TRANSMET I.S.

INTRINSICALLY SAFE DEWPOINT TRANSMITTER

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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1. INTRODUCTION

1.1 General

The Intrinsically Safe TRANSMET I.S. Ceramic Dewpoint Transmitter measures dewpoint over the range -100/+20°C. It is designed for use within the following hazardous areas: Class I, Division 1, Groups A, B, C & D T4 when used with an appropriate safety barrier(s).

The TRANSMET I.S. is connected as a 3-wire transmitter with a current sink output, which can be switch selected for either 4-20mA or 0-20mA. This output is linear over the entire dewpoint measurement range, from -100/+20°C DP.

TRANSMET I.S. is approved as an intrinsically safe device for use in hazardous locations.

Factory Mutual Research Corporation (FM)

TRANSMET I.S. confirms to the Approval Standard FM3610 (October 1988) and carries the following marking code: **Intrinsically Safe CL I, Div 1, Gp A, B, C & D T4.**

C.E.N.E.L.E.C

Transmet I.S. conforms to the **C.E.N.E.L.E.C.** standards specified in **BS EN 50014** and **BS EN 50020**; with certification code **EEx ia IIC T4**.

Before using TRANSMET I.S. in any hazardous environment, be sure you are fully familiar with the above Factory Mutual or C.E.N.E.L.E.C. standards relating to the certification of this instrument and also with the further information relating to intrinsically safe apparatus to be found in Article 504 in the National Electrical Code, ANSI/NFPA 70 or equivalent codes of practice in the country of installation.

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

1.2 Ceramic Sensing Element

TRANSMET I.S. utilizes a Ceramic Moisture Sensor manufactured from metalized ceramics using thin and thick film technologies. The Kahn ceramic moisture sensor is virtually chemically inert with inherently fast response, high calibration stability and high resilience to corrosive environments. TRANSMET I.S. measures humidity by monitoring the electrical response exhibited by the sensor to variations in partial pressure of water vapor of the gas composition to which it is exposed.

1.3 Calibration

Calibrations are performed using precision dewpoint generators and transfer standard optical hygrometers which have been calibrated directly at the National Institute of Standards & Technology **(NIST)** Gaithersburg, MD, USA.

1.4 Manufacturing Quality

Your TRANSMET I.S. should reach you in perfect working condition. We have rigorous procedures at every stage of production to ensure that the materials of construction, manufacturing, calibration and final test procedures meet the requirements laid down by our Quality System.

1.5 TRANSMET I.S. Identification

The TRANSMET I.S. can be identified by a serial number label located on the outside of the TRANSMET I.S. housing. The label also describes the I.S. certification for TRANSMET I.S.

2. MECHANICAL INSTALLATION

TRANSMET I.S. is provided with a 5/8"UNF parallel mounting thread which is suitable for housing in an optional flow-through sampling block. The body of the TRANSMET I.S. is designed to mate with the bonded seal provided (optional stainless steel bonded viton seal available). With TRANSMET I.S. the bonded seal provided should be placed over the sensing part of the transmitter before it is screwed into the sampling block. TRANSMET I.S. can also be mounted by direct insertion.

If TRANSMET I.S. is to be mounted in the optional sampling block, appropriate gas couplings should be selected and fitted (using PTFE tape) into the female 1/8"NPT (taper) threads provided. Sample gas flow can be in either direction through the block. If the TRANSMET I.S. is to be mounted by direct insertion, appropriate care should be taken to insure a proper seal.

Although the operation of TRANSMET I.S. is not sample flow-rate dependent, it is important to insure that the flow velocity through the sample line connecting the sample source to the sample block is high enough to avoid long time lags in response to changes in humidity at the sample source. We therefore recommend a flow rate of 1 to 5 liters/minute at sample point (or equivalent at pressure) be set when TRANSMET I.S. is mounted in the standard sampling block and that the instrument is mounted as close as possible to the sample point. The gas sample may then be returned to the process gas stream via the 2nd port in the sample block, or alternatively, if operating conditions allow, the gas sample can be vented - a vent pipe of at least 1 meter in length should be fitted to the outlet port of the sample block. In direct insertion applications a wide range of gas flow velocities are acceptable. Flow velocities up to 20 meters/second are acceptable with the protection given by the standard sintered guard.

