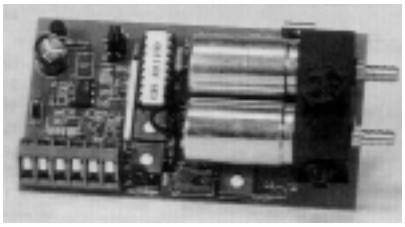
# Pulse Width Modulated to Pneumatic Output (Closed Loop)

## Dual and Single Valve, Standard and Fail Safe

## FEATURES



- Accepts contact closure, transistor, or triac inputs
- Field Selectable Input Pulse Ranges, plus
- Phase Cut and 0-10 second window PWM
- Field adjustable min/max pressure output
- Adjustable Manual Override
- Anodized aluminum manifold with gauge port, blue manifold for fail safe (FS) model
- Closed loop control, maintains last commanded branch pressure
- LED Status indicator for power
- Branch pressure feedback signal

## APPLICATIONS

- VAV Damper Motor Control
- Compressor Staging
- Any Pneumatic Actuator Control

## DESCRIPTION

The PWP*.2 converts a pulse, phase cut, or digital PWM signal into a proportional pneumatic signal ranging from 0-15 psig. The pneumatic output is proportional to the signal input. The PWP*.2 has an adjustable manual override potentiometer to INCREASE or DECREASE the pneumatic output and an LED for power and signal status indication. An unlit LED indicates no power to the PWP*.2, slow blink indicates power but no signal detected, and fast blink indicates a signal being received. Standard output is 15 psig (up to 20 with special calibration) and has 255 steps of resolution. The PWPO.2 is a single valve version that has no restrictor and does not bleed or exhaust air. Its operation depends on its branch line consuming between 14 and 73 scim. The PWP1.2,5.2, and 7.2 are bleed types, with branch exhaust response times determined by orifice size and pressure differentials. The PWP2.2 and PWP2.2FS incorporate two valves and are not constant bleed interfaces. Their branch exhaust flow and response time are similar to its load rate. The PWP*.2 maintains the last commanded pneumatic pressure by

## SPECIFICATIONS

**Electrical Requirements**

**Power Supply**

**Supply Voltage**

24 VDC (+/- 10%) or 24 VAC (22 to 28 volts at terminals)

**Supply Current**

160 mA maximum on standard model, 200 mA maximum on FS (fail safe) model

**Input**

**Pulse Source**

Relay contact closure, triac, or transistor (solid state relay)

**Pulse Trigger Level**

9 to 24 VAC or VDC

**Off Time Between Pulses**

10 milliseconds minimum

**Pulse Duration/Resolution**

Selectable ranges:

**Version #1**

In seconds of relay contact closure, triac or transistor (solid state relay),
255 steps of resolution.
.1 to 10 sec
in 0.1 sec increments
0.02 to 5 sec
in 0.02 sec increments
0. 1 to 25 sec
in 0. 1 sec increments
0.59 to 2.93 sec
in 0.01 sec increments

**Version #2**

.023 to 6 sec
0 to 10 second Duty Cycle Pulse, measured within a 10 second window.

**Version #3**

0 to 20V Staefa TM Phase Cut

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## Dual and Single Valve, Standard and Fail Safe

## SPECIFICATIONS

**FEEDBACK OUTPUT**

**Feedback Signal Range**
0-5 VDC = Output Span (psig)

**MECHANICAL REQUIREMENTS**

**AIR SUPPLY**

**Supply Pressure**
Maximum 30 psig, mimimum 25 psig

**Air Consumption**
See chart under Ordering Information

**Output Pressure Range**
0-15 psig or specify special calibration up to 20 psig

**Air Flow**
Supply valves @ 20 psig (138 kPa) main/15 psig (103 kPa) out, 750 scim. Branch Line requires 2 cubic inches (minimum).

