User Guide IM/7835–EN Rev. Q

7835
Hydrazine Monitor

Power and productivity
for a better world™

The Company

We are an established world force in the design and manufacture of measurement products for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

EN ISO 9001:2000

Cert. No. Q 05907

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.

0255

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

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 address on the back cover, 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.

Caution. This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense.

1.11 Service and Repairs

Other than the serviceable items listed in Section 10, page 27, 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

Warning.

- Read all relevant sections of this guide before configuring the system or modifying system parameters.
- Install and use this equipment as detailed in this guide. Install and use associated equipment in accordance with the relevant national and local standards.
- System configuration must be carried out only by users or personnel with approved access rights (user privileges).

2.1 General

The 7835 Hydrazine Monitor uses an electro-chemical cell to measure the amount of hydrazine in boiler water. The information provided by the monitor can be used to avoid expensive overdosing of hydrazine or more costly damage to boiler plant due to the under-dosing of hydrazine.

The 7835 is an accurate reliable monitor providing trouble-free operation and requiring a minimum of routine maintenance. It measures hydrazine over two ranges: 0 to 100 µg kg^{-1} and 0 to 1000 µg kg^{-1} – the ranges are selected manually or, if required, switched by the monitor automatically.

The monitor is housed in 2, lockable steel cases consisting of a liquid handling section (sensor unit) and an electronics section (transmitter unit). The electronic case is protected to IP55 and can be separated from the liquid handling section by up to 100m (325 ft).

2.2 Sensor Unit

The liquid handling section contains a constant-head unit feeding sample to a sensor that can be refurbished. Reagent solution to raise the pH of the sample is added via a micro-porous disc. During the calibration sequence, a solenoid valve blocks the flow of sample that diverts to the drain and allows flow of the standard solution. Reagent and standard solutions are held in containers with transparent ends, mounted inside the sensor unit case.

2.3 Transmitter Unit

Operation and programming of the 7835 is via 4 keys and a digital display located on the front of the transmitter.

In operation, the transmitter can display measured hydrazine (µg kg-1) and the sample temperature. Set-up of alarm, retransmission and calibration parameters is achieved in programming mode, where key parameters are protected by security codes.

Hydrazine values can be retransmitted to remote equipment using the retransmission output facility. The values retransmitted are set automatically to the range selected.

Remote alarm indication is provided by 2 relay outputs. Relays are programmed to activate when the hydrazine level moves either above or below a pre-defined trip point.

Remote range indication is provided by 2 relay outputs. The low range relay is active when the range selected is 0 to 100 µg kg-1 and the high range relay is active when the range selected is 0 to 1000 µg kg-1. In automatic mode the range relays are activated automatically.

2 Further relay outputs are available to indicate when a calibration is in progress and if the last calibration failed.

The transmitter unit is provided with 6 cable glands fitted to the gland plate on the left hand side of the case.

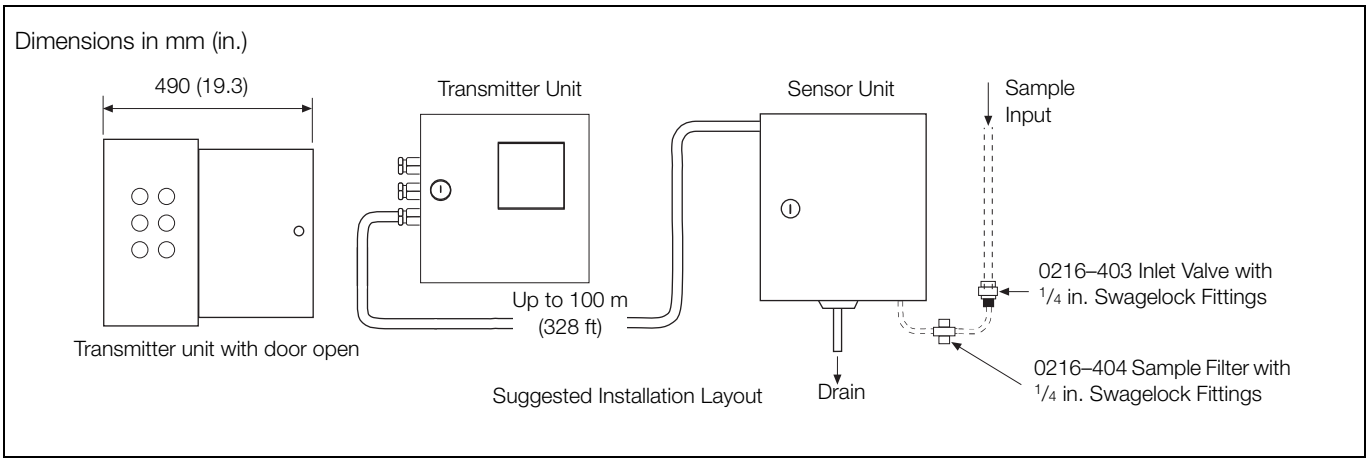


Fig. 2.1 System Layout

3 Mechanical Installation

3.1 Unpacking

Caution. Visually inspect equipment for damage before installing. Do not install damaged or faulty equipment.

3.2 End of Life Disposal

3.2.1 Transmitter

The transmitter unit does not contain any substance that causes undue harm to the environment and must be disposed of in accordance with the Directive on Waste Electrical and Electronic Equipment (WEEE). It must not be disposed of in Municipal Waste Collection.

3.2.2 Sensor and Sensor (Wet Section Assembly)

ABB recommend returning the sensor back to the Company for safe disposal, preferably with the electrolyte/filling solution cleaned out before dispatch.

The sensor wet section assembly must be emptied, cleaned and disposed of in accordance with the Directive on Waste Electrical and Electronic Equipment (WEEE).

3.3 Cleaning

Clean the transmitter and sensor units using warm water and a mild detergent only. Do not hose down the sensor unit.

3.4 Installation Conditions

Mount both units in a clean, vibration-free environment, avoiding direct radiant heat, sunlight and draughts. Avoid areas likely to have contaminating gases, particularly chlorine.

Mount the sensor no more than 10 m (30 ft.) from any associated sample cooler – see Section 4.7, page 12. The transmitter can be mounted up to 100 m (325 ft.) away from the sensor unit.

The holes for wall mounting both units are suitable for 8 mm (0.32 in.) diameter fasteners and are located as shown in Figs. 3.1 and 3.2, page 7.

Leave sufficient space in front of the cases for access, and to the side for making cable connections to the transmitters.

Caution.

- Locate the transmitter and sensor units in a position where their temperature and humidity specification are not exceeded and ensure it is protected from direct sunlight, rain, snow and hail.
- Select a location away from strong electrical and magnetic fields. If this is not possible, particularly in applications where mobile communications equipment is expected to be used, screened cables within flexible, earthed metal conduit must be used.

3.5 Overall Dimensions

3.5.1 Transmitter Unit

Wall mounting is by 4 x 8 mm (0.32 in.) diameter fasteners on 230 x 230 mm (9.0 x 9.0 in.) centers – see Fig. 3.1, page 7.

1. Unlock the door and open fully.
2. Remove all 4 screws and remove the terminal cover plate.
3. To release the electronics assembly plate, remove all 6 screws.
4. Remove the safety earth (ground) bonding leads attached to the metal case.
5. Release the 2 x M6 captive screws securing the electronics assembly plate to the back of the case and remove completely.
6. Fix case to wall or panel.
7. Replace the electronics assembly plate, secure it with the captive screws, and replace the earth (ground) bonding leads. Refit all 6 screws.
8. Re-position the terminal cover plate and refit all 4 screws.

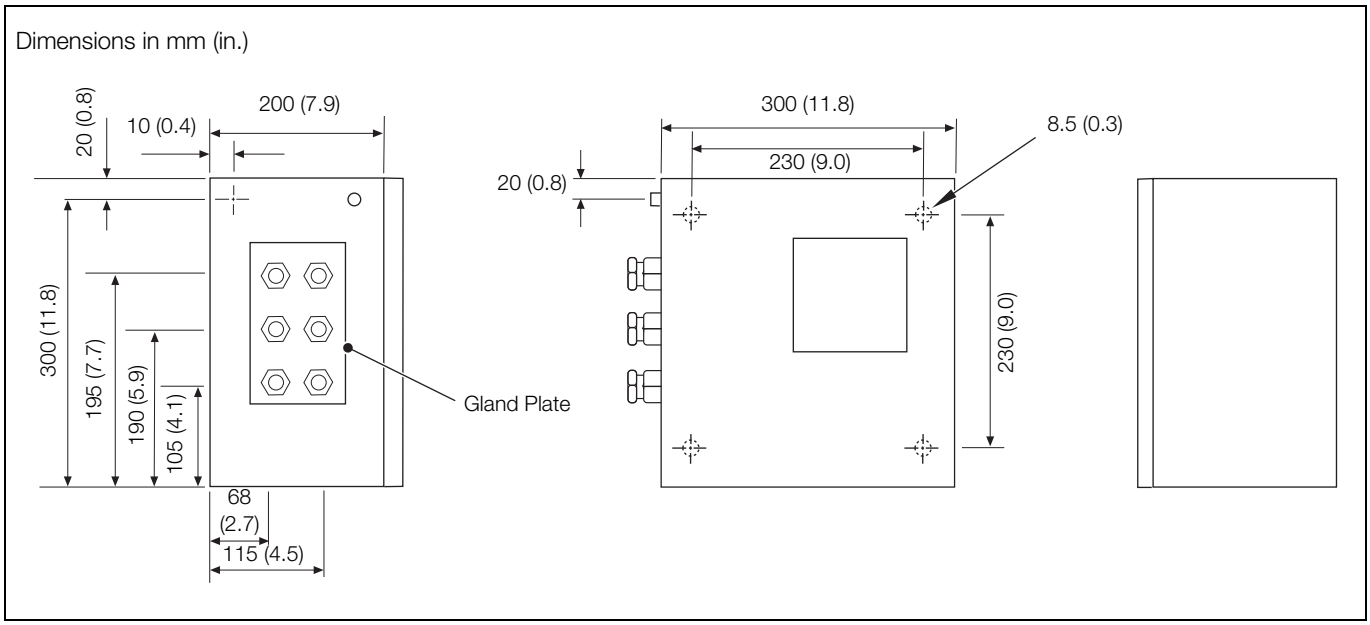


Fig. 3.1 Transmitter Unit Dimension and Installation detail

3.5.2 Sensor Unit

Wall mounting is by 4 x 8 mm (0.32 in.) diameter fasteners on 330 x 230 mm (13.0 x 9.0 in.) centers – see Fig. 3.2). For access to case mounting holes release the panel at the captive bolts and ease it forwards.

