	56.47	5.63	11010000	81.57	8.09
00010001	6.67	0.75	01010001	31.76	3.21	10010001	56.86	5.67	11010001	81.96	8.13
00010010	7.06	0.78 0.83	01010010	32.16 32.55	3.25	10010010	57.25 57.65	5.71 5.75	1 1 0 1 0 0 1 0	82.25 82.75	8.17 8.21
00010011	7.43	0.83	01010011	32.33	3.33	10010011	58.04	5.79	11010011	83.14	8.25
00010100	8.24	0.87	01010100	33.33	3.37	10010100	58.43	5.83	11010100	83.53	8.29
00010101	8.63	0.85	01010101	33.73	3.41	11010101	58.82	5.86	11010101	83.92	8.32
00010111	9.02	0.98	01010111	34.12	3.44	10010111	59.22	5.90	11010111	84.31	8.36
00011000	9.41	1.02	01011000	34.51	3.48	10011000	59.61	5.94	11011000	84.71	8.40
00011001	9.80	1.06	01011001	34.90	3.52	10011001	60.00	5.98	11011001	85.10	8.44
00011010	10.20	1.10	01011010	35.29	3.56	10011010	60.39	6.02	11011010	85.49	8.48
00011011	10.59	1.14	01011011	35.69	3.60	10011011	60.78	6.06	11011011	85.88	8.52
00011100	10.98	1.18	01011100	36.08	3.64	10011100	61.18	6.10	11011100	86.27	8.55
00011101	11.37	1.21	0 1 0 1 1 1 0 1	36.47	3.67	10011101	61.57	6.13	11011101	86.67	8.59
00011110	11.76	1.25	01011110	36.86	3.67	10011110	61.96	6.17	11011110	87.06	8.63
00011111	12.16	1.29	01011111	37.25	3.75	10011111	62.35	6.21	11011111	87.45 87.84	8.67 8.75
00100000	12.55 12.94	1.33	01100000	37.65 38.04	3.79	10100000	62.75 63.14	6.29	1 1 1 0 0 0 0 0 1	88.24	8.75
00100001	13.33	1.41	01100001	38.43	3.87	10100001	63.53	6.33	11100001	88.63	8.79
00100010	13.73	1.45	01100010	38.82	3.90	10100010	63.92	6.36	11100010	89.02	8.82
00100100	14.12	1.48	01100100	39.22	3.94	10100100	64.31	6.40	11100100	89.41	8.86
00100101	14.51	1.52	01100101	39.61	3.98	10100101	64.71	6.44	11100101	89.90	8.90
00100110	14.90	1.56	01100110	40.00	4.02	10100110	65.10	6.48	11100110	90.20	8.94
00100111	15.29	1.60	01100111	40.39	4.06	10100111	65.49	6.52	11100111	90.59	8.98
00101000	15.69	1.64	01101000	40.78	4.10	10101000	64.88	6.56	11101000	90.98	9.02
00101001	16.06	1.68	01101001	41.18	4.14	10101001	66.27	6.59	11101001	91.37	9.05
00101010	16.47	1.71	01101010	41.57	4.17	10101010	66.67	6.63	11101010	91.76	9.09
00101011	16.86	1.75	01101011	41.96	4.21	10101011	67.06	6.67	11101011	92.16	9.13
00101100	17.25	1.79	01101100	42.35	4.25	10101100	67.45	6.71	11101100	92.55	9.17
00101101	17.65 18.04	1.83	01101101 01 01 01 01 110 110 110 110 11	42.75 43.14	4.29	10101101	67.84 68.24	6.75	1 1 1 0 1 1 0 1 1 1 1 0 1 1 1 0	92.94 93.33	9.21
00101110	18.43	1.87	01101110	43.14	4.33	10101111	68.63	6.83	11101110	93.33	9.23
00101111	18.82	1.94	01101111	43.92	4.40	10101111	69.02	6.86	111101111	94.12	9.29
00110000	19.22	1.98	01110000	44.31	4.44	10110000	69.41	6.90	11110000	94.51	9.36
00110010	19.61	2.02	01110010	44.71	4.48	10110010	69.80	6.94	11110010	94.90	9.40
00110011	20.00	2.06	01110011	45.10	4.52	10110011	70.20	6.98	11110011	95.29	9.44
00110100	20.39	2.10	01110100	45.49	4.56	10110100	70.59	7.02	11110100	95.69	9.48
00110101	20.78	2.14	01110101	45.88	4.60	10110101	70.98	7.60	11110101	96.08	9.52
00110110	21.18	2.18	01110110	46.27	4.63	10110110	71.37	7.09	11110110	96.47	9.55
00110111	21.57	2.21	01110111	46.67	4.67	10110111	71.76	7.13	11110111	96.86	9.59
00111000	21.96	2.25	01111000	47.06	4.71	10111000	72.16	7.17	11111000	97.25	9.63
00111001	22.35	2.29	01111001	47.45	4.75	10111001	72.55	7.21	11111001	97.65	9.67
00111010	22.75	2.33	01111010	47.84	4.79	10111010	72.94	7.25	11111010	98.04	9.71
00111011	23.14	2.37	01111011	48.24	4.83	10111011	73.33	7.29	11111011	98.43	9.75
00111100	23.53	2.41	01111100	48.63	4.87	10111100	73.73 74.12	7.33 7.36	11111100	98.82 99.22	9.78 9.82
00111101	24.31	2.44	01111101	49.02	4.90	10111101	74.12	7.40	111111101	99.22	9.82
00111110	24.71	2.48	01111110	49.41	4.94	1011111	74.31	7.44	11111111	100.00	9.80
00111111	∠¬./1	4.34	V 1 1 1 1 1 1 1	₹7.00	<b>サ.</b> ノ0	10111111	77.70	/. <del>TT</del>		100.00	7.70

