AWT420

Universal 4-wire, dual-input transmitter

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Measurement made easy

Introduction

The AWT420 is a universal 4-wire, dual-input transmitter suitable for the measurement and control of a wide range of parameters including pH, ORP, conductivity, turbidity/suspended solids, dissolved oxygen, chlorine, and UIM.

The AWT420 supports both traditional analog and advanced digital EZLink sensors.

This Operating Instruction provides the operation and maintenance procedures for the AWT420 transmitter for use in nonhazardous areas.

For information on the AWT420 transmitter for use in hazardous areas, refer to INF/ANAINST/012.

For information on the sensors, including installation, commissioning, operation and maintenance procedures, refer to the specific sensor manual.

For more information

Further publications for the AWT420 transmitter are available for free download from:
www.abb.com/measurement
or by scanning this code:

Links and reference numbers for the transmitter publications are also shown below:

	Search for/click on:
AWT420 transmitter – Data Sheet	DS/AWT420
AWT420 transmitter – Commissioning Instruction	CI/AWT420
AWT420 transmitter – Hazardous area information	INF/ANAINST/012
AWT420 transmitter – HART Communications Supplement	COM/AWT420/HART
AWT420 transmitter – HART FDS Communications Supplement	COM/AWT420/HART/FDS
AWT420 transmitter – PROFIBUS Communications Supplement	COM/AWT420/PROFIBUS
AWT420 transmitter – MODBUS Communications Supplement	COM/AWT420/MODBUS
AWT420 transmitter – Ethernet Communications Supplement	COM/AWT420/ETHERNET

Contents

1 Health & Safety 4
Document symbols 4
Safety precautions 4
Potential safety hazards 4
AWT420 transmitter – electrical 4
Safety standards 4
Product symbols 4
Product recycling and disposal (Europe only) 5
End-of-life battery disposal 5
Information on RoHS Directive 2011/65/EU (RoHS II) . 5
Cleaning 5

2 Cybersecurity 5
Communication protocol-specific security 5

3 Overview 6

4 Calibration and sensor setup 7

5 Hot plug-in (EZLink sensors only) 7
Sensor setup parameters 7
Transmitter configuration parameters 7
Sensor addition 8
Sensor replacement 8
Replacing the sensor with a sensor of the same type 8
Keep existing transmitter setup parameters for use with the new sensor 8
Replacing a sensor with a sensor of a different type 9
Sensor removal 9
Permanently remove a sensor 9
Temporarily remove a sensor 9
Device behavior on sensor removal 9

6 Operation 10
Front panel keys 10
Modes of operation 11
Operator menus 11
Operating modes 12
View mode 14
Diagnostics View 14
Signals View 14
Chart View 14
Alarms View 14
Outputs View 14
Log mode 15
Log entries 15

7 Data logging 16
SD card 16
Install the SD card 16
Remove the SD card 16
Archive file types 17
Data files 17
Log files 17
Daylight saving 17
Start of daylight saving period 17
End of daylight saving period 17

8 Password security and access level 18
Setting passwords 18
Access Level 18

9 Bluetooth capability and the EZLink Connect app 19
Download EZLink Connect for Android™ 19
Download EZLink Connect for iOS® 19
Pair your mobile device to a transmitter 19
Bluetooth menus 19
Operating system requirements 19

10 Software upgrade 20
EZLink Connect 20
PC/laptop 20
SD card 20
FTP 20
Transmitter/sensor upgrade via Bootloader 20
Factory reset via Bootloader 21

11 Display icons 22
Diagnostic icons 22
NAMUR icons 22
Alarm, hold, and clean icons 22
Title bar icons 22
Status bar icons 23
Log icons 23

12 Configuration (Advanced access level) 24
Calibrate 25
Sensor Setup 26
Device Setup 26
Display 27
Process Alarm 31
Process alarm examples 31
Media Card 32
Control 33
Communication 35
Device Info 36
Analog sources and digital input/output sources 37
Analog sources 37
Digital output sources 37
Digital input sources 37

13 Sensor setup menus 38
2-electrode conductivity 38
2-electrode conductivity – dual-input calculated values setup 39
4-electrode conductivity 40
pH/Redox/ORP 41
Turbidity 42
Turbidity/Suspended solids 43
Dissolved oxygen 43
ACL410 chlorine 43
ACL420 chlorine 43
Universal Input Module – custom sensor type 44
Universal Input Module calculations 47
PV calculations 47
SV calculations 47
Sensor setup menus – dual verification 48

14 Calibration procedures. 49
2-electrode conductivity. 49
2-electrode conductivity, resistivity or concentration calibration 50
4-electrode conductivity 52
4-electrode conductivity calibration. 53
pH/Redox/ORP 54
pH/Redox/ORP calibration. 55
1-Point calibration 55
2-Point calibration 56
1-Point automatic calibration. 59
2-Point automatic calibration. 60
In Process calibration (pH) 61
Sample collection. 62
Sample complete 63
Temperature calibration 64
Turbidity. 65
Sensor verification. 65
To perform a calibration: 67
Zero calibration (Formazine) 67
Span calibration (Formazine) 67
Zero calibration (Dry Standard). 67
Span calibration (Dry Standard) 67
Turbidity Total Suspended Solids (TSS) 70
Turbidity TSS sensor verification 71
Preparing the verification tool and locking the sensor in place. 71
Turbidity TSS calibration. 72
1-Point calibration 72
2-Point calibration 73
TSS calibration 74
1-Point calibration 74
2-Point calibration 75
TSS manual calibration 77
In Process calibration. 77
Sample collection. 77
Collection complete. 78
Universal Input Module 80
PV Span Calibration. 80
PV Zero Calibration 82
Automatic zero calibration 82
Chlorine calibration 83
ACL410 calibration. 83
ACL420 calibration. 83
Dissolved oxygen calibration. 83

15 Troubleshooting. 84
Diagnostic messages. 84
AWT420 transmitter diagnostics 85
2-electrode conductivity diagnostics. 86
4-electrode conductivity diagnostics. 87
pH diagnostics. 88
Turbidity diagnostics. 90
TSS diagnostics 91
Universal Input Module diagnostics 93
Chlorine diagnostics 94
Dissolved oxygen diagnostics. 94

Appendix A PID control. 95
Operator pages 95
Reverse or direct-acting control 95
Dual-acting (Acid and Base) control. 95
Operator menus. 96
Control action. 96
Reverse-acting control 96
Direct-acting control. 96
Dual-acting control 97
Manual Reset (proportional band offset) 97
Output type. 98
Analog output 98
Time proportioning output. 98
Pulse frequency output 98

Appendix B Spares. 99
Sensor module assemblies. 99
AWT420 pH/ORP PCB upgrade/spares kit 99
AWT420 2-electrode conductivity PCB upgrade/ spares kit 99
AWT420 4-electrode conductivity PCB upgrade/ spares kit 99
AWT420 Turbidity PCB upgrade/spares kit 99
AWT420 Universal Input Module upgrade/ spares kit 99
EZLink module assemblies 99
AWT420 EZLink PCB upgrade/spares kit 99
AWT420 EZLink HazLoc PCB upgrade/ spares kit 99
Communications module assemblies 100
AWT420 HART PCB upgrade/spares kit. 100
AWT420 Profibus PCB upgrade/spares kit. . . . 100
AWT420 Modbus PCB upgrade/spares kit 100
AWT420 Ethernet PCB upgrade/spares kit. . . . 100
AWT420 analog output PCB upgrade/ spares kit 100
Mounting kits 100
Panel-mount kit 100
Pipe-mount kit 100
Wall-mount kit. 100
Weathershield kits 100
Weathershield kit 100
Weathershield and pipe-mount kit 100
Gland packs. 101
Standard cable glands 101
EZLink connectors/cables 101
EZLink and EZLink HazLoc connector assembly. 101
EZLink extension cable assembly 101

1 Health & Safety

Document symbols

Symbols that appear in this document are explained below:

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Note
'Note' indicates useful or important information about the product.

Safety precautions

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

⚠ WARNING

Bodily injury

Installation, operation, maintenance and servicing must be performed:

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

Potential safety hazards

AWT420 transmitter – electrical

⚠ WARNING

Bodily injury

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

- Up to 240 V AC may be present. Be sure to isolate the supply before removing the terminal cover.

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

Safety standards

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

Product symbols

Symbols that may appear on this product are shown below:


Protective earth (ground) terminal.


Functional earth (ground) terminal.

Alternating current supply only.

Direct current supply only.


This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and/or death. The user should reference this instruction manual for operation and/or safety information.


This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.


The equipment is protected through double insulation.


Recycle separately from general waste under the WEEE directive.

Product recycling and disposal (Europe only)

ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible. The European Waste Electrical and Electronic Equipment (WEEE) Directive that initially came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life-cycle of electrical and electronic equipment. In conformity with European local and national regulations, electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.

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

End-of-life battery disposal

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

Information on RoHS Directive 2011/65/EU (RoHS II)

ABB, Industrial Automation, Measurement & Analytics, UK, fully supports the objectives of the ROHS II directive. All in-scope products placed on the market by IAMA UK on and following the 22nd of July 2017 and without any specific exemption, will be compliant to the RoHS II directive, 2011/65/EU.

Cleaning

The complete transmitter can be hosed down if it has been installed to IP66/NEMA 4X standards, i.e., cable glands are correctly fitted and all unused cable entry holes are blanked off.

Warm water and a mild detergent can be used.

2 Cybersecurity

This product and the EZLink Connect app is designed to be connected to and to communicate information and data via a digital communication interface.

It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be). You shall establish and maintain any appropriate measures (such as but not limited to the application of authentication measures etc.) to protect the product, the EZLink Connect app, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB provides functionality testing on the products and updates that we release, you should institute your own testing program for any product updates or other major system updates (to include but not limited to code changes, configuration file changes, third-party software updates or patches, hardware change out, etc.) to ensure that the security measures that you have implemented have not been compromised and system functionality in your environment is as expected.

Communication protocol-specific security

The HART® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

The Modbus® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

The PROFIBUS® PA protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

The PROFIBUS DP protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

3 Overview

The AWT420 is a universal 4-wire single or dual-input transmitter suitable for the measurement and control of a wide range of parameters including pH, ORP, conductivity, turbidity/ suspended solids and dissolved oxygen (depending on the module[s] fitted).

Sensor and communication modules plug directly into their corresponding slot on the transmitter backboard.

The AWT420 supports both traditional analog and advanced digital EZLink™ sensors. The transmitter can be wall, panel or pipe mounted.

Information from the sensor is sent to the transmitter via a sensor interface board. The process reading is displayed on the main page and can be displayed as a graph in the **Chart View** – refer to page 14 for details of view options.

Diagnostic messages inform the user of the system status and can be logged for review. The system status can also be assessed remotely using optional HART®, Modbus®, PROFIBUS® or Ethernet communications.

Installation and commissioning is simplified with plug-and-play digital sensor connections and automatic sensor recognition and set-up.

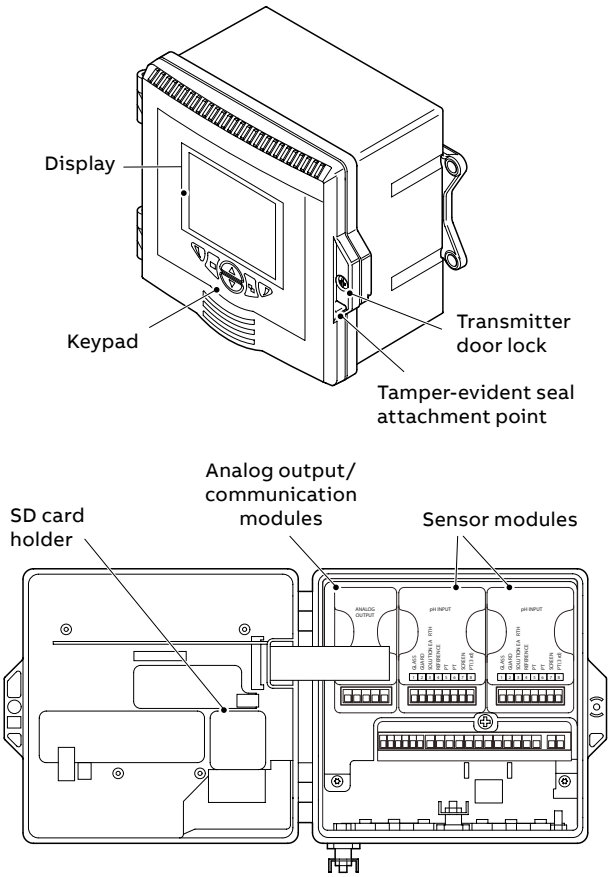


Figure 1 AWT420 transmitter – main components

4 Calibration and sensor setup

NOTICE

Do not attempt to setup the transmitter unless both the sensor and transmitter are fully installed and ready for operation.

The menu structure, general operation and menu descriptions are detailed on page 24.

Refer to page 10 for details of menu navigation and parameter selection/adjustment.

Ensure all electrical connections have been made correctly and switch on the power to the transmitter. If the sensor is being commissioned for the first time, sensor calibration and set-up is recommended for best results.

5 Hot plug-in (EZLink sensors only)

Hot plug-in is a feature of the AWT420 transmitter that enables sensors to be added, removed or replaced without the need to power down the transmitter. The EZLink connector enables sensors to be connected and disconnected without tools and without opening the transmitter enclosure. Hot plug-in also enables a sensor to be configured in one location, then installed in a different location without the need to reconfigure the sensor as all the configuration values are stored in the sensor.

Hot plug-in recognizes both the connection of a replacement sensor to an input channel previously used by another sensor and the connection of a new sensor to a previously unused input channel.

The **Easy Setup** menu is displayed when a new or replacement sensor is connected to the transmitter.

For the purposes of the remainder of this section, the following definitions apply:

Sensor setup parameters

Are those that are sensor-specific and are stored in the sensor (for example, sensor tag, serial number, cleaning interval, units, date of manufacture etc.). For some sensor types, the setup parameters may also include primary variable, measurement units and measurement range. The transmitter maintains a copy of these parameters as long as the sensor is connected.

Transmitter configuration parameters

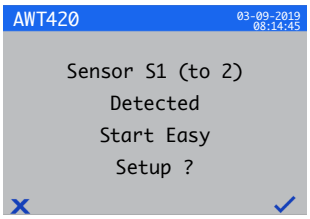
Transmitter configuration parameters are those that define transmitter operation, for example, current output assignment and range, relay and alarm assignment. Some sensor types also store sensor setup parameters in the transmitter.

...5 Hot plug-in (EZLink sensors only)

Sensor addition

To add a new sensor to the unused input channel:

1 Connect the sensor to the transmitter EZLink connector. The transmitter detects the new sensor automatically and loads the sensor setup parameters stored in the sensor. When upload is complete, the **Easy Setup** prompt is displayed:



2 Press the key (✓) to start **Easy Setup** or press the key (✗) to use the sensor setup parameters stored in the sensor.

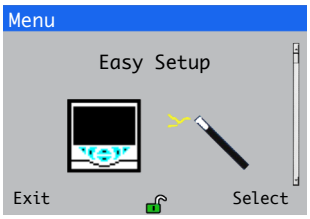
NOTICE

The steps that follow are applicable only if **Easy Setup** is selected.

3 Press the key (**Edit**) to change the default value/setting to the required value/selection. Press the key (**Next**) to accept the default or revised value/selection and advance to the next parameter.

Sensor parameters that can be configured in this way are sensor-specific. Refer to the relevant sensor operating instruction.

4 On completion of **Easy Setup**, the display returns to the **Easy Setup** start screen:



Sensor replacement

A sensor can be replaced by a sensor of the same type or a different type. If a sensor is replaced by one of the same type, the sensor setup parameters from the sensor being removed can be retained (see page 8) for use with the new sensor, or set to use the values stored in the new sensor.

Replacing the sensor with a sensor of the same type

To replace a sensor of the same type and retain existing sensor setup parameters:

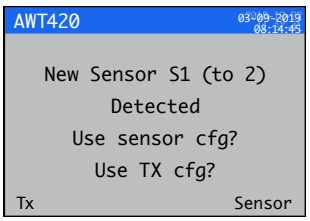
1 Disconnect the old sensor from the EZLink connector. The diagnostic message ⊗ **S1 (to 2):Removed** is displayed in the status bar at the bottom of the main **Operator** page.

Keep existing transmitter setup parameters for use with the new sensor

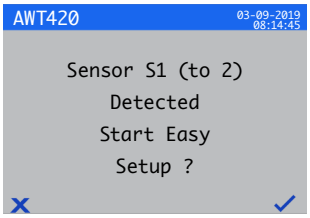
Do not acknowledge sensor removal after the ⊗ **S1 (to 2):Removed** warning is displayed. If sensor removal is acknowledged, the transmitter configuration for the channel is reset to factory defaults.

1 To maintain the value of analog, digital and relay outputs during sensor replacement, press the key and select **Manual Hold** from the Operator page menu.
If a failure current has been configured for an analog output, the output's value is not held. Sensor removal is classed as a failure by the diagnostic system and this overrides the existing analog output current.

2 Connect the new sensor to the same EZLink connector.
A user prompt is displayed asking which configuration to use:



3 Press the (**TX**) to use the sensor configuration saved in the transmitter (used with the sensor previously connected) or press the key (**Sensor**) to use the sensor configuration stored in the new sensor.
The **Easy Setup** prompt is displayed:



4 Press the key (✕) to cancel **Easy Setup** and start measurement using the sensor immediately, or press the key (✓) to edit the sensor configuration using the **Easy Setup** menu.

Replacing a sensor with a sensor of a different type

1 Disconnect the old sensor from the EZLink connector. The diagnostic message ⊗ **S1 (to 2):Removed** is displayed in the status bar at the bottom of the main **Operator** page.

2 Press the key and select **Ack Sensor Removed** from the **Operator** page menu to reset the transmitter configuration parameters for this sensor to factory default values.

3 Connect and configure the new sensor as described on page 8.

Sensor removal

When a sensor is disconnected, the diagnostic message ⊗ **S1 (to 2):Removed** is displayed in the status bar at the bottom of the main **Operator** page.

Permanently remove a sensor

Press the key and select **Ack Sensor Removed** from the **Operator** page menu. This clears all the output settings associated with the input (including analog output sources and alarm sources) and disables any associated digital output and relay sources. If one sensor remains connected, the **Operator page** display for the remaining sensor and any diagnostic messages related to the sensor removed are cleared. If no sensors are connected, the **Operator page** is blank.

Temporarily remove a sensor

Do not acknowledge sensor removal as described above. Sensor setup parameter settings for the input channel are retained.

NOTICE

To maintain the value of analog, digital and relay outputs during temporary sensor removal, press the and select **Manual Hold** from the **Operator** page menu.

If a failure current has been configured for an analog output, the output's value is not held. Sensor removal is classed as a failure by the diagnostic system and this overrides the existing analog output current.

If a sensor is subsequently refitted, reconnection is detected by the transmitter and measurement using the sensor resumes. The diagnostic message is cleared and the state of any analog, digital and relay outputs are restored together with their associated alarm settings.

Device behavior on sensor removal

If a sensor is assigned as the source of an analog output and the sensor is disconnected from the transmitter, the analog output is driven to the configured failure current. If a failure current has not been configured, the analog output is driven to the minimum configurable output current.

If a sensor is assigned as the source of a low process alarm and the sensor is disconnected from the transmitter, the alarm is triggered. All digital outputs and relays assigned to the same alarm source are also set according to their configured polarity.

6 Operation

Front panel keys

The transmitter is operated using the front panel keys.
Prompts associated with active keys are displayed on each screen.
Diagnostic messages are detailed on page 84, display icon descriptions are detailed on page 22.

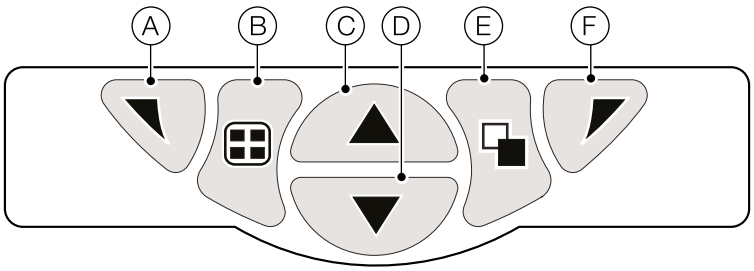


Figure 2 Front panel keys

Table 1 Key functions

Key		Function	Description
A		Navigation key – left and Operator menu access key	When any **Operating**, **View** or **Log** page is displayed, opens or closes the **Operator** menu and returns to the previous menu level.
B		View key	Toggles the view between **Operator** pages, **View** screens and **Log** screens – see Figure 3. **Note**. Disabled in **Configuration** mode.
C		Up key	Used to navigate up menu lists, highlight menu items and increase displayed values.
D		Down key	Used to navigate down menu lists, highlight menu items and decrease displayed values.
E		Group key	Toggles between: • **Operator** pages (1 to 5) when an **Operator** page is selected with the **View** key. • View screens (**Diagnostics View, Signals View, Alarms View** and **Outputs View**) when the **Diagnostics View** screen is selected with the **View** key. • Log screens (**Calibration Log, Alarm Log, Audit Log** and **Diagnostics Log**) when the **Calibration Logs** screen is selected with the **View** key. See Figure 3. **Note**. Disabled in **Configuration** mode.
F		Navigation key – right and Cal shortcut key	At menu level, selects the highlighted menu item, operation button or edits a selection. When any **Operator, View** or **Log** page is displayed, used as a shortcut key to access the **Calibrate** level.

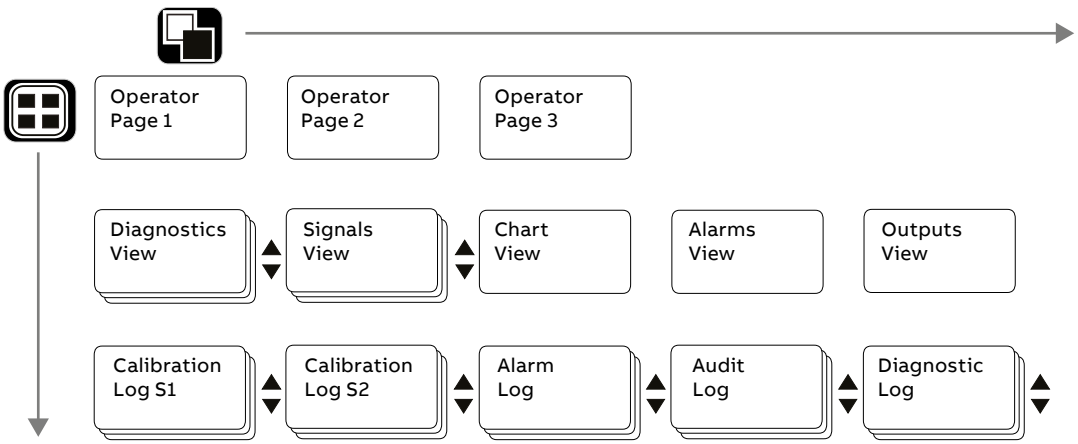


Figure 3 Menu navigation overview

Note.
The calibration log for a sensor (S1 to S2) is displayed only if that sensor is fitted.

Modes of operation

The transmitter has four modes of operation – all modes are accessed from the **Operator** menu – see Figure 4:

- **Operating**: displays real-time sensor values on **Operating Pages** – see page 12.
- **View**: displays diagnostic messages, alarms, output values, signals (including the flow rate where applicable) and (chart) traces – see page 14.
- **Log**: displays recorded diagnostic, calibration and audit events and alarms – see page 15.
- **Configuration**: enables the transmitter to be configured – see page 24.

Operator menus

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

Referring to Figure 4:

- **Operator** menus (A) are accessed from any **Operator, View** or **Log** page by pressing the key (B).
- **Operator** submenus (indicated by the arrow) are selected by pressing the key (C).
- The **Calibrate** page can be opened directly from an **Operator** page (bypassing the **Configuration** level menus) using **CAL** shortcut (D). Press the key (C) (below the **CAL** prompt).

