SMART PRESSURE TRANSMITTER

For Differential/Gauge/Absolute/High Pressure Measurement

Application Areas:
- Nuclear
- Water & Wastewater
- Chemicals
- Petrochemical
- Oil & Gas
- Pulp & Paper
- Food & Beverage,
- Pharmaceutical
- Power
- Renewable Energy
- Alternate Fuel

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“Autrol America Inc. (AAI) range of transmitters includes a complete range of “intelligent” high performance transmitters for Temperature, Gauge, Absolute, Vacuum & Differential pressure measurements for standalone monitoring and/or closed loop control applications. These “intelligent” microprocessor-based “Smart” transmitters features a two-wire loop powered 4 to 20mA current outputs with “Digital” HART as standard (Foundation Fieldbus optional) communication(s) for seamless integration with a host control system such as DCS, PLC, SCADA, AMS, PDM and/or a local Hand Held Communicator (HHC).”

Description of Product

The APT3100 series of smart transmitters have excellent stability, high accuracy and include features that facilitate easy installation, start up and minimum maintenance thereby lowering process downtime and overall cost of ownership in the long run.

Autrol transmitters are equipments with analog (4/20mA - 2 wire) and digital (HART or Foundation Fieldbus) communication protocols for seamless integration with a host Control System such as DCS, PLC, SCADA, AMS, PDM and/or Hand Held Communicator (HHC). Through Digital HART Protocol one can easily acquire process measured variable, configure and modify its various Parameters (Range, Tag Name and Damping, Transfer Function, Trimming).

These transmitters are equipped with an automatic temperature compensation function integrated into its advanced signal processing circuitry to ensure high reliability and performance corresponding to change of ambient temperature.

Features

- Superior Performance
- High Reference Accuracy : +/-0.075% of Calibrated Span
- Long-Term Stability
- High Rangeability (100 : 1)
- Flexibility
- Data Configuration with HART Configurator
- Zero Point Adjustment
- Reliability
- Continuous Self-Diagnostic Function
- Automatic Ambient Temperature Compensation
- Fail-mode Process Function
- EEPROM Write Protection
- CE EMC Conformity Standards (EN5081-2, EN50082-2)

Function

- Flexible Sensor Input : DP, GP, AP, Vacuum
- Various Output : 4 ~ 20mA, Digital Signals
- Setting Various Parameters : Zero/Span, Trim, Unit, Fail-mode, etc
- Self Diagnostic Function : Sensor, Memory
- A/D Converter, Power, etc
- Digital Communication with HART protocol
- Explosion-proof Approval & Intrinsic Safety Approval : KOSHA, KTL, CSA, FM, ATEX
TRUE SMART

The heart of Autrol smart transmitter is a microprocessor-based high performance module. In addition, each transmitter is ambient temperature characterized using state-of-art technologies to ensure maximum transmitter accuracy and minimized drift over a wide range of operating temperatures.

On integrated sensor models such as in APT3100 series transmitters the characteristics data of its sensor are stored in internal non-volatile EEPROM to minimize measuring error. On non sensor transmitter models such as ATT2100 temperature transmitters, it has a linearization table built in wherein user can modify the various necessary values in field per the added temperature sensor (RTD or T/C) characteristics to get better accuracy from the overall measurement system. Its integral microprocessor module then automatically converts the required value referring to the customized linearization table.

All transmitters include advanced self diagnostic functions for detecting any malfunctions of sensor and/or fault of A/D converter, internal memory and microprocessor. All diagnostic/error status is transmitted to a connected Master by analog current signal (fail mode current 3.75mA or 22mA) or digital HART (or FF) communication.

The transmitters have Last Value Status (L V S) function for safety of instrumentation. When the sensor input occurs in abnormal status, output is fixed to the previous value and when the recovery to normal status, output is updated to the current value. If abnormal status of sensor is being continued during the defined interval, the fault is recognized as a sensor failure & reported accordingly for corrective action.

OPEN ARCHITECTURE

Using a Device Master (AMS, PMD etc) or a hand-held terminal, PC configuration program or HART Compatible DCS, PLC or SCADA the user can change, modify and review parameters of smart transmitter through HART communication. There functions provide convenience for your calibration and maintenance practice.

