ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION | OI/ASO550-EN REV. G

Navigator 500
Sodium analyzer

Navigator 500 sodium analyzer

Measurement made easy

Introduction

The Navigator 500 sodium analyzer is designed to provide continuous monitoring and control of power station boiler feed water / steam condensate.

The analyzer comprises a Navigator 540 transmitter with multiple wet-section capability for up to 4 wet-sections.

This Operating Instruction provides installation, operation and maintenance procedures for the Navigator 550 sodium wet-section and a Navigator 540 transmitter.

For more information

Further publications for the Navigator 500 sodium analyzer are available for free download from:

www.abb.com/measurement

or by scanning this code:

	Search for or click on
Commisioning Instruction Navigator 550 Sodium wet-section	CI/ASO550-EN
Commisioning Instruction Navigator 540 Transmitter	CI/AWT540-EN

Contents

1 Health & Safety

1.1 Safety precautions

Be sure to read, understand and follow the instructions contained within this manual before and during use of the equipment. Failure to do so could result in bodily harm or damage to the equipment.

Warning. Installation, operation, maintenance and servicing must be performed:

- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations

1.2 Potential safety hazards

1.2.1 Navigator 550 sodium wet-section – electrical

The Navigator 550 sodium wet-section operates on 24V DC supplied from the transmitter.

There are no hazardous voltages present.

1.2.2 Navigator 550 sodium wet-section – chemical reagents

Warning. To ensure safe use when handling chemicals, the following points must be observed:

- Review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards.
- Protective eye wear and hand wear must always be used when contact with chemicals is possible.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant Material Safety Data Sheets (where applicable) may be obtained from the Company, together with servicing and spares information.

1.2.3 Navigator 540 transmitter – electrical

Warning. To ensure safe use when operating this equipment, the following points must be observed:

- Up to 240V AC may be present. Be sure to isolate the supply before removing the terminal cover.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.

Safety advice concerning the use of the equipment described in this manual or any relevant Material Safety Data Sheets (where applicable) may be obtained from the Company, together with servicing and spares information.

1.3 Safety standards

This product has been designed to satisfy the requirements of IEC61010-1:2010 3rd edition 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500, NIST and OSHA.

1.4 Safety conventions

Warning. In this manual, a warning is used to indicate a condition which, if not met, could cause serious personal injury and / or death. Do not proceed beyond a warning until all conditions have been met.

Caution. A caution is used to indicate a condition which, if not met, could cause minor or moderate personal injury and / or damage to the equipment. Do not proceed beyond a caution until all conditions have been met.

Note. A note is used to indicate important information or instructions that should be considered before operating the equipment.

1.5 Symbols

1.5.1 Navigator 550 sodium wet-section

Symbols that appear on this product are shown below:

⎓	Direct current supply only.
	This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the need for protective eye wear.
	This symbol indicates the need for protective hand wear.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

1.5.2 Navigator 540 transmitter

Symbols that appear on this product are shown below:

	Functional earth (ground) terminal.
	Protective earth.
	Alternating current supply only.
	This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and / or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.
	Recycle separately from general waste under the WEEE directive

1.6 Product recycling and disposal (Europe only)

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. To conform to European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user. ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible.

Note. For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

1.6.1 End-of-life battery disposal

The transmitter contains a small lithium battery (located on the processor / display board) that must be removed and disposed of responsibly in accordance with local environmental regulations.

1.7 Restriction of Hazardous Substances (RoHS)

	The European Union RoHS Directive and subsequent regulations introduced in member states and other countries limits the use of six hazardous substances used in the manufacturing of electrical and electronic equipment. Currently, monitoring and control monitors do not fall within the scope of the RoHS Directive, however ABB has taken the decision to adopt the recommendations in the Directive as the target for all future product design and component purchasing.

2 Overview

2.1 Navigator 550 sodium wet-section

The Navigator 550 sodium wet-section has been designed for use with an ABB Navigator 540 transmitter to provide continuous monitoring and control of power station boiler feed water / steam condensate. Sampling points include mixed bed outlets in water treatment plants, extraction pump discharge, boiler feed, boiler drum and steam.

The wet-section contains a sodium ion responsive electrode and a silver / silver chloride reference electrode housed in an acrylic flowcell. The electrode pair measures the sodium concentration in the sample. The flowcell houses a temperature sensor for temperature compensation, sample stream valves and calibration valves.

The measurement range specification is 0.01 ppb to 10,000 ppb. The correct pH value of the sample is achieved by pre-treatment with an alkaline vapor*. Calibration is achieved by exposing the sensor to calibration solution* with the low and high calibration valves. A calibration can be initiated manually when required, or automatically with programmable daily frequency ranges, from 1 to 7 days and 1 to 8 weeks.

**For information about reagent solutions, contact the local ABB representative.*

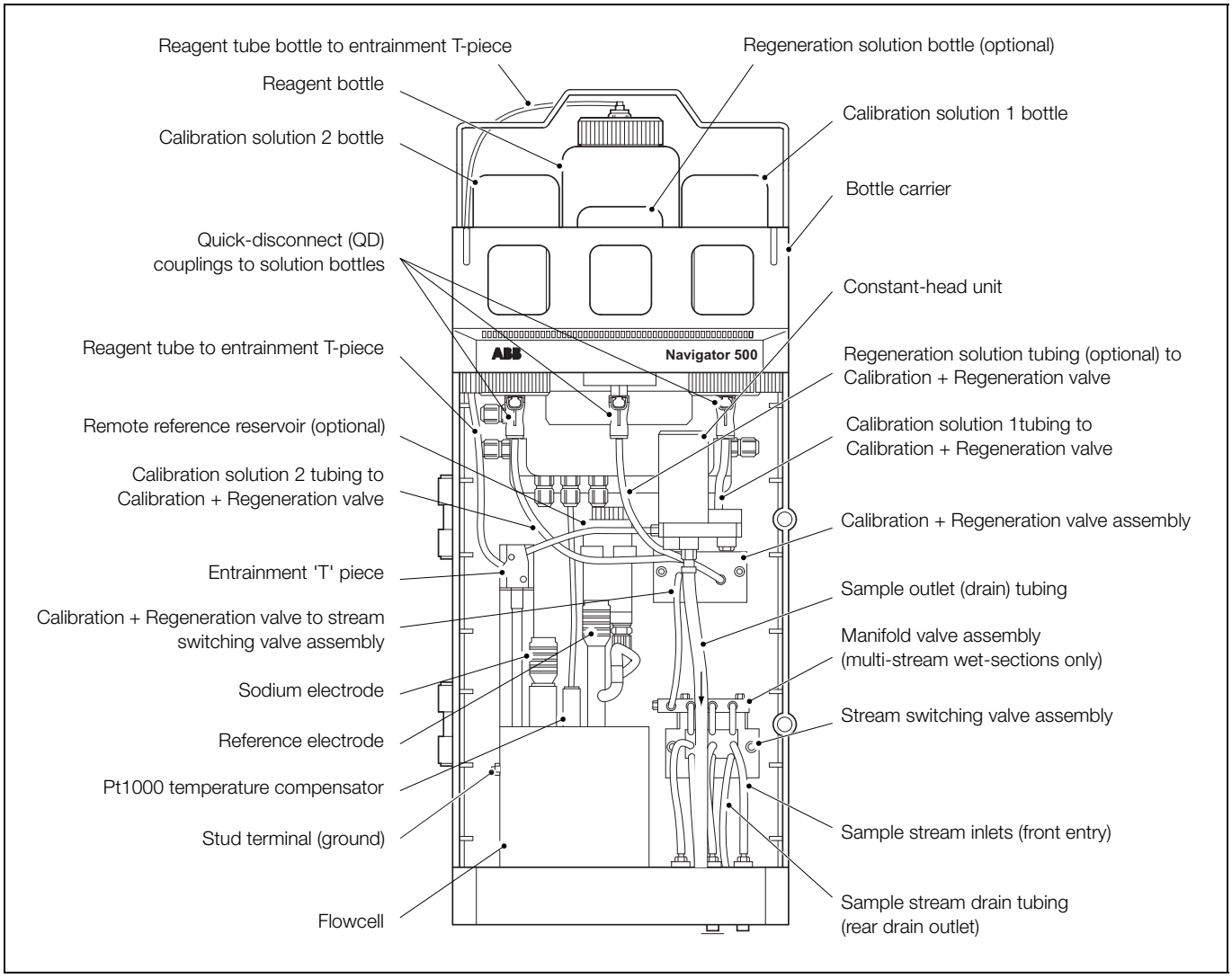


Fig. 2.1 Sodium wet-section main components (multi-stream version without flowmeters shown)

2.2 Navigator 540 transmitter

The Navigator 540 transmitter is designed for continuous monitoring and control of power station boiler feed water / steam condensate and must be used in conjunction with an associated ABB wet-section to measure levels of low level dissolved oxygen / sodium / hydrazine. Wet-sections are parameter-specific.

Information from the wet-section is sent to the transmitter via a communication board, where the process reading is displayed on the main page and can be displayed as a graph in the *Chart View* – refer to Section 6.7, page 33 for details of view options.

Diagnostic messages inform the user of the analyzer status and can be logged for review. The analyzer status can also be assessed remotely using programmable alarms, current output diagnostic functions, using optional Ethernet communications.

The transmitter has a multiple wet-section capability which enables it to control and display information from up to 4 wet-sections (excludes multi-stream wet-sections). Section 3.3, page 13 shows an example of the multiple wet-section set up.

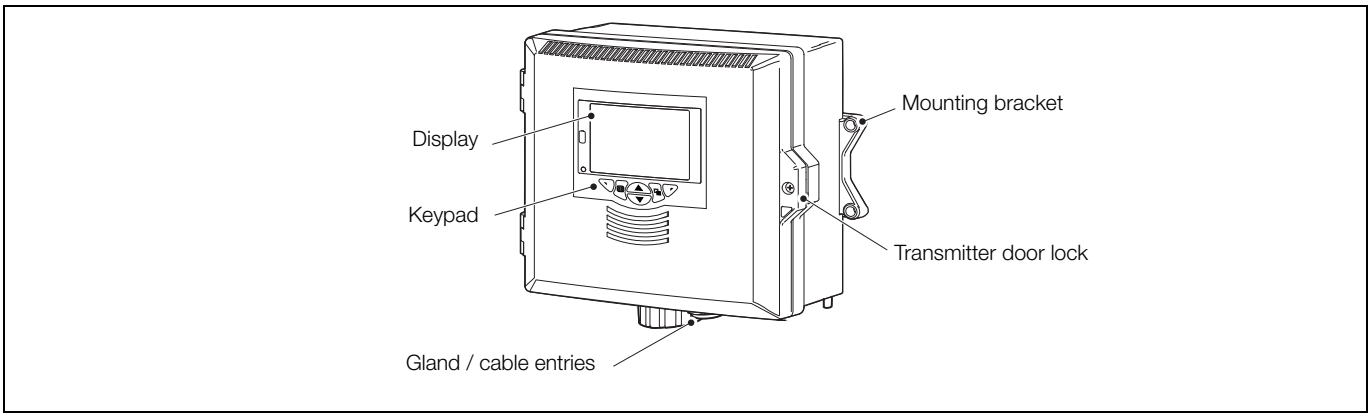


Fig. 2.2 Navigator 540 transmitter – main components

3 Installation

3.1 Installing the wet-section

3.1.1 Sample requirements

Ensure the sampling point is as close as possible to the wet-section and provides a thoroughly-mixed representative sample.

- Sample must contain less than 10 ppm suspended solids with a particle size no greater than 60 µm. (If particle sizes exceed 60 µm, use a 60 µm filter.)
- Sample temperature must be within the range 5 to 55 °C (41 to 131 °F).
- Sample flow rates must be within the range 100 to 400 ml/min (6.10 to 24.4 to cu in./min.).
- Sample must not exceed 1.5 bar gauge (21.75 psi).

3.1.2 Location

For general location requirements refer to Fig. 3.1. Install in a clean, dry, well ventilated and vibration-free location giving easy access. Avoid rooms containing corrosive gases or vapors, for example, chlorination equipment or chlorine gas cylinders.

Select a location away from strong electrical and magnetic fields. If this is not possible, particularly in applications where mobile communications equipment is expected to be used, screened cables within flexible, earthed metal conduit must be used.

The standard solution and reagent containers are mounted at the top of the wet-section panel. Standard solution containers are connected via quick-disconnect (QD) couplings. If the transmitter has to be mounted directly above the wet-section, allow at least 270 mm (11 in.) separation between the two units for access to solution containers.

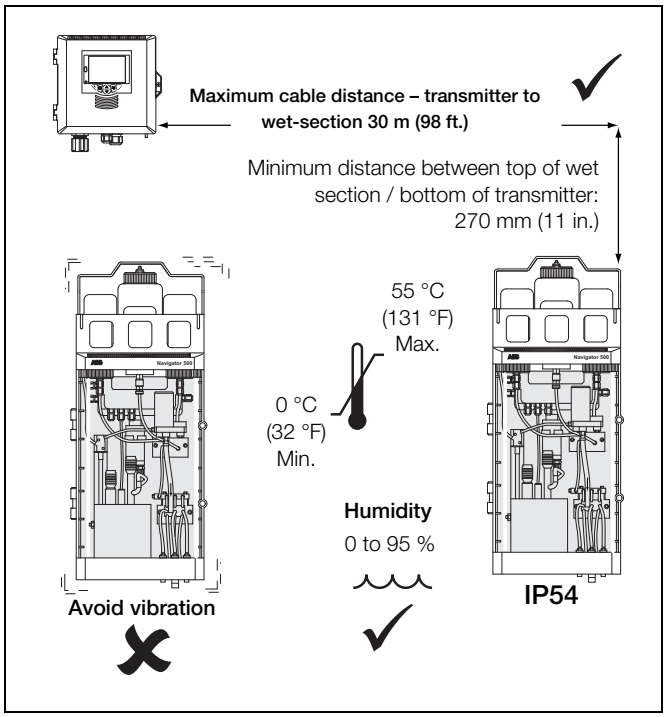


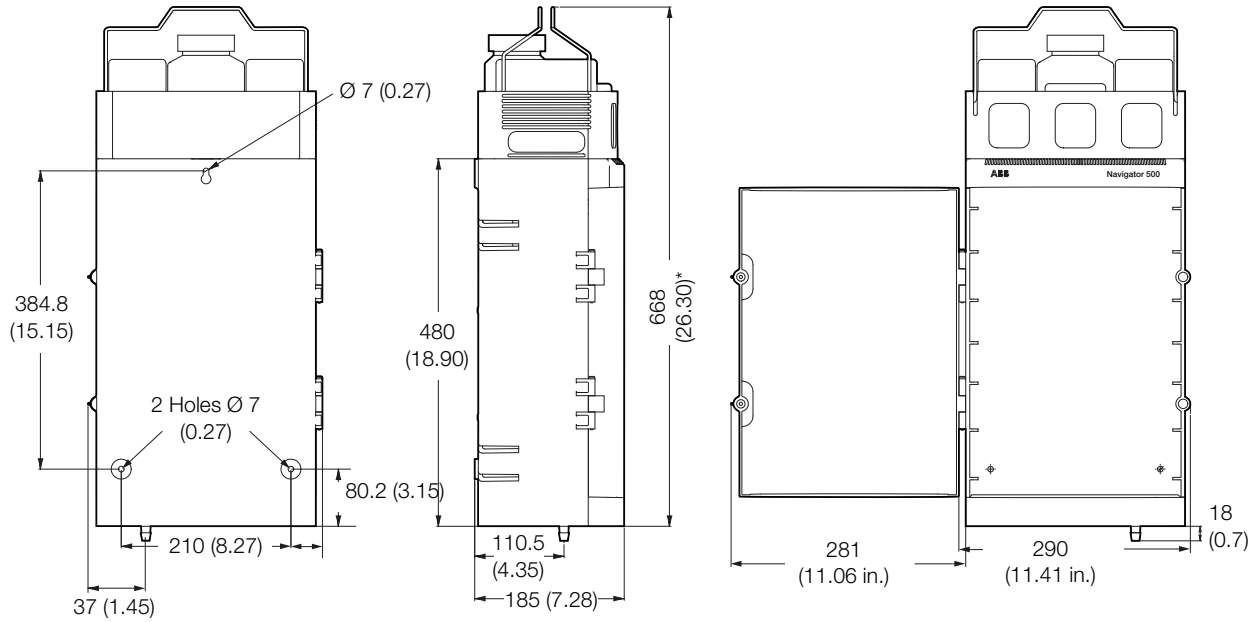
Fig. 3.1 Wet-section location

3.1.3 Mounting the wet-section

Refer to Fig. 3.2 for wet-section dimensions. The wet-section weighs 4.5 kg (10 lb) – excluding bottle carrier and solutions.

Note. Clearance – the enclosure doors can open 180°. If mounting in a confined area, allow sufficient clearance for door opening.

Dimensions in mm (in.)



*When installing, allow a further 60 mm (2.36 in.) min. to remove the bottle carrier assembly, or 135 mm (5.31 in.) min. to remove the calibration solution bottle from the carrier.

Fig. 3.2 Sodium wet-section dimensions

Referring to Fig. 3.3:

1. Mark the wall using the dimensions shown.
2. Drill and plug 3 holes (A) and (B) in the wall suitable for M6 or 1/4 in. fixings.
3. Screw in top fixing (A), leaving a gap of 20 mm (0.78 in.) between the fixing head and the wall.
4. Hang the wet-section onto fixing (A), ensuring the wet-section is retained firmly against the wall.

   Note. It is not possible to adjust fixing (A) once the wet-section is placed over it.

5. Secure the wet-section to the wall using 2 fixings (B).

Dimensions in mm (in.)

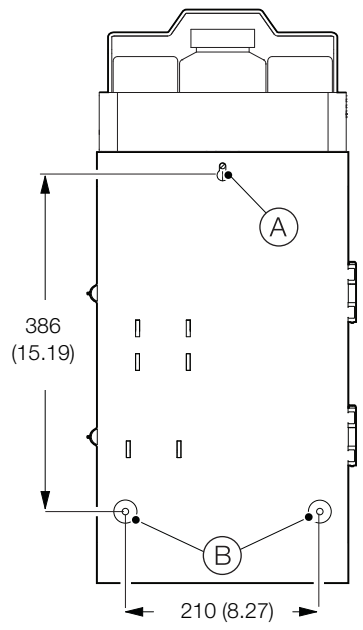


Fig. 3.3 Mounting the wet-section

3.1.4 Connecting the external sample lines

Note.

- Sample inlet tubing to the base of the wet-section is customer-supplied.
- Sample inlet tubing must have sufficient wall thickness to withstand the highest sample pressure. Keep tubing lengths short.
- Keep sample drains as short as possible and vertical to enable the sample to drain freely.
- Where particulate matter is present (for example, magnetite in boiler samples) it is recommended that a 60 micron sample filter is fitted to the sample inlet line.

To make external sample inlet connections:

1. Fit a shut-off valve (not supplied) at each sample inlet.

Referring to Fig. 3.4:

2. Connect sample inlet tubing as follows:
   a. For **multi-stream** wet-sections **without flowmeters**, connect 1/4 in. ID (or equivalent) plastic tubing (1 tube per stream) to barbed connectors (A).
   b. For **multi-stream** wet-sections **with flowmeters**, connect 3/8 in. ID (or equivalent) plastic tubing (1 per stream) to spigot on flowmeters (B).
   c. For **single-stream** wet-sections **without flowmeter**, connect 1/4 in. ID (or equivalent) plastic tubing to barbed connector (C).
   d. For **single-stream** wet-sections **with flowmeter**, connect 3/8 in. ID (or equivalent) plastic tubing to spigot on flowmeter (D).
3. Ensure the wet-section internal sample stream drain tubing and sample outlet tube is routed through the drain outlets at the base of the wet-section and through the funnel (E) – refer to Fig. 8.5, page 65 (multi-stream) or Fig. 8.7, page 67 (single-stream) for tubing location details at the base of the wet-section enclosure.
4. Connect the flowcell drain tubing (customer-supplied) to the barbed connector at the base of the wet-section (F).

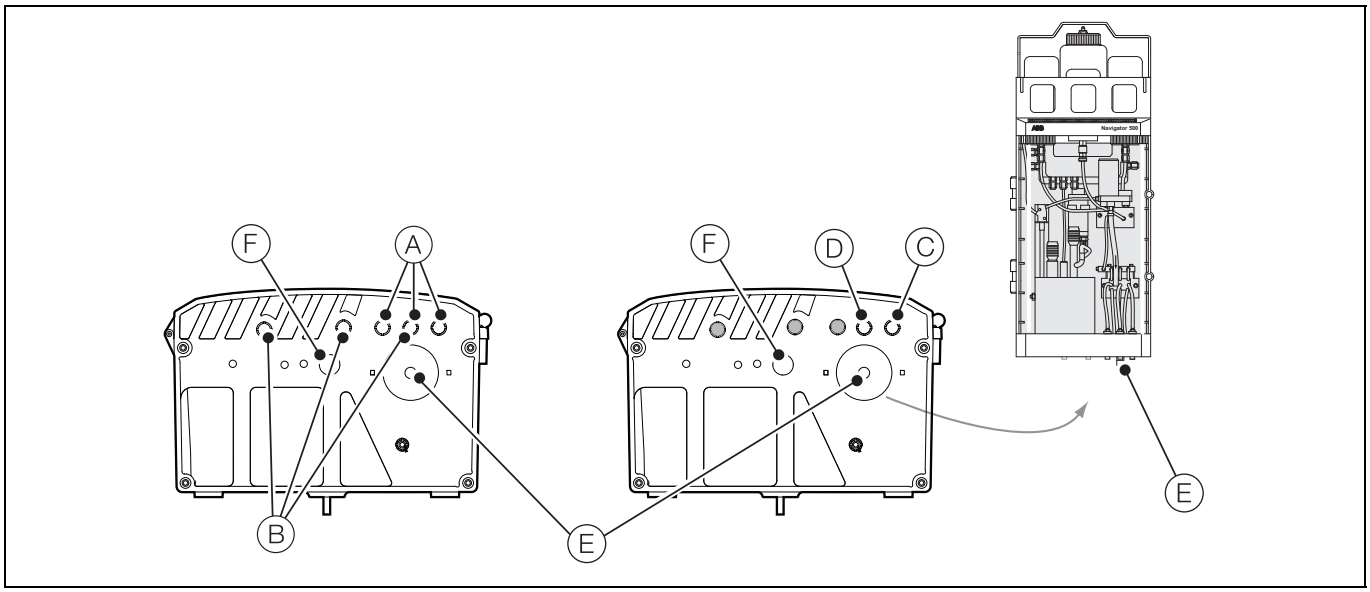


Fig. 3.4 Connecting the external sample lines

3.1.5 Connecting the reagent / calibration / regeneration tubing

The following tubing connections must be made on site, all other tubing connections are factory-made. All other internal wet-section tubing connections are factory-made.

Referring to Fig. 3.5:

1. Connect the end of reagent tubing (A) to the connector (B) on the reagent bottle.
2. Connect the calibration solution 2 tubing QD coupling plug (C) to the mating connector (D) at the base of the calibration solution 2 bottle.
3. If an optional regeneration bottle is fitted, connect the regeneration solution tubing QD coupling plug (E) to the mating connector (F) at the base of base of the regeneration solution bottle.
4. Connect the calibration solution 1 tubing QD coupling plug (G) to the mating connector (H) at the base of the calibration solution 1 bottle.

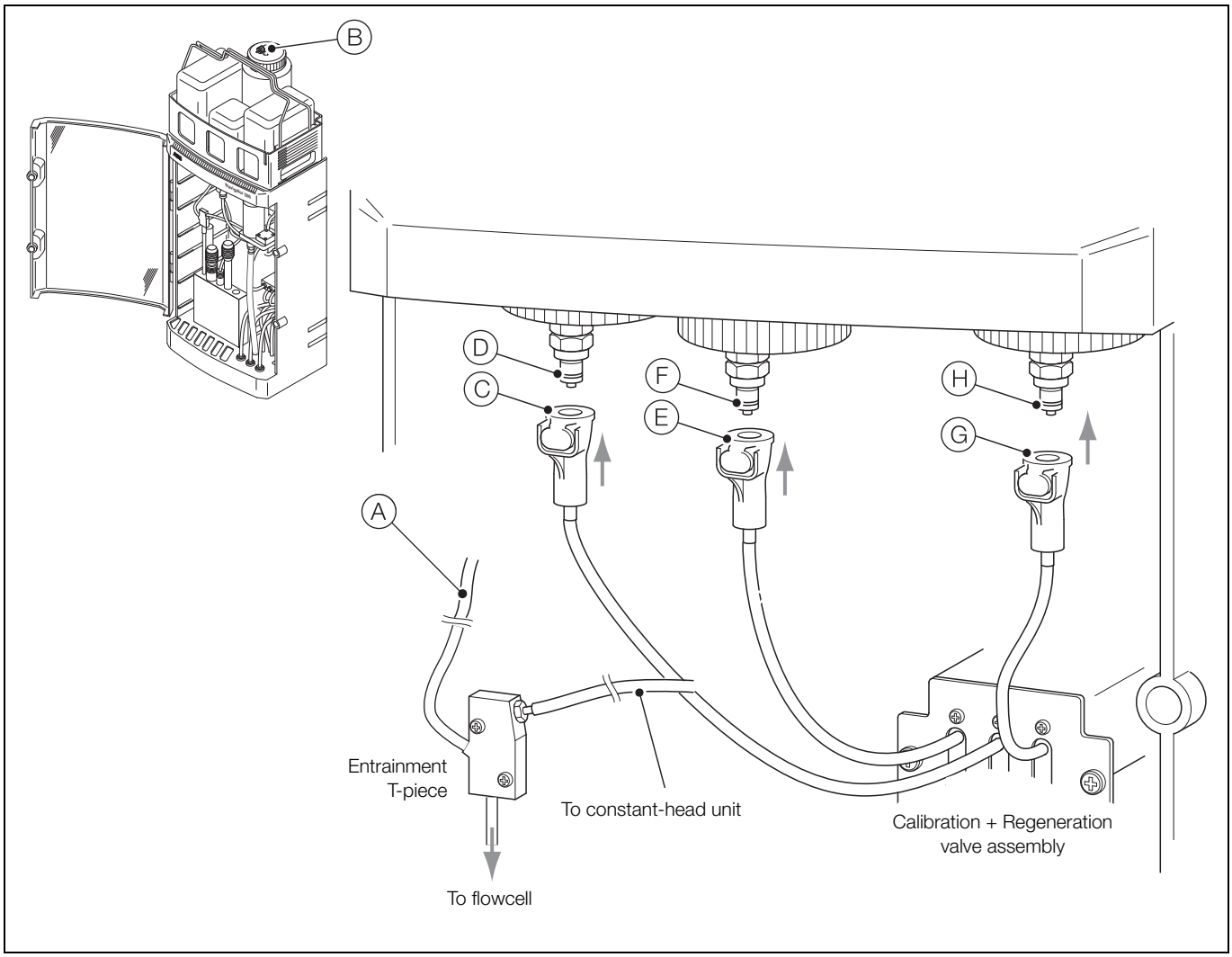


Fig. 3.5 Reagent, calibration and (optional) regeneration tubing connections

3.2 Installing the transmitter

3.2.1 Transmitter optional accessories

Optional accessories comprise:

Cable gland kit

3.2.2 Transmitter location

For transmitter general location requirements refer to Fig. 3.6. Install in a clean, dry, well ventilated and vibration-free location providing easy access. Avoid rooms containing corrosive gases or vapors, for example, chlorination equipment or chlorine gas cylinders.

Warning. The transmitter is not fitted with a switch – an isolation device such as a switch or circuit breaker conforming to local safety standards must be fitted to the final installation. It must be fitted in close proximity to the transmitter, within easy reach of the operator and marked clearly as the isolation device for the transmitter.

