
FLOWSERVE®

# *Valtek Beta Positioners*

## *for Control Valves*

# *Valtek Beta Positioner Features*

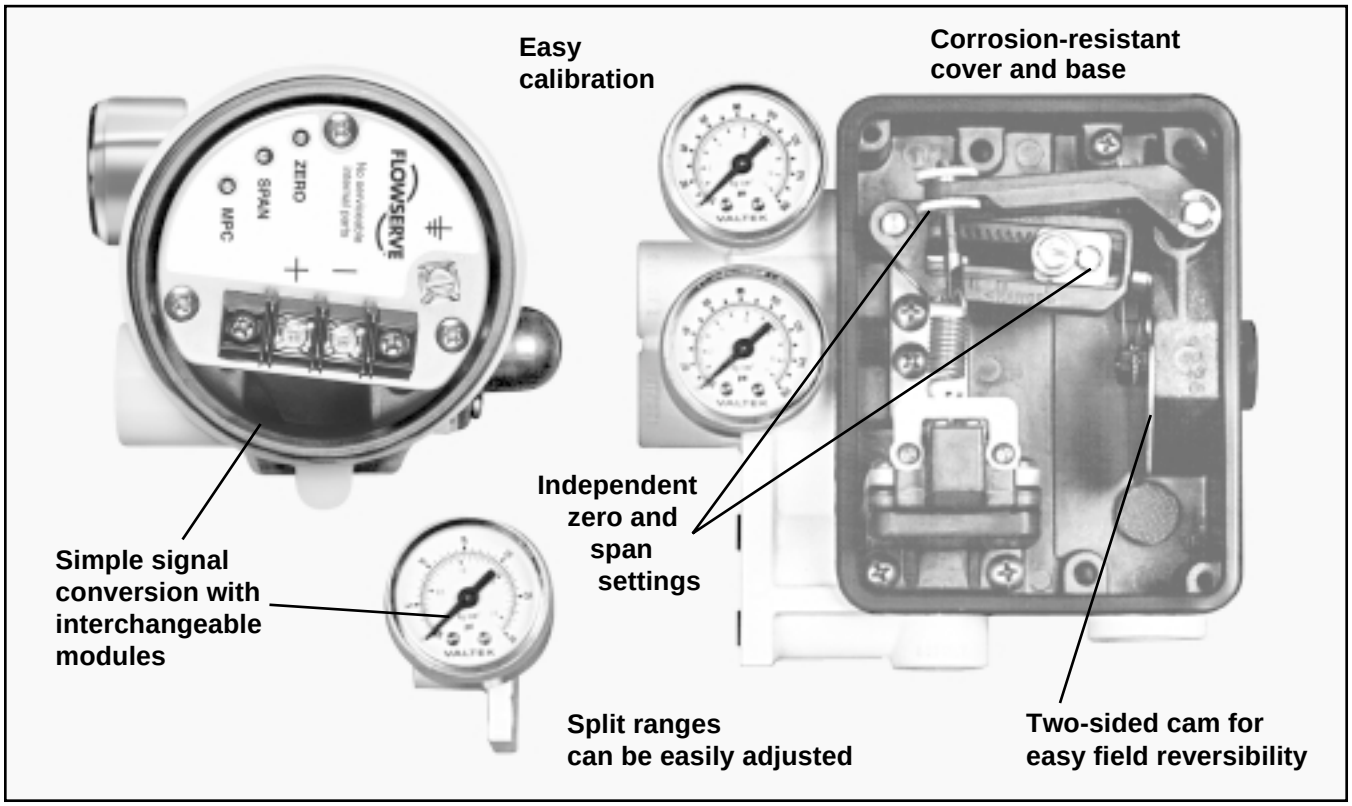



**Figure 1: Features of Beta Positioner with Pneumatic or Electro-pneumatic modules**


**Figure 2: Beta Positioner Mounted on Linear Actuator**

The Beta™ positioner is a single or double-acting, force-balanced instrument that provides fast, sensitive and accurate positioning of diaphragm or cylinder actuators. It is available with either a pneumatic module for air control signals or an electro-pneumatic (I/P) module for milliamp current control signals. Designed for high performance, this positioner is compact, field reversible and ruggedly built for reliability in severe industrial environments.