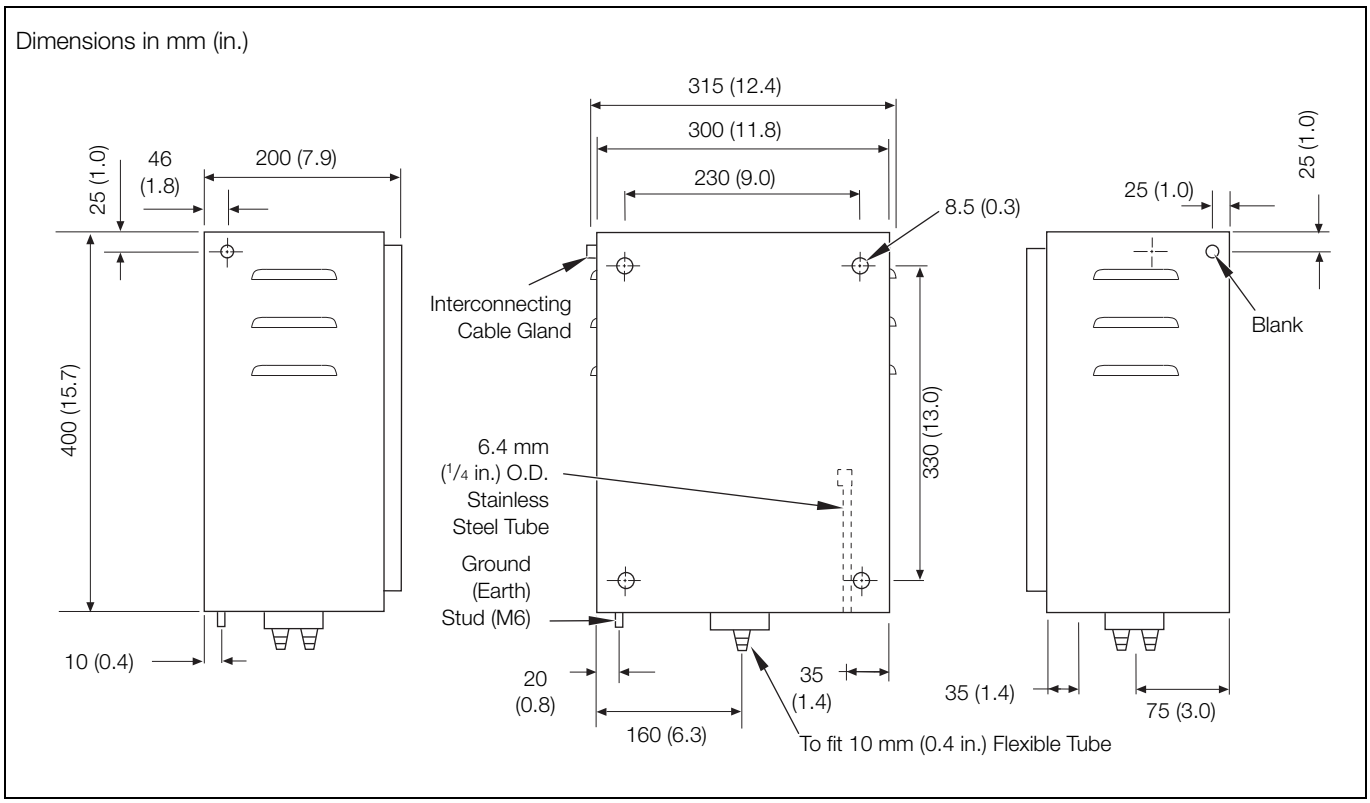


Fig. 3.2 Sensor Unit Dimension and Installation Detail

4 Electrical Installation

4.1 Electrical Safety

Warning.

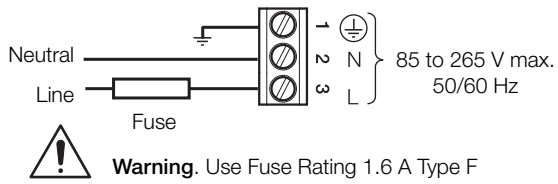
- The transmitter is not fitted with a switch therefore a disconnecting device such as a switch or circuit breaker conforming to local safety standards must be fitted to the final installation. It must be fitted in close proximity to the instrument within easy reach of the operator and must be marked clearly as the disconnection device for the transmitter – see Fig. 4.1.
- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.
- 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 5 A and 90 °C (194 °F) minimum, that conforms to either IEC60227 or IEC 60245. The terminals accept cables from 0.8 to 2.5 mm^2 (18 to 14 AWG).
- The equipment conforms to Installation Category II of IEC 61010.
- All connections to secondary circuits must have basic insulation.
- After installation, there must be no access to live parts, for example, terminals.
- Terminals for external circuits are for use only with equipment with no accessible live parts.
- If the equipment is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.
- All equipment connected to the transmitter's terminals must comply with local safety standards (IEC 60950, EN601010-1).

Caution.

- Always route signal leads and power cables separately, preferably in earthed (grounded) metal conduit.
- Make connections only as shown.
- Maintain Environmental Protection at all times.
- Ensure the seal and mating surfaces are clean to maintain environmental rating.
- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further $^1/_2$ to $^3/_4$ turn using a suitable spanner or wrench.
- Fit blanking plugs where required.
- Inductive loads must be suppressed or clamped to limit voltage swings.
- Operation of outputs is programmable.

4.1.1 Power Supply Connections

Note. Tighten power supply terminal screws to a torque of 0.8 Nm (7 lb-in.).



Warning. Use Fuse Rating 1.6 A Type F

Fig. 4.1 Power Supply Connections

4.2 Transmitter Unit – Access to Terminals

Warning. Isolate the transmitter from power supplies before removing the cover.

Referring to Fig. 4.2:

1. Unlock the door (A) and open fully.
2. Remove all 4 screws (B) and remove the terminal cover plate (C).

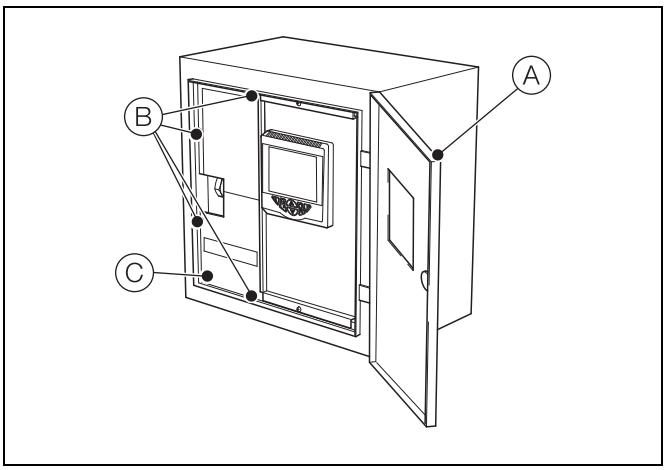
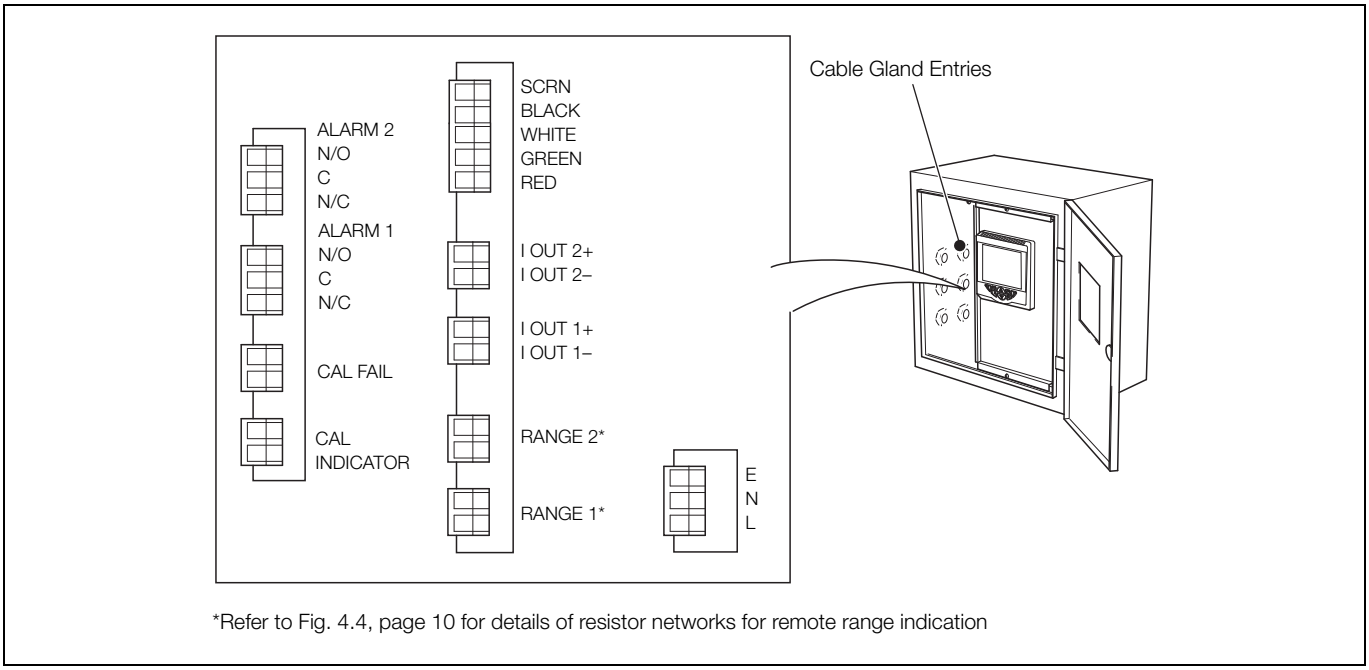


Fig. 4.2 Transmitter Unit Access to Terminals

4.3 Transmitter Unit – Cable Gland Entries and Connections

1. Cut the cable from the sensor unit to a suitable length to reach the transmitter for termination on transmitter terminal blocks.
2. Push the end of the cable through one of the supplied glands in the gland plate.
3. Prepare the cable end and attach it to the terminal block. Individual terminal blocks can be unplugged from the terminal board pins if required.
4. Pass the remaining cables through the glands. Prepare the cable ends and attach them to the terminal blocks as shown in Fig. 4.3.

Make earth (ground) connections to the stud terminal on the bottom of the transmitter unit.



*Refer to Fig. 4.4, page 10 for details of resistor networks for remote range indication

Fig. 4.3 Transmitter Unit Cable Gland Entries and Electrical Connections

4.4 Transmitter Unit – Ancillary Equipment

4.4.1 Recorders

The choice of 2 different isolated recorder output signals enables the monitor to be used with a wide variety of recording and data processing equipment. A 2-pen recorder is necessary; pen 1 indicating the hydrazine concentration and pen 2 the monitor range.

4.4.2 Range Indication

The remote range indication relays can be used in different arrangements to suit the requirements of the installation. The relays can, for example, be wired directly into the PLC or data logger but, if a recorder is used, a method of indicating the range set is required.

Suitable range indication recorder input can be provided using a resistor network that consist of 4, 1/4 watt resistors. Connect the network as shown in the two examples in Fig. 4.4. A recorder with suitable voltage and resistance inputs can be provided by ABB. The recorder provides 60 % scale deflection for Range 1 and 70 % scale deflection for Range 2.

Ensure other arrangements are designed to suit the requirements of the system. Ensure that all external equipment is set up and working according to the instructions supplied.

