ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION

Aztec 600 ISE ammonia and flouride

Single-stream ion-selective analyzers

Measurement made easy

Introduction

This publication provides installation, operation and maintenance procedures for the Aztec 600 ISE ammonia and flouride anlayzers.

For more information

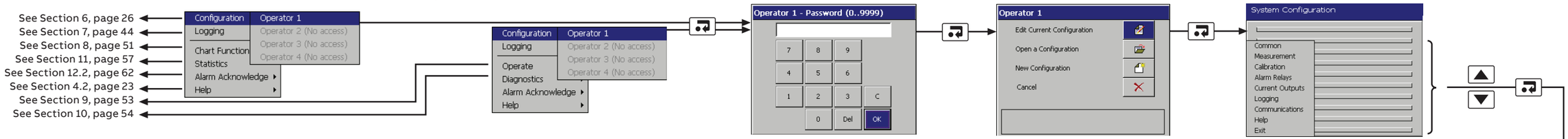
Further publications for the Aztec 600 ISE ammonia and flouride anlayzers are available for free download from www.abb.com (see links and reference numbers below) or by scanning this code:

	Search for or click on:
AAM631 Aztec 600 ISE ammonia analyzer Data sheet	DS/AAM631-EN
AFM631 Aztec 600 ISE fluoride analyzer Data sheet	DS/AFM631-EN

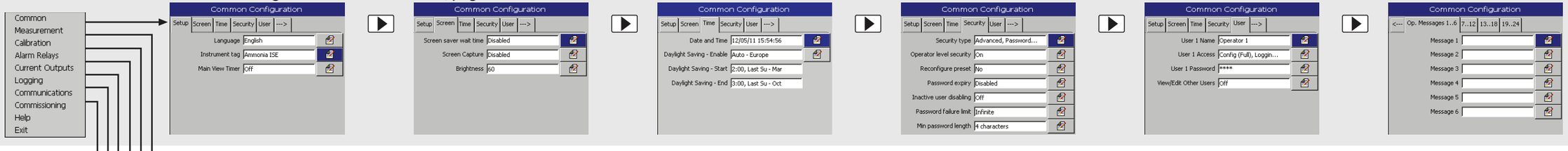
Configuration Level

Chart View Menu – see Section 2.1, page 8

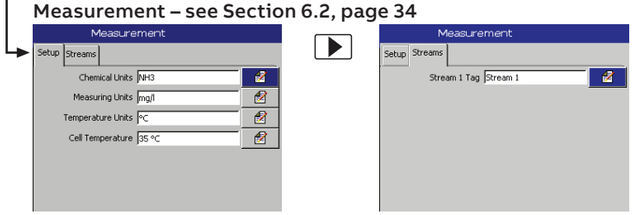
Indicator View Menu – see Section 2.1, page 8



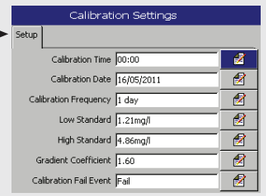
Common Configuration – see Section 6.1, page 28



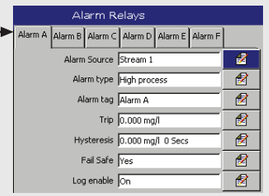
Measurement – see Section 6.2, page 34



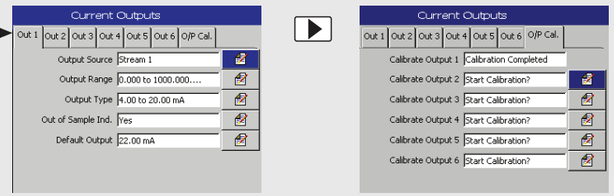
Calibration – see Section 6.3, page 35



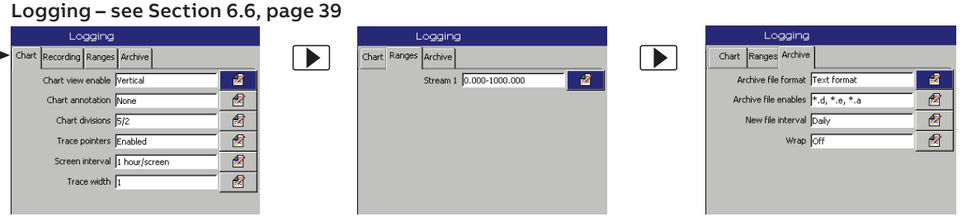
Alarm Relays – see Section 6.4, page 36



Current Outputs – see Section 6.5, page 38



Logging – see Section 6.6, page 39



Logging * – see Section 7, page 44

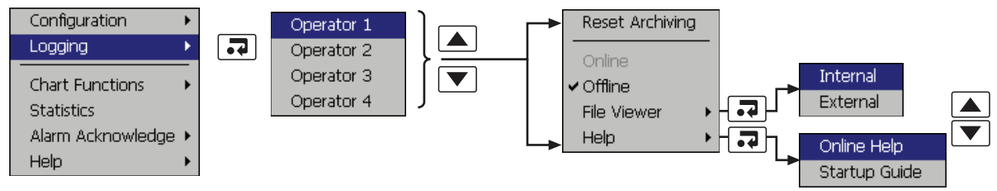
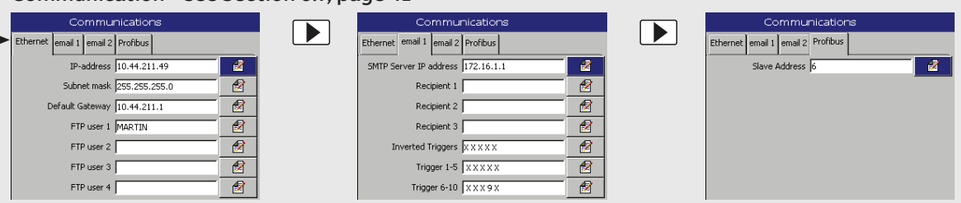


*Chart View Menu shown – logging options from this top level menu cannot be accessed from 'Configuration / Logging'

Communication – see Section 6.7, page 41



Contents

1 Safety

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

1.1 Health & Safety

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

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

1.2 Electrical Safety – CEI / IEC 61010-1:2001-2

This equipment complies with the requirements of CEI / IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500, NIST and OSHA.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.3 Symbols – CEI / IEC 61010-1:2001-2

One or more of the following symbols may appear on the equipment labelling:

	Protective earth (ground) terminal.
	Functional earth (ground) terminal.
	Direct current supply only.
	Alternating current supply only.
	Both direct and alternating current supply.
	The equipment is protected through double insulation.
	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.
	This symbol indicates that the marked item can be hot and should not be touched without care.

	This symbol indicates the presence of devices sensitive to electrostatic discharge and indicates that care must be taken to prevent damage to them.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the need for protective eye wear.
	This symbol indicates the need for protective hand wear.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	Products marked with this symbol indicates that the product contains toxic or hazardous substances or elements. The number inside the symbol indicates the environmental protection use period in years.

1.4 Product Recycling Information

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. In conformity with 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.

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.

1.5 Product Disposal

Note. The following only applies to European customers.

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. The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) that came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment.

In conformity with European local and national regulations (EU Directive 2002/96/EC stated above), electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.

1.6 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.

1.7 Chemical Reagents

Warning. To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards. Protective eye wear and protective hand wear. is always recommended when contact with chemicals is possible.

1.8 Safety Precautions

Please read the entire manual before unpacking, setting up, or operating this instrument.

Pay particular attention to all warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

1.9 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 move beyond a warning until all conditions have been met.

If a warning sign appears on the instrument itself, refer to Precautionary Labels – UL Certification and Electrical Safety – CEI / IEC 61010-1:2001-2 for an explanation.

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 move 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.

1.10 Safety Recommendations

For safe operation, it is imperative that these service instructions be read before use and that the safety recommendations mentioned herein be scrupulously respected. If danger warnings are not heeded to, serious material or bodily injury could occur.

Warning. The installation of the instrument should be performed exclusively by personnel specialized and authorized to work on electrical installations, in accordance with relevant local regulations.

1.11 Service and Repairs

Other than the serviceable items listed in Appendix G, page 90, none of the instrument's components can be serviced by the user. Only personnel from ABB or its approved representative(s) is (are) authorized to attempt repairs to the system and only components formally approved by the manufacturer should be used. Any attempt at repairing the instrument in contravention of these principles could cause damage to the instrument and corporal injury to the person carrying out the repair. It renders the warranty null and void and could compromise the correct working of the instrument and the electrical integrity or the CE compliance of the instrument.

If you have any problems with installation, starting, or using the instrument please contact the company that sold it to you. If this is not possible, or if the results of this approach are not satisfactory, please contact the manufacturer's Customer Service

1.12 Potential Safety Hazards

The following potential safety hazards are associated with operating the analyzer:

- Electrical (line voltage)
- Potentially hazardous chemicals

2 Introduction

The Aztec ion-selective (ISE) range comprise advanced, single-stream, analyzers used to measure the levels of ammonia or fluoride in water treatment plants.

The measurement involves the addition of a reagent solution* to the sample under constant temperature conditions. This results in a reacted solution containing ions whose presence can be detected by the sensor. When exposed to the reacted sample, the sensor generates an electrical potential that changes in proportion to changes in concentration of the target ion.

During operation, the signal generated from the sensing system is converted by the analyzer into data and this information is presented on the display.

Analyzer main components are shown in Fig. 2.1. The hinged lower door provides environmental protection for the liquid-handling section to ensure stabilized measurement conditions.

To maintain optimum measurement accuracy, the analyzer performs a 2-point calibration automatically by introducing standard solutions of known concentrations. The analyzer utilizes solenoid valves to introduce this solution automatically, at predetermined intervals.

Data is stored in the analyzer's internal memory and can be archived either to an SD Card or via an Internet connection. The SD card can also be used to upgrade the analyzer's software – see Appendix F, page 89.

This manual describes the operation and maintenance of the following Aztec 600 ion-selective analyzers:

- Aztec 600 ISE Ammonia
- Aztec 600 ISE Fluoride

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

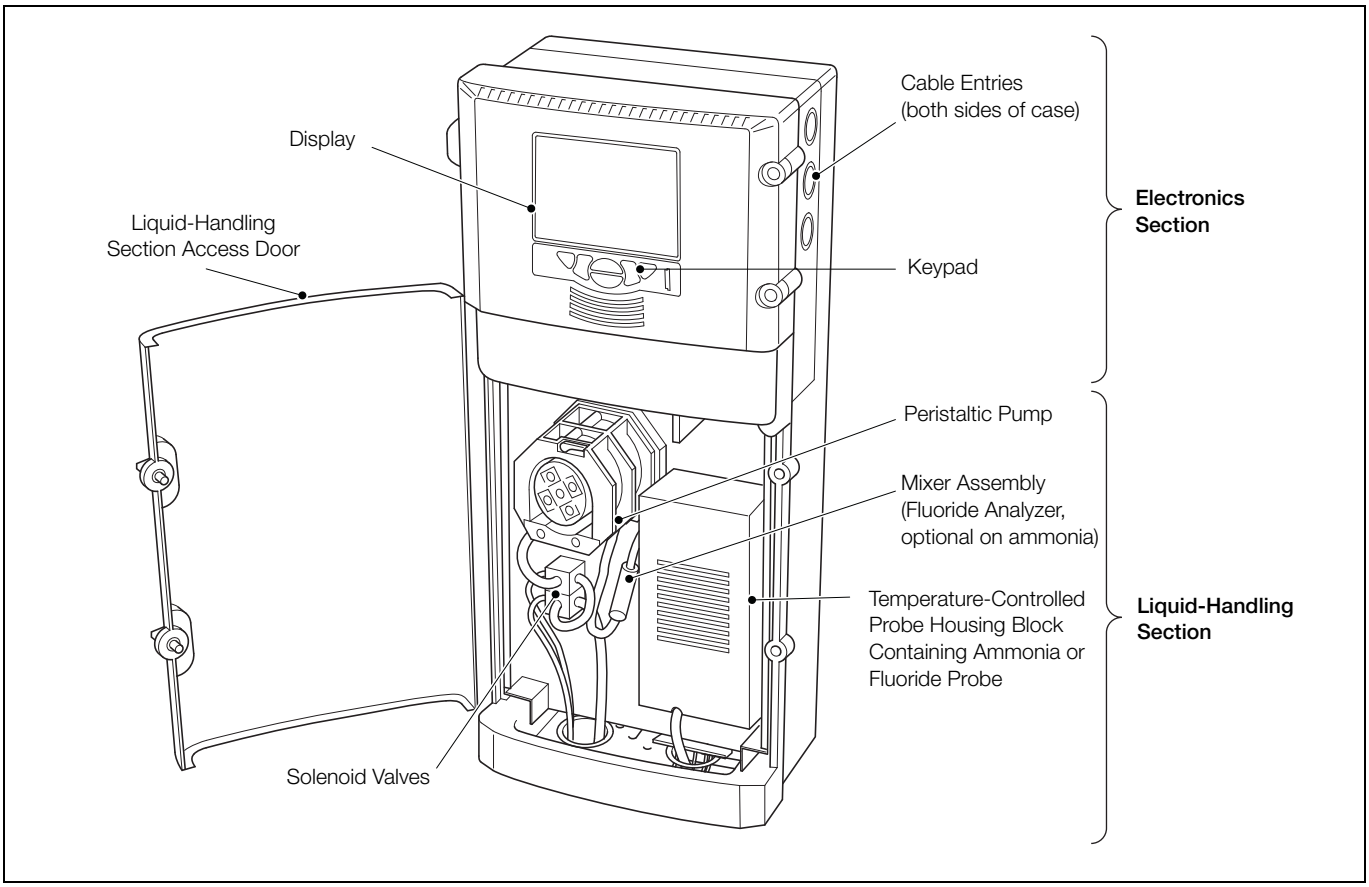
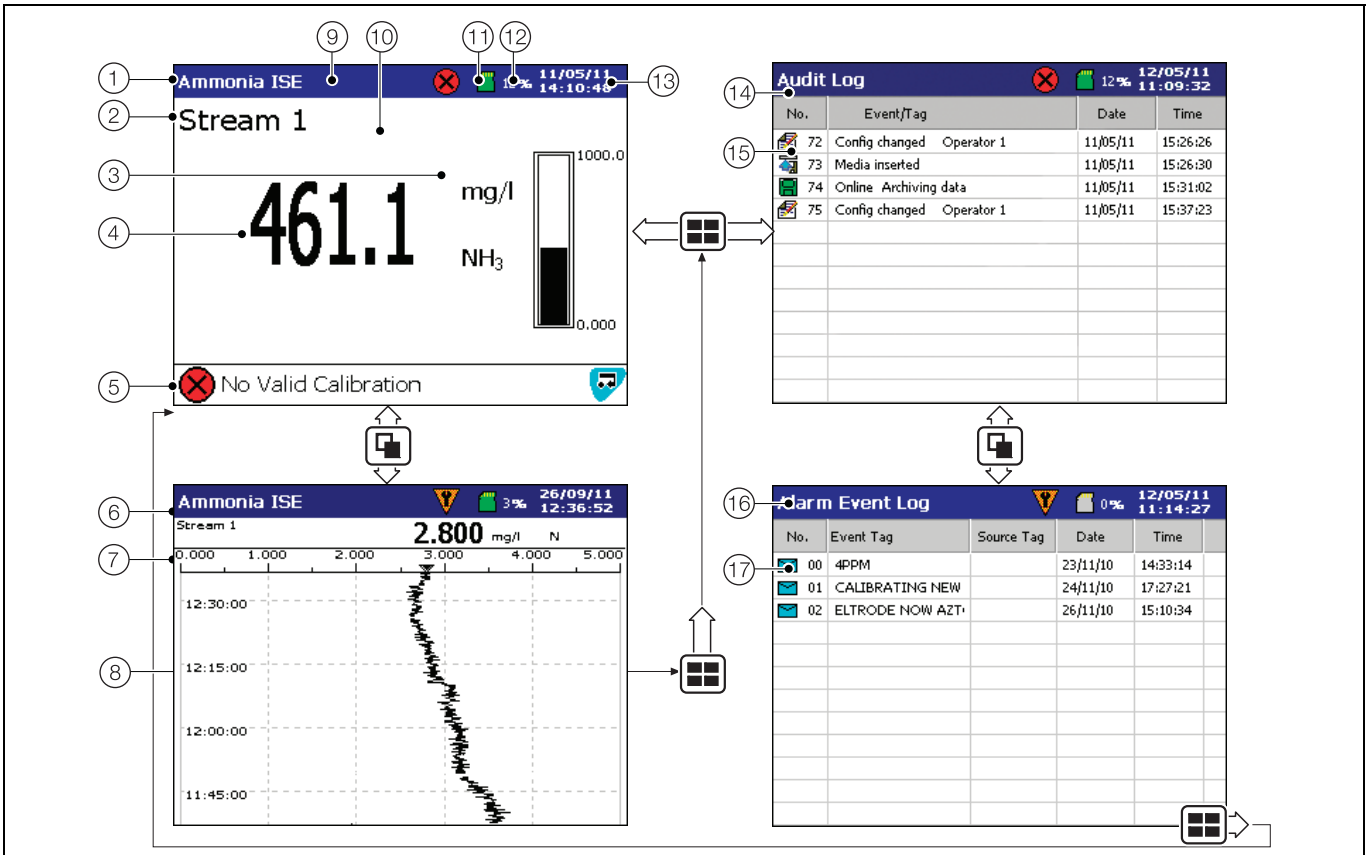


Fig. 2.1 Main Components

2.1 Operator Display Overview

The Operator screen is the default display.



Item	Feature	Item	Feature
①	Instrument name and measurement parameter	⑩	Measurement bar
②	Stream name	⑪	Status Icon – see Section 12.3.1, page 62 (Audit Log icons), see Section 12.3.2, page 63 (Alarm Log icons), see Section 12.3.3, page 63 (Status icons)
③	Measurement unit	⑫	Indication of SD card capacity full / empty as a % – associated with displayed status icon
④	Measured value	⑬	Current date and time
⑤	Diagnostic icon and message – see Section 12, page 58	⑭	Audit Log screen
⑥	Chart view **Note.** Alarm Event and Operator Message annotations are not shown on the chart unless enabled – see Section 6.6.1, page 39	⑮	Audit Log icon, event, date and time – see Section 12.3.1, page 62
⑦	Measured values and measurement units	⑯	Alarm Event Log screen
⑧	Chart trace	⑰	Alarm icon, event, date and time – see Section 12.3.2, page 63
⑨	Status bar		

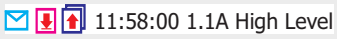
Table 2.1 Overview of Aztec 600 Operator and Log Screens

Note.

1. **Alarm Status**
   - Flashing red alarm event icon – alarm active and unacknowledged
   - Continuous red alarm event icon – alarm active and acknowledged

2. **Alarm Event and Operator Message Annotations**

   If Alarm event annotation is enabled and an alarm becomes active, a red alarm event icon surrounded by a channel colored box is displayed at the point at which the alarm occurred, together with the alarm time and tag. For example:

   If more than one alarm occurs in the same sample period:
   - and the second alarm on a channel becomes active, its icon is added behind the first.
   - and more than one operator message is active (max. 6), a second icon is added behind the first.
   - the new alarm event icons appear to the left of earlier icons.
   - the time and tag of the oldest alarm (right-most icon) only is displayed.

3 Installation

3.1 Optional Accessories

Optional accessories comprise:

- Reagent tray
- Calibration solution level sensor(s)
- Profibus capability (including separate manual – part no. IM/AZT6PBS)

3.2 Sampling Requirements

Selection of a good, representative sampling point is critical to obtain optimum performance from the analyzer.

To reduce sample dead time, locate the analyzer as close to the sampling point as possible.

Use small diameter tubing for the sampling line to minimize the lag time but large enough not to block.

The sample must also conform to the following conditions:

- Sample flow rate must be greater than 200 ml/min (7 fl oz [US]/min) and less than 500 ml/min (17 fl oz [US]/min).
- Sample temperature must be within the range 1 to 40 °C (32 to 104 °F).
- Samples must not contain particles exceeding 100 microns in size. Above these levels, an external filter must be fitted to the sample lines.
- Sample must be at atmospheric pressure. It must be as close to the analyzer as possible and the sampling point must provide a thoroughly mixed representative sample.

3.3 Location

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

It is also advisable to have adjacent drains near ground level, so that the waste outlet from the analyzer can be as short as possible, together with maximum fall.

If the optional reagent tray is used, mount it directly below the bottom tray of the analyzer housing – see Section 3.4.1, page 11.

The power supply and power isolation switch must be adjacent to the analyzer.

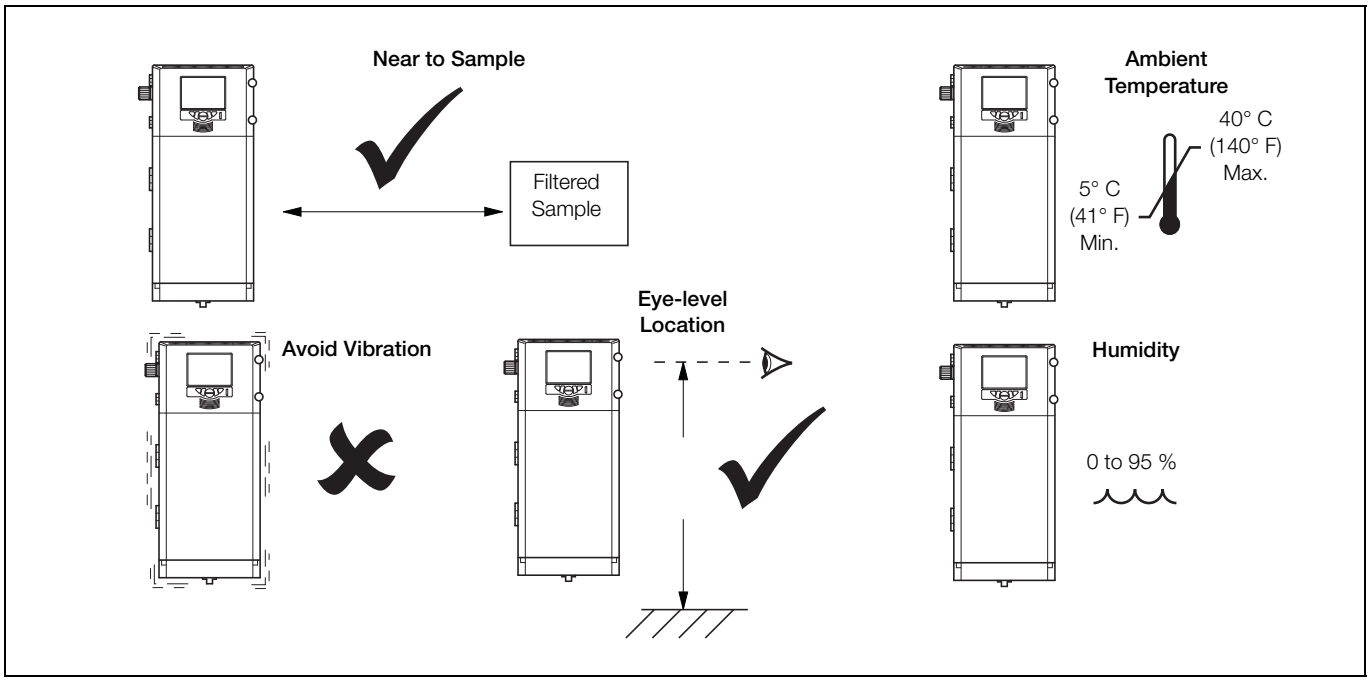


Fig. 3.1 Location

3.4 Mounting

3.4.1 Mounting Dimensions

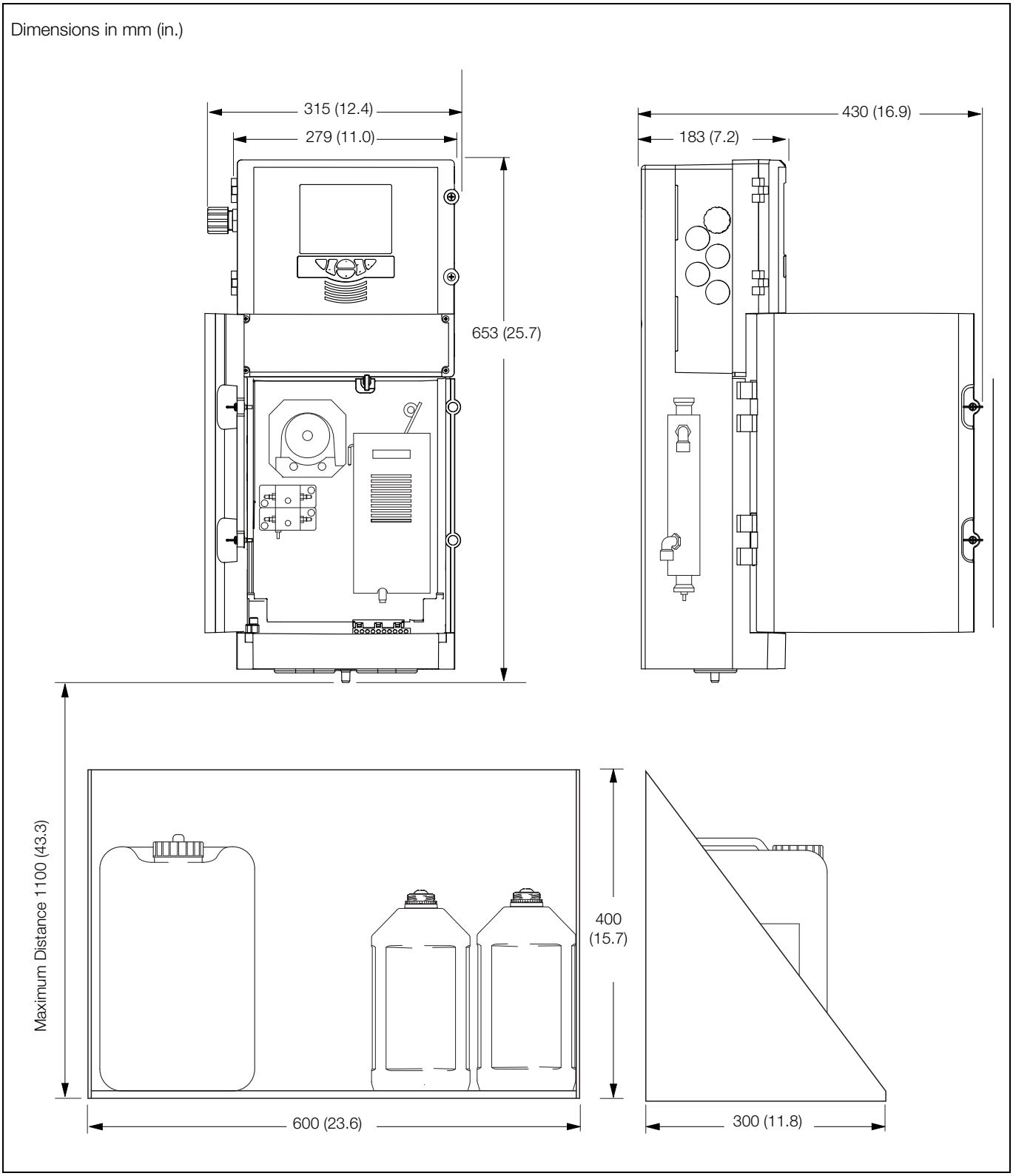


Fig. 3.2 Mounting Dimensions

3.4.2 Mounting the Analyzer

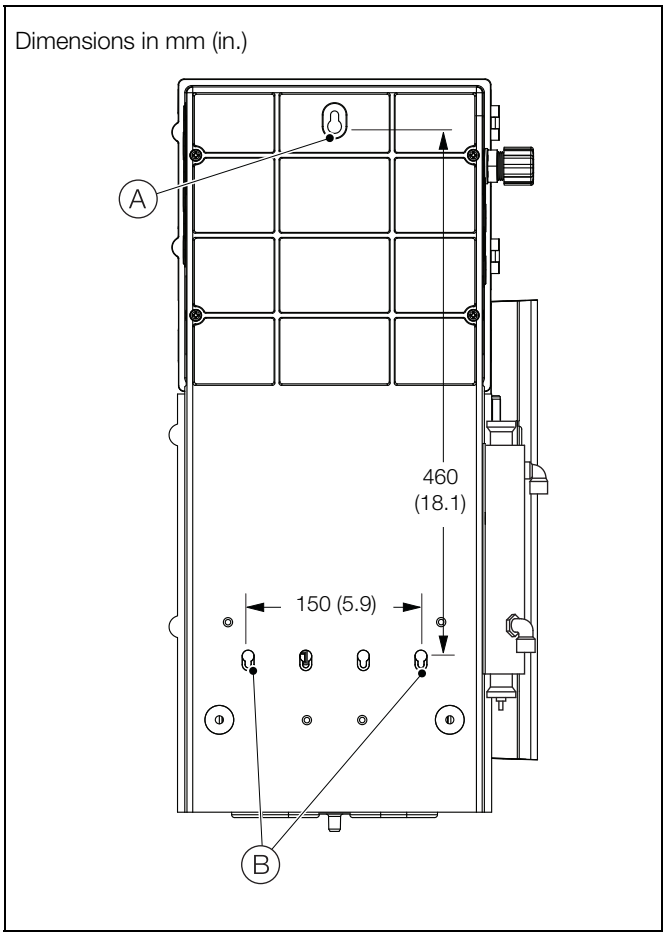


Fig. 3.3 Mounting the Analyzer

Note. Clearance – the enclosure doors can open 180°. If mounting in a confined area, allow sufficient clearance for cables on the door hinge side (min. 270 mm [10.6 in.]) and 100 mm (3.93 in.) on door opening side.

Referring to Fig. 3.3:

1. Mark the wall using the dimensions shown.
2. Drill and plug 3 holes (A) and (B), 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 analyzer onto fixing (A), ensuring the analyzer is retained firmly against the wall.

   Note. It is not possible to adjust fixing (A) once the analyzer is placed over it. If necessary, remove the analyzer and adjust the fixing.

