User Guide IM/AV4ORG Rev. D

AV410, AV411, AV412, AV420 and AV422
Single and dual input dissolved organics 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

Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

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

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

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.

Health and Safety

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

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. 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 hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

Analyzer Model Number	Description of Analyzer	Sensor A	Sensor B
AV410	Single Input Low Range	7320 100	–
AV411	Dual Input Low Range	7320 100	7320 100
AV412	Dual Input Low and High Range	7320 100	7320 200
AV420	Single Input High Range	7320 200	–
AV422	Dual Input High Range	7320 200	7320 200

Table 1.1 AV400 Series Dissolved Organics Monitor Options

1 INTRODUCTION

1.1 Introduction

Warning. The sensor emitter module contains a high intensity xenon strobe lamp that emits ultraviolet (UV) radiation. ***This must NOT be viewed with the naked eye and must NEVER be operated while outside the sensor***. Under normal operating conditions, it is not possible to see the light source but, if the sensor is dismantled with electrical power applied, it may be possible to expose the eyes to the strobe flash.

Many dissolved organic compounds (DOC) found commonly in potable water absorb ultraviolet radiation. These include Humic Acids, that gives water a characteristic yellow color, and dissolved organics, that result in the formation of Trihalomethanes (THMs).

The monitor is designed for use as a surrogate color monitor, coagulation monitor/controller and to monitor for THM precursors in potable water treatment plants.

1.2 Principle of Operation

The broad-spectrum, high intensity xenon strobe lamp, housed in the emitter module, generates pulses of light that pass through the sample water in the flowcell to a filtering and detection system, contained in the receiver module. The received light pulses are analyzed at two wavelengths; the measurement wavelength of 254 nm and the reference wavelength of 405 nm (at which the sample constituents of interest do not absorb). This dual light path system provides information that enables the measured value to be corrected for any turbidity due to suspended matter in the sample. The monitor is calibrated with a pure solution of a suitable organic compound of known carbon content.

An automatic, microprocessor-controlled, dual-wiper system, housed in the cleaner module, cleans the flowcell optical windows periodically to ensure that the sensor remains functional. Samples containing large solids and/or very high concentrations of solids must be pre-filtered.

1.3 AV400 Series Systems – Fig. 1.1

Note. An AV400 System is supplied factory-configured as a matched system with each component bearing the same serial number. If any part of a system is replaced (transmitter or sensor[s]), ***a complete factory re-calibration must be carried out*** – see Section 7.

- The **AV410** and **AV411** low range monitors are primarily for use in potable water applications, such as monitoring the effectiveness of the coagulation control, THM precursor detection and final treated water quality.

  Range: **0 to 20mgl^{-1} C** maximum.

- The **AV420** and **AV422** high range coagulation monitors are designed for use in potable water treatment plants to predict the coagulant dose to be applied to the raw water and to detect the rise in DOC from algal bloom toxins.

  Range: **0 to 100mgl^{-1} C** maximum.

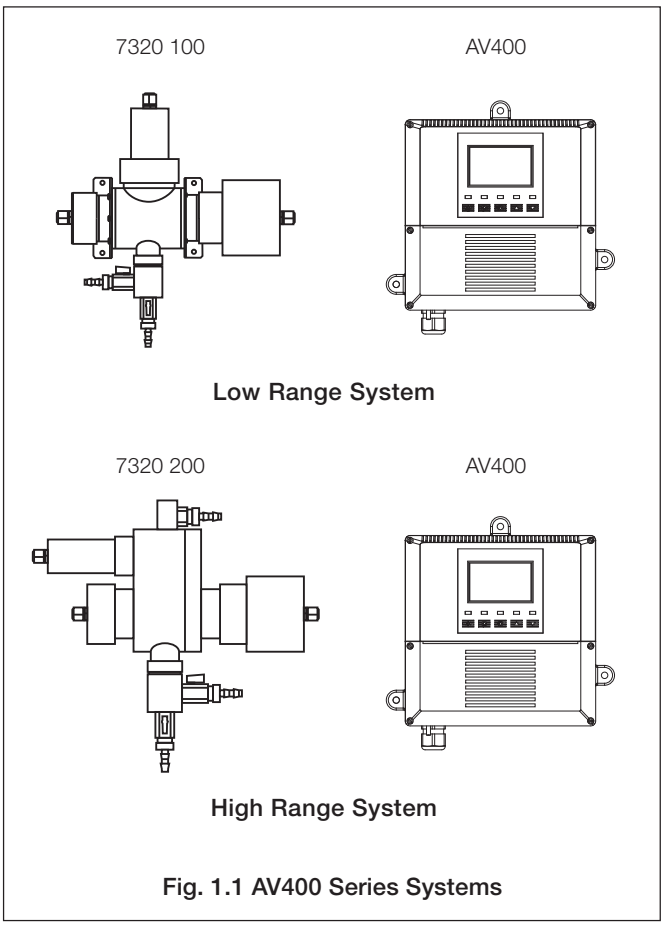


Fig. 1.1 AV400 Series Systems

2 OPERATION

2.1 Powering Up the Monitor

Warning. Ensure all connections are made correctly, especially to the earth studs – see Section 6.5.

1) Ensure the input sensor(s) is (are) connected correctly.
2) Switch on the power supply to the transmitter. A start-up screen is displayed while internal checks are performed; then the *Operating Page* (Section 2.3) is displayed as the dissolved organics measuring operation starts.

2.2 Displays and Controls – Fig. 2.1

The upper and center display lines each comprise a 4½ digit, 7-segment digital display that shows the actual value of the measured parameter and alarm set points, followed by a 6-character dot matrix display showing the associated units. The lower line is a 16-character dot matrix display showing operating and programming information.

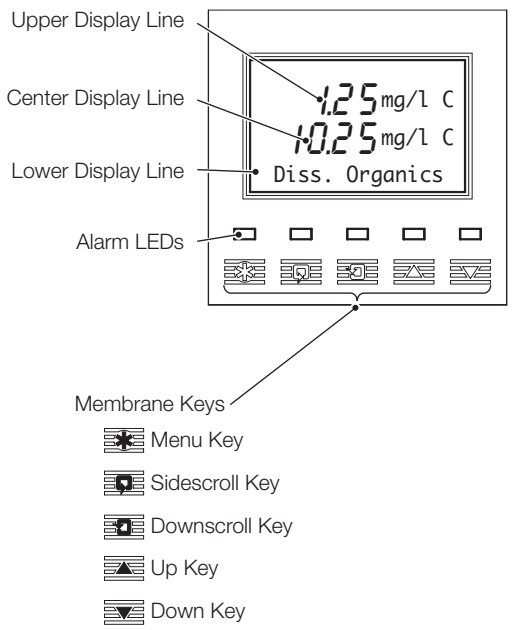
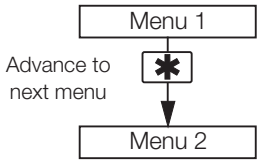
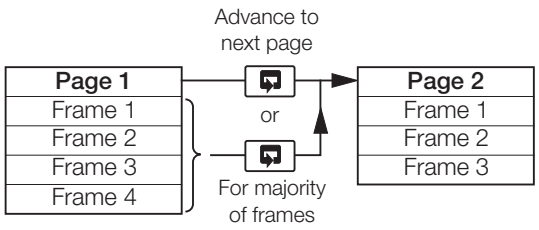


Fig. 2.1 Location of Controls and Displays

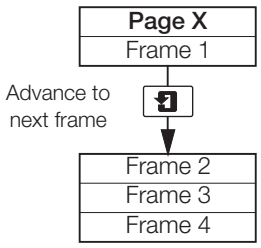
2.2.1 Membrane Key Functions – Fig. 2.2



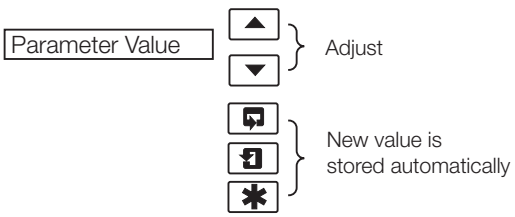
A – Moving Between Menus



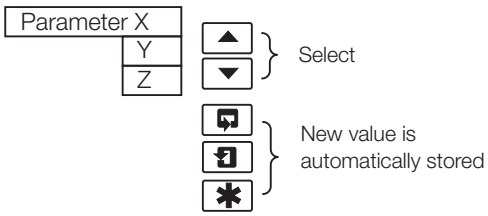
B – Advancing to Next Page



C – Moving Between Frames



D – Adjusting and Storing a Parameter Value



E – Selecting and Storing a Parameter Choice

Fig. 2.2 Membrane Key Functions

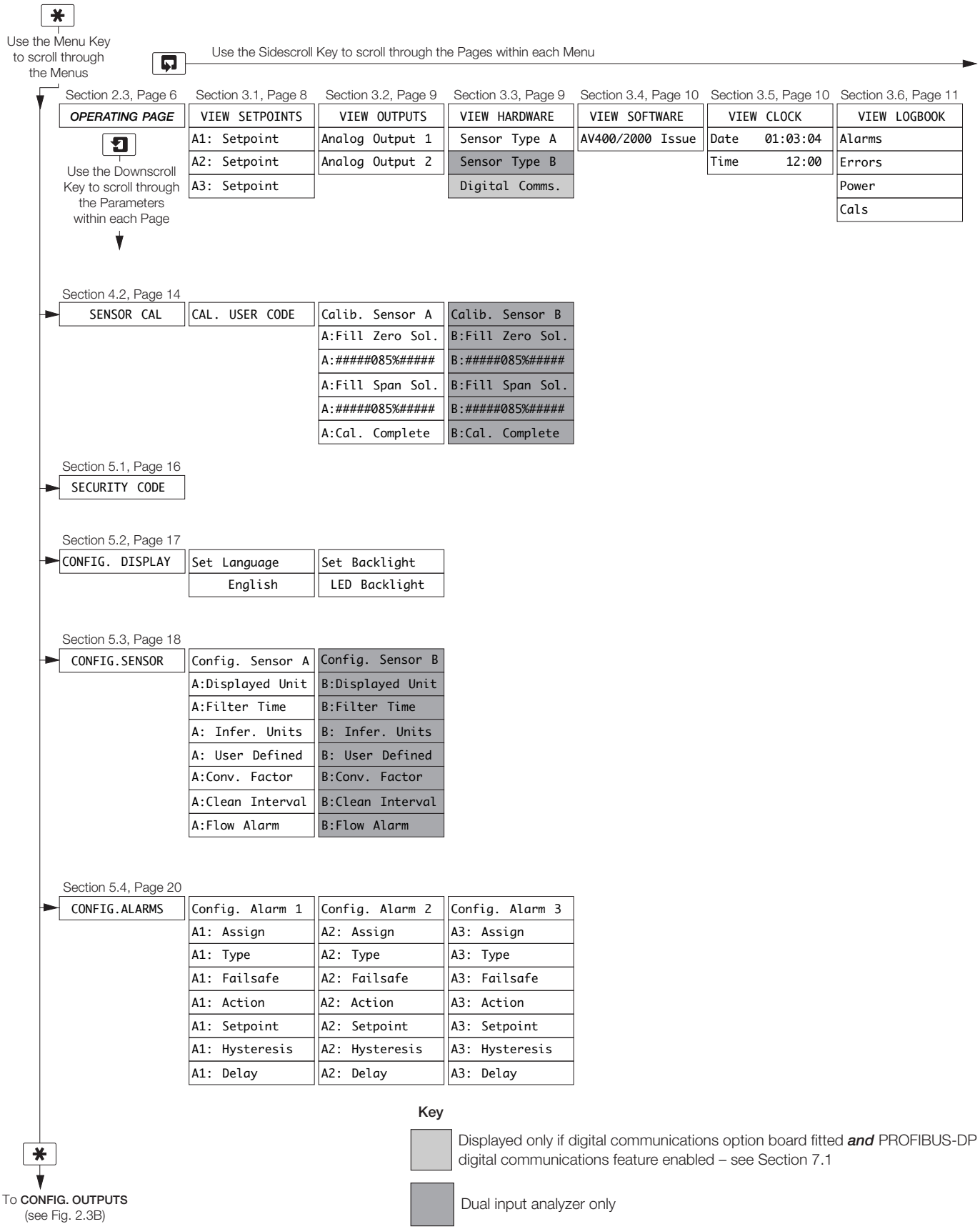


Fig. 2.3A Overall Programming Chart

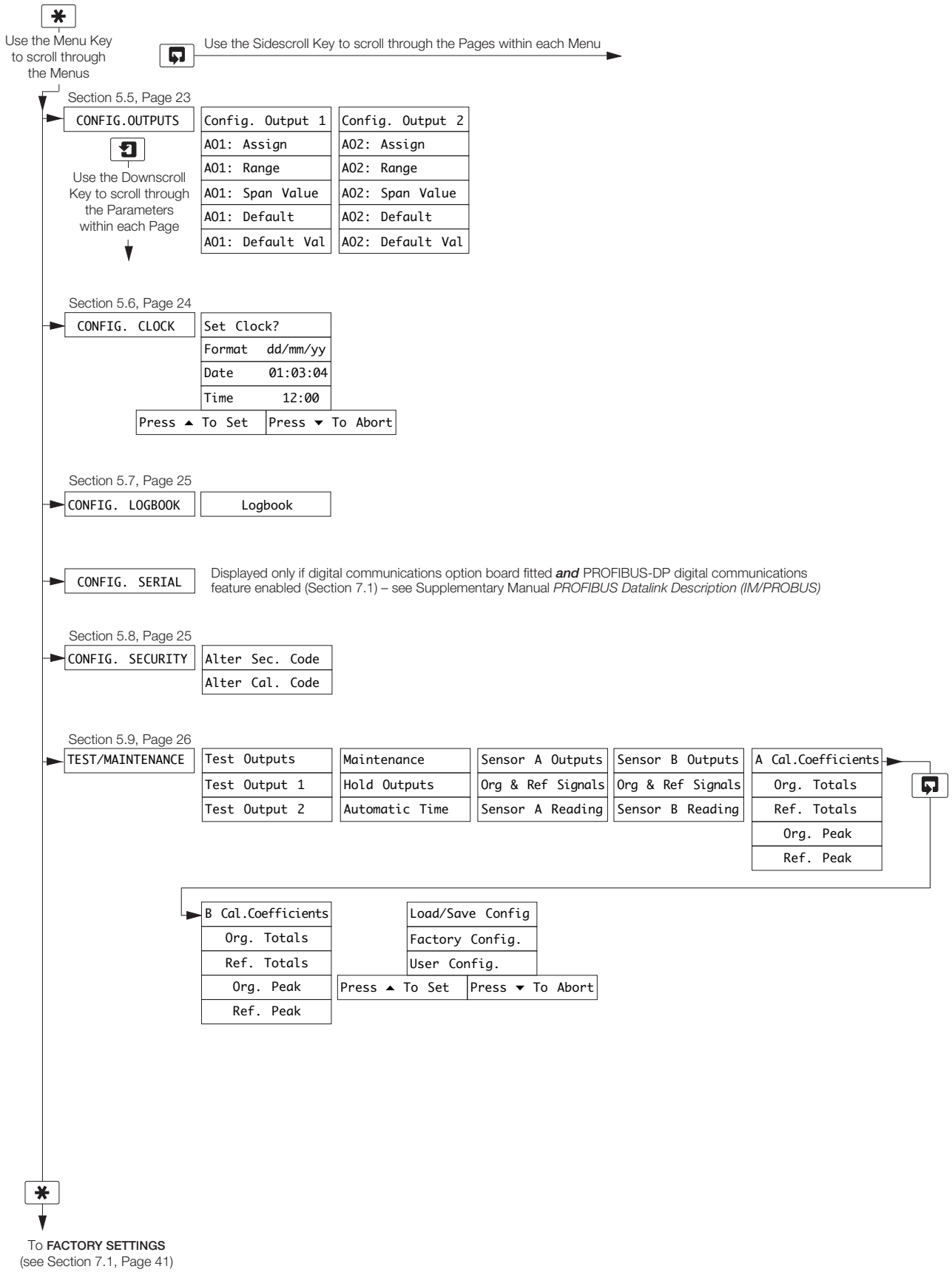
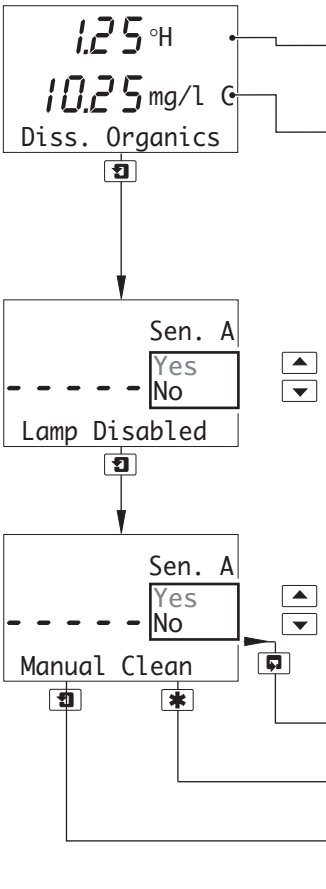


Fig. 2.3B Overall Programming Chart

2.3 Operating Page

2.3.1 Single Input Dissolved Organics



Measured Values
Reading in inferred units, e.g. **Colour (°H)**. For units available, refer to **Inferred Units** in Section 5.3.

Concentration of dissolved organics in mgl^{-1}.

Note. If **Lamp Disabled** (see below) is set to **Yes**, `Lamp Disabled` is shown in the lower display line and no values are displayed.

Disabling the Lamp

Warning. Disable the lamp before performing any maintenance on the sensor – see also **Warning** on page 2.

If **Yes** is selected, `Lamp Disabled` is shown in the lower display line.

Manual Cleaning
Select **Yes** to initiate the sensor cleaning system.

VIEW SETPOINTS See Section 3.1.

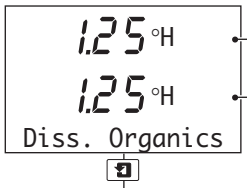
SENSOR CAL See Section 4.2.

WASH FUNCTION A3: Type set to **Wash** (Section 5.4.) – See Section 2.3.3.

Diss. Organics A3: Type not set to **Wash** (Section 5.4.) – Return to the top of the page.

...2.3 Operating Page

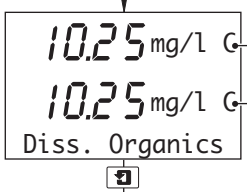
2.3.2 Dual Input Dissolved Organics



Measured Values in Inferred Units
Sensor A reading in inferred units, e.g. **Colour (°H)**. For units available, refer to **Inferred Units** in Section 5.3.

Sensor B reading in inferred units.

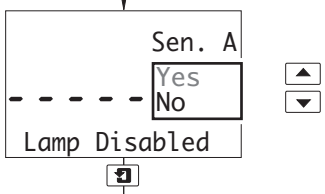
Note. If **Lamp Disabled** (see below) is set to **Yes**, `Lamp Disabled` is shown in the lower display line and no values are displayed.



Equivalent Values in mgl^{-1}
Sensor A.

Sensor B.

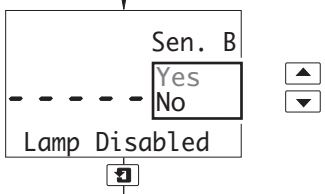
Note. If **Lamp Disabled** (see below) is set to **Yes**, `Lamp Disabled` is shown in the lower display line and no values are displayed.



Disabling the Lamp – Sensor A

Warning. Disable the lamp before performing any maintenance on the sensor – see also **Warning** on page 2.

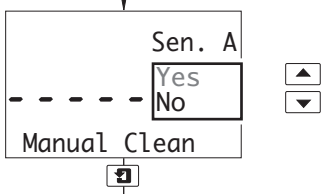
If **Yes** is selected, `Lamp Disabled` is shown in the lower display line.



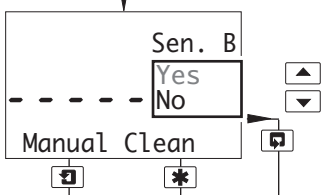
Disabling the Lamp – Sensor B

Warning. Disable the lamp before performing any maintenance on the sensor – see also **Warning** on page 2.

If **Yes** is selected, `Lamp Disabled` is shown in the lower display line.



Manual Cleaning – Sensor A
Select **Yes** to initiate the Sensor A cleaning system.



Manual Cleaning – Sensor B
Select **Yes** to initiate the Sensor B cleaning system.

VIEW SETPOINTS — See Section 3.1.

SENSOR CAL — See Section 4.2.

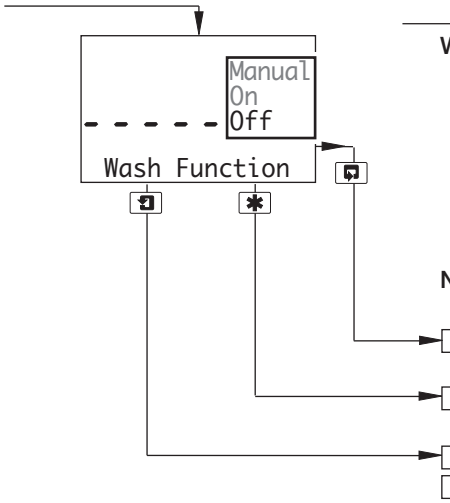
WASH FUNCTION — A3: Type set to **Wash** (Section 5.4.) – See Section 2.3.3.

Diss. Organics — A3: Type not set to **Wash** (Section 5.4.) – Return to the top of the page.

…2.3 Operating Page

2.3.3 Wash Function

Note. The Wash function is available only if **A3: Type** is set to **Wash** – see Section 5.5.



