SHAW-DRY INSTRUCTION MANUAL

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SHAW-DRY INSTRUCTION MANUAL

GENERAL DESCRIPTION The SHAW-DRY is a low-cost instrument designed for continuous operation and gives a trend -indication of dewpoint temperature, together with an infinitely adjustable alarm function and an analogue 0-100mV 0utput.

CABINET All aluminium precision die-casting 168 x 92 x 135mm. Weight l.3kgs.
Designed for panel mounting or wall mounting. Fixing centres 172 x 64 mm.
Panel cut-out 155 x 129mm.

CONNECTIONS All connections are made to the terminals located on the internal printed circuit board (PCB). Access to the PCB is obtained by opening the meter front, after undoing the screw located at the right-hand side of the instrument front panel. Cables should be taken through the shielded holes in the base of the instrument.

POWER SUPPLY can be 100/120V a.c. or 200/240Va.c. 3OVA. The switch next to the transformer is used to change between these two alternatives, and also shows for which it is set. The power supply connections are at the top right-hand corner of the PCB, next to the fuse.

OUTPUT SIGNAL There is an output signal of 0-l00mV d.c. at maximum scale reading, and is suitable for high impedance loads of 50K ohms or greater. Connections for this output are via the terminal block marked +OUT- located just below the power selector at the left-hand edge of the PCB
This output signal may be used as the input signal to the:-

SIGNAL CONVERTOR which is available as an optional extra, which can be pre-programmed to effect many choices of outputs ranging from straight forward linear Dewpoint conversion to linearising PPM values. This unit is required if a fully isolated output of either Ma or mV is required, please contact our technical department to discuss the possibilities.

SENSOR The sensor is connected to the instrument by means of special coaxial cable which should be connected to the terminals + (centre conductor) and -(screen) located roughly in the middle of the bottom edge of the PCB marked +IN-.

ALARM FUNCTION Connection to the contacts of the alarm relay is through the terminals marked NO, C and NC located at the bottom right-hand corner of the PCB. (Note that the normally closed and normally open connections are reversed if the instrument is wired for fail-safe operation). Contact rating is 2A at 240V a.c. Adjustment of the alarm trip position is by means of the control VP2 Alarm Set, which will be found on the bottom edge of the PCB. The arrow head moulded into the head of the potentiometer may be used as a rough indicator of the alarm trip position. If it is necessary to set the alarm trip position with greater accuracy, proceed as follows:

1. Disconnect the coaxial cable from the. socket on the sensor.

2. Apply a short circuit to the plug on the remote end of the coaxial cable.

3. Adjust the Automatic Calibration control until the instrument reads the required alarm trip position.

4. Adjust the alarm set control until the alarm is just energised.

5. Re-connect the sensor and carry out the Automatic Calibration procedure.

SHAW-DRY INSTRUCTION MANUAL

INSTALLATION. The installation drawing at the end of this manual shows all the components which may be used in a dry gas measurement application, although not all items are needed in every installation.

A sample of the gas to be monitored is taken from the upper surface of the main gas line (or from a vertical section of the pipe) in order that dirt or condensate should not be introduced into the sample. 1/8 o.d. stainless steel pipe is the preferred sample connection although all components we supply are available with fittings for 1/4 o.d. or 6mm o.d. pipe for those cases where a larger diameter pipe is preferred.

The sample pipe should first be connected to a filter unit if there is any risk of dirt or liquid entrainment in the sample. The filter unit should be positioned as close to the main line as possible in order to protect the sample system as well as the sensor from contamination. From the filter unit the sample passes through a pressure regulator (a simple needle valve is frequently sufficient for this purpose), when it is necessary for the pressure to be reduced. From the pressure control the sample passes immediately into the sensor mounted in its sensor holder. The outlet of the sensor holder is connected to the desiccant chamber (if used) and then to the flow indicator (again, if used). The sample is normally vented to atmosphere. It is important to note that nothing is installed before the sensor unless it is absolutely necessary this is to avoid any risk of changing the moisture content of the sample before it has been measured! In particular avoid pressure regulators with rubber diaphragms and flow meters.

Where possible, the sample piping should run upwards from the sample point to the sensor so that any contamination introduced into the system will tend to fall back into the main line, and not be forced further into the sample system. If a downward sloping sample connection is necessary, form a U-bend before the sensor, with a drain tap, which should be checked regularly for condensate.

If any other analysis of the sample is needed (for oxygen content, for example) install the other analyser after the Shaw sensor: our sensor does not change the composition of the sample in any way.

For a closed loop sample system, the exhaust from the sensor should be connected to a lower pressure point within the main system, in order that a flow should be induced within the sample system.

By reversing the order of items 4 & 6 (Installation Schematic) - the pressure control and the sensor in its holder - the sensor can be made to operate at line pressure.

When the system is installed and a stable reading has been obtain, INCREASE THE SAMPLE FLOW RATE temporarily, and if a drier reading results, it indicates that the original flow rate was too low, or that there is a leak in the system allowing ambient moisture into the sample.

INSTALLATION CONDITIONS

INSTRUMENT: All Shaw instruments will operate within a temperature range of —30/+40 deg C. Select an installation position where this temperature range will not be exceeded, particularly avoiding positions where direct sunlight may fall upon the instrument, especially when it is installed in a weatherproof enclosure (which naturally has no ventilation).

SHAW-DRY INSTRUCTION MANUAL

WALL MOUNTING The two mounting brackets should be fastened to the instrument using the two screws provided, so that the brackets are flush with the back of the instrument. Provide a secure mounting for the four screws which will hold the brackets to the wall. The fixing centres for wall mounting are given on the General Arrangement drawing, page thirteen.

PANEL MOUNTING The instrument will have been delivered with the mounting brackets in the panel mounting position. Having made a suitable cut-out in the panel (see page two for details), remove the brackets from the instrument, position the instrument in the panel from the front, refit the brackets and tighten the two clamp screws to secure it in place. Finally tighten the lock nuts firmly.

VIBRATION Shaw instruments are widely used in ships engine rooms and similar situations where vibration is present. However, to obtain maximum life and reliability we recommend that an installation position be selected where the minimum vibration will be present. Alternatively arrange for resilient mountings.