# **DIMENSION** inches (mm)

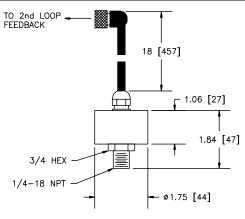
# BB



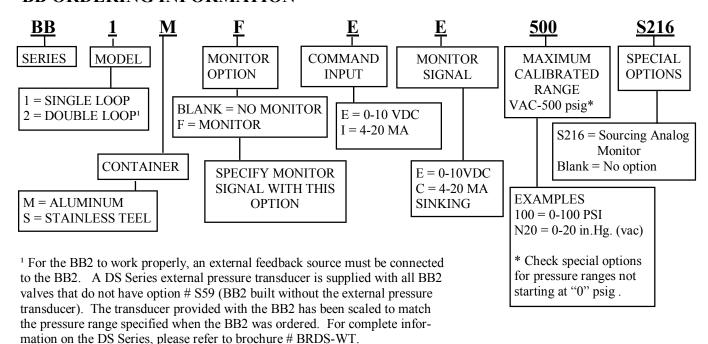
# **BKT-01 BRACKET**

# 

# **DS SERIES PRESSURE TRANSDUCER**



### BB ORDERING INFORMATION



#### **POWER CORD**

3 PIN CORDS					
H6033 H6036 H6312 H6315	3' length 6' length 12' length 15' length				
H6320 20' length <b>5 PIN CORDS</b>					
H6053 H6056 H6512 H6515 H6520	3' length 6' length 12' length 15' length 20' length				
DIGTIAL CORDS					
13 PC-10 H618P	10' length (Additional lengths available) Electrical Connector. No Cord.				

# MOUNTING BRACKET

BKT-01

Proportion-Air products are warranted to the original purchaser only against defects in material or workmanship for one (1) year from the date of manufacture. The extent of Proportion-Air's liability under this warranty is limited to repair or replacement of the defective unit at Proportion-Air's option. Proportion-Air shall have no liability under this warranty where improper installation or filtration occurred.

All specifications are subject to change without notice. THIS WARRANTY IS GIVEN IN LIEU OF, AND BUYER HEREBY EXPRESSLY WAIVES, WARRANTIES OR LIABILITIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY OBLI-GATION OF PROPORTION-AIR WITH REGARD TO CONSEQUENTIAL DAMAGES, WARRANTIES OF MERCHANTABILITY, DE-SCRIPTION, AND FITNESS FOR A PARTICULAR PURPOSE.

WARNING: Installation and use of this product should be under the supervision and control of properly qualified personnel in order to avoid the risk of injury or death.

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