SHAW AUTOMATIC DEWPOINT METER MANUAL
July 2003

INSTRUCTION MANUAL FOR MODELS SADP, SADP-TR & SADP-D

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MODELS: SADP, SADP-TR & SADP-D

The SADP & SADP-TR are a battery operated portable unit designed for spot checks or continuous use, and gives direct indication in dewpoint temperature and parts per million on a 12cm analogue scale, SADP-D versions perform the same function but display only Dewpoint on a LCD display.

The instrument may be used to give a continuous reading as long as sample gas is flowing through the test chamber [head] of the instrument, a reading will be given of the gas moisture content. Alternatively results are obtained in a few minutes when making spot checks.

RANGES

SADP-{r}:	**Range:**
Purple: **{P}**	-100 / 0 deg.C DP, 0-6000 PPM.
Silver: **{S}***	-100 / -20 deg.C DP, 0-1000 PPM, and 0-10 on TR version.
Red: **{R}**	-80 / -20 deg.C DP, 0-1000 PPM, 0-10 on TR version.
Grey : **{GY}**	-80 / 0 deg.C DP, 0 - 6000 PPM, and 0-10 on TR version.
Yellow: **{Y}***	-60 / 0 deg.C DP, 10 - 6000 PPM.
Blue: **{BL}***	-80 / +20 deg.C DP, 0 - 23,000 PPM, (manual-cal).
*	Special order ranges.

CABINET

Aluminium and zinc-plated steel, stove enamelled. 202mm wide x 225mm deep x 276mm high [320mm high with test chamber (head) in the open position]. Typical weight 5kgs. Four feet fitted for bench use.

The instrument is provided as standard with a padded carrying case with shoulder strap, a moisture calculator, a screwdriver for the Automatic Calibration control, a special key for the security plate covering the battery carriers, and a 2 metre length of special spiral-cut flexible PTFE (Teflon) sample pipe.

SAMPLE CONNECTIONS

There is a push-on sample connection on each side of the test chamber [head] of the instrument. These connections are reversible and flow direction is not important. The fittings are designed for pipe having an internal bore of approximately 6mm [1/4''']. Only the PTFE (Teflon) pipe provided should be used as other materials are unsuitable. The sample pipe should be heated for a few seconds before being pushed onto the instrument connection for the first time. This will provide a gas-tight connection and ensure accurate results.

POWER SUPPLY

The instrument is supplied with 6 C-size R14 cells. In normal use these will last for one to two years.

Rechargeable batteries may be used, if required, as long as the instrument is not to be used in a hazardous area [from the point of view of fire or explosion risk]. The use of re-chargeable batteries invalidates the certification of the equipment for use in hazardous areas.

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SENSOR

The sensor is mounted inside the test chamber [head] of the instrument, and is accessible by removing the test chamber from the instrument as follows:

1. Undo the three screws in the base flange of the head assembly and lift the complete head off the instrument. Pull out the plug from the sensor.

2. Using a 22mm AF spanner, unscrew the sensor from the head assembly. Do not leave the head without a sensor fitted for more than a few minutes, as the desiccant will absorb moisture from the room air.

3. When refitting the sensor, push the coaxial plug in firmly and don't forget to fit the brass spacer.

CONTROLS

SADP instruments have a single rotary switch to the right of the indicator, which controls the power supply, the battery check and the range selection (in dual range models) . The switch positions are marked on the instrument fascia. SADP-D models have a single on/off switch

BATTERIES AND BATTERY CHECK

On SADP models when the battery check position is selected the reading should be in the green sector, or to the right of it. If the reading is to the left of the green sector, then the batteries should be replaced. SADP-D models have a battery symbol in the display which comes on when the batteries require replacing.
To replace the batteries, first remove the instrument from its carrying case. The battery holders will be found on the instrument back panel, and protected by a metal plate which has details of the safety certification marked on it. Remove the plate by undoing the 2 special screws with the key provided, take off the cap of each battery carrier, and replace the batteries with 6 VARTA Baby R14P cells. Always replace all 6 batteries at the same time, and do not leave completely discharged batteries in the instrument. Do not mix batteries and always replace them in a non hazardous location.

HAZARDOUS AREA USE - SAFETY

All SADP Shaw Automatic Dewpoint meters are certified Intrinsically Safe as a standard feature. They must be fully assembled to meet the certification requirements, i.e. they must not be switched on in a hazardous location if any component is missing or removed. E.G. battery cover plate or sensor head assembly etc.

The USA certification is to CLASS I, ZONE 0 AEx ia IIB+H2 T6, which effectively means that the instruments may be used in any environment except a coal mine.

The ATEX certification is ℳ II 1 G EEx ia IIC T6.
This means

ℳ-European certification mark for electrical equipment for use explosive atmospheres
II -Areas classified hazardous due to presence of flammable gases or vapour
1 -Areas classified as Category 1 Risk according to the ATEX Directive (equates to Zone 0)
G -Risk due to presence of flammable gases or vapours according to the ATEX Directive
EEx ia - intrinsic safety level of protection ia according to EN 50202:2002
IIC - suitable for use with all classes of gasses and vapours
T6 - the product has a maximum surface temperature of 85°C (in an ambient temperature range of -20°C to + 40°C) and can be used with any gases or vapours which have an ignition temperature above this.

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OPERATION

Brief operating instructions will be found on the label fastened to the top of the instrument cabinet. The standard test procedure is as follows:

1. Switch the instrument on, and check the battery condition.

2. At the sample point to be tested open the sample valve or regulator slightly and check that no dirt or condensate is expelled. [If any dirt or condensate is present, wait until it is cleared, or abandon the test].

   The pressure of the sample source is not important: **however the instrument needs a small sample of the air or gas which has been reduced to atmospheric pressure at the sample point (It must not exceed 2Bar for safe operation)** - easily achieved by opening the valve just enough to allow a small flow to escape through the dewpoint meter.

3. Connect the PTFE sample pipe supplied with the instrument between the sample tapping point and the instrument, using either of the connections of the head/sensor assembly.

4. Adjust the sample valve or regulator to give a gentle flow through the instrument, [5/10 L/min. is ideal — but the flow rate is not particularly critical. **Do not exceed a flow of about 20 L/min].**

5. Allow the sample to flow for 2 or 3 minutes in order to purge the sample pipe (a longer time might be needed if testing very dry gas - drier than about -65 c. dewpoint). Then place a finger over the outlet connection of the instrument head, and the sample pressure will cause the head to open. Remove finger from the instrument when the head is fully open. [If there is insufficient sample pressure, fit a length of 1 or 2 metres of flexible pipe to the outlet connection of the instrument head, and slowly raise the head by hand].

6. The instrument reading will move up the scale (wetter), and stabilise. When there is no further change in reading, note the result. If the reading moves up the scale (wetter) and then moves down the scale (drier) then either the sample pipe was not purged enough before the head was raised, or the sample is becoming drier during the test. (Perhaps by taking the sample from a pipe in which the gas has been stagnant for some time).

