

AVID SMARTCAL INTELLIGENT POSITIONERS

NON-INCENDIVE INTRINSICALLY SAFE AND EXPLOSIONPROOF

Smart positioners for both spring-return and double-acting actuators on rotary and linear valves. Available with HART®, FOUNDATION Fieldbus™ and Profibus PA™ protocols.



FEATURES

- Non-contact valve position measurement via Hall effect sensor. Eliminates the need for drive arms, linkages and increases overall resolution, accuracy and reliability.
- 3-button interface and graphical LCD for auto-calibration and information display.
- Negligible bleed for reduced air consumption.
- Single button advanced auto-calibration.
- Valve speed adjustable via user control.
- Easy configuration of split range and reverse acting operation.
- High-flow spool valve option for larger actuator/valves. Eliminates the need for volume boosters in some applications.
- Standard 4-20 mA position feedback transmitter - HART® version only.
- Available with optional dry contact limit switches.
- Highly visible position indicator for rotary applications.
- Easily accommodates large stroke valves, such as knife gates.
- Fully compatible with AMS™ software and DTM.
- Rugged aluminum and stainless steel enclosures for maximum protection.
- Engineered resin enclosure is robust yet lightweight with exceptional chemical, UV and impact resistance.

GENERAL APPLICATION

SmartCal intelligent positioners provide a range of options for actuator calibration, position feedback, performance verification and control valve status intelligence.

TECHNICAL DATA

Enclosures

Engineered resin
Aluminum
Stainless steel

Communication protocol

HART®
FOUNDATION Fieldbus™
Profibus PA™



AVID SMARTCAL INTELLIGENT POSITIONERS

NON-INCENDIVE INTRINSICALLY SAFE AND EXPLOSIONPROOF

AGENCY APPROVALS

Non-incendive	
Area classification (NEC 500)	
All models	Class I, Division 2, Groups A, B, C & D; Class II & III, Division 2, Groups F & G/ T4 Ta = 85°C
Enclosure standards (ANSI/NEMA 250)	
HART	NEMA 4
Foundation Fieldbus / Profibus PA	NEMA 4, 4X
Intrinsically safe	
Area classification (NEC 500)	
HART	Class I, II & III, Division 1, Groups A, B, C, D, E, F & G/ T4 Ta = 85°C
Foundation Fieldbus / Profibus PA	Class I, II & III, Division 1, Groups A, B, C, D, E, F & G/ T4 Ta = 80°C
Enclosure standards (ANSI/NEMA 250)	
HART	NEMA 4 with approved IS barrier
Foundation Fieldbus / Profibus PA	NEMA 4, 4X with approved IS barrier
Area classification (ATEX/IEC/INMETRO)	
All models	Ex ia IIC T4
Enclosure standards (IEC)	
	IP66
Explosionproof	
Area classification (NEC 500 and 504)	
All models	Class 1, Division 1, Groups C & D; Class II & III, Division 1, Groups E, F & G; AEx d / Ex d 1, IIB T5
Enclosure standards (ANSI/NEMA 250)	
All models	NEMA 4X, 6P
Area classification (ATEX/IEC/INMETRO)	
	Ex d IIB T5 Ex d IIIC T85°C: II 2 D Ex d tb IIIC T85°C
Enclosure standards (IEC)	
	IP66



SmartCal on a typical linear diaphragm valve

NON-CONTACT POSITION FEEDBACK

Unlike conventional positioners, the SmartCal feeds back accurate valve position without the need for linkages, levers and rotary or linear seals. Position sensing is performed by a non-contact sensor, employing Hall effect magnetic principles. This enables the use of advanced control strategies where knowledge of valve position is used in predictive and other algorithms.

ROTARY CONTROL

There is no hysteresis within the positioner. This feature allows extremely accurate tracking of the control signal to within 0.1 mA. The non-contact position sensor is embedded within the SmartCal housing. An external magnetic module, attached to the output shaft of the actuator and housed in the indicator assembly, rotates about this sensor. An analog-to-digital converter interfaces between the sensor and a microprocessor. It rotates about this sensor generating position signal which is linearized to improve accuracy and linearity of the controlled position commanded by the instrument signal.