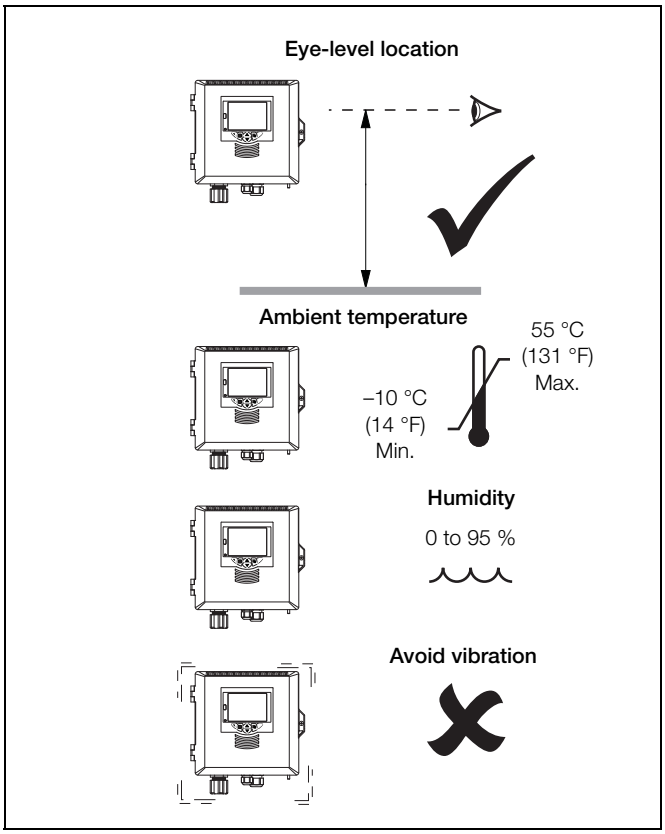


Fig. 3.6 Transmitter location

3.2.3 Panel mounting

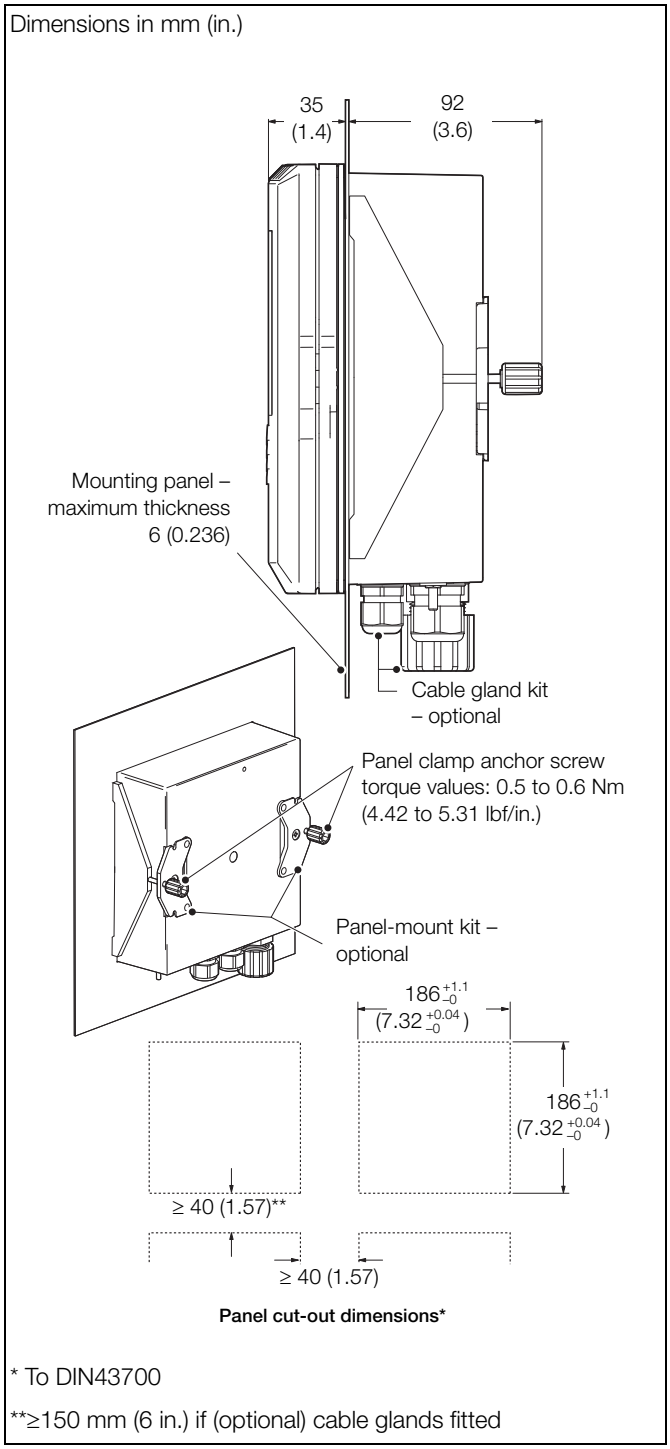


Fig. 3.7 Transmitter panel-mount option

3.2.4 Pipe mounting

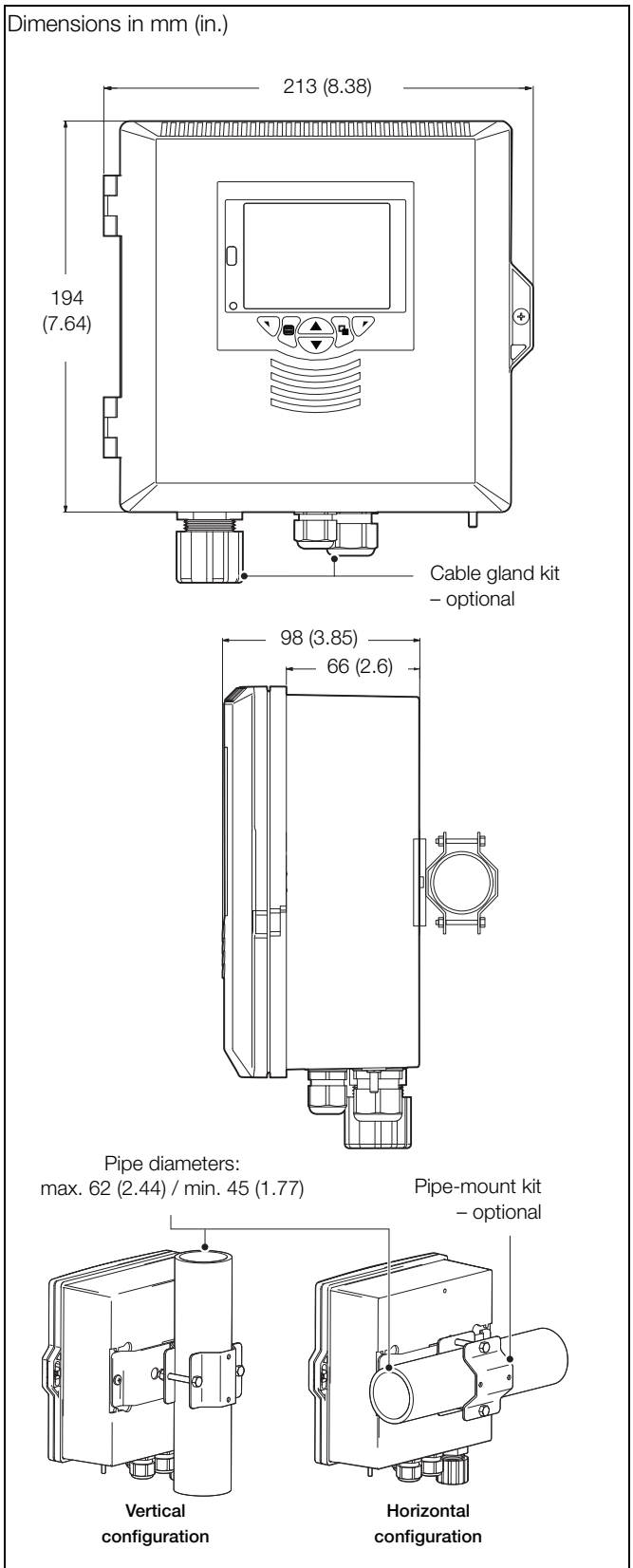


Fig. 3.8 Transmitter pipe-mount options

3.2.5 Wall mounting

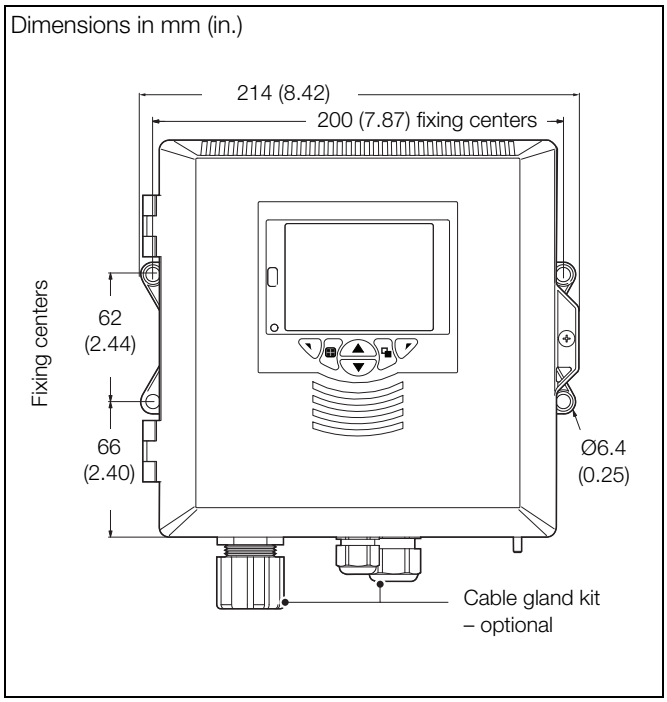


Fig. 3.9 Transmitter wall-mount option

3.3 Multiple wet-section setup

Fig. 3.10 shows the multiple wet-section setup (4 wet-sections maximum).

Note.

- Maximum length of cable from transmitter to single-stream wet-section(s) = 30 m (92 ft.).
- Multi-stream wet-sections cannot be connected.

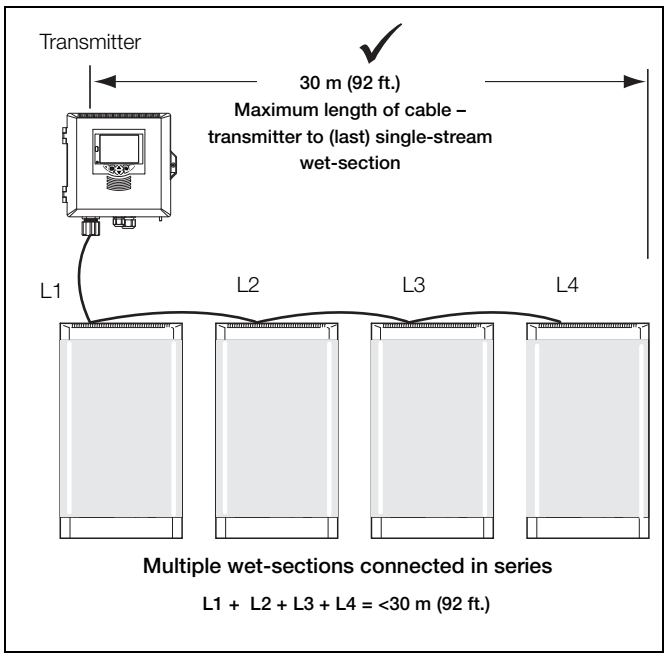


Fig. 3.10 Multiple wet-section setup – maximum cable length

3.4 Electrical connections – wet-section

3.4.1 Solution ground

A stud terminal is located on the left hand side of the flow cell, see Fig. 2.1, page 6. This stud is provided so that the solution can be grounded to ensure there is not a build up of static charge. Static charge can build up when high purity liquids flow over non-conductive surfaces and may result in a noisy signal output. It is recommended that a 16/0.2 mm wire (green/yellow outer insulation) is connected from the flow cell stud terminal of each wet-section to the nearest suitable equipotential earth; for example the earth stud on the transmitter.

3.4.2 Accessing the wet-section PCB

This section is applicable only for multiple wet-section systems.

Note.

- For single wet-section systems, the Modbus cable is connected to the wet-section at the factory – only transmitter connections are required.
- If additional wet-sections are added they must be connected in series – refer to Appendix C, page 78.
- The following procedure is required only when connecting additional wet-sections to an existing analyzer.

Warning. Isolate power supplies to the transmitter and wet-section before attempting to access the wet-section PCB.

Referring to Fig. 3.11:

1. Open the wet-section door by releasing the 2 door locks (A).
2. Remove the 4 screws (B) and associated plastic screw retaining washers (C) holding the wet-section PCB cover in place and remove the cover.
3. Feed the supplied communications cable through the channel in the rear corner of the main case (as fitted cable), then through the cable gland and make the connections shown in 3.12, page 15.

Note. When refitting the cover, ensure that the O-ring seal (D) in the PCB housing is located correctly in its groove.

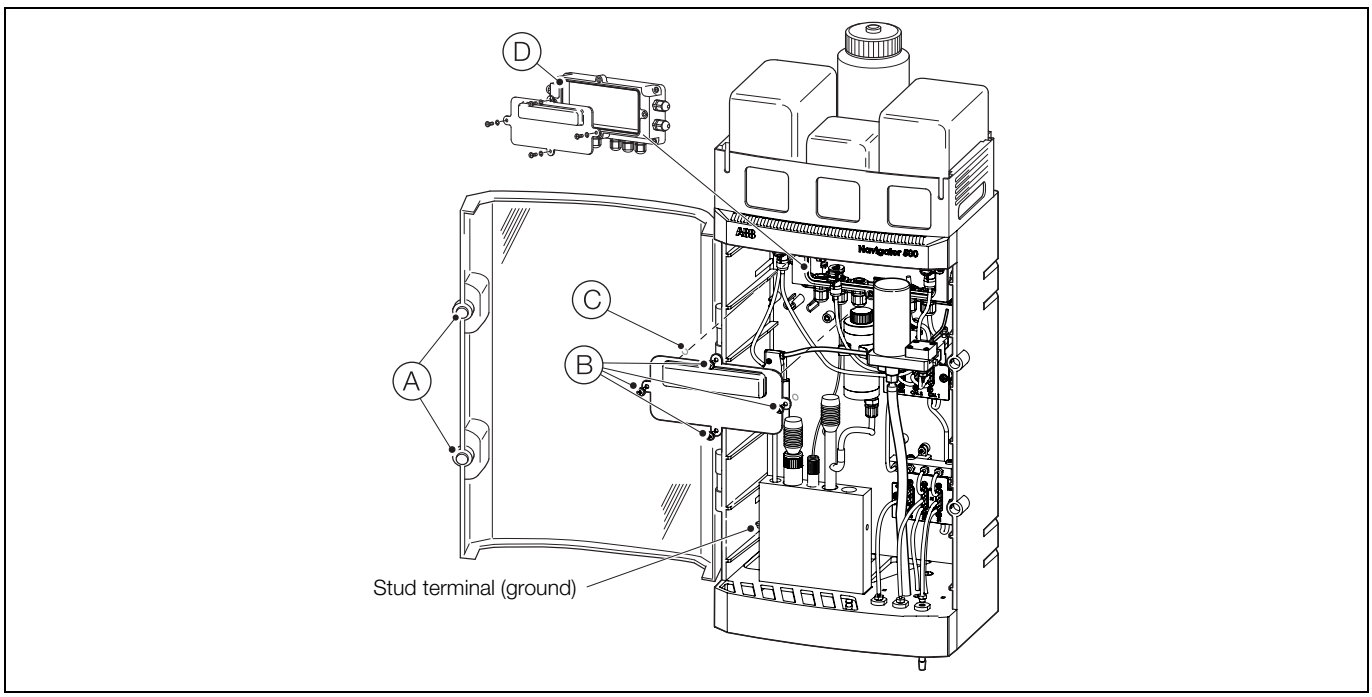


Fig. 3.11 Accessing the wet-section PCB

3.4.3 Wet-section PCB connections

Note.

- Refer to Section 3.5.2, page 18, for connection details at the transmitter.
- Serial cable connections at each additional wet-section are made into the same terminals IDs as the factory-fitted serial cable.
- Refer to Appendix C, page 78, for multiple wet-section setup and serial connection details.

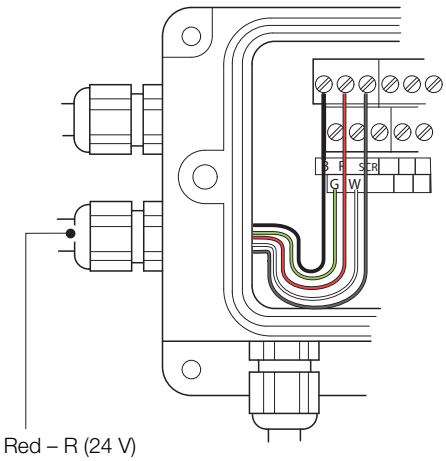


Fig. 3.12 Additional serial cable connections to multiple wet-sections

Cable	Color	Terminal ID	Description
Serial			
	Red	R	24 V
	Black	B	0 V
	Green	G	Data +ve
	White	W	Data –ve
	Screen	SCR	Screen
Stream switch valve – single-stream			
	Red	1	Valve 1 +ve
	Black	2	Valve 1 –ve
Stream switch valve – multi-stream			
	Green	1	Valve 1 +ve
	Brown	2	Valve 1 –ve
	Red	3	Valve 2 +ve
	Black	4	Valve 2 –ve
	Yellow	5	Valve 3 +ve
	Orange	6	Valve 3 –ve

Table 3.1 Factory-made connections

Cable	Color	Terminal ID	Description
Calibration valve			
	Green	7	Cal valve 1 +ve
	Brown	8	Cal valve 1 –ve
	Red	9	Cal valve 2 +ve
	Black	10	Cal valve 2 –ve
	Yellow	11	Regen valve +ve
	Orange	12	Regen valve –ve
Reserved for pump (connection via separate PCB)			
	Red	14	+ve
	Black	18	–ve
Flowmeter (if fitted)			
Stream 1			
	Red	13	+ve
	Brown	15	GND
	Black	17	–ve
Stream 2 (multi-stream only)			
	Orange	20	+ve
	Yellow	22	GND
	Green	24	–ve
Stream 3 (multi-stream only)			
	Blue	19	+ve
	Violet	21	GND
	Grey	23	–ve
Pressure switch			
	Red	25	N/A
	Black	26	N/A
Reference electrode			
	Black	32	N/A
Sodium electrode			
	Screen	34	N/A
	Core	36	N/A
Pt1000 temperature sensor			
	Red	33	N/A
	Blue	35	N/A

Table 3.1 Factory-made connections (Continued)

3.5 Electrical connections – transmitter

Warning.

- If the transmitter is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.
- Remove all power from supply, relay, any powered control circuits and high common mode voltages before accessing or making any connections. Use cable appropriate for the load currents: 3-core cable rated 3 A and 75 °C (167 °F) minimum, and voltage: 100 / 240 V that conform to either IEC 60227 or IEC 60245, or to the National Electrical Code (NEC) for the US, or the Canadian Electrical Code for Canada. The terminals accept cables AWG 26 to 16 (0.14 to 1.5 mm^2).
- Ensure the correct fuses are fitted – Fig. 3.14, page 18 for fuse details.
- Replacement of the internal battery must be carried out by an approved technician only.
- The transmitter conforms to Installation Category II of IEC 61010.
- All connections to secondary circuits must have insulation to required local safety standards. After installation, there must be no access to live parts, for example, terminals. Use screened cable for signal inputs and relay connections. Route signal leads and power cables separately, preferably in an earthed (grounded) flexible metal conduit.
- All equipment connected to the transmitter's terminals must comply with local safety standards (IEC 60950, EN61010-1).
- The ethernet and bus interface connectors must only be connected to SELV circuits.

USA and Canada Only

- The supplied cable glands are provided for the connection of signal input and ethernet communication wiring ONLY.
- The supplied cable glands and use of cable / flexible cord for connection of the mains power source to the mains input and relay contact output terminals is not permitted in the USA or Canada.
- For connection to mains (the mains input and relay contact outputs), use only suitably rated field wiring insulated copper conductors rated min. 300 V, 16 AWG, 90C. Route wires through suitably rated flexible conduits and fittings.

3.5.1 Accessing the transmitter connection board

Note. Electrical connections to the wet-section connection board are identified in the Section 3.4.3, page 15. Before fitting cable glands, identify the connections required and cable gland entries to be used.

Referring to Fig. 3.13:

1. Using a suitable screwdriver, release door retaining screw (A) and open the transmitter door.
2. Release cover plate retaining screw (B) and remove cover plate (C).
3. Slide retaining clip (D) off blanking plug (E) and remove the blanking plug.
4. Fit cable gland (F) and secure using nut (G).
5. Remove gland cover (H) and route mains power supply cable (J) through it.
6. Route the cable through cable gland (F) and into the enclosure case.

   Note. Cable glands are supplied with single- and twin-holed bushes. Use the single-holed bush for the mains power cable.

7. Make connections to the power supply connection terminals (K).
8. Tighten gland cover (H).
9. Refit cover plate (C) and secure it with retaining screw (B).
10. Close the transmitter door and secure with door retaining screw (A).

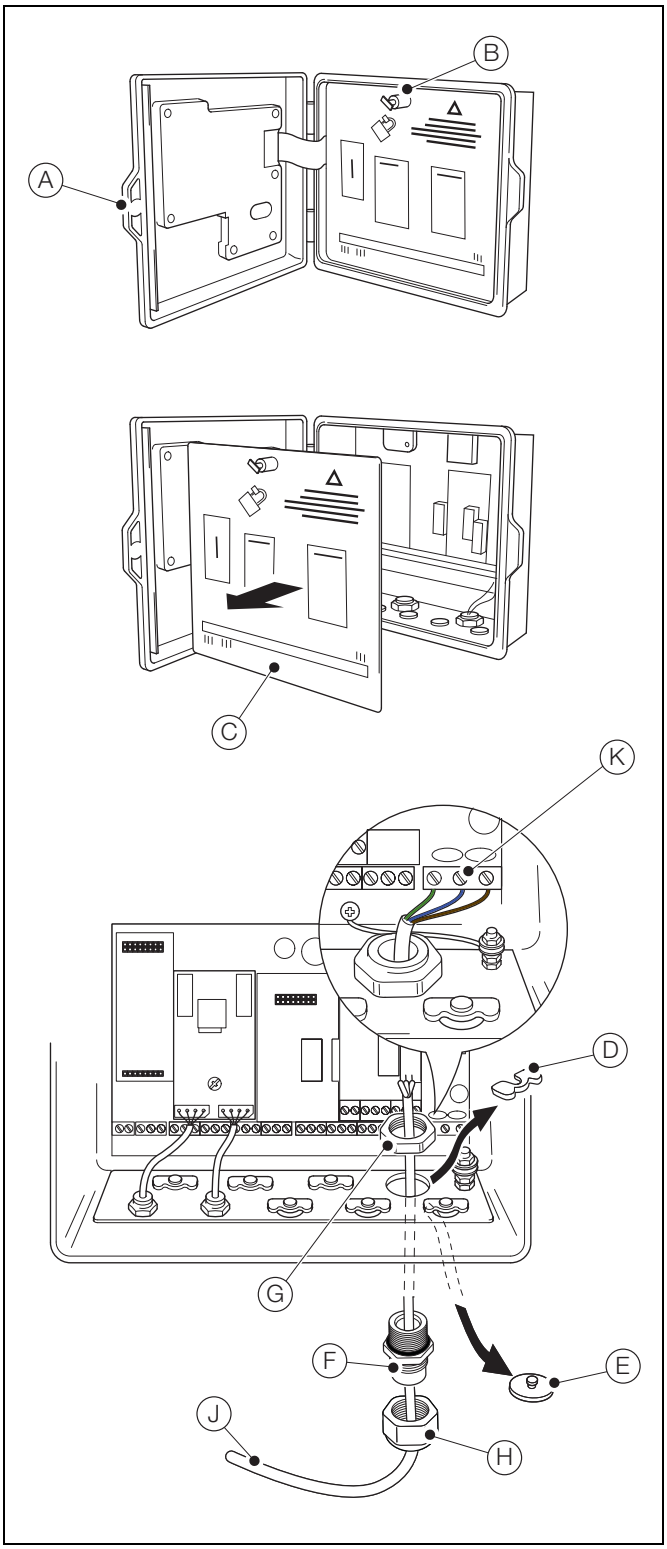


Fig. 3.13 Accessing the transmitter board and making electrical connections

3.5.2 Transmitter connections

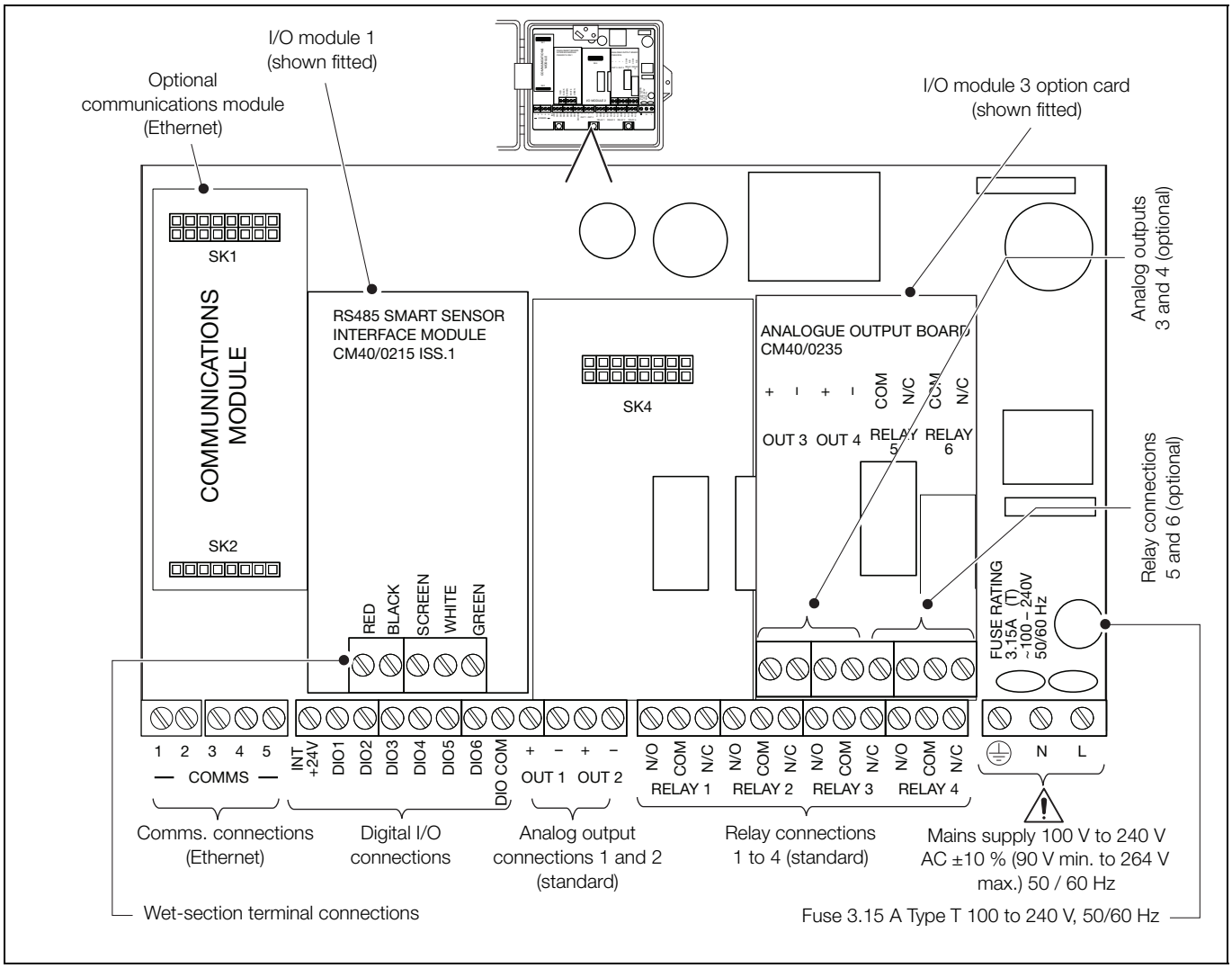


Fig. 3.14 Connections overview

3.5.3 Digital I/O, relays and analog output connections

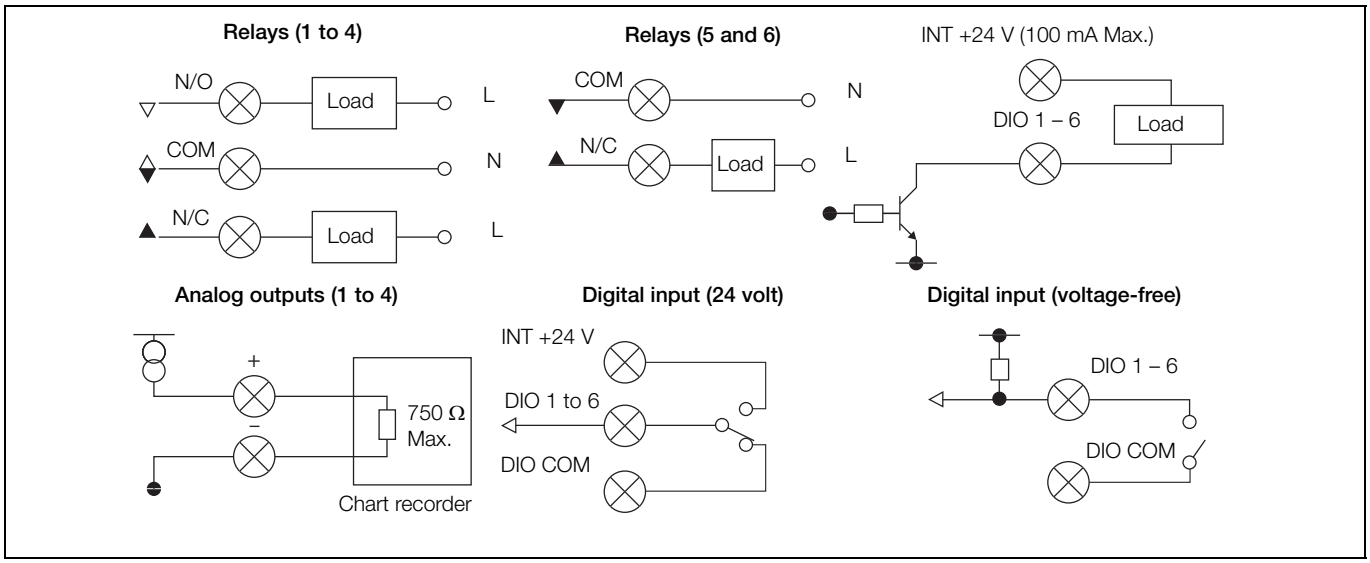


Fig. 3.15 Digital I/O, relays and analog output connections

4 Setup

This section describes how to set the analyzer up for first-time use.

If multiple wet-sections are to be connected to a transmitter, an additional setup procedure is required – see Appendix C, page 78.

Caution. Do not attempt to setup the analyzer unless the wet-section and transmitter are fully installed and ready for operation.

4.1 Setting-up the wet-section

4.1.1 Fitting the electrodes

Note. O-rings must be fitted correctly and the inside of the electrode connectors must be dry and completely sealed (moisture reduces the circuit impedance and affects the wet-section performance).

Referring to Fig. 4.1:

1. Unpack sodium electrode (A) and carefully remove the rubber teat – retain the teat for storage. Unscrew (but do not remove) plastic sleeve (B) and slide sodium electrode (A) fully into plastic sleeve (B).
2. Carefully tighten plastic sleeve (B) (with sodium electrode (A) in place) until electrode bulb (C) passes through O-ring (D).