Wash Function

`Off` – Wash function off. Lower display line of *Operating Page* shows `WASH INHIBITED`.

`On` – Wash function controlled automatically. Lower display line of *Operating Page* shows `WASH IN PROGRESS`.

`Manual` – Enables wash function to be initiated manually – see below.

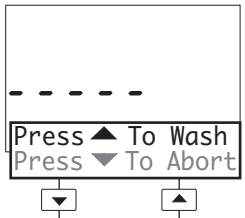
Note. Set **Wash Function** to **Off** before removing the sensor from the process.

VIEW SETPOINTS – See Section 3.1.

SENSOR CAL. – See Section 4.1.

Press To Wash – **Wash Function** set to **Manual** – see below.

Diss. Organics – **Wash Function** not set to **Manual**. The display returns to the top of the Operating Page.



Press to Wash (Manual Wash only)

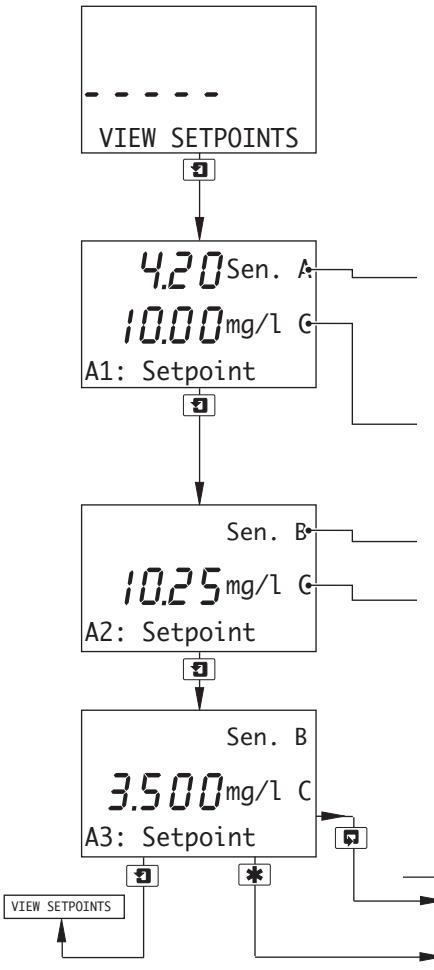
Press ▲ to Wash and **Press ▼ to Abort** are shown alternately on the lower display line.

WASH IN PROGRESS – Press the [▲] key to initiate the wash cycle. The display returns to the top of the *Operating Page* and the lower display line shows `WASH IN PROGRESS` until the wash cycle is completed. The **Wash Function** selection reverts to the one that was set before **Manual** was selected.

Diss. Organics – Press the [▼] key to abort the wash cycle. The display returns to the top of the *Operating Page*.

3 OPERATOR VIEWS

3.1 View Set Points



View Set Points
This page shows alarm set points. The value of each of the set points is shown, together with the name of the parameter it's assigned to.

Alarm assignments, set point values and relay/LED actions are programmable – see Section 5.4. Those shown in the following frames are examples only.

Alarm 1 Set Point
Alarm set point in inferred units, e.g. **Colour (°H)**. For units available, refer to **Inferred Units** in Section 5.3. The units displayed alternate between the inferred units selected (see Section 5.3) and the alarm assignment indication (**Sen. A** [or **Sen. B** – dual input monitors only]) – see Section 5.4.

Alarm set point in units selected for display – see **Displayed Units** in Section 5.3.

Alarm 2 Set Point
Alarm set point assignment – see Section 5.4.

Alarm set point in units selected for display – see **Displayed Units** in Section 5.3.

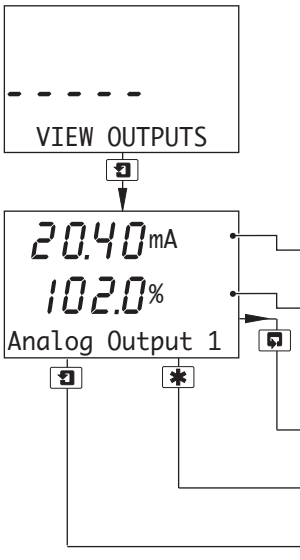
Note. **Inferred Units** for Sensor B (dual input monitors only) set to **None** –see Section 5.3.

Alarm 3 Set Point

VIEW OUTPUTS See Section 3.2.

SENSOR CAL See Section 4.2.

3.2 View Outputs



Theoretical Analog Output
There are two analog outputs that are assigned automatically depending on monitor configuration. On a single input monitor, both are assigned to Sensor A. On a dual input monitor, Output 1 is assigned to Sensor A and Output 2 is assigned to Sensor B.

Live current output value being retransmitted.

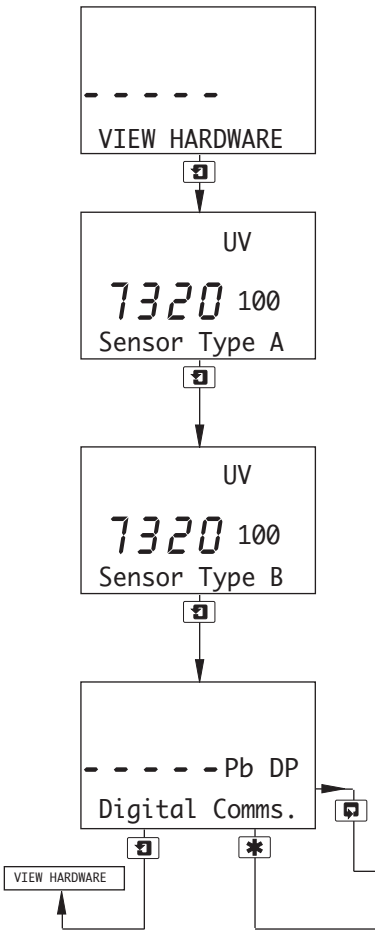
Current output shown as a percentage of full scale for the output range set in **CONFIG. OUTPUTS** – see Section 5.5.

VIEW HARDWARE – See Section 3.3.

SENSOR CAL – See Section 4.2.

Analog Output 2 – Advance to analog output 2.

3.3 View Hardware



Sensor Type A
Displays the sensor type selected for the Sensor A input in the **Factory Settings** page – see Section 7.1.

7320 **100** – Low Range (0 to 20mgl^{-1} C)
7320 **200** – High Range (0 to 100mgl^{-1} C)

Sensor Type B – Dual input monitors only
Displays the sensor type selected for the Sensor B input in the **Factory Settings** page – see Section 7.1.

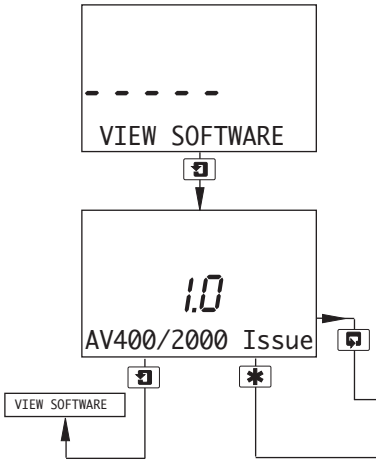
Digital Communications Option Board
Note. Displayed only if the digital communications option board is fitted.

Displays the communications type enabled in the **Factory Settings** page – see Section 7.1.

VIEW SOFTWARE – See Section 3.4.

SENSOR CAL – See Section 4.2.

3.4 View Software

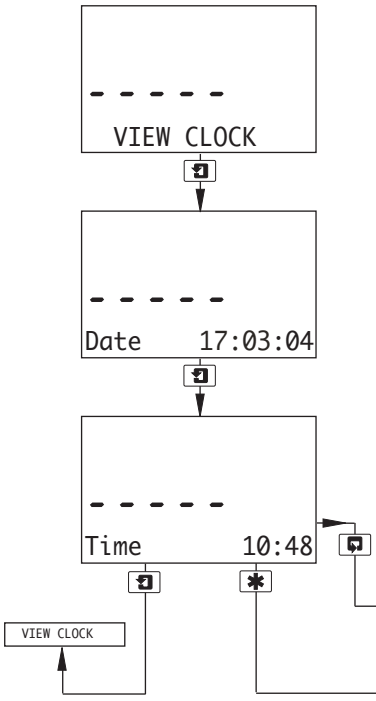


Issue
Shows the version number of the software.

VIEW CLOCK See Section 3.5.

SENSOR CAL See Section 4.2.

3.5 View Clock



Date
Shows the current date.

Time
Shows the current time.

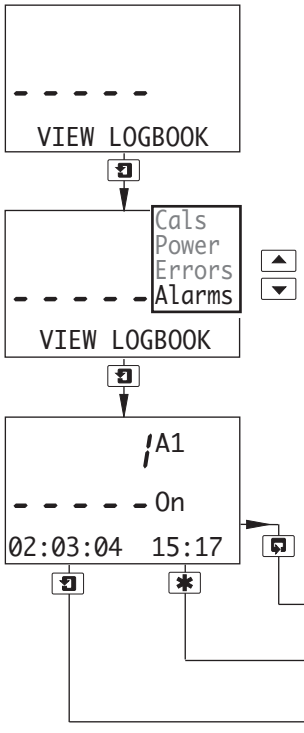
VIEW LOGBOOK **Logbook** set to **On** (Section 5.7) – see Section 3.6.

Diss. Organics **Logbook** set to **Off** (Section 5.7) – see Section 2.3.

SENSOR CAL See Section 4.2.

3.6 View Logbook

Note. The View Logbook function is available only if **Logbook** is set to **On** – see Section 5.7.



The logbook stores data entries for alarm events, sensor errors, power failures and sensor calibrations.

View Logbook
Use the ▲ and ▼ keys to access the **Alarms** logbook.

Note. If no entries are stored in the **Alarms** logbook, the display shows `No More Entries`.

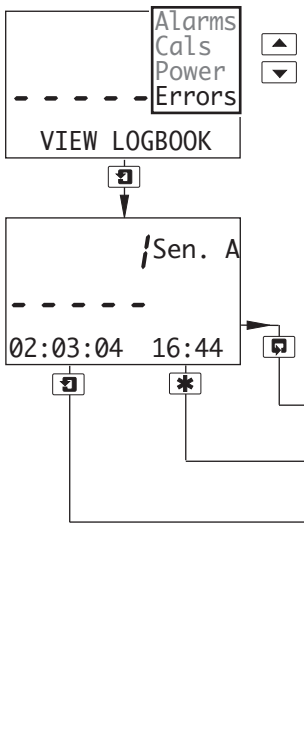
Alarms
The **Alarms** logbook contains up to 10 entries (entry 1 is the most recent), each comprising an alarm number, alarm state (On or Off), and the date/time of the occurrence.

Diss. Organics — *Operating Page* – see Section 2.3.

SENSOR CAL — See Section 4.2.

2 A1 — Advance to entries 2 to 10.

Note. If no more entries are stored, the display shows `No More Entries`.



View Logbook
Use the ▲ and ▼ keys to access the **Errors** logbook.

Note. If no entries are stored in the **Errors** logbook, the display shows `No More Entries`.

Errors
The **Errors** logbook contains up to 5 entries (entry 1 is the most recent), each comprising the sensor letter, error number, and the date/time of the occurrence.

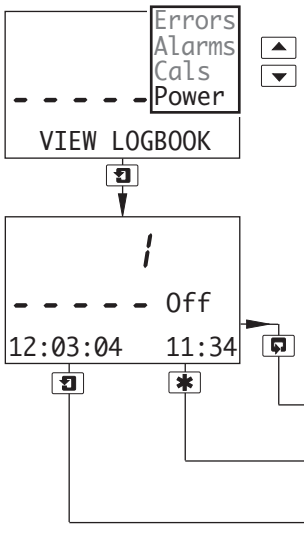
Diss. Organics — *Operating Page* – see Section 2.3.

SENSOR CAL — See Section 4.2.

2 Sen. A — Advance to entries 2 to 5.

Note. If no more entries are stored, the display shows `No More Entries`.

...3.6 View Logbook



View Logbook
Use the ▲ and ▼ keys to access the **Power** logbook.

Note. If no entries are stored in the **Power** logbook, the display shows `No More Entries`.

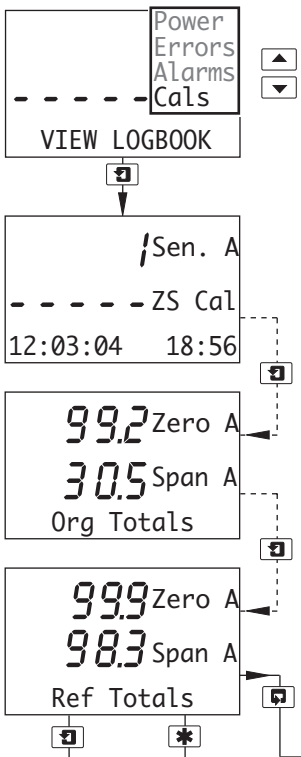
Power
The **Power** logbook contains up to 2 entries (entry 1 is the most recent), each comprising the power state (On or Off), and the date/time of the occurrence.

Diss. Organics — *Operating Page* – see Section 2.3.

SENSOR CAL — See Section 4.2.

2 — Advance to entry 2.

Note. If no more entries are stored, the display shows `No More Entries`.



View Logbook
Use the ▲ and ▼ keys to access the **Cals** logbook.

Note. If no entries are stored in the **Cals** logbook, the display shows `No More Entries`.

Calibration
The **Cals** logbook contains up to 5 entries (entry 1 is the most recent), each comprising 3 frames. Frame 1 contains the entry number, sensor letter, calibration type (Z = Zero, S = Span, ZS = Zero and Span) and the date/time of the occurrence.

Frames 2 and 3 contain the raw outputs from the sensor for both the Zero and Span solutions. These values equate to the percentage light transmission through the standard solutions.

Diss. Organics — *Operating Page* – see Section 2.3.

SENSOR CAL — See Section 4.2.

2 Sen.A — Advance to entries 2 to 6 for single input monitors.
2 Sen.A — Advance to entries 2 to 3 for sensor A on dual input monitors.
4 Sen.B — Advance to entries 4 to 6 for sensor B on dual input monitors.

Note. If no more entries are stored, the display shows `No More Entries`.

4 SETUP

4.1 Sensor Calibration Standard Solutions

UV absorption is a non-specific, aggregate measurement of organic carbon concentration therefore true standards are not available. A standard solution, made from potassium hydrogen phthalate, is used for calibration purposes and the monitor produces readings in units of mgl^{-1} of carbon defined against this calibration standard.

Note. Clean the flowcell internally (see Section 8) before calibration to ensure that the standard solutions, particularly the zero standard, are not contaminated with organic material that may be present inside the flowcell.

4.1.1 Zero Standard Solution

High purity water is used for the zero standard solution and must be as fresh as possible. If storage is unavoidable, use a glass container to prevent contamination. Some plastics, for example polythene and polypropylene, may be acceptable, but regardless of material, the container must be meticulously clean and kept solely for the purpose of storing the zero standard solution.

Note. The high purity water used for the zero solution and for diluting the span standard solution must contain less than $50\mu gl^{-1}$ TOC. It is recommended that the water is obtained from purification systems comprising reverse osmosis and de-ionization units but freshly distilled water can also be used. De-ionized water is not recommended as it often contains significant levels of organics.

4.1.2 Span Standard Solution

The span standard solution is prepared from potassium hydrogen phthalate ($KOOC.C_6H_4.COOH$, carbon content = 47.05 %), Analytical Reagent grade and high purity water.

To prepare a $1000mgl^{-1}C$ carbon stock standard solution:

1. Dry 2.125±0.005g of potassium hydrogen phthalate at 120°C for 2 hours.
2. Dissolve the dried potassium hydrogen phthalate in 500ml high purity water.
3. make up to 1 litre in a volumetric flask.

The solution may be stored in a glass bottle in a refrigerator, without freezing, for up to 12 months.

Working standard solutions for system calibration must be freshly prepared from the stock standard when required. Dilute the stock solution with high purity water. Discard the working standard solution after use.

7320 100 Low Range Sensor – $10mgl^{-1}C$:
Dilute 10ml of the stock standard solution to 1 litre high purity water in a volumetric flask.

7320 200 High Range Sensor – $50mgl^{-1}C$:
Dilute 50ml of the stock standard solution to 1 litre high purity water in a volumetric flask.

4.1.3 Calibration Checks

The sensor's emitter module contains an optical system with very stable electronics that eliminate electronic drift, therefore, routine calibration is normally unnecessary. However, it may be necessary to check system accuracy, particularly after cleaning the flowcell.

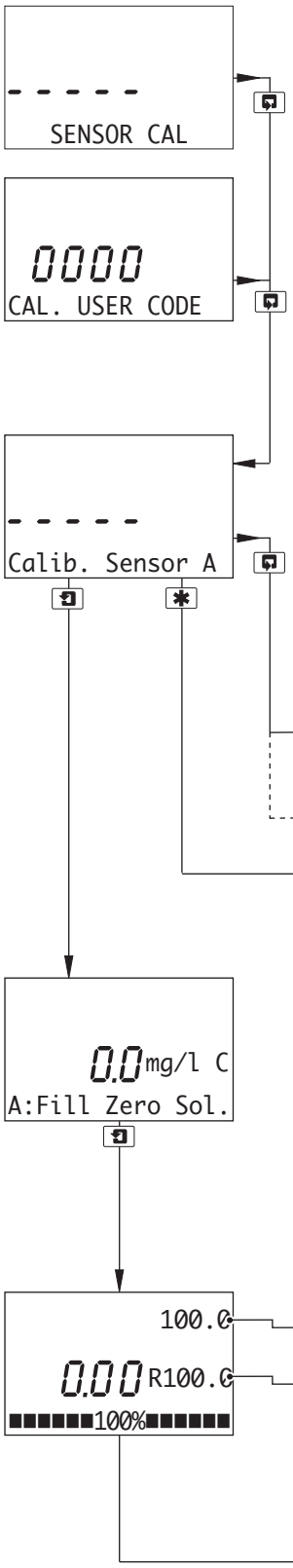
A calibration check is carried out by filling the flowcell with the Zero and Span standard solutions and observing the readings in the *Operating Page* – see Section 2.3.

The solutions are poured in from the top of the flowcell.

7320 100 Low Range Sensor:
Remove the wiper module, fill the flowcell and refit the wiper module.

7320 200 High Range Sensor:
Remove the filler plug on top of the flowcell and use the funnel provided.

4.2 Sensor Calibration



Sensor Calibration

Sensor Calibration Security Code

Note. This frame is displayed only if **Alter Cal. Code** is not set to zero – see Section 5.8.

Enter the required code number (between 0000 and 19999) to gain access to the sensor calibration pages. If an incorrect value is entered, access to the calibration pages is prevented and the display reverts to the **SENSOR CAL.** frame.

Calibrate Sensor A

Note. A full calibration comprises a zero and a span calibration. However, it is possible to carry out zero and span calibrations independently by aborting the one that is not required (press the ↵ key to initiate the calibration and press it again before the calibration is complete). If either calibration is aborted, **A:Cal Incomplete** is shown on the lower display line (see next page). The **Cals** logbook records the calibration type as zero (**Z**), span (**S**) or both (**ZS**) – see Section 3.6, page 12.

`Calib. Sensor B` Sensor B calibration (dual input monitors only) is identical to Sensor A calibration.

`SENSOR CAL` Single input monitors only – return to main menu.

`SECURITY CODE` **Alter Sec. Code** not set to zero (Section 5.8) – see Section 5.1.

`CONFIG. DISPLAY` **Alter Sec. Code** set to zero (Section 5.8) – see Section 5.2.

Zero Calibration

Fill the flowcell with high purity water – see Section 4.1.1.

Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before zero calibration is complete, the display advances automatically to the **A:Fill Span Sol.** frame.

Raw Output from Sensor

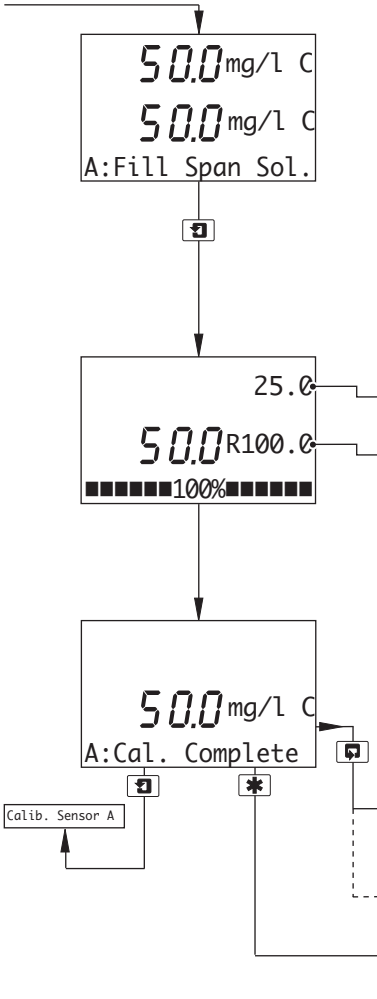
Organics total signal
Reference total signal

} These values equate to the percentage light transmission through the sample.

As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next frame.

`A:Fill Span Sol.` Continued on next page.

…4.2 Sensor Calibration



Span Calibration
Fill the flowcell with the required span standard calibration solution – see Section 4.1.2.

Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before span calibration is complete, **A:Cal Incomplete** is shown on the lower display line (see below).

Raw Output from Sensor
Organics total signal
Reference total signal
} These values equate to the percentage light transmission through the sample.

As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next frame.

Calibration Completed
A message is displayed at the end of calibration:
A:Cal Complete – calibration successful
A:Cal Incomplete – zero and/or span calibration aborted

Calib. Sensor B — Sensor B calibration (dual input monitors only) is identical to Sensor A calibration.