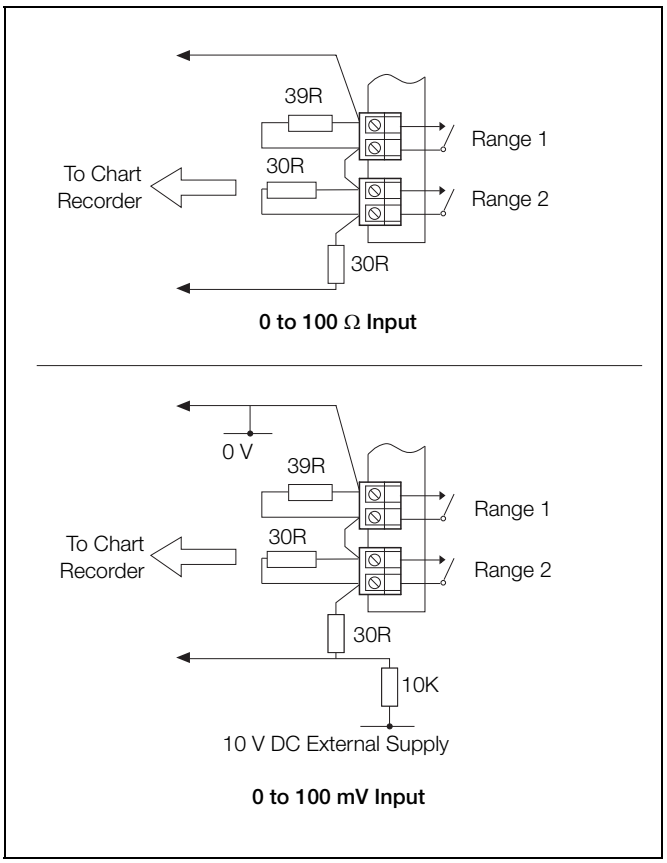


Fig. 4.4 Resistor Network for Remote Range Indication (0 to 100 Ω and 0 to 100 mV Input Options)

4.5 Sensor Unit – Access to Terminals

Warning. Isolate the transmitter from power supplies before removing the cover.

Referring to Fig. 4.5:

1. Unlock the door (A) and open fully.
2. Remove all 4 screws (B) and remove the terminal cover plate (C).

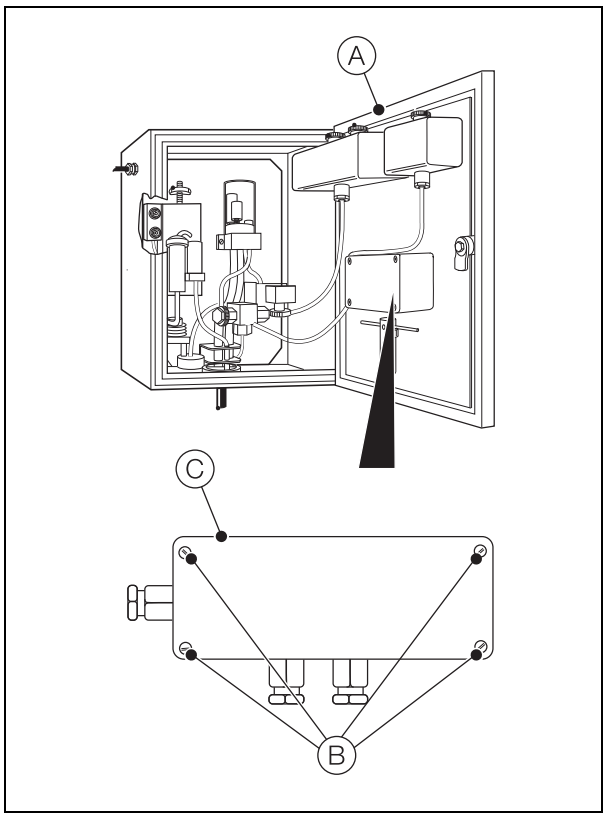


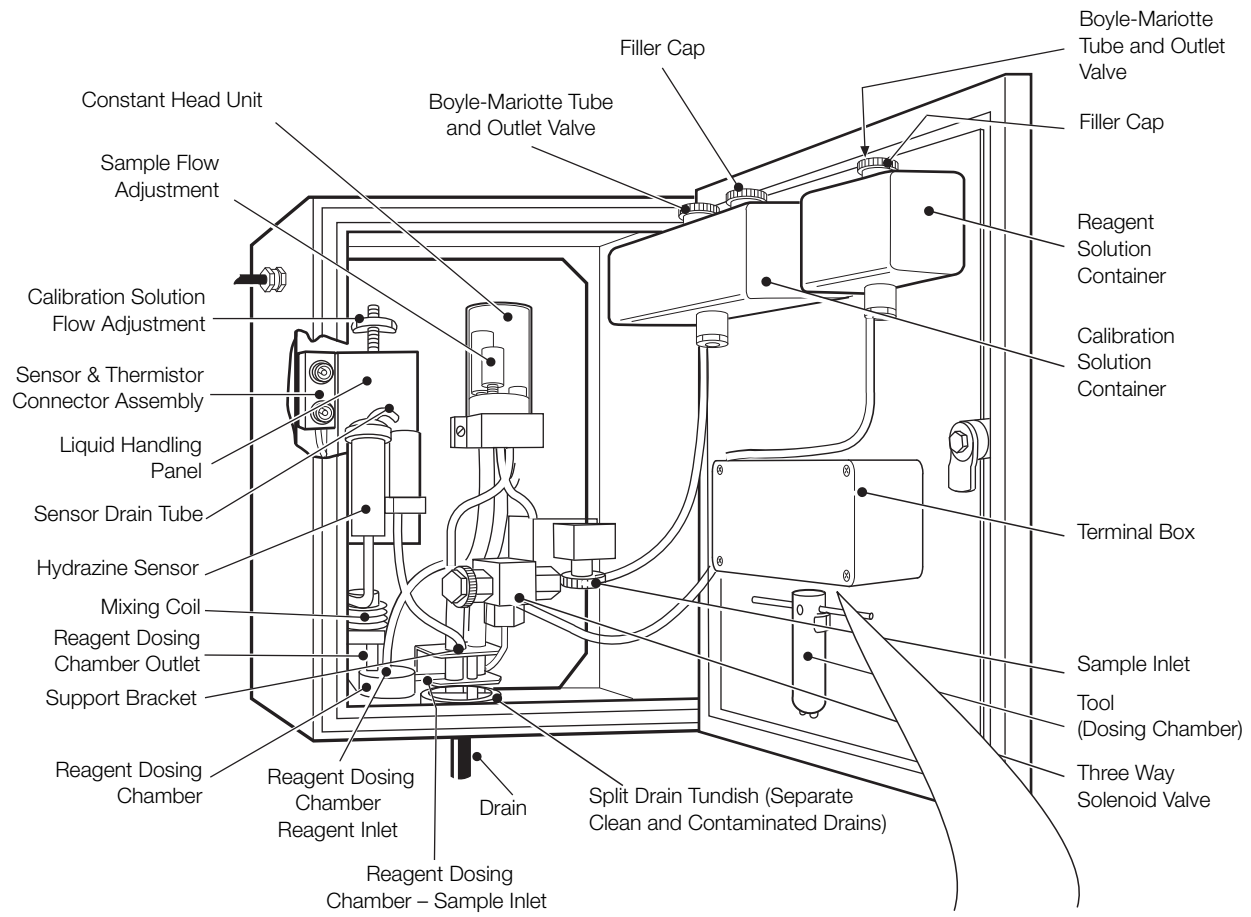
Fig. 4.5 Sensor Unit – Access to Terminals

4.6 Sensor Unit – Cable Gland Entries and Connections

The cable gland for connections within the sensor unit is located at the top right-hand side of the case but can be transferred to the opposite side if this is more convenient.

A 2 m (6.5 ft.) length of 4-way overall screened cable is normally supplied for interconnecting the sensor and transmitter units; longer lengths may be ordered separately. The interconnecting cable is routed to a terminal block in a electrical connection box on the inside of the case door – see Fig. 4.6. Push one end of the cable through the cable gland in the sensor unit case and then the junction box, prepare the cable end and connect it to the terminal block as shown in Fig. 4.6. Tighten the cable glands. If the gland in the case has been transferred to the left-hand side, support the cable using the two cable ties provided.

Make earth (ground) connections to the stud terminal on the bottom of the transmitter unit.



Terminal Box Connections

B	0V	Black
R	24V	Red
SCR	Screen	–
G	Tx/Rx +	Green
W	Tx/Rx –	White
7	24S	Solenoid Valve
8	S	Solenoid Valve
31	Hydrazine Sensor +	Red
32	Hydrazine Sensor –	Blue
33	Pt1000 Temperature Sensor	Yellow
35	Pt1000 Temperature Sensor	Black

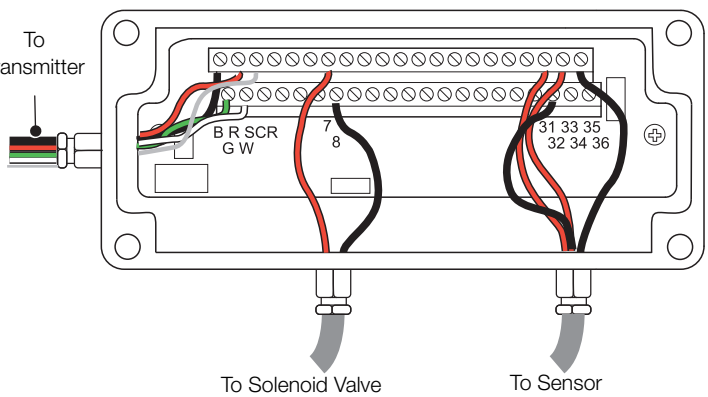


Fig. 4.6 Sensor Unit Cable Gland Entries and Electrical Connections

4.7 Sensor Unit – Sample Requirements

Warning. The maximum pressures and temperatures specified must not be exceeded. Where pressure-reducing equipment is used, install a pressure relief valve between this and the sample inlet to the monitor.

4.8 Sensor Unit – External Pipe Connections

Ensure the sample temperature and pressure are suitable for measurement – see Section 11, page 28. If necessary, use sample cooling and pressure-reducing equipment.

If particulate matter is present, such as oxides of iron, an in-line filter is essential – see Section 9, page 21.

4.8.1 Inlet Pipe

Connect sample to the sensor unit using suitable de-scaled stainless steel tube, 6.3 mm (0.25 in.) OD. Connect this tube to the sample inlet coupling on the right-hand side of the panel via the grommet in the base of the case.

The inlet tubing must have sufficient wall thickness to withstand the highest sample pressure and the pipe lengths must be kept short. Bend the inlet pipe to a right-angle outside the case to allow removal of the liquid handling panel when required.

An isolator valve (not supplied) is necessary in the sample inlet line to the sensor unit.

4.8.2 Drain Pipe

The drain from the split tundish at the bottom of the sensor unit case consists of two stub pipe connections suitable for 10 mm (0.4 in.) bore plastic or rubber tubing. Clean water waste can be taken from one connection (and NaOH dosed waste from the other connection can be used for pH checking) grab sample collection or can be directed to a contaminated-water drain.