   Position the sodium electrode so that, when the plastic sleeve is tightened against O-ring (D), the electrode bulb is just above the bottom of the flowcell chamber (E).
3. Ensure O-ring (F) is fitted at the top of the sodium electrode.
4. Connect red-sleeved sodium connector (G) to the top of the sodium electrode and tighten.
5. Unpack reference electrode (H) and remove the rubber teat – retain the teat for storage.
6. For systems without an optional reservoir, unplug the black rubber filling hole plug (I) (check the reference electrode has sufficient solution – top up if necessary).

   For systems with an optional reservoir fitted, proceed to step10, then connect the reservoir tube to the reference electrode arm as described in Section 4.1.2, page 20.
7. Remove the supplied O-ring (J) (temporarily secured to the top of the right-hand chamber) and fit it over the reference electrode body.
8. Carefully position the reference electrode centrally in the right-hand chamber (K) so that the ceramic plug (L) is between 5 and 10 mm (0.2 to 0.4 in.) from the bottom of the chamber.
9. Ensure O-ring (M) is fitted at the top of reference electrode.
10. Connect black-sleeved reference electrode connector (N) to the top of reference electrode and tighten.

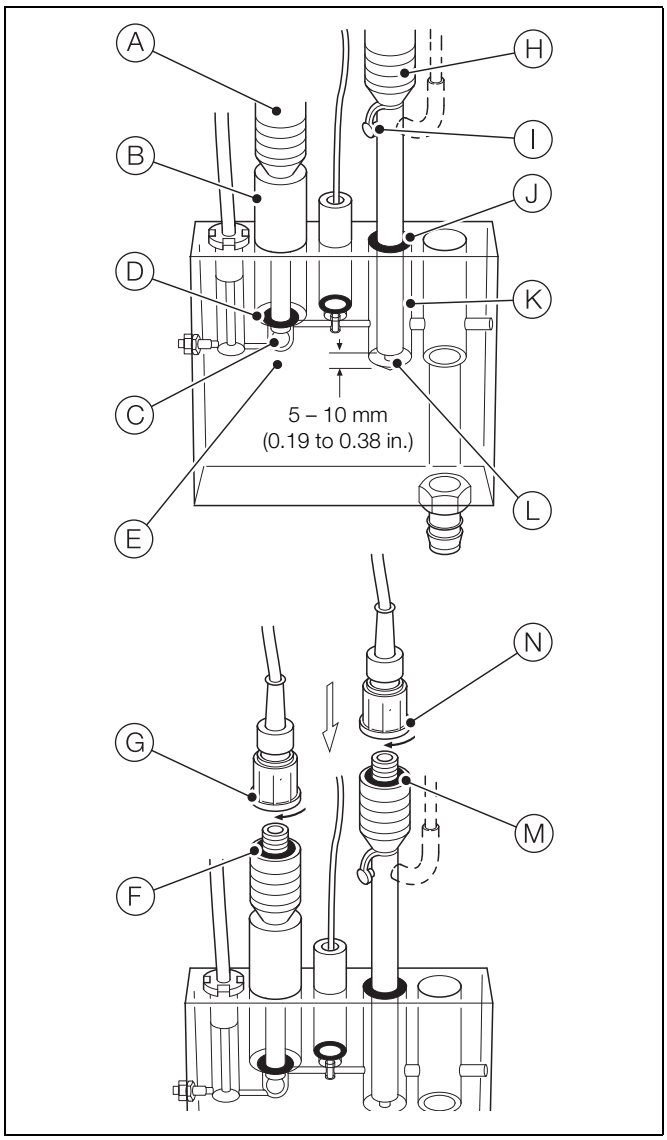


Fig. 4.1 Fitting the sodium and reference electrodes

4.1.2 Fitting and filling the reservoir (option)

Note. The reservoir is supplied partially-assembled. Assemble only immediately before using the wet-section (to avoid the possibility of solution drying out if the wet-section is stored for any length of time).

Referring to Fig. 4.2:

1. Push reservoir (A) into clip (B).
2. Slide the lower end of the reservoir tube (C) onto reference electrode filler tube (D).

   Note. Ensure the reservoir tube is not kinked and does not contain air bubbles.

3. Remove filler cap (E) from the reservoir (A).
4. Fill the reservoir with 3.5 KCl solution and squeeze the reservoir tube (C) repeatedly to expel any bubbles.
5. Unscrew filler plug (G) 1 turn from the fully-closed position to avoid creating a vacuum.
6. Ensure O-ring (F) is in place and replace filler cap (E).

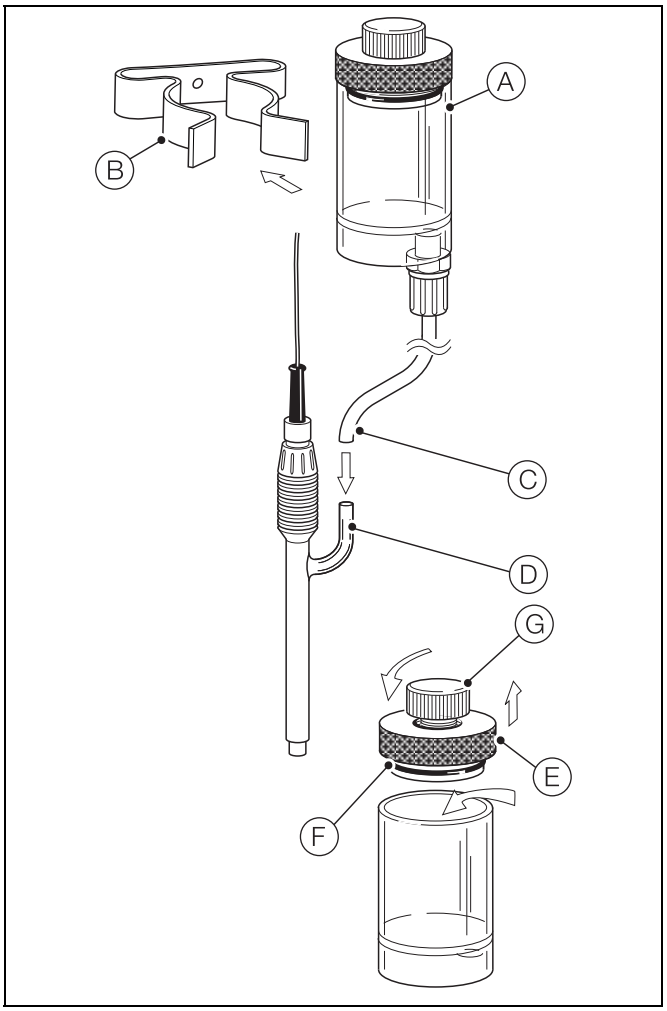


Fig. 4.2 Fitting and filling the reservoir

4.1.3 Sensor panel

1. Fill the reagent solution container with appropriate solution.
2. Open the shut-off valve upstream of the wet-section panel and adjust it until sample is overflowing from the overflow pipe of the constant-head unit.

   The maximum and minimum flow rates are 400 to 100 ml/min (24.4 to 6.10 cu in./min).

3. Ensure that sample is passing from the constant-head unit to the flowcell and that the entrainment of reagent is operating; the entrainment should be regular, not intermittent.

   Allow at least one hour before carrying out a calibration.

4. If the wet-section is a multiple wet-section configuration, check / set the DIP switches on the wet-section PCB – see Appendix C, page 78.
5. Start-up the transmitter as described in the Section 4.2.
6. Perform a two-point calibration:
   - for single-stream wet-sections refer to Section 5.2, page 22
   - for multi-stream wet-sections refer to Section 5.3, page 23
7. The wet-section is now ready for use.

4.2 Transmitter start-up

Ensure all electrical connections have been made and switch the power to the transmitter on. If the wet-section is being commissioned for the first time, programming and calibration of parameters is required – refer to Section 5.2, page 22 (single-stream) or Section 5.3, page 23 (multi-stream) to perform a calibration for the first time.

The menu structure, general operation and menu descriptions, including *Calibration* are detailed Section 7, page 42.

5 Calibration

This section describes how to calibrate the analyzer once it is operational. Calibrations are initiated via the *Cal* prompt displayed on *Operator* pages, or via the *Calibration Level* and *Advanced Level* menus or as a *Scheduled* calibration.

Note.

- Calibration menus can be accessed from the *Advanced* level only – refer to Section 5.1 to access the *Calibrate* level.
- If calibration standard solution values need to be changed from their default values, the values must be set from the *Advanced / Calibrate / Calibration Setup* menu only – refer to Section 5.1 to access the *Calibrate* level.

Caution.

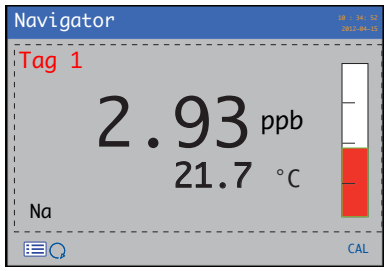
- Do not calibrate the analyzer until the wet-section and transmitter are installed and ready for operation – refer to Section 4, page 19.
- Allow at least 1 hour for the wet-section to stabilize before running a calibration.

5.1 Accessing the Configuration level menus

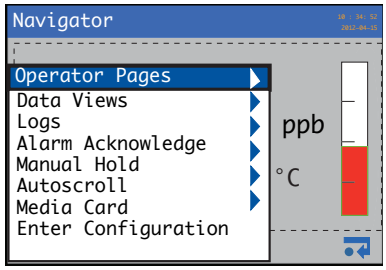
The configuration level menus are used to configure the wet-section(s) and set parameter values – see Fig. 7.1, page 42 for an overview of menus.

To enter *Configuration Level* menus:

1. Press the key (below the icon).

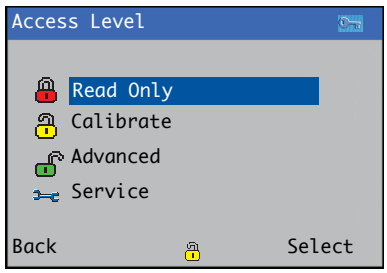


The *Operator* menus are displayed:



2. Press the key to select the *Enter Configuration* menu and press the key (below the icon).

   The *Access Level* page is displayed:



3. Use the key to scroll to the *Advanced* access level and press the key (below the *Select* prompt) to enter the top level *Configuration* menus.

   Use the / keys to scroll between top level menus and press the key (below the *Select* prompt on each top level menu) to enter that level.

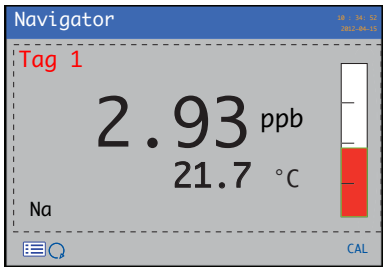
Note.

- Refer to Section 7, page 42, for menu descriptions.
- Refer to Section 6.1, page 29, for details of menu navigation and parameter selection / adjustment.

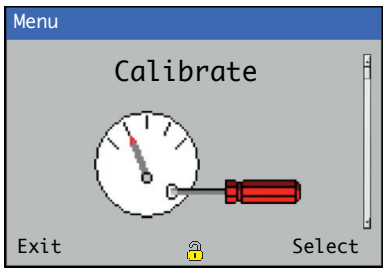
5.2 Performing a calibration for the first time – single-stream wet-section

To perform a quick two-point calibration from an *Operator* page:

1. Press the ▽ key (below the *Cal* prompt).

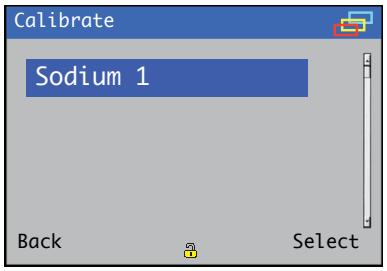


The *Calibrate* page is displayed:



2. Press the ▽ key (below the *Select* prompt).

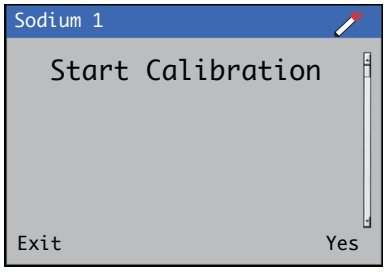
The *Calibrate* / *Sodium* 1 (2, 3, 4) page is displayed.



Use the △ / ▽ keys to select the wet-section to be calibrated.

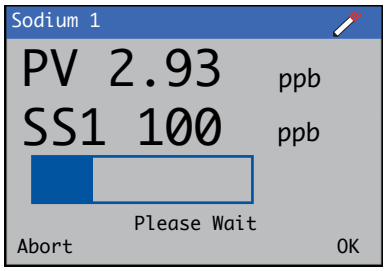
3. Press the ▽ key (below the *Select* prompt on the *Calibrate* / *Sodium* 1 [2, 3, 4] page).

The *Sodium 1 (2, 3 or 4) / Start Calibration* page is displayed:



4. Press the ▽ key (below the *Yes* prompt on the *Start Calibration* page).

The *Calibration* page is displayed with a bar graph to indicate calibration progress:

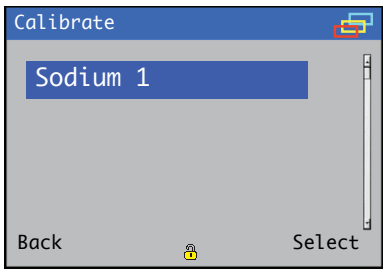


At the end of the calibration, and if the calibration is successful, the *Active Slope*, *Active Offset, Last Slope* and *Last Offset* values in the *Signals View* are updated – see Section 6.6, page 33 for details of *View* modes.

> **Note.** The *Active Slope* and *Active Offset* values are not updated if the calibration fails. The *Calibration Log* is updated with the *Active Slope* and *Active Offset* values.

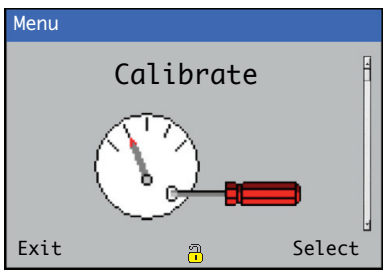
5. To exit the *Calibration* page, press the ▽ key (below the *OK* prompt). Calibration continues and calibration progress can be monitored from the *Calibration View* – see Fig. 5.1, page 24.

The *Calibrate* / *Sodium* page is displayed.



6. Press the ◁ key (below the *Back* prompt).

The *Calibrate* page is displayed:

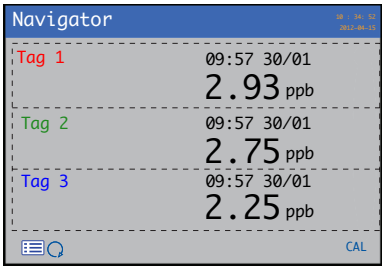


7. Press the ◁ key (below the *Exit* prompt) to return to the *Operator* page.

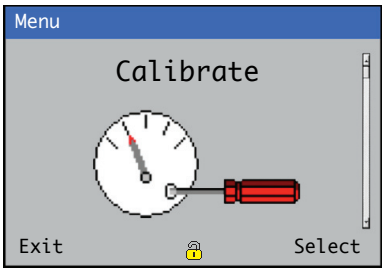
5.3 Performing a calibration for the first time – multi-stream wet-section

To perform a quick calibration from an *Operator* page:

1. Press the key (below the *Cal* prompt).

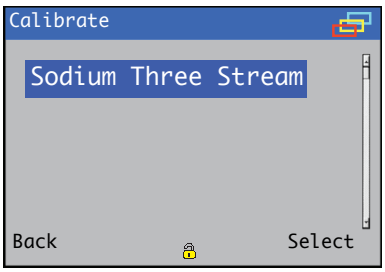


The *Calibrate* page is displayed:



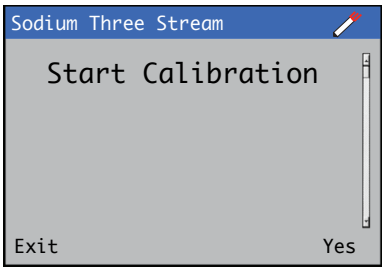
2. Press the key (below the *Select* prompt).

The *Calibrate / Sodium Three Stream* page is displayed.



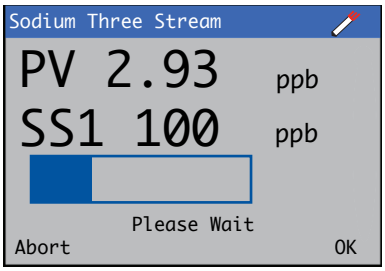
3. Press the key (below the *Select* prompt on the *Calibrate / Sodium Three Stream* page).

The *Sodium Three Stream / Start Calibration* page is displayed:



4. Press the key (below the *Yes* prompt on the *Sodium Three Stream / Start Calibration* page).

The *Calibration* page is displayed with a bar graph to indicate calibration progress:

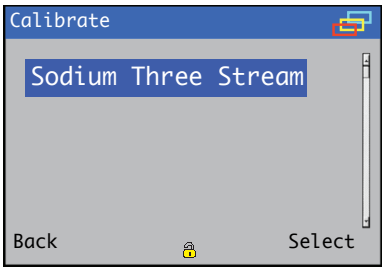


At the end of the calibration, and if the calibration is successful, the *Active Slope*, *Active Offset, Last Slope* and *Last Offset* values in the *Signals View* are updated – see Section 6.6, page 33 for details of *View* modes.

> **Note.** The *Active Slope* and *Active Offset* values are not updated if the calibration fails. The *Calibration Log* is updated with the *Active Slope* and *Active Offset* values.

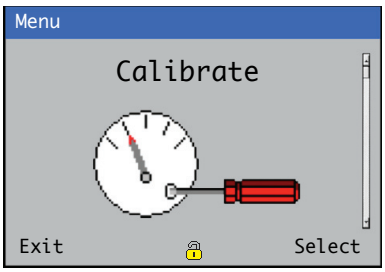
5. To exit the *Calibration* page, press the key (below the *OK* prompt). Calibration continues and calibration progress can be monitored from the *Calibration View* – see Fig. 5.1, page 24.

The *Calibrate / Sodium Three Stream* page is displayed.



6. Press the key (below the *Back* prompt on the *Calibrate / Sodium Three Stream* page).

The *Calibrate* page is displayed:



7. Press the key (below the *Exit* prompt) to return to the *Operator* page.

5.4 Calibration parameters – offset and slope

A mV offset is calculated after a single-point or a two-point calibration. This value represents the difference in millivolt output of the electrode pair compared to the ideal output. The slope is calculated when a two-point calibration is performed and is an indication of the quality of the electrode pair. A two-point calibration can fail if the slope value is outside the pass criteria set in the software – refer to Table A.2, page 75, for a description of the calibration pass limits.

5.5 Calibration options

Single-point or two-point calibrations can be performed depending on the operating conditions. A single-point calibration (low and high) adjusts the mV offset only, a two-point calibration adjusts the mV offset and the slope (sensitivity) of the electrode.

Note. Perform a low-point calibration weekly and a two-point calibration monthly. However, a suitable schedule must be set to suit the operating conditions and applications.

5.5.1 Scheduled calibration

Automatic calibrations can be performed with a frequency of 1 day to 8 weeks. Perform calibrations frequently to ensure accurate readings and verify the performance of the wet-section.

To set up a scheduled calibration:

1. Access the configuration level *Calibrate* menu – see Section 5.1, page 21.
2. Configure the schedule at the *Sensor 1 (4)* (single-stream) or *Sensor Three Stream / Scheduled Calibration / Type*, *Frequency*, *Interval* and *Time of Next Cal.* menu options.

5.5.2 Monitoring calibration progress

If the *Calibration* page is exited by press the ▽ key (below the *OK* prompt) before the calibration has completed, progress can be monitored from the *View* mode – see Fig. 5.1.

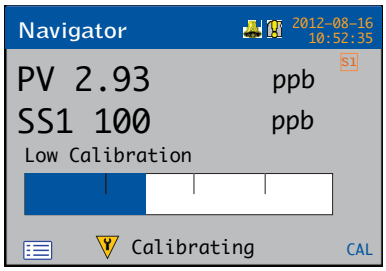


Fig. 5.1 Calibration view

At the end of the calibration, and if the calibration is successful, the *Active Slope*, *Active Offset, Last Slope* and *Last Offset* values in the *Signals View* are updated – see Section 6.6, page 33 for details of *View* modes.

Note. The *Active Slope* and *Active Offset* values are not updated if the calibration fails. The *Calibration Log* is updated with the *Active Slope* and *Active Offset* values.

5.5.3 Abort calibration

Calibrations can be stopped manually by pressing the ◁ key (below the *Abort* prompt) while the *Calibration* page is displayed (see page 22).

The calibration valve closes enabling the sample to flow past the sensor again. A calibration recovery period commences and the *Calibration Log* displays *Cal Aborted* – see Section 6.7.1, page 35.

If the pressure switch on the constant-head unit detects there is no solution present during the calibration, the calibration is stopped automatically. The *Diagnostic Log* (see Section 6.7, page 34) displays a *Cal Failed* diagnostic and *No Low Cal* or *No High Cal* depending on the valve that was energized. The *Calibration Log* displays a *Cal Aborted* entry – see Section 6.7.1, page 35.

5.5.4 Process calibration procedure

The process calibration procedure can be used to make minor adjustments to the concentration value. When a process calibration procedure has been run and has completed, a *Process Calibration* (PC) offset is calculated. Subsequently, the displayed concentration has this offset in concentration subtracted from the measured sodium concentration.

The following steps describe how to take a sample from the wet-section for independent tests and adjust the sodium concentration reading accordingly. If the sodium concentration is already known, steps 1 and 10 can be omitted.

Note.

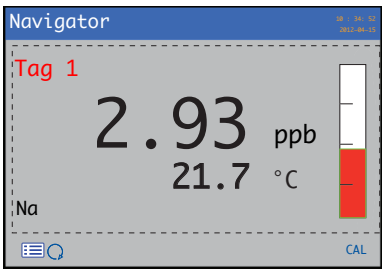
- Process calibrations should be used only to make minor adjustments to the concentration value. If the displayed concentration differs significantly from the expected concentration, perform a *Two-Point* calibration from the *Calibrate* level – see Section 7.1.1, page 43.
- A process calibration can be carried out only on single-stream and multi-stream wet-sections with 1 stream enabled.

To run a *Process Calibration* procedure:

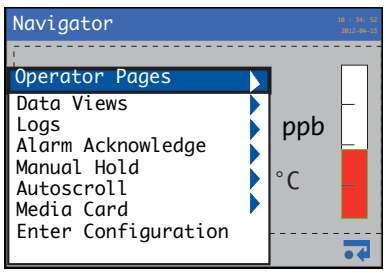
1. Obtain a clean sample vessel of suitable size for the volume of sample required.

At the transmitter:

2. Press the key (below the icon).

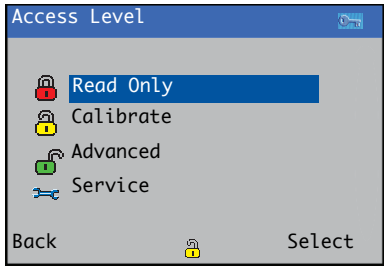


The *Operator* menus are displayed:

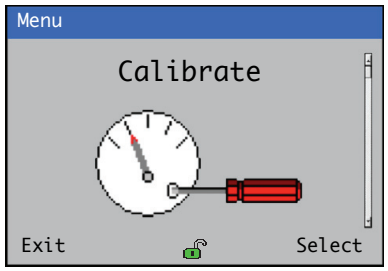


3. Press the key to select the *Enter Configuration* menu and press the key (below the icon).

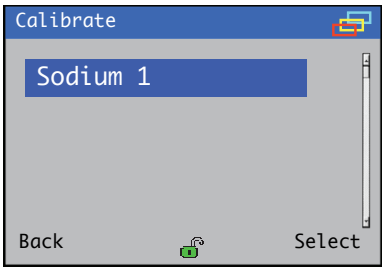
The *Access Level* page is displayed:



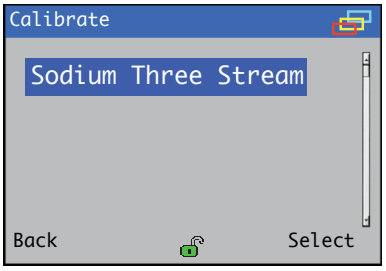
4. Use the key to scroll to the *Advanced* access level and press the key (below the *Select* prompt) to enter the top level *Configuration* menus.
5. If the *Calibrate* page is not displayed, use the / keys to scroll to the *Calibrate* page:



6. Press the key (below the *Select* prompt).
   - If one or more single-stream wet-sections are connected, the *Calibrate / Sodium 1 (2, 3, 4)* page is displayed:

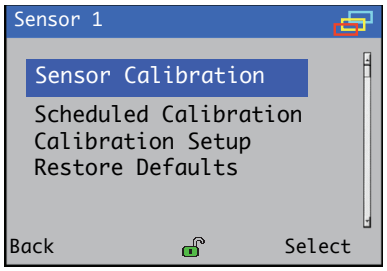


   - If a multi-stream wet-section is connected, the *Calibrate / Sodium Three Stream* page is displayed:



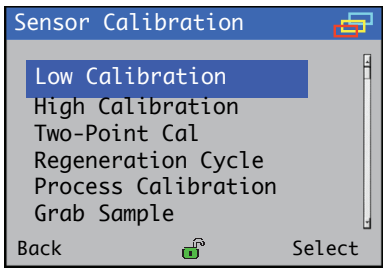
7. Press the key (below the *Select* prompt).

   The *Sensor 1 (4)* / *Sensor Three Stream* page (dependent on single-stream / multi-stream configuration) is displayed with the *Sensor Calibration* menu selected:



8. Press the key (below the *Select* prompt on the *Sensor 1 (4)* / *Sensor Three Stream* page).

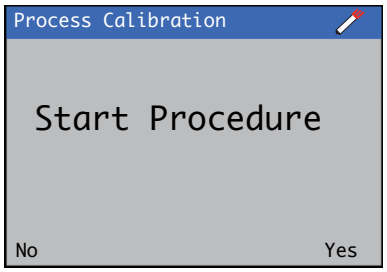
   The *Sensor Calibration* page is displayed:



   Press the key to highlight the *Process Calibration* menu.

9. Press the key (below the *Select* prompt).

   The *Process Calibration* page is displayed:



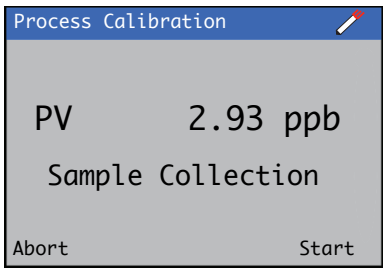
At the wet-section:

10. Place the drain tube from the constant-head unit into the sample vessel (during the sampling period an average sodium concentration value is determined).

At the transmitter:

11. Press the key (below the *Yes* prompt).

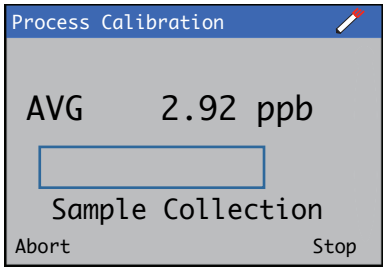
    The *Process Calibration* / *Sample Collection* page is displayed:



> **Note.** To abort the process calibration procedure during this collection press the key (below the *Abort* prompt).

12. Press the key (below the *Start* prompt).

    The next *Process Calibration* / *Sample Collection* page is displayed with a progress bar:

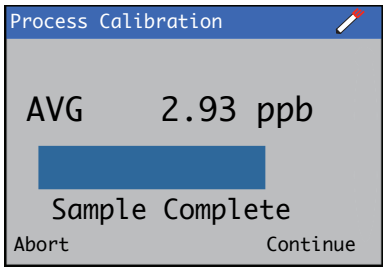


    When sufficient sample has been collected in the sample vessel, the collected sample must be analyzed using a laboratory method or another analyzer to determine the concentration of sodium in the sample.

13. Press the key (below the *Stop* prompt) to stop the procedure manually.

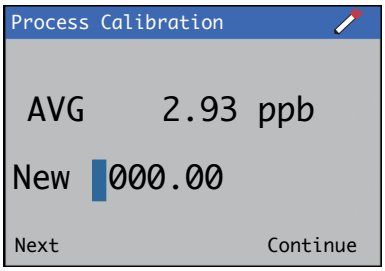
> **Note.** If the procedure is not stopped manually, it stops automatically after 30 minutes.

    The next *Process Calibration* / *Sample Complete* page is displayed with the progress bar populated:



14. Press the key (below the *Continue* prompt).

    The next *Process Calibration* page displayed shows an average of the reading obtained:

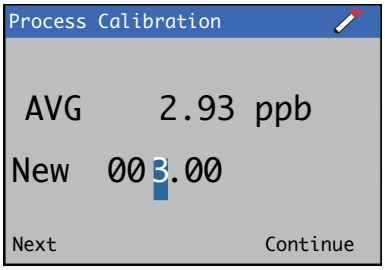


    A new value can be added at this page.

> **Note.** If the new concentration value is not entered into the transmitter within 5 hours of the sample collection the process calibration procedure is aborted automatically.

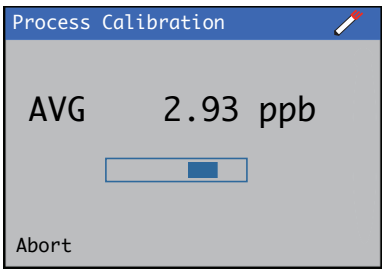
15. Use the / keys to move the cursor to the numeral to be edited in the *New 000.00* reading on the screen.

    To enter the value, press the key (below the *Next* prompt).

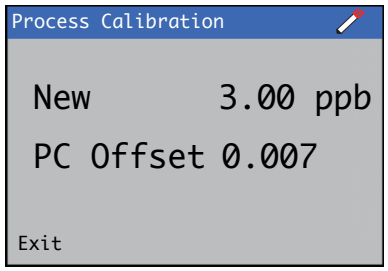


    Once the new value has been entered, press the key (below the *Continue* prompt).