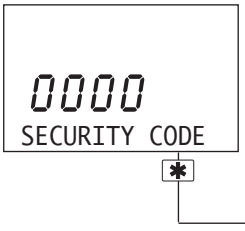
SENSOR CAL — Single input monitors only – return to main menu.

SECURITY CODE — **Alter Sec. Code** not set to zero (Section 5.8) – see Section 5.1.

CONFIG. DISPLAY — **Alter Sec. Code** set to zero (Section 5.8) – see Section 5.2.

5 PROGRAMMING

5.1 Security Code

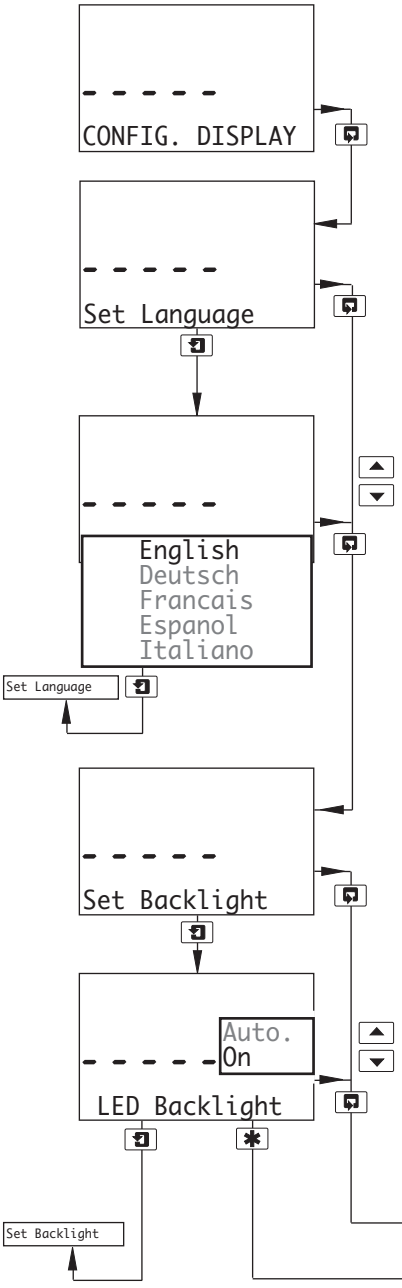


Note. This frame is displayed only if **Alter Sec. Code** is not set to zero – see Section 5.8.

Enter the required code number (between 0000 and 19999) to gain access to the configuration pages. If an incorrect value is entered, access to the configuration pages is prevented and the display reverts to the *Operating Page* – see Section 2.3.

CONFIG. DISPLAY See Section 5.2.

5.2 Configure Display



Set Language
Sets the language to be used on all displays.

Language
Use the ▲ and ▼ keys to select the required language.

Set Up Display Backlight

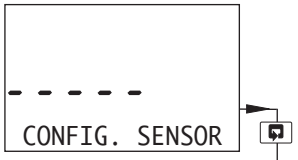
Backlight
Use the ▲ and ▼ keys to select the required backlight option:

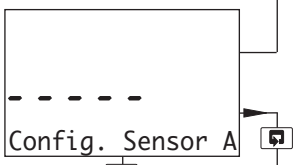
- `On` – Backlight is always on.
- `Auto.` – Backlight comes on at each button press and switches off one minute after the last button press.

`CONFIG. DISPLAY` Return to main menu.

`CONFIG. SENSOR` See Section 5.3.

5.3 Configure Sensors

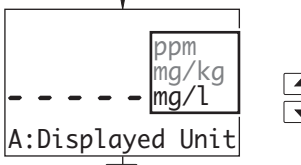




Configure Sensor A

Config. Sensor B — Sensor B configuration (dual input monitors only) is identical to Sensor A configuration.

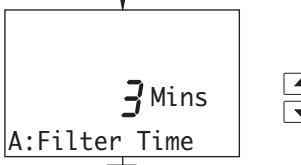
CONFIG. SENSOR — Single input monitors only – return to main menu.



Displayed Units

Select the units required for display:

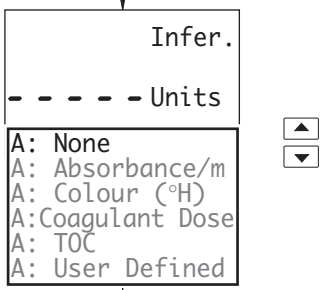
- `mg/l` – milligrammes per litre
- `mg/kg` – milligrammes per kilogramme
- `ppm` – parts per million



Filter Time

To prevent short term variations in reading, typically due to air bubbles in the sample, the sensor signal can be configured to provide an average reading over a set period of time. Set the required filter time, between 1 and 10 minutes in 1 minute increments.

Note. Use the lowest value that provides an acceptably stable reading. The default value is 3 minutes.



Inferred Units

The monitor is calibrated and operates in mgl^{-1} dissolved organic carbon but can be configured to display values in inferred units:

- `None` – The monitor displays all sensor readings in mgl^{-1}.
- `Absorbance/m` – A conversion factor of 1.5 is applied to the sensor signal.
- `Colour (°H)` – displayed in °H
- `Coagulant Dose` – displayed in mgl^{-1}
- `TOC` – displayed in mgl^{-1}

  (`Colour (°H)`, `Coagulant Dose`, `TOC`: The conversion factor set in the **A:Conv. Factor** frame (see next page) is applied to the sensor signal.)
- `User Defined` – The required units are entered in the **A: User Defined** frame (see next page) and the conversion factor set in the **A:Conv. Factor** frame (see next page) is applied to the sensor signal.

Notes.

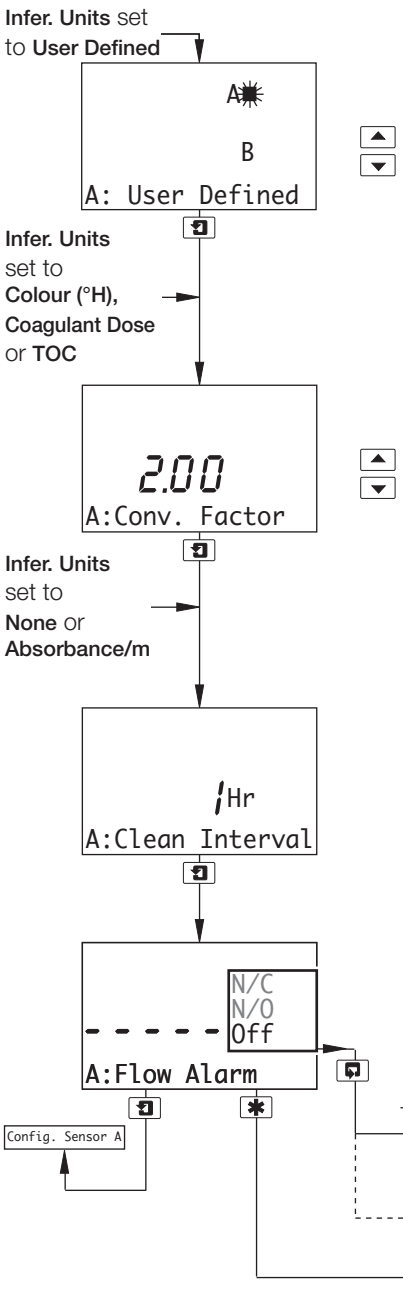
- With the exception of **Absorbance/m**, the conversion factor must be determined by laboratory analysis of the actual sample.
- When inferred units are selected for display, all values for alarm settings, current output ranges and calibration values remain in mgl^{-1} dissolved organics but the equivalent inferred unit is displayed.

A: User Defined — **Infer. Units** set to **User Defined** – continued on next page.

A:Conv. Factor — **Infer. Units** set to **Colour (°H)**, **Coagulant Dose** or **TOC** – continued on next page.

A:Clean Interval — **Infer. Units** set to **None** or **Absorbance/m** – continued on next page.

…5.3 Configure Sensors



User Defined Units
Enter the units to be displayed in the operating pages.

A flashing cursor is shown in the upper display line. Press the ▲ and ▼ keys until the first character of the required units is shown in the center display line. Press the ↵ key to enter the character into the upper display line and advance the cursor one character. Repeat the process for the remaining characters to a maximum of 6.

Press the ↵ key to save the user defined units and advance to the next frame.

Conversion Factor
Enter the conversion factor, determined by laboratory analysis, to be applied to the sensor signal for the chosen inferred units, between 0.10 and 9.00 in 0.01 increments.

Notes.
- It is assumed that the applied conversion factor remains constant.
- The monitor measures absorbance of dissolved organics at 254nm only. If the conversion factor changes, the monitor readings may not agree with independent laboratory results until a new conversion factor is determined and entered.

Cleaning Interval
Select the required interval between automatic cleaning operations:
15, 30 or 45 minutes or 1, 2, 4, 6, 12 or 24 hours.

Note. The cleaning interval setting is determined by plant experience. Check the condition of the flowcell and optical windows at appropriate intervals to determine the optimum setting.

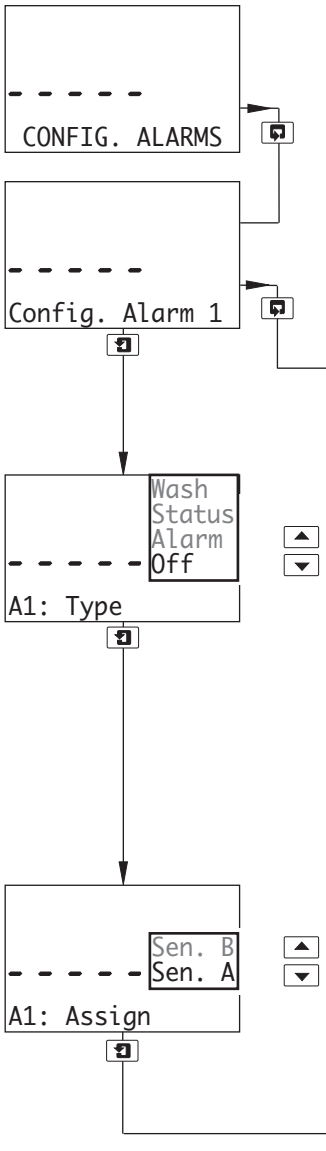
Flow Alarm
Set the input switch contact condition required during normal operations:
- `Off` – Input switch contact disabled
- `N/O` – Normally open
- `N/C` – Normally closed

`Config. Sensor B` Sensor B configuration (dual input monitors only) is identical to Sensor A configuration.

`CONFIG. SENSOR` Single input monitors only – return to main menu.

`CONFIG. ALARMS` See Section 5.4.

5.4 Configure Alarms



Configure Alarm 1

Config. Alarm 2 Alarms 2 and 3 configuration is identical to Alarm 1.

Alarm 1 Type

Select the type of alarm required:

- `Off` – The alarm is disabled, the alarm LED is off and the relay is de-energized at all times.
- `Alarm` – The monitor is configured to generate an alarm in response to a specified sensor reading.
- `Status` – An alarm is generated if either a power failure or a condition occurs that causes any of the error messages in Table 9.1 (page 54) to be displayed.
- `Wash` – Alarm 3 is configured to control the wash sequence.

Note. The wash alarm type can be assigned only to alarm 3 and is displayed only when the lower display shows **A3: Type.**

Alarm 1 Assign

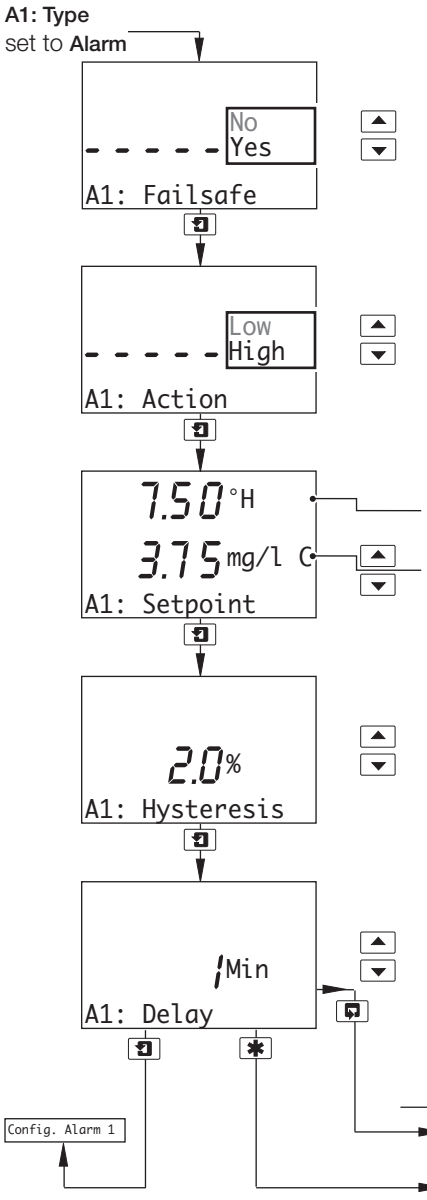
Select the alarm assignment required:

- `Sen. A` / `Sen. B` – The monitor activates an alarm if the dissolved organics content of the process fluid measured by the selected sensor exceeds or drops below the value set in the **Alarm 1 Set Point** parameter, depending on the type of **Alarm 1 Action** selected – see next page.

Config. Alarm 1 **A1: Type** set to **Off** or **Status** – return to top of page.

A1: Failsafe **A1: Type** set to **Alarm** – continued on next page.

…5.4 Configure Alarms



Alarm 1 Failsafe
Select **Yes** to enable failsafe action, otherwise select **No**.
Refer to Figs. 5.1 to 5.5 (page 22).

Alarm 1 Action
Select the alarm action required, **High** or **Low**.
Refer to Figs. 5.1 to 5.5 (page 22).

Alarm 1 Set Point
Inferred units. Displayed only if **Infer. Units** set to anything other than **None** – see Section 5.3.

Set the alarm set point to the required value. High range between 0.0 and 100.0 in 0.1 increments and low range between 0.00 and 20.00 in 0.01 increments.

Alarm 1 Hysteresis
A differential set point can be defined between 0 and 5% of the alarm set point value. Set the required hysteresis in 0.1% increments.
Refer to Figs. 5.1 to 5.5 (page 22).

Alarm 1 Delay
If an alarm condition occurs, activation of the relays and LEDs can be delayed for a specified time period. If the alarm clears within the period, the alarm is not activated.

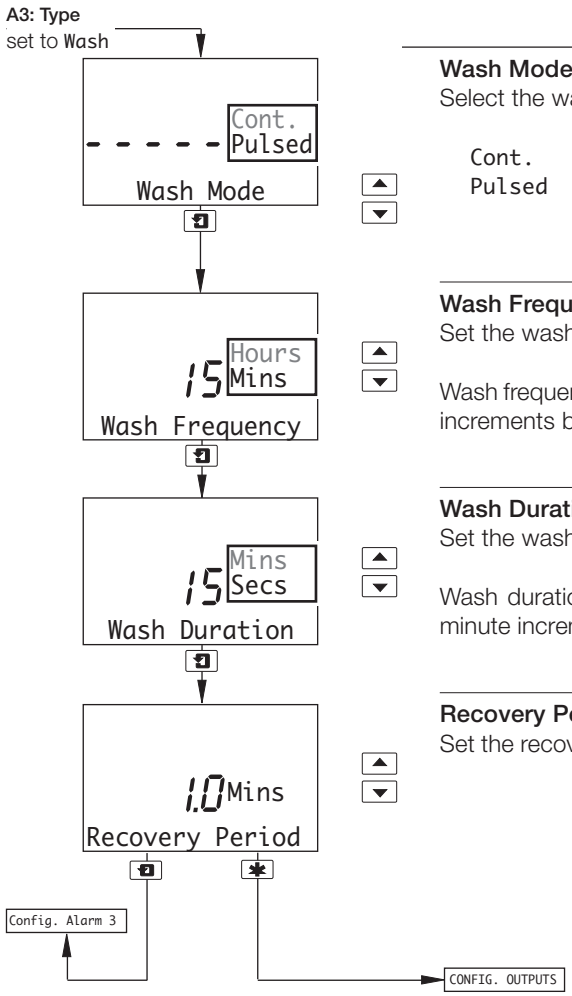
Set the required delay, in the range 0 to 100 minutes in 1 minute increments.
Refer to Figs. 5.1 to 5.5 (page 22).

Config. Alarm 2 Alarms 2 and 3 configuration is identical to Alarm 1.

CONFIG. OUTPUTS See Section 5.5.

...5.5 Configure Alarms

5.5.1 Wash Cycle Configuration (applicable only to Alarm 3)



Wash Mode
Select the wash mode required.

`Cont.` – (continuous) the relay remains energized for the wash duration
`Pulsed` – the relay is switched on and off every second for the duration of the wash, – see Fig. 5.1

Wash Frequency
Set the wash frequency required.

Wash frequency is set in 15 minute increments between 15 and 45 minutes, then in 1 hour increments between 1 and 24 hours.

Wash Duration
Set the wash duration required.

Wash duration is set in 15 second increments between 15 and 45 seconds, then in 1 minute increments between 1 and 10 minutes.

Recovery Period
Set the recovery period required, between 0.5 and 5.0 minutes in 0.5 minute increments.

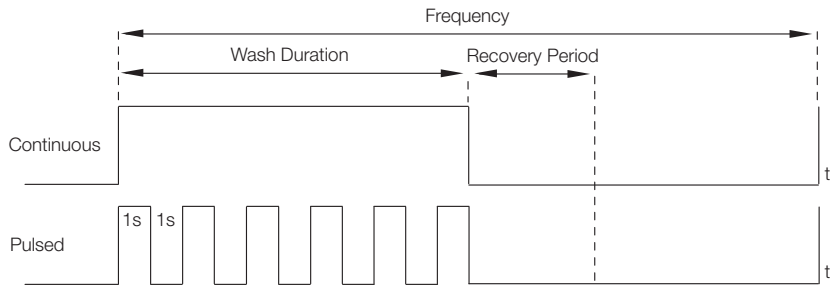


Fig. 5.1 Pulsed and Continuous Wash Cycles

…5.4 Configure Alarms

Note. The following examples illustrate **High Alarm Actions**, i.e. the alarm is activated when the process variable exceeds the defined set point. **Low Alarm Actions** are the same except the alarm is activated when the process variable drops below the defined set point.

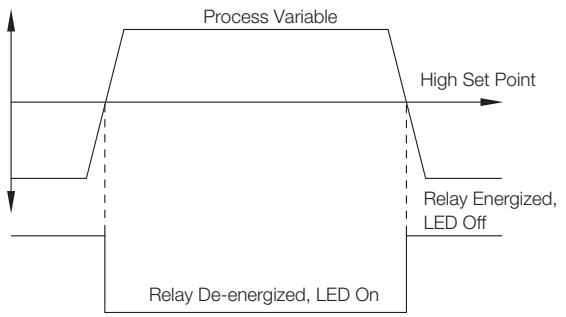


Fig. 5.1 High Failsafe Alarm without Hysteresis and Delay

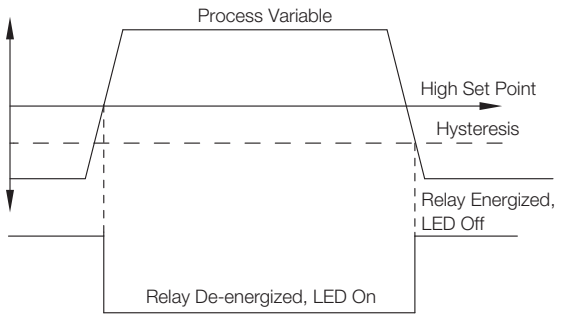


Fig. 5.2 High Failsafe Alarm with Hysteresis but no Delay

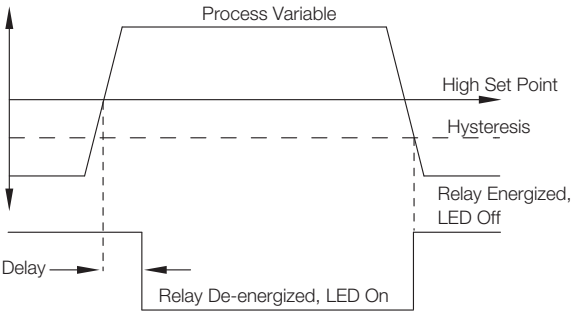


Fig. 5.3 High Failsafe Alarm with Hysteresis and Delay

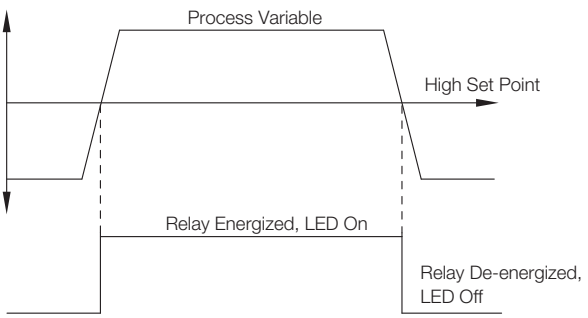


Fig. 5.4 High Non–Failsafe Alarm without Delay and Hysteresis

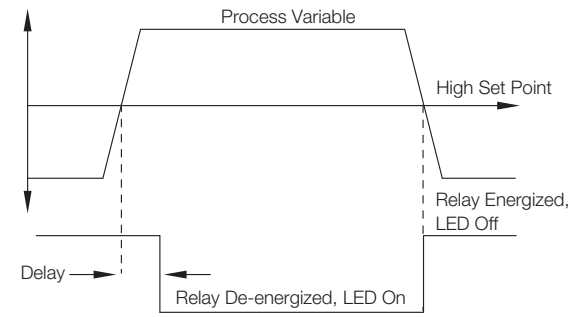
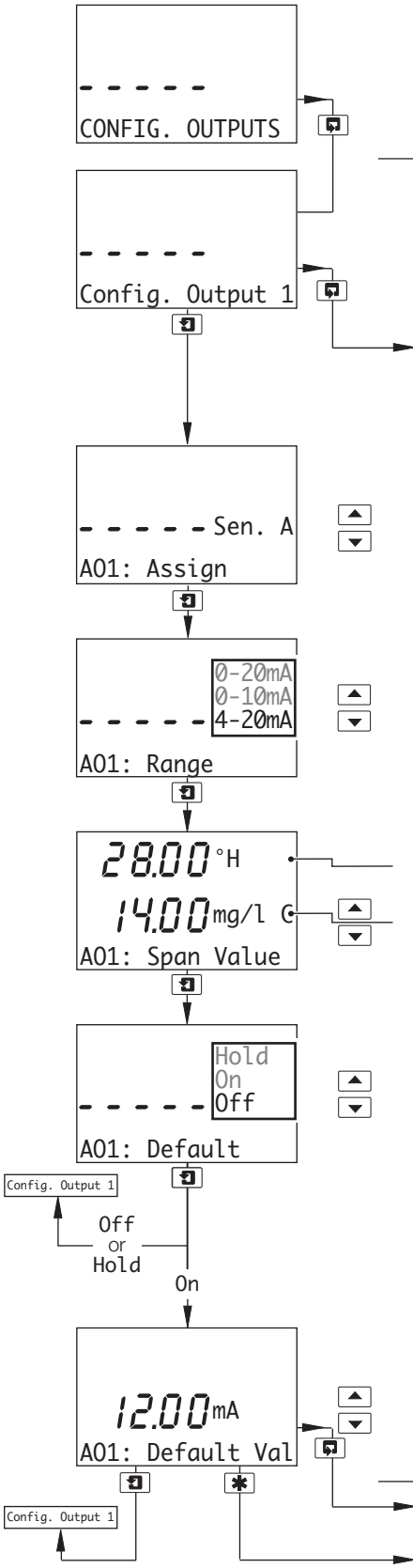


Fig. 5.5 High Failsafe Alarm with Delay but no Hysteresis

5.5 Configure Outputs



Configure Output 1

Config. Output 2 Output 2 configuration is identical to Output 1 configuration.