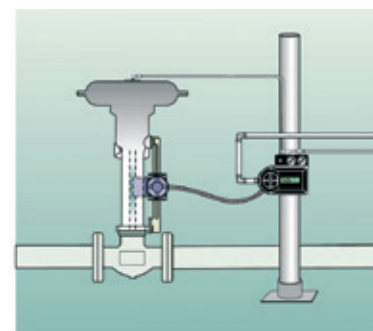
LINEAR CONTROL

The SmartCal non-contact proximity sensor provides a reliable measurement of valve stem position. A static slide-by trigger magnet, attached to the valve stem, is the only moving part. Output updating takes place twenty times per second.

The SmartCal is a fully digital positioner allowing for multiple control algorithms leading to better controllability for a large range of actuators and enables a wide range of diagnostic information to be generated.

REMOTE MOUNT CAPABILITY

The SmartCal has the ability to be mounted remotely (up to 15 m/50 feet) from the device it is controlling (Please consult about greater distances). This allows the positioner to be isolated if the control valve is located in either a high vibration or extremely corrosive environment.



Pipe mount SmartCal with remote and cable set

AVID SMARTCAL INTELLIGENT POSITIONERS

NON-INCENDIVE INTRINSICALLY SAFE AND EXPLOSIONPROOF

Negligible bleed

The SmartCal positioner is designed to consume the least possible amount of control air at steady state. This means lower process air consumption and reduced demand on instrument air compressors. To increase reliability, the SmartCal employs a patented lapped spool and floating sleeve design. This balanced construction relies on an air bearing which eliminates any metal-to-metal contact and results in a mean time between failures (MTBF) of 1,666,666.7 hours or 333.3 years.

Integrated position transmitter

The SmartCal is available with an integrated 4-20 mA position feedback transmitter. This cost-effective feature eliminates the need to buy externally mounted devices when knowledge of valve position is required remotely.

AutoCal intelligent calibration, local keypad

SmartCal intelligent positioners are equipped with a 3-button keypad for performing on-site electronic calibration. System calibration is performed easily, requiring only minutes to accomplish. It offers the operator a choice of linear, quick-opening or equal percentage modes. Split range and reverse acting operation are also configured simply.

The single button AutoCal feature allows simple zero and span adjustments as well as PID and transducer calibration. SmartCal positioners offer the option of HART®, FOUNDATION Fieldbus™ or Profibus PA.

On-board sensors/error detection

The SmartCal positioner has the capability to constantly monitor its own operation. If an error or failure condition occurs, it will be displayed on the local LCD. If the positioner is supplied with a HART® interface, the error codes are displayed on a hand-held terminal or PC maintenance station as shown below:

Err3 = Low input pressure
or clogged filter

Err6 = Calibration error

AVID
SmartCal HART Rev 1.02.00
25.5°C
R %PS 56.4 %SP 56.4
12.0mA ERR3

The alarm conditions and additional diagnostic capabilities are provided through a number of sensor elements in the transducer. A pressure switch detects low air pressure entering the positioner. In conjunction with a supply pressure switch, it can be identified whether this is caused by a restricted filter or a genuine low supply pressure condition. A 0-100% position feedback transmitter is available integrated within the positioner's electronics.

Local LCD display

The local LCD display provides a range of on-site diagnostic information. While the valve is being controlled by the positioner and the error signal is NOT zero, the displayed information will show both setpoint and position as a percentage. The range of values displayed is from 0.0% (fully closed) to 100% (fully open). The resolution displayed is in 0.1% increments although internal calculations are maintained more precisely.

AVID
SmartCal HART Rev 1.02.00
25.5°C
R %PS 56.4 %SP 56.4
12.0mA ACAL

PID control

The SmartCal uses proportional, integral and derivative functions, making it a true PID servo system. By combining intelligence based on present, past and the prediction of future events, the SmartCal's controller is able to minimize errors and provide a precise control response.

Autotuning

Tuning, or setting of the PID functions, is carried out automatically by the microprocessor within the SmartCal. This eliminates complex and time-consuming manual procedures.

HART® protocol

The SmartCal positioner responds to HART® commands for ease of calibration and provides intelligence for the control valve through a microprocessor-based diagnostic system utilizing the HART® protocol.