Because of its interchangeability with System 80 pneumatic and electro-pneumatic positioners, the Beta positioner can be mounted on either Valtek® linear or rotary actuators or other manufacturers' actuators. Two and three-way split ranges are available without special feedback springs.

The Beta positioner with NT 3000 module is intrinsically safe for class I, division I, groups A, B, C and D; class II, groups E, F and G, when installed with the appropriate energy limiting safety barriers. It is also explosion proof in class I, division I, groups B, C and D; class II, groups E, F & G. Ratings are certified by Factory Mutual and the Canadian Standards Association.

# *Valtek Beta Positioner Advantages*

| | |
|---|---|
| **P/P or I/P Signal Convertible** | Field conversion from one control signal to another is easily accomplished by replacing one module with the other. |
| **Minimum Pressure Cutoff** | When initiated, causes the NT 3000 module output to decrease to near zero when the input signal falls below a user-determined point. |
| **Shock and Vibration Resistant** | Beta positioners are designed with a high natural frequency coupled with pneumatic damping – unaffected by vibrations with acceleration up to 2 G's, and frequencies to 500 Hz. |
| **For Single or Double-acting Actuators** | Usable with either single or double-acting actuators (both linear and rotary) makes the modular Beta positioner versatile. |
| **Easily Field Reversed** | Action can be reversed in the field by simply turning the cam over, reversing the anti-backlash spring and changing the output tubing. |
| **Easy Calibration Procedures** | Calibration is easy due to minimal interaction between zero and span. Positioner adjustments are totally enclosed for protection and to discourage tampering. |
| **Split-Range Service** | Standard signal ranges are 4 - 20 mA for the electro-pneumatic (I/P) model and 3 - 15 psi for the pneumatic (P/P) model. Optional ranges are 10 - 50 mA and 6 - 30 psi, respectively. All models can be calibrated for a 2 or 3-way split range. |
| **Replaceable Coalescing Filter** (NT 3000 module only) | Removes particles that could clog transducer. Large orifice/air passages provide additional protection against clogging. |
| **Simplified Maintenance** | The positioner's simplicity, modular design and few parts, make maintenance quick and easy. |
| **No Regulator Required** | The Beta positioner with the pneumatic or I/P module is designed to withstand 150 psi at all ports, and is relatively insensitive to supply pressure fluctuation. |
| **Changeable Flow Characteristics** | Easily changed cam provides characterized flow feedback. |
| **Insensitive to Mounting Position** | Positioner can be mounted in any orientation without affecting performance. |
| **Output Gauge Helps Monitor Unit** | Indicates transducer output to the positioner, permitting easy verification of transducer and positioner calibration. |
| **Self-controlling Internal Regulator** (NT 3000 module) | Reduces pressure to 22 psi, eliminating need for external regulator. |
| **Corrosion Resistant Parts for Long Life** | Cover and base assembly are epoxy powder painted and continuously purged from the inside with instrument air. Internal working parts are constructed from 300 series stainless steel, anodized aluminum or Buna-N. |
| **Low Air Consumption** | Steady state air consumption is .25 SCFM @ 60 psi supply maximum (.31 SCFM with I/P module). |
| **High Air Flow Gain Model** | Standard on 200 square-inch actuators and above, optional on others. |
| **Oxygen Service Model** | Pneumatic models are available with Fluorosilicone diaphragms and O-rings, cleaned and assembled in a clean room. |