Assign

Select either Sensor A (**Sen. A**) or Sensor B (**Sen. B**).

Range

Select the analog output current range for the selected output.

Span Value

Inferred units. Displayed only if **Infer. Units** set to anything other than **None** – see Section 5.3.

Adjust the displayed reading to the required span value. Low range between 5.00 and 20.00 and high range between 20.0 and 100.0

Default Output

Select the system reaction to failure:

- `Off` – Ignore failure and continue operation.
- `On` – Stop on failure. This drives the analog output to the level set in the **Default Val** frame below.
- `Hold` – Hold the analog output at the value prior to the failure.

Default Value

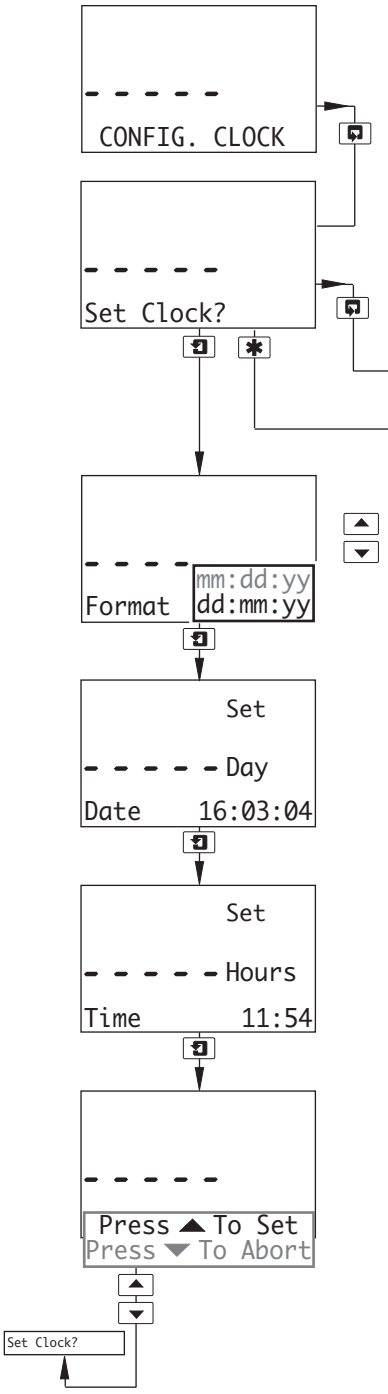
The level to which the analog output is driven if a failure occurs.

Set the value, between 0.00 and 22.00mA.

Config. Output 2 Configure Output 2.

CONFIG. CLOCK See Section 5.6.

5.6 Configure Clock



Set Clock
Set the system clock.

CONFIG. CLOCK Return to main menu.

CONFIG. LOGBOOK See Section 5.7.

Date Format
Select the required date format.

Date
Set the date in the format selected above.

Press ◙ to move between the day, month and year fields.
Use the ▲ and ▼ keys to adjust each field.

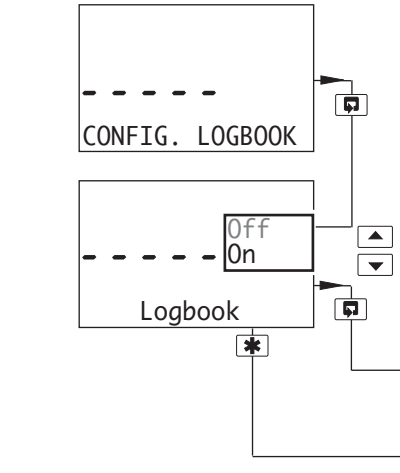
Time
Set the time in the form hh:mm.

Press ◙ to move between the hours and minutes fields.
Use the ▲ and ▼ keys to adjust each field.

Press ▲ to Set and **Press ▼ to Abort** are shown alternately on the lower display line.

Press the appropriate key to set the clock or abort the changes.

5.7 Configure Logbook



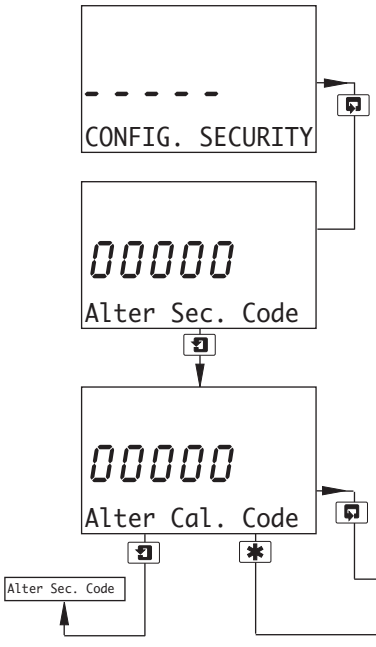
Configure Logbook
Set the logbook to **On** or **Off**.
If **Off** is selected, all data entries in the logbook are cleared.

CONFIG. LOGBOOK — Return to main menu.

CONFIG. SERIAL — Option board fitted ***and*** Serial Communications feature enabled (Section 7.1) – see Supplementary Manual *PROFIBUS Datalink Description (IM/PROBUS)*.

CONFIG. SECURITY — Option board not fitted ***or*** option board fitted but Serial Communications feature ***not*** enabled (Section 7.1) – see Section 5.8.

5.8 Configure Security



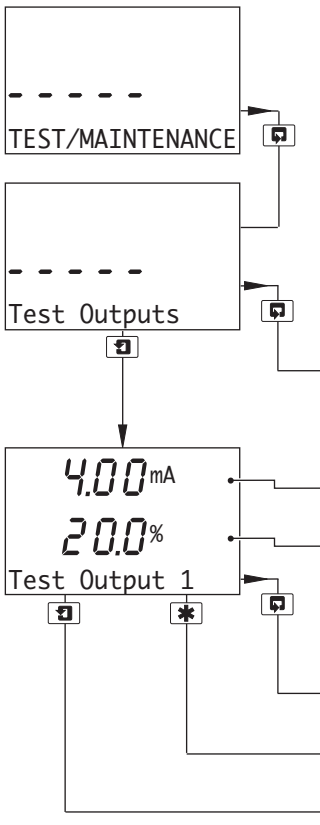
Alter Security Code
Set the security code to a value between 0000 and 19999.

Alter Calibration Code
Set the sensor calibration access code to a value between 0000 and 19999.

CONFIG. SECURITY — Return to main menu.

TEST/MAINTENANCE — See Section 5.9.

5.9 Test Outputs and Maintenance



Test Outputs
Displays the output test details for the analog outputs.

Test Output 1 frame only is shown. The format of **Test Output 2** frame is identical.

Maintenance — Continued below.

Test Output 1
The theoretical output current value.

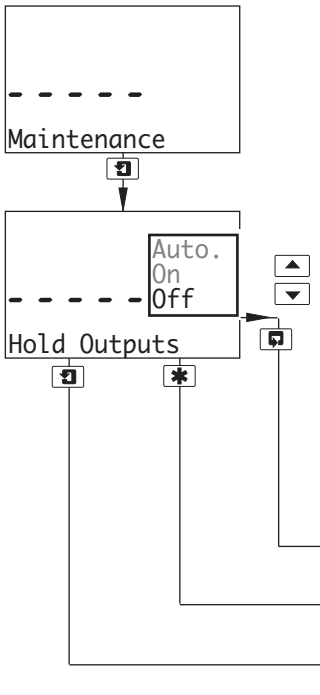
Output current as a percentage of the full range current.

Use the ▲ and ▼ keys to adjust the displayed theoretical output current value to give the output required.

Maintenance — Continued below.

FACTORY SETTINGS — See Section 7.1.

Test Output 2 — Advance to Test Output 2.



Maintenance

Hold Outputs
Enables the relay action and analog outputs to be maintained.

- `Auto.` – Changes in relay action and analog outputs are disabled during sensor calibration.
- `On` – Changes in relay action and analog outputs are disabled.
- `Off` – Changes in relay action and analog outputs are not disabled.

Note. The LEDs flash while the monitor is in 'Hold' mode.

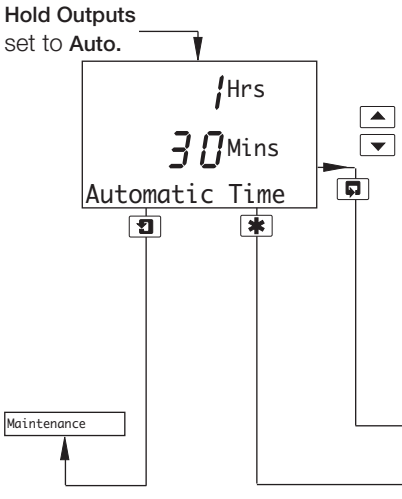
Sensor A Outputs — Continued on next page.

FACTORY SETTINGS — See Section 7.1.

Maintenance — **Hold Outputs** set to **Off** or **On** – return to main menu.

Automatic Time — **Hold Outputs** set to **Auto.** – continued on next page.

...5.9 Test Outputs and Maintenance



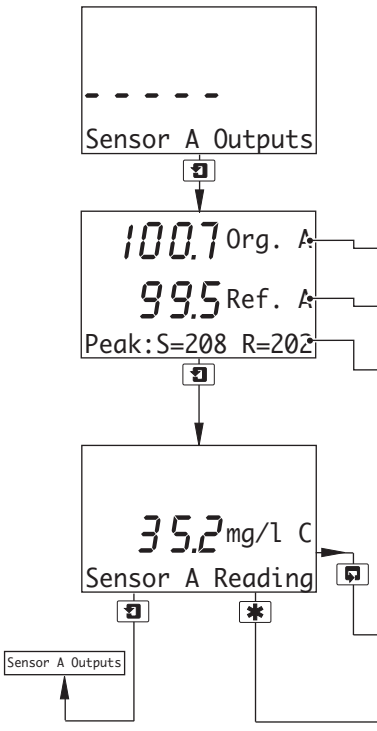
Automatic Time
If required, set a time period between 1 and 6 hours, in 30 minute increments, for which the outputs are held when **Hold Outputs** is set to **Auto.**

At the default setting of **Off**, changes in relay action and analog outputs are disabled during sensor calibration and enabled automatically at the end of the procedure.

If a time is set, changes in relay action and analog outputs are disabled during sensor calibration but, if the calibration is not completed within the set time, the calibration is aborted, the display returns to the *Operating Page* and **CAL. ABORTED** is displayed.

Sensor A Outputs — Continued below.

FACTORY SETTINGS — See Section 7.1.



Sensor A Outputs

Organics and Reference Signals
Organics total signal
Reference total signal
These values equate to the percentage light transmission through the sample.

The peak values of the light pulse generated by the strobe lamp.

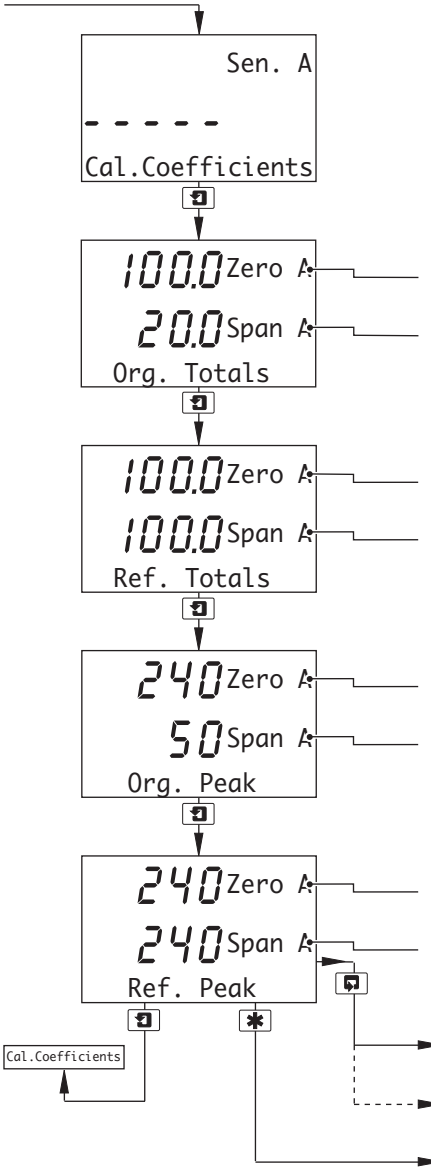
Instantaneous Reading
Internal damping function disabled – display shows instantaneous reading from sensor.

Sensor B Outputs — Sensor B outputs (dual input monitors only) are identical to Sensor A outputs.

Cal.Coefficients — Single input monitor – continued on next page.

FACTORY SETTINGS — See Section 7.1

…5.9 Test Outputs and Maintenance



Calibration Coefficients (Sensor A)
The values for organics signal/reference totals and organics signal/reference peaks displayed below equate to the percentage light transmission through the sample. They are stored during a sensor calibration and are shown for diagnostic purposes only.

Organics Signal Totals
Calibration Zero

Calibration Span

Reference Signal Totals
Calibration Zero

Calibration Span

Organics Signal Peak
Calibration Zero

Calibration Span

Reference Signal Peak
Calibration Zero

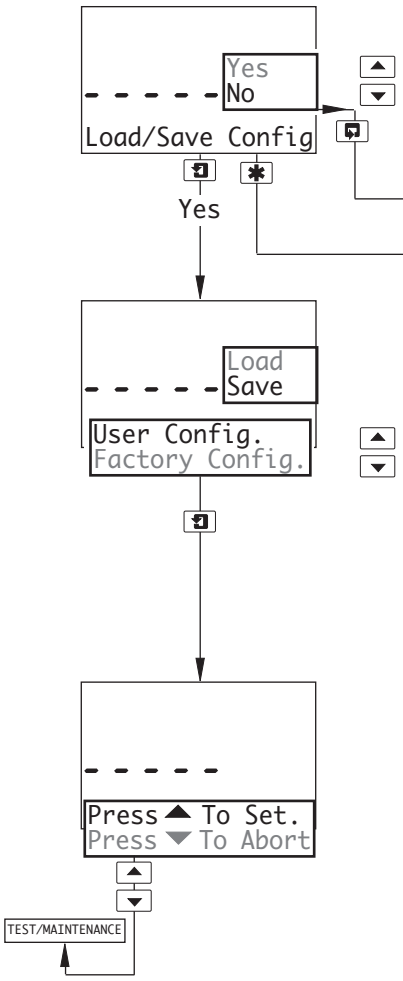
Calibration Span

Sensor B calibration coefficients (dual input monitors only) are identical to Sensor A calibration coefficients.

Single input monitor – continued on next page.

See Section 7.1.

...5.9 Test Outputs and Maintenance



Load/Save Configuration
Select whether a configuration is to be loaded or saved.

Note. If **No** is selected, pressing the ↵ key has no effect.

TEST/MAINTENANCE Return to main menu.

FACTORY SETTINGS See Section 7.1.

Load User/Factory Configuration

Note. Applicable only if **Load/Save Config** is set to **Yes**.

`Factory Config.`	– resets all the parameters in the **Configuration Pages** to the Company Standard.
`Save User Config.`	– saves the current configuration into memory.
`Load User Config.`	– reads the saved user configuration into memory.

User Config. and **Factory Config.** are displayed alternately if a User Configuration has been saved previously. Select the configuration required.

Press ▲ to Set and **Press ▼ to Abort** are displayed alternately on the lower display line.

Press the appropriate key to load/save the configuration or abort the changes.

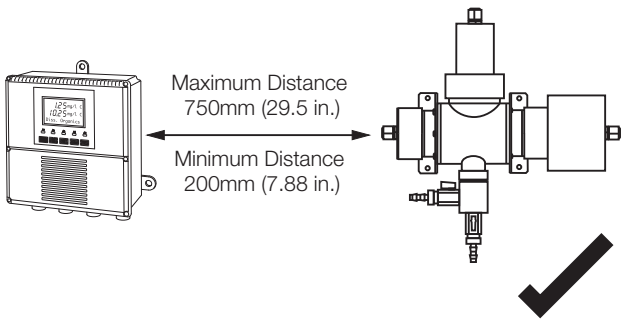
6 INSTALLATION

6.1 Siting Requirements – Fig. 6.1

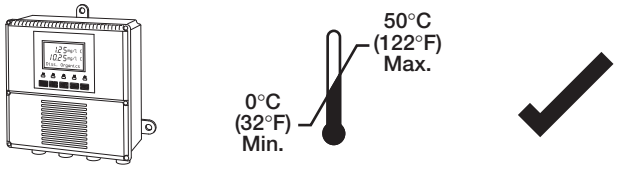
6.1.1 Transmitter

Notes.

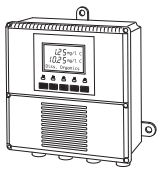
- Mount in a location free from excessive vibration.
- Mount away from harmful vapours and/or dripping fluids.
- Where possible, mount the transmitter at eye level to allow an unrestricted view of the front panel displays and controls.



A – Distance Between Analyzer and Sensor



B – Within Temperature Limits



C – Within Environmental Limits

* Refer to Specification on page 58.

Fig. 6.1 Siting Requirements

6.1.2 Sensor

Notes.

- The sensor is supplied fitted with mounting brackets.
- Secure the sensor to a suitable vertical surface in a location that enables easy access for maintenance and calibration.