FOUNDATION Fieldbus™ protocol

The SmartCal also features the FOUNDATION Fieldbus™ communication protocol, is an industry proven international standard (IEC 61158) designed for use in the process industry. Its features include multi-drop capabilities (as many as 32 devices per segment), extended trunk length, and single loop integrity. It also offers control in the field, power and communications on a shielded twisted pair network and compatibility with intrinsically safe networks.

A key feature of the FF protocol is the ability to select where control of the process is situated – in the host, in the field or in various combinations of both locations.

Profibus PA™ protocol

The SmartCal also features the Profibus PA™ communication protocol. Similarly to the Foundation Fieldbus devices, Profibus PA™ (Process Automation) physical layer confirms to the IEC61158-2 international industry proven standard allowing for multi-drop communication to 32 devices per segment and extended trunk length. The SmartCal is an intrinsically safe positioner utilizing single, twisted pair shielded cable for power and communication. Functional advantages include transmission reliability, self-test functions, diagnostic, distributed intelligence, local and remote auto-calibration. To simplify integration of SmartCal provides GSD (General Station Description) containing key device data as well as EDD (Electronic Device Description) and DTM (Device Type Manager).

AVID SMARTCAL INTELLIGENT POSITIONERS

NON-INCENDIVE INTRINSICALLY SAFE AND EXPLOSIONPROOF

SMARTCAL INTELLIGENT POSITIONERS WITH HART®, FOUNDATION FIELDBUS™ AND PROFIBUS PA NETWORK CAPABILITIES

Proven, Interoperable solutions even in the Harshest Environments

The SmartCal positioner series has been successfully used for more than 15 years in many challenging and diverse applications in industries such as, Oil and Gas, Chemical, Power, Pulp and Paper and Sugar and Ethanol. Although it has a proven track record, is constantly improving the SmartCal line of positioners. Recent developments have enhanced the SmartCal electronics robustness and performance even when submitted to vibration and EMI. In the mechanical arena, an explosion proof solution and stainless steel housing option is now available. Software upgrades ensure the SmartCal is up to date with the most recently released industry standards, like the FF's ITK 6.0.1 (one of the first in the market) and the SmartCal is now compatible with the Profibus PA protocol.

Our goal is to provide the SmartCal user with a truly open, independent and interoperable solution able to interface with different host system brands and vendors.

In order to support the integration of SmartCal positioners in to the user's host system of choice, you can download all the necessary HART®, Fieldbus Foundation or Profibus files from the internet. Please visit:

- For HART:
 - EDD (available at <http://www.hartcomm.org> in the Product Catalog - Wired Products menu)
 - DTM (available at <http://www.fdtgroup.org> in the Product Catalog - Certified DTM's catalog)
- For Foundation Fieldbus
 - EDD (available at www.fieldbus.org in the End User Resources - Registered Products)
- For Profibus PA
 - EDD (available at <http://www.hartcomm.org> in the Product Catalog - Wired Products menu or at <http://www.fdtgroup.org> in the Product Catalog - Certified DTM's catalog)

Additional features and benefits

SmartCal provides intelligence to the control valve through microprocessor-based systems using the HART®, FOUNDATION Fieldbus™ and Profibus PA protocols respectively. These offer additional benefits in intelligent calibration, control and on-line diagnostics.

Intelligent calibration

Accurate measurement of valve stem position, input signal, actuator pressure, cycle time and cycle count data are recorded during normal operation, providing information for control valve signature generation. The positioner has a local LCD display which indicates valve position, set-point in percentage open, calibration status, alarms status and, for the FOUNDATION Fieldbus and Profibus PA versions, whether the SmartCal is in local or fieldbus control.

Intelligent control

Control valves are the most maintenance-intensive components commonly used in instrumentation and control systems. Internal parameter sensing within the valve positioner gives early warning of the need for maintenance.

On-line diagnostics

The SmartCal possesses the capability to predict rather than react to valve maintenance needs. Operating personnel gain a real time perspective on the state of control at the valve, including a view of operating integrity and emerging alert conditions. Timely information about each control valve's condition is quickly made available to the plant's production and maintenance engineers.

The principal advantage of online diagnostics is the ability to detect deviations from established patterns of behavior as they occur under actual operating conditions.