Note: The correct selection of the cable gland for TRANSMET I.S. is essential with regards to I.S. installations. The specified IP65 rating of the instrument will only be maintained if an equivalent or higher IP rated cable gland is fitted. See TRANSMET I.S. specification for dimensions.

After installation into the gas stream, the TRANSMET I.S. housing may be positioned at any angle through approximately 330° of rotation, to allow for the cable gland positioning. To position the Sensor housing first loosen the large clamping nut sufficient to allow free rotation of the housing around the Sensor body.

WARNING: TRANSMET I.S. is fitted internally with a stop device to prevent full 360° rotation of the housing around the Sensor body. **Rotation beyond 330° may internally damage the Sensor**. The stop device is only to provide indication to the installer when maximum travel in either direction has been reached.

Rotate the Sensor housing until the cable gland is in the desired position. While firmly holding the housing in position, retighten the large clamp nut up against the housing seal using a wrench of the correct size. Do not apply excessive force.

High pressure samples may be measured up to a maximum of 5000 PSIG. Make sure that the correct pipe fittings are used and that the bonded seal provided is used to seal the radial face of TRANSMET I.S./ sensor block seal.

Similarly, TRANSMET I.S. is suitable for measuring samples below atmospheric pressure. Care should be taken at joints and pipe fittings that no leak exists which could allow ambient air to contaminate the sample gas. If there is doubt, a standard leak test procedure should be employed (helium or vacuum seal).

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3. OPERATING PRECAUTIONS

Precautions should be taken to protect the Kahn Ceramic Moisture Sensor from damage. Statistical information indicates that the vast majority of failures are caused either by incorrect sampling methods, sampling positions or inadequate protection against dangerous substances.

3.1 Sampling Hints

As mentioned in section 2, TRANSMET I.S. may be provided with a sampling block that will enable a small sample of process gas to be diverted past the ceramic sensing element before returning to the main gas stream or being bled off to atmosphere. Alternatively, TRANSMET I.S. can be mounted directly into a flowing gas stream in a duct or pipe, provided there is no form of contamination within the duct/pipe that will damage the ceramic sensing element. (See Section 3.3).

Sample system guidelines:

a) Be sure that the sample is representative of the gas under test.

The sample point should be as close to the critical measurement point as possible. For example in a glove box application, mount the TRANSMET I.S. at the exit of the glove box, not at the gas entry point. Always use the shortest run of tubing possible between two points.

b) Minimize dead space in sample lines.

Minimize couplings and tubing. Where possible build up sampling tubing specifically for the job and do not use tubing previously installed for another application. Dead space in sample lines increases response time by holding water molecules that are released to the passing gas sample.

c) Remove any particulate matter or oil from the gas sample.

The Ceramic Moisture Sensor element of TRANSMET I.S. is protected against particulate contamination by a 80μm stainless steel sintered guard. This protects against physical damage caused by large particles at high velocity such as rust in a compressed air line. However, fine particles will not be prevented from contact with the Ceramic Sensing Element. If high concentrations of fine particles are present in the sample flow they may "blind" the Ceramic Moisture Sensor element and reduce its response speed. If TRANSMET I.S. is installed in a system where particulate such as degraded desiccant or pipe swarf and rust are present, use a particulate in-line filter. Contact Kahn Technical Sales staff for further advice on filtering techniques.

d) Use high quality sample tubing and fittings.

We would recommend that, wherever possible, stainless steel tubing, fittings and components (e.g. filters) be used. This is particularly important when measuring low dewpoints since materials other than stainless steel may have undesirable characteristics such as the adsorbing of moisture on the walls, which slows down response and in extreme circumstances gives false readings. For temporary applications, or where stainless steel tubing is not feasible, use high quality, thick-walled PTFE tubing as this exhibits similar characteristics to stainless steel.