   If in doubt about the suitability of the sample flow rate, or the materials of the sample pipe being used, increase the sample flow rate after the final reading has been obtained. If the instrument moves to a drier reading this indicates that the original flow rate was too low, or that there is a leak in the system allowing ambient moisture into the sample, or that the sample pipe itself is still wet.

7. After the test is complete, and if continuous reading is not needed, close the instrument head ready for the next test.

8. Note these instruments are designed for rapid moisture determination when operated from Dry to Wet, in this case they should give a 95% step change within 30 seconds. When operated Wet to Dry we cannot quote any response time as this is dependant upon many variables but will be considerably longer than the Dry to Wet response time.

CALIBRATION CHECKING

When Shaw invented the capacitance sensor many years ago it was a real breakthrough. The second major breakthrough came when we introduced the unique Automatic Calibration System for our sensors.

This is a major advantage of the Shaw measurement system. No other instrument can he 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, for example, that the Yellow Spot sensor used in the Model SADP-Y for the range -60 to 0 C dewpoint will read 0 deg C when exposed to gas at 0 deg C dewpoint, but will continue to read 0 deg 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. In practice there is not an immediate cut-off, and the 0 deg C dewpoint mark on the dial will be found at about 3 deg below the Automatic Calibration line. This enables the instrument to retain the maximum possible accuracy throughout its range.

In practice, the instrument's calibration is checked as follows:

AUTOMATIC CALIBRATION All Models excluding SADP-Bl

1. Ensure that no gas sample is connected to the instrument head connections. Switch meter to Read, or Standard range if a TR Model. Switch to On for SADP-D models.
2. Raise the head of the instrument by hand and pump it up and down a few times, ending in the raised position.
3. After about 1 minute (not critical, but not more than a few minutes) check the instrument reading. On SADP models it should be at the Automatic Calibration line. It is not critical within 1 or 2 degrees. N.B. Extremes of humid or dry room air conditions may affect the reading slightly - see below. SADP-D models must be set to the Wet limit of the sensor, see table of P2 for details.
4. If the reading requires adjustment locate the Automatic Calibration control, which is to be found on the front panel of the instrument, and using the small screwdriver provided, turn the control clockwise to increase the reading (wetter) or anti-clockwise to decrease it.
5. Close the instrument head.

NOTE: When the outside temperature is below 0 deg C or in an Air-Conditioned environment the room dewpoint may also be below 0. Under these conditions we suggest that an independent check of the room dewpoint be made against which the calibration can be set or, more easily, assume that the room dewpoint temperature is the same as the outdoor air temperature. This will be quite sufficient except in very unusual weather conditions.

MANUAL CALIBRATION For Models SADP-Bl and SADP-D-Bl

The wide range of the Model SADP-Bl and SADP-D-Bl means that very rarely will the room air dewpoint be above the maximum of the range. This means that true Automatic Calibration will not work. To overcome this, simply use a wet & dry bulb hygrometer, or similar, to determine the room air dewpoint temperature, and at stage (4) above set the reading to the actual air dewpoint. There is, of course, no Automatic Calibration line on these meters.

We suggest you check the automatic calibration a minimum of two to three times each year, and that annually the instrument is returned for a full range calibration check

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THE SENSOR

The Shaw High Capacitance Sensor has been undergoing continuous development since it was invented by Mr. J. L. Shaw in the late 1940's. Protected by world patents the sensor is manufactured by a unique automated process, which results in a long life device with fast response, high accuracy and good stability.

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 the capacitor. The capacitance value, and the change in capacitance over the measuring range of each sensor is many times greater than any other device, resulting in a system which can operate at low frequency [50 or 60Hz] 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 limited, their energy will consequently be reduced and 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 [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. Even molecules such as Hydrogen which may enter the pores, have such a low dielctric constant, and will not condense, and so cannot interfere with the reading.

This is a feature unique to the Shaw sensor. All other sensors of the capacitance type are affected by molecules such methanol which cause great inaccuracy.

TEMPERATURE

Shaw sensors are designed to work at room temperature. Typical ambient variations experienced throughout the world are quite acceptable, but avoid placing the instrument in direct sunlight or near a source of radiant or convected heat. In countries, which experience extremes of temperature, always carry out the Automatic Calibration with the instrument at its operating temperature.

For special applications where high or low temperature operation seems unavoidable please refer to your local Shaw dealer or us.

PRESSURE

The Shaw sensor is a water vapour pressure detector. The Automatic Dewpoint Meter operates with the sensor at atmospheric pressure, and the readings given in dewpoint temperature and parts per million are therefore correct at 1 bar [A]. However, dewpoint temperature is directly proportional to pressure, and the results obtained from the instrument can be referred to any other pressure by use of the Shaw pressure calculator, which is supplied with the instrument. Instructions for the use of the calculator are printed on it.

RESPONSE TIME

The response time of any water vapour pressure detector will naturally be very much quicker from dry to wet, than from wet to dry. This is the reason that the Shaw Automatic Dewpoint Meter is so successful: the sensor is kept in a dry condition when it is not in use, and therefore results are obtained in the quickest possible time.

To check whether a particular instrument is within specification, carry out the Calibration procedure, close the instrument head and note the reading 10 minutes later. It should be drier than mid range. If the reading is wetter than this after the 10 minute period then either the sieve in the head/sensor assembly is wet, or there is some other problem and the complete instrument, should be returned to our works for examination.

DESICCANT

The sensor is kept dry when not in use by the desiccant contained in the head assembly. In the Model SADP this is designed to maintain the sensor at about -70 C dewpoint, many years' experience has shown that this maintains the optimum responsiveness of the sensor.

The Dual Range instruments (model SADP-TR) use desiccant which maintains the sensor drier than -70 C dewpoint as these instruments will most often be used to test the moisture content of very dry gas, this has been found to be more satisfactory.

The above readings should be obtained when the instrument has been left with the head in the closed position for a few hours - e.g. overnight. As the desiccant only has to dry a very small volume of air or gas after each test, and is completely isolated from the test gas and the room air, it has a life of approximately 5 years in normal use. After very long service, or in case of accident the desiccant can easily be replaced as follows:

1. Grasp the plastic ring, which separates the inner and outer sections of the head assembly, and unscrew it until it can be removed. Pull the inner section out of the outer section.

2. Unscrew the plain brass base of the inner section, discard the old desiccant and replace with new (available from us in the two types suitable for single or dual range instruments)

3. Check that the white seal is in place in the base of the inner section and then re-assemble the head assembly.

ELECTRICAL FUNCTION CHECK

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

1. Switch the 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. Remove the instrument head by taking out the 3-screws in the base flange, and disconnect the sensor by pulling out the coaxial plug.

4. Switch instrument to the Battery Check position to confirm that the batteries are in good condition (replace them if they are not), and then select the read position (STD range on dual range models).