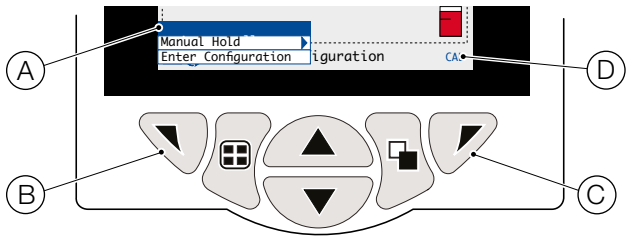


Figure 4 Operator menus

Operator menus comprise:

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

Note. Active values are still indicated on the display.

- **Manual Clean**: initiates a sensor cleaning cycle.
- **Ack.Sensor Removed** (displayed only if a sensor is disconnected from the transmitter): confirms permanent sensor removal and resets transmitter configuration settings to factory default for the sensor input.
- **Media Card**: displays the status of the SD™ card and enables the operator to place the SD card online or offline.
- **Autoscroll** (enabled on **Operator** pages only): displays **Operator** pages sequentially when multiple sensors are fitted.
- **Enter Configuration** (enabled on all pages): enters **Configuration** parameters via the **Access Level** – see page 18 for access levels and password security options.

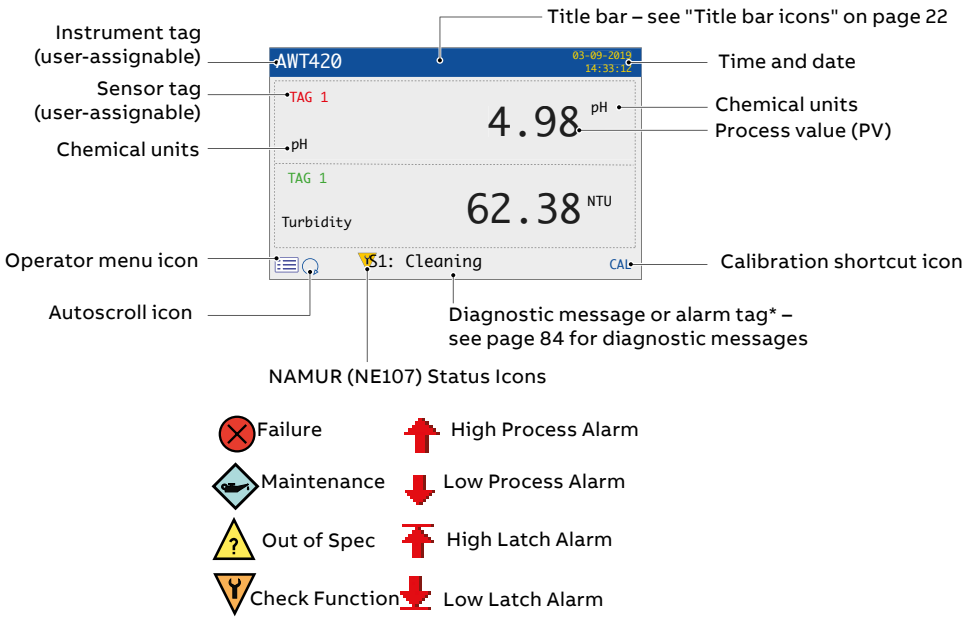
...6 Operation

Operating modes

In operating mode, process values (PVs) from connected sensors are displayed on **Operator Pages**. A maximum of 3 **Operator Pages** can be displayed.

Operator Page 1 (the default page) displays the PVs from all connected sensors simultaneously (a maximum of 2 sensors can be connected). The remaining 2 **Operator** pages display values from individual sensors (in sensor order).

In Figure 5, **Operator** page 1 shows that 2 sensors are connected (pH and turbidity).



*The highest priority diagnostic or alarm is displayed.
Other active diagnostic/alarm states can be viewed on the **Diagnostics View** – see page 22.

Figure 5 Operator Page (multiple sensors)

Figure 6 shows an overview of **Operator** pages 2 to 3. Each **Operator Page** displays the **PV** and temperature from a single sensor. Fixed, color-coded, user-assignable tags (one for each fitted sensor) and color-coded bar graphs aid identification of each sensor.

The bar graph indicates the PV. Minimum and maximum PVs are configurable in the **Sensor Setup** level. If the measured PV is above the maximum specified range of the sensor (refer to the sensor's **Operating Instruction**), the bar graph flashes to indicate the value is outside the specified range.
When multiple sensors are fitted and **Autoscroll** is selected from the **Operator Menu** (see page 11), the display scrolls through each available **Operator Page** consecutively.

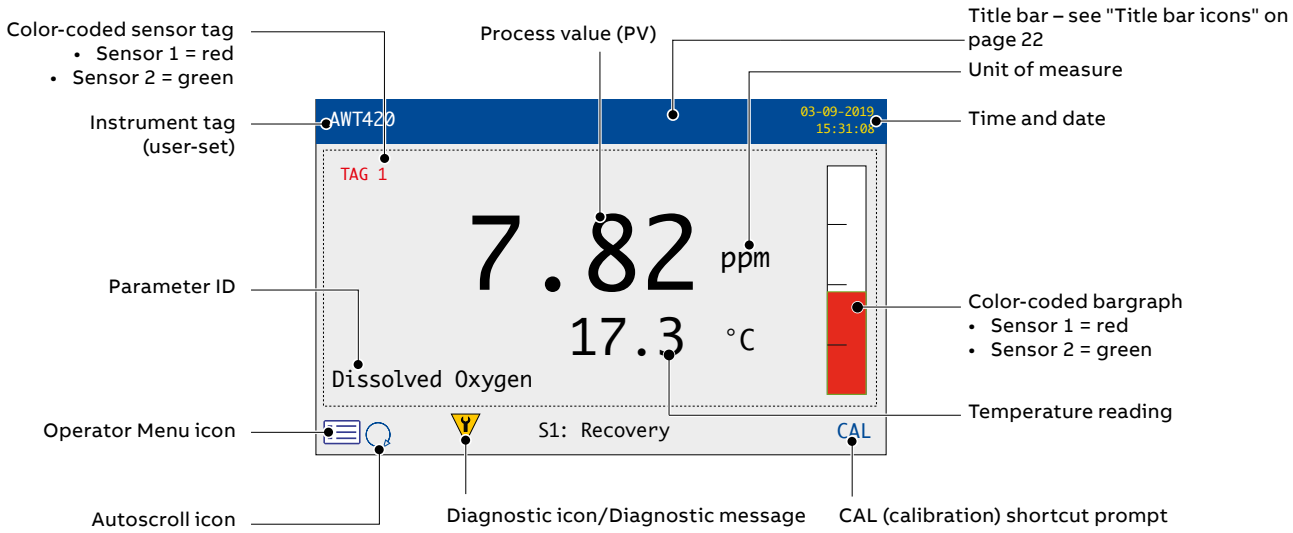


Figure 6 Operator pages – overview

...6 Operation

View mode

Pages displayed in View mode comprise:

- **Diagnostics View** – displays a list of active diagnostic messages identified by priority and message – see Figure 7
- **Signals View** – displays a list of active signals and their values (1 page per sensor) – see Figure 8
- **Chart View** – represents the sensor readings as a series of color-coded traces – see Figure 9
- **Alarms View** – displays a list of alarms, source and status – see Figure 10
- **Outputs View** – displays a list of the analog outputs, output value and percentage of output value – see Figure 11

Diagnostics View

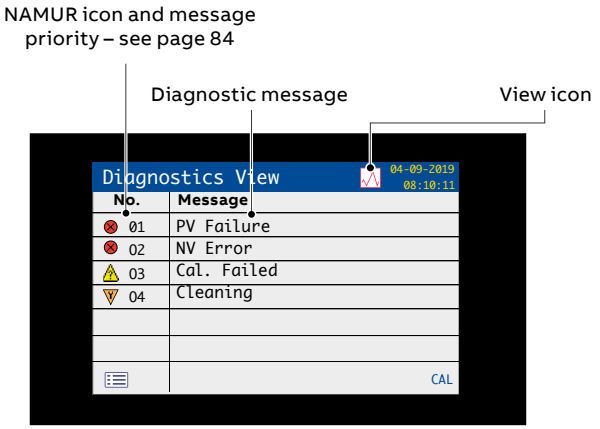


Figure 7 Diagnostics View

Signals View

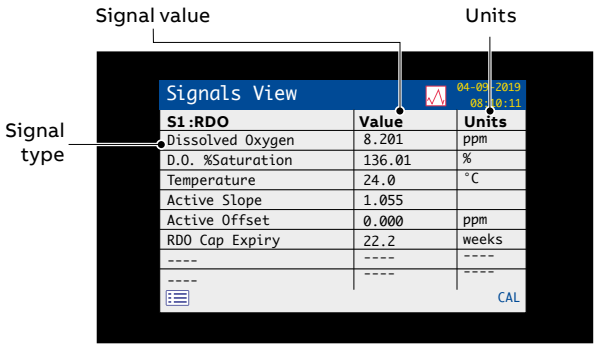


Figure 8 Signals View

Chart View

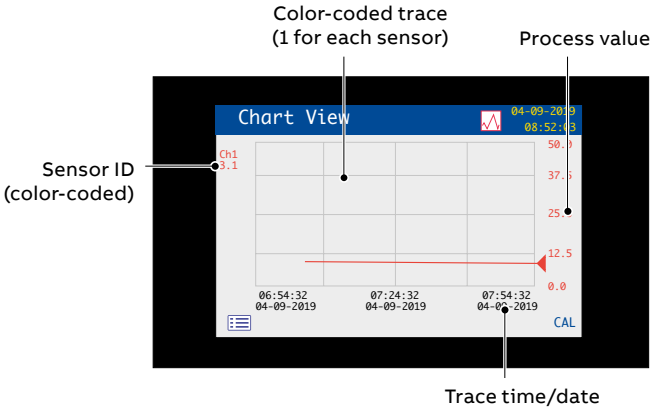


Figure 9 Chart View

Alarms View

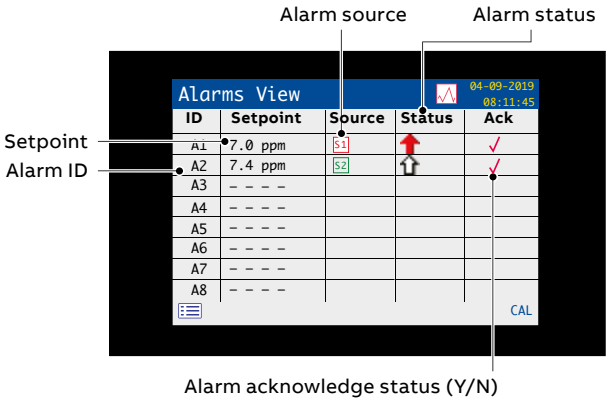


Figure 10 Alarms View

Outputs View

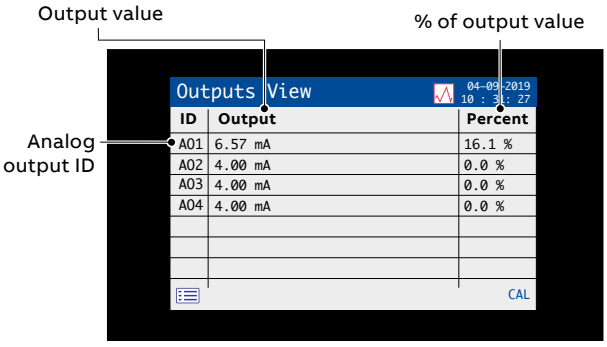


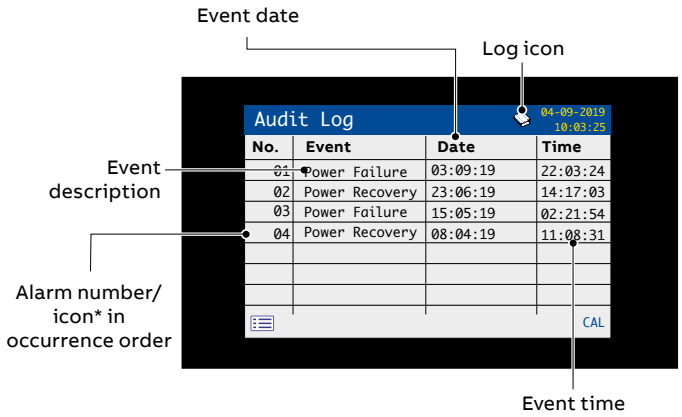
Figure 11 Outputs View

Log mode

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

Log mode pages comprise:

- **Calibration Logs**: a history of calibration routines. One log is provided for each sensor and is displayed only if the sensor is fitted. Each log can store 15 entries that are displayed in date order.
- **Alarm Log**: a history of alarm events.
- **Audit Log**: a history of analyzer activity.
- **Diagnostics Log**: a history of diagnostic events.



*Icons not displayed on **Alarm Log** or **Calibration Log**

Figure 12 Log page example (Audit Log shown)

Log entries

Example **Calibration Log** entries with descriptions are shown in Table 2. Example **Audit Log** entries together with a description are shown in Table 3. The **Diagnostics Log** shows the history of diagnostic messages that have been displayed in the **Diagnostics View** – see page 14.

Table 2 Calibration Log entries

Log entry	Description
Cal Failed	Calibration procedure failed due to low slope or sample temperature error.
Cal Aborted	Calibration aborted manually by the user.
Cal Missed	**Note**. Sensor-type specific.

Table 3 Audit Log entries

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

7 Data logging

SD card

An SD card is kept in the transmitter. Data is archived to the removable media automatically at set intervals. Archiving continues until the removable media is full, archiving then stops. To ensure all required data is archived successfully, swap the SD card periodically for an empty one.

Note

- Logging of data is possible only when an SD card is fitted and online – in this state, data and events are lost.
- ABB's DataManager Pro software can be used to store and view data archived from the transmitter.
- A 2 GB SD card has sufficient capacity for >5 years data.

NOTICE

- To avoid potential damage or corruption to data recorded on removable media, take care when handling and storing.
- Do not expose to static electricity, electrical noise or magnetic fields.
- When handling an SD card, take care not to touch any exposed metal contacts.
- Back-up critical data stored on removable media regularly.

Install the SD card

Referring to Figure 13:

1 Remove the screw (A) and open the transmitter door.

2 Pull out the SD card cover (B).

3 Push the SD card (C) up into the slot. It clicks into position. The LED (E) comes on and the flashing **!** on the SD card icon on the display goes out.

4 Install the SD card cover (B).

5 Close the transmitter door and install the screw (A).

6 Press the Operator menu key, and scroll down to **Media Card**.

7 Select **Online** to set the SD card online. The SD card icon on the display turns green.

Remove the SD card

Referring to Figure 13:

1 Remove the screw (A) and open the transmitter door.

2 Push the button (D) to set the SD card offline. The LED goes out and the SD card icon on the display turns gray.

3 Pull out the SD card cover (B).

4 Push the SD card (C) up until it clicks, then pull it down to remove it.

5 Install the SD card cover (B).

6 Close the transmitter door and install the screw (A).

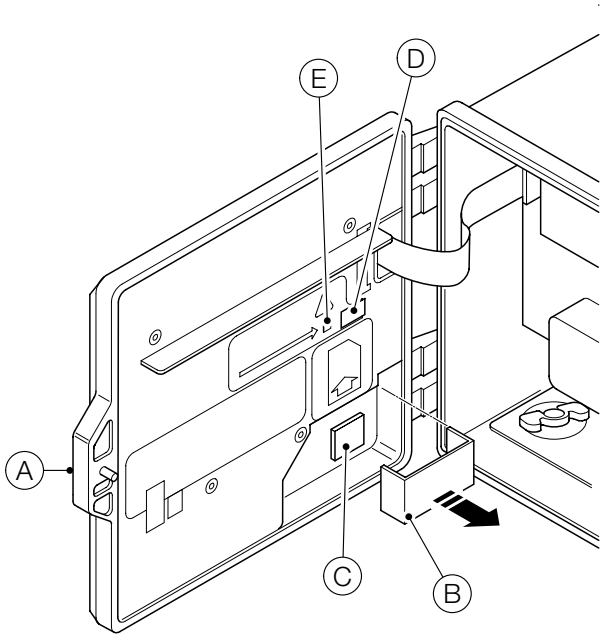


Figure 13 SD card insertion and removal

Archive file types

All files created by the transmitter are assigned filenames automatically. Each type of file is assigned a different file extension. Archive files are created as text format, comma-separated data files.

The file type and extension for **Data** text files is '.D00'
<ddmmmyy><hhmmss><instrument tag>.D00

The file type and extension for **Event** log files (containing historical entries from the **Audit, Calibration, Diagnostic** and **Alarm** logs is '.A00'.

<ddmmmyy><hhmmss><instrument tag>.A00

Note.

- The 'instrument tag' is set in the **Device Setup** level (see page 31) when the user has access at **Advanced** level – see page 18.
- The time and date are formatted according to the format selected in the **Display** level (**Date & Time**).
- The transmitter's internal clock can be configured to adjust automatically at the start and end of **Daylight Saving** periods – see "Daylight saving" on page 17.

Configuration filenames are preset as Config1 to Config8. The configuration file type and extension is '.CFG'.

Data files

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

Alternatively, detailed graphical analysis of the data can be performed on a PC using ABB's DataManager Pro data analysis software.

New data files are created if:

- the transmitter configuration is changed
- one of the current files exceeds the maximum permissible size (a new file is created at 00:00:00 a.m. on the following day) – data is logged into the existing file continuously until the new file is created
- the daylight saving period starts or ends
- working files cannot be found/are corrupted
- the date and/or time is changed

The filename is formatted as follows:

- Data logs: <ddmmmyy><hhmmss><instrument tag>.D00

Log files

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

Event logs: <ddmmmyy><hhmmss><instrument tag>.A00

Daylight saving

Files containing data generated during the daylight saving period have '~DS' appended to the filename. Daily files start at 00:00:00.

Start of daylight saving period
A daily file is started at 00:00:00 on 30th March 2019, filename:
30Mar19_00_00_00_AWT 420.D00

Summertime starts at 2:00 a.m. on 30th March 2019 and the clock changes automatically to 3:00 a.m.

The existing file is closed and a new file is created, filename:
30Mar19_03_00_00_AWT 420~DS.D00

The file '30Mar19_00_00_00_AWT 420.D00' contains data generated from 00:00:00 to 01:59:59.

The file '30Mar19_03_00_00_AWT 420~DS.D00' contains data generated from 03:00:00.

End of daylight saving period
A daily file is started at 00:00:00 on 26th October 2019, filename:
26Oct19_00_00_00_AWT 420~DS.D00

Summertime ends at 3:00 a.m. on 26th October 2019 and the clock changes automatically to 2:00 a.m.

The existing file is closed and a new file is created, filename:
26Oct19_02_00_00_AWT 420.D00

The file '26Oct19_00_00_00_AWT 420~DS.D00' contains data generated from 00:00:00 to 02:59:59.

The file '26Oct19_02_00_00_AWT 420.D00' contains data generated from 02:00:00.

8 Password security and access level

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

Setting passwords

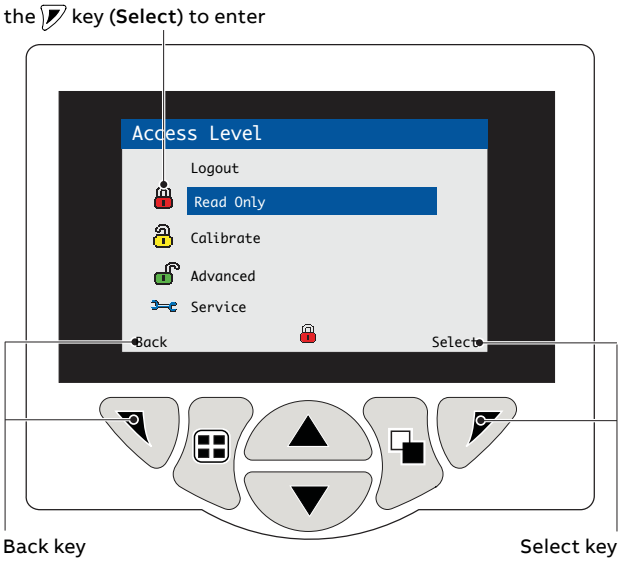
Passwords can be set to enable secure access at 2 levels: **Calibrate** and **Advanced**. The **Service** level is password protected at the factory and reserved for factory use only. Passwords can contain up to 6 characters and are set, changed or restored to their default settings at the **Device Setup/ Security Setup** parameter – see page 26.

Note.
When the transmitter is powered-up for the first time, the **Calibrate** and **Advanced** levels can be accessed without password protection. Protected access to these levels can be allocated as required.

Access Level

The **Access Level** is entered via the **Operator** menu/**Enter Configuration** menu option – see page 11.

Access levels – scroll to level using the ▲/▼ keys and press the ◤ key (**Select**) to enter



Back key

Select key – used to enter levels or **Enter Password** screen

Figure 14 Access level screen

Table 4 Access level menu details

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

Cursor/Password character indicator (maximum 6 characters)

Cursor – scroll characters using the ▲/▼ keys;
press ◥ (Next) to accept character;
press ◤ (OK) to accept password while last character is highlighted

Figure 15 Enter password screen

9 Bluetooth capability and the EZLink Connect app

The AWT420 supports Bluetooth® Low Energy (BLE) version 4.2 as standard.

You can connect to AWT420 transmitters that are in range (one device at a time, a limit of the Bluetooth technology using the EZLink Connect app).

Download the EZLink Connect app only from the Google Play™ store or the Apple® App Store®.

Download EZLink Connect for Android™

For the Android version of EZLink Connect, download from:

Download EZLink Connect for iOS®

For the iOS version of EZLink Connect, download from:

EZLink Connect lets you read live values and diagnostics from a paired AWT420 transmitter, and view the calibration log, the diagnostics log, and the audit log.

In the app, you can also see the related documentation for the AWT420 transmitter, and other CWA products from ABB.

Pair your mobile device to a transmitter

To pair the EZLink Connect app with an AWT420 transmitter, use a pairing PIN that is available from:
Communication > **Bluetooth** > **Pairing PIN menu**.

Bluetooth menus

Table 5 Bluetooth menu descriptions

Menu	Description
Device Enable	Enables or disables power to the Bluetooth module. When disabled, the module no longer advertises and is not connectable.
Device Name	Read only device name. This device name forms part of the advertising data used by the module, allowing the user to differentiate between other Bluetooth devices in range when scanning for devices to connect to. This Bluetooth device name is generated automatically from the instrument tag. Therefore, whenever the transmitter's instrument tag is changed, the Bluetooth device name changes to reflect it.
Pairing PIN	The fixed 6-digit PIN is used when pairing the transmitter and mobile device. When paired, the PIN is no longer required when reconnecting, because the pairing information is stored in the module.
Generate New PIN	Lets you generate a new pairing PIN. The transmitter randomly generates the new PIN.

Operating system requirements

ABB recommends Android 10.0 or later, or iOS 12.0 or later to install the EZLink Connect app.

For the cybersecurity requirements, refer to page 4.

10 Software upgrade

The AWT420 software is periodically updated to resolve bugs and support new features. Upgrades can be installed from the SD card via **Bootloader**.

Note. Use only an approved SD card formatted with FAT16/FAT32, and no bigger than 32 GB.