Use the lowest internal diameter tubing possible to reduce response time, but take care not to induce pressure differentials by aiming for too high a flow rate through small bore tubing. A sampling flow up to 1 to 5 L/min (or equivalent at pressure) will be satisfactory for TRANSMET I.S. to operate correctly.

3.2 Response Characteristics

Response characteristics from dry to wet are orders of magnitude faster than from wet to dry. Time taken to dry down TRANSMET I.S. from ambient conditions to the operational dewpoint level of the process will normally be shorter than the time taken to dry down the process itself. Therefore, when TRANSMET I.S. is installed into the system prior to system start-up, there is normally no time lag before representative test results are obtained.

When a TRANSMET I.S. is installed into an operational system, then typically fifteen to thirty minutes should be allowed for any tubing, filter and TRANSMET I.S. to reach equilibrium with the sample gas passing through.

3.3 Which Gases to Measure

TRANSMET I.S., by nature of its design, is suitable for measurement of the moisture content of a wide variety of gases. In general, if the gas (in conjunction with water vapor) is not corrosive to base metals then it will be suitable for measurement by the Transmitter. However gases containing entrained solids or hydrocarbon mists should be filtered before presentation to the sensor using a coalescing filter. If only particulate matter is present in the sample line then a particulate in-line filter is all that is required. Suitable filters are available from Kahn Instruments.

If a very dry gas, which would become corrosive when coming into contact with higher concentrations of moisture, is to be measured, then the instrument must be purged with an inert gas immediately after the measurement has been made. This will prevent any potentially corrosive gases remaining in the sensor block from contaminating the sensor.

4. MAINTAINING THE TRANSMET I.S.

Routine maintenance of TRANSMET I.S. should only require regular re-calibrations. The normal calibration period is one year. This re-calibration work can only be performed by exposure of the Moisture Sensor to sample gases of known moisture content. Calibration services traceable to NIST are provided by Kahn Instruments.

The frequency of re-calibrations required in order to maintain the performance of TRANSMET I.S. transmitter is primarily dependent on the composition of the gas to which the Moisture Sensor is exposed, i.e. content of liquid and particulate contaminates, corrosive elements, etc. (refer to section 3 of this manual for guidance). In most applications annual re-calibration ensures that the stated accuracy of TRANSMET I.S. is maintained.

5. TRANSMET I.S. SPECIFICATION

I.S. Certification code	
FM approval	Intrinsically Safe Class I, Division 1, Groups A, B, C & D T4
C.E.N.E.L.E.C.	EEx ia IIC T4. To B.S. EN 500 14 and B.S. EN 500 20
Sensor type	Kahn Ceramic Moisture Sensor
Gas wetted components	316 Stainless steel
Sensor mounting thread	5/8"UNF
Housing	316 Stainless steel natural finish
Ingress protection	IP65, NEMA 4
Electrical connection	Internal screw terminals. Connection Capacity: Solid / Stranded / Conductor sizes: mm^2/mm^2/AWG = 0.14 - 0.5 / 0.14 - 0.5 / 26 - 20
Dimensions	Outline: 172mm long x 106mm high x 86mm diameter (lid)
Weight	1.1Kg
Cable gland port	½" BSP
Power	Max. 30V regulated DC supply Min. 6V regulated DC supply Current consumption 15mA ± 30% (not including dewpoint signal current)
Operating modes	Selectable 0-20mA or 4-20mA linear current sink output corresponding to °C dewpoint
Range	-100 / +20°C (-148 / +68°F) dewpoint
Accuracy	±1°C between +20°C DP & -60°C DP ±2°C between -60°C DP & -100°C DP
Resolution	0.1°C between +20°C DP & -80°C DP 1°C between -80°C DP & -100°C DP
Operating temperature	-20 / +40°C (-4 / +104°F)
Storage temperature	-40 / +70°C (-40 / 158°F)
Operating pressure	Max. 5000 psig
Flow rate	0 to 10 Normal Liters per minute
Gas Velocity	Max. 20 meters per second
Associated I.S. system apparatus	**SYSTEM 1:** (Zener diode barrier system) - See SYSTEM 1 drawing **SYSTEM 2:** (Isolation barrier(s) system) - See SYSTEM 2 drawing