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

6. Adjust the Automatic Calibration control to give a reading of full scale. (i.e. on the Automatic Calibration line.)

7. Remove the short circuit and the reading should return to the left-hand end of the scale. If adjustment is necessary, remove the cabinet cover, after removing the screws on either side and pulling it upwards, and locate the control marked VP3 on the printed circuit board.
   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. Apply a load of 8.6k Ohms to the sensor cable plug. Re-adjust the reading to full scale, using the Automatic Calibration Control.

9. Increase the load to 18.6K Ohms. The reading should decrease to 62% of scale + 1%.

10. Increase the load to 62K Ohms. The reading should decrease to 21.5% of scale with the same tolerance as above.

11. Re-fit the head assembly, and carry out the Automatic Calibration procedure.

Note removal of the lid or adjustment of any internal control may invalidate guarantee

THIS COMPLETES THE ELECTRICAL FUNCTION CHECK.

N.B. Please note that VP1 on the printed circuit board is factory set. If the adjustment of this control is altered, it will be necessary to return the instrument to our works.

GUARANTEE

All Shaw products are guaranteed conditionally for a period of two years from purchase, exceptions being accidental damage, or damage caused by misuse or abuse. This period may be reduced to one year if the instrument is purchased from the stock of one of our overseas dealers. A Guarantee certificate is available by request.

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IMPORTANT

Shaw sensors are suitable for many different industrial 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 (S02) can be monitored as long as the moisture content is low - generally less than 100VPM. If in doubt, please check with us first.

TROUBLE SHOOTING

SYMPTOM: WET READING	REMEDY
CAUSE: Static on Indicator	Moisten indicator faces with a 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 sample gas.	Stop gas supply, switch meter off and close Head
CAUSE: Short circuit of coaxial cable	Remove instruments Head by undoing 3 screws in base flange and disconnect plug from sensor. If meter still reads over Full Scale, cure the short circuit in the cable or plugs. (Or replace cable)
CAUSE: Short circuit in Sensor. **This must not be performed on any Sensor within its guarantee period Without our written authorisation.**	With Head in closed position apply 20 to 50V D.C. VERY briefly (less than 0.1 second) to the sensor connections (coaxial socket). Polarity not important. When short circuit cured, check Automatic Calibration. If unsuccessful, return Head/Sensor assembly to us or your local dealer.

SYMPTOM: ZERO READING	REMEDY
CAUSE: Co-ax lead disconnected	Remove instrument head and reconnect co-ax cable to sensor.
CAUSE: Open circuit on sensor.	Disconnect plug from sensor and connect centre pin of plug to outer connection (i.e. short-circuit the cable). Reading of more than maximum will be obtained. Check sensor connection or replace sensor

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

SYMPTOM: WET READING	REMEDY
CAUSE: Comparison of readings with manual cooled-mirror device.	This type of indicator reads about 10 deg. too dry at about -50 deg dewpoint due to temperature gradients within the device. The error increases at drier levels.

SYMPTOM: SLOW RESPONSE	REMEDY
CAUSES: Water vapour in system. Flow rate too low. Sample pipe too large. Unsuitable sample pipe.	Sample flow rate of 5/10 L/min. is optimum. Do not exceed 20L/min. Check if there is any possibility of sensor being contaminated with oil or dirt deposits.

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

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 deq C.

PARTS 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 the same as 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.

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.

COPYRIGHT SHAW MOISTURE METERS, WESTGATE, BRADFORD, ENGLAND BD1 3SQ. 1988

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SADP & SADP-D Specification

Accuracy:	+/-1PPM , (+/-3 deg.C DP Red Spot, +/-4 deg.C DP, all others).
Type:	Portable hygrometer in stove enamelled zinc plated steel and alloy case, complete with padded carrying case. For table top or portable use with dessicant chamber for rapid readings. Certified intrinsically safe for operation in hazardous areas to Class I, Zone 0 Aex.ia IIB +H2 T6.
Dimensions / Weight:	Overall dimensions: 202mm x 225mm x 276mm High (320mm with head extended) Weight: 4 Kg approx.
Display:	SADP 12cm Taut Band indicating meter showing Dewpoint and ppm, with amplified range of 0-10ppm on TR versions. SADP-D 2cm 3 1/2 Digit LCD wit battery check symbol.
Sensor Connection:	Internal.
Power Supply:	9V DC (6 x VARTA Baby R14P cells) Internal
Sampling:	Pressure: atmospheric with flow rate of 5 - 10 litres/minute
Outputs:	None.
Calibration:	Autocal on all but Blue range.
Accessories / Options:	SU4 Lo, Med or Hi Sample system for sample conditioning pressurised gases to atmospheric conditions and controlled flow.

Sensor Type {r}:	**Sensor Range:**
Purple: **{P}**	-100 / 0 deg.C DP, 0-6000ppm, (auto-cal)
Red: **{R}**	-80 / -20 deg.C DP, 0-1000ppm, and 0-10 on TR version, (auto-cal)
Grey : **{G}**	-80 / 0 deg.C DP, 0 - 6000 ppm, and 0-10 on TR version, (auto-cal)
Blue : **{Bl}**	-80 / +20 deg.C DP, 0 - 23,000 ppm (manual-cal)

To Order:	Analogue versions SADP {r}: suffix TR if required for G and R ranges only. Digital Versions SADP-D-{r}

CERTIFICATION INFORMATION AND DETAILS

HAZARDOUS AREA OPERATION

Your SADP, SADP-D is certified as intrinsically safe by the following bodies:

BASEEFA (2001) Ltd, Harpur Hill, Buxton, Derbyshire, SK17 9JN.

Tel +44 (0) 1298 28255, Fax +44 (0) 1298 28216, E-mail info@baseefa2001.biz
Intrinsically safe to: m II 1 G EEx ia IIC T6 cert no. Baseefa03ATEX0065X

Factory Mutual System, 1151 Boston-Providence Turnpike, PO Box 9102, Norwood,
MA 02062 USA.

Tel +1 781 762 4300, Fax +1 781 762 9375. www.fmglobal.com
FM Project ID: 3197005

SADP models

Intrinsically Safe Class I, Zone 0
AEx ia IIB + H2 T6, and
Intrinsically Safe Class I. Division 1
Groups A & B, C, D T6

SADP-D models

Intrinsically Safe Class I, Zone 0
AEx ia IIB + H2 T6, and
Intrinsically Safe Class I. Division 1
Groups A & B, C, D T6

The following information is for your safe usage of the equipment

Maximum Operating Pressure: 2 Bar (1 Bar for accurate results)

Operating Temperature: -20 to +40 deg. C

Electrical Rating:9 V DC

Hazardous Area operation requires that the instrument is fully assembled. (P3 for further details)

ACCEPTED USER SERVICING PROCEDURES

Batteries must be changed in a non-hazardous location only. (See Page 3 for accepted battery types & further details)

Calibration (user Auto-cal) as per instructions on instrument and Page 5 of manual