5 Commissioning

Warning. This equipment uses chemical solutions in its operation. Suitable precautions must be taken to ensure safe handling.

Caution. This equipment will be damaged if subjected to freezing conditions.

5.1 Start-Up

Perform the following procedure:

1. Power-up the transmitter at the external source.
2. Assemble the sensor as described in Section 9.4.5, page 25.
3. Check that the solution flows through the sensor – see Section 5.3, page 13.
4. Fill standard solution and reagent solution containers with appropriate solutions – see Section 9.1, page 21.
5. Ensure the outlet valve on the reagent solution container is closed and remove the reagent tube from the membrane clamp, situated on the top of the reagent dosing chamber.
6. Hold the reagent tube over the tundish and open the reagent container valve. Allow the reagent to flow through the tube to displace any air bubbles.
7. Close the reagent container valve and reconnect the tube to the membrane clamp.
8. Open the reagent container valve and establish flow through the new disc by clamping the sample inlet tube and applying suction from a plastic syringe to the reagent dosing chamber outlet – see Fig. 4.6, page 11.
9. Replace the outlet tube and remove the clamp.
10. Allow approximately one hour for caustic dosage to be established (the pH of the effluent at the sensor outlet must be at least 10.5).
11. Program the transmitter as described in Section 6, page 16.
12. Enter the concentration of the standard solution in the *Calibrate* menu.
13. Alarms and analog outputs are configured in the *Input/Output* menu.
14. Calibrate as detailed in Section 7, page 19.
15. The transmitter is now in operation.

Note. If, during normal operation, the transmitter does not display the expected hydrazine level, refer to Section 8, page 20 for fault-finding information.

5.2 Sensor Unit

The sensor unit is shown in Fig. 4.6, page 11. It consists of a metal case of similar construction to the transmitter case, with the pipework carrying the sample mounted on a panel bolted to the back with 4 x M6 captive bolts.

Sample enters through a grommet in the bottom of the case and travels to a constant head unit via the sample inlet coupling. From there it flows to a solenoid operated changeover valve that, when energized during the calibration sequence (see Section 4, page 8) replaces the sample with a standard solution. From the valve, the sample flows through the reagent dosing chamber containing a porous disc (through which reagent is added to raise the pH of the sample to 10.5) and then on to the mixing coil before passing to the hydrazine sensor.

The hydrazine sensor and its overflow funnel are mounted on a sub-panel whose height relative to the standard solution can be adjusted to provide the correct rate of flow through the sensor. In addition, when the sensor is supplied with sample from the constant head unit, the flow can be adjusted by raising or lowering the overflow tube in the head unit. These flows are preset in the factory but can be adjusted if necessary – see Section 5.3, page 13.

Overflows from the constant head unit and the sensor drain to a tundish in the bottom of the case. Normal operation flow paths are shown in Fig. 5.1, page 15 and, for the calibration sequence, in Fig. 5.2, page 15.

5.3 Setting Flowrates

The flowrates of standard solution and sample through the sensor are preset at the factory. To check and, if necessary, reset these flow rates, proceed to the following sections.

5.3.1 Standard Solution Flowrate

Set this flowrate first:

1. Close the sensor unit sample isolator valve.
2. Fill the standard solution container with standard solution or high purity water. Open the outlet valve at the container.
3. Start a calibration to energize the solenoid valve and to allow the flow of standard solution; this starts a 15 minute calibration sequence at the transmitter. Use a 50 ml (1.7 fl. oz.) syringe to draw solution from the sensor drain tube until any air bubbles are removed. Top-up the container as necessary.
4. Wait ten minutes to allow the temperature to stabilize.

> **Caution.** Do NOT rotate the sensor with the top of the unit.

5. Rotate the sensor, using the main body of the sensor, to allow access for a 50 ml (1.7 fl. oz.) measuring cylinder under the drain tube outlet.
6. Allow the liquid to drip freely into the 50 ml (1.7 fl. oz.) measuring cylinder. It must not run down the side of the cylinder. If the flow rate is not within 0.2 ml min^{-1} of the value in Table 5.1, adjust by loosening the 2 liquid handling panel securing screws and move the panel up or down (using the thumb wheel) to decrease or increase the flow respectively. Left to right adjustment increases flow. Tighten the screws when the correct flow rate has been achieved.

> **Note.** If the flow rate check is not achieved within the calibration time, restart a calibration. A failed calibration may be displayed but can be ignored at this early setting up stage.

7. Allow all the high purity water to drain from the standard solution container.

5.3.2 Sample Flowrate

> **Warning.** The sample is dosed with sodium hydroxide and the concentration, although low at first, increases if any spillage is left to evaporate. Take care to dispose of the outflow safely.

1. Open the sample isolator valve to the sensor unit. Normal operation flow paths are shown in Fig. 5.1, page 15 and, for the calibration sequence in Fig. 5.2, page 15.
2. The flow rate of sample (from the constant head unit) through the sensor can now be checked. Ensure that sample is flowing through the sensor, i.e. CAL is not displayed and the solenoid valve is de-energized. Read the temperature of the sample and refer to Table 5.1. Wait ten minutes for the temperature to stabilize. Measure the flow rate with a measuring cylinder as described in Section 5.3.1. If the flow rate is not within 0.2 ml min^{-1} of the value given in the table, adjust by rotating the overflow tube in the constant head unit. Anti-clockwise adjustment increases flow.
3. Relocate the drain tubes in the drain tundish.

Sample Temp. ° C	Sample Flow (ml/min)	Sample Temp. ° C	Sample Flow (ml/min)
5	14.0	32	21.7
6	14.3	33	21.9
7	14.7	34	22.1
8	15.0	35	22.3
9	15.4	36	22.5
10	15.7	37	22.7
11	16.0	38	22.9
12	16.3	39	23.1
13	16.6	40	23.3
14	16.9	41	23.5
15	17.2	42	23.7
16	17.5	43	23.9
17	17.8	44	24.1
18	18.1	45	24.3
19	18.4	46	24.4
20	18.7	47	24.6
21	19.0	48	24.8
22	19.2	49	24.9
23	19.5	50	25.1
24	19.7	51	25.2
25	20.0	52	25.4
26	20.3	53	25.5
27	20.5	54	25.7
28	20.8	55	25.8
29	21.0	54	25.7
30	21.2	55	25.8
31	21.5		

Table 5.1 Relationship of Sample Temperature to Flow

5.3.3 Sample Temperature

The temperature of the sample water is monitored continuously using a Pt1000 resistance thermometer housed in the sensor flowcell. Hydrazine measurement is compensated automatically for variations in sample temperature and flow within the set range – see Table 5.1, page 14.

If the temperature of the sample rises above 55 °C (131 °F), the display reads 'hot' and the current outputs remains at the last known values; returning to normal measurement when the temperature falls below 55 °C (131 °F).

If the sample temperature falls below 5 °C (41 °F), hydrazine concentration is still displayed but a fixed automatic temperature compensation appropriate to 5 °C (41 °F) is applied.

The temperature is required to determine the necessary sample flow from Table 5.1, page 14 when setting-up the monitor.

