Data Sheet
SS/8036_5

Sodium Monitor

Model 8036

- **Wide measuring range (0.01µgkg^{-1} to 10mgkg^{-1})**
  – covers all power station applications
- **Full sample temperature compensation**
  – maximises measurement accuracy
- **'Pumpless' liquid handling section**
  – low maintenance
- **Automatic range changing**
  – switches the current output in steps covering two decades
- **Simple calibration sequence**
  – automatically controlled by the microprocessor

The prevention of damage to the boilers on modern power stations becomes more and more critical as the cost of repairs and out of service plant continually rises. To reduce the effect of boiler tube corrosion and the formation of scale on the inside of the tubes, the levels of impurities in the various parts of the steam/water cycle must be carefully monitored.

Sodium ions are normally the most abundant species in solution found in boiler plant, therefore the measurement of sodium provides a valuable indication of the overall purity of the solution. Whilst on-line conductivity can give useful information concerning the total concentration of the ionic species, it is far less sensitive than a specific measurement for sodium.

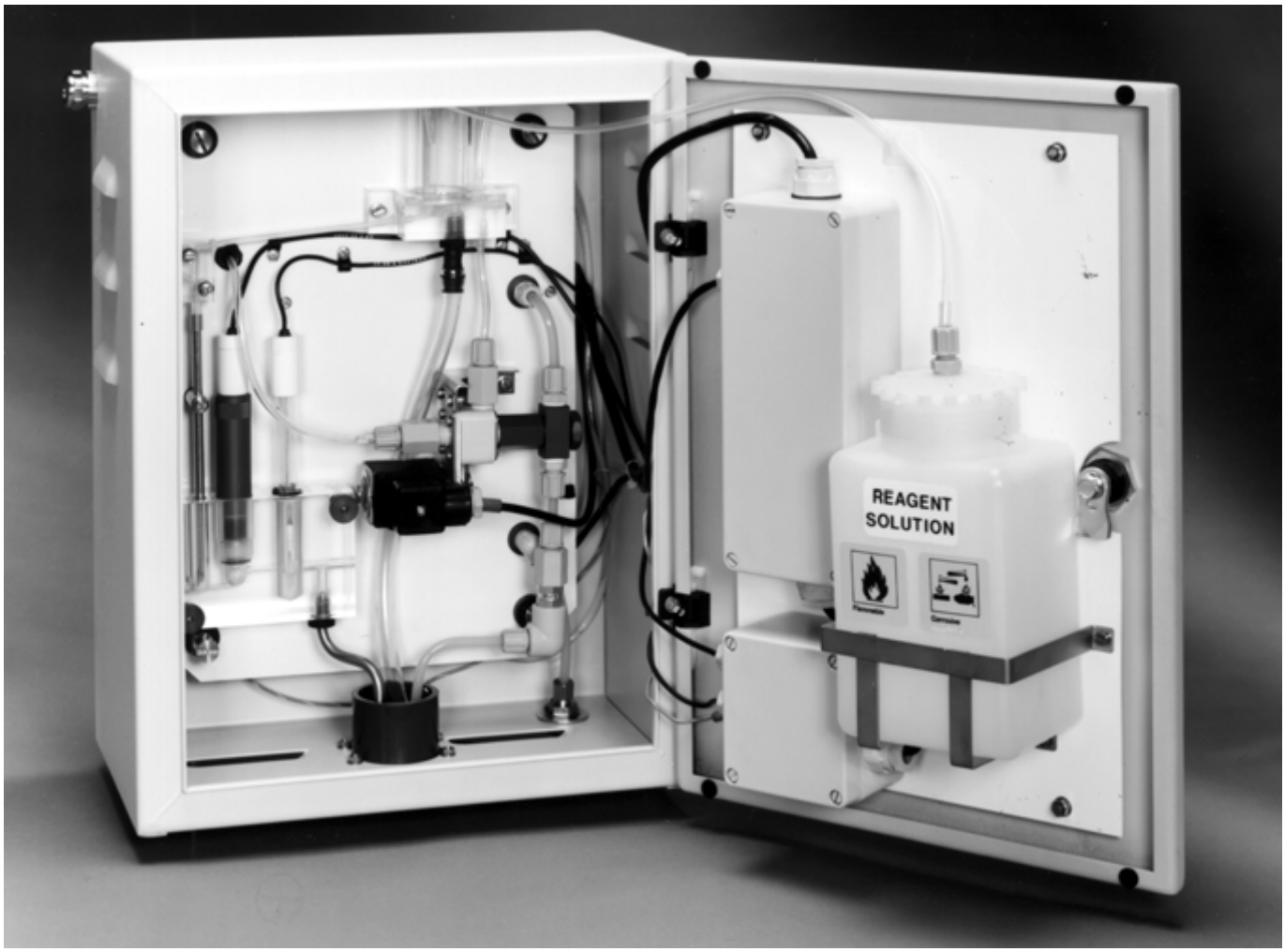
The sample points where sodium would be required on-line are:

Water treatment plant
On the outlet of cation and mixed resin exchange beds sodium measurement would give an early indication of resin exhaustion and treated water quality.

Condensate monitoring at the extraction pump discharge
This provides an indication of very small condenser leaks. Condensers are operated under vacuum, therefore ingress of cooling water, which contains high levels of sodium, even on inland water cooled stations, can be detected.

Saturated steam in drum boilers
The monitoring of sodium in the saturated steam between the boiler drum and the superheater to detect carryover, in conjunction with sodium monitoring in the condensate (the sodium balance) can indicate problems of deposition of sodium on superheated tubes and turbine blades.

Once-through boilers
Since the purity of the boiler water is more stringent in these boilers, sodium monitoring is carried out after the condensate polishing plant, boiler feed and superheated steam to assist in maintaining water/steam purity within limits.



8036-200 Liquid Handling Section

General Information

The ABB 8036 Sodium Monitor is a microprocessor-based instrument which uses a sodium ion selective electrode together with a reference electrode to carry out a potentiometric determination of the sodium ion concentration in the sample.

The monitor is designed to meet the exacting standards for sodium measurement of nuclear and fossil-fuelled power stations, providing fast response and high accuracy at both high and low sodium concentration levels.

The electronic transmitter unit is housed in a wall-mounted steel case. The liquid handling system is mounted in a separate steel case which can be sited at a distance of up to 100m from the electronics.

Ranges provided are 0.01μgkg^{-1} to 1$mgkg^{-1}$ or 0.1μgkg^{-1} to 10$mgkg^{-1}$ in four overlapping steps, which can be selected manually, or if required can be switched automatically by the microprocessor as the concentration changes. Two current outputs, together with two concentration alarm relay outputs are available, plus relay outputs to indicate the range currently in use from a remote location.

The liquid handling section is virtually maintenance-free due to the ‘pumpless’ design and contains a heat exchanger to equate standard and sample solution temperature and so reduce calibration time.

Liquid Handling Section

The liquid handling section contains the following components: heat exchanger; pressure relief valve; solenoid valve; constant head unit; 'T' piece and entrainment tube; flow cell containing the electrodes; reagent container and pre-amplifier junction box.

Heat exchanger –

this is used to bring the standard solution close to the temperature of the sample during calibration. Thermal differences therefore are minimised and calibration times reduced.

Pressure relief valve –

during a calibration sequence the sample flow to the constant head unit is stopped. The valve releases the pressure to prevent pressurising the sample line.

Solenoid valve –

under the control of the microprocessor the valve is used to switch between sample in normal running mode and standard solution during a calibration sequence.

Constant head unit –

this removes the effect of changes in sample pressure and flow rate. An excess flow to the constant head unit provides a rapid transportation from the sample point to the monitor.

'T' Piece and entrainment tube –

an arrangement which introduces the ammonia or diethylamine reagent vapour to the sample to produce alkaline conditions which are necessary for sodium measurements.

Flowcell –

this is a perspex block which present the sample to the electrode pair under flowing conditions.