The SmartCal positioner's diagnostic capability observes the following parameters:

- Valve position vs. input signal.
- Actuator pressure vs. valve position.
- Airset filter outlet pressure.
- Confirmation of principal operating pressures within the positioner.
- Pressure generation within packing gland area.
- These enable the following to be diagnosed:
 - 'Stick-slip' detection.
 - Excessive static position error.
 - Low air supply pressure.
 - Clogged air supply filter.
 - Restricted transducer nozzle.
 - Transducer diaphragm air leak.
 - Non-functioning spool valve.
 - Calibration error

AVID SMARTCAL INTELLIGENT POSITIONERS

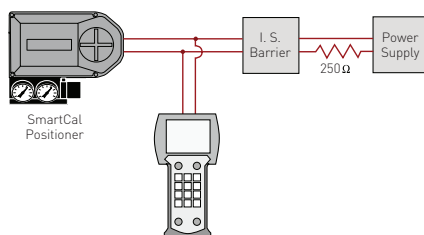
NON-INCENDIVE INTRINSICALLY SAFE AND EXPLOSIONPROOF

HAND-HELD TERMINALS

HART®

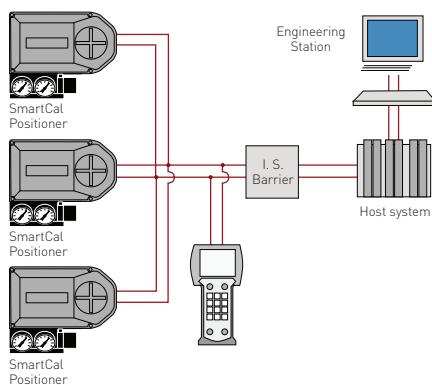
A single 4-20 mA SmartCal positioner with up to two master devices may be connected to each HART® loop. The primary master is generally a management system or a PC while the secondary unit can be a handheld terminal or laptop computer.

A standard hand-held HART® Communicator is available for making field operations as uniform as possible. Communication is accomplished by superimposing a high frequency signal on top of the 4-20 mA output signal. This allows simultaneous communication and output without comprising loop integrity.



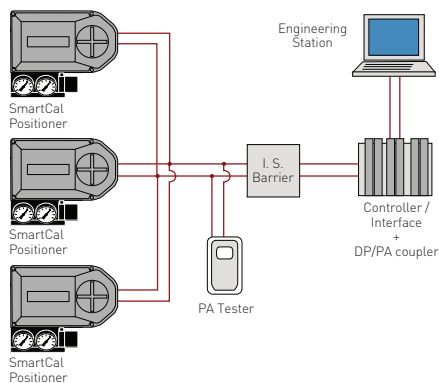
Foundation Fieldbus

Foundation Fieldbus compatible hand held terminals (like the Rosemount Field Communicator) can communicate with SmartCal positioners via the FF protocol.



Profibus PA

Similar to the Fieldbus Foundation, a Profibus PA tester, like the MTL FBT6-PA, can be used in hazardous areas. Several testers and bus analyzers are also available to be used directly from the DP network in the safe area.



AVID SMARTCAL INTELLIGENT POSITIONERS

NON-INCENDIVE AND INTRINSICALLY SAFE

TECHNICAL SPECIFICATIONS

Electrical	HART	FOUNDATION Fieldbus™	Profibus PA™
Input signal	4-20 mA	Two wire FOUNDATION Fieldbus™	Two wire Profibus PA™
Minimum voltage	9.0 V DC	9.0 V DC	9.0 V DC
Maximum voltage	30.0 V DC	32.0 V DC	32.0 V DC
Impedence	450 ohms at 20 mA	N/A	N/A
Reverse polarity protection	Yes	Polarity insensitive	Polarity insensitive
Pneumatic			
Supply pressure*	15 to 45 psi (low pressure option) 40 to 120 psi (high pressure option)		
Output flow rate	8.0 scfm at 25 psi 16.2 scfm at 90 psi		
Air consumption	0.03 scfm at 20 psi (low) 0.08 scfm at 90 psi (high)		
High flow option	40 scfm at 90 psig supply 10% to 90% non-condensing		
Technical			
Linearity	± 0.5% Rotary ± 1.0% Linear (for travel under 1.25		
Valve travel	Rotary: Minimum 45°, Maximum 95° Linear: Minimum 0.25		
Hysteresis	0.2% of span		
Repeatability	0.2% of span		
Environmental			
Operating temperature	-40°F to +185°F [-40°C to +85°C]		
Thermal coefficient	3% / 100°C		
Mechanical			
Connections	Pneumatic: ¼" BSP (F) (¾" BSP (F) for High Flow version) (NPT optional) Electrical: M20, ½" NPT (F) optional		
Materials of construction	Enclosure: Nylon, glass filled Cover gasket: Silicone Pneumatic manifold: Aluminum anodized die cast zinc Pneumatic seals: NBR		
Weight	3.27 Kg (7.2 pounds)		
Optional features			
Airset	Filter regulator combo with 5 micron filter element		
Limit switches	Two SPST hermetically sealed switches (rated for 2 A at 24 V DC)		
Feedback transmitter	4-20 mA output (loop powered) HART only		