INSTALLATION CONDITIONS: SENSOR

PRESSURE The Shaw sensor is a water vapour pressure detector. This means that it is sensitive to its operating pressure. However, dewpoint temperature is directly proportional to pressure (as the pressure of a gas is increased the dewpoint temperature increases to a wetter level) and so the dewpoint temperature readings given by the instrument remain correct regardless of the pressure at which the sensor is used. IMPORTANT: It is most important to remember that the parts per million (VPM) scale on the instrument is only correct when the sensor is operating at 1 bar(A) pressure. If the sensor is operating at any other pressure the readings in VPM must be corrected by the use of a pressure nomograph or calculator (available from us).

Although Shaw sensors are in regular use at up to 200bar it is generally preferred that the sensor be operated at 1 bar(A). The advantages of this are:

1. The readings will not be affected by changes in the gas pressure in the main pipe.

2. With a typical line pressure of about 7 bar the sensor will never be exposed to free water, even under major fault conditions, as the sample of gas at 1 bar will have a dewpoint temperature of only about 0 deg C. This means that the instrument readings continue to give useful information, and recovery of the sensor after the fault condition has been cured will be very much quicker. The sensor is a water vapour pressure detector, and free water is an enormous overload. Contamination of the sensor with free water will, at best make the calibration suspect and so should be avoided. This is true for ALL electronic sensors, regardless of the claims made by some manufacturers.

If readings at line pressure are necessary, we can supply a special scale, which will show the line pressure dewpoint temperature with the sensor operating at 1 bar. The line pressure must be reasonably constant for this to be satisfactory. Alternatively, if the sensor is operated at line pressure, the standard scale will indicate the correct dewpoint temperature directly without correction.

SHAW-DRY INSTRUCTION MANUAL

VACUUM As stated above the Shaw Sensor is a water vapour pressure detector. It therefore follows that it will operate under vacuum and continue to indicate correctly the water vapour pressure, which remains. As with high-pressure operation it is important to remember that the VPM scale is only correct with the sensor operating at 1 bar. The dewpoint temperature readings remain correct regardless of the system pressure or vacuum.

Also remember, when changing the pressure in systems containing small amounts of water vapour, that a new equilibrium must be established at a new pressure before the final reading will be obtained. Out-gassing or absorption of water vapour molecules from the pores of the materials out of which the system is constructed can cause a considerable time delay, sometimes leading to unexpected results!

RESPONSE TIME The response time from dry to wet of all Shaw sensors is a maximum of 30 seconds for 90% of a step change, depending upon the moisture level and the temperature. The response from wet to dry depends very much upon the operating conditions, and will be affected by the sensor and gas temperature and pressure, and the sample flow rate. In general, the sensor is able to establish a new equilibrium water vapour pressure after a change in conditions at least as quickly as the system in which it is installed.

In order to obtain the best possible system response time it is important to design the sample system carefully. Use the smallest sample pipe possible (we usually suggest 1/8 o.d.) and use the shortest possible length. It is always preferable to use a longer coaxial cable to the sensor, rather than a long sample pipe from the sample point. The sample flow rate should be adequate for the size of sample system: for an average installation having perhaps 2 metres of 1/8 o.d. pipe before the sensor, a flow rate of about 1 L/min. is quite sufficient. If a longer sample pipe is used, then the sample flow should be increased. If necessary, install a by-pass type of system with a high flow rate purging the system and a small proportion of that flow passing over the sensor.

When the system is installed and a stable reading has been obtain, INCREASE THE SAMPLE FLOW RATE temporarily, and if a drier reading results, it indicates that the original flow rate was too low, or that there is a leak in the system allowing ambient moisture into the sample.

IMPORTANT Shaw sensors are suitable for many different industrial and research applications. Most gases can be checked for their moisture content, and there is no need for the calibration to be altered when changing between different gases, even such different gases as Carbon Dioxide and Hydrogen: the sensor operates only with reference to the water vapour content. However there are some gases which must be avoided as they are not compatible with the materials of construction of the sensor. Ammonia and Chlorine must be avoided at all times, even in small quantities. HCL also attacks the sensors very quickly. Gases such as Sulphur Dioxide (SO2) can be monitored, as long as the moisture content is low, generally less than l00 VPM. If in doubt, please check with us first.

GUARANTEE

Shaw products are guaranteed for two years from date of purchase, excluding the Low Spec sensor which is guaranteed for 6 months, only excluding accidental damage or misuse. (This may be limited to one year if purchasing from the stock of one of our overseas distributors)

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SHAW-DRY INSTRUCTION MANUAL

COMMISSIONING AND CALIBRATION CHECKING

One of the most valuable advantages of the Shaw measurement system is the Automatic Calibration feature. Not surprisingly, some other manufacturers suggest that there is some doubt about its effectiveness: this is because no other instrument can be checked so easily and quickly.

The system relies on the fact that each sensor is designed to give no further increase in reading when it reaches its maximum moisture level. This means that, for instance, the special Grey Spot Shaw-Dry sensor will read 0 deg. C dewpoint, and will continue to read 0 C dewpoint when it is exposed to wetter gas. The system can therefore be calibrated very simply by exposing the sensor to anything wetter than 0 deg. C dewpoint, and adjusting the reading to that point on the dial. This enables the instrument to retain the maximum possible accuracy throughout it range.

1. Turn the control marked Automatic Calibration fully anti-clockwise (until it clicks), and then turn it about 3 turns clockwise). Connect one end of the sensor cable to the instrument, and the other end to the coaxial socket on the end of the sensor, this is exposed when the lid is removed from the can in which the sensor is packed. A reading of less than full scale, but above the minimum (left-hand) scale marking should be obtained. This confirms that the instrument, cable and sensor are all working correctly.

2. Disconnect the sensor cable from the sensor and remove the sensor from its dry packing. Reconnect the cable to the sensor and, after the sensor has been exposed to the room air for about 1 minute, adjust the Automatic Calibration control on the Moisture Analyser so that the reading is at the Automatic Calibration line.

3. Disconnect the sensor cable from the sensor, install the sensor in its working position, and reconnect the sensor cable to the sensor socket. The complete system is now calibrated.

WE RECOMMEND THAT THE AUTOMATIC CALIBRATION BE CHECKED ONCE OR TWICE A YEAR: -

1. Remove the Sensor from its normal. position so it is exposed to room air.

2. Leave the Sensor for about one minute (not critical, but not more than a few minutes)

3. IF NECESSARY, adjust the Automatic Calibration Control so that the meter reading is on the AUTOMATIC CALIBRATION LINE.

