CERMET II I.S. HYGROMETER

SYSTEM 2 INSTALLATION

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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1. INTRODUCTION

1.1 General

Kahn Instruments manufactures a wide range of on-line and portable instruments for the determination of moisture content in air and gases. In addition, the company manufactures humidity calibration systems for industrial and scientific users.

CERMET II I.S. utilizes the TRANSMET I.S. intrinsically safe dewpoint transmitter as the sensor coupled with the CERMET II advanced monitor as the display unit.

1.2 CERMET II I.S. Hygrometer Overview

The CERMET II I.S. Hygrometer is a continuous, on-line instrument for the measurement of absolute moisture content in a gas. It is designed to fulfill a wide range of applications and provide for the monitoring and/or control of moisture in gases. The instrument consists of three component parts: monitor, interface unit and sensor (TRANSMET I.S. transmitter). The monitor and sensor are individually calibrated to a single standard allowing combinations of sensor (TRANSMET I.S. dewpoint transmitter) and monitor to be totally interchangeable.

The standard instrument covers the ranges -100°Cdp to +20°Cdp (-148°Fdp to +68°Fdp), 0 to 9999 parts per million by volume (ppmV) as well as 0 to 1000 LB/MMSCF and g/m^3 for natural gas. Selection of the displayed hygrometric unit is factory set but may be easily changed by the user. Dual alarm relay contacts are provided which are user configurable both in terms of setpoint and operating mode. Optionally, 1 or 2 additional relays can be fitted with Form A type contacts (see section 2.2.2 for details). Isolated current output is standard and factory set at 4 - 20mA; optional output is 0 - 10 VDC.

The monitor can be supplied with an optional pressure input channel to accept the signal from any loop-powered intrinsically safe 2-wire pressure transmitter. Pressure can be scaled and displayed to appropriate engineering units. The pressure signal can then be used to provide automatic pressure compensation on the primary channel of either LB/MMSCF, g/m^3 or ppmV.

1.3 TRANSMET I.S. Overview

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 appropriate isolation barrier(s).

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.

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 when used with appropriate isolation barrier(s).

Factory Mutual Research Corporation (FM)

TRANSMET I.S. conforms 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.

Canadian Standards Association (CSA)

The Transmet I.S conforms to the following Standards: CSA 22.2 No. 0-1991, 142-M1987, 157-M1992, UL 508, UL 913 and carries the Hazardous Area designation: Intrinsically Safe Ex ia, Class I, Division I, Group A, B, C and D, T4(+60C).

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

Transmet I.S. conforms to the C.E.N.E.L.E.C. standards specified in **EN 50014:1997 + amendments 1 & 2**, **EN 50020:1994** and **EN 50284:1999**, with certification code **EEx ia IIC T4 (-20 °C<Ta<60 °C)**.

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.

1.4 Interface Unit Overview

The interface unit consists of the following components:

- Power supply (or power supply components)
- Isolation Barriers

The power supply provides necessary power voltage to the Transmet I.S sensor (typically 24 VDC). The isolation barriers limit the electrical-spark energy that can arise in hazardous areas to levels that are not sufficient to ignite an explosive atmosphere and galvanically isolate the hazardous area circuitry from safe area circuitry.

1.5 Outline of Complete System

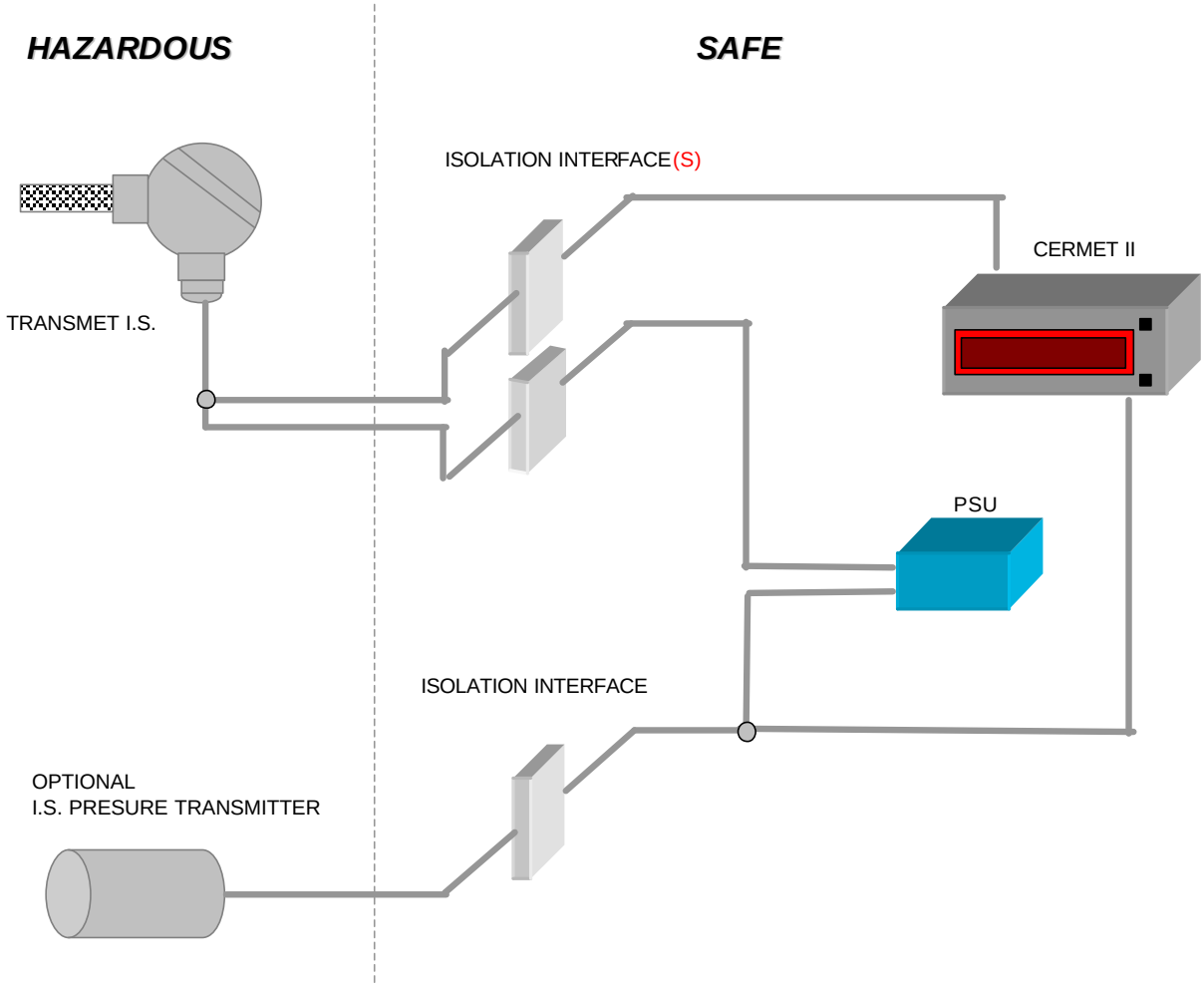

Figure 1. Complete System

1.6 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.