5. Secure the analyzer to the wall using 2 fixings (B).

3.4.3 Mounting the Optional Reagent Tray

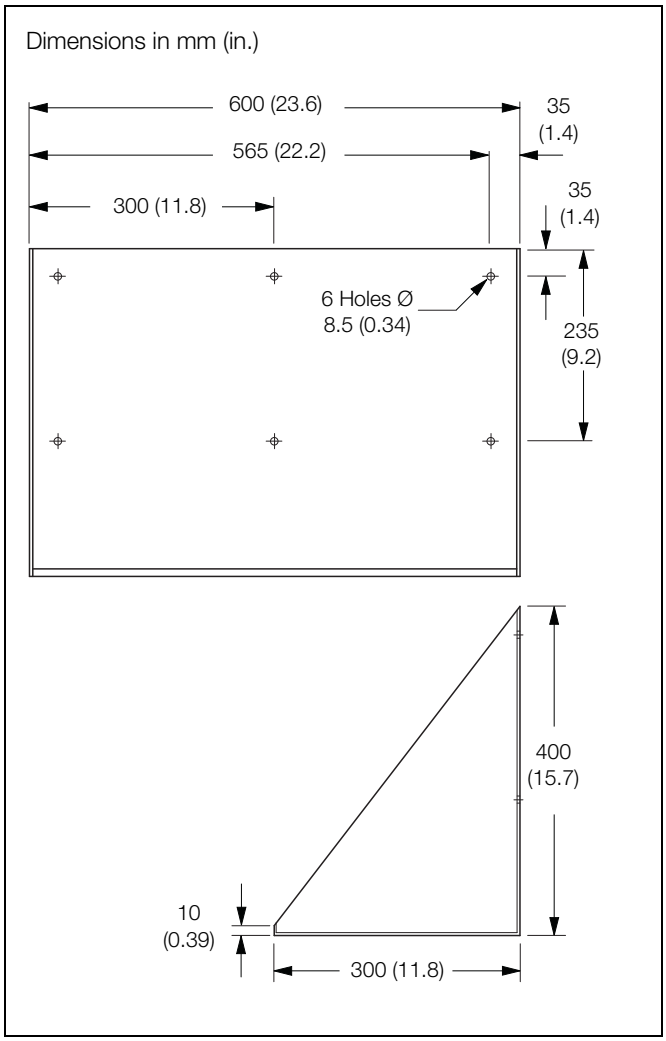


Fig. 3.4 Reagent Tray (Optional)

If used, place the reagent tray no more than 1100 mm (43.3 in.) from the analyzer's bottom tray – see Fig. 3.2, page 11.

Referring to Fig. 3.4:

1. Mark the wall using the dimensions shown.

   Alternatively, support the tray against the wall and mark through the mounting holes.
2. Drill and plug mounting holes suitable for M8 or 5/16 in. fixings.
3. Secure the tray to the wall using M8 or 5/16 in. fixings.

3.5 Electrical Connections

Warning.

- The analyzer is not fitted with a switch therefore 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 analyzer within easy reach of the operator and must be marked clearly as the isolation device for the analyzer.
- Remove all power from supply, relay and 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 0.8 to 2.5 mm^2 (18 to 14 AWG).
- Ensure the correct fuses are fitted – see Fig. 3.5, page 14 for fuse details.
- Use screened cable for signal inputs and relay connections.
- Replacement of the internal battery (type Varta CR2025 3V lithium cell) must be carried out by an approved technician only.
- The analyzer 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.
- If the analyzer is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.
- All equipment connected to the analyzer's terminals must comply with local safety standards (IEC 60950, EN61010-1).
- Route signal leads and power cables separately, preferably in an earthed (grounded) flexible metal conduit.
- 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 (mains input and relay contact outputs), use only suitably rated field wiring insulated copper conductors rated min. 300 V, 14 AWG, 90C. Route wires through suitably rated flexible conduits and fittings.

3.5.1 Connections Overview

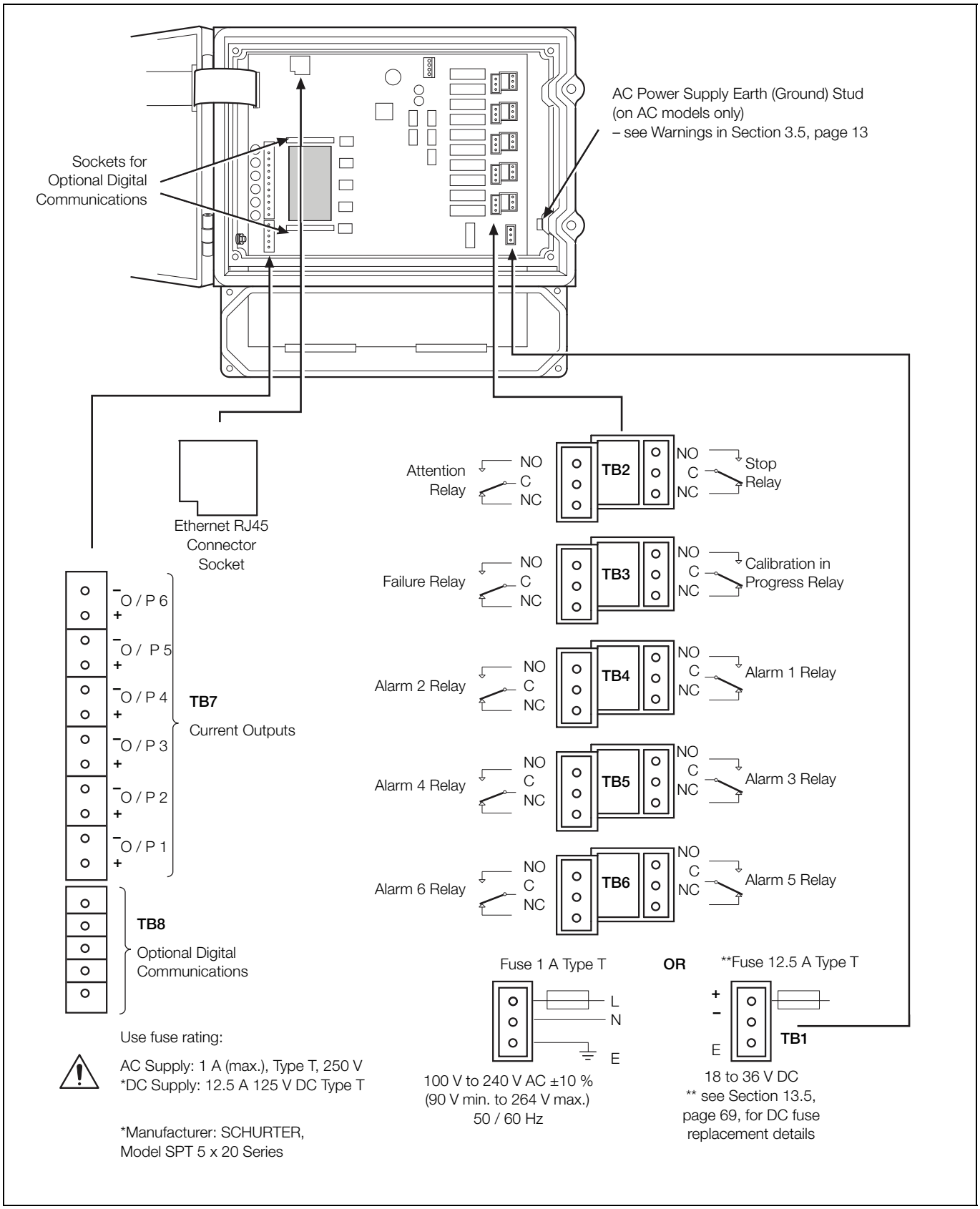


Fig. 3.5 Connections Overview

3.5.2 General Connections

Note.

- Cable entry holes are located on both sides of the enclosure.
- Application board connection terminal blocks TB1 to TB8 are identified in Fig. 3.5 on page 14.

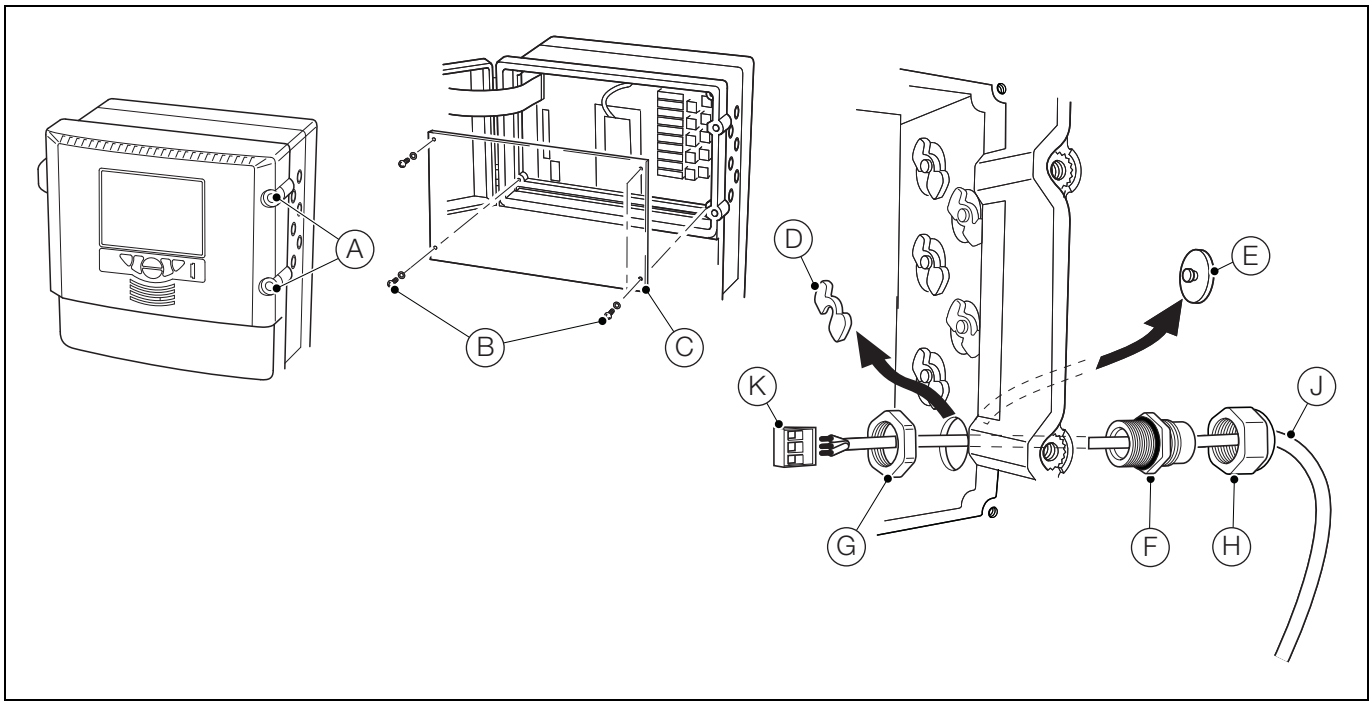


Fig. 3.6 Accessing and Making Electrical Connections

Referring to Fig. 3.6:

1. Turn the electronics section door retaining screws (A) ¼ turn counter-clockwise and open the door.
2. Using a cross-head screwdriver, remove 4 screws (B) and remove transparent 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 cable (J) through it.
6. Route the cable through cable gland (F) and through 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. Remove terminal block connection plug (K) and, using a small flat-bladed screwdriver, make connections to the plug. Ensure wires are connected to the correct terminals – see Fig. 3.5, page 14.
8. Reconnect the terminal block connection plug to the application board socket.
9. Tighten gland nut (H).
10. Repeat steps 3 to 9 for each required connection.
11. If required, connect the Ethernet cable – see Section 3.5.3, page 16.
12. Refit transparent cover plate (C) and secure using 4 screws (B). Close the door to the electronics section and turn door retaining screws (A) ¼ turn clockwise to secure.

3.5.3 Ethernet Connection

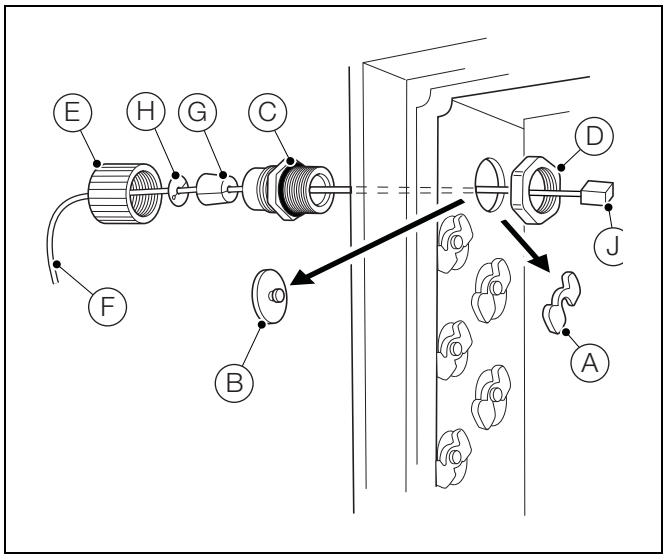


Fig. 3.7 Ethernet Connections

The Ethernet gland is different from the other connections to accommodate an RJ45 plug:

1. Referring to steps 1 and 2 in Section 3.5.2, page 15, open the electronics section door and remove the transparent cover plate.
2. Referring to Fig. 3.7:
   a. Slide retaining clip (A) off blanking plug (B) and remove the blanking plug.
   b. Fit cable gland (C) and secure using nut (D).
   c. Remove gland cover (E) and route cable (F) through it.
   d. Fit the rubber split-bush (G) and split-washer (H) over the cable.
   e. Route the cable through cable gland (C) and into the enclosure case.
   f. Plug the RJ45 connector (J) into the Ethernet RJ45 connector socket on the application board (see Fig. 3.5, page 14 for location details) and tighten gland nut (E).
3. Referring to step 12 in Section 3.5.2, page 15, refit the transparent cover plate and close and secure the electronics section door.

3.5.4 Alarm Relay Contact Protection and Interference Suppression

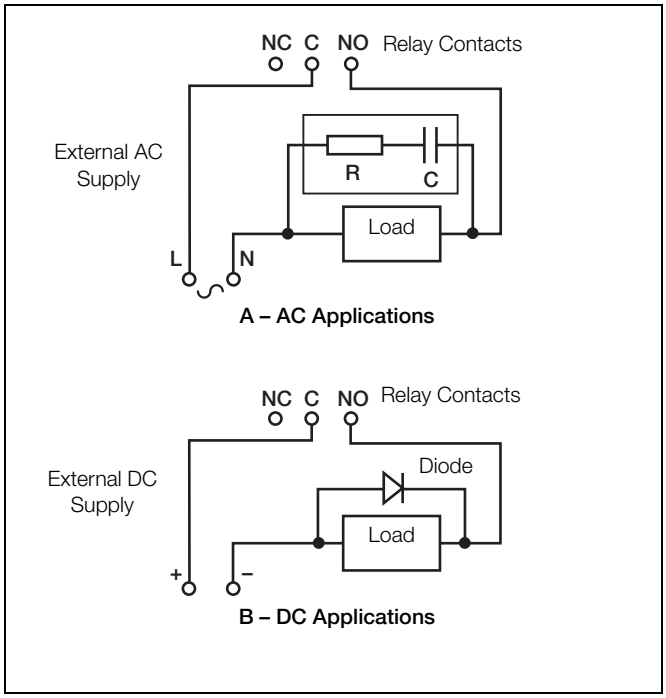


Fig. 3.8 Relay Contact Protection

If the relays are used to switch loads on or off, the relay contacts can become eroded due to arcing. Arcing also produces RFI that can cause analyzer malfunctions and incorrect readings. To minimize the effects of RFI, arc suppression components are required; these are resistor / capacitor networks for AC applications or diodes for DC applications. These components can be connected across the load.

Maximum relay ratings are:

- 250 V, 5 A AC, 1250 VA (non-inductive)
- 30 V, 5 A DC 150 W

For AC applications the value of the resistor / capacitor network depends on the load current and inductance that is switched. Initially, fit a 100R / 0.022 µF RC suppressor unit. If the analyzer malfunctions the value of the RC network is too low for suppression and an alternative value must be used.

For DC applications fit a diode – see Fig. 3.8. For general applications use an alternative IN5406 type (600 V peak inverse voltage at 3 A).

Note. For reliable switching the minimum voltage must be >12 V and the minimum current >100 mA.

3.6 Preparing the Analytical Section

3.6.1 Connecting Sample Inlet and Drain Lines

The sample pot fills with sample and over-flows at the top to maintain a constant head from where sample is taken to be measured.

The sample outlet line (Ⓑ in Fig. 3.9) must be routed to maintain a gravity-fed drain.

The float inside the pot contains a small magnet that operates a reed switch. When the float is in the uppermost position the switch is held closed. If the sample stops flowing the float drops slowly, allowing the reed switch to open, providing a sample flow failure indication.

Using rigid nylon tubing:

1. Connect the sample supply line to sample inlet connection Ⓐ (6 mm OD tubing).
2. Connect the drain line to sample outlet connection Ⓑ (10 mm OD tubing).

3.6.2 Connecting the Waste Line

A 0.5 m (1.64 ft) length of flexible $^{5}/_{16}$ in. internal diameter PVC tubing (Ⓒ in Fig. 3.9) is supplied fitted to the flowcell drain connection and routed through the grommet in the hole in the bottom tray. Connect it to either an appropriate waste drain or container.

Note. If necessary, a longer analyzer waste line can be fitted but its length **must** be kept to the absolute minimum required.

Ensure the tubing is kink-free, as short as possible and routed as vertically as possible to enable free drainage.

Caution. Analyzer waste is contaminated with reagents. Dispose of the waste in accordance with local regulations.

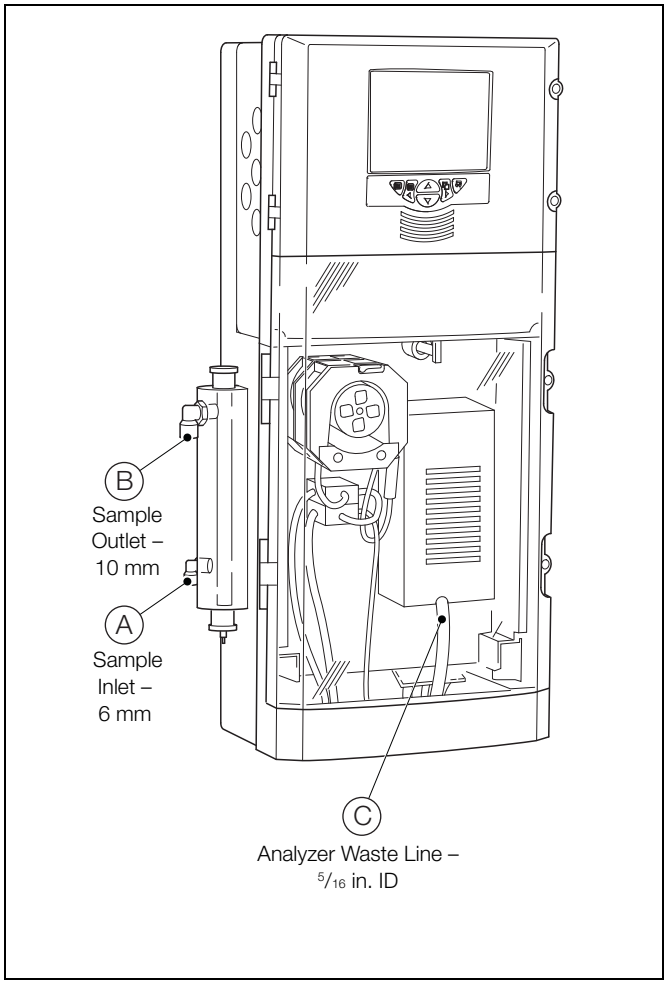


Fig. 3.9 Connecting the Sample Inlet, Drain and Analyzer Waste Lines

3.6.3 Fitting Peristaltic Pump Pressure Plate

To prevent premature wear to the pump tubing, the analyzer is supplied from the factory with the pump tubing pressure plate not fitted. The pressure plate must be fitted and secured for the pump to function correctly – referring to Fig. 3.10:

1. Ensure pump tubing (A) is positioned correctly over pump capstan rollers (B).
2. Ensure pump tubing sleeves (C) and shims (D) are fitted correctly in pump lower plate.
3. Fit pump pressure plate locking pin (E) to the pump pressure plate (F) as shown, ensuring that it does not protrude from the rear face of the pump pressure plate.

> **Note.** During step 4, it is **very important** to ensure that:
> - the pump tubing is not pinched
> - the pump tubing remains correctly located over the pump capstan rollers
> - each tube enters its respective groove in the pressure plate
> - the sleeves and shims remain in position

4. Position the pump pressure plate over the pump tubing and capstans and press down firmly until fully home, ensuring the pump tubing remains in position.
5. Press locking pin (E) fully home and turn ¼ turn clockwise to lock the pump pressure plate in position.

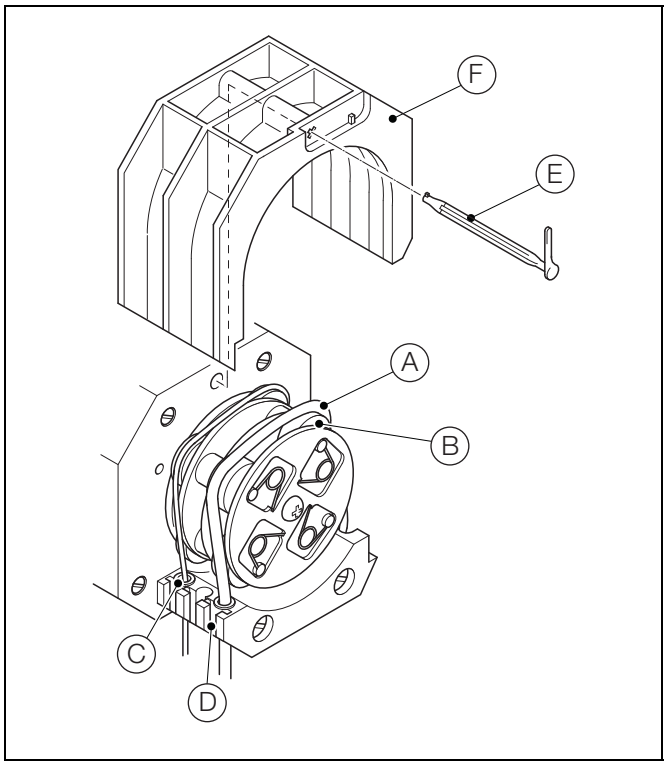


Fig. 3.10 Fitting Peristaltic Pump Pressure Plate

3.6.4 Connecting Reagent and Calibration Solutions

Warning.

- Reagents and calibration solutions may contain hazardous chemicals. Ensure that safety information is read and understood before handling the solutions.
- Wear appropriate protective clothing when handling reagent and calibration solutions.

Note. Take care when installing the reagent and calibration solution to prevent contamination. Keep the level sensors dry and avoid handling the stems.

1. Place the unopened reagent and calibration solution containers in a suitable position no more than 1100 mm (43.3 in.) from the analyzer's bottom tray or on the optional reagent tray (if fitted – see Section 3.4.3, page 12).
2. Referring to Fig. 3.11, hold the reagent level sensor by clamp ring (A) and:
   a. Using a dry, lint-free cloth, remove any foreign matter from level sensor stem (B).
   b. Remove the reagent container cap and store in a clean, safe place.
   c. Insert the reagent level sensor into the reagent container, ensuring that all connections are still in place.
   d. Check that the end of the level sensor is in close proximity to the bottom of the reagent container. If required, unscrew clamp ring (A), adjust nut (C) to position the sensor correctly, then secure with clamp ring (A).
   e. Secure the reagent level sensor to the reagent container with cap (D).
   f. Remove the calibration solution container cap and store in a clean, safe place.

   Note. Step 2g is applicable only if the analyzer is fitted with the standard calibration solution tubing sinker.

   g. Lower the sinker on the end of the calibration solution line to the bottom of the calibration solution container.

   Note. Step 2h is applicable only if the analyzer is fitted with the optional calibration solution level sensor.

   h. Repeat steps 2a to 2e to connect the calibration solution level sensor to the calibration solution container.

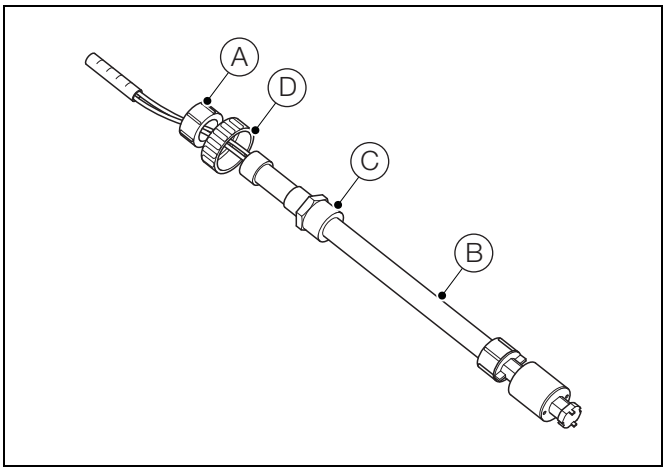


Fig. 3.11 Reagent / Calibration Solution Level Sensor

Note.

- When using the analyzer to measure ammonia samples with concentrations typically above 300 ppm, it is strongly recommended that a mixer assembly (part number AW621 045) is fitted to ensure adequate mixing of the higher strength reagent solution – see Fig. 3.13, page 21.
- Refer to Appendix A, page 76 for further guidance on reagent and standard solutions.

3.6.5 Ammonia Probe Preparation

The ammonia probe is supplied in kit form and must be assembled before use. Referring to Fig. 3.12:

1. Unscrew end cap (A) from probe body (B). Rinse the probe body with distilled or de-ionized water and allow to drain.
2. Remove the teat from glass pH electrode (C). Rinse the electrode with distilled or de-ionized water and dry with a paper tissue.
3. Screw electrode (C) into probe body (B) until the top of the electrode is flush with the top of the probe body.
4. Note the number on the electrode cap (D) that is aligned with the mark on the body. Unscrew the electrode 4 full turns using the number and mark as reference.
5. Insert membrane (E) into end cap (A) and place membrane sealing washer (F) centrally on it.
6. Screw end cap (A) firmly onto body (B); both body seal (G) and membrane sealing washer (F) must be under compression but do not screw the end cap on so tightly that membrane (E) distorts.
7. Hold the probe upright and inject the filling solution provided through filling hole (H). Fill the probe to a depth of between 50 and 60 mm (1.96 and 2.36 in.), ensuring that reference element (J) is immersed in the solution. Wipe any excess filling solution from the body.
8. Tap the end of the probe with the finger to dislodge any air bubbles trapped between the end of the electrode and the membrane.
9. Screw electrode (C) down 4 turns until the number on electrode cap (D) noted at step 4 is again aligned with the mark on the body (the top of the electrode should be flush with the top of the probe body).
10. Screw electrode (C) down a further 1.0 ±0.1 turns. Check that the tip of the electrode is pressing against the membrane. If the electrode response is sluggish, screw the electrode down by a further 0.2 to 0.3 turns. DO NOT overtighten – this will puncture the membrane.
11. Push probe cap (K) onto the top of probe body (B) ensuring it covers filling hole (H).

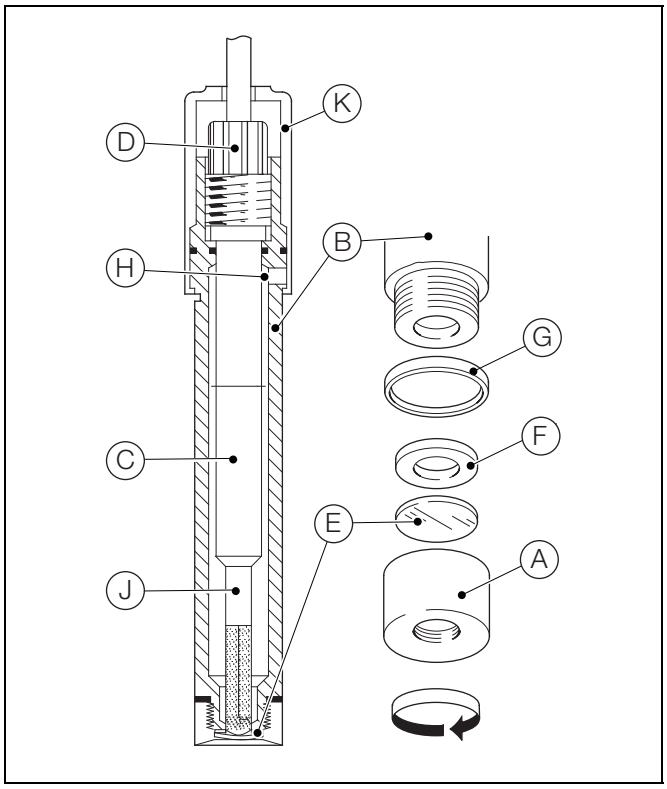


Fig. 3.12 Ammonia Probe Assembly

Note. A newly-assembled ammonia probe must be fitted to the analyzer and exposed to sample for 2 to 4 hours before a calibration is attempted.

Note. For measurements of very strong ammonia solutions, the molarity of the ammonium chloride in the filling solution (normally 0.1M Ammonium Chloride) should ideally be adjusted such that it is 2 – 3 times greater than the molarity of the strongest Ammonia solution to be measured.

If the probe is to be used continually near its upper limit (>200 ppm), it may be preferable to add 0.2 g ammonium chloride to the 50 ml filling solution bottle, to prolong the interval required between filling solution replenishment.

3.6.6 Fluoride Probe Preparation

The fluoride probe is supplied with a protective end cap to prevent the Lanthanum Fluoride crystal (forming its tip) from drying out and from being scratched or chipped. To prepare for use, remove the end cap and carefully rinse the tip in distilled water.

3.6.7 Fitting the Probe

Referring to Fig. 3.13, fit the ammonia or fluoride probe as follows:

1. Hinge down temperature-controlled block cover (A) to gain access to block (B).

> **Note.** During step 2, when fitting ammonia probe, take care not to damage the membrane.

2. Position probe (C) into the recess in the temperature-controlled block (ensuring that probe tip (D) is fully inserted into flowcell (E)) and rotate retaining clip (F) to hold the probe in position.
3. Close the temperature-controlled block cover (A).
4. Connect probe lead (G) to coaxial socket (H).