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6. TRANSMET I.S. CABLE CONNECTIONS

6.1 Cable Connection

The cable used for installation can be of any type as long as it meets the intrinsically safe requirements set out by the appropriate standards and TRANSMET I.S. SYSTEM drawing. For the standards, refer to section 7.2. For the system drawings, refer to the SYSTEM 1 (Zener barrier system) and SYSTEM 2 (Isolation barrier(s) system) at the end of this manual.

6.2 Terminal Block Connection

Connections to the TRANSMET I.S. are made via 3 terminals of an 8-way screw terminal block located on the TRANSMET I.S. PCB (annotated TB1). The terminal block has its terminals labeled 1 to 8, however, only terminals 5,6 and 8 are required to connect the TRANSMET I.S. To gain access to the terminal block, unscrew the lid of the TRANSMET I.S housing.

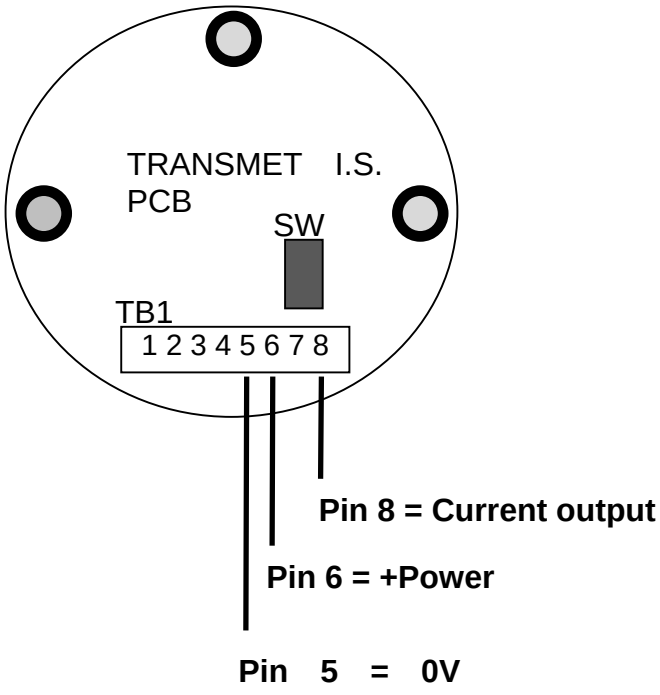


Figure 1 Terminal block connections

6.3 Cable Screen Termination

Any cable used on the installation must be shielded. This shield must always be connected to Ground of the TRANSMET I.S. To ease the shield connection, a lead assembly is provided and is attached to the TRANSMET I.S. PCB. This lead assembly is connected to TRANSMET I.S. ground. The lead is green in color and is terminated with a Butt-crimp as shown below in Fig 2. Refer to the appropriate SYSTEM drawing before choosing a cable type.