    The process calibration offset is calculated and a page with a moving time bard is displayed for the duration of the calculation:



    When the calculation is finished, a new page showing the new reading and process calibration offset values is displayed

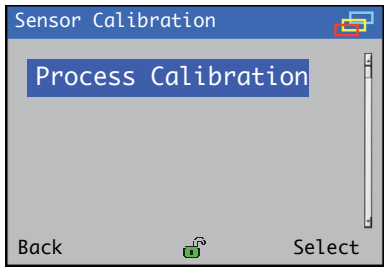


    The *Process Calibration (PC) Offset* is displayed in the transmitter's *Signals View* – *see* Section 6.6, page 33.

    It is toggled with the *Concentration Value*. The Process Calibration (PC) *Offset* is also displayed in the transmitter's *Calibration Log*.

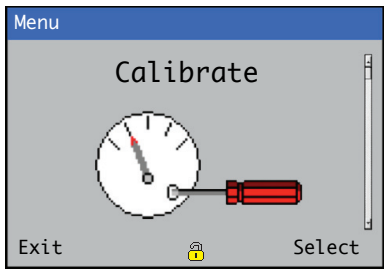
> **Note.** The PC Offset can be removed from the concentration calculation by carrying out a single- or two-point calibration.

16. Press the key (below the *Exit* prompt) to return to the *Sensor Calibration* page



17. Press the key (below the *Back* prompt).

    The *Calibrate* page is displayed:



18. Press the key (below the *Exit* prompt) to exit the configuration level menu.

5.5.5 Grab sample

Pour the sample to be measured into the High Calibration bottle (it is advisable to rinse the bottle with the sample to remove the residuals of the calibration solution). The grab sample procedure can then be initiated manually via the *Calibration* menu. The default grab sample time is 15 minutes but can be set between 10 and 60 minutes depending on the level of accuracy required and the level of sodium to be measured.

The grab sample is displayed on-screen as entry G and logged in the *Calibration Log* – see Section *6.7*, page 34.

To set up a *Grab Sample* routine:

1. Access the configuration level *Calibrate* menu – see Section 5.1, page 21).
2. Run the *Grab Sample* routine at the *Sensor 1(4)* (single-stream) or *Sensor Three Stream / Sensor Calibration / Grab Sample* menu option.

5.6 Calibration timings

Low point and high point calibrations are 15 minutes each.

5.6.1 Recovery period

The recovery period allows time for the wet-section to return to the *Process Value* after a calibration. Current outputs and alarms are held during the recovery period if the *Hold Output* option is enabled.

To enable the *Hold Outputs* option:

1. Access the configuration level *Calibrate* menu (see Section 5.1, page 21).
2. Select *Enable* at the *Sensor 1 (4)* (single-stream) or *Sensor Three Stream* / *Hold Outputs* menu option.

The default value for the recovery period is 15 minutes but can be configured between 10 and 60 minutes.

5.7 Regeneration procedure

If the sodium electrode is exposed to low concentrations (less than 1 ppb) for prolonged periods of time, sodium ions are leached from the surface of the electrode into the sample. This can accelerate the aging process of the electrode, resulting in poor response times, inaccurate readings and a limitation to respond to low sodium concentrations.

It is recommended that the electrode is regenerated at regular intervals to minimize this ageing process and ensure accurate, repeatable readings.

Perform a regeneration procedure once a month either manually or automatically (if the *Automatic Regeneration* option is available) prior to a two-point calibration:

- to perform an automatic regeneration, refer to Section 8.3, page 61
- to perform a manual regeneration, refer to Section 8.4, page 63

6 Operation overview – transmitter

6.1 Front panel keys

The transmitter is operated using the keys on the front panel. These enable local navigation and selection of software options on all displays, acknowledgement and data logging and monitoring. Prompts associated with active keys are displayed on each screen. Diagnostic messages are detailed in Appendix A.1, page 72, display icon descriptions are detailed in Section 6.10, page 40.

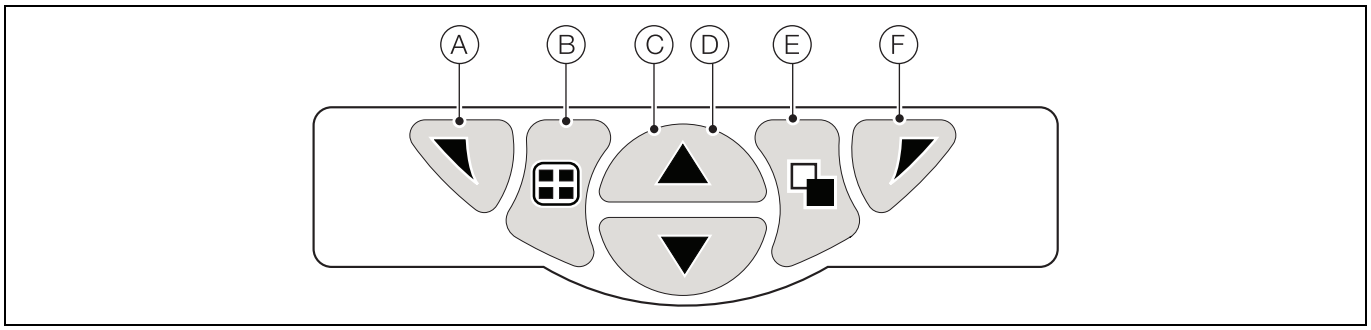


Fig. 6.1 Front panel keys

Key functions are described in the following table:

Key	Function	Description
Ⓐ	Navigation key – left and *Operator Level* access key	At menu level, selects the highlighted menu item, edit a selection or return to the previous menu level. When *Operator* page is displayed, opens or closes the *Operator* menu.
Ⓑ	View key	Toggles the view between *Operator* pages, *Diagnostic View* and *Calibration Log* screens. **Note**. Not enabled in *Configuration* mode.
Ⓒ	Up key	Used to navigate up menu lists, highlight menu items and increase displayed values.
Ⓓ	Down key	Used to navigate down menu lists, highlight menu items and decrease displayed values.
Ⓔ	Group key	Toggles between: ■ *Operator* pages (1 to 5) when an *Operator* page is selected at the *Group* key. ■ *View* screens (*Alarms, Outputs, Signals, Chart* and *Diagnostic*) when the *Diagnostic View* screen is selected at the *Group* key. ■ *Log* screens (*Alarm, Audit, Diagnostic* and *Calibration*) when the *Calibration Log* screen is selected at the *Group* key. **Note**. Not enabled in *Configuration* mode.
Ⓕ	Navigation key – right and *Cal* shortcut key	At menu level, selects the highlighted menu item, operation button or edits a selection. At *Operator* page level, used as a shortcut key to access the *Calibrate* level.

Table 6.1 Front panel key functions / descriptions

6.2 Transmitter operation modes

The transmitter has 4 modes of operation – all modes are accessed from the *Operator* menu – see Fig. 6.2.

- *Operating* – used to display real-time wet-section values on *Operating Pages* – refer to Section 6.5, page 31.
- *View* – used to display diagnostic messages, alarms, output values, signals (including the flow rate where applicable) and (chart) traces – refer to Section 6.6, page 33.
- *Log* – used to display recorded (diagnostic, calibration, audit) events and alarms – refer to Section 6.7, page 34.
- *Configuration* – used to configure the transmitter – refer to Section 7, page 42.

6.3 Operator menus

Note. *Operator* menus **cannot** be accessed directly from the *Configuration* level.

Referring to Fig. 6.2, *Operator* menus (A) are accessed from any *Operating*, *View* or *Log* page by pressing the ◥ key (B).

To select *Operator* sub-menus (indicated by the ▶ arrow) press the ◢ key (C).

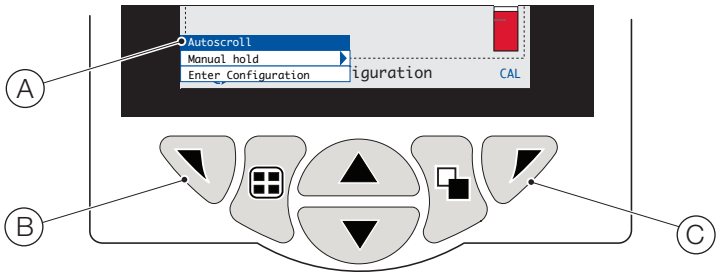


Fig. 6.2 Operator menus

Operator menus comprise:

- *Operator Pages* – displays the *Operator Page* for each available wet-section.
- *Data Views* – displays enabled data views.
- *Logs* – displays enabled *Log* views.
- *Alarm Acknowledge* – acknowledges the active alarm displayed in the *Alarms View*.
- *Manual Hold* – holds (freezes) the current outputs and alarms for the selected wet-section(s).

  Note. Active values are still indicated on the display.

- *Autoscroll* (enabled on *Operator* pages only) – displays *Operator* pages sequentially when multiple wet-sections are fitted.
- *Media Card* – displays the status of the SD Card / USB stick (enabled only media module is fitted).
- *Enter Configuration* – enabled on all pages – enters *Configuration* parameters via the *Access Level* – refer to Section 6.9.2, page 39 for access levels and password security options.

CAL shortcut – initiates a calibration directly from an *Operator Page*, press the ◢ key (C) (below the *CAL* prompt). This shortcut opens the *Calibrate* page, bypassing the *Configuration* level menus.

6.4 Navigation overview

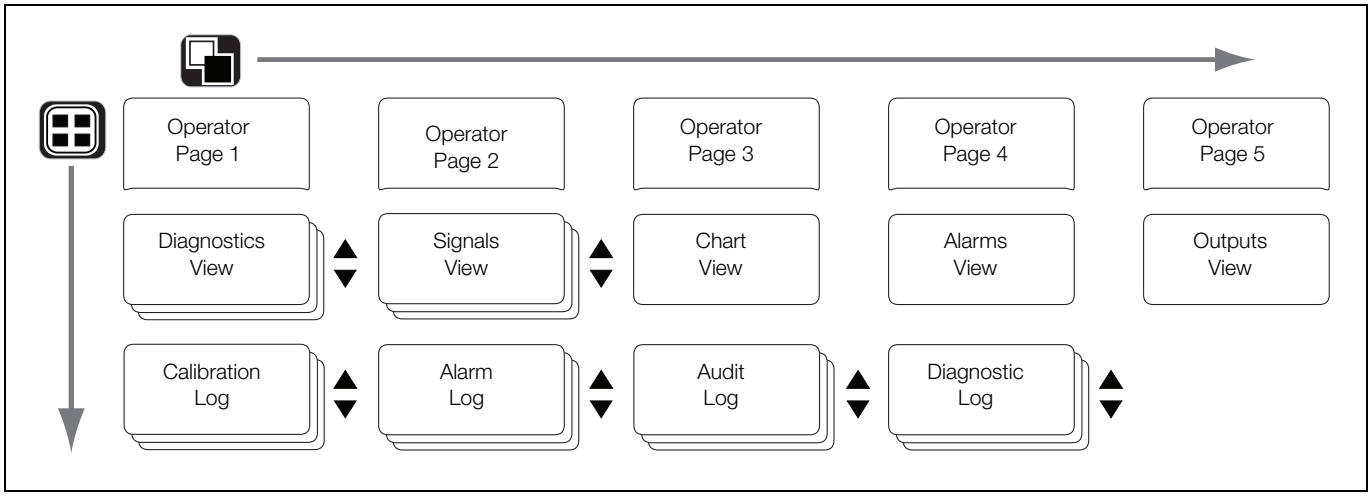


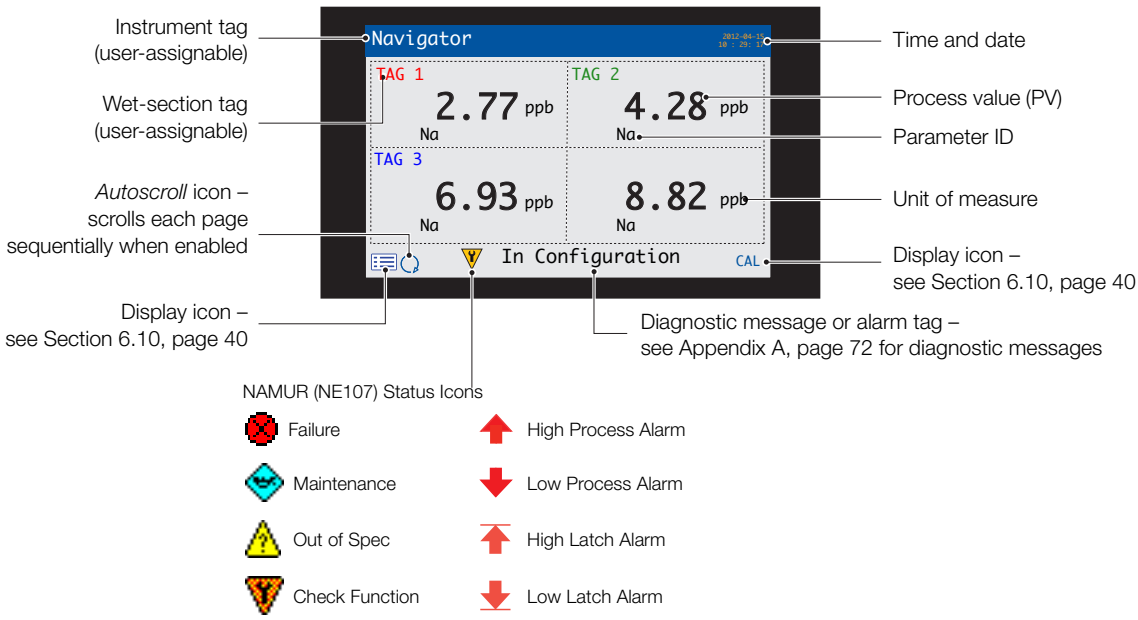
Fig. 6.3 Menu navigation

6.5 Operating mode

In operating mode, values from connected wet-sections are displayed on *Operator Pages*. A maximum of 5 *Operator Pages* can be displayed.

Operator Page 1 (the default page) displays values from all connected wet-sections simultaneously (a maximum of 4 wet-sections can be connected). The remaining *Operator Pages* can be assigned to display values from individual wet-sections (in any wet-section order). To achieve this, each wet-section must be associated with a template in the *Configuration* level / *Display* / *Operator Templates* parameters – see page 50.

In Fig. 6.4, *Operator Page 1* shows that 4 wet-sections are connected.



*The highest priority diagnostic or alarm is displayed. Other active diagnostic / alarm states can be viewed on the *Diagnostics View* – see page 33.

Fig. 6.4 Operator Page 1 (sodium multiple wet-section)

Fig. 6.5 shows an overview of *Operator Pages 2 to 5*. Each *Operator Page* displays the process value (PV) and temperature from a single wet-section. Fixed, color-coded, user-assignable tags (one for each connected wet-section) and color-coded bargraphs aid identification of each wet-section.

The bargraph indicates the PV (minimum and maximum values on the chart are configurable in the *Sensor Setup* level). If the PV is above the maximum specified range of the wet-section, the bargraph flashes to indicate the value is out of range.

When multiple wet-sections are connected, and if *Autoscroll* is selected from the *Operator Menu* (see Fig. 6.2, page 30), the display scrolls through each available *Operator Page* consecutively.

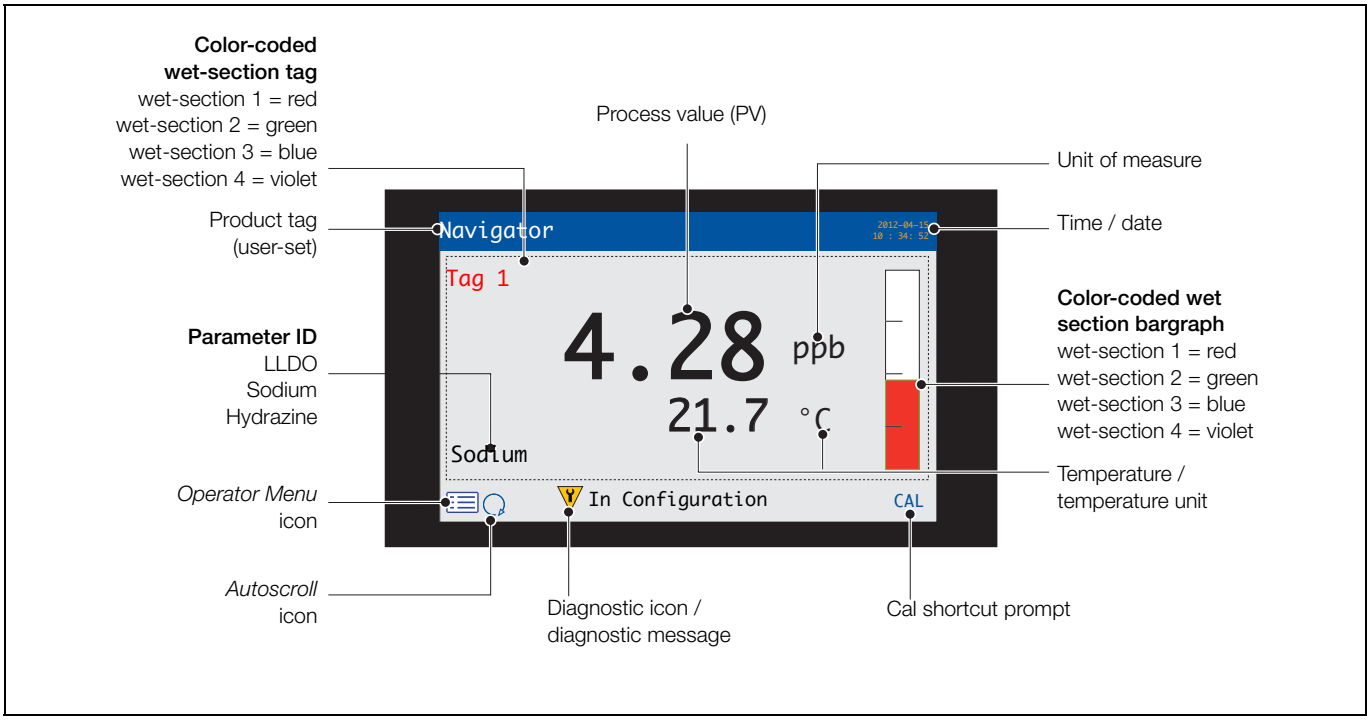


Fig. 6.5 Operator Pages 2 to 5 – overview

6.6 View mode

Pages displayed in *View* mode comprise:

- *Diagnostics View* – displays a list of diagnostic messages identified by priority and message – see Fig. 6.6
- *Alarms View* – displays a list a list of alarms identified by priority (sequence number), source and status – see Fig. 6.7
- *Outputs View* – displays a list of alarms identified by analog output ID, output value and percentage of output value – see Fig. 6.8
- *Signals View* – displays a list of active signals and their values – see Fig. 6.9
- *Chart View* – represents the wet-section readings as a series of color-coded traces – see Fig. 6.10

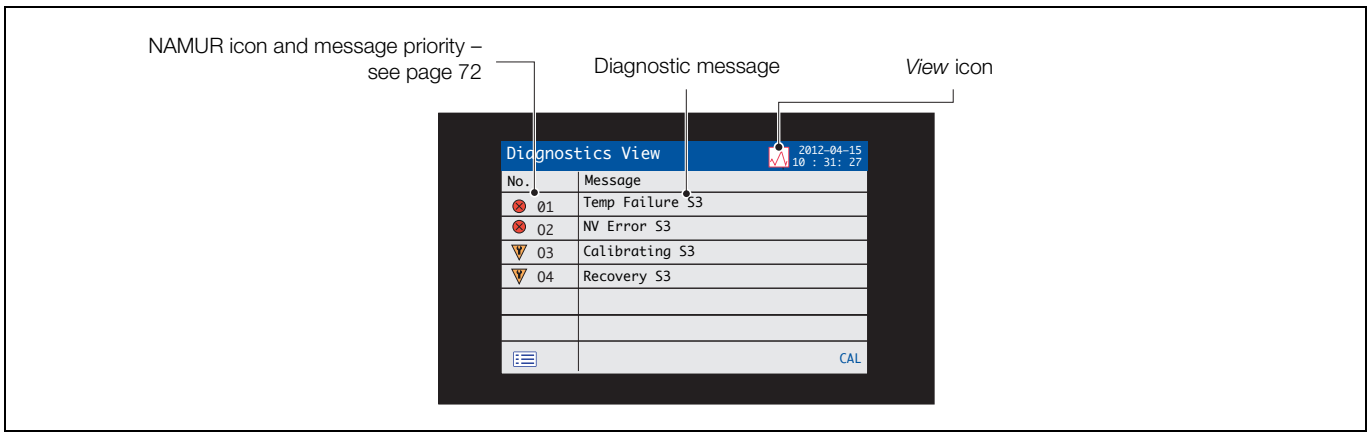


Fig. 6.6 Diagnostics View

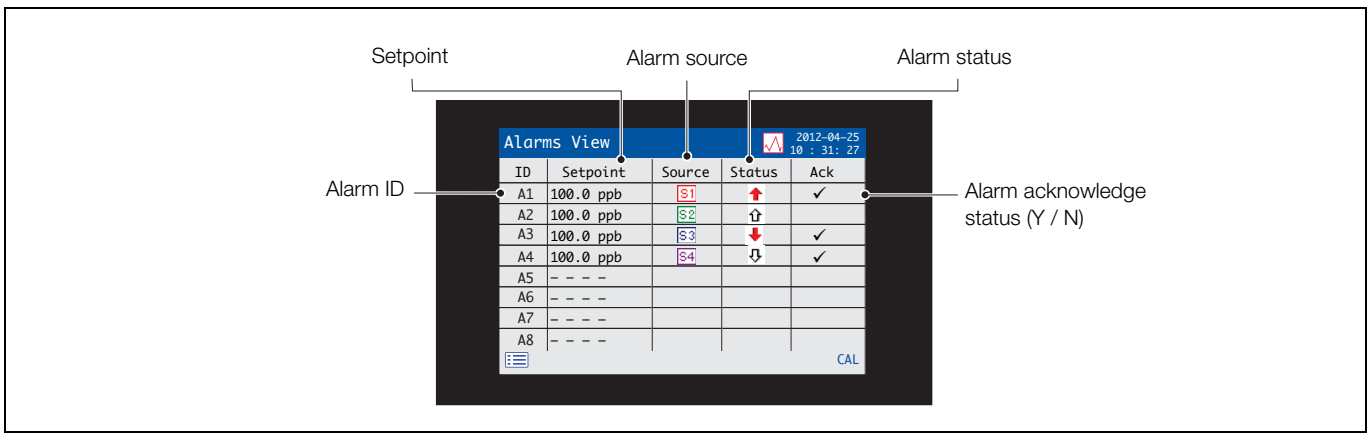


Fig. 6.7 Alarms View

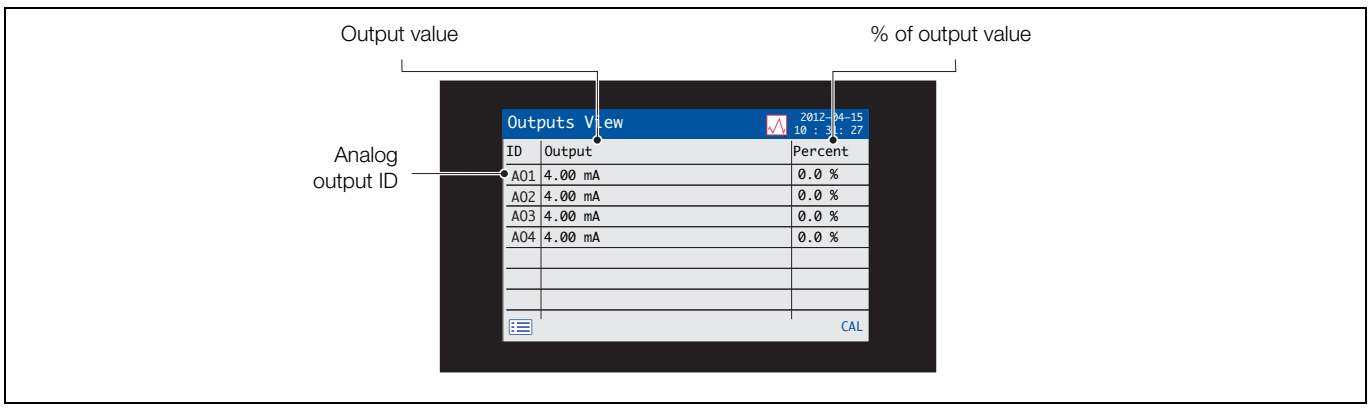


Fig. 6.8 Outputs View

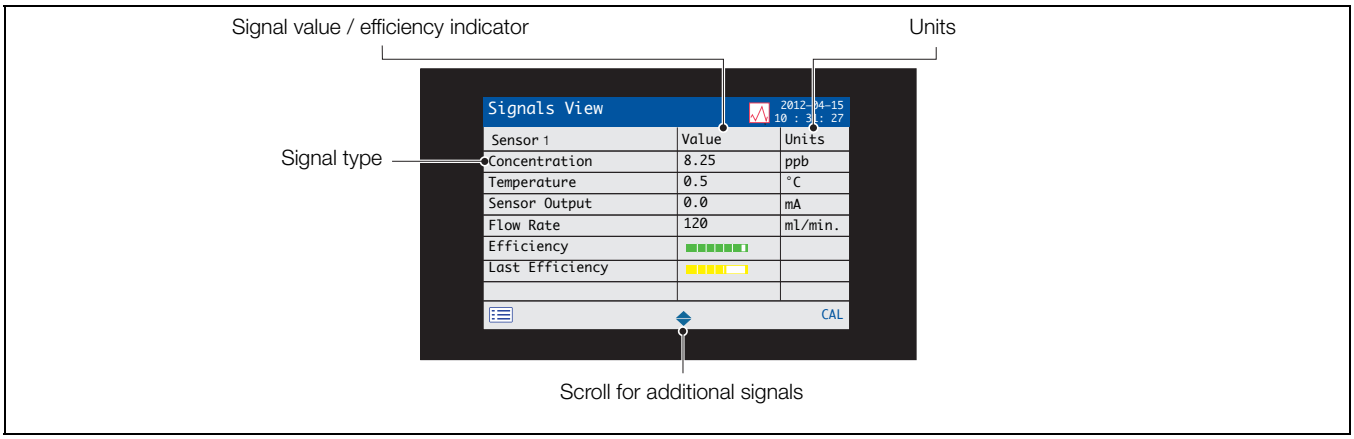


Fig. 6.9 Signals View

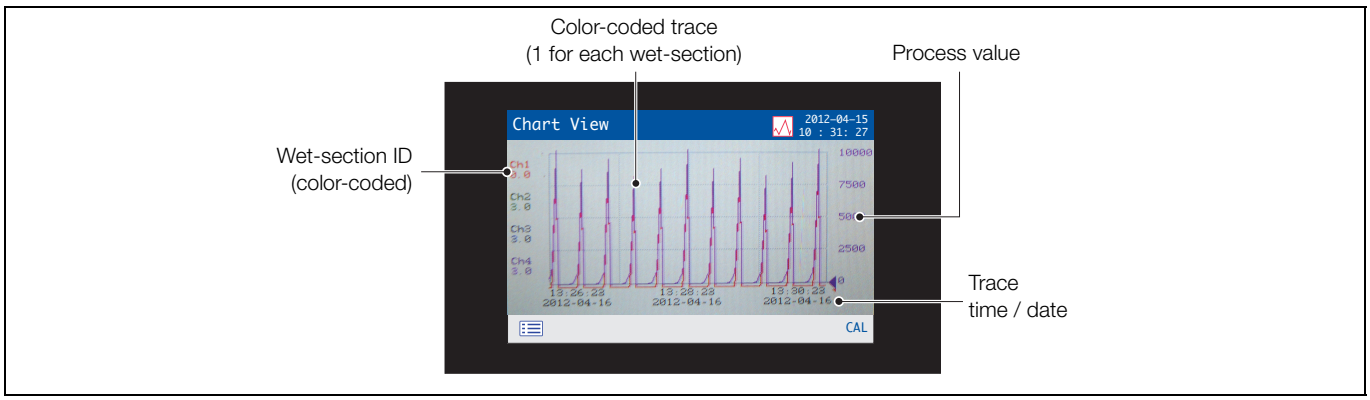


Fig. 6.10 Chart View

6.7 Log mode

Log mode pages display logged information in the sequence it occurred.

Log mode pages comprise:

- *Calibration Log*: a history of calibration routines.
- *Alarm Log*: a history of alarm events.
- *Audit Log*: a history of analyzer activity.
- *Diagnostic Log*: a history of diagnostic events.

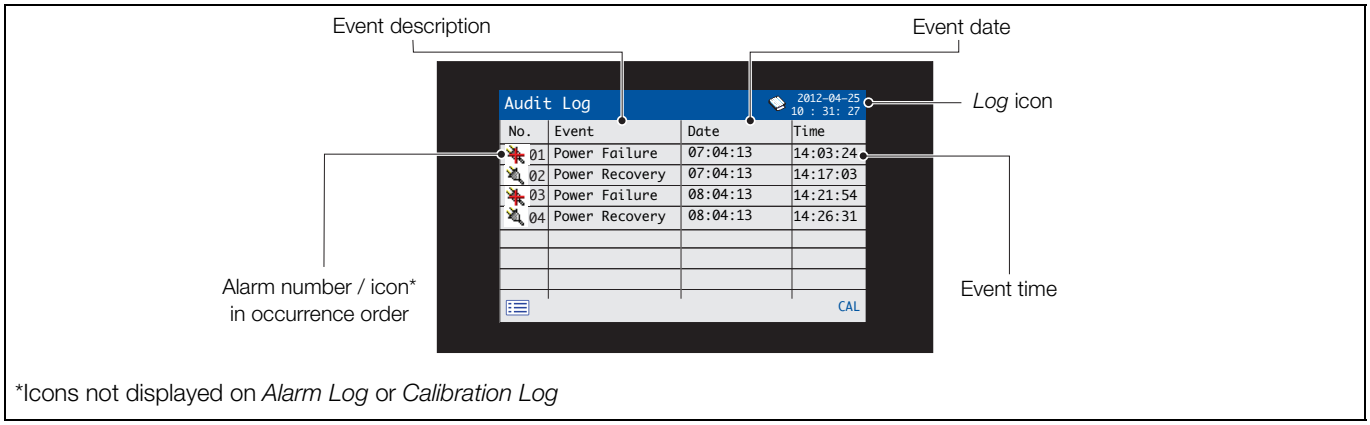


Fig. 6.11 Log page (example of Audit Log shown)

6.7.1 Calibration log entries

Possible calibration log entries along with a description are shown in Table 6.2. The possible *Audit Log* entries along with a description are shown in Table 6.3. The *Diagnostic Log* shows the history of diagnostic messages that have been displayed in the *Diagnostic View* – see Appendix A, page 72 for diagnostic messages.