1.7 Manufacturing Quality

Your instrument 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.

2. PREPARING CERMET II I.S. MONITOR FOR USE

The CERMET II I.S. Hygrometer is supplied with a full accessory package. Please check that all the items indicated on the packing checklist are present in the delivery.

NOTE: The CERMET II I.S. Monitor is NOT in itself INTRINSICALLY SAFE and therefore must not be installed in the hazardous area.

2.1 Installing the Monitor

The monitor can operate within the environment limits of 0°C to 50°C, 0 to 90% RH.

The monitor case is designed for panel mounting. However, it can be used as a bench mounted device without any special preparation.

For panel mounting, a suitable cutout should be made in the panel to be used. A rectangular cutout of 92 x 45mm (DIN 1/8) is necessary (see Figure 2. Panel Cutout). Optional IP66/NEMA 4 cover provides additional front panel protection for harsh environments.

NOTE: A minimum depth behind the panel of 5.5" is required for the monitor, its connectors and wiring (see Figure 3. Case Dimensions).

The monitor should be inserted into the panel cutout from the front and secured using the two brackets with securing screws on the sides of the front case.

All electrical connections through the rear panel are made via plug and socket terminals to facilitate easy removal of the monitor when in service (see Figure 5. Monitor Electrical Connection).

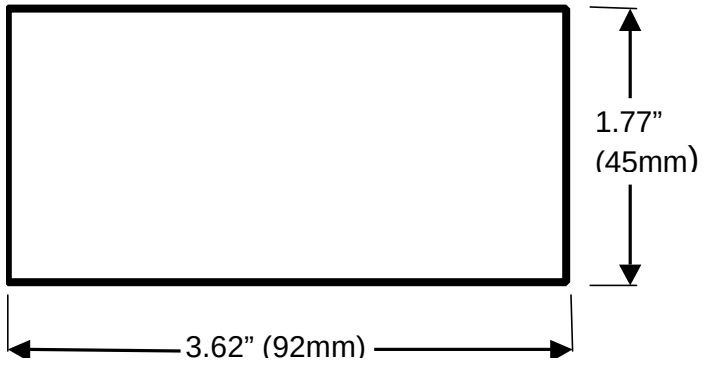

Figure 2. Panel Cutout

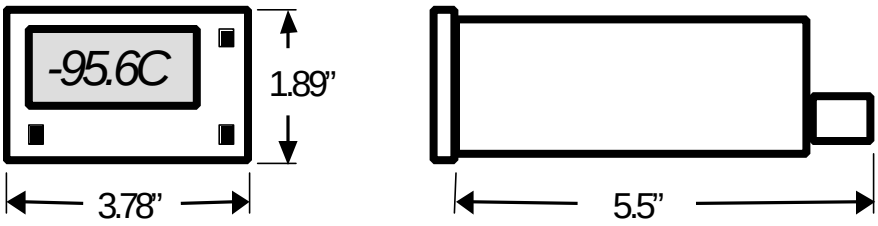

Figure 3. Case Dimensions

2.2 Electrical Connections

When the monitor is securely fastened in position, the electrical connections can be made to the back panel.