Electrical Function check as per Page 8 of manual, in a Non-Hazardous area only

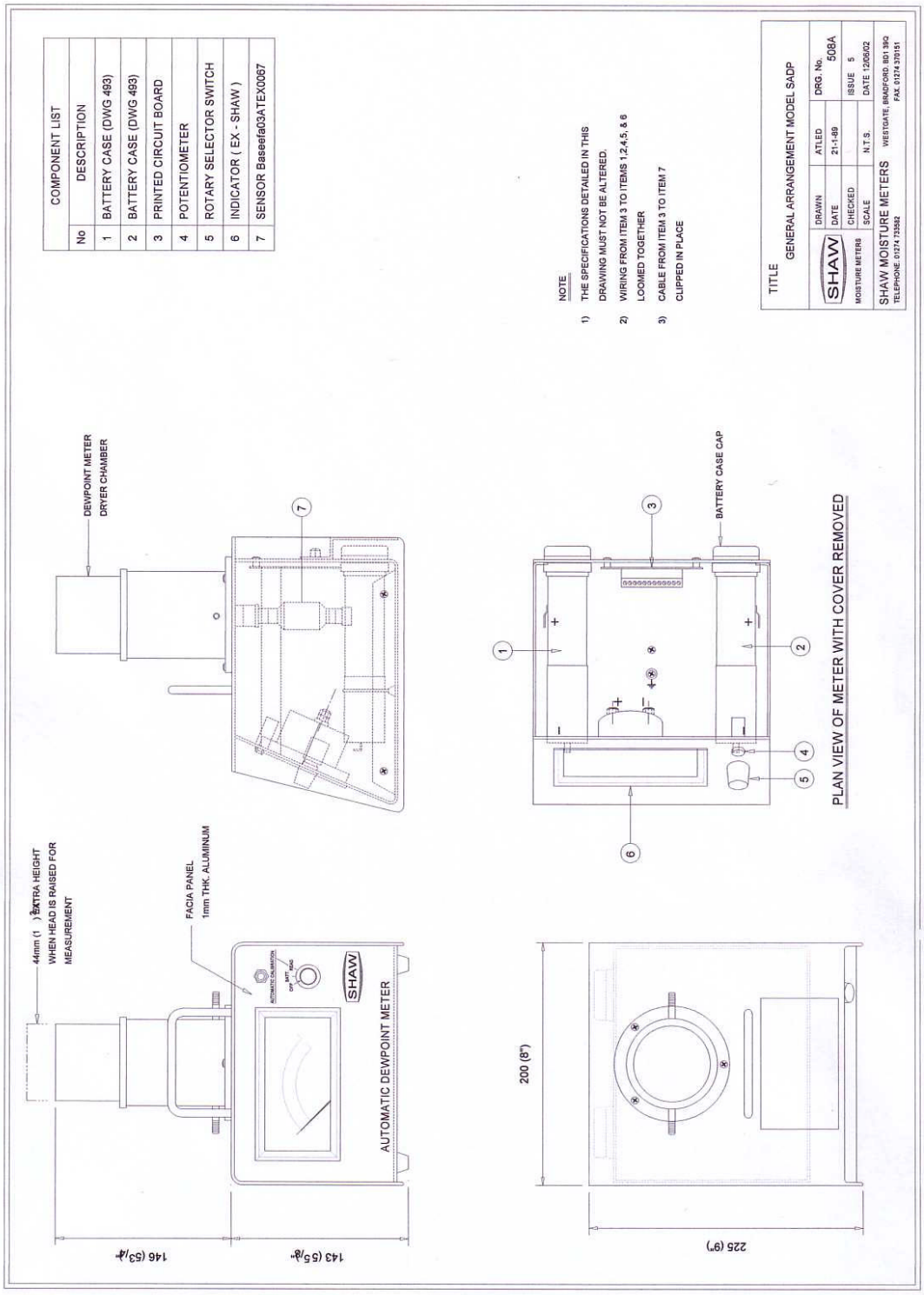
SPECIAL CONDITION OF CERTIFICATION

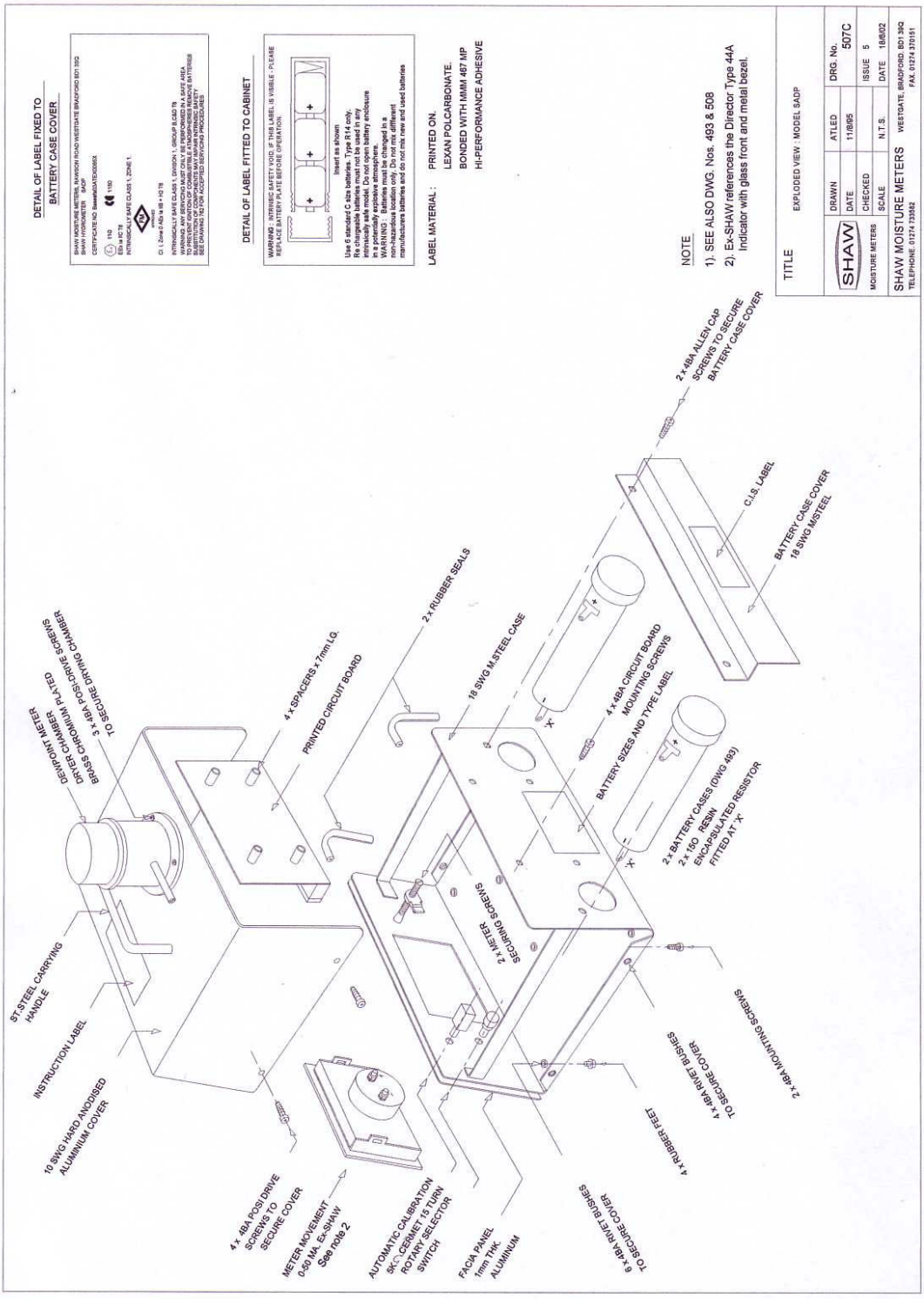
The enclosure is made from aluminium with a protective coating.
Care must be taken to ensure the protective coating is not damaged by impact or abrasion.

