

# AMT-Ex Dewpoint Transmitter



## User Manual

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## Instruction Manual



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# 1 General Information

The Model AMT-Ex Dewpoint Hygrometer is a 3 wire 4-20mA powered transmitter, used for continuous measurement of moisture in a process gas or compressed air. The Model AMT-Ex transmitter can be factory configured to output a 4-20mA linear signal for any of the following moisture units:- °C or °F dewpoint, ppm(v), ppb(v), g/m<sup>3</sup>, and lb/MMSCF.

The long lasting sensing element offers excellent sensitivity, repeatability and response speed. Each unit is supplied with a Certificate of Calibration, traceable to International Humidity Standards, validating accuracy to ± 2°C dew point.

Model AMT-Ex is ATEX certified and provides an Intrinsically Safe Dewpoint Transmitter for hazardous area use when installed with the appropriate isolator

The transmitter also incorporates an Automatic Calibration (AUTOCAL) feature, which allows the user to carry out field calibration / span check. The AUTOCAL feature is operated by means of two small buttons built within the transmitter enclosure. To avoid tamper, the buttons are locked in normal operation and can only be activated by following a special routine.

The integral RISC microprocessor circuitry of the Model AMT-Ex transmitter allows high resolution with advanced self-diagnostics for fault conditions. It also enables periodic re-calibration of the moisture sensor, storing calibration data within the fully self-contained unit.

The mechanics of the Model AMT-Ex transmitter have been designed to cope with extreme environmental conditions. The rugged stainless steel construction offers protection to IP66 (NEMA4X), with the transmitter electrical connections made via secure industrial type connector.

Model AMT-Ex transmitters can withstand 35,000 kPa (350bar) maximum pressure and by employing low resistance cable, the transmitter can be located at significant distances, in excess of 1000 meters, from the safe area.

Designed with the operator in mind, for reliable and accurate measurements, the Model AMT-Ex is extremely easy to install and operate, requiring little or no maintenance.

The AMT-Ex transmitter is supplied with a Certificate of calibration an instruction manual and 2m connection cable.

**NOTE:** Corrosive Gases: The Sensor should not be exposed to corrosive gases (or corrosive contaminants in the gas sample) as these can chemically attack the sensor, impairing calibration accuracy and/or damaging it beyond economic repair. Examples of such gases are mercury (Hg), ammonia (NH<sub>3</sub>), chlorine (Cl<sub>2</sub>) etc. Strong oxidising agents such as ozone (O<sub>3</sub>) should also be prevented from coming into contact with the sensor.

# 2 Safety Information

Read the safety information below, before use.

## 2.1 Warnings

The AMT-Ex is intrinsically safe and certified to ATEX and IECEx standards. Therefore, it can be used in hazardous areas.

**Certification:** ATEX Marking –



II 1GD Ex ia IIC T4 Ex iaD 20 T135°C (– 20°C ≤ Ta ≤ +60°C)

**Certification:** IECEx Marking –

IECEx BAS 07.0080 Ex ia IIC T4 Ex iaD 20 T135°C (– 20°C ≤ Ta ≤ +60°C)

It is the responsibility of the user to ascertain the suitability of the AMT-Ex for use in hazardous areas. Risk assessments should be performed prior to use, taking into account the AMT-Ex certifications, and the location and the gas being monitored etc.

### **3 Installing the AMT-Ex in a Air/Gas Sampling System**

The piping installation schematic diagram (see section 3.1) shows all components, which could be used in a dry gas measurement application although not all the items shown will be required for every installation.

Care should be taken to ensure that the sample presented to the AMT-Ex is not contaminated with any component that will damage, contaminate or affect the AMT-Ex in a way that will impair the unit's accuracy.

It is strongly recommended that the sample should not contain particulate matter, oil, hydrocarbon or any other condensate. If these components contaminate the sample system and/or the measuring sensor, the AMT-Ex response time will be lengthened, although the sensor calibration will not be effected.

The flow rate, although not critical to the sensor measurement, should be low enough to avoid abrasion to the sensor surface without being so low as to extend the system response time to an unacceptable level. In general, a flow rate of between 2 and 3 litres/min at NTP will give the right balance.