FIELD PROGRAMMABLE

All Autrol transmitter have a fully programmable front panel from which users can directly input values (e.g. range, zero/span, sensor type, thermocouples, RTD and mV and automatic temperature compensation) to reduce cost of installation and commissioning eliminating need of a additional configuration tools.

Stable Measurable Accurate Reliable Transmitters
Electronics Module

The Electronics module consists of a circuit board sealed in an enclosure. There is a MCU module, a power module, an analog module, an LCD module and a terminal module included within the transmitter. All circuit boards are tropicalised suitable for hot and humid, and damp and cold climates. The MCU modules acquire the digital value from the analog module and apply correction coefficients selected from EEPROM. The output section of the power module converts the digital signal to a 4~20 mA output. The MCU module communicates with the HART-based Configurator or Control Systems such as DCS. The Power modules have a DC-to-DC Power conversion circuit and an Input/output isolation circuit. An optional LCD module plugs into the MCU module and displays the digital output in a user-configured unit.

Sensor Inputs

The model APT3100-D, G, H is available in a differential pressure sensor of a capacitance type. The capacitance pressure sensor measures differential and gauge pressure and is commonly used in flow and level applications. Both sides of the capacitance sensor transmit process pressure from the process isolators to the sensor.

The model APT3100-A is available in an absolute pressure sensor of a piezo-resistive type and measures absolute pressure.

The sensor module converts the capacitance or the resistance to the digital value. The MCU module calculates the process pressure based on the digital value.

The sensor modules include the following features:
- +/-0.075% accuracy, the most accurate sensor in the industry.
- The software of the transmitter compensates for the thermal effects, improving performance.
- Precise Input Compensation during operation is achieved with temperature and pressure correction coefficients that are characterized over the range the transmitter and stored in the sensor module EEPROM memory.
- EEPROM stores sensor information and correction coefficients separately from MCU module, allowing for easy repair, reconfiguration and replacement.

Basic Setup

APT3100 Pressure transmitter can be easily configured from any host that supports the HART protocol.
- Operational Parameters
- Operational Parameters.
- 4~20mA Points (Zero/Span)
- Engineering Units
- Damping Time: 0.25 ~ 60 sec
- Tag: 8 alphanumeric characters
- Descriptor: 16 characters
- Message: 32 characters.
- Date: day/month/year

Calibration and Trimming

- Lower/Upper Range (zero/span)
- Sensor Zero Trimming
- Zero Point Adjustment
- DAC Output Trimming
- Transfer Function
- Self-Compensation

Self-Diagnosis and Others

- CPU & Analog Module Fault Detection
- Communication Error
- Fail-mode Handling
- LCD Indication
- Temperature Measurement of Sensor Module

For application support, quotations, pricing and lead times please contact our sales department directly at sales@autroltransmitters.com. Additional details including product technical specifications can be found online at www.autroltransmitters.com
Range and Sensor Limits
Refer to Table 1

Zero and Span Adjustment Limits
• Zero and span values can be set anywhere within the range limits stated in Table 1.
• Span must be greater than or equal to the minimum span stated in Table 1

Output (Analog Current and Digital Data)
• Two wire 4~20mA user-configurable for linear or square root output, digital process value superimposed on 4~20mA signal, available to any host that conforms to the HART protocol

Power Supply & Load Requirement
• External power supply required
  Transmitters operate on 11.9 to 45 V dc.
  * 250 ohm load-- 17.4 Vdc
  * Up to a 550 ohm load -- 24 Vdc
  Max. Loop Resistance = (E - 11.9)/0.022
    (E = Power Supply Voltage)
• Supply Voltage
  11.9 ~ 45 Vdc -- operation
  17.4 ~ 45 Vdc -- HART Communications
  11.9 ~ 42 Vdc -- CSA Approval
• Loop Load
  0 ~ 1500 ohm – Operation
  250 ~ 550 ohm -- HART Communications

EMC Conformity Standards
• EMI (Emission) – EN50081-2:1993
• EMS (Immunity) – EN50082-2:1995