Temperature sensor –

this is contained in the flowcell and provides data for temperature compensation of sodium readings.

Reagent container –

the bottle containing the reagent is heated to improve vaporisation at low ambient temperatures.

Pre-amplifier and junction box –

this contains a pre-amplifier which converts the high impedance mV signal from the electrodes to a low impedance current signal suitable for connection to the transmitter unit. The waterproof junction box is used to provide a convenient connection for the electrode pair.

Calibration Method

A calibration solution bottle containing a sodium solution of known concentration is placed in a tray on top of the liquid handling case. The value of the solution is fed into the transmitter unit by operation of push buttons on the facia panel. After pressing the calibration button, no further action is required by the operator as the monitor automatically introduces the calibration solution, carries out any adjustments and then returns the monitor to the sample mode. If two point calibration is required, the above procedure is repeated after entering the value of the second solution.

Calibration on sample is possible (selectable internally) if the concentration is determined by some independent method.

Maintenance

Calibration

1- to 4-weekly (depending on operating conditions).

Change reagent solutions

2- to 4-weekly (depending on operating conditions).

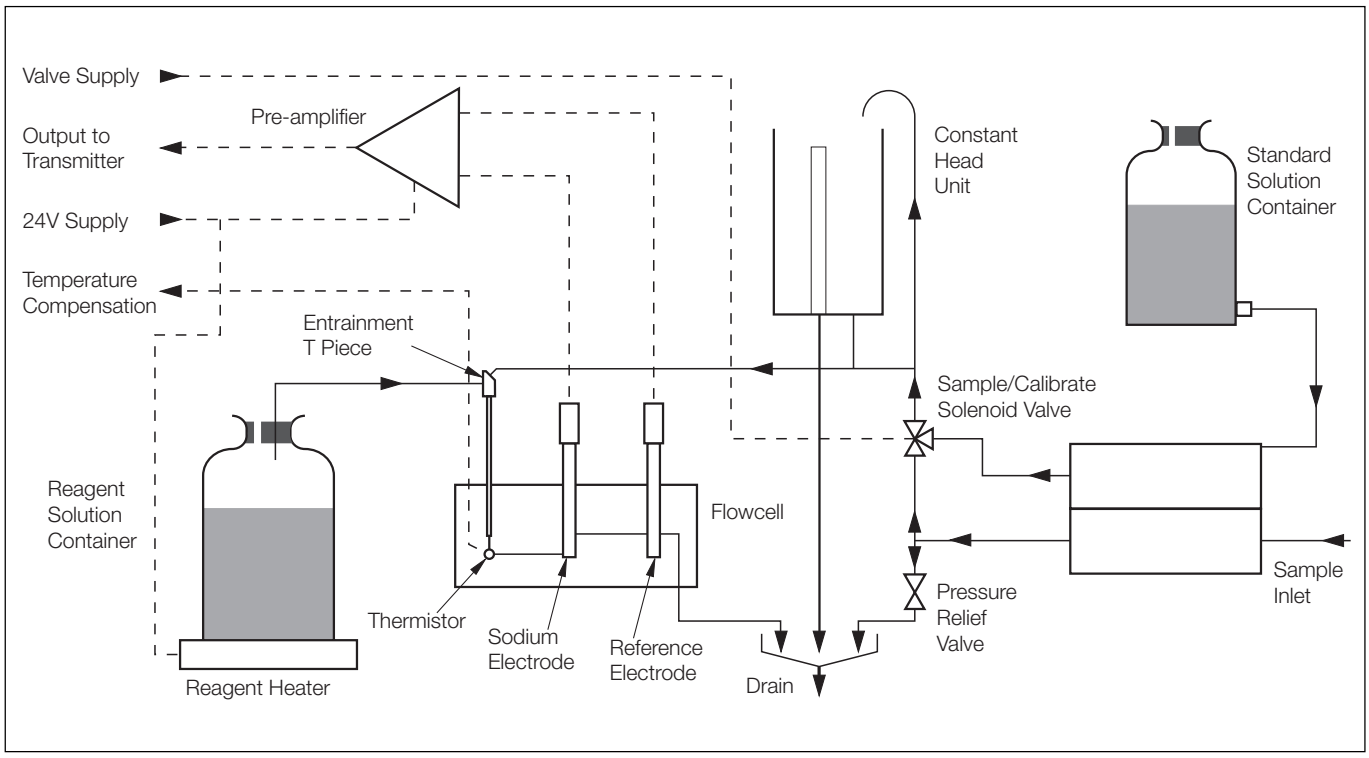
Change monitor tubing

12-monthly

Reagent