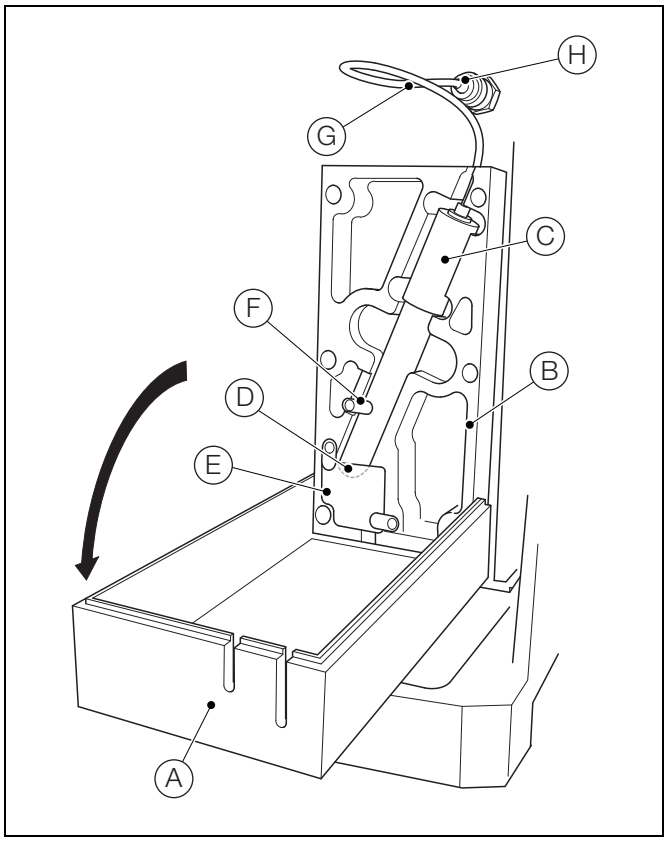


Fig. 3.13 Fitting Ammonia / Fluoride Probe

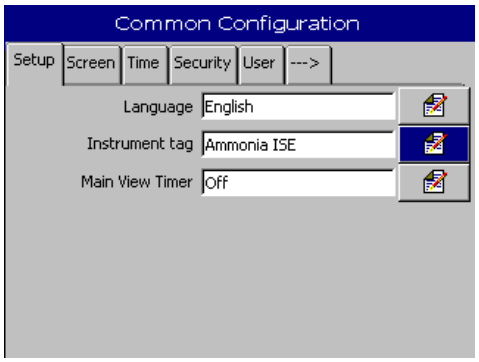
4 Getting Started

4.1 Overview

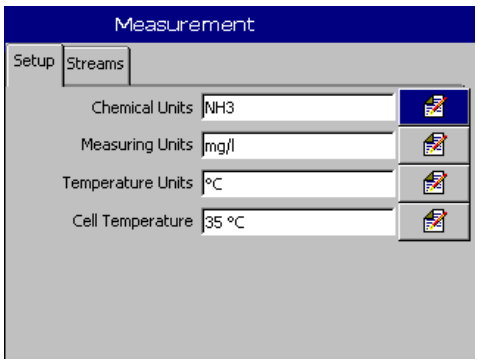
The following procedure describes how to start up and configure the analyzer prior to operation.

1. Ensure the analyzer is installed and electrically connected correctly – see Section 3, page 10.
2. Ensure the correct reagents / calibration solutions are connected to the analyzer – see Section 3.6, page 17.
3. Ensure sample is connected correctly to the analyzer and that the flow rate, temperature, pressure and particulate size are within the specified limits – see Section 14, page 70.
4. Switch on power to the analyzer.

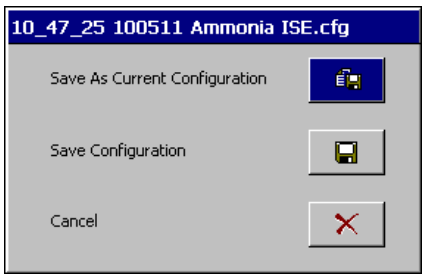
   After an initial power-up period, the main operator screen is displayed.
5. Press the ☰ key and use the ▲ and ▼ keys to select 'Common Configuration' to configure the analyzer:
   - Setup – see Section 6.1.1, page 28
   - Screen – see Section 6.1.2, page 28
   - Time – see Section 6.1.3, page 29
   - Security – see Section 6.1.4, page 30
   - User – see Section 6.1.5, page 33
   - Operator Messages – see Section 6.1.6, page 33



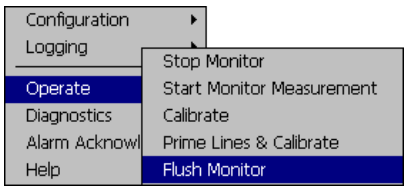
6. Press the ☰ key and use the ▲ and ▼ keys to select 'Measurement' to set up the analyzer's measurement parameters:
   - Setup – see Section 6.2.1, page 34
   - Streams – see Section 6.2.2, page 34



7. Press the ☰ key and use the ▲ and ▼ keys to select 'Exit' to exit configuration. A prompt is displayed asking if the current configuration is to be saved:

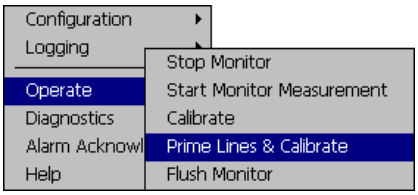


8. Press the ↵ key to save the configuration to the analyzer's internal memory.
9. Press the ☰ key and use the ▲ and ▼ keys to select 'Operate' followed by 'Flush Monitor' and press the ↵ key.



   Allow the analyzer to flush for a minimum of 1 hour to enable the measurement probe to stabilize.

10. Press the ☰ key and use the ▲ and ▼ keys to select 'Operate' followed by 'Prime lines and Calibrate' and press the ↵ key.



When the priming sequence is complete, a stabilizing period is initiated to allow the measurement cell temperature to stabilize. Once stabilized, calibration is performed automatically; the analyzer then enters measuring mode.

4.2 On-line Help

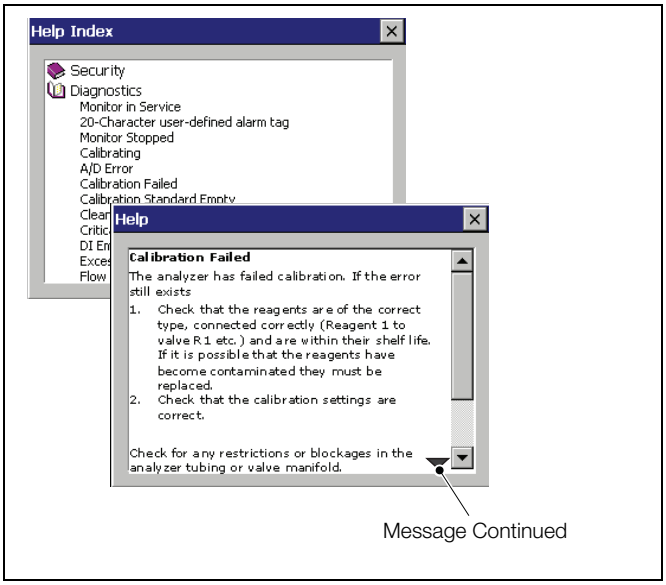


Fig. 4.1 On-line Help

If any alarms or messages appear on the operator screen, press the ↵ key to open the help at the relevant diagnostic help topic. For example, if the 'Calibration Failed' message is active and the help is opened, the help opens at the 'Calibration Failed' diagnostic topic.

1. Press the ☰ key and use the ▲ and ▼ keys to select 'Help'. Press the ↵ key to open the help.
2. To exit the on-line help, press the ☰ key until returned to the screen from where help was selected from.

5 Operation

Warning.

Protective eye wear and protective hand wear is recommended when contact with chemicals is possible. Take appropriate Health & Safety precautions.

5.1 Front Panel Controls

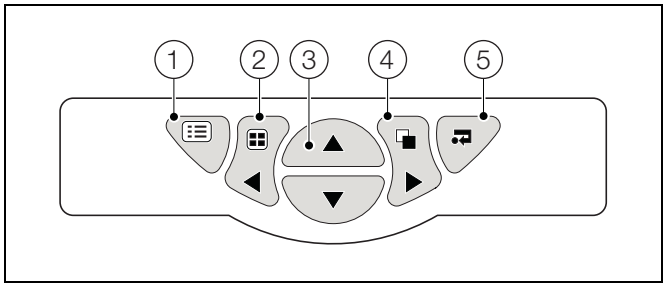


Fig. 5.1 Front Panel Controls

a **Menu Key** ☰ – Displays or hides the context-sensitive operator menu associated with each view. It also cancels the menu without making a change or returns to the previous menu level.

b **Group Key** ⊞ – Toggles between the operator and audit log screens.
Left Key ◀ – Scroll left.

c **Up / Down Keys** ▲ ▼ – Highlights menu items and scrolls through previously recorded data.

d **View Key** ⧉ – Toggles between the operator and chart screens.
Right Key ▶ – Scroll right.

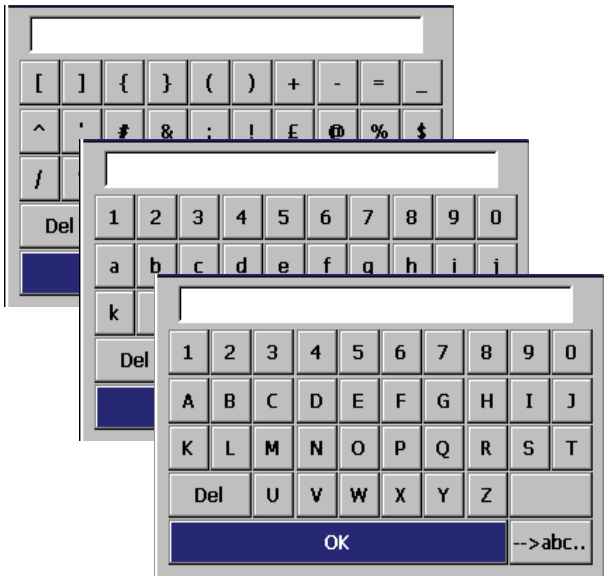
e **Enter Key** ↵ – Selects the highlighted menu item, operation button or edit selection.

5.2 Navigation and Editing

Depending on the type of field to be edited, the software provides a variety of methods for entering values.

5.2.1 Text Editing

If the field to be edited requires text, a keyboard is displayed:



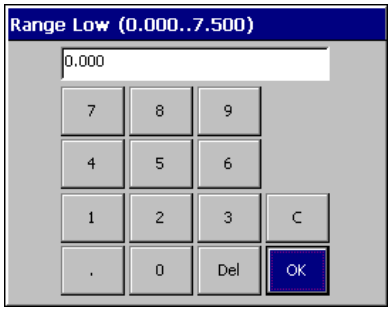
To enter text, use the ▲, ▼, ◀ and ▶ keys to highlight the required character and press ↵.

There are three set of characters, uppercase, lowercase and symbols. To toggle between each, highlight the bottom, right-hand button and press ↵.

To finish, highlight 'OK' and press ↵ or press ☰ to exit without making any changes.

5.2.2 Numeric Editing

If the field to be edited requires a numeric value, a number-pad is displayed:



To enter a number, use the ▲, ▼, ◀ and ▶ keys to highlight the required number and press ↵.

To finish, highlight 'OK' and press ↵ or press ☰ to exit without making any changes.

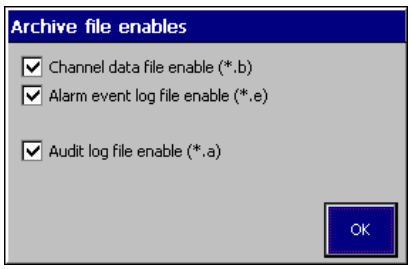
The 'C' key cancels the edit operation and exits back to the previous screen.

The 'Del' key executes the delete and backspace functions on characters or digits entered in the text box

5.2.3 Other Methods of Editing

There are several other methods of editing, for example:

Checkboxes



To toggle the selection, use the ▲ and ▼ keys to highlight the required checkbox and press ↵.

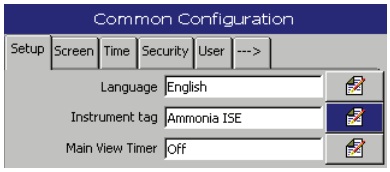
To finish, highlight 'OK' and press ↵ to exit and save changes or press ☰ to exit without making any changes.

Slider Bars

To select a value, use the ▲ and ▼ keys to move the slider.

To finish, press ↵ to exit and save changes or press ☰ to exit without making any changes.

Tabs

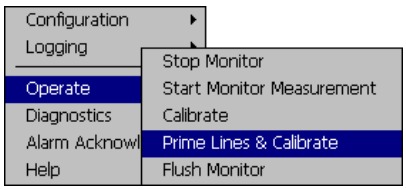


To select a tab, use the ◀ and ▶ keys.

> **Note.** The ---> tab indicates that there are more tabs available.

5.2.4 Menus

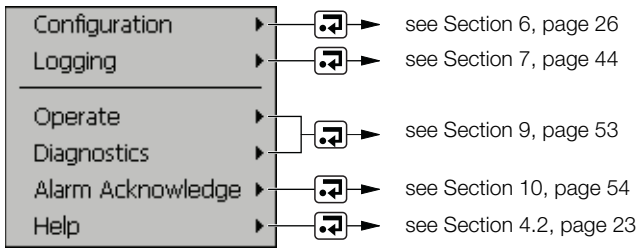
Press ☰ to open the menu and use the ▲ and ▼ keys to select a menu item. Press ↵ to open the menu item:



5.3 Software Screen Structure

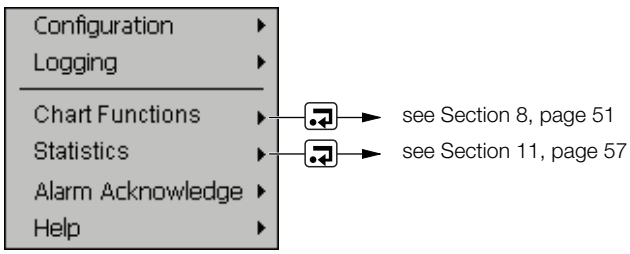
5.3.1 Indicator View Menus

When menus are accessed from the 'Indicator View', the 'Operate' and 'Diagnostics' menu options are displayed.



5.3.2 Chart View Menus

When menus are accessed from the 'Chart View', the 'Chart Functions' and 'Statistics' menu options are displayed.



6 Configuration

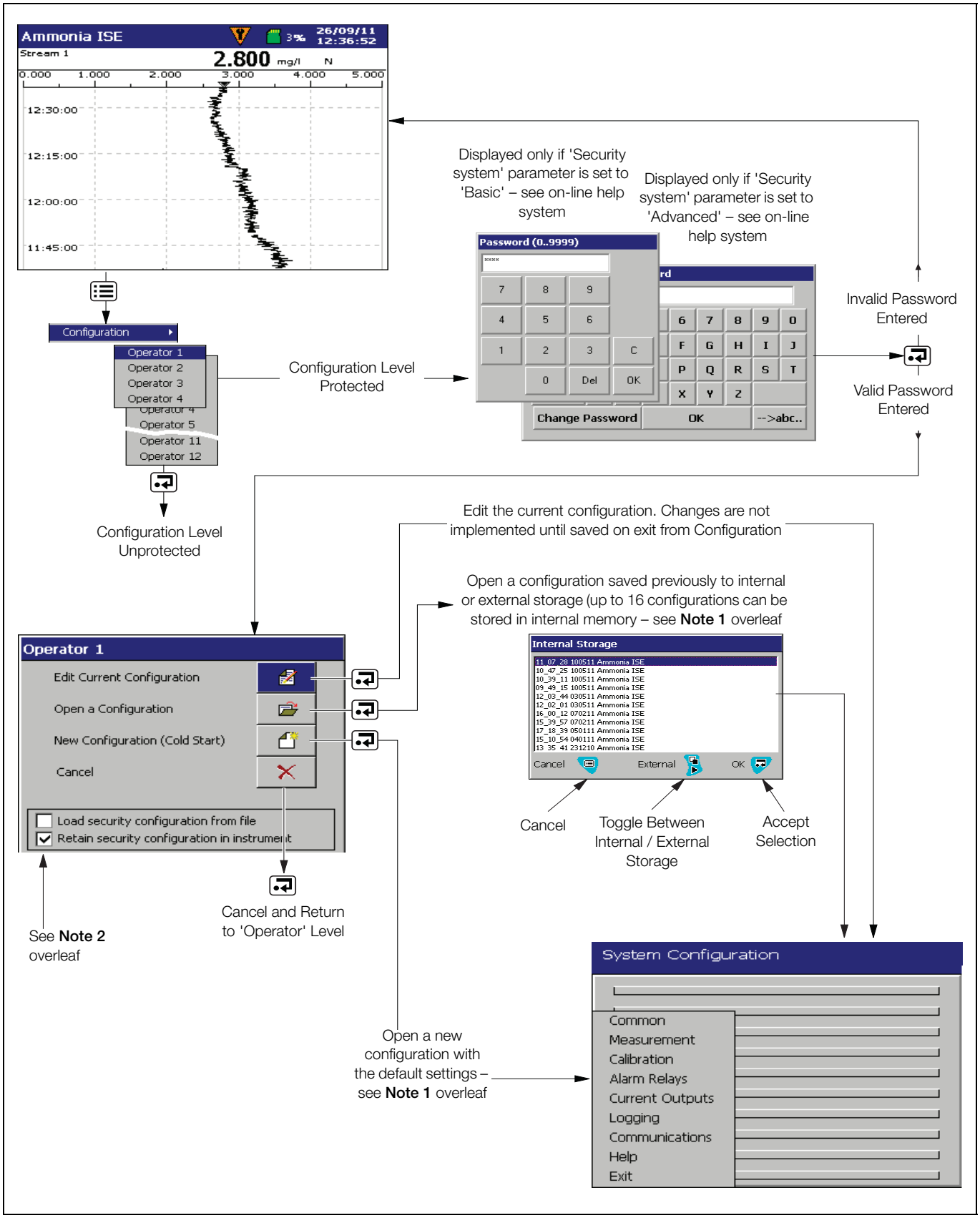


Fig. 6.1 System Configuration

Note.

- If 'New Configuration' or 'Open Configuration' is selected and the modified configuration file is saved, new data files for all log files are created and any unarchived data is lost
- Existing security configuration parameters are retained when a configuration is opened from file or when a new configuration is loaded (the security remains as currently configured). Check 'Load security configuration from file' to overwrite the current configuration with data from the file to be loaded.
- The option to load or retain the security configuration applies only to Advanced Security mode and is available only to the System Administrator (User 1 – see page 31). If a new or existing configuration file is opened by a user other than the System Administrator, existing security settings are retained.

Exiting Configuration Level

When exiting Configuration Level, the following conditions apply:

Note.

- The current, active configuration is saved to internal storage.
- Selecting 'Save as Current Configuration' suspends recording for a short time while the new configuration is implemented.
- When saving the current configuration to internal storage, the file is saved automatically with a '<time><date><instrument tag>.cfg' filename.
- When saving the current configuration to external storage, the file is saved automatically to internal storage, as well as to the external archive media as '<time><date><instrument tag>.cfg'.
- When 'Save Configuration' is selected, the configuration file is stored as '<time><date><instrument tag>.cfg' on internal or external storage.
- Changes are saved to non-volatile memory only when one of the save options above has been selected. Any powerdown before this results in lost configuration changes.
- Selecting 'Cancel' discards unsaved changes and returns the analyzer to the 'Operate' level.
- New internal data files for enabled recording channels are created if any of the following configuration parameters are changed:
  - Recording channel source
  - Channel tag
- A warning is displayed if a configuration change results in the creation of new internal data files for enabled recording channels. Select 'Yes' to accept the configuration change. Select 'No' to cancel the configuration change.

6.1 Common

There are nine tabs in the Common screen:

6.1.1 Setup

Fields	Description
Language	Lists the available languages. A new language selection does not take effect until the configuration is saved.
Instrument Tag	The analyzer's instrument tag text is displayed in the top-left corner of the operator views. Up to 20 characters can be used. The instrument tag is also displayed on the analyzer on configuration files and audit log files.
Main View Timer	The time after no key presses the display reverts to the main operator screen (excludes 'Configuration' screens).

6.1.2 Screen

Fields	Description
Screen saver wait time	The time delay for the screen-saver. The screen dims after the time set.
Screen Capture	Toggles between 'Enabled' and 'Disabled'. **Note**. An SD card must be fitted for screen capture. If enabled, press ↵ to capture the current log or chart screen to the **VRD\BMP** folder on the SD card. A confirmation dialog box is displayed for each screen capture.
Brightness	Adjusts the brightness of the screen.

6.1.3 Time

Fields	Description
Date and Time	**Warning**. Changing the time can result in the permanent loss of data. Once it is changed a warning is displayed stating that recording is disabled until the configuration has been saved.
Daylight Saving – Enable	Enables automatic daylight saving time adjustment. Options are: ■ **Off**. The 'Daylight Saving – Start' and 'Daylight Saving – End' fields are not available. ■ **Auto – USA**. The start and end of the daylight saving period in the USA is calculated automatically. The clock is incremented automatically by 1 hour at 2:00 am on the second Sunday in March and decremented automatically by 1 hour at 2:00 am on the first Sunday in November. ■ **Auto – Europe**. The start and end of the daylight saving period in Central Europe is calculated automatically. The clock is incremented automatically by 1 hour at 2:00 am on the last Sunday in March and decremented automatically by 1 hour at 2:00 am on the last Sunday in October. ■ **Auto – Custom**. The start and end date and time can be edited.
Daylight Saving – Start	If 'Daylight Saving – Enable' is set to USA or Europe, the start date is displayed but cannot be edited. If 'Daylight Saving – Enable' is set to 'Custom' the date and time can be edited.
Daylight Saving – End	If 'Daylight Saving – Enable' is set to USA or Europe, the end date is displayed but cannot be edited. If 'Daylight Saving – Enable' is set to 'Custom' the date and time can be edited.

6.1.4 Security

The analyzer is fitted with an internal security switch that, in combination with the 'Configuration security' parameter settings (see page 31), is used to prevent unauthorized access to the Configuration Level.

Two methods of configuration access protection are available:

1. **Password protection** (Factory Default)
   The Configuration level can be accessed only when the correct password has been entered.
2. **Internal security switch protection**
   The Configuration level can be accessed only when the internal security switch is set to the 'Enabled' position.

	'Configuration security' parameter setting (see page 31)	
Internal Security Switch Setting (see Fig. 6.2)	**'Password protected'** (Factory Default)	**'Internal switch protected'** (Alternative)
Disabled (Factory Default)	Password Access	No Access
Enabled	Free Access	Free Access

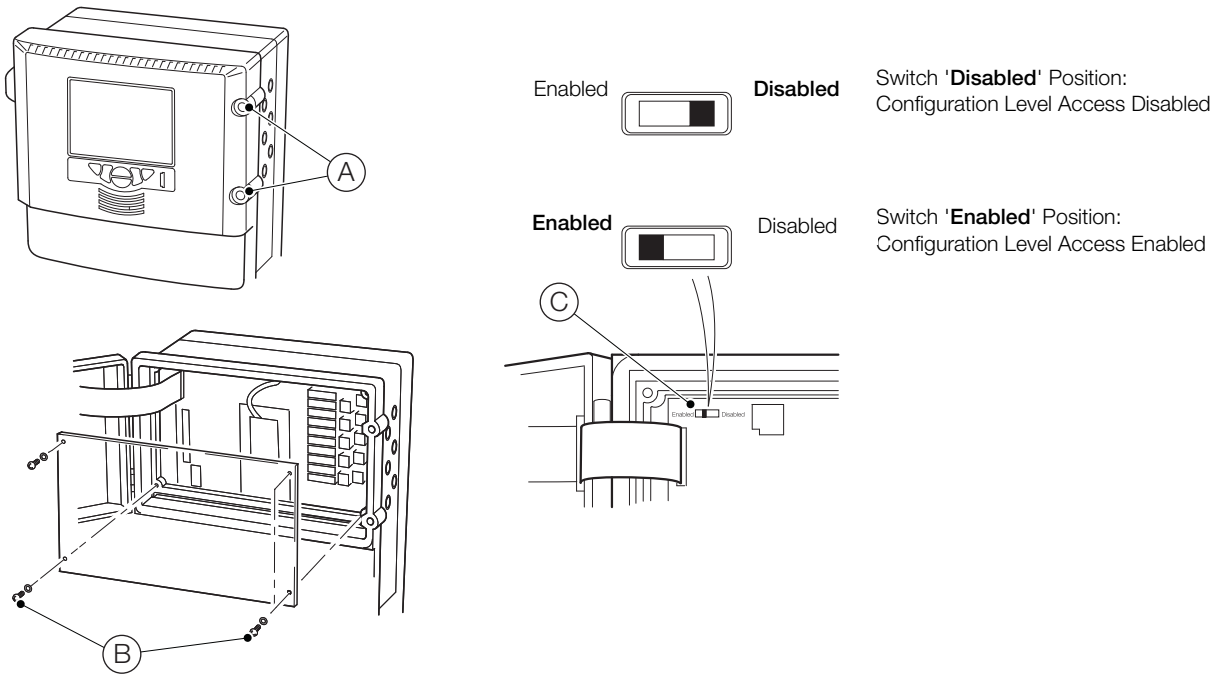


Fig. 6.2 Accessing the Internal Security Switch

To access the internal security switch:

1. Switch off the power supply to the analyzer and turn the two door retaining screws (A) 1/4 turn counter-clockwise.
2. Using a cross-head screwdriver, remove the four cover plate retaining screws (B) and remove the cover plate.
3. Set the security switch (C) to the required position.

Note. The Internal Security Switch is, by default, set to 'Disabled' and should only be used to access the Configuration level when 'Configuration security' is set to 'Internal switch protected' – see page 31. **Do Not** use the switch to access the Configuration level when 'Configuration security' is set to 'Password protected' (default setting) unless the Password has been forgotten. The switch overrides Password protection, enabling free access to the Configuration level.

Note. User 1 is the **System Administrator** and the only user with access to the 'Security type' parameter – see Table 6.1.

User 1	User 1 (System Administrator) Security Rights
System Administrator	Set initial password-protected access to Calibration & Maintenance and Logging menus.
	Is the only user with access to the 'Security type' parameter.
	Set initial password-protected access to the Configuration menu when 'Security type / Configuration security' parameter is set to 'Password Protected'.
	Set initial user permissions – other users can subsequently change their own passwords if permission has been set by User 1.
	Set password expiry dates and disable Inactive user accounts after a set time.
	Set password failure limits and minimum password lengths

Table 6.1 System Administrator Security Rights

Fields	Description
Security type	A page opens with two fields: ■ **Security system** – toggles between 'Basic' and 'Advanced'. – Basic: Allows access to the 'Configuration' menu for up to four users (User 1 to 4) – a unique password of up to four digits can be set for each user. A separate password can be set to access the 'Calibration & Maintenance' and 'Logging' menus – up to four users share this password. – Advanced: Allows up to twelve users password-protected access to any of the 'Configuration', 'Calibration & Maintenance' or 'Logging' menus. Each user can be assigned a unique 20-digit (alphanumeric) case-sensitive password (minimum password lengths can be set). ■ **Configuration security** – toggles between 'Password protected' and 'Internal switch protected'. – Password protected (factory default): With the internal security switch set to 'Disabled' (factory default), the 'Configuration' level can be accessed only when the correct password is entered. – Internal switch protected: With the internal security switch set to 'Disabled' (factory default), the 'Configuration' level cannot be accessed. **Note.** If the internal security switch is set to 'Enabled', the Configuration Level can be accessed without the need to enter a password and should be used only if the password has been forgotten. See Fig. 6.2 on page 30 for switch positions.

Fields	Description
Operator level security	Sets access to the 'Calibration & Maintenance' and 'Logging' menus. If set to 'Off', no password is required. If set to 'On' and 'Security type' is set to 'Basic' an additional 'Operator level password' field is displayed. If set to 'On' and 'Security type' is set to 'Advanced', all users are required to enter their user password to gain access to the 'Calibration & Maintenance' and 'Logging' menus.
The following field is displayed only if 'Security system' is set to 'Basic' and 'Operator level security' is set to 'On'.	
Operator level password	All users are required to enter this password to gain access to the 'Calibration & Maintenance' and 'Logging' menus.
The following fields are displayed only if 'Security system' is set to 'Advanced'.	
Reconfigure preset	Passwords are set initially by User 1 (System Administrator) but any user can make subsequent changes to their own password. When set to 'Yes' each user must change their password after it is used for the first time following initial configuration.
Password expiry	Select the number of days that the password is valid for. When a password expires, the user is prompted to provide a new password.
Inactive user disabling	Select the number of days after which an inactive user's access privileges are de-activated.
Password failure limit	Enter the number of consecutive incorrect password entries allowed by a user. If the number of incorrect entries exceeds this limit, the user's access privileges are de-activated and can be reinstated only by the System Administrator (User 1).
Min password length	Sets the minimum length required for user's passwords.

6.1.5 User

Fields	Description
If 'Security system' is set to 'Basic' this tab lists the four users, User 1 to User 4. Selecting a user opens a new page with two fields: ■ Name – the user's name, up to 20 characters. ■ Password – each user can be assigned a unique 4-digit security code for Configuration level access.	
If 'Security System' is set to 'Advanced' and User 1 (administrator) is logged on, the 'User' tab shows additional fields:	
User 1 Name	User 1 identification tag – up to 20 characters.
User 1 Access	A page opens with two checkboxes to select whether User 1 has 'Calibration and Maintenance' and / or 'Logging access'.
User 1 Password	User 1's password – a unique 20-character (alphanumeric) security code. A minimum password length applies.
View / Edit Other Users	Selects the other user's access levels and passwords. If selected additional fields appear:
User X Name	Where X is the user number (2 to 12) – up to 20 characters can be used.
User X Access	Where X is the user number (2 to 12). A dialog box is displayed listing the access available for the user: ■ Logging ■ Configuration (No access) ■ Configuration (Load) ■ Configuration (Limited) ■ Configuration (Full)
User X Password	Where X is the user number (2 to 12). The password for User X.
If 'Security System' is set to 'Advanced' and a user other than User 1 is logged on, the 'User' tab has three fields. These fields can be edited only if User 1 has set the security field 'Reconfigure preset' to 'Yes' – See page 32. Where X is the user number (2 to 12).	
User X Name	User X identification tag. Up to 20 characters.
User X Access	Where X is the user number (2 to 12). A dialog box is displayed listing the access available for the user: ■ Logging
User X Password	User X's password – a unique 20-character (alphanumeric) security code. A minimum password length applies.

