Navigator 500

Low level dissolved oxygen analyzer

Measurement made easy

—
Navigator 500 low level dissoved oxygen analyzer

Introduction

The Navigator 500 low level dissolved oxygen 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 540 transmitter and a Navigator 550 low level dissolved oxygen wet-section.

For more information

Further publications for the Navigator 500 low level dissolved oxygen 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 Low level dissolved oxygen wet-section	CI/ADS550-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 and 551 low level dissolved oxygen wet-section

The Navigator 550 and 551 dissolved oxygen wet-section operates on 24V DC supplied from the transmitter.

There are no hazardous voltages present.

There are no chemical or burn hazards and Protective Personal Equipment (PPE) is not required.

1.2.2 Navigator 540 transmitter

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) can 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 low level dissolved oxygen wet-section

Symbols that appear on this product are shown below:

	Direct current supply only.
	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 instruments 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 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 wet-section to measure levels of low level dissolved oxygen, sodium or 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 6.6, 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 and current output diagnostic functions using optional Ethernet communications.

The transmitter has a multiple wet-section capability that 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.

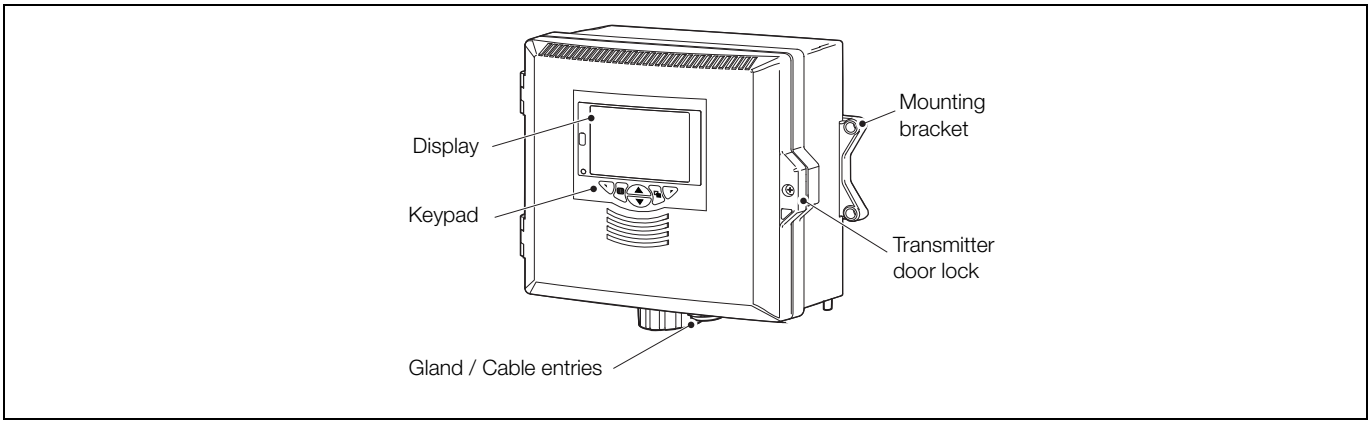


Fig. 2.1 Navigator 540 transmitter – main components

2.2 Navigator ADS550 wet-section

The Navigator ADS550 low level dissolved oxygen 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.

The wet-section contains the measurement cell and calibration valve, along with the electronics that stores the calibration data and calculates the concentration reading. The information from the wet-section is sent to the transmitter via Modbus communications.

The ADS550 wet-section uses an electrochemical cell to measure the amount of dissolved oxygen in water. It is an accurate reliable wet-section requiring minimum routine maintenance. Calibration is achieved by exposing the sensor to air saturated with water – therefore there is no need for calibration solution. A calibration can be manually initiated when required or set to automatic with the programmable frequencies ranging from 1 day to 2 months.

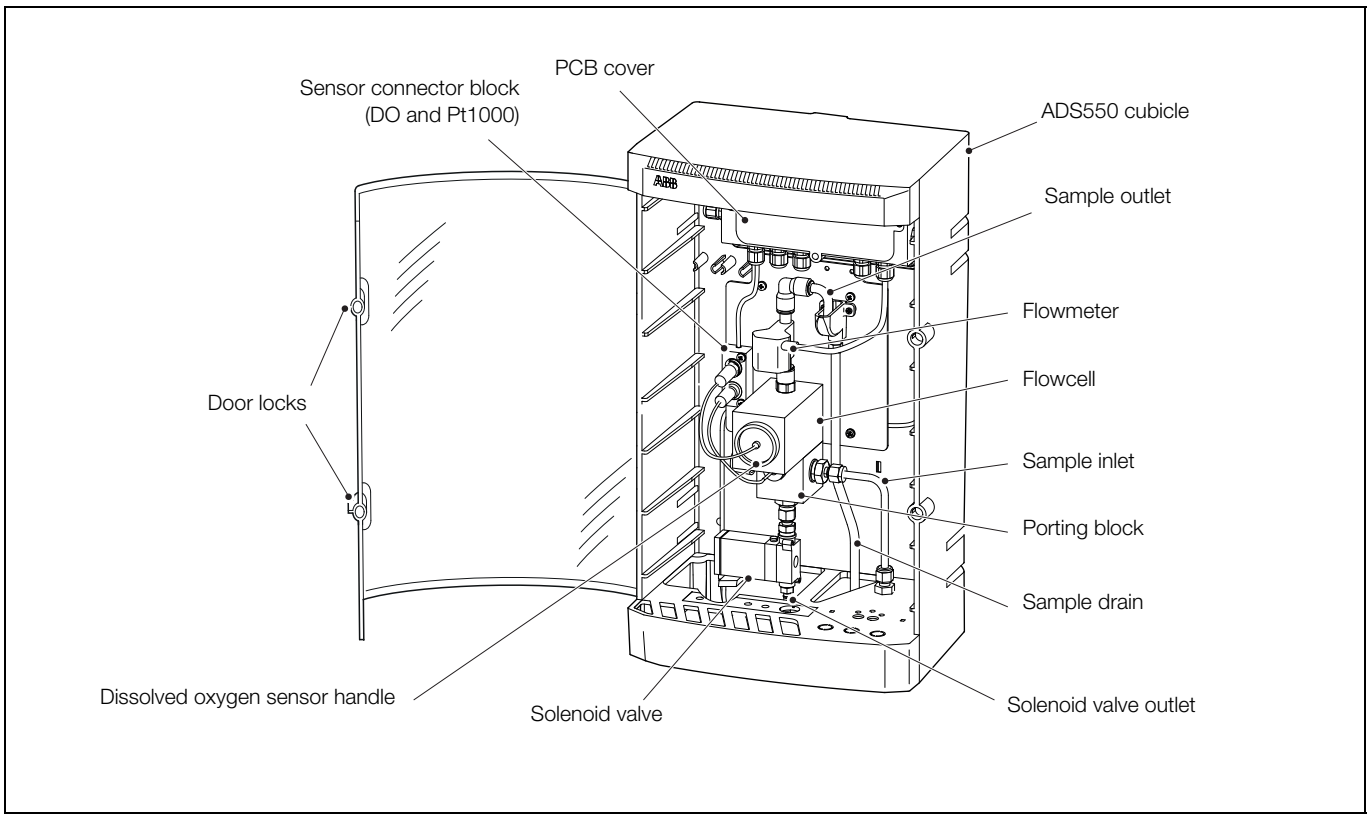


Fig. 2.2 ADS550 low level dissolved oxygen wet-section – main components

2.3 Navigator ADS551 flowcell

The Navigator ADS551 flowcell assembly for low level dissolved oxygen 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. The flowcell assembly has an integral PCB housing for communication to the transmitter via Modbus protocol.

The flowcell is available in the following configurations (sample line connection options comprise: 1/4 in. or 6 mm pipe sizes):

- basic
- with calibration valve
- with flowmeter
- with flow control needle valve

The ADS551 flowcell assembly uses an electrochemical cell to measure the amount of dissolved oxygen in water. It is an accurate reliable wet-section requiring minimum routine maintenance. Calibration is achieved by exposing the sensor to air saturated with water – therefore there is no need for calibration solution. A calibration can be manually initiated when required or set to automatic with the programmable frequencies ranging from 1 day to 2 months

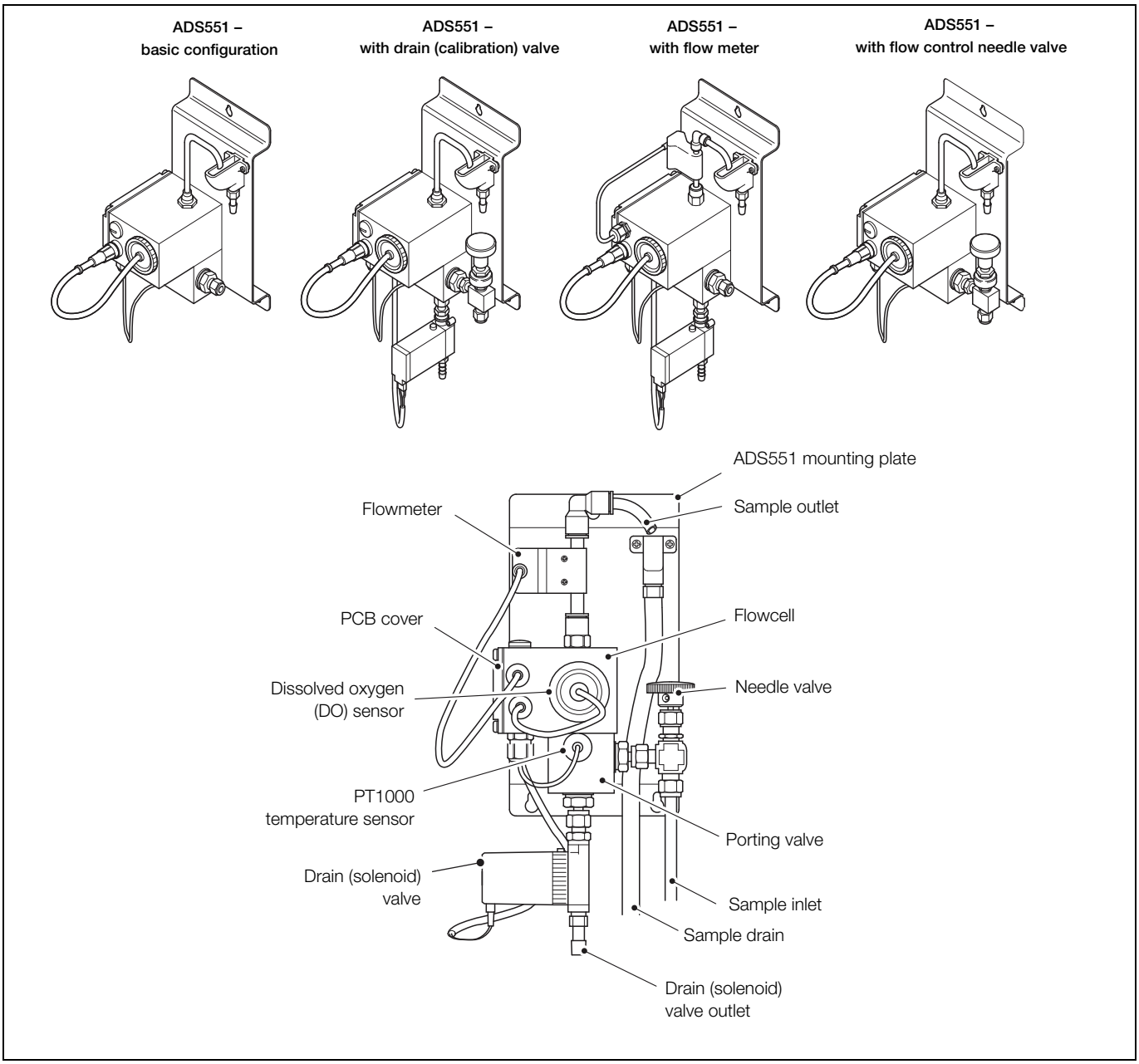


Fig. 2.3 ADS 551 low level dissolved oxygen wet-section – configuration options

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).

> **Note.** If the measured sample temperature exceeds 55 °C (131 °F), the calibration valve opens automatically to protect the dissolved oxygen sensor from thermal overload. The valve closes after 30 minutes, but if the sample temperature still exceeds 55 °C (131 °F) the valve re-opens.

- Sample flow rates must be within the range 100 to 300 ml/min (6.10 to 18.30 cu in./min) – recommended 150 ml/min (9.15 cu in./min).
- Sample pressure must not exceed 2 bar gauge (29 psi).

3.1.2 Location

For general location requirements refer to Fig. 3.1. Install both the transmitter and wet-section indoors, 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.

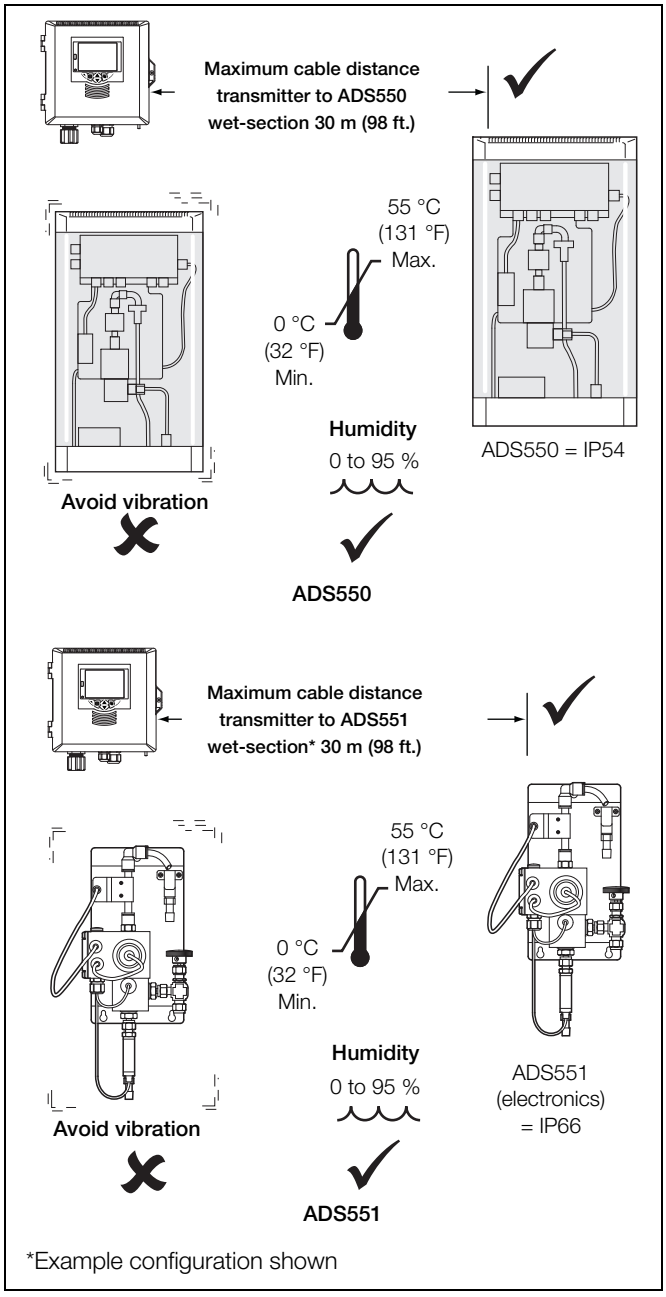


Fig. 3.1 Locating the wet-section

3.1.3 Mounting the ADS550 wet-section cubicle

Refer to Fig. 3.2 for ADS550 cubicle dimensions. The cubicle with wet-section weighs 4.5 kg (10 lb).

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

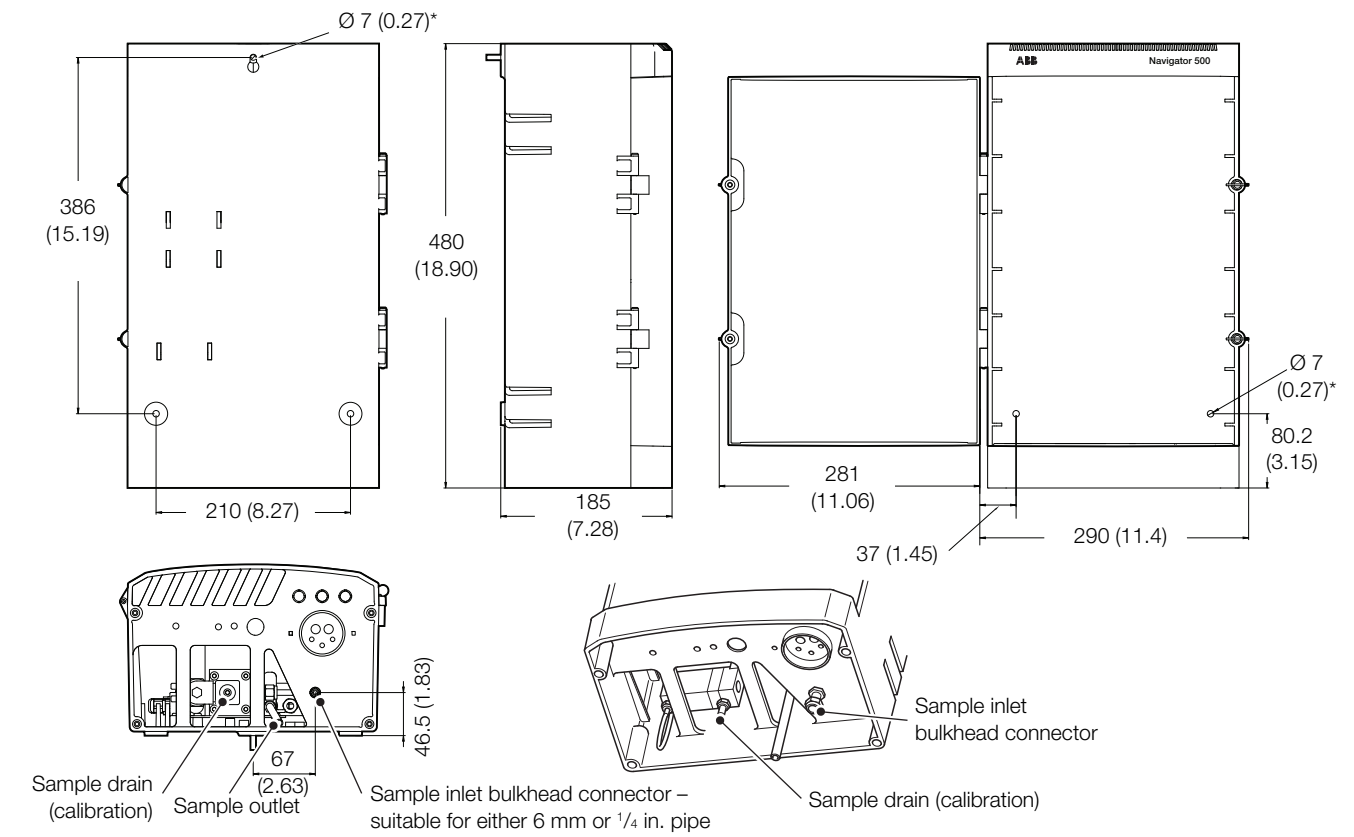


Fig. 3.2 ADS550 wet-section cubicle dimensions

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).