The transmitter/sensor firmware can be uploaded to the SD card in several ways:

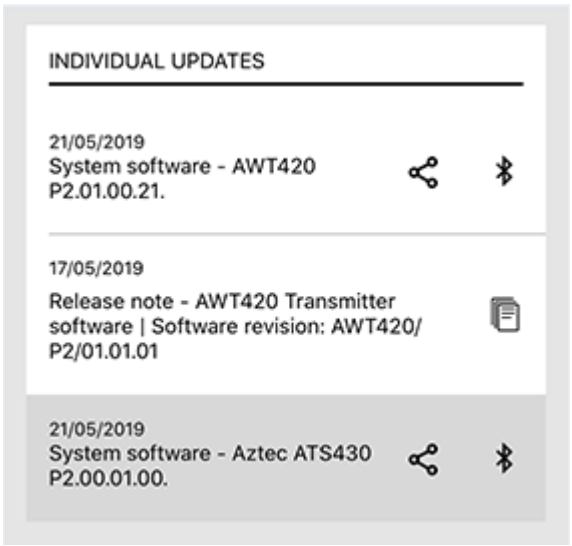
- Using **EZLink Connect** app, the latest firmware version can be uploaded via Bluetooth to the SD card of the transmitter from your smartphone or tablet, while operating.
- Using your laptop/PC, download the latest software from ABB Library.
- Using FTP to transfer to the SD card fitted to the transmitter whilst it is operating (optional Ethernet module required).
- Copy the files to an SD card.

EZLink Connect

Notes. Requires an Internet connection on your smartphone/tablet and can take up to 30 minutes.
The SD Card should be fitted and online before beginning (see **Bootloader** instructions below):

1 Ensure that your smartphone/tablet is paired with the correct AWT420.

2 From **Firmware upgrades**, tap to download the latest software from the ABB Library.



3 Tap the Bluetooth icon to view devices available in **Device List**.

4 Select the device to be upgraded.

5 When prompted, enter the **Service** password and **Upload** to transfer the downloaded firmware file to the AWT420 transmitter SD card via Bluetooth.

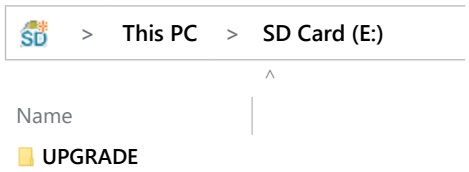
6 Continue by following the steps in "Transmitter/sensor upgrade via Bootloader".

PC/laptop

1 Download the firmware (Internet connection necessary) from ABB Library.
The zip file should have the following folder structure:
`\UPGRADE\AWT420\XX _ YY _ ZZ`

SD card

1 Unzip and save to the root of the SD card.
The unzipped folder should look like this:



2 Safely remove from your PC to avoid file corruption.

FTP

The SD card should be fitted and online before beginning (see Bootloader instructions).

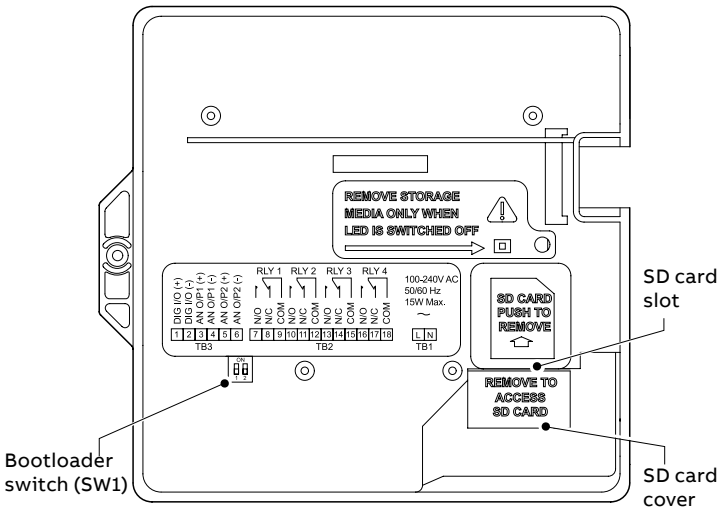
1 Unzip and save the whole upgrade folder to your PC.

2 Using your preferred FTP client, transfer the upgrade folder and its contents to the root of the SD card in the desired AWT420.

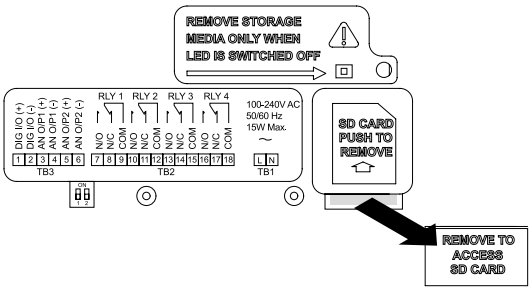
Note. If there are previous updates on the SD card, the latest version is installed.

Transmitter/sensor upgrade via Bootloader

1 Open the door of the unit to access the Bootloader switch and SD card slot.

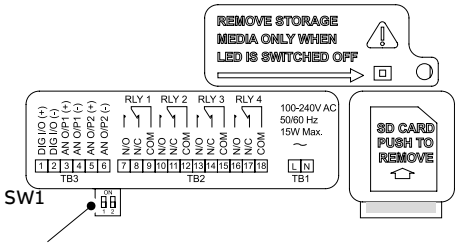


2 Remove the SD card cover by pulling it out towards you.

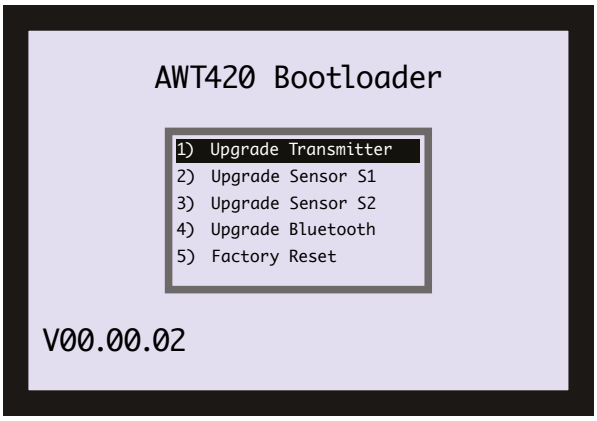


If an SD card is fitted for recording data, remove it first, then insert the upgrade SD card and push in until it clicks into place.

3 Set the Bootloader switch **SW1** to **ON** (up).



4 Close and secure the door and power up the unit. The Bootloader is displayed within 10 to 15 seconds.



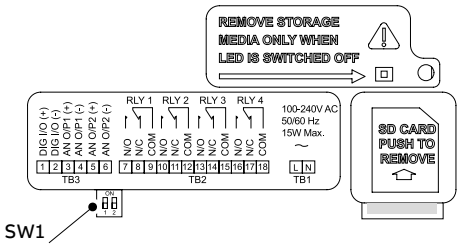
Note. If the Bootloader does not load, ensure you are using a compatible SD card with the correct files and folder structure.

5 Transmitter/sensor software upgrade:

- Transmitter software upgrade:
  Select **Upgrade Transmitter** and press the key.
- Sensor software upgrade:
  Select **Upgrade Sensor Sx** and press the key.

The upgrade takes approximately 60 seconds and displays **Transmitter upgraded successfully** on completion.
Note. If the software is incorrect, the transmitter displays the message **Firmware verification failed**.

6 Power down the AWT420.
Open the door and switch Bootloader switch **SW1** to **OFF** (down).



7 Remove the upgrade SD card, re-fit recording SD card (if necessary) and replace the SD card cover.

8 Close and secure the door and power up the AWT420.
You can check the software revision of transmitter/sensors from the **Device Info** menu.

Factory reset via Bootloader

1 Follow steps 1 to 4 of "Transmitter/sensor upgrade via Bootloader" on page 20.

2 Select "Factory Reset".

3 Continue with steps 6 to 8 of "Transmitter/sensor upgrade via Bootloader".

11 Display icons

Diagnostic icons

When a diagnostic condition is detected, the associated NAMUR icon, plus the highest priority diagnostic message, is displayed in the **Status Bar** when the transmitter is in **Operator View** mode – refer to page 84 for diagnostic messages.

If the status bar displays a diagnostic message, press the key to see all diagnostic messages.

NAMUR icons

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

Alarm, hold, and clean icons

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

Title bar icons

	Media online: 0 to <20 % full.
	Media online: 20 to <40 % full.
	Media online: 40 to <60 % full.
	Media online: 60 to <80 % full.
	Media online: 80 to <100 % full.
	Media online: full (icon toggles when full).
	Media offline: 0 to <20 % full.
	Media offline: 20 to <40 % full.
	Media offline: 40 to <60 % full.
	Media offline: 60 to <80 % full.
	Media offline: 80 to <100 % full.
	Media offline: not inserted (not logging).
	Attempt to datalog/go online with no card fitted.
	Any alarm is active.
	Bluetooth: not connected/connected.

Status bar icons

Refer to page 84 for diagnostic (NAMUR) icons and descriptions.

	Operator menu – displays the Operator menu when the key is pressed.
	Autoscroll – indicates that Operator pages are displayed sequentially. Displayed only when Autoscroll enabled from the Operator menu. Disabled if 1 Operator page only is configured for display.
CAL	Calibration – shortcut access to the Calibration page when the key is pressed.
	Enter – selects the highlighted option from the Operator menus when the key is pressed.
	Service Level*
	Advanced Level* – indicates that Advanced Level parameters are enabled for the current user.
	Calibrate Level* – indicates that the Calibration Level parameters are enabled for the current user.
	Read Only Level* – indicates that the transmitter is in Read Only mode. All parameters are locked and cannot be configured.
	High process alarm active/inactive.
	Low process alarm – active/inactive.
	High latch alarm – active/inactive.
	Low latch alarm – active/inactive.

*Not displayed at **Operator** levels.

Log icons

	Source: sensor 1 (red) S1 = sensor 1 process value. T1 = sensor 1 temperature.
	Source sensor 2 (green) S2 = sensor 2 process value. T2 = sensor 2 temperature.
	Power failed/power restored.
	Configuration changed.
	System Error.
	File created.
	Media inserted/removed.
	Media on-line/off-line.
	Media full.
	Date/time or daylight saving start/end changed.
	High process alarm active/inactive.
	Low process alarm – active/inactive.
	High latch alarm – active/inactive.
	Low latch alarm – active/inactive.
	Alarm acknowledged.

12 Configuration (Advanced access level)

Service level menus (not shown) are password-protected at the factory, and are intended for use by authorized ABB service technicians only.

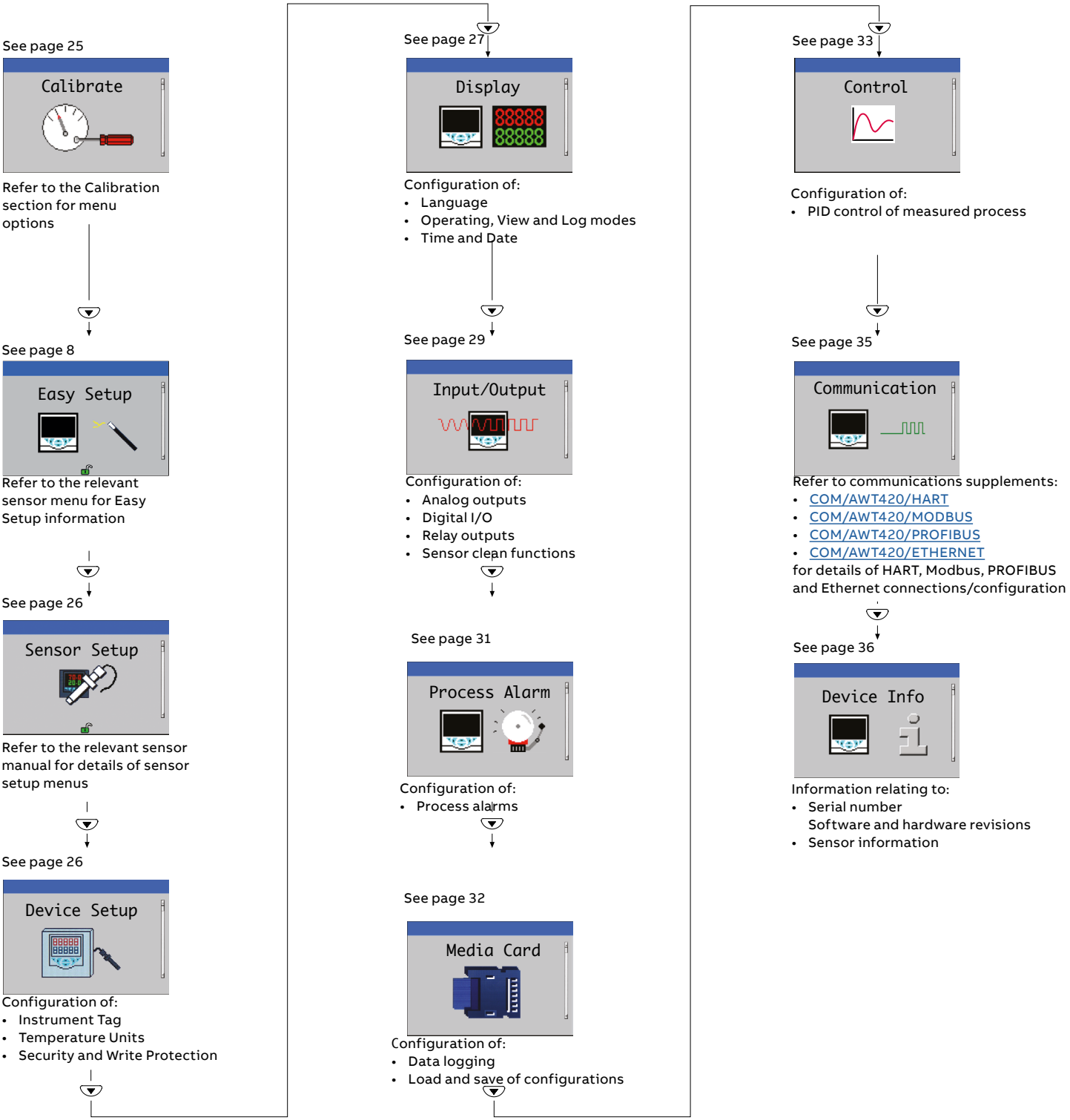
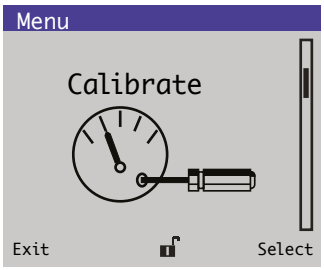


Figure 16 Configuration (Advanced access level) overview

Calibrate



Used to calibrate the sensor.

Note. **Calibrate** menus are sensor-specific – refer to the **Calibration** section for specific routines.

Access to the **Calibrate** menu is permitted via the **Calibrate** and **Advanced** levels or directly from an **Operator** page using the **Cal** button.

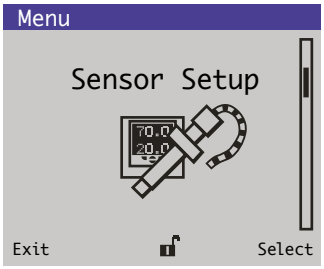
Menu	Comment	Default
S1: <Sensor Type>	**Note**. Displayed only if a sensor is fitted to slot 1.	
S1: <Sensor Tag>	Access the sensor 1 specific calibration pages, refer to the Calibration section for specific routines.	
S2: <Sensor Type>	**Note**. Displayed only if a sensor is fitted to slot 1.	
S2: <Sensor Tag>	Access the sensor 1 specific calibration pages, refer to the Calibration section for specific routines.	
pH Buffers	**Note**. Displayed only if at least one pH sensor is fitted and **Measurement Type** = pH.	
Buffer 1	Set the type/value of buffer solution 1. • Supported buffer solutions from table below/user-defined.	Technical 4.01pH
Used Buffer 1	**Note**. Displayed only if **Buffer 1 Type** = **User Defined**. Set the user defined buffer characteristic curve using the five point linearizer table (pH against °C).	N/A
Buffer 2	Set the type/value of buffer solution 2. • Supported buffer solutions from table below/user-defined.	Technical 7.00pH
Used Buffer 2	**Note**. Displayed only if **Buffer 2 Type** = **User Defined**. Set the user defined buffer characteristic curve using the five point linearizer table (pH against °C).	N/A
Hold Outputs	Set to automatically hold current outputs and alarms whilst a calibration is being performed. • **Disabled/Enabled**.	Disabled

Table 6 Buffer solutions

Technical 4.01 pH
Technical 7.00 pH
Technical 10.01 pH
DIN19266 1.679 pH
DIN19266 4.005 pH
DIN19266 6.865 pH
DIN19266 9.180 pH
DIN19266 10.012 pH
NIST 4.001 pH
NIST 6.881 pH
NIST 9.225 pH
NIST 10.062 pH
Phth. Free 4.00 pH
ABB Sachet 4.01 pH
ABB Sachet 7.00 pH
ABB Sachet 9.18 pH
User Defined 1
User Defined 2

…12 Configuration (Advanced access level)

Sensor Setup

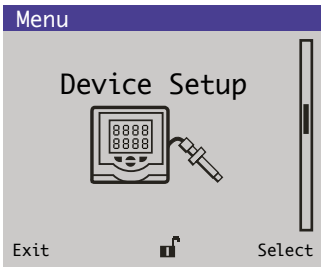


Used to access standard setup parameters.

Sensor Setup menus are sensor-specific – refer to the **Calibration** section and relevant sensor manual for full details of sensor setup.

Menu	Comment	Default
S1: <Sensor Type>: <Sensor Tag>	**Note.** Displayed only if a sensor is fitted to slot 1. Access the sensor 1 specific setup pages, refer to the **Sensor setup** section (page 38).	
S2: <Sensor Type>: <Sensor Tag>	**Note.** Displayed only if a sensor is fitted to slot 2. Access the sensor 2 specific setup pages, refer to the **Sensor setup** section (page 38).	
Calculated Values	**Note**. Displayed only if two 2-electrode conductivity sensors are fitted. Access the Calculated Values specific setup pages, refer to the Sensor Setup section (page 47)	
Dual Verification	**Note**. Displayed only if two sensors of the same type are fitted. Access the dual verification specific setup pages. Refer to the sensor setup section (page 48)	
Hold Outputs	Hold the device outputs	

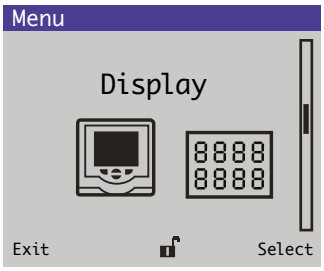
Device Setup



Used to access standard setup parameters.

Menu	Comment	Default
Initial Setup		
Instrument Tag	Enter an alphanumeric transmitter identification tag (16 characters maximum)	AWT420
Temperature Units	Select the units in which all temperatures are displayed: **°C/°F**	°C
Security Setup		
Calibrate Password	Set the password to enable access at **Calibrate** level.	Not factory-set
Advanced Password	Available only at **Advanced** access level.	Not factory-set
Service Access		
Service Password	Reserved for use by authorized ABB service technicians	Set at factory
Write Protection		
Restore Defaults	Select to restore ALL transmitter configuration parameters to their default values and restart the transmitter.	

Display



Used to select the display language, setup **Operator** page templates (1 to 3), enable diagnostic, view and log functions, set the device's display brightness/contrast and set the time and date.

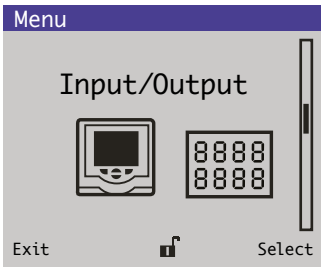
Menu	Comment	Default
Language	Select the display language: English, German, French, Italian, Spanish, Portuguese, Russian, Turkish, Chinese, Polish	English
Operator Templates		
Page 1 (to 5) Template	Refer to page 12 for **Operator Template** examples. **Note**. **Operator Page** templates are assigned automatically to display all sensors currently connected and cannot be changed – see page 12.	
View/Log Enables	Select to enable/disable the following **Views** and **Logs**.	
Diagnostics View		
Signals View		
Chart View	See page 14 for examples of **Operator pages** in **View** mode.	
Alarm View		
Analog OP View		Enable (all)
Calibration Log		
Alarm Log	See page 15 for examples of **Operator pages** in **Log** mode.	
Audit Log		
Diagnostics Log		
Chart View	**Note.** **Chart View** menus displayed only when **Chart View** is enabled. The chart displays the primary analog value from the sensor.	
Channel S1 (to S2)		
Source	**Chart View** channel sources are assigned automatically and cannot be changed.	
Tag	Enter an alphanumeric tag (3 characters maximum) to identify the sensor signal on the chart.	TAG1
Chart Duration	Select a chart duration: 1, 2, 4, 8, 12, 16, 20, 24 hours	1 h

…12 Configuration (Advanced access level)

…Display

Menu	Comment	Default
Date & Time	Select to set the transmitter's date, local time and daylight saving start/end times:	
Date Format	Select the date format required: • DD–MM–YYYY/MM–DD–YYYY/YYYY–MM–DD.	YYYY-MM-DD
Date & Time	Set the date in the format selected at Date Format above and the time in the fixed format: • HR:MINS:SEC.	
Daylight Saving	Select to set the daylight saving parameters.	
DS Region	Select the geographical region to base the daylight saving hours on: • Off – select to disable daylight saving. • Europe – select to set European-standard daylight saving start and end times automatically. • USA – select to set USA-standard daylight saving start and end times automatically. • Custom – select to set daylight saving start and end times manually for regions other than Europe or USA. **Note**. The **DS Start Time/Occurrence/Day/Month** and **Time** menus (below) are displayed only when **Custom** is selected.	Off
DS Start Hour	Set the daylight saving start hour in 1-hour increments.	1 2
DS Start Occurrence	Select the day within the month to start daylight saving. For example, to set daylight saving to start on the second Sunday of the selected month, select **Second**.	Last Last
DS Start Day	Select the day of the month on which daylight saving is to start. **Note**. The **DS Start Occurrence** parameter must be valid within the month for the selected day.	Sunday Sunday
DS Start Month	Select the month on which daylight saving is to start. **Note**. The **DS Start Occurrence** parameter must be valid within the month for the selected day.	Sunday Sunday
DS End Hour	Set the daylight saving end time in1-hour increments.	1 2
DS End Occurrence	Select the day within the month to end daylight saving. For example, to set daylight saving to end on the second Sunday of the selected month, select **Second**.	Last Last
DS End Day	Select the day of the month on which daylight saving is to end. **Note**. The **DS End Occurrence** parameter must be valid within the month for the selected day.	Sunday Sunday
DS End Month	Select the day of the month on which daylight saving is to end. **Note**. The **DS End Occurrence** parameter must be valid within the month for the selected day.	Sunday Sunday
Brightness	Sets the display brightness.	

Input/Output



Used to enable configuration of analog outputs, digital inputs and outputs and relays.