6.1.6 Operator Messages

Fields	Description
Messages (1 to 24)	Up to 24 messages can be defined to indicate a particular event or action has occurred. These are displayed on the chart when the relevant annotation is enabled.

6.2 Measurement

There are two tabs in the Measurement screen:

6.2.1 Setup

Fields	Description
Chemical Units	For certain parameters there is a choice of units to display the results.
Measuring Units	The results can be expressed in a variety of units, for example by weight (mg or µg) or by volume (ppm or ppb).
Temperature Units	The results can be expressed in either Celsius (°C) or Fahrenheit (°F).
Flowcell and Heated Block Temperature	The flowcell and heated block are heated and can be controlled at temperatures between 25 and 50 °C (77 and 122 °F). Default temperatures are: ■ Ammonia – 35 °C (95 °F) ■ Fluoride – 30 °C (86 °F)

6.2.2 Streams

Fields	Description
Stream 1	The Stream tag text is displayed in the operator views. Up to 20 characters can be used. The Stream tag is also displayed in the configuration files and audit log files.

6.3 Calibration

There is one tab in the Calibration screen.

6.3.1 Setup

Fields	Description
Calibration Time	The time the analyzer calibrates.
Calibration Date	The next date when a calibration is due.
Calibration Frequency	Frequency at which an automatic calibration is performed.
Low Standard	The concentration of the low standard.
High Standard	The concentration of the high standard.
Gradient Coefficient	The gradient coefficient is an indication of the variation between the actual calibration curve and the ideal calibration curve. A limit to the gradient coefficient can be set (ideal coefficient =1). Above this limit the analyzer fails a calibration. Default fail criteria occurs when the coefficient exceeds 1 ± 0.6.
Calibration Fail Event	If set to 'Fail' (default), the analyzer stops and displays a failed calibration message when a calibration fails. If set to 'Attention', the analyzer continues running after a failed calibration (using the last valid calibration data). Both passed and failed calibration data can be viewed in the Audit Log.

6.4 Alarm Relays

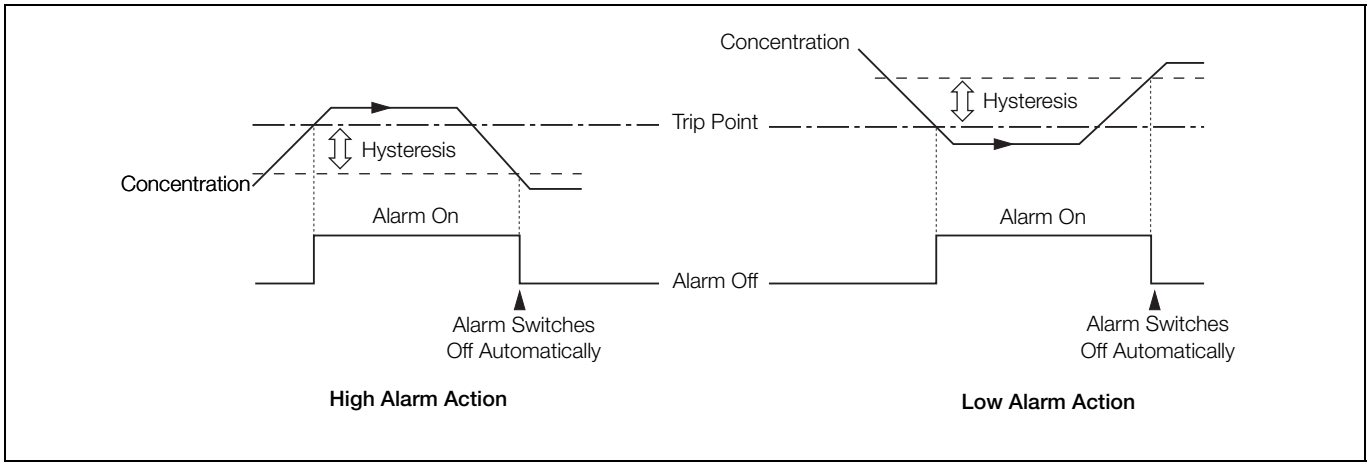


Fig. 6.3 High / Low Process Alarms

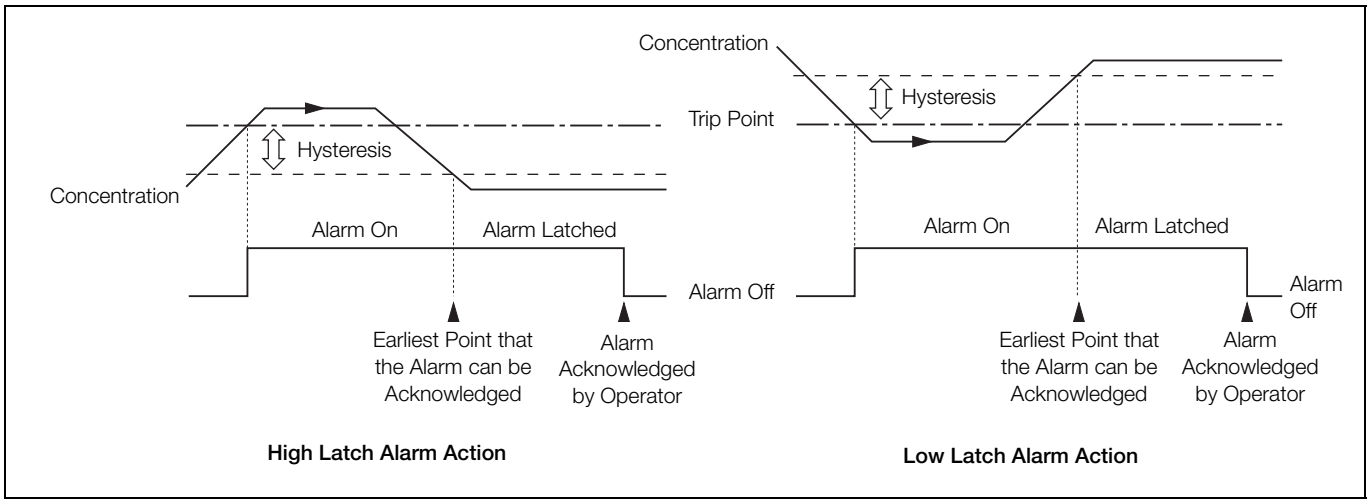


Fig. 6.4 High / Low Latch Alarms

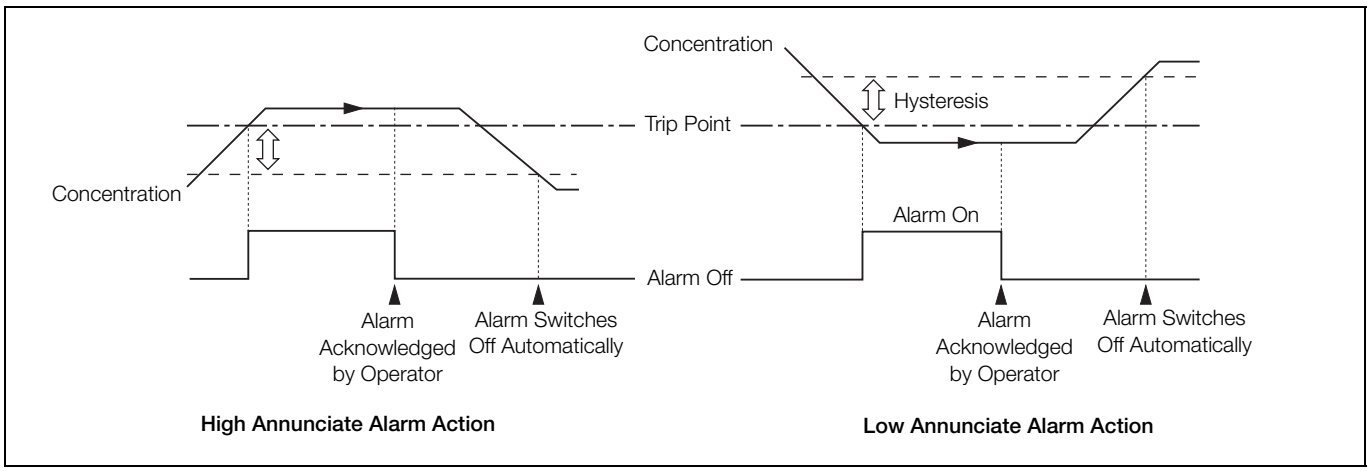
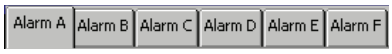


Fig. 6.5 High / Low Annunciate Alarms

There are six tabs in the Alarm Relays screen, one for each alarm:



Fields	Description
Alarm Source	Each of the six alarms can be configured independently to one of the following sources: ■ None – no other fields are visible ■ Stream 1
The following fields are displayed only if 'Alarm Source' is set to 'Stream 1':	
Alarm Type	If 'Alarm Source' is set to Stream 1, the alarm type can be set to: ■ High / Low process – see Fig. 6.3, page 36. ■ High / Low latch – see Fig. 6.4, page 36. ■ High / Low annunciate– see Fig. 6.5, page 36. ■ Out of sample – the alarm state is active if an out-of-sample condition occurs in the selected stream source.
Alarm Tag	The Alarm identification tag – up to 20 characters.
Trip	The value at which the alarm is to activate.
Hysteresis	When 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 value is reset – see page 36 for hysteresis actions. The hysteresis value is set in concentration units and the hysteresis time is set in seconds (0 to 5000 s).
Fail Safe	If set to 'Yes' the alarm relay is normally energized and is de-energized when an alarm condition occurs. If set to 'No' the alarm relay is normally de-energized and is energized when an alarm condition occurs.
Log Enable	If set to 'On' all changes in the alarm state in the Alarm Event log are recorded – see Section 7.5.3, page 49.

6.5 Current Outputs

There are seven tabs in the Outputs screen, one for each output and an output calibration tab:

6.5.1 Outputs 1 to 6

Fields	Description
Output Source	The 'Output Source' field can be set to one of the following options: ■ None – no other fields are visible ■ Stream 1
The following fields are displayed only if 'Output Source' is set to 'Stream 1':	
Output Range	The low and high limits for the output range. Both values can be set independently. If the difference between the low and high limits is too small, the output is very noisy.
Output Type	The electrical low and high limits (0 to 22 mA). For example, if the low and high limits for 'Output Range' are set to 0 and 1000 mg/l respectively, and the electrical low and high limits are set to 4.00 and 20.00 mA, at 0 mg/l the output is 4.00 mA and at 1000 mg/l the output is 20.00 mA.
Out of Sample Ind.	Out of sample indicator. If set to 'Yes', the output goes to the default output value when an out of sample condition occurs for the selected stream source.
The following field is displayed only if 'Out of Sample Ind.' is set to 'Yes':	
Default Output	The output value used when an out of sample condition occurs and 'Out of Sample Ind.' is set to 'Yes' (0 to 22 mA).

6.5.2 Output Calibration

Fields	Description
Calibrate Output 1 (to 6)	Enables each output to be calibrated.

6.6 Logging

There are four tabs in the 'Logging' screen:

6.6.1 Chart

Fields	Description
Chart view enable	The orientation and direction of the chart display. Options are: ■ Horizontal -->■ Horizontal <--■ Vertical
Chart annotation	Enables chart annotations to be visible. Options are: ■ None■ Alarms■ Alarms & Operator Messages
Chart divisions	The major and minor chart divisions.
Trace pointers	Toggles the trace pointers on / off.
Screen interval	The amount of data shown on the screen.
Trace width	The width of each trace in pixels (1 to 3).

6.6.2 Recording

Fields	Description
Sample Rate	The recording sample rate for stream 1. Default setting is 30 seconds.

6.6.3 Ranges

Fields	Description
Chart Low **Chart High**	The chart low / high scale settings for stream 1.

6.6.4 Archive

Used to configure the data that is to be recorded on the SD card – see Section 7.1, page 45.

When external archive media contains approximately 300 files, its read / write performance becomes too slow, archiving is stopped automatically and the icon is displayed alternating with the icon. In this condition, data continues to be recorded to internal memory. Replace the SD card with an empty card to prevent loss of unarchived data.

Fields	Description
Archive file format	Select the archive file format required – Text format or Binary format.
Archive file enables	At least one of these options must be selected for data to be archived automatically to an SD Card. A dialog box is displayed showing the log files that are to be recorded: ■ Text format file containing the channel data (*.d). **or** Binary format file containing channel data (*.b). ■ Alarm event log file enable (*.e) ■ Audit log file enable (*.a)
New file interval	Available only if 'Wrap' is set to 'Off' and 'Archive file format' is set to 'Text format'. The interval that text format stream data files are created. Options are: ■ Off ■ Hourly ■ Daily ■ Monthly
Wrap	If set to 'On', the oldest archived data on the SD card is deleted automatically when the SD card approaches its maximum capacity. If set to 'Off', archiving stops when the SD card is full. The analyzer continues to store data internally – see Section 7.1, page 45. When an empty SD card is inserted, archiving continues from the point that the last archive was made.

6.7 Communications

There are four tabs in the 'Communications' modules screen:

6.7.1 Ethernet

Configures the way in which the analyzer can be accessed via an Ethernet network – see Appendix E on page 85.

Fields	Description
IP-address	The IP-address to be assigned to the analyzer. The IP address is used by the TCP / IP protocol to distinguish between different devices. The address is a 32 bit value expressed with four values (0 to 255), each separated by a period (.).
Subnet mask	The subnet mask is used to indicate which part of the IP address is for the network ID and which is for the host ID. Set each section that is part of the network ID to 255. For example, 255.255.255.0 indicates first 24 bits are for the network ID.
Default Gateway	The IP address for the 'Default gateway' (for example, router, switch) required to communicate with other networks. The default setting is '0.0.0.0'
FTP user 1 to FTP user 4	Enables up to four users to access the analyzer via the internet. A dialog box is displayed with four options: ■ **User name** – the name of user granted FTP access (up to 12 characters). ■ **Password** – the password required for FTP login (up to 12 characters). ■ **Access Level** – toggles between 'Full' or 'Read-only' access. ■ **Remote Operation** – toggles between 'None', 'Operator' or 'Configuration'. **Note**. If a user is given full access via FTP, that user is able to select from the saved configuration files in the analyzer.

6.7.2 E-mail 1 and E-mail 2

The analyzer can be configured to send e-mails to a maximum of 6 recipients in response to certain events. The addressees can all subscribe to the same SMTP server or the analyzer can be configured to send e-mails via 2 different SMTP servers to a maximum of 3 addressees per server.

Up to 10 independently-configurable triggers may be enabled to generate an e-mail when the selected source becomes active. When a trigger source becomes active, an internal 1 minute delay timer is started. At the end of that minute, an e-mail is generated that includes, not only the event that initiated the delay timer, but every other event that occurred during the delay period together with any enabled reports. The data returned in the e-mail therefore reflects the real-time alarm state at the time the e-mail was generated, not the state when the first trigger source became active.

Each e-mail sent includes a link to the analyzer's embedded web server, enabling the analyzer's data and status to be viewed remotely using an internet browser on a PC.

Fields	Description
SMTP Server IP Address	The IP address of the SMTP server e-mails are routed through.
Recipient 1 to Recipient 3	The e-mail address of recipient 1 to 3.
Inverted Triggers	The option to invert triggers 1 to 6.
Trigger 1 to 10	The trigger for an e-mail message to be sent. A dialog box is displayed with three options: ■ **None** – no triggers are set. ■ **Archive state** – a dialog box is displayed with six options: – Archive media not present – Too many files on the archive media – Archive media 100 % full – Archive media 80 % full – Archive media present – Archive on-line ■ **Event group** – A dialog box is displayed with four options: – None – Process Alarm – Namur Type – Diagnostic Event Open an event group option to display further sub-options.

6.7.3 Profibus

Refer to separate Profibus manual – IM/AZT6PBS.

6.8 Commissioning

Note. Access to the Commissioning Level is protected by an Internal Security Switch. The switch is, by default, set to 'Disabled' and should be set to 'Enabled' only if the measurement parameter is to be changed. For further information on the function of the Internal Security Switch, refer to Section 6.1.4, page 30.

There is one tab in the Commissioning screen:

6.8.1 Setup

Fields	Description
Instrument type	The parameter to be measured by the analyzer. The options for ISE analyzers are: ■ Ammonia ISE ■ Fluoride ISE
Streams Fitted	Fixed at 1.
Serial Number	The serial number of the analyzer.
Mode of Operation	Options are: ■ Normal Run Mode ■ Demonstration Mode ■ Test Mode **Note.** ■ Test mode is for diagnostic use only. **Do not** leave the analyzer running in this mode. ■ Before selecting 'Test Mode', disable archiving to SD card to prevent stored data conflicts.
Clear NonVol	Select 'Yes' to clear the analyzer's non-volatile memory. **Note.** Selecting 'Yes' resets 'Instrument type' (see above) to its default setting of 'Iron monitor' therefore the correct measurement parameter must be reselected.
Motor Speed	Default setting is 2.80 rpm
Economy Mode	Reduces reagent consumption (thereby lowering running costs) at the expense of a slower response time. The options are: ■ Off ■ 2.0 rpm.

7 Logging

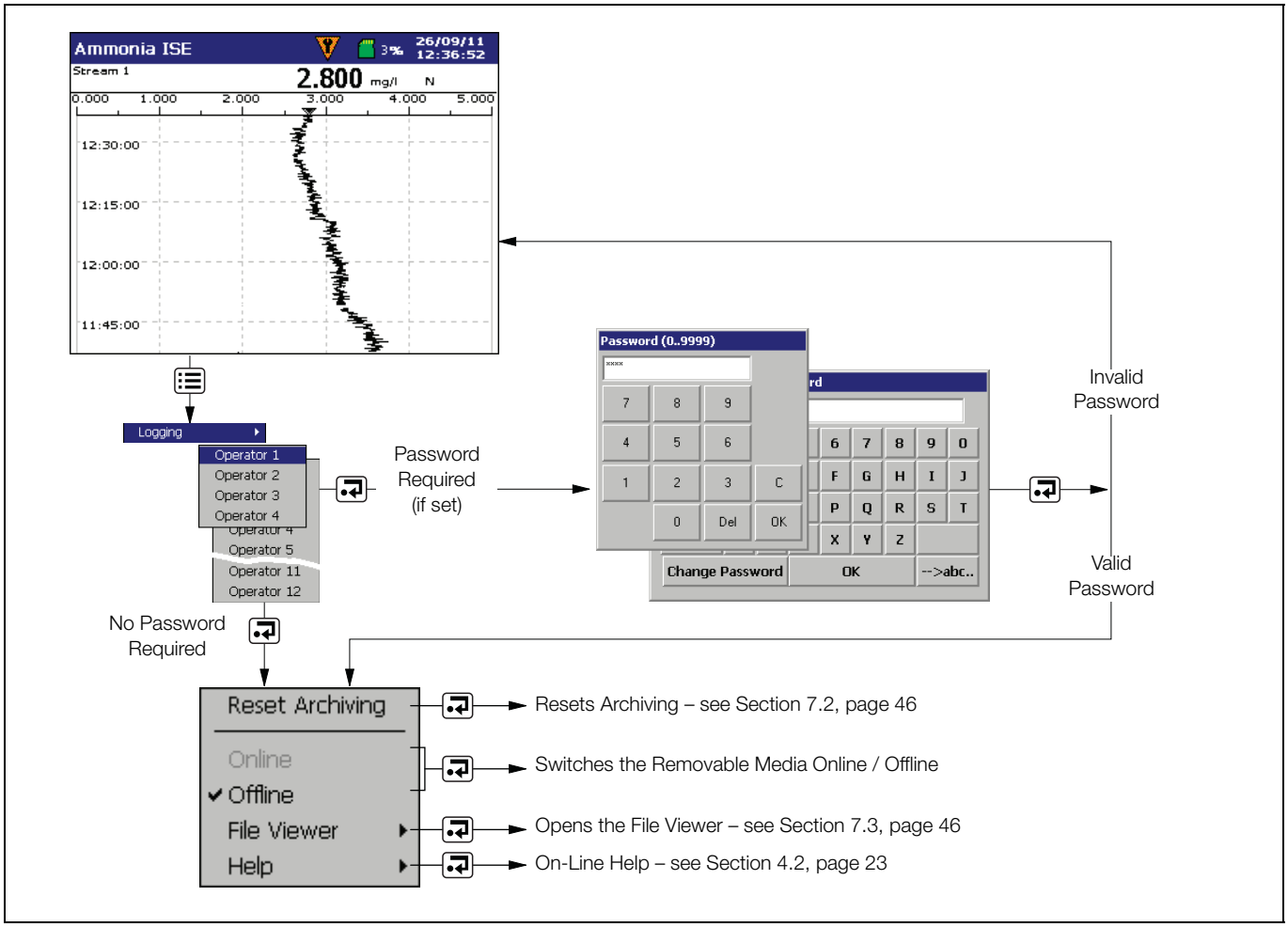


Fig. 7.1 Recording and Archiving

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

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

Sample data can be saved to removable media as either binary-encoded or comma-separated files.

Additional files can also be archived:

- Alarm event log data
- Audit log data
- Configuration files
- Screen capture images

The measured value is logged at default intervals of 30 seconds.

Approximate durations for continuous recording of 1 stream is shown in Table 7.1 (internal storage), Table 7.2 (external text format files) and Table 7.3 (external binary format files).

Storage capacity onto internal (Flash) memory:

Capacity	30 seconds
8 Mb	3 years

Table 7.1 Internal Storage Capacity (1 Stream)

External (archive) capacities for text format files:

Sample Rate	128 Mb
30 seconds	>10 years

Table 7.2 Text Formatted Archive Files (1 Stream)

External (archive) capacities for binary format files:

Sample Rate	128 Mb
30 seconds	>10 years

Table 7.3 Binary Formatted Archive Files (1 Stream)

7.1 SD Cards

There are two methods of archiving to an SD card:

- **An SD card is kept in the analyzer**

  Data is copied automatically to the SD card at set intervals. The SD card is then swapped periodically for an empty one.

  Depending on how the configuration has been set, data is added either to the card until it is full and then stops archiving or the oldest data on the SD card is overwritten by the newest.

  > **Note.** To set up the analyzer to archive data to an SD card automatically – see Section 6.6.4, page 40.

  It is advisable to back-up critical data stored on an SD card regularly. The analyzer's internal memory provides a buffer for the most recent data so if data stored on an SD card is lost, it can be re-archived – see Section 7.2, page 46.

- **Data is copied to an SD card when required**

  An SD card is inserted into the analyzer and a prompt is displayed asking the user to select the unarchived data to be copied – see Section 12, page 58.

7.1.1 SD Card Insertion / Removal

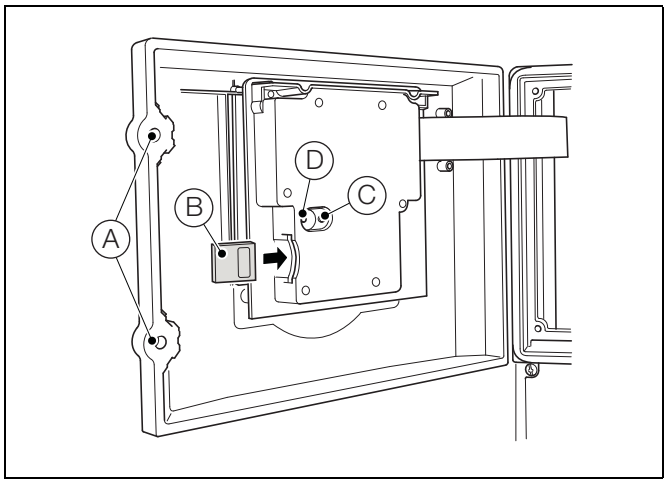


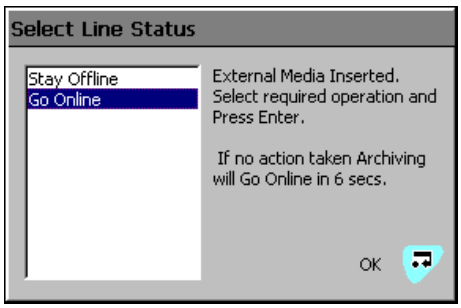
Fig. 7.2 SD Card Removal

To access the SD Card:

1. Ensure the analyzer is offline.
2. Use a large flat-headed screwdriver to release the two door catches (A).
3. Open the door and insert the SD card (B).

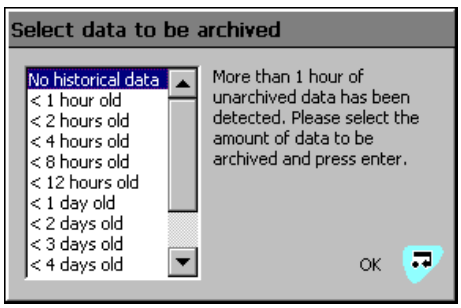
   The red LED (D) is illuminated when the SD card is in use by the analyzer.
4. To remove the SD card, If the red LED is illuminated, press the button (C) and wait until the LED goes out.
5. Remove the SD card from the socket. The SD card can then be inserted into an appropriate card reader attached to a PC and the data downloaded.

When an SD card is inserted and there is <1 day (Binary format) or <1 hour (Text format) of data in internal memory, a dialog box is displayed giving the user the choice of putting the media on-line or remaining offline. If no selection is made within 10 seconds, the media card is placed on-line automatically:

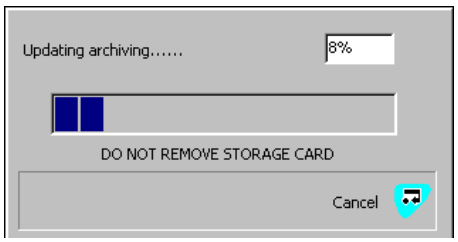


Note. Data stored in the internal memory buffer can still be transferred to the archive media when the archive media is placed on-line again (providing it is not off-line so long that the un-archived data in the internal memory is overwritten).

When an external archive media card is inserted and there is >1 day (Binary format) or >1 hour (Text format) of data in internal memory, a dialog box is displayed prompting the user to select either the data to be archived or remain off-line:



Select the data to be archived and press the ↵ key. A progress bar is displayed:



The files are copied to the SD Card.

7.1.2 External Media Status Icons

The status of external media is indicated by icons displayed in the Status Bar – see Table 2.1, page 8.

For a list of Status icons, refer to Section 12.3.3, page 63.

7.2 Reset Archiving

If 'Reset Archiving' is selected, all data in the internal memory is re-archived to external media.

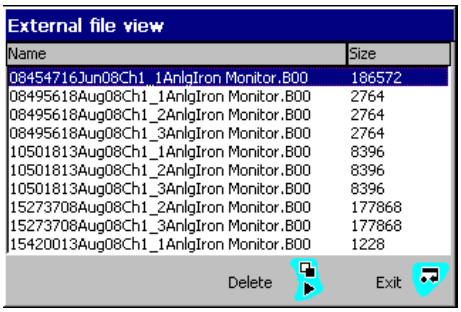
Note. Ideally, insert a blank media storage card before selecting this function.

To re-archive data:

1. Insert an SD card, with sufficient free space, into the analyzer.
2. Select 'Off-line' in the menu.
3. Select 'Reset archiving' in the menu.
4. Select 'On-line' in the menu.
5. Select the data to be archived if >1 hour (Text format) or >1 day (Binary format) of data in internal memory and press the ↵ key.

7.3 File Viewer

A prompt is displayed providing the option to view either internal or external files (if an SD card is present).



Use the ▲ and ▼ keys to scroll up and down the screen.

If viewing files on the SD card, files can be deleted by highlighting a file and pressing the ⌫ key.

7.4 Archive File Types

Archive files are created in text format or binary format, depending on the format selected at the 'Archive File Format' parameter – see Section 6.6.4, page 40.

7.5 Text Format Data Files

Text format archived data is stored in a comma-separated value format and can be imported directly into a standard spreadsheet, for example, Microsoft® Excel (as shown in Figs. 7.3 and 7.4.

The files can also be saved in ASCII text format.

Alternatively, the data can be analyzed graphically in detail on a PC using ABB's DataManager Pro data analysis software.

	A	B	C	D	E	F	G	H	I	J
1	Instrument tag	Aluminium Monitor	Serial Number		Date format	0	Instrument type			
2	Configuration file		15_12_12 170908 Aluminium Monitor.cfg							
3	Tag		Data							
4										
5	CH1.1	Stream 1		No. dp's =	3	Eng lo =	0	Eng hi =	0.4	mg/l
6	CH1.2	OFF								
7	CH1.3	OFF								
8										
9	Date	Time	Stream 1							
10			CH1.1	CH1.2	CH1.3					
11			mg/l							
12			instant	OFF	OFF					
13	17/09/2008	07:12:47	0.112							
14	17/09/2008	07:17:47	0.104							
15	17/09/2008	07:22:47	0.104							
16	17/09/2008	07:27:47	0.104							
17	17/09/2008	07:32:47	0.104							

Fig. 7.3 Example of Text Format Channel Data File

	A	B	C	D	E	F	G	H
1	Instrument tag	Aluminium Monitor	Serial Number		Date format	0	Instrument type	Aztec 600
2								
3								
4	Date	Time	Type of event	Description	Op id			
5								
6								
7	15/09/2008	12:27:16	Power recovery					
8	15/09/2008	12:28:10	Monitor Stopped					
9	15/09/2008	12:37:55	Config changed		Operator 1			
10	15/09/2008	13:01:00	Calibration Passed					
11	15/09/2008	13:01:00	OD Low = 0.056	OD High = 0.545				

Fig. 7.4 Example Text Format Audit Log File

7.5.1 Text Format Stream Data Filenames

Text format stream data files can be configured to contain data gathered over a predefined period of time (selected at the 'New File Interval' parameter) – see Section 6.6.4, page 40. The 'Instrument Tag' is set in the configuration – see Section 6.1.1, page 28.