Update Time and Turn-On Time
• Time : 0.12 seconds
• Turn-On Time : 3 seconds

Failure Mode
• Fail High : Current ≥ 21.75 mA
• Fail Low : Current ≤ 3.75 mA

Storage Temperature
-40°C to 85°C (without condensing)

Process Temperature Limits
• (Range codes and approval codes may affect limits)
  -40°C to 120°C (-40 to 248 °F )

Isolation
• Input/output isolated to 500Vrms (707 Vdc)

Working Pressure Limits (silicone oil)
Model DP & GP 0 ~ 13.79 MPa ---------- # 3 ~ 8
Model GP 0 ~ 80.00 MPa ---------- # 9
Model HP 0 ~ 3.12 MPa ---------- # 4 ~ 7
Model AP 0 ~ 700 KPa ------- # 4
0 ~ 4000 KPa ------- # 5
0 ~ 7000 KPa ------- # 6

Hydrostatic Test Pressure
Model DP 3000 psi (20.7 MPa)
Model HP 6750 psi (46.5 MPa)
Model GP 2000 psi (13.8 MPa) -- # 3 ~ 8
11600 psi (80.0 MPa) --- # 9
11600 psi (80.0 MPa) --- # 0
Model AP 101.5 psi (700 KPa) --- # 4
580 psi (4000 KPa) --- # 5
1015 psi (7000 KPa) --- # 6

Burst Pressure
Model DP, GP & HP 10000 psi (68.9MPa)
Model AP 2000 psi (13.8MPa)

5 Digits LCD
• Expresses all pressure unit and flow unit in 5 digits.
• Select decimal place (0 to 4)
Physical Specifications

Wetted Materials
- Isolating Diaphragms ----316L SST, Monel, Tantalum, HAST-C
- Drain/Vent Valves -------316 SST, HAST-C
- Flanges and Adapters———316 SST, HAST-C
- O-ring ------------------Viton, PTFE

Non-wetted materials
- Fill Fluid ---------------Silicone oil or Inert fill
- Bolts -------------------Stainless Steel
- Electronics Housing -----Aluminum, Flameproof and Waterproof (IP67)
- Cover O-ring ------------Buna-N
- Paint -------------------Epoxy-Polyester or Polyurethane
- Mounting Bracket -------2-inch Pipe, 304 SST, Painted
- Carbon Steel with 304 SST U-bolt
- Nameplate ---------------304 SST

Electrical connections
- 1/2-14 NPT conduit with M4 Screw Terminals

Process Connections
- 1/4-18 NPT on 2.126 inch (54.0 mm) centers on flanges for Standard
- 1/2-14 NPT on Process Adapter (option) Refer to drawing in the last page

Weight
- 3.9 kg (excluding options)

KOSHA Approvals (KOSHA: Korea Occupational Safety & Health Agency)
- K1 Code:
  Flameproof for Class I, Zone 1: Ex d II C T6, IP67
  Ambient Temperature: -20 to 60 °C
  Max. Process Temperature: 80 °C
  Power Supply: Max. 45 Vdc
  Output: 4 to 20 mA + HART, Max. 22 mA

KTL Certification (KTL: Korea Testing Laboratory)
- K2 Code:
  Intrinsic Safety: Ex ia IIC T5
  Ambient Temperature: -20 to 60 °C
  Max. Process Temperature: Max. 100 °C
  Entity Parameter: Umax=40Vdc, IMAX=165mA, Pmax = 0.9W

FM (Factory Mutual explosion proof) Approvals
- F1 Code:
  Explosion proof for Class I, Division 1
  Groups A, B, C and D
  Dust-ignition proof for Class II, Division 1,
  Groups E, F and G
  Dust-ignition proof for Class II, Division 1
  “T6, see instruction for temperature code if process temperature above 85°C”
  Ambient Temperature: -20 to 60°C
  Enclosure: indoors and outdoors, NEMA Type 4X
  Conduit seal required within 18” for Group A only.
  Nonincendive for Class I, Division 2, Groups A, B, C & D
  Class II, Division 2, Groups E, F & G; and Class III, Division 1,
  Temperature Code T4
  Ambient Temperature: -20 to 60°C
  Enclosure: indoors and outdoors, NEMA Type 4X