Log entry	Description
Cal Failed	Calibration procedure failed due to high / low slope or out of calibration solution or sample temperature error during a calibration procedure.
Cal Aborted	Calibration aborted manually by the user.
Cal Missed	Scheduled calibration missed due to: – user being in *Man. Valve Control* menu. – manual calibration in progress (on same wet-section) – user in *Service* login. This log entry is also displayed if a calibration associated with a regeneration is missed due to *No Sample* state.
Coefficients (Slope and mV Offset)	The Slope and mV Offset are displayed – refer to Section 5.4, page 24 for a description of these coefficients.

Table 6.2 Calibration Log entries

Log entry	Description
Power Failure	Power to the transmitter is lost.
Power Recovery	Transmitter restarted after a power loss.
In Config.	User in *Advanced / Configuration* mode.
Time / Date Changed	User has changed date / time.
Daylight Saving	Time changed due to daylight saving.

Table 6.3 Audit Log entries

6.8 Logging

Data recorded in the transmitter's internal memory can be archived to a removable Secure Digital (SD) card or USB stick. The transmitter continuously records **all** data to its internal memory and keeps track of which data has been archived.

Note. ABB's DataManager software can be used to store and view data archived from the transmitter.

The amount of time that data remains in the transmitter's internal memory depends on the sample rate – see Table 6.4. Sample data is saved to removable media as comma-separated files.

Configuration files are saved as binary-encoded files. Additional files can also be archived:

- Event log files (these files contain *Audit Log, Alarm Log, Diagnostic Log* and *Calibration Log* data)
- Data log files
- Configuration files

The transmitter's internal memory supports a maximum of 10 *Data Log* and *Event Log* files only and a maximum of 8 *Configuration* files. Durations for continuous recording are shown in Table 6.4 (internal storage).

5 s	10 s	30 s	1 m	5 / 10 / 30 m	1 hr
30 days	60 days	180 days	300 days	300 days	300 days

Table 6.4 Internal (flash) memory storage capacity

A 2GB SD card / USB stick has sufficient external storage capacity for >5 years data.

6.8.1 SD card / USB stick

Caution. To avoid potential damage or corruption to data recorded on an SD card / USB stick, take care when handling and storing. Do not expose to static electricity, electrical noise or magnetic fields. When handling the SD card / USB stick take care not to touch any exposed metal contacts.

There are two methods of archiving to an SD card / USB stick:

- **An SD card / USB stick is kept in the transmitter**

  Data is archived to the SD card / USB stick automatically at set intervals. Archiving continues until the SD card / USB stick full; archiving then stops. To ensure all required data is archived successfully, the SD card / USB stick should be swapped periodically for an empty one.

  Note. It is not advisable to leave a USB stick in the transmitter permanently.

  It is advisable to back-up critical data stored on an SD card / USB stick regularly. The transmitter's internal memory provides a buffer for the most recent data only so, if data stored on an SD / USB stick card is lost, it can be re-archived.

- **Data is copied to an SD card / USB stick when required**

  When a SD card / USB stick is inserted into the transmitter, the media status can be set to *Online* causing unarchived data to be copied to the media – see Section 7, page 42 / *Media Card* menu level.

6.8.2 SD card / USB stick insertion and removal

To access the SD card / USB stick:

1. Ensure the transmitter is offline.
2. Use a large Pozi-drive screwdriver to release the door catch (A).
3. Open the door and insert the SD card / USB stick (B).

   The red LED (C) is lit when the SD card / USB stick is in use by the transmitter.
4. To remove the SD card / USB stick, if the red LED is lit, press button (D) and wait until the LED goes out.
5. Pull the SD card / USB stick out of its socket. The SD card / USB stick can then be inserted into an appropriate card reader USB port on the PC and the data downloaded.

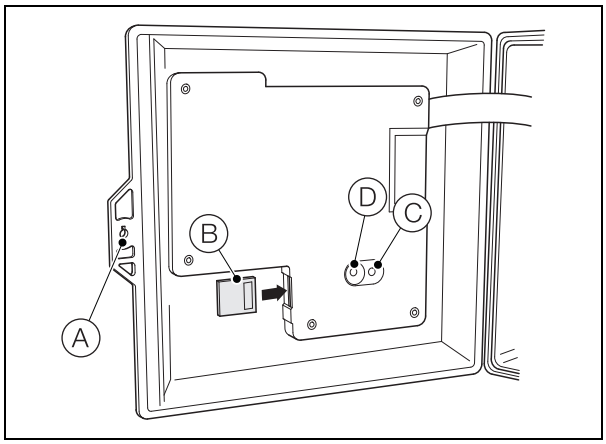


Fig. 6.12 SD card / USB stick insertion and removal

Note. Data stored in the internal memory buffer can still be transferred to the SD card / USB stick when the archive media is placed on-line again (providing it is not off-line so long that the un-archived data in the internal memory is overwritten).

6.8.3 Archive file types

All archive files created by the transmitter (except for configuration files) are assigned filenames automatically. Each type of archived file is assigned a different file extension.

Archive files are created as text format data files.

The file type and extension for **Data** text files is '.DOO'

- <ddmmyy><hhmmss><monitor tag>.DOO

The file type and extension for **Event** log files (containing historical entries from the *Audit, Calibration, Diagnostic* and *Alarm* logs is '.AOO'.

- <ddmmyy><hhmmss><monitor tag>.AOO

Note.

- The 'monitor tag' is set in the *Device Setup* level (see page 42) when the user has access at *Advanced* level – see Section 6.9, page 39.
- The time and date are formatted according to the format set in *Display / Date & Time* level – see page 42.

  The transmitter's internal clock can be configured to adjust automatically at the start and end of *Daylight Saving* periods – see page 42.

Configuration filenames are user-entered. The configuration file type and extension is '.cfg'.

6.8.4 Data files

Text format archived data is stored in a comma-separated value (CSV) format and can be imported directly into a standard spreadsheet, for example, Microsoft® Excel.

Alternatively, you can carry out detailed graphical analysis of the data on a PC using ABB's DataManager data analysis software.

New data files are created in the following circumstances:

- The transmitter configuration is changed.
- One of the current files exceeds the maximum permissible size (a new file is created at 12:00 a.m. on the following day. Data is logged into the existing file continuously until the new file is created.
- When the daylight saving period starts or ends.
- When working files cannot be found / are corrupted.

The filename is formatted as follows:

- Data logs: <ddmmyy><hhmmss><monitor tag>.DOO

6.8.5 Log files

The Alarm Event, Calibration, Diagnostic and Audit logs are archived into the same file. The filenames are formatted as follows:

- Event logs: <ddmmyy><hhmmss><instrument tag>.AOO

6.8.6 Daylight saving

Files containing data generated during the daylight saving period have '~DS' appended to the filename.

Start of daylight saving period

A daily file is started at 00:00:00 on 30th March 2013 filename:

30Mar13ASO550.D00

Summertime starts at 2:00am on 30th March 2013 and the clock changes automatically to 3:00am.

The existing file is closed and a new file is created filename:

30Mar13ASO550~DS.D00

The file '30Mar13ASO550.D00' contains data generated from 00:00:00 to 01:59:59.

The file '30Mar13ASO550~DS.D00' contains data generated from 03:00:00.

End of daylight saving period

A daily file is started at 00:00:00 on 26th October 2013 filename:

26Oct13ASO550~DS.D00

Summertime ends at 3:00am on 26th October 2013 and the clock changes automatically to 2:00am.

The existing file is closed and a new file is created filename: 26Oct13ASO550.D00

The file '26Oct13ASO550~DS.D00' contains data generated from 00:00:00 to 02:59:59.

The file '26Oct13ASO550.D00' contains data generated from 02:00:00.

Note. Daily files start at 00:00:00.

6.9 Password security and Access Level

Passwords are entered at the *Enter Password* screen accessed via the *Access Level* – see Section 6.9.2, below.

6.9.1 Setting passwords

Passwords can be set to enable secure access at 2 levels: *Calibrate* and *Advanced*. The *Service* level is password protected at the factory and reserved for factory use only.

Passwords can contain up to 6 characters and are set, changed or restored to their default settings at the *Device Setup / Security Setup* parameter – see page 48.

Note. When the transmitter is powered-up for the first time, the *Calibrate* and *Advanced* levels are not password protected. Protected access to these levels can be allocated as required.

6.9.2 Access Level

The *Access Level* is entered via the *Operator* menu / *Enter Configuration* menu option – see Section 6.3, page 30.

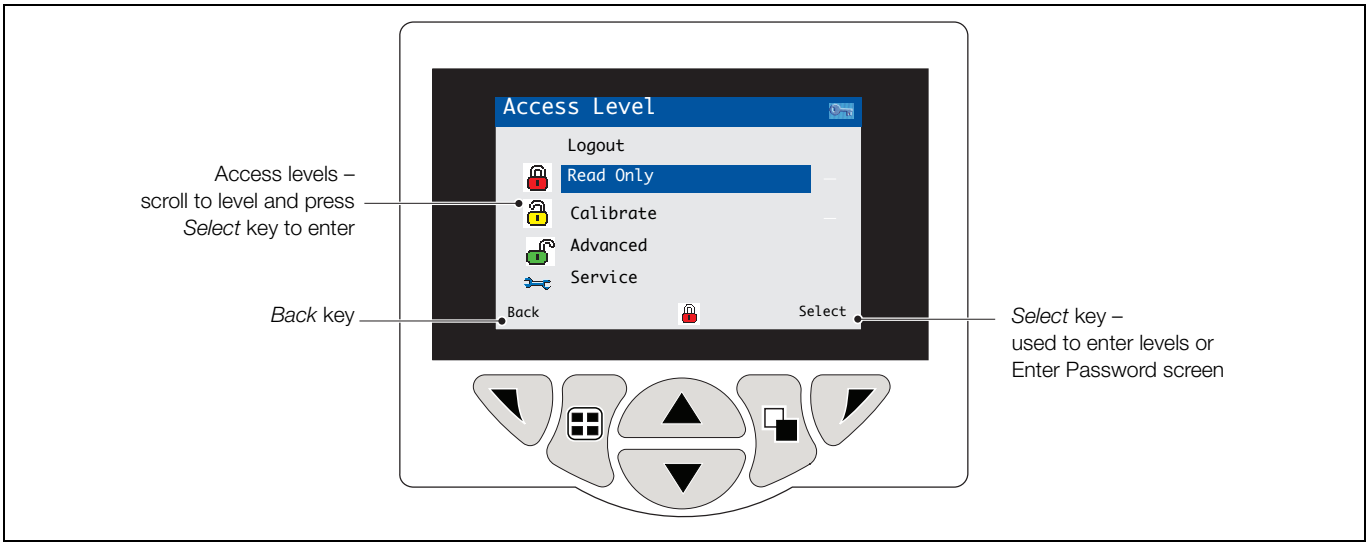


Fig. 6.13 Access Level

Level	Access
Logout	Displayed after *Calibrate* or *Advanced* level are accessed. Logs the user out of current level. If passwords are set, a password must be entered to access these levels again after selecting *Logout*.
Read Only	View all parameters in read-only mode.
Calibrate	Enables access and adjustment of *Calibrate* parameters (refer to Section 5, page 21 for calibration details).
Advanced	Enables configuration access to all parameters.
Service level	Reserved for authorized service technicians only.

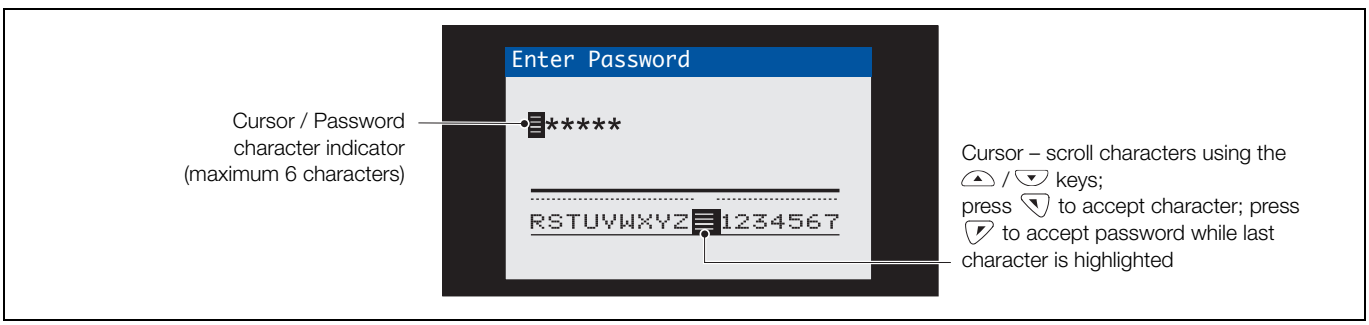


Fig. 6.14 Enter Password screen

6.10 Display icons

6.10.1 Diagnostic icons

Note.

- When a diagnostic condition is detected the associated NAMUR icon plus the highest priority diagnostic message is displayed in the Status Bar when the transmitter is in Operator View mode – refer to Appendix A, page 72 for diagnostic messages.
- If the status bar displays a diagnostic message, press the key to see all diagnostic messages.

NAMUR icons

	*Diagnostic* icon – *Out of Specification*.
	*Diagnostic* icon – *Maintenance Required*.
	*Diagnostic* icon – *Failure*.
	*Diagnostic* icon – *Check Function*.

Alarm, Hold and Calibration icons

	*Alarm* – indicates a user-defined alarm condition (20-character) and flashes intermittently with an associated NAMUR diagnostic icon.
	Hold – indicates that alarms / analog outputs are in a manual hold state.
	Calibrating – indicates that a calibration is in progress.

6.10.2 Title bar icons

	*Log* mode – indicates that one of the *View* pages is currently displayed (*Calibration, Alarm, Audit or Diagnostic*)
	*View* mode – indicates that one of the *View* pages is currently displayed (*Diagnostics, Alarms, Outputs, Signals* or *Chart*).
	Media on-line: 0 to <20 % full.
	Media on-line: 20 to <40 % full.
	Media on-line: 40 to <60 % full.
	Media on-line: 60 to <80 % full.
	Media on-line: 80 to <100 % full.
	Media on-line: full (icon toggles when full).
	Media off-line: 0 to <20 % full.
	Media off-line: 20 to <40 % full.
	Media off-line: 40 to <60 % full.
	Media off-line: 60 to <80 % full.
	Media off-line: 80 to <100 % full.
	Media off-line: not inserted (not logging).
	Media off-line: not inserted, logging active – icon display toggles with *Media off-line: not inserted (not logging)* icon.

6.10.3 Log icons

S1 T1	Source: wet-section 1 (red) S1 = sensor for wet-section 1 T1 = temperature for wet-section 1
S2 T2	Source wet-section 2 (green) S2 = sensor for wet-section 2 T2 = temperature for wet-section 2
S3 T3	Source wet-section 3 (blue) S3 = sensor for wet-section 3 T3 = temperature for wet-section 3
S4 T1	Source wet-section 4 (violet) S4 = sensor for wet-section 4 T4 = temperature for wet-section 4
	Power failed / power failed
	Configuration changed
	System Error
	File created / deleted
	Media inserted / removed
	Media on-line / off-line
	Media full
	Date / time or daylight saving start / end changed
	High process alarm active / inactive
	Low process alarm – active / inactive
	High latch alarm – active / inactive
	Low latch alarm – active / inactive
	Alarm acknowledged

6.10.4 Status bar icons

	*Operator* menu – displays the Operator menu when the ◥ key is pressed.
	*Autoscroll* – selected from the Operator menu (displayed when *Autoscroll* enabled). Indicates Operator pages are displayed sequentially. Disabled if 1 Operator page only is configured for display.
CAL	*Calibration* – shortcut access to the Calibration page when the ◤ key is pressed.
	*Enter* – selects the highlighted option from the *Operator* menus when the ◤ key is pressed.
	*Service Level* – indicates that alarms and analog outputs are held.
	*Advanced Level* – indicates that *Advanced Level* parameters are enabled for the current user.
	*Calibrate Level* – indicates that the *Calibration Level* parameters are enabled for the current user.
	*Read Only Level* – indicates that the transmitter is in *Read Only mode.* All parameters are locked and in cannot be configured.

7 Menu descriptions

7.1 Menu overview

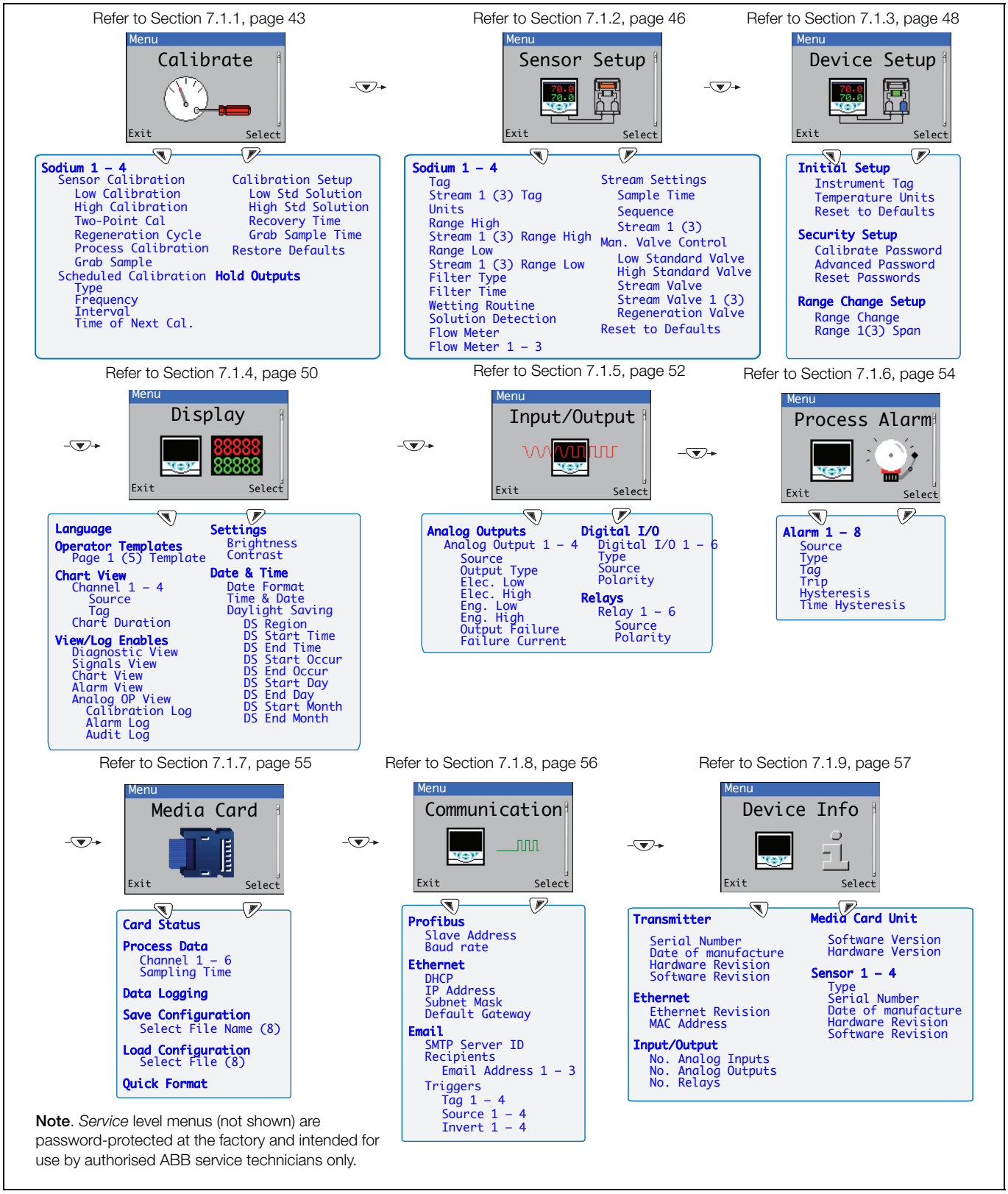
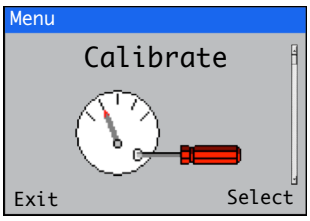


Fig. 7.1 Overview of sodium menus

7.1.1 Calibrate



Used to calibrate the wet-section, regenerate the wet-section, set up calibration parameters, process calibrations and initiate *Grab Sample* routines.

Access to the *Calibrate* menu is permitted via the *Calibrate and Advanced* levels only.

Menu	Comment	Defaults
Sodium 1 – 4	The identity of the sodium wet-section being calibrated (if a sodium multi-steam wet-section, *Sodium* only is displayed).	
Sensor Calibration		
Low Calibration	Performs a single-point offset calibration using the low standard calibration solution. The default calibration time is 15 minutes and is followed by a Recovery period. The active offset value is adjusted after this calibration. This calibration adjusts for any drift in the reading and should be performed weekly or as required. **Note**: During the calibration the sample is directed to drain via the sample stream valve.	15 min.
High Calibration	Performs a single-point span calibration using the high standard calibration solution. The default calibration time is 15 minutes and is followed by a *Recovery* period. The active offset value is adjusted after this calibration. **Note**: During the calibration the sample is directed to drain via the sample stream valve.	15 min.
Two-Point Cal	Performs a two-point calibration. Runs both a low calibration and a high calibration. The total default calibration time is 30 minutes and is followed by a *Recovery* period. The active offset value and slope are calculated after this calibration. This calibration compensates for any drift in the reading and changes in the sensitivity and should be performed weekly or as required. If the slope is calculated to be less than 80 % or greater than 110 % the calibration has failed, a *Cal Failed* diagnostic appears and the offset and slope are not updated. **Note**: During the calibration the sample is directed to drain via the sample stream valve.	30 min.
Regeneration Cycle	Displayed only if *Regeneration Fitted* is enabled. Performs a regeneration automatically followed by a two-point calibration. The regeneration procedure energizes the regeneration valve (if fitted) for 1 minute to expose the electrode to the regeneration solution. A regeneration recovery period is then initiated, which last for 2 hours. The recovery period is followed by a two-point calibration. Refer to Section 5.7, page 28 for more details of the *Regeneration* procedure.	

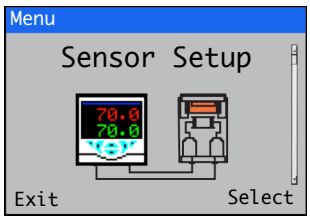
Continued on next page…

Menu	Comment	Defaults
Process Calibration	Performs a process calibration. This calibration can be used to adjust the concentration value on the wet-section to a value that has been determined in the laboratory. It should only be used to make minor adjustments to the reading. A large discrepancy between the lab and wet-section readings could be due to errors in calibration solutions or indicate problems with the wet-section. A *Process Calibration* can not be initiated on a multi-stream transmitter unless one stream only is enabled. **Note**: There is no recovery period after a process calibration.	
Grab Sample	Performs a Grab Sample routine. The *Grab Sample* function can be used to measure the sodium concentration of an external sample, for example, from another point in the process. **Note**: During a grab sample routine the sample connected to the wet-section is directed to drain via the sample stream valve.	
Scheduled Calibration		
Type	Selects the type of scheduled calibration.	
Off Low Standard Cal. High Standard Cal. Two-Point Cal. Regeneration Cycle		
Frequency	Selects the scheduled calibration frequency.	
Off Daily Weekly	Selectable options: *Daily, 2, 3, 4, 5, 6, 7* days. Selectable options: *Weekly, 2, 3, 4, 5, 6, 7, 8* weeks.	
Interval	Selects the scheduled calibration interval.	
Time of Next Cal.	Selects the time and date of the next and subsequent scheduled calibrations. Scheduled calibrations are not performed until the date / time set is reached. The date of the next scheduled calibration is updated automatically according to the frequency set. For example, if *Frequency* is *5* days and *Time of Next Cal*. is*12:00:00 2013-01-05*, it is updated automatically to: *12:00:00 2013-01-10*. **Note**: If the scheduled calibration cannot be run, or is not successful, the next scheduled calibration date is updated according to the *Frequency* set and a *Missed Scheduled Cal*. diagnostic message is created. Parameters are not enabled if *Frequency* is *Off*.	2000.01.01 00:00:00

Continued on next page…

Menu	Comment	Defaults
Calibration Setup		
Low Std Solution	Sets the low standard calibration solution value between 50 and 10,000 ppb.	100 ppb
High Std Solution	Sets the high standard calibration solution value between 50 and 10,000 ppb.	1000 ppb
Recovery Time	Sets the recovery time in minutes (between 10 and 60 minutes). This value can be adjusted to ensure the wet-section has adequate time to reach a stable reading after a calibration. The default setting is 15 minutes, but this may need to be extended if the process concentration is very low; especially if a high calibration has been carried out.	15 min.
Grab Sample Time	Sets the grab sampling time in minutes.	15 min.
Restore Defaults	Restores *Calibrate* parameters to their default values / settings.	
Hold Outputs	Enables / Disables the *Hold Outputs* function. Outputs include current outputs and alarms.	

7.1.2 Sensor Setup



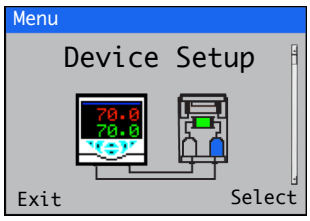
Used to set the wet-section tag, measurement units, operational and stream ranges and filter type and enable / disable the *Flow Meter* (optional) and *Manual Valve Control* functions.

Menu	Comment	Default
Sodium 1 – 4	The identity of the sodium wet-section being set up (if a sodium multi-steam wet-section, *Sodium* only is displayed).	
Tag	**Note**: Single-stream wet-sections only. Sets the (colored) 16-character alphanumeric wet-section tag displayed on *Operator Pages*.	TAG 1
Stream 1 (3) Tag	**Note**: Multi-stream wet-sections only. Sets the 16-character alphanumeric tag for each selected stream displayed on *Operator Pages*.	
Units	Selects the measurement units: ppb / µg/l / µg/kg.	ppb
Range High	**Note**. Single-stream wet-sections only. Sets the range span in *Chart* and *Bargraph* views.	
Stream 1 (3) Range High	**Note**. Multi-stream wet-sections only. Sets the range span in *Chart* and *Bargraph* views.	
Range Low	**Note**. Single-stream wet-sections. Sets the range zero in *Chart* and *Bargraph* views.	
Stream 1 (3) Range Low	**Note**. Multi-stream wet-sections only. Sets the range zero in *Chart* and *Bargraph* views.	
Filter Type	Selects the filter type: *Off / Min / Max / Average / Rolling Point*.	Off
Filter Time	Sets the filter (input) time (5 to 100 seconds).	5 seconds
Wetting Routine	Enables / disables the wetting routine. The wetting routine is initiated when a *No Samples* situation is detected. It energizes the high calibration solution valve for 1 minute every 24 hours. The wetting routine is terminated if sample returns.	

Continued on next page…

Menu	Comment	Defaults
Solution Detection	Enables / disables the solution detection function.	
Flow Meter	**Note**. Single-stream wet-sections only. Enables / disables flow measurement.	Disabled
Flow Meter 1 – 3	**Note**. Multi-stream wet-sections only. Enables / disables flow measurement for the selected stream.	Disabled
Stream Settings	**Note**. Multi-stream wet-sections only.	
Sample Time	Sets the how long each stream is sampled.	15 min.
Sequence	Sets the order in which the streams are sampled, a maximum of 8 entries are permitted. A 0 indicates the end of the sequence. An example sequence for streams 1 to 3 is: 1,2,3,1,2,3,0 where the 3 streams are sampled consecutively.	1,2,3,1,2,3,1,2,1 (3-stream)
Stream 1 (3)	Enables / Disables the selected stream (disabled streams are not sampled).	
Man. Valve Control	The solenoid valve can be energized manually. The current concentration value is shown for reference. When the *Man. Valve Control* parameter is exited, the valve returns to the closed state. **Note**: Press the ⌃ key to open the valve manually, press the ⌄ key to close the valve manually.	
Low Standard Valve	Enables the *Low Standard Valve* for manual control.	
High Standard Valve	Enables the *High Standard Valve* for manual control.	
Stream Valve	**Note**. Single-stream wet-sections only. Enables the *Stream Valve* for manual control.	
Stream Valve 1 – 3	**Note**. Multi-stream wet-sections only. Enables the selected *Stream Valve* for manual control.	
Regeneration Valve	If fitted, enables the *Regeneration Valve* for manual control.	
Reset to Defaults	Resets all wet-section parameters to their default values.	Disabled

7.1.3 Device Setup



This level is used to access standard setup parameters.