Note. The time and date are formatted according to the date format set in 'Common Configuration' – see Section 6.1.3, page 29.

Once configured, the filenames for each archive file are assigned automatically.

New File Interval	Filename
Hourly	<hour> <day, month, year> <filename tag>.d00
Daily	<day, month, year> <filename tag>.d00
Monthly	<month, year> <filename tag>.d00
None	<filename tag>.d00

Table 7.4 Text Format Stream Data Format

Filename extensions are assigned according to the data type archived, as detailed in Table 7.5.

Data	Text Format File Extension
Stream data	*.D**
Alarm Event Log data files containing the historical record of the alarm events related to the stream plus the history of any operator messages – see Section 7.5.3, page 49.	*.E**
Audit Log data files containing the historical entries from the audit log – see Section 7.5.3, page 49.	*.A**

Table 7.5 Text Data Filename Extensions

In addition to creating new stream data files according to the 'New File Interval', they are also created in the following circumstances:

- If the analyzer's power is lost then restored.
- If the analyzer is taken offline and the archive media removed, replaced or refitted.
- If the analyzer's configuration is changed.
- If one of the current files exceeds the maximum permissible size.
- When the daylight saving period starts or ends.

Note. The analyzer's internal clock can be configured to adjust automatically at the start and end of 'Daylight Saving Time' periods.

When one of the above conditions occurs, new stream data files are created for each enabled group and the file extension index on each new file is incremented by one from the previous file.

Example: If the original file had an extension of .D00, after one of the above events a new file is created with the same filename but an extension of .D01.

7.5.2 Text Format Stream Data – Example Filenames

New file interval set to Hourly, Filename tag set to Process Group 1; date is 10th April 2012; Channel data and alarm event log files only enabled:

9:00am new file created in which all channel data recorded between 9:00 and 9:59:59 is archived in the following file:

09_00_10 Apr12_Process_Group_1.d00

09:12am Power interrupt occurs

09:13am Power restored and new file created:

09_00_10 Apr12_Process_Group_1.d01

10:00am New file created in which all data recorded between 10:00 and 10:59:59 is archived.

10_00_10 Apr12_Process_Group_1.d00

Note.

Hourly files start exactly on the hour (for example, 8:00am, 9:00am, 10:00am).

Daily files start at 00:00:00.

Monthly files start at 00:00:00 on the first of the month.

7.5.3 Text Format Log Files (Audit and Alarm Log)

Alarm Event logs for each process group and the Audit log are archived into individual files.

The filenames are formatted as shown in Table 7.6.

Log File	Filename
Alarm Event	<hour min> <day, mm, yy> <process group tag>.e00
Audit Log	<hour min> <day, mm, yy> <instrument tag>.a00

Table 7.6 Text Format Log File Format

If one of the archive log files becomes full (>64000 entries) a new file is created with an extension incremented by 1, for example: a01, e01.

New text format log data files are also created when the daylight saving period starts.

7.5.4 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 2012 filename:

30Mar12AW633.D00

Summertime starts at 2:00am on 30th March 2012 and the clock changes automatically to 3:00am.

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

30Mar12AW633~DS.D00

The file '30Mar12AW633.D00' contains data generated from 00:00:00 to 01:59:59.

The file '30Mar12AW633~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 2012 filename:

26Oct12AW633~DS.D00

Summertime ends at 3:00am on 26th October 2012 and the clock changes automatically to 2:00am.

The existing file is closed and a new file is created filename: 26Oct12AW633.D00

The file '26Oct12AW633~DS.D00' contains data generated from 00:00:00 to 02:59:59.

The file '26Oct12AW633.D00' contains data generated from 02:00:00.

7.5.5 Text Format Data Verification and Integrity

When text format data is saved to the archive media it is checked automatically to verify that the data stored on the media matches exactly what is stored in the internal memory.

7.6 Binary Format Data Files

Binary format archived data is stored in a secure binary encoded format. A separate file is created for each recording channel. The log data is stored in an encrypted text format.

The files can be read on a PC using ABB's DataManager Pro data analysis software package.

7.6.1 Binary Format Data Filenames

When the 'Archive file format' parameter is set to 'Binary format', the 'New File Interval' parameters (see Section 6.6.4, page 40) are disabled and binary format filenames are created with the content – see Table 7.7.

Data Type	Filename Content
Stream Data	<Start Time HHMMSS> <Start Date DDMMMYY> Ch<Group><Channel><monitor tag> e.g.: 14322719Mar12Ch1_2Final Water3
Alarm Event Log Data	<Start Time HH_MM> <Start Date DDMMMYY> <Process Group Tag> e.g.: 14_3219Mar12Final Water5
Audit log Data	<Start Time HH_MM> <Start Date DDMMMYY> <Instrument Tag> e.g.: 14_3219Mar12Final Water3

Table 7.7 Binary Format Data Filenames

Filename extensions are assigned according to the data type archived – see Table 7.8.

Data	Binary Format File Extension
Stream data	*.B**
Alarm Event Log data files – the historical record of the alarm events related to the stream plus the history of any operator messages	*.EE*
Audit Log data files – the historical entries from the audit log	*.AE*

Table 7.8 Binary Format Data Filename Extensions

7.6.2 Binary Format Stream Files

A new binary format archive file is created under the following conditions:

- When the current file for the stream does not exist on the media card.
- When the maximum permissible size (5 Mb) of the existing data file is exceeded.
- When the recording channel's configuration is changed.
- When the daylight saving period starts or ends (stream data files generated during the daylight saving period have –DS appended to the filename).

Note. The analyzer's internal clock can be configured to adjust automatically at the start and end of 'Daylight Saving Time' periods.

Filename Examples

Example 1 – Start of daylight saving period:
Archiving is started at 01:45:00 on 30th March 2012 – filename: 01450030Mar12Ch1_1AnlgAW633.B00.

Summertime starts at 2:00am on 30th March 2012.
The clock changes automatically to 3:00am.
The existing file is closed and a new file is created –filename: 03000030Mar12Ch1_1AnlgAW633~DS.B00.

The file '01450330Mar12Ch1_1AnlgAW633.B00' contains data generated from 01:45:00 to 01:59:59 (before summertime starts).

The file '03000030Mar12Ch1_1AnlgAW633~DS.B00' contains data generated from 03:00:00 (after summertime starts).

Example 2 – End of daylight saving period:
Archiving is started at 00:15:00 on 26th October 2012 – filename: 00150026Oct12Ch1_1AnlgAW633~DS.B00.

Summertime ends at 3:00am on 26th October 2012.
The clock changes automatically to 2:00am.
The existing file is closed and a new file is created –filename: 02000026Oct12Ch1_1AnlgAW633.B00.

The file '00150026Oct12Ch1_1AnlgAW633~DS.D00' contains data generated from 00:15:00 to 02:59:59 (before summertime ends).

The file '02000026Oct12Ch1_1AnlgAW633' contains data generated from 02:00:00 (after summertime ends).

7.6.3 Binary Format Log Files

A new binary format log file is created under the following conditions:

- When an existing (valid) binary file does not exist on the media card.
- When the maximum size (64000 entries) is exceeded.
- When the daylight saving period starts or ends.

7.6.4 Daylight Saving

Files containing data generated during the daylight saving period have '~DS' appended to the filename – see Section 7.5.4, page 49 for examples of appended filenames.

Note. Binary format archive files created during the daylight saving period (summertime) are compatible with the database feature of Version 5.8 (or later) only of ABB's DataManager Pro data analysis software package.

7.6.5 Binary Format Data Verification and Integrity

When data is saved to the archive media it is checked automatically to verify that the data stored on the media matches exactly what is stored in the internal memory.

Each block of data in the channel data files has its own data integrity check. This enables the integrity of the data stored on the external media card to be verified when it is viewed using ABB's DataManager Pro software package.

The log files also contain built-in integrity checks enabling the integrity of the data to be verified by the DataManager Pro software.

8 Chart Functions

Note. The 'Chart Functions' menu can be accessed only from the 'Chart View' screen.

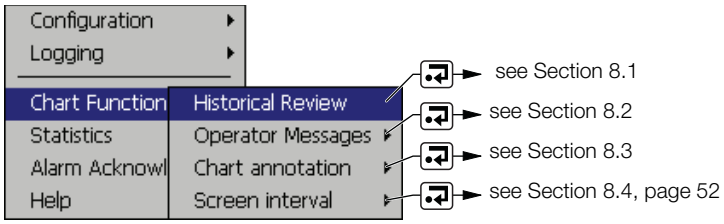


Fig. 8.1 Chart Functions

8.1 Historical Review

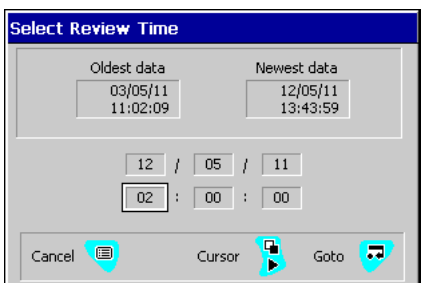
Note. While in Historical Review mode:

- Invalid historical data (for example, when recording has stopped) is denoted by '– – –' in the digital indicator.
- Operator messages generated are added to the alarm event log at the present time, not the time indicated by the cursor.
- All data stored in the analyzer's internal memory can be viewed.
- If daylight saving is enabled (see Section 7.5.4, page 49) ***and*** the selected 'Goto' target date / time is within the daylight saving period, 'Daylight Saving' is displayed on the dialog box.

Enables a historical view of the chart. While in the 'Historical Review' screen an animated icon is displayed at the top of the screen. The analyzer exits 'Historical Review' mode automatically after 15 minutes if no key is pressed.

Selecting the 'Historical Review' menu item changes the screen to the history view – use the ▲ ▼ keys to scroll up and down the screen.

Selecting the 'Historical Review' menu item a second time gives the option of either exiting the historical review or to go to a specified date / time:



Press the ◀ ▶ keys to select the date / time and press the ▲ ▼ keys to change the selected value.

To finish, press or press to escape without making any changes. The screen displays the chart at the selected date / time. Use the ▲ ▼ keys to scroll up and down the screen.

8.2 Operator Messages

These are messages that can be used to annotate the chart. These can be selected from up to 24 pre-defined messages – see Section 6.1.6, page 33. Alternately, the messages can be user-defined.

Annotations can also be added remotely via the web – see Appendix E, page 85.

The annotation is added to the chart at the time it is entered. For example:

An entry is also included in the Alarm Event Log.

Note. Annotations added while in 'Historical Review' are added to the chart at the time of entry **not** on the chart as it is displayed on the screen.

8.3 Chart Annotation

Toggles any operator messages and / or alarms on / off.

8.4 Screen Interval

Used to control the amount of data displayed on the screen. A longer screen interval displays more data, a shorter screen interval displays data over a shorter time period. In both cases, the full trace is preserved by plotting the maximum and minimum samples for each display.

When a different screen interval is selected from this menu, it is retained only as long as the Chart View screen is displayed. To save a different screen interval (as the default for future use), refer to Section 6.6.1, page 39, select the screen interval required and save the revised configuration on exit.

Selection of higher sampling rates during configuration (see Section 6.6.2, page 39) may reduce the maximum 'Screen interval' permitted (unavailable selections are 'greyed-out' in the menu). This ensures that large amounts of data do not slow the screen refresh rate.

9 Operate

Note. The 'Operate' menu can be accessed only from the 'Indicator View' screen.

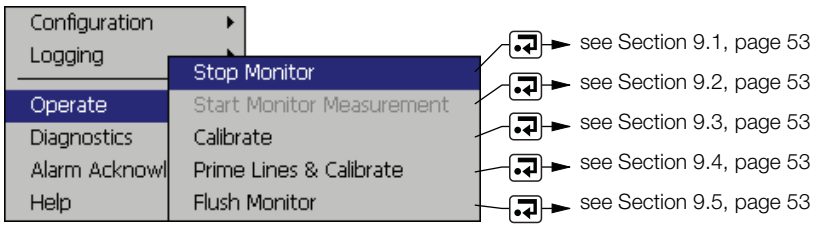


Fig. 9.1 Operate Menu

9.1 Stop Monitor

Select to stop the analyzer. The temperature of the measurement cell is maintained at the set level ensuring no warm-up delay when the analyzer is restarted.

9.2 Start Monitor Measurement

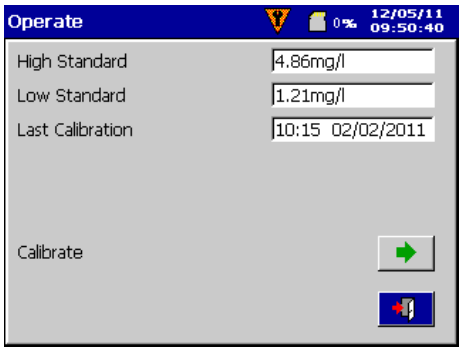
Select to start the analyzer. If the analyzer was switched off at the mains, or a fault had occurred, measurement does not start until the measurement cell reaches the operating temperature set during configuration – see Section 6.2.1, page 34. The message 'Temperature Stabilising' appears at the bottom of the screen until the cell is up to temperature.

If the analyzer has not been used for an extended period of time, allow it to operate for a few hours and then recalibrate.

The analyzer runs automatically until it is switched off.

9.3 Calibrate

A manual calibration can be performed at any time. It is not necessary to stop the analyzer.



Highlight the button and press to initiate calibration.

When calibration is complete, the measurement cycle begins automatically.

9.4 Prime Lines and Calibrate

When the reagents are changed, or the analyzer is either operated for the first time or operated following an extended period of shut down, prime the reagent and sample lines – see Section 4.1, page 22. The 'Prime' function draws in each reagent, sample and standard in turn, filling the lines and then pumping to waste. An automatic calibration is then started. After calibration the measurement sequence begins automatically.

If the analyzer is switched off at the mains without stopping operation via the menu, or if a power supply failure occurs, the analyzer starts the Prime Lines and Calibrate routine automatically when power is restored.

9.5 Flush Monitor

This facility pumps sample through the flow cell continuously but does not store or display measurement values.

The routine can be used **without** a prior calibration and is useful when the measurement parameter is changed, for example, from ammonia to fluoride.

When flushing is selected, the operation continues until stopped by the user or a different operation such as 'Calibration' is selected.

10 Diagnostics

Note. The 'Diagnostics' menu can be accessed only from the 'Indicator View' screen.

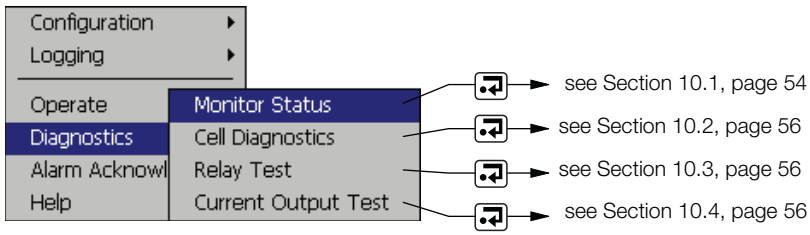


Fig. 10.1 User Diagnostic Screens

10.1 Monitor Status

There are four tabs in the Monitor Status screen:

10.1.1 Status

Fields	Description
Current State	Displays the current state of the analyzer (for example, Measuring, Calibrating, Off).
Sample Conc. / Millivolts	Sample Concentration is the current estimated concentration, derived from the raw electrode signal. This is displayed only when there is a valid calibration.
Cell Temperature	The current recorded cell temperature.

10.1.2 Cal

Fields	Description
Calibration State	Displays the standard currently being measured during the calibration cycle (for example, Measuring Low, Measuring High, Sample, Recovery Period).
Percentage Complete	A 'real-time' indication of calibration progress.
mV, Low / High	The measured electrode mV of the low standard and high standard of the previous calibration.
Sample Conc. / Millivolts	The raw signal from the measuring electrode shown as a voltage (–2048 to 2047 mV) and also converted into a concentration value. This value is displayed only when a valid calibration exists.
Last Gradient / Gradient Coefficient	The Last Gradient is the mV change per decade change in concentrate. The Gradient Coefficient is an indication of the difference between the calculated calibration gradient and the Nernstian calibration gradient. If the gradient exceeds the limits set by the user, the analyzer fails calibration. Default fail criteria occurs when the coefficient is outside the range 0.4 to 1.6.
mV Offset / %Slope	mV offset is the mV difference from the expected mV value for any standard, compared to a reference value. % slope is the slope compared to the theoretical temperature-compensated change in mV (% absolute).
Time Last Calibration	The date and time of the previous calibration.

10.1.3 I / O

Fields	Description
mA o / p 1 to 6	Displays the current mA output for each of the analog outputs.
Sample	Displays the side sample pot level sensor reading (empty or OK).
High Std	Displays the calibration high standard level sensor reading (empty or OK).
Low Std	Displays the calibration low standard level sensor reading (empty or OK).
Buffer	Displays the buffer solution level sensor reading (empty or OK).
Clean Sol	Displays the cleaning solution level sensor reading (empty or OK).

10.1.4 Info

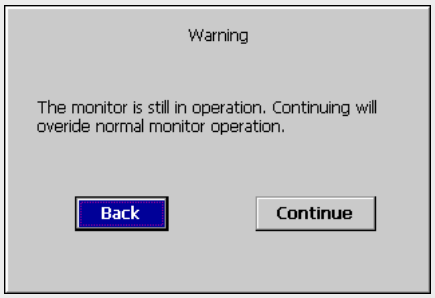
Fields	Description
Software Version	The version number of the software release.
LL App.	The version number of the low level application code
OS	The version number of the Operating System.
HMI	The version number of the user interface code.
Head	Not applicable to ion-selective analyzers.
Serial Number	The analyzer's serial number.

10.2 Cell Diagnostics

Cell Diagnostics enables the user to control the operation of the analyzer manually – bringing in reagents and sample etc. It also displays the detector output in real time giving an insight into how the analyzer is performing.

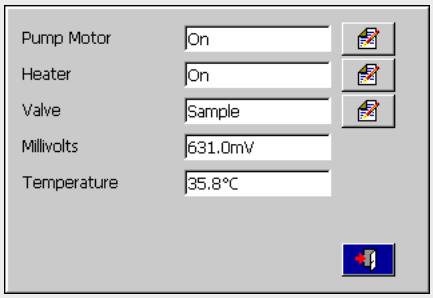
Note.

If this procedure is selected when the analyzer is in operation, a warning is displayed:



Note.

Select **Back** and press ↵ to return to normal operation. Select **Continue** and press ↵ to continue to cell diagnostics. This stops the current analyzer operation:



Fields	Description
Pump Motor	Enables the user to toggle the pump on and off.
Heater	Enables the user to toggle the heater on and off
Valve	Enables the user to select which valve to open (and therefore which liquid to import). Only one valve can be opened at any one time.
Millivolts	Displays the probe voltage (–1280 to 2047 mV) in real time.
Temperature	Displays the flow cell temperature in real time.

10.3 Relay Test

All of the alarm relays can be set individually or reset to check their operation.

Note. This procedure affects the analyzer relay functions and the analyzer **overrides** the normal state.

10.4 Current Output Test

Within the Current Output Test Screen the user is able to check the analyzer current outputs manually.

A calibrated ammeter is required for this test. Put the leads from the ammeter onto the two current output terminals on the I / O board – see Section 3.5.1, page 14.

Check that the value shown on the analyzer LCD is the same value shown on the ammeter.

Use the ▲ and ▼ keys to increase / decrease the milliamp value.

If the ammeter and analyzer do not agree it may be necessary to recalibrate the current outputs – see Section 6.5.2, page 38.

Note. This procedure affects the current outputs of the analyzer and the analyzer **overrides** their normal state

11 Statistics

Note. The 'Statistics' menu can be accessed only from the 'Chart View' screen.

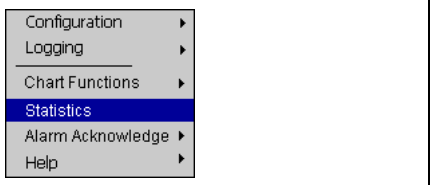
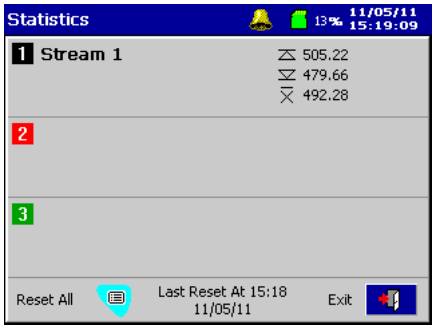


Fig. 11.1 Statistics Selection

Statistics displays the highest, lowest and mean values of the sample since the analyzer was either switched on or the value was reset.



Press the ☰ key to reset the value.

12 Diagnostic Information and Icons

12.1 Analyzer Diagnostic Information

The analyzer 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 analyzer are added to the analyzer's audit log.

Table 12.1 shows icon types, diagnostic messages and ON / OFF status for the fixed relays, all of which operate in the fail-safe condition.

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

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

Icon	Diagnostic message	Stop Relay	Attention Relay	Calibration Relay	Failure Relay
	**Monitor in Service** The analyzer is measuring correctly.	ON	ON	ON	ON
	**20 Character User-defined Alarm Tag** User-defined alarm message.	—	—	—	—
	**Sample Flow Failure** The analyzer cannot detect any sample flow. If there is sufficient flow to the analyzer, check that: 1. the float is located in the side-sample pot and is unrestricted. 2. the end cap of the side-sample pot is positioned to allow the magnetic float to be within the area of operation of the reed switch. 3. the float switch lead is connected correctly to the interconnection board. 4. the magnetic reed switch is operating correctly.	ON	OFF	ON	ON
	**Monitor Stopped** Analyzer operation has been stopped by the user.	OFF	ON	ON	ON
	**Monitor Off** Analyzer operation has not been started.	ON	ON	ON	ON
	**Monitor Off** A failure has caused the analyzer to stop operation and switch off all services.	ON	ON	ON	OFF
	**Priming** The analyzer is priming the tubing. The priming routine draws in each reagent, sample and standard in turn, filling the tubing and then pumping to waste. An automatic calibration starts when the priming routine is completed.	OFF	ON	ON	ON

Table 12.1 Diagnostic Information, Relay Operations and Inhibits (Sheet 1 of 4)

Icon	Diagnostic message	Stop Relay	Attention Relay	Calibration Relay	Failure Relay
	**Calibrating** A calibration routine is being run.	ON	ON	OFF	ON
	**Temperature Stabilizing** In Measurement Mode In Calibrate Mode This message is displayed at startup and remains until the measurement head temperature has stabilized to within 1% of the programmed operating temperature.	 OFF OFF	 ON ON	 ON OFF	 ON ON
	**Override Mode** The analyzer is in Override Mode. Normal running has been overridden by the operator. The Override Mode is useful to check analyzer operation manually. The analyzer remains in Override Mode until it is stopped.	OFF	ON	ON	ON
	**Flushing** The analyzer is in flushing mode. This facility carries out a continuous routine but does not store or display measurement values. The routine can be used without a prior calibration and is useful when a analyzer is swapped from one parameter to another. The analyzer remains in flushing mode until it is stopped.	OFF	ON	ON	ON
	**A / D Error** A hardware error exists on the main board. Power the analyzer down, wait for 10 seconds and power-up again. If the error persists, contact the local ABB representative.	ON	ON	ON	OFF
	**Calibration Failed** 'Calibration Fail Event' set to 'Fail' (see Section 6.3.1, page 35) 'Calibration Fail Event' set to 'Attention' (see Section 6.3.1, page 35) or Calibration Failed with Probe Stability Failure **Note.** If 'Calibration Fail Event' is set to 'Attention', the analyzer continues to measure after a failed calibration using the last valid calibration. The analyzer has failed calibration. Check that: 1. the reagents are of the correct type, connected correctly and are within their shelf life. If it is possible that the reagents have become contaminated replace them. 2. the calibration settings are correct. 3. there are no restrictions or blockages in the analyzer tubing. 4. each reagent / sample is drawn into the measurement head correctly. 5. the electrode is connected correctly. If the error persists, contact the local ABB representative.	 OFF OFF	 ON OFF	 OFF OFF	 OFF OFF

Table 12.1 Diagnostic Information, Relay Operations and Inhibits (Sheet 2 of 4)

Icon	Diagnostic message	Stop Relay	Attention Relay	Calibration Relay	Failure Relay
	Calibration Standard Empty The calibration standard bottle is empty. Replace the calibration solution.	OFF	ON	ON	OFF
	Critical Temperature Reached This alarm is initiated if the analyzer temperature rises above 60 °C (140 °F) during temperature control. 1. Check that the ambient temperature limits have not been exceeded. 2. Contact the local ABB representative.	ON	ON	ON	OFF
	Excessive Secondary Current in Electronics Too much current is being drawn by the electronics in the system; this causes the analyzer to go into automatic shutdown. ■ Contact the local ABB representative.	ON	ON	ON	OFF
	Heating Failure The analyzer has failed to reach operating temperature. This alarm is initiated if the analyzer temperature fails to rise 0.5 °C (0.9 °F) within 2 minutes during the temperature stabilizing routine. 1. Check the integrity of the cable connecting the temperature probe in the flow cell to the interconnection board. 2. Contact the local ABB representative.	OFF	ON	ON	OFF
	High Standard Solution Empty The high standard solution bottle is empty. Refill or replace the high standard solution bottle.	OFF	ON	ON	OFF
	Internal Communications Failed Communication between the main board and the display assembly has failed. 1. Check the ribbon cable connection to the main board. 2. Contact the local ABB representative.	ON	ON	ON	OFF
	Internal Electronics Temperature Too High / Low The internal temperature of the electronics enclosure is either too high or too low. 1. Check that the ambient temperature limits have not been exceeded. 2. Contact the local ABB representative.	ON	ON	ON	OFF
	Low Standard Solution Empty The low standard solution bottle is empty. Refill or replace the low standard solution bottle.	OFF	ON	ON	OFF

Table 12.1 Diagnostic Information, Relay Operations and Inhibits (Sheet 3 of 4)

Icon	Diagnostic message	Stop Relay	Attention Relay	Calibration Relay	Failure Relay
	**No Valid Calibration** There is no valid calibration stored within the analyzer memory. ■ Calibrate the analyzer.	OFF	ON	ON	OFF
	**Non-Volatile Memory Error** There is a problem with either the display electronics or the main board memory. ■ Power the analyzer down, wait for 10 seconds and power-up again. If the error persists, contact the local ABB representative.	ON	ON	ON	OFF
	**Probe Failure** The probe is disconnected or the probe has failed. 1. Check the probe connections. 2. Replace the probe. Restart the analyzer in either Measurement Mode or Calibrate Mode to clear the message.	OFF	ON	ON	OFF
	**Reagent Empty** The reagent bottle is empty. Refill or replace the reagent bottle.	OFF	ON	ON	OFF

Table 12.1 Diagnostic Information, Relay Operations and Inhibits (Sheet 4 of 4)

12.2 Alarm Acknowledge

To acknowledge a particular alarm, use the ▲ and ▼ keys to highlight it in the menu and press the ↵ key.

> **Note.** Active unacknowledged alarms are identified by a flashing red alarm event icon. Active acknowledged alarms are identified by a continuous red alarm event icon.

To acknowledge all active alarms simultaneously, select 'All' and press the ↵ key.

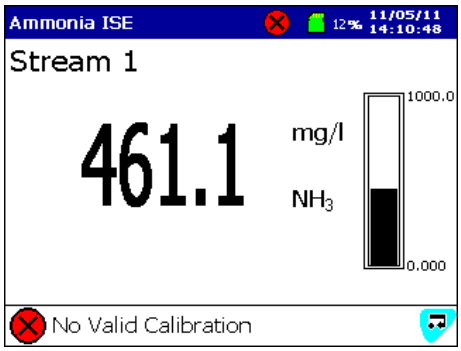


Fig. 12.1 Alarm Example

12.3 Audit Log and Alarm Event Log

The 'Audit Log' and 'Alarm Event Log' are used to display a list of events and alarms identified by icon, sequence number, date and time.

The 'Audit Log' provides an historical log of system activity and the 'Alarm Event Log' provides an historical log of all alarm events in the sequence they occurred.

When the number of entries in each log has reached 500, the oldest data is overwritten by the newest data. Entries are renumbered so that the number of the oldest entry is always 00.

Both logs are accessible from the chart view and bar view – see Section 2.1, page 8 for details of how to navigate to these logs.

> **Note.** Use the ▲ and ▼ keys to scroll through log data.

12.3.1 Audit Log – Icons

Icon	Event
	Power failed
	Power restored
	Configuration changed
	File created
	File deleted
	Archive media inserted
	Archive media removed
	Archive media off-line
	Archive media on-line
	Archive media full
	System error / reset archiving
	Date / time or daylight saving start / end changed
	Security change
	FTP logon
	Information
	Failure – see Section 12.1, page 58
	Maintenance Required – see Section 12.1, page 58
	Out of Specification – see Section 12.1, page 58
	Check Function – see Section 12.1, page 58

12.3.2 Alarm Event Log – Icons

Note.

- A **flashing** red alarm icon indicates an active and unacknowledged alarm.
- A **continuous** red alarm icon indicates an active and acknowledged alarm.

Icon	Event
	High process alarm – active / inactive
	Low process alarm – active / inactive
	High latch alarm – active / inactive
	Low latch alarm – active / inactive
	High annunciate alarm – active / inactive
	Low annunciate alarm – active / inactive
	Clean-in-progress alarm – active / inactive
	In sample alarm
	Out of sample alarm
	Daylight saving start / end changed
	Alarm acknowledged
	Operator message

12.3.3 Status Icons

Note. Status icons are displayed in the Status Bar – see Fig. 2.1, page 8.

Icon	Event
	Historical review active
	External archive media on-line with % used indication
	External archive media off-line with % used indication
	External archive media not inserted (yellow flashing exclamation mark)
	Media update in progress. Do not remove media while this symbol is displayed
	External media 100% full, archiving stopped (green / grey icon, flashing white cross)
	Warning! Too many files (green icon – media online, grey icon – media offline)

13 Maintenance

Warning. 