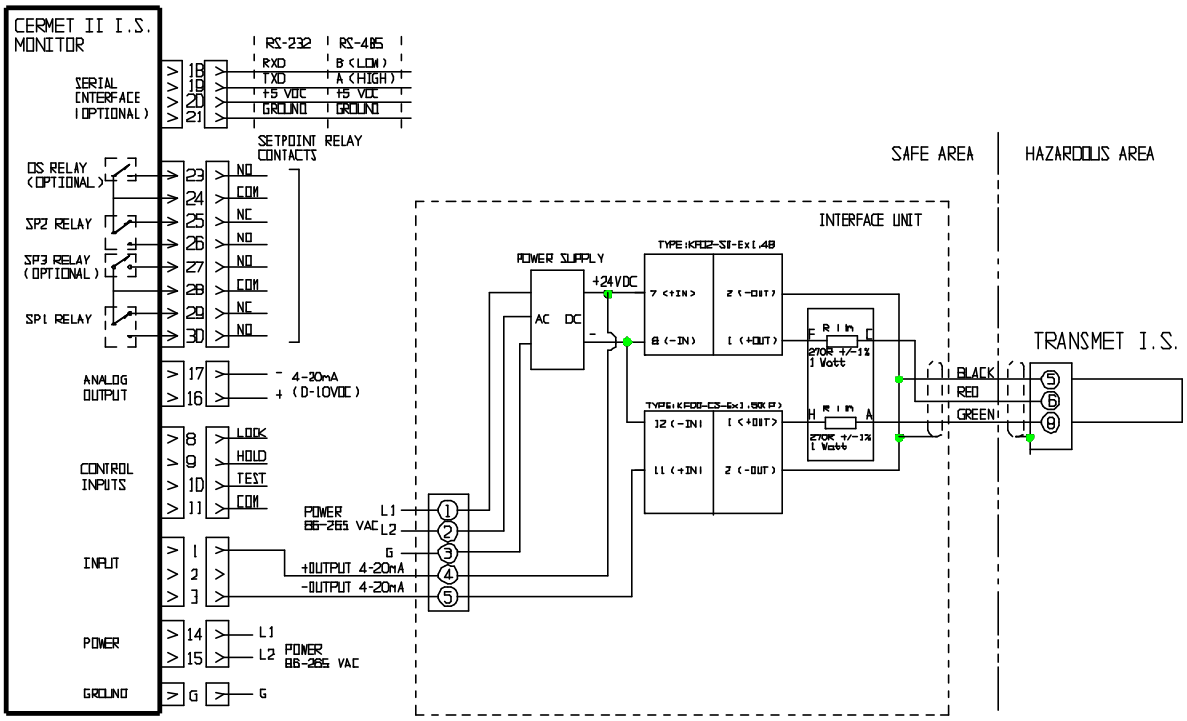

Figure 4. Instrument Wiring Diagram

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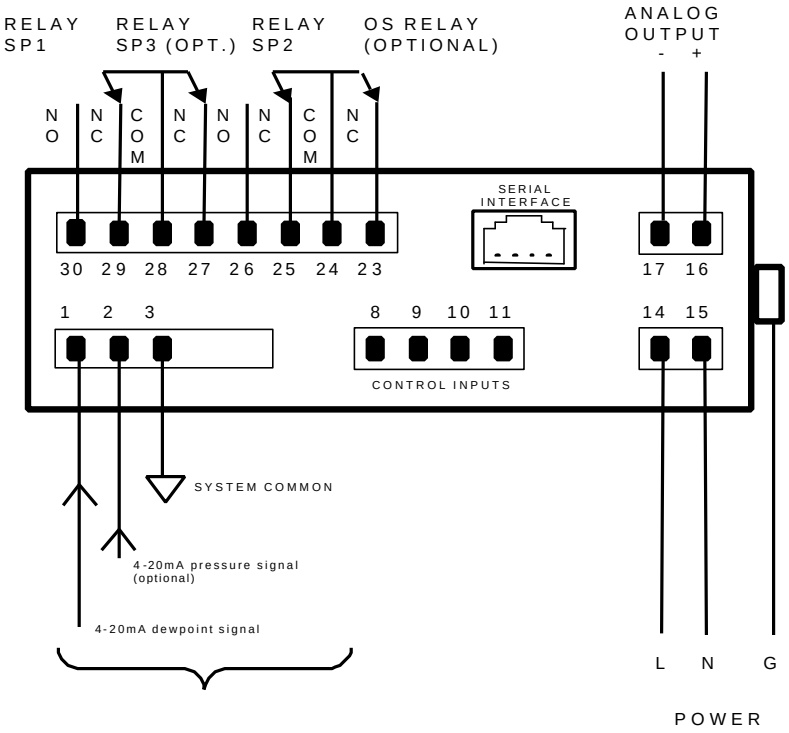

Figure 5. Monitor Electrical Connection

Figure 5 above shows the connections for power, dewpoint sensor, pressure sensor, alarm relays and analog output. These details are also repeated on the label attached to the monitor. The exact factory setup of the monitor can also be obtained by reference to the label applied to the monitor case.

2.2.1 Electrical Power

The power supply to the monitor may be one of the following:

a) 86-265 VAC 50/60Hz - **factory default setting**
b) 18-36 VAC and 9-60VDC - **optional**

The power supply voltage is indicated on the connection details label located on the monitor.

As soon as power is connected at the rear of the monitor, the display will register a reading. The monitor is provided for continuous operation and does not feature a power ON/OFF switch.

2.2.2 Setpoint (Alarm) Relays

SP1 and SP2 are Form C (single pole, changeover) relay contacts and can be connected as Normally Open or Normally Closed. Connections are NO - Normally Open, NC - Normally Closed and COM - common. Contacts are rated 240 VAC, 10A or 24 VDC, 8A (non-inductive load).

Optional additional relays SP3 and Open Sensor (OS) have Form A (single pole, normally closed) relay contacts and are Normally Closed only. Connections are NC - normally closed and COM - common. Contacts are rated 240VAC, 5A or 30VDC, 5A (non-inductive load).

Configuration of setpoints for operation as under \ over range or band limit is covered in section 7.3.

2.2.3 Analog Output

The monitor as standard provides an isolated 4 to 20 mA (optionally 0-10VDC) linear output over the entire operating range of the instrument in the selected engineering units. The output can be digitally scaled to cover a partial range of the measurement parameter. See **CAL** (under setup codes) in appendix 2.

The maximum load resistance that can be connected between pin 16(+) and pin 17(-) for a **CURRENT** output is 500 Ohms (No minimum).

The minimum load that can be connected to pin 16(+) and pin 17(-) for a **VOLTAGE** output is 5 kOhms (No maximum).

2.2.4 Digital Interface

The monitor can be supplied with an optional RS232 or RS485 digital interface. A 6-foot RS232 cable, terminated with 9 pin “D” connector, is available on request.

3. TRANSMET I.S.

3.1 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 code for TRANSMET I.S.

3.2 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. Remove the protective cap before installation and retain for future use.

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).

3.3 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.

3.4 Sampling Hints

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 is 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.

3.5 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.

3.6 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 Transmet I.S. 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.

3.7 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 contaminants, 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.

4. TRANSMET I.S. CABLE CONNECTION

4.1 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 4.4. For the system drawings, refer to the SYSTEM 2 (Isolation barrier(s) system) at the end of this manual.

4.2 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.

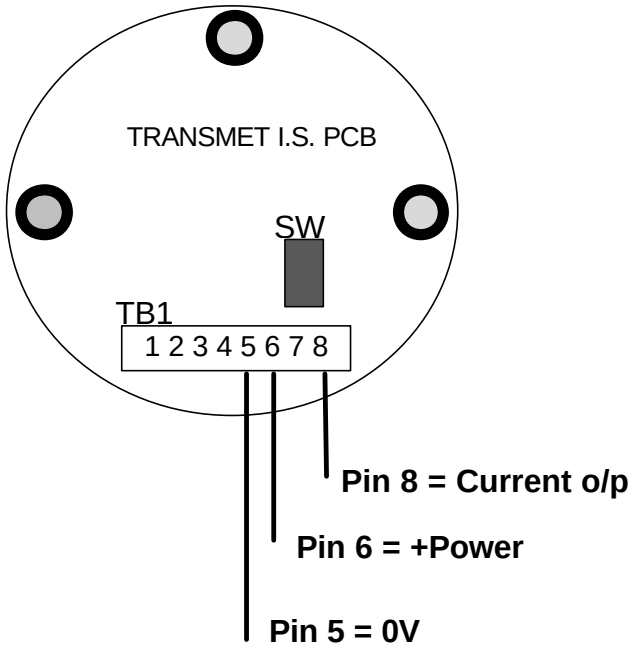

Figure 6. Terminal Block Connections

4.3 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 7. Refer to the appropriate SYSTEM drawing before choosing a cable type.