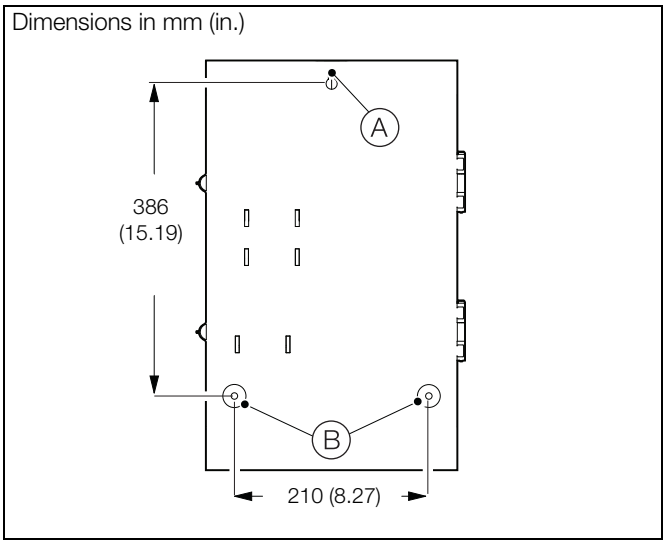


Fig. 3.3 Mounting the ADS550 wet-section cubicle

3.1.4 Mounting the ADS551 wet-section

Refer to Fig. 3.4 for ADS551 wet-section / mounting panel dimensions. The wet-sections weigh:

- basic 1.1 kg (2.4 lb)
- with calibration valve 1.2 kg (2.6 lb)
- with flowmeter 1.2 kg (2.6 lb)
- with flow control needle valve 1.2 kg (2.6 lb)
- all options selected 1.3 kg (2.8 lb)

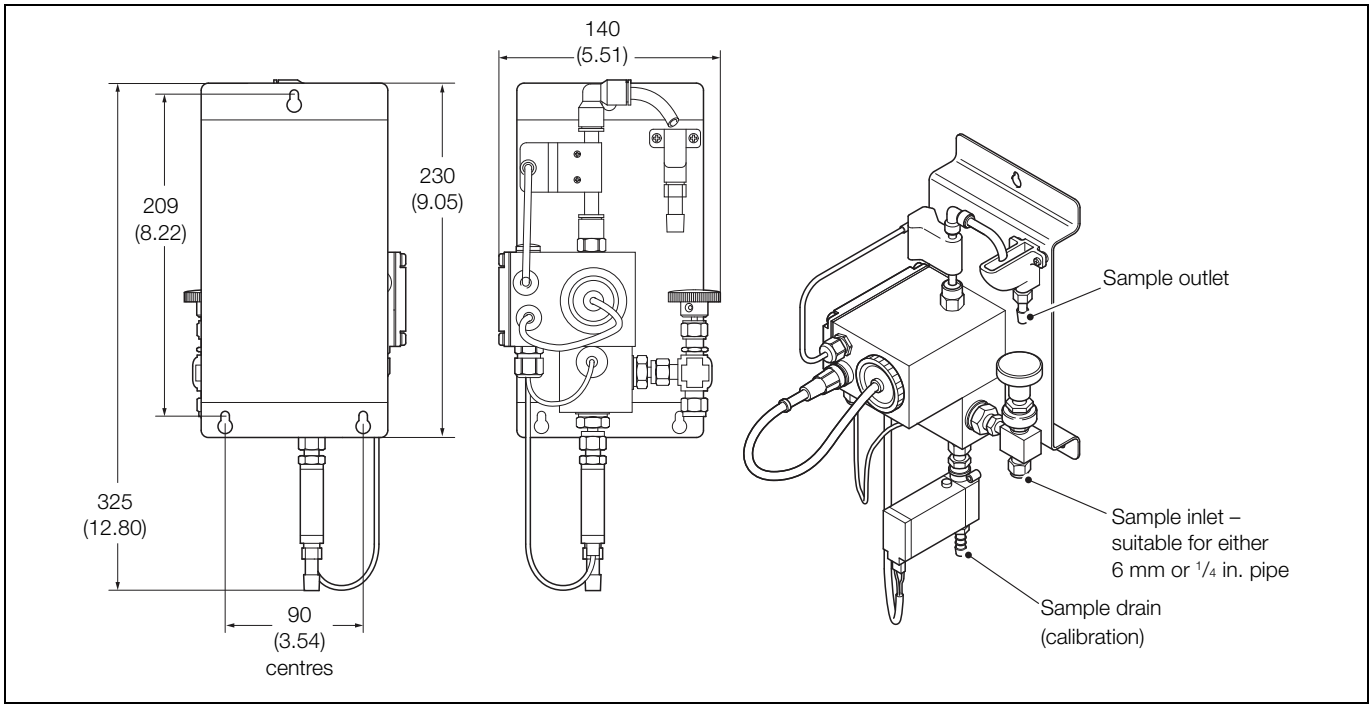


Fig. 3.4 ADS551 wet-section / mounting panel dimensions

Referring to Fig. 3.5:

1. Mark the wall using the dimensions shown.
2. Drill and plug 3 holes (A) and (B) in the wall suitable for M5 or 3/16 in. fixings.
3. Screw in top fixing (A), bottom fixings (B) leaving a gap of 20 mm (0.78 in.) between the fixing heads and the wall.
4. Hang the panel onto fixings (A) and (B) ensuring the panel is retained firmly against the wall.
5. Secure fixings (A) and (B) the panel to the wall.

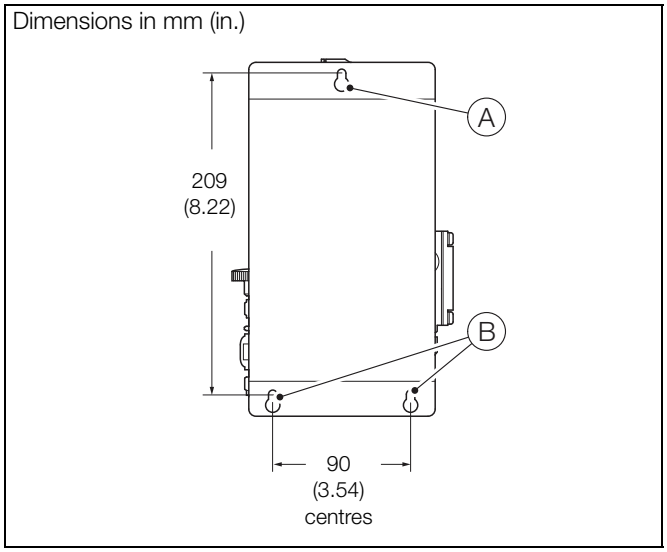


Fig. 3.5 Mounting the ADS551 wet-section panel

3.1.5 Connecting the sample lines

Note.

- Sample inlet tubing, sample outlet tubing and drain tubing is customer-supplied.
- Stainless steel is highly recommended for sample inlet lines as it prevents ingress of oxygen via the sample tubing. Nylon tubing has a low oxygen permeability and can be used as an alternative to stainless steel, but stainless steel is the preferred option.
- All sample drains must be kept as short as possible and be vertical to enable the sample to drain freely during a calibration routine.
- Ensure the drain tubing outlet is open to atmosphere.

Referring to Fig. 3.6:

1. Connect the sample outlet tubing (A) using flexible PVC tubing 10 mm (3/8 in.) ID fitted to barbed connector (B) at the base of sample outlet (C).
2. Connect the drain tubing (D) using flexible PVC tubing 10 mm (3/8 in.) ID fitted to the barbed connector at the base of drain valve (E).
3. Connect sample inlet tubing (F) (typically stainless steel), 6 mm or 1/4 in. OD (depending on customer requirement) to the bulkhead (ADS550) / needle valve (ADS551) connector (G). Alternatively, nylon tubing 6 mm or 1/4 in. OD could be fitted with suitable inner support fitting.

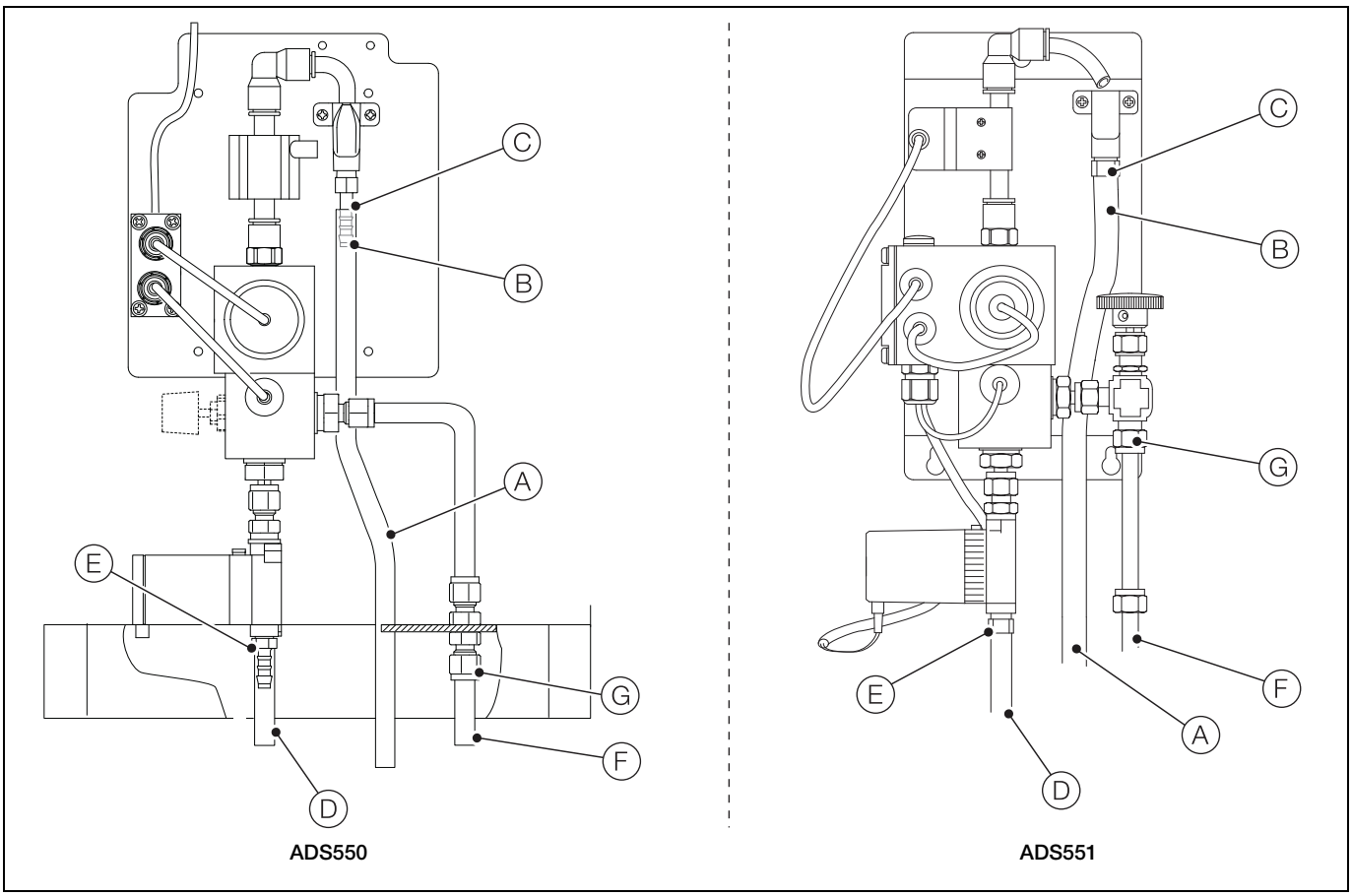


Fig. 3.6 Connecting the sample lines

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. 3.7. 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.

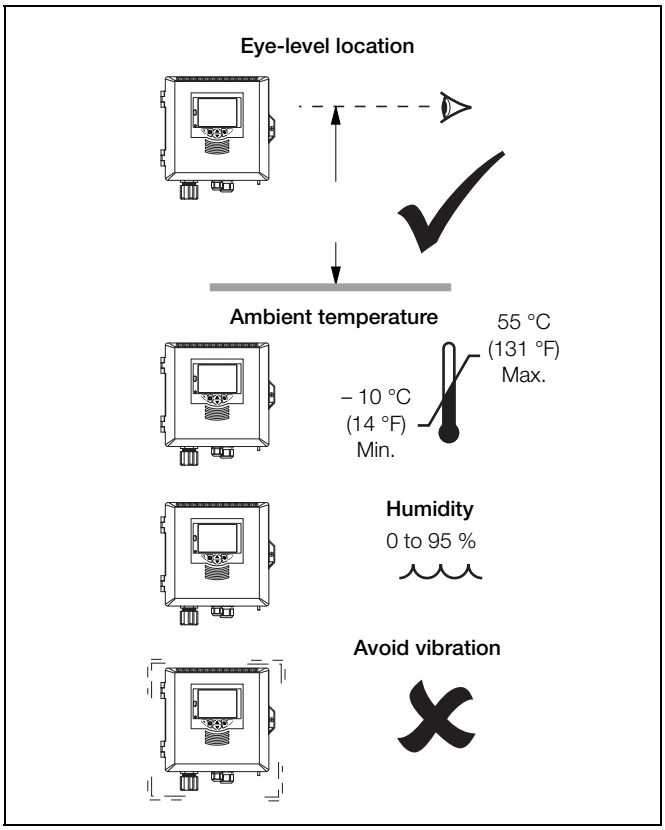


Fig. 3.7 Transmitter location

3.2.3 Panel mounting

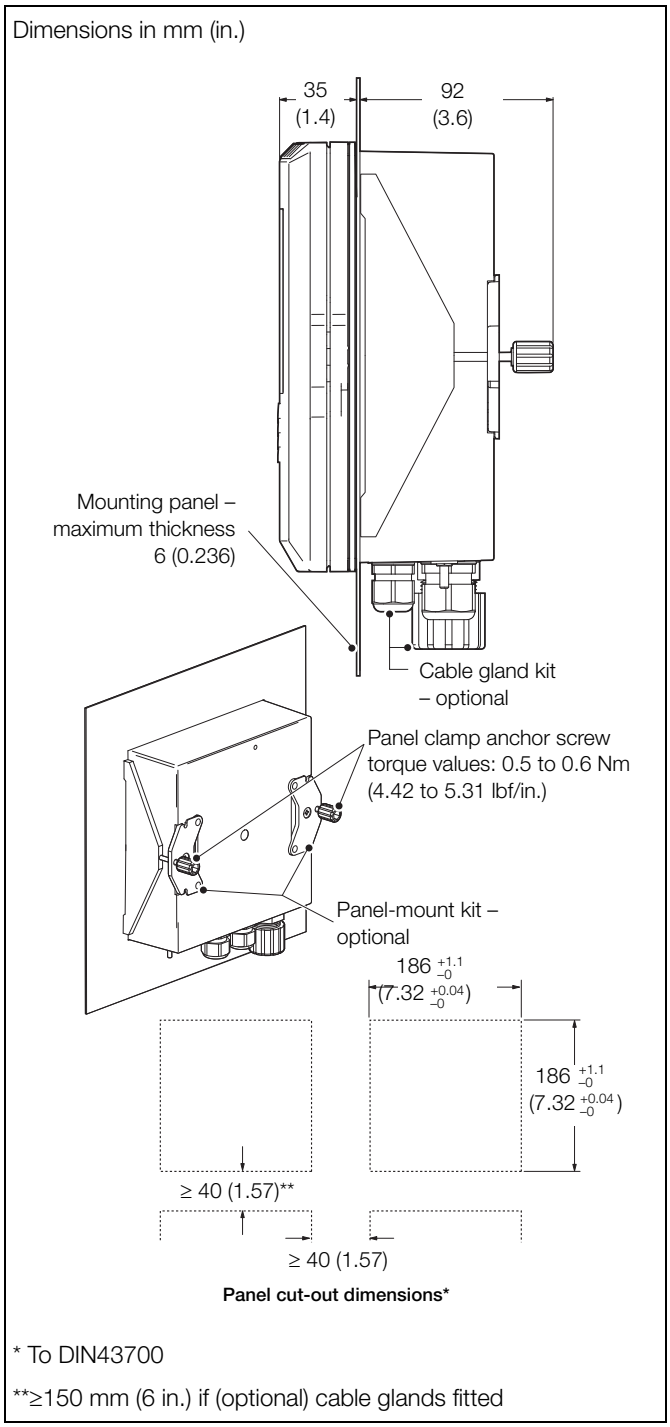


Fig. 3.8 Transmitter panel-mount option

3.2.4 Pipe mounting

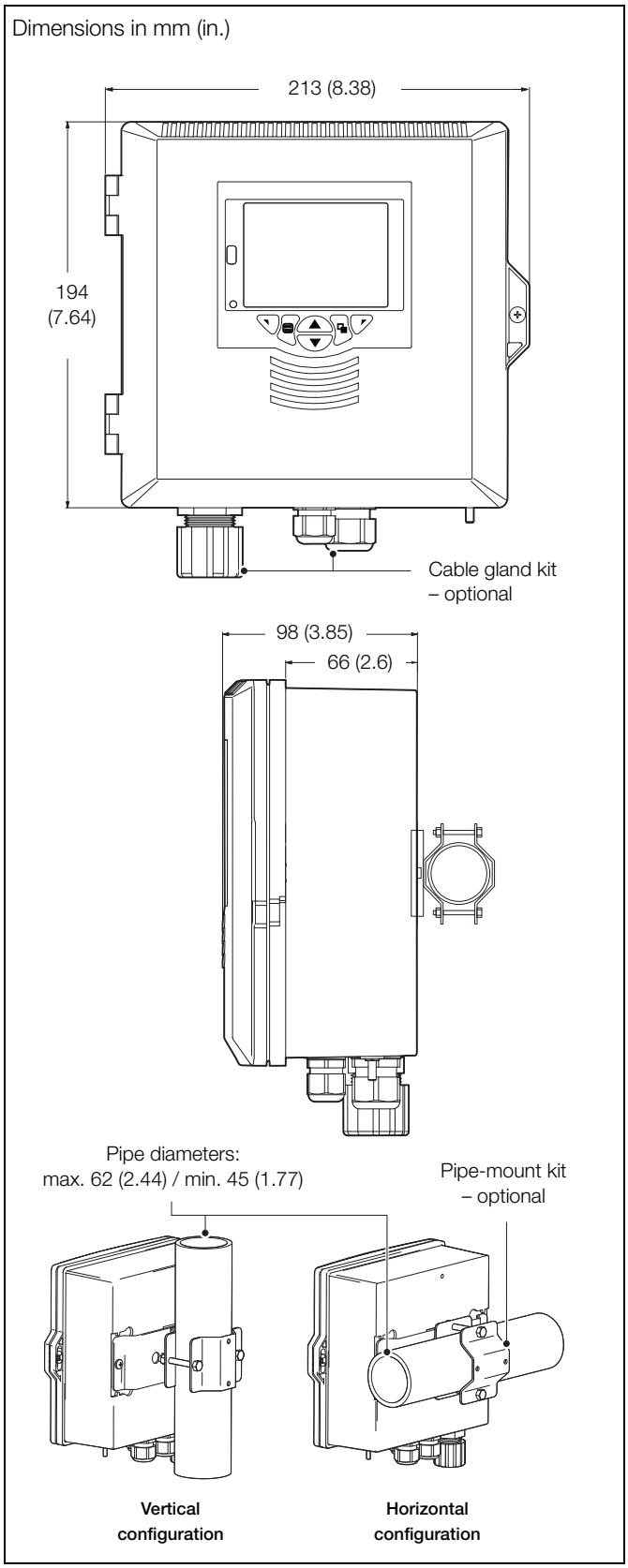


Fig. 3.9 Transmitter pipe-mount options

3.2.5 Wall mounting

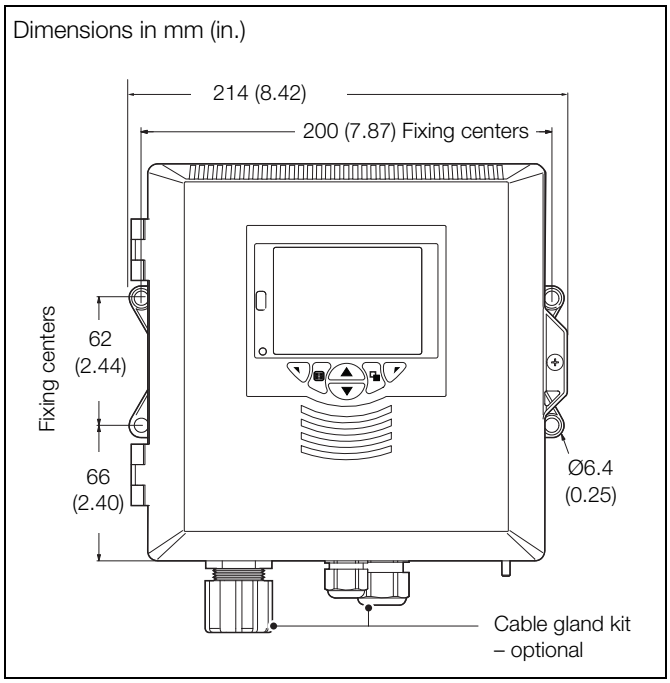


Fig. 3.10 Transmitter wall-mount option

3.3 Multiple wet-section setup

Fig. 3.11 shows the multiple wet-section setup – 4 wet-sections maximum (ADS550 wet section type shown for example only).

Note.

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

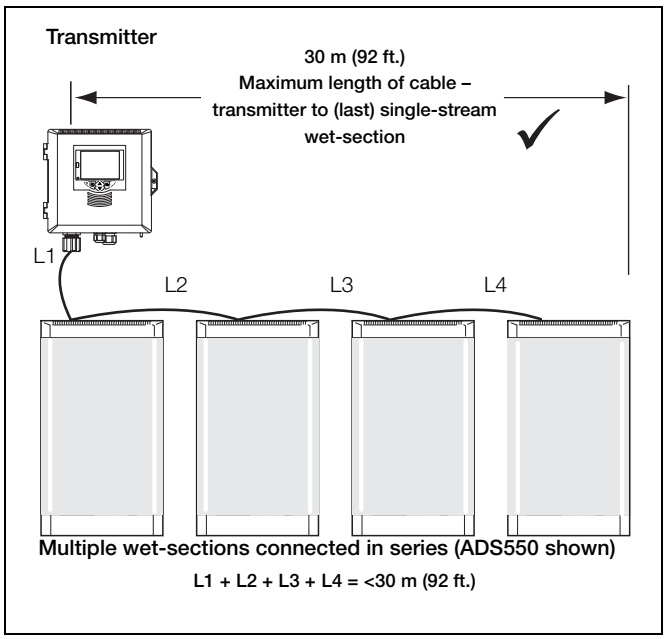


Fig. 3.11 Multiple wet-section setup – maximum cable length

3.4 Electrical connections – wet-section

3.4.1 Accessing the wet-section PCB – ADS550

This section is applicable only to 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 B, page 64.
- 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. 3.12:

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. Remove the blanking plug by loosening the gland nut, feed the supplied communications cable through the cable gland and make the connections shown in Fig. 3.13, page 15.