- Ensure personal protective equipment (PPE) such as **gloves** and **eye protection** are worn during any maintenance and that any spillages are cleaned-up using clean water.
- To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards.
- Take care if cleaning any spillages and observe all relevant safety instructions – see Section 1, page 3.
- General cleaning of the instrument should be carried out using a damp cloth only, mild detergent can be used as a cleaning aid. Do not use Acetone or any organic solvents.
- Isolate electrical components before maintenance or cleaning.
- Observe all health and safety procedures for handling chemicals – see Section 1, page 3.

Aztec 600 analyzers are designed to be as maintenance-free as possible. The inherent product design and auto-calibrating features reduce the amount of maintenance required to external cleaning (sample lines, etc.), changing the reagents and scheduled annual maintenance only.

If followed correctly, the recommendations in this section help prolong the life and enhance the performance of the analyzer, thus reducing long-term operating costs. Operating costs can be further reduced by selecting 'Economy Mode' during Commissioning – see Section 6.8, page 43. This is designed to reduce reagent consumption at the expense of a slower response time.

Maintenance is divided into three categories:

- changing reagents
- regular visual checks
- annual scheduled maintenance

13.1 Changing Reagents and Standard Solutions

Reagent and standard solution requirements and consumption rates are illustrated in Appendix A of this manual.

To prevent the reagent and standard solutions from running out, check consumption as regularly as possible to predict the optimum changeover time.

Use the following procedure when changing the reagent / standard solutions:

1. Stop the analyzer – see Section 9.1, page 53.
2. Check that the shelf lives of the new reagent / standard solution bottles are sufficient for the expected period of use.
3. Remove the caps from each bottle and change them one by one.

Caution.

- Avoid contamination of the solutions.
- When removing the reagent / standard solution level sensors, ensure that no contact is made with the stem, especially with bare hands.
- Do not top-up solution bottles.
- Dispose of the used bottles and contents safely, according to national or local regulations. Analyzer performance relies heavily on the integrity of these solutions so it is very important to prepare, store and handle them with care.

4. Ensure the tubes are inserted correctly and the float switches are free to move.
5. When the level sensors are correctly in place, hand-tighten the bottle caps. This protects against the ingress of dust, water etc.
6. Select 'Prime lines and Calibrate' and press the ↵ key.

Take care when storing the bottles. Ensure they are date stamped, used in strict rotation and not used after the expiry date.

13.2 Regular Visual Checks

Inspect the analyzer on a regular basis to ensure the correct functioning of the system and to check the integrity of the readings:

- Check for leaks, particularly around the sample and drain pipework connections.
- Confirm sample flow by checking delivery to the constant-head unit and effluent from the drain.
- Check liquid levels in the reagent and standard solution bottles.
- Inspect all tubing and liquid-handling components for leaks and deterioration.
- Check for malfunction indications on the analyzer display.

13.3 Annual Maintenance

Annual maintenance required:

- Replace pump tubing and capstans – see Section 13.3.1
- Replace analyzer tubing – see Section 13.3.2, page 67

Annual maintenance kits, that include all the components required, are available.

Annual refurbishment ensures a high level of reliability from the analyzer.

Re-order the kit when used so that all the items are available throughout the following year's operation.

For part numbers, refer to the Spares section – see Appendix G on page 90.

13.3.1 Replacing Pump Tubing and Capstans

Note. Flush replacement tubing with clean water before fitting it to the analyzer.

Tools required

- No. 2 Pozidriv screwdriver
- Long-nosed pliers

Procedure

1. Press the ☰ key and use the ▲ and ▼ keys to select 'Operate' followed by 'Stop Monitor' and press the ↵ key.
2. Referring to Fig. 13.1:
   a. Release thumbscrews (A) and open the liquid-handling section door.
   b. Unlock catch (B), pull the liquid-handling section panel forward and lock into the vertical position using catch (B).

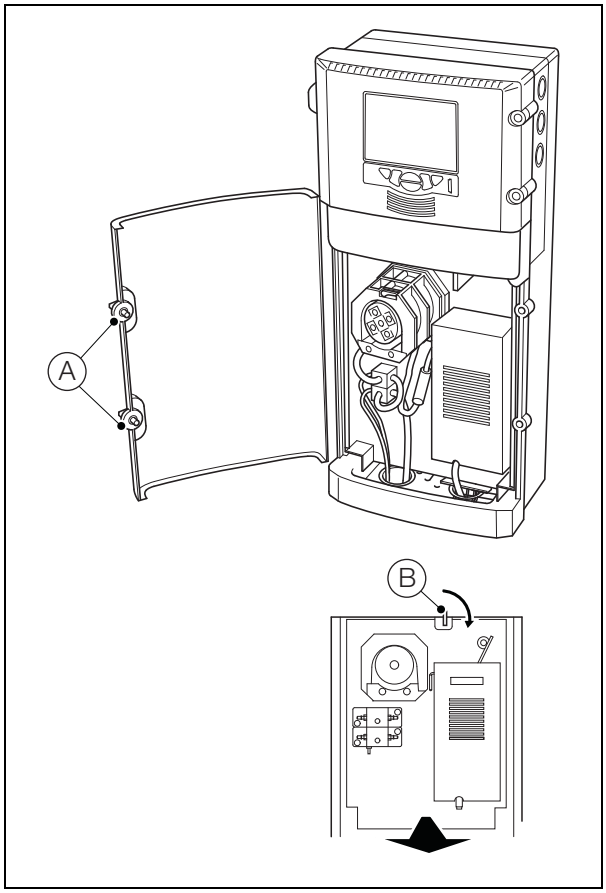


Fig. 13.1 Accessing the Pump

3. Referring to Fig. 13.2:
   a. Press down on pump pressure plate (C), turn pressure plate locking pin (D) 1/4 turn counter-clockwise and withdraw the pin. Lift the pump pressure plate clear of the pump.
   b. Disconnect the heated block assembly inlet tube (Ammonia analyzer only) or mixer assembly inlet tube (Fluoride analyzers only) (E) from tee-piece (F) and pull tee-piece, reagent and sample tubes free of slots in lower support plate.
   c. Disconnect sample pump tube (G) from the valve manifold connector.
   d. Disconnect reagent pump tube (H) from the in-line mini barbed nipple connector located below the lower valve manifold.
   e. Remove shims (J) and sleeves (K), complete with pump tubing and tee-piece from the lower support plate and discard the complete assembly.
   f. Remove pump capstan securing screw and washers (L).
   g. Remove nameplate (M), front pump capstan, center spacer and rear pump capstan. Discard the 2 x pump capstans.
   h. Fit new rear pump capstan to pump drive shaft, followed by the center spacer and the new front pump capstan, ensuring pump rollers are aligned. Fit nameplate (M) and secure with screw and washers (L).
   i. Fit new sleeves (K) to new reagent (H) and sample (G) pump tubing (hold the hole in the sleeves open with a pair of long-nosed pliers while pushing the tubes through).
   j. Insert sleeves (K) and pump tubing into the lower support plate, ensuring the thin (reagent) tubing (H) is fitted to the rear location and the thick (sample) tubing (G) to the front. Route end of reagent tubing (H) through holes in valve manifolds.
   k. Fit reagent and sample pump tubing to new tee-piece part no. 26-1003-B (F) as shown. Slide tubing into correct slot in lower support plate.
   l. Fit new shims (J) to the slots in the support plate as shown.
   m. Gently pull the new tubing down through sleeves (K) and into contact with pump rollers. Ensure tee-piece (F) is positioned under the lower support plate as shown and reagent tubing (H) is correctly routed through holes in valve manifolds.
   n. Ensure the tubing is aligned correctly over the rollers.
   o. Ensure pump tubing sleeves (K) and shims (J) are located correctly in pump lower plate as shown.
   p. Ensure pump pressure plate locking pin (D) is not protruding from the rear face of the pump pressure plate (C).

Note. During step q, it is **very important** to ensure that:

- the pump tubing is not pinched
- the pump tubing remains correctly located over the pump capstan rollers
- each tube enters its respective groove in the pressure plate
- the sleeves and shims remain in position

   q. Position the pump pressure plate over the pump tubing and capstans and press down firmly until fully home.
   r. Press locking pin (D) fully home and turn 1/4 turn clockwise to lock the pump pressure plate in position.
   s. Connect sample pump tube (G) to the valve manifold connector.

Note. DO NOT reconnect tubes (E) and (H) at this stage – they are reconnected during steps 3 and 7 or 8 in Section 13.3.2.

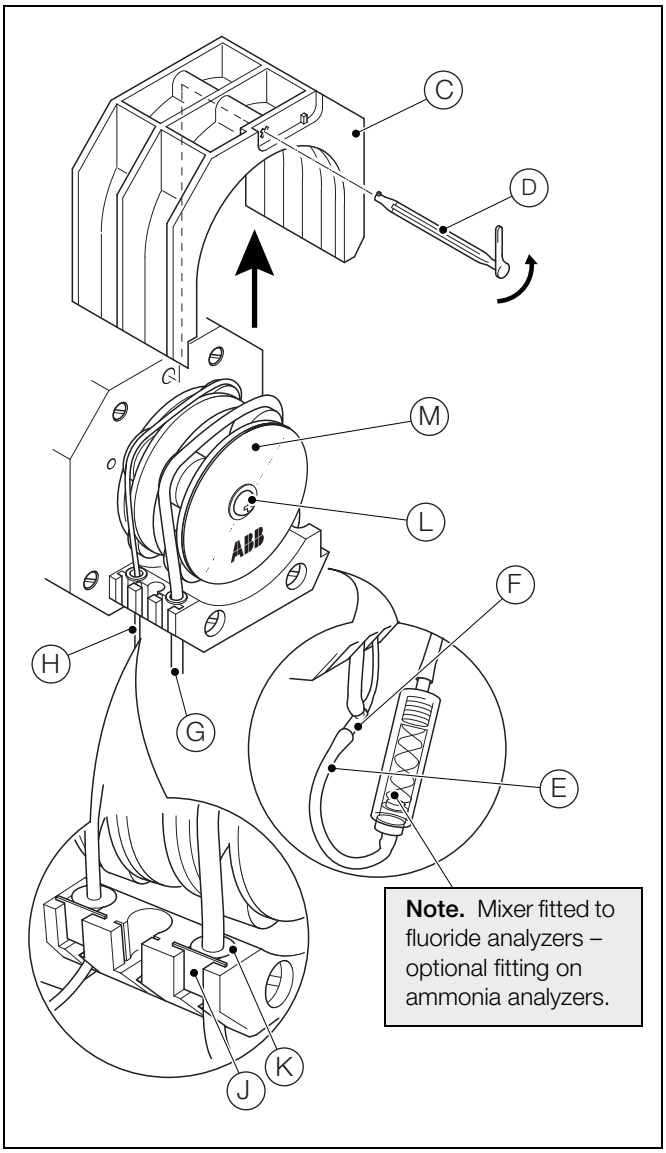


Fig. 13.2 Replacing the Pump Tubing and Capstans

13.3.2 Replacing Analyzer Tubing

Note. Take note of the routing of all tubes removed in the following procedures to ensure the replacement tubing is routed correctly.

Referring to Fig. 13.3:

1. Remove low calibration solution tubing (A) from valve connector and discard.

   Fit 1.5 m (5 ft), 3/32 in. ID Tygon tube part no. 0212362.

2. Remove high calibration solution tubing (B) from valve connector and discard.

   Fit 1.5 m (5 ft), 3/32 in. ID Tygon tube part no. 0212362.

3. Remove in-line mini barbed nipple connector (C), complete with reagent inlet tubing (D) and discard.

   Connect one end of new in-line mini barbed nipple connector part no. 0214060 to reagent tubing – see (H) in Fig. 13.2.

   Fit 1.5 m (5 ft) size 13 Tygon tube part no. 26-0027-A to other end of mini connector.

4. Remove flowcell drain tube (E) from flowcell drain / outlet connector and discard.

   Fit 1 m (39 in) tube part no. 0212176.

5. Remove sample inlet tubing (F) from valve connector and side sample pot lower connector and discard.

   Fit 420 mm (16.5 in) of 3/32 in. ID Tygon tube cut from remaining length of tube part no. 0212362.

6. Remove valve manifold interconnect tubing (G) from valve connectors and discard.

   Fit 120 mm (4.7 in) of 3/32 in. ID Tygon tube cut from remaining length of tube part no. 0212362.

Note. Step 7 is applicable only to ammonia analyzers.

7. Remove heated block assembly inlet tube (J) and discard.

   Fit remaining 140 mm (5.5 in) of 3/32 in. ID Tygon tube part no. 0212362.

Note. Steps 8 and 9 are applicable only to fluoride analyzers (ammonia optional).

8. Remove mixer assembly inlet tube (J) and discard.

   Fit 75 mm (3 in) of 3/32 in. ID Tygon tube cut from remaining length of tube part no. 0212362.

9. Remove heated block assembly inlet tube (K) and discard.

   Fit 30 mm (1.2 in) of 3/32 in. ID Tygon tube cut from remaining length of tube part no. 0212362.

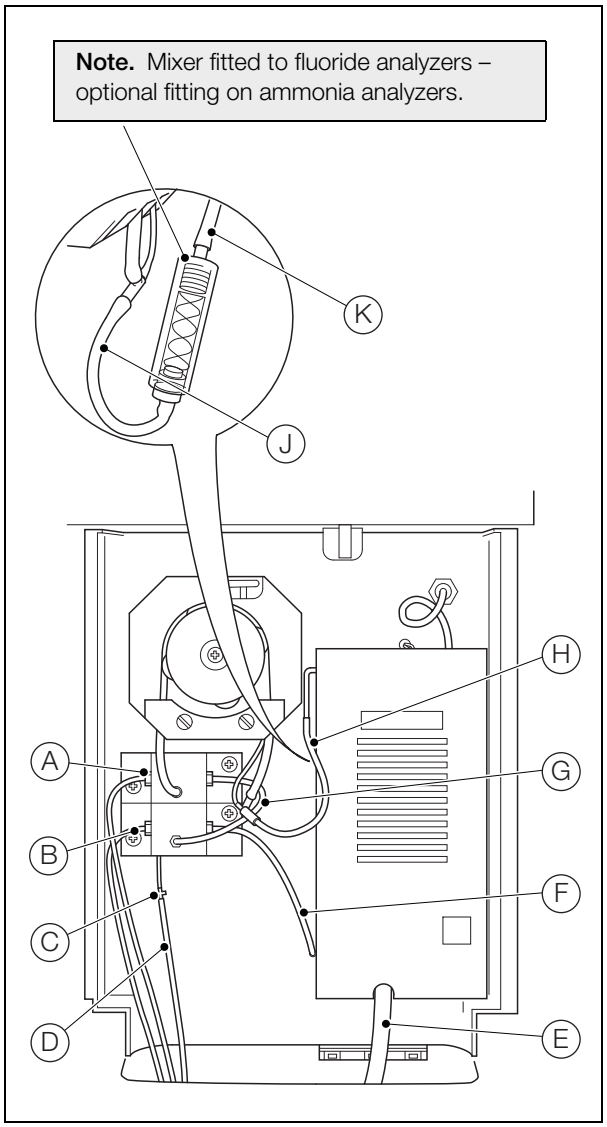


Fig. 13.3 Replacing the analyzer tubing

10. Referring to Fig. 13.1:
    a. Release catch (B), push the liquid-handling section panel rearwards into the enclosure and lock it into position with catch (B).
    b. Close the liquid-handling section door and secure with thumbscrews (A).
11. Replace reagent tube in reagent bottle.
12. Prime and calibrate the analyzer – see Section 4.1, page 22.

13.4 Replacing Ammonia Probe Membrane

Referring to Fig. 13.4:

1. Unscrew end cap (A) from probe body (B) and allow filling solution to drain.
2. Remove probe cap (C).
3. Carefully unscrew glass electrode (D) from body.
4. Rinse the probe body with distilled or de-ionized water and allow to drain.
5. Rinse the electrode with distilled or de-ionized water and dry with a paper tissue.
6. Remove membrane sealing washer (E) and membrane (F) from end cap (A) and discard.
7. Replace probe body seal (G) with new item.
8. Insert new membrane (F) into end cap (A) and place new membrane sealing washer (E) centrally upon it.
9. Screw electrode (D) into body (B) until the top of the electrode is flush with the top of the probe body.
10. Note the number on the electrode cap (H) that is aligned with the mark on the body. Unscrew the electrode 4 full turns using the number and mark as reference.
11. Screw end cap (A) firmly onto body (B); both body seal (G) and membrane sealing washer (E) must be under compression but do not screw the end cap on so tightly that membrane (F) distorts.
12. Hold the probe upright and inject the filling solution provided through filling hole (J). Fill the probe to a depth of between 50 and 60 mm (1.96 and 2.36 in.), ensuring that reference element (K) is immersed in the solution. Wipe any excess filling solution from the body.
13. Tap the end of the probe with the finger to dislodge any air bubbles trapped between the end of the glass electrode and the membrane.
14. Screw electrode (D) down 4 turns until the number on electrode cap (H), noted at step 4 is again aligned with the mark on the body (the top of the electrode should be flush with the top of the probe body).
15. Screw electrode (D) down a further 1.0 ±0.1 turns. Check that the tip of the electrode is pressing against the membrane. If the electrode response is sluggish, the electrode may be screwed down by a further 0.2 to 0.3 turns. DO NOT overtighten – this will puncture the membrane.
16. Push probe cap (C) onto the top of the probe body so that it covers filling hole (J).

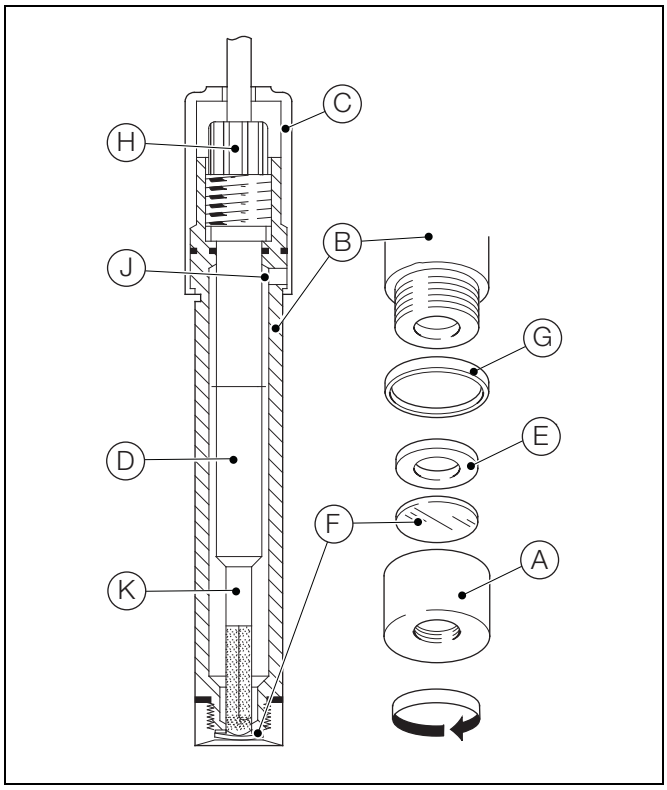


Fig. 13.4 Replacing Ammonia Probe Membrane

13.5 Replacing the DC Fuse

Caution. Use only replacement fuse: 12.5 A 125 V DC Type T, SCHURTER, Model SPT 5 x 20 Series

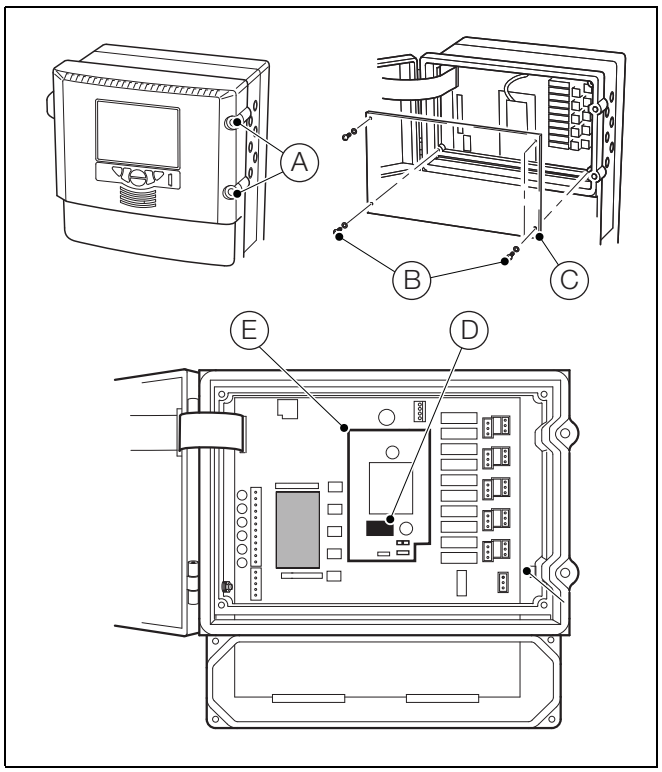


Fig. 13.5 Replacing the DC Fuse

Referring to Fig. 13.5:

Warning. Isolate the analyzer and cables from electrical supply.

1. Turn the electronics section door retaining screws (A) 1/4 turn counter-clockwise and open the door.
2. Using a cross-head screwdriver, remove 4 screws (B) and remove transparent cover plate (C).
3. Carefully remove the fuse from fuse holder (D) on DC power board (E).
4. Fit a new fuse (12.5 A 125 V DC Type T, SCHURTER, Model SPT 5 x 20 Series) into fuse holder (D) on DC power board (E).
5. Refit transparent cover plate (C) and secure using 4 screws (B). Close the door to the electronics section and turn door retaining screws (A) 1/4 turn clockwise to secure.

14 Specification – Aztec ISE Ammonia

Measurement

Units

- NH_3
- NH_3-N
- NH_4

Range

- 0.050 to 1000 ppm NH_3

Measurement principle

Gas-sensing ammonia probe

Measurement mode

Continuous

Measurement performance

Accuracy[1]

- <±5 % of reading[2] or ±0.02 ppm for 0.05 to 500 ppm NH_3 (whichever is the greater)
- <±7.5 % of reading[2] for 500 to 1000 ppm NH_3

Repeatability

- <±2 % of reading[3] or ±0.02 ppm (whichever is the greater)

Response time

- Normal operating mode: T90 typically 5 minutes
- EcoMode: T90 typically <7.5 minutes

Resolution

- 0 to 10 ppm – 0.001 ppm
- 10 to 100 ppm – 0.01 ppm
- 100 to 1000 ppm – 0.1 ppm

Calibration

2-point, automatic calibration, with the option of manual initiation. The interval between automatic calibrations is selectable manually from four times a day to once per week.

Environmental data

Ambient operating temperature:

5 to 40 ºC (41 to 104 ºF)

Ambient operating humidity:

Up to 95 % RH non-condensing

Sample temperature:

1 to 40 °C (32 to 104 °F)

Sample flow:

Continuous, 200 to 500 ml/min

Sample pressure:

5 psi maximum

Sample limitations:

Samples containing particles 100 microns (0.004 in) in diameter or larger may require pre-filtration.

Maintenance

Routine service interval:

12 months

Display

Color, TFT, liquid crystal display (LCD) with built-in backlight and brightness adjustment

Diagonal display area:

- 145 mm (5.7 in)
- 76800 pixel display[4]

Dedicated operator keys

- Group select / left cursor
- View select / right cursor
- Menu key
- Up / increment key
- Down / decrement key
- Enter key

1. Maximum measured error across full measurement range.
2. Testing based on **IEC 61298 Parts 1-4 : Edition 2.0 2008-10**.
3. Testing based on **BS ISO 15839 : 2003**.
4. A small percentage of the display pixels may be either constantly active or inactive. Max. percentage of inoperative pixels <0.01 %.

Mechanical data

Ingress protection

IP31**

Sample connections

Inlet:

- 6 mm OD x 1/4 in. BSP push-fit elbow

Outlet:

- 10 mm OD x 3/8 in. BSP push-fit elbow

Dimensions

Height:

- 653 mm (25.7 in)

Width:

- 366 mm (14.4 in) max.

Depth:

- 183 mm (7.2 in) door closed
- 430 mm (16.9) door open

Weight:

- 15 kg (33 lb)

Materials of construction

Electronics enclosure:

- 10 % glass-loaded polycarbonate

Main enclosure:

- Noryl

Lower tray:

- 20 % glass-loaded polypropylene

Door:

- Acrylic

** Not evaluated for UL or CB

Electrical

Power supply ranges

- 100 to 240 V max. AC 50 / 60 Hz ± 10 %
  (90 to 264 V AC, 45/65 Hz)
- 18 to 36 V DC (optional)

Power consumption

75 W max. – AC
100 W max. – DC

Analog outputs

6 isolated current outputs, fully assignable and programmable over a 0 to 20 mA range (up to 22 mA if required)

Alarms / relay outputs

One per unit:

- Stop relay
- Attention relay
- Failure relay
- Calibrate relay

Six per unit:

- Fully user-assignable alarm relays

Rating

Voltage:

- 250 V AC
- 30 V DC

Current:

- 5 A AC
- 5 A DC

Loading (non-inductive):

- 1250 VA
- 150 W

Connectivity / communications

Ethernet connection

Web server with ftp for real-time monitoring, configuration, data file access and e-mail capability

Communications

PROFIBUS DP V1.0 (optional)

Data handling, storage and display

Security

Multi level security:

- Operator and configuration password or security switch

Storage

Removable Secure Digital (SD) card

Trend analysis

Local and remote

Data transfer

SD card or FTP

Approvals, certification and safety

Safety approval

cULus

CE mark

Covers EMC & LV directives
(including latest version EN 61010)

General safety

EN61010-1

Overvoltage Class II on inputs and outputs

Pollution category 2

EMC

Emissions & immunity

Meets requirements of IEC61326 for an industrial environment

DS/AAM631–EN Rev. A

15 Specification – Aztec ISE Fluoride

Measurement

Range

- 0.100 to 100 ppm F

Measurement principle

Combination fluoride ion-selective electrode

Measurement mode

Continuous

Measurement performance

Accuracy[1]

- <±2 % of reading[2] or ±0.02 ppm for 0.1 to 10 ppm F (whichever is the greater)
- <±3 % of reading[2]

Repeatability

- <±2 % of reading[3] or ±0.02 ppm (whichever is the greater)

Response time

- Normal operating mode: T90 typically 5 mins
- EcoMode: T90 typically <7.5 mins

Resolution

- 0 to 10 ppm – 0.001 ppm
- 10 to 100 ppm – 0.01 ppm

Calibration

2-point, automatic calibration, with the option of manual initiation. The interval between automatic calibrations is selectable manually from four times a day to once per week.

Environmental data

Ambient operating temperature:

5 to 40 ºC (41 to 104 ºF)

Ambient operating humidity:

Up to 95 % RH non-condensing

Sample temperature:

1 to 40 °C (32 to 104 °F)

Sample flow:

Continuous, 200 to 500 ml/min

Sample pressure:

5 psi maximum

Sample limitations:

Samples containing particles 100 microns (0.004 in) in diameter or larger may require pre-filtration.

Maintenance

Routine service interval:

12 months

Display

Color, TFT, liquid crystal display (LCD) with built-in backlight and brightness adjustment

Diagonal display area:

- 145 mm (5.7 in)
- 76800 pixel display[4]

Dedicated operator keys

- Group select / left cursor
- View select / right cursor
- Menu key
- Up / increment key
- Down / decrement key
- Enter key

1. Maximum measured error across full measurement range.
2. Testing based on **IEC 61298 Parts 1-4 : Edition 2.0 2008-10**.
3. Testing based on **BS ISO 15839 : 2003**.
4. A small percentage of the display pixels may be either constantly active or inactive. Max. percentage of inoperative pixels <0.01 %.

Mechanical data

Ingress protection

IP31**

Sample connections

Inlet:

- 6 mm OD x 1/4 in BSP push-fit elbow

Outlet:

- 10 mm OD x 3/8 in BSP push-fit elbow

Dimensions

Height:

- 653 mm (25.7 in)

Width:

- 366 mm (14.4 in) max.

Depth:

- 183 mm (7.2 in) door closed
- 430 mm (16.9 in) door open

Weight:

- 15 kg (33 lb)

Materials of construction

Electronics enclosure:

- 10 % glass-loaded polycarbonate

Main enclosure:

- Noryl

Lower tray:

- 20 % glass-loaded polypropylene

Door:

- Acrylic

** Not evaluated for UL or CB

Electrical

Power supply ranges

- 100 to 240 V max. AC 50 / 60 Hz ± 10 %
  (90 to 264 V AC, 45/65 Hz)
- 18 to 36 V DC (optional)

Power consumption

75 W max. – AC
100 W max. – DC

Analog outputs

6 isolated current outputs, fully assignable and programmable over a 0 to 20 mA range (up to 22 mA if required)

Alarms / relay outputs

One per unit:

- Stop relay
- Attention relay
- Failure relay
- Calibrate relay

Six per unit:

- Fully user-assignable alarm relays

Rating

Voltage:

- 250 V AC
- 30 V DC

Current:

- 5 A AC
- 5 A DC

Loading (non-inductive):

- 1250 VA
- 150 W

Connectivity / communications

Ethernet connection

Web server with ftp for real-time monitoring, configuration, data file access and e-mail capability

Communications

PROFIBUS DP V1.0 (optional)

Data handling, storage and display

Security

Multi level security:

- Operator and configuration password or security switch

Storage

Removable Secure Digital (SD) card

Trend analysis

Local and remote

Data transfer

SD card or FTP

Approvals, certification and safety

Safety approval

cULus

CE mark

Covers EMC & LV directives
(including latest version EN 61010)

General safety

EN61010-1

Overvoltage Class II on inputs and outputs

Pollution category 2

EMC

Emissions & immunity

Meets requirements of IEC61326 for an industrial environment

DS/AFM631–EN Rev. A

Appendix A – Reagents and Standard Solutions

Warning. 

- Ensure personal protective equipment (PPE) such as **gloves** and **eye protection** are worn during any maintenance and that any spillages are cleaned-up.
- Observe all health and safety procedures for handling chemicals.

A.1 Reagent and Standard Solutions – Ammonia-ISE

A standard set of reagents for the Aztec 600 ISE ammonia analyzer comprises 1 reagent, a low calibration standard and a high calibration standard.

A.1.1 Reagent

The ammonia reagent is a mixture of EDTA-di-sodium salt and alkali solution (NaOH-sodium hydroxide) held in a 10 l container.