4. Put the Sensor back in its normal position. THAT S ALL THERE IS TO IT!

SENSOR CABLE

The sensor cable which is used to connect the sensor to the instrument is of the co-axial type. It has a 75 ohm impedance and a capacitance of 50pF or less per metre. Using this cable which is available from us it is possible to position the sensor up to 1000m away from the instrument (300m if a zener barrier unit is used). Instruments are despatched with a standard two metres of cable, unless a longer length is requested.
When using a longer length of cable for the sensor connection, the instrument may show a small reading with the sensor disconnected. This is quite normal, and is due to the capacitance of the cable itself. Locate the Meter Zero control (VP4) on the circuit board of the instrument and adjust the instrument reading (and the output signal) to zero with the cable connected to the instrument, but without the sensor.

SHAW-DRY INSTRUCTION MANUAL

SHAW WEATHERPROOF MODULES: INSTRUCTIONS

Shaw Weatherproof Modules are manufactured from high impact polycarbonate and GRP and are rated IP65. SWS-SS models are the sample system only. The Instructions given here are in addition to the general instructions given elsewhere in the manual which relate mainly to the meter and sensors operation.

1. All units should be mounted securely on a vertical surface.

2. Access to the inside of the enclosure is obtained by disengaging the locking devices.

3. Ensure that all gas/air connections are secure, and that there are no leaks.

4. Observe correct polarity and voltage of all electrical connections and provide a secure earth (ground) connection.

5. Install the sensor, carrying out the automatic calibration procedure as described earlier in this manual.

6. BEFORE connecting the gas/air sample, open the flow indicator valve fully, and close the regulator completely (both fully anti-clockwise).

7. Check that the sample pressure does not exceed the maximum for which the unit is designed. (This will be 28 or 200 or 400bar, depending on your order specification.

8. Turn on the sample at source and then slowly open the regulator (clockwise) until the flow indicator reading is just over its maximum calibration mark.

9. Close the flow indicator valve (clockwise) until the flow indicator shows the required flow rate (usually about 1 to 2 L/min.

10. Observe the small reading on the pressure gauge (if fitted). This is not critical, and will not influence the meter readings. A zero reading will warn of loss of sample.

11. Re-fit lid and securely fasten.

Other operational information will be found in the other pages in this manual.

NOTES: The sensor for the unit will be supplied in its own separate packing. We suggest that it remains in this packing until the complete unit has been installed, and the sample piping purged.

The sample piping to the unit should be kept a short as possible. The sample tapping point should be on an upper surface of the main line (or on a vertical section), and piping should run upwards to the Shaw unit wherever possible. These precautions will help to avoid possible contamination of the unit with condensate under fault conditions. If downward sloping pipe is unavoidable, from a U bend with drain tap immediately before the Shaw unit, and check regularly for condensate.

Examine, and replace the filter cartridge at intervals determined by the amount of contamination and the sample flow rate.

SHAW-DRY INSTRUCTION MANUAL

THE SHAW SENSOR: DESCRIPTION, THEORY AND OPERATING CONDITIONS

The Shaw High Capacitance Sensor has been undergoing continuous development since it was invented by Mr.. J. L. Shaw in the late 1940 s.

CONSTRUCTION of the sensor starts with an ultra-high purity aluminium wire, which is coated with a hygroscopic layer and finally covered by a film of porous gold. The gold film and the aluminium core form the plates of a capacitor. The capacitance value, and the change in capacitance value over the measuring range of each sensor (which is at least 100 times greater than in any other sensor of this type) is measured at supply frequency (50 or 60Hz) which enables long cable lengths (up to 1000M) of cable to be used between each sensor and the analyser without any risk of interference or pick-up from external cables or other sources. Some of the water vapour molecules in the atmosphere surrounding the sensor will enter the dielectric layer where, due to the extremely small size of the pores, their Brownian motion will be restricted and the energy will be removed from the molecules so that they will condense into liquid water. Due to the very high dielectric constant of water (about 80) compared with the other vapours which may be present, this produces a marked change in the dielectric value of the sensor which is then measured by the analyser. A dynamic equilibrium will exist between the water vapour outside the sensor and the condensed water within the pores. This equilibrium is maintained, and the response time of the sensor can generally be considered to be at least as quick as the system into which it is installed.

Molecules larger than water vapour (which is one of the smallest gas molecules) cannot enter the pores, making the sensor resistant to many contaminants and specific to water vapour pressure regardless of the carrier gas. (Molecules of gases such as Hydrogen will enter the sensor pores, but their dielectric strength is small enough that no measurable change occurs in the sensor)

TEMPERATURE Shaw sensors are designed to work at normal room temperature. Our long experience of exporting to countries throughout the world has shown that ambient temperature variations can safely be ignored for all practical purposes, so long as the temperature range for each sensor given below is not exceeded. In particular, avoid placing any sensor in direct sunlight or near a source of radiant or convected heat. For special applications where high or low temperature operation seems unavoidable, please refer to your local Shaw dealer or us.

OPERATING TEMPERATURE: The Shaw-Dry Grey spot sensor operate accurately in the temperature range –35 to +40 deg. C

ACCURACY The Shaw-Dry Grey spot sensor or SE-LS-GY is designed to show trends within its overall range, rather than absolute values. The accuracy is to better than +/-7 deg. C Dewpoint.

IDENTIFICATION. Shaw Sensors are identified by two grey spots on the handle.

SHAW-DRY INSTRUCTION MANUAL

HAZARDOUS AREA INSTALLATION The Shaw Sensor has been approved for use as part of an intrinsically safe circuit. This means that it may be installed in an area where there is risk of fire or explosion. The instrument must be located in a safe area, and the length of coaxial cable between the instrument and sensor must be no more than 300 metres. In addition, a Zener Barrier Unit must be installed in the safe area and connected between the instrument and its sensor.

The Zener Barrier Unit is a device, which limits the amount of energy, which can reach the sensor, even in a major fault condition, to less than that required to cause a spark which could ignite the explosive gas.

All instruments ordered for hazardous area operation are supplied with a copy of the relevant certificate. This can be BASEEFA (U.K.), CENELEC (European) or FACTORY MUTUAL (U.S.A.).

CONSTANT TEMPERATURE UNIT. This is used in place of the Sensor Holder when there is a risk of condensation on the sensor due to wide ambient temperature variations or, in non-standard applications, when the gas dewpoint temperature may be higher than the ambient temperature. It should be used in exactly the same way as the Sensor Holder, and the thermostat should be set to the temperature indicated on the information supplied with the sensor.

BASIC DEFINITIONS

WATER VAPOUR PRESSURE is the pressure exerted by the water vapour contained in any mixture of gases. The total pressure exerted by the gas mixture is the sum of the pressures exerted by its components - including the water vapour. Water Vapour Pressure varies in direct proportion to the total gas pressure.