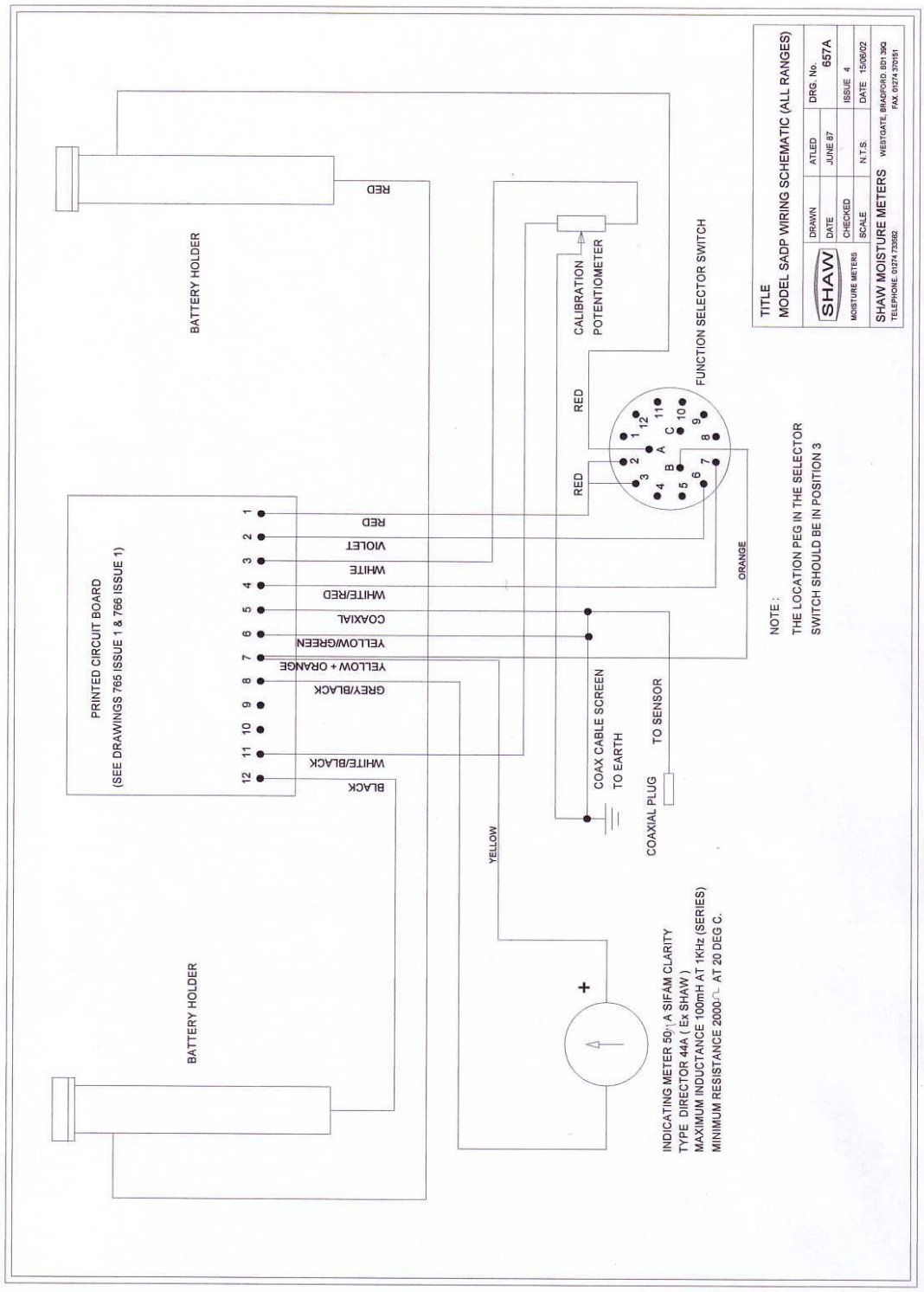
TITLE
Intrinsic Safety Compliance Details