ATEX Approvals
- E1 Code:
  CE0344 Ex II 2 G Ex d IIC T6 or T5
  Operating Temperature: -20°C ≤ Tamb ≤ +60°C
  T6 for process < 85°C; T5 for process < 100°C

Enclosure: Type 4x, IP66
Power Supply: 11.9 to 42 Vdc Max.
Output Signal: 4 to 20 mA + HART
Ambient Temp.: -20 to 60 °C

Additional details including product technical specifications can be found online at www.autroltransmitters.com.
SMART PRESSURE TRANSMITTER

APT3100

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General Specifications

1) APT3100 Pressure Sensor Range & URL

<table>
<thead>
<tr>
<th>Range Code</th>
<th>DP/GP/HP</th>
<th>Upper Range (URL) (KPa)</th>
<th>Lower Range (LRL) (KPa)</th>
<th>Calibrated Span (KPa)</th>
<th>Calibrated Span (KPa)</th>
<th>AP</th>
<th>Range (KPa)</th>
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<tbody>
<tr>
<td>2</td>
<td>0.075~1.5</td>
<td>1.5</td>
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<td>3</td>
<td>0.15~7.5</td>
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<td>0.15</td>
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<td>NA</td>
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<tr>
<td>4</td>
<td>0.373~37.3</td>
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<td>-37.3</td>
<td>0.373</td>
<td>-0.373</td>
<td>2~250</td>
<td>0~250</td>
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<td>5</td>
<td>1.865~186.5</td>
<td>186.5</td>
<td>-186.5</td>
<td>1.865</td>
<td>-1.865</td>
<td>10~1500</td>
<td>0~1500</td>
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<td>6</td>
<td>6.9~690</td>
<td>690</td>
<td>-690</td>
<td>6.9</td>
<td>-6.9</td>
<td>20~2500</td>
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<td>7</td>
<td>20.68~2068</td>
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<td>8</td>
<td>68.95~6895</td>
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<tr>
<td>9</td>
<td>200.8~20680</td>
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<tr>
<td>0</td>
<td>413.7~41370</td>
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<td>-41370</td>
<td>413.70</td>
<td>-413.70</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

2) Electrical Specifications

- Power Supply: 11.9 ~ 45 Vdc
- HART loop resistance: 250 ~ 550 ohm
- Output Signal: 4 ~ 20 mA dc/HART
- Isolation: 500 ms (707 Vdc)

3) Performance Specifications

- Reference Supply: ±0.075% of Span (0.1URL±Span ≤ URL)
- ±(0.025+0.005xURL/Span)% of Span (0.01URL±Span ≤ 0.1URL)

- Ambient Temperature: -40 ~ +85 °C
- LCD Meter Ambient Temp.: -30 ~ +80 °C
- Humidity Limits: 5% ~ 100% RH

- Process Temperature Limits: -40°C ~ +120 °C

- Power Supply Effects: ±0.005% of Span per Volt

- Static Pressure Effects: ±0.1% of URL per 7MPa (Zero Error)
- ±0.2% of Reading per 7MPa (Span Error)

- Mounting Position Effects: Zero Shift up to 350Pa No Span Effect

4) Physical Specifications

- Isolating Diaphragm: 316L SST
- Drain & Vent Valve: 316 SST (Adapter – Option)
- Flange & Adapter: 316 SST
- O-ring: Viton, PTFE
- Electronic Housing: Aluminum
- Bolts & Bolting Flange: 304 SST

- Process Connection Size: 1/4 - 18 NPT
- Electrical Connections: 1/2 – 14 NPT with M4
- Weight (excluding Option Items): 3.9 Kg
- Angle or Flat type
- Housing Class: Waterproof (IP67), 4X, IP66

5) Hazardous Location Certifications (option)

- Korea Standards Approval
- Overseas Standards Approval

- Flameproof Approval: Ex d IIC T6 (KOSHA)
- Intrinsic Safety Approval: Ex ia IIC T5 (KTL)
- CSA Explosion proof Approval
- FM Explosion proof Approval
- ATEX Flame proof Approval
## APT3100 SERIES - SMART PRESSURE TRANSMITTERS