DEWPOINT TEMPERATURE is defined as the temperature to which the gas must be cooled in order that it should be saturated with water vapour (i.e.: 100% relative humidity.) For practical reasons it is referred to water above 0 deg C and ice below 0 deg C.

PER MILLION BY VOLUME: ppm(v) or VPM is the ratio of the water vapour pressure to the total gas pressure.

PARTS PER MILLION BY WEIGHT: ppm(w) is similar to VPM, except that the figure is modified according to the ratio of the molecular weight of water vapour to the molecular weight of the carrier gas mixture.

RELATIVE HUMIDITY is the ratio of the actual water vapour pressure in the gas to the saturation water vapour pressure at the same temperature.

TROUBLE SHOOTING

SYMPTOM: ERRATIC READINGS	REMEDY
CAUSE:	Static on Indicator: Moisten indicator face with 50/50 mixture of detergent and water, or use proprietary anti-static cleaner. DO NOT POLISH INDICATOR FACE

SYMPTOM: FULL SCALE READING	REMEDY
CAUSE: Wet gas:	Stop gas supply and switch meter off.
Short circuit on sensor:	Disconnect plug from sensor and if meter cable or connections still reads over FSD, cure the short circuit in the cable or connections or replace cable.
Short circuit sensor:	Disconnect plug from sensor and note that the meter reading returns to zero. Fit new sensor, or apply approx. 20V d.c. to the sensor MOMENTARILY with the sensor in a known dry condition, polarity is not important.

SYMPTOM: ZERO READING	REMEDY
CAUSE: Open circuit on cable:	Disconnect plug from sensor and connect centre pin of plug to the outer connection. No reading will be obtained. Repair cable.
CAUSE: Open circuit on sensor:	Test as for open circuit on cable, but note that reading over FSD obtained. Check sensor connection or replace sensor.
CAUSE:Instrument un-serviceable:	Connect centre pin of sensor cable socket on instrument to its outer connection and note that no reading is obtained even with sensitivity control setting increased. Return instrument for service.
CAUSE: Automatic Calibration: wrongly set	Readjust to correct setting [i.e. carry out the Automatic Calibration procedure].

TROUBLE SHOOTING

SYMPTOM: WET READING	REMEDY
CAUSE: Leak in system or use of unsuitable pipe.	Cure the leak, or replace unsuitable pipe with copper or stainless steel. Flexible connections should be made with PTFE pipe. NEVER use rubber or plastic pipe.

SYMPTOM: SLOW RESPONSE	
CAUSES: Water vapour in system. : Flow rate too low: Sample pipe too large: Unsuitable sample pipe:	It is usually more satisfactory to bleed a sample of gas at atmospheric pressure through the sensor in its sensor holder and to use 1/8 [3mm] o.d. sample pipe. See above re sample pipe material.

SYMPTOM: DRY READING	REMEDY
CAUSE: Automatic Calibration: wrongly set, or faulty Sensor	Check Automatic Calibration, or return sensor for full calibration check by us.

SYMPTOM: CONSTANT READING	REMEDY
CAUSE: Condensation in sample system.	Condensation will occur if the temperature of the sample system, at any point is below [colder] than the dewpoint temperature of the sample gas. Once having formed, the sample reaching the sensor will have a dewpoint equal to the temperature of the condensation, regardless of the dewpoint of the sample at the sample point.

ELECTRICAL FUNCTION CHECK

If there is any doubt about the functioning of the Analyser, the following tests may be carried out.

1. Switch instrument off.

2. Check that meter reading is accurately at the zero [left-hand] end of the scale. If not, adjust the reading by means of the plastic screw on the meter face.

3. Disconnect the sensor[s].

4. Check the required power supply [110 or 230V a.c.] and then switch instrument on.

5. Apply a short circuit to the sensor cable socket on the instrument, the voltage is extremely low, so there is no hazard.

6. Adjust the Automatic Calibration to give a reading of full scale.

7. Remove the short circuit and the reading should return to the left-hand end of the scale. This establishes that there is no major fault in the instrument. If the tests so far do not produce the expected results, the instrument should be returned to our Bradford works, or your local dealer.

8. Remove the short circuit and replace it with a load of 8.6K ohms. Readjust the reading to full scale, using the Automatic Calibration.

9. Increase the load to 18.6K ohms. The reading should decrease to 61% of scale +/-1%

10. Increase the load to 62K ohms. The reading should decrease to 21% of scale with the same tolerance as above.

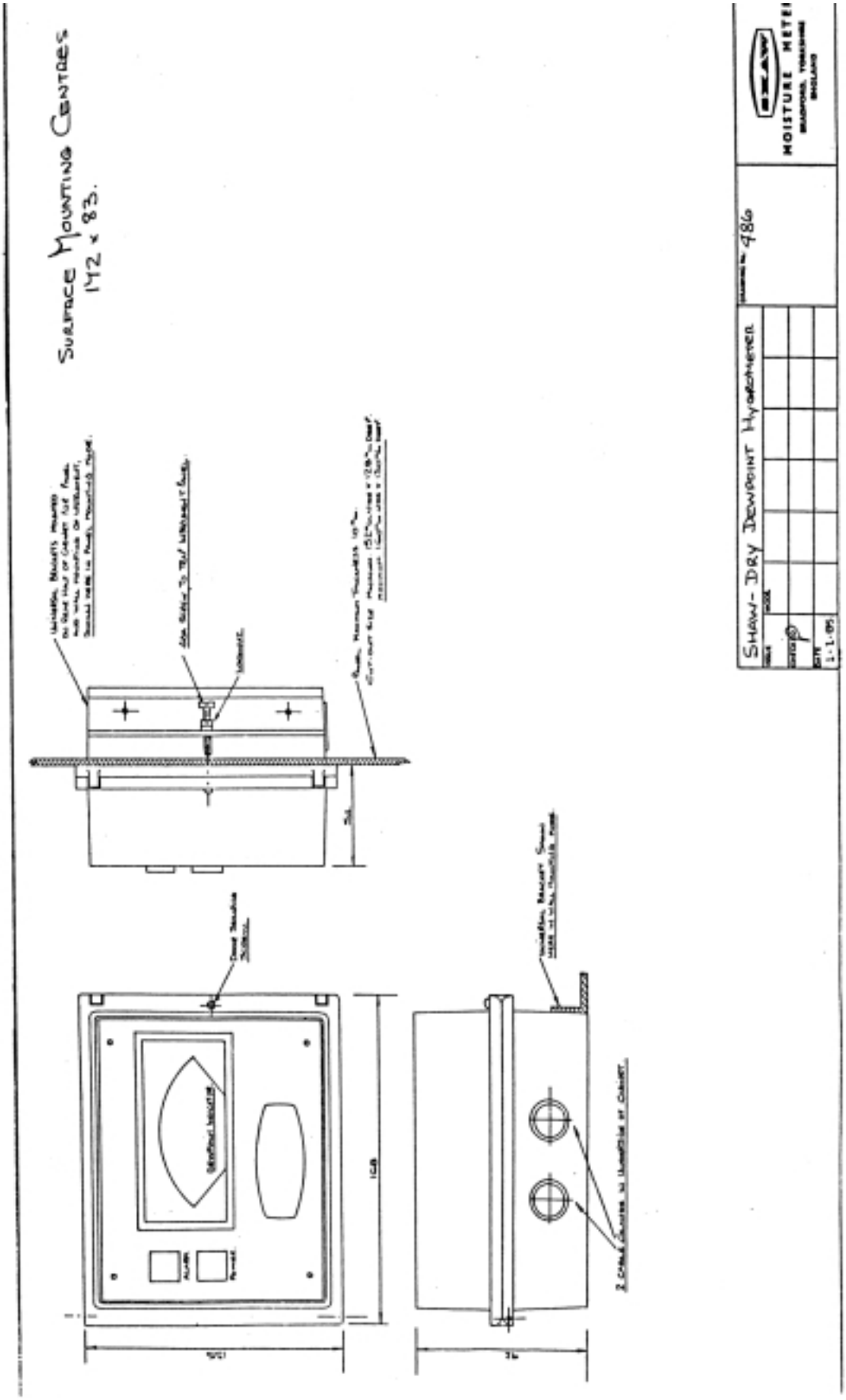
11. Using any type of continuity tester, check the normally open and normally closed contacts of the alarm relay, using the Set alarm control to operate the relay.