Menu	Comment	Default
Analog Outputs	The analog outputs can be configured to retransmit the process variable and temperature values and have a configurable range from 0 to 22 mA.	
HART Curr. Out		
PV Range Hi **PV Range Lo** **Output Value** **Failure Current**	See Communications Supplement COM/AWT420/HART.	
Analog Output 1 (to 4)	Analog outputs 3 and 4 are available only if an option board is fitted.	
Source	Select the sensor signal to be assigned to the output.	None
Output Type	Select the **Analog Output** 1 (to 4) type: • Linear • Log 2 Decade • Log 3 Decade • Log 4 Decade • Bi-linear Bi-linear is only available if sensor fitted is 2-electrode conductivity and measurement type = conductivity The output characteristic is selectable dependent on sensor type.	Linear
Elec High * **Elec Low ***	Set the minimum and maximum electrical range output values within the range 0.00 to 22.00 mA.	
Eng High * **Eng Low ***	Set the minimum and maximum engineering range output values within the range of measurement permitted by the sensor selected as the source.	
Output Failure *	Select to enable/disable the output failure function. When Enabled, the current output can be driven to a preset value if a **Failure** category diagnostic state occurs for the selected source – see page 22.	Enabled
Failure Current**	Set a value within the range 0 to 22 mA that the current output is driven when a **Failure** category diagnostic state is present – see page 22.	22.0
The following menus are displayed only if sensor fitted is 2-electrode conductivity and measurement type = Bi-linear		
X Breakpoint	Set input breakpoint in Engineering units of source	0.0
Y Breakpoint	Set output breakpoint in Electrical range output units	12.0
Calibrate		
AOP1(4) Trim 4 mA	Adjust 4 mA (use the ▲/▼ keys to set the mA reading to 4 mA).	
AOP1(4) Trim 20 mA	Adjust 20 mA (use the ▲/▼ keys to set the mA reading to 20 mA).	
Digital I/O		
Type	Select the **Digital I/O** type: • Off • Input • Output	Off
Source	Select the digital signal to be assigned to the input/output – see page 37.	None
Polarity	Sets the polarity of the digital input/output signal – see Table 7 on page 30.	Non Inverted
Relays		
Relay 1 (to 4)		
Source	Selects the digital signal to be assigned to the relay – see page 37.	None
Polarity	Sets the polarity of the relay output – see Table 8 on page 30.	Non Inverted

* Displayed only if **Source** is NOT set to **None**
** Displayed only if **Output Failure** is set to **Enabled**

…12 Configuration (Advanced access level)

…Input/Output

Menu	Comment	Default
Cleaning 1 (2) – Input/Output		
Sensor To Clean	Set the sensor to be cleaned: • Sensor 1/Sensor 2	Sensor 1
O/P Assignment	Set the assignment of the cleaner to an output: • Not Assigned/Relay 1/Relay 2/Relay 3/Relay 4/Digital O/P	Not Assigned
Clean Interval	Set the interval between cleans: • Off/15 mins/30 mins/45 mins/1 to 24 hours	Off
Clean Type	Set the clean type: • Continuous/Pulsed.	Continuous
Clean On Time	Set the duration of the clean: • 1 to 60 s	30 s
Clean Off Time	Set the duration between cleans: • 1 to 60 s **Clean Type = Pulsed**	30 s
Number Of Pulses	Set the number of pulses: • 1 to 10 pulses **Clean Type = Pulsed**	1 pulse
Recovery Time	Set the time delay between the completion of cleaning and the display of a new reading on the operator page: • 1 to 10 min	1 min
Clean Duration	Displays the total duration of the clean: • **Clean Type** set to **Continuous** = **Clean on Time + Recovery Time** • Clean Type set to **Pulsed** = **(Clean on Time + Clean Off Time) × Number of Pulses + Recovery Time**	N/A
Next Clean	Set the date and time of the next scheduled clean.	N/A

Table 7 Digital input/output polarity

Digital input (volt-free): polarity = non-inverted

Input status	Output state
Open	Inactive
Closed	Active

Digital input (volt-free): polarity = inverted

Input status	Output state
Open	Active
Closed	Inactive

Digital output (open collector): polarity = non-inverted

Source status	Output state	Logic voltage*
Active	On	0 V
Inactive	Off	3.3 V

Digital output (open collector): polarity = inverted

Source status	Output state	Logic voltage*
Active	Off	3.3 V
Inactive	On	0 V

* The measured voltage across digital I/O connections with no auxiliary devices fitted

Table 8 Relay output polarity

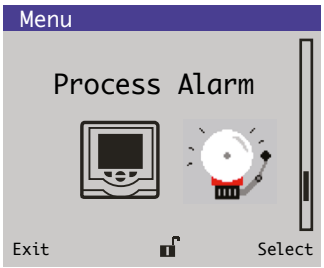
Relay output: polarity = non-inverted

Source status	Relay state	N/C Contact	N/O Contact
Active	Energized	Open	Closed
Inactive	De-energized	Closed	Open

Relay output: polarity = inverted

Source status	Relay state	N/C Contact	N/O Contact
Active	De-energized	Closed	Open
Inactive	Energized	Open	Closed

Process Alarm



Used to configure up to 8 independent process alarms.

Menu	Comment	Default
Alarm 1 (to 8)		
Source	Select the sensor signal for the process alarm source.	
Type	Select the alarm type: • High Process/Low Process/High Latch/Low Latch	
Tag	Enter an alphanumeric alarm identification tag (16 characters maximum). The tag is displayed as a diagnostic message and appears in the **Diagnostic Status Bar** and on the **Diagnostic View** page at **Operator** level – see page 12.	
Trip	Set a trip value in engineering units.	
Hysteresis	Set a hysteresis trip value in engineering units. The alarm is activated at the alarm trip level but deactivated only when the process variable has moved into the safe region by an amount equal to the hysteresis value – see Process alarm examples (Figure 17 and Figure 18) below.	
Time Hysteresis	Set a time hysteresis trip value between 0.0000 and 9999.0 seconds. If the alarm trip value is exceeded, the alarm is not activated until the **Time Hysteresis** value has expired. If the signal goes out of the alarm condition before the **Time Hysteresis** has expired, the hysteresis timer is reset.	

Process alarm examples

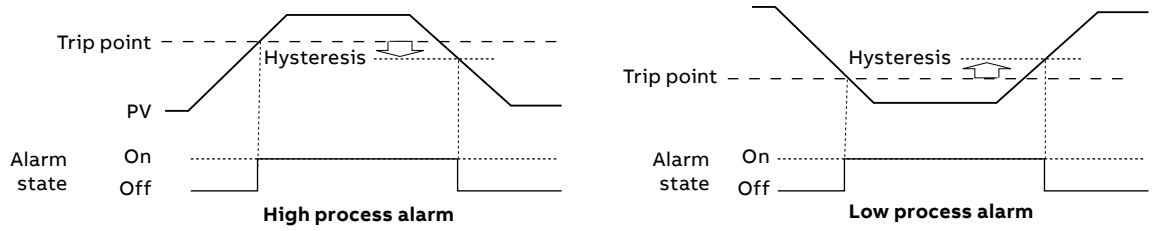


Figure 17 High and low process alarm action

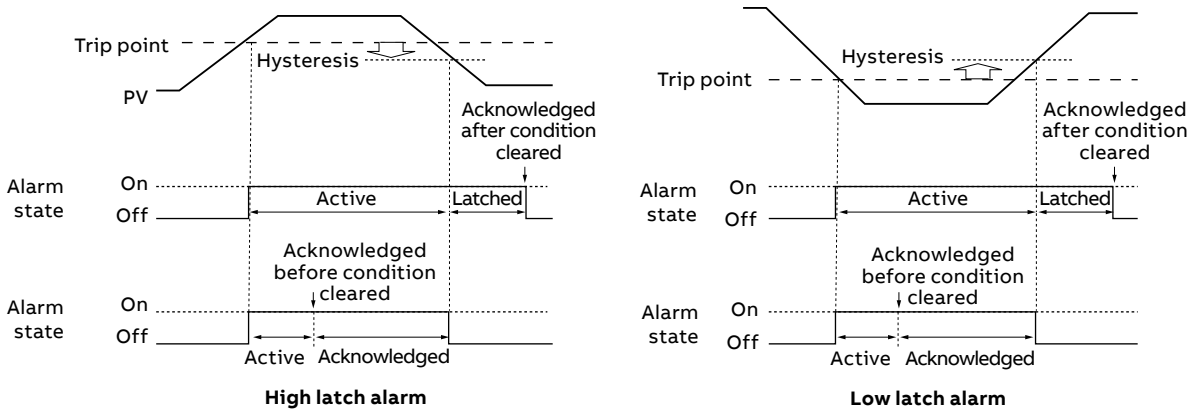
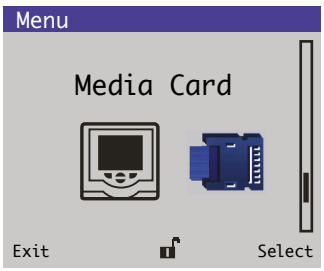


Figure 18 High and low latch alarm action

…12 Configuration (Advanced access level)

Media Card



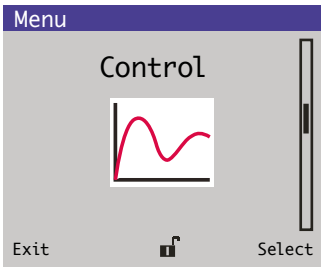
Used to enable/disable data logging, select the source of the data to be logged, save and load configuration files and to format external media.

Menu	Comment	Default
Data Logging		
Channel 1 (to 6)	Select the source of the data to be logged – see page 37 for sources.	
Sampling Time	Select the sampling duration time: • 5/10/30 seconds • 1/5/10/30 minutes • 1 hour	5 s

Note. The following menus are displayed only if an SD card is inserted and has been placed online.

Save Configuration		
Select File		
Config1 (to 8)	Select a position in which to create and save a configuration file containing user-defined sensor parameters to external media. Up to 8 files can be created. If a file exists in a position, it is displayed as **Config1(Overwrite)**. Either overwrite the existing file or select a new position in which to save it. **Note**. Wait until the progress bar is complete and the **OK** soft key prompt reappears before pressing the key. Pressing during a save operation cancels it prematurely resulting in an unusable configuration file.	
Load Configuration		
Select File		
Config1 (to 8)	Select a position from which to load a configuration file containing user-defined sensor parameters from external media. The most recently saved file is displayed. Press the key to display a list of other positions containing configuration files. Only positions containing configuration files are displayed.	
Format Card	Press the key (**Yes**) to format the SD card if required. **Note**. Formatting erases all data currently on the SD card.	

Control



PID control functionality is available for both channels of the AWT420 transmitter. Conductivity channels are configurable for reverse or direct-acting control. pH channels are configurable for reverse-acting, direct-acting or dual (Acid/Base) control.

Control outputs are configurable for Analog, Time Proportioning or Pulse Frequency output. Analog control outputs can be assigned to any of the available analog outputs. Time proportioning control outputs can be assigned to any of the available relays or digital outputs and pulse frequency control outputs can be assigned to any of the available relays or digital outputs.

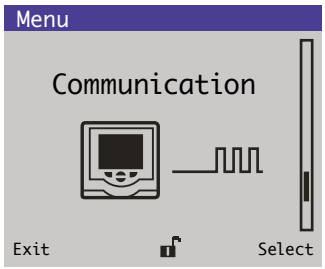
Menu	Comment	Default
PID 1 (2)		
Control Action	Off, Reverse-acting, Direct-Acting, Dual-acting.	Off
Control Mode	Auto, Manual	Auto
Reverse Control **Direct Control**	If **Control Action** = **Reverse** or **Direct-Acting**:	
Setpoint	Numeric value, limited to PV Range.	PV range low
Control Type	P, P+I, P+I+D, P+D.	P
Proportional Band	Numeric value: 0.1 to 999.9 %.	100 %
Integral Action Time	If **Control Type** = **P+I** or **P+I+D**: • Numeric value: 1 to 7200 s.	1 sec
Derivative Action Time	If **Control Type** = **P+I+D** or **P+D**: • Numeric value: 0.1 to 999.9 s.	999.9 sec
Manual Reset	If **Control Type** = **P** or **P+D**: • Numeric value: 0.0 to 100.0 %	0.0 %
Output Type	Analog, Time Proportioning, Pulse Frequency.	Analog
Cycle Time	If **Output Type** = **Time Proportioning**: • Numeric value: 1.0 to 300.0 s.	10 sec
Pulse Frequency	If **Output Type** = **Pulse Frequency**: • Numeric value: 1 to 120 pulses per minute	60 pulses/min
Acid Controller	Acid = Dual-acting.	
Setpoint (SPA)	Numeric value: SPB + 0.5 to 16.0.	PV range high
Control Type	P, P+I.	P
Proportional Band	Numeric value: 0.1 to 999.9 %.	100 %
Integral Action Time	Enabled if **Control Type** = **P+I**: • Numeric value: 1 to 7200 s.	1 sec
Output Type	Analog, Time Proportioning, Pulse Frequency.	Analog
Cycle Time	If **Output Type** = **Time Proportioning**: • Numeric value: 1.0 to 300.0 s.	10 sec
Pulse Frequency	If **Output Type** = **Pulse Frequency**: • Numeric value: 1 to 120 pulses per minute	60 pulses/min

…12 Configuration (Advanced access level)

…Control

Menu	Comment	Default
…Sensor 1 (2)		
Base Controller	If **Control Action** = **Dual-acting**.	
Setpoint (SPB)	Numeric value: –2.0 to SPB – 0.5.	PV range low
Control Type	P, P+I.	P
Proportional Band	Numeric value: 0.1 to 999.9 %.	100 %
Integral Action Time	If **Control Type** = **P+I**: • Numeric value: 1 to 7200 s.	1 sec
Output Type	Analog, Time Proportioning, Pulse Frequency.	Analog
Cycle Time	If **Output Type** = **Time Proportioning**: • Numeric value: 1.0 to 300.0 s.	10 sec
Pulse Frequency	If **Output Type** = **Pulse Frequency**: • Numeric value: 1 to 120 pulses per minute	60 pulses/min
Power Recovery		
Recovery Mode	Auto, Manual, Last.	Auto
Default Output	If **Recovery Mode** = **Manual**: • Numeric value If **Control Action** = **Reverse-** or **Direct-Acting**: • 0.0 to 100.0 % If **Control Action** = **Dual**: • –100.0 to 100.0 %	0.0 %
Sensor Failure		
Action	None, Hold, Default Output.	None
Default Output	If **Sensor Failure Action** = **Default Output**: • Numeric value If **Control Action** = **Reverse-** or **Direct-Acting**: • 0.0 to 100.0 % If **Control Action** = **Dual**: • –100.0 to 100.0 %	0.0 %
PID 2	As PID 1 menus.	
Operator Control	Enabled, Disabled	Enabled

Communication



Communication level menus for Modbus, Profibus, HART, Ethernet are enabled only if an optional communications module is fitted.

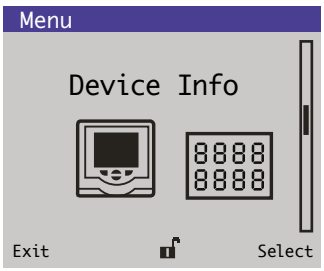
Refer to the communications supplementary manuals for full details of MODBUS, Profibus, HART and Ethernet connections and configuration together with tables detailing Profibus slot/indexes and MODBUS coils and registers:

- Modbus Communications supplement (COM/AWT420/MODBUS)
- Profibus Communications supplement (COM/AWT420/PROFIBUS)
- HART Communications supplement (COM/AWT420/HART)
- Ethernet Communications supplement (COM/AWT420/ETHERNET)

Menu	Comment	Default
Modbus	Displayed only if a Modbus communication module is fitted	
PROFIBUS	Displayed only if a PROFIBUS communication module is fitted	
HART	Displayed only if a HART communication module is fitted	
Ethernet	Displayed only if an Ethernet communication module is fitted	
Bluetooth	The AWT420 features a fully certified Bluetooth® 4.2 Low Energy module. This allows users wireless communication with the transmitter using the dedicated CWA mobile application. The mobile application is available for both Android™ and iOS™ operating systems. **Note**. Only mobile devices with support for Bluetooth® 4.2 or newer are compatible.	
Device Enable	Enables or disables power to the Bluetooth module. When disabled the module is no longer advertising and is not connectible.	Enabled
Device Name	Read only device name. This device name forms part of the advertising data used by the module allowing the user to differentiate between other Bluetooth devices within range when scanning for devices to connect to. This Bluetooth **Device Name** is generated automatically from the instrument tag. Therefore, whenever the transmitters instrument tag is changed the Bluetooth **Device Name** changes to reflect it.	
Pairing PIN	The fixed 6-digit PIN number used when pairing the transmitter and mobile device. Once paired the PIN number is no longer required when re-connecting as the bonding information is stored within the module.	
Generate New PIN	Allows the operator to generate a new pairing PIN. The new pairing pin number is generated randomly by the transmitter.	

…12 Configuration (Advanced access level)

Device Info



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

Menu	Comment	Default
Transmitter		
Serial Number	The transmitter's serial number.	
Software Revision	The transmitter's software version number.	
Hardware Revision	The transmitter's hardware version number.	
Date of Manufacture	The date of manufacture of the transmitter.	
PROFIBUS DP	Displayed only if an PROFIBUS communications module is fitted.	
Hardware Revision	The hardware revision of the PROFIBUS DP module.	
Software Revision	The software revision of the PROFIBUS DP module.	
Ethernet	Displayed only if an Ethernet communications module is fitted.	
MAC Address	The Ethernet module's physical address.	
Bluetooth	Bluetooth menus always displayed.	
MAC Address	Read only Media Access Control Address (MAC) of the Bluetooth module. The hardware identification number that uniquely identifies each device. This is fixed by the manufacturer and cannot be changed.	
Firmware Revision	The revision number of the firmware within the Bluetooth module.	
eLabel	The regulatory approval information for the Bluetooth module.	
S1 (to S2)		
Sensor Type	The type of sensor connected.	
Model type	Displayed only if a pH sensor is connected. The type of pH/Redox (ORP) digital sensor.	
Glass type	Displayed only if a pH sensor is connected. The type of glass for the pH digital sensor.	
Temp Range Low	Displayed only if a pH sensor is connected. The lowest temperature value set.	
Temp Range High	Displayed only if a pH sensor is connected. The highest temperature value set.	
Product Code	Displayed only if a pH sensor is connected. The sensor product code.	
Wiper Fitted	Displayed only if a turbidity sensor is connected.	
Serial Number	Displayed only if a digital sensor is connected. The sensor serial number.	
Cap Serial Number	Displayed only if an optical dissolved oxygen sensor is connected. The serial number of the cap fitted to the sensor.	
Software Revision	The software version number of the sensor.	
Hardware Revision	The hardware version number of the sensor.	
Date of Manufacture	The date of manufacture of the sensor.	

Analog sources and digital input/output sources

Analog sources

Source name*	Description
S1 (to 2) primary value	Measured primary value for associated sensor.
S1 (to 2) secondary value	Measured secondary value for associated sensor.
S1 (to 2) tertiary value	TSS only – temperature
S1 (to 2) control O/P	Control output – single
S1 (to 2) control O/P (A)	Control output – dual (acid)
S1 (to 2) control O/P (B)	Control output - dual (base)
Inferred pH	Calculation based on dual 2-electrode conductivity.
Ratio	Calculation based on dual 2-electrode conductivity.
% Passage	Calculation based on dual 2-electrode conductivity.
% Rejection	Calculation based on dual 2-electrode conductivity.
Average	Dual verification.
Difference	Dual verification.
Maximum	Dual verification.
Minimum	Dual verification.

Digital output sources

Source name*	Description
Alarm 1 (to 8) State	Process alarm state (alarm 1 to 8).
S1 (to 2) Failure	The associated sensor is in the failed state – see 'Troubleshooting' page 84 for possible causes.
S1 (to 2) Out of Spec.	The associated sensor is out of specification – see 'Troubleshooting' page 84 for possible causes.
S1 (to 2) Maintenance	The associated sensor requires maintenance – see 'Troubleshooting' page 84 for possible causes.
S1 (to 2) Function Check	The associated sensor requires checking – see 'Troubleshooting' page 84 for possible causes.
Tx Failure	The transmitter is in the failed state – see 'Troubleshooting' page 84 for possible causes.
Tx Out of Spec.	The transmitter is out of specification – see 'Troubleshooting' page 84 for possible causes.
Tx Maintenance	The transmitter requires maintenance – see 'Troubleshooting' page 84 for possible causes.
Tx Function Check	The transmitter requires checking – see 'Troubleshooting' page 84 for possible causes.
S1 (to 2) Cal in Progress	A calibration is in progress for the associated sensor.
S1 (to 2) Cal Failed	The last calibration has failed for the associated sensor.
S1 (to 2) Clean	A clean is in progress for the associated sensor.
S1 (to 2) control O/P	Control output – single.
S1 (to 2) control O/P (A)	Control output – dual (acid).
S1 (to 2) control O/P (B)	Control output – dual (base).
S1 (to 2) Calibration filter inlet	Scheduled calibration filter/valve control.
S1 (to 2) Calibration filter outlet	Scheduled calibration filter/valve control.
Dual calibration filter inlet	Scheduled calibration filter/valve control.
Dual calibration filter outlet	Scheduled calibration filter/valve control.
S1 (to 2) Buffer pump	Chlorine buffer pump control.

Digital input sources

Source name*	Description
S1 (to 2) Hold	The measured concentration for the associated sensor can be held via the digital input.
S1 (to 2) Clean Sequence	**Note**. Applicable only to some sensor types. Initiates an automated cleaning sequence.
Low flow sensor	An external flow sensor can be connected to prompt flow.

Note. It is recommended that a momentary switch is used to start or abort digital input operations and a toggle switch is used for the hold functionality.
To start a digital input operation – hold the momentary switch for a minimum of two seconds; release the switch when the digital input operation starts.
To abort a digital input operation – hold the momentary switch for a minimum of two seconds; release the switch when the digital input operation aborts.

*(2) = maximum number of sensors if multiple sensors are connected.

13 Sensor setup menus

2-electrode conductivity

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages.**	TAG1
Measurement Type	Select measurement type: • Conductivity/Concentration/Resistivity **Note**. If a change is made the I/O sources are reset.	Conductivity
Note. The following menus are displayed only if measurement type = **Conductivity**		
Conductivity Unit	Select the conductivity units: • mS/cm/µS/cm	µS/cm
Cell Constant	Enter the cell constant of the measuring cell used – see the relevant conductivity cell manual.	1.00
Range High	Set the span value used in **Chart** and **Bargraph** views.	Cell constant dependent – see table below
Range Low	Set the zero value used in **Chart** and **Bargraph** views.	0
Note. The following menus are displayed only if measurement type = **Concentration**		
Cell Constant	Enter the cell constant of the measuring cell used – see the relevant conductivity cell manual.	N/A
Concentration Unit	Select the concentration units: • None(Blank)/ppm/mg/l/ppb/µg/l/%/Custom	N/A
Custom Units	**Note**. Displayed only if concentration units = **Custom** Enter an alphanumeric string (6 characters maximum) for the custom (user defined) concentration units.	N/A
Conc. Curve Table	Set the user defined concentration curve using the 6-point linearizer table (concentration against conductivity).	N/A
Range High	View the span value used in **Chart** and **Bargraph** views.	N/A
Range Low	View the zero value used in **Chart** and **Bargraph** views.	N/A
Filter Type	Select the signal filtering type: • None/Low/Medium/High	None
Temp. Comp. Type	Set the type of temperature compensation: • Manual/Automatic/None	Automatic
Manual Temperature	**Note.** Displayed only if temperature compensation type = **Manual** Enter the temperature of the sample within the range –10.0 to 120.0 °C.	25.0 °C
TC Curve	**Note.** Not displayed only if temperature compensation type = **None** Set the temperature compensation characteristic required: • TC Coeff./Standard KCl/UPW (Low TC)/UPW (High TC)/Pure H_20 (Neutral)/ Pure H_2O (Acid)/Pure H2O (Base)/NaOH/HCl/NaCl/NH_3/User Defined	TC Coeff
User Def. TC Curve	**Note.** Displayed only if temperature compensation curve = **User Defined** Set the user defined temperature compensation curve using the six point linearizer table (% against °C).	N/A
TC Coefficient	**Note.** Displayed only if temperature compensation curve = **User Defined** Enter the temperature coefficient (α x 100) of the solution (0.01 to 5.00 %/°C). If unknown, the temperature coefficient (α) of the solution must be calculated – see page 72.	2.00 %/°C
Reference Temperature	**Note**. Displayed only if TC Curve = TC Coeff. (Supported with software version ACS200/P2/00.01.03, hardware 2 onwards) Set the reference temperature compensation: • 25 °C (77 °F) / 20 °C (68 °F)	25 °C (77 °F)
Sensor Diagnostics		
Polarisation	Detect excessive polarisation condition: • Enabled/Disabled	Disabled
Out Of Solution	Detect **Out Of Solution** condition: • Enabled/Disabled	Disabled
Reset To Defaults	Select to reset all **Sensor Setup** parameters to their default values.	