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>D</th>
<th>F</th>
<th>H</th>
<th>G</th>
<th>A</th>
</tr>
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<tbody>
<tr>
<td>APT3100-D</td>
<td>Differential Pressure Transmitters (Static Pressure 13.79 MPa / 2000psi)</td>
<td>Y</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>APT3100-F</td>
<td>Flow Transmitters (w/pulse output, For General Purpose Area use only)</td>
<td>-</td>
<td>Y</td>
<td>-</td>
<td>-</td>
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<tr>
<td>APT3100-H</td>
<td>Flow Transmitters for High Line Pressure (Static Pressure 31.02 MPa / 4500psi)</td>
<td>-</td>
<td>-</td>
<td>Y</td>
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<tr>
<td>APT3100-G</td>
<td>Absolute Pressure Transmitters</td>
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### M SPAN (URL-LRL) SETTINGS ALLOWED

<table>
<thead>
<tr>
<th>CODE</th>
<th>APT3100-D</th>
<th>APT3100-F</th>
<th>APT3100-H</th>
<th>APT3100-G</th>
<th>APT3100-A</th>
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<tbody>
<tr>
<td>2</td>
<td>0.30 to 6 inH2O</td>
<td>0.30 to 6 inH2O</td>
<td>NA</td>
<td>0 to 6 inH2O</td>
<td>NA</td>
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<tr>
<td>3</td>
<td>0.6 to 30 inH2O</td>
<td>0.6 to 30 inH2O</td>
<td>NA</td>
<td>0.6 to 30 inH2O</td>
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<tr>
<td>4</td>
<td>1.5 to 150 inH2O</td>
<td>1.5 to 150 inH2O</td>
<td>1.5 to 150 inH2O</td>
<td>1.5 to 150 inH2O</td>
<td>10 to 1000 inH2O</td>
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<td>5</td>
<td>7.5 to 750 inH2O</td>
<td>7.5 to 750 inH2O</td>
<td>7.5 to 750 inH2O</td>
<td>7.5 to 750 inH2O</td>
<td>1.5 to 217 psIA</td>
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<td>6</td>
<td>1 to 100 psi</td>
<td>1 to 100 psi</td>
<td>1 to 100 psi</td>
<td>1 to 100 psi</td>
<td>3 to 362 psIA</td>
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<tr>
<td>7</td>
<td>3 to 300 psi</td>
<td>3 to 300 psi</td>
<td>3 to 300 psi</td>
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<tr>
<td>8</td>
<td>10 to 1000 psi</td>
<td>10 to 1000 psi</td>
<td>CF</td>
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<td>CF</td>
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<td>XX</td>
<td>Special</td>
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### MOUNTING - FLANGE SIZE/MATERIAL

<table>
<thead>
<tr>
<th>FLANGE/ADAPTERS</th>
<th>DRAIN/VENT</th>
<th>DIAPHRAGM</th>
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<tbody>
<tr>
<td>M11</td>
<td>316SSST</td>
<td>316LSSST</td>
</tr>
<tr>
<td>M12</td>
<td>316SSST</td>
<td>Hast-C</td>
</tr>
<tr>
<td>M13</td>
<td>316SSST</td>
<td>Monel</td>
</tr>
<tr>
<td>M14</td>
<td>316SSST</td>
<td>Tantalum</td>
</tr>
<tr>
<td>M21</td>
<td>Hast-C</td>
<td>Hast-C</td>
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<tr>
<td>M22</td>
<td>Hast-C</td>
<td>Monel</td>
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<tr>
<td>M23</td>
<td>Hast-C</td>
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### HAZARDOUS LOCATION CERTIFICATIONS

<table>
<thead>
<tr>
<th>CODE</th>
<th>General Purpose (IP67/ NEMA4X)</th>
<th>K0</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>K4</th>
<th>K5</th>
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<tr>
<td></td>
<td>General Safety Approval Ex d IIC T6</td>
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<td>Y</td>
<td>Y</td>
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<tr>
<td></td>
<td>KTL Intrinsic Safety Approval Exa IIC</td>
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<td>Y</td>
<td>Y</td>
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<tr>
<td></td>
<td>ATE ( KEMA ) Flameproof Ex d IIC T6 or T5</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>ATE ( KEMA ) Intrinsic Safety ( pending)</td>
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<td>CF</td>
<td>CF</td>
<td>CF</td>
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<tr>
<td></td>
<td>FM/IN/MC Explosion proof for USA &amp; Canada Class III, Division 1/2, Group A-D/E-G</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>FM Intrinsic Safety ( pending)</td>
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### PROCESS CONNECTION