# *Valtek Beta Positioner*
# *NT 3000 Module Features*

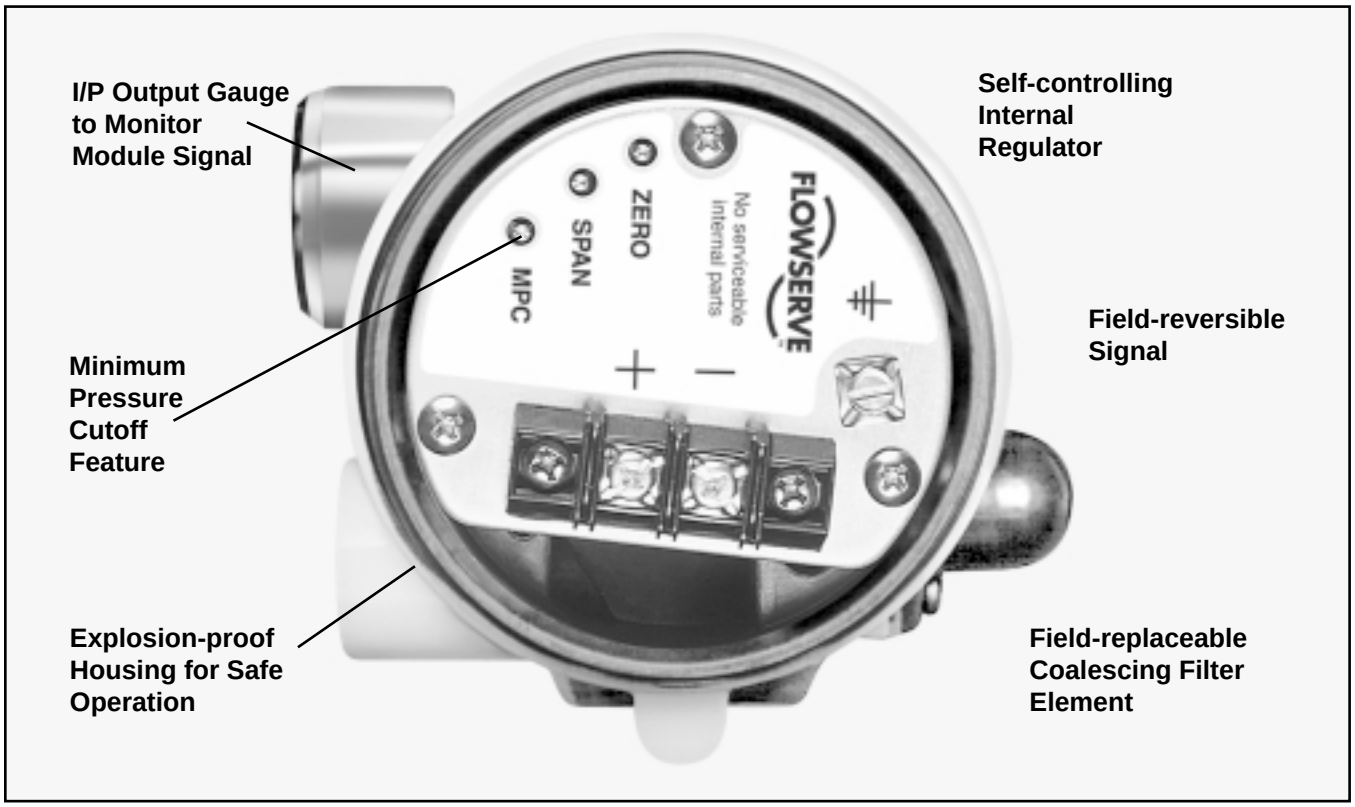



**Figure 3: Features of NT 3000 Electro-pneumatic Transducer Module**

## Minimum Pressure Cutoff

The NT 3000 electro-pneumatic module has a "Minimum Pressure Cutoff" (MPC) feature, which allows the user to preset the positioner so when the input signal falls below a user-adjustable current the pressure output falls rapidly to near zero psi, causing the valve to close. This feature is generally used when the service requires a tight shutoff or to prevent throttling near the valve seat.

The MPC is a simple, low-cost means of achieving tight shutoff, which traditionally has required less desirable methods. Traditional methods have included installing a three-way solenoid valve between the transducer and positioner; installing a block valve upstream of the control valve; or setting the positioner's zero adjustment to close the valve at a higher signal, adversely affecting positioner accuracy. These methods can be time consuming and expensive in addition to affecting positioner accuracy.