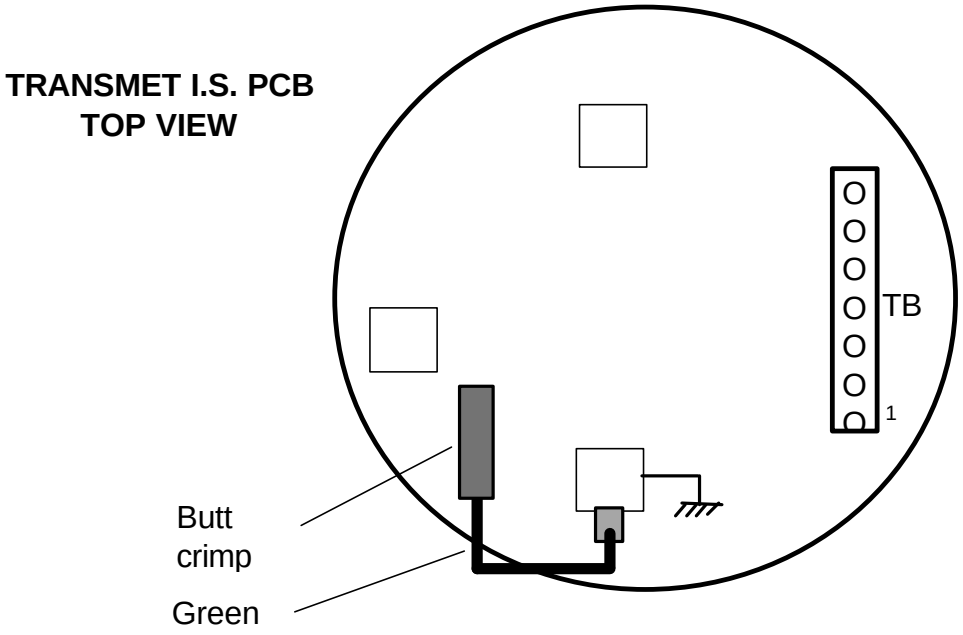

Figure 7. Cable shield connection

4.4 Installation in Hazardous Areas

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

TRANSMET I.S. conforms 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.**

TRANSMET I.S conforms to the following CSA Standards: CSA 22.2 No. 0-1991, 142-M1987, 157-M1992, UL 508, UL 913 and carries the Hazardous Area designation: Intrinsically Safe Ex ia, Class I, Division I, Group A, B, C and D, T4(+60C).

TRANSMET I.S. conforms to the **C.E.N.E.L.E.C.** standards specified in **EN 50014:1997 + amendments 1 & 2**, **EN 50020:1994** and **EN 50284:1999**, with certification code **EEx ia IIC T4 (-20 °C<Ta<60 °C)**.

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 (contact Kahn Instruments Inc. for details), or using two GALVANICALLY ISOLATED BARRIER units as shown in SYSTEM 2 drawing (see Figure 10).

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.

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5. TRANSMET I.S. CURRENT OUTPUT

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°Cdp.

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. 6 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. 8 below).

Note: Current range can be changed while the TRANSMET I.S. is in operation.

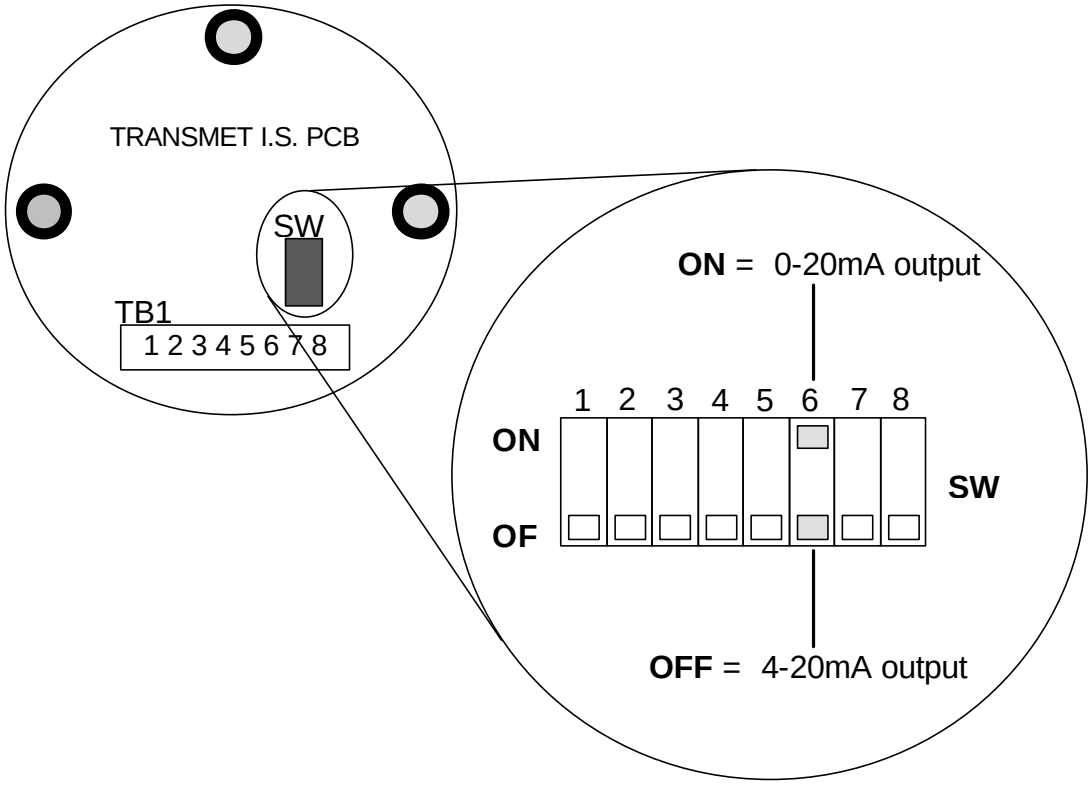

Figure 8. Current Output Switch Settings

6. CONNECTING TRANSMET I.S. TO CERMET II MONITOR

SAFETY FIRST

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 **EN 50014:1997 + amendments 1 & 2**, **EN 50020:1994** and **EN 50284:1999**, with certification code **EEx ia IIC T4 (-20 °C<Ta<60 °C)**.

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TRANSMET I.S. can be installed using either a SHUNT DIODE BARRIER unit (contact Kahn Instruments Inc. for details), or using two GALVANICALLY ISOLATED BARRIER units as shown in SYSTEM 2 drawing (see Figure 10).

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.

NOTE: The Interface Unit (if supplied) provides the connection between Transmet I.S. sensor and the monitor according to the SYSTEM 2 drawing.

7. CERMET II I.S. MONITOR SETUP

There are two levels of operation, USER and ADVANCED.

User allows:

- Changing of the setpoint values;
- Monitoring of the min/max values.

Advanced programming allows setting of the following options:

- advanced setpoint programming;
- analog output calibration and scaling;
- auxiliary (optional) channel setup;
- setting the engineering units;
- other related advanced functions.

To access the advanced programming press and release SETUP and Ý simultaneously to scroll through the menus.

7.1 Setup Security Feature

To prevent unauthorized access to the internal settings, the monitor is equipped with two DIP-switches located on the display board of the monitor, which can be accessed underneath the faceplate (refer to Figure 9. Location of the LOCKOUT Switches). The PROGRAM LOCKOUT switch SW2 is responsible for enabling or disabling the code programming mode. The SETPOINT LOCKOUT switch SW1 enables or disables the setpoint programming. OFF position of either switch will enable that mode, ON position will disable that mode.