**Filtering**
Furnished with integral-in-barb 80-100 micron filter (Part # PIN1004) Optional standard barb (PNO02) with external 5 micron in-line filter (PN021)

**CONNECTIONS**

**Wire Size**
Up to two 18 AWG wires

**Terminal Type**
451, Captive screw with cage clamp in nickel plated copper alloy

**Pneumatic Fitting**
Removable brass barbed fittings for Main and Branch tubing mounted in machined aluminum manifold with black anodized finish (blue anodized manifold for FS model). Supplied w/plugged 1/8-27-FNPT gauge port. Guage installed at additional cost

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nature of its closed loop electronic design, regardless of branch line leaks. If power fails to the PWP2.2, branch line pressure remains constant if the branch line does not leak air. **FAIL-SAFE:** The exhaust valve allows exhaust of branch air on **PWP2.2FS** (fail-safe) N.O. power failure, and the PWP1, 5, or 7.2 will continue to bleed through the orifice until branch pressure is zero psig. Manifold color is blue. The output will not "wrap around" if the pulse length exceeds the maximum of the range selected. The PWP*.2 has a branch line feedback signal of 0-5 VDC, which the controller can use to monitor the branch line pressure. The input can be a relay contact closure, transistor, triac, phase cut, or 0-10 second Duty Cycle Pulse measured within a 10 second window.

## ORDERING

Please specify the following product numbers:
For the PWP*.2: **435012**
For the PWP0/1/5/7.2: **435013**
For thePWP2.2: **435014**
Also, indicate the following information:

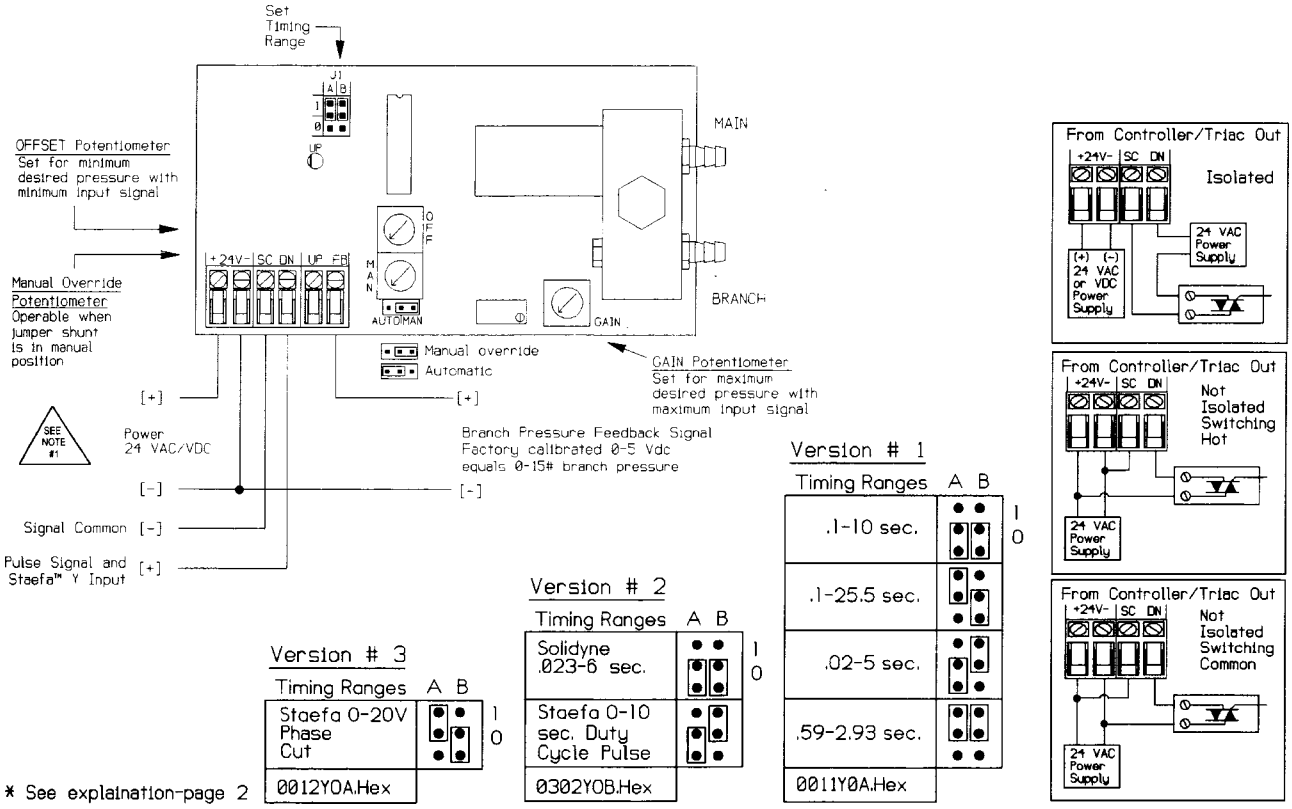
**PWIP**__ __ __**Version** ___ **#1, 2 or 3** (See "Input: Pulse Duration" with___**ENC1?** in Specifications Column)
- OUTPUT PRESSURE 0-15 psig or specify special calibration up to 20 psig.
- G -with 0-30 psi gauge
- 2.21FS - 2 valve - exhausts on power failure - 750 scim supply valve, 750 scim exhaust
- 0.2 - 1 valve - no bleed No air consumption - requires downstream bleed
- 1.2 - 1 valve - .010" bleed orifice -73 scims +/-5%
- 2.2 - 2 valve - maintains branch pressure -750 scirn supply valve, 750 scim exhaust
- 5.2 - 1 valve - .005" bleed orifice - 14 scims +1-5%
- 7.2 - 1 valve - .007" bleed orifice - 41 scims +/-5%