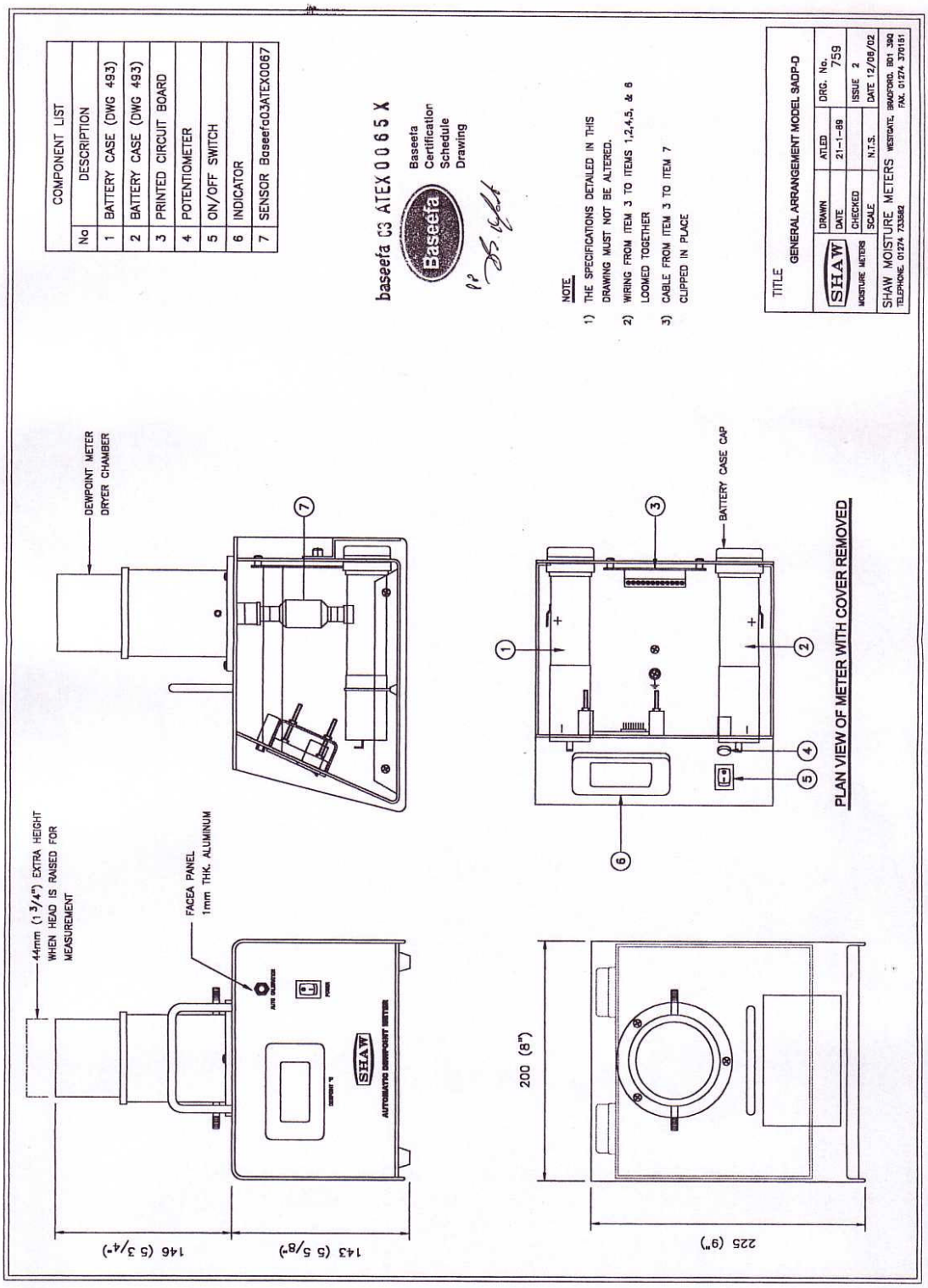
SHAW MOISTURE METERS	DRAWN	ATLED	DRG. No. 762
	DATE	14/5/03	
	CHECKED		ISSUE 1
	SCALE	N.T.S.	DATE 14/5/03

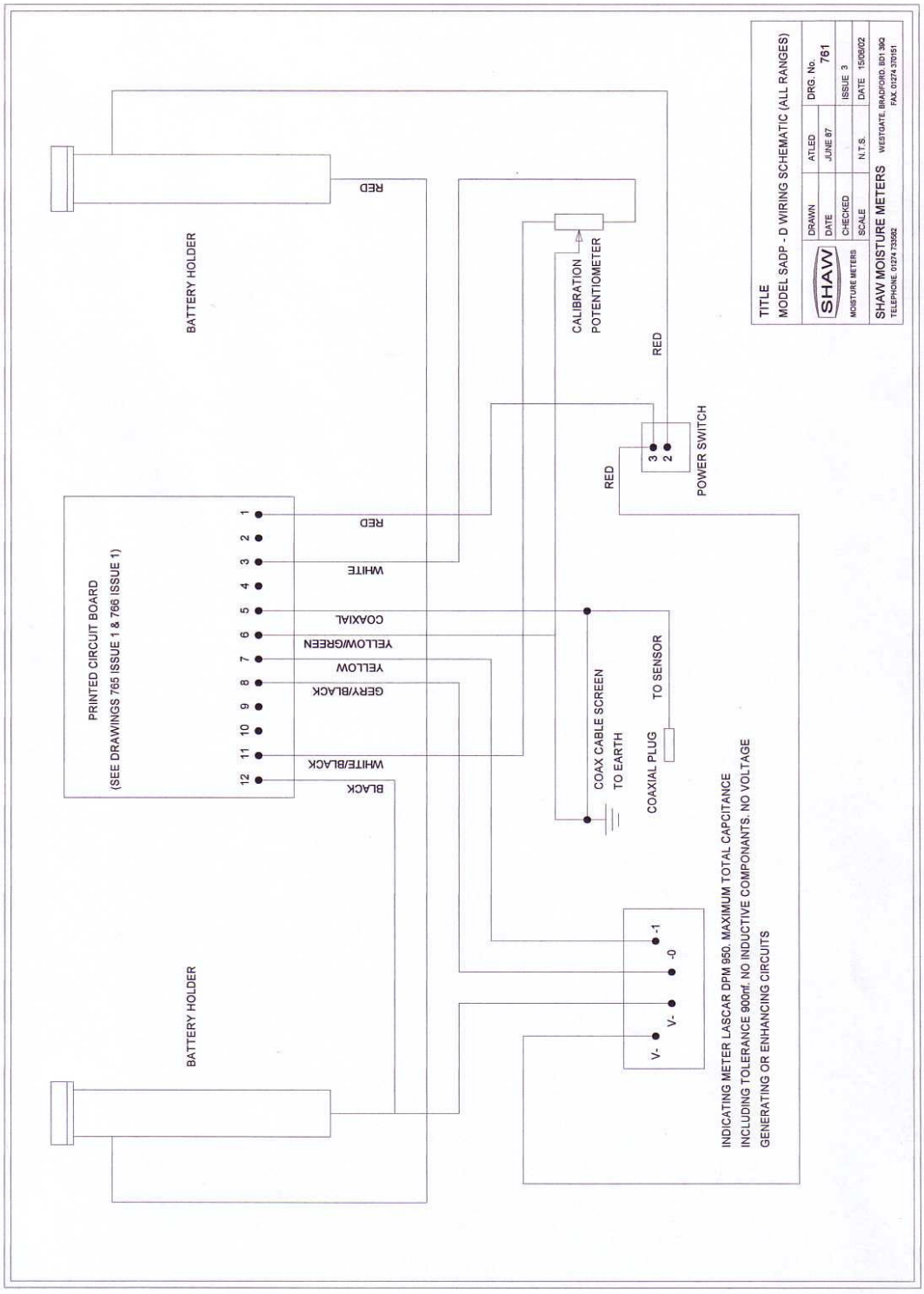
SHAW MOISTURE METERS
TELEPHONE. 01274 733582
WESTGATE, BRADFORD. BD1 3SQ
FAX. 01274 370151


COMPONENT LIST
No
DESCRIPTION
1 BATTERY CASE (DWG 493)
2 BATTERY CASE (DWG 493)
3 PRINTED CIRCUIT BOARD
4 POTENTIOMETER
5 ROTARY SELECTOR SWITCH
6 INDICATOR (EX - SHAW)
7 SENSOR Baseefa03ATEX0067
NOTE
1) THE SPECIFICATIONS DETAILED IN THIS DRAWING MUST NOT BE ALTERED.
2) WIRING FROM ITEM 3 TO ITEMS 1,2,4,5, & 6 LOOMED TOGETHER
3) CABLE FROM ITEM 3 TO ITEM 7 CLIPPED IN PLACE
TITLE
GENERAL ARRANGEMENT MODEL SADP
SHAW
MOISTURE METERS
DRAWN ATLED
DATE 21-1-99
CHECKED
SCALE N.T.S.
DRG. No. 508A
ISSUE 5
DATE 12/06/02
SHAW MOISTURE METERS WESTGATE, BRADFORD, BD1 3RQ
TELEPHONE 01274 733582 FAX 01274 370151
DEWPOINT METER
DRYER CHAMBER
BATTERY CASE CAP
PLAN VIEW OF METER WITH COVER REMOVED
44mm (1 3/4") EXTRA HEIGHT WHEN HEAD IS RAISED FOR MEASUREMENT
FACIA PANEL 1mm THK. ALUMINUM
AUTOMATIC DEWPOINT METER
SHAW
200 (8")
225 (9")
143 (5 5/8")
146 (5 3/4")