12. Using a suitable high impedance multimeter, check the value of the output signal against the instrument specification.

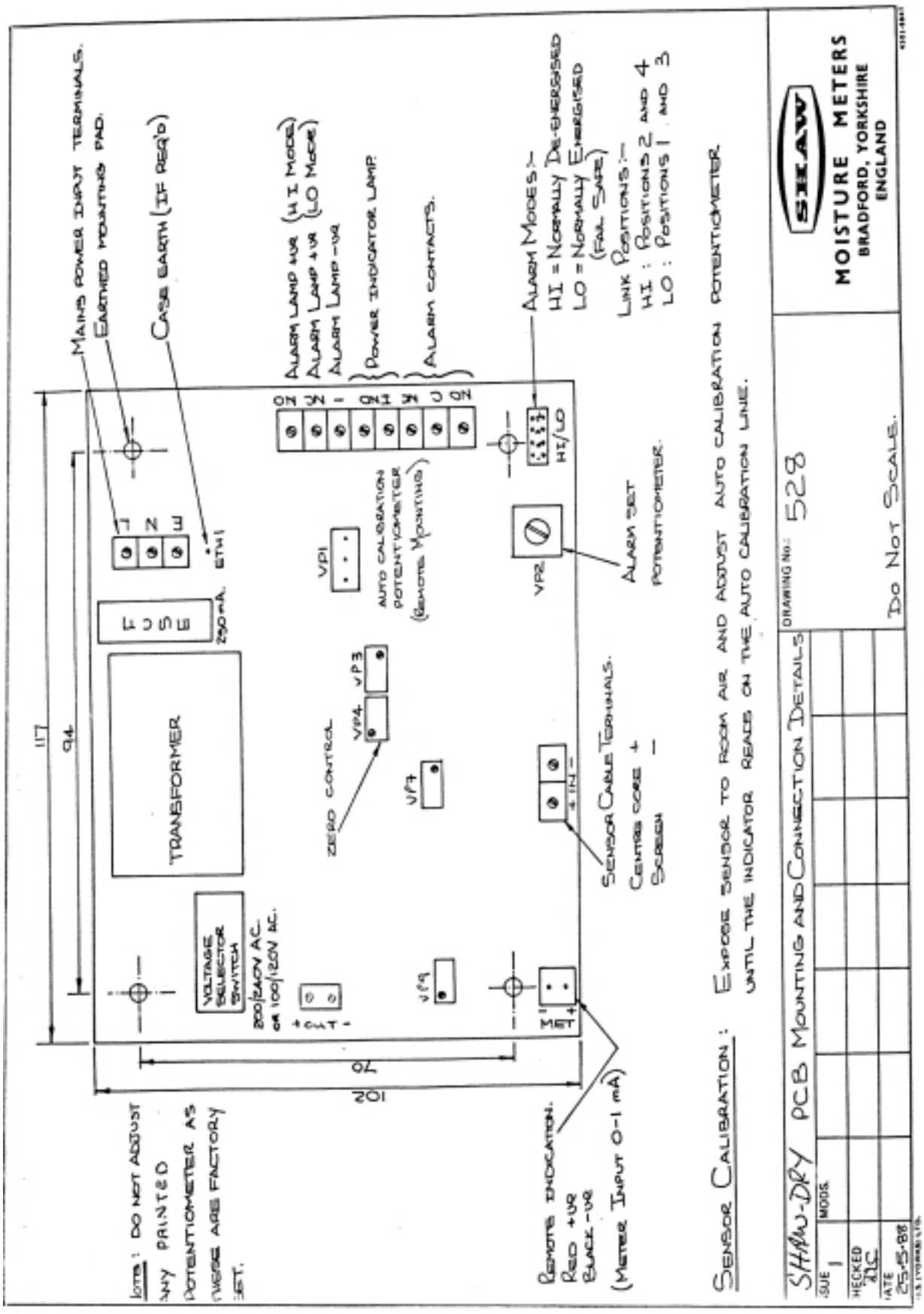
13. After testing the instrument electrically, reset the Automatic Calibration of the sensor.