All factory calibrated products are NIST traceable.
Certificates of Compliance must be ordered with products.

# Pulse Width Modulated to Pneumatic Output (Closed Loop)

## Pulse Modulated Input to Pneumatic Output with Bleed Orifice

## INSTALLATION DIAGRAM– PWP0/1/5/7.2




## INSTALLATION INSTRUCTIONS – PWP0/1/5/7.2

**READ THESE INSTRUCTIONS BEFORE YOU BEGIN INSTALLATION.** Ground yourself before touching board. Some components are static sensitive.

### MOUNTING

Circuit board maybe mounted in any position. If circuit board slides out of snap track, a non-conductive "stop" may be required. Use only fingers to remove board from snap track. Slide out of snap track or push against side of snap track and lift that side of the circuit board to remove. Do not flex board or use tools.

### POWER CONNECTIONS

THIS PRODUCT ACCEPTS 24 VOLTS AC OR DC POWER

Be sure to follow all local and electrical codes. Refer to wiring diagram for connection information.

1) The secondary supply voltage to the interface should be isolated from earth ground, chassis ground, and neutral leg of the primary winding. Any field device connected to this transformer must use the same common. If you are not sure of other field device configuration, use separate transformers. If you do not observe this, proper operation including feedback may not function.

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## Pulse Width Modulated to Pneumatic Output (Closed Loop)