6.2 Mounting the Transmitter – Figs. 6.2 and 6.3

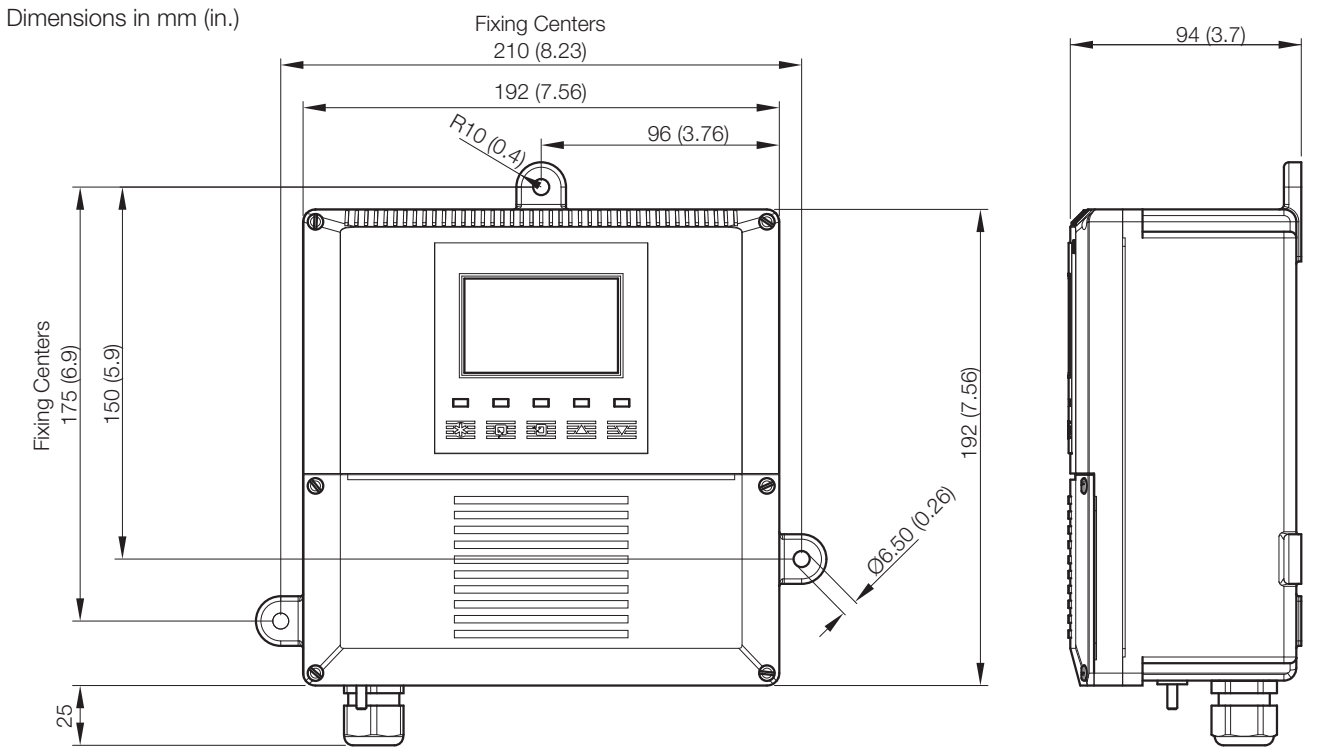


Fig. 6.2 Overall Dimensions

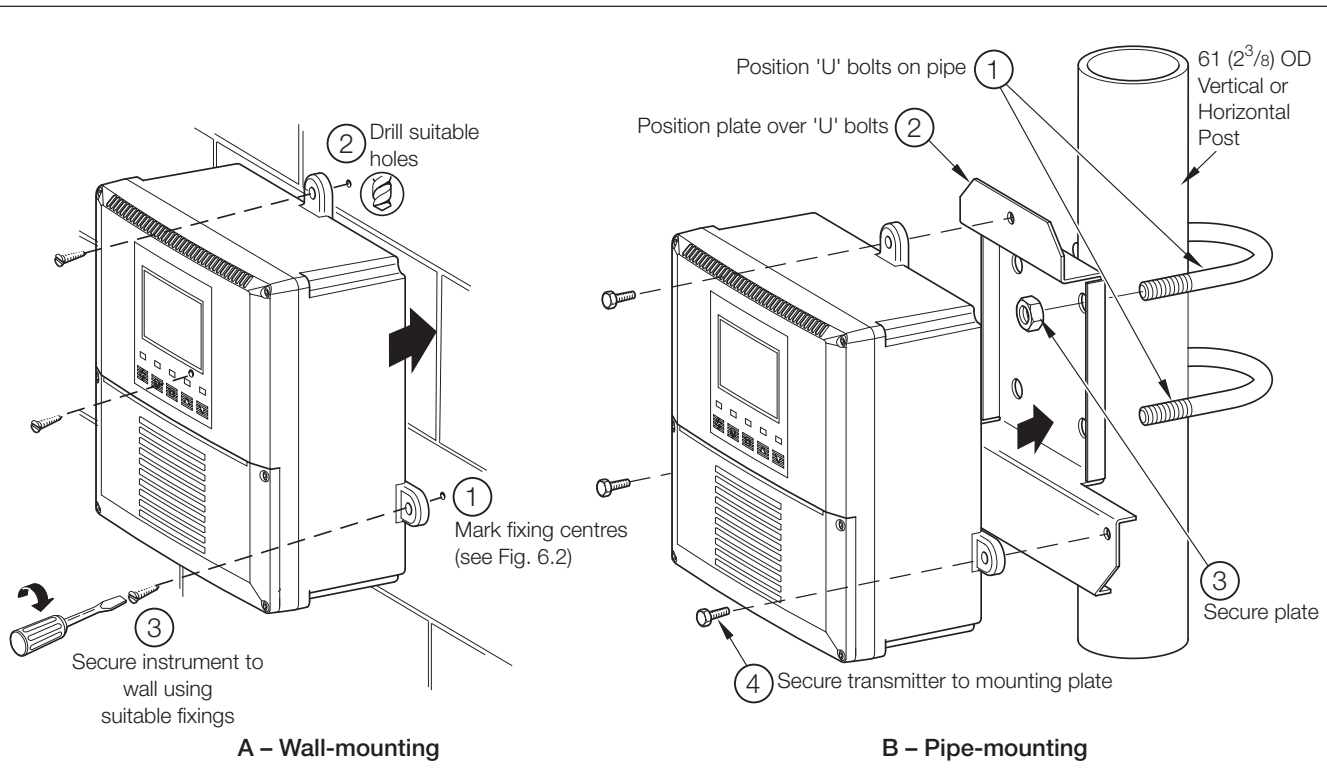
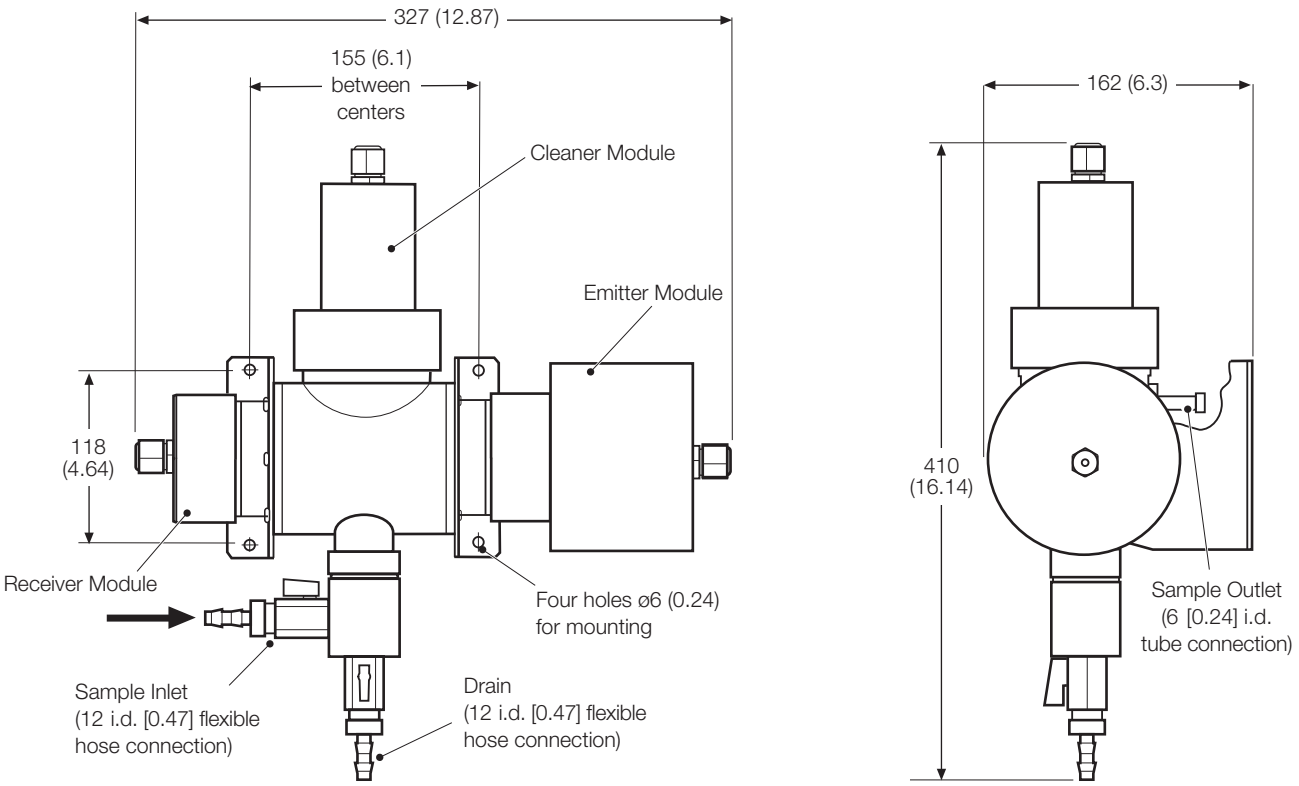


Fig. 6.3 Wall-/Pipe-mounting

6.3 Installing the Sensor – Figs. 6.4 and 6.5

Notes.
- Use flexible plastic or rigid PVC, polypropylene or metal connecting pipework, depending on the installation.
- Fit isolating valves to enable removal of the sensor.

Dimensions in mm (in.)



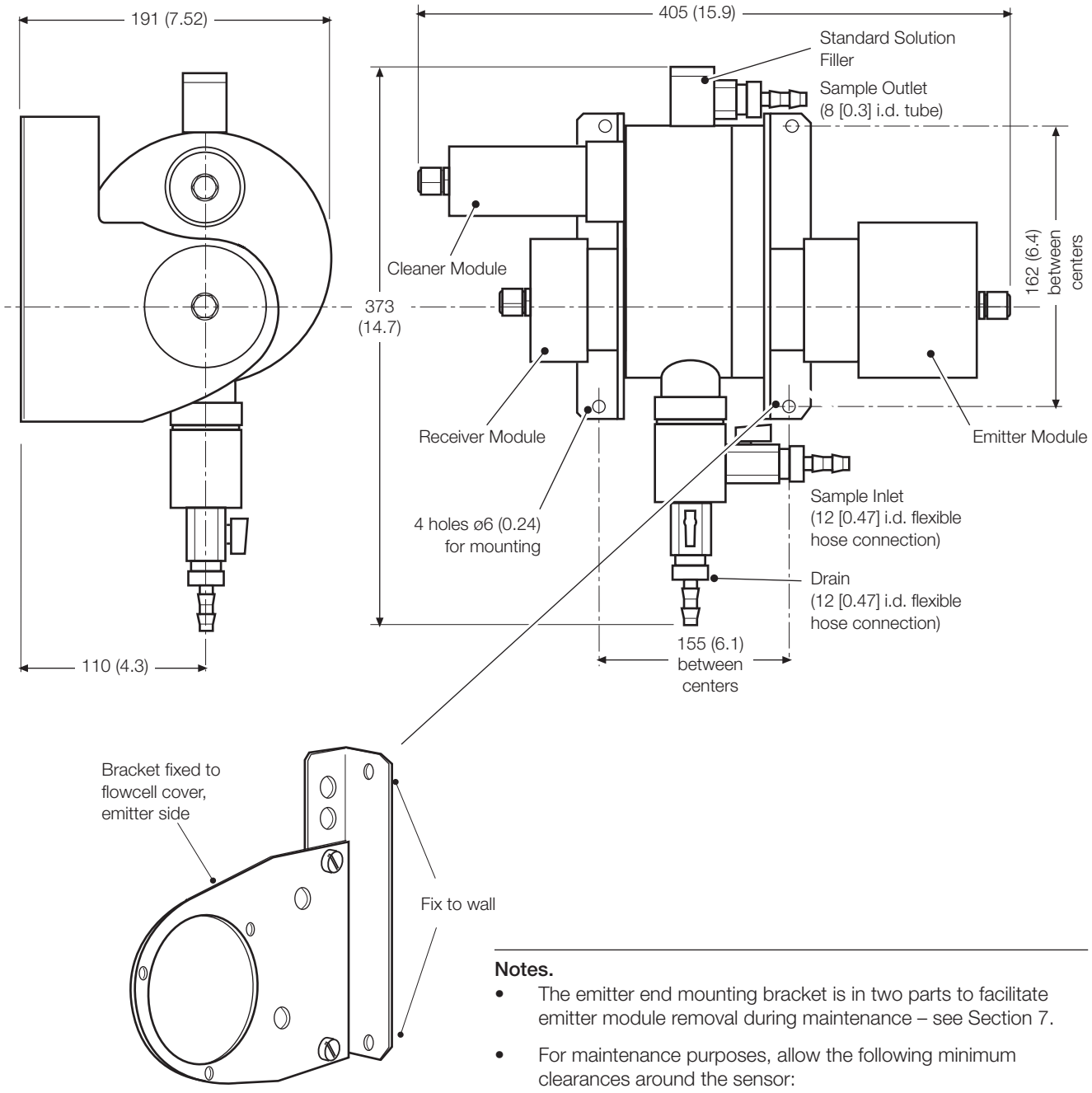
Note. For maintenance purposes, allow the following minimum clearances around the sensor:

Left (for receiver module removal)	–	100 mm (3.94 in.)
Right (for emitter module removal)	–	100 mm (3.94 in.)
Top (for cleaner module removal)	–	200 mm (7.87 in.)

Fig. 6.4 7320 100 Low Range Sensor – Overall Dimensions and Mounting Details

…6.3 Installing the Sensor – Figs. 6.4 and 6.5

Dimensions in mm (in.)



Notes.

- The emitter end mounting bracket is in two parts to facilitate emitter module removal during maintenance – see Section 7.
- For maintenance purposes, allow the following minimum clearances around the sensor:
  - Left (for receiver module removal) – 150mm (5.9 in.)
  - Right (for emitter module removal) – 100mm (3.94 in.)
  - Top (for cleaner module removal) – 200mm (7.87 in.)

Fig. 6.5 7320 200 High Range Sensor – Overall Dimensions and Mounting Details

6.4 Installing the Optional De-bubbler – Figs. 6.6 and 6.7

Dimensions in mm (in.)

De-bubbler
Part Number
7997 500

Note. The de-bubbler ***MUST*** be mounted vertically with the flow upwards.

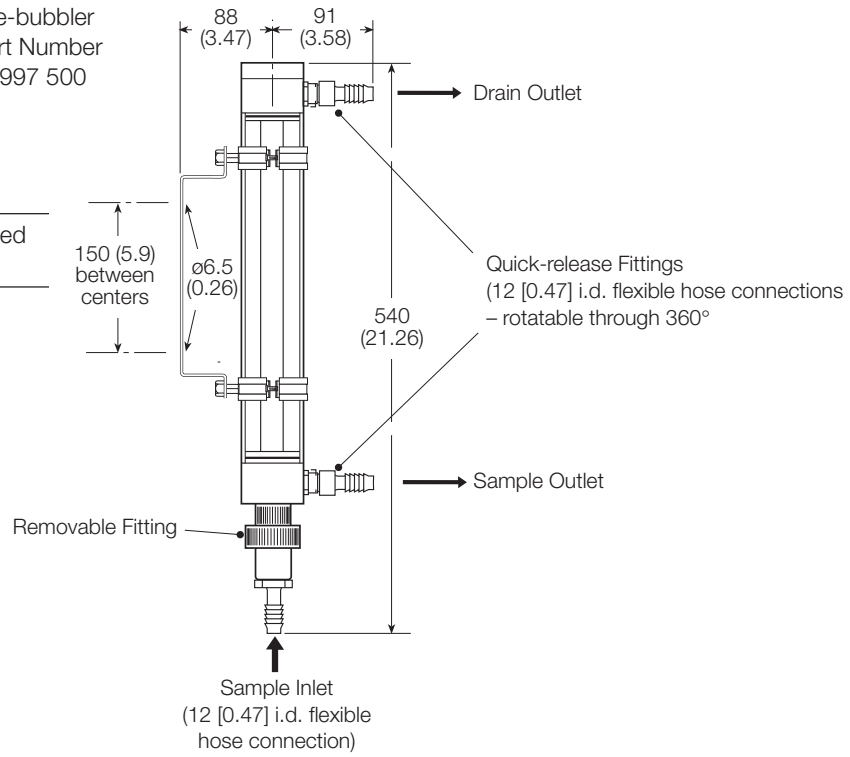
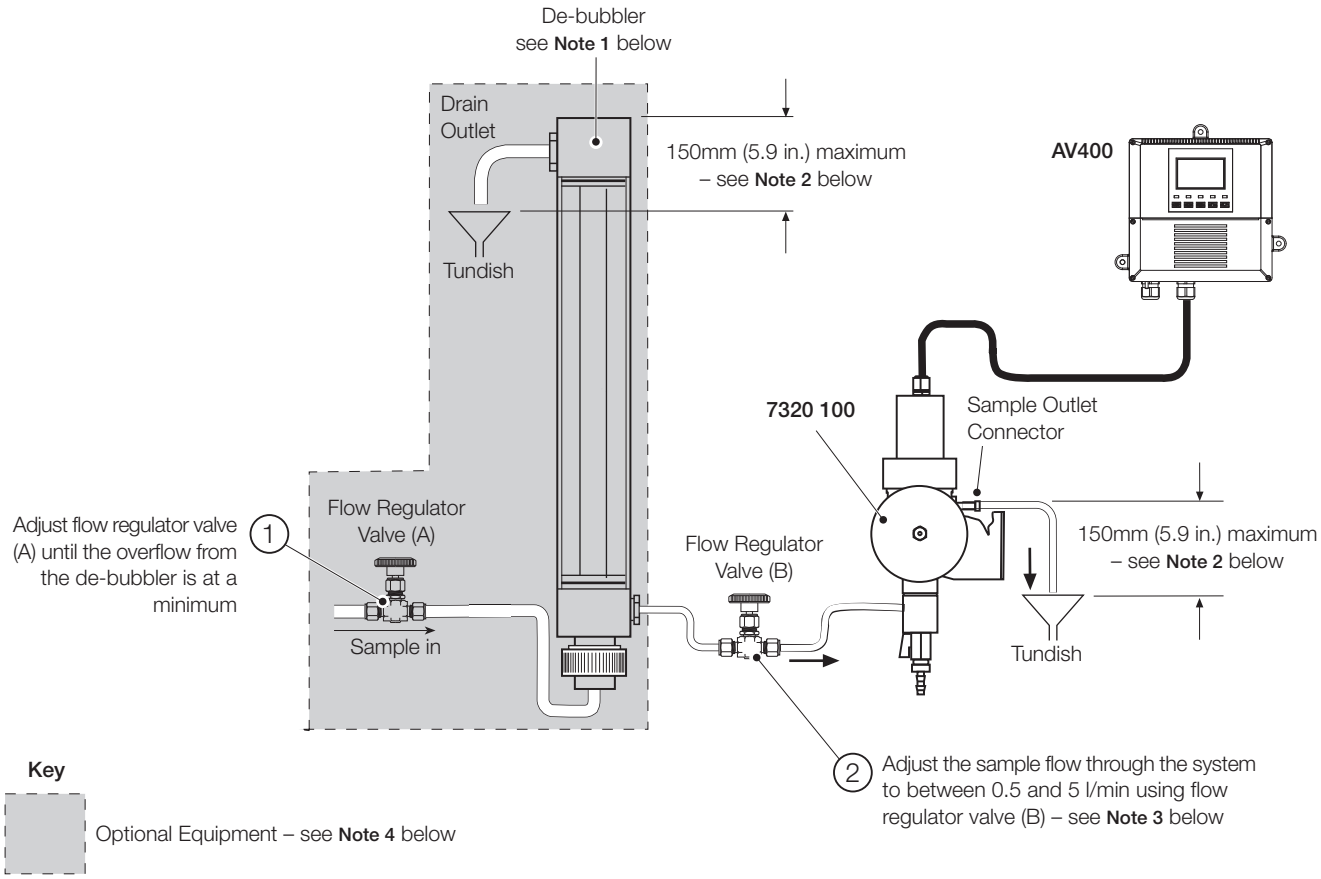


Fig. 6.6 Overall Dimensions

…6.4 Installing the Optional De-bubbler – Figs. 6.6 and 6.7



Notes.

1. The de-bubbler ***MUST*** be mounted vertically with the flow upwards.
2. Degassing of the sample causes very erratic readings. To prevent degassing, do not exceed stated distance.
3. Adjust the flowrate as required to prevent blockages in the pipework and/or sediment build-up in the flowcell.
4. Install flow regulating valves and a flow indicator to simplify maintenance and ensure consistent performance. These items are not supplied with the AV400 Series UV Dissolved Organics Monitor system.

Fig. 6.7 Typical De-bubbler Installation

6.5 Electrical Connections

Warnings.

- 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 transmitter within easy reach of the operator and must be marked clearly as the disconnection device for the transmitter.
- Remove all power from supply, relay and any powered control circuits and high common mode voltages before accessing or making any connections.
- The power supply earth (ground) **must** be connected to reduce the effects of RFI interference and ensure the correct operation of the power supply interference filter.
- The power supply earth (ground) must be connected to the earth (ground) stud on the analyzer case – see Fig. 6.9.
- Use cable appropriate for the load currents. The terminals accept cables from 20 to 14 AWG (0.5 to 2.5mm^2) UL Category AVLV2.
- The monitor conforms to Mains Power Input Insulation Category III. All other inputs and outputs conform to Category II.
- All connections to secondary circuits must have basic insulation.
- After installation, there must be no access to live parts e.g. terminals.
- Terminals for external circuits are for use only with equipment with no accessible live parts.
- The relay contacts are voltage-free and must be appropriately connected in series with the power supply and the alarm/control device which they are to actuate. Ensure that the contact rating is not exceeded. Refer also to Section 6.5.1 for relay contact protection details when the relays are to be used for switching loads.
- Do not exceed the maximum load specification for the selected analog output range.
  The analog output is isolated, therefore the –ve terminal must be connected to earth (ground) if connecting to the isolated input of another device.
- If the monitor 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, EN61010-1).

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 flexible conduits and fittings.

Notes.

- Four earth (ground) – studs are fitted to the transmitter case for bus-bar earth (ground) connection – see Fig. 6.10.
- Always route sensor signal cables and mains-carrying/relay cables separately, ideally in earthed (grounded) metal conduit.
- The screens of the sensor's emitter, receiver and cleaner cables ***must*** be enclosed in yellow/green sleeving and connected to the earth (ground) stud fitted to the transmitter case closest to the cable's entry point – see Fig. 6.10.
- Ensure that cables enter the transmitter through the glands nearest the appropriate screw terminals and are short and direct. Do not tuck excess cable into the terminal compartment.
- Ensure that the NEMA4X/IP66 rating is not compromised when using cable glands, conduit fittings and blanking plugs/bungs (M20 holes). The M20 glands accept cable of between 5 and 9mm (0.2 and 0.35 in.) diameter.