The EDTA in the reagent is added to prevent blockages in the analyzer's internal pipework. Blockages are caused when, due to the high pH, metal ions (for example, calcium and magnesium) present in the sample form insoluble hydroxides. EDTA combines with the metal ions to prevent this happening. It also prevents hardness precipitation and inaccuracies caused by complexing of ammonia with some metal ions.

The sodium hydroxide releases the available ammonia in a free form by adjusting the pH of the sample solution to a value greater than 11.

Note. There are 2 options of ammonia reagent solution. For applications that may typically be expected to exceed 300 ppm NH_3, it is recommended that reagent AWRS620/0304 is used. For most other applications, reagent AWRS620/0301 is likely to be suitable.

A.1.2 Standard Solutions

2 standard solutions of known concentration appropriate to the measuring range are required for analyzer calibration:

- Low ammonia standard solution
  (factory default is 1.214 mg/l NH_3 = 1 mg/l NH_3-N)
- High ammonia standard solution
  (factory default is 4.856mg/l NH_3 = 4 mg/l NH_3-N)

Note. Solutions as low as 0.25 mg l^{-1} NH_3-N at an ambient temperature of 25 °C and under normal light conditions can be prepared with care, but must be used immediately. A solution prepared in this way loses 10 % of its concentration over a 7 day period, making it unsuitable for long-term use.

A.2 Reagent and Standard Solutions – Fluoride-ISE

A standard set of reagents for the Aztec 600 ISE fluoride analyzer comprises 1 reagent, a low calibration standard and a high calibration standard.

A.2.1 Reagent

The fluoride reagent is a Hexametaphosphate buffer solution held in a 10 l container.

The Hexametaphosphate adjusts the pH of the sample to 5.25 to prevent the formation of hydrogen fluoride (HF) and hydroxide ions that act as an interferent. The buffer also complexes other potential interferents such as aluminium and iron.

A.2.2 Standard Solutions

Note. The user has the ability to assign different standard concentration values. It is strongly recommended that the appropriate standard solutions are selected to suit the application measuring range.

2 standard solutions of known concentration appropriate to the measuring range are required for analyzer calibration:

- Low fluoride standard solution
  (factory default is 0.5 mg/l F)
- High fluoride standard solution
  (factory default is 1.5 mg/l F)

A.3 Reagent and Standard Solution Consumption

The reagent consumption rate depends on the selected operating mode:

- Standard operating mode – 10 liters (2.6 gal [US]) every 2 months
- Economy operating mode – 10 liters (2.6 gal [US]) every 3 months

The standard solution consumption rate is dependant on both the selected operating mode and the frequency and type of calibration but is typically:

- Standard operating mode – 2.5 liters (0.7 gal [US]) every 2 months
- Economy operating mode – 2.5 liters (0.7 gal [US]) every 3 months

However, ABB recommend that the standard solution is replaced every 3 months to ensure accuracy.

Typical reagent and sample flow rates are:

- Standard operating mode
  - Reagent – 0.12 mls (0.003 fl oz [US]) per minute
  - Sample – 2 mls (0.07 fl oz [US]) per minute
- Economy operating mode
  - Reagent – 0.085 mls (0.002 fl oz [US]) per minute
  - Sample – 1.43 mls (0.05 fl oz [US]) per minute

Appendix B – Troubleshooting

B.1 Analyzer Malfunction

In the majority of cases, problems experienced are associated with the probe so check this first – see Appendix B.3. If the problem remains, check the chemistry (see Appendix B.2) and the liquid handling section as described below. Other faults, their possible causes and suggested remedies are shown in Table B.1 on page 78.

Check mechanical components that are involved with the liquid handling systematically. For example, check pump and valves for correct operation and tubing and tubing connections for leaks or blockages that could change the chemical conditions within the analyzer.

To minimize malfunctions, ensure the system is functioning correctly. To check the integrity of the readings, ABB recommended that the analyzer and the sampling system is visually inspected on a regular basis as follows:

- Check for leaks, particularly around the sample and drain pipe connections.
- Confirm sample flow by checking delivery to the constant head unit and effluent from the drain.
- Check the liquid flow over the probe membrane / sensing surface.
- Check liquid levels in the reagent and standard solution containers.
- Check for malfunction indications on the analyzer's display.

B.2 Reagent and Standard Solutions

Any unpredictable problems may be due to the standard or reagent solutions or their flow through the analyzer. If any doubts exist regarding the integrity of these solutions, replace them with freshly prepared solutions in the early stages of the fault-finding process. Ensure that appropriate concentrations of the reagent and standard solutions are used. When changing standard or reagent solutions, replace the container also, removing the empty / used one for thorough cleaning. **DO NOT** top-up reagent and / or standard solutions.

B.3 Probe Malfunction

B.3.1 Ammonia Analyzer

In the event of an ammonia probe malfunction, check for leakage past the membrane. This is indicated by the internal filling solution – it incorporates a yellow-colored indicator that changes to blue if the probe membrane, or membrane seal, allows alkaline reagent to leak into the probe. If this has occurred replace the membrane – see Section 13.4, page 68. The solution keeps indefinitely.

B.3.2 Fluoride Analyzer

A noisy sensor output can be caused by excessive bubble build-up on the sensing end of the fluoride probe.

Fault	Possible Cause	Remedy
Noisy electrode output	Air bubbles present on probe tip	1. Remove probe to clear air bubbles and refit 2. Check sample supply and check for air leaks
	Heated block temperature too high	Lower temperature setting in configuration
	Osmotic effects due to high concentrations of dissolved species	Take appropriate measures to ensure the sample is suitable for measurement
	Ammonia analyzers only – Interferents in sample (sample may contain high concentrations of anionic detergents)	Take appropriate measures to ensure the sample is suitable for measurement
	Ammonia probe membrane fault	Check membrane is not punctured, creased, blistered or loose – adjust or replace membrane as required
	Faulty electrical connections	Check BNC connector and other probe electrical connections
	Inadequate mixing of the reagent solution	Ensure mixer is in place (if required)
Ammonia probe response slow	Probe membrane damaged or sensing end fouled	1. Check membrane is not punctured, creased, blistered or loose – adjust or replace membrane as required 2. Carefully clean probe membrane surface with jet of clean water from wash bottle or syringe.
Fluoride probe response slow	Probe sensing end fouled	Clean probe end face
Excessive reading drift	Heated block assembly temperature control faulty	1. Check temperature setting in configuration 2. Check Pt1000
	Electrode unstable	Ammonia – 1. Membrane loose – adjust membrane 2. Membrane swollen or damaged – replace membrane 3. Filling solution exhausted – replace filling solution 4. If fault persists, replace electrode
		Fluoride – Replace probe
	Faulty reference electrode	Ammonia – Replace glass electrode
		Fluoride – Replace probe
High readings	Ammonia probe response slow	1. Check probe and replace membrane if required 2. Check reference electrode for signs of stripping of chloridised layer
	Calibration configuration values input incorrectly	Check calibration input values and calibration solutions values. Use mV Offset to give indication – the further from 0 mV, the more likely it is that the standard values are different to the true standard concentrations
	Sample contaminated	Take appropriate measures to ensure the sample is suitable for measurement

Table B.1 Faults, Causes and Suggested Remedies

Fault	Possible Cause	Remedy
Low readings	Incorrect calibration	Check calibration solutions for accuracy
	Ammonia probe response slow	1. Check probe and replace membrane if required 2. Check reference electrode for signs of stripping of chloridised layer
	Calibration values incorrectly input into configuration	Check calibration input values and calibration solutions value. Use mV Offset to give indication – the further from 0mV, the more likely it is that the standard values are different to the true standard concentrations
	Ammonia stripping in tubing and instrument feed lines	Check for contamination in all tubing and feed lines – clean or replace as required
	Sample contaminated	Take appropriate measures to ensure the sample is suitable for measurement
Calibration failure	Incorrect calibration solution value(s) entered in configuration	Enter correct value
	Incorrect calibration solution(s)	Check quality – replace / remake if necessary
	Insufficient / incorrect calibration solution supply	1. Check valve manifold fluid connections 2. Check valve electrical connections 3. Check calibration solution levels and refill if required 4. Check tubing for blockages 5. Check pump speed and pump tubing for wear
	Insufficient or incorrect reagent	Check levels and quality – replace if required
	Faulty probe	Ammonia & Fluoride – Check end of probe is clear of any possible fouling
		Fluoride – Replace membrane and recalibrate
Calibration failure with low Gradient Coefficient or % Slope indication	Incorrect calibration solution(s)	As above
	Insufficient / incorrect calibration solution supply	As above
	Insufficient or incorrect reagent	As above
	Faulty probe	As above
	Electrode insensitive	Ammonia – Replace membrane – if symptom resists, replace probe. See also 'Calibration failure' remedies
		Fluoride – Replace probe. See also 'Calibration failure' remedies
Calibration failure with High Gradient Coefficient or % Slope indication	Incorrect calibration solution(s)	As above
	Insufficient / incorrect calibration solution supply	As above

Table B.1 Faults, Causes and Suggested Remedies (Continued)

Fault	Possible Cause	Remedy
Calibration failure with slow probe response	Probe sensing end fouled	1. Check end of probe is clean and clear of any possible fouling 2. Check pump speed and tubing 3. Check for loss of coating on reference element (Ammonia probes only)
	Pump speed too slow	Check pump speed
	Analyzer and / or pump tubing obstructed or damaged	Check analyzer and pump tubing for signs of blockage or damage
	Ammonia probe reference electrode coating damaged	Replace glass electrode
Excessive mV Offset (> ±45 mV)	Incorrect calibration solution(s)	Check quality and replace / remake if necessary
	Insufficient / incorrect calibration solution supply	1. Check valve manifold fluid connections 2. Check valve electrical connections 3. Check calibration solution levels and refill if required 4. Check tubing for blockages 5. Check pump speed and pump tubing for wear
	Faulty probe	Ammonia & Fluoride – Check end of probe is clear of any possible fouling
		Fluoride – Replace membrane and recalibrate

Table B.1 Faults, Causes and Suggested Remedies (Continued)

Appendix C – Principle of Operation – Ammonia Analyzers

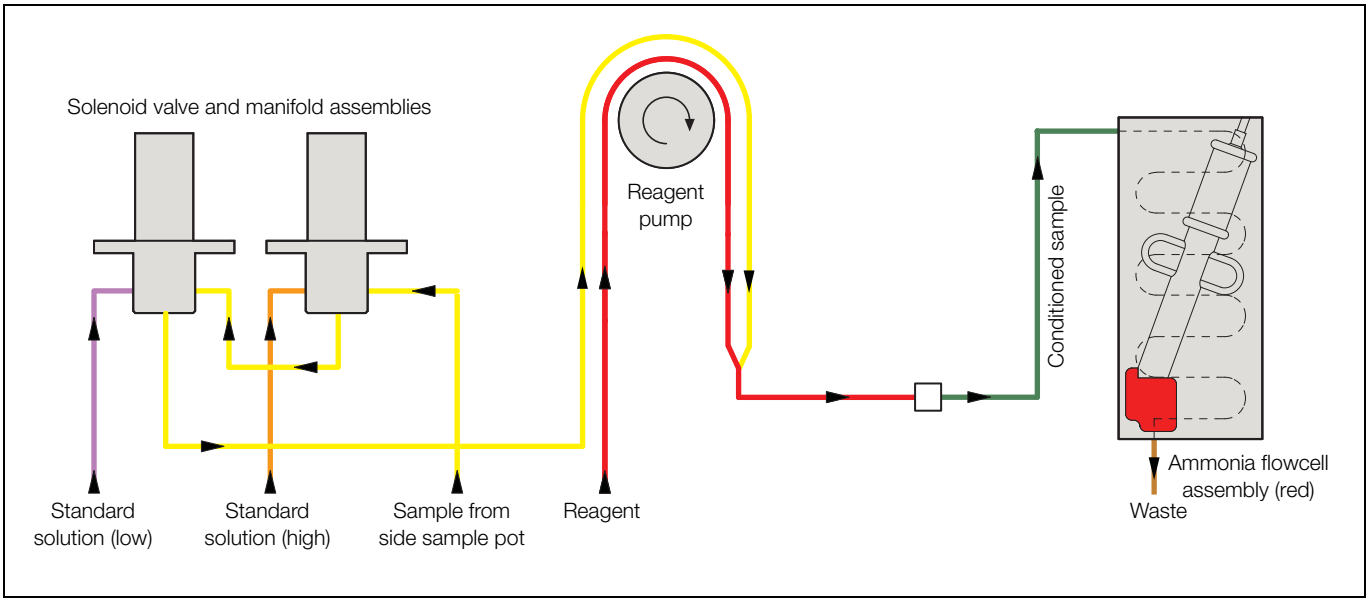


Fig. C.1 Flow Schematic

C.1 General Operation

The analyzer uses an ammonia probe. The probe contains a glass pH electrode (whose pH-sensitive glass membrane forms a slightly convex tip) and a robust, long-life reference electrode. The two electrodes are combined into a single assembly and are connected as a pH measuring pair through an internal reservoir of filling solution. The filling solution is 0.1 M ammonium chloride saturated with silver chloride and is separated from the sample by a gas-permeable hydrophobic membrane fitted to the tip of the probe.

As sample flows past the probe membrane, the partial pressures of the ammonia gas in the sample on one side of the membrane and the filling solution on the other equalize, transferring gas across the membrane. At equal pressure, the concentration of ammonia in the thin film of filling solution between the probe membrane and the pH-sensitive glass electrode membrane equals that in the sample. The resultant change in the pH value of the thin film is measured by the pH electrode pair, creating an output potential related to the ammonia concentration in the sample. Like most ion-selective electrodes, the ammonia probe produces an output that is logarithmic in respect to concentration.

The analyzer's sequence of operation is as follows:

1. Sample is supplied to a side sample pot constant head unit by a sample pump. Excess sample overflows to drain.

   Note. The constant head unit is fitted with a float switch that signals an 'Out-of-sample' condition by triggering an 'Out-of-Sample' alarm.

2. From the constant head unit, the sample is drawn through the normally open ports of solenoid valves SV1 and SV2 by one channel of a peristaltic pump.
3. Reagent is drawn through another channel of the peristaltic pump and mixed with the sample.

   Note. The sample and reagent tube diameters are sized to obtain the correct ratio of sample and reagent.

4. The conditioned sample is pumped into a flowcell containing the ammonia probe. The probe is enclosed in a heated block housing a heat-exchanger, ensuring that the body of the probe remains at a constant temperature and also at a temperature in agreement with that of the sample and standard solutions.
5. When exposed to the reacted sample, the probe produces an electrical potential that changes in proportion to the changes in activity of the measured ion.
6. The probe is connected to the electronics section where, after digital conversion, the signal is processed by microprocessor.
7. After measurement, the sample flows to waste via a contaminated drain connection.

During calibration, Low and High standard solutions are introduced sequentially in place of the sample by means of solenoid valves SV1 and SV2. The resultant millivolt Low and millivolt High readings from the probe are stored as the calibrated readings. The analyzer can be configured to perform automatic calibrations from every 6 hours to once per week. A calibration can also be initiated manually if required.

C.2 Theory of Operation

Ion-selective electrodes are useful tools in analytical chemistry. Rapid measurements of a great variety of species over wide concentration ranges can be made with the appropriate ion-selective electrode with parts-per-billion sensitivity.

The ion-selective electrode used for ammonia measurement is a gas sensing electrode. This type of electrode comprises a plastic body with a hydrophobic, gas-permeable membrane at one end. An electrode with a pH-sensitive glass membrane is screwed down against this membrane, trapping a thin film of an internal filling solution. At equilibrium, the membrane potential is mainly dependent on the activity of the target ion outside the membrane and is described by the following Nernst equation:

$$E = E^0 + (2.303RT/ nF) \times \text{Log } (A)$$

Where:

- E = total potential (in mV) developed between the sensing and reference electrodes
- E^0 = constant characteristic of the particular ISE / reference pair
- 2.303 = conversion factor from natural to base10 logarithm
- R = Gas Constant (8.314 joules/degree/mole)
- T = Absolute Temperature
- n = charge on the ion (with sign)
- F = Faraday Constant (96,500 coulombs)
- Log (A) = logarithm of the activity of the measured ion

The measured voltage (Eq.1) is proportional to the Logarithm of the concentration and the sensitivity of the electrode is expressed as the electrode slope (in millivolts per decade of concentration). Therefore the electrodes can be calibrated by measuring the voltage in solutions containing, for example, 10 ppm and 100 ppm of the target ion. The Slope is the slope of the (straight) calibration line drawn on a graph of mV versus Log concentration.

for example:

$$\text{Slope} = \frac{mV_{\text{High STD}} \text{ (100 ppm)} - mV_{\text{Low STD}} \text{ (10 ppm)}}{\text{Log100} - \text{Log10}}$$

Therefore, the slope equals the difference in the voltages since Log100 – Log10 = 1.

Unknown samples can be determined by measuring the voltage and plotting the results versus the concentration values on a calibration graph. Essentially, the only variables in the above expression are $E - E^0$ (ΔE) and concentration which, when plotted against each other, produces a linear relationship assuming a constant sample temperature.

The exact value of the slope can be used as indication of the efficiency of the ion-selective electrode in use. The slope value for a monovalent cation determined at 25 °C = 59 mV (–59 mV for a monovalent anion). This indicates that for every decade change in concentration there will be a 59 mV change in the potential output from the electrode.

To maintain a high degree of measurement accuracy, periodic calibration is required. This is usually performed automatically in online analyzers at which time the slope is recalculated. However, most of the changes in the output from the electrode pair are a result of zero drift that over a period of time can become quite large (for example, ±50 mV) before it begins to adversely affect performance.

Appendix D – Principle of Operation – Fluoride Analyzers

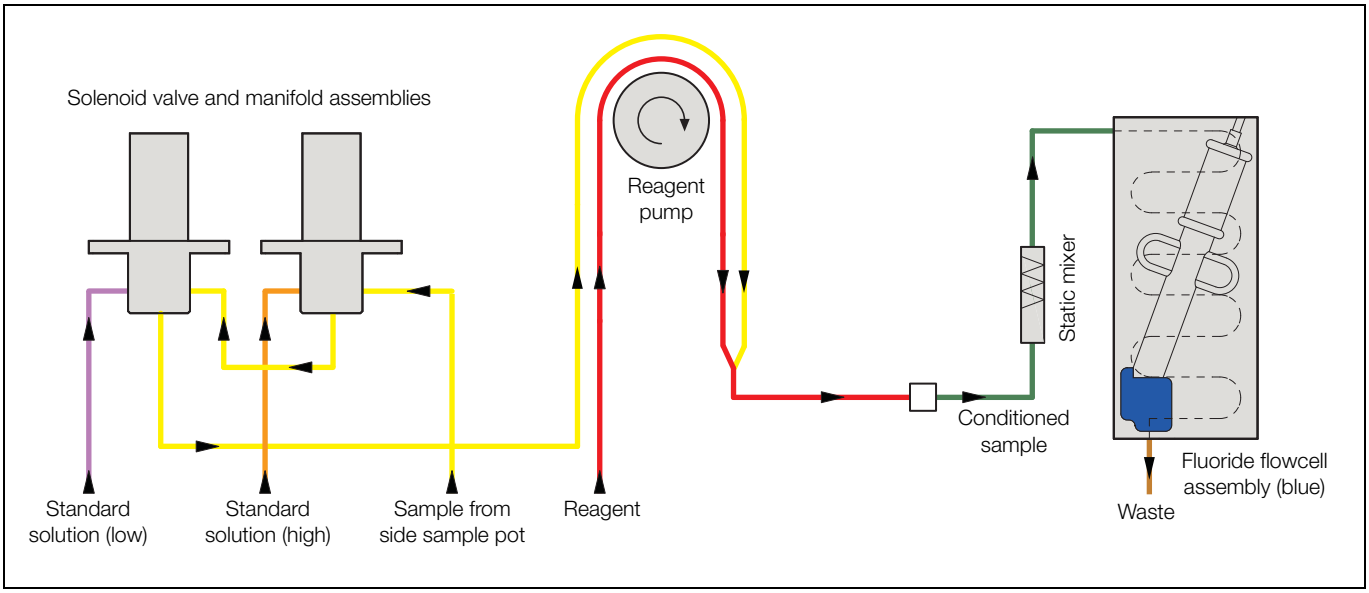


Fig. D.1 Flow Schematic

D.1 General Operation

The analyzer uses an ion-selective electrode comprising a fluoride sensing tip and a reference electrode. The fluoride sensing tip contains a single crystal of Lanthanum Fluoride, an ionic conductor in which fluoride ions are mobile. When the electrode is immersed in a solution containing fluoride ions, the difference in fluoride ion activity across the membrane causes an electrical potential be generated. Like most ion-selective electrodes, the fluoride probe produces an output that is logarithmic with respect to the measured concentration.

The analyzer's sequence of operation is as follows:

1. Sample is supplied to a side sample pot constant head unit by a sample pump. Excess sample overflows to drain.

   Note. The constant head unit is fitted with a float switch that signals an 'Out-of-sample' condition by triggering an 'Out-of-Sample' alarm.

2. From the constant head unit, the sample is drawn through the normally open ports of solenoid valves SV1 and SV2 by one channel of a peristaltic pump.
3. Reagent is drawn through another channel of the peristaltic pump and mixed with the sample.

   Note. The sample and reagent tube diameters are sized to obtain the correct ratio of sample and reagent.

4. The conditioned sample is pumped first through a static mixer, then into a flowcell containing the fluoride probe. The probe is enclosed in a heated block housing a heat-exchanger, ensuring that the body of the probe remains at a constant temperature and also at a temperature in agreement with that of the sample and standard solutions.
5. When exposed to the reacted sample, the probe produces an electrical potential that changes in proportion to the changes in activity of the measured ion.
6. The probe is connected to the electronics section where, after digital conversion, the signal is processed by microprocessor.
7. After measurement, the sample flows to waste via a contaminated drain connection.

During calibration, Low and High standard solutions are introduced sequentially in place of the sample by means of solenoid valves SV1 and SV2. The resultant millivolt Low and millivolt High readings from the probe are stored as the calibrated readings. The analyzer can be configured to perform automatic calibrations from every 6 hours to once per week. A calibration can also be initiated manually if required.

D.2 Theory of Operation

Ion-selective electrodes are useful tools in analytical chemistry. Rapid measurements of a great variety of species over wide concentration ranges can be made with the appropriate ion-selective electrode with parts-per-billion sensitivity.

The ion-selective electrode used for fluoride measurement is a solid-state electrode. This type of electrode comprises a plastic body containing an internal reference and Lanthanum Fluoride half-cells. At equilibrium, the membrane potential is mainly dependent on the activity of the target ion outside the membrane and is described by the following Nernst equation:

$$E = E^0 + (2.303RT/ nF) \times \text{Log } (A)$$

Where:

E	=	total potential (in mV) developed between the sensing and reference electrodes
E^0	=	constant characteristic of the particular ISE / reference pair
2.303	=	conversion factor from natural to base10 logarithm
R	=	Gas Constant (8.314 joules/degree/mole)
T	=	Absolute Temperature
n	=	charge on the ion (with sign)
F	=	Faraday Constant (96,500 coulombs)
Log (A)	=	logarithm of the activity of the measured ion

The measured voltage (Eq.1) is proportional to the Logarithm of the concentration and the sensitivity of the electrode is expressed as the electrode Slope (in millivolts per decade of concentration). Therefore the electrodes can be calibrated by measuring the voltage in solutions containing, for example, 10 ppm and 100 ppm of the target ion. The Slope is the slope of the (straight) calibration line drawn on a graph of mV versus Log concentration.

for example:

$$\text{Slope} = \frac{mV_{\text{High STD}}\ (100\ \text{ppm}) - mV_{\text{Low STD}}\ (10\ \text{ppm})}{\text{Log100} - \text{Log10}}$$

Therefore, the slope equals the difference in the voltages since Log100 – Log10 = 1.

Unknown samples can be determined by measuring the voltage and plotting the results versus the concentration values on a calibration graph. Essentially, the only variables in the above expression are $E - E^0$ (ΔE) and concentration which, when plotted against each other, produces a linear relationship assuming a constant sample temperature.

The exact value of the slope can be used as indication of the efficiency of the ion-selective electrode in use. The slope value for a monovalent cation determined at 25 °C = 59 mV (–59 mV for a monovalent anion). This indicates that for every decade change in concentration there will be a 59 mV change in the potential output from the electrode.

To maintain a high degree of measurement accuracy, periodic calibration is required. This is usually performed automatically in online analyzers at which time the slope is recalculated. However, most of the changes in the output from the electrode pair are a result of zero drift that over a period of time can become quite large (for example, ±50 mV) before it begins to adversely affect performance.

Appendix E – Web Server

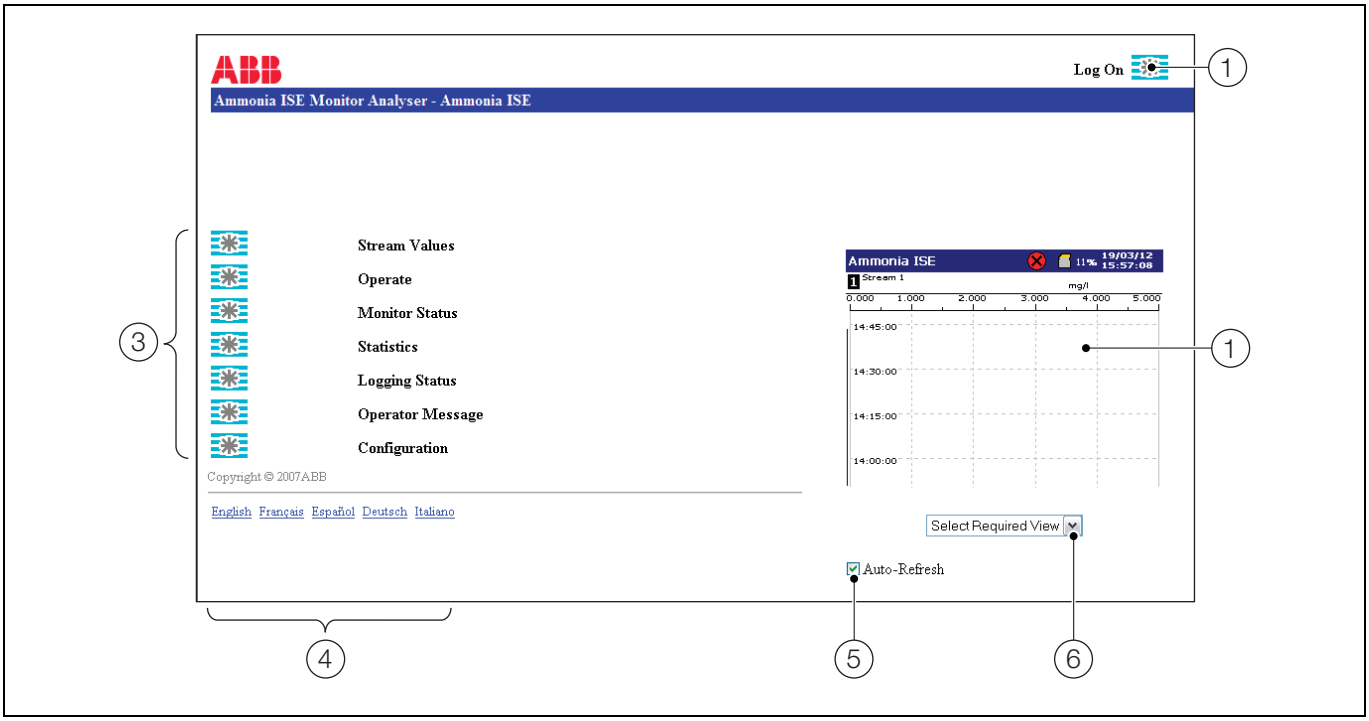


Fig. E.1 Web Server Screen

The analyzer is fitted with an ethernet card as standard and, when the appropriate configuration settings have been made, users can access the analyzer's data via an Ethernet network.

In addition, files can be transferred to and from the analyzer via an FTP connection.

(1) **Log On** – click to log on to the analyzer to enable configuration access (displayed only if the analyzer is configured for FTP access – see Section 6.7.1, page 41).

(2) **Analyzer View** – displays the current screen of the analyzer. If the analyzer has a screen-saver set, it does not affect this view.

(3) **Access Buttons** – provides access to the analyzer's data if the user has the appropriate access permission.

- **Stream Values** – see Appendix E.1, page 86
- **Operate** – see Appendix E.2, page 86
- **Monitor Status** – see Appendix E.3, page 86
- **Statistics** – see Appendix E.4, page 86
- **Logging Status** – see Appendix E.5, page 86
- **Operator Message** – see Appendix E.6, page 86
- **Configuration** – see Appendix E.7, page 87

(4) **Language Selection** – selects the language for the web pages.

(5) **Auto-Refresh** – updates the analyzer view automatically.

(6) **View Selection** – selects the required analyzer view:

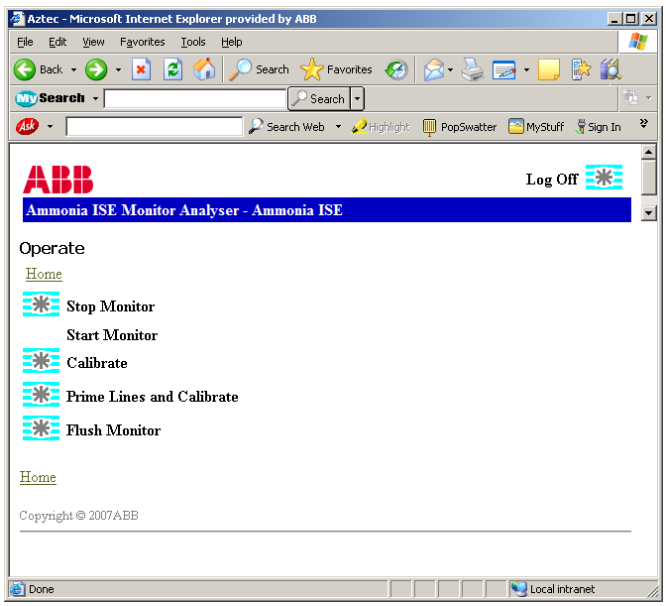
- Alarm / Event Log
- Audit Log
- Chart View
- Bar View

E.1 Stream Values

Stream	Tag	Value	Time of last measurement	Alarms	Alarm Ack
1	Stream 1	4 ppm	11.00 2 Mar 2012		

E.2 Operate

Note. Menu options from the 'Operate' window start the routine described when the associated button is selected.