* As required by actuator for proper control

NON-INCENDIVE AND INTRINSICALLY SAFE

114
[4.50]

28
[1.12]

22.3
[.88]

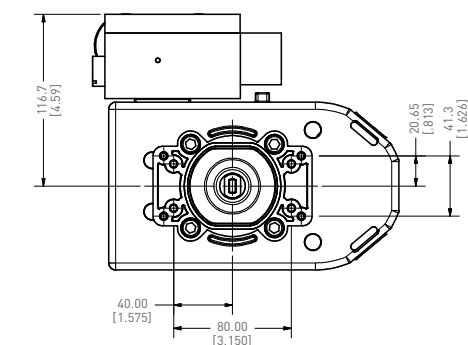
95.1
[3.75]

11.05 A/F
[0.435]

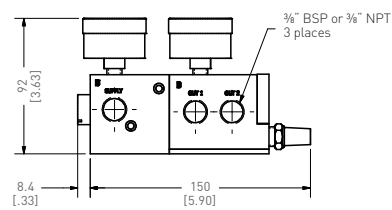
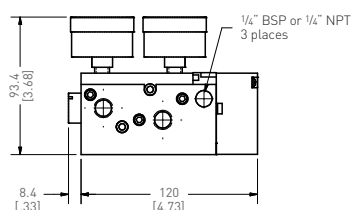
16 mm Ø

208
[8.20]

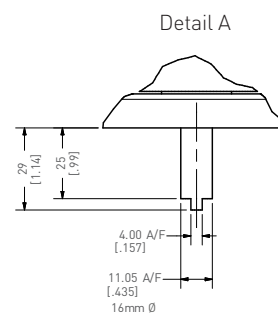
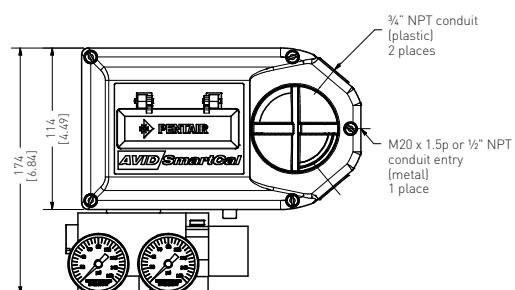
M5 x 0.8p or 10-32 UNF
Hex head screws
4 places



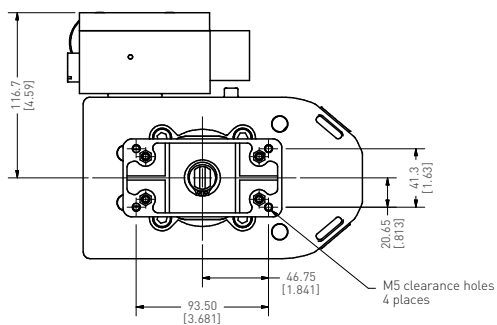
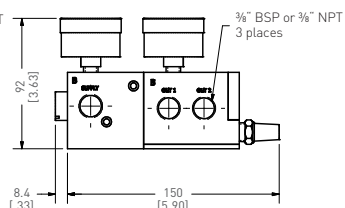
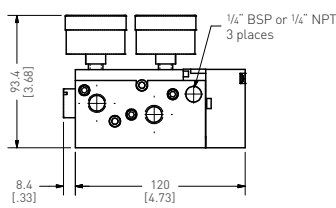
High flow