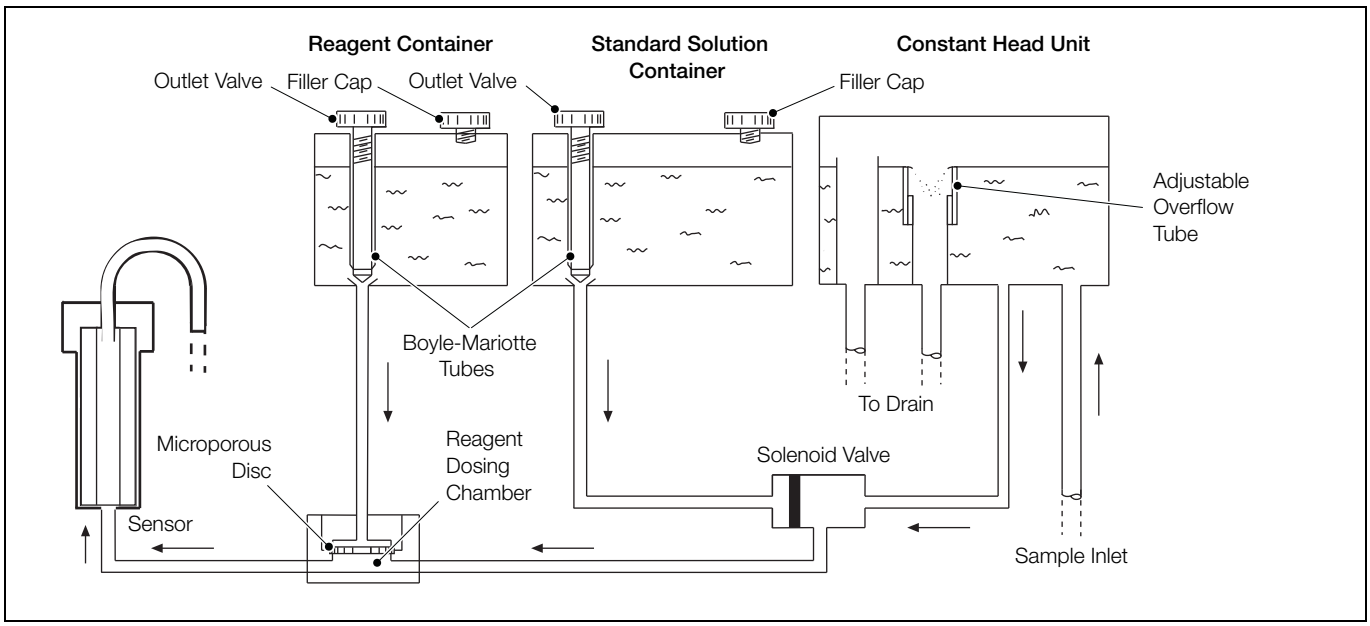


Fig. 5.1 Sample System During Normal Operation – Flow Diagram

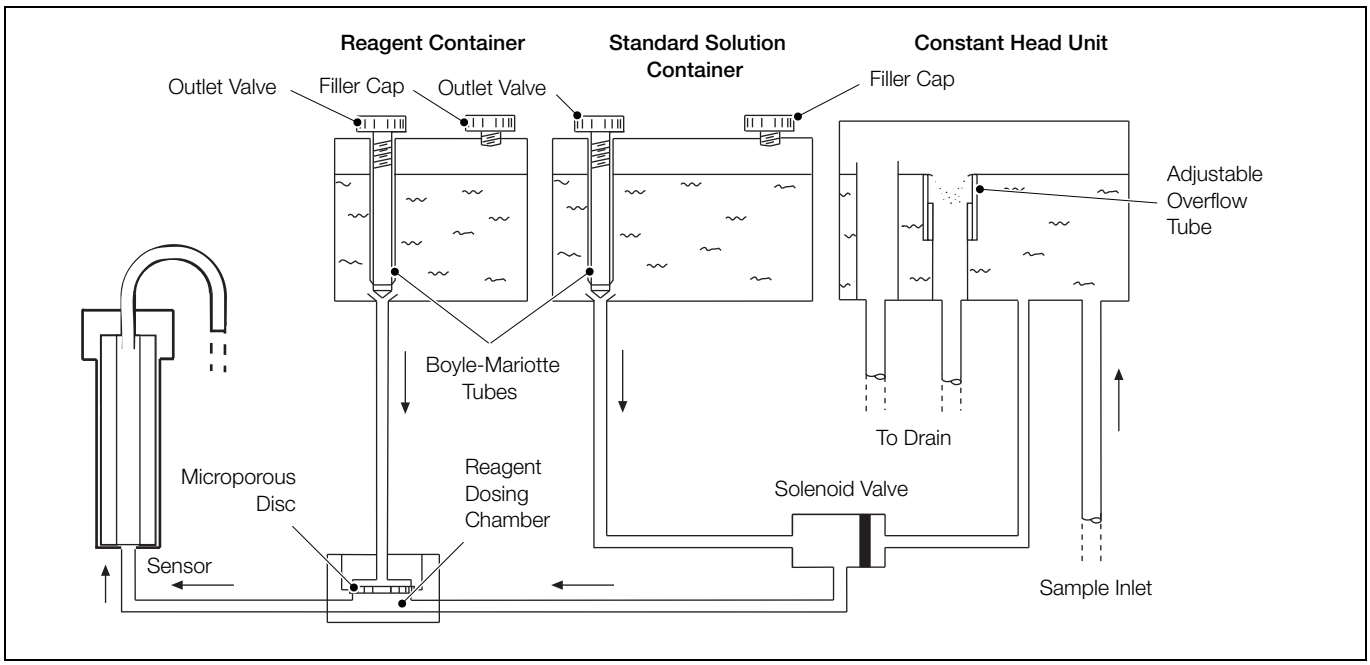


Fig. 5.2 Sample System During Calibration Phase – Flow Diagram

6 Programming

6.1 Operator Page and Keys

The Operator page, icons and front panel keys are shown in Fig. 6.1:

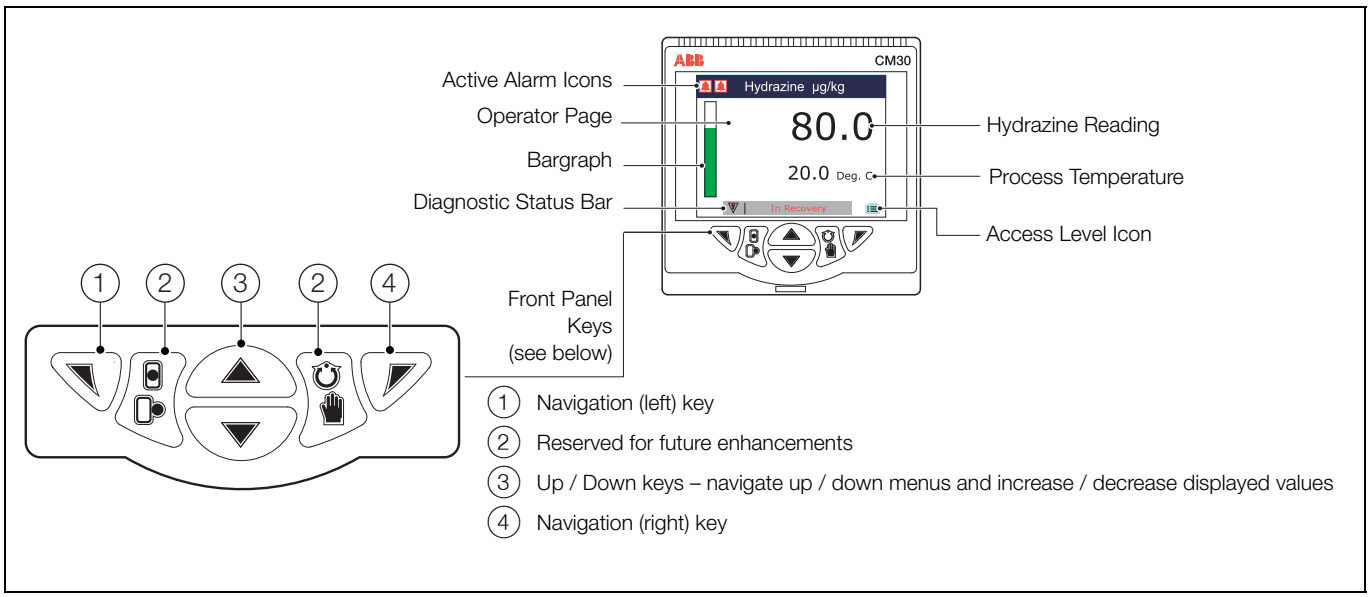


Fig. 6.1 Operator Page and Keys

6.2 Access Level and Entering Passwords

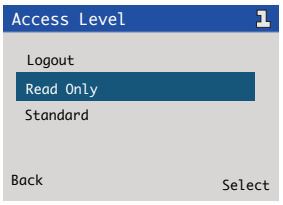
Passwords can be set to enable secure end-user access to the Standard level. Passwords are set, changed or restored to their default settings at the *Device Setup/Security Setup* parameter – see page 17.

Note. When the monitor is powered-up for the first time the Standard level can be accessed without password protection. Protected access to this level must be allocated on-site as required.

To enter the Access Level:

1. From the *Operator page (see Fig. 6.1)*, press ◸.

   The *Access Level* is displayed:



Menu	Access
Logout	Displayed after the *Standard* level has been accessed. Logs the user out of *Standard level*. If passwords are set, a password must be entered to access *Standard level* again after selecting *Logout*.
Read Only	Enables most parameter settings to be viewed as read-only fields.
Standard	Enables access to the Standard *level* and adjustment of all enabled parameters for system setup, configuration and control.

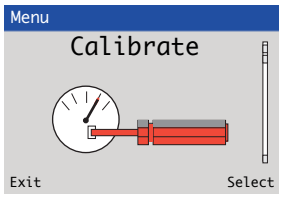
2. Use the ▲/▼ keys to scroll to and highlight the required level.
3. Press ◸ to select the level highlighted.

   If no password has been set, the *Calibration* menu is shown – see Section 6.3.1, page 17.

   If a password has been set, the *Enter Password* menu is shown and a password must be entered to access further menus – see *Device Setup* / *Security Setup* (page 17) for details of how to setup passwords.
4. To return to the *Operator* page from *Access Level*, press ◹.

6.3 Menus

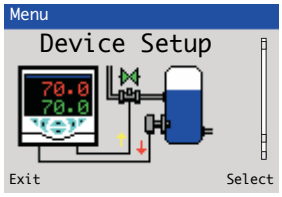
6.3.1 Calibrate



Enables the sensor to be calibrated and the standard solution value to be set.

Sensor Calibration	Calibrates the sensor against the *calibration standard* value. Press ▷ to start the calibration routine. If the routine is stopped (by pressing ◁) after the calibration has started, a recovery routine is started and a diagnostic message is displayed on the Operator page diagnostic status bar – see Section 8.2, page 20
Standard Solution	Sets the *Standard Solution* value (displayed as µg kg^{-1}) – min. 0.0, max. 1000.0.
Restore Defaults	Restores system calibration parameters to their default (factory-set) values.

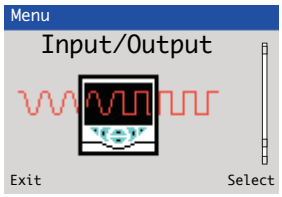
6.3.2 Device Setup



Provides access to standard setup parameters to determine the type of control/indication required. Also provides the ability to create non-standard configurations for special application requirements.

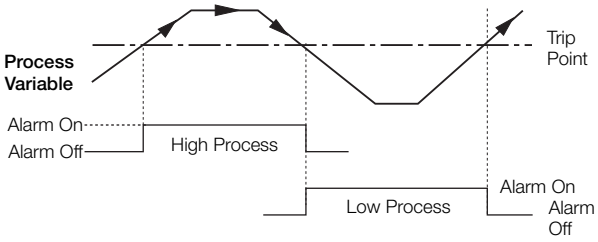
Range	Sets the system operating range (the range alarm outputs correspond to the analog output range).
Automatic	In automatic mode, the analog outputs switch between high and low ranges automatically.
Low Range	The analog output is fixed at 0 to 100 µg kg^{-1} and the *Low Range* alarm is activated at this value.
High Range	The analog output is fixed at 0 to 1000 µg kg^{-1} and the *High Range* alarm is activated at this value.
Security Setup	Used to set password access to the *Standard* level and reset the password. Each password can have up to 6 alphanumeric characters. **Note**. A password is not set at the factory and must be entered by the end user.
Standard Password	*Sets the password to access Standard Level* menus. To create a password: 1. From the *Device Setup* main menu, press ▷ and, at the *Device Setup* parameter screen, use the △/▽ keys to highlight the *Security Setup* parameter. 2. Press ▷ to display the *Security Setup* page and use the △/▽ keys to highlight the *Standard Password* parameter. 3. Press ▷ twice to display the *Standard Password* page. 4. Use the △/▽ keys to highlight the first alphanumeric password character and press ◁ to accept the character. 5. Repeat step 4 for the remaining characters. 6. When the last character has been highlighted, press ▷ to set the password for *Standard level* access.
Reset Password	Resets the password to factory values.

6.3.3 Input/Output



Configures analog outputs and relays.

Analog Output 1(2)	The analog outputs can be set to retransmit an analog value with a configurable range from 0 to 20 mA.
Range	Sets the output range as one of: 0 to 10 mA, 0 to 20 mA or 4 to 20 mA.
Test	Performs a self-test against the selected mA range.
Alarm Relay 1(2)	
Alarm Type	
Off	Switches the alarm off.
High Process	Alarm activated on high process signal.
Low Process	Alarm activated on low process signal.
Alarm Trip	Sets a value at which the alarm is tripped.
Alarm Polarity	Sets the relay condition when an alarm is activated
Failsafe	The relay is de-energized (normally closed) when an alarm is activated.
Non-Failsafe	The relay is energized (normally open) when an alarm is activated.



6.3.4 Device Info

Displays read-only factory-set parameters for the transmitter and sensor.

Transmitter	
Serial Number	The transmitter's serial number.
Date of Manufacture	The transmitter's date of manufacturer.
Hardware Revision	The transmitter's hardware revision.
Software Revision	The transmitter's software revision.
Sensor	
Sensor Type	The sensor type.
Serial Number	The sensor's date of manufacturer.
Date of Manufacture	The sensor's date of manufacturer.
Hardware Revision	The sensor's hardware revision.
Software Revision	The sensor's software revision.

7 Calibration

7.1 Calibrating the System – General Tasks

Depending on the operating conditions, perform a calibration every 1 to 4 weeks.

Rinse out the standard solution container with a small amount of fresh standard solution before filling and open the outlet valve from the container.

7.2 Sensor Calibration

Note. During the calibration and recovery period the alarm functions and analog outputs are maintained at their existing value(s) prior to calibration.

To perform a sensor calibration:

1. At the transmitter, enter the *Standard* access level and, at the *Calibrate* menu, press ◩. A list of calibration parameters is displayed:

   ```
   Calibrate
      Sensor Calibration
      Standard Solution
      Restore Defaults
   ```

2. Use the ◠/◡ keys press to highlight the *Sensor Calibration* option and press ◩.

   The *Sensor Calibration* page is displayed.