E.3 Monitor Status

Status	Calibration	I/O	Information
Current State			Off
Sample Concentration / Detector mV			N/A / 40.35 mV
Cell Temperature			29.0 °C

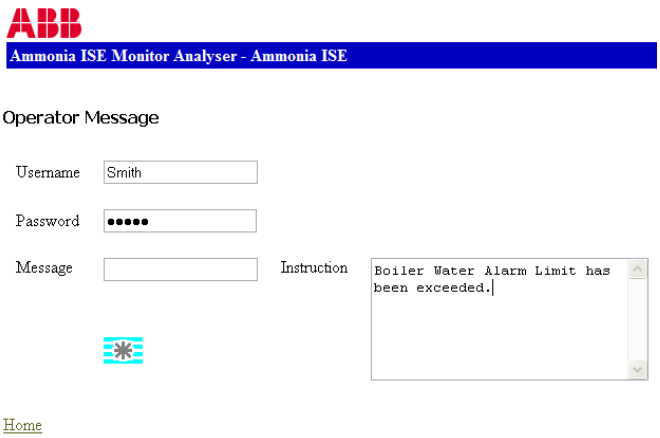
E.4 Statistics

Stream	Tag	Minimum	Maximum	Average	Since
1	Stream 1	127.7ppm	156.3ppm	142.0ppm	10:21 2 Mar 2012

E.5 Logging Status

Description	Status
Media Status	Off-Line
Memory Used	11%
Time Remaining	< 1 Hour
Archive Status	OFF

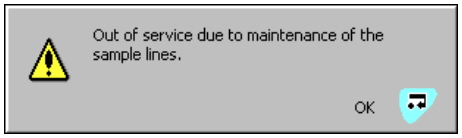
E.6 Operator Message



An 'Operator Message' is displayed on the chart view. For example:

An entry is also included in the 'Alarm Event Log'.

An Instruction is displayed on the analyzer as a warning, for example:



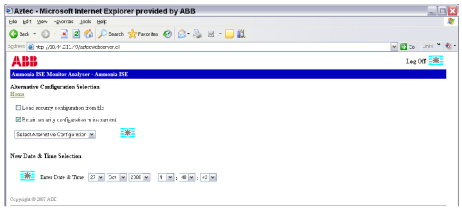
Operator instructions can be removed only by pressing the ↵ key.

To send an operator message or instruction to the analyzer:

1. Type the 'User name' and 'Password'. Up to 160 characters can be used. These are the FTP username and password that are set in the configuration – see Appendix E, page 85.
2. Type either the message or an instruction (only one field can be populated at any one time).
3. Click the ✳ button to send the message or instruction to the analyzer.

E.7 Configuration

Note. A user must be logged-on for the configuration button to be enabled.



E.8 FTP Access

Files can be transferred between the analyzer and a remote computer via an FTP connection if the analyzer has been configured with the appropriate settings – see Appendix E, page 85.

Either Microsoft Internet Explorer version 5.5 (or later) or MS-DOS can be used as an FTP client.

E.9 FTP Access via Internet Explorer

Note. FTP access requires Internet Explorer version 5.5 or later.

Before data can be accessed via FTP, Internet Explorer must be configured with the appropriate options.

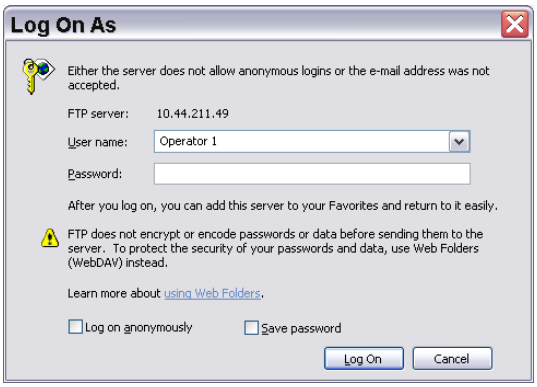
To ensure that the latest data file is copied, Internet Explorer must be set to check for newer versions of stored pages on every visit to a page. Internet Explorer must also be set to enable FTP access.

To configure Internet Explorer:

1. From the Internet Explorer 'Tools' menu select 'Internet Options'.
2. In the 'General' tab of the displayed dialog box, click the 'Settings' button in the 'Temporary Internet Files' grouping.
3. From the options for 'Check for newer versions of stored pages:', select 'Every visit to the page' and click 'OK'.
4. Select the 'Advanced' tab of the 'Internet Options' dialog box, ensure that the 'Enable folder view for FTP sites option' under the 'Browsing' heading is selected and click 'OK'.

To access data stored on the analyzer via Internet Explorer:

1. Start Internet Explorer.
2. In the 'Address' bar, enter 'ftp://' followed by the IP address of the analyzer from which the files are to be copied. A log-in dialog box is displayed:



3. Type the 'User name' and 'Password' and press enter. The folders that are present on the analyzer are displayed.
4. Open the folder containing the file to be displayed. The files within the folder can be displayed in any standard Explorer view (small icon, large icon, list or details) by selecting the appropriate option from the 'Views' menu.

Note. The SDMMC folder containing the data files is visible only if an SD card is present and logging is set to 'On-line' – see Section 9, page 53.

5. Files / Folders can be copied to / from the analyzer.

Note. An audit log entry is created and displayed for each FTP logon giving details of the logon user name and access (full or read-only). When Internet Explorer is used as the FTP client, two log-ons are performed at the start of each session, resulting in two log entries.

E.10 FTP Access via DataManager

DataManager can be used with FTP to access data files that have been saved to the archive media (SD card) inserted in the analyzer. For DataManager configuration details for FTP access, refer to the DataManager User Guide (IM/DATMGR).

E.11 File Transfer Program

A File Transfer Scheduler Program (FTSP) is available that enables archive and configuration files to be transferred automatically to a PC using FTP. The transferred files can be stored either on the local drive of the PC or on a network drive for easy access and secure back-up.

To download the FTSP program (FTS.exe), enter the following (without spaces) in your web browser's Address bar:

http://search.abb.com/library/ABBLibrary.asp?DocumentID=FTS.exe&LanguageCode=en&DocumentPartId=&Action=Launch

To download the FTSP User Guide (IM/SMFTS), enter the following (without spaces) in a web browser's address bar:

http://search.abb.com/library/ABBLibrary.asp?DocumentID=IM/SMFTS&LanguageCode=en&DocumentPartId=&Action=Launch

Appendix F – Updating the Software

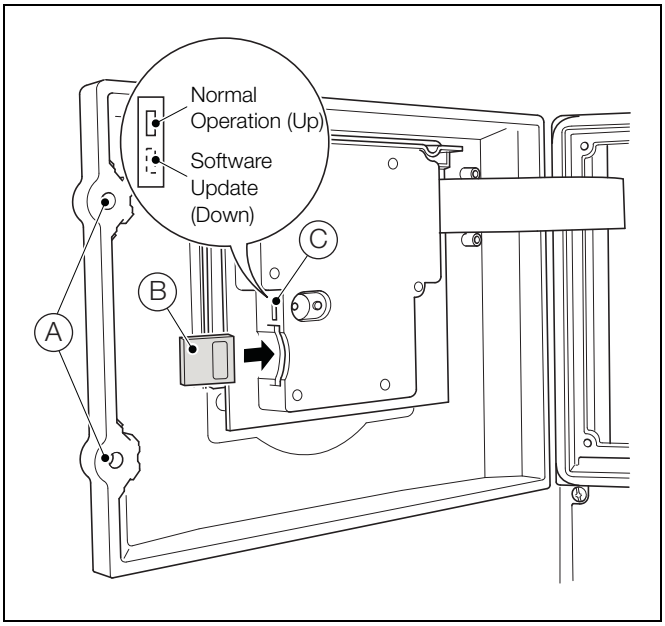
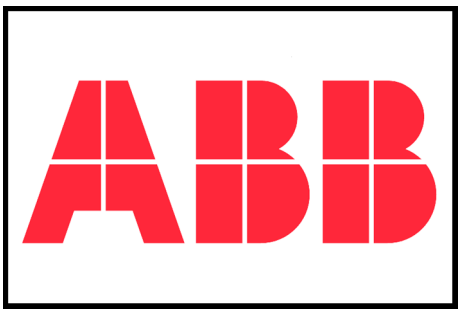
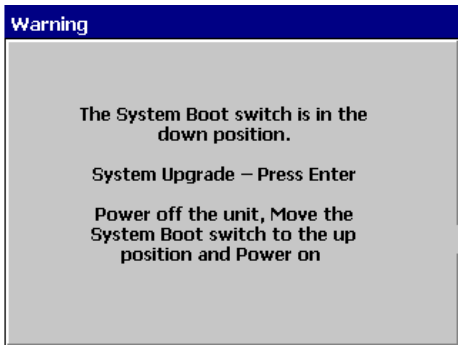


Fig. F.1 SD Card Removal

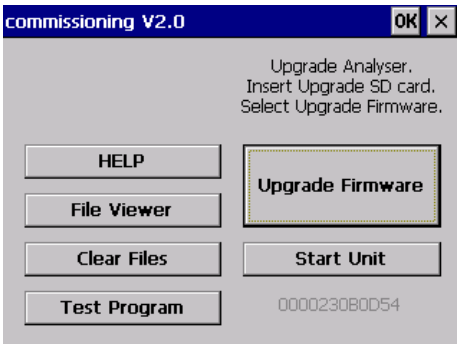
1. Stop analyzer operation by selecting 'Stop Monitor' from the main operator menu.
2. Ensure the analyzer is switched off.
3. Use a large flat-headed screwdriver to release the two door catches (A).
4. Remove the SD card (B).
5. Refer to the documentation on the web site (http://www.abb.com) for details of any software updates.
6. Download the software and transfer it to a blank SD card using an appropriate card reader.
7. Set the switch (C) (above the SD card socket) to the lower position (Software Update).
8. Insert the SD card, close the door and switch on the analyzer. A start-up message appears for a short duration (approximately 5 seconds) followed by a 'File Load Progress' bar then the 'ABB' splash screen:



9. A 'Warning' screen appears next. This provides the option to upgrade the existing system software or exit without upgrading:



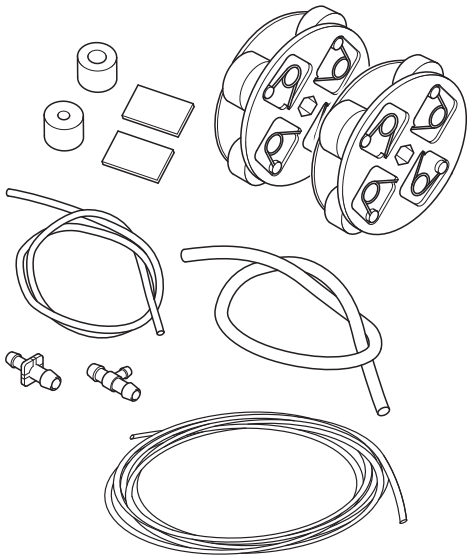
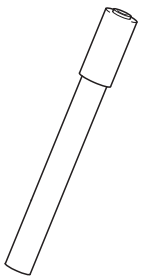
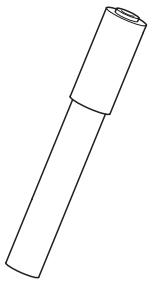
10. To proceed, press the ↵ key.
11. The 'Commissioning V2.0' screen appears with the 'Upgrade Firmware' button selected:

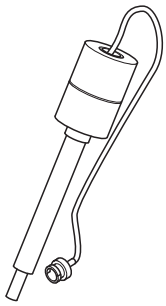


12. To upgrade the existing system software, press the ↵ key to start the process. The software is transferred to the analyzer in sections.
13. Press the ↵ key as each section is installed (installation may take a few minutes).
14. Open the door and move the switch to the up position.
15. Close the door and re-tighten the door catches (A in Fig. F.1).
16. Turn power off and then on to restart the analyzer.

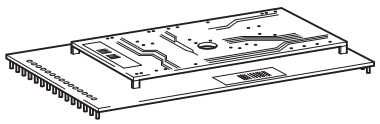
Appendix G – Spare Parts

G.1 Maintenance Kits

Part No.	Description
AW620 020	Annual consumable spares kit 
8001 621	Fluoride probe kit 
8002 620	Ammonia probe kit 

Part No.	Description
8002 621	Ammonia probe inner electrode 
AW620 023	Ammonia probe maintenance kit (includes 10 off seals per kit) 

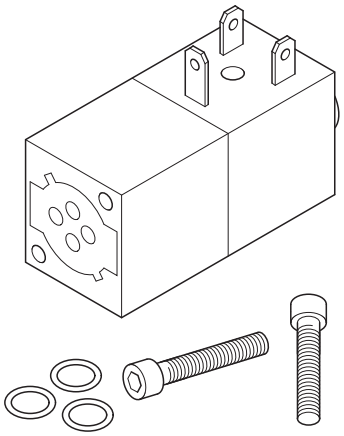
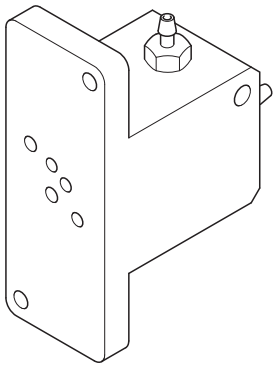
G.2 Upgrade Kits

Part No.	Description
AW600 067 	Profibus PCB assembly 

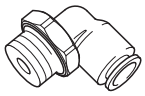
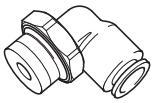
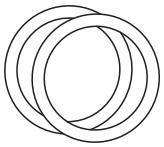
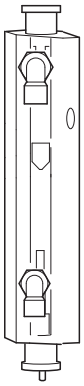
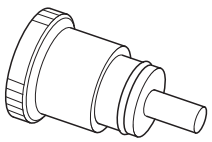
G.3 Reagents

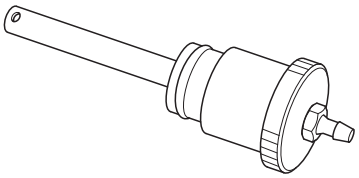
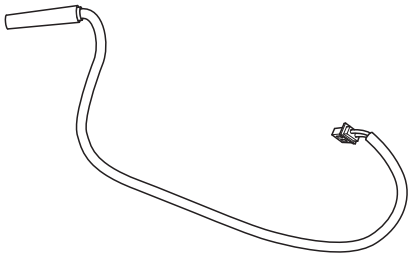
Part No.	Description
AWRK620/0300	Set of Ammonia Reagents – 1 each of: ■ Ammonia reagent (10 l) ■ Ammonia low standard 1 mg/l NH_3-N (2.5 l) ■ Ammonia high standard 4 mg/l NH_3-N (2.5 l)
AWRS620/0301	Ammonia reagent (10 l)
AWRS620/0302	Ammonia low standard 1 mg/l NH_3-N (2.5 l)
AWRS620/0303	Ammonia high standard 4 mg/l NH_3-N (2.5 l)
AWRS 620/0304	Ammonia reagent high strength (10 l) (for use when measuring greater than 300 ppm NH_3)
AWRS 620/0305	Ammonia standard 10 mg/l NH_3-N (2.5 l)
AWRS 620/0306	Ammonia standard 100 mg/l NH_3-N (2.5 l)
AWRK620/1200	Set of Fluoride Reagents – 1 each of: ■ Hexametaphosphate buffer 1 (10 l) ■ Fluoride low standard 0.5 mg/l F (2.5 l) ■ Fluoride high standard 1.5 mg/l F (2.5 l)
AWRS620/1201	Fluoride buffer (10 l) – Hexametaphosphate buffer used when measuring >0.2 mg/l F
AWRS620/1202	Fluoride low standard 0.5 mg/l F (2.5 l)
AWRS620/1203	Fluoride high standard 1.5 mg/l F (2.5 l)
8002 240	Ammonia electrode filling solution (60 ml)

G.4 Valve Assemblies and Associated Parts

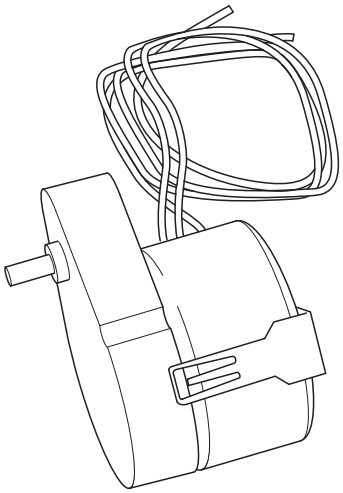
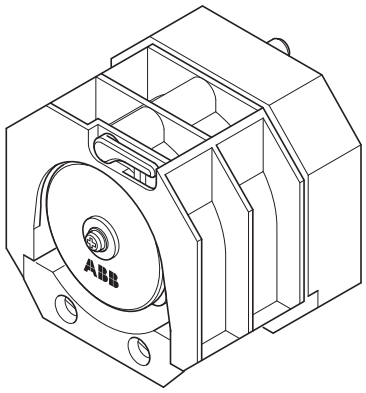
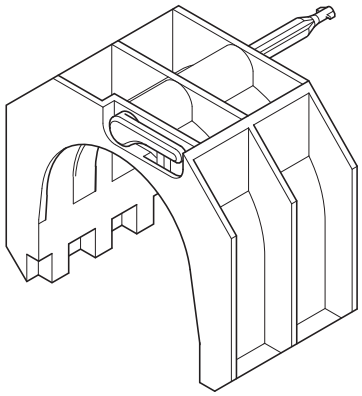
Part No.	Description
AW620 030	Valve solenoid assembly 
AW620 031	Valve manifold assembly – complete with barbed connectors 

G.5 Side Sample Pot Assembly and Associated Parts

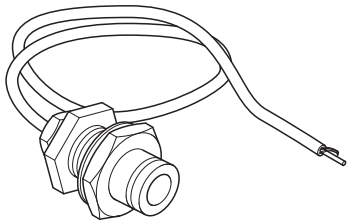
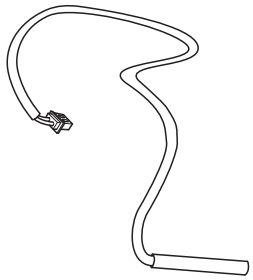
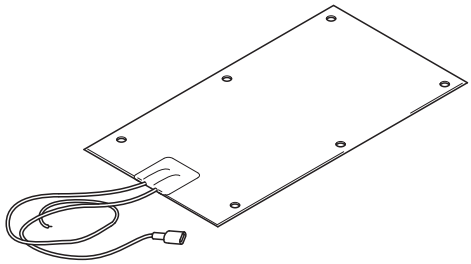
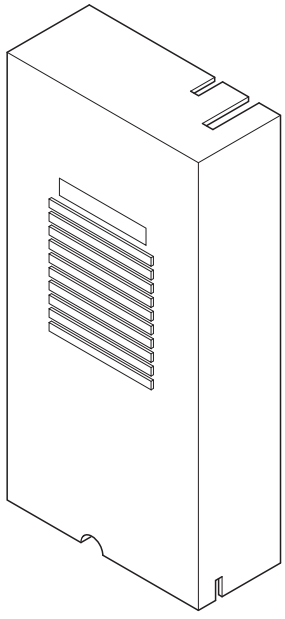
Part No.	Description
AW630 062	Side sample pot elbow fitting – $^{3}/_{8}$ in BSPP x 10 mm 
AW630 063	Sample float assembly 
AW630 065	Side sample pot elbow fitting – $^{1}/_{4}$ in BSPP x 6mm 
AW630 067	O-rings for side sample pot, top and bottom caps 
AW630 079	Side sample pot assembly 
AW630 084	Sample pot top cap – complete with O-ring 

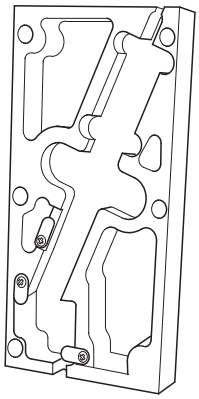
Part No.	Description
AW630 085	Sample pot bottom cap – complete with O-ring and barbed fitting 
AW630 096	Side sample pot reed switch 

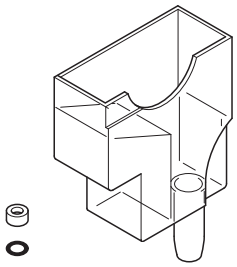
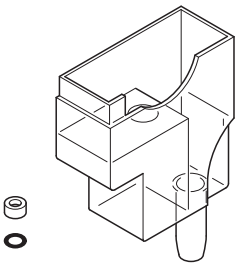
G.6 Pump Motor Assemblies and Associated Parts

Part No.	Description
AW620 040	Pump motor assembly 
AW620 041	Pump head assembly (no motor) 
AW620 043	Pump motor coupling 
AW620 044	Spare pump head pressure plate with locking pin 

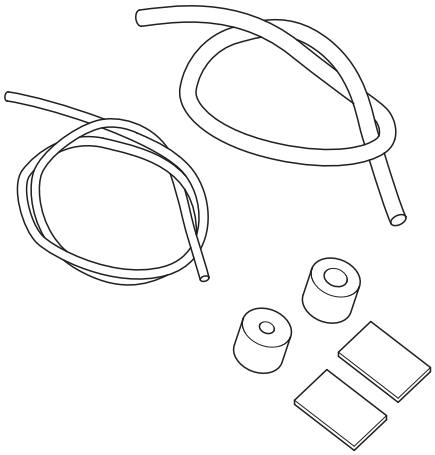
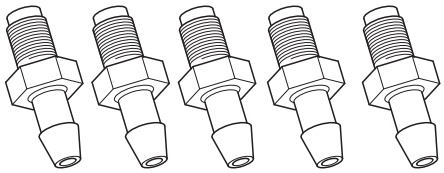
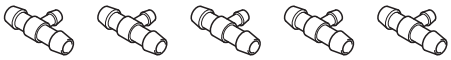
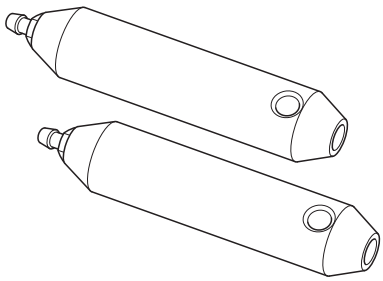
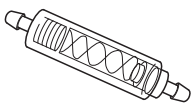
G.7 Flowcell Assemblies and Associated Parts

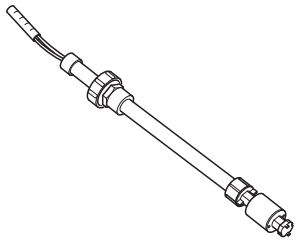
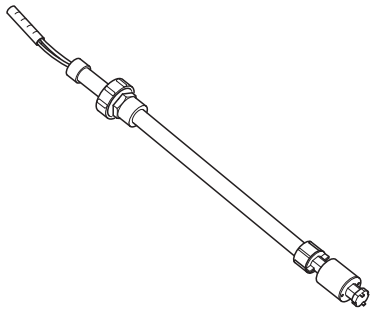
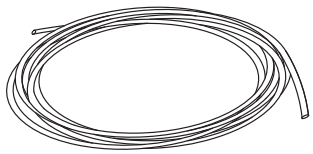
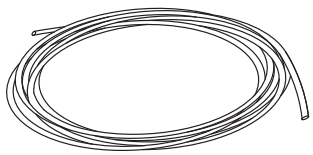
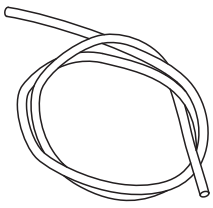
Part No.	Description
AW620 015	Probe interconnection cable assembly 
AW620 016	Pt1000 assembly 
AW620 017	Heater mat assembly 
AW620 025	Heated block cover assembly 

Part No.	Description
AW620 026	Heated block assembly 

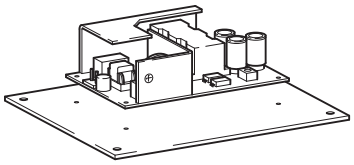
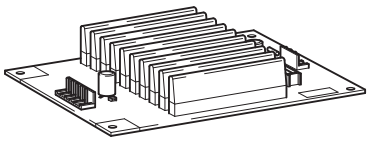
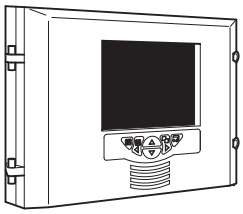
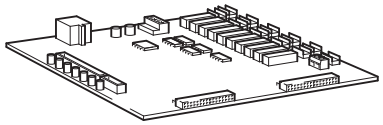
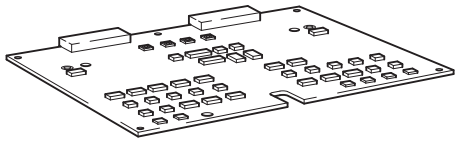
Part No.	Description
AW622 051	Ammonia flowcell assembly (Red) 
AW621 051	Fluoride flowcell assembly (Blue) 

G.8 Plumbing and Tubing

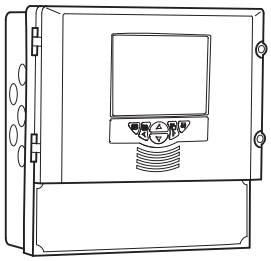
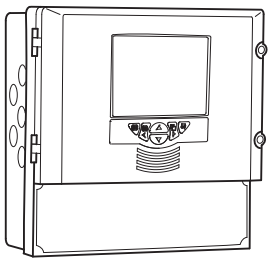
Part No.	Description
AW620 060	Pump tube kit 
AW620 067	Pack of 5 M6 barbed fittings for valve manifolds 
AW620 068	Pack of 5 replacement tee-pieces 
AW620 069	Pack of 2 line weights 
AW621 045	Inline mixer assembly 

Part No.	Description
AW620 072	Level sensor assembly – 2.5 l / 5 l 
AW620 073	Level sensor assembly – 10 l 
AW620 058	Analyzer tubing – ISE Buffer (box, 15 m [50 ft]) 
AW620 059	Analyzer tubing – ISE Sample (bag, 15 m [50 ft]) 
AW620 061	Contaminated drain tubing 1.5 m (5 ft) 

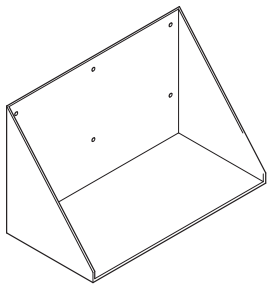
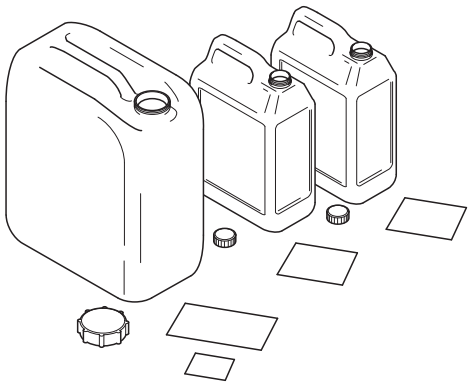
G.9 Electronic Boards

Part No.	Description
AW600 051	Aztec / Navigator PSU kit – AC 
AW600 056	Aztec / Navigator PSU kit – DC 
AW630 068	Front door assembly with membrane keypad plus display 
AW630 073	Application PCB assembly 
AW630 087	Interconnection PCB assembly 

G.10 Transmitter Assembly

Part No.	Description
AW630010	Transmitter assembly (fully tested) – AC 
AW630 011	Transmitter assembly (fully tested) – DC 

G.11 Accessories

Part No.	Description
03-0051	Reagent support tray – stainless steel 
AW620 045	Reagent and standard bottle pack comprising: 1 x empty 10 l bottle + cap + labels 2 x empty 2.5 l bottles + caps + labels 

Index

Acknowledgements

Microsoft and Excel are registered trademarks of Microsoft Corporation in the United States and / or other countries

Products and customer support

Automation Systems
For the following industries:
— Chemical & Pharmaceutical
— Food & Beverage
— Manufacturing
— Metals and Minerals
— Oil, Gas & Petrochemical
— Pulp and Paper

Drives and Motors
— AC and DC Drives, AC and DC Machines, AC Motors to 1kV
— Drive Systems
— Force Measurement
— Servo Drives

Controllers & Recorders
— Single and Multi-loop Controllers
— Circular Chart and Strip Chart Recorders
— Paperless Recorders
— Process Indicators

Flexible Automation
— Industrial Robots and Robot Systems

Flow Measurement
— Electromagnetic Flowmeters
— Mass Flowmeters
— Turbine Flowmeters
— Wedge Flow Elements

Marine Systems & Turbochargers
— Electrical Systems
— Marine Equipment
— Offshore Retrofit and Refurbishment

Process Analytics
— Process Gas Analysis
— Systems Integration

Transmitters
— Pressure
— Temperature
— Level
— Interface Modules

Valves, Actuators and Positioners
— Control Valves
— Actuators
— Positioners

Water, Gas & Industrial Analytics Instrumentation
— pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
— Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Monitors
— Zirconia Oxygen Monitors, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

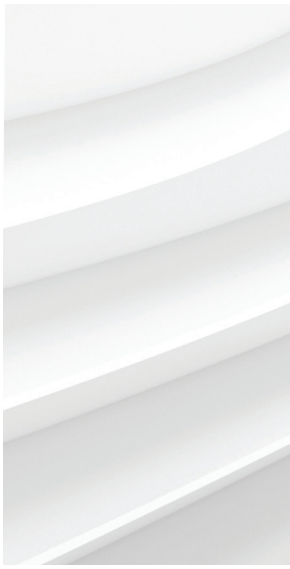
USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
— A listing evidencing process operation and alarm logs at time of failure.
— Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

ABB Limited
Measurement & Analytics
Oldends Lane
Stonehouse, Gloucestershire
GL10 3TA
UK
Tel: +44 (0)1453 826 661
Fax: +44 (0)1453 829 671

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



We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.

© ABB 2018
All rights reserved

3KXA800002R4201

OI/AXM630-EN Rev. J 08.2018