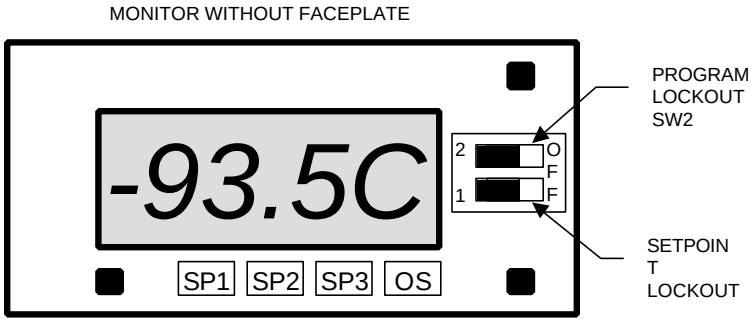

Figure 9. Location of the LOCKOUT Switches

7.2 Selecting the Engineering Units

Enter the PROGRAM UNLOCK mode as described in Section 7.1 Setup Security Feature, and press SETUP and Ý to scroll through the menus.

The monitor can display Dewpoint in °C or °F, ppmv, lb/mmscf or g/m^3 (Natural Gas). The selection of these units is achieved by setting CODE 4 and CODE 7 as shown below: (See Appendix 2, CODE 4 & CODE 7 for full details).

To display Dewpoint set CODE 7	to	000	
To display Dewpoint in °C set CODE 4	to	200	
To display Dewpoint in °F set CODE 4	to	210	
To display ppmv set CODE 7	to	100	
To display lb/mmscf set CODE 7		to	200
To display g/m^3 set CODE 7	to	300	

To set the range and resolution for ppmv, lb/mmscf and g/m^3 , set digit 3 of CODE 7 to :

0 1 – 9999
1 0.1 – 999.9
2 0.01 – 99.99
3 0.001 – 9.999

For example, by setting CODE 7 to 102, the monitor displays ppmv with a resolution of 0.01 to a maximum of 99.99, above which, message oVEr will be displayed.

Notice that regardless of the engineering unit selected, pressing the Ý button will switch the display to indicate the dewpoint in degrees C. Pressing the SETUP button will return the display into a previous indication mode.

7.3 Changing the Setpoint Values

Before amending the setpoint values, make sure that the monitor is in the SETPOINT UNLOCK mode as described in 7.1 Setup Security Feature.

Press SETUP and ⇓ simultaneously to gain access to the setpoint codes.

The setpoints of the relays are set by setting **SP_n** (where n = 1 to 4 and represent SP1 to 4) to the required level. The units of the setpoints change according to the source of the setpoints, i.e. if the indicator is displaying ppmv, then the setpoints are set in ppmv.

For the relays to be energized above the setpoint **SPC_n = 0xx**.
For the relays to be energized below the setpoint **SPC_n = 1xx**.

The source of relay setpoints are set by setting digit 2 of **SPC_n** i.e. **xnx** as shown below:

0 Displayed value **(DEFAULT)**

1	Dewpoint
2	Pressure
3	Not applicable for Cermet II I.S.
4	Not applicable for Cermet II I.S.
5	Not applicable for Cermet II I.S.
6	Not applicable for Cermet II I.S.

For example, if you wish the relay to trip at a certain dewpoint value while the indicator is displaying ppmv, then **SPC_n = x1x.**

The secondary relay function is set by digit 3 of **SPC_n** i.e. **xxn** as shown below:

0	No function **(DEFAULT)**
1	Relay latched
2	De-energize relay
3	No function
4	Not applicable for Cermet II I.S.
5	Not applicable for Cermet II I.S.
6	Not applicable for Cermet II I.S.
7	Setup for hysteresis, delay type and make/break delay times

For example, if you wish the relay to trip above the setpoint using the displayed value, but to remain latched, then **SPC_n = 001**. It will then remain latched until the supply to the indicator is removed or **SPC_n = 002**.

The function of the relay annunciators is set by digit 1 of CODE 1 i.e. **nxx.** As shown below:

0	LED annunciators always OFF
1	LED annunciators ON when relays are de-energized
2	LED annunciators ON when relays are energized **(DEFAULT)**

Hysteresis, Make/Break Delay & Delay Type

Associated with each setpoint is a Hysteresis Value, Make delay time, Break delay time and a delay type. To gain access to these parameters, set **SPC_n = xx7** and to scroll the features press ⇑ or ⇓.

The hysteresis value is a value which the relay trips above and below the nominal setpoint. For example, if SP1 is set to -10.0 and the HYST is set to 2.0 and the relay is set to energize above the setpoint, then the relay will energize when the setpoint source rises above -8.0 and is de-energized when the setpoint source falls below -12.0.

The Make delay is the delay between the setpoint being reached and the relay energizing. For example, if **M_d = 0.02.30** then the relay will be energized 2 minutes and

thirty seconds after the trip point has been reached.

The Break delay is the delay between the relay being energized and it de-energizing. For example, if **b_d = 0.01.12** then when the relay is energized it will remain energized for 1 minute and 12 seconds, after which it will be de-energized.

The maximum make and break delay time is 9 hours 6 mins and 6 seconds in increments of 1 second.

The setpoint can have four different delay types: **NorM** (normal), **rEPt** (repeat), **1Shot**, and **PuLSE.**

If **deLAY = NorM** then the relay will function normally with the inclusion of the time delays.

If **dELAY = rEPt** then the make and break delays will repeat continually until the setpoint source goes to a level to deactivate the setpoint. For example, if the make delay = 10 seconds & break delay = 5 seconds, then after the trip point is reached, the relay will energize after 10 seconds and remain energized for 5 seconds after which it will de-energize for 10 sec and then energize for 5 seconds etc.

If **dELAY = PuLSE** then if using the make and break times mentioned above, the relay will energize after 10 seconds, de-energize after 5seconds and remain de-energized.

If **dELAY = 1Shot** then if using the make and break times mentioned above, the relay will energize after 10 seconds and remain energized.

7.4 Analog Output Scaling

Enter the PROGRAM UNLOCK mode as described in 7.1, press SETUP then Ý, then SETUP again. Now use Ý and ß to scroll through to the CAL menu.

The analog output can be scaled by setting CAL to 061 and setting the zero value to the required output at 4mA (or 0V) and the full scale value to the output required at 20mA (or 10V).

For example, if the output is required to go from -90.0°Cdp at 4mA to +10°Cdp at 20mA then set Zero to -90.0 and F.S. to 10.0

To exit the CAL menu, set CAL to 052 and use Ý to scroll through the menus.