Conductivity cell constant	Conductivity measuring range
0.01	0 to 200 µS/cm
0.05	0 to 1,000 µS/cm 0 to 1 mS/cm
0.10	0 to 2,000 µS/cm 0 to 2 mS/cm
1.00	0 to 20,000 µS/cm 0 to 20 mS/cm

2-electrode conductivity – dual-input calculated values setup

Menu	Comment	Default
Calculation Type	Calculations are performed using the inputs from both sensors. Select the required calculation from the following options: No Calculation/Inferred pH (NaOH)/Inferred pH (NaOH+NaCl)/Inferred pH (NH_3)/ Inferred pH (NH_3+NaCl)/Difference/Ratio/% Passage/% Rejection **Inferred pH (NaOH)** Calculates a pH value in the range 7.00 to 11.00 pH based on the type of chemical dosing and the conductivity readings. **Note:** The temperature compensation characteristic **TC Curve** for signal B should be set to **NaOH**. **Inferred pH (NaOH+NaCl)** Calculates a pH value in the range 7.00 to 11.00 pH based on the type of chemical dosing and the conductivity readings. **Note:** The temperature compensation characteristic **TC Curve** for signal A should be set to **NaCl**. **Note:** The temperature compensation characteristic **TC Curve** for signal B should be set to **NaOH**. **Inferred pH (NH_3)** Calculates a pH value in the range 7.00 to 10.00 pH based on the type of chemical dosing and the conductivity readings. **Note:** The temperature compensation characteristic **TC Curve** for signal B should be set to **NH_3**. **Inferred pH (NH_3+NaCl)** Calculates a pH value in the range 7.00 to 10.00 pH based on the type of chemical dosing and the conductivity readings. **Note:** The temperature compensation characteristic **TC Curve** for signal A should be set to **NaCl**. **Note:** The temperature compensation characteristic **TC Curve** for signal B should be set to **NH_3**. **Difference** Calculates the difference between the two conductivity inputs: Difference = B − A **Ratio** Calculates the ratio of the two conductivity inputs: $\text{Ratio} = \frac{B}{A}$ **% Passage** Calculates the amount of conductivity as a percentage that passes through the cation exchange unit: $\%\text{Passage} = \frac{A}{B} \times 100$ **% Rejection** Calculates the amount of conductivity as a percentage that is absorbed in the cation exchange unit: $\%\text{Rejection} = \left(1 - \frac{A}{B}\right) \times 100$	No Calculation
Note. The following menus are displayed only if Calculation Type = Inferred pH.		
Before Cation Limit	Set the required before-cation conductivity limit, between: • 0.000 and 100.0 µS/cm Inferred pH (NaOH) • 0.000 and 100.0 µS/cm Inferred pH (NaOH+NaCl) • 0.000 and 25.00 µS/cm Inferred pH (NH_3) • 0.000 and 25.00 µS/cm Inferred pH (NH_3+NaCl)	N/A
After Cation Limit	Set the required after-cation conductivity limit, between: • 1.000 and 100.0 µS/cm Inferred pH (NaOH) • 1.000 and 250.0 µS/cm Inferred pH (NaOH+NaCl) • 0.060 and 10.00 µS/cm Inferred pH (NH_3) • 0.060 and 25.00 µS/cm Inferred pH (NH_3+NaCl)	N/A
pH Range	View the measuring range for the selected Inferred pH calculation • 7.00 to 11.00 pH Inferred pH (NaOH) • 7.00 to 11.00 pH Inferred pH (NaOH+NaCl) • 7.00 to 10.00 pH Inferred pH (NH_3) • 7.00 to 10.00 pH Inferred pH (NH_3+NaCl)	N/A
Signal Arrangement	Set the signal arrangement: • A = S1, B = S2/A = S2, B = S1 **Note:** For inferred pH: • A = Conductivity measurement **A**fter cation column. • B = Conductivity measurement **B**efore cation column.	N/A

…13 Sensor setup menus

4-electrode conductivity

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages**.	TAG1
Measurement Type	Select measurement type: • Conductivity/Concentration **Note**. If a change is made the I/O sources are reset.	Conductivity
Note. The following menus are displayed only if **Measurement Type** = **Conductivity**		
Conductivity Unit	Select the conductivity units: • mS/cm/µS/cm	mS/cm
Sensor Group	Enter the sensor group for the measuring cell used – • Group A/Group B see the relevant conductivity cell manual.	Group A
Range High	Set the span value used in **Chart** and **Bargraph** views.	Sensor Group dependent – see table below
Range Low	Set the zero value used in **Chart** and **Bargraph** views.	0
Note. The following menus are displayed only if **Measurement Type** = **Concentration**		
Sensor Group	Enter the sensor group for the measuring cell used – • Group A/Group Bw see the relevant conductivity cell manual.	N/A
Conc. Solution	Note. Displayed only if **Sensor Group** = **Group A** Select the Concentration Solution • NaOH/HCl/H_2SO_4/H_3PO_4/NaCl/KOH/Custom	N/A
Concentration Unit	**Note**. Displayed only if **Conc. Solution** = **Custom** Select the Concentration Units • None(Blank)/ppm/mg/l/ppb/µg/l/%/Custom	N/A
Custom Units	**Note**. Displayed only if **Concentration Units** = **Custom** Enter an alphanumeric string (6 characters maximum) for the custom (user defined) concentration units.	N/A
Conc. Curve Table	Set the user defined concentration curve using the 6-point linearizer table (concentration against conductivity).	N/A
Range High	View the span value used in **Chart** and **Bargraph** views.	N/A
Range Low	View the zero value used in **Chart** and **Bargraph** views.	N/A
Filter Type	Select the signal filtering type: • None/Low/Medium/High	None
Temp. Comp. Type	Set the type of temperature compensation: • Manual/Automatic/None	Automatic
Manual Temperature	**Note**. Displayed only if **Temp. Comp. Type** = **Manual** Enter the temperature of the sample within the range –10.0 to 120.0 °C.	25.0 °C
TC Curve	**Note**. Not displayed only if **Temp. Comp. Type** = **None** Set the type of automatic temperature compensation required: • TC Coeff./Standard KCl/NaOH/NaCl/HCl/H_2SO_4/H_3PO_4/KOH/User Defined	TC Coeff
User Def. TC Curve	**Note**. Displayed only if **TC Curve** = **User Defined.** Set the user defined temperature compensation curve using the six point linearizer table (% against °C).	N/A
TC Coefficient	**Note**. Displayed only if **TC Curve** = **User Defined.** Enter the temperature coefficient (α x 100) of the solution (0.01 to 5.00 %/°C). If unknown, the temperature coefficient (α) of the solution must be calculated.	2.00 %/°C
Reference Temperature	**Note**. Displayed only if TC Curve = TC Coeff. (Supported with software version ACS400/P2/00.01.03, hardware 2 onwards) Set the reference temperature compensation: • 25 °C (77 °F) / 20 °C (68 °F)	25 °C (77 °F)
Sensor Diagnostics		
Dirty Sensor	Detect dirty sensor condition: • Enabled/Disabled	Disabled
Out Of Solution	Detect Out Of Solution condition: Enabled/Disabled	Disabled
Reset To Defaults	Select to reset all **Sensor Setup** parameters to their default values	

Sensor group	Conductivity measuring range
A	0 to 2,000 mS/cm
B	0 to 2,000 µS/cm

pH/Redox/ORP

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages.**	TAG1
Measurement Type	Select measurement type: • pH/Redox/ORP **Note**. If a change is made the I/O sources are reset.	pH
Range High	Set the span value used in **Chart** and **Bargraph** views.	14.00
Range Low	Set the zero value used in **Chart** and **Bargraph** views.	0.00
Filter Type	Select the signal filtering type: • None/Low/Medium/High	None
Note. The following menus are displayed only if **Measurement Type** = **pH.**		
Temp. Compensation	Set the type of temperature compensation: • Manual/Automatic/Auto solution	Automatic
Solution Coeff.	**Note**. Displayed only if **Temp. Compensation** type = **Auto solution.** Set the solution coefficient (pH or mV change per 10 °C) of the solution being monitored.	N/A
Manual Temperature	**Note.** Displayed only if **Temp. Compensation** type = **Manual.** Enter the temperature of the sample within the range –10.0 to 120.0 °C.	N/A
Note. The following menus are displayed only if **Measurement Type** = **Redox/ORP.**		
Temperature Sensor	Set the type of temperature measurement: • Manual/Automatic **Note.** If **Temperature Sensor** type = **Manual**, the temperature value is not displayed in the associated **Operator page** or **Signals View**.	N/A
Low Slope Limit	A pH probe degrades over time. As this happens the slope calculated by a calibration procedure gradually decreases. Set the slope value below which a calibration fails. The low slope warning diagnostic is activated if the calibration calculates a slope less than 20 % above this value.	40 %
Sensor Diagnostics		
Broken Glass	**Note:** Displayed only if **Measurement Type** = **pH.** Detect broken glass condition: • Enabled/Disabled	Disabled
Out Of Solution	Detect Out Of Solution condition: • Enabled/Disabled	Disabled
Ref. Poisoning	**Note:** Displayed only if a digital (EZLink) sensor is connected. Detect a contaminated reference electrode: • Enabled/Disabled	Disabled
Ref. Failure	**Note:** Displayed only if a digital (EZLink) sensor is connected. Detect a failed reference electrode: • Enabled/Disabled	Disabled
Ref. Blocked	Detect a blocked reference electrode: • Enabled/Disabled	Disabled
Ref. Alarm Limit	**Note:** Displayed only if **Ref. Blocked** sensor diagnostic is **Enabled.** A blocked reference electrode is detected when the impedance of the reference electrode exceeds a given limit. Set the impedance value above which the reference blocked diagnostic is activated.	N/A
Reset To Defaults	Select to reset all **Sensor Setup** parameters to their default values.	

…13 Sensor setup menus

Turbidity

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages.**	TAG1
Sensor Type	Select the sensor type: • 7998 011/7998 012/7998 016	N/A
Turbidity Units	Select the turbidity units: • NTU/FNU	NTU
Range High	Set the span value used in **Chart** and **Bargraph** views.	40.00 NTU (sensor types: 7998 011, 7998 016) 400.0 NTU (sensor type: 7998 012)
Range Low	Fixed at 0.0 NTU.	0.0
Filter Type	Select the signal filtering type: • None/Low/Medium/High	None
Bubble Rejection	Select the bubble rejection filtering type: • None/Low/Medium/High	None
Note. The following menus are displayed only if the sensor has a wiper fitted. Validity sensor type: 7998 011 or 7998 012		
Wiper Clean Freq.	Set the interval between cleans: • Off/15 mins/30 mins/45 mins/1 to 24 hours	Off
Next Clean	**Note**. Displayed only if a wiper clean frequency has been configured Set the time for the next wiper clean to occur.	N/A
Reset Wiper Lifetime	Use to restart the wiper lifetime counter after wiper replacement.	N/A
Reset To Defaults	Select to reset all **Sensor Setup** parameters to their default values.	

Turbidity/Suspended solids

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages.**	TAG1
Senor Type	Select measurement type: • Turbidity/Suspended solids **Note**. If a change is made the I/O sources are reset.	Turbidity
Turbidity Units	Select the turbidity units • NTU/FNU	NTU
TSS Units	Select the total suspended solids units • mg/L / ppm for readings above 1000 mg/L (ppm) the units change automatically to g/L (ppt).	mg/L
Range High	Set the span value used in **Chart** and **Bargraph** views.	4000 NTU
Range Low	Set the zero value used in **Chart** and **Bargraph** views.	0
Filter Type	Select the signal filtering type: • None/Low/Medium/High	None
Note. The following menus are displayed only if the sensor has a wiper fitted.		
Wiper Clean Freq.	Set the interval between cleans: • Off/15 mins/30 mins/45 mins/1 to 24 h	Off
Next Clean	**Note**. Displayed only if a wiper clean frequency has been configured Set the time for the next wiper clean to occur.	N/A
Reset Wiper Lifetime	Use to restart the wiper lifetime counter after wiper replacement.	N/A
Reset To Defaults	Select to reset all **Sensor Setup** parameters to their default values.	

Dissolved oxygen

Refer to OI/ADS420 for the full list of sensor setup menus for ADS420.

ACL410 chlorine

Refer to OI/ACL410 for the full list of sensor setup menus for ACL410.

ACL420 chlorine

Refer to OI/ACL420 for the full list of sensor setup menus for ACL420.

…13 Sensor setup menus

Universal Input Module – custom sensor type

Menu	Comment	Default
Tag	Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages.**	TAG1
Sensor Type	Select sensor type: • Custom / ACL410 **Note**. If a change is made, the I/O sources are reset.	Custom
PV Options		
Type	Select PV type: • Current / Voltage / Frequency / Resistance / Temperature	Current
Electrical Units	Select the electrical units. Selectable units are in Table 9 on page 45	
Electrical Range High **Electrical Range Low**	Configure the electrical ranges. Available ranges are outlined in Table 9 on page 45 **Note.** Range electrical range configuration not displayed if PV Type = Temperature	Refer to Table 10 on page 45
Measurement Type	Refer to Table 11 on page 46	Custom
Unit	Select the PV units. Available options are limited based on the measurement type selected. Refer to Table 12 on page 46 **Note**. Not displayed if PV Type = Temperature. Temperature units may be configured in Device Setup	
Custom Unit	**Note**. Only displayed if Unit = Custom. Enter an alphanumeric string (6 characters maximum) for the custom (user defined) units	
Decimal Places	Select the decimal places. This sets the maximum decimal places shown in **Operator** and **Signals** view: • X / X.X / X.XX / X.XXX	X.X
Range High	Limited to 99999 to –9999	100
Range Low	Limited to 99999 to –9999	0
Filter Duration	Limited from 0 to 900 seconds	0 s
Linearizer	Set the linearizer curve using the 6-point linearizer table.	• Input 0, 20, 40, 60, 80, 100 • Output 1, 1, 1, 1, 1, 1
Note. The following menu is displayed only if PV type is not temperature or resistance.		
Temp. Compensation	Select temp. compensation to be applied: • None / Manual / Auto	None
Note. The following menu is displayed only if Temp. Compensation is Manual		
Manual Temperature	Limited to –40 to 200.0 °C	25.0 °C
Temp. Comp. Curve	Set the temperature compensation curve using the 6-point table	• Input 0, 20, 40, 60, 80, 100 • Output 1, 1, 1, 1, 1, 1
SV Options		
Type	The SV type shall be configurable to the following options: • None / Voltage / Current / Frequency / Resistance / Temperature. If PV is configured to current, voltage, or frequency, it shall only be possible to set SV Type as None, Resistance, or Temperature. If PV is configured to Resistance or Temperature, it shall only be possible to set SV as None, Current, Voltage, or Frequency. If Temp. Comp. Type is set to Manual or Auto, SV shall be set to Temperature.	Temperature
Note. The following menus are displayed only if Type is not None		
Electrical Units	• Select the electrical units. Selectable units are in Table 9 on page 45	µA
Electrical Range High **Electrical Range Low**	Configure the electrical ranges. Available ranges are in Table 9 on page 45 **Note**. Range electrical range configuration not displayed if SV Type = Temperature	Refer to Table 10 on page 45
Unit	Select the SV units. Available options are limited based on the measurement type selected. See Table 12 on page 46 **Note**. Not displayed if SV Type = Temperature. Temperature units may be configured in Device Setup	
Custom Unit	**Note**. Only displayed if Unit = Custom. Enter an alphanumeric string (6 characters maximum) for the custom (user defined) units	
Decimal Places	• Select decimal places. This sets the maximum decimal places shown in **Operator** and **Signals** view: • X / X.X / X.XX / X.XXX	X.X

Range High	Limited to 99999 to –9999	100
Range Low	Limited to 99999 to –9999	0
Filter Duration	Limited from 0 to 900 seconds	0 s
Linearizer	Set the linearizer curve using the 6-point linearizer table	• Input 0, 20, 40, 60, 80, 100 • Output 1, 1, 1, 1, 1, 1
Voltage Output Sel.	Select voltage output: • Disabled / mV / 5 V / 12 V / 24 V	Disabled
Note. The following menu is displayed only if Voltage Output Sel. = mV		
Millivolt Output	Select the millivolt output bias voltage. Limited from 0 to 1,000 mV	0 mV
Reset to Defaults	Reset all sensor values to defaults	

Table 9 Electrical Range High & Electrical Range Low

Type	Voltage	Current	Frequency	Resistance	Temperature
Electrical Range High	0 mV	0 µA	1 Hz	50 Ω	–40 °C
Electrical Range Low	1,000 mV	50,000 µA	6,000 Hz	10,000 Ω	200 °C
Units	mV	nA, µA, mA	Hz	Ω	°C or °F

Table 10 Default values

PV Type	Voltage	Current	Frequency	Resistance	Temperature
Electrical Range Low	0 mV	4,000 µA	1 Hz	50 Ω	–40 °C
Electrical Range High	1,000 mV	20,000 µA	6,000 Hz	10,000 Ω	200 °C

…13 Sensor setup menus

…Universal Input Module – custom sensor type

Table 11 Available engineering units

Unit
None
NTU
FNU
FTU
FAU
ppm
mg/L
ppb
µg/L
µg/kg
mg/kg
Nm3/h
Bar
°C
°F
µS/cm
µS/m
mS/cm
mS/m
TDS
MΩ
Ω
pH
mV
SAT
%
mA
mL/s
µA
mL/m
PSU
PPT
mbar
mmHg
Weeks
Days
g/L
ppt
MΩ-cm
Custom S1 PV Unit*
Custom S2 PV Unit*
nA
PSI
Hz
Custom S1 SV Unit*
Custom S2 SV Unit*

*Custom units are defined in sensor setup. See UIM menus above.

Table 12 Measurement types and allowable units

Measurement type	Allowable units
Custom	All
pH	pH, User1, User2
Redox	mV, User1, User2
Temperature	N/A (use device units)
Conductivity	µS/cm, mS/cm, µS/m, User1, User2
Concentration	None, %, ppm, ppb, ppt, g/L, mg/L, µg/L, User1, User2
Resistivity	MΩ-cm, User1, User2
Dissolved oxygen	ppm, ppt, mg/L, g/L, User1, User2
%Sat	%Sat, User1, User2
Turbidity	NTU, FNU, FAU, FTU, User1, User2
Suspended solids	ppm, ppt, mg/L, g/L, User1, User2
Chlorine	ppm, ppb, mg/L, µg/L, User1, User2
Chlorine dioxide	ppm, ppb, mg/L, µg/L, User1, User2
Ozone	ppm, mg/L, User1, User2
Flow	mL/s, mL/h, m3/h, User1, User2
Pressure	PSI, mbar, barA, mmHg, User1, User2
Millivolts	mV, User1, User2
Current	mA, µA, nA, User1, User2
Resistance	Ω, MΩ, User1, User2

Universal Input Module calculations

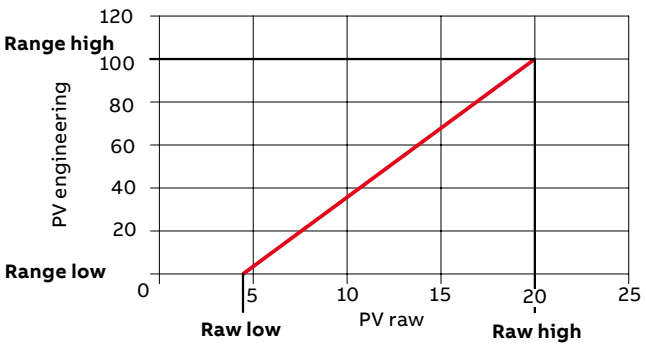
The Universal Input Module can be configured in many different ways for a variety of different input types. This section outlines the calculations that the universal input module performs to allow the user to understand the configurations that are possible. The UIM comes with a preconfigured setup for use with the ACL410, which removes the need for manual configuration.

The steps the UIM takes to produce a final value are outlined below.

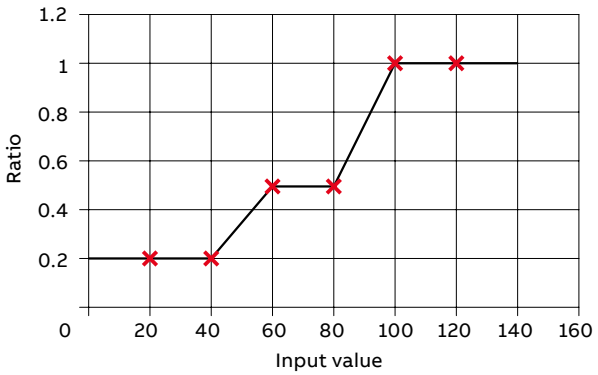
PV calculations

1 Raw PV is measured based on the selected PV type. This can be Current, Voltage, Frequency, Resistance or Temperature.

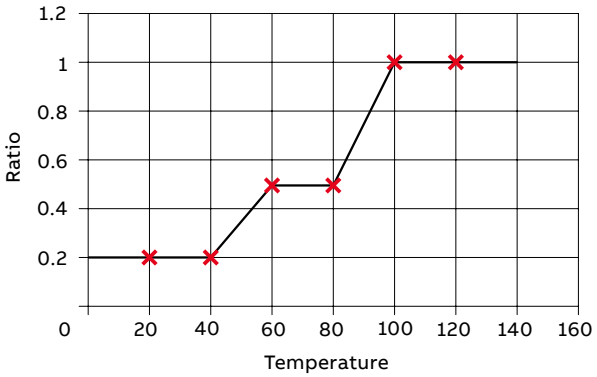
2 Engineering value is calculated based on the configured ranges and the raw PV. The graph below outlines how this is performed:



3 If a linearizer has been configured then this is applied. The linearizer is a set of input/ratio pairs that are used to scale the engineering value obtained in step 2. An example linearizer is shown below.
Note. The software will automatically extrapolate between input value points
Note. If the input value is less than the lower pair then the ratio used will be the value defined in the lowest pair
Note. If the input value is more than the highest pair then the ratio used will be the value defined in the highest pair.



4 If a temperature linearizer has been enabled then this is applied. The linearizer is a set of temperature/ratio pairs that are used to scale the engineering value obtained in Step 3. An example linearizer is shown below.
Note: the software will automatically extrapolate between temperature points
Note. If the temperature is less than the lower pair then the ratio used will be the value defined in the lowest pair
Note. If the temperature is more than the highest pair then the ratio used will be the value defined in the highest pair:



5 The user calibration is applied. This is a linear two point calibration defined by the “Calibrate” menus in the transmitter.

6 The user filter is applied. This is a moving average filter with a period of between 0 and 900s as defined by the filter length parameter

SV calculations

The SV calculations are identical to the PV calculations, however it is not possible to enable temperature compensation on the SV.

…13 Sensor setup menus

Sensor setup menus – dual verification

Menu	Comment	Default
Calculation type	Calculations are performed using the inputs from both sensors. Select the required calculation from the following options: None • Average • Difference • Maximum • Minimum	None

When dual verification is used, two sensors are placed in the same measuring point, and then the readings can be used to give additional information.
The AWT420 allows for the following calculations to be performed. The result of the calculation can then be used to control current outputs, configure alarms, or be made available on the communication output module fitted:

- Difference: This reports the difference between the measured values. Ideally this will be 0, and any large deviation from zero can be used to indicate that one of the sensors is malfunctioning:

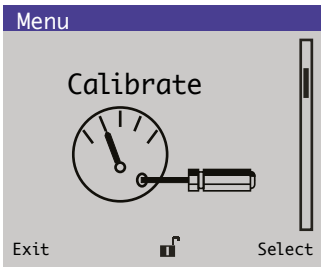
  $PV_{Difference}=abs(PV_{S1}-PV_{S2})$

- Average: This can be used to obtain a more stable results than may be possible with a single sensor. The average of the values obtained by each sensor is calculated:

  $PV_{Average}=(PV_{S1}+PV_{S2})/2$

14 Calibration procedures

2-electrode conductivity



The conductivity/concentration/resistivity/temperature calibration is a smart one-point calibration routine that allows for single- or dual-point calibrations. By initiating calibrations at two different conductivity/concentration/resistivity/temperature values having ample separation, the AWT420 transmitter automatically adjusts the offset, slope, or both in order to obtain the best sensor performance. Since this routine only uses the most recent calibration data, calibration can be conducted throughout the sensor's life thus ensuring consistent sensor performance. If an incorrect calibration has been entered, the **Restore Cal Defaults** menu returns transmitter calibration values to factory settings.