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

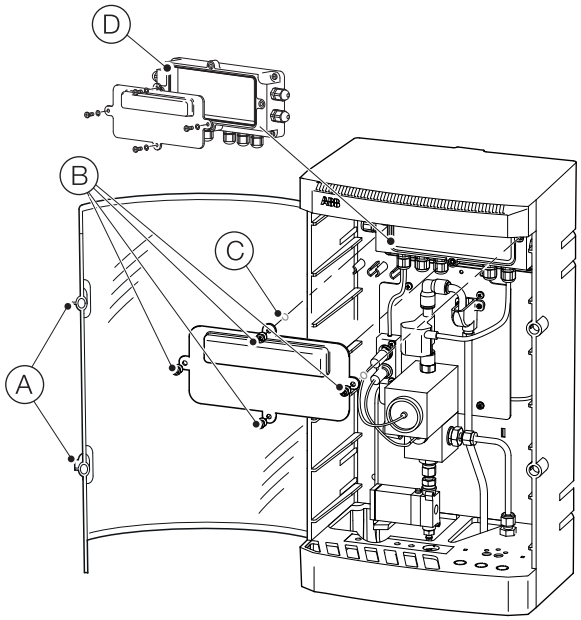
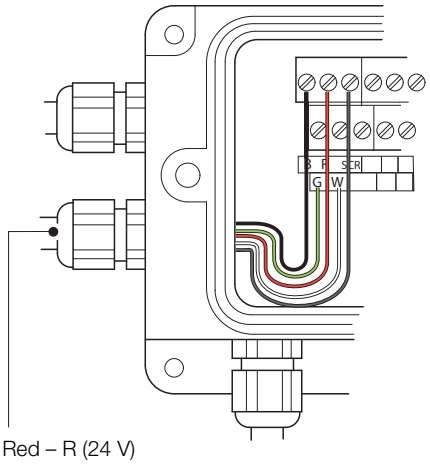


Fig. 3.12 Accessing the wet-section PCB

3.4.2 Wet-section PCB connections – ADS550

Note.

- Refer to Section 3.5.2, page 20 for connection details at the transmitter.
- Serial cable connections at each additional wet-section are made into the same terminal IDs as the factory-fitted serial cable.
- Refer to Appendix B, page 64, for multiple wet-section setup and serial connection details.



Red – R (24 V)
Black – B (0 V)
Green – G (Data +ve)
White – W (Data –ve)
Screen – SCR

Fig. 3.13 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
Drain valve	Red	9	+ve
	Black	10	–ve
Flowmeter	Red	13	+ve
	Brown	15	GND
	Black	17	–ve
Sensor block	Blue	31	+ve LLDO sensor
	Red	32	–ve LLDO sensor
	Black	33	Pt1000
	Yellow	35	Pt1000

Table 3.1 Factory-made connections

3.4.3 Accessing the wet-section PCB – ADS551

This section is applicable only to 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 B, page 64.
- 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. 3.14:

1. Remove the 4 screws and washers (A) and remove and retain PCB cover (B) and housing gasket (C).

Note. When refitting the cover, ensure seal (C) is located correctly on the housing.

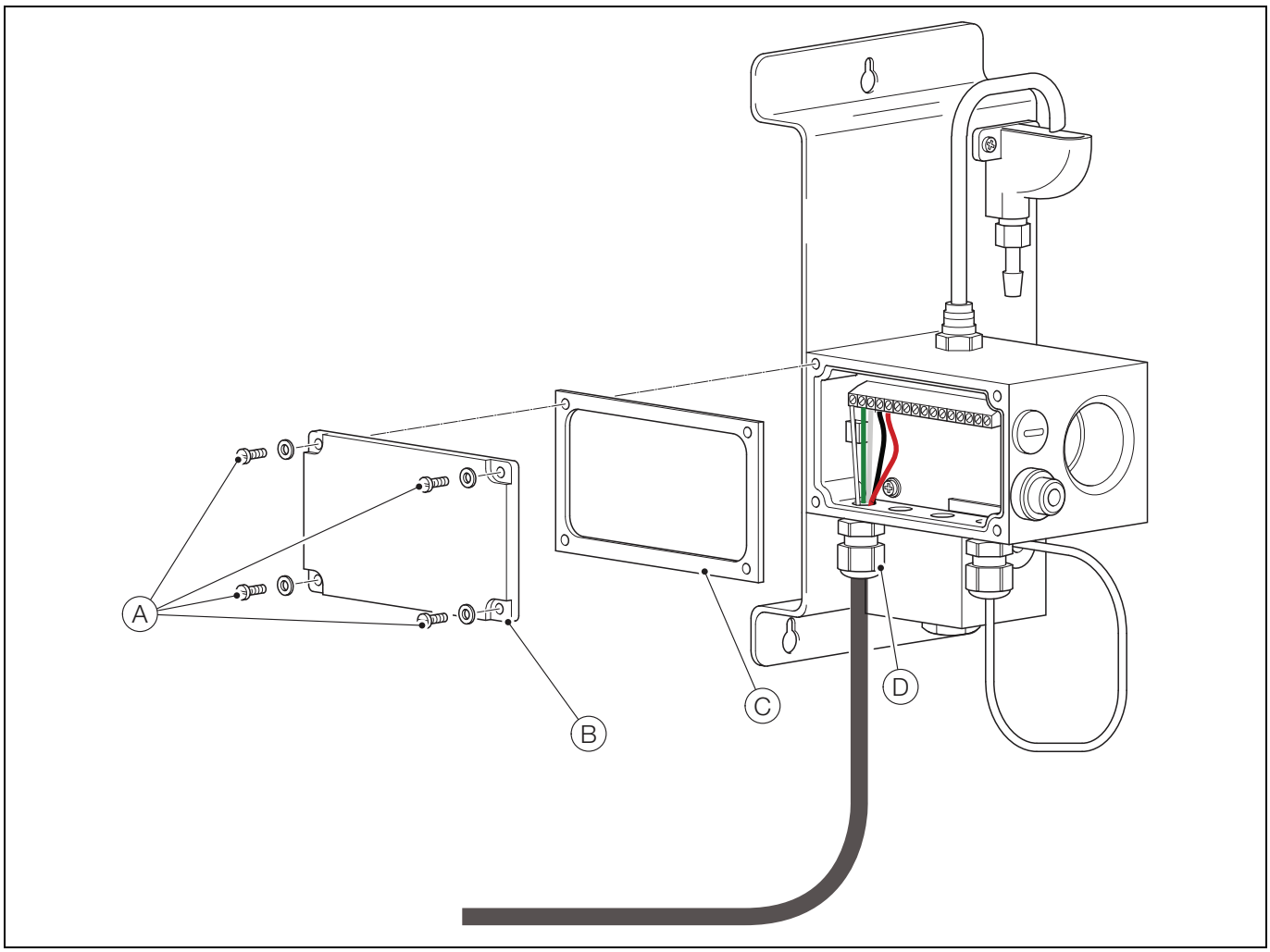


Fig. 3.14 Accessing the wet-section PCB – ADS551

3.4.4 Wet-section PCB connections – ADS551

Note.

- Refer to Section 3.5.2, page 20 for connection details at the transmitter.
- Serial cable connections at each additional wet-section are made into the same terminal IDs as the factory-fitted serial cable.
- Refer to Appendix B, page 64, for multiple wet-section setup and serial connection details.

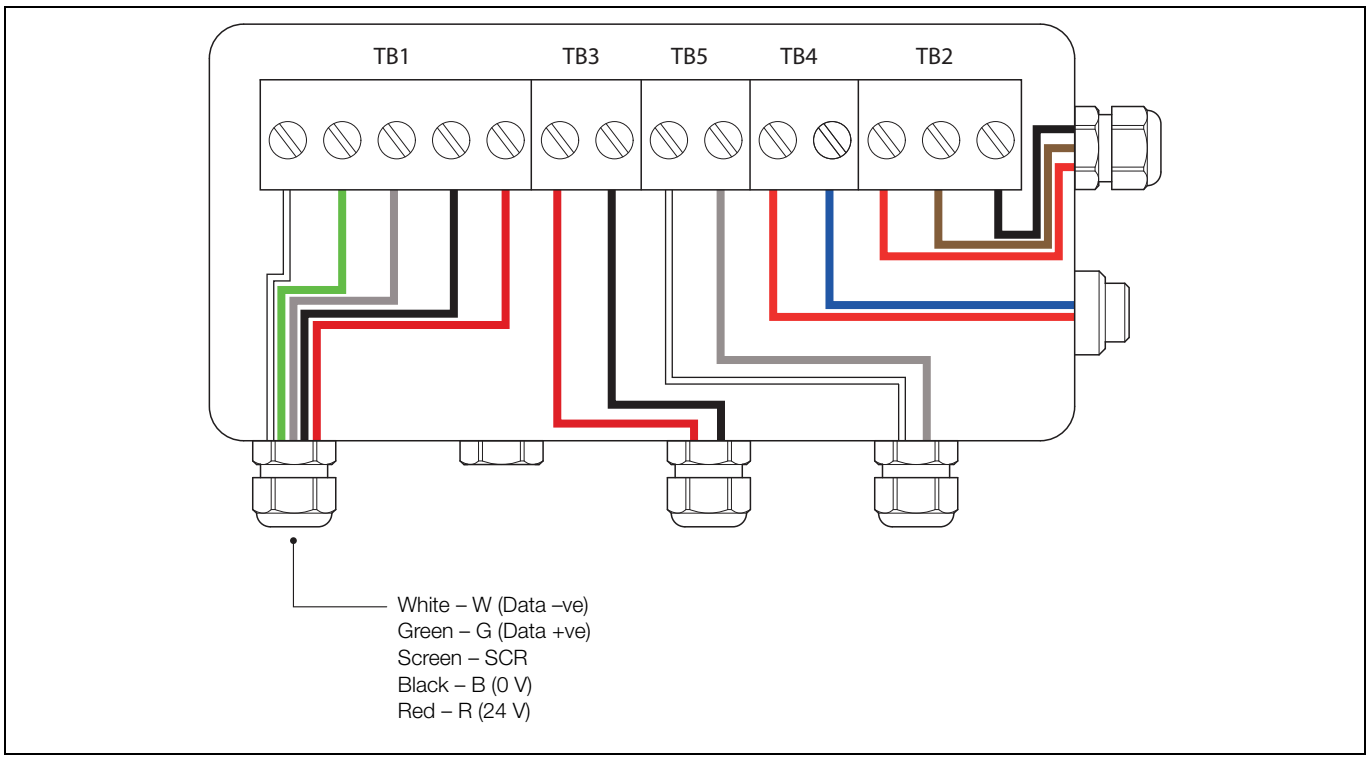


Fig. 3.15 Additional serial cable connections to multiple wet-sections – ADS551

Cable	Color	Terminal block ID	Description
Serial	White	TB1	Data –ve
	Green		Data +ve
	Screen		Screen
	Black		0 V
	Red		24 V
Drain valve	Red	TB3	+ve
	Black		–ve
Temp sensor	White	TB5	Pt1000
	Screen		Pt1000
LLDO sensor	Red	TB4	+ve LLDO sensor
	Blue		–ve LLDO sensor
Flowmeter	Red	TB2	+ve
	Brown		GND
	Black		–ve

Table 3.2 Factory-made connections – ADS551

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 – see Fig. 3.17, page 20 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 at the wet-section connection board are identified in Section 3.4.2, page 15. Before fitting cable glands, identify the connections required and cable gland entries to be used.

Referring to Fig. 3.16:

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).

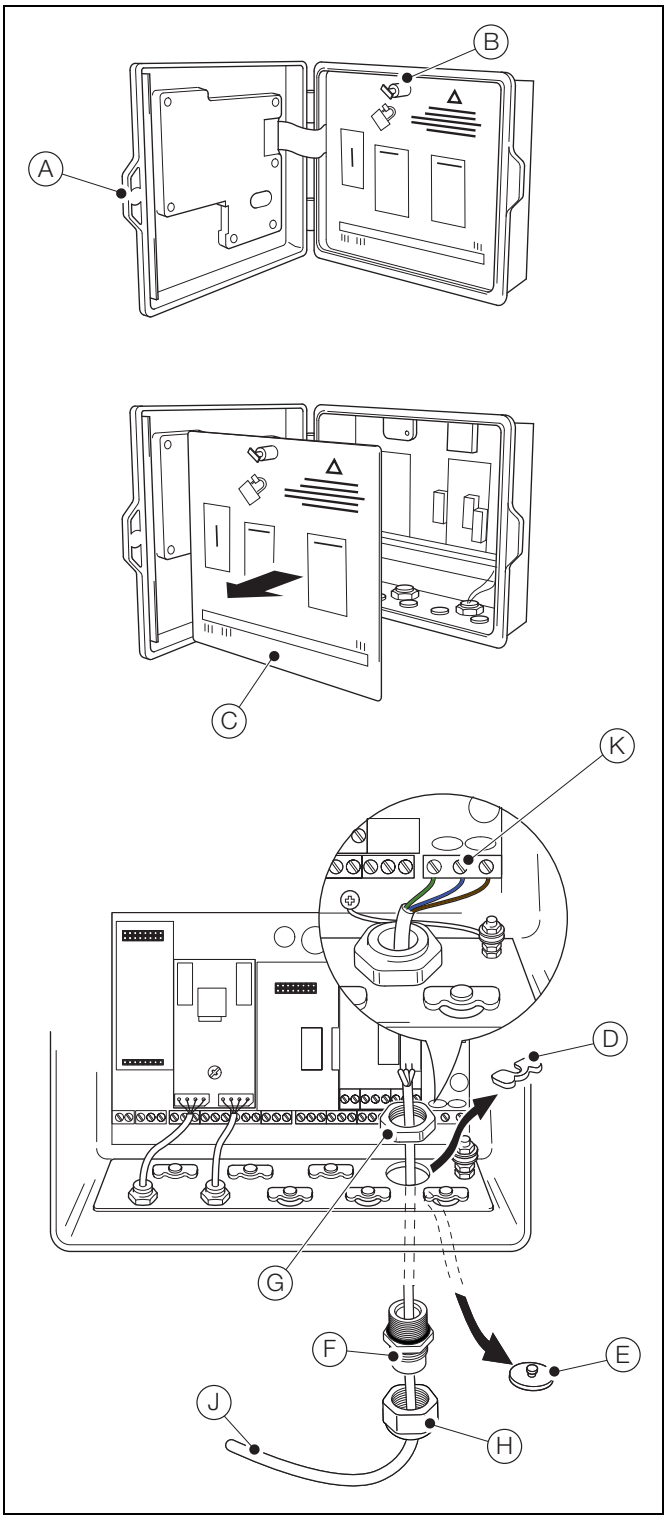


Fig. 3.16 Accessing the transmitter board and making electrical connections

3.5.2 Transmitter connections

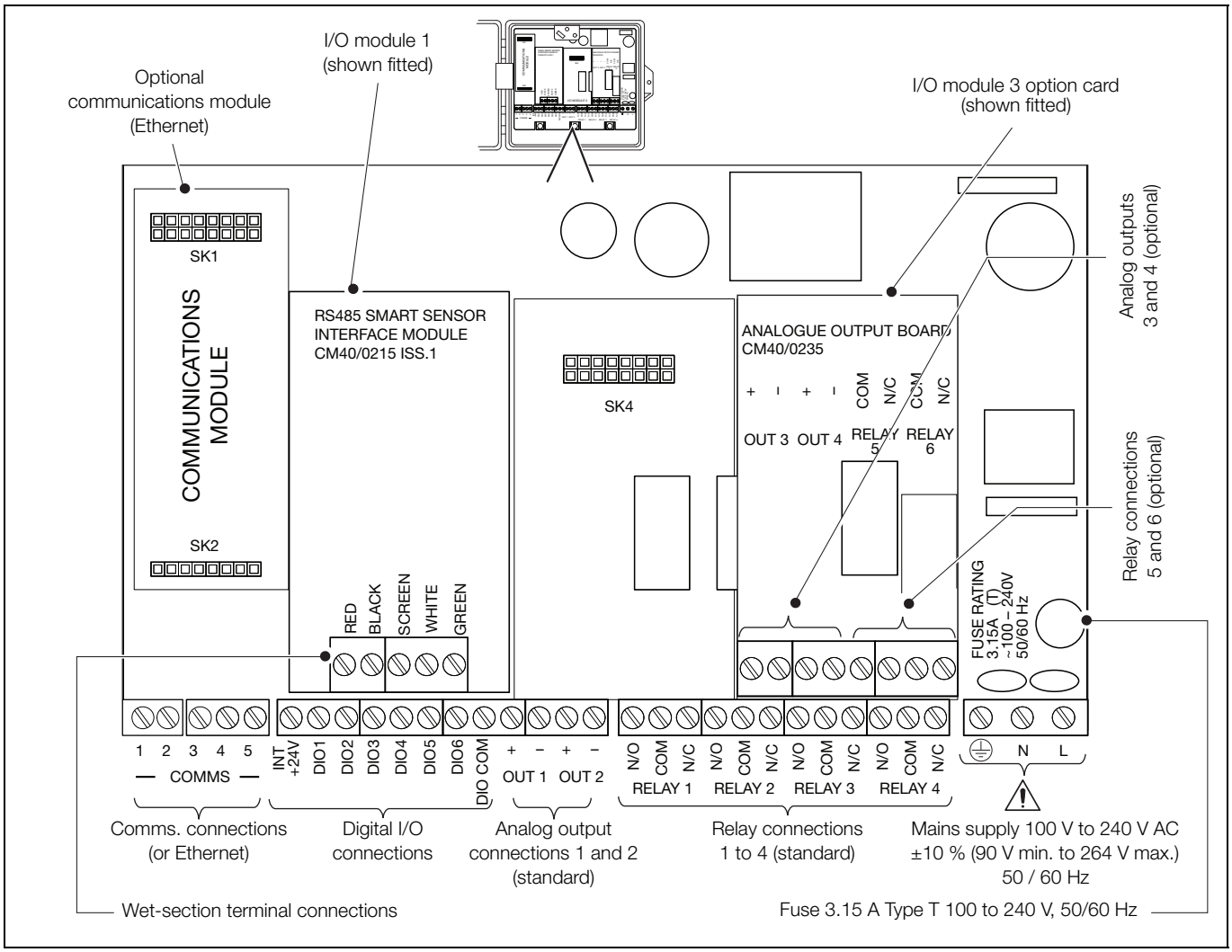


Fig. 3.17 Connections overview

3.5.3 Digital I/O, relays and analog output connections

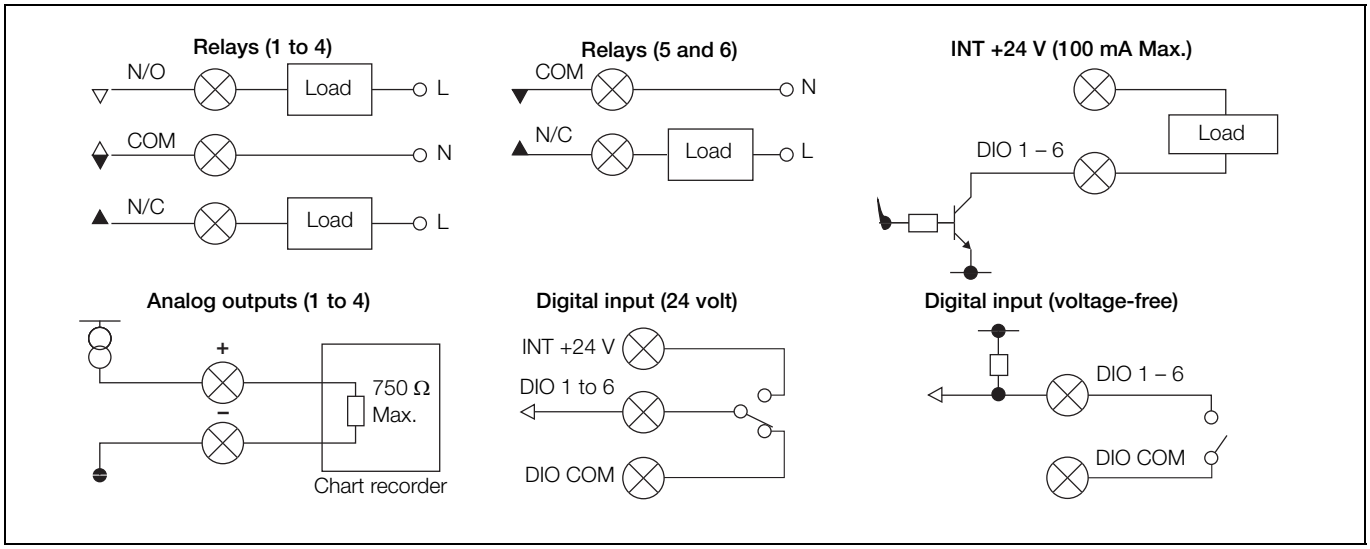


Fig. 3.18 Digital I/O, relays and analog output connections

4 Setup

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

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

If multiple wet-sections are being connected to a transmitter, an additional setup procedure is required – Appendix B, page 64.