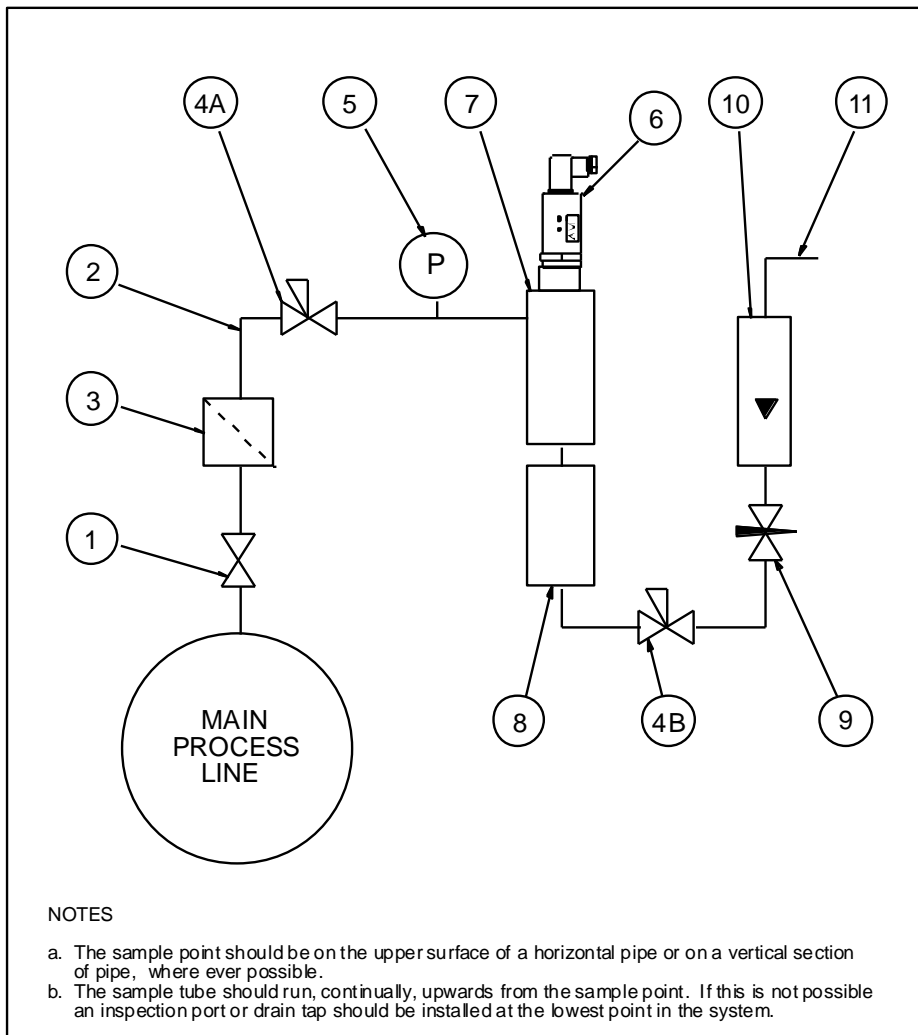
The sensor is a variable capacitor, which is directly affected by changes in partial pressure of water vapour. These changes are proportional to the dew/frost point temperature.

Partial pressure of water vapour is directly affected by total pressure and, this being the case, the instrument will display the dew/frost point temperature at whatever total pressure the sensor is exposed, therefore care should be taken to ensure that the sample pressure, at the sensor is that at which the dew/frost point readings are required.

Where a sensor is calibrated to read absolute moisture content (e.g. ppm(V)) it is essential that this is done at a given operating pressure and that this pressure is maintained in the normal process operation. Failure to maintain this pressure will result in read-out errors.

The measuring transmitter can be installed directly into the process line but this does create problems with access for maintenance and calibration. It is for these reasons that we recommend that the transmitter be installed in a bypass, fast loop or total loss sample system where the transmitter is accessible without interrupting the main process flow line.