0.880 SG (35% w/v) Ammonia solution (suitable for sodium levels >0.5µgkg^{-1}) or

50% diethylamine solution



Schematic of Liquid Handling Section

Transmitter Unit

The current from the pre-amplifier representing the output from the electrode pair and the temperature information is processed by the main electronic section which converts these signals to a digital display of sodium concentration. It also provides current, alarm and remote indication of range outputs as well as the power supply for the liquid handling section.

The digital display is a 7-segment LED type which indicates the following information;

Sodium concentration

µgkg^{-1} or mgkg^{-1}

Sample mode

indicates sample sodium concentration. During calibration – indicates either of the two calibration sequences (CA1 or CA2).

Calibration concentration

displays the values of CA1 (the primary calibration solution) or CA2 (the secondary calibration solution) – also indicates when a calibration is in progress and shows if a single or two-point calibration has been initiated.

An instantaneous display of concentration during calibration can also be obtained.

Alarm settings

displays high or low alarm setting

µgkg^{-1} to mgkg^{-1}

Calibration fail

displays CF following a two-point calibration if the slope value is less than 80%

Slope value

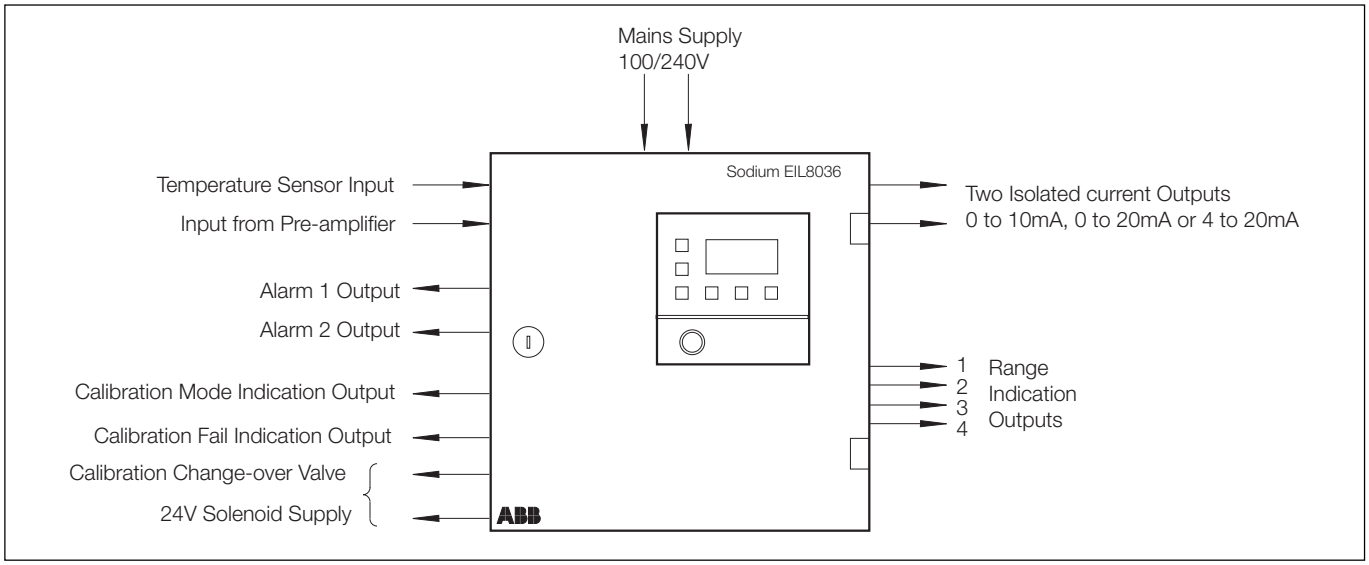
displays the percentage slope of the electrode pair

8036-100 Transmitter Unit

The information displayed depends upon the operating conditions and which push buttons on the monitor facia are operated.