The AWT420 transmitter can be configured as a Conductivity, Resistivity or Concentration device, the smart one-point calibration routine automatically uses the same units as the measured process variable.

Note. Access the calibrate menu via the **Calibrate** and **Advanced** levels only.

Menu	Comment	Default
Conductivity Cal	See typical procedure, see page 50.	N/A
Concentration Cal	See typical procedure, see page 50.	N/A
Resistivity Cal	See typical procedure, see page 50.	N/A
Temperature Cal	See Temperature Calibration procedure, see page 64.	N/A
Edit Cal		
PV Slope	Edit the **PV Slope** value. • Valid slope values range from 80 to 120 %	100 %
PV Offset	Edit the sensor **PV Offset**. Valid offset values are: • ±20 µS/cm for cell constants of 1.00 • ±4 µS/cm for cell constants of 0.10 • ±0.8 µS/cm for cell constants of 0.01	0 µS/cm
Temperature Slope	Edit the **Temperature Slope** value. • Valid slope values range from 40 to 160 %	100 %
Temperature Offset	Edit the **Temperature Offset** value. • Valid offset values are ±40 °C.	0 °C
Restore Cal Defaults	Resets slope and offset values to factory default.	N/A

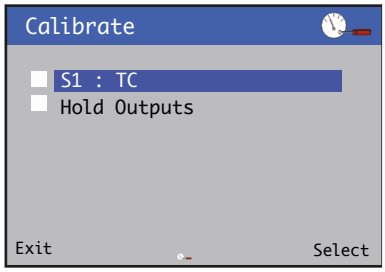
…14 Calibration procedures

2-electrode conductivity, resistivity or concentration calibration

Once the sensor has been installed and has reached the temperature of the process solution, verify the process variable value using a grab sample and an external validation device having the same type of temperature compensation.

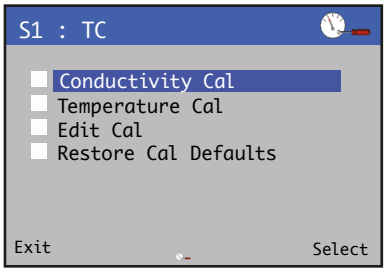
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



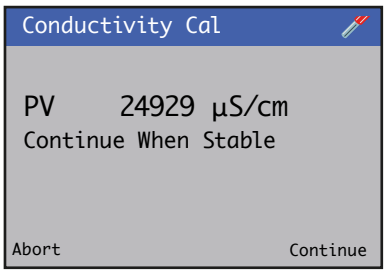
2 Use the /keys to select **S1 : TC** and press the key.

The **S1 : TC** menu is displayed:



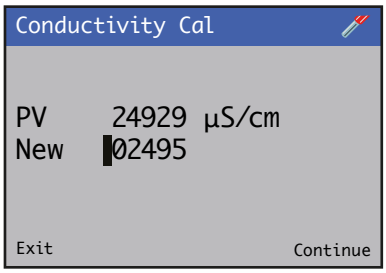
3 Use the /keys to select **Conductivity Cal** and press the .

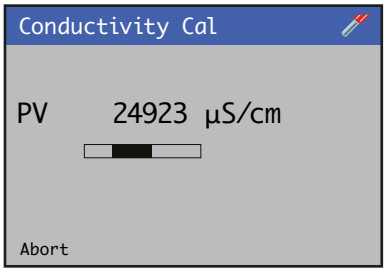
The **Conductivity Cal** menu is displayed:



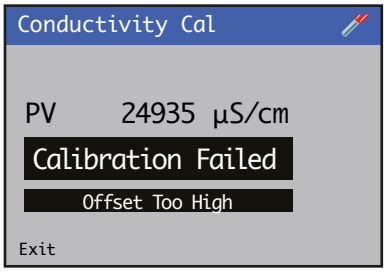
4 Confirm the displayed reading is stable and the key.

5 Press the key to enter a new value (the transmitter takes several seconds to validate the calibration):





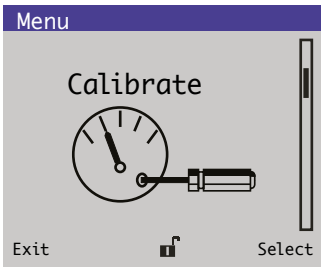
Invalid new calibration values generate an error message and the calibration value is not accepted.



If the new value is valid, **Slope** and **Offset** values are displayed.

...14 Calibration procedures

4-electrode conductivity



The conductivity/concentration/temperature calibration is a smart one-point calibration routine that allows for single- or dual-point calibrations. By initiating calibrations at two different conductivity/concentration/temperature values having ample separation, the AWT420 transmitter automatically adjusts the offset, slope, or both to obtain the best sensor performance.

Because this routine uses only the most recent calibration data, calibration can be conducted throughout the sensor's life thus ensuring consistent sensor performance. If an incorrect calibration is entered, the **Restore Cal Defaults** option returns the transmitter calibration values to factory settings.

The AWT420 transmitter can be configured as a conductivity or concentration device, the smart one-point calibration routine automatically uses the same units as the measured process variable.

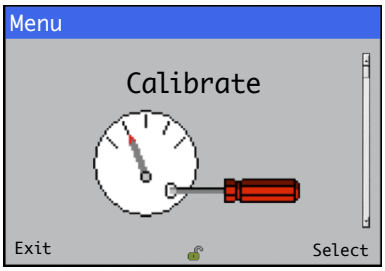
Note. Access to the **Calibrate** menu is via **Calibrate** and **Advanced** levels only.

Menu	Comment	Default
Conductivity Cal	See typical procedure, see page 53.	N/A
Concentration Cal	See typical procedure, see page 53.	N/A
Resistivity Cal	See typical procedure, see page 53.	N/A
Temperature Cal	See Temperature Calibration procedure, see page 64.	N/A
Edit Cal		
PV Slope	Edit the **PV Slope** value. Valid slope values range from 80 to 120 %	100 %
PV Offset	Edit the sensor **PV Offset**. Valid offset values are: • ±20 µS/cm for cell constants of 1.00 • ±4 µS/cm for cell constants of 0.10 • ±0.8 µS/cm for cell constants of 0.01	0 µS/cm
Temperature Slope	Edit the **Temperature Slope** value. Valid slope values range from 40 to 160 %	100 %
Temperature Offset	Edit the **Temperature Offset** value. • Valid offset values are ±40 °C.	0 °C
Restore Cal Defaults	Resets slope and offset values to factory default.	N/A

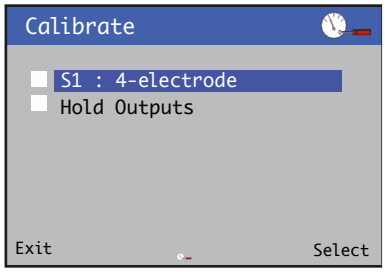
4-electrode conductivity calibration

Once the sensor has been installed and has reached the temperature of the process solution, verify the process variable value using a grab sample and an external validation device having the same type of temperature compensation.

1 At the **Calibrate** level, press the key:

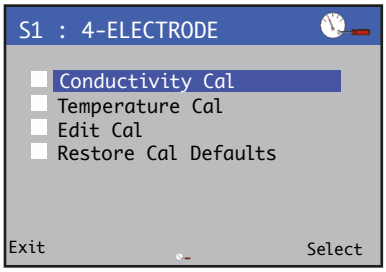


The **Calibrate** menu is displayed:



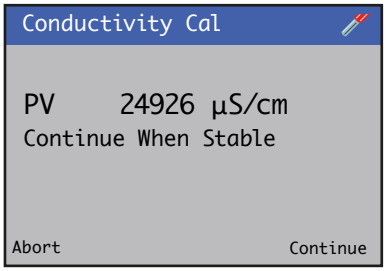
2 Use the ▲/▼ keys to select **S1 : 4-electrode** and press the key.

The **S1 : TC** menu is displayed:



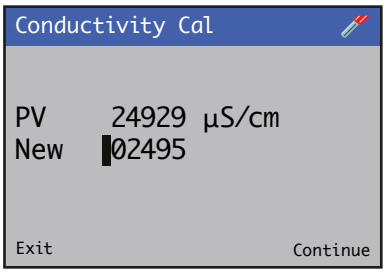
3 Use the ▲/▼ keys to select **Conductivity Cal** and press the key.

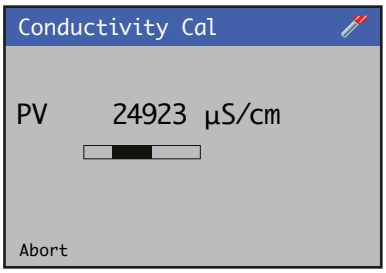
The **Conductivity Cal** menu is displayed:



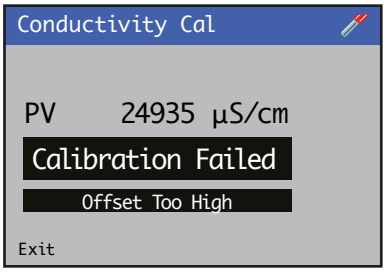
4 Confirm the displayed reading is stable and the key.

5 Press the key to enter a new value (the transmitter takes several seconds to validate the calibration):





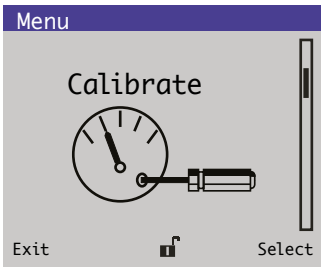
Invalid new calibration values generate an error message and the calibration value is not accepted.



If the new value is valid, the **Slope** and **Offset** values are displayed.

...14 Calibration procedures

pH/Redox/ORP



This section describes how to calibrate the sensor and involves measuring the sensor's sensitivity to pH and temperature by exposing the sensor to samples of known pH/Temperature values

Notes.

- Access to the **Calibrate** menu is via **Calibrate** and **Advanced** levels only.
- During calibration, current outputs and alarms are set to hold automatically if **Hold Outputs** is enabled – see below.

Menu	Comment	Default
Sensor Cal	See **pH/Redox/ORP calibration**, page 41 There are four possible calibration modes: • 1-point manual calibration (adjusts the calibration check value) • 2-point manual calibration (adjusts the check and slope values) • 1-Point automatic calibration (adjusts the calibration check value) • 2-Point automatic calibration (adjusts the check and slope values) **Note.** Automatic calibrations are not available for Redox/ORP measurements	
Temperature Cal*	See **Temperature calibration procedure**, page 64**.**	
Edit Cal		
pH Slope	**Note:** pH sensors only. Edit the slope value: • Valid slope values range from 40 to 150 %	100 %
pH Offset	**Note:** pH sensors only. Edit the offset value: • Valid offset values are: 2.00 to 12.00 pH	7.00 pH
mV Slope	**Note:** Redox/ORP sensors only. Edit the slope value: • Valid slope values range from 40 to 150 %	100 %
mV Offset	**Note:** Redox/ORP sensors only. Edit the offset value: • Valid offset values are: ±240 mV	0 mV
Temp. Slope*	Edit the temperature slope value: • Valid slope values range from 20 to 150 %	100 %
Temp. Offset*	Edit the temperature offset value: • Valid offset values are ±40 °C	0 °C
Sample Collection	**Note:** pH sensors only. See **In process calibrations**, page 77.	
Collection Complete	**Note:** pH sensors only See **In process calibrations**, page 77.	
Restore Cal Defaults	Resets slope and offset values to default values.	

* Only available when using an analog sensor

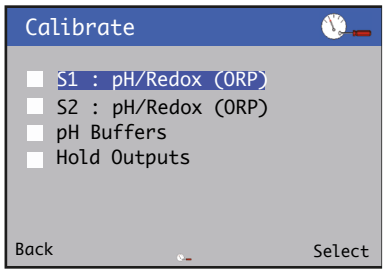
pH/Redox/ORP calibration

Used to calibrate the sensor to measure pH using pH buffers. The automatic calibration provides automatic temperature compensation to the selected buffer.

1-Point calibration

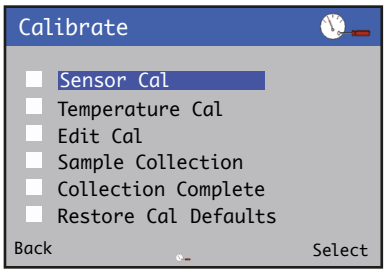
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



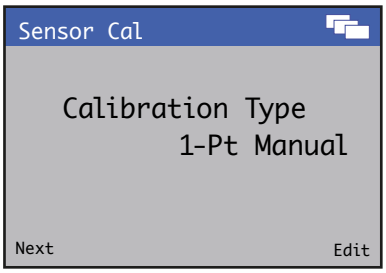
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The pH calibration menu is displayed:



3 Use the ▲/▼ keys to select sensor calibration and press the key to confirm selection.

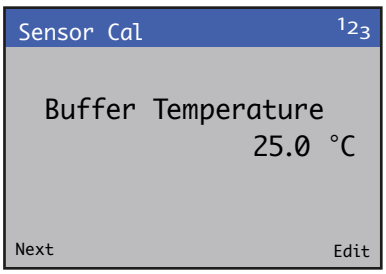
The calibration type is displayed:



4 Use the key to edit the calibration type.
Use the ▲/▼ keys to select the required calibration type and press the key to confirm selection.

Press the key to proceed to the next step.

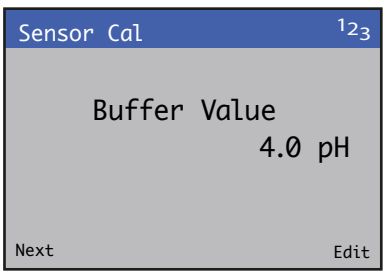
If the sensor is analog, the buffer temperature is displayed:



5 Use the key to edit the buffer temperature.
Use the ▲/▼ keys to set the temperature and press the key to confirm changes.

Press the key to proceed to the next step.

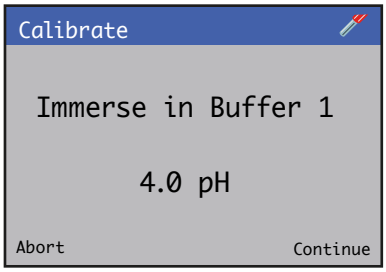
The buffer value is displayed:



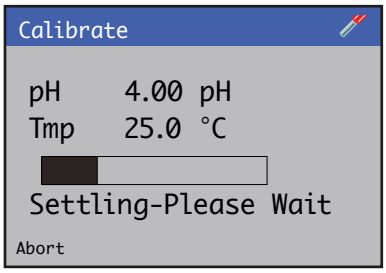
...14 Calibration procedures

6 Use the key to edit the buffer value. Use the ▲/▼ keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.



7 Place the sensor into buffer 1 and press the key to perform the calibration. The calibration process screen is displayed.



On completion the result screen is displayed.

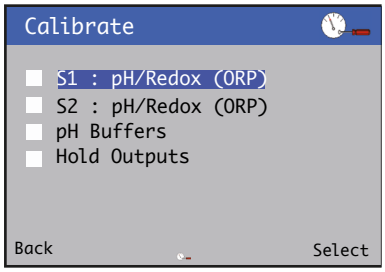
- If the calibration passes, the slope and offset values are displayed.
- If the calibration fails, the failure reason is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key.

2-Point calibration

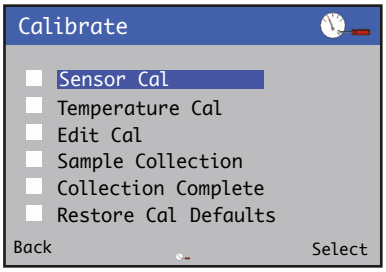
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



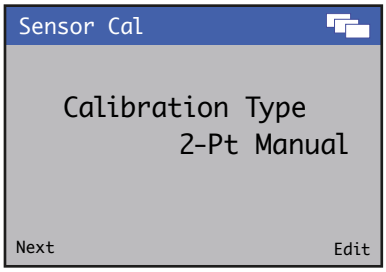
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The pH calibration menu is displayed:



3 Use the ▲/▼ keys to select sensor calibration and press the ◤ key to confirm selection.

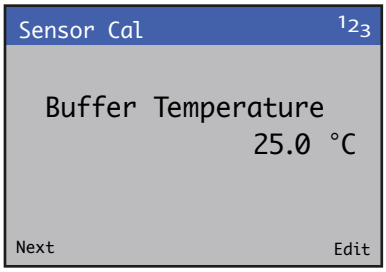
The calibration type is displayed:



4 Use the ◤ key to edit the calibration type.
Use the ▲/▼ keys to select the required calibration type and press the ◤ key to confirm selection.

Press the ◥ key to proceed to the next step.

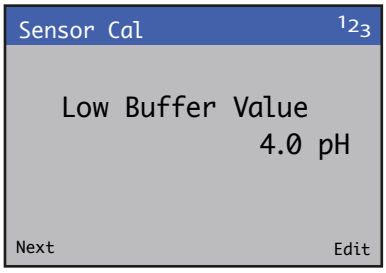
If the sensor is analog, the buffer temperature is displayed:



5 Use the ◤ key to edit the buffer temperature.
Use the ▲/▼ keys to set the temperature and press the ◤ key to confirm changes.

Press the ◥ key to proceed to the next step.

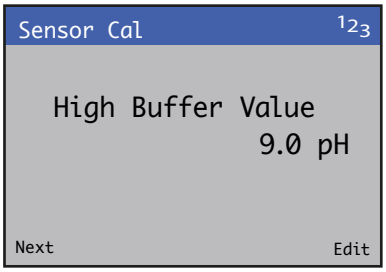
The first buffer value is displayed:



6 Use the ◤ key to edit the low buffer value.
Use the ▲/▼ keys to set the value and press the ◤ key to confirm changes.

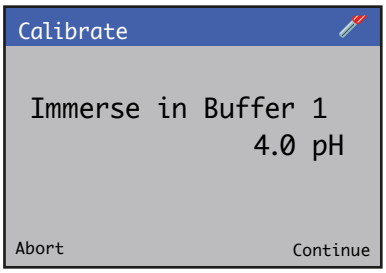
Press the ◥ key to proceed to the next step.

The second buffer value is displayed:



7 Use the ◤ key to edit the high buffer value.
Use the ▲/▼ keys to set the value and press the ◤ key to confirm changes.

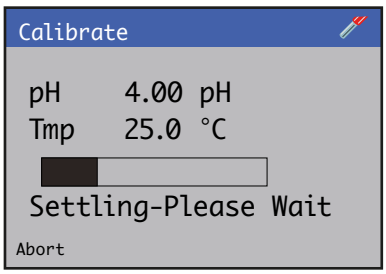
Press the ◥ key to proceed to the low buffer calibration:



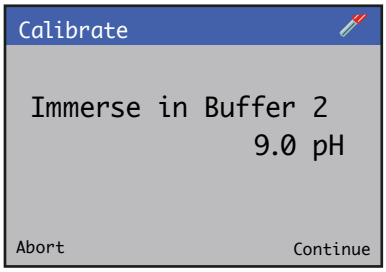
...14 Calibration procedures

...pH/Redox/ORP calibration

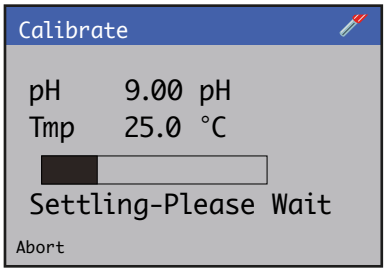
8 Place the sensor into buffer 1 and press the key to perform the low buffer calibration. The calibration process screen is displayed:



- If the calibration fails the result screen is displayed with the reason for failure.
- If the calibration passes the procedure moves automatically to the high buffer calibration.



9 Place the sensor into buffer 2 and press the key to perform the high buffer calibration. The calibration process screen is displayed:



On completion the result screen is displayed.

- If the calibration passes the slope and offset values are displayed.
- If the calibration fails, the failure reason is displayed.

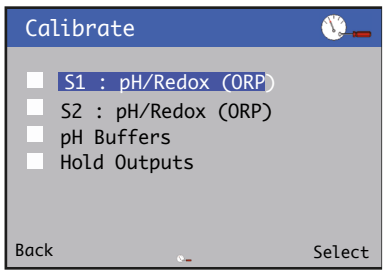
Note. The calibration can be canceled at any time during the process by pressing the **Abort** key.

1-Point automatic calibration

Note. Before starting the calibration ensure the pH buffers are set to the correct values.

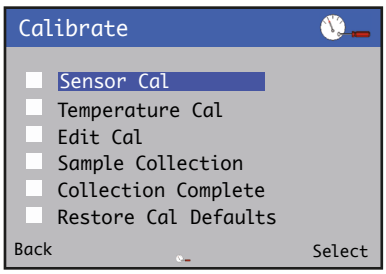
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



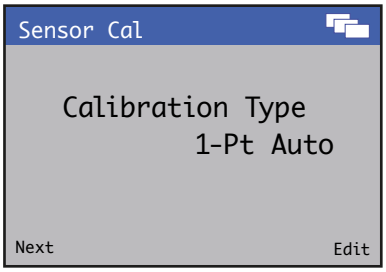
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The pH calibration menu is displayed:



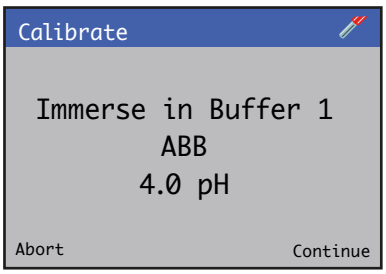
3 Use the ▲/▼ keys to select sensor calibration and press the key to confirm selection.

The calibration type is displayed:

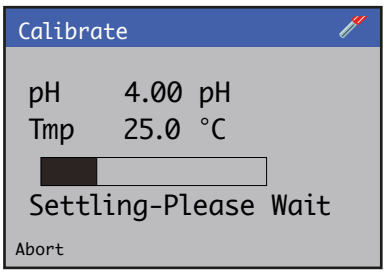


4 Use the key to edit the calibration type.
Use the ▲/▼ keys to select the required calibration type and press the key to confirm selection.

Press the key to proceed to the next step.



5 Place the sensor into buffer 1 and press the key to perform the calibration. The calibration process screen is displayed.



On completion the result screen is displayed.

- If the calibration passes, the slope and offset values are displayed.
- If the calibration fails, the failure reason is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key.

...14 Calibration procedures

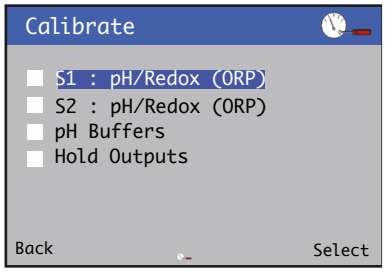
...pH/Redox/ORP calibration

2-Point automatic calibration

Note. Before starting the calibration ensure the pH buffers are set to the correct values.

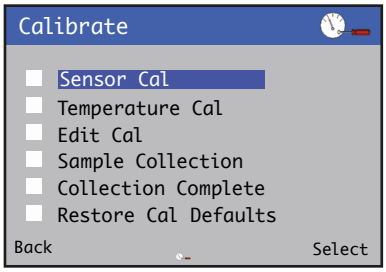
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



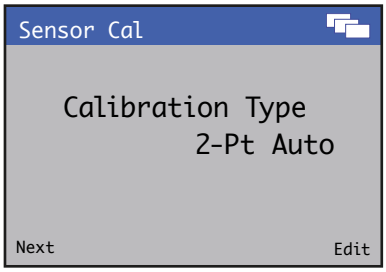
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The pH calibration menu is displayed:



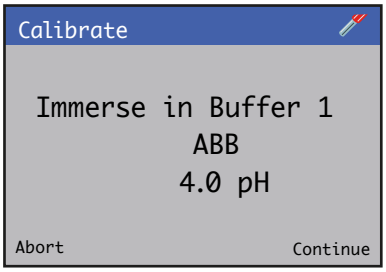
3 Use the ▲/▼ keys to select sensor calibration and press the key to confirm selection.