### 3.1 Piping installation Schematic



### 3.2 Component Index

- 1) Sample Isolation Valve - This is a recommended item as it allows access to the sample system without interrupting the main process line.
- 2) Sample Tube – This should be stainless steel for dry air or gas applications but copper or carbon steel can be used where wetter gases are to be measured. If any section of the sample tube must be flexible then PTFE should be used. In most cases, 3mm OD (1/8”) is sufficient as it provides good system response time within minimum flow. 6mm OD (1/4”) tube can be used where pressure drops across the 3mm tube are too high
- 3) Filter Unit – A filter unit is recommended when the samples are likely to contain particulate matter. If the air/gas sample contains heavy hydrocarbon condensate, the filter must be of the coalescing type with a drain. The filter unit should be positioned as close to the sample point as practical.
- 4) Pressure Reduction Valve or Pressure Regulator – If the sample is to be measured at atmospheric pressure then the valve 4A should be fitted and 4B omitted from the system. If the sample is to be measured, at full line pressure and the exhaust vented to atmosphere, then valve 4B should be fitted and 4A omitted from the system. If measurements are to be taken at full line pressure and the sample is to be returned to a part of the main line or a vent, which is at a pressure higher than atmospheric, and the input to that line needs a controlled pressure then both 4A and 4B will be required.
- 5) Sample Pressure Gauge – This is not a critical part of the moisture measurement but may be required if Dew/Frost point measurements are to be made at higher than atmospheric pressure.

- 6) Measuring Transmitter, see “Appendix A – AMT-Ex with Connector, General Arrangement”.
- 7) Transmitter Holder, see “Appendix B – Transmitter Holder General Arrangement”.
- 8) Desiccant Chamber – This item is required when the sampling is to be intermittent. When installed it prevents the ingress of wet air to the sample system, while the sample is not flowing, improving the response time.
- 9) Flow Control Valve – This can be a separate item or combined with the flow indicator.
- 10) Flow Indicator – The recommended sample flow is 2 to 3 SL/M.
- 11) Sample Exhaust – The exhaust can be vented to atmosphere or returned to the process line as discussed above.

### 3.3 Installing and Commissioning the Model AMT-Ex Transmitter

It is advisable to carry out an initial purge routine of the sample loop, before installing the transmitter, in order to remove the possibility of sensor damage on start-up.

Refer to the sample system schematic in section 4.1. Open the inlet isolation valve slowly, until a small flow of air/gas at atmospheric pressure flows through the inlet pipe work to the transmitter holder and exhausts through the sensor entry port of the transmitter holder.

Allow this purge to continue for about 15 to 20 minutes to remove any residual moisture from the sample pipe work and components.

Close the inlet isolation valve and install the transmitter into the transmitter holder. Locate and secure the four-pin transmitter cable connector in positioned on the transmitter. Use the locking screw in order to affect a weatherproof seal.

**NOTE :** - The Plug and socket will only locate in one position, as the GND pin is different to the other three pins.

Open the inlet valve slowly, again and, by opening all valves after the transmitter holder, allow a low-pressure purge through the whole sample system. (Note. If a closed by-pass loop is installed, this section of the procedure is not possible).

Set the required pressures and flows within the sample loop.

This completes the installation and commissioning but, on initial start-up, it could take several hours for the system to reach equilibrium.

**WARNING:** Leaving the transmitter installed in plant that will be unused for long periods of time will, inevitably, cause damage to the sensing element, due to condensation or air-bound contamination, rendering it inaccurate or unusable. It is, therefore, critically important to note that, if procedure 2.3 is being carried out as part of initial tests and/or plant acceptance trials, prior to shipping and storage, the transmitter should be removed from the system, following completion of the tests/trials and stored in its original packaging, ensuring that the desiccant capsule is in place, up to the time of final plant commissioning.

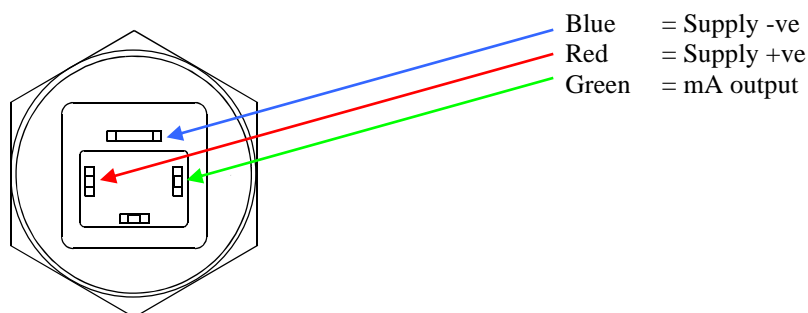
It is further recommended that, if the transmitter is to be stored for periods of 12 months, or more, a factory calibration verification be carried out, to ensure that any transit or storage damage, that may have occurred, is identified and corrected, prior to final installation and commissioning.