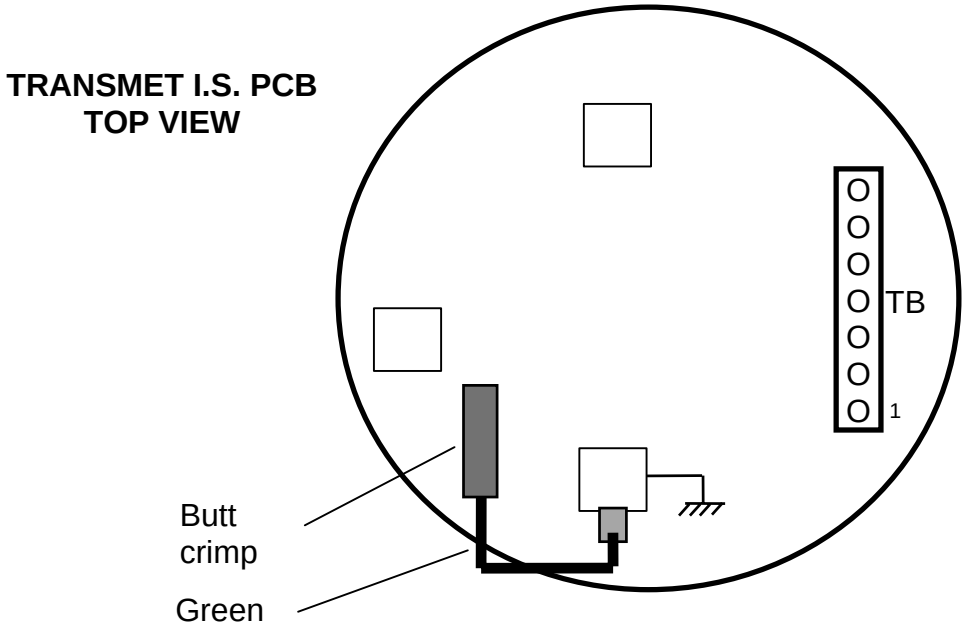


Figure 2 Cable shield connection

6.4 Installation in Hazardous Areas

TRANSMET I.S. is approved as an intrinsically safe device for use in hazardous locations.

TRANSMET I.S. confirms to FM Approval Standard FM3610 (October 1988) and carries the following marking code: **Intrinsically Safe CL I, Div 1, Gp A, B, C & D T4.**

The instrument conforms to the **C.E.N.E.L.E.C.** standards specified in **BS EN 50 014** and **BS EN 50 020**, with certification code **EEx ia IIC T4**.

Before using TRANSMET I.S. in any hazardous environment, ensure you are fully familiar with the above FM or C.E.N.E.L.E.C. standards relating to the certification of this instrument and also with the further information relating to intrinsically safe apparatus to be found in Article 504 in the National Electrical Code, ANSI/NFPA 70 or equivalent codes of practice in the country of installation.

TRANSMET I.S. can be installed using either a SHUNT DIODE BARRIER unit as shown in SYSTEM 1 drawing on page 19, or alternatively, if a factory I.S. ground is not available, using two GALVANICALLY ISOLATED BARRIER units as shown in SYSTEM 2 drawing on page 20.

For the System 1 (Zener barrier system) the transmitter and the barrier safety ground must be bonded such that for all practical purposes they are at equal potential. This requirement must be interpreted in accordance with the codes of practice for installation of intrinsically safe apparatus within the country in which the product is being installed. Typically the connection of the bonding conductor to the Transmet I.S. Transmitter is made using a ground tag installed under the cable gland.

NOTE: Installation of TRANSMET I.S. **MUST** be as per either system drawing in order to comply with the intrinsic safety certification for TRANSMET I.S.

7. TRANSMET I.S. OUTPUT

7.1 Selecting the Current Output Range

There are two current ranges available from the TRANSMET I.S. which are switch selectable, as either 4 to 20mA or 0 to 20mA, both corresponding to a dewpoint of -100 to +20°C dp. An 8-way DIP switch is located on the TRANSMET I.S. PCB and is accessed by removing the TRANSMET I.S. housing lid. The 8-way DIP switch is annotated SW1. (See Fig. 3 below). Switches 1 to 5, 7 & 8 on the 8-way DIP switch must be **off**. Switch 6 is used to select the current range (see Fig. 3 below). **Note:** Current range can be changed while the TRANSMET I.S. is in operation.