Menu	Comment	Default
Initial Setup		
`Instrument Tag`	A 16-character alphanumeric device (transmitter) identification tag displayed in the title bar on all *Operator* pages.	Navigator
`Temperature Units`	Selects the temperature units displayed (°C or °F).	°C
`Reset to Defaults`	Resets the configuration to the factory default settings.	
Security Setup	Security access levels are provided, each protected by a password of up to 6 alphanumeric characters.	
`Calibrate Password`	Provides access to *Calibrate* level only. (Not factory-set.)	
`Advanced Password`	Provides access to all configuration parameters. (Not factory-set.)	
`Reset Passwords`	Clears all passwords.	
Range Change Setup	**Notes**. ■ Displayed only if 1 single-stream wet-section is connected. ■ *Range 3* must always be the largest range, *Range 1* must always be the lowest. ■ Range Changing is disabled automatically when the sensor type is changed.	
`Range Change`	When *Enabled*, *Analogue Output 2*, *Relays 3* and *4* are configured automatically for range changing and are not available via the *Input/Output* sections.	Disabled

`Range 1 Span`
`Range 2 Span`
`Range 3 Span`
	For correct operation, *Range 1 Span* should be the lowest range and *Range 3 Span* should be the highest range.
	When *Enabled* – the following zero and span ranges 1 to 3 are set automatically:
	Range **Zero** **Span**
	1 0 100
	2 0 1000
	3 0 10000
	The range spans can be changed to suit end-user's requirements.	

Continued on next page…

…Range Change Setup

Analog output operation

Analogue output 2 is used for the range changing functionality and is scaled depending on the range selected. The mA range is set automatically to 4 to 20 mA.

Analog output 2

Range	Zero	Span
1	0 % of mA range	100 % of mA range
2	0 % of mA range	100 % of mA range
3	0 % of mA range	100 % of mA range

Note. When range changing is enabled, the *Analog Output 2* parameter option in the *Input / Outputs* level is not available – see Section 7.1.5, page 52.

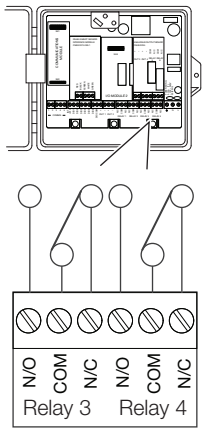
Relay operation

Relays 3 and 4 are used for the range changing functionality.

Connect Relay 3 – N/O to Relay 4 – COM

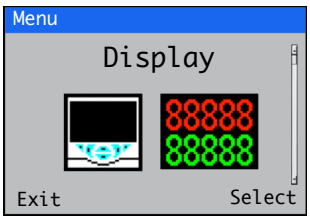
The range selection outputs can be determined as shown in the following table:

Range	Voltage-free contact	
1	Relay 3 – N/C	Relay 3 – COM
2	Relay 4 – N/C	Relay 3 – COM
3	Relay 4 – N/O	Relay 3 – COM



Note. When range changing is enabled, *Relay 3 and 4* parameter options in the *Input / Outputs* level are not available – see Section 7.1.5, page 52.

7.1.4 Display



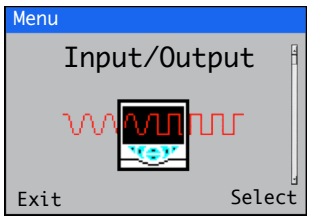
Used to select the display language, setup *Operator* page templates (1 to 5), enable diagnostic, view and log functions, set the device's display brightness / contrast and set the time and date.

Menu	Comment	Default
Language	Selects the display language: *English / German / French / Italian / Spanish*.	English
Operator Templates	Enables a template to be assigned to a wet-section for display purposes – refer to Section 6.5, page 31 for *Operator Template* examples.	Page 1
`Page 1 (to 5) Template`	*Page 1* template cannot be set, this defaults to the number of wet-sections connected.	
Chart View	The chart can be configured to display the trend for 1, 2, 3 or 4 PV and / or temperature values. The engineering ranges for the values are configured in the *Sensor Setup* menu – see page 46. **Note**: This menu is displayed only when *Chart View* is *Enabled* at the *Operator Functions / Chart View*.	
`Channel 1 (to 4)`		
`Source`	Selects the signal (PV and temperature) to be displayed on the chart.	
`Tag`	A 3-character, alphanumeric tag used to identify the parameter on the chart.	
`Chart Duration`	Selects the chart duration from 1, 2, 4, 8, 12, 16, 20 and 24 hours.	
View/Log Enables	Enables / disables the following *View and Log* functions: *View* functions: *Diagnostics View / Signals View / Chart View / Alarm View / Analog OP View* – refer to Section 6.6, page 33 for examples of *Operator Pages* in *View* mode. *Log* functions: *Calibration Log / Alarm Log / Audit Log / Diagnostics Log* – refer to Section 6.7, page 34 for examples of *Operator Pages* in *Log* mode.	

Continued on next page…

…Menu	Comment	Default
Settings	Sets the following display parameters.	
Brightness	Increases / decreases the device's brightness settings to suit local environmental conditions.	
Contrast	Increases / decreases the device's contrast settings to suit local environmental conditions.	
Date & Time	Sets / formats the device's date, local time and daylight saving start / end times:	
Date Format	*DD–MM–YYYY / MM–DD–YYYY / YYYY–MM–DD*.	DD-MM-YYYY
Date & Time	Sets the device date and time in the format: (date format set at *Date Format* menu) XX–XX–XXXX / time (fixed format) HR:MINS:SEC.	01.01.2000
Daylight Saving	Sets the daylight saving parameters.	Off
DS Region	Selects the geographical region daylight saving hours are based on: ■ *Off* – daylight saving is disabled. ■ *Europe* – selects standard daylight saving start and end times automatically. ■ *USA* – selects standard daylight saving start and end times automatically. ■ *Custom* – used to set custom daylight saving start and end times manually for regions other than Europe or USA. **Note**: The *DS Start Time / Occur / Day / Month* and *Time* menus (below) are activated only when *Custom* is selected at the *DS Region* menu.	
DS Start Time DS End Time	Sets the daylight saving start time and end time, selected from 1-hour increments.	
DS Start Occur DS End Occur	Selects the day within the month that daylight starts / ends – for example, to set daylight saving to start (or end) on the second Monday of the selected month, select Second.	
DS Start Day DS End Day	Sets the day of the month daylight saving starts / ends. **Note**: The DS Start Occur / DS End Occur parameters must be valid within the month for the selected day.	
DS Start Month DS End Month	Sets the month daylight saving starts / ends.	

7.1.5 Input/Output



Input/Output level enables configuration of analog outputs, digital inputs and outputs and relays.

Menu	Comment	Default
Analog Outputs	The analog outputs can be configured to retransmit the process variable and temperature values and have a configurable range from 0 to 22 mA.	
Analog Output 1 to 4	*Analog Outputs 3* and *4* are available only if an option board is fitted – see page 18.	
Source	Selects the analog signal to be assigned to the output – see Table 7.1, page 58.	None
Output Type	Selects the output type required: ■ Linear ■ Log 2 Decades ■ Log 3 Decades ■ Log 4 Decades	Linear
Elec Low Elec High	The maximum and minimum engineering range output value (0 to 22 mA range).	4 mA 20 mA
Eng Low Eng High	The maximum and minimum engineering range output value. If the *Output Type* selection is logarithmic the *Eng Low* value is set automatically to 2, 3 or 4 decades below the *Eng High* value.	0 10,000
Output Failure	When enabled, the current output can be driven to a preset value if a *Failure* category diagnostic state occurs for the selected source – see page 72.	Enabled
Failure Current	Sets a preset value the current output is driven to when a *Failure* category diagnostic state is present. – see page 72. **Note**: Active only if *Output Failure* is *Enabled*.	22.0

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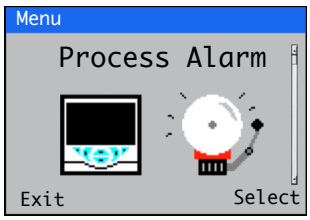
…Menu	Comment	Default
Digital I/O	See page 18 for digital I/O connections.	
Digital I/O 1 to 6	Sets the polarity of the input or output signal	
Type	Sets the *Digital I/O* to operate as an output or an input: *Off* – no action taken. *Output* – the *Digital I/O* operates as an output. *Volt Free* – high input detected when volt-free switch across input is closed. *24 Volt* – digital input low <5 V, high> 11 V (maximum input 30 V).	Off
Source	Selects the digital signal to be assigned to the output – see Table 7.2, page 58.	None
Polarity	Sets the polarity of the output signal. *Inverted* – for an output, if the source is active the output is low. For an input, if a high signal is detected the input is inactive. *Non Inverted* – for an output, if source is active the output is high. For an input, if a low signal is detected the input is inactive.	Non Inverted
Relays		
Relay 1 to 6	*Relays 5* and *6* are available only if an option board is fitted – see page 18.	
Source	Selects the digital signal to be assigned to the relay – see Table 7.3, page 58.	None
Polarity	Sets the polarity of the relay: *Inverted* – if the source is active the relay is energized. *Non Inverted* – if the source is inactive the relay is energized.	Non Inverted

7.1.6 Process Alarm



Used to configure up to 8 independent process alarms.

Menu	Comment	Default
Alarm 1 to 8		
Source	Selects the analog value for the process alarm source.	None
Type	Selects the alarm type from: ■ High Process ■ Low Process ■ High Latch ■ High Latch	High Process
Tag	The alarm *Tag* is displayed as a diagnostic message and appears in the *Diagnostic Status Bar* and on the *Diagnostic View* page at *Operator* level – see page 31.	Alarm <n>
Trip	The alarm trip level in engineering units.	0.0
Hysteresis	The hysteresis trip level in engineering units. Activated at the alarm trip level but deactivated only when the process variable has moved into the safe region by an amount equal to the hysteresis value – see Process alarm examples below.	0.0
Time Hysteresis	If an alarm trip value is exceeded, the alarm does not become active until the *Time Hysteresis* value has expired. If the signal goes out of the alarm condition before the *Time Hysteresis* has expired, the hysteresis timer is reset.	0

Process alarm examples

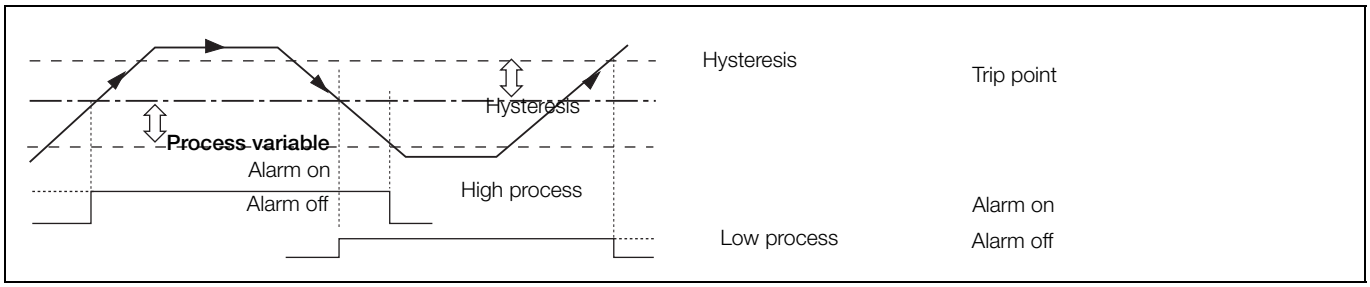


Fig. 7.2 High and low process alarm action

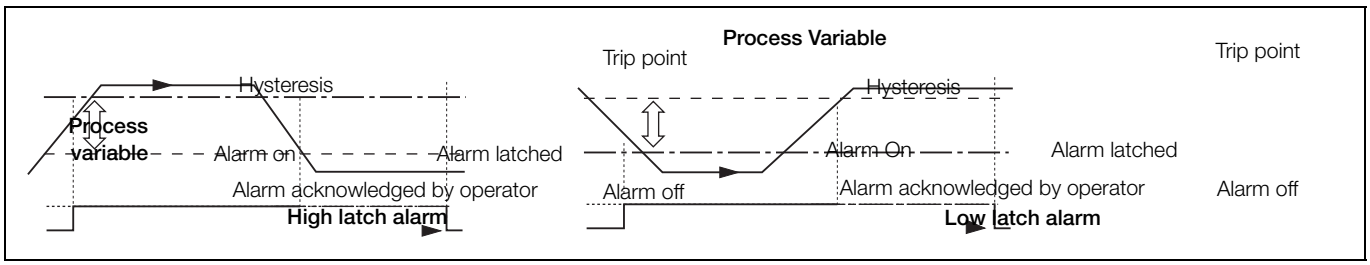
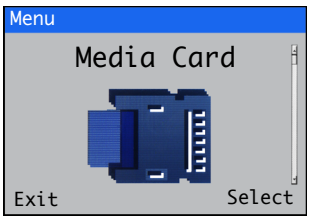


Fig. 7.3 High and low latch alarm action

7.1.7 Media Card

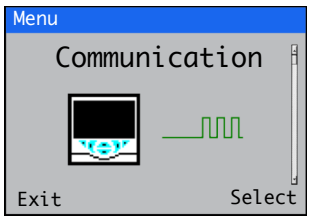


Used to set the card on / off status, select the process data to be logged, enter file configuration selection and save details and to format the media card.

Media Card level menus are enabled only if an optional media card module is fitted.

Menu	Comment	Default
Card Status	Selects card status, *Online / Offline*.	Online
Process Data		
`Channel 1 to 6`	Selects the source to be logged – refer to Section 7.2, page 58 for sources.	
`Sampling Time`	Selects the sampling duration time: 5 / 10 / 30 seconds 1 / 5 / 10 / 30 minutes 1 hour	5 s
Data Logging	*Enabled / Disabled* data logging. In *Enable* mode data can be written to internal / external media. In *Disable* mode, data is prevented from being written to internal / external media.	Enabled
Save Configuration		
`Select File Name (8)`	Enables a user-selected filename to be specified for the current configuration to be saved.	
Load Configuration		
`Select File (8)`	Selects the configuration file to be loaded from a list of previously saved files.	
Quick Format	*Disabled / Enabled*. Runs a quick format routine on the SD card / USB stick inserted into the transmitter's card reader.	Disabled

7.1.8 Communication

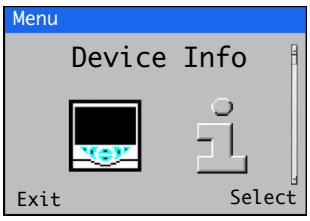


Communication level menus are enabled only if an optional communications module is fitted.

Ethernet and Email menus enabled only if a Ethernet communications module is fitted.

Menu	Comment	*Default*
Profibus		
Slave Address	Sets the device-specific slave address for identification on the network.	
Baud Rate	A read-only value (range 0 to 12000 K) taken from the PC the network is connected to.	
Ethernet		
DHCP	Sets DHCP (Dynamic Host Control Protocol) on / off. Set to *On* if the IP address is to be allocated dynamically by the network. Set to *Off* if the IP address is defined statically.	
IP Address	Sets the IP address to be assigned to the wet-section. The IP address is used by the TCP/IP protocol to distinguish between different devices. The address is a 32-bit value expressed with 4 values (0 to 255), each separated by a period (.). **Note**. Configurable only if *DHCP* is disabled.	
Subnet Mask	The subnet mask is used to indicate which part of the IP address is used for the network ID and which part is used for the host ID. Set each bit that is part of the network ID as '1's, for example: 255.255.255.0 indicates the first 24 bits are for the network ID.	
Default Gateway	Sets the IP address for the Default Gateway (router or switch) used to communicate with other networks. **Note**. This setting is required only if a router (or switch) is used.	000.000.000.000
Email		
SMTP Server ID	The IP (Internet Protocol) address of the SMTP (Simple Mail Transport Protocol) server used to distribute emails.	
Recipients		
Email Address 1 – 3	Enter the email address(es) of the recipient(s).	
Triggers		
Tag 1 – 4	The trigger description that appears in the subject title.	
Source 1 – 4	Up to 4 independently-configurable triggers can be enabled to generate an email when the selected source becomes active (the email can be sent to up to 3 recipients).	
Invert 1 – 4	If enabled, an email is generated when the *Source* becomes inactive instead of active.	

7.1.9 Device Info



Displays read-only factory-set details for the transmitter and connected wet-section(s).

Menu	Comment	Default
Transmitter		
Serial Number	The transmitter's serial number.	
Date of Manufacture	The transmitter's date of manufacture.	
Hardware Revision	The transmitter's hardware version number.	
Software Revision	The transmitter's software version number.	
Ethernet	Enabled only when an Ethernet communications module is fitted – see page 18.	
Ethernet Revision	The Ethernet module software version.	
MAC Address	The Ethernet physical address.	
Input/Output		
No. Analog Inputs	The number of analog inputs available.	
No. Analog Outputs	The number of analog outputs available.	
No. Relays	The number of relays available.	
Media Card Unit		
Software Version	The media card unit's software version number.	
Hardware Version	The media card unit's hardware version number.	
Sensor 1 – 4		
Type	The wet-section type(s) connected.	Sodium 1 (4)
Serial Number	The serial number.(s) of connected wet-section(s).	
Date of Manufacture	The date of manufacture of connected wet-section(s).	
Hardware Revision	The hardware version number(s) of connected wet-section(s).	
Software Revision	The software version number(s) of connected wet-section(s).	

7.2 Analog sources and digital input / output sources

7.2.1 Analog sources

Source name*	Description
Low Level D. O. 1 (4) Hydrazine 1 (4) Sodium 1 (4)	Measured concentration value for the associated wet-section.
Sodium Stream 1	Measured concentration value for stream 1.
Sodium Stream 2	Sodium multi-stream: measured concentration value for stream 2.
Sodium Stream 3	Sodium multi-stream: measured concentration value for stream 3.
Temperature 1 (4)	Measured temperature value for the associated wet-section.
Temperature 1	Sodium multi-stream: measured temperature value for stream 1.
Temperature 2	Sodium multi-stream: measured temperature value for stream 2.
Temperature 3	Sodium multi-stream: measured temperature value for stream 3.

Table 7.1 Analog sources

7.2.2 Digital output sources

Source name*	Description
Alarm 1 (8) State	Process alarm state (alarm 1 to 8).
S1 (4) Failure	The associated wet-section is in the failed state – see Appendix A, page 72 for possible causes.
S1 (4) Out of Spec.	The associated wet-section is out of specification – see Appendix A, page 72 for possible causes.
S1 (4) Maintenance	The associated wet-section requires maintenance – see Appendix A, page 72 for possible causes.
S1 (4) Function Check	The associated wet-section requires checking – see Appendix A, page 72 for possible causes.
Tx Failure	The transmitter is in the failed state – see Appendix A, page 72 for possible causes.
Tx Out of Spec.	The transmitter is out of specification – see Appendix A, page 72 for possible causes.
Tx Maintenance	The transmitter requires maintenance – see Appendix A, page 72 for possible causes.
Tx Function Check	The transmitter requires checking – see Appendix A, page 72 for possible causes.
S1 (4) Cal in Progress	A calibration is in progress for the associated wet-section.
S1 (4) Cal Failed	The last calibration has failed for the associated wet-section.

Table 7.2 Digital output sources

7.2.3 Digital input sources

Source name*	Description
S1 (4) High Std Cal	High standard calibrations.
S1 (4) Low Std Cal	Low standard calibrations.
S1 (4) 2-Pt Cal	Two-point calibrations.
S1 (4) 2-Regen Cal	A sensor regeneration sequence is followed automatically by a two-point calibration.
S1 (4) Hold	The measured concentration for the associated wet-section can be held via the digital input.

Note. It is recommended that a momentary switch is used to start or abort calibrations and a toggle switch is used for the hold functionality.

To start a calibration – hold the momentary switch for a minimum of two seconds; when the calibration starts release the switch.

To abort a calibration – hold the momentary switch for a minimum of two seconds; when the calibration aborts release the switch.

Table 7.3 Digital input sources

*(4) = maximum number of wet-sections if multiple wet-sections are connected.

8 Maintenance

8.1 Chemical solutions

The reagents and calibration solutions detailed in this section are required to keep the wet-section operating. Solutions should be stored in plastic bottles and, where possible, should be freshly made.

8.1.1 Reagent solutions

Two alternative reagent solutions may be used, depending on the required lower limit of measurement. Concentrated ammonia solution, that provides adjustment of sample pH to a minimum of 10.7 (if fresh 35 % w/v ammonia solution is used) is suitable for measurements of sodium ion to approximately 0.5 µg kg^{-1}. At concentrations below this, hydrogen ion interference becomes significant and a reagent of di-isopropylamine (DIPA) should be used. This adjusts the sample pH between 11.2 and 11.5 and enables measurements to be made down to 0.1 µg kg^{-1}.

1. Concentrated ammonia solution – 1 liter (0.22 US gal.).

   Warning. This reagent must only be handled under a fume hood. It causes burns and is irritating to the eyes, respiratory system and skin. Wear rubber gloves and eye protection. In warm weather pressure increases in the bulk container of ammonia and the cap must be released with care.

   A 35 % w/v solution (s.g. 0.88) is recommended, but lower concentrations, to a minimum of 30 % w/v (s.g. 0.89), can be used.

2. Di-isopropylamine – 1 liter (0.22 US gal.).

   Warning. DIPA is an extremely inflammable and irritating colorless liquid with an ammoniacal odor. Handle with care at all times.

   The following points must also be noted:

   - Avoid breathing vapor and avoid contact with skin and eyes.
   - Work under a fume hood, wearing rubber gloves and eye protection.
   - Keep away from sources of ignition. No smoking
   - In the event of a fire, extinguish with water spray, foam, dry powder or carbon dioxide.
   - If a spillage occurs, shut off all possible sources of ignition and instruct others to keep at a safe distance. Mop up spillage with plenty of water, diluting greatly. Ventilate the area well to evaporate any remaining liquid and dispel vapor.
   - Effluent from the wet-section contains DIPA (if this reagent is used). Contact with it should also be avoided.

8.1.2 Standard solutions

The following instructions refer to the preparation of 100 µg l^{-1} and 1 mg l^{-1} sodium, STANDARD SOLUTION 1 (LOW) and 2 (HIGH) respectively. Alternative concentrations can be prepared within the measuring range selected by appropriate dilution of the stock solution.

It is not advisable to prepare static sodium solutions of less than 50 µg l^{-1} because low concentration solutions rapidly become contaminated and change in concentration.

Although the HIGH and LOW standard solutions are typically one decade apart in sodium concentration, any concentration difference can be used if the HIGH solution is at least five times the concentration of the LOW solution. It is necessary to have a significant change in electrode output to achieve an accurate calibration.

For all practical purposes, 'µg l-1' can be considered equal to 'µg kg^{-1}' ('ppb') and 'mg l^{-1}' equal to 'mg kg^{-1}' ('ppm').

To prepare stock solution (1000 mg l^{-1} sodium ions):

1. Dissolve 2.543 (±0.001) g of analytical reagent grade sodium chloride in approximately 100 ml high purity water. Transfer this solution to a one liter volumetric flask and make up to the one liter mark with more high purity water to give a stock solution of 1000 mg l^{-1} sodium ions. Store in a plastic container.
2. Pipette 10 ml of this solution to a one liter volumetric flask. Make up to the one liter mark with high purity water to give a solution of 10 mg l^{-1} sodium ions.
3. Pipette 10 ml of the 10 mg l^{-1} solution into a one liter volumetric flask and make up to the one liter mark with high purity water to give the LOW standard solution of 100 µg l^{-1} sodium ions. Transfer this solution to the bottle labelled STANDARD SOLUTION 1 (LOW).
4. Transfer 100 ml of the 10 mg l^{-1} solution to a one liter volumetric flask and make up to the mark with high purity water to give the HIGH standard solution of 1 mg l^{-1} sodium ions. Transfer this solution to the bottle labelled STANDARD SOLUTION 2 (HIGH).

Note. High purity water = water containing less than 2 µg l^{-1} sodium ions and a specific conductivity of less than approximately 0.2 µS cm^{-1}.

8.1.3 Salt bridge solution

This solution is required for refilling the double junction silver / silver chloride reference electrode at extended intervals. The solution supplied with the electrode (3.5 M potassium chloride) should be used for refilling using the plastic pipette provided.

8.2 Scheduled servicing

The following procedures are guides to the maintenance requirements of the wet-section. The procedure chosen depends on the particular installation and sample conditions.

8.2.1 Weekly

If the wet-section is running continuously at high concentrations (>100 µg kg^{-1}) perform a weekly single-point calibration – see Section 5.5, page 24.

8.2.2 Monthly

1. Replace the bottle of reagent solution at regular intervals (see Fig. 2.1, page 6 for bottle location). If ammonia is being used, the level of solution should not be allowed to fall by more than 1/4. Discard the remaining reagent solution (predominantly water).

Note. The frequency at which reagent needs to be replaced is dependent on the ambient temperature and the concentration of sodium being measured (for accurate low sodium readings, the solution may require replacement more frequently).

2. Refill the reference electrodes using the solution supplied with the electrode:
   - for versions **with** a reservoir, check the level in the reference electrode reservoir and refill if below 10 mm (0.4 in.) – refer to Section 4.1.2, page 20, for filling instructions.

   Referring to Fig. 8.1:

   - for versions **without** a reservoir, ensure the level of solution in reference electrode (A) is above the flowcell block (B). Refill as required.

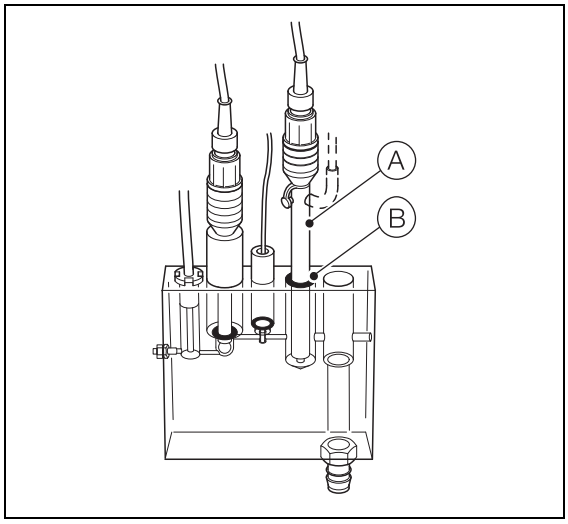


Fig. 8.1 Checking solution level, non-reservoir wet-sections

3. Check sodium concentration.
   - When the sodium concentration is above 1 µg kg^{-1}, perform a two-point calibration – see Section 5.5, page 24; note the *Slope* value.
   - When the sodium concentration is below 1 µg kg^{-1}, apply the regeneration procedure automatically or manually – see Section 8.3, page 61 (automatic) or Section 8.4, page 63 (manual).

Note.
- It is important that this procedure is carried out at regular 1-monthly intervals and that the process is started as soon as a new electrode is put into service.
- It is extremely difficult to recover an 'old' electrode.

4. Perform a automatic or manual regeneration procedure:
   - to perform an automatic regeneration (available only if optional regeneration hardware is fitted), refer to Section 8.3, page 61
   - to perform a manual regeneration, refer to Section 8.4, page 63

Note. For information about the regeneration solution, contact the local ABB representative.

8.2.3 12-Monthly

1. Check the condition of all plastic tubing; replace it as required – refer to Section 8.6, page 65 for multi-stream wet-sections or Section 8.7, page 67 for single-stream wet-sections.
2. Clean the flowcell and the Pt1000 temperature compensator to remove any deposits.

   Referring to Fig.8.2:

   a. Remove the Pt1000 temperature compensator (A) by unscrewing the compensator sleeve (B) and withdrawing the Pt1000 temperature compensator from the flowcell (C).

   b. Clean the Pt1000 temperature compensator (A) and flowcell (C) using high purity water.

   c. When replacing the Pt1000 temperature compensator, ensure that the O-ring (D) is in place below the flange on the compensator, and the skid washer (E) is in place above the flange.

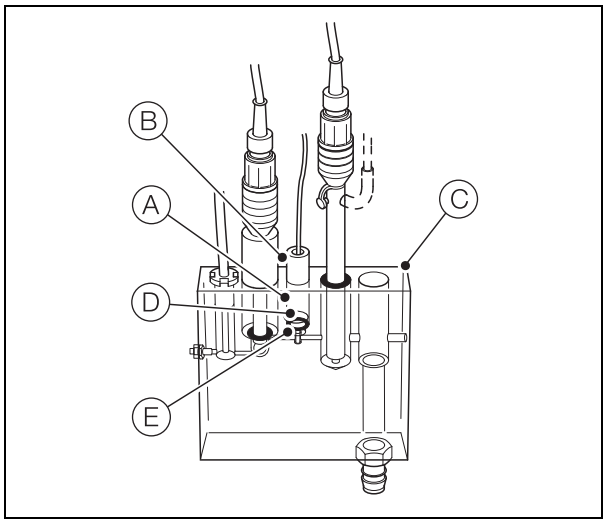


Fig. 8.2 Cleaning the flowcell and Pt1000 temperature compensator

8.3 Automatic regeneration

The regeneration valve is energized for 1 minute. The analyzer then starts a 2-hour regeneration recovery period. After the recovery period a two-point calibration is initiated automatically.

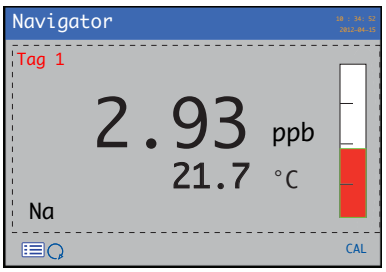
A scheduled regeneration does not commence if the *No Samples* diagnostic (see Appendix A.1, page 72) is active.

It is not advisable to perform a manual regeneration procedure (see Section 8.4, page 63) if the *No Samples* diagnostic is active.

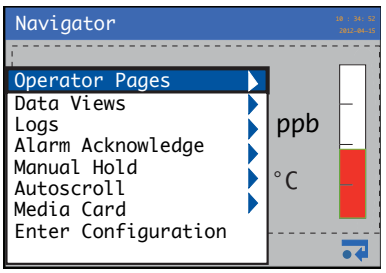
Note. If it is detected that no regeneration solution is present, the regeneration valve is de-energized automatically and a recovery period is initiated. A two-point calibration is initiated after the recovery period.