### 3.4 Wiring the AMT-Ex

The AMT-Ex is a 3-Wire 4-20mA transmitter.

For typical electrical connection see Appendix A & B:

### 3.5 Connector Pins



## 4 Normal Operation

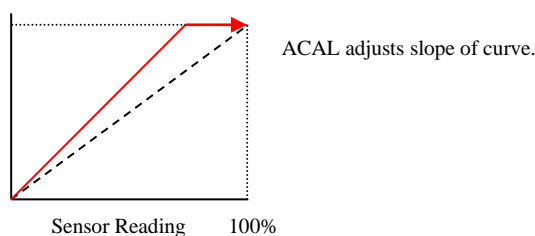
### 4.1 Analogue 4-20mA Mode (3-wire)

In normal operation, the transmitter will produce a 4-20mA signal, which is proportional to the level of moisture in the gas being monitored. The moisture reading is sampled and up dated once per second. The AMT-Ex has 3020 distinct steps over the 4 to 20mA range corresponding to a resolution of 0.005mA.

## 5 Autocal

**Warning Do Not power down during the AutoCal process as this can lead to corruption of the AMT's memory.**

AutoCal allows the user to ensure accuracy to the laboratory calibration by checking the span of the transmitter and correcting for any deviation. It should be operated periodically, every 2 to 3 months or when verification of the AMT-Ex Transmitter is required.



The AMT-Ex is supplied with an electronic autocal, which allows the calibration span of the transmitter to be adjusted. The autocal is controlled by the 2 buttons located on the side of the AMT –Ex transmitter labelled 'W' (wet) and 'D' (dry).

**Note : - The AMT-Ex must be connected to an indicator or some device able to supply an accurate measurement of the mA output.**

### 5.1 A Pre-conditioning the transmitter

To perform the autocal, the transmitter needs to be removed from the process gas at which point the display/indicator will read the ambient dewpoint or full scale (if the ambient dewpoint level is above the range of the AMT-Ex). Expose the transmitter to the known autocal moisture level and allow the



transmitter to attain equilibrium. (For technical questions and advice on the time taken to attain equilibrium Contact your AMT-Ex supplier)

### **Method 1: -**

Expose to a known moisture level. (**Applicable to all versions of AMT-Ex Transmitters**)

If a known gas is available within the range of the transmitter, then the AMT-Ex can be AutoCaled against this value.

### **Method 2: -**

Saturating method. (**Only applicable to 0°C (32°F) and –20°C (-4°F) top end range AMT-Ex transmitters**)

When the AMT-Ex sensing element is exposed to a dewpoint level above the top end range of the transmitter, the sensor will saturate and the transmitter can be AutoCaled to 0°C or –20°C. For both 0°C and –20°C AMT-Ex's, ambient dewpoint is usually adequate to saturate the sensor.

### **Method 3: -**

Set against Ambient moisture level. (Only applicable to 20°C (68°F) top end range AMT transmitters)

When the ambient dewpoint is known, then the AMT-Ex can be AutoCaled to the ambient value.

## **5.2 Entering Autocal Mode**

Once the transmitter has been pre-conditioned, the AutoCal Mode of the AMT can be activated. Press and hold the 'W' and 'D' buttons, simultaneously for 5 seconds. **ONLY PRESS THE BUTTONS IF THE SENSOR IS PROPERLY PRE-CONDITIONED. FAILURE TO COMPLY WILL CORRUPT THE TRANSMITTERS CALIBRATION.**

The attached 4-20mA display will (after the 5 seconds) indicate the bottom range of the AMT-Ex (or 4mA if reading current) for 5 seconds, confirming that autocal mode has been entered. The buttons should be released once the display indicates the bottom range.