The push buttons on the facia are used to set/display the alarm values, the calibration solution concentration, the electrode slope value and to trigger a calibration sequence. Two overall ranges are available (selected internally) covering five decades i.e. 0.01µgkg^{-1} to 1mgkg^{-1} or 0.1µgkg^{-1} to 10mgkg^{-1}. A five position switch selects any of two consecutive decades within these ranges. There is also an automatic range change position.

Two isolated current outputs provide remote indication of reading; logarithmic or linear output can be selected and four sets of contacts give a remote indication of range. Further sets of contacts energise during a calibration sequence and alarm conditions.



8036-100 Inputs/Outputs

Specification

Ranges

0.01µgkg^{-1} to 1mgkg^{-1} or 0.1µgkg^{-1} to 10mgkg^{-1} internally selectable

Accuracy

±10% of concentration or ±0.02µgkg^{-1} whichever is the greater

Reproducibility

±5% of concentration at constant temperature

Response time

1 to 100µgkg^{-1} less than 4 mins. for 90% step change

100 to 1µgkg^{-1} less than 6 mins. for 90% step change

Outputs

Two isolated current outputs in the range 0 to 10, 0 to 20 or 4 to 20mA. Max. impedance 1kΩ logarithmic or linear.

Remote range indication

Two voltage-free contacts rated 250V 2A non-inductive

External alarms

Two normal or fail-safe, high and low concentration alarms.

Calibration Mode indication

Calibration Fail indication

All voltage-free 250V 2A non-inductive

Calibration

Manual initiation of automatic calibration sequence. Calibration frequency 1 to 4 weeks (depending on operating conditions)

Battery back-up

4 weeks

Installation Information

Sample temperature

5° to 55°C

Sample flow

50 to 500 ml/minute

Sample pressure

Min. 0.14 bar (2 psig)

Ambient temperature

0° to 55°C

Dimensions of sensor unit

300mm wide x 400mm high x 200mm deep

Mounting for sensor unit

Four holes 8.5mm diameter
230mm horizontal
330 mm vertical

Weight of sensor unit

11kg

...Installation Information

Connections to sensor unit

Sample inlet:	6mm O.D. compression fitting
Sample drain:	10mm flexible, atmospheric drain
Sample line material:	Stainless steel
Electrical:	Via gland – cable size 7 to 10.5mm
Max. core size:	Mains 32/0.2mm Signal 24/0.2mm

Dimensions of transmitter unit

300mm wide x 300mm high x 200mm deep

Mounting for transmitter unit

230mm horizontal
230mm vertical

Weight of transmitter

12kg

Electrical connection

Via glands in terminal box.

Power supply requirements

100/110/120/200/220/240V 50/60Hz 100VA

Power supply tolerances

Voltage +10% –20%

Frequency min. 47Hz max. 65Hz min.

Case protection of transmitter unit

IP55

Maximum distance between sensor and transmitter unit

To conform with EMC Directive the units **must be close-coupled**

EMC

Emissions

Conforms to EMC Directive 89/336/EEC

Classifications

BS EN 50081 – 2

BS EN 50082 – 2

Design and manufacturing standards

CE mark

Electrical safety

IEC348

Note.

In order to comply with the above it is essential that the sensor connecting cable be installed in metallic conduit, otherwise a total loss of performance at certain frequencies may occur, depending upon the installation.

The metallic conduit must be bonded to both cases to ensure continuity over the total system.