Beta positioners with the NT 3000 module are shipped with the minimum pressure cutoff feature disabled. It is easily enabled in the field by using the MPC potentiometer to adjust the cutoff point (for example, 4.1 mA).

## Coalescing Filter

A frequently encountered problem with most manufacturers' transducers is clogging in the air passageways. The NT 3000 module avoids this problem with its integral, field-replaceable coalescing filter that ensures a long-life and trouble-free operation. In addition to the dirt particles captured by traditional air filters, the NT 3000 coalescing filter traps oils and moisture from the supply air.

## I/P Output Gauge

The NT 3000 module has an output gauge to help monitor the process system. The gauge with its 0 to 160 psi (0 to 11 kg/cm$^2$) scale can help make troubleshooting a process loop simple. Controller output signal vs. module output is easily verified using this gauge. On-site visual maintenance is also simplified using the output gauge.

# Valtek Beta Positioner
## Positioner Operation

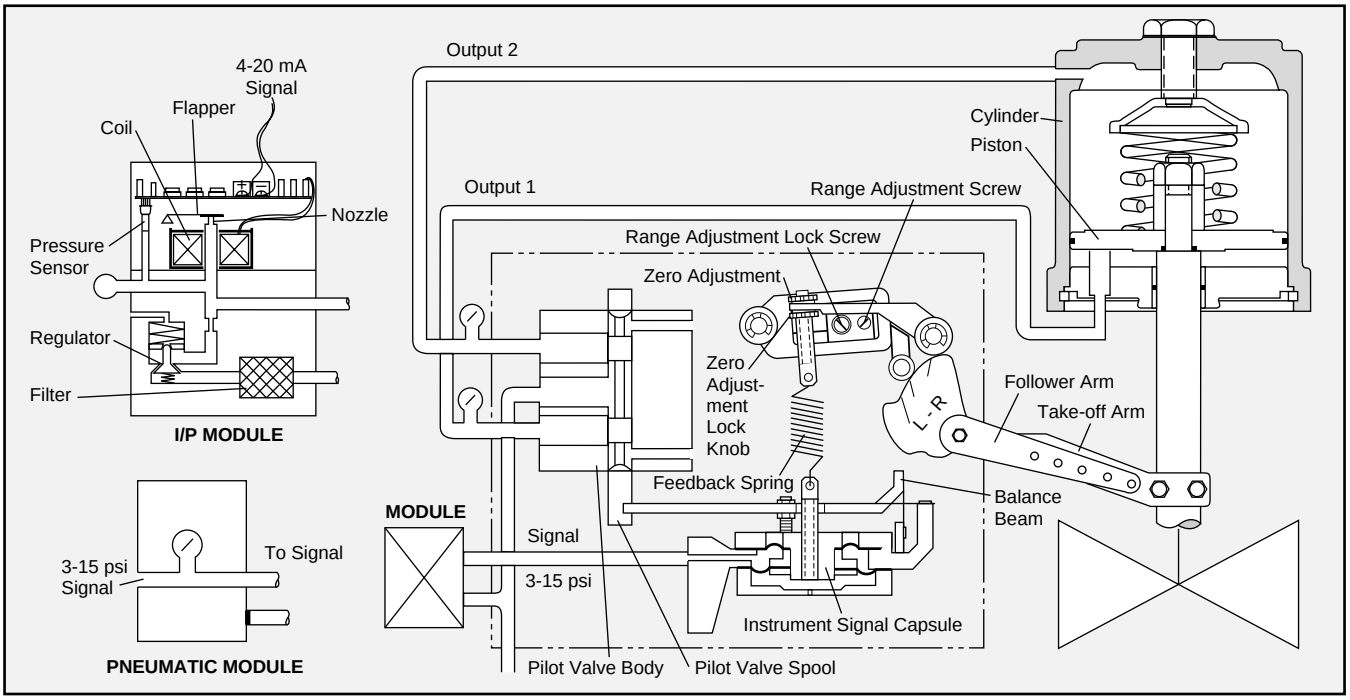



**Figure 4: Positioner Schematic for Air-to-Open (Retract)**

The Beta positioner is a force-balanced instrument. Figure 4 shows a Beta positioner, with either a pneumatic or electro-pneumatic module, installed on a double-acting actuator for air-to-open action. Positioning is based on a balance of two forces; one proportional to the instrument signal and the other proportional to the stem position.