3. Press ◩ to start the calibration.

   A bar indicates the calibration progress and the message *Settling-Please Wait* is displayed beneath the time bar. (Sensor calibration typically lasts 15 minutes.) The hydrazine value and process temperature are also displayed.

4. When calibration is complete, the hydrazine value (as µg kg) efficiency and calibration coefficient ratings are displayed, for example:

   ```
   Hyd            80.0 µg/kg
   Efficiency     100.0%
   Coefficient    0.1917
   ```

5. Press ◹ to exit the *Sensor Calibration* option and return to the *Calibrate* page.

6. To return to the *Operator* page, press ◹ or, to set the *Standard Solution* value, press ◩ and proceed to step 3 in Section 7.3.

7.3 Setting the Standard Solution Value

To set the *Standard Solution* value:

1. At the transmitter, enter the *Standard* access level and, at the *Calibrate* menu, press ◩. A list of calibration parameters is displayed:

   ```
   Calibrate
      Sensor Calibration
      Standard Solution
      Restore Defaults
   ```

2. Use the ◠/◡ keys press to highlight the *Standard Solution* option and press ◩.

   The *Calibrate* page is displayed.

3. Press ◩ to edit the *Standard Solution* value and press the ◹ key to move to each number in the value.

   Use the ◠/◡ keys to increase/decrease each number.

4. When value is set, press ◩ to return to the *Calibrate* page.

5. Press ◹ twice to return to the *Calibrate* main menu.

7.4 Restoring Calibration Defaults

To restore calibration coefficients to their factory-set defaults:

1. At the transmitter, enter the *Standard* access level and, at the *Calibrate* menu, press ◩. A list of calibration parameters is displayed:

   ```
   Calibrate
      Sensor Calibration
      Standard Solution
      Restore Defaults
   ```

2. Use the ◠/◡ keys press to highlight the *Restore Defaults* option and press ◩.

   The *Calibrate* page is displayed with a blank *Restore Defaults* progress bar.

3. Press ◹ to start the *Restore Defaults* routine.

   The progress bar indicates completion status and, when the routine is complete, the bar reverts to empty.

4. Press ◹ twice to return to the *Calibrate* main menu.

8 Troubleshooting

8.1 Diagnostics Classification Codes

Diagnostic messages and icons conforming to the NAMUR NE107 classification code are used to define information during operation – a typical diagnostic message is shown in Fig. 8.1.

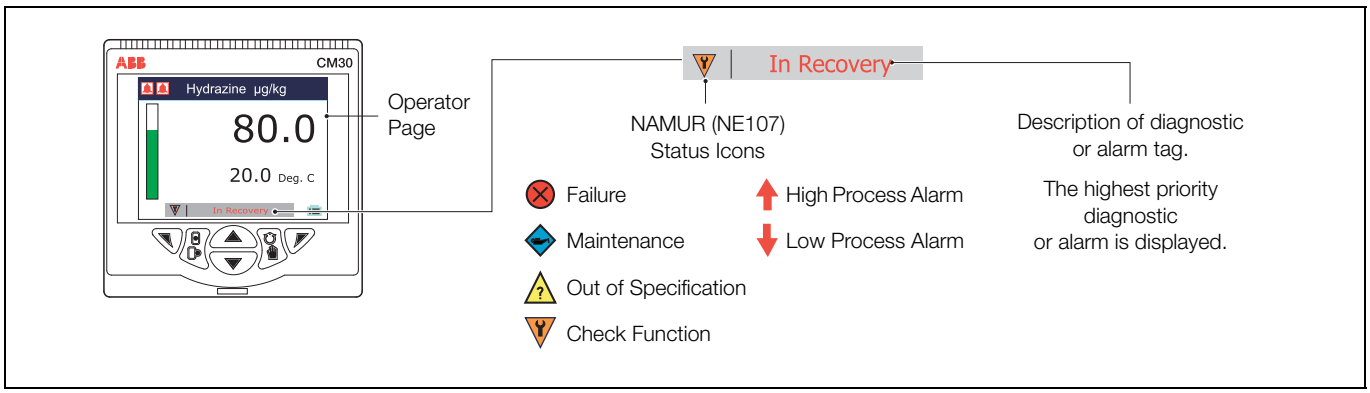


Fig. 8.1 Diagnostic Status Bar

8.2 Diagnostics Messages

Icon	Message	Possible Cause	Suggested Action
	Comms Failed	Power supply unit has failed or cable between transmitter and sensor unit is damaged.	Check wiring between transmitter and sensor unit. Check voltage across red and black wires is approximately 24 V. If problem not resolved contact local service organization.
	Pt1000 Failed	Pt1000 has failed or the cable from sensor terminal box to temperature sensor is broken.	Check wiring inside sensor unit. If problem not resolved contact local service organization.
	ADC Failed	Temporary or permanent failure of analog to digital converter on the sensor terminal board.	Cycle power to device. If problem persists replace sensor terminal board/contact local service organization.
	Invalid Setting	Switch in sensor terminal box is set incorrectly.	Ensure switch adjacent to the terminals in the sensor terminal box is in the up position.
	In Recovery	After a calibration has been completed the alarms and analog outputs are held for the duration of the recovery period to allow the sample to stabilize to the normal measurement.	Message disappears automatically once the recovery period has expired. Alarms and analog outputs become active.
	Last Cal. Failed	Calibration has failed.	Sensor needs replacing.
	Temperature Hot	The temperature of the sample water has exceeded 55 °C (131 °F).	Hydrazine concentration is held automatically at the last known value. Normal measurements are resumed when the temperature falls below 55 °C (131 °F).
	Temperature Cold	The temperature of the sample water has fallen below 5 °C (41 °F).	Hydrazine concentration is still displayed but a fixed temperature compensation appropriate to 5 °C (41 °F) is applied.
	Cal. Near Fail	Sensor approaching the end of its life and is likely to fail soon.	Sensor (or system) requires attention soon.

Table 8.1 Diagnostic Messages

9 Maintenance

9.1 Chemical Solutions

Warning. Sodium Hydroxide is extremely caustic and must be handled with great care. Wear gloves and eye protection.

The following reagents and standard solutions are required to maintain the monitor in operation. Solutions must be stored in plastic bottles and, where possible, should be freshly made.

9.1.1 Reagent Solution – 5m (20% W/V) Sodium Hydroxide

The solution used to fill the reagent container is made up as shown below; consumption is approximately 250 ml in 2 to 4 weeks.

1. Weigh out 2.5 (±0.1) g EDTA and transfer to a 500 ml (16.9 fl oz) measuring flask (a little high purity water can be used to help this transfer).
2. In a separate vessel, weigh out 100 (±1) g sodium hydroxide, NaOH, pellets (analytical reagent grade) and dissolve in approximately 300 ml (10.0 fl oz) high purity water in a plastic container. Allow this solution to cool.
3. Transfer this solution to the measuring flask, shake well to dissolve the EDTA and top up to the mark with more high purity water.

9.1.2 Standard Solution

Warning. Hydrazine Sulphate is an irritant to skin and eyes. Avoid breathing the dust. Wear gloves, eye protection and a dust mask when handling this substance.

Chose a convenient level for the hydrazine concentration of the standard solution – typically 30 or 80 µg kg^{-1}. Other concentrations can be used if required.

Note. Hydrazine solutions deteriorate with time: replace the stock solution at monthly intervals. Dilute standard solutions must be freshly prepared.

Prepare a stock solution of 1000 mg l^{-1} hydrazine as follows:

1. Weigh out 4.058 (±0.001) g analytical reagent grade hydrazine sulphate (N_2H^4,H_2SO_4) and dissolve in approximately 800 ml (27.0 fl oz) high purity water.
2. Transfer to a 1 l (33.81 fl oz) volumetric flask and top up to the mark with more high purity water.
3. Dilute the stock solution to provide the required standard solution for the particular measuring range (usually 30 or 80 µg kg^{-1}).

9.2 Scheduled Servicing

The procedure outlined is a guide to the maintenance requirements of the monitor. The actual servicing schedule depends on the particular installation and sample conditions.

9.2.1 Weekly

1. Check level of reagent container. When level is near the bottom of the container remove the container from panel, empty contents, rinse with high purity water and refill with reagent. Clean up any spillages and do not top-up container.

   Warning. It is imperative that all leaks of potentially aggressive chemical solutions receive attention as soon as possible and all spillages are cleaned up.

2. Perform a calibration as described in Section 4.

9.2.2 Six-Monthly

1. Replace tubing if stained or age hardened – see Section 9.2.3, page 22.
2. Replace the porous disc as follows:
   a. Close the sample isolator valve to the monitor.

      Warning. The reagent is extremely caustic and must be handled with great care. Wear gloves and eye protection.

   b. Close the outlet valve on the reagent solution container and remove the reagent tube from the membrane clamp, located on the top of the reagent dosing chamber – see Fig. 4.6, page 11.
   c. Remove the two sample tubes from the chamber, unscrew the bracket and remove the chamber from the panel.
   d. Locate the lugs of the tool provided in the recesses in the membrane clamp on top of the reagent dosing chamber and unscrew the membrane clamp. Retain the 'O'-ring located in the recess of the clamp.
3. Remove the old disc with the end of a screwdriver and dispose of it safely. Rinse the chamber and fit a new 'O' ring (part number 0211 068) and disc. Fit the membrane clamp and 'O' ring (part number 0211 120) and tighten the clamp.
4. Fit the chamber to the panel and connect the sample inlet tube.
5. Hold the reagent tube over the tundish and open the reagent outlet valve to allow the reagent to flow through the tube to displace any air bubbles.
6. Close the reagent outlet valve and connect the reagent tube to the top of the reagent dosing chamber.
7. Open the reagent outlet valve.

8. Block the chamber sample inlet and establish flow through the new disc by applying suction from a plastic syringe to the reagent dosing chamber outlet – see Fig. 4.6, page 11.
9. Connect the sample inlet tube to the chamber (side).
10. Allow approximately 1 hour for caustic dosage to be established (the pH of the effluent at the sensor outlet must be at least 10.5).
11. Calibrate as described in Section 7, page 19.

9.2.3 Yearly

Sensor unit retubing (Fig. 9.1)

Replace all the tubing in the sensor unit using the internal retubing kit – see Section 10, page 27. At the same time, empty both the standard solution and reagent containers and replace the 3 O-rings on each; 2 on the valve and 1 on the filler cap.

Remove and replace all tubes as detailed in the following procedure.

Warning. This unit contains caustic and other solutions which must be handled with care. Wear gloves and eye protection.

Caution. Retubing must be performed using only the above kit. Modifications to the tubing could affect critical flow paths within the monitor.

Clean up any chemical spillages immediately when performing this procedure.