After the 5 seconds delay the AMT-Ex will revert to the measured dewpoint and the buttons will be active.

## **5.3 Adjust the autocal**

Use the 'W' and 'D' buttons to move the reading up or down so that the desired dewpoint is displayed.

**Method 1:** - Adjust the AMT-Ex reading until the indicator reads the known moisture level.

**Method 2:** - Adjust the AMT-Ex reading until the indicator reads 0°C or –20°C whichever is applicable to the AMT-Ex being AutoCaled

**Method 3:** - Adjust the AMT-Ex reading until the indicator reads the known ambient moisture reading.

## **5.4 Completing the autocal**

Once the desired value is reached, the autocal process can be completed simply by leaving the buttons untouched for 30 seconds. After the 30 seconds, the display will indicate the bottom of the range for a period of 5 seconds and then the AMT-Ex will exit the autocal mode.

The AMT-Ex will now output the corrected dewpoint and can be reinserted into the process.

A graphical description of the autocal modes is given on the next page.

## 5.5 AMT-Ex Range AutoCal Method Lookup Table

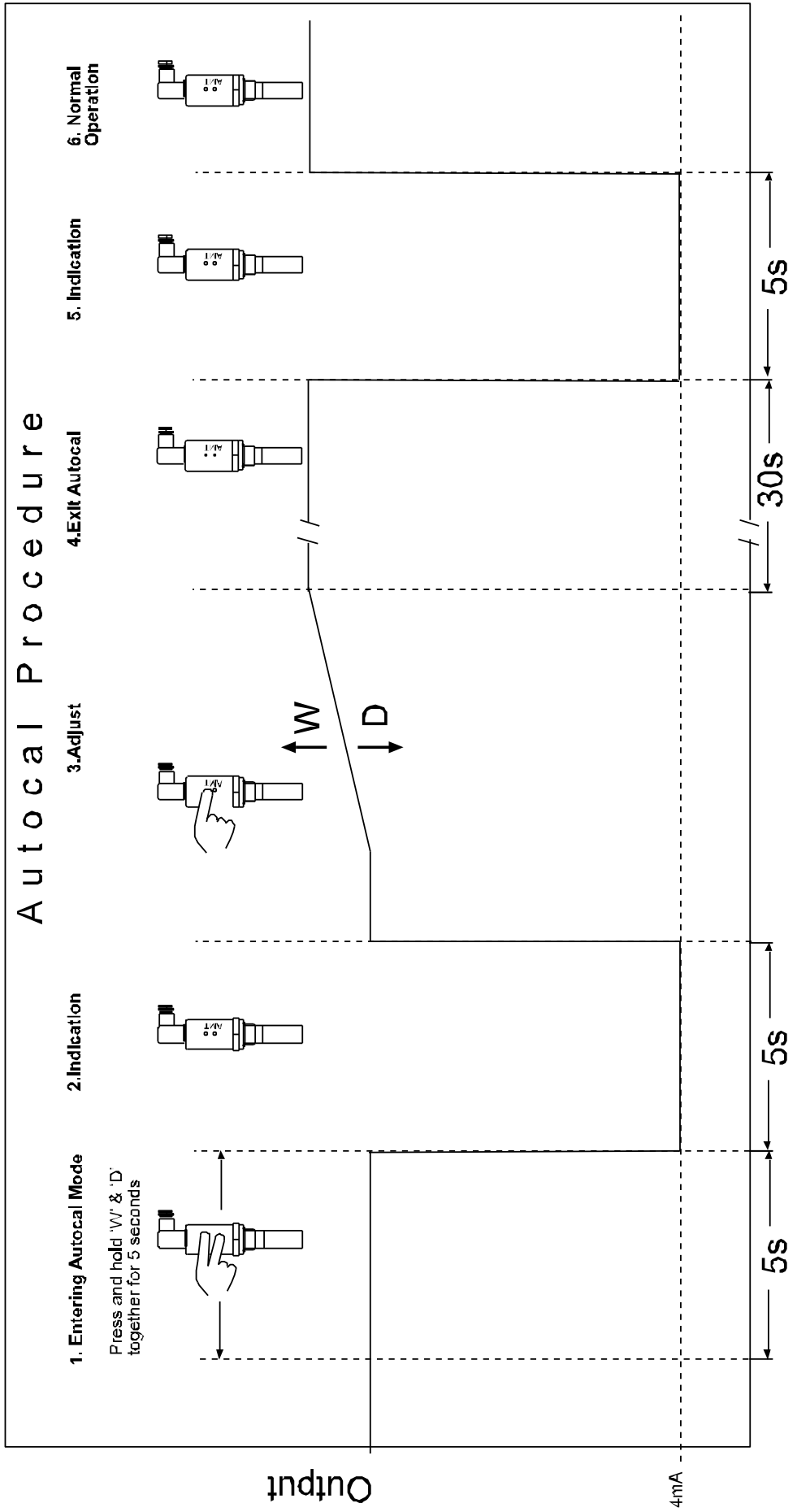
Use the table below to decide which AutoCal methods are appropriate for your AMT-Ex.