Ordering Information

Supplied with monitor

Instruction manual

Low level sodium and reference electrode

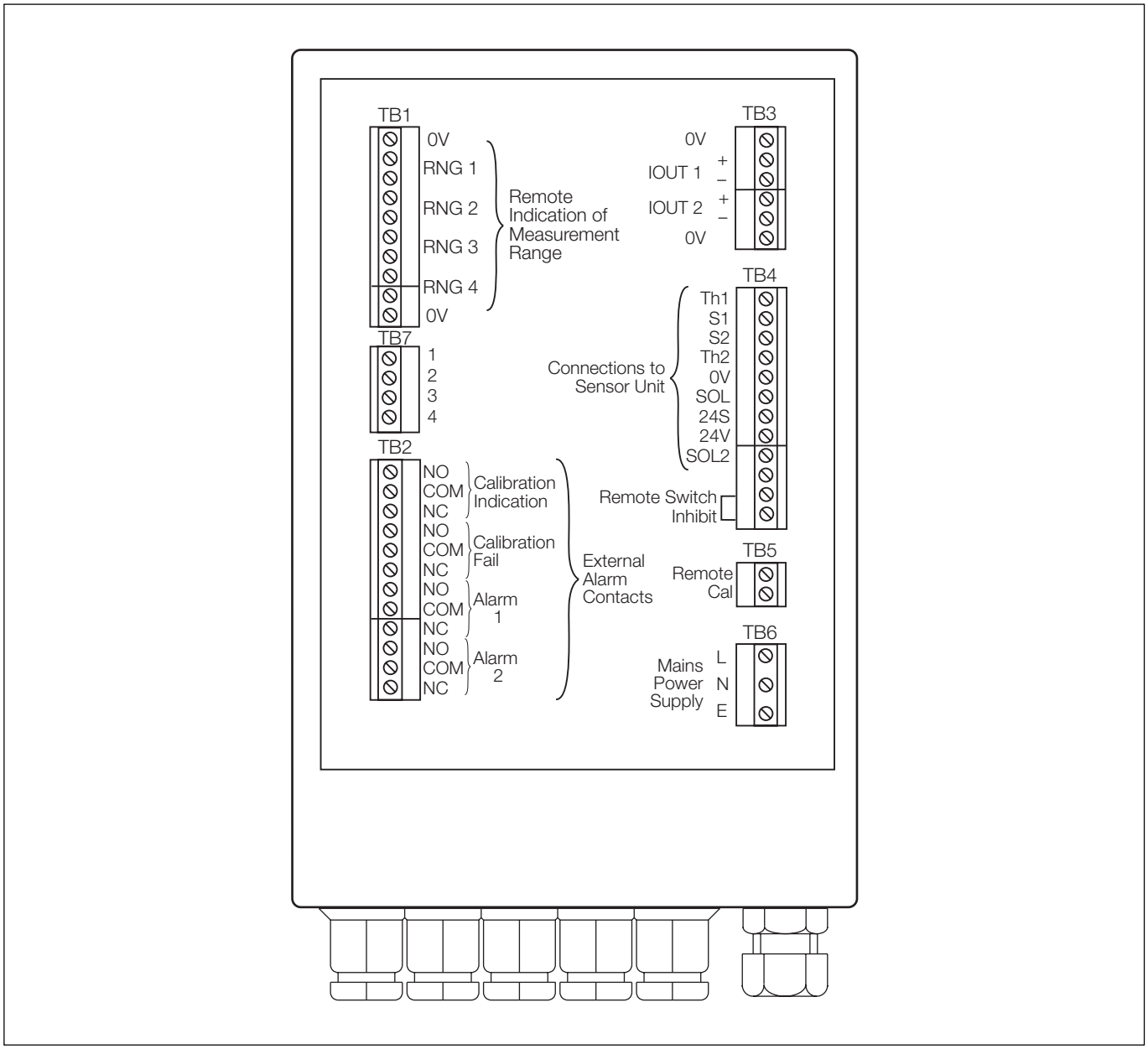
2.5m of connection cable

Additional option

Sensor unit signal extension cable (length to be specified) and junction box