Dimensions in inches, metric dimension (mm) in parentheses



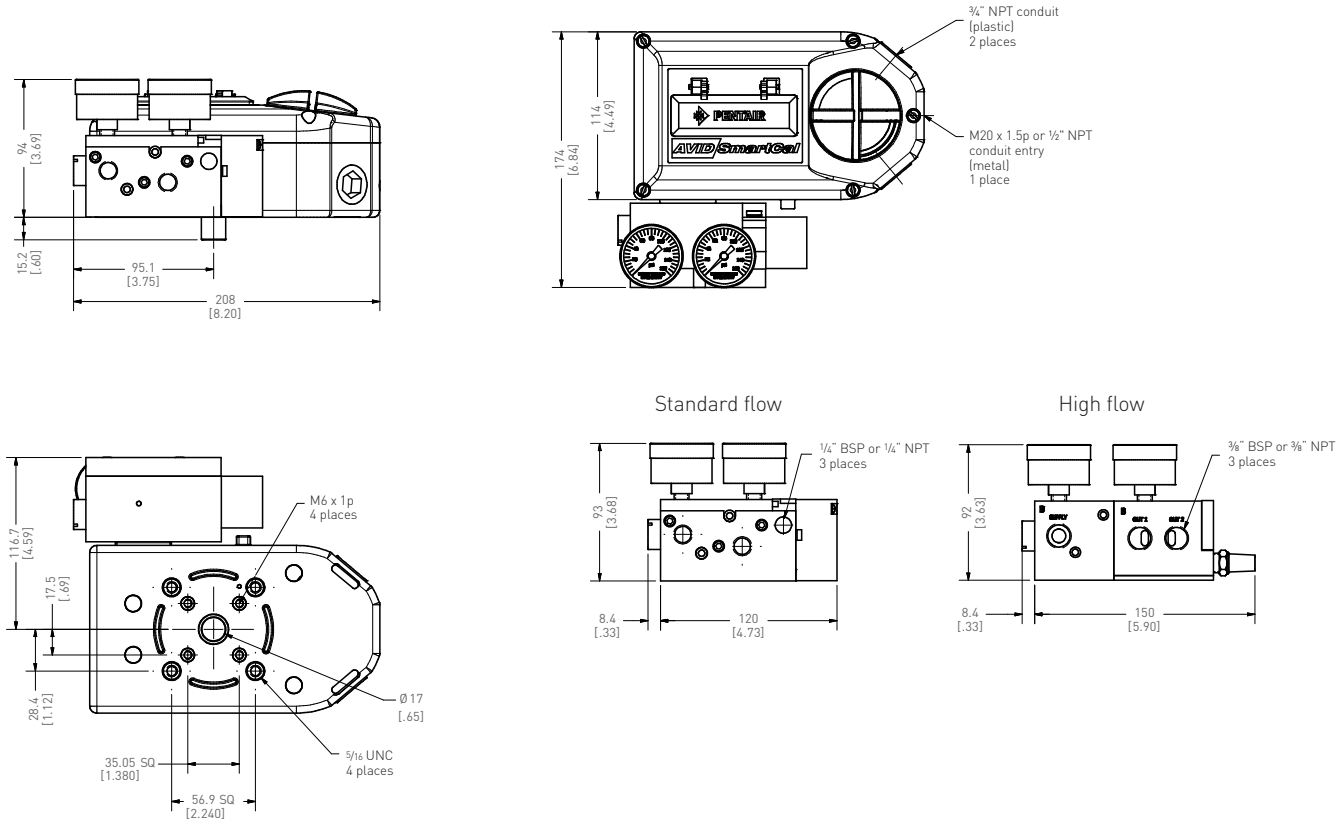
High flow



Dimensions in inches, metric dimension (mm) in parentheses

AVID SMARTCAL INTELLIGENT POSITIONERS
NON-INCENDIVE AND INTRINSICALLY SAFE

DIMENSIONS - LINEAR CONTROL



Dimensions in inches, metric dimension (mm) in parentheses

AVID SMARTCAL INTELLIGENT POSITIONERS

EXPLOSIONPROOF

TECHNICAL SPECIFICATIONS

COMMON ELECTRICAL CONNECTIONS			
Electrical	HART	FOUNDATION Fieldbus™	Profibus PA™
Input signal	4-20 mA	Two wire FOUNDATION Fieldbus™	Two wire Profibus PA™
Minimum voltage	9.0 V DC	9.0 V DC	9.0 V DC
Maximum voltage	30.0 V DC	35.0 V DC	35.0 V DC
Impedence	450 ohms at 20 mA	N/A	N/A
Reverse polarity protection	Yes	Polarity insensitive	Polarity insensitive
Pneumatic			
Supply pressure*	15 to 45 psi (low pressure option) 40 to 120 psi (high pressure option)		
Output flow rate	8.0 scfm at 25 psi 16.2 scfm at 90 psi		
Air consumption	0.03 scfm at 20 psi (low) 0.08 scfm at 90 psi (high)		