…6.5 Electrical Connections

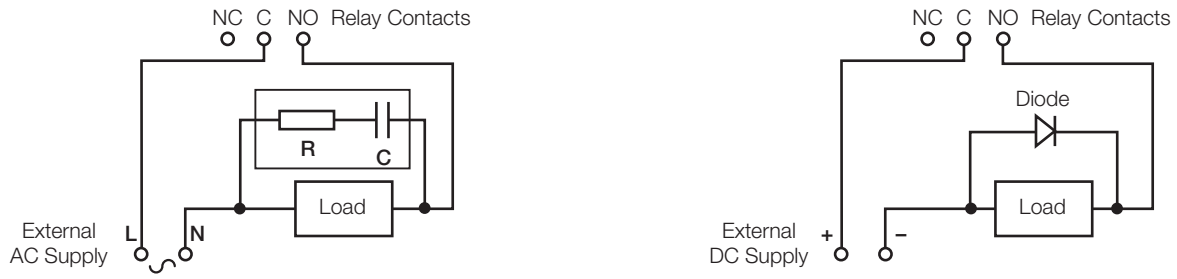
6.5.1 Relay Contact Protection and Interference Suppression – Fig. 6.8

If the relays are used to switch loads on and off, the relay contacts can become eroded due to arcing. Arcing also generates radio frequency interference (RFI) that can result in monitor malfunctions and incorrect readings. To minimize the effects of RFI, arc suppression components are required; resistor/capacitor networks for AC applications or diodes for DC applications. These components can be connected either across the load or directly across the relay contacts. The RFI components must be fitted to the relay terminal block along with the supply and load wires – see Fig 6.8.

For **AC applications** the value of the resistor/capacitor network depends on the load current and inductance that is switched. Initially, fit a 100R/0.022µF RC suppressor unit (part no. B9303) as shown in Fig. 6.8A. If the transmitter malfunctions (locks up, display goes blank, resets etc.) the value of the RC network is too low for suppression and an alternative value must be used. If the correct value cannot be obtained, contact the manufacturer of the switched device for details on the RC unit required.

For **DC applications** fit a diode as shown in Fig. 6.8B. For general applications use an IN5406 type (600V peak inverse voltage at 3A).

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



A – AC Applications

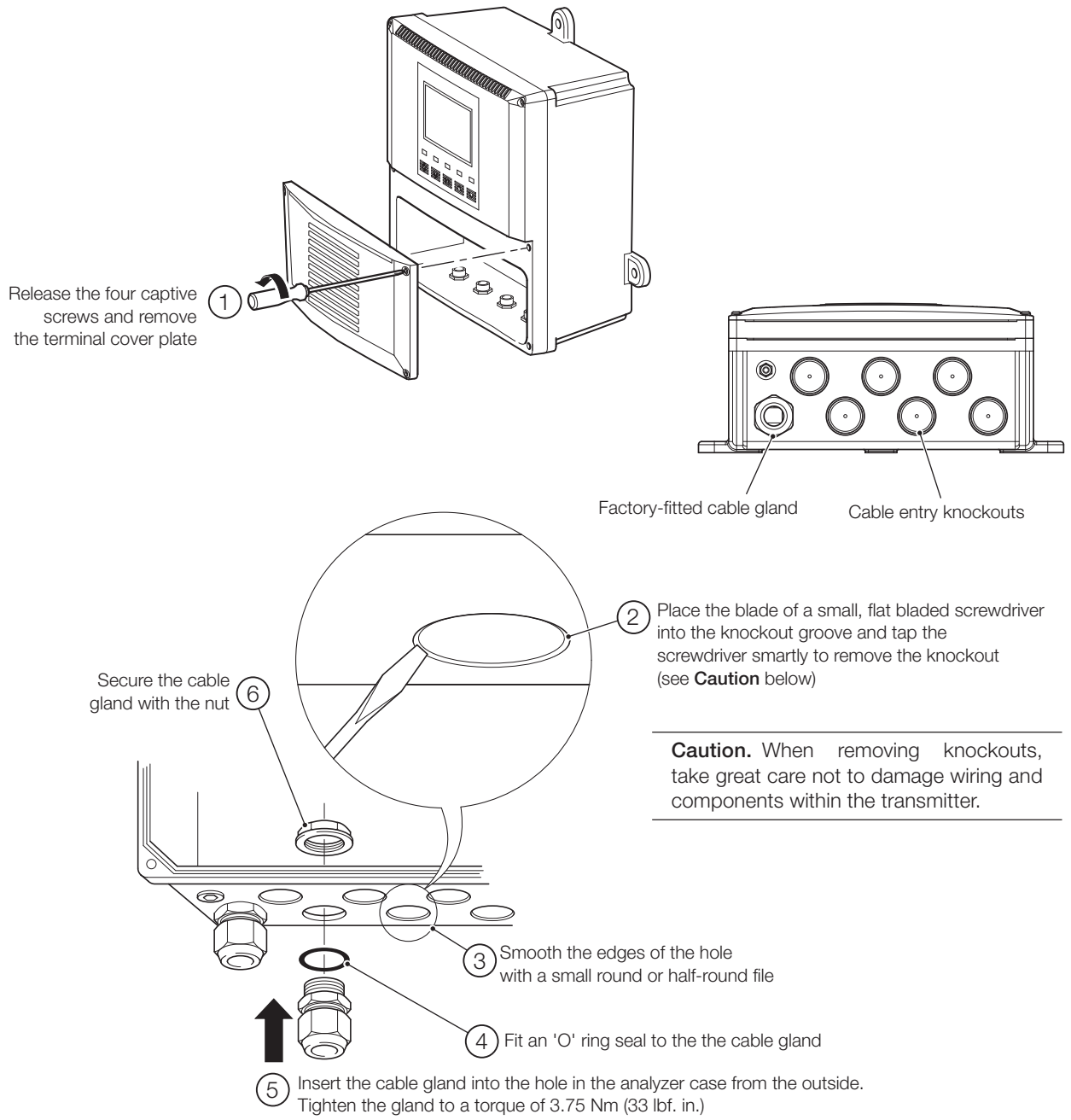
B – DC Applications

Fig. 6.8 Relay Contact Protection

…6.5 Electrical Connections

6.5.2 Cable Entry Knockouts – Fig. 6.9

The monitor is supplied with 7 cable glands, one fitted and six to be fitted, as required, by the user – see Fig. 6.9.



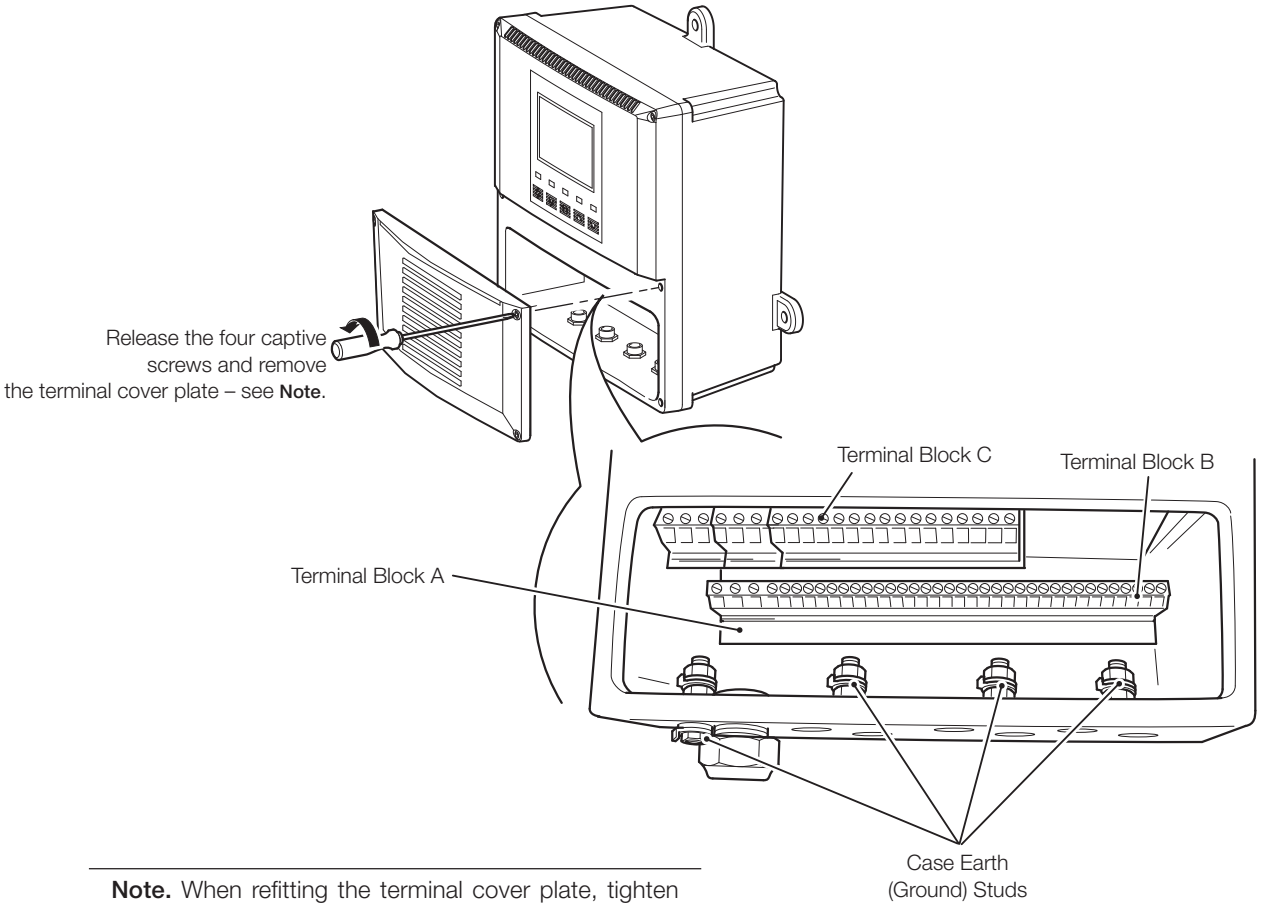
Caution. When removing knockouts, take great care not to damage wiring and components within the transmitter.

Note. The cable glands must be tightened to a torque of 3.75 Nm (33 lbf. in.)

Fig. 6.9 Cable Entry Knockouts

…6.5 Electrical Connections

6.5.3 Access to Terminals – Fig. 6.10

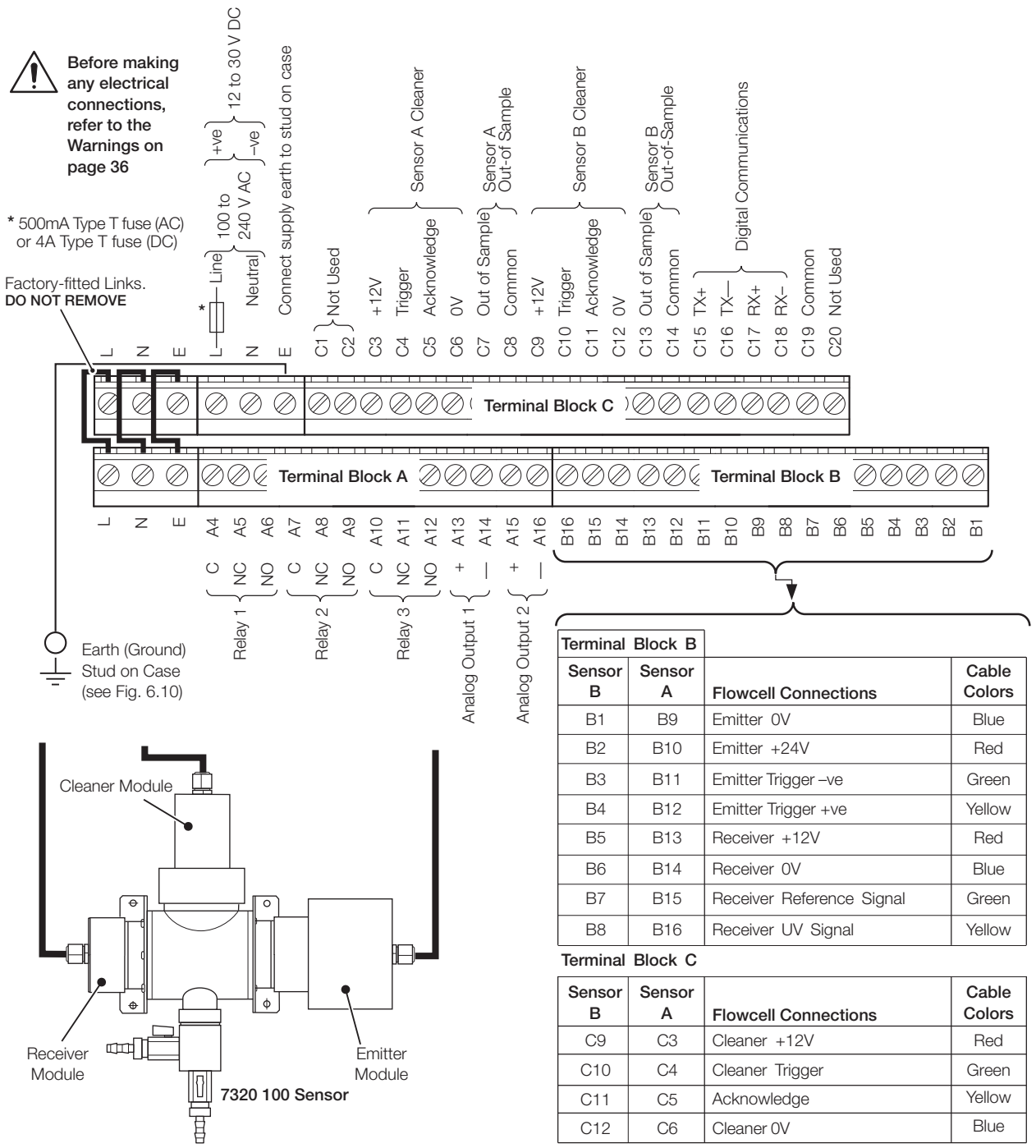


Note. When refitting the terminal cover plate, tighten the captive screws to a torque of 0.40 Nm (3.5 lbf. in.)

Fig. 6.10 Access to Terminals

…6.5 Electrical Connections

6.5.4 Connections – Fig. 6.11



Terminal Block B

Sensor B	Sensor A	Flowcell Connections	Cable Colors
B1	B9	Emitter 0V	Blue
B2	B10	Emitter +24V	Red
B3	B11	Emitter Trigger –ve	Green
B4	B12	Emitter Trigger +ve	Yellow
B5	B13	Receiver +12V	Red
B6	B14	Receiver 0V	Blue
B7	B15	Receiver Reference Signal	Green
B8	B16	Receiver UV Signal	Yellow

Terminal Block C

Sensor B	Sensor A	Flowcell Connections	Cable Colors
C9	C3	Cleaner +12V	Red
C10	C4	Cleaner Trigger	Green
C11	C5	Acknowledge	Yellow
C12	C6	Cleaner 0V	Blue

Notes.

- The screens of the sensor's emitter, receiver and cleaner cables **must** be enclosed in yellow/green sleeving and connected to the earth (ground) stud fitted to the transmitter case closest to the cable's entry point – see Fig. 6.10.
- Dual input versions – connect each sensor to the correct input terminals (A or B) as indicated on the sensor's cables.
- Use the three-hole cable gland provided with the sensor for the sensor cables.
- Tighten the terminal screws to a torque of 0.60 Nm (5.3 lbf. in.).

Fig. 6.11 Connections

7 CALIBRATION

Note. An AV400 System is supplied factory-configured as a matched system with each component bearing the same serial number. If any part of a system is replaced (transmitter or sensor[s]), ***a complete factory re-calibration must be carried out***.

7.1 Factory Settings

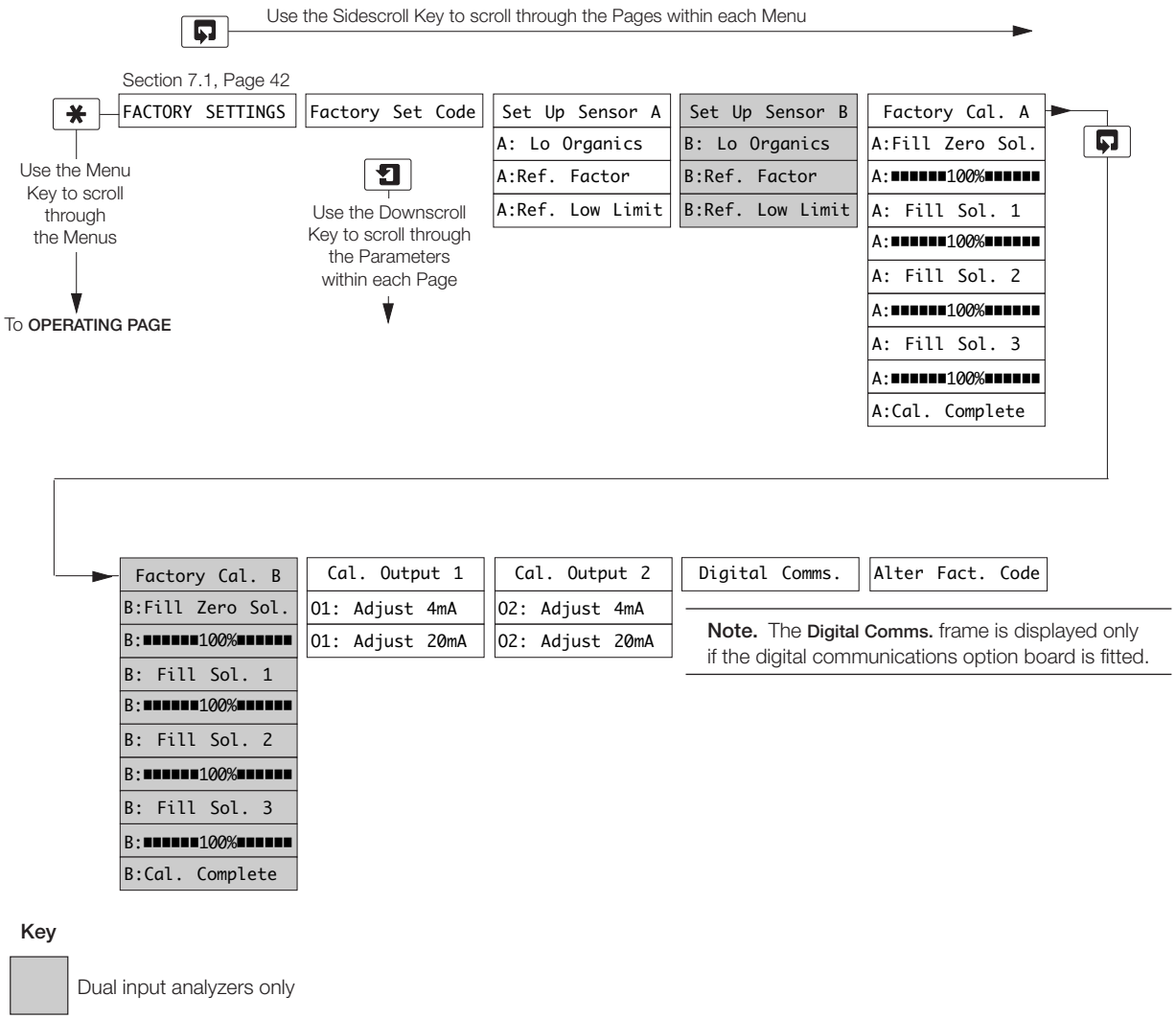
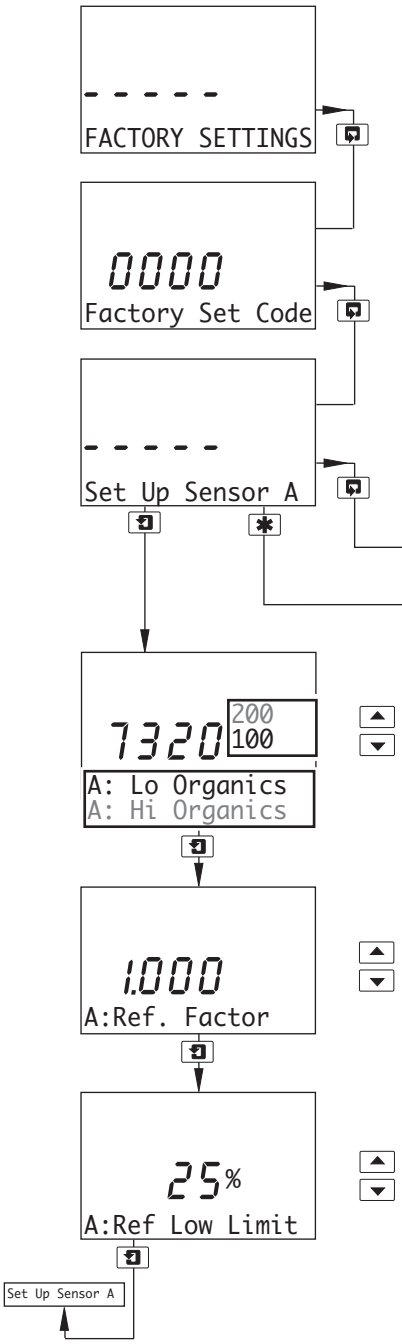


Fig. 7.1 Overall Factory Settings Chart

…7.1 Factory Settings



Factory Settings Access Code
Enter the required code number, between 0000 and 19999, to gain access to the factory settings. If an incorrect value is entered, access to subsequent frames is prevented and the display reverts to the top of the page.