The calibration type is displayed:

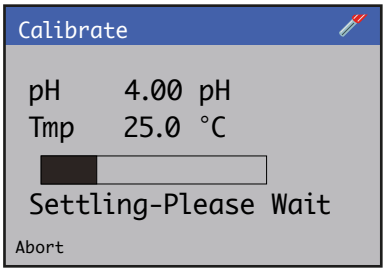


4 Use the key to edit the calibration type.
Use the ▲/▼ keys to select the required calibration type and press the key to confirm selection.

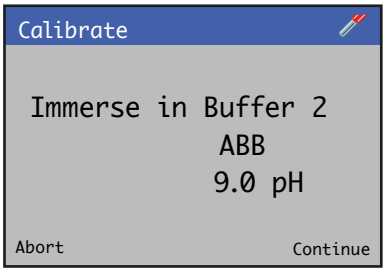
Press the key to proceed to the next step.



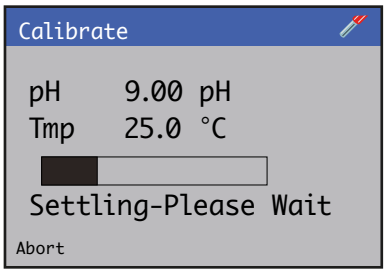
5 Place the sensor into buffer 1 and press the key to perform the low buffer calibration. The calibration process screen is displayed:



- If the calibration fails the result screen is displayed with the reason for failure.
- If the calibration passes the procedure moves automatically to the high buffer calibration.



6 Place the sensor into buffer 2 and press the key to perform the high buffer calibration. The calibration process screen is displayed:



On completion the result screen is displayed.

- If the calibration passes the slope and offset values are displayed.
- If the calibration fails, the failure reason is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key.

In Process calibration (pH)

The **In Process** calibration is used when it is not possible to remove the sensor from the process to perform the calibration. In this calibration mode the actual sample is used to calibrate the sensor.

In Process calibration is performed in two steps:

1 Sample collection
A grab sample is taken from the process and the sensor records the measured value of the sample at that time.

Note. The grab sample should be taken as close to the sensor as possible during the data collection period.

Performing this step erases any sample collections performed previously for the selected sensor. Only the last sample collection is stored in each sensor.

2 Collection complete
The pH of the sample is measured in the laboratory and entered into the transmitter.

This sample must correspond to the last sample collection step performed, or the calibration may not be correct.

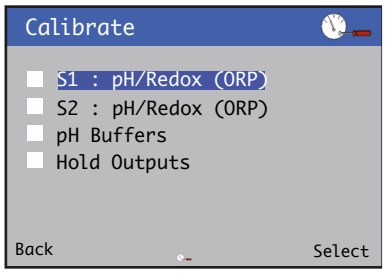
...14 Calibration procedures

...pH/Redox/ORP calibration

Sample collection

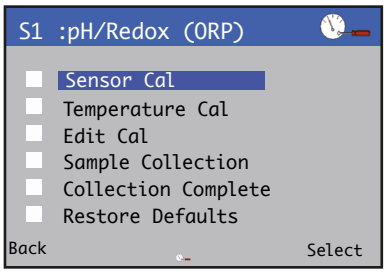
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



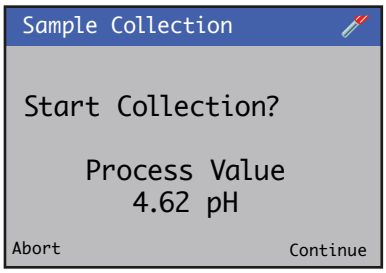
2 Use the ▲/▼ keys to select the sensor to be calibrated, for example, **S1 :pH/Redox (ORP)** and press the key.

The menu options for **S1 :pH/Redox (ORP)** are displayed:



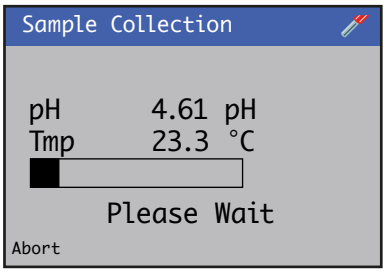
3 Press the ▲/▼ keys to select **Sample Collection** and press the key to confirm selection.

The **Collect Sample** screen is displayed with the prompt **Start Collection?**

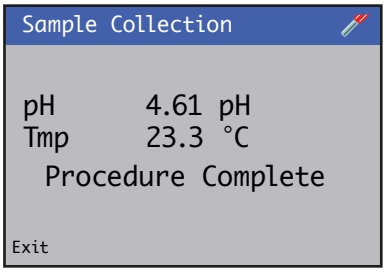


4 Press the key to start the data collection.

The **Collect Sample** progress screen is displayed:



When the procedure is complete, a confirmation screen is displayed:



The value of the acquisition is now stored.

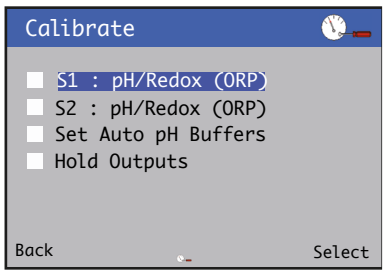
5 Press the key to return to the **Calibrate** level.

6 Continue to the **Sample Complete** section to perform the second step of the procedure.

Sample complete

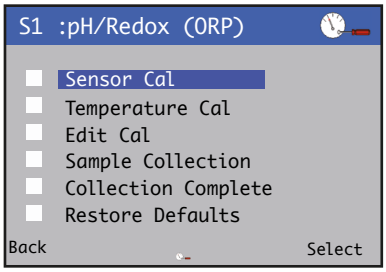
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



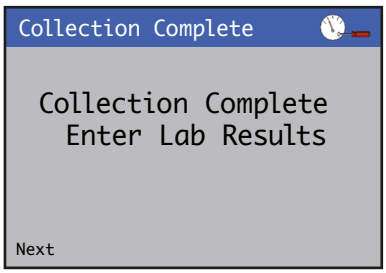
2 Use the ▲/▼ keys to select the sensor to be calibrated, for example, **S1 :pH/Redox (ORP)** and press the key.

The menu options for **S1 :pH/Redox (ORP)** are displayed:

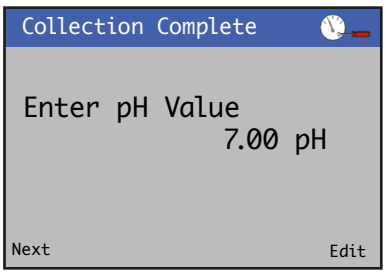


3 Use the ▲/▼ keys to select **Collection Complete** and press the key.

The **Collection Complete** menu is displayed:

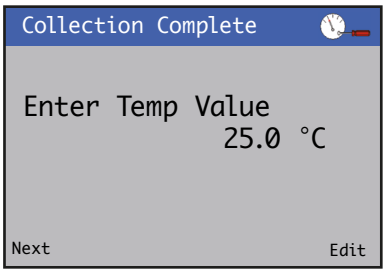


4 Press the key.
The screen displays a prompt to enter a pH value:



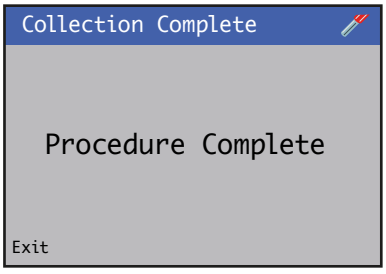
5 Press the key and enter the value of the pH sample using the key and the ▲/▼ keys to adjust the value, press the key to complete and to move to the enter temp value screen.

6 The screen displays a prompt to enter a temperature value:



7 Press the key and enter the temperature of the sample from the lab, using the key and the ▲/▼ keys to adjust the value. Press the key to complete and the key to progress.

When the procedure is complete, a confirmation screen is displayed:



8 Press the key to return to the **Calibrate** level.

In Process calibration is now complete.

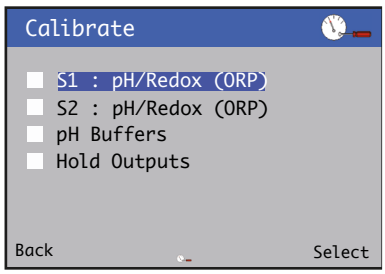
...14 Calibration procedures

Temperature calibration*

*Only displayed for analog pH sensors.

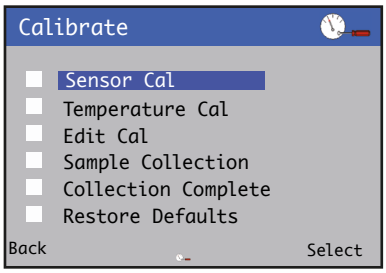
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



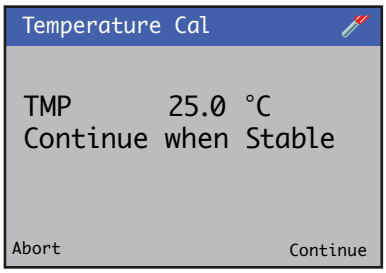
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The pH calibration menu is displayed:



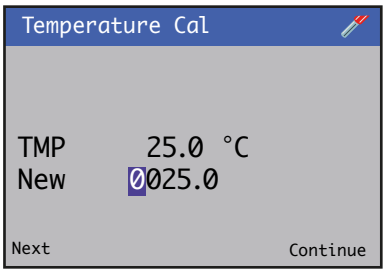
3 Press the ▲/▼ keys to select **Temperature Cal** and press the key to confirm selection.

The temperature calibration screen is displayed:



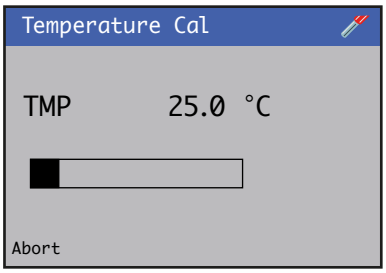
4 Wait for the displayed value to stabilize and press the key to proceed to the next step.

The buffer temperature is displayed:



5 Use the ▲/▼ and keys to set the temperature and press the key to confirm changes.

The temperature calibration process screen is displayed:



On completion the result screen is displayed.

- If the calibration passes the slope and offset values are displayed.
- If the calibration fails the reason for failure is displayed.

Note. The calibration can be canceled at any time during the process by pressing the Abort key ( ).

Turbidity

Menu	Comment	Default
Sensor Verification	Performed using the span DRY Standard.	
Turbidity Cal	There are four calibration modes: • 1-Pt Formazine • 1-Pt Dry Standard • 2-Pt Formazine • 2-Pt Dry Standard	
Span Standard	Formazine Standard value DRY Standard value	
Turbidity Offset	Manual adjustment of the turbidity reading.	
Restore Cal Defaults	Resets slope and offset values to default values.	

Sensor verification

A sensor verification is performed using the DRY STANDARD as follows:

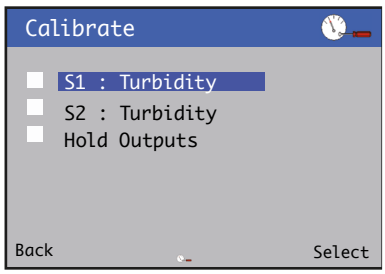
1. Close the isolating valve installed upstream of the sensor.
2. Close the sensor inlet valve and open the drain valve. Allow the sensor to drain.
3. Carefully remove the wiper unit (7998 011 and 012) or the wiper plug (7998 016) to aid complete drainage of the system.
4. When the system is empty, close the drain valve.
5. Thoroughly dry the flow chamber internally using clean tissue.
6. Thoroughly clean and dry the emitter and receiver lenses using clean tissue.
7. Insert the dry calibration standard ensuring the NTU value indication faces the receiver and the locating lug engages correctly.
8. Start the verification
9. Remove the dry standard and place it in its storage container.
10. Refit the wiper unit (7998 011 and 012) or wiper plug (7998 016).
11. Close the drain valve.
12. Open the inlet valve and ensure that the flow through the sensor is 0.5 to 1.5 L/min

...14 Calibration procedures

...Turbidity

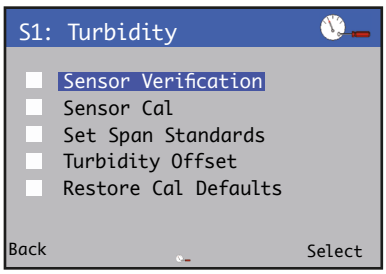
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



2 Use the / keys to select the sensor to be calibrated, and press the key to confirm selection.

The Sensor calibration menu is displayed:

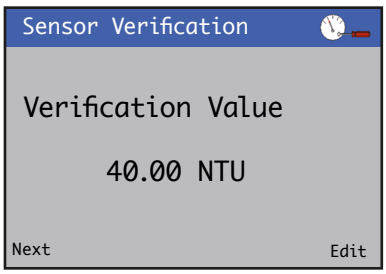


3 Use the / keys to select **Sensor Verification** and press the key to confirm selection.

The **Verification Standard** value is displayed.

4 Use the key to edit the **Calibration Standard Value**. Use the / keys to set the **Calibration Standard Value** and press the key to confirm selection.

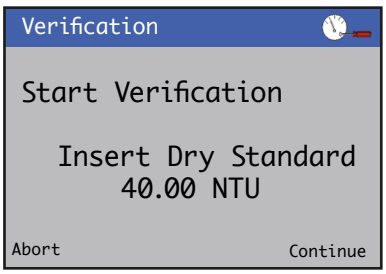
Press the key to proceed to the next step.



The **Start Verification** prompt is displayed.

5 Use the key to start the calibration and proceed to the next step.

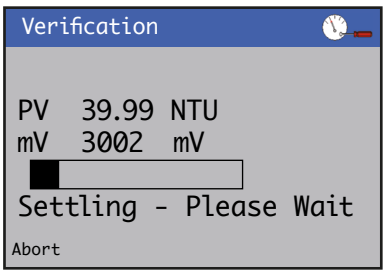
(Press the key to abort the calibration.)



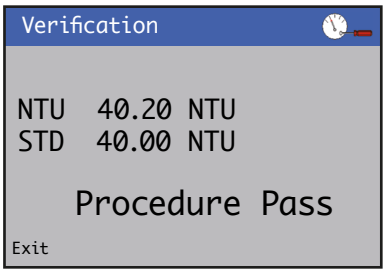
The verification progress is displayed.

The Turbidity and probe mV values are shown and after approximately 1 minute will automatically move onto the next step.

(Press the key to abort the calibration.)



The verification results are displayed:



6 Press the key to exit the verification.

Note. The verification process can be canceled at any by pressing the **Abort** key ().

The calibration sequence can be either a 1-point or 2-point calibration. A 1-point calibration is a span-calibration only and a 2-point calibration consists of a zero-calibration followed by a span-calibration.

To perform a calibration:

- Close the isolating valve installed upstream of the sensor.
- Close the sensor inlet valve and open the drain valve; allow the sensor to drain.
- Carefully remove the wiper unit (7998 011 and 012) or the wiper plug (7998 016) to aid complete drainage of the system. When the system is empty, close the drain valve.
- Thoroughly dry the flow chamber internally using clean tissue.
- Thoroughly clean and dry the emitter and receiver lenses using clean tissue.

Zero calibration (Formazine)

- Fill the flow chamber with the deionized water and refit the wiper unit (7998 011 and 012) or wiper plug (7998 016).
- When the calibration is complete, open the drain valve. Allow the sensor to drain. Ensure all the deionized water is removed.
- Thoroughly dry the flow chamber internally using clean tissue.
- Thoroughly clean and dry the emitter and receiver lenses using clean tissue.
- Start the zero calibration.
- After approximately 1 minute the display moves to the next frame automatically.

Span calibration (Formazine)

- Thoroughly dry the flow chamber internally using clean tissue.
- Thoroughly clean and dry the emitter and receiver lenses using clean tissue.
- Fill the flow chamber with the formazine span solution and refit the wiper unit (7998 011 and 012) or wiper plug (7998 016).
- Start the span calibration; a wipe is performed.
- After approximately 1 minute the display moves to the next frame automatically.
- When the calibration is complete, open the drain valve. Allow the sensor to drain. Ensure all the formazine span solution is removed.
- When the system is empty, close the drain valve.
- Open the inlet valve and ensure that the flow through the sensor is 0.5 to 1.5 l/min.

Zero calibration (Dry Standard)

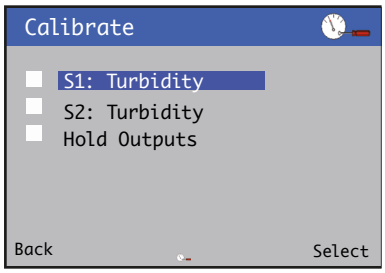
- Insert the dry calibration standard with the zero NTU indication facing the optical receiver ensuring the lug engages correctly.
- Start the zero calibration.
- After approximately 1 minute the display moves to the next frame automatically.
- Remove the dry standard, rotate it through 180° and refit it, ensuring the NTU value indication faces the receiver, and the locating lug engages correctly.

Span calibration (Dry Standard)

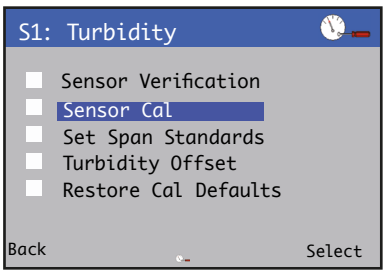
- Remove the dry standard, rotate it through 180° and refit it, ensuring the NTU value indication faces the receiver, and the locating lug engages correctly.
- Start the span calibration.
- After approximately 1 minute the display moves to the next frame automatically.
- When the calibration is complete. Remove the dry standard and place it in its storage container.
- Refit the wiper unit (7998 011 and 012) or wiper plug (7998 016). Close the drain valve.
- Open the inlet valve and ensure that the flow through the sensor is 0.5 to 1.5 l/min.

1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



2 Use the / keys to select the sensor to be calibrated, and press the key to confirm selection.
The **Sensor calibration** menu is displayed:



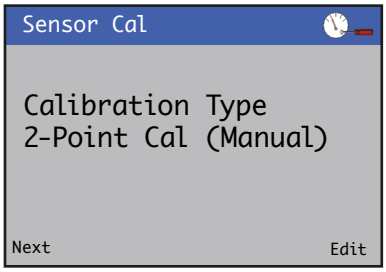
3 Use the / keys to select **Sensor Cal** and press the key to confirm selection.
The **Calibration Type** is displayed.

...14 Calibration procedures

...Turbidity

4 Use the key to edit the **Calibration Type**.
Use the /keys to select the required **Calibration Type** and press the key to confirm selection.

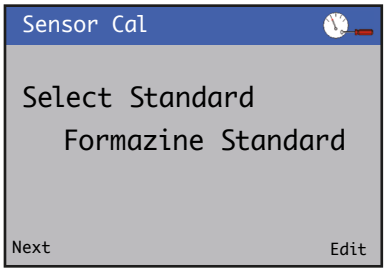
Press the key to proceed to the next step.



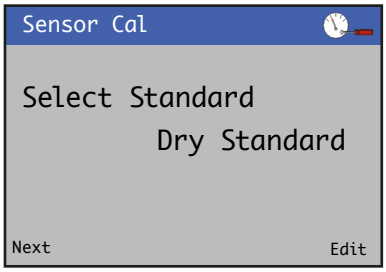
The **Select Standard** is displayed.

5 Use the key to edit the **Calibration Standard**.
Use the /keys to select the required **Calibration Standard** and press the key to confirm selection.

Press the key to proceed to the next step.



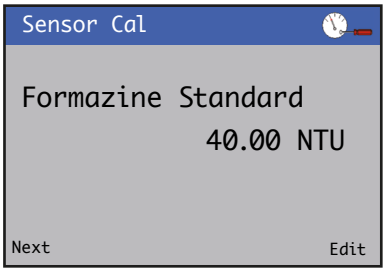
OR



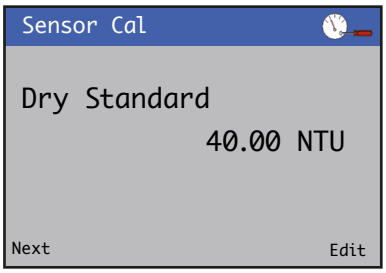
The **Calibration Standard** value is displayed for manual calibrations only.

6 Use the key to edit the **Calibration Standard** value.
Use the /keys to set the **Calibration Standard** value and press the key to confirm selection.

Press the key to proceed to the next step.

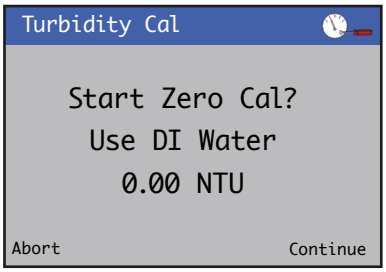


OR

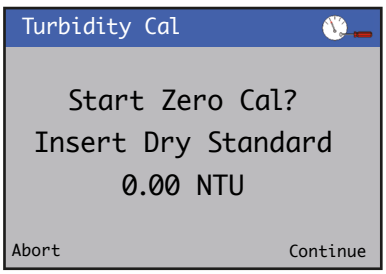


The **Start Calibration** prompt is displayed.

7 Use the key to start the calibration and proceed to the next step.
(Press the key to abort the calibration).

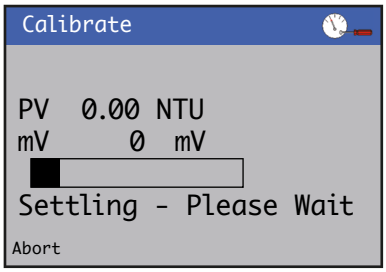


OR

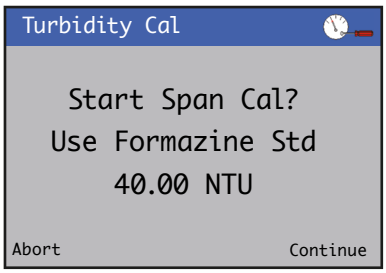


The calibration progress is displayed.

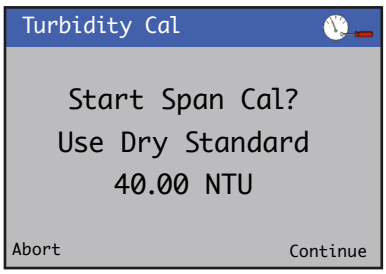
The turbidity and probe mV values are shown and after approximately 1 minute automatically move on to the next step.
(Press the key to abort the calibration).



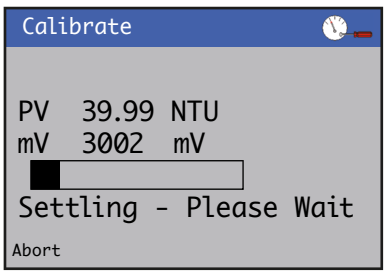
8 Use the key to start the calibration and proceed to the next step.
(Press the key to abort the calibration).



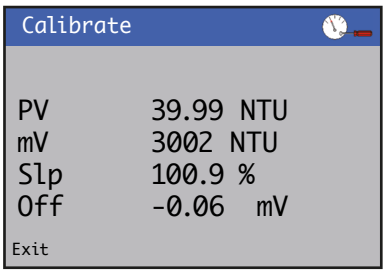
OR



The calibration progress is displayed.
The turbidity and probe mV values are shown and after approximately 1 minute automatically move on to the next step.
(Press the key to abort the calibration).



The calibration results are displayed.
(Press the key to abort the calibration).



On completion the result screen is displayed.