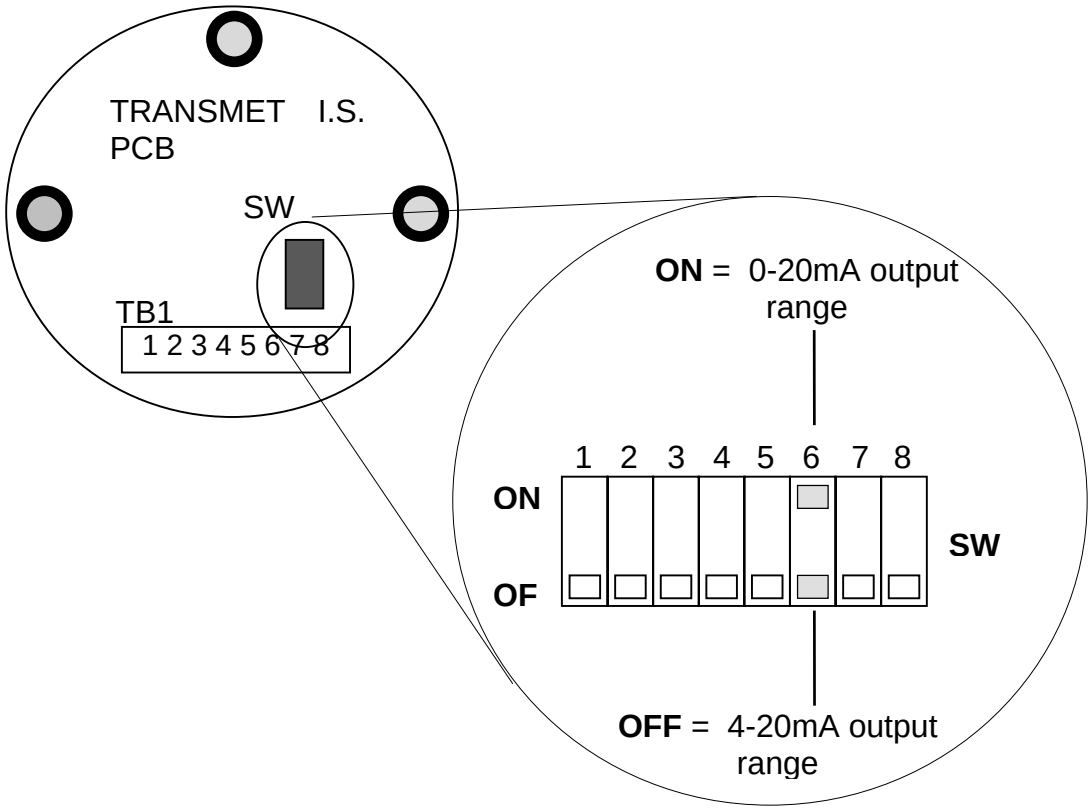


Figure 3 Current output switch settings

7.2 Measuring the Current Output from TRANSMET I.S. for a SYSTEM 1 Installation

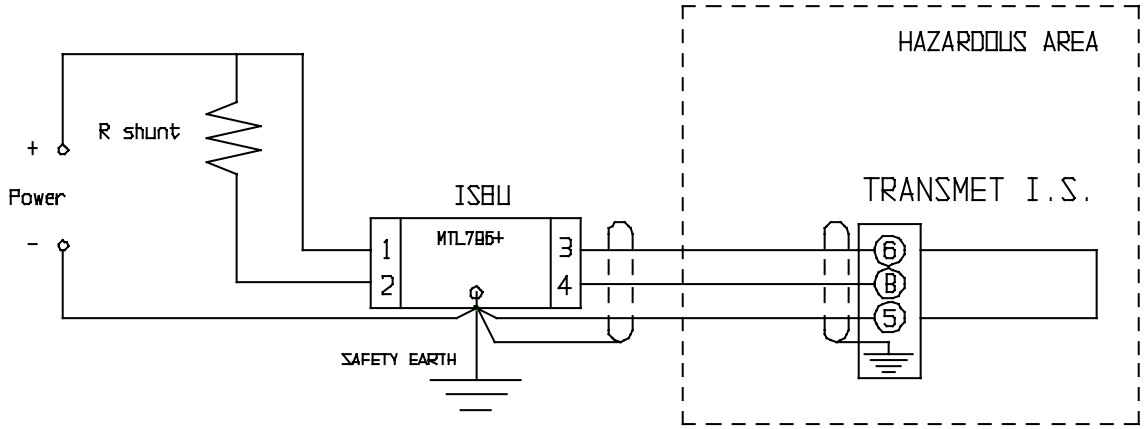
This method uses a shunt resistor in-line with the current signal line on the safe side of an intrinsically safe application. The current flowing through the shunt resistor produces a differential voltage (Vdiff) across it, which can be directly measured or interfaced to a control or metering system. The method is illustrated below in Fig 4.