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<thead>
<tr>
<th>CONNECTION</th>
<th>FILL FLUID</th>
<th>ELECTRICAL CONNECTION</th>
<th>OPTIONS</th>
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<tbody>
<tr>
<td>S</td>
<td>1/4 - 1/2 NPTF (Standard)</td>
<td>1/2 - 14 NPTF (Oval Flange Adapter)</td>
<td>M1/LCD Indicator</td>
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<tr>
<td>O</td>
<td>Inert Fill Fluid (Halocarbon Oil)</td>
<td>special</td>
<td>LV</td>
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### ELECTRICAL CONNECTION

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<th>ELECTRICAL CONNECTION</th>
<th>OPTIONS</th>
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<tr>
<td>K</td>
<td>Low Voltage 1-5v, 4 wire</td>
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<tr>
<td>MP/L1</td>
<td>Lighting Protector (Internal Type)</td>
<td>CF</td>
</tr>
<tr>
<td>F1/L1</td>
<td>Side Vent/Drain Top</td>
<td>Y</td>
</tr>
<tr>
<td>F2/L2</td>
<td>Side Vent/Drain Bottom</td>
<td>Y</td>
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<tr>
<td>MP/L1</td>
<td>Multi - Planar</td>
<td>Y</td>
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### ORDERING INFORMATION

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1) "-" - Not Available for selected configuration
2) CF- Consult Factory. Minimum order quantities may apply.
3) 'EA'- Enhanced Accuracy of 0.04% calibrated span is available for below range codes only:
   APT3100-D/F: 3, 4, 5, 6
   APT3100-G: 3, 4, 5, 6
   APT3200-G: 3, 4, 5
   Turn Down ratio 100:1, 3 years stability.
4) DXC1- Requires full model code refer DXC1 sheet
5) Use "O" for Oval Flange Adapter for 1/2" NPTF Process Connections
6) Use "F1" & "F2" quote only if "side" drain/vent is required. All APT3100 transmitters are shipped standard with "Rear" Drain/Vent
7) Use "MP" option to select a direct replacement for the Coplaner style transmitters with vertical mount and bottom process connections
8) Use "T" Teflon O-Ring for corrosive services. APT3100 transmitters are shipped standard with VITON O-Rings in contact with process.
9) Standard Warranty is two (2) years from supply
10) Information included on Certified Drawing will be:
   Customer: PO Number*, Customer Name :*, Project : (if applicable ), MODEL /OPTION code: (model code being ordered), TAG or TAG(s) : if applicable
   Calibration Range : Shipped Cal Range
   * Hence if ordering for specific end user/project please include this information else we will use default (PO #)
11) Angle/Flat Bracket Shipped Loose, separate bo-(6-5-4), includes bracket + U Bolt + Mounting Screws for 3100&3200/2100
12) LV - 1-5V is currently available on on 3200G series and requires special HART modem (to be purchased directly) to be used with the STT20
Installation with mounting bracket

2" Pipe Mounting Bracket Model Angle Type

2" Pipe Mounting Bracket Model Flat Type
SMART PRESSURE TRANSMITTER

Connection Diagram of Signal, Power, HHT for Transmitter

1) HHT (HART Communicator) or PC Configurator may be connected at any termination point in the signal loop.
2) HART Communication requires a loop resistance between 250 and 550 ohm @ 24 Vdc.
3) Transmitter operates on 11.9 to 45.0 Vdc transmitter terminal voltage.
   - Applied Power:
     * 11.9 ~ 45.0 Vdc for General Operation
     * 17.4 ~ 45.0 Vdc for HART Communication
     * 17.4 ~ 42.0 Vdc for CSA Approval (Power supply must not exceed 42.0 Vdc)

Dimensions of Transmitter (mm)

For application support, quotations, pricing and lead times please contact our sales department directly at sales@autroltransmitters.com. Additional details including product technical specifications can be found online at www.autroltransmitters.com