High flow option	40 scfm at 90 psig supply 10% to 90% non-condensing		
Technical			
Linearity	± 0.5% Rotary ± 1.0% Linear (for travel under 1.25		
Valve travel	Rotary: Minimum 45°, Maximum 95° Linear: Minimum 0.25		
Hysteresis	0.2% of span		
Repeatability	0.2% of span		
Environmental			
Operating temperature	-40°F to +185°F [-40°C to +85°C]		
Thermal coefficient	3% / 100°C		
Mechanical			
Connections	Pneumatic: ¼ Electrical: ½		
Materials of construction	Enclosure:	Aluminum Stainless steel	
	Cover gasket:	Silicone	
	Pneumatic manifold:	Anodized aluminum and 316 stainless steel	
	Pneumatic seals:	NBR	
Weight	7.2 pounds		
Optional features			
Airset	Filter regulator combo with 5 micron filter element		
Limit switches	Two SPST hermetically sealed switches (rated for 2 A at 24 V DC)		
Feedback transmitter	4-20 mA output (loop powered) HART only		

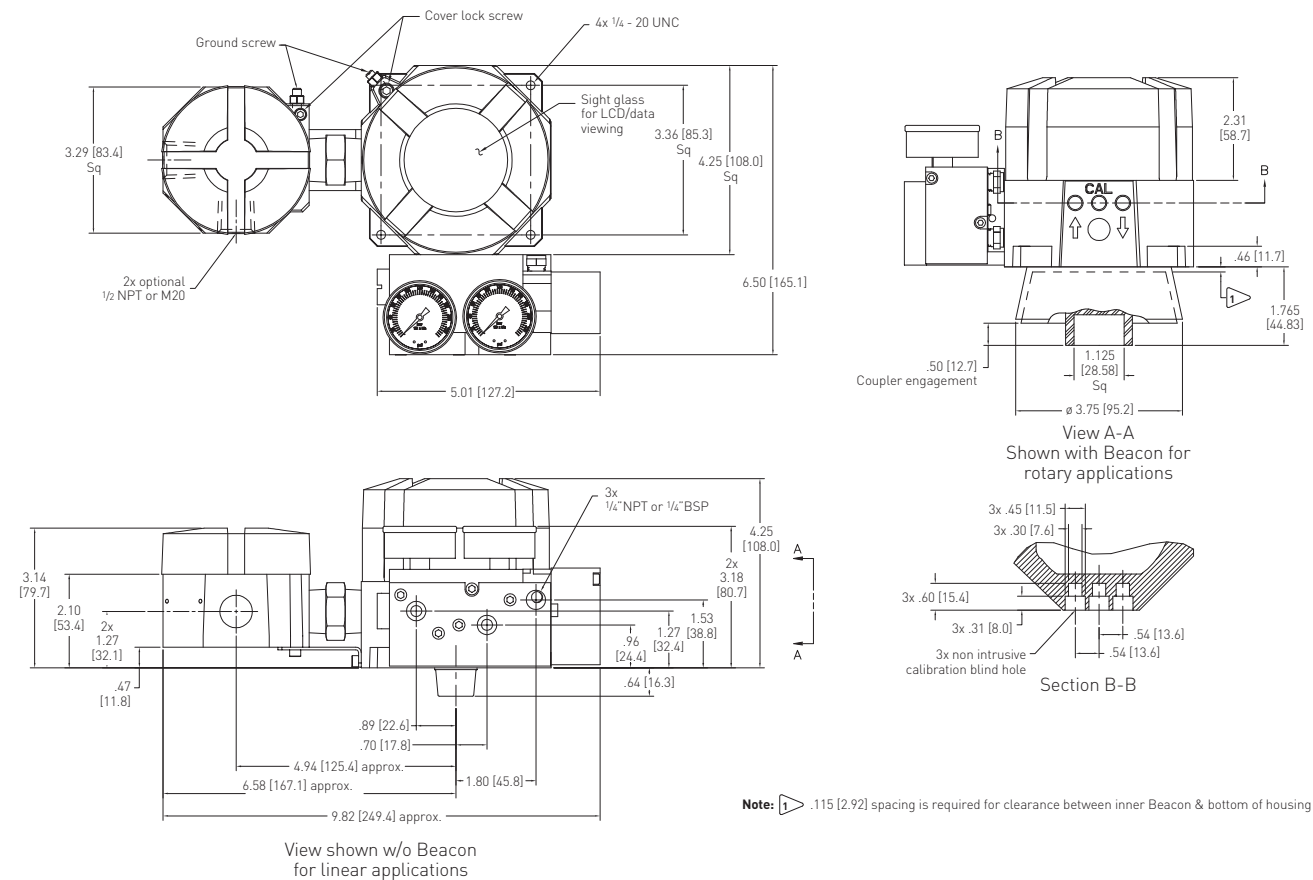
* As required by actuator for proper control