Range			Methods Appropriate
-80 to -20°C	-112°F to -4°F		1 & 2
-110 to -20°C	-166°F to -4°F		1 & 2
-120 to -20°C	-184°F to -4°F		1 & 2
-65 to 0°C	-85°F to 32°F		1 & 2
-80 to 0°C	-112°F to 32°F		1 & 2
-100 to 0°C	-148°F to 32°F		1 & 2
-65 to 20°C	-85°F to 68°F		1 & 3
-100 to 20°C	-148°F to 68°F		1 & 3
-120 to 20°C	-184°F to 68°F		1 & 3
1-1000ppm(v)	0.1-100ppm(v)	0.01-10ppm(v)	1
1-1000ppb(v)			1
0.01-10g/m <sup>3</sup>	0.001to1g/m <sup>3</sup>		1
0.1-10lb/MMSCF	0.1-25lb/MMSCF	0.1-50lb/MMSCF	1

## 6 Faults/Errors

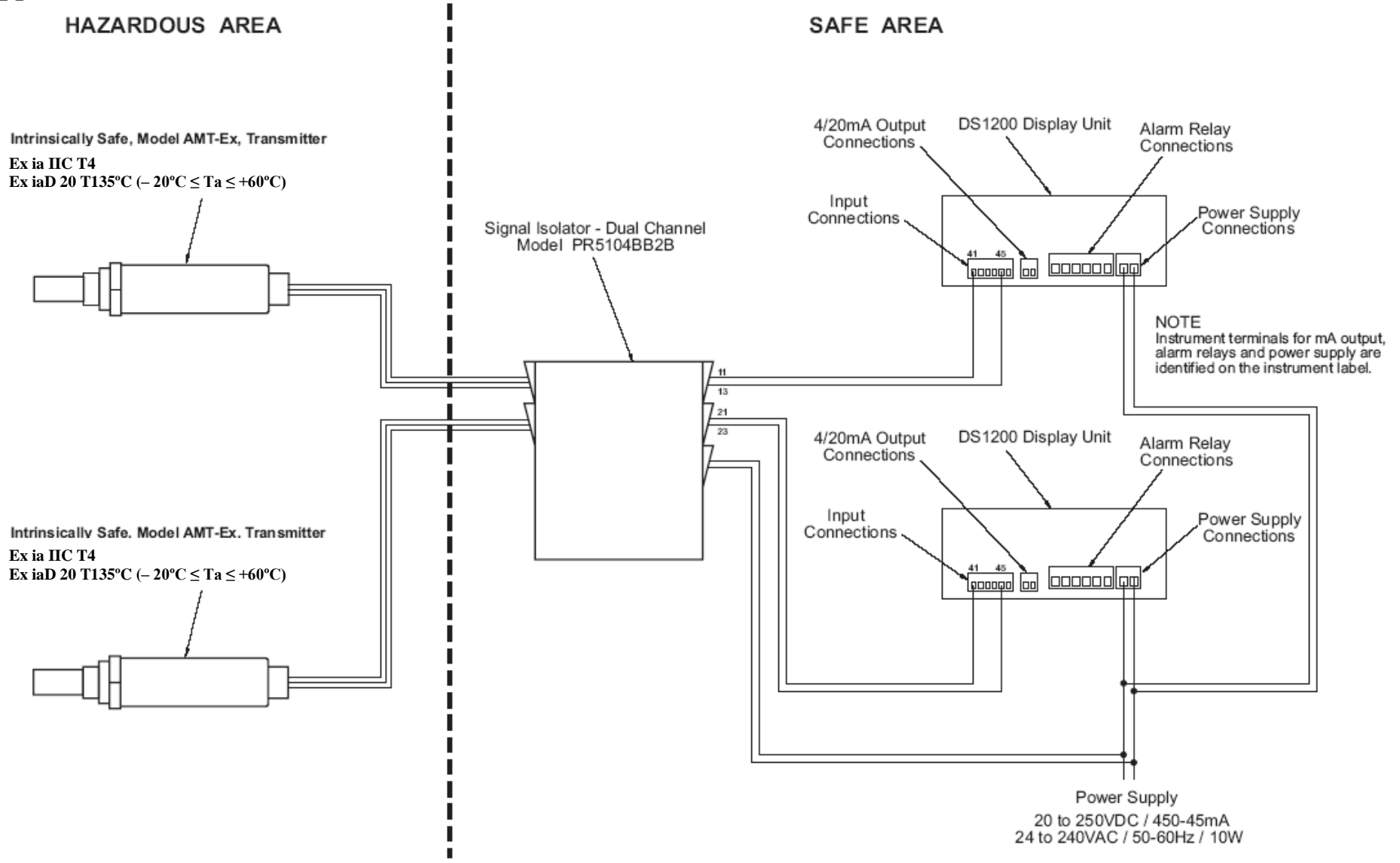
If the sensor is short-circuited, the transmitter will produce a constant 20.75mA output.