DETAIL OF LABEL FIXED TO BATTERY CASE COVER
DETAIL OF LABEL FITTED TO CABINET
LABEL MATERIAL : PRINTED ON. LEXAN POLCARBONATE. BONDED WITH MMM 467 MP HI-PERFORMANCE ADHESIVE
NOTE
1). SEE ALSO DWG. Nos. 493 & 508
2). Ex-SHAW references the Director Type 44A Indicator with glass front and metal bezel.
TITLE EXPLODED VIEW MODEL 5ADP
SHAW MOISTURE METERS WESTGATE. BRADFORD. BD1 3RQ
TELEPHONE 01274 733582 FAX. 01274 370151
DRAWN ATLED DRG. No. 507C
DATE 11/8/95 ISSUE 5
CHECKED
SCALE N.T.S. DATE 18/8/02
DEWPOINT METER
BRASS CHROMIUM PLATED
TO SECURE DIVING CHAMBER
4 x SPACERS x 7mm LG.
PRINTED CIRCUIT BOARD
2 x RUBBER SEALS
18 SWG M.STEEL CASE
2 x 4BA ALLEN CAP SCREWS TO SECURE BATTERY CASE COVER
C.I.S. LABEL
BATTERY CASE COVER 18 SWG M/STEEL
4 x 4BA CIRCUIT BOARD MOUNTING SCREWS
BATTERY SIZES AND TYPE LABEL
2 x BATTERY CASES (DWG 493)
2 x 150 RESW ENCAPSULATED RESISTOR FITTED AT 'X'
2 METER SECURING SCREWS
5/T STEEL CARRYING HANDLE
INSTRUCTION LABEL
10 SWG HARD ANODISED ALUMINIUM COVER
4 x 4BA POSI DRIVE SCREWS TO SECURE COVER
METER MOVEMENT 0-50 MA. Ex-SHAW See note 2
AUTOMATIC CALIBRATION 5K CERMET 15 TURN ROTARY SELECTOR SWITCH
FACIA PANEL 1mm THK. ALUMINUM
6 x 4BA RIVET BUSHES TO SECURE COVER
4 x RUBBER FEET
4 x 4BA RIVET BUSHES TO SECURE COVER
2 x 4BA MOUNTING SCREWS


TITLE
MODEL SADP WIRING SCHEMATIC (ALL RANGES)
SHAW
MOISTURE METERS
DRAWN
ATLED
DRG. No.
DATE
JUNE 87
657A
CHECKED
ISSUE 4
SCALE
N.T.S.
DATE 15/08/02
SHAW MOISTURE METERS WESTGATE, BRADFORD, BD1 3BQ
TELEPHONE. 01274 733582 FAX. 01274 370151
BATTERY HOLDER
RED
CALIBRATION POTENTIOMETER
FUNCTION SELECTOR SWITCH
PRINTED CIRCUIT BOARD
(SEE DRAWINGS 765 ISSUE 1 & 766 ISSUE 1)
RED
VIOLET
WHITE
WHITE/RED
COAXIAL
YELLOW/GREEN
YELLOW + ORANGE
GREY/BLACK
WHITE/BLACK
BLACK
ORANGE
NOTE :
THE LOCATION PEG IN THE SELECTOR
SWITCH SHOULD BE IN POSITION 3
COAX CABLE SCREEN
TO EARTH
TO SENSOR
COAXIAL PLUG
YELLOW
INDICATING METER 50μA SIFAM CLARITY
TYPE DIRECTOR 44A (Ex SHAW)
MAXIMUM INDUCTANCE 100mH AT 1KHz (SERIES)
MINIMUM RESISTANCE 2000Ω AT 20 DEG C.


COMPONENT LIST
No DESCRIPTION
1 BATTERY CASE (DWG 493)
2 BATTERY CASE (DWG 493)
3 PRINTED CIRCUIT BOARD
4 POTENTIOMETER
5 ON/OFF SWITCH
6 INDICATOR
7 SENSOR Baseefa03ATEX0067
baseefa 03 ATEX 0065 X
Baseefa
Certification
Schedule
Drawing
NOTE
1) THE SPECIFICATIONS DETAILED IN THIS DRAWING MUST NOT BE ALTERED.
2) WIRING FROM ITEM 3 TO ITEMS 1,2,4,5, & 6 LOOMED TOGETHER
3) CABLE FROM ITEM 3 TO ITEM 7 CLIPPED IN PLACE
TITLE
GENERAL ARRANGEMENT MODEL SADP-D
SHAW MOISTURE METERS
DRAWN ATLED
DATE 21-1-99
CHECKED
SCALE N.T.S.
DRG. No. 759
ISSUE 2
DATE 12/08/02
WESTGATE, BRADFORD, BD1 3QQ
TELEPHONE 01274 733942
FAX. 01274 370151
DEWPOINT METER
DRYER CHAMBER
44mm (1 3/4") EXTRA HEIGHT WHEN HEAD IS RAISED FOR MEASUREMENT
FACEA PANEL 1mm THK. ALUMINUM
BATTERY CASE CAP
PLAN VIEW OF METER WITH COVER REMOVED
146 (5 3/4")
143 (5 5/8")
200 (8")
225 (9")


TITLE
MODEL SADP - D WIRING SCHEMATIC (ALL RANGES)
SHAW
MOISTURE METERS
DRAWN
ATLED
DRG. No.
761
DATE
JUNE 87
ISSUE 3
CHECKED
SCALE
N.T.S.
DATE 15/08/02
SHAW MOISTURE METERS
WESTGATE, BRADFORD, BD1 3SQ
TELEPHONE 01274 733582
FAX 01274 370151
BATTERY HOLDER
RED
CALIBRATION POTENTIOMETER
RED
POWER SWITCH
3
2
RED
PRINTED CIRCUIT BOARD
(SEE DRAWINGS 765 ISSUE 1 & 766 ISSUE 1)
1
2
3
4
5
6
7
8
9
10
11
12
RED
WHITE
COAXIAL
YELLOW/GREEN
YELLOW
GERY/BLACK
WHITE/BLACK
BLACK
COAX CABLE SCREEN
TO EARTH
TO SENSOR
COAXIAL PLUG
-1
-0
V-
V-
BATTERY HOLDER
INDICATING METER LASCAR DPM 950. MAXIMUM TOTAL CAPCITANCE
INCLUDING TOLERANCE 900nf. NO INDUCTIVE COMPONANTS. NO VOLTAGE
GENERATING OR ENHANCING CIRCUITS

Baseefa

24 August 2002

1. **QUALITY ASSURANCE NOTIFICATION**

2. **Equipment or Protective Systems or Components Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC**

3. **Notification number: Baseefa ATEX 0969**

4. Equipment or Protective systems or Components are as listed. See schedule 1.

5. Applicant: See Manufacturer

6. Manufacturer: Shaw Moisture Meters
   Rawson Road
   Westgate
   Bradford
   BD1 3SQ

7. Baseefa (2001) Ltd., Notified Body No. 1180 for Annexes IV and VII in accordance with article 9 of the Council Directive 94/9/EC of the 23 March 1994, notifies to the applicant that the actual manufacturer has a quality system which complies with Annexes IV and VII of the Directive.