7.5 Display Brightness Adjustment

To adjust the display brightness:

-press SETUP and Ý buttons simultaneously, the display toggles between [bri] and [5], where 5 is default setting;

-adjust the display brightness required (from 0 to 7) by using Ý or ß buttons;

-press SETUP several times to exit the programming mode.

7.6 Digital Communications

The monitor can be supplied with an optional ASCII RS232 or RS485 serial interface.

The communication settings can be found by setting CAL to 100, then pressing the SETUP button once and then Ý and ß to change the baud rate. Baud rates are 300, 600, 1200, 2400, 4800, 9600, 19,200 and 57.6K. Press the SETUP button again to advance to the parity bit and then Ý and ß to change the parity bit. Parity settings are odd, even or off. Press the SETUP button again to advance to the address settings. Address settings are 0 to 255. Note, address 0 is not a valid RS485 address. Press the SETUP button again to return to CAL.

The communications uses the following default protocol:

Baud rate	9600
Data bits	8
Parity	none
Flow control	Xon/Xoff

The message to read and write to the monitor follows the following format:

1) Start Character
   "s" or "S" for the start character (must be first character in string).

2) Meter Address
   An ASCII number from "0" to "255" for the meter address. If the character following the start character is not an ASCII number, then address 0 is assumed. All meters respond to address 0.

3) Read/Write Command
   The next character must be an ASCII "R" or "r" for read, or an ASCII "W" or "w" for write. Any other character will abort the operation.

4) Register Address

The register address for the read/write operation is specified next. It can be either an ASCII number from "0" to "255" or registers 1 - 18 can be accessed by entering and ASCII letter from "A" to "R" (or "a" to "r", not case sensitive). If the address character is omitted in a read command, the meter will always respond with the data value currently on the display. (The register address must be specified for a write command).

5) Separator Character

After the register address in a write command, the next character must be something other than an ASCII number. This is used to separate the register address from the data value. It can be a space or a "," or any other character except a "$" or a "*".

6) Data Value

After the separator character, the data value is sent. It must be an ASCII number in the range of "-32766" to "32766".

7) Message Terminator

The last character in the message is the message terminator and this must be either a "$" or a "*". If the "$" is used as a terminator, a minimum delay of 50mS is inserted before a reply is sent. If the "*" is used as a terminator, a minimum delay of 2mS is inserted before a reply is sent. (the "$" and "*" characters must not appear anywhere else in the message string).

Examples:

SR$	Read display value, 50mS delay, all meters respond.
s15r$	Read display value, 50mS delay, meter address 15 responds.
Sr130*	Read Code 1 setting, 2mS delay, all meters respond.
s2wb-10000$	Write -10000 to the display register of meter address 2, 50mS delay.
SW65 200$	Write 200 to the SP1 Hysteresis register, 50mS delay, all meters respond.
s10w148,7*	Change brightness to 7 on meter address 10, 2mS delay.
sr6$	Reads SP1
sw6-100$	Sets SP1 to –10.0
sr5$	Reads pressure value

A full list of the register that can be read or written to can be found in Appendix 1.

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8. PRESSURE COMPENSATION

Enter the PROGRAM UNLOCK mode as described in 7.1.

The monitor has the ability to to provide a pressure compensated value for ppmv, lb/mmscf or g/m^3.

8.1 Using a Pressure Transducer

The Cermet II I.S. monitor can be supplied with optional dual 4-20 mA input signal conditioner board. One channel is used to measure dewpoint, another channel is used to measure pressure. In order to enable the use of a pressure transducer, set CODE 4 to 100 (dual channel mode), by pressing SETUP and Ý to scroll through the menus.

If you wish to display Dewpoint while measuring pressure, then set CODE 4 to 100 to show Dewpoint in °C or 110 in °F.

To display pressure in PSIG set CODE 6 to 000, or set CODE 6 to 100 to display in BARG.

Manual Pressure Input Calibration

The pressure input channel needs to be calibrated in order to match the range of the pressure transducer. This is achieved by setting CAL to 012 and entering values for offset OFF_2 and scale SCA_2.

SCA_2 = 0.0062 per 100 PSIG
OFF_2 = pressure range – ((20,000 x (pressure range/1000))/16)

For example, for a pressure transducer with a range of 0 to 1000 PSIG

SCA_2 = 0.0062 x 10 = 0.0620

OFF_2 = 1000 – ((20,000 x (1000/1000))/16) = 1000 – 1250 = -250

If you are using a pressure transducer in BARG, then you have to convert the value to PSIG by multiplying it by 14.5.

For a pressure transducer with a range of 0 to 100 BARG :

100 BARG = 1450 PSIG

SCA_2 = 0.0062 x 14.5 = 0.0899

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OFF_2 = 1450 – ((20,000 x (1450/1000))/16 = 1450 – 1813 = -363

To exit the CAL menu, set CAL to 000 and press Ý to scroll through the menus.

Automatic Pressure Input Calibration

The pressure input can alternatively be calibrated using a 4 and 20mA source. To do this, connect the current source between pin 2 (+) and pin 3 (-).

Set CAL to 022 and press SETUP. The monitor will then display ZEro and flash 0. Set the mA source to 4.0mA and press SETUP to set 0 at 4mA.

Press SETUP and the monitor will display SPAn and flash the full scale pressure value. Set the mA source to 20.0mA and use the Ý & ß buttons to set the required pressure range. Then press SETUP to set the required pressure for 20.0mA.

Set CAL to 000 and press Ý to leave the menus.

8.2 Using a Fixed Pressure Input in Single Channel Mode

In order to display pressure compensated values of ppmv, lb/mmscf and g/m^3 without the use of a pressure transducer the pressure value must be entered manually.

Enter the PROGRAM UNLOCK mode. Use SETUP and Ý to scroll through the menus and select code 7.

Select the required pressure compensated value, i.e. CODE 7 = 1xx for ppmv, 2xx for lb/mmscf or 3xx for g/m^3 , and CAL = 052.

Exit the menus and exit the PROGRAM UNLOCK MODE. Press SETUP for two seconds, and the display will show the set pressure. To change the pressure, use Ý and ß and then press SETUP.

8.3 Pressure Transducer Connection

To maintain the level of intrinsic safety of the system, the optional pressure transducer must be connected to the monitor using the appropriate Isolation Barrier. Contact Kahn Instruments for details regarding the pressure transducer installation.

9. MONITOR MAINTENANCE

The CERMET II I.S. monitor does not require regular re-calibration or servicing. However, if a fault with the monitor is suspected, contact Kahn Instruments technical support.