1. Close the sample isolator valve and allow the sensor unit liquid handling system to drain.
2. Place absorbent tissue at the bottom of the case to soak up any spillages.
3. Close the outlet valve on the reagent container.
4. Note the arrangement in the support bracket, remove the sensor overflow drain tube and constant head unit feed tube and two drain tubes.
5. Cut 0212 156 (460 mm [18.11 in]) in half and fit to constant head unit drain stubs. Feed tubing down through support bracket.
6. Fit 7835 229 (first of 2) to constant head unit outlet and solenoid valve.
7. Fit 0212 154 to sensor overflow drain stub and feed through support bracket.

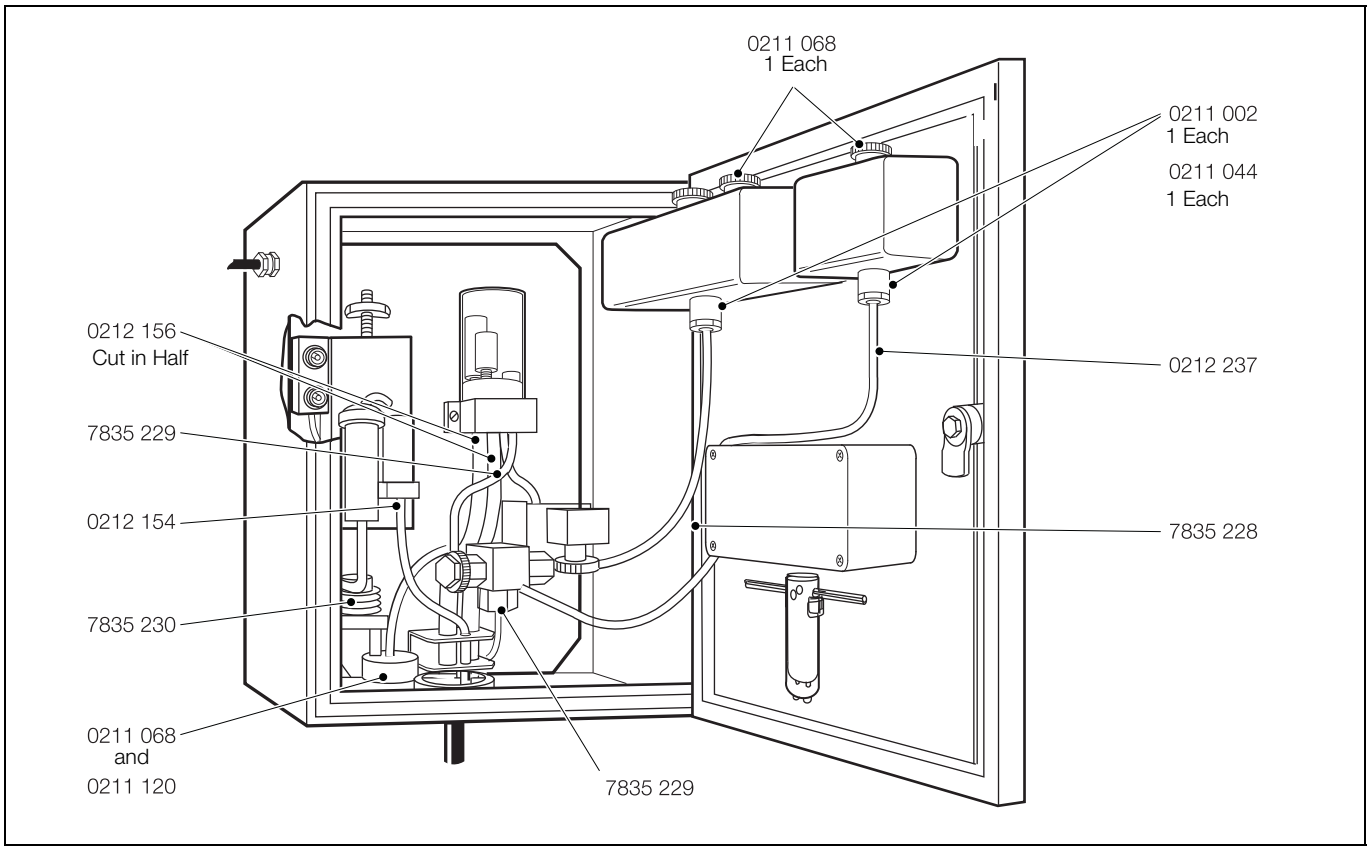


Fig. 9.1 Location of Flexible Tubing Items and 'O'-Rings in Sensor Unit

8. Cut all three drain tubes to a length of approx. 50 mm (2 in.) below the bracket to leave angled ends.
9. Remove the mixing coil from the base of the sensor and from the reagent dosing chamber outlet, unwinding it from the coil former. Connect 7835 230 to the reagent dosing chamber outlet and lead it behind the coil former. Wind on closely and, without twisting, 4 complete turns and locate the tube in the coil former slot. Connect to the sensor base.
10. Remove the tube between the reagent dosing chamber and the solenoid valve and replace with 7835 229 (second of 2).
11. Remove the tube between the standard solution container and the solenoid valve. Replace with 7835 228 but leave container end unconnected.
12. Disconnect the reagent solution tube from the reagent dosing chamber and hold over the tundish. Disconnect the tube at the container end and allow to drain. Replace with 0212 237, but leave container end unconnected.
13. Remove the 2 solution containers, drain and rinse.
14. Open the outlet valve of the standard solution container and remove the stem completely. Remove the outlet union with a 20 mm A/F spanner.
15. Use a smooth blunt needle to remove external and internal O-rings from the union and external O-ring from the stem.
16. Replace with 0211 044, 0211 002 and 0211 068, respectively (supplied in the retubing kit). Replace the union and then the stem.
17. Fit the tube from the solenoid valve.
18. Fit the container onto the pillars. Tighten the screws.
19. Repeat the above for the reagent solution container; loop the tube from the filter behind the standard solution tube and over the electrical connection box.
20. Refurbish the sensor as required. Follow the procedure in Section 9.4.5, page 25.
21. Follow the procedures in Section 5.1, page 13, from step 3 onwards.

9.3 Shut-down Procedures

9.3.1 Sensor Unit

If the monitor is to be shut down for longer than 1 week, perform the following procedure:

1. Turn the sensor plugs, located on the side of the liquid handling panel, a half turn anti-clockwise and disconnect them by pulling them from the sockets.

   Warning. The gel in the hydrazine sensor contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

2. Carefully pull the hydrazine sensor out of its mounting clips on the sub-panel.
3. Holding the sensor over the drain tundish, pull off the sample inlet tube and let the sensor drain. Leave the end of the inlet tube dipping into the tundish.
4. Carefully dismantle the sensor and wash the components thoroughly in high purity water to remove all traces of gel. Dry and reassemble.
5. Replace the sensor in its mounting clips.

   Warning. The reagent is extremely caustic and must be handled with great care. Wear gloves and eye protection.

6. Close the outlet valve on the reagent container, carefully pull the tube off the reagent dosing chamber and remove the reagent container. Either empty the contents into a storage container or discard, rinse out the container and replace in the sensor unit.
7. Clean the porous disc by attaching a piece of tubing to the reagent dosing chamber outlet (see Fig. 4.6, page 11) and place the other end in a beaker of high purity water. Close the reagent dosing chamber sample inlet. Attach a large syringe (for example 50 ml) to the reagent inlet and draw the water through the disc. Repeat this several times.
8. Reassemble the panel, clean up any spillage and then close the door.

9.3.2 Transmitter Unit

Isolate the electrical supply to the unit.

9.4 Unscheduled Servicing

9.4.1 Monitor Malfunction

Diagnostic messages on the display are used to indicate abnormal monitor operation – see Section 8, page 20.

Any unpredictable problems may be due to the standard- or reagent-solutions; check flowrate of these solutions. If any doubts exist regarding the integrity of these solutions, replace with freshly-prepared solutions in the early stages of the fault-finding investigations. The accuracy of the monitor is governed by the condition of all the solutions involved that may be made incorrectly, or contaminated.

Check mechanical components involved with the liquid handling regularly for leaks or blockages, as they change the chemical conditions around the electrode. The majority of problems are associated with the chemistry and the liquid handling section.

9.4.2 Calibration Fail Alarm

Calibration problems, normally shown as a *Last Cal. Failed* diagnostic message and alarm, indicate that the output of the sensor is less than 25 % efficient and 80 µg kg^{-1}. standard solution. The monitor calculates the corresponding minimum outputs for other solution values. The problem is likely to be resolved through one or more of the following checks:

1. Check that the red and blue sensor plugs are inserted fully into the red and blue sockets, respectively.
2. Replace the standard solutions as a fresh solution may solve the problem. Check that the solenoid valve is energized (a loud click is produced when the calibration is initiated) and that the standard solution is flowing through the sensor.
3. Check that the standard solution value entered into the monitor is correct for the solution used.
4. Check the sodium hydroxide solution dosing by measuring the pH of the sample flowing through the sensor; it must be at least 10.5.
5. Check that the two electrodes are clean. The silver cathode can be cleaned only when the sensor is refurbished. The platinum anode can be cleaned when required – see Sections 9.4.3 and 9.4.4, page 25.
6. Check the condition of the gel in the sensor. In normal operation the life is usually 3 to 6 months. The gel should have even color, even consistency and no signs of separation or drying out. If the gel shows signs of being very liquid and leaks out of the sensor, refurbish the sensor – see Section 9.4.5, page 25.
7. The shelf life of the gel before use can vary, but can be up to 1 year providing that the syringe cap is fitted tightly and, as in step 6, the gel must have even color, even consistency and no signs of separation or drying out.
8. Remove any air trapped in the flow paths with a syringe and then check the flow rates of both the standard solution and the sample – see page 14.
9. Check the sample temperature reading on the display against a thermometer reading of the sample.

If there are discrepancies between monitors and independent laboratory results, investigate the points in steps 2, 3, 4 and 8.

Electronic problems are unlikely, but the operation of the electronics can be checked using a current source to simulate the output from the sensor. For details of this procedure, refer to Section 9.4.6, page 26.

9.4.3 Cleaning The Platinum Anode and Sensor Ceramic

1. Switch off sample flow to the monitor.
2. Loosen the rubber bung on the top of the sensor and carefully withdraw the platinum anode from the centre of the ceramic tube.
3. Insert the brush, supplied in the sensor kit, down the bore of the ceramic tube (ensuring it still contains some sample) rotate gently and withdraw.

> **Warning.** Avoid any spillage of acid and take care not to allow any acid to touch the rubber bung.

4. Clean the platinum anode by immersing it in a test tube containing 50 % nitric acid for a few minutes.
5. Rinse the electrode in high purity water and return it to the sensor.