8. This Notification is based upon Audit Report No. 98/7546 issued the 06/08/1999.

   This Notification can be withdrawn if the manufacturer no longer satisfies the requirements of the Annexes IV and VII.

   Results of periodical re-assessment of the quality system are a part of this Notification.

9. This Notification is valid until 19/08/2005 and can be withdrawn if the manufacturer does not satisfy the quality assurance re-assessment.

10. According to Article 10 [1] of the Directive 94/9/EC the CE marking shall be followed by the identification number 1180 identifying the notified body involved in the production control stage.

    This Notification may only be reproduced in its entirety and without any change.

Schedule 1

Equipment protection concepts for which the manufacturer has been assessed:

Ex "ia"

Equipment types for which the manufacturer has been assessed:

Instrumentation, measurement and control equipment

The EC Type Examination certificates covered by this Notification are agreed between the Applicant and Baseefa (2001) Ltd.

Baseefa (2001) Ltd.
Health and Safety Laboratory Site
Harpur Hill, Buxton, Derbyshire, SK17 6BS. United Kingdom.
Tel. +44 (0)1298 28255 Fax. +44 (0)1298 28216
e-mail info@baseefa2001.biz web site www.baseefa2001.biz
Registered in England No. 4305578 at 13 Dovedale Crescent, Buxton, Derbyshire, SK17 9BJ

R S SINCLAIR
DIRECTOR
On behalf of Baseefa (2001) Ltd.

Certificate Number
Baseefa03ATEX0065X

Baseefa

Issued 21st July 2003
Page 1 of 3

1 **EC - TYPE EXAMINATION CERTIFICATE**

2 **Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC**

3 EC - Type Examination Certificate Number: **Baseefa03ATEX0065X**

4 Equipment or Protective System: **AUTOMATIC DEWPOINT METERS TYPES SADP AND SADP-D**

5 Manufacturer: **SHAW MOISTURE METERS**

6 Address: **Rawson Road, Westgate, Bradford, BD1 3SQ**

7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Baseefa (2001) Ltd. Notified body number 1180, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential Report No. **02(C)0371**

9 Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014: 1998 + Amendments 1 & 2 EN 50020: 2002 EN 50284: 1999

except in respect of those requirements listed at item 18 of the Schedule.

10 If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC - TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12 The marking of the equipment or protective system shall include the following :

Ex **II 1 G EEx ia IIC T6**

This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa (2001) Ltd. Customer Reference No. **0969** Project File No. **02/0371**

This certificate is granted subject to the general terms and conditions of Baseefa (2001) Ltd. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

R S SINCLAIR
DIRECTOR
On behalf of
Baseefa (2001) Ltd.

Baseefa (2001) Ltd.
Health and Safety Laboratory Site, Harpur Hill,
Buxton, Derbyshire SK17 9JN
Telephone +44 (0) 1298 28255 Fax +44 (0) 1298 28216
e-mail info@baseefa2001.biz web site www.baseefa2001.biz
Registered in England No. 4305578 at 13 Dovedale Crescent, Buxton, Derbyshire, SK17 9BJ

13 **Schedule**

14 **Certificate Number Baseefa03ATEX0065X**

15 Description of Equipment or Protective System

The Automatic Dewpoint Meters SADP and SADP-D each comprise a sensor contained within a drying/sampling chamber which is mounted on top of a transportable stove enamelled aluminium instrument case with an anodised front panel which provides a degree of protection of at least IP20. Within the case is a printed circuit board containing the Dewpoint measuring circuit. The Type SADP provides an analogue display of the Dewpoint whilst the display of the SADP-D is digital. Both instruments are battery powered, the batteries being integral with the battery case. The batteries are non-rechargeable types and their removal is only permissible in the Safe Area. Two assemblies of 3 x 1.5V cells provide a nominal supply of 9V.

Only the following batteries may be used:

Manufacturer	Chemistry	Voltage	Part Code
VARTA	Zinc Carbon	1.5V nominal	STANDARD, BABY, R 14 P, C, UM2

The sensor, which is certified as ⟨Ex⟩II 1G EEx ia IIC T6, certificate No. Baseefa03ATEX0067, functions by presenting a capacitance which varies according to temperature and moisture content of the medium present.

16 Report Number

Certification Report 02(C)0371.

17 Special Conditions for Safe Use

1. The enclosure is made from aluminium with a protective coating. Care should be taken to make sure the protective coating is not damaged by impact or abrasion.

18 Essential Health and Safety Requirements

All relevant Essential Health and Safety Requirements are covered by the standards listed at item 9.

19 Drawings and Documents

Drawings Common to Automatic Dewpoint Meters Types SADP and SADP-D

Number	Sheet	Issue	Date	Description
763	1 of 1	2	26.03.01	Shaw MK9 DC Issue 5 Analogue/Digital Circuit Diagram
764	1 to 2	1	_____	Model SADP/D Automatic Dewpoint Meter - PCB Board Component List
765	1 of 1	1	02.03.00	Model SADP V1.0 Automatic Dewpoint Meter - PC Board Component Layout. Top View
766	1 of 1	1	02.03.00	Model SADP V1.0 Automatic Dewpoint Meter - PC Board Track Layout. Rear View
493	1 of 1	5	15.06.02	SADP/SADP-D battery Carrier Details

Drawings Specific to Automatic Dewpoint Meter Type SADP

Number	Sheet	Issue	Date	Description
507C	1 of 1	5	18.06.02	Exploded View : Model SADP
508A	1 of 1	5	12.06.02	General Arrangement Model SADP
657A	1 of 1	4	15.06.02	Model SADP Wiring Schematic

Drawings Specific to Automatic Dewpoint Meter Type SADP-D

Number	Sheet	Issue	Date	Description
759	1 of 1	2	12.06.02	General Arrangement Model SADP-D
760	1 of 1	2	12.06.02	Exploded View : Model SADP-D
761	1 of 1	3	15.06.02	Model SADP-D Wiring Schematic (All Ranges)