10. TECHNICAL SPECIFICATIONS

10.1 CERMET II Monitor

Display:	5 digit LED
Dewpoint Measurement Ranges:	-100° C to +20° C, -148° F to +68° F, 0 to 9999 ppmv, 0 to 1000 lb/mmscf, g/m^3 (Natural Gas).
Pressure input channel:	4-20mA input scaleable to any engineering units.
Electronic accuracy:	PPMV range ±1% of reading, LB/MMSCF range ±1% of reading, secondary channel ±0.5% FS.
Outputs:	Isolated 4-20mA as standard (max load 500 ohms) or 0-10V optional (min load 5 kOhms), spanned to full calibration range, scaleable by user.
Alarm Relays:	Two relays SP1 and SP2 are standard. Control action and setpoint are user programmable. Form C contacts rated 10 A, 240 VAC or 8 A 24 VDC non-inductive load. Relays SP3 and SP4 (OS) are optional. Control action and setpoint are user programmable. Form A contacts rated 5 A, 240 VAC or 5 A, 30 VDC non-inductive load.
Operating environment:	0° to +50° C, 0 to 90%RH.
Power supply:	86-265 VAC, 50/60 Hz standard. Optionally: 18-36 VAC or 9-60VDC.
Power consumption:	Max 10 Watts.
Power connection:	6 feet, 3 wire.
Weight:	1.32 lbs.
Environmental protection:	IP54 / NEMA 12. Optional protection cover to IP66 / NEMA 4.

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10.2 TRANSMET I.S. Transmitter

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 50014:1997 + amendments 1 & 2, EN50020:1994 and EN50284:1999.
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	IP66, 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	2.43 lbs. (1.1Kg)
Cable gland port	½" BSP
Power	Max. 28V regulated DC supply Min. 10V regulated DC supply Current consumption 15mA ± 30% (not including dewpoint signal current sink)
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 (300 barg)
Flow rate	0-20 standard cubic feet per hour (0 to 10 Normal Liters per minute)
Gas Velocity	Max. 60 feet per second (20 meters per hour)

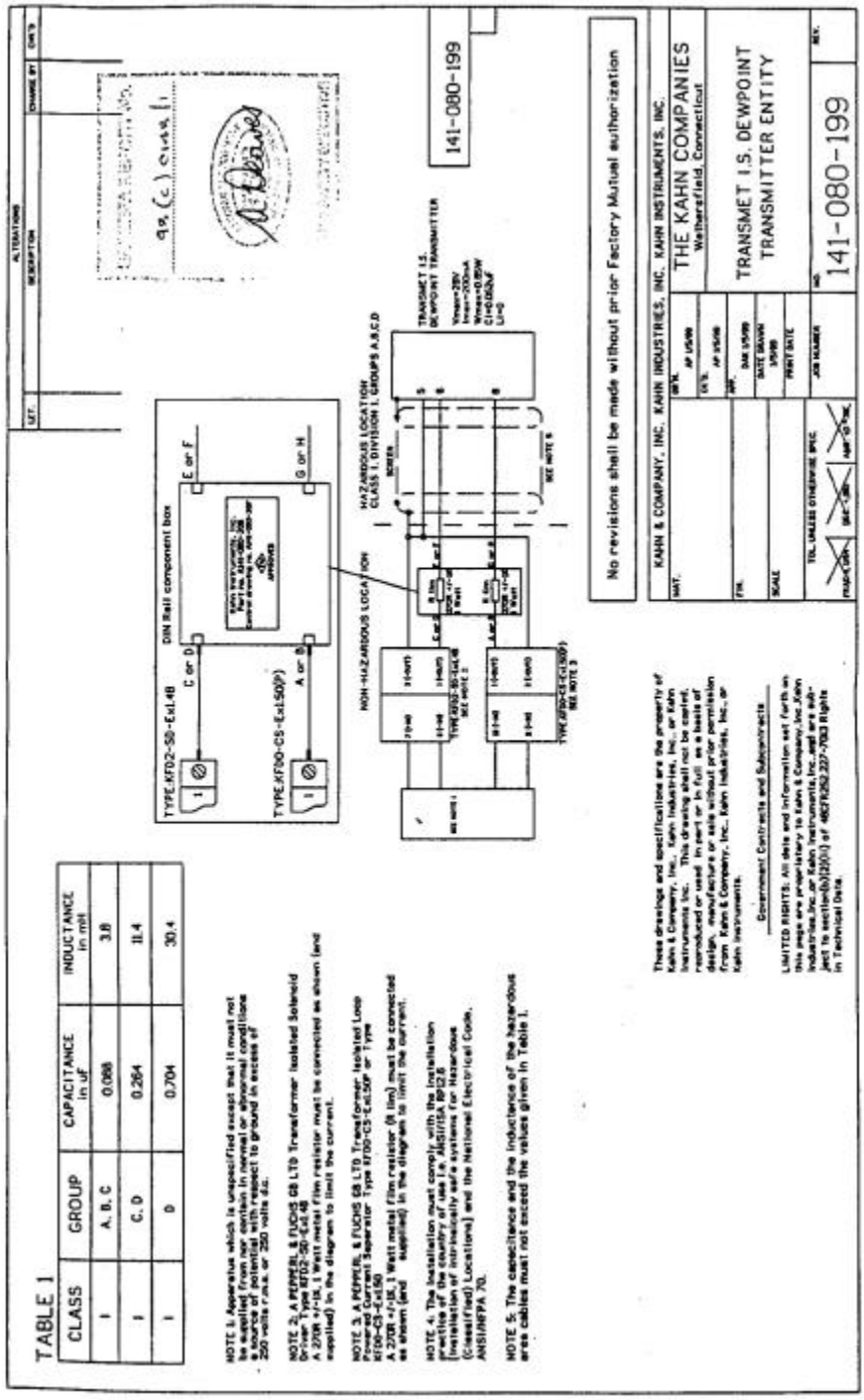

Figure 10. Isolation Barrier Installation Method

ATTACHMENT 1

Register Settings Accessible by Digital Communication

Register number	Function	Read only
1	Alarm Status	
2	N/A	
3	Processed Data – Result	✓
4	Processed Data – Channel 1 (dewpoint)	✓
5	Processed Data – Channel 2 (pressure)	✓
6	Setpoint 1	
7	Setpoint 2	
8	Setpoint 3	
9	Setpoint 4	
10 to 23	N/A	
24	Scale Value – Result	
25	Scale Value – Channel 1	
26	Scale Value – Channel 2	
27	Offset Value – Result	
28	Offset Value – Channel 1	
29	Offset Value – Channel 2	
30 to 33	N/A	
34	D/A Zero – Analogue O/P 1	
35	N/A	
36	D/A Full Scale – Analogue O/P 1	
37 to 64	N/A	
65	Hysteresis - Setpoint 1	
66	Hysteresis - Setpoint 2	
67	Hysteresis - Setpoint 3	
68	Hysteresis - Setpoint 4	
69 to 70	N/A	
71	Make Delay - Setpoint 1	
72	Make Delay - Setpoint 2	
73	Make Delay - Setpoint 3	
74	Make Delay - Setpoint 4	
75 to 76	N/A	
77	Break Delay - Setpoint 1	
78	Break Delay - Setpoint 2	
79	Break Delay - Setpoint 3	
80	Break Delay - Setpoint 4	
81 to 128	N/A	
129	Cal Mode	

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130	Code 1
131	Code 2
132	Code 3
133	Code 4
134	Code 5
135	Code 6

Register Settings Accessible by Digital Communication cont.