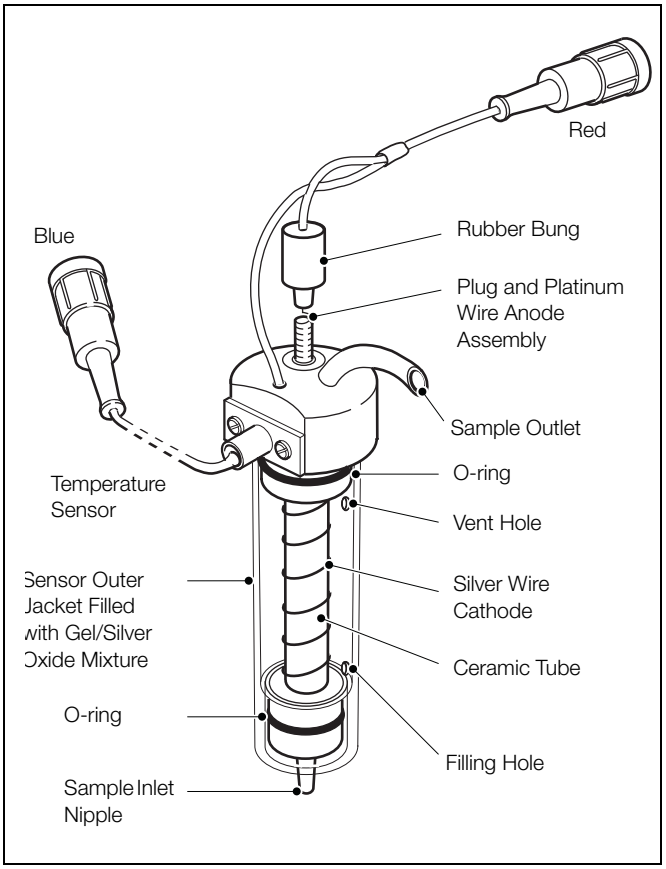


Fig. 9.2 Hydrazine Sensor

9.4.4 Sensor Check

Before checking the sensor, ensure that the fault condition is not due to incorrect sample and calibration flow rates caused by an air bubble in the sensor or flow line. To remove air, lift the platinum electrode slightly by the rubber bung and allow some liquid to escape, carrying any bubbles with it. Alternatively, connect a syringe to the sensor outlet and apply slight suction.

9.4.5 Refurbishing The Sensor

A good indication of whether the sensor needs refurbishing is the state of the gel in the outer jacket. If the gel appears to have dried out, separated or become liquid, the sensor requires refurbishing.

Sensor disassembly

Referring to Fig. 9.2, page 25:

1. Close the sample isolator valve and allow the constant head unit to empty.
2. Turn the sensor plugs, located on the side of the liquid handling panel, half turn anticlockwise and disconnect them by pulling them from the sockets.
3. Carefully pull the hydrazine sensor out of its mounting clips on the sub-panel.

> **Warning.** The gel in the hydrazine sensor contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

4. Holding the sensor over the drain tundish, pull off the sample inlet tube and let the tube and sensor drain. Leave the end of the inlet tube dipping into the tundish.
5. Carefully dismantle the sensor as detailed below and wash the components thoroughly to remove all traces of gel.
6. Clean the ceramic and the platinum anode as shown in Section 9.4.3, page 25.

> **Warning.** Avoid any spillage of acid, and take care to keep all electrical connectors free of acid.

7. If still in place, remove the outer jacket of the sensor.
8. If the silver cathode is tarnished or blackened, dip a cotton wool bud in 50 % nitric acid and clean the wire to restore it to its original matt silver color. Rinse thoroughly with high purity water.
9. Rinse the cotton wool bud and safely dispose of it.
10. Loosen the rubber bung on the top of the sensor and carefully withdraw the platinum anode from the centre of the ceramic tube.

> **Warning.** Clean up any spillage of the caustic solution.

11. Soak the ceramic tube for 1 hour in 2 % sodium hydroxide solution, rinse with high purity water and reassemble the sensor.

Sensor assembly

Referring to Fig. 9.2, page 25:

1. Replace the platinum anode.
2. Holding the white closure cap tightly in place on the filling syringe, snap the syringe plunger into position and remove the white closure cap.
3. Place the blue Luer fitting on the syringe nozzle.

> **Warning.** The gel contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

4. Slowly inject the filling gel through the bottom filling hole in the outer jacket of the sensor until it reaches the top vent hole.
5. Remove the syringe and replace its closure cap.
6. Push the sensor into the clips on the sub-panel – the clips incorporate small protrusions that cover the filling and exit holes in the outer jacket.
7. Connect the tube from the mixing coil to the bottom of the sensor.

> **Note.** Take care to hold the sensor firmly at the top so that the centre portion is not pushed out when the tube is connected

8. Plug the red and blue sensor connectors into their respective colored sockets on the liquid handling panel.

9.4.6 Simple Electronic Check

In the unlikely event that a problem is encountered with the monitor, use a current (µA) source and a resistance box to test the transmitter.

A Sensor Simulator is available to make an overall check on the functioning of the transmitter unit.

The simulator, that connects to the analog board, produces a current output to emulate the hydrazine sensor signal and also provides the necessary resistance to simulate Pt1000 values. Refer to the simulator manual for full details of its use, or connect a current source plus a resistance box to the transmitter.

> **Note.** The monitor calibration signals are established by read-only software and cannot be changed by users.

To perform a simulated calibration proceed as follows:

1. Open the sensor unit door and locate the electrical connection box mounted on the door (see Fig. 4.6, page 11).
2. Open the connection box and disconnect the sensor and thermistor connections as follows:

   31: +ve Sensor (R)

   32: –ve Sensor (B)

   33: Pt1000 (Y)

   35: Pt1000 (Bk)

3. Connect the appropriate wires of the current source and resistance box to TB2 as follows:

   current source +ve: 31:

   current source –ve: 32:

   Resistance box: 33:

   Resistance box: 35:

4. Set the appropriate resistance value corresponding to the thermistor resistance at the nominal sample temperature, for example:

   20 °C = 1077.9 Ω

5. Select the nominal calibration value to 80 µg kg^{-1}.
6. Set the current source to 25 µA.
7. Initiate a calibration sequence by pressing the CAL button.
8. After 15 minutes the display reads the selected concentration value.
9. Check the monitor range with different µA values. The relative values are as follows:

µA	µg kg^{-1}
3.125	9.1
6.250	19.2
12.500	39.5
18.750	59.7
25.000	80.0
31.250	100.3

> **Note.** When the electronic systems are operating correctly, the displayed concentration value should be within ± 0.2 µg kg^{-1} of the selected value.

10 Spares List

10.1 Refurbishment Spares

One year's requirements.

Part No.	Description	Qty
7830 061	Cell recharge kit	4
7835 060	Internal PVC retubing kit	1
7835 284	Microporous disc	2
7835 367	Reagent dosing chamber membrane clamp	2
0211 068	O-ring for above	2
0211 120	O-ring for above	2

10.2 Strategic Spares

(Parts rarely requiring replacement.)

Part No.	Description		Qty
7835 825	4-way interconnecting cable (by length)	2 m (6.5 ft.)	1
7835 826		5 m (16.4 ft.)	1
7835 827		10 m (32.8 ft.)	1
7835 828		25 m (82.0 ft.)	1
7835 829		50 m (164.0 ft.)	1
7835 830		100 m (328.0 ft.)	1
7835 708	Digital controller		1
7835 755	Connection board		1
B12529	Power supply		1
B12899	Fuse, 630 mA quick blow 20 x 5 mm		1
7835 384	Hydrazine sensor		1
0232 062	Solenoid valve		1
7835 210	Constant head assembly		1
7835 355	Standard solution container		1
7835 350	Reagent solution container		1
7835 364	Nipple (reagent solution container outlet)		1
7835 272	Nipple (standard solution container outlet)		1
0211 068	O-ring (reagent dosing chamber)		1
0211 002	O-ring (standard and reagent solution container)		1
0211 044	O-ring (standard and reagent solution container)		1
0211 012	O-ring (standard and reagent solution container)		1
7835 368	Reagent dosing chamber		1
7835 375	Thermistor & sensor connector mounting bracket assembly		1
7835 226	Sensor electrical lead assembly		1
0216 403	External sample input valve		1
7835 430	Microporous disc replacement tool		1
0216 404	Sample filter, 1/4 in. fittings, 60 microns		1
9435 040	Remote range recorder resistor kit		1
9439 950	Sensor simulator		1

11 Specification

General

Range:
- 0 to 100.0, 0 to 1000.0 µg kg^{-1} with automatic range change

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

Sample flow:
- 25 to 500 ml min^{-1} (0.8 to 17 fl oz min^{-1})

Sample pressure:
- 15 millibar (0.217 psi) minimum

Ambient temperature:
- 0 to 55 °C (32 to 131 °F)

Accuracy:
- 5 % of reading or 2 µg kg^{-1} whichever is the greater for hydrazine concentrations up to 500 µg kg^{-1}
- Better than 10 % of reading above 500 µg kg^{-1}

Response time:
- 90 % of a step change in less than 3 minutes

Stability:
- 5 % of reading or 2 kg^{-1} per week, whichever is the greater

Outputs:
- 2 isolated current outputs in the range 0 to 10, 0 to 20 or 4 to 20 mA
- 750 Ω maximum impedance

External alarms:
- 2 normal or fail-safe, high and low concentration alarms
- Calibration Mode indication
- Calibration Fail indication
- All volt-free, 250 V, 2 A non-inductive

Calibration:
- Manual initiation of automatic calibration sequence
- Every 1 to 4 weeks depending on operating conditions

Environmental data

Transmitter and sensor

Ambient temperature:
- 0 to 55 °C (32 to 131 °F)

Storage temperature:
- –20 to 70°C (–4 to 158 °F)

Operating humidity:
- Up to 95% RH, non-condensing

Sunlight:
- Store and operate out of direct sunlight

Installation information

Mounting

Sensor and transmitter:
- 4 holes: 8.5 mm (0.33 in.) diameter
  230 mm (9.05 in.) horizontal
  330 mm (13.0 in.) vertical

Weight

Sensor:
- 11 kg (24 lb)

Transmitter:
- 11 kg (24 lb)

Dimensions

Sensor unit:
- 300 wide x 400 high x 200 mm deep (11.8 wide x 15.7 high x 7.9 in. deep)

Transmitter:
- 300 wide x 300 high x 200 mm deep (11.8 wide x 11.8 high x 7.9 in. deep)

Maximum distance between sensor and transmitter:
- 100 m (328 ft.)

Connections to sensor unit

Sample inlet:
- 6.3 mm (1/4 in.) OD compression fitting

Sample waste:
- 10 mm (0.39 in.) flexible – atmospheric drain

Sample line material:
- Stainless Steel

Ingress protection

Transmitter:
- IP55

Electrical

Electrical cable

Via gland cable:

- size:
  5 to 9 mm (0.2 to 0.35 in.)

Maximum core size:

- mains:
  32 ±0.2 mm (1.26 ±0.008 in.)
- signal:
  24 ±0.2 mm (0.94 ±0.008 in.)

Electrical connection

Via 6 glands fitted to gland plate

Power supply requirements

85 to 265 V AC, 50/60 Hz, 50 VA

Remote range indication

2 volt-free contacts rated 250 V AC, 2 A non-inductive

EMC

Emissions

Conforms to EN61326–1 : 2006

Design and manufacturing standards

CE mark

Electrical safety

BS–EN 61010 – 1 : 2001

DS/7835-EN Rev. K

Notes

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 Analyzers
- Zirconia Oxygen Analyzers, 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.

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IM/7835–EN Rev. Q 10.2012

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