Set Up Sensor A

Note. The values in the display lines for sensor calibration are shown as examples only – the actual values obtained will differ.

Set Up Sensor B Continued on next page.

Diss. Organics *Operating Page* – see Section 2.3.

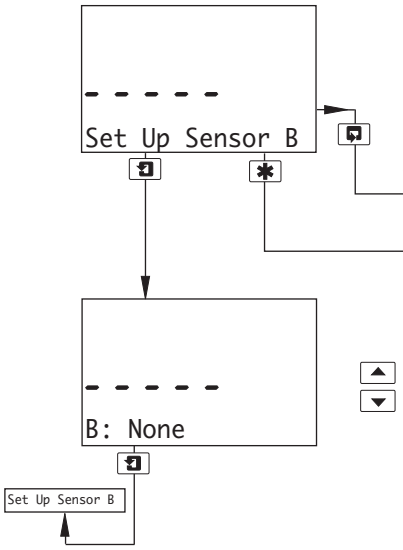
Select Sensor Type
Select the sensor type connected to sensor input A.
7320 100 – Low Range 0 to 20mgl^{-1} C
7320 200 – High Range 0 to 100mgl^{-1} C

Note. **DO NOT** select option 7330 100. The hardware is incompatible.

Reference Factor
Set to 1.000.

Reference Signal Lower Limit
Set the reference signal level at which the Low Signal status message is displayed (default = 25%), between 0 and 25% in 1% increments – see Table 9.1 on page 54.

…7.1 Factory Settings



Set Up Sensor B

Factory Cal. A Continued on next page.

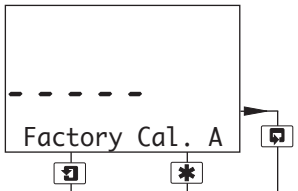
Diss. Organics *Operating Page* – see Section 2.3.

Select Sensor Model

For single input monitors, the display appears as shown.

For dual input monitors, Sensor B type selection is identical to Sensor A.

…7.1 Factory Settings



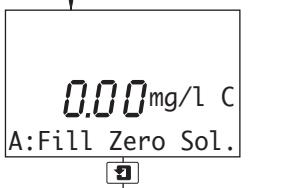
Calibrate Sensor A

Note. The Factory Calibration matches the specific linearity characteristics of the sensor to the transmitter.

Factory Cal. B — Sensor B calibration (dual input monitors only) is identical to Sensor A calibration.

Cal. Output 1 — Single input monitors only – continued on page 46.

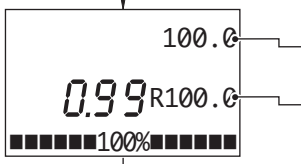
Diss. Organics — *Operating Page* – see Section 2.3.



Zero Calibration
Fill the flowcell with de-ionized water.

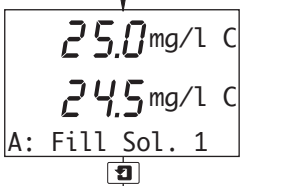
Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before calibration is complete, the calibration is aborted and the display advances automatically to the next step.



Raw Output from Sensor
Organic signal

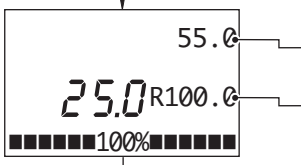
Reference signal
As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next step.



Calibrate with Solution 1
Fill the flowcell with a 5mgl^{-1} (7320 100 sensor) or 25mgl^{-1} (7320 200 sensor) span standard solution prepared from the stock standard solution – see Section 4.1.2.

Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before calibration is complete, the calibration is aborted and the display advances automatically to the next step.

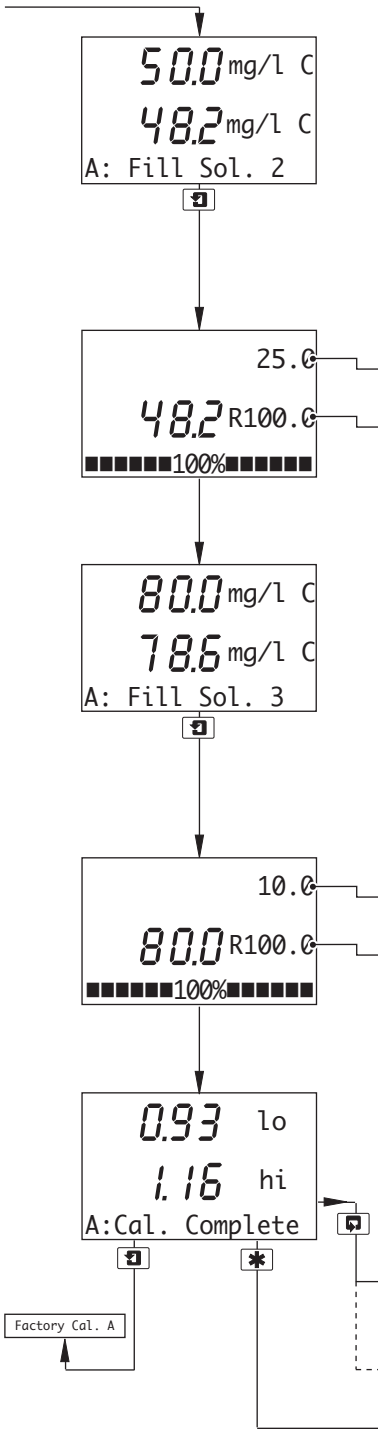


Raw Output from Sensor
Organic signal

Reference signal
As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next step.

A: Fill Sol. 2 — Continued on next page.

…7.1 Factory Settings



Calibrate with Solution 2
Fill the flowcell with a 10mgl^{-1} (7320 100 sensor) or 50mgl^{-1} (7320 200 sensor) span standard solution prepared from the stock standard solution – see Section 4.1.2.

Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before calibration is complete, the calibration is aborted and the display advances automatically to the next step.

Raw Output from Sensor
Organic signal

Reference signal
As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next step.

Calibrate with Solution 3
Fill the flowcell with a 15mgl^{-1} (7320 100 sensor) or 80mgl^{-1} (7320 200 sensor) span standard solution prepared from the stock standard solution – see Section 4.1.2.

Press the ↵ key to initiate calibration.

Note. If the ↵ key is pressed again at any time before calibration is complete, the calibration is aborted, the display advances automatically to the next frame and **A:Cal Incomplete** is shown on the lower display line.

Raw Output from Sensor
Organic signal

Reference signal
As calibration proceeds, a progress indicator appears in the lower display line. After 3 minutes, the lower display line shows ■■■■■■100%■■■■■■, the display then advances automatically to the next step.

Calibration Completed
Cal Complete is displayed to indicate a successful calibration.

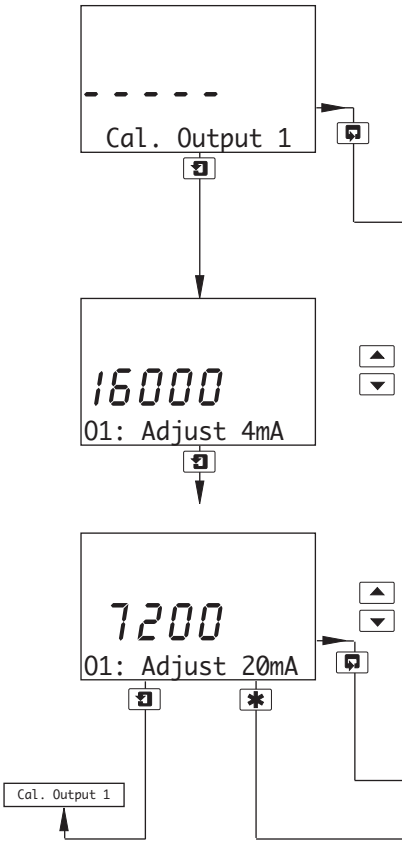
Note. **Cal Incomplete** is displayed if ***any*** part of the is calibration is aborted.

Factory Cal. B — Sensor B calibration (dual input monitors only) is identical to Sensor A calibration.

Cal. Output 1 — Single input monitors only – continued on page 46.

Diss. Organics — *Operating Page* – see Section 2.3.

…7.1 Factory Settings



Calibrate Output 1

Note. When adjusting the 4 and 20mA output values, the display reading is unimportant and is used only to indicate that the output is changing when the ▲ and ▼ keys are pressed.

Cal. Output 2 See below.

Adjust 4mA
Set the milliammeter reading to 4mA.

Note. The analog output range selected in **Configure Outputs** (see Section 5.5) does not affect the reading.

Refer to Fig. 6.11 for connection details.

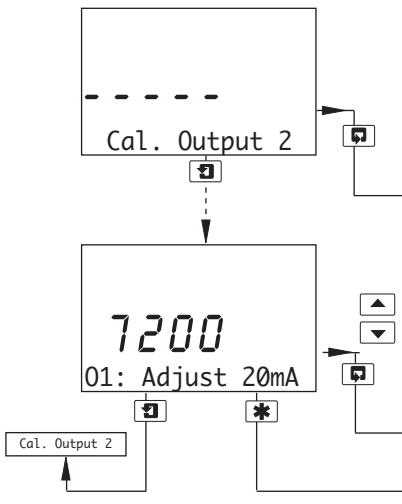
Adjust 20mA
Set the milliammeter reading to 20mA.

Note. The analog output range selected in **Configure Outputs** (see Section 5.5) does not affect the reading.

Refer to Fig. 6.11 for connection details.

Cal. Output 2 Continued below.

Diss. Organics *Operating Page* – see Section 2.3.



Calibrate Output 2

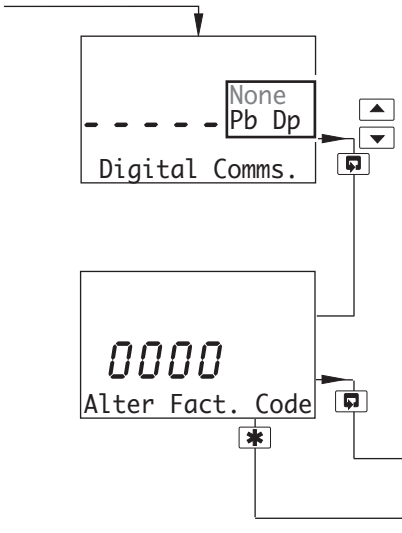
Note. Output 2 calibration is identical to Output 1 calibration.

Option Board Continued on next page.

Option Board Continued on next page.

Diss. Organics *Operating Page* – see Section 2.3.

...7.1 Factory Settings



Configure Digital Communications Option Board

Select the communications mode required:

`Pb Dp` – PROFIBUS-DP digital communications enabled
`None` – Digital communications disabled

Alter Factory Code

Set the factory settings access code to a value between 0000 and 19999.

FACTORY SETTINGS Return to main menu.

Diss. Organics *Operating Page* – see Section 2.3.

8 SENSOR MAINTENANCE

8.1 Scheduled Maintenance

Warning. DO NOT open the emitter module. It uses high voltages that can cause serious injury or death.

Note. The emitter and receiver modules contain no user-serviceable parts and are sealed in clean and dry conditions at the factory. Opening them will lead to degraded performance. See also the **Warning** above.

The following maintenance schedule is a general guide only. The systems are designed for a wide range of applications where the nature of the sample can vary considerably, therefore it is necessary to amend the schedule to suit the particular installation and sample conditions.

8.2 Cleaning the Sensor

Routine maintenance is limited to cleaning out the flowcell manually to remove accumulated fouling or sediment. The flowcell ***must*** be cleaned prior to calibration (see Section 4) to ensure that the Zero and Span standards are not contaminated by organic matter that may be present inside.

8.2.1 Dismantling and Cleaning – Figs. 8.1 to 8.4

Warning. Isolate the transmitter and sensor from the power supply before dismantling the sensor.

Warning. The sensor emitter module contains a high intensity xenon strobe lamp that emits ultraviolet (UV) radiation. ***This must NOT be viewed with the naked eye and must NEVER be operated while outside the sensor***. Under normal operating conditions, it is not possible to see the light source but, if the sensor is dismantled with electrical power applied, it may be possible to expose the eyes to the strobe flash.

Notes.

- The emitter and receiver modules contain precision optical components and must be handled accordingly.
- The emitter module contains the power supply, voltage control and lamp components. As a result, it is heavy and requires extra support.
- Do not support the modules by the cable(s) entering their enclosures.
- Ensure that the O-rings are removed with the screw collars securing the cleaner, emitter and receiver modules; it is possible for these seals to be left inside the flowcell.

…8.2.1 Dismantling and Cleaning – Figs. 8.1 to 8.4

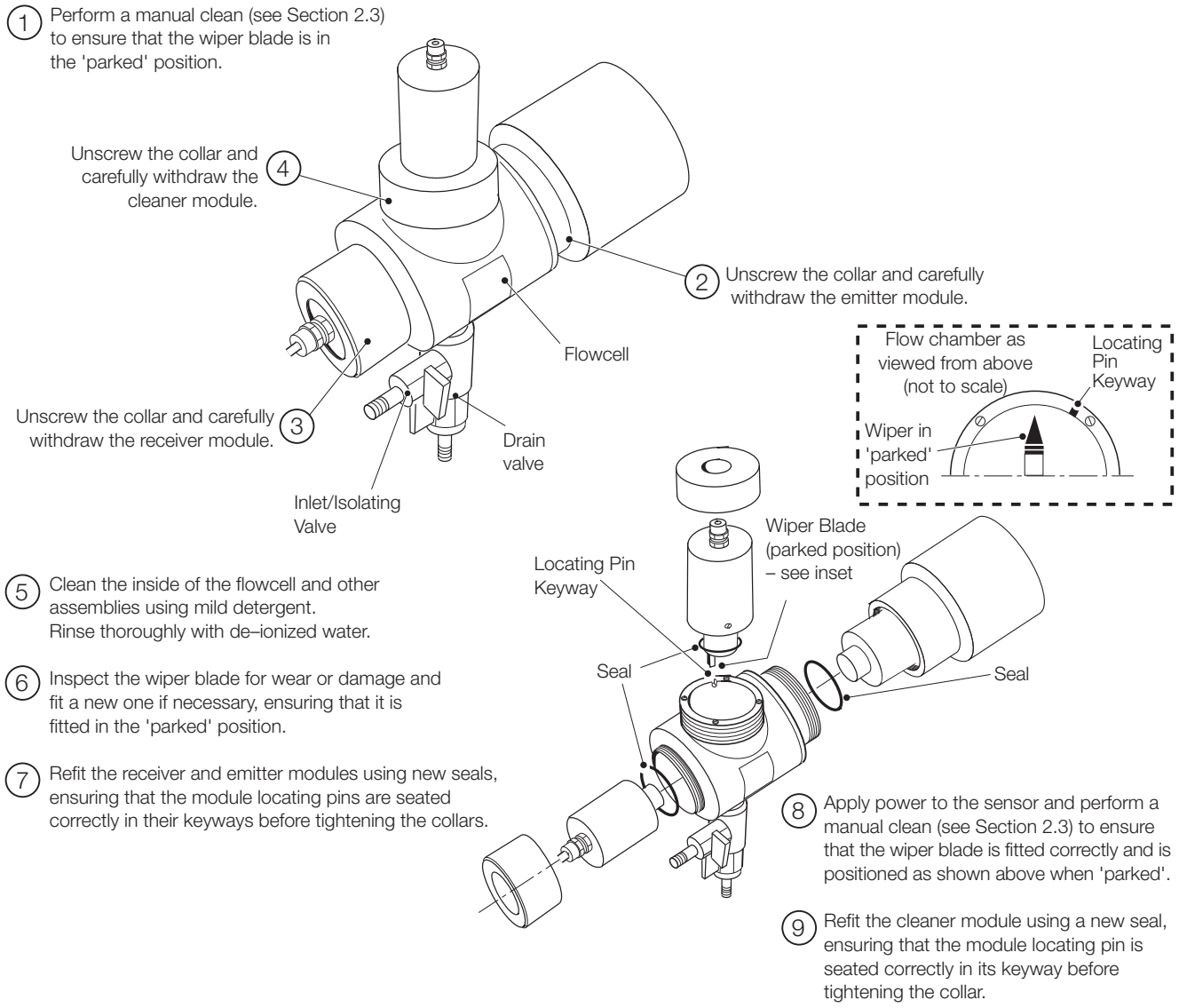
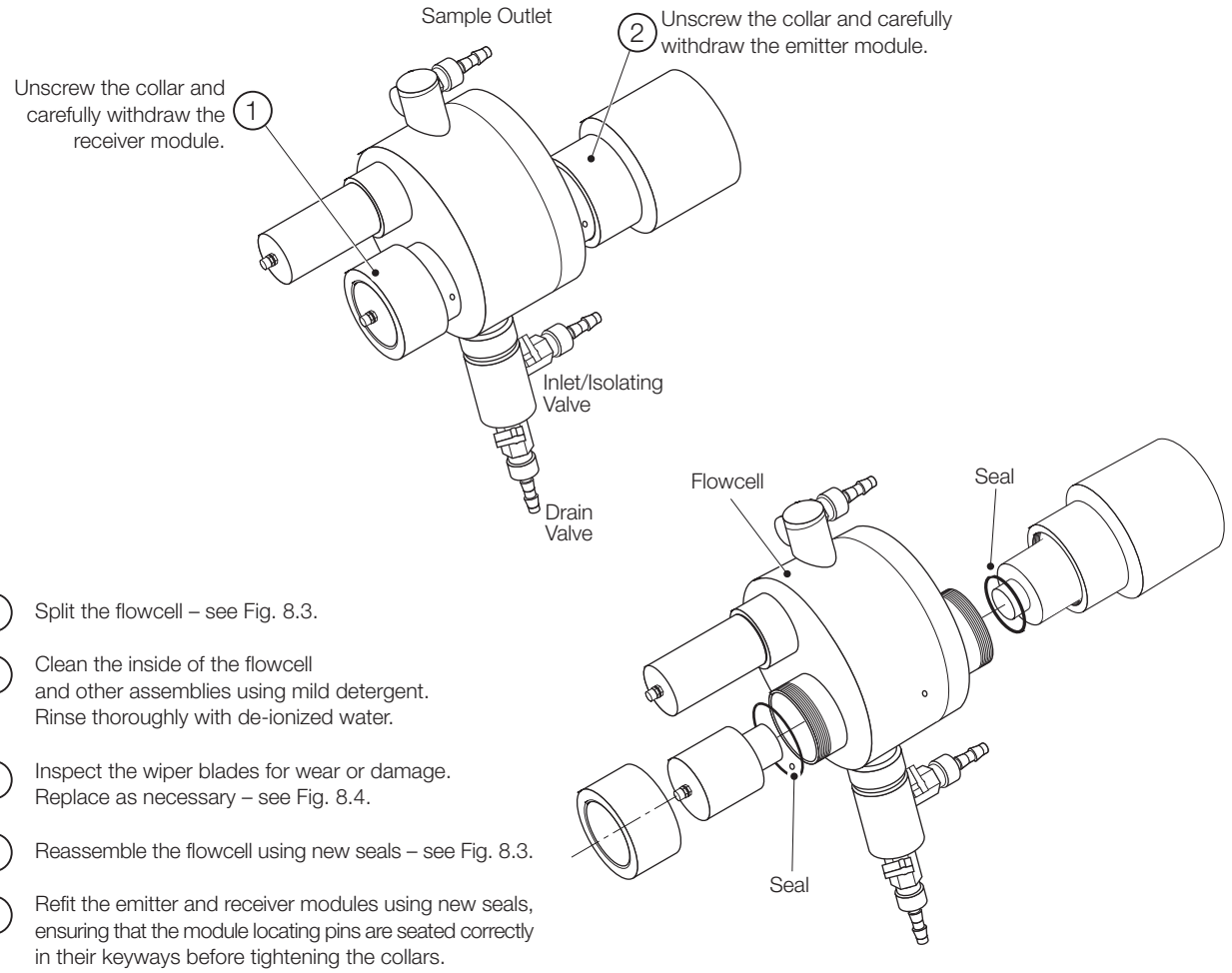


Fig. 8.1 7320 100 Low Range Sensor – Dismantling and Cleaning

…8.2.1 Dismantling and Cleaning – Figs. 8.1 to 8.4

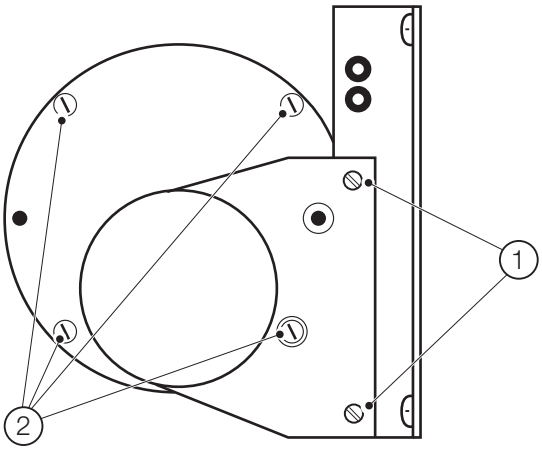


3. Split the flowcell – see Fig. 8.3.
4. Clean the inside of the flowcell and other assemblies using mild detergent. Rinse thoroughly with de-ionized water.
5. Inspect the wiper blades for wear or damage. Replace as necessary – see Fig. 8.4.
6. Reassemble the flowcell using new seals – see Fig. 8.3.
7. Refit the emitter and receiver modules using new seals, ensuring that the module locating pins are seated correctly in their keyways before tightening the collars.