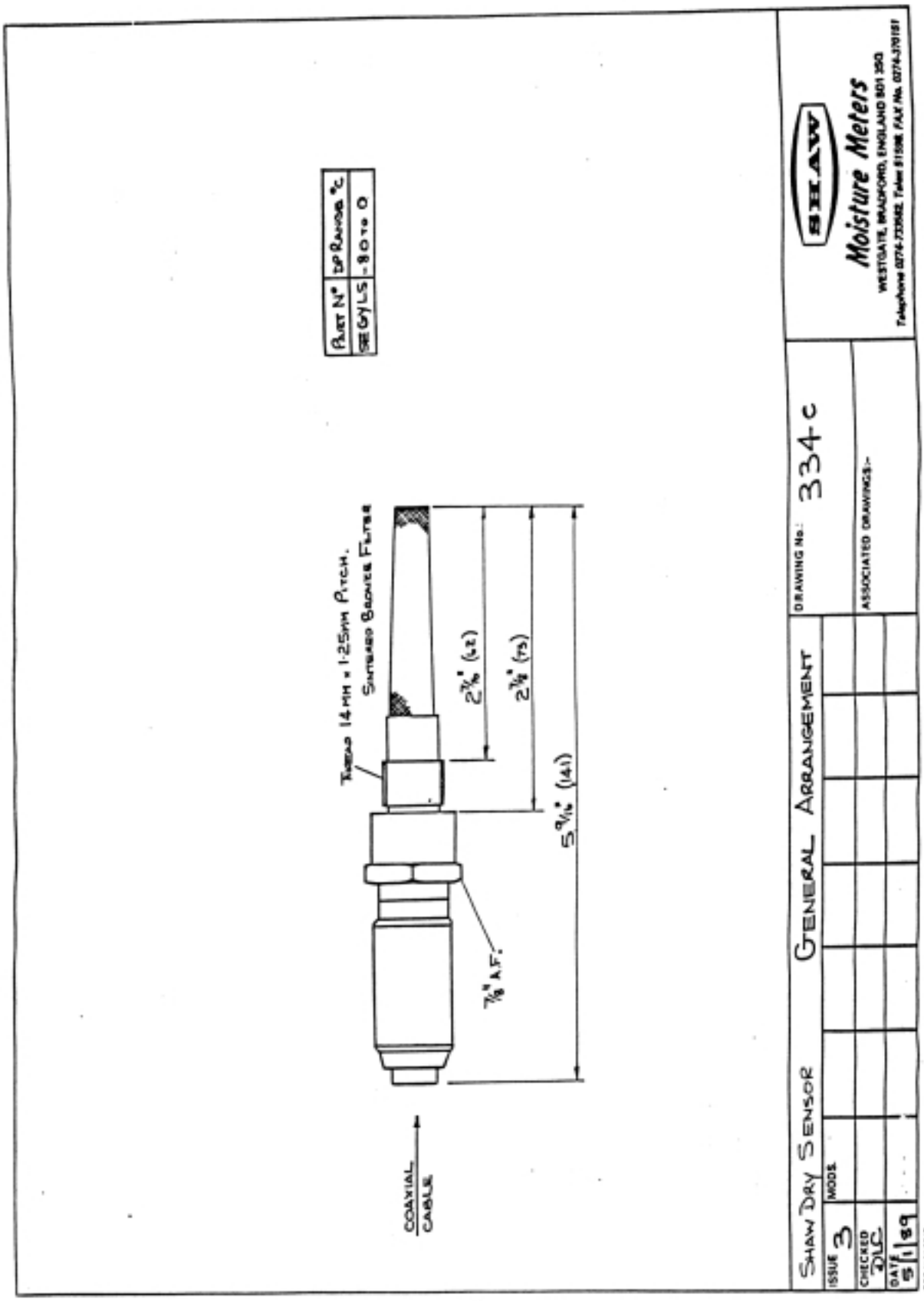
This completes the Electrical Function Test

NB: As the body of the sensor is earthed, it is important that the earth potential at the sensor is the same as that in the power supply earth to avoid stray pick-up. This is very rarely a problem, but if in doubt, check for a voltage between the sensor body and the sensor holder before installing the sensor.


Surface Mounting Centres
142 x 83.
SHAW-DRY Dewpoint Hygrometer
MOISTURE METE

SHAW-DRY INSTRUCTION MANUAL




Part N° | DP Range °C
SE GYLS-80 to 0
Thread 14 mm x 1·25mm Pitch.
Sintered Bronze Filter
2⅜" (61)
2⅞" (73)
5⅝" (141)
⅞" A.F.
COAXIAL CABLE
SHAW Moisture Meters
WESTGATE, BRADFORD, ENGLAND BD1 3SQ
Telephone 0274-733582. Telex 51598. FAX No. 0274-370151
DRAWING No: 334c
ASSOCIATED DRAWINGS:-
SHAW DRY SENSOR
GENERAL ARRANGEMENT
ISSUE 3
MODS
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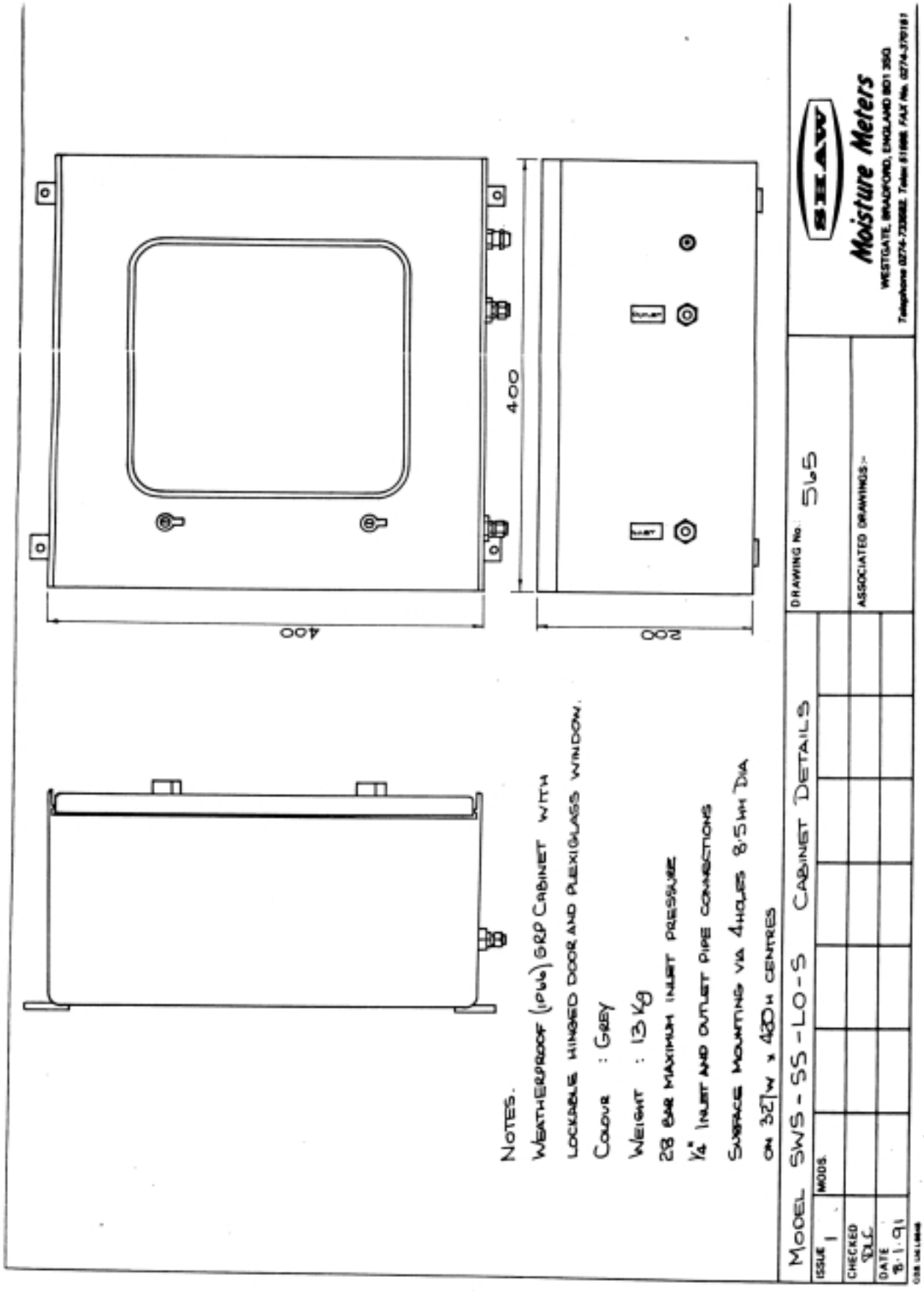
DATE 5/1/89