Power Voltage and Shunt Resistance limits

Refer to Figure 3 for the information regarding the voltage required to power the Transmet I.S. while using specific shunt resistance value.

7.3 Cable Requirements / Limits for SYSTEM 1 Installation

Refer to section 6 and the SYSTEM 1 drawing for details.



Power Voltage VDC	Rshunt Resistance Ohm
14-18	50
15-18	100
16-18.5	200
17-19	250

Figure 4 Current measurement for SYSTEM 1

7.4 Measuring the Current Output from TRANSMET I.S. for a SYSTEM 2 Installation.

Contact Kahn Instruments for technical details regarding System 2 installation.

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8. USING TRANSMET I.S. INTERFACE UNIT

The optional Transmet I.S. interface unit can be supplied to simplify the installation of the Transmet I.S. hygrometer. The interface unit includes the following components mounted on the metal plate:

- Intrinsically Safe Barrier Unit (ISBU);
- Signal isolator/converter;
- Power supply with 96-260 VAC input ;
- Terminal block for safe area connections.

The interface unit allows conversion of the current sink output of the Transmet I.S. into an isolated current or voltage signal. This signal is convenient to interface with customer supplied PLC, computer-based data acquisition systems or other equipment. The user can select one of the following isolated output signals from the interface unit:

- 0-5 VDC
- 0-10 VDC
- 0-1 mADC
- 4-20 mADC (default)
- 0-20 mADC

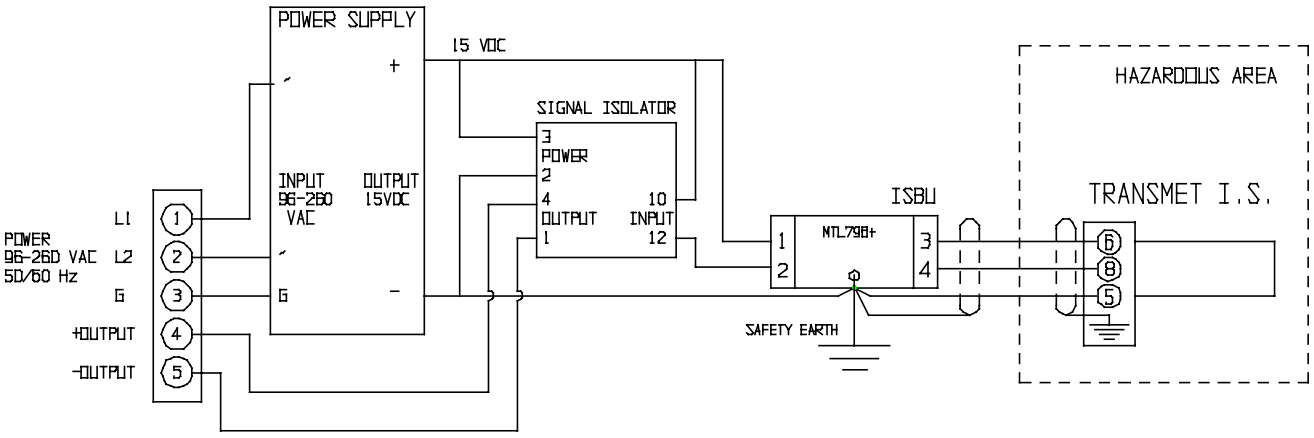

Figure 5 Interface Unit Wiring Diagram

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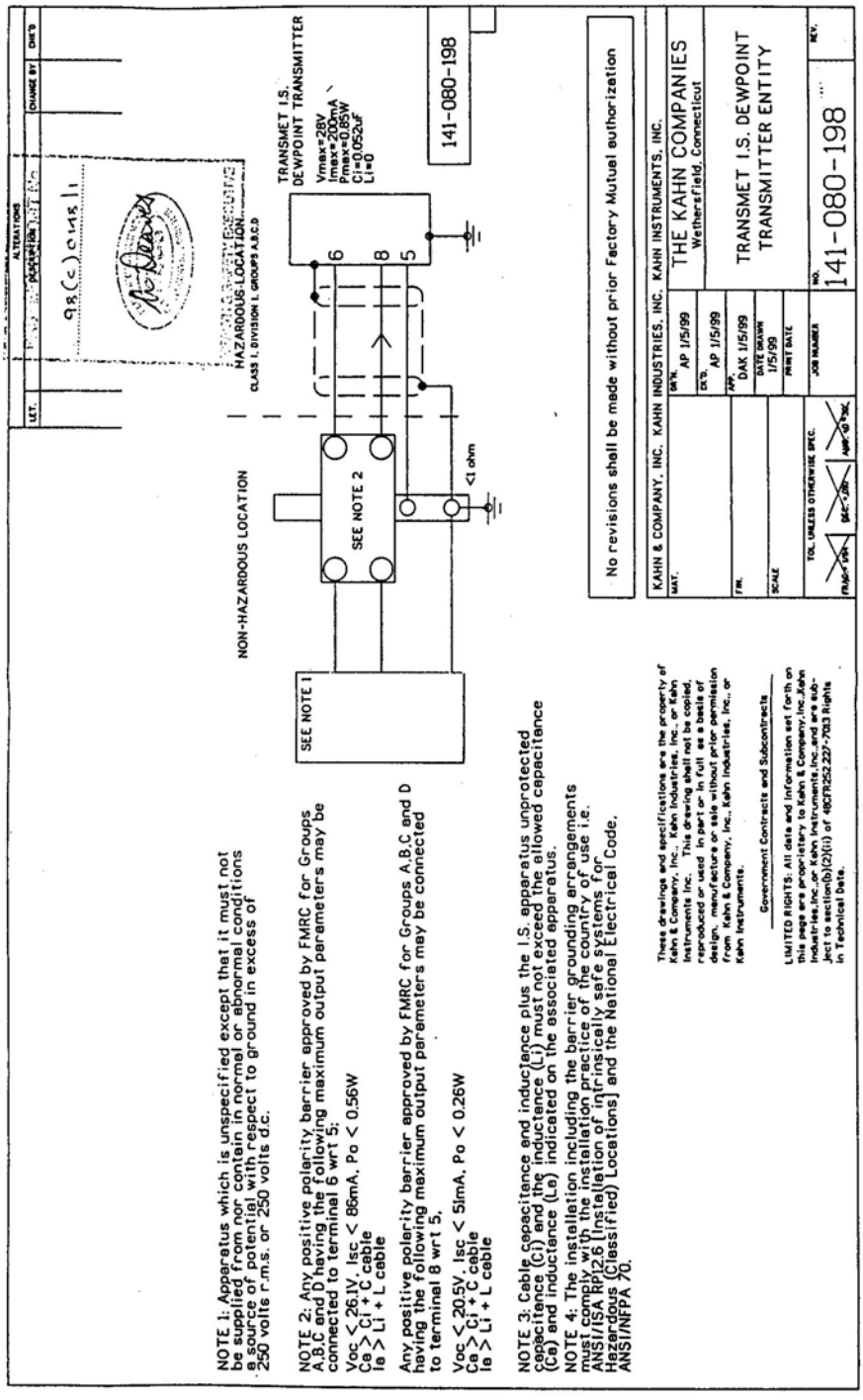
9. INTRINSICALLY SAFE SYSTEM 1 DRAWING

Zener barrier installation method



10. INTRINSICALLY SAFE SYSTEM 2 DRAWING

Isolation barrier installation method