With the NT 3000 model, the current signal is first converted to a 3-15 psi air signal. For the pneumatic model, the 3-15 psi signal is passed directly into the positioner. The transducer receives an electric input signal and converts it to an output proportional to the input. The supply pressure is filtered and regulated in the transducer by a filter element and an internal regulator.

The output of the transducer is controlled by a feedback loop consisting of a pressure sensor, electromagnetic pressure modulator and circuit board. The pressure modulator consists of a stiff flapper that is attracted by the electromagnet to a nozzle. The nozzle-flapper spacing determines the transducer output.

Based on the difference between the input and the output measured by the pressure sensor, the circuit board sends a current to the pressure modulator that adjusts the nozzle-flapper spacing to provide the correct output.

The detailed sequence of positioner operations are as follows: An increase in the instrument signal forces the instrument signal capsule and balance beam downward. This motion of the balance beam also pulls the pilot valve spool downward from its equilibrium position. This opens the pilot valve ports, supplying air to port 1 and exhausting air from port 2. This causes the actuator piston to move upward.

This upward motion of the piston is transmitted back to the positioner through the feedback linkage and cam resulting in the spring being stretched proportionally to the valve position. The piston continues to stroke upward until the force in the feedback spring increases sufficiently to counter the force generated by the instrument signal capsule. At this point, the balance beam and spool begin to return to their equilibrium position. As the valve spool ports start to close, the air flow rate to the actuator is decreased.

After the piston has reached the required position, the feedback spring tension force will equal the force generated in the instrument signal capsule. The balance beam and instrument signal capsule will remain in their equilibrium positions with no air flowing to the actuator until a change in the instrument signal is made.

A decrease in the instrument signal reverses the described actions causing a proportional downward movement of the actuator piston and stem.

# *Valtek Beta Positioner*
# *Specifications and Performance*

## Table I: NT 3000 Electo-pneumatic Transducer Module Specifications

| Specification | Pneumatic Module | NT 3000 Transducer Module |
|---|---|---|
| Input signal range: | 3-15 psi, 2 or 3-way split range; 6-30 psi, 2 or 3-way split range; 4-way split range | 4-20 and 10-50 mA with 2 or 3 and 4-way split range |
| Supply pressure | 30 psi to 150 psi | Same |
| Ambient temperature limits | Standard model: -20° F to +185° F<br>Ext. temp. model: -50° F to +250° F | Standard model: -20° F to +180° F<br>Ext. temp. model: -40° F to +180° F |
| Connections | Supply, instrument and output: 1/4-inch NPT; Gauges: 1/8-inch NPT | Signal: 1/2-inch NPT elect. conduit;<br>Output: 1/4-inch NPT; Gauges: 1/8-inch NPT |
| Standard materials | Stainless steel, anodized aluminum, nickel-plated steel, epoxy powder-painted steel and Buna-N | Same |
| Loop Load | N/A | 5.3 volts + 5 ohms (270 ohms at 20 mA) |
| Hazardous Location Approvals<br>(FM and CSA approved) | N/A | Intrinsically safe: Class I, Division 1, Groups A, B, C, D; Class II, Groups E, F, G<br>Explosion-proof: Class I, Division 1, Groups B, C, D; Class II, Groups E, F, G<br>Non-incendive: Class I, Division 2, Groups A, B, C, D, F, G |
| Net weight | 3 lbs. | 5.5 lbs. |