To start an automatic regeneration:

1. Press the key (below the icon).

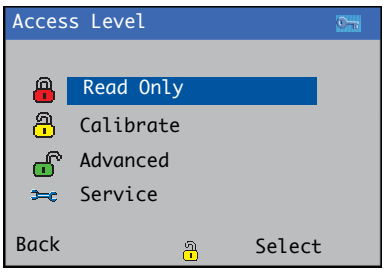


The *Operator* menus are displayed:



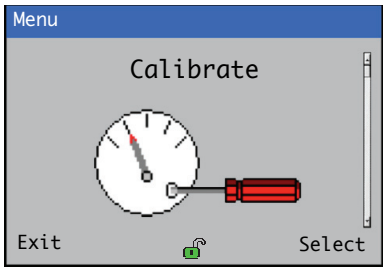
2. Press the key to scroll to the *Enter Configuration* menu and press the key (below the icon).

   The *Access Level* page is displayed:

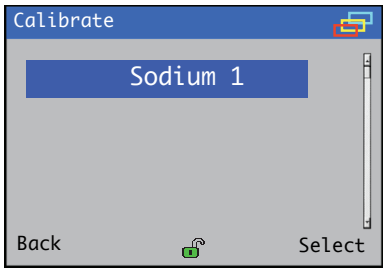


3. Use the key to scroll to the *Advanced* access level and press the key (below the *Select* prompt) to enter the top level *Configuration* menus.

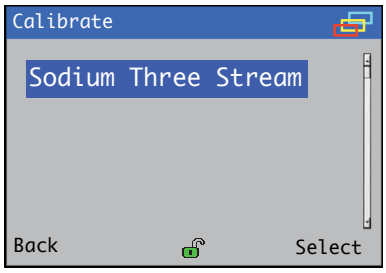
4. If the *Calibrate* page is not displayed, use the ▲ / ▼ keys to scroll to the *Calibrate* page:



5. Press the ◤ key (below the *Select* prompt).
   - If one or more single-stream wet-sections are connected, the *Calibrate / Sodium 1 (2, 3, 4)* page is displayed:

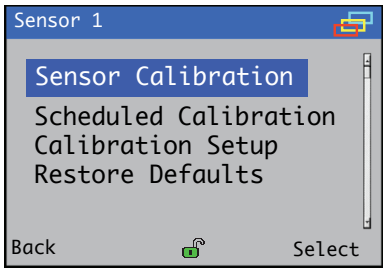


   - If a multi-stream wet-section is connected, the *Calibrate / Sodium Three Stream* page is displayed:



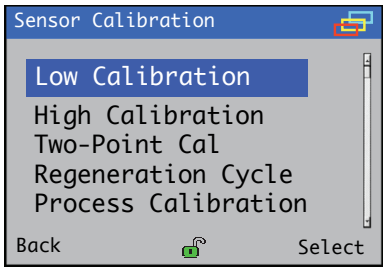
6. Press the ◤ key (below the *Select* prompt).

   The following page is displayed with the *Sensor Calibration* menu selected:



7. Press the ◤ key (below the *Select* prompt).

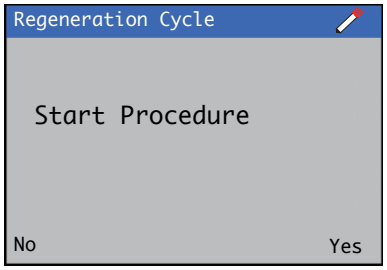
   The *Sensor Calibration* page is displayed:



   Press the ▼ key to highlight the *Regeneration Cycle* menu.

8. Press the ◤ key (below the *Select* prompt).

   The *Regeneration Cycle* page is displayed:



   Press the ◤ key (below the *Yes* prompt) to start the regeneration procedure.

8.4 Manual regeneration

Referring to Fig. 8.3:

1. Carefully unscrew plastic sleeve (A) a few turns (with sodium electrode (B) in place).
2. Withdraw sodium electrode (B) from the sleeve and flowcell (C) (it is not necessary to detach the electrode lead (D)).
3. Remove O-ring (E).
4. Prepare two plastic beakers, one containing about 50 ml of etch solution, the other about 200 ml high purity water.
5. Dip the electrode in the etch solution for 60 (±5) seconds then rinse in high purity water.

> **Caution.** Do not to exceed the etch time or the electrode's performance may be permanently degraded.

6. Dispose of the etch solution safely by diluting with plenty of water (use fresh etch solution each time).
7. Refit O-ring (E), sodium electrode (B) and screw plastic sleeve (A) finger-tight (do not over-tighten).
8. Run the wet-section for 1 to 2 hours on sodium sample before attempting a calibration.

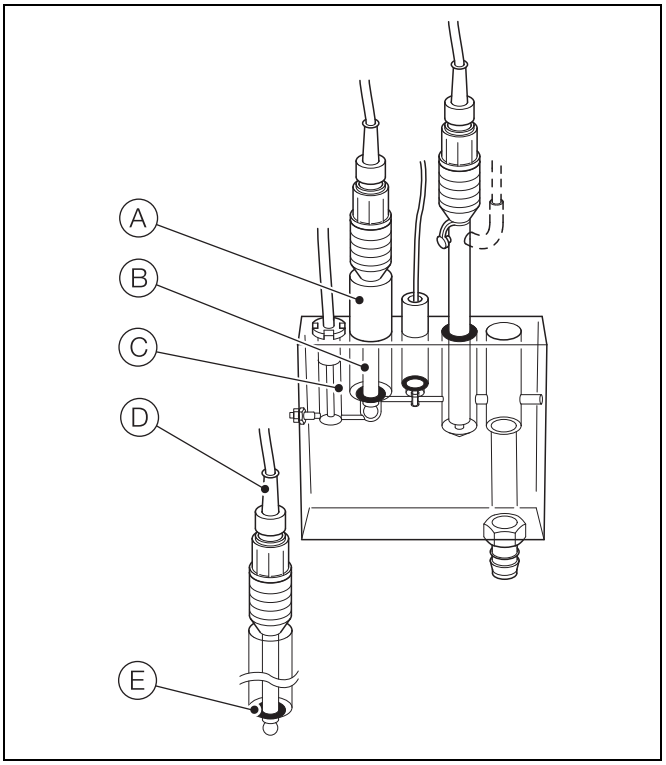


Fig. 8.3 Manual regeneration of sodium electrode

8.5 Shut-down procedures

> **Warning.** Observe relevant safety procedures when handling reagent solutions.

1. Close the sample valve upstream of the wet-section.
2. Remove the reagent container (see Fig. 2.1, page 6 for bottle locations) and store or dispose of the solution safely. If disposing, rinse the container thoroughly.
3. Fill the regeneration solution container (if fitted) with high purity water and energize the regeneration valve via the *Man. Control Valve* menu (see Section 7.1.2, page 47) for 5 minutes.
4. Fill the calibration solution containers with high purity water and perform a two-point calibration to flush the wet-section.
5. Remove the electrodes and follow storage procedure in Section 8.5.1.
6. Use a syringe to flush all tubing with high purity water. This removes any particulate deposits.
7. Switch off the mains supply to the transmitter.

> **Note.** For multiple wet-section installations, do not switch off the mains supply to the transmitter if operation of the remaining wet-sections needs to be continued.

8.5.1 Preparing the sodium and reference electrodes for storage

Referring to Fig. 8.4:

1. Unscrew (but do not remove) plastic sleeve (A) and carefully slide sodium electrode (B) out of the flowcell (C).
2. Fill the rubber teat (D) (supplied with the sodium electrode) with High Cal solution or typically with 1 mg kg^{-1} sodium containing a few drops of concentrated ammonia solution and push the teat over the end of the sodium electrode.
3. Carefully withdraw reference electrode (E) from the flowcell.
4. Fill the rubber teat (F) (supplied with the reference electrode) with salt bridge solution and push the teat over the end of the reference electrode.
5. Refit the filling hole plug (G) (non-reservoir option) or (H) (reservoir option) to seal the refill aperture.

Note. Do not let electrodes dry out.

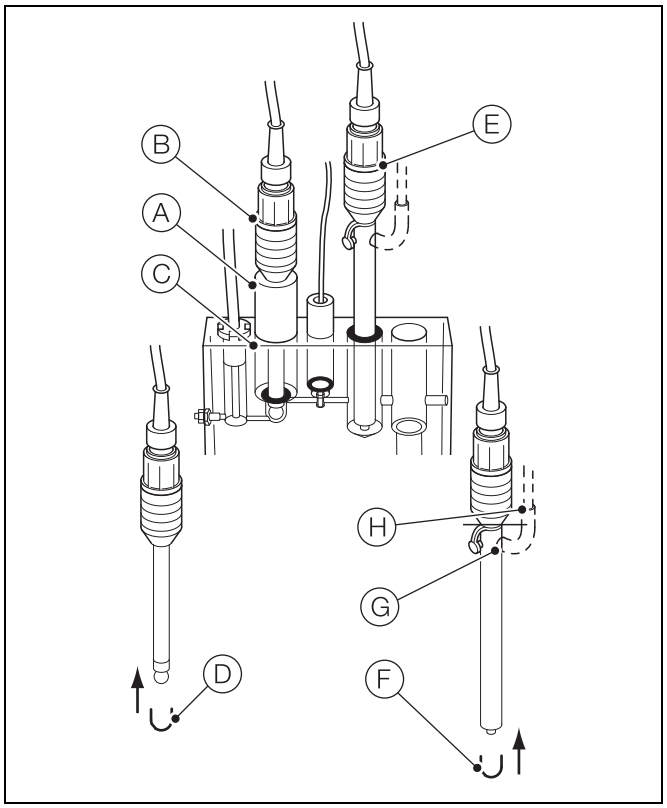


Fig. 8.4 Preparing the sodium and reference electrodes for storage

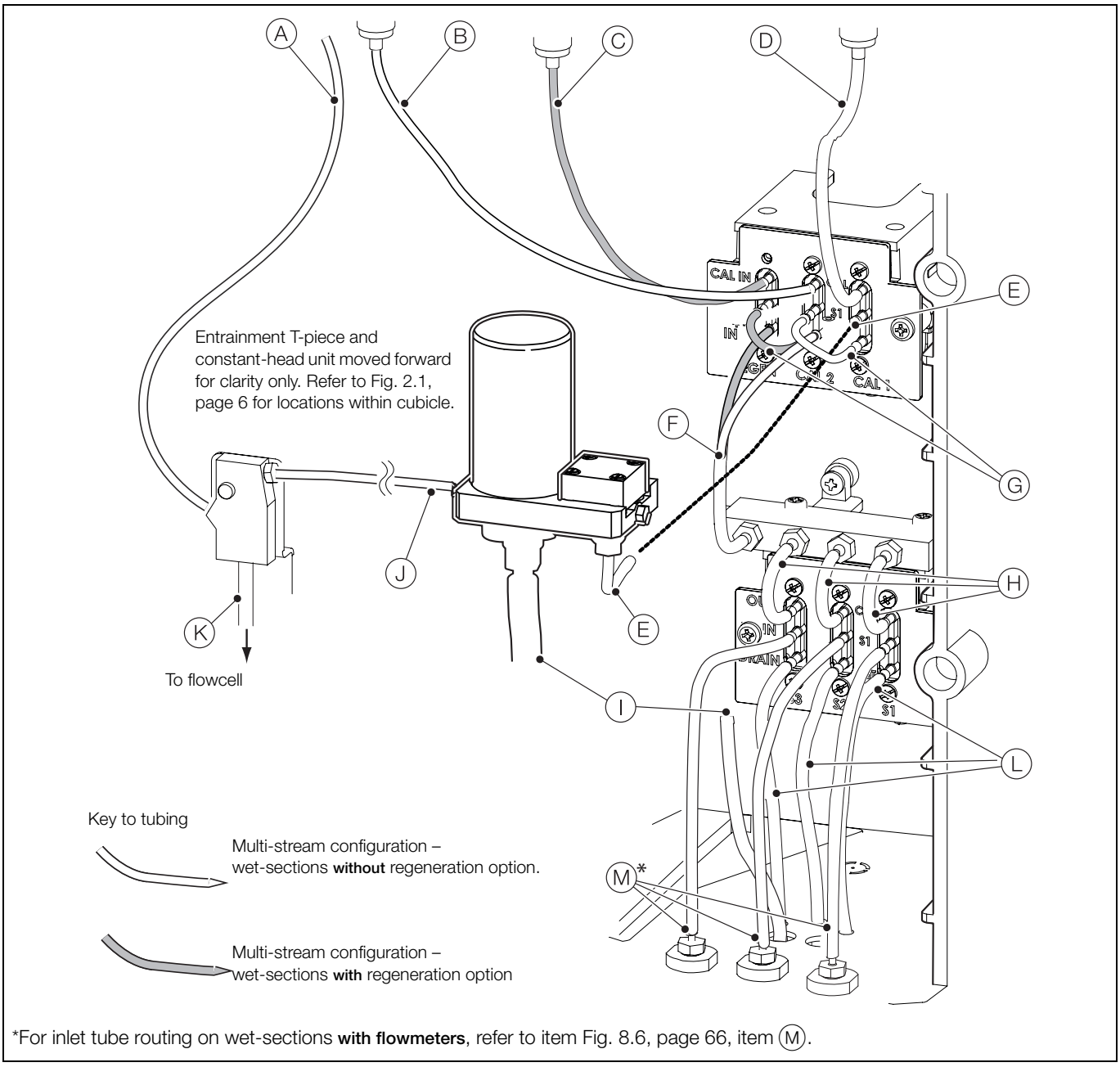
8.6 Replacing plastic tubing – multi-stream wet-sections

It is recommended that all plastic tubing is replaced every 12 months. Use only the correct size and type of tubing – refer to Fig. 8.5 and Fig. 8.6 (page 66) for tubing location and Table 8.1, page 66 for tubing lengths.

Two sections of tubing are critical:

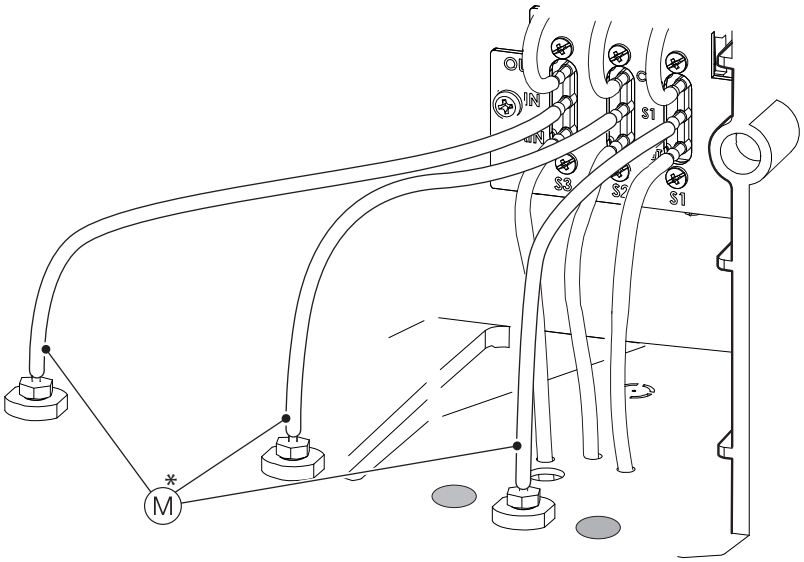
- tubing (item (A)) between the reagent container and entrainment 'T' piece – this must be a polyethylene-lined tube with good chemical resistance to the reagent.
- tubing (item (J)) between the constant-head unit and the entrainment 'T' piece – cut 100 mm (4 in.) of the 1 mm ID silicon rubber tube and fit onto the tube connectors. The tube should be taut to prevent interference with the flow and self-starting characteristics.

Note. Tubes (B), (C) and (D) use QD couplings at the solution bottles, all other tubing connections are to barbed connectors.



*For inlet tube routing on wet-sections **with flowmeters**, refer to item Fig. 8.6, page 66, item (M).

*Fig. 8.5 Physical arrangement, all plastic tubing – sodium multi-stream wet-section **without** flowmeters*



*For inlet tube routing on wet-sections **without flowmeters**, refer to Fig. 8.5, page 65, item Ⓜ.

*Fig. 8.6 Physical arrangement, inlet tubing only – sodium multi-stream wet-section **with** flowmeters*

Item	Description	Length mm (in.)	Part number and size	Quantity
Ⓐ	Reagent tubing	550 (21.6)	0212397 3/32 in. ID x 5/32 in. OD	1
Ⓑ	Calibration solution 2 tubing (disconnect QD coupling first)	250 (10)	0212214* 1/16 in. ID x 1/8 in. OD	1*
Ⓒ	Regeneration solution tubing (if fitted) – disconnect QD coupling first	250 (10)		1*
Ⓓ	Calibration solution 1 tubing (disconnect QD coupling first)	250 (10)		1*
Ⓔ	Constant-head to calibration + regeneration valve assembly	50 (2)	0212362* 3/32 in. ID x 5/32 in. OD Tygon	1*
Ⓕ	Calibration + regeneration valve assembly to manifold valve assembly (same tubing used for optional regeneration / non-regeneration wet-sections)	145 (5.7)		1*
Ⓖ	Regeneration / Calibration 2 / Calibration 1 jumper tubing	50 (2)		2*
Ⓗ	Switching valve to manifold valve	50 (2)		3*
Ⓘ	Sample outlet tubing	280 (11)	0212189 1/4 in. ID x 3/8 in. OD	1
Ⓙ	Constant-head to entrainment 'T' piece tubing	100 (4)	0212206 1 mm ID x 1 mm wall	1
Ⓚ	Entrainment 'T' piece to flowcell chamber tubing	Factory-fitted		
Ⓛ	Drain tubing – same length for wet-sections with / without flowmeters	145 (5.7)	0212362* 3/32 in. ID x 5/32 in. OD Tygon	1* per stream
Ⓜ	Inlet tubing, streams 1 to 3 – wet-section without flowmeters (see Fig. 8.5, page 65)	145 (5.7)		1* per inlet
	Inlet tubing – wet-section with flowmeters (see Fig. 8.6):			
	Stream 1	145 (5.7)		1*
	Stream 2	190 (7.5)		1*
	Stream 3	245 (9.6)		1*

Table 8.1 Schedule of replacement of plastic tubing – multi-stream sodium (3-stream)

*Tubing must be cut to correct length.

8.7 Replacing plastic tubing – single-stream wet-sections

It is recommended that all plastic tubing is replaced every 12 months. Use only the correct size and type of tubing – refer to Fig. 8.7 for tubing location and Table 8.2, page 68 for tubing lengths.

Two sections of tubing are critical:

- tubing (item (A)) between the reagent container and entrainment 'T' piece – this must be a polyethylene-lined tube with good chemical resistance to the reagent.
- tubing (item (I)) between the constant-head unit and the entrainment 'T' piece – cut 100 mm (4 in.) of the 1 mm ID silicon rubber tube and fit onto the tube connectors. The tube should be taut to prevent interference with the flow and self-starting characteristics.

Note. Tubes (B), (C) and (D) use QD couplings at the solution bottles, all other tubing connections are to barbed connectors.

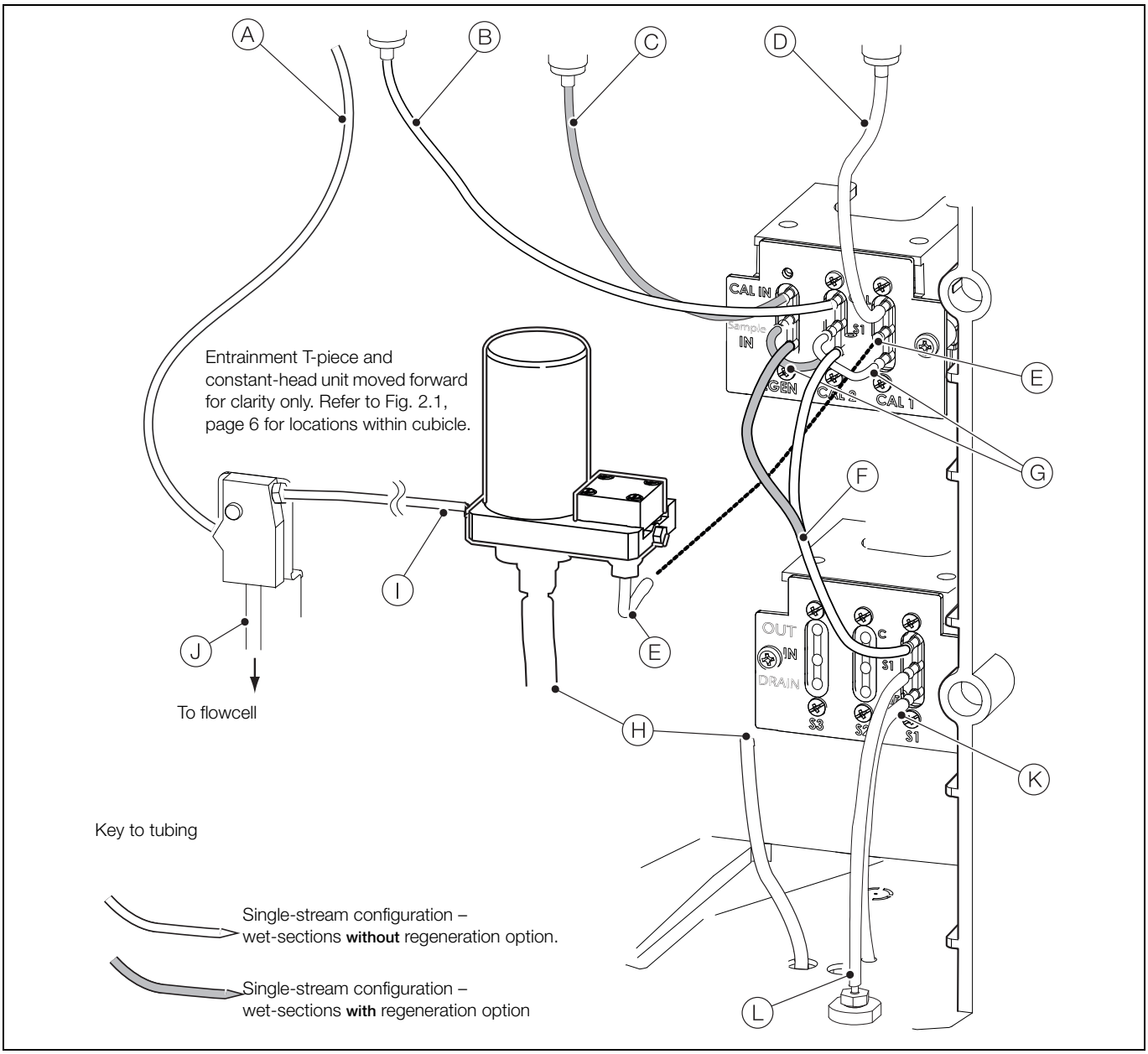


Fig. 8.7 Replacement of plastic tubing – single-stream sodium

Item	Description	Length mm (in.)	Part number	Quantity
Ⓐ	Reagent tubing	550 (21.6)	0212397 $^{3}/_{32}$ in. ID x $^{5}/_{32}$ in. OD	1
Ⓑ	Calibration solution 2 tubing (disconnect QD coupling first)	250 (10)	0212214* $^{1}/_{16}$ in. ID x $^{1}/_{8}$ in. OD	1*
Ⓒ	Regeneration solution tubing (if fitted) – disconnect QD coupling first	250 (10)		1*
Ⓓ	Calibration solution 1 tubing (disconnect QD coupling first)	250 (10)		1*
Ⓔ	Constant-head to calibration + regeneration valve assembly	50 (2)	0212362* $^{3}/_{32}$ in. ID x $^{5}/_{32}$ in. OD Tygon	1
Ⓕ	Calibration + regeneration valve assembly to switching valve assembly – same tubing used for optional regeneration / non-regeneration wet-sections	145 (5.7)		1*
Ⓖ	Regeneration / Calibration 2 / Calibration 1 jumper tubing	50 (2)		2*
Ⓗ	Sample outlet tubing	280 (11)	0212189 $^{1}/_{4}$ in. ID x $^{3}/_{8}$ in. OD	1
Ⓘ	Constant-head to entrainment 'T' piece tubing	100 (4)	0212206 1 mm ID x 1 mm wall	1
Ⓙ	Entrainment 'T' piece to flowcell chamber tubing	Factory-made		
Ⓚ	Drain tubing – same length for wet-sections with / without flowmeters	145 (5.7)	0212362* $^{3}/_{32}$ in. ID x $^{5}/_{32}$ in. OD Tygon	1*
Ⓛ	Inlet tubing – same length for single-stream wet-sections with / without flowmeters	145 (5.7)		1*

Table 8.2 Schedule of replacement of plastic tubing – single-stream sodium

*Tubing must be cut to correct length.

9 Specification – analyzer

Operation

Measuring range
0.01 to 10,000 ppb

Units of measure
ppb, µg/l, µg/kg

Accuracy
±5 % of reading or ±0.1 ppb, whichever is the greater (applies only when sample is within ±5 °C of calibration temperature)

Repeatability
±5 % of reading or ±0.1 ppb, whichever is the greater (applies within a ±5 °C [±9 °F] variation)

Response time
1 to 100 ppb <4 mins;
100 to 1 ppb <4 mins for a 90 % step change

Multi-stream measurement
Sample time programmable between 10 and 60 min.

Resolution
0.001 ppb

Temperature compensation
5 to 55 °C (41 to 131 °F) automatic using a Pt1000

AutoCal frequency
Programmable from 1 to 7 days or 1 to 8 weeks

Sample temperature
5 to 55 °C (41 to 131 °F)

Sample pressure
1.5 bar gauge (21.7 psi) maximum

Sample flow rate
100 to 400 ml/min

Sample connections
1/4 ID flexible tubing to barbed connector

Environmental data

Ambient operating temperature:
0 to 55 ºC (32 to 131 ºF)

Ambient operating humidity:
Up to 95 % RH non-condensing

Storage temperature:
– 20 to 70 °C (–4 to 158 °F) without sensor
0 to 55 °C (41 to 131 °F) with sensor

Approvals, certification and safety

CE mark

cULus

General safety
EN61010-1
Pollution degree 2
Insulation class 1

EMC

Emissions & immunity
Meets requirements of IEC61326 for an industrial environment and domestic emissions

Maintenance

Periodic calibration:
User-defined

DS/ASO550–EN Rev. E

10 Specification – transmitter

Operation

Display

89 mm (3.5 in) color 1/4 VGA TFT, liquid crystal display (LCD) with built-in backlight and brightness / contrast adjustment

Language

English, German, French, Italian, Spanish

Keypad

6 tactile membrane keys:

Group select / left cursor, view select / right cursor, menu key, up, down, enter key

No of inputs

Up to 4 single-stream or 1 multi-stream wet-section

Mechanical data

Protection

IP66 / NEMA 4X

Dimensions

Height – 194 mm (7.64 in) minimum (excluding glands)

Width – 214 mm (8.42 in) – excluding glands

Depth – 98 mm (3.85 in) door closed – minimum (excluding fixing brackets)

Weight – 1.5 kg (3.3 lb)

Materials of construction

Glass-filled polycarbonate

Security

Password protection

Calibrate and Advanced – user-assigned
Service level access – factory-set

Electrical

Power supply ranges

100 to 240 V AC max., 50 / 60 Hz ± 10 %
(90 to 264 V AC, 45/65 Hz)

Power consumption

<10W

Terminal connections rating

AWG 26 to 16 (0.14 to 1.5 mm^2)

Analog outputs

2 standard

2 optional

Galvanically isolated from the rest of the circuitry, 500 V for 1 minute. Range-programmable source and range 0 to 22 mA, maximum load 750 Ω @ 20 mA

Relay outputs

4 standard

2 optional

Fully-programmable. Contacts rated at 2A @ 110 / 240 V. Standard relays are changeover. Optional relays are normally closed (N/C).

Digital inputs / outputs

6 standard, user-programmable as input or output

Minimum input pulse duration: 125 ms

Input – volt-free or 24 VDC (conforms to IEC 61131-2)

Output – open-collector, 30 V, 100 mA max.
(conforms to IEC 61131-2)

Connectivity / communications

Ethernet (optional)

TCP/IP, HTTP

Data logging

Storage

Measurement value storage (programmable sample rate)

Audit Log*, Alarm Log*, Calibration log, Diagnostics log, Configuration changes

Chart view

On local display

Historical review

Of data

Data transfer

Secure digital (SD) card interface / USB stick – Windows-compatible FAT file system, data and log files in Excel and DataManager Pro compatible formats

**Audit Log* and *Alarm Log* data are stored in the same log file.*

DS/ASO550–EN Rev. F

11 Specification – wet-section

Mechanical data

Protection

IP54

Dimensions

Height – 668 mm (26.30 in), including solution bottles

Width – 290 mm (11.41 in) – door shut

Depth – 185 mm (7.28 in) door closed – minimum (excluding fixing brackets)

Weight – 4.5 kg (10 lb)

Electrical

Power supply ranges (supplied by transmitter)

24 V DC max.

Power consumption

8 W max.

DS/ASO550–EN Rev. E

Appendix A – Troubleshooting

A.1 Diagnostic messages

The transmitter is programmed to display diagnostic messages to provide information on servicing requirements and any other conditions that develop during operation.

All diagnostic messages displayed on the transmitter are added to the transmitter's *Audit Log*.

The tables below show icon types, diagnostic messages and possible causes / suggested remedial action.

Note. The diagnostic icons in the following tables conform to NAMUR 107.