4.1 Fitting the dissolved oxygen sensor

Caution.

- Only install the oxygen sensor immediately prior to use. The sensor has a limited shelf life and ideally should NOT be stored longer than 6 months. Store under cool conditions.
- Take special care to line up the two pins in the oxygen sensor with their respective sockets before making the connection and tightening.
- Take care not to damage the delicate membrane on the face of the dissolved oxygen sensor.
- Ensure that the mating surfaces (carrying the electrical connection) of the dissolved oxygen sensor and connector body are clean and completely dry.
- Do not overtighten the clamping screw.

Referring to:

– Fig. 4.1, page 22 for ADS550:

– Fig. 4.2, page 23 for ADS551:

1. Remove the top from the dissolved oxygen sensor container.
2. Unscrew the protective cap from the rear of the dissolved oxygen sensor.
3. Fit (or replace, if fitting a new dissolved oxygen sensor) the smaller of the 2 O-rings (A) (3/4 in. ID) onto the connector body (B). Locate the sensor (C) on the connector body (B) ensuring the pins and sockets are engaged correctly and tighten the connector nut (D) onto the sensor (C).
4. Slide the thrust washer (E) over the connector body (B).
5. Insert the complete assembly into the flowcell (F) ensuring the larger of the 2 O-rings (G) (7/8 in. ID) is fitted (or replaced, if fitting a new sensor).
6. Use the clamping screw (H) to secure the dissolved oxygen sensor assembly and screw in firmly using finger-pressure only.
7. Push the (red) sensor connector (I) onto the sensor connector block (J) firmly and tighten ONE TURN clockwise.

Note. Wet-section enclosure, oxygen sensor container and protective cap not shown for clarity

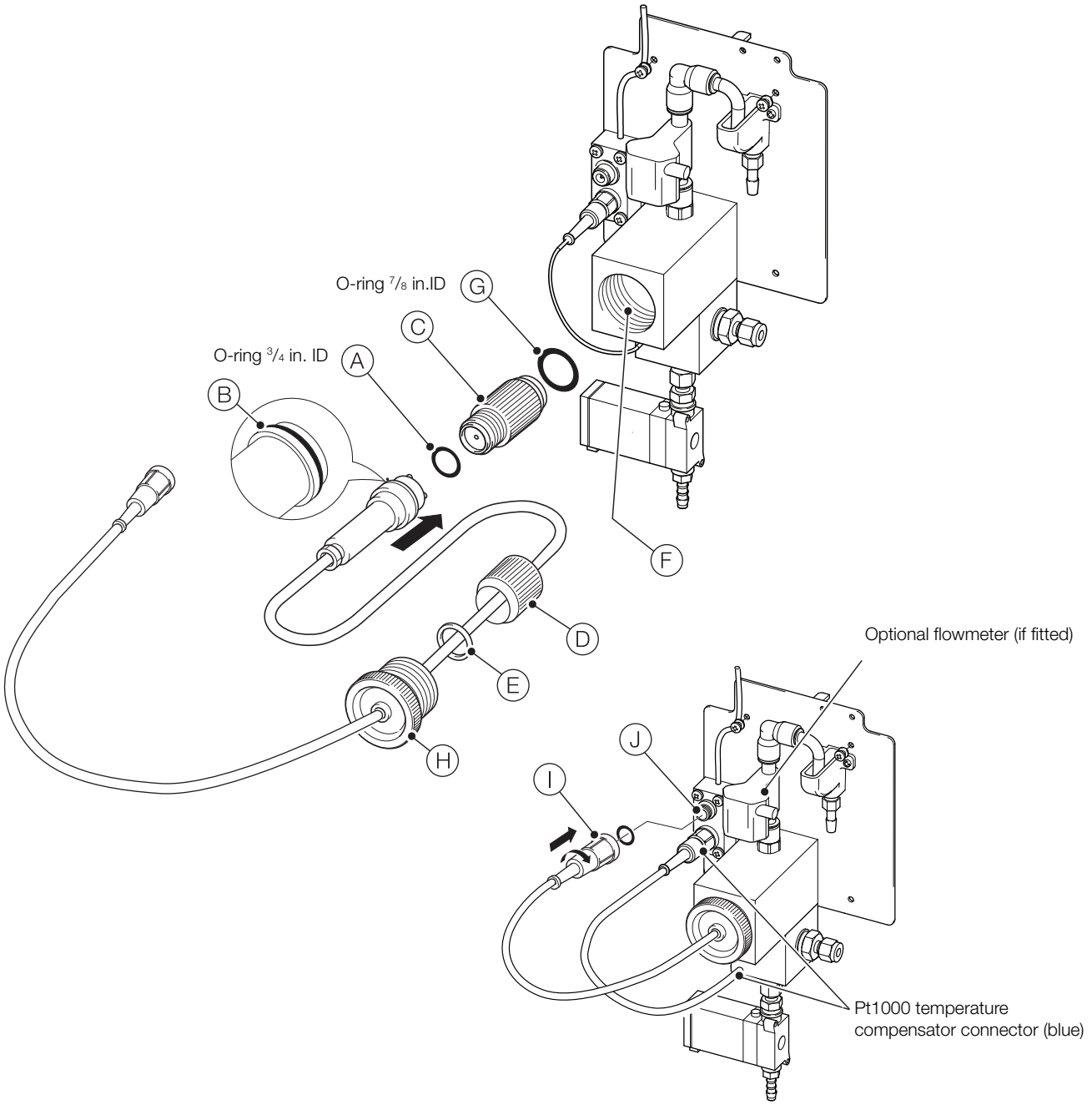


Fig. 4.1 Fitting and connecting the dissolved oxygen sensor – ADS550

Note. Dissolved oxygen sensor container and protective cap not shown for clarity

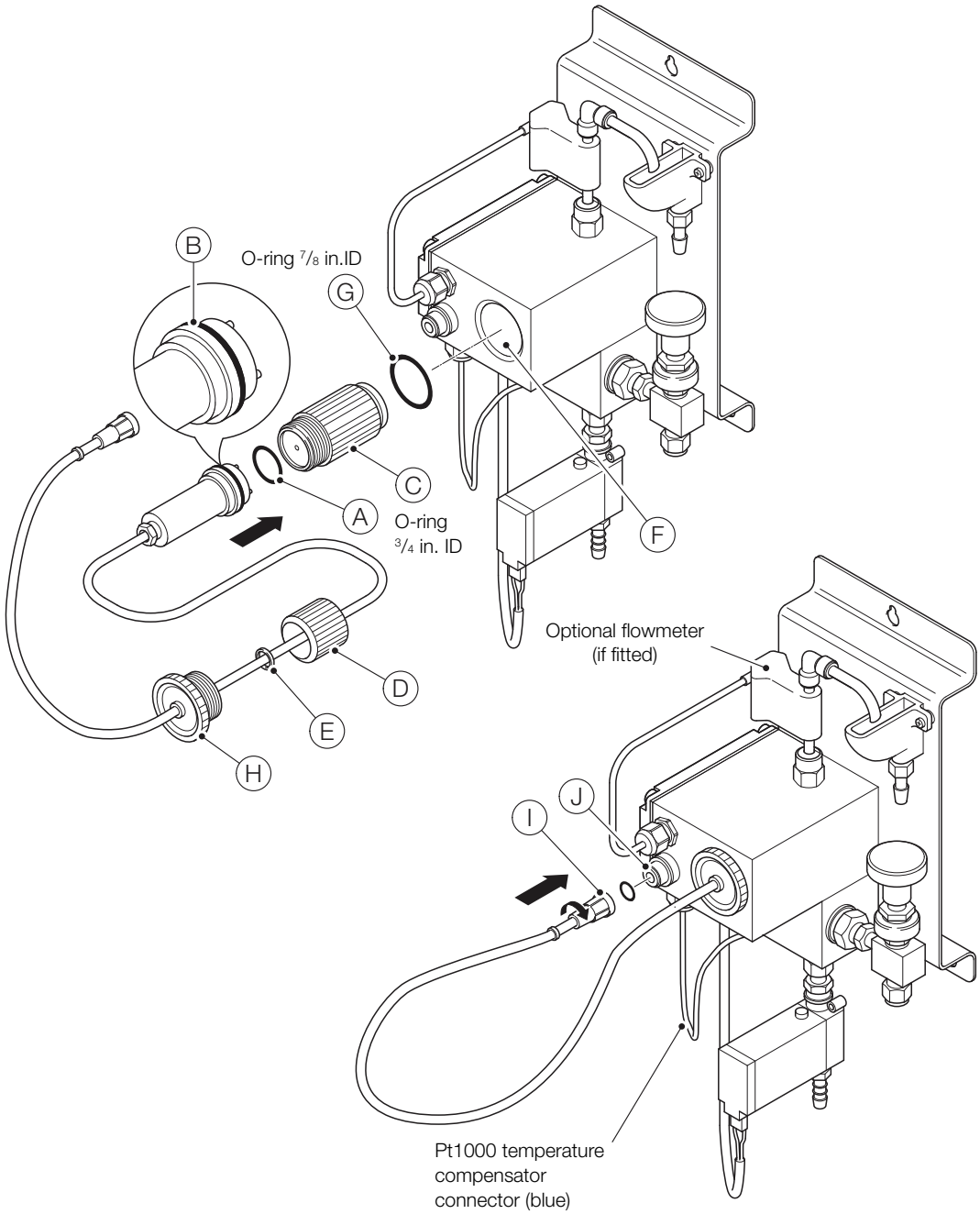


Fig. 4.2 Fitting and connecting the dissolved oxygen sensor – ADS551

4.2 Transmitter start-up

Ensure all electrical connections have been made and switch the power on to the transmitter. If the wet-section is being commissioned for the first time, calibration and programming of parameters is required – refer to Section 5.1, page 26 to perform a calibration for the first time.

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

4.3 Checking sample flow

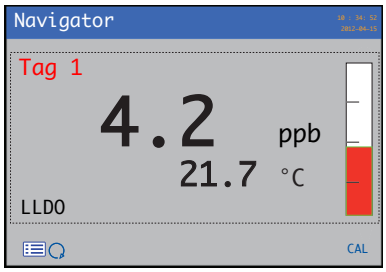
Check that the sample flows correctly in both normal operation and during a calibration or thermal overload (see Section 3.1.1, page 8), this is achieved by simulating a calibration manually from the transmitter.

Note.

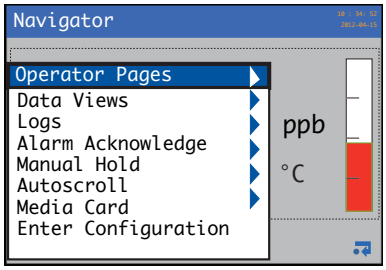
- Refer to Section 7, page 42, for menu descriptions.
- Refer to Section 6.1, page 29, for details of menu navigation and parameter selection / adjustment.

To simulate a calibration manually:

1. Access the Calibration level menus by pressing the key (below the icon on an *Operator* page).

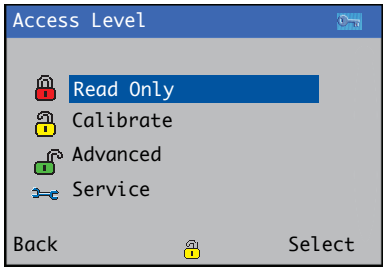


The *Operator* menus are displayed:



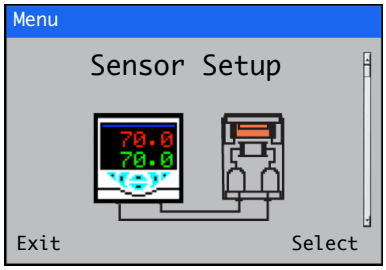
2. Press the key to select the *Enter Configuration* menu and press the key (below the icon).

The *Access Level* page is displayed:

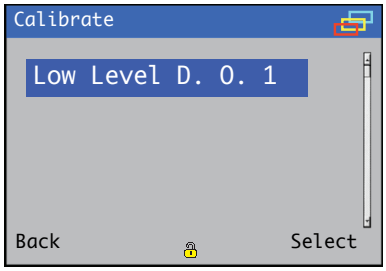


3. Use the key to scroll to the *Advanced* access level and press the key (below the *Select* prompt) to enter the top level *Configuration* menus.

Use the / keys to scroll to the *Sensor Setup* menu and press the key (below the *Select* prompt) to enter the *Sensor Setup* level menus.

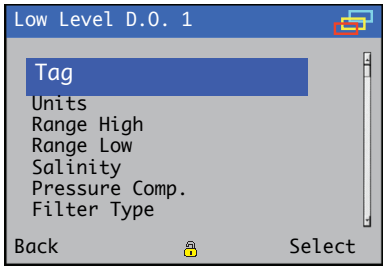


The *Calibrate* / *Low Level D. O 1 (4)* page is displayed:



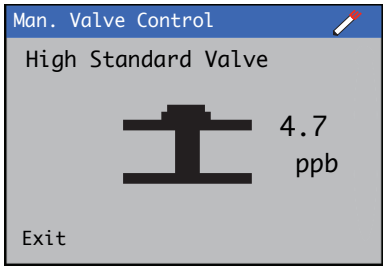
4. Press the key (below the *Select* prompt).

The *Low Level D.O.1 (4)* menu page is displayed:

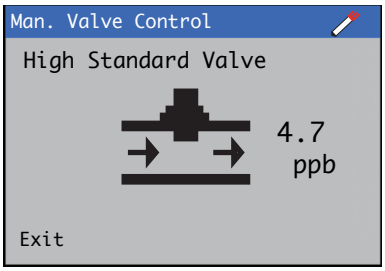


5. Press the key to select the *Man. Valve Control* menu and press the key (below the *Select* prompt).

The *Man. Valve Control* page is displayed with the valve in the closed position:



6. Press the ▲ key to energize (open) the solenoid valve to allow the flow of standard solution.

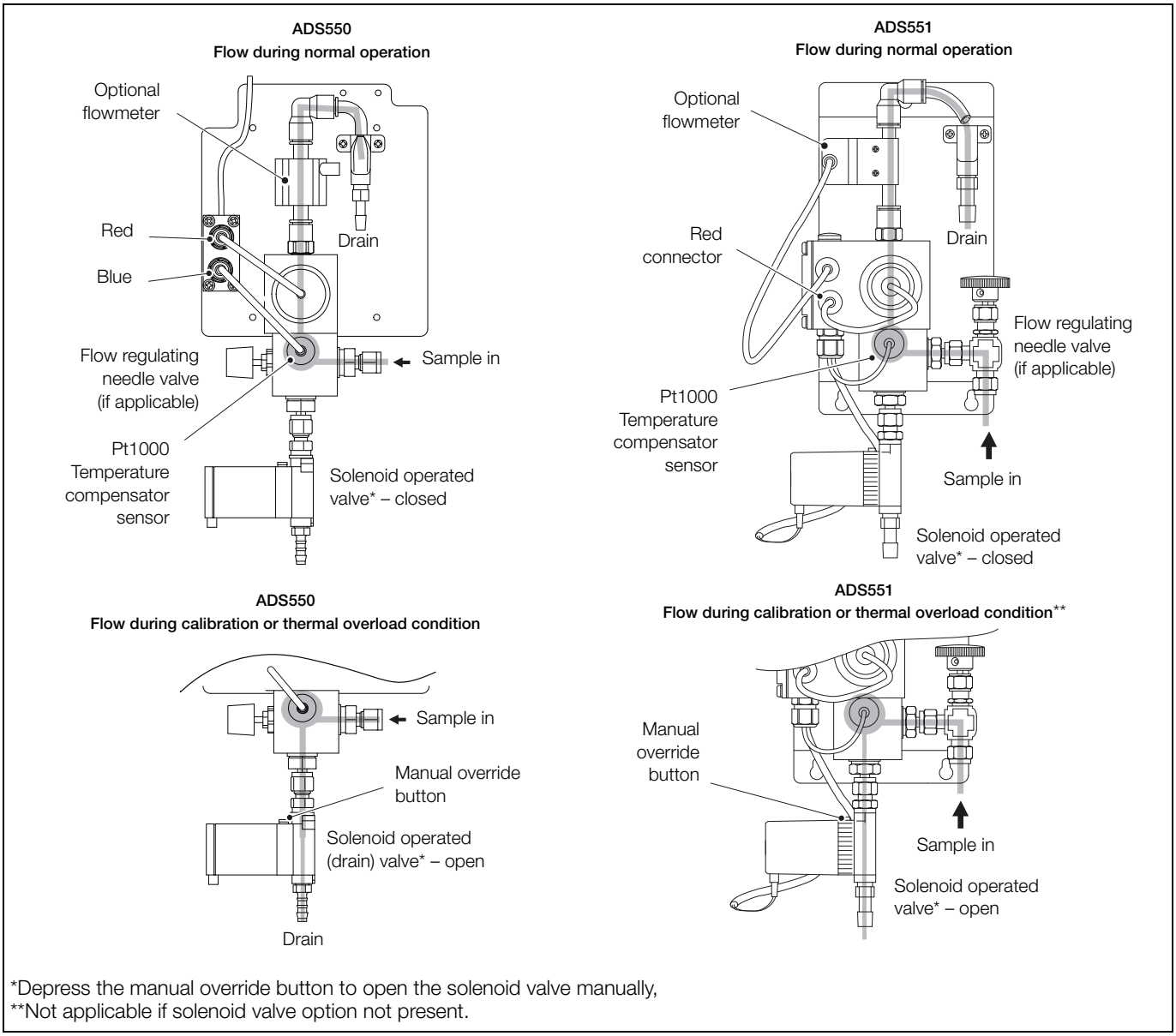


Note. When the page is exited (by pressing the ◥ key below the *Exit* prompt), the valve reverts to the previous state (closed).

– **If a flowmeter is fitted**: with the needle valve fully open, adjust the maximum flow rate (300 ml/min [18.30 cu in./min]) using the external valve adjustment. When set, adjust the needle valve until a flow of 150 ml/min is achieved – this reduces sample waste and ensures a good flow rate across the sensor.

– **If a flowmeter is not fitted**: adjust the flow rate using an external valve and measure the flow rate independently or by collecting the sample in a container for a specified period. Next, adjust the external valve until a flow rate of 150 ml/min (9.15 cu in./min) is achieved – this reduces sample waste and ensures a good flow rate across the sensor.

7. Carefully remove the dissolved oxygen sensor and check that the flowcell is empty. If sample still flows, check that the installation meets the sample requirements in Section 3.1.1, page 8.



*Depress the manual override button to open the solenoid valve manually,
**Not applicable if solenoid valve option not present.

Fig. 4.3 Sample flow schematic

5 Calibration

This section describes how to calibrate the analyzer once it is operational. Calibration involves measuring the wet-section's sensitivity to oxygen by exposing the sensor to air.

Calibrations are initiated via the *Cal* prompt displayed on *Operator* pages or via the *Calibration Level* and *Advanced Level* menus as a *Scheduled* calibration.

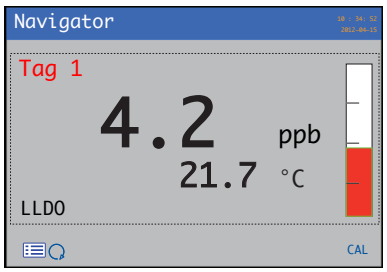
Caution.

- Do not calibrate the analyzer until the wet-section and transmitter are installed and ready for operation – refer to Section 4, page 21.
- Allow at least 1 hour for the wet-section to stabilize before running a calibration.