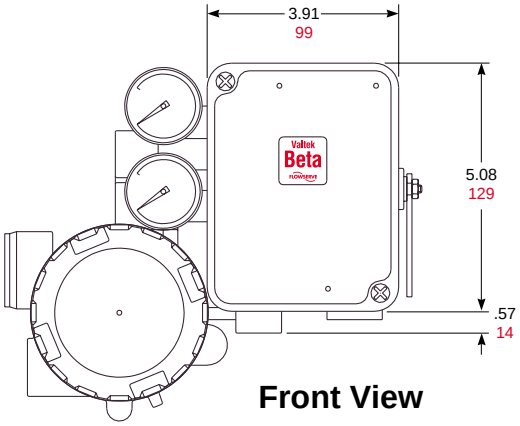
## Table II: Beta Positioner Performance*

| | | Pneumatic Module | NT 3000 Module |
|---|---|---|---|
| **Independent Linearity –** Maximum deviation from a best fit straight line | | ±1.0% F.S. | ±1.0% F.S. |
| **Hysteresis –** Maximum position error for the same value of input when approached from opposite ends of the scale. | | 0.5% F.S. | 0.5% F.S. |
| **Repeatability –** Maximum variation in position for the same value of input when approached from the same direction. | | 0.2% F.S. | 0.2% F.S. |
| **Response Level –** Maximum change in input required to cause a change in valve stem position in one direction. | | 0.2% F.S. | 0.2% F.S. |
| **Dead Band –** Maximum change in input required to cause a reversal in valve stem movement. | | 0.3% F.S. | 0.3% F.S. |
| **Resolution –** Smallest possible change in valve stem position. | | .1% F.S. | .1% F.S. |
| **Steady State Air Consumption** @ 60 psi | | .25 SCFM | .31 SCFM |
| **Supply Pressure Effect –** Position change for a 10 psi supply pressure change. | | .05 % F.S. | .06% F.S. |
| **"Open-loop" Gain –** Ratio of cylinder pressure unbalance to instrument pressure change with locked stem. | | 300:1 psi/psi @60 psi | 400:1 psi/mA @60 psi |
| **Maximum Flow Capacity** @ 60 psi | | 11 SCFM | 11 SCFM |
| **Frequency Response –**<br>(With sinusoidal input of ±5% F.S. centered about 50% F.S.) | -6 dB Frequency<br>Phase Angle at -6dB | .8 Hz<br>-71° | .8 Hz<br>-71.1° |
| **Stroking Speed –** | Closed to open - | 2.3 in/sec. | 2.3 in/sec. |
| | Open to closed - | 1.3 in/sec. | 1.3 in./sec. |

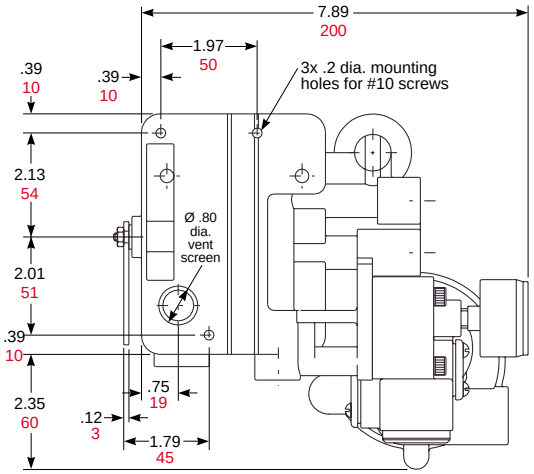
*Data is based on tests of the Beta positioner mounted on a double-acting cylinder actuator having a piston area of 25 square inches with a valve stroke of 1.5 inches and 60 psi supply pressure. Instrument signal was 3-15 psi with pneumatic module and 4-20 mA with I/P module.

# *Valtek Beta Positioner*
# *Dimensions with Electro-pneumatic (I/P) Module*

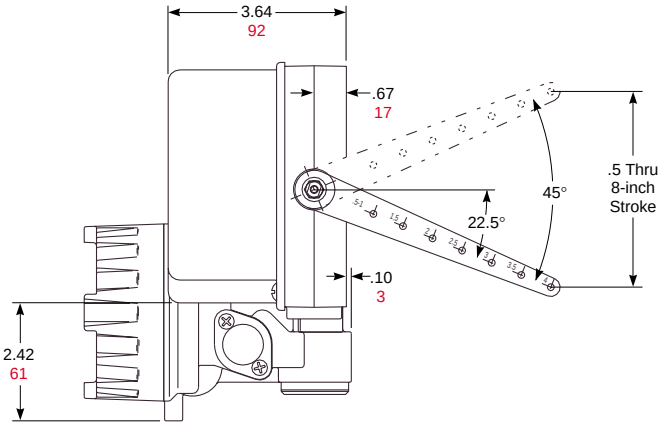
(inches / mm)