### Pulse Modulated Input to Pneumatic Output with Bleed Orifice

## SPECIFICATIONS

**Pneumatic Tubing Size/Type**
1/4" O.D. nominal polyethylene

**Dimensions**
4.0"L x 2.175"W x 1.5"H
(mounted in snaptrack)

**Shipping Weight**
7. 1 oz. - PWPO.2, 1.2, 5.2,
and 7.2 and 9.0 oz.- PWP2.2 and
8.9 oz. for PWP2.2FS

**Mounting**
Furnished with 2.25" wide x 4.0"
length of snaptrack
(ENC1 Optional)

**Environmental Requirements**

**Operating Temperature Range**
32 to 120°F

**Storage Temperature Range**
-20 to 150°F

**Operating Humidity Range**
5 to 95% non-condensing

2) If the 24 volt AC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, AC Transorb, or other spike snubbing device across each of the shared coils. Without these snubbers, coils produce very large voltage spikes when de-energizing that can cause malfunction or destruction of electronic circuits.
3) If the 24 volt DC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, DC Transorb, or a diode placed across the coil or inductor. The cathode or banded side of the diode (or DC Transorb) connects to the positive side of the power supply. Do not power without main air supply provided.
4) You should measure the actual voltage output of the secondary. If the output is not fully loaded you may read a higher voltage than the circuit board can handle. The gauge port will accept a miniature 1/8" FNPT back-ported pressure gauge to allow direct reading of branch line pressure. The gauge should be sealed by teflon sealing tape, and should be just snug. A back up wrench should be used to hold the manifold.
Warranty does not include malfunction due to clogged valve. Main airport is filtered with the supplied 80-100 micron integral-in-barb filter. Periodically check the filter for contamination and flow reduction, and clean with a brush or replace if needed (Part # PNO04).
The surface between the manifold and pressure transducer is a pressure seal. Do NOT stress the circuit board or allow the manifold to move. Hold the manifold in one hand while installing pneumatic tubing onto the barbed fittings and use care when removing tubing to avoid damaging fittings or moving manifold. The bleed orifice can be unscrewed with a 1/4" hex nut driver for cleaning or inspection. Do not lose the sealing gasket or insert anything into the precision orifice. Clean by swabbing with a degreaser and blowing clean air through the orifice from the opposite direction. The color of the hex nut indicates orifice size: brass =.007"; silver .010"; copper= .005"
This unit requires at least two cubic inches of branch air line capacity to operate without valve oscillation, and main air must be minimum of 2 psig above highest desired branch output pressure.
The input signal will not cause "wrap around" or start over if the upper range limit is exceeded.

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## Pulse Width Modulated to Pneumatic Output (Closed Loop)

### Pulse Modulated Input to Pneumatic Output with Bleed Orifice

**CHECKOUT**

SIGNAL INPUTS: **Version #1**. See jumper positions, page 1. Connect the pulse input positive (+) to the down (DN) terminal, and common to the signal common (SC) terminal. **Version #2**. Solidyne PWM signal and 0 -10 second Duty Cycle Pulse of Barber Colman™ , Robertshaw™ or Staefa™ No pulse within 10 seconds= minimum output. Pulse equal or exceeding 10 seconds= maximum output. **Version #3**. For Staefa Smart II™ 0-20 Volt Phase Cut, 0-100% input connect Y to DN terminal, and common to SC (-) terminal. Trigger level above approx. 5% and below 95% of phase cut waveform (i.e. 5-95% min./max. or 5% lower and upper detection deadband).

The PWPO, 1, 5, 7.2 is factory calibrated at 0 psig minimum and 15 psig maximum output. This output can be re-calibrated to match the pressure range of the actuator using the GAIN and OFFset potentiometer as follows: (Note: The ZERO potentiometer is factory set. Do not adjust.)

1. Setting the minimum pressure. Make sure the signal input is disconnected. Place the OVERRIDE shunt to the AUTO position. Drive the PWPO, 1, 5, 7.2 to the minimum position by removing the 24V power connection for 3 seconds, then re-connect. Adjust the OFFset pot to the desired pressure output, or until the actuator just starts to move. The adjustment range of the OFFset pot is 0-10 psig.
2. Setting the maximum pressure. Now place the OVERRIDE shunt to the MAN position. Turn the OVERRIDE pot to produce the maximum branch line pressure available. Turn the GAIN pot for the maximum desired output pressure, or until the actuator just stops. The range of the GAIN pot is 10.5 to 20.0 psig. Note: Be sure the MAIN air pressure is at least 2 psig greater than the desired maximum branch output pressure.
3. Repeat. Because the OFFset and GAIN pots are slightly interactive, steps 1 and 2 must be repeated until the desired minimum and maximum pressures are repeatable. Since the OVERRIDE pot is set for maximum pressure, it is only required that you move the manual override jumper shunt back and forth from MAN to AUTO when repeating steps 1 and 2. Calibration is usually accomplished in less than 3 iterations. Now, select one of the four input timing ranges with the shunt as shown in Figure A.

Without power, the status LED will not be illuminated. Apply power and the "STATUS" LED will blink slowly (twice per second), and the PWPO, 1 5,7.2 will be at the lowest signal input state, or 0 psig. Apply minimum and maximum input signals and measure the re-

## Pulse Width Modulated to Pneumatic Output (Closed Loop)

### Pulse Modulated Input to Pneumatic Output with Bleed Orifice

### SPECIFICATIONS

**Power Supply Voltage** 24 VDC (+/- 10%)

**Air Supply**
24 VAC (22 V min, 28 V max-)
Maximum 25 psig, minimum 20 main air supply

**Supply Current**
150mA 0-15 psig output, 0-20 output optional

**Feedback Signal Output**
Factory Calibrated 0-5 VDC = 0-15 psig or 0-5 VDC= 0-20 psig optional

sponse. Version #11: The "STATUS" LED will flash quickly when the PWPO, 1, 5, 7.2 is receiving an input pulse, at the rate of the minimum resolution of the selected pulse range, ( i.e. .1 to 25.5 second range, the LED will flash .1 second on, .1 second off). Exception: .59 to 2.93s range - LED remains constant. Version #2 & 3: .023-6 seconds - 1 flash, then pause. 0-10 second Duty Cycle - 3 flashes, then pause. Staefa Phase Cut - 2 flashes, then pause. The input signal will NOT cause "wrap around" or start over if the upper range limit is exceeded.