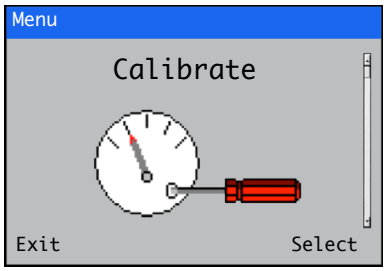
5.1 Performing a calibration for the first time

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

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

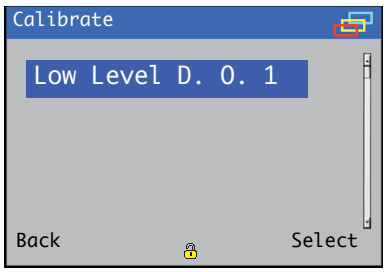


The *Calibrate* page is displayed:



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

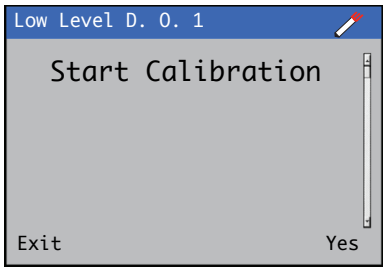
The *Calibrate / Low Level D. O 1(4)* page is displayed with all available wet-sections shown:



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

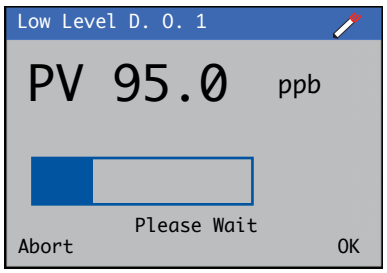
3. Press the key (below the *Select* prompt).

The *Low Level D. O. 1 (2, 3 or 4) / Start Calibration* page is displayed:



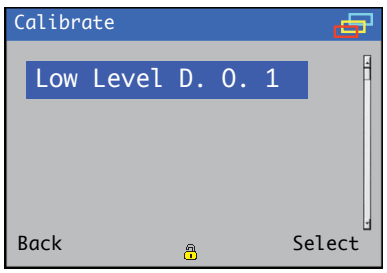
4. Press the key (below the *Yes* prompt).

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



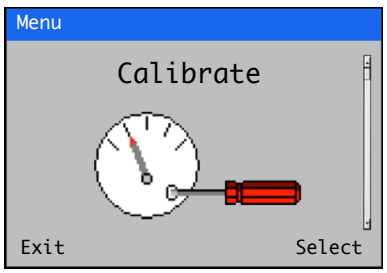
5. To exit the *Calibration* page, press the key (below the *OK* prompt). Calibration continues and calibration progress can be monitored from the *Calibration View* – see Fig. 5.1, page 27.

The *Calibrate / Low Level D. O 1 (4)* 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.

5.2 Calibrating in air – ADS550 / 551 with calibration valve fitted

When calibrating in air, the calibration valve opens, the sample diverts to drain exposing the sensor to air. The displayed value is the sensor reading based on the last calibration.

During a calibration, the progress can be monitored from the *Calibration View* – see Fig. 5.1.

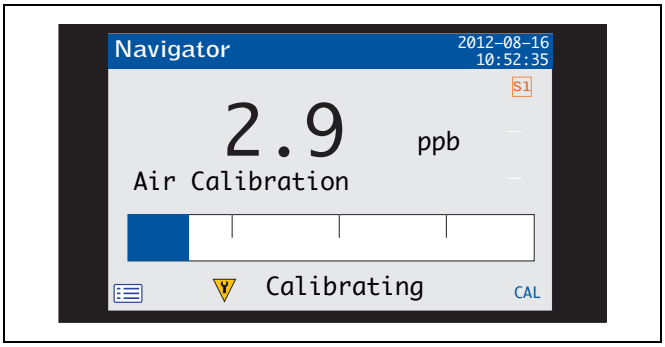


Fig. 5.1 Calibration view (with calibration valve fitted)

During Proceed to Section 5.4.

5.3 Calibrating in air – AD551 without calibration valve fitted

Enter the calibration screen (*Air Calibration / Expose Sensor*).

Expose the sensor to air using the following procedure:

1. Shut off the sample flow.
2. Remove the sensor from the flowcell.
3. Carefully dry the sensor with a soft tissue and expose the sensor to air.
4. Press *Next* on the transmitter.

During Proceed to Section 5.4.

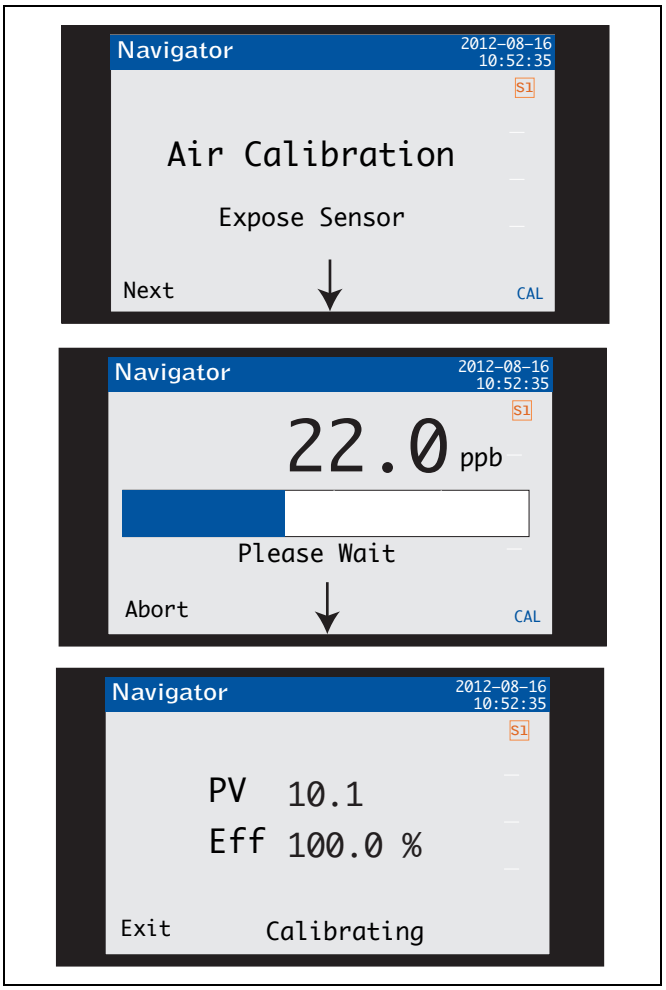
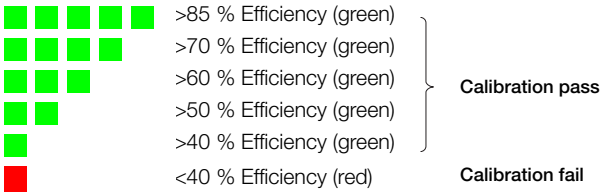


Fig. 5.2 Calibration procedure (without calibration valve fitted)

5.4 Sensor efficiency

At the end of the calibration, the *Efficiency* and *Last Efficiency* values in the *Signals View* (see page 34) and *Calibration Log* (see page 34) are updated if the calibration is successful. An indication of sensor efficiency is displayed as a 1 to 5-bar:



Note. The *Active Efficiency* value is not updated if the calibration fails. The *Calibration Log* is updated with the *Cal Efficiency* value.

5.5 Abort calibration

A calibration can be aborted by pressing the ◹ (*Abort*) key while the *Calibration* page is displayed (see Section 5.1, page 26) – the calibration valve closes enabling the sample to flow past the sensor. A calibration recovery period commences and the *Calibration Log* (see page 34) displays the message *Cal Aborted* – see Section 6.7.1, page 35 for *Calibration Log* entries.

5.6 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.

Note. Flowmeter options only – a scheduled calibration does not start if a *Low Flow* diagnostic is active.

5.7 Calibration timings

5.7.1 Wait period

There is a wait period of 3 minutes while the sensor is exposed to air before the stability of the sensor is checked. After 3 minutes a stability check is performed.

5.7.2 Stability period

The readings are monitored for up to 2 minutes until a stable reading is achieved. When stability is achieved, the calibration valve closes enabling sample to flow past the sensor and the efficiency value is calculated.

5.7.3 Slow sensor response

If the output from the sensor does not stabilize during the Stability Period the calibration is not accepted and a *Cal Failed* diagnostic is displayed, the *Calibration Log* is updated with a *Slow Cal* message.

Note. The last sensor efficiency value is not updated in the *Signals View* if the sensor is slow to respond.

5.7.4 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 still held during the recovery period if the *Hold Output* option is enabled (see Section 7.1.1, page 43). The default value for the recovery period is 30 minutes but can be configured between 10 and 60 minutes via the *Calibration* menu in the transmitter.

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 61, *display icon descriptions* are detailed in Section 6.10, page 40.

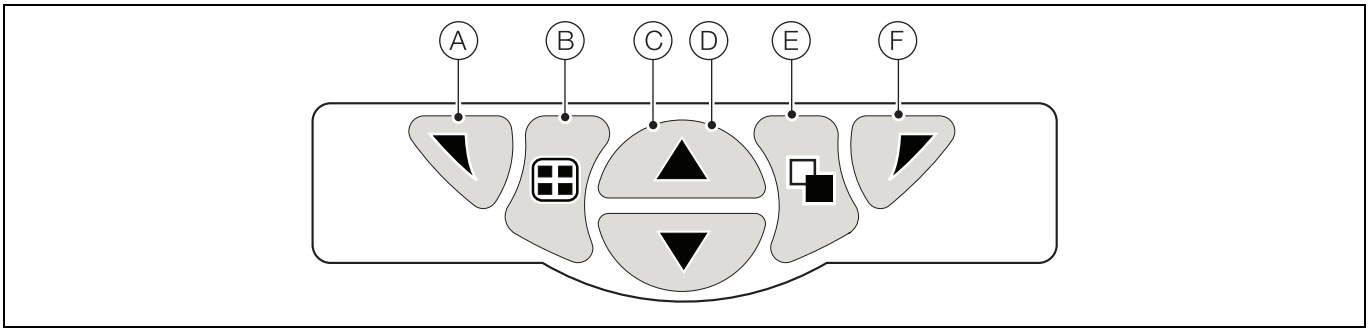


Fig. 6.1 Front panel keys

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.
Ⓒ	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).

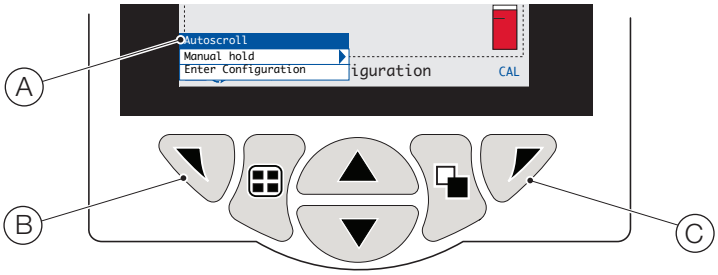


Fig. 6.2 Operator menus

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

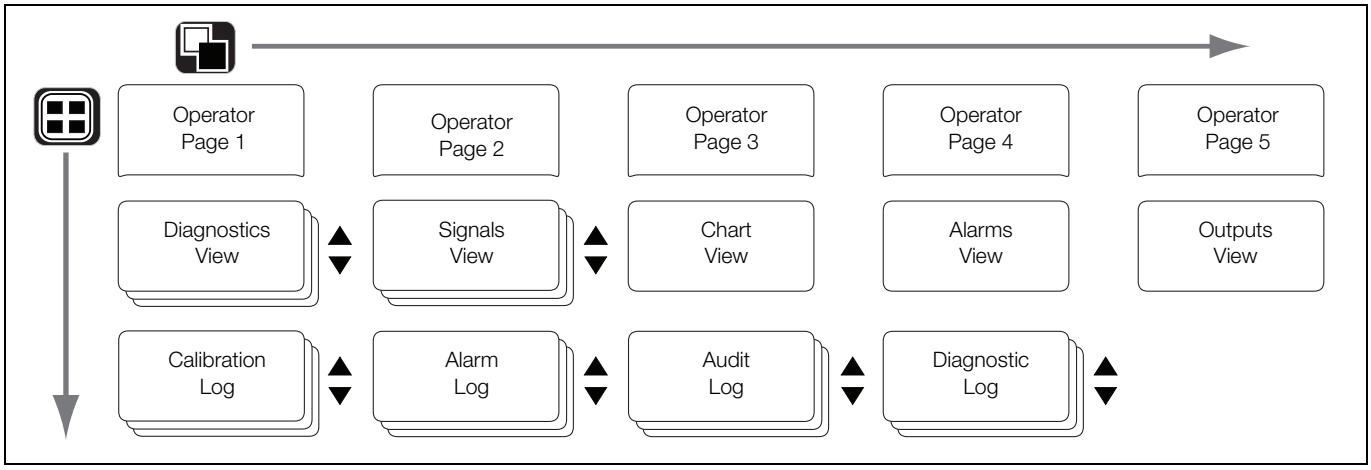


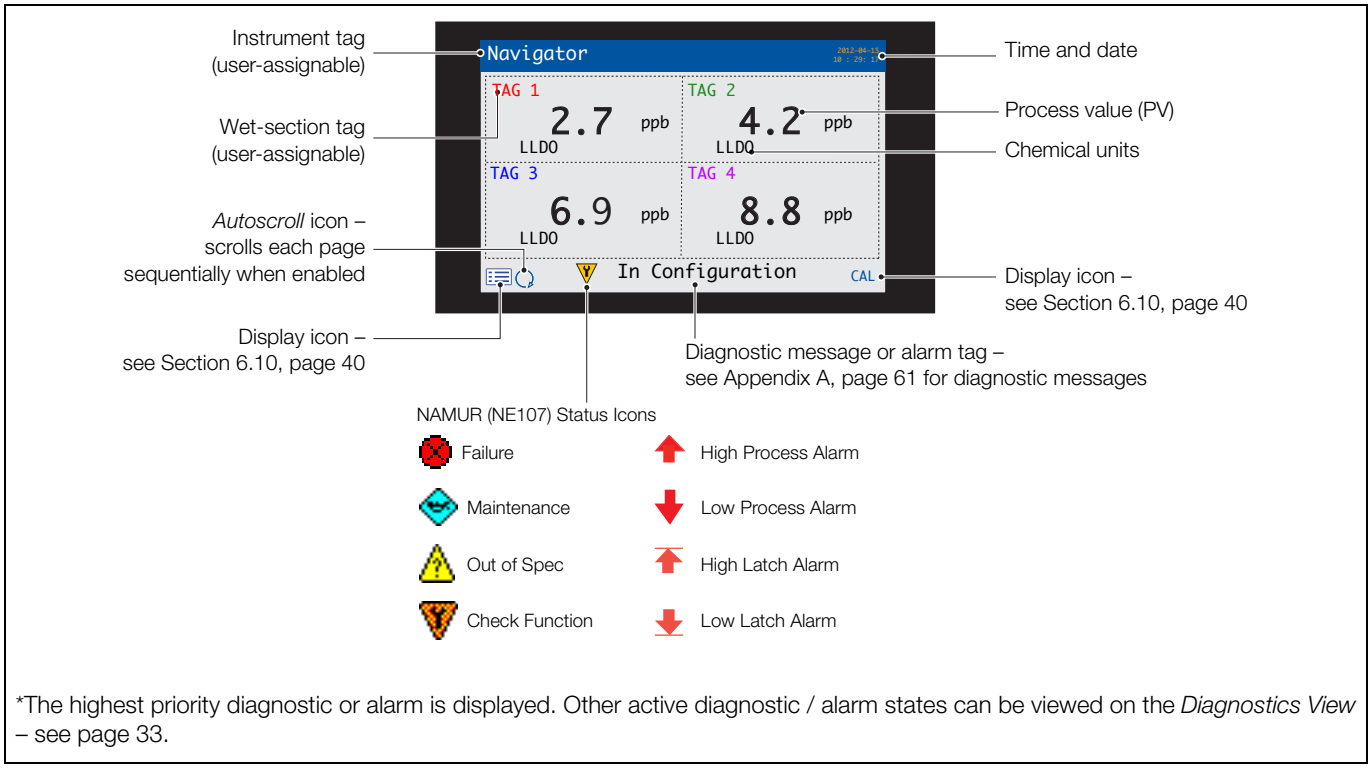
Fig. 6.3 Menu navigation

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* – see page 47.

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 (low level dissolved oxygen 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 fitted 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 fitted and, if *Autoscroll* is selected from the *Operator Menu* (see Fig. 6.2, page 30), the display scrolls through each available *Operator Page* consecutively.

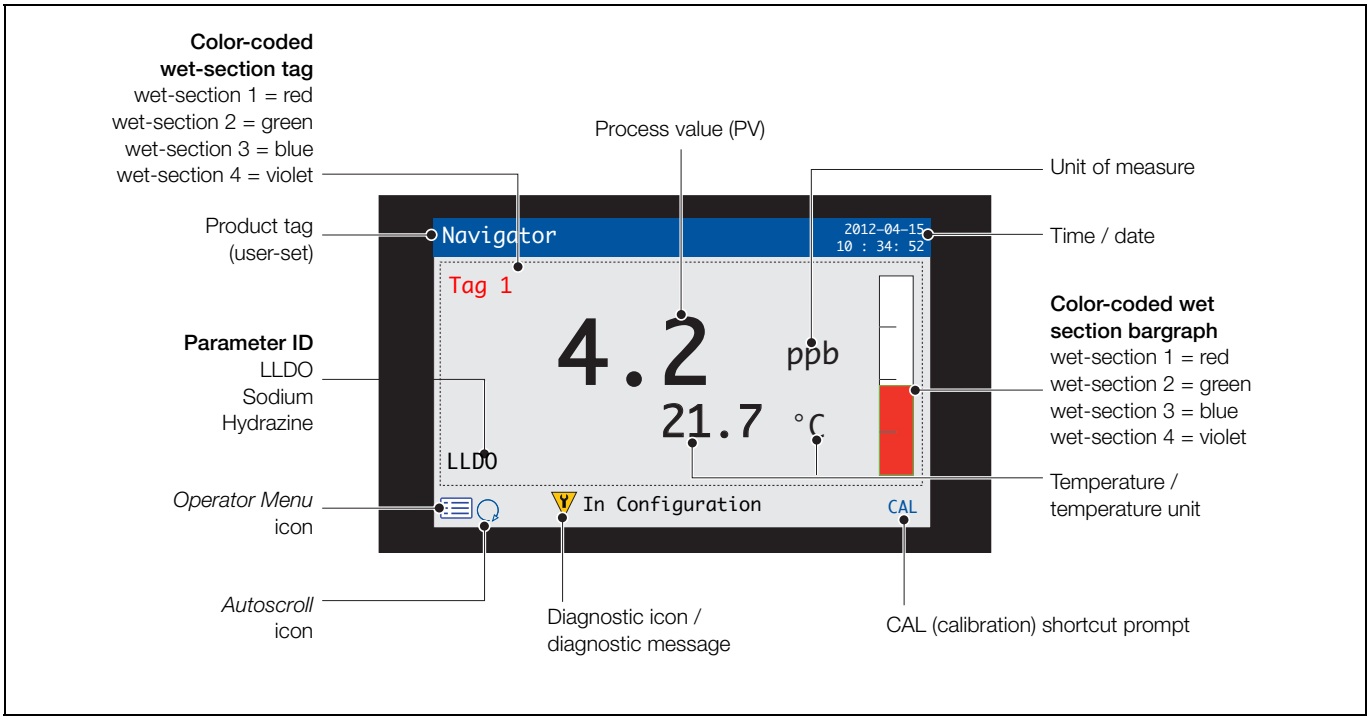


Fig. 6.5 Operator Pages 2 to 5 – overview

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 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