If the sensor is open-circuited, the transmitter will produce a constant 20.50mA output.

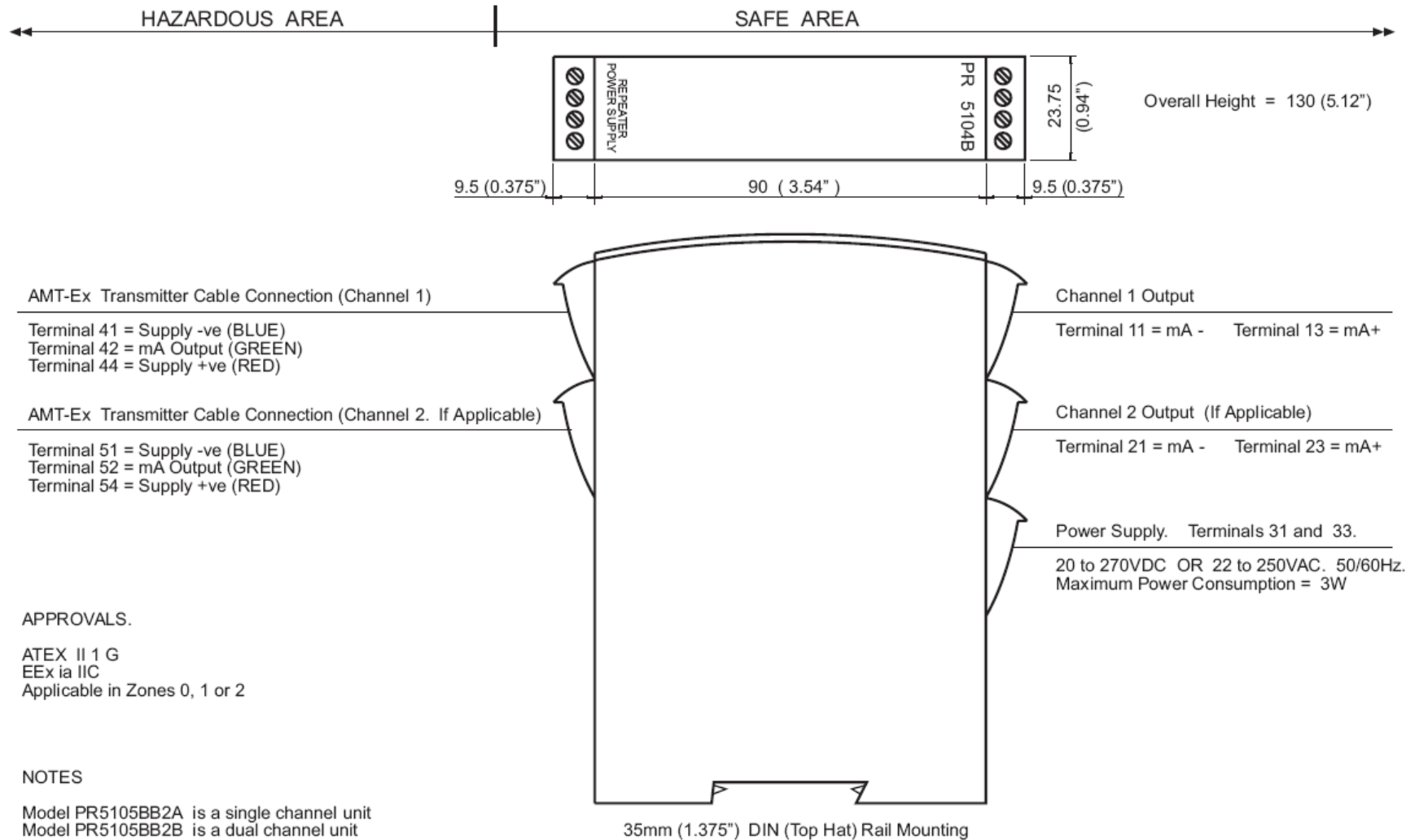


## 7 Appendix A – AMT-Ex / PR5104BB2A / DS1200 - Installation Schematics

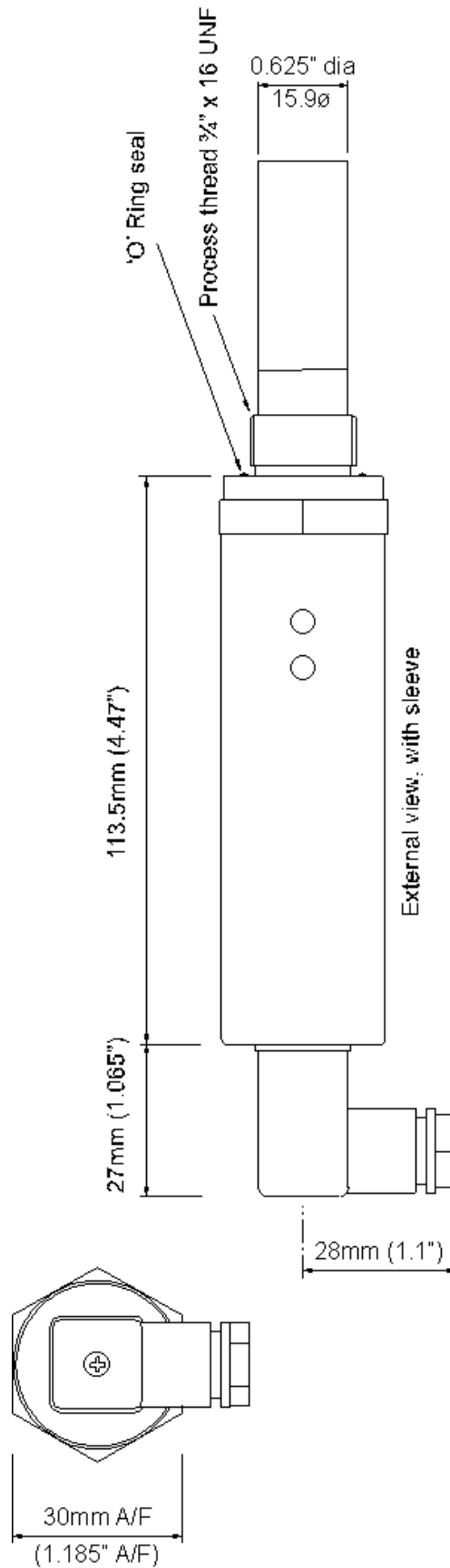
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## 8 Appendix B – PR5104BB2A to AMT-Ex Connections



## 9 Appendix C - AMT-EX with Connector, General Arrangement



# 10 Appendix B – Transmitter Holder General Arrangement