AVID SMARTCAL INTELLIGENT POSITIONERS

EXPLOSIONPROOF

DIMENSIONS - ROTARY CONTROL / LINEAR CONTROL



Dimensions in inches, metric dimension (mm) in parentheses

Note: Product shown is standard flow variant

AVID SMARTCAL INTELLIGENT POSITIONERS

SELECTION GUIDE

Base Model														
SM	AVID SmartCal Positioner													
Area Clasification														
G Non- Hazardous / General Purpose														
I Intrinsically Safe														
X Flameproof / Explosionproof														
Material of Construction														
R Resin														
A Aluminium														
S 316 Stainless Steel														
Application														
0 General Purpose - HART (Engineered resin only)														
F Foundation Fieldbus														
P Profibus PA														
Conduit Entry														
1 ½														
2 M20														
Mounting & Remote Options														
D Direct Mount Engineered Resin Housing														
X Direct Mount Explosion-Proof Housing														
R Remote Mount Housing (Aluminium MOD3 Type) ss or aluminum														
S Remote Mount Housing (316 Stainless Steel N4S Type) ss or aluminum														
Bracket Type														
D Modmount Metric - Engineered Resin Enclosure														
E Modmount Imperial-Engineered Resin Enclosure														
J Modmount Metric & 'J3' Electronics-Engineered Resin Enclosure														
K Modmount Imperial & 'J3' Electronics-Engineered Resin Enclosure														
M Direct mount style (MRP/79U)- Aluminum and Stainless Steel enclosure														
N Bracket kits for all other actuators - Al and SS enclosure - Consult Factory														
Switch Options														
0 None fitted														
1 One K-Block Sensor (Engineered Resin Elclosure only)														
Manifold Options														
B BSP Ports														
N NPT Ports														
X BSP Ports & Closed Loop Breathing														
Y NPT Ports & Closed Loop Breathing														
Flow Type														
0 Standard Flow - ¼" Ports (Aluminum Manifold)														
P Standard Flow - ¼" Ports (Aluminum Manifold & SS Gauges)														
S Standard Flow - ¼" Ports (316 Stainless Steel Manifold & SS Gauges)														
H High Flow - ⅜" Ports (Aluminum Manifold)														
Q High Flow - ⅜" Ports (Aluminum Manifold & SS Gauges)														
T High Flow - ⅜" Ports (316 Stainless Steel Manifold & SS Gauges)														
Certification														
0 Non Hazardous														
A ATEX														
I IECEX														
F North American														
Revision														
R* Internal Revision Number														
SM	-	X	S	F	2	D	D	0	B	-	0	A	R1	= Model Number SM-XSF2DD0B-0AR1