The pneumatic output changes when the input pulse has been completed. Pressure output between the minimum and maximum values will be linear, therefore software algorithms should be easy to derive. The feedback signal range on all selections is 0 to 5 vdc and is proportional to the output pressure range (Factory calibrated 0-15 psig ).

The PWP1, 5, 7.2 are a constant bleed controller and utilize a precision orifice to maintain a measured flow of air across the valve. The PWPO.2 does not have a bleed orifice and depends on a downstream pneumatic branch bleed of 14 to 73 scim. Use the PWPO.2 only when the downstream pneumatic system components continually exhaust air. For proper operation, combined exhaust air flow (PWP orifice loss and branch system loss) must be between 14 and 73 scim.

To use the manual override, place the AUTO/MAN jumper shunt in the MAN position. Using a small bladed screwdriver, turn the top adjust pot to increase or decrease the pneumatic output. Return AUTO/MAN to AUTO position when finished.

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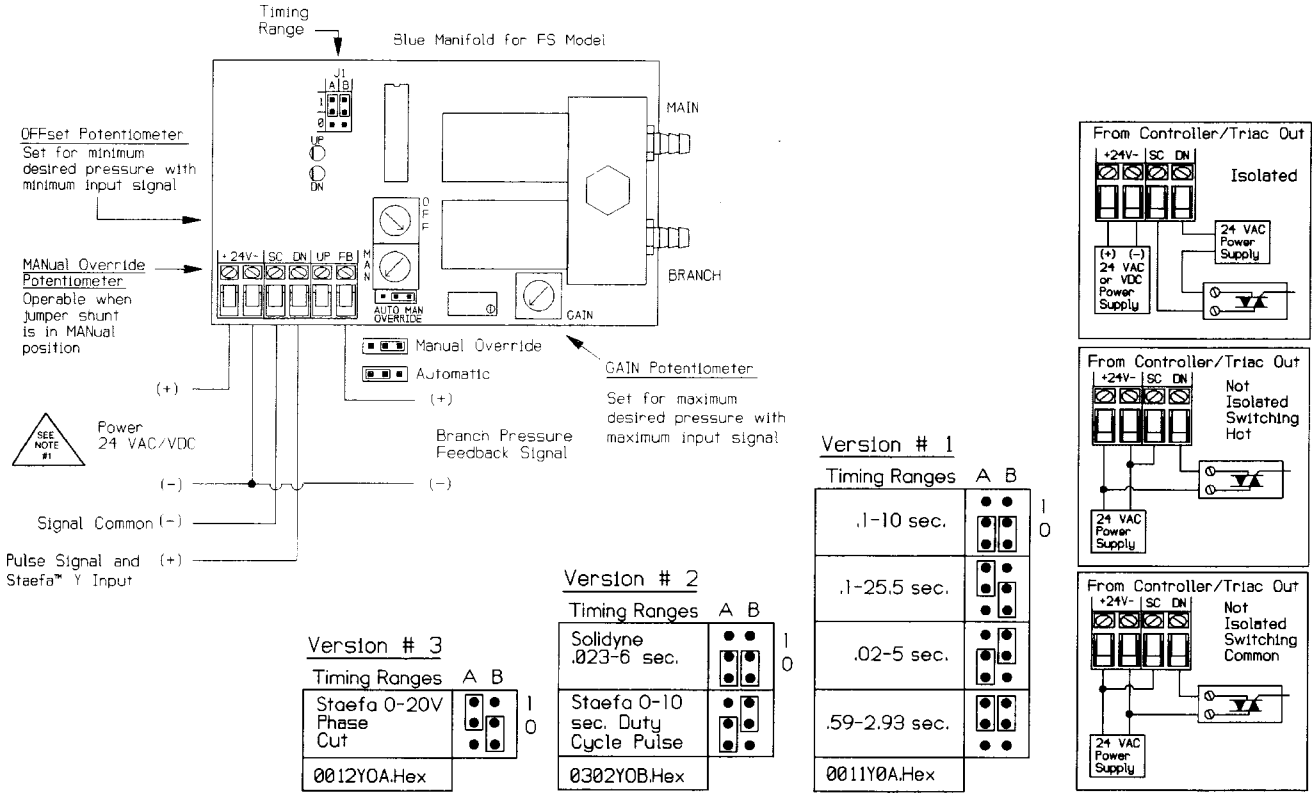
# Pulse Width Modulated to Pneumatic Output (Closed Loop)