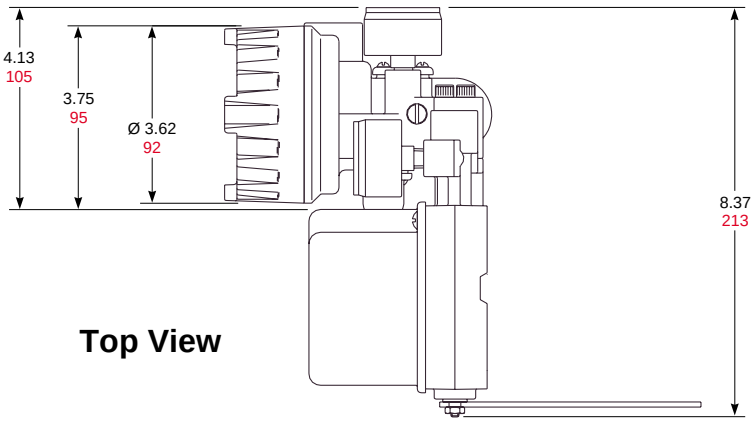

**Front View**




**Back View**



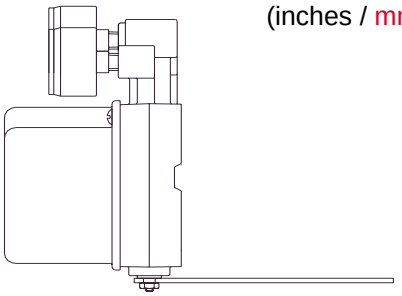

**Side View**




**Top View**

# *Valtek Beta Positioner*
# *Dimensions with Pneumatic (P/P) Module*

(inches / mm)



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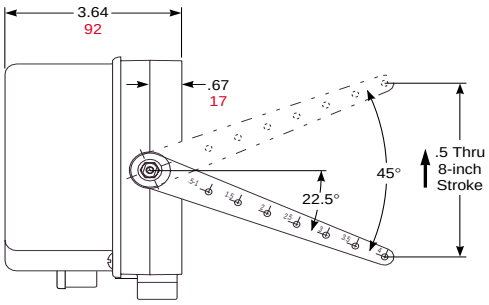


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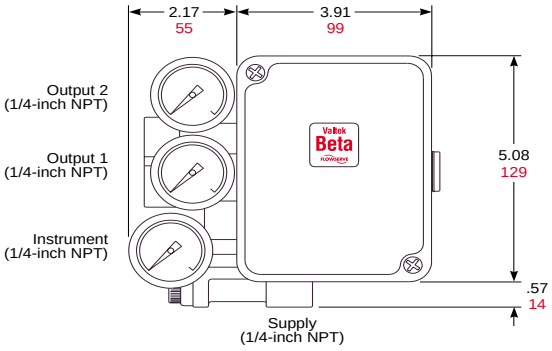
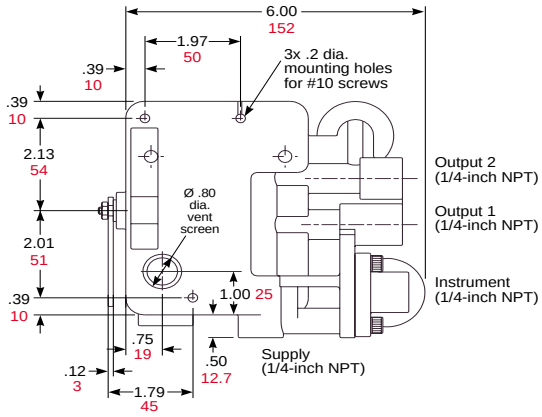



**Front View**




**Back View**

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