Fig. 8.2 7320 200 High Range Sensor – Dismantling and Cleaning

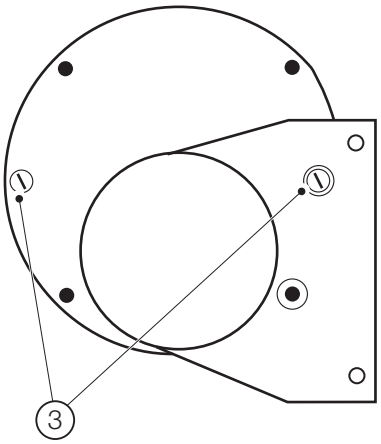
…8.2.1 Dismantling and Cleaning – Figs. 8.1 to 8.4

View from emitter end



1 Remove the two screws securing the mounting plate to the angle bracket.

2 Remove the four stainless steel screws holding the flowcell halves together.

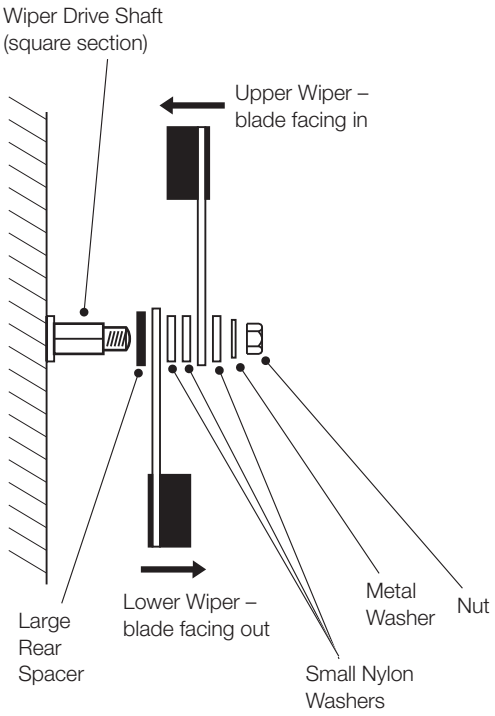


3 Insert two of the stainless steel screws into the holes indicated and screw them in them slowly and evenly to push the cell halves apart. When the O-ring seal is clear of the body, the cell halves should separate easily.

Note. Reassembly is the reverse of dismantling.

Fig. 8.3 7320 200 High Range Sensor – Splitting the Flowcell

…8.2.1 Dismantling and Cleaning – Figs. 8.1 to 8.4



Notes.

- The proper functioning of the cleaner system depends on the correct assembly of the washers and orientation of the wiper blades.
- Do not use the wiper blade arms to rotate the wiper drive shaft.

1. Remove the wiper blade securing nut.
2. Remove the blades and washers from the drive shaft.
3. Ensure the blade drive shaft is correctly positioned by performing a manual clean (see Section 2.3) to 'park' the blades.
4. Reassemble the components on the drive shaft in the order shown, ensuring the wiper blades are in the parked position, i.e. horizontal.
5. Using suitable spanners, prevent the wiper drive shaft from turning and tighten the wiper blade securing nut.
6. Perform a manual clean (see Section 2.3) to check system operation. Ensure blades 'park' correctly.

Wiper Blades in the Parked Position

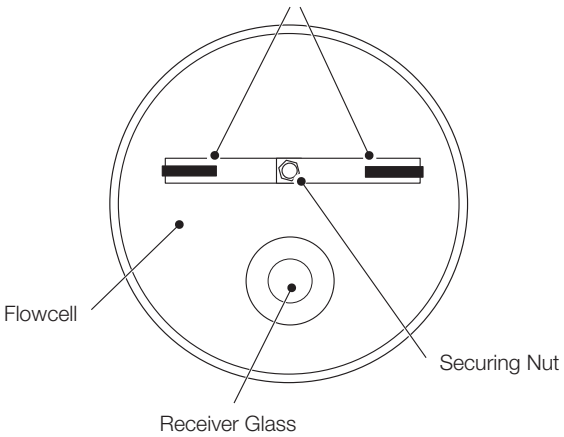


Fig. 8.4 7320 200 High Range Sensor – Replacing the Wiper Blades

8.3 Replacing the Emitter and Receiver Modules

Notes.

- The emitter and receiver modules are matched during manufacture. If either module fails, return both to the Company for repair/replacement.
- Refer to the Warnings and Notes in Sections 8.1 and 8.2.1 before removing the modules from the flowcell.
- Under **NO** circumstances dismantle the modules.

1) Isolate the system from the power supply.
2) Disconnect the cables from the emitter and receiver modules.
3) Refer to Fig. 8.1 (7320 100 Low Ranger Sensor) or Fig. 8.2 (7320 200 High Range Sensor) and remove the emitter and receiver modules.
4) Refer to Fig. 8.1 (7320 100 Low Ranger Sensor) or Fig. 8.2 (7320 200 High Range Sensor) and fit the new modules.
5) Refer to Fig. 6.11 and reconnect the emitter and receiver cables.
6) Restore the power supply to the system and allow to warm up for five minutes.
7) Adjust the emitter brightness – see Section 8.4.

8.4. Adjusting the Emitter Brightness

1) Fill the flowcell with high purity water.
2) Select the **TEST/MAINTENANCE** Page (see Section 5.9).
3) Scroll to the **Org. Totals** frame (page 28) for the relevant sensor.
4) Remove the small plug on the left hand side of the emitter module.
5) Using a long, small-bladed screwdriver, adjust the multi-turn potentiometer until **Span A** (or **Span B**) value reads **100** ±10.

Note. If this value cannot be obtained, contact the Company.

6) Check that the **Span A** values in the **Org. Peak** and **Ref. Peak** frames are between 200 and 250.

Note. If these values are outside the limits, contact the Company.

7) Refit the plug removed at step 4.
8) Calibrate the sensor – see Section 4.2.
9) Return the system to normal operation.

9 DIAGNOSTICS

9.1 Status Messages

The diagnostic facilities incorporated in the software displays the appropriate system status message (see Table 9.1) in the *Operating Page* (see Section 2.3) if a fault is detected.

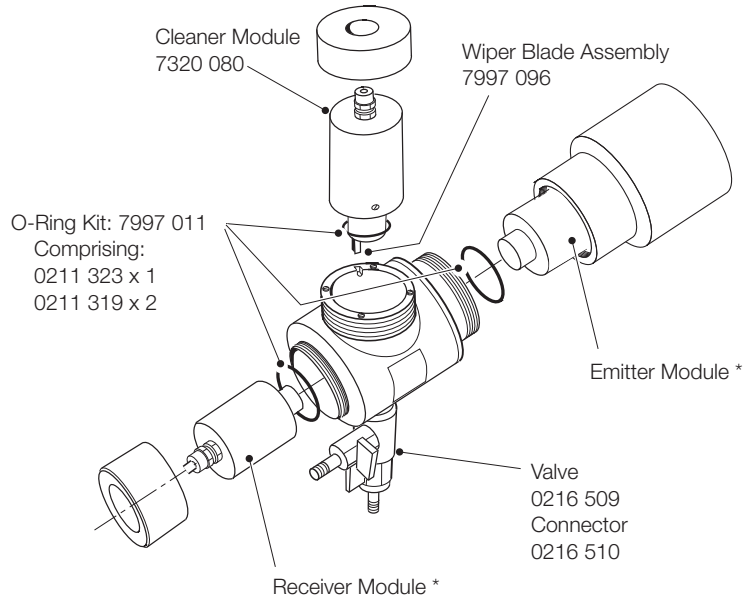
Status Message	Cause	Action
A: Lamp Disabled B: Lamp Disabled	The sensor lamp has been disabled manually in the *Operating Page*.	See Section 2.3.
A: Out of Sample B: Out of Sample	Loss of sample/flow pressure detected by the external sample switch contact.	Restore sample/flow pressure.
A: Low Signal B: Low Signal	No signal received from the sensor. Possible causes are:	
	a) Sensor requires cleaning.	Clean sensor – see Section 8.2.
	b) Failure of the cleaner module.	Dismantle sensor to reveal wiper blades (see Section 8.2) and check operation of cleaner module by performing a manual clean – see Section 2.3.
	c) Faulty connections between monitor/sensor.	Check monitor/sensor connections – see Section 6.5.
	d) Failure of lamp power supply.	Return the emitter ***and*** receiver modules to the Company for repair.
	e) Failure of the emitter and/or receiver module.	Return the emitter ***and*** receiver modules to the Company for repair.
A: Cleaner Fail B: Cleaner Fail	Failed or jammed cleaner module.	Contact the Company.
Input Brd. Fault 24 V Power Loss 12 V Power Loss Check FlexiCable RAM Fault	Monitor hardware fault.	Contact the Company.

Table 9.1 Status Messages

9.2 Unstable or Erratic Readings

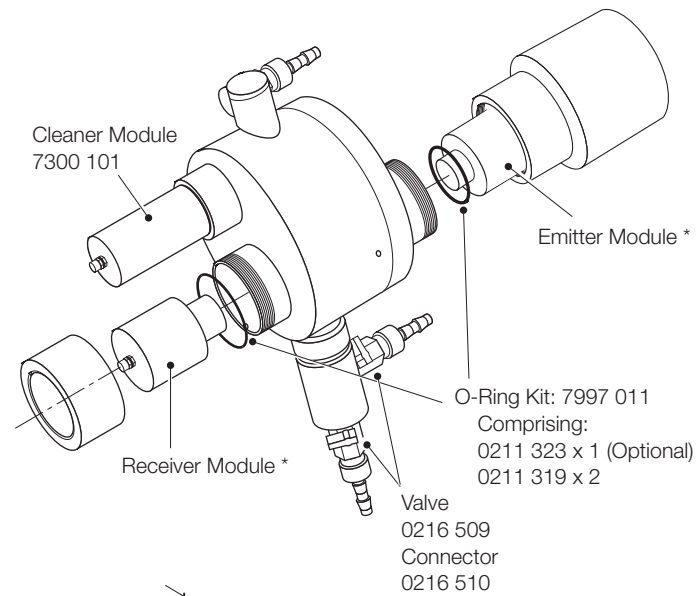
This is usually caused by air bubbles in the sample and is more pronounced on the low level sensor due to its greater sensitivity. These bubbles are usually as a result of degassing of the sample caused by either a drop in sample pressure or a rise in sample temperature. Cleaning the optical windows and increasing the flow through the flowcell usually overcomes the problem but if it is severe, install a de-bubbler unit – see Section 6.4.

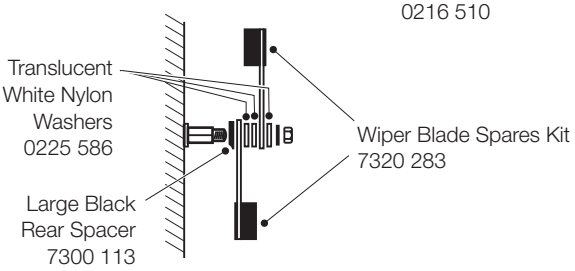
If erroneous or unexpected results are obtained the fault may be indicated by an error message – see Table 9.1. However, some faults may cause problems with monitor calibration or give discrepancies when compared with independent laboratory measurements.



* Emitter and Receiver Modules (matched pair) – 7320 181

Fig. 10.1 7320 100 Spares





* Emitter and Receiver Modules (matched pair):
7320 181 Low Range Organics (7320 100)
7320 281 High Range Organics (7320 200)

Fig. 10.2 7320 200 Spares

Description	Part Number
AV400 Monitor	Contact the Company
Processor and Main PSU/P Board (85 to 260V AC)	AX400/0249
Processor and Main PSU/P Board (12 to 30V DC)	AX400/0259
AV400 EPROM	AX400/2000
Display Module	AX400/0295
Multifunction Board (85 to 260V AC)	AX400/0425
Multifunction Board (12 to 30V DC)	AX400/0426
UV Scanning Input Board	AX400/0415
Seal – Terminal Cover	AX400/0119
Seal – Main Case	AX400/0118
Pipe Mounting Kit	AX400/0090

Table 10.1 AV400 Monitor Spares

Specification

General

Sensor range

(Based on potassium hydrogen phthalate calibration standards)

AV410/411	Low range 0 to 20mgl^{-1}C
AV420/422	High range 0 to 100mgl^{-1}C

Linearity

Low range	±2% of reading or 0.15mgl^{-1} C whichever is the greater
High range	±2% of reading or 0.5mgl^{-1} C whichever is the greater

Reproducibility

Low range	±0.15mgl^{-1} C
High range	±0.5mgl^{-1} C

Inferred units

Absorbance units/metre

Color (°H)

Coagulant dose (mgl^{-1})

TOC (mgl^{-1})

User Defined

Maximum current output scale expansion

Low range	0 to 2mgl^{-1} C
High range	0 to 20mgl^{-1} C

Response time

Normally three minutes for 90% step change depending on damping factor

Lamp life

Rated by the manufacturer at 1.2 x 10^9 flashes
(10 years continuous operation at the rate of one flash at 2s intervals [typical] equates to 13.1% of the rated lamp life)

Internal wiper cleaning system

Programmable, operation frequency 15, 30, 45 and 60 minutes 2, 4, 6, 12 and 24 hours

Maximum distance between transmitter and sensor

750mm (29.5 in.)

Sample

Flow rate

0.5 to 5l min^{-1} (free of air bubbles).
A higher flow rate is required at high turbidity levels

Temperature

0 to 40°C (32 to 104°F)

Pressure

The sensor should be operated at atmospheric pressure but can withstand 3bar (43.4 psi) max.

Display

Type

Dual 4$^1/_2$-digit, 7-segment backlit LCD

Information

16-character, single line dot matrix

Resolution

Low range	0.01mgl^{-1}
High range	0.1mgl^{-1}

Energy saving function

Backlit LCD configurable as ON or Auto Off after 60 seconds

Logbook

Electronic record of major events and calibration data

Real-time clock

Records time for logbook and auto cleaning

Diagnostics

Out of sample

Lamp disabled

Loss of signal

Electronic failure

Languages

English

French

German

Italian

Spanish

Outputs

Current Outputs

Number of signals

2 fully isolated current outputs supplied as standard, configurable to one or both sensor outputs

Current outputs also programmable to any value between 0 and 22mA to indicate system failure

Output current

0 to10mA, 0 to 20mA or 4 to 20mA

Maximum load resistance

750Ω at 20mA

Accuracy

±0.25% FSD ±5% of reading

Resolution

0.1% at 10mA, 0.05 at 20mA

Serial communication

PROFIBUS

Relay outputs

Number of relays

Three supplied as standard,
configurable to one or both sensor inputs or status

Set point adjustment

Fully programmable as normal or failsafe, high/low or status

Hysteresis

Programmable 0 to 5% in 0.1% increments

Delay

Programmable 0 to 100 minutes in 1 minute intervals

Relay contacts

Single-pole changeover

Rating 5A 115/230V AC, 5A DC

Insulation

2kV RMS contacts to earth/ground

Power supply

Voltage requirements

100 to 240 V AC, 50/60 Hz
(90 V Min. to 264 V Max. AC)

Optional 12 to 30 V DC

Power consumption

20 W

Insulation

Mains to earth (line to ground) 2kV RMS

Mechanical Data

Transmitter

IP65 (not evaluated under UL certification)

Dimensions 192mm (7.56 in.) high x 230mm (9.06 in.) wide x 94mm (3.7 in.) deep

Weight	1kg (2.2 lb)

Sensor

Low Range	Dimensions 327mm (12.87 in.) wide x 410mm (16.14 in.) high x 162mm (6.38 in) deep
High Range	Dimensions 405mm (15.94 in.) wide x 373mm (14.68 in.) high x 136mm (5.35 in) deep
Weight	6kg (13.2 lb)

Cable entry types

Standard	5 or 7 x M20 cable glands
N. American	7 x knockouts suitable for ½ in. Hubble gland

Environmental Data

Operating temperature limits

0 to 50°C (32 to 122°F)

Storage temperature limits

–25 to 75°C (–13 to 167°F)

Operating humidity limits

Up to 95%RH non-condensing

EMC emissions and immunity

Meets requirements of:

EN61326 (for an industrial environment)

EN50081-2

EN50082-2

Approvals, Certification and Safety

Safety approval

UL

CE Mark

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

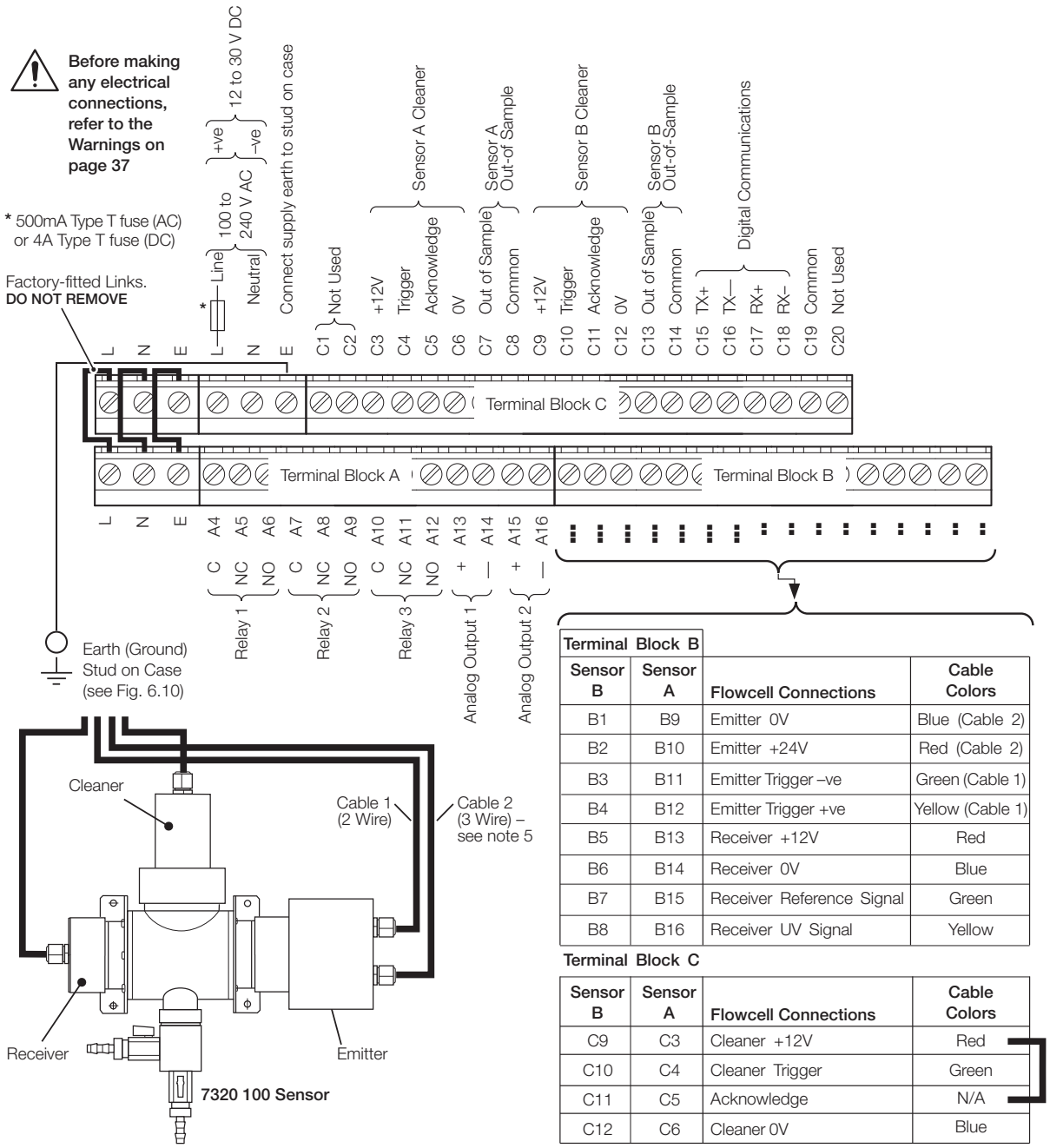
General safety

EN61010-1

Overvoltage Class II on inputs and outputs

Pollution Category 2

APPENDIX A REPLACING A 7320 TRANSMITTER WITH AN AV400



Terminal Block B

Sensor B	Sensor A	Flowcell Connections	Cable Colors
B1	B9	Emitter 0V	Blue (Cable 2)
B2	B10	Emitter +24V	Red (Cable 2)
B3	B11	Emitter Trigger –ve	Green (Cable 1)
B4	B12	Emitter Trigger +ve	Yellow (Cable 1)
B5	B13	Receiver +12V	Red
B6	B14	Receiver 0V	Blue
B7	B15	Receiver Reference Signal	Green
B8	B16	Receiver UV Signal	Yellow

Terminal Block C

Sensor B	Sensor A	Flowcell Connections	Cable Colors
C9	C3	Cleaner +12V	Red
C10	C4	Cleaner Trigger	Green
C11	C5	Acknowledge	N/A
C12	C6	Cleaner 0V	Blue

Notes.

1) The screens of the sensor's emitter, receiver and cleaner cables must be enclosed in yellow/green sleeving and connected to the earth (groud) stud fitted to the transmitter case closest to the cable's entry point – see Fig A.1.
2) Dual input versions – connect each sensor to the correct input terminals (A or B) as indicated on the sensor's cables.
3) Use the three-hole cable gland provided with the sensor for the sensor cables.
4) Fit a link between C3 and C5. This stops a false Cleaner Fail messages occuring, as the 7320 system cleaner module does not generate the Cleaner Acknowledge signal used in the AV400 for the Cleaner Fail Diagnostic.
5) Remove the existing tag from the green wire and fit an eyelet tag. Connect the green wire (Cable 2) to the AV400 Transmitter earth (ground) stud.
6) Tighten the terminal screws to a torque of 0.60 Nm (5.3 lbf. in.).

Fig. A.1 Connections

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.

Contact us

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