400
400
200
NOTES.
WEATHERPROOF (IP66) GRP CABINET WITH
LOCKABLE HINGED DOOR AND PLEXIGLASS WINDOW.
COLOUR : GREY
WEIGHT : 13 Kg
28 BAR MAXIMUM INLET PRESSURE
¼" INLET AND OUTLET PIPE CONNECTIONS
SURFACE MOUNTING VIA 4 HOLES 8.5mm DIA
ON 327W x 430H CENTRES
MODEL SWS-SS-LO-S CABINET DETAILS
DRAWING No 565
ASSOCIATED DRAWINGS :-
SHAW
Moisture Meters
WESTGATE, BRADFORD, ENGLAND BD1 3SQ
ISSUE 1
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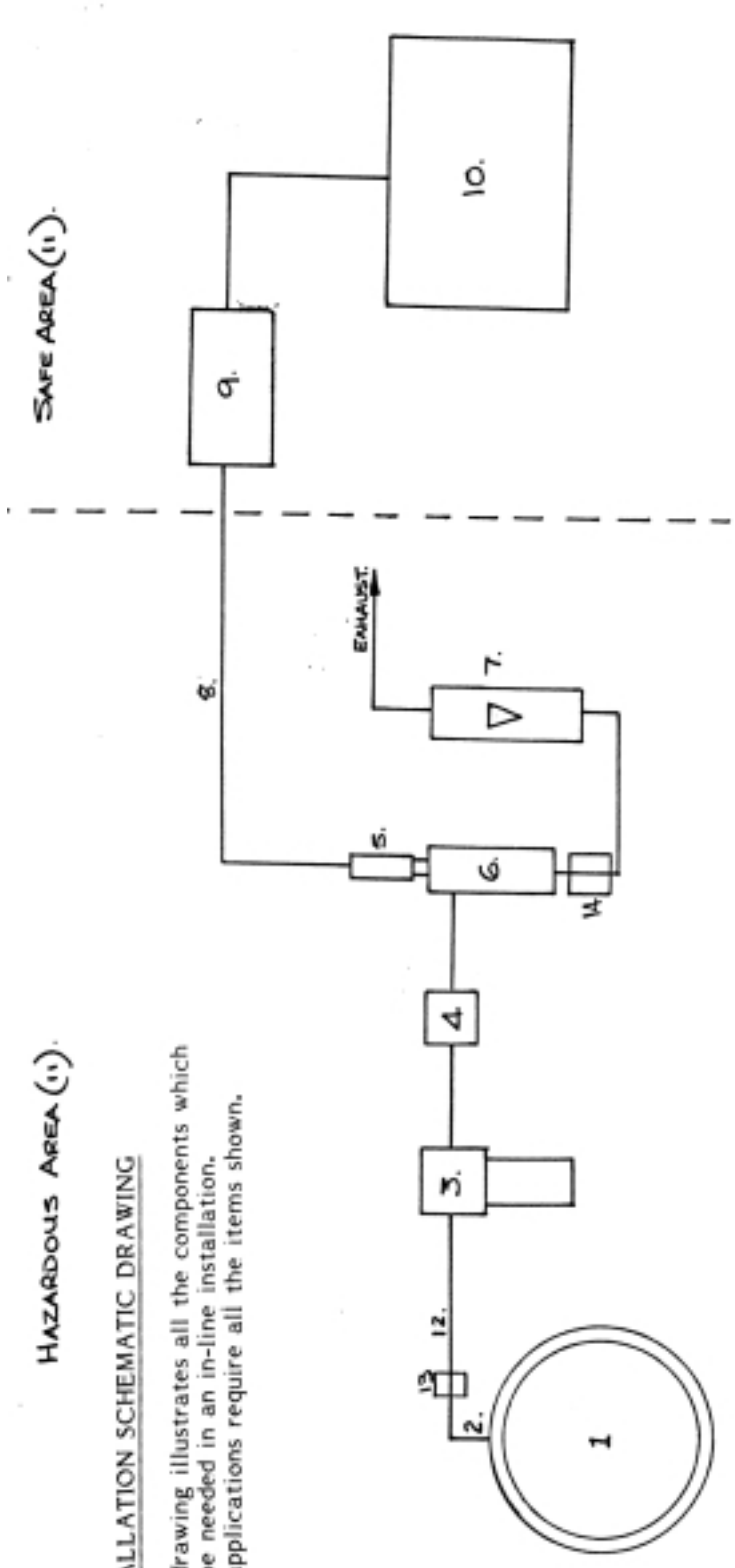

INSTALLATION SCHEMATIC DRAWING

This drawing illustrates all the components which may be needed in an in-line installation. Few applications require all the items shown.