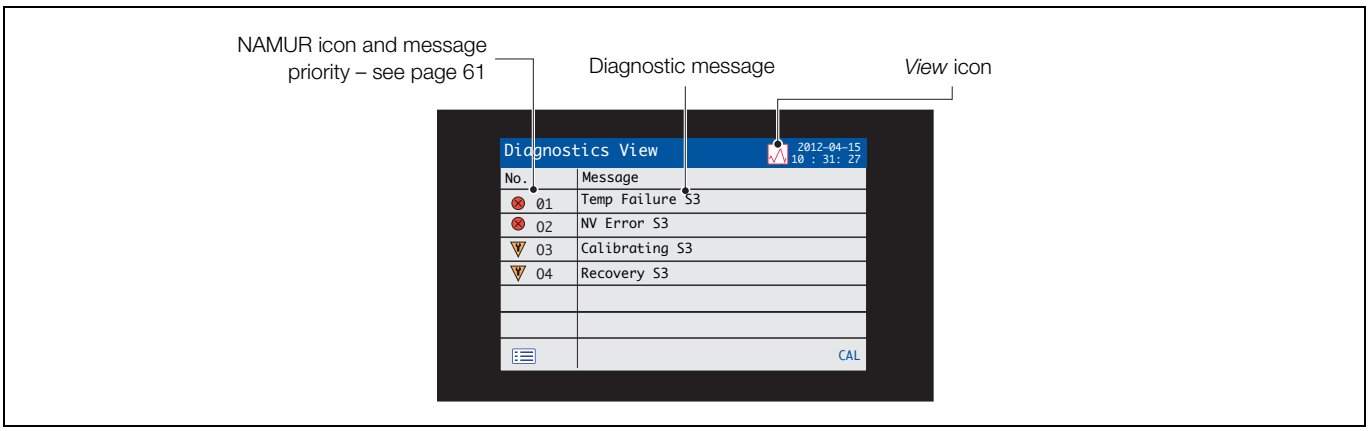


Fig. 6.6 Diagnostics View

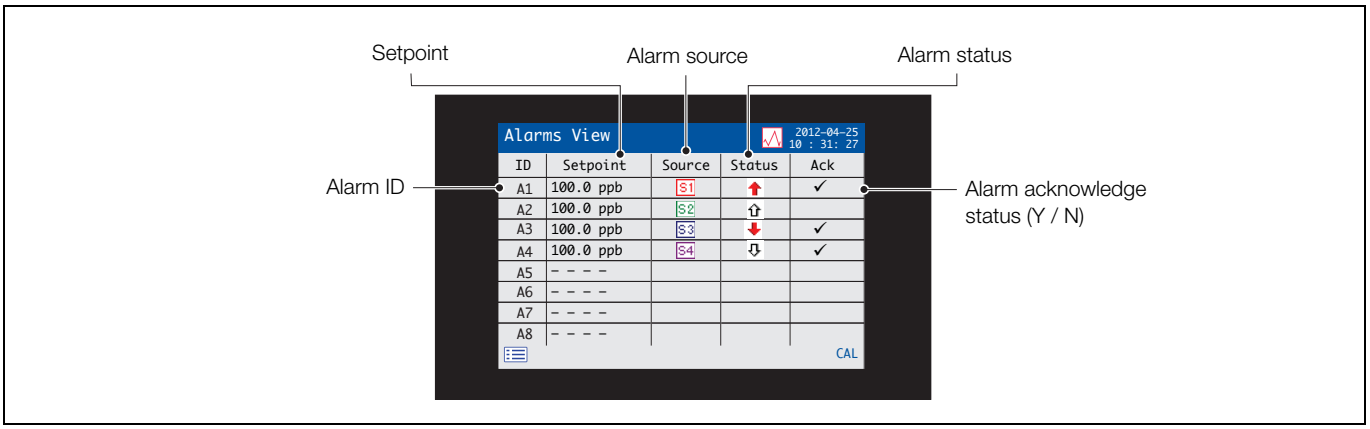


Fig. 6.7 Alarms View

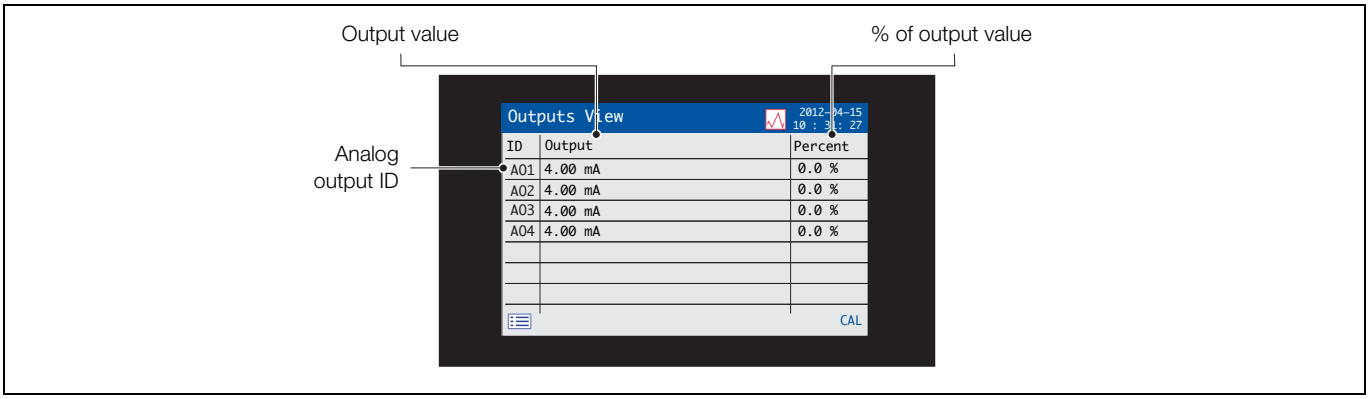


Fig. 6.8 Outputs View

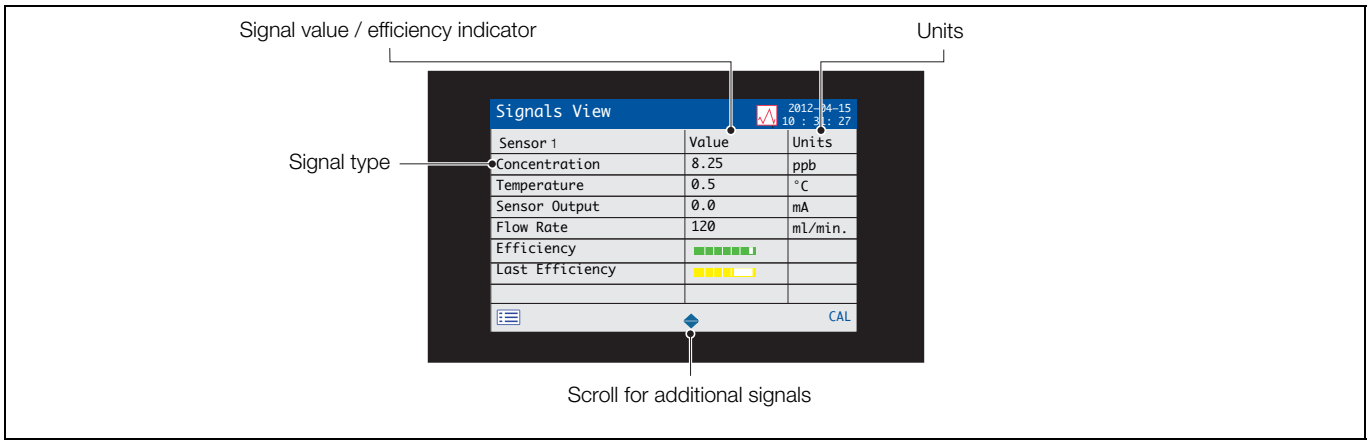


Fig. 6.9 Signals View

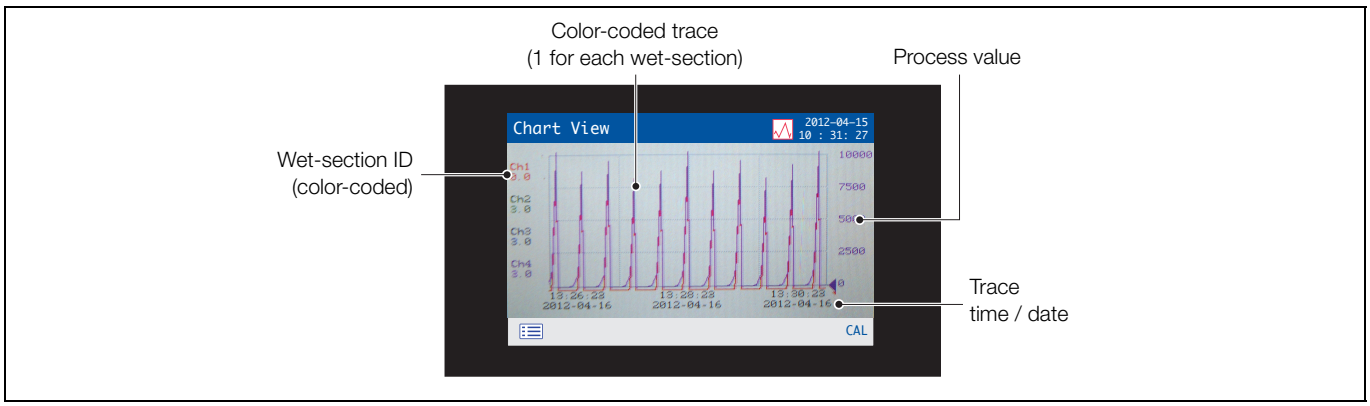


Fig. 6.10 Chart View

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.

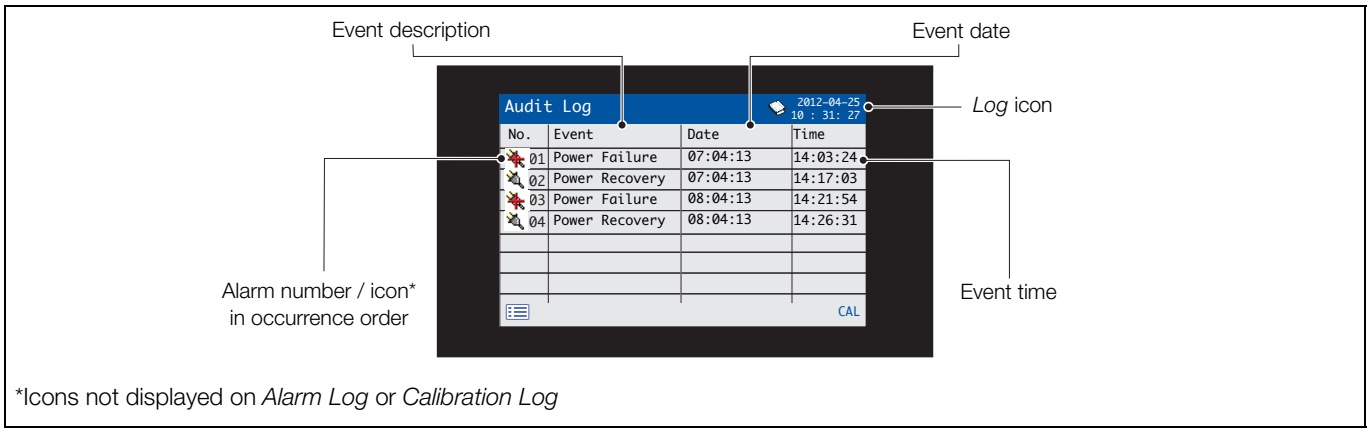


Fig. 6.11 Log page (example of Audit Log shown)

6.7.1 Log entries

Possible *Calibration Log* entries along with a description are shown in Table 6.2. 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 61.

Log entry	Description
Cal Failed	Calibration procedure failed due to low sensor efficiency or sample temperature error.
Cal Aborted	Calibration aborted manually by the user.
Slow Cal	Calibration failed due to instability of reading.
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. Calibration missed if *Flow Error* diagnostic is active.
Efficiency	An indication of the sensor efficiency.

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 2 GB 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.

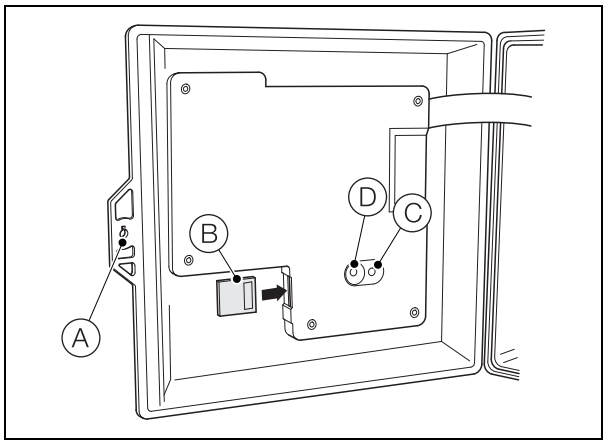


Fig. 6.12 SD card / USB stick insertion and removal

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><instrument 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><instrument tag>.AOO

Note.

- The 'instrument tag' is set in the *Device Setup* level (see page 45) 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><instrument 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:

30Mar13ADS550.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:

30Mar13ADS550~DS.D00

The file '30Mar13ADS550.D00' contains data generated from 00:00:00 to 01:59:59.

The file '30Mar13ADS550~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:

26Oct13ADS550~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: 26Oct13ADS550.D00

The file '26Oct13ADS550~DS.D00' contains data generated from 00:00:00 to 02:59:59.

The file '26Oct13ADS550.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 45.

Note. When the transmitter is powered-up for the first time, the *Calibrate* and *Advanced* levels can be accessed without password protection. 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.

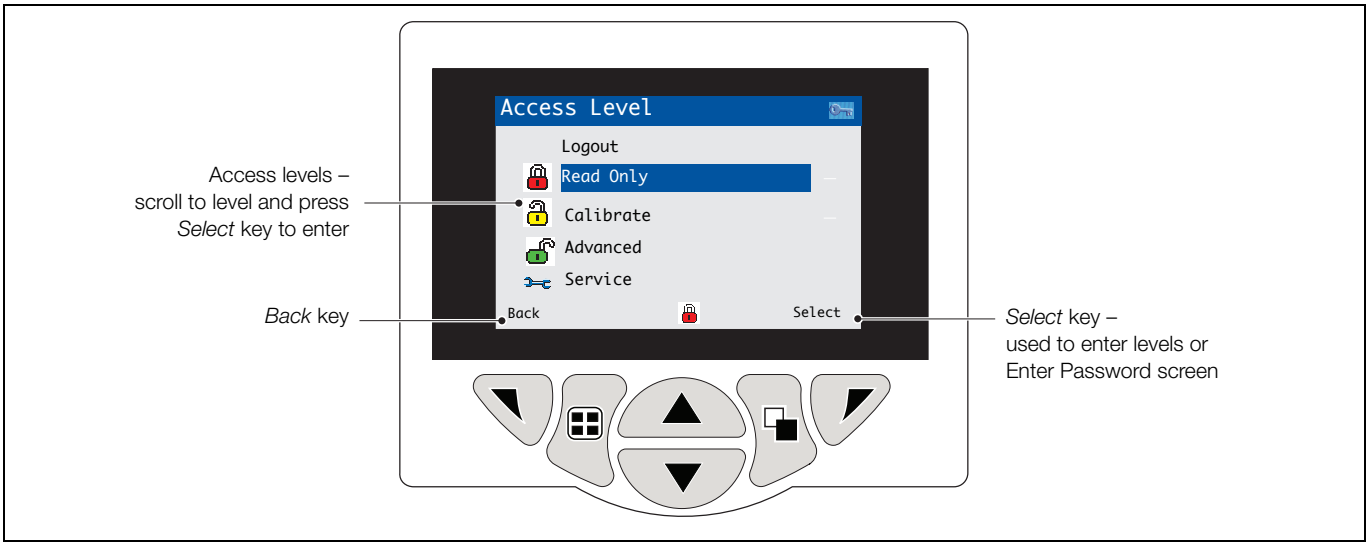


Fig. 6.13 Access Level

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 26 for calibration details.
Advanced	Enables configuration access to all parameters.
Service level	Reserved for authorized service technicians only.

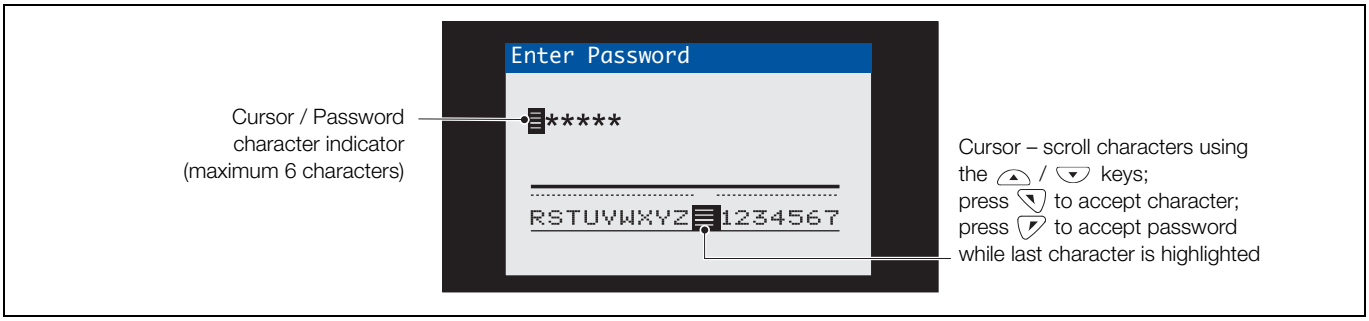


Fig. 6.14 Enter Password screen

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 61 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 T4	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.
	*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 cannot be configured.

7 Menu descriptions

7.1 Menu overview

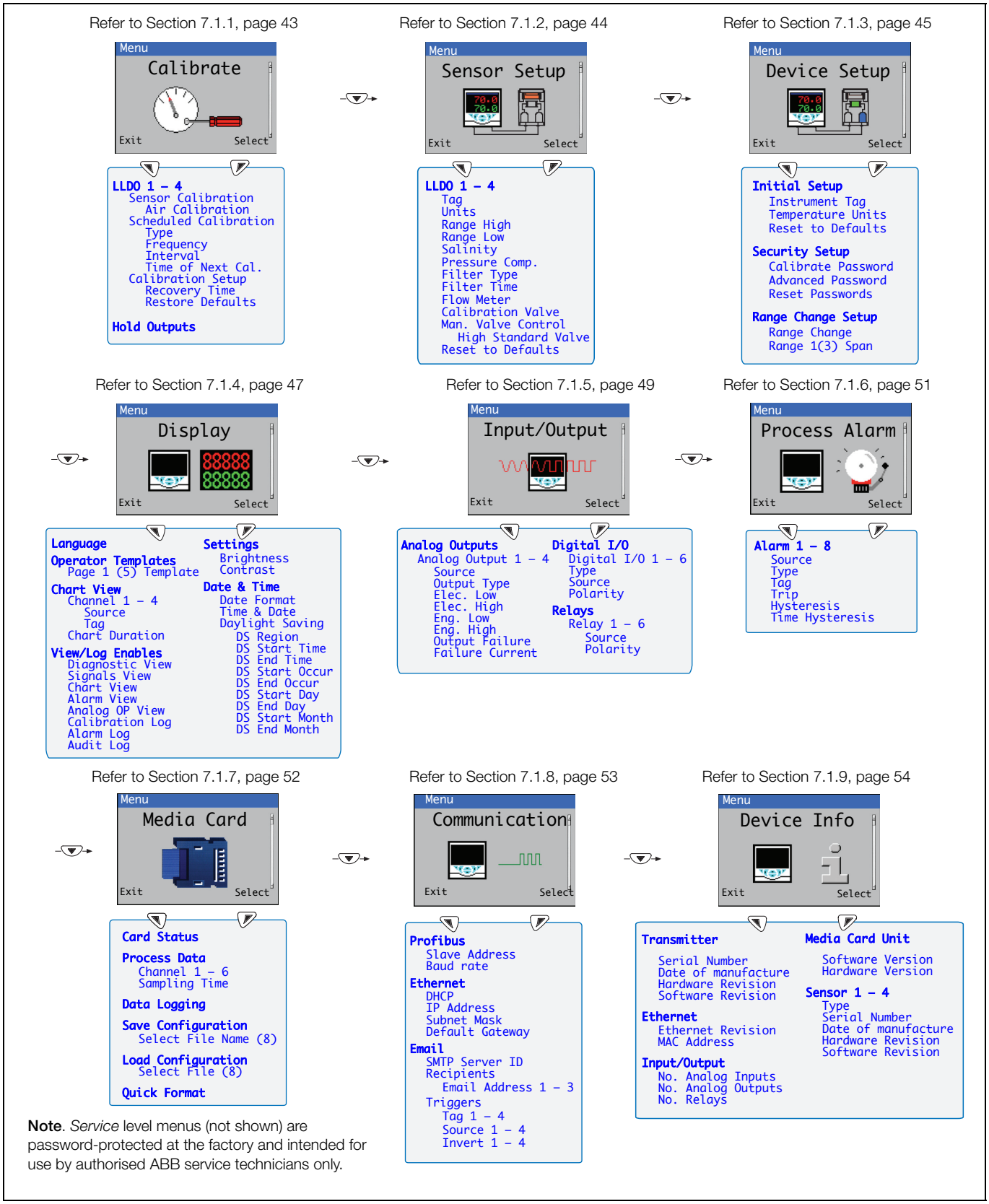
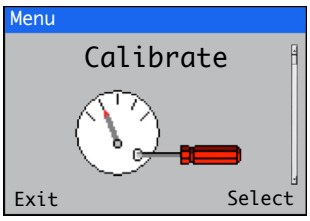


Fig. 7.1 Overview of low level dissolved oxygen menus

7.1.1 Calibrate

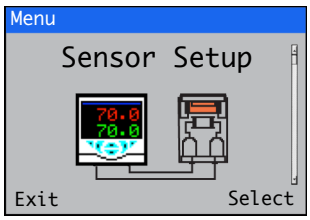


Used to calibrate the wet-section, adjust the *Recovery Time* and to enable / disable the *Hold Outputs* function.

