MS1 Conductivity Meter
User Instructions

1. Conductivity measurements

The instrument has an on/off switch and three range switches, 0 - 200 micro-Siemens per centimetre (µS/cm), 0 - 2 milli-Siemens per centimetre (mS/cm) and 0 - 20 mS/cm (1 mS/cm = 1000 µS/cm). LEDs indicate the range selected.

Ensure the temperature of the sample is as near to 25°C as possible. The maximum temperature must not exceed 45°C.

Switch on the instrument and press the right hand switch to select the highest range, 20 mS/cm.

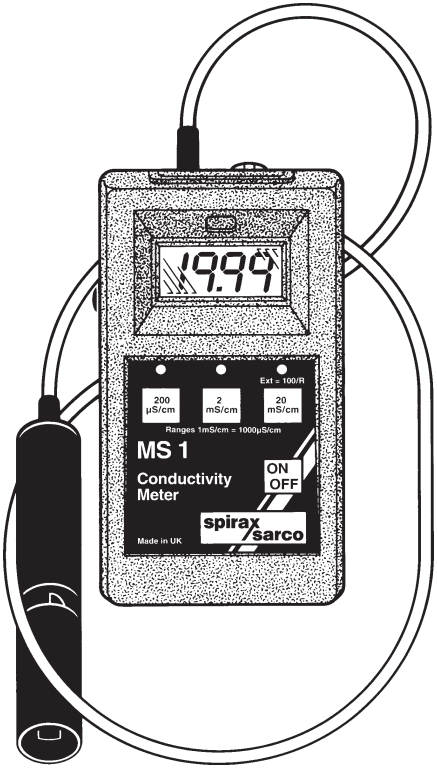
With the sensor shroud in place, immerse the lower half of the sensor in the sample and wait for 15 seconds to allow the temperature compensation to take effect.

View the dislayed reading.

For a more accurate reading select the next lower range.

The display will indicate '1' if it cannot give a reading at the range selected.

If this happens, switch to the next highest range.



Example:-

Sensor in mains water at 25°C

Range selected	Display reads	x 1000 = µS/cm
20 mS/cm	0.52 mS/cm	520 µS/cm
2 mS/cm	0.517 mS/cm	517 µS/cm
200 µS/cm	1	—

After taking a reading rinse the sensor and switch off the instrument. The instrument will automatically switch off after approximately 5 minutes.

2. TDS measurements

The conductivity meter can be used to obtain a good estimate of the total dissolved solids or TDS of a sample of water. For a **neutral** sample the temperature compensated conductivity reading can be converted to a TDS in ppm as follows:

TDS = (conductivity in µS/cm) x 0.7

3. Taking samples of boiler water

It is very important to take a representative sample of boiler water for analysis. The first part of any sample drawn from a level gauge glass drain or from an external level control chamber will contain relatively pure water mainly consisting of condensed steam. This must be flushed away before a true sample can be obtained.

A sample cooler should always be used for taking samples of boiler water. If water is simply drawn from the boiler, a proportion will violently flash off into steam as its pressure is reduced. This is not only very dangerous, but any subsequent analysis will be inaccurate due to the loss of flash steam. Since for analysis a sample temperature close to 25°C is required a sample cooler will also save time.

4. Neutralising the sample of boiler water

Since acids and alkalis have a large effect on the electrical conductivity, in order to obtain a measurement of the TDS of a sample of boiler water it is necessary to neutralise the alkalinity.

Proceed as follows:-

a. Add a few drops of phenolphthalein indicator solution to the cooled sample. If the sample is alkaline a strong purple colour is obtained.
b. Add acetic acid (typically 5%) drop by drop to neutralise the sample, mixing the sample until the colour disappears.
c. Measure the conductivity and convert to TDS as described in Section 2.

5. Maintenance

The sensor should be cleaned from time to time depending on use. Remove the shroud from the sensor and clean the carbon electrodes gently with a bristle brush and ordinary kitchen liquid cleaner. Rinse well under running water and replace the shroud.

Replace the battery when the warning indicator shows on the display. Slide open the battery compartment on the back of the instrument to obtain access to the single 9 V battery (PP3 or equivalent).

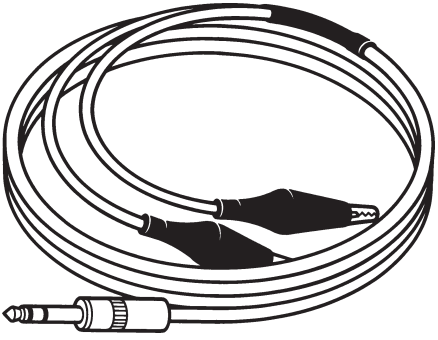
No other maintenance is possible. The sensor is permanently wired into the instrument so in case of damage the whole unit should be returned for repair.

6. Using the extension lead

An extension lead is provided to allow ac resistance measurements to be obtained on installed conductivity probes in order to check their condition. To use the extension lead, plug it into the instrument and connect the crocodile clips directly to the probe terminals. Press the 20 mS/cm range switch. The ac resistance in ohms is then 100 divided by the displayed reading.

For example:-

Display reads 5.00
Resistance = 100 ÷ 5.00 = 20 Ω.
The minimum resistance that can be measured is 5 Ω.



MS1 Extension Lead

7. Determining the probe condition

In order to determine the probe condition, its cell constant, (the factor relating liquid conductivity and probe resistance), must be found.

To find the cell constant:-

Multiply the conductivity at 25°C by the figure in the table below to find the conductivity at boiler temperature.

Boiler pressure (bar g)	5	7	10	15	20	32
Multiply by	3.68	3.91	4.18	4.53	4.8	5.28

- Divide the resulting conductivity reading (in µS/cm) by 1,000,000 to give a conductivity in S/cm.
- Multiply this figure by the probe resistance in ohms, (see Section 6) to obtain the cell constant.

A typical cell constant for the probe used in BCS 1, 2, and 4 systems is 0.3, (approximately).
The probe used in the BCS3 system will have a typical cell constant of 0.3 to 0.7.
If a cell constant above 0.7 is found for a BCS1, 2, or 4, or above 1.0 for a BCS3, the probe is suspect and should be removed for inspection and, if necessary, cleaning or replacement.
A low cell constant indicates that the probe is able to conduct well, whereas a high cell constant indicates that the probe tip has become less conductive, perhaps due to a build-up of scale.
A very low cell constant, however, could indicate an internal short circuit. The further the probe tip from any part of the boiler, the higher the cell constant.

Example:-

A BCS3 system fitted to a boiler operating at 10 bar g (saturated temperature 184°C).
The conductivity meter reads 4800 µS/cm for an un-neutralised sample at 25°C.
The probe resistance, measured using the meter and extension lead, is 20 ohm.
- Multiply the conductivity by the figure given in the table for a 10 bar boiler:-
  4800 x 4.18 = 20064.
- Divide by 1,000,000 to give a conductivity in S/cm:-
  20064 ÷ 1,000,000 = 0.020064
- Multiply by the probe resistance in ohms to obtain the cell constant:-
  0.020064 x 20 = **0.40128**

The cell constant of the probe is well within the 0.3 to 0.7 range and attention is not required.

8. Calibration

The instrument is pre-calibrated and should need no adjustment in normal use.
If calibration to a standard solution or a master instrument is required, remove the sealing plug to the left of the display and adjust the potentiometer using a small screwdriver. The calibration range is +/- 20 % over 20 turns (approximately). Calibration does not affect the measurement of resistance when using the extension lead.