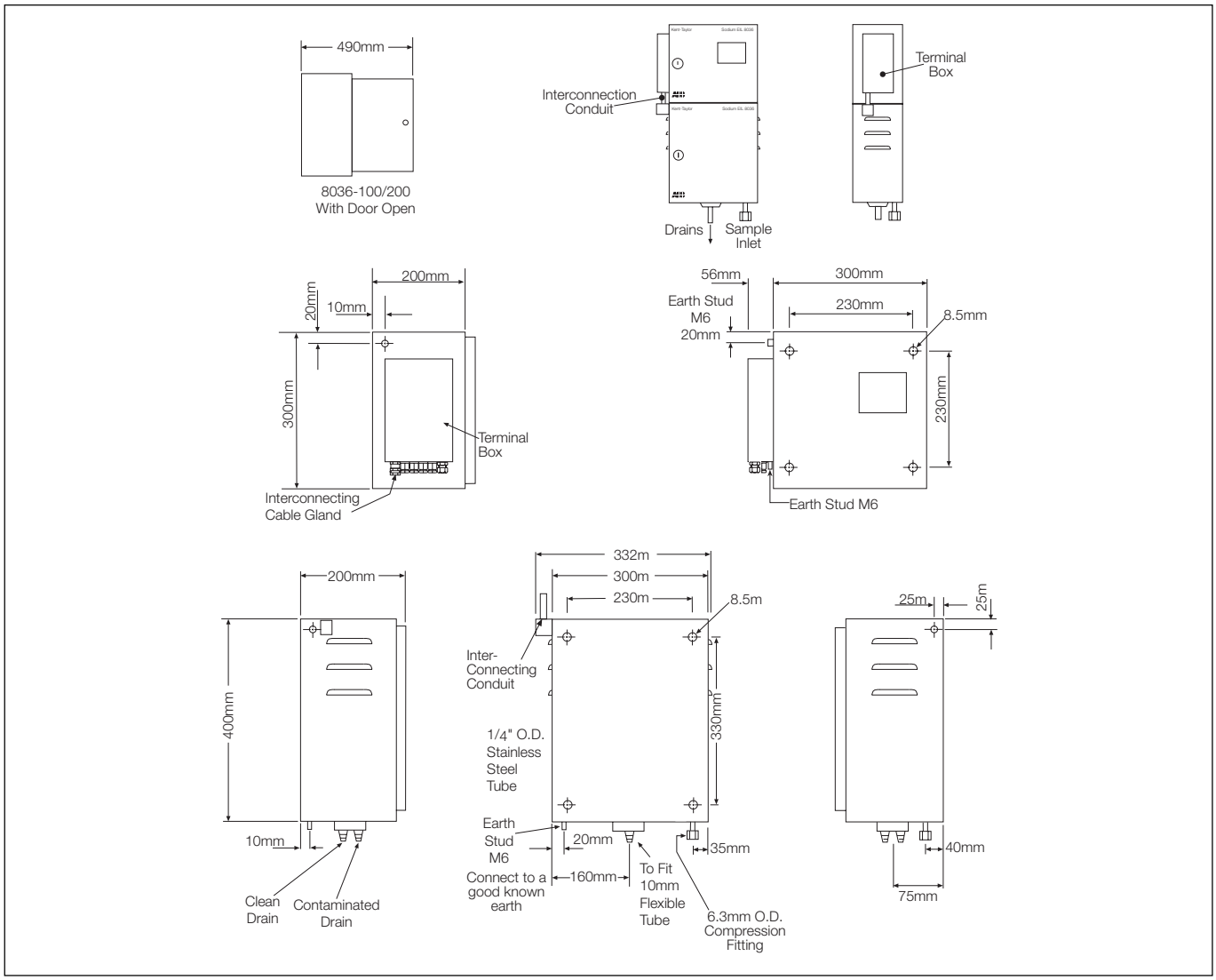
60 micron sample filter

Details of suitable sample cooling equipment can be supplied following details of application.



Model 8036 Electrical Connections

Overall Dimensions



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