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

Menu	Comment	Default
LLDO 1 – 4	The identity of the low level dissolved oxygen wet-section being calibrated.	
Sensor Calibration		
Air Calibration	Performs a 1-point calibration in water-saturated air.	
Scheduled Calibration		
Type		
Air Calibration		
Frequency	Selects the scheduled calibration frequency.	
Off		
Daily	Daily interval – selectable options: *Daily, 2, 3, 4, 5, 6, 7* days.	
Weekly	Weekly interval – 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
Calibration Setup		
Recovery Time	Sets the recovery time in minutes (range 5 to 120 minutes).	30 min.
Restore Defaults	Restores *Calibrate* parameters to their default values / settings.	
Hold Outputs	Enables / disables the *Hold Outputs* function. If Enabled then Current Outputs and Alarm functions are held during calibrations and subsequent recovery periods.	Disabled

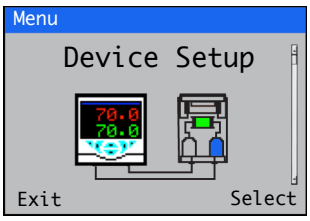
7.1.2 Sensor Setup



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

Menu	Comment	Default
LLDO 1 – 4	The identity of the low level dissolved oxygen wet-section being set up.	
Tag	Sets the 16-character alphanumeric wet-section tag displayed on *Operator Pages*.	TAG 1
Units	Selects the measurement units: ppb / µg/l or µg/kg	ppb
Range High	Sets the span value in *Chart* and *Bargraph* views.	1000
Range Low	Sets the zero value in *Chart* and *Bargraph* views.	0
Salinity	Salinity correction is required when monitoring water containing high quantities of dissolved salts. Enter the required value between 0 and 80 parts-per-thousand (ppt). Leave at the default value of 0 ppt if salinity correction is not required.	0
Pressure Comp.	Barometric pressure compensation. Set the local barometric pressure to between 500 and 800 mm/Hg. If the barometric pressure is unknown, leave at the default sea-level value of 760 mm/Hg.	760
Filter Type	Selects the filter type: *Off / Min / Max / Average / Rolling Point*	Off
Filter Time	Sets the filter (input) time (5 to 100 sec.).	5 sec.
Flow Meter	Enables / Disables the flow sensor function (active only if the flow sensor option is fitted).	Enabled
Calibration Valve	Enables / Disables the calibration valve.	Enabled
Man. Valve Control	The solenoid valves 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 selected valve manually, press the ▼ key to close the valve manually.	
High Standard Valve	Enables the High Standard 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`	The device (transmitter) identification tag.	Navigator
`Temperature Units`	Selects the temperature units displayed (°C or °F).	°C
`Reset to Defaults`	Restores *Device Setup* parameters to their default settings.	
Security Setup		
`Calibrate Password`	Sets the password to enable access at *Calibrate* level. (Not factory-set).	
`Advanced Password`	Sets the password to enable access at *Advanced* level. (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 0 200
	2 0 2000
	3 0 20000
	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 49.

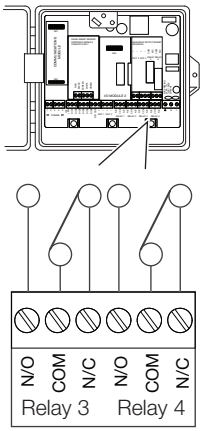
Relay operation

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

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

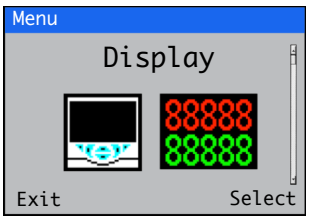
The range selection outputs can be determined as shown in the following table:

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 49.

7.1.4 Display



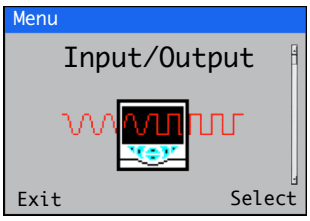
Used to select the display language, setup *Operator* page templates (1 to 5), enable diagnostic, view and log functions, set the device's display brightness / contrast and set the time and date.

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 fitted.	
Chart View	The chart can be configured to display the trend for 1, 2, 3 or 4 analog values. The engineering ranges for the process variable values are configured in the *Sensor Setup* menu – see page 44. **Note**: This menu is displayed only when *Chart View* is *Enabled* at the *Operator Functions / Chart View*.	
`Channel 1 (to 4)`		
`Source`	Selects the process variable signal 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



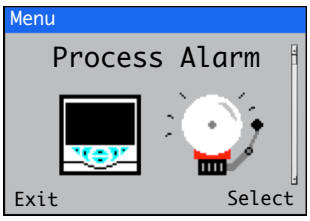
Input/Output level enables configuration of analog outputs, digital inputs and outputs and relays.

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 20.	
Source	Selects the analog signal to be assigned to the output – see Table 7.1, page 55.	None
Output Type	Selects the output type require:. ■ 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 20,000
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 61.	Enabled
Failure Current	Sets a preset value the current output is driven to when a *Failure* category diagnostic state is present. – see page 61. **Note**. Active only if *Output Failure* is *Enabled*.	22.0

Continued on next page…

…Menu	Comment	Default
Digital I/O	See page 20 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 55.	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 20.	
Source	Selects the digital signal to be assigned to the relay – see Table 7.3, page 55.	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

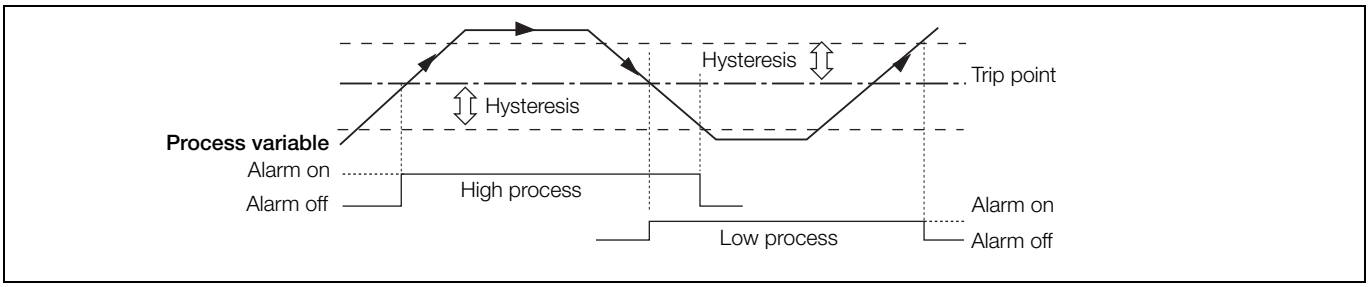


Fig. 7.2 High and low process alarm action

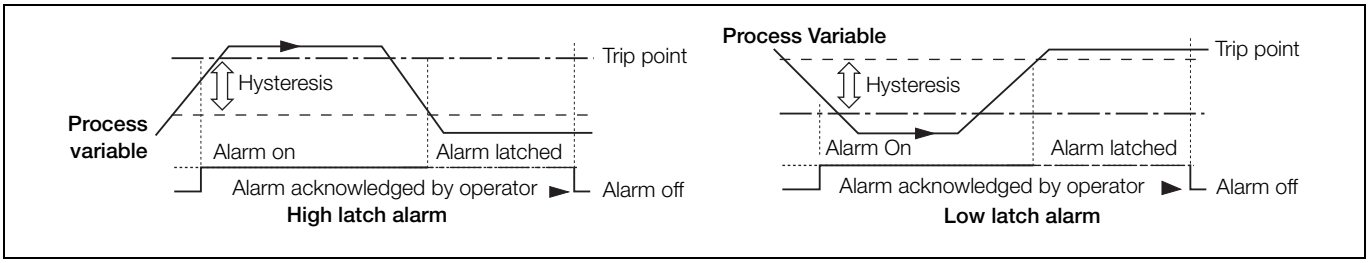
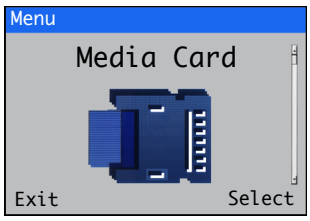


Fig. 7.3 High and low latch alarm action

7.1.7 Media Card

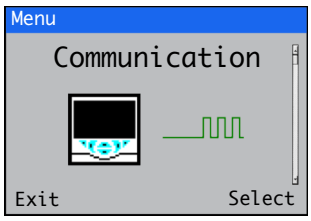


Used to set the card on / off status, select the process data to be logged, enter file configuration selection and save details and to format the media card.

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*.	On Line
Process Data		
`Channel 1 to 6`	Selects the source to be logged – refer to Section 7.2, page 55 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

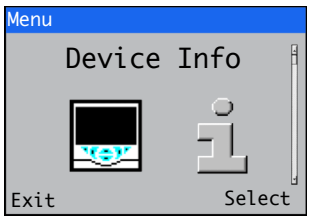


Communication level menus are enabled only if an optional communications module is fitted.

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 20.	
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.	Low Level D. O. 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)	Measured concentration value for the associated wet-section.
Temperature 1 (4)	Measured temperature value for the associated wet-section.

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 61 for possible causes.
S1 (4) Out of Spec.	The associated wet-section is out of specification – see Appendix A, page 61 for possible causes.
S1 (4) Maintenance	The associated wet-section requires maintenance – see Appendix A, page 61 for possible causes.
S1 (4) Function Check	The associated wet-section requires checking – see Appendix A, page 61 for possible causes.
Tx Failure	The transmitter is in the failed state – see Appendix A, page 61 for possible causes.
Tx Out of Spec.	The transmitter is out of specification – see Appendix A, page 61 for possible causes.
Tx Maintenance	The transmitter requires maintenance – see Appendix A, page 61 for possible causes.
Tx Function Check	The transmitter requires checking – see Appendix A, page 61 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	Air calibrations can be initiated from the digital input for the associated wet-section.
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 Introduction

No routine maintenance is required for this wet-section other than periodic calibration – see Section 5, page 26. However, if following a calibration the sensor output shows one red bar, the sensor may have become exhausted and should be replaced.

If the output shows 2 green bars the sensor should be replaced in the near future.

Storage Note.

DO

- use sensors in date rotation
- at all times, store sensors in a dry and cool environment
- store sensors in a refrigerator to extend their life, but DO NOT let them freeze

DO NOT

- let sensors dry out, either in storage or in use
- leave sensors in vehicles where they are likely to freeze or be exposed to high temperatures
- store / leave sensors on-site without protection from direct sun or high temperatures
- use the sensor if its sealed environment has dried out

8.2 Cleaning / changing the dissolved oxygen sensor

Caution.

- Only install the dissolved oxygen sensor immediately prior to use, otherwise leave stored in its protective container.
- Take special care to line up the two pins in the dissolved oxygen sensor with their respective sockets before making the connection and tightening.
- When cleaning the dissolved oxygen sensor, take care not to damage the delicate membrane on dissolved oxygen sensor face.
- Ensure that the mating surfaces (carrying the electrical connection) of the dissolved oxygen sensor and connector body are clean and **completely** dry.

8.2.1 Cleaning the dissolved oxygen sensor

A dirty membrane can cause a low sensor output.

Referring to Fig. 8.1, page 58 (ADS550): Fig. 8.2, page 58 (ADS551)

1. Drain flowcell (A) by opening solenoid valve (B) manually via either the *Sensor Setup / Man. Valve Control* parameter at the transmitter (see Section 7.1.2, page 44) or, if sample is switched off, by pressing manual override button (C) on the solenoid valve body.
2. Unscrew clamping screw (D) and carefully remove the complete dissolved oxygen sensor assembly (E) from flowcell cavity (F). Take care not to let O-ring (G) fall out.
3. Inspect dissolved oxygen sensor (H). If the sensor membrane is clean, refit the dissolved oxygen sensor assembly by proceeding to steps 4 and 5.

   If deposits are visible on the sensor membrane, remove them by gently wiping with a moist paper tissue. For oily or greasy deposits, moisten the tissue with a mild detergent or, if necessary, with iso-propyl alcohol (propan-2-ol). After cleaning, dry the interior of flowcell cavity (F) with a paper tissue or soft cloth. Ensure O-ring (G) is located correctly on the shoulder near the front of the flowcell cavity.
4. Carefully insert dissolved oxygen sensor assembly (E) into flowcell cavity (F) and secure in place using clamping screw (D).

   Caution. Do not overtighten the clamping screw – apply finger-pressure only.
5. Close solenoid valve B using the *Sensor Setup / Man. Valve Control* parameter at the transmitter (see Section 7.1.2, page 44) if applicable, or reinstate sample flow.
6. Let the sensor stabilize for at least 2 hours, then perform a calibration – see Section 5, page 26.

   It is recommended that an additional calibration is carried out after a period of 12 to 24 hours – this improves the initial calibration and hence measurement accuracy.

   If a low sensor efficiency is displayed, refer to Appendix A, page 61.

8.2.2 Changing the dissolved oxygen sensor

Referring to Fig. 8.1, page 58 (ADS550): Fig. 8.2, page 58 (ADS551)

1. Drain the flowcell (A), by opening solenoid valve (B) manually via either the *Sensor Setup / Man. Valve Control* parameter at the transmitter (see Section 7.1.2, page 44) or, if the sample is switched off, by pressing manual override button (C) on the solenoid valve body.
2. Unscrew clamping screw (D) and remove the complete dissolved oxygen sensor assembly (E) from flowcell cavity (F).
3. Carefully unscrew connector nut (I) from connector body (J) and withdraw the connector body from dissolved oxygen sensor (H). Discard dissolved oxygen sensor (H) and sealing washer (K).
4. Remove O-ring (G) from flowcell cavity. Dry the interior of the flowcell cavity with a tissue or soft cloth and fit a new O-ring ((G), supplied) in place at flowcell cavity (F). Ensure the O-ring is located correctly on the shoulder near the front of the flowcell cavity.
5. Remove the new dissolved oxygen sensor from its container, taking care not to damage the delicate membrane. Unscrew the protective cap from the rear of the new dissolved oxygen sensor.
6. Fit a new sealing washer (K) (supplied) to connector body (J), engage the pins and sockets correctly and locate and secure connector body (J) onto new dissolved oxygen sensor (H).
7. Carefully insert dissolved oxygen sensor assembly (E) into flowcell cavity (F) and secure in place using clamping screw (D).

   Caution. Do not overtighten the clamping screw – apply finger-pressure only.
8. Close the solenoid valve (B) using the *Sensor Setup / Man. Valve Control* parameter at the transmitter (see Section 7.1.2, page 44) if applicable, or reinstate sample flow.
9. Let the sensor stabilize for at least 2 hours, then carry out a calibration – see Section 5, page 26.

   It is recommended that an additional calibration is carried out after a period of 12 to 24 hours – this improves the initial calibration and hence measurement accuracy.

   If a low sensor efficiency is displayed, refer to Appendix A, page 61.

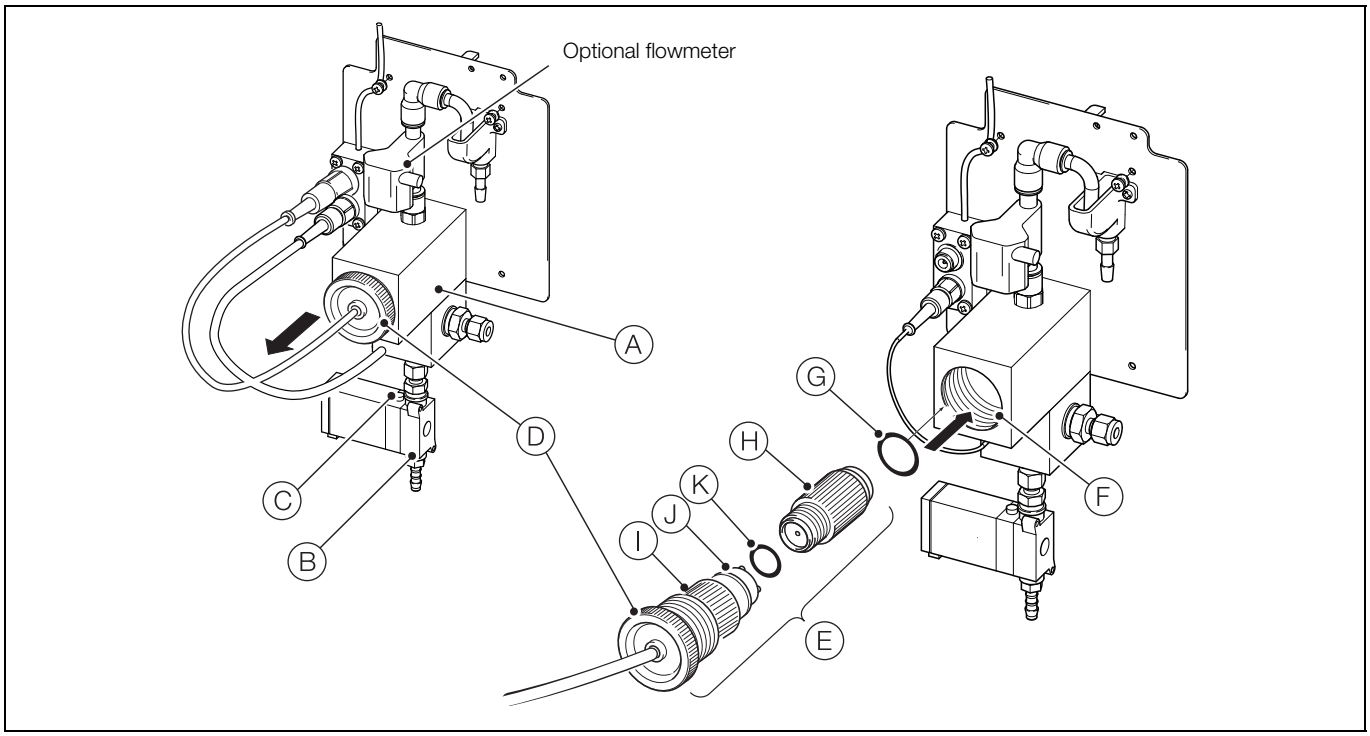


Fig. 8.1 Cleaning / Changing the dissolved oxygen sensor – ADS550

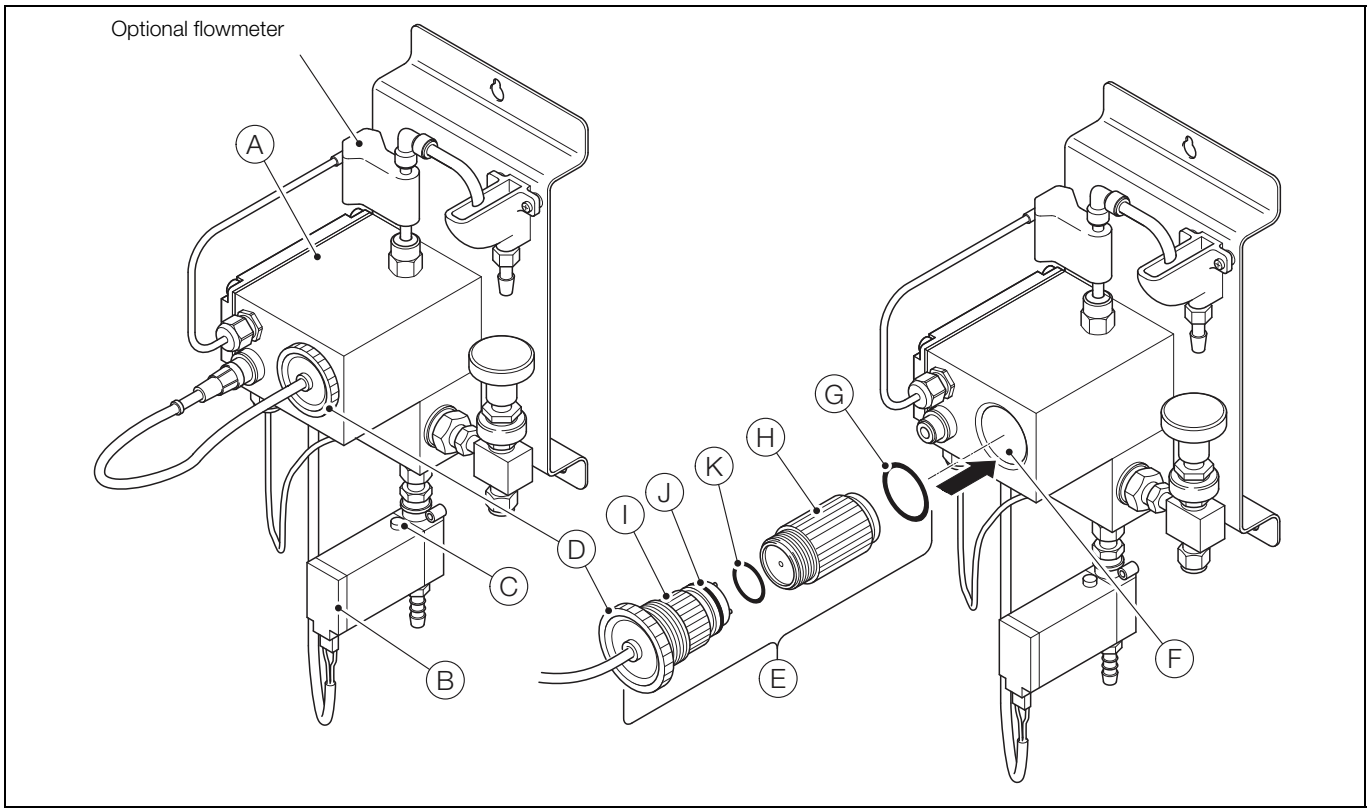


Fig. 8.2 Cleaning / Changing the dissolved oxygen sensor – ADS551

9 Specification – analyzer (ADS550 / ADS551)

Operation

Measuring range
0 to 20,000 ppb

Units of measure
ppb, µg/l, µg/kg

Accuracy
±5 % of reading or ±1 ppb, whichever is the greater

Repeatability
±3 % of reading or ±1 ppb, whichever is the greater

Response time
1 minute for a 90 % step change

Resolution
0.1 ppb

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

Salinity correction
Preset within the range 0 to 80 ppt

Barometric pressure correction
Preset within the range 500 to 800 mm Hg

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
2 bar gauge (29 psi) maximum

Sample flow rate
100 to 300 ml/min

Sample connections
1/4 in. or 6 mm OD pipe (stainless steel recommended)

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

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 V DC (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*, Alarms log*, Calibration log, Diagnostics log, Configuration changes

Chart view

On local display

Historical review

Of data

Data transfer

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/ADS550-EN Rev. D

11 Specification – ADS550 wet-section

Mechanical data

Protection

IP54

Dimensions

Height – 480 mm (18.90 in.)