Diagnostic Icon	NAMUR Status
	Failure
	Check function
	Out of specification
	Maintenance required

Icon	Diagnostic message	Possible cause and suggested action
	**ADC Failure (S1, S2, S3, S4)**	Wet-section failure (temporary or permanent failure of analog to digital converter for wet-section 1, 2, 3, 4). Cycle power to the transmitter. If problem persists replace electronics inside wet-section, contact local service organization.
	**Excessive Power**	The wet-section is drawing more current than available. The power being drawn from the transmitter exceeds the maximum permitted level. Check the wiring to all wet-sections connected for possible wiring problems. Check any digital outputs powered from the +24 V out terminal. Ensure the limits are not exceeded.
	**Int Comms Error**	Communication to wet-section failure Communication to one or all the wet-sections has failed during cyclic reads. Check wiring between transmitter and wet-sections.
	**No Samples**	**Sodium multi-stream only** No samples available (at wet-section). If a multiple wet-section setup, the transmitter cannot detect any samples flowing into the wet-section.
	**No Sample (S1, S2, S3, S4)**	No sample available (at wet-section). Check sample flow rates are >50 ml/min.
	**NV Error Comm Bd**	NV error – comms. board (CRC Comms.) Failure of non-volatile memory on communications board or permanent corruption of its data. Cycle power to the transmitter. If problem persists check all configuration parameters and correct any errors. If problem still persists contact local service organization.
	**NV Error Main Bd**	NV error – main board (CRC Comms.) Failure of non-volatile memory on main board or permanent corruption of its data. Cycle power to the transmitter. If problem persists check all configuration parameters and correct any errors. If problem still persists contact local service organization.
	**NV Error Proc Bd**	NV error – processor board (CRC Comms.) Failure of non-volatile memory on processor display board or permanent corruption of its data. Cycle power to the transmitter. If problem persists check all configuration parameters and correct any errors. If problem still persists contact local service organization
	**NV Error (S1, S2, S3, S4)**	Failure of wet-section (1, 2, 3, 4) non-volatile memory or permanent corruption of its data. Cycle power to the transmitter. If problem persists check all configuration parameters for all wet-sections and correct any errors. If problem still persists contact local service organization.

Table A.1 Diagnostic messages (Sheet 1 of 3)

Icon	Diagnostic message	Possible cause and suggested action
	**NV Error SW Key 1**	NV error – software key 1 (CRC Comms.) Failure of non-volatile memory on software key 1 board or permanent corruption of its data. Cycle power to the device. If problem persists check all configuration parameters and correct any errors. If problem still persists contact local service organization.
	**Temp Failure (S1, S2, S3, S4)**	Temperature sensor failure for wet-section1 (2, 3, 4). The temperature compensator or associated connections are either open-circuit or short-circuit. Check wiring temperature compensator connections to the PCB.
	**Calibrating (S1, S2, S3, S4)**	Calibrating. Displayed during calibration of wet-section (1, 2, 3, 4). On a multiple wet-section setup, this inhibits other wet-sections being calibrated.
	**In Hold Mode (S1, S2, S3, S4)**	Wet-section (1, 2, 3, 4) in manual hold mode via front panel. Analog outputs and alarms are held. To exit manual hold press the ⍂ key, scroll to *Manual Hold* and select the appropriate wet-section(s).
	**Recovery (S1, S2, S3, S4)**	Wet-section(s) performing a recovery stage after calibration, regeneration, or after exiting *Man.Valve Control* – see page 47. During the recovery period, outputs and alarms are held if *Hold Outputs* is enabled – see page 45.
	**Regeneration**	A regeneration routine is being run. Refer to Section 5.7, 28 for details of this routine.
	**Simulation On**	The analyzer is operating in *Simulation* mode.
	**Cal.Failed (S1, S2, S3, S4)**	Last wet-section calibration failed. Check reagent is entraining (bubbles at end of entrainment tube, check reagent is fresh). Check the calibration solution.
	**Flow Error (S1, S2, S3, S4)** *Displayed only if flowmeter is fitted*	Sample flow rate is less than 50 mlmin.(3.05 cu in.min.) Increase the sample flow to the wet-section.
	**Media Card Full**	Memory card is full, no more data can be saved to the card. Replace memory card.
	**Missed Cal. (S1, S2, S3, S4)**	Missed last schedule calibration.
	**PV Range (S1, S2, S3, S4)**	Process value (PV) measured is out of the specified range of the wet-section. 0 to 10,000 ppb.
	**Sample Cold (S1, S2, S3, S4)**	Sample solution temperature lower than 5 °C (41 °F). Increase the temperature of the sample.
	**Sample Hot (S1, S2, S3, S4)**	Sample solution temperature higher than 55 °C (131 °F). Reduce the temperature of the sample.

Table A.1 Diagnostic messages (Sheet 2 of 3)

Icon	Diagnostic message	Possible cause and suggested action
	**Media Near Full**	Memory card is more than 90% full. Replace memory card.
	**No Low Cal (S1, S2, S3, S4)**	Out of low calibration solution. Replace low calibration solution and start a calibration. **Note**. Displayed only if *Solution Detection* is enabled.
	**No High Cal (S1, S2, S3, S4)**	Out of high calibration solution. Replace high calibration solution and start a calibration. **Note**. Displayed only if *Solution Detection* is enabled.
	**No Regen.Sol (S1, S2, S3, S4)**	Out of regeneration solution. Replenish solution. **Note**. Displayed only if regeneration hardware is fitted and solution detection is enabled.
	**No Sample (S1, S2, S3, S4)**	**Sodium multi-stream only** No sample available at wet-section. Check sample flow rates are >50 ml/min.

Table A.1 Diagnostic messages (Sheet 3 of 3)

A.2 Calibration pass and fail limits

After a two point calibration, the percentage Slope is calculated. The calibration pass limits and their meanings are shown in Table A.2.

Any unexpected results may be due to the standard or reagent solutions. If doubts exist about the integrity of these solutions, replace them with freshly prepared solutions in the early stages of the fault-finding investigations.

The accuracy of the wet-section is affected by the condition of all the solutions involved, one or more of which can be incorrectly made or contaminated.

Measuring the pH of the effluent from the flowcell indicates the amount of buffering of the sample. The minimum pH depends on the minimum sodium concentration, but the pH value is calculated as shown below.

pH must be greater than pNa + 3, so ideally at:

100 µg kg^{-1} Na+, the pH must be greater than 8.4

10 µg kg^{-1} Na+, the pH must be greater than 9.4

1 µg kg^{-1} Na+, the pH must be greater than 10.4

0.1 µg kg^{-1} Na+, the pH must be greater then 11.4

Note. If the reagent is allowed to become completely exhausted, the reading may be very erratic due to the lack of ionic strength adjustment of the high purity sample.

Check mechanical components involved with liquid handing systematically for leaks or blockages as they change the chemical conditions around the electrode. Most problems are found to be associated with the chemistry, electrodes and the liquid handling section.

Percent slope	Action
Slope > 110 %	Calibration unacceptable. New coefficients ignored and the transmitter continues to use the last known good coefficients. Check correct calibration standards have been used. Check the correct calibration standard values have been entered into the transmitter.
80 % <Slope <110 %	Calibration acceptable. New coefficients are used saved and the transmitter uses these values for subsequent calculations.
Slope < 80 %	Calibration unacceptable. New coefficients are ignored and the transmitter continues to use the last known good coefficients. Check the correct calibration standards have been used. Check the correct calibration standard values have been entered into the transmitter. If solutions are satisfactory, replace the electrode pair.

Table A.2 Calibration pass limits

A.3 Checking the temperature input

1. Check that the wet-section responds to a temperature input. Disconnect the Pt1000 temperature compensator leads in the wet-section PCB (see Section 3.4.3, page 15) and connect a suitable resistance box to the wet-section PCB inputs.

   Note. Resistance boxes have an inherent residual resistance which may range from a few milliohms up to 1 ohm. This value must be taken into account when simulating input levels, as should the overall tolerance of the resistors within the box.

2. Check that the transmitter displays the correct values as set on the resistance box – see Table A.3. Incorrect readings usually indicate an electrical calibration problem.

Temperature °C (°F)	Resistance Ω
0 (32)	1000.0
10 (50)	1039.0
20 (68)	1077.9
30 (86)	1116.7
40 (104)	1155.4
50 (122)	1194.0
60 (140)	1232.4

Table A.3 Temperature readings for resistance inputs

3. If the readings checked at step 2 are correct, perform a resistance check on the Pt1000 temperature compensator and confirm the values are as shown in Table A.3.
4. If the readings are still incorrect, check the connector block cable connections at the wet-section PCB and their condition.

A.4 Incorrect or erratic flow rate readings

Incorrect or erratic flow rate readings may be due to a blockage in the flowmeter. Stop the flow of sample to the wet-section, remove the flowmeter and back-flush it with water or air. Re-connect the flowmeter, start the sample flow and check the flow reading. If the problem persists a replacement flowmeter may be required – see page 82.

A.5 Erratic sodium readings

If the sodium reading appears noisy/erratic carry out the following checks:

- check the entrainment of reagent is regular and not intermittent
- check the reagent has not become exhausted – either check the pH of the sample exiting the flow cell (see Section A.2, page 75 for ideal pH values) or install a fresh bottle of reagent solution.
- check the flow cell stud terminal (Fig. 2.1, page 6) is connected securely to a suitable earth (for example, the earth stud on the transmitter).

Appendix B – Multi-stream sodium wet-section

The sample streams enter the bottom of the wet-section (via flow meters if fitted), diverting sample to the sample valve manifold (mounted on the top of the bracket) and the calibration valve manifold to the constant-head unit. The solenoid valves are used to switch between sample streams. If a stream valve is energized the sample flows up to the constant-head unit via the manifold and is measured by the wet-section. If a stream valve is de-energized the sample is diverted directly to drain.

The sample time is the duration of time between the stream valve energizing and the corresponding stream value updating on the transmitter. Between updates the reading on each stream is held. The sample time is the same duration for all streams. The sample time is normally set to 15 minutes, but may need to be increased if the difference is sodium concentration between streams is significant or if an accurate low concentration reading is required. Table B.1 shows suggested sample times for different sodium concentrations.

Sodium concentration: previous stream (ppb)	Sodium concentration: current stream (ppb)	Recommended sampling times (minutes)	Upscale / Downscale change
0.1	5	20	Upscale
0.1	50	15	Upscale
5	50	10	Upscale
50	50	10	Upscale
5	0.1	35	Downscale
50	0.1	40	Downscale
50	5	10	Downscale
500	50	10	Downscale

Table B.1 Recommended sample times for sodium concentration values

The stream sequence is normally set to sample each stream in turn – for example, on a three stream wet-section the sequence would be set to 1, 2, 3. However, greater priority could be given to a particular stream (for example, stream 1) by programming the sequence 1, 2, 1, 3 or 1, 1, 1, 2, 3.

If only 1 stream is enabled the wet-section functions as a single-stream version and continuously measures the sodium concentration. This is useful for troubleshooting as there is a concentration update every second.

B.1 Multi-stream with flowmeters fitted

The flow rate measurements are used by the wet-section PCB to determine whether there is enough sample flow to measure each stream – it is advisable to ensure at least 100 ml/min of sample is supplied to each stream. The wet-section does not sample a stream if the flow rate drops below 50 ml/min.

If the sample flow rate is measured to be less than 50 ml/min, the *Flow Error* diagnostic activates for that stream (see page 73). If the sample flow rate drops below 50 ml/min while the stream is being sampled, the concentration value is not updated and the wet-section starts to sample the next available stream in the stream sequence.

If all streams are below the required flow rate of 50 ml/min, the *No Samples* diagnostic is displayed (see page 74). This situation should be avoided. If the wet-section is going to be without sample for extended periods the Shutdown Procedure should be followed – see Section 8.5, page 63.

B.2 Multi-stream with no flowmeters fitted

If during the sampling period the stream is detected to be *Out of Sample* via the *Out of Solution* pressure switch, the *No Sample* diagnostic activates for that stream, the stream valve is de-energized and the stream value is not updated (see Appendix A.1, page 72). The next enabled stream in the stream sequence is then sampled.

If all streams are detected to have no sample the *No Samples* diagnostic is displayed and the wet-section searches for an available stream. This procedure energizes each valve in the stream sequence for up to 14 seconds; this continues until a stream is detected to be in sample, it then continues to sample that available stream. The *No Samples* situation should be avoided. If the wet-section is without sample for extended periods, follow the shutdown procedure – see Section 8.5, page 63.

Appendix C – Multiple wet-section setup

A single Navigator 540 transmitter can monitor up to 4 wet-sections. The wet-sections can be any combination of the three Navigator 500 parameters – sodium, low level dissolved oxygen and hydrazine. Note that the transmitter cannot monitor more than 1 wet-section if the wet-section is a multi-stream sodium.

If an additional wet-section is added to a transmitter, the procedures in Sections C.1 and C.2 must be performed.

C.1 Configuring the device address

The unique device address assigned to the wet-section (1 to 4), enables the transmitter to identify the wet-section on the data transmission link. Each wet-section must have its own unique address. The address can be set by SW1 as shown in Table C.1 and Fig. C.1. LEDs D4 and D5 indicate the slave address of the PCB.

Slave address	SW1.1	SW1.2	LED D4	LED D5
1	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	ON
3	ON	OFF	ON	OFF
4	ON	ON	ON	ON

Table C.1 Configuring the device address

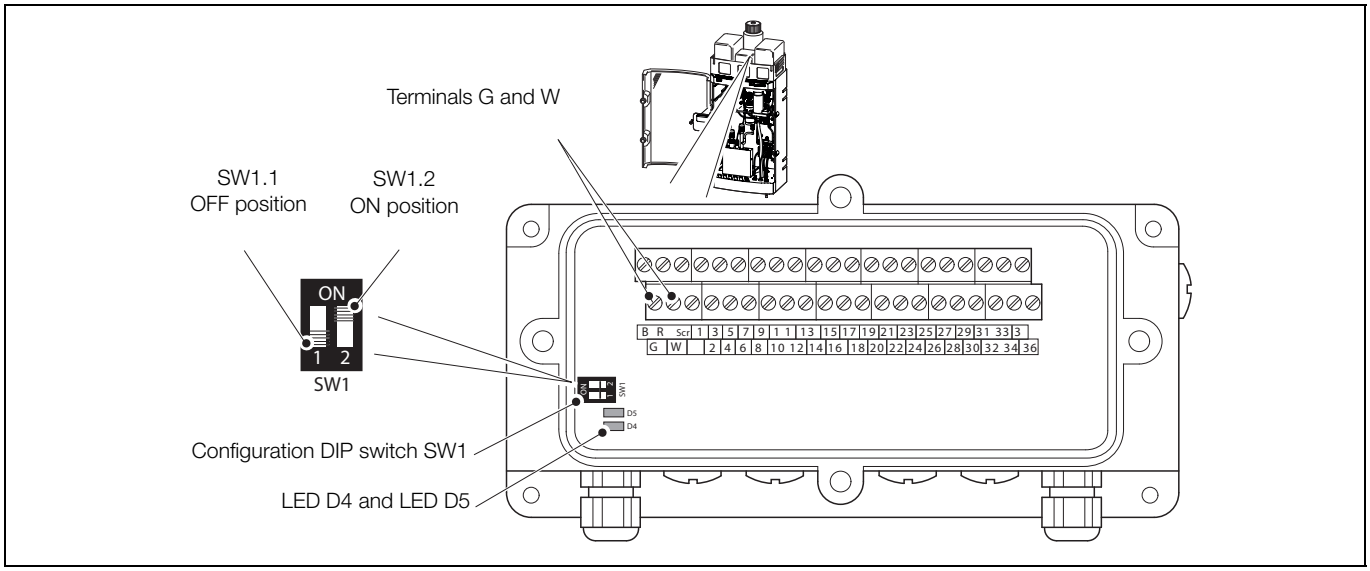


Fig. C.1 Configuration DIP switch SW1 and LED D4 / D5 location

C.2 Serial connections

Each wet-section must be connected in a 'daisy chain' format as shown in Fig. C.2.

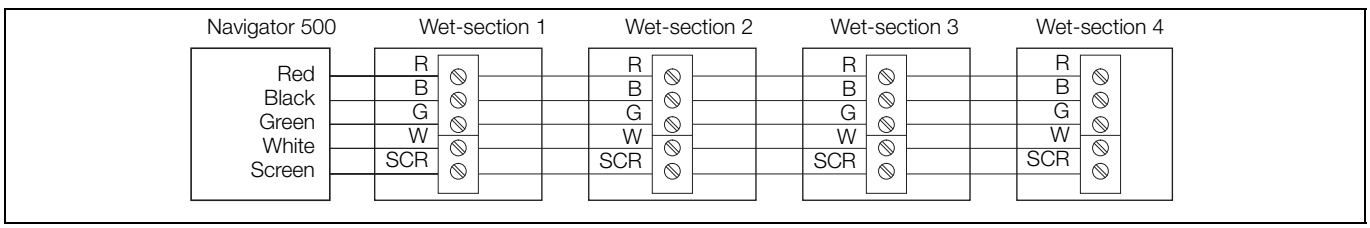


Fig. C.2 Serial connections

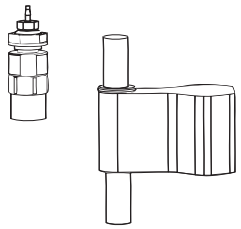
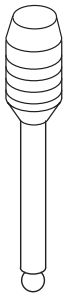
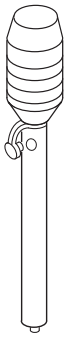
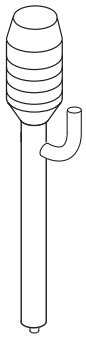
Note. The total cable length between the transmitter and the last wet-section must not exceed 30 m (98 ft.).

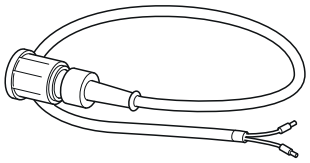
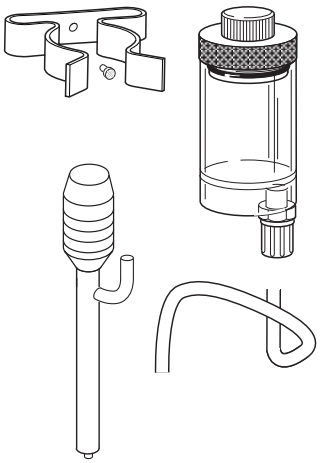
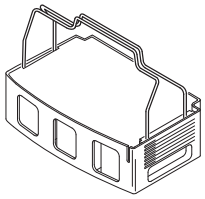
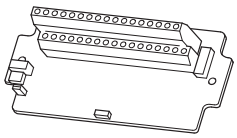
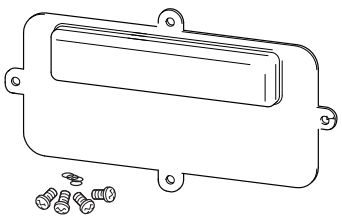
Appendix D – Spare parts and consumables

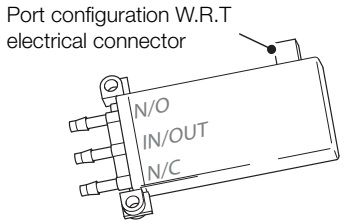
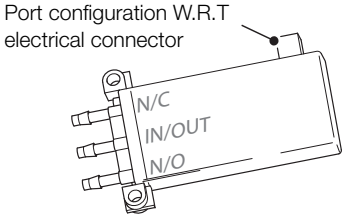
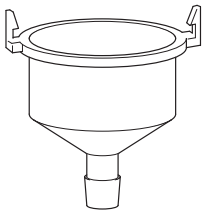
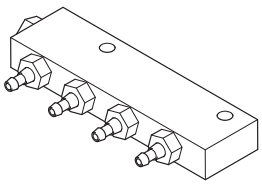
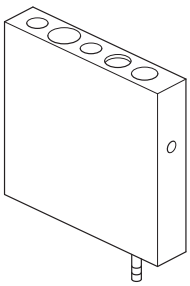
D.1 Navigator 500 sodium consumables

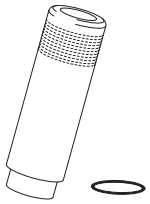
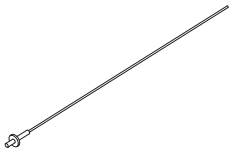
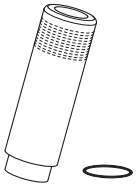
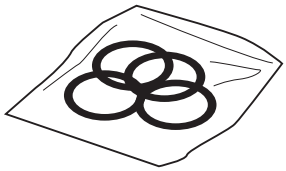
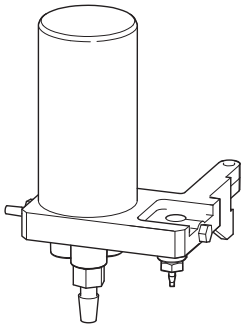
Part No. / Type	Usage / Volume
AWRS5000101 Sodium reagent – ammonia	General purpose sodium measurements for concentrations above 0.5 ppb. Provides up to 30 days of continuous operation. Shelf life 18 months – also available as a kit (AWRK5000111, see below).
AWRS5000102 Sodium reagent – DIPA	For low level sodium measurements (less than 0.5 ppb) and cation bed applications. Provides up to 8 weeks of continuous operation. Shelf life 1 year – also available as a kit (AWRK5000112).
AWRS5000103	Sodium regeneration solution. Provides approximately 15 automatic regenerations. Shelf life 1 year – also available as a kit (AWRK5000113).
AWRS5000104	Navigator 500 sodium standard – 100 ppb sodium / 1 x 1 liter bottle.
AWRS5000105	Navigator 500 sodium standard – 1000 ppb sodium / 1 x 1 liter bottle.
AWRK5000111 Sodium reagent kit – ammonia	General purpose sodium measurements. 6 x 1 liter bottles of ammonia solution (AWRS5000101). Provides up to 6 months operation. Shelf life 18 months.
AWRK5000112 Sodium reagent kit	Provides up to 12 months operation. DIPA 6 x 1 liter bottles. Shelf life 1 year.
AWRK5000113 Sodium regeneration kit	4 x 0.5 liter bottles.
AWRK5000114 Sodium standards kit	6 x 1 liter bottles 100 ppb. 6 x 1 liter bottles 1000 ppb.

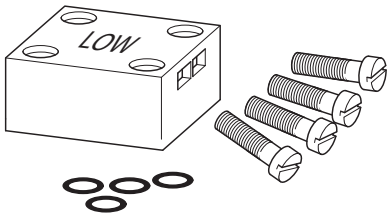
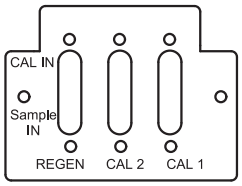
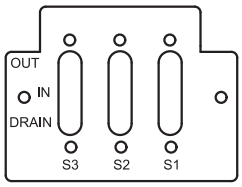
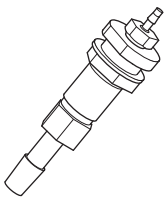
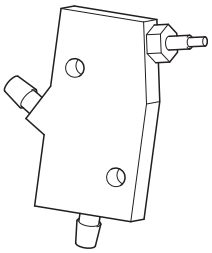
D.2 Navigator 500 sodium wet-section spares

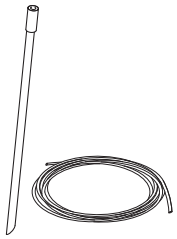
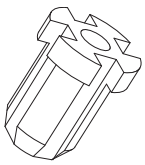
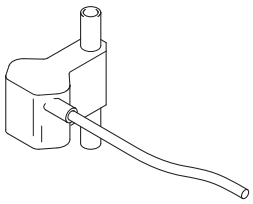
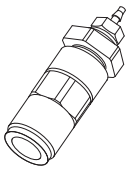
Part No.	Description
AW500 040	Flowmeter upgrade kit 
AW501 030	ASO550 sodium electrode 
AW501 035	ASO550 reference electrode for non reservoir-fed systems 
AW501 036	ASO550 reference electrode for reservoir-fed systems 

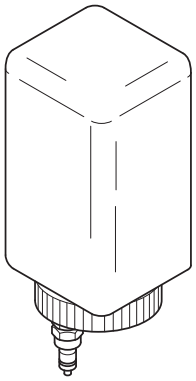
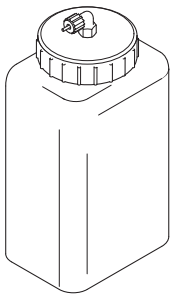
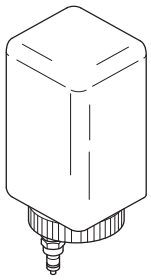
Part No.	Description
1048880	Sodium electrode cable assembly 
AW501 037	Reservoir-fed electrode upgrade kit 
AW501 040	Bottle carrier assembly, including handles (accessory) 
AW501 050	Sodium wet-section PCB 
AW501 051	PCB housing seals 
AW501 052	Terminal cover, O-ring and screws 

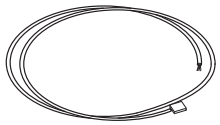
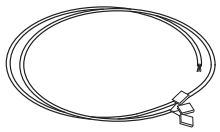
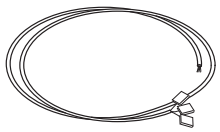
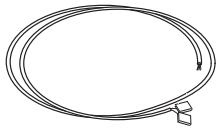
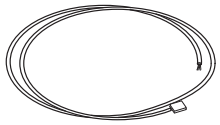
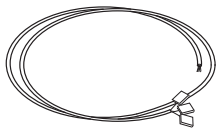
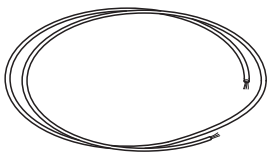
Part No.	Description
AW501 053	Solenoid valve – Multi-stream Cal / Stream switch 
AW501 077	Solenoid valve – Single-stream, stream diversion 
AW501 054	Funnel – drain 
AW501 055	Multi-stream manifold assembly 
AW501 056	Flowcell assembly 

Part No.	Description
AW501 057	Sodium electrode sleeve and O-ring 
AW501 058	Pt1000 assembly (sodium) plus O-ring 
AW501 059	Pt1000 sleeve and O-ring 
AW501 060	O-ring pack (4off) – Pt1000 and electrodes 
AW501 061	Constant head assembly including connectors and O-ring 

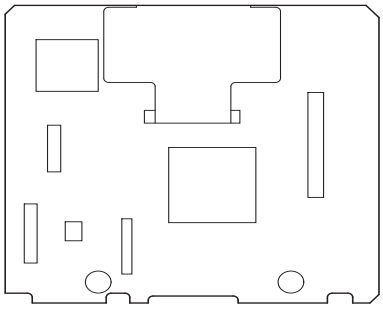
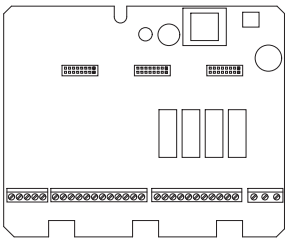
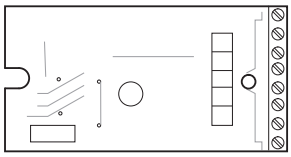
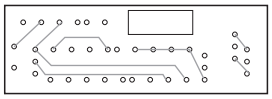
Part No.	Description
AW501 062	Pressure switch assembly (2 in.set point) including O-ring and fasteners 
AW501 063	Solenoid valve mounting plate, calibration and stream switching  
AW501 064	Sample adaptor kit – non-flowmeter 
AW501 065	Entrainment piece assembly 

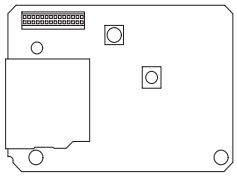
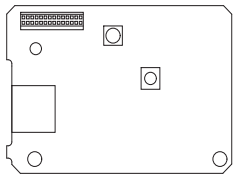
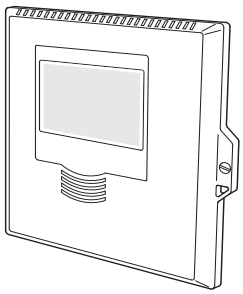
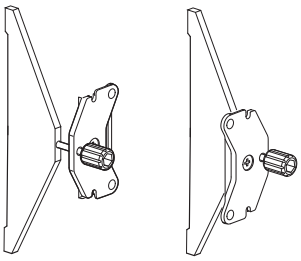
Part No.	Description
AW501 066	Entrainment tube and connecting tubing 
AW501 067	Entrainment tube centralizing collar 
AW501 068	Flowmeter – sodium 
AW501 069	Flowmeter adaptor kit 
AW501 075	Tubing kit (includes tubing supplied in AW501 076) – required for 12-monthly maintenance, (see Section 8.2.3, page 61)
AW501 076	Calibration and reagent solution tubing only kit – required for 12-monthly maintenance (see Section 8.2.3, page 61)

Part No.	Description
AW501 070	Calibration solution bottle kit assembly – includes hazard labels: Calibration Solution 1 and Calibration Solution 2 
AW501 071	Reagent solution bottle kit assembly – includes hazard labels for Ammonia solution and separate hazard label for Di-isopropylamine (DIPA) solution 
AW501 072	Regeneration solution bottle kit assembly – includes hazard label 

Part No.	Description
AW501 080	Cable assembly – single-stream sodium solenoid valve 
AW501 081	Cable assembly – multi-stream sodium solenoid valve 
AW501 082	Cable assembly – calibration and reagent solenoid valve 
AW501 085	Cable assembly – pressure switch 
AW501 086	Cable assembly – flowmeter single-stream 
AW501 087	Cable assembly – flowmeter multi-stream 
AW501 090 AW501 091 AW502 092 AW502 093	Modbus cable assembly: 1.5 m (4.9 ft.) 5 m (16.4 ft.) 10 m (32.8 ft.) 20 m (65.6 ft.) 

D.3 Navigator 540 transmitter

Part No.	Description
AW500 050	AWT processor board spares kit 
AW500 051	AWT main board spares kit 
AW500 052	AWT sensor input PCB (Digital RS485) 
AW500 053	AWT analogue output PCB (2 current outputs + relays) 

Part No.	Description
AW500 054	AWT SD media PCB spares kit 
AW500 055	AWT USB media PCB spares kit 
AW500 056	Door assembly spares kit 
AW500 058	AWT Profibus DPV1 PCB 
AW500 060	AWT panel-mount kit 

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