NOTES:

1. MAIN AIR/GAS LINE
2. SAMPLE POINT: ON UPPER SURFACE TO AVOID CONDENSATE OR OTHER CONTAMINATION.
3. FILTER UNIT. (IF USED).
4. PRESSURE REGULATOR (IF USED). N.B. IF FITTED AFTER SENSOR INSTEAD OF BEFORE SENSOR, METER WILL INDICATE LINE PRESSURE DEWPOINT.
5. SENSOR.
6. SENSOR HOLDER (OR CONSTANT TEMPERATURE UNIT FOR SOME SPECIAL APPLICATIONS).
7. FLOW INDICATOR (IF USED).
8. COAXIAL CABLE.
9. ZENER BARRIER UNIT (IF USED).
10. MOISTURE ANALYZER.
11. ONLY APPLIES TO CERTIFIED (INTRINSICALLY SAFE INSTALLATIONS: SEE CERTIFICATE AND REGULATIONS.
12. SAMPLE PIPE. COPPER OR STAINLESS STEEL ⅛", ¼" OR 6⅜". O.D.
13. ISOLATION VALVE.
14. DESICCANT CHAMBER (IF USED)

HYGROMETRIC EQUIVALENTS

DEWPOINT DEG C	DEWPOINT DEG F	VAPOUR PRESSURE mm Hg *	RELATIVE HUMIDITY % @ 20 C	PARTS PER MILLION by VOLUME	+++	DEWPOINT DEG C	DEWPOINT DEG F	VAPOUR PRESSURE mm Hg *	RELATIVE HUMIDITY % @ 20 C	PARTS PER MILLION by VOLUME
-150	-238	7 x 10(-15)	3.9 X 10(-14)	9.2 x 10(-12)	+++	-52	-62	.02305	.131	30.329
-140	-220	3 x 10(-10)	1.7 x 10(-9)	3.9 x 10(-7)	+++	-50	-58	.02961	.169	38.961
-130	-202	7 x 10(-8)	4.0 x 10(-8)	9.2 x 10(-6)	+++	-48	-54	.03786	.216	49.816
-120	-164	9 x 10(-8)	5.4 x 10(-7)	1.2 x 10(-4)	+++	-46	-51	.04819	.275	63.408
-118	-180	.00000015	.0000009	.00020	+++	-44	-47	.06108	.348	80.368
-116	-177	.00000025	.0000014	.00033	+++	-42	-44	.07709	.440	101.43
-114	-173	.00000041	.0000023	.00054	+++	-40	-40	.09691	.553	127.51
-112	-170	.00000066	.0000038	.00087	+++	-38	-36	.12133	.692	159.64
-110	-166	.00000107	.0000061	.00141	+++	-36	-33	.15133	.863	199.12
-108	-162	.00000169	.0000096	.00222	+++	-34	-29	.1880	1.07	247.37
-106	-159	.00000266	.000015	.00350	+++	-32	-26	.2328	1.33	306.32
-104	-155	.00000413	.000024	.00543	+++	-30	-22	.2871	1.64	377.76
-102	-152	.00000636	.000036	.00837	+++	-28	-18	.3529	2.01	464.34
-100	-148	.00000968	.000055	.0127	+++	-26	-15	.4323	2.47	568.82
-98	-144	.00001459	.000083	.0192	+++	-24	-11	.5277	3.01	694.34
-96	-141	.00002178	.00012	.0287	+++	-22	-8	.6422	3.66	845.00
-94	-137	.00003224	.00018	.0424	+++	-20	-4	.7790	4.44	1025.00
-92	-134	.00004729	.00027	.0622	+++	-18	0	.9421	5.37	1239.61
-90	-130	.00006879	.00039	.0905	+++	-16	+3	1.136	6.48	1494.74
-88	-126	.00009924	.00057	.1305	+++	-14	+7	1.365	7.78	1796.05
-86	-123	.00014205	.00081	.1869	+++	-12	+10	1.636	9.33	2152.63
-84	-119	.0002018	.00115	.2655	+++	-10	+14	1.956	11.15	2573.68
-82	-116	.0002844	.00162	.3742	+++	-8	+18	2.331	13.29	3067.11
-80	-112	.0003981	.00227	.5238	+++	-6	+21	2.771	15.80	3646.05
-78	-108	.0005533	.00316	.7280	+++	-4	+25	3.285	18.73	4322.37
-76	-105	.0007638	.00436	1.005	+++	-2	+28	3.884	22.15	5110.53
-74	-101	.0010476	.00597	1.378	+++	0	+32	4.581	26.12	6027.63
-72	-98	.0014275	.00814	1.878	+++	+2	+36	5.292	30.18	6963.16
-70	-94	.001933	.0110	2.543	+++	+4	+39	6.099	34.78	8025.00
-68	-90	.002603	.0148	3.425	+++	+6	+43	7.012	39.99	9226.32
-66	-87	.003483	.0199	4.583	+++	+8	+46	8.045	45.88	10585.53
-64	-83	.004635	.0264	6.099	+++	+10	+50	9.209	52.52	12117.10
-62	-80	.006135	.0350	8.072	+++	+12	+54	10.518	59.98	13839.47
-60	-76	.008076	.0461	10.626	+++	+14	+57	11.988	68.37	15773.68
-58	-72	.010576	.0603	13.916	+++	+16	+61	13.635	77.76	17940.79
-56	-69	.013780	.0786	18.132	+++	+18	+64	15.478	88.27	20365.79
-54	-65	.01787	.1019	23.513	+++	+20	+68	17.535	100.00	23072.37

* Courtesy of the American Institute of Physics Handbook, Third Edition, published by McGraw-Hill book company.

Relative Humidity and PPM figures are derived from WVP. Figures are in equilibrium with water above, and ice below, 0 C.

WATER VAPOUR PRESSURE is the pressure exerted by the water vapour content of a gas. The total pressure exerted by the gas mixture is equal to the sum of the pressures exerted by its components - including water vapour. Water vapour pressure varies in direct proportion to the total gas pressure.

DEWPOINT TEMPERATURE is the temperature to which the gas must be cooled in order that it should be saturated with water vapour (100% relative humidity). Dewpoint temperature varies in direct proportion to the total gas pressure.

PARTS PER MILLION by VOLUME is the ratio of the water vapour pressure to the total gas pressure. It is not affected by variations in the total pressure, as the ratio remains the same.

RELATIVE HUMIDITY is the ratio of the water vapour pressure to the saturation water vapour pressure at the same temperature and total pressure. It varies in direct proportion to the total pressure.

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