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/ADS550-EN Rev. D

12 Specification – ADS551 flowcell

Mechanical data

Protection

IP65 (PCB enclosure protected to IP66)

Dimensions

Height – 325 mm (12.80 in.)

Width – 135 mm (5.31 in.)

Depth – 160 mm (6.30 in.)

Weight – 1.5 kg (10 lb)

Electrical

Power supply ranges (supplied by transmitter)

24 V DC max.

Power consumption

8 W max.

DS/ADS551-EN

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.
	**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 2)

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 at temperature compensator connections to the PCB.
	**Calibrating (S1, S2, S3, S4)**	Displayed during calibration of wet-section (1, 2, 3, 4), when wet-section is exposed to air. On a multiple wet-section setup, this inhibits the calibration of other wet-sections.
	**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, or after exiting *Man. Valve Control* – see page 44. During the recovery period, outputs and alarms are held if *Hold Outputs* is enabled – see page 43.
	**Simulation On**	The analyzer is operating in *Simulation* mode.
	**Cal. Failed (S1, S2, S3, S4)**	Last wet-section calibration failed. Refer to Appendix A.2, page 63 and Appendix A.3, page 63.
	**Flow Error (S1, S2, S3, S4)** *Displayed only if flowmeter is fitted*	Sample flow rate is less than 100 ml/min (6.10 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 20,000 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. **Note**. If the sample temperature is above 55 °C (131 °F), the calibration valve is energized to divert the hot sample directly to drain, as high temperatures can damage the sensor. The calibration valve de-energizes after 30 minutes. During this 30-minute period the *Concentration* and *Temperature* readings in the *Signals View* are held.
	**Media Near Full**	Memory card is more than 90% full. Replace memory card.

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

A.2 Low sensor efficiency / slow sensor calibration or no response to dissolved oxygen changes

1. Check that the sample drains fully from flowcell. If the sample does NOT drain fully check:
   a. Operation of solenoid valve.
   b. Sample inlet flow rate does not exceed 300 ml/min (18.30 cu in./min) maximum with needle valve (if fitted) fully open.
   c. Sample fluid paths are free flowing and clear of partial blockages.
   d. Solenoid valve drain tube is not kinked, blocked, excessively long, does not rise along its length.
   e. Flow meter (if fitted) is not blocked or dirty.
   f. Solenoid valve opens when activated by transmitter.
2. Replace the sensor as an initial check. It is also important that all program parameters have been set correctly and have not been altered inadvertently.

   If the fault persists:
3. Check that the wet-section responds correctly to the current input. Connect a current source to the sensor input connectors on the wet-section PCB – see Table 3.1, page 15. Check the expected current value is shown on the *Signals View* (see Section 6.6, page 33). Failure to respond to the input usually indicates a fault with the wet-section PCB (or comms cable or transmitter), a replacement wet-section PCB may be required.
4. If the response in (3) is correct, select the *Signals View* (see Fig. 6.9, page 34) and set the current source to a value which gives an on-scale D.O. reading on the transmitter. Make a note of the current source setting and the D.O. reading.

   Disconnect the current source, reconnect the sensor cable and connect the current source to the sensor connector (red socket) end of the cable (ensure the polarity is correct). Set the same current value on the source and check that the transmitter displays the noted reading in this configuration. If check 3 is correct but check 4 fails, check the connector block cable connections at the wet-section PCB and their condition. If the response for both checks is correct, fit a new sensor and calibrate it.

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 Fig. 3.13, 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.2. Incorrect readings usually indicate an electrical calibration problem.

Temperature °C (°F)	Resistance Ω
0 (32)	1000.0
10 (50)	1039.0
20 (68)	1079.3
30 (86)	1116.7
40 (104)	1155.4
50 (122)	1194.0
60 (140)	1232.4

Table A.2 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.2.
4. If the readings are still incorrect, check the connector block cable connections at the wet-section PCB and their condition.

A.4 High sample readings

If the sample reading is higher than expected, the most likely reason is air ingress into the main sample line.

1. Ensure the sample tubing used is impermeable to oxygen – stainless steel tubing is recommended.
2. Check and tighten ALL sample connections as it is possible to have an air leak into the sample without sample leaking.

A.5 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 67.

Appendix B – Multiple wet-section setup

A single Navigator 500 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 B.1 and B.2 (below) must be performed.

B.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 B.1 and Fig. B.1 below. 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 B.1 Configuring the device address

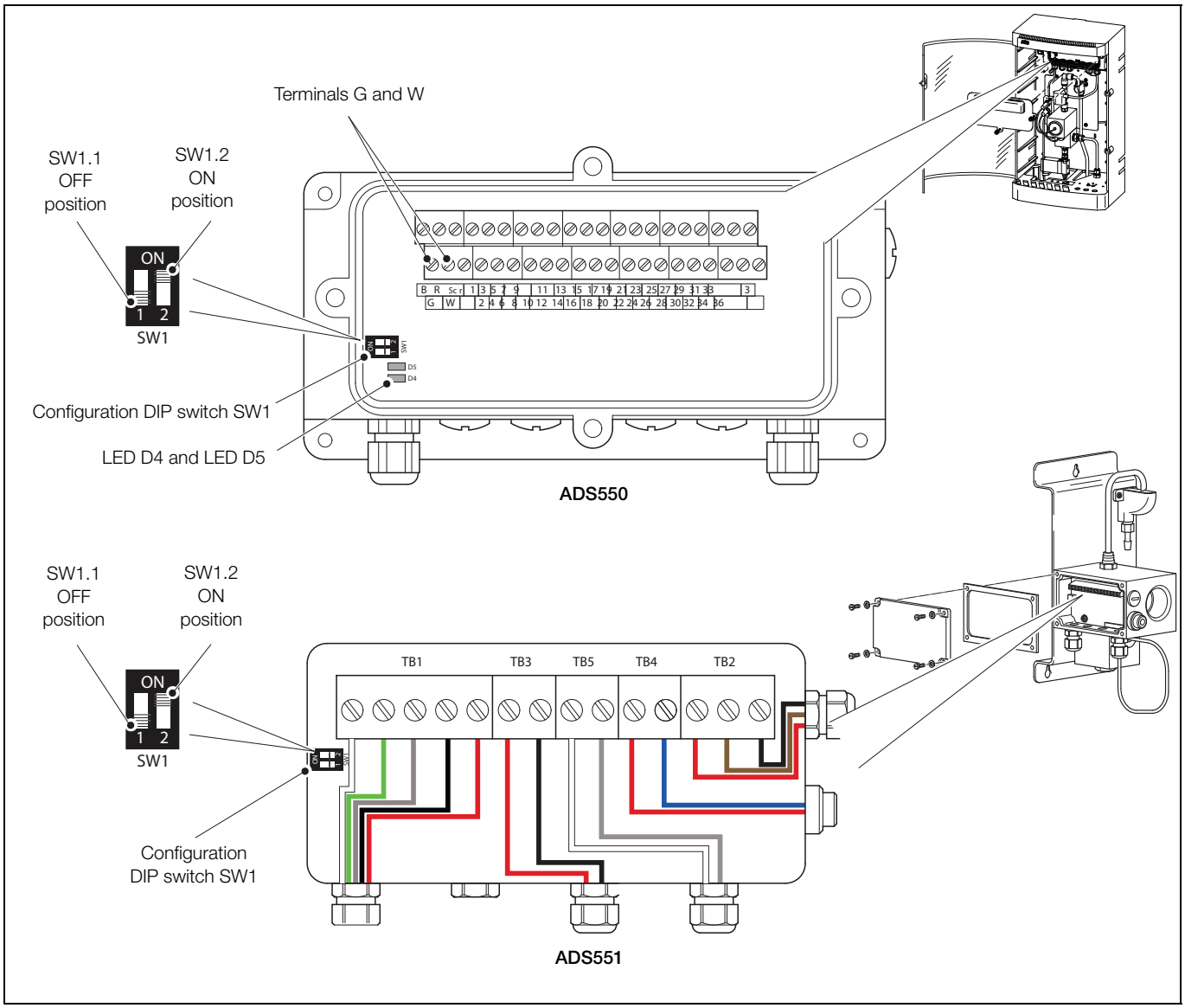


Fig. B.1 Configuration DIP switch SW1 (ADS550/ 551) and LED D4 / D5 location (ADS550)

B.2 Serial connections

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

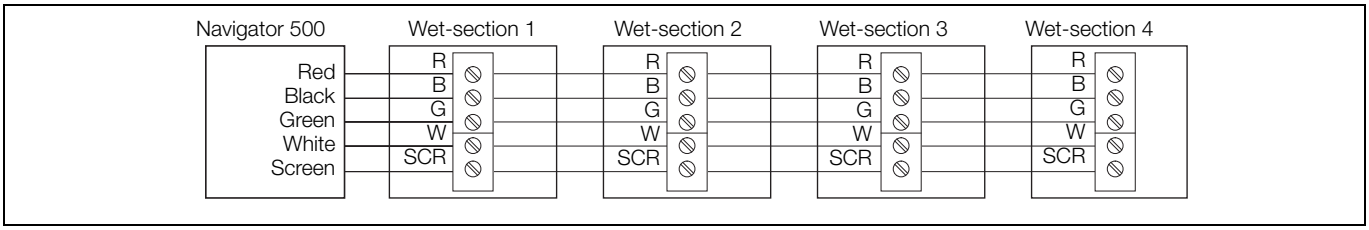


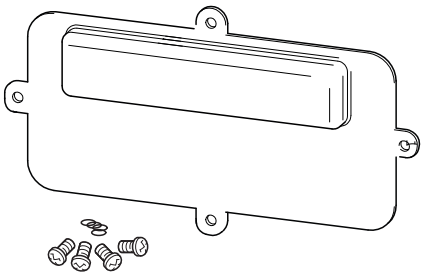
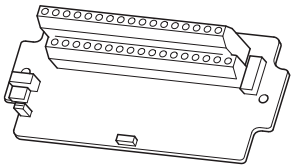
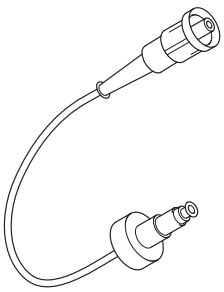
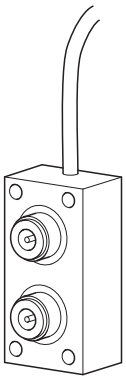
Fig. B.2 Serial connections

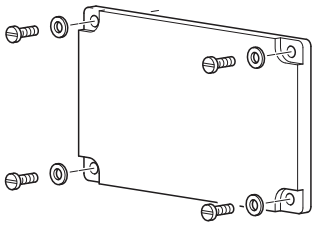
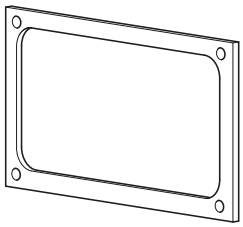
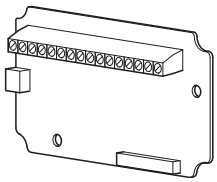
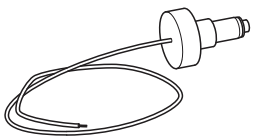
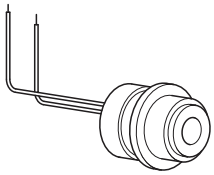
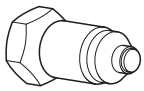
Note.

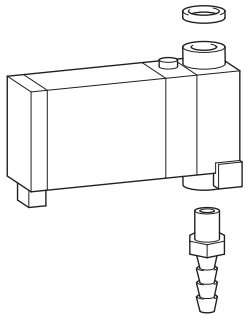
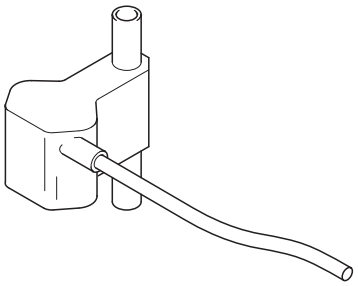
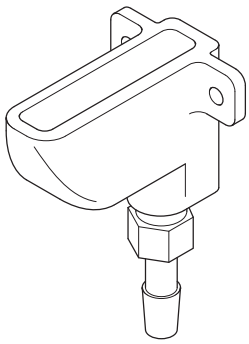
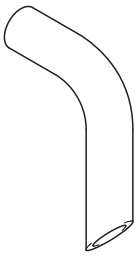
- The total cable length between the transmitter and the last wet-section must not exceed 30 m (98 ft.).
- Referring to Fig. B.2, fit a 120 Ω termination resistor between G and W at the far end of the chain.

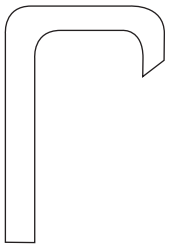
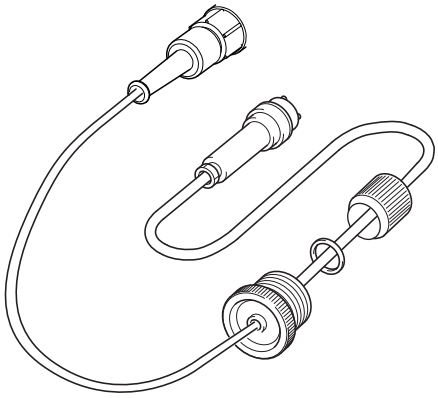
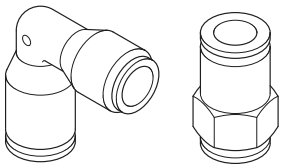
Appendix C – Spare parts

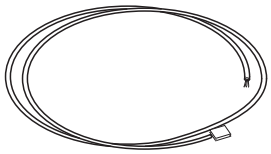
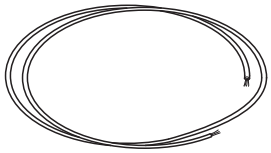
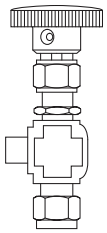
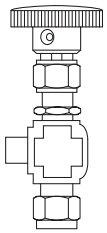
C.1 Low level dissolved oxygen wet-section

Part No.	Description
AW502 052	Terminal cover, O-ring and screws (ADS550 only) 
AW502 050	Dissolved oxygen wet-section PCB (ADS550 only) 
AW502 051	PCB housing seals (ADS550 only) 
AW502 055	Pt1000 temperature compensator assembly, screw ring and O-ring (ADS550 only) 
AW502 058	Sensor connector block (ADS550 only) 

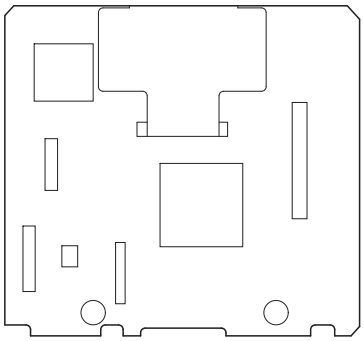
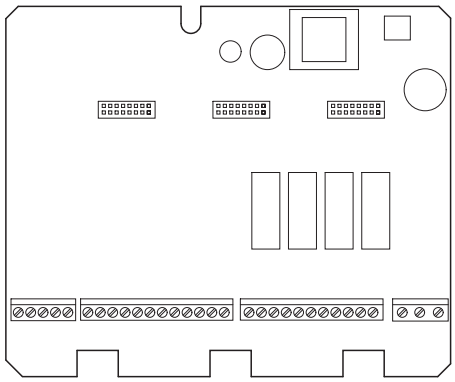
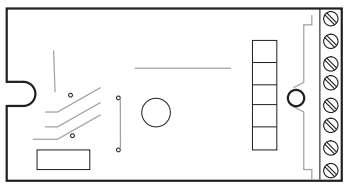
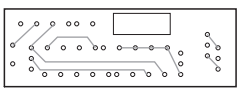
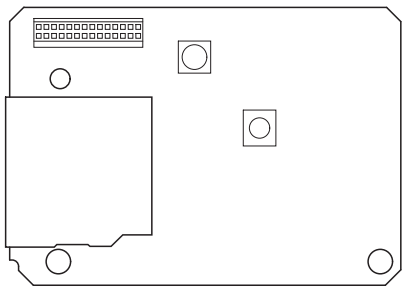
Part No.	Description
AW502 227	Flowcell PCBA housing cover (ADS551 only) 
AW502 221	Flowcell housing lid gasket (ADS551 only) 
AW502 225	PCB Assembled Board LLDO Flowcell – spare 
AW502 223	Seal kit (ADS551 only) 
AW502 220	Pt1000 temperature compensator assembly (ADS551 only) 
AW502 224	LLDO flowcell connector (ADS551 only) 
AW502 222	LLDO flowcell blanking plug (ADS551 only) 

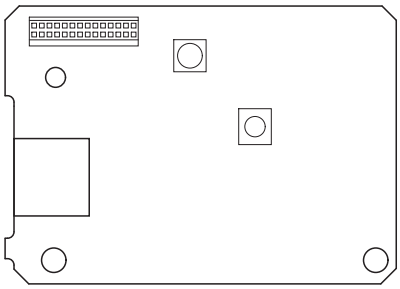
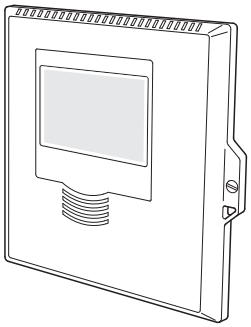
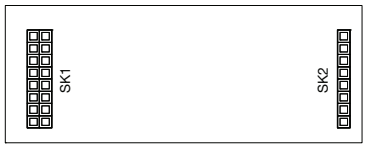
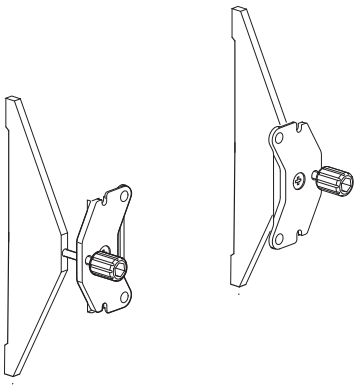
Part No.	Description
AW502 056	Drain valve assembly including bonded seal 
AW502 060	Flowmeter assembly 
AW502 065	Tundish assembly 
AW502 066	Sample outlet pipe – flowmeter fitted 

Part No.	Description
AW502 067	Sample outlet pipe – flowmeter not fitted 
AW502 081	Sensor cable assembly 
AW502 080	ADS550 and ADS551 low level dissolved oxygen sensor assembly 
AW502 061	Qd connector kit including elbow 

Part No.	Description
AW502 085	Cable assembly – LLDO calibration solenoid valve 
	Modbus cable assembly:
AW502 090	1.5 m (4.9 ft.)
AW502 091	5 m (16.4 ft.)
AW502 092	10 m (32.8 ft.)
AW502 093	20 m (65.6 ft.) 
AW502 068	Flow control valve – spare (imperial) 
AW502 069	Flow control valve – spare (metric) 

C.2 Navigator 540 transmitter spares

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) 
AW500 054	AWT SD media PCB spares kit 

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

Appendix D – ADS551 upgrade kits

Part No.	Description
AW502 240	Calibration solenoid valve – upgrade kit
AW502 270	Flow control valve – upgrade kit (imperial)
AW502 275	Flow control valve – upgrade kit (metric)

Notes

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Sales

Service

Software

ABB Limited
Measurement & Analytics
Oldends Lane, Stonehouse
Gloucestershire,
GL10 3TA
UK
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671
Email: instrumentation@gb.abb.com

ABB Inc.
Measurement & Analytics
125 E County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

abb.com/measurement

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3KXA494550R4201

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