## Pulse Width Modulated Input to Pressure Output Standard and Fail Safe

## INSTALLATION DIAGRAM – PWP2.2




## INSTALLATION INSTRUCTIONS – PWP2.2

**READ THESE INSTRUCTIONS BEFORE YOU BEGIN INSTALLATION.** Ground yourself before touching board. Some components are static sensitive.

### MOUNTING

Circuit board may be mounted in any position. If circuit board slides out of snap track, a nonconductive "stop" may be required. Use only fingers to remove board from snap track. Slide out of snap track or push against side of snap track. NOTE: Lift that side of the circuit board to remove. Do not flex board or use tools.

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# Pulse Width Modulated to Pneumatic Output (Closed Loop)

## Pulse Width Modulated Input to Pressure Output Standard and Fail Safe

## SPECIFICATIONS

**Power Supply Voltage**
24 VDC (+/- 10%)

**Air Supply**
Maximum 25 psig, minimum 20 main air supply 24 VAC (22 V min., 28 V max.) at 0-15 psig output pressure range or specify PWP2.2 terminals special calibration

**Supply Current**
160 mA max. (200 mA max. FS model) Air Flow @ 20 psig main/1 5 psig out, Supply

**Feedback Signal Output**
Factory Calibrated
0-5 VDC = 0-15 psig valve 750 scim, Exhaust rate: PWP2.2 - 750 or specify special calibration scim, PWP2.2FS - 750 scim.

**POWER CONNECTIONS**

THIS PRODUCT ACCEPTS 24 VOLTS AC OR DC POWER
Be sure to follow all local and electrical codes. Refer to wiring diagram for connection information.

1) The secondary supply voltage to the interface should be isolated from earth ground, chassis ground, and neutral leg of the primary winding. Any field device connected to this transformer must use the same common. Grounding should be to the system common only. If you are not sure of other field device configuration, use separate transformers. If you do not observe this, proper operation of the PWP including feedback may not function

2) If the 24 volt AC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, AC Transorb, or other spike snubbing device across each of the shared coils. Without these snubbers, coils produce very large voltage spikes when de-energizing that can cause malfunction or destruction of electronic circuits.

3) If the 24 volt DC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, DC Transorb, or a diode placed across the coil or inductor. The cathode or banded side of the diode (or DC Transorb) connects to the positive side of the power supply. Do not power without main air suppy provided.

4) You should measure the actual voltage output of the secondary. If the output is not fully loaded you may read a higher voltage than the circuit board can handle. The gauge port will accept a miniature 1/8" FNPT back-ported pressure gauge to allow direct reading of branch line pressure. The gauge should be sealed by teflon sealing tape, and should be just snug. A backup wrench should be used to hold the manifold.

Warranty does not include malfunction due to clogged valve. Main airport is filtered with the supplied 80-100 micron integral-in-barb filter. Periodically check the filter for contamination and flow reduction, and clean with a brush or replace if needed (Part # PNO04). The surface between the manifold and pressure transducer is a pressure seal. Do NOT stress the circuit board or allow the manifold to move. Hold the manifold in one hand while installing pneumatic tubing onto the barbed fittings and use care when removing tubing to avoid damaging fittings or moving manifold. GAUGE POSITION ADJUSTMENT. If installation requires adjustment of the gauge for proper reading of the face, turn the gauge counter clockwise. 0 rings in the bottom of the gauge port will allow this without leakage. This unit requires at least two cubic inches of branch air line

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capacity to operate without valve oscillation, and main air must be minimum of 2 psig above highest desired branch output pressure. The input signal will not cause "wrap around" or start over if the upper range limit is exceeded.