Register number	Function	Read only
136	Code 7	
136	Code 8	
138	to 141	Reserved
142	Setpoint 1 Control Register	
143	Setpoint 2 Control Register	
144	Setpoint 3 Control Register	
145	Setpoint 4 Control Register	
146 to 147	N/A	
148	Brightness	
149	Baud rate Settings	
150	Serial Address	
151 to 152	N/A	
153	Model Number	✓
154	Version Number	✓
155 to 192	N/A	
193	Delay Type – Setpoint 1	
194	Delay Type – Setpoint 2	
195	Delay Type – Setpoint 3	
196	Delay Type – Setpoint 4	

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ATTACHMENT 2

Setup Codes

CAL (Calibration modes for input and output.)

1st digit (left most): Calibration mode

Digit:	Function
0	Calibration functions as per 2nd and 3rd digit
1	Set baud rate, parity and serial address

2nd digit: Calibration function

Digit:	Function
0	No function
1	Manual calibration (channel as per 3rd digit)
2 to 4	N/A
5	Manual adjust
6	Analog output scaling (analogue channel as per 3rd digit)
7	Analog output calibration

3rd digit: Object for calibration

Digit:	Function
0	No function
1	Processed result (dewpoint, ppmv, lb/mmscf, g/m^3)
2	Pressure input

DEFAULT VALUE = 052

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CODE 1 **(Tendency Indication, Additional LED's, Display data source, Display flashing, Decimal points, Display rounding)**

1st digit (left most): additional LED's

Digit:	Function
0	LED annunciators are always off
1	LED annunciators are on when relays are de-energized
2	LED annunciators are on when relays are energized
3	N/A

2nd digit: Display data source

Digit:	Function
0	Processed data - result (dewpoint, ppmv, lb/mmscf, g/m^3)
1	Processed data - channel 1 (dewpoint only)
2	Processed data - pressure
3 to7	N/A

3rd digit: 0 only

DEFAULT VALUE = 200

CODE 2 **(Totalizer functions & calibration of linearization tables)**

Access denied.

DEFAULT VALUE = 000

CODE 3 **(Serial mode and analog output source)**

Access denied.

DEFAULT VALUE = 000

CODE 4 **(Channel 1, Measurement task, sampling rate)**

1st digit (left most): Analog sample rate

Digit:	Function
0	Single channel (60Hz)
1	Dual channel (60Hz)
2	Single channel (50Hz)

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3	Dual channel (50Hz)

2nd digit: Analog output 1 source

Digit:	Function
0	Dewpoint in degrees C
1	Dewpoint in degrees F

3rd digit: 0 only

DEFAULT VALUE = 010

CODE 5 (Channel 1 Processing)

DEFAULT VALUE = 100

CODE 6 (Channel 2, Measurement task)

1st digit (left most): Measurement task

Digit:	Function
0	Pressure in PSIG
1	Pressure in BARG
2	N/A

2nd digit: 0 only

3rd digit: 0 only

DEFAULT VALUE = 000

CODE 7 (Result processing)

1st digit (left most): Measurement task

Digit:	Function
0	Dewpoint
1	ppmv
2	lb/mmscf (Natural Gas)
3	g/m^3 (Natural Gas)

2nd digit: 0 only

3rd digit: Range for result

Digit:	Function
0	1 – 9999
1	0.1 – 999.9
2	0.01 – 99.99
3	0.001 – 9.999

DEFAULT VALUE = 000

CODE 8 (Data logging and print mode options)

Access denied.

DEFAULT VALUE = 000

SPC (Setpoint control 1 – 6, accessed from SETUP/Down menu after setpoints)

Relay latching, relay setup, source

1st digit (left most): Relay sense

Digit:	Function
0	Relay energized above setpoint value
1	Relay energized below setpoint value
2 to 3	N/A

2nd digit: Setpoint source

Digit:	Function
0	Processed result data (dewpoint, ppmv, lb/mmscf, g/m^3)
1	Dewpoint only
2	Pressure
3	Not applicable for Cermet II I.S.
4	Not applicable for Cermet II I.S.
5	Not applicable for Cermet II I.S.
6	Not applicable for Cermet II I.S.

3rd digit: Setpoint function for SP1 – SP4

Digit:	Function
0	No function
1	Relay latched

2 De-energized relay
3 N/A
4 Not applicable for Cermet II I.S.
5 Not applicable for Cermet II I.S.
6 Not applicable for Cermet II I.S.
7 Setup hysteresis, make/break delay and delay type

DEFAULT VALUE = 000

ATTACHMENT 3

Error Messages

The table below represents the possible error messages that can be seen on the hygrometer monitor under different conditions.

Error message	Possible cause	Action
Under	1. Measured dewpoint is below the measurement range (-100°C/-148°F)	Contact Kahn Instruments regarding your application
	2. Sensor is out of calibration or damaged	Contact Kahn Instruments for sensor repair or recalibration
Over	1. Measured dewpoint is above the measurement range (+20°C/+68°F)	Contact Kahn Instruments regarding your application
	2. Sensor was in contact with liquid water	Dry the sensor out with a stream of dry gas
	3. Sensor is out of calibration or damaged	Contact Kahn Instruments for sensor repair or recalibration
	4. Sensor is contaminated	Contact Kahn Instruments for sensor repair and application assistance
Open	1. Bad electrical connection between sensor and monitor	Verify connectivity of the sensor cable
	2. Internal sensor failure	Contact Kahn Instruments for sensor repair
	3. Internal monitor failure	Contact Kahn Instruments for monitor repair
ErrE	Internal monitor temporary memory corruption due to unusually high power voltage spike	Perform the following monitor resetting procedure: 1. Turn the power OFF. 2. Press and hold the Ý and ß buttons. 3. Turn the power ON

		4. Release the Ý and ß buttons. 5. Verify the monitor settings (alarm setpoints, output scaling, etc.)