**CHECKOUT**

**SIGNAL INPUTS: Version #1**. See jumper positions, page 1. Connect the pulse input positive (+) to the down (DN) terminal, and common to the signal common (SC) terminal. **Version #2**. Solidyne PWM signal and 0 -10 second Duty Cycle Pulse of Barber Colman™ , Robertshaw™ or Staefa™ . No pulse within 10 seconds= minimum output. Pulseequal or exceeding 10 seconds= maximum output. **Version#3**. For Staefa SmartII™ 0-20 Volt Phase Cut, 0-100% input connect Y to DN terminal, and common to SC (-) terminal. Trigger level above approx. 5% and below 95% of phase cut waveform (i.e. 5-95% min./max. or 5% lower and upper detection deadband). The PWP2.2 is factory calibrated at 0 psig minimum and 15 psig maximum output. This output can be re-calibrated to match the pressure range of the actuator using the GAIN and OFFset potentiometer as follows: (Note: The ZERO potentiometer is factory set. Do not adjust.).

1. Setting the minimum pressure. Make sure the signal input is disconnected. Place the OVERRIDE shunt to the AUTO position. Drive the PWP2.2 to the minimum position by removing the 24V power connection for 3 seconds, then re-connect. Adjust the OFFset pot to the desired pressure output, or until the actuator just starts to move. The adjustment range of the OFFset pot is 0-10 psig.
2. Setting the maximum pressure. Now place the OVERRIDE shunt to the MAN position. Turn the MANual pot to produce the maximum branch line pressure available. Turn the GAIN pot for the maximum desired output pressure, or until the actuator just stops. The range of the GAIN pot is 10.5 to 20.0 psig. Note: Be sure the MAIN air pressure is at least 2 psig greater than the desired maximum branch output pressure.
3. Repeat. Because the OFFset and GAIN pots are slightly interactive, steps 1 and 2 must be repeated until the desired minimum and maximum pressures are repeatable. Since the OVERRIDE pot is set for maximum pressure, it is only required that you move the manual override jumper shunt back and forth from MAN to AUTO when repeating steps 1 and 2. Calibration is usually accomplished in less than 3 iterations. Now, select one of the four input timing ranges with the shunt as shown in Figure A.

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### Pulse Width Modulated Input to Pressure Output Standard and Fail Safe

Without power, the status LED will not be illuminated. Apply power and the "STATUS" LED will blink slowly (twice per second), and the PWP2.2 will be at the lowest signal input state, or 0 psig. Apply minimum and maximum input signals and measure the response. Version #1 Operation: STATUS LED will flash quickly when PWP2.2 is receiving an input pulse, at the rate of the minimum resolution of the selected pulse range, ( i.e. . 1 to 25.5 second range, the LED will flash . 1 second on, .1 second off). Exception: .59 to 2.935s range - LED remains constant. Version #2 & 3 Operation: .023-6 seconds - 1 flash, then pause. Staefa Phase Cut-2 flashes, then pause. 0-10 second dutycycle - 3 flashes, then pause. The input signal will NOT cause "wrap around" or start over if the upper range limit is exceeded. The pneumatic output changes when the input pulse has been completed. Pressure output between the minimum and maximum values will be linear, therefore software algorithms should be easy to derive. The feedback signal range on all selections is 0 to 5 VDC and is proportional to the output pressure range (Factory calibrated 0-15 psig ).

The PWP2.2 incorporates two valves and is not a constant bleed controller. Its branch exhaust flow and response time is not limited by an internal restrictor and is similar to its load rate. If power is lost, the PWP2.2 will not exhaust any air from the branch line. The PWP2.2 is ideal for long branch line runs, multiple actuators, and outside air dampers because of its 750 scirn capacity. The FAIL SAFE model, PWP2.2FS, will exhaust its branch line pressure to 0 psig on a power failure.

Manual override: Place the AUTO/MAN jumper in the MAN position. Using a small bladed screwdriver, increase or decrease the pneumatic output. Return AUTO/MAN to AUTO position when finished.