- If the calibration passes, the new settings are displayed.
- If the calibration fails, the reason for failure is displayed.

Note. The calibration process can be canceled at any time by pressing the Abort key

...14 Calibration procedures

Turbidity Total Suspended Solids (TSS)

This section should be read in conjunction with Operating instruction OI/ATS430.

Menu	Comment	Default
Sensor Verification	See **Turbidity TSS Sensor Verification** – page 71.	
Turbidity Cal	See **Turbidity calibration** – page 72. There are two possible calibration modes: • 1-point • 2-point	
TSS Cal	See **TSS calibration** – page 74. There are two possible calibration modes: • 1-point • 2-point	
TSS Manual Cal	See **TSS manual calibration** – page 76.	
Sample Collection	See **In process calibrations** – page 77.	
Collection Complete	See **In process calibrations** page 77.	
Restore Cal Defaults	Resets slope and offset values to default values.	

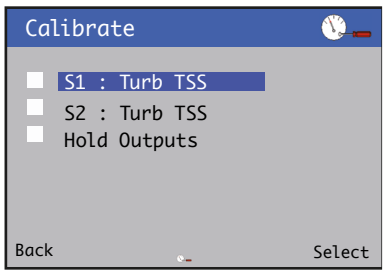
Turbidity TSS sensor verification

Preparing the verification tool and locking the sensor in place

Refer to operating instruction OI/ATS430.

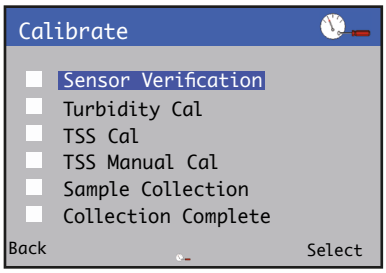
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



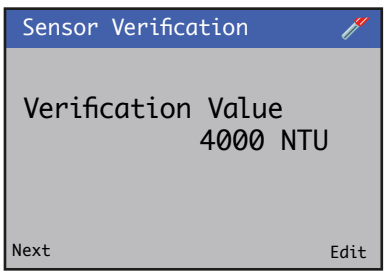
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The TSS calibration menu is displayed:



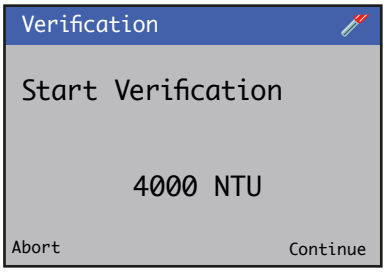
3 Press the ▲/▼ keys to select **Sensor Verification** and press the key to confirm selection.

The Verification Value is displayed:



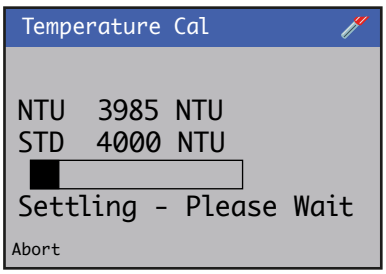
4 Use the key to edit the verification value.
Use the ▲/▼ keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.



5 Ensure the sensor is inserted in the verification tool and press the key to start the verification routine.

The verification process screen is displayed:



On completion the result is displayed.

Procedure Pass

or

Procedure Failed

Note. The verification process can be canceled at any time during the process by pressing the **Abort** key ( ).

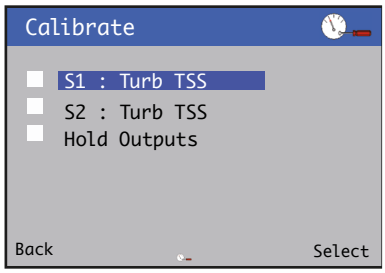
...14 Calibration procedures

Turbidity TSS calibration

1-Point calibration

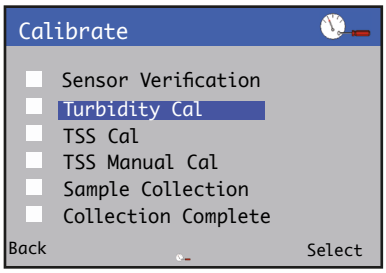
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



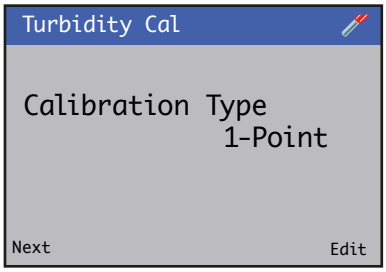
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The **Turbidity Cal** menu is displayed:



3 Press the ▲/▼ keys to select **Turbidity Cal** and press the key to confirm selection.

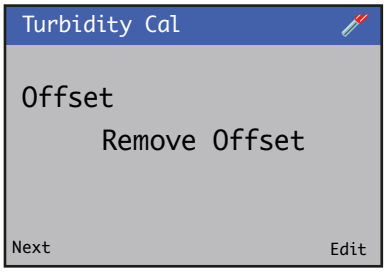
The **Calibration Type** is displayed:



4 Use the key to edit the **Calibration Type**.
Use the ▲/▼ keys to select the required **Calibration Type** and press the key to confirm selection.

Press the key to proceed to the next step.

The **Offset** setting is displayed:

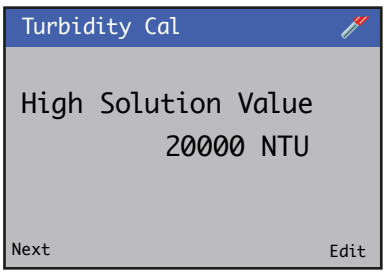


5 For most cases a zero offset is suitable. However, in situations where an offset was previously determined during a 2-point calibration, it is possible to retain the previously measured offset during the 1-point calibration.

Use the key to edit the **Offset** setting.
Use the ▲/▼ keys to select either **Remove Offset** or **Retain Offset** and press the key to confirm changes.

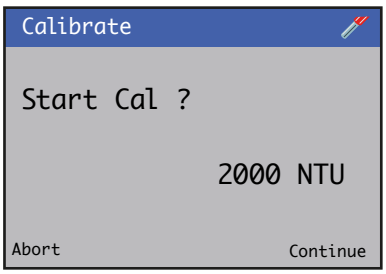
Press the key to proceed to the next step.

The **High Solution Value** is displayed:



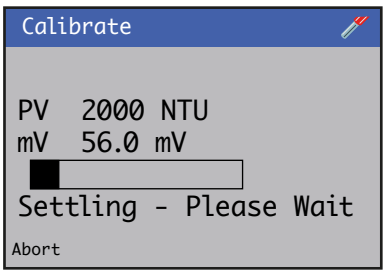
6 Use the key to edit the solution value.
Use the ▲/▼ keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.



7 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:



On completion the result screen is displayed.

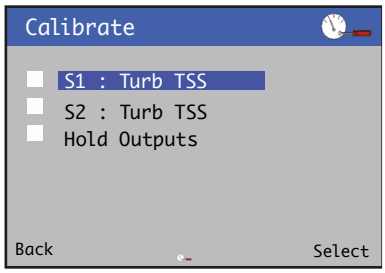
- If the calibration passes the new settings are displayed.
- If the calibration fails the reason for failure is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key ( ).

2-Point calibration

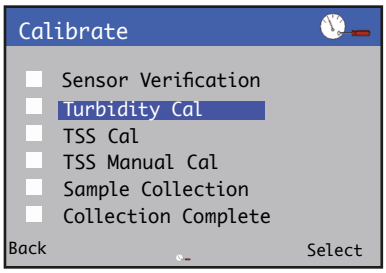
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



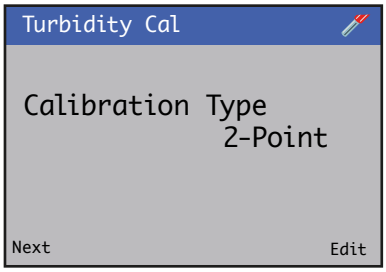
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The **Turbidity Cal** menu is displayed:



3 Press the ▲/▼ keys to select **Turbidity Cal** and press the key to confirm selection.

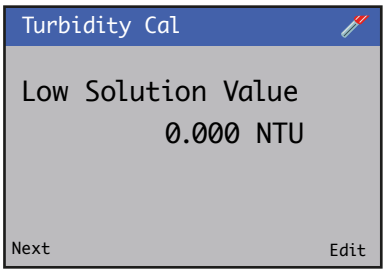
The **Calibration Type** is displayed:



4 Use the key to edit the **Calibration Type**.
Use the ▲/▼ keys to select the required **Calibration Type** and press the key to confirm selection.

Press the key to proceed to the next step.

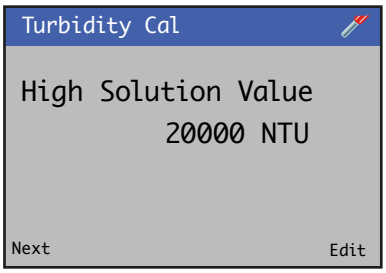
The **Low Solution Value** is displayed:



5 Use the key to edit the **solution value**.
Use the ▲/▼ keys to set the value and press the key to confirm changes.

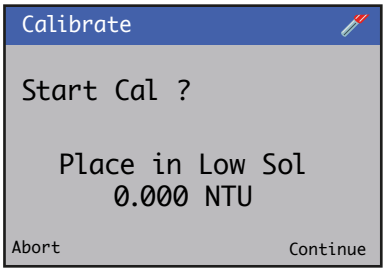
Press the key to proceed to the next step.

The **High Solution Value** is displayed:



6 Use the key to edit the solution value.
Use the ▲/▼ keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.

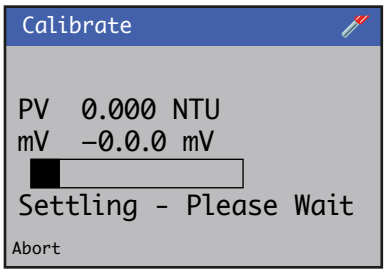


...14 Calibration procedures

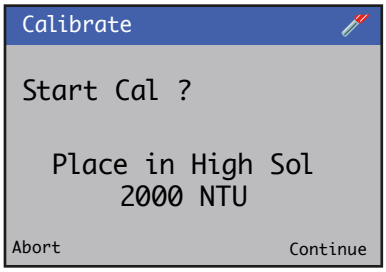
...Turbidity TSS calibration

7 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:

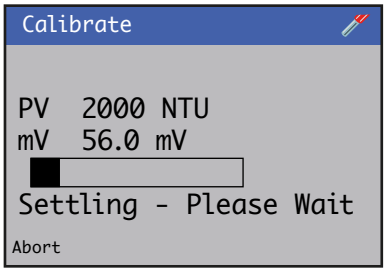


- If the calibration fails the result screen is displayed with the reason for failure.
- If the calibration passes the procedure moves automatically to the high buffer calibration.



8 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:



On completion the result screen is displayed.

- If the calibration passes the new settings are displayed.
- If the calibration fails the reason for failure is displayed.

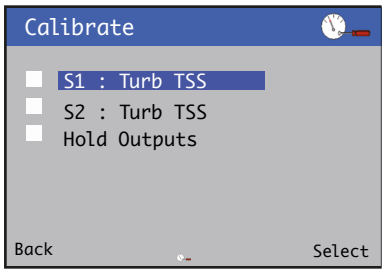
Note. The calibration can be canceled at any time during the process by pressing the **Abort** key ( ).

TSS calibration

1-Point calibration

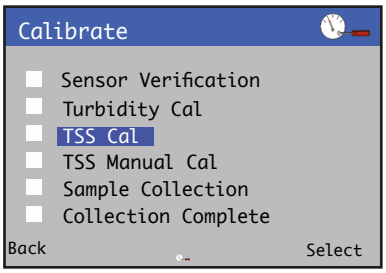
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



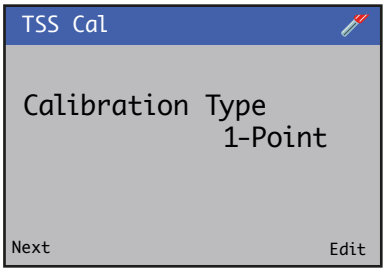
2 Use the / keys to select the sensor to be calibrated, and press the key to confirm selection.

The **TSS Cal** menu is displayed:



3 Press the / keys to select **TSS Cal** and press the key to confirm selection.

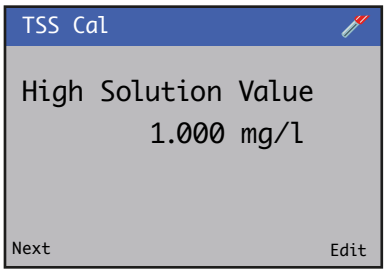
The **Calibration Type** is displayed:



4 Use the key to edit the **Calibration Type**.
Use the /keys to select the required **Calibration Type** and press the key to confirm selection.

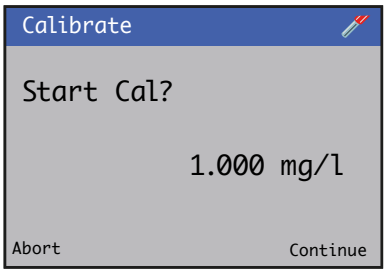
Press the key to proceed to the next step.

The **High Solution Value** is displayed:



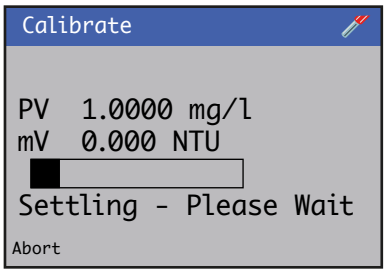
5 Use the key to edit the **High Solution Value**.
Use the /keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.



6 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:



On completion the result screen is displayed.

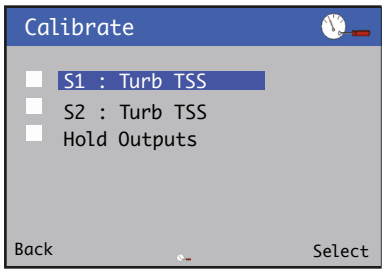
- If the calibration passes the new settings are displayed.
- If the calibration fails the reason for failure is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key ().

2-Point calibration

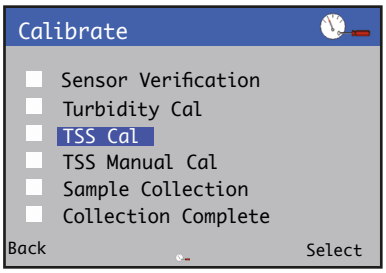
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



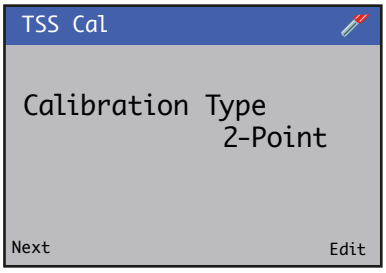
2 Use the /keys to select the sensor to be calibrated, and press the key to confirm selection.

The **Turbidity Cal** menu is displayed:



3 Press the /keys to select **Turbidity Cal** and press the key to confirm selection.

The **Calibration Type** is displayed:



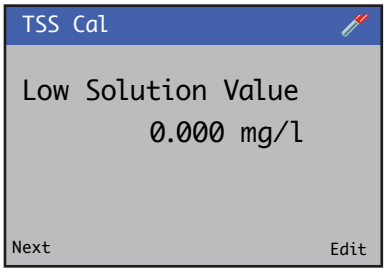
...14 Calibration procedures

...TSS calibration

4 Use the key to edit the **Calibration Type**.
Use the /keys to select the required **Calibration Type** and press the key to confirm selection.

Press the key to proceed to the next step.

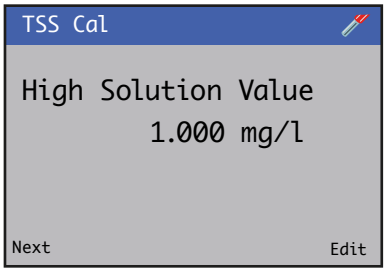
The **Low Solution Value** is displayed:



5 Use the key to edit the **solution value**.
Use the /keys to set the value and press the key to confirm changes.

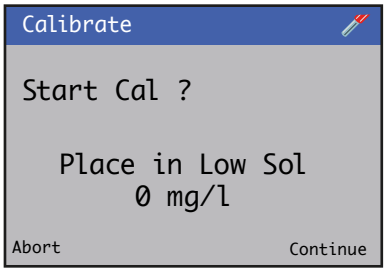
Press the key to proceed to the next step.

The **High Solution Value** is displayed:



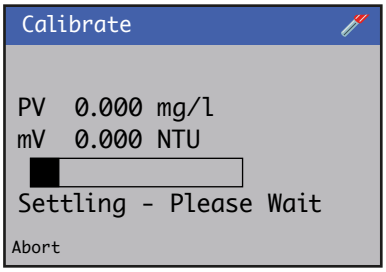
6 Use the key to edit the solution value.
Use the /keys to set the value and press the key to confirm changes.

Press the key to proceed to the next step.

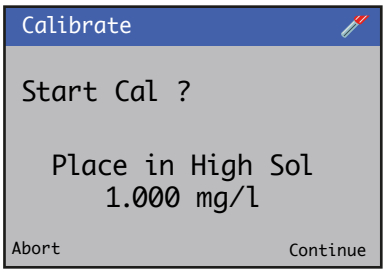


7 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:

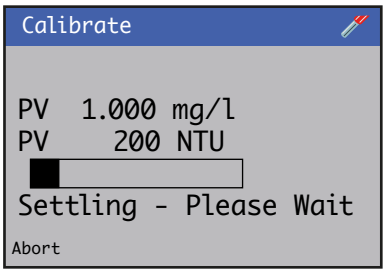


- If the calibration fails the result screen is displayed with the reason for failure.
- If the calibration passes the procedure moves automatically to the high buffer calibration.



8 Ensure the sensor is inserted in the solution and press the key to start the verification routine.

The calibration process screen is displayed:



On completion the result screen is displayed.

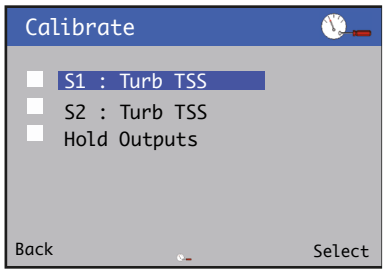
- If the calibration passes the new settings are displayed.
- If the calibration fails the reason for failure is displayed.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key ().

TSS manual calibration

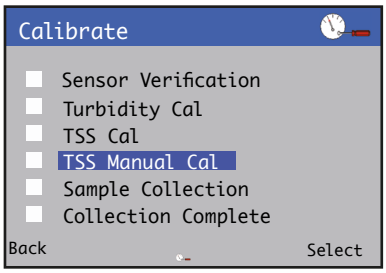
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



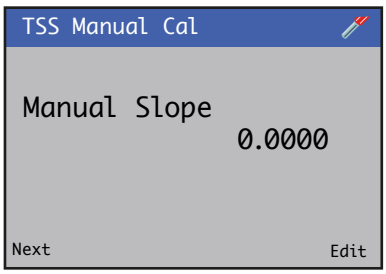
2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

The **TSS Manual Cal** menu is displayed:



3 Press the ▲/▼ keys to select **TSS Manual Cal** and press the key to confirm selection.

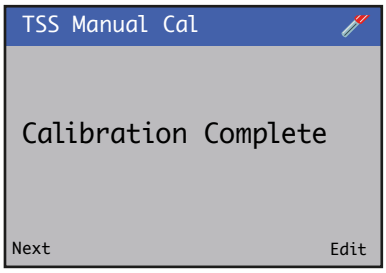
The calibration slope is displayed:



4 Use the key to edit the slope.
Use the ▲/▼ keys to select the required **Calibration Type** and press the key to confirm selection.

Press the key to proceed to the next step.

The **Calibration Complete** screen is displayed:



In Process calibration

In process calibration is used when it is not possible to remove the sensor from the process to perform the calibration. In this calibration mode the actual sample is used to calibrate the sensor.

The in process calibration takes place in two steps:

- **Sample collection**

A grab sample is taken from the process and the sensor records the measured value of the sample at that time. The grab sample should be taken as close to the sensor as possible during the data collection period.

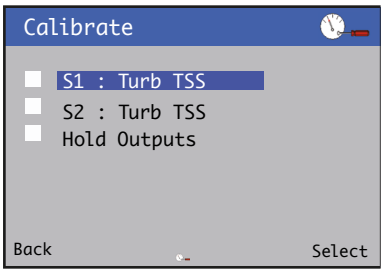
- **Collection complete**

The total suspended solids of the sample is measured in the laboratory and entered into the transmitter. This sample must correspond to the last sample collection step performed.

Sample collection

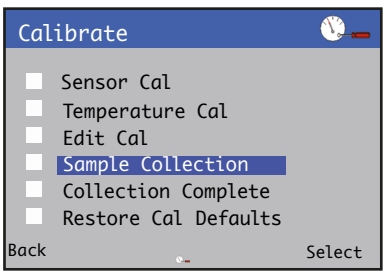
1 At the **Calibrate** level, press the key:

The **Calibrate** menu is displayed:



2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the key to confirm selection.

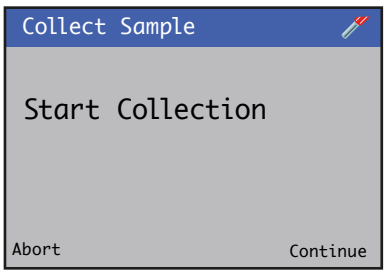
The **Sample Collection** menu is displayed:



...14 Calibration procedures

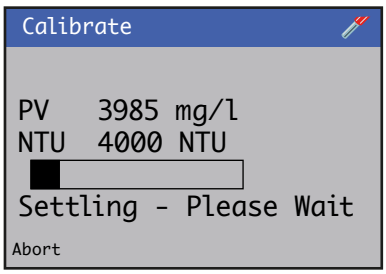
...In Process calibration

3 Use the ▲/▼ keys to select **Sample Collection** and press the ◤ key to proceed to the next step.

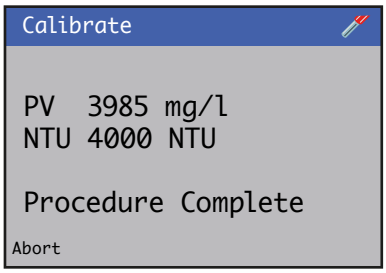


4 Press the ◥ key to proceed to the next step.

The collection process screen is displayed:



On completion the collection complete screen is displayed:



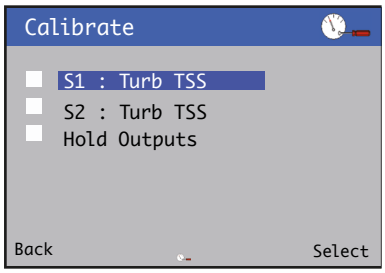
The value of the sample turbidity is now stored.

Note. The calibration can be canceled at any time during the process by pressing the **Abort** key (◥).

Collection complete

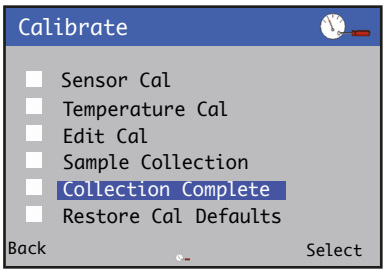
1 At the **Calibrate** level, press the ◤ key:

The **Calibrate** menu is displayed:

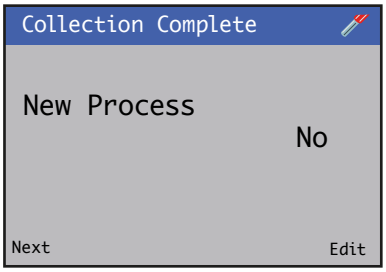


2 Use the ▲/▼ keys to select the sensor to be calibrated, and press the ◤ key to confirm selection.

The **Collection Complete** menu is displayed:



3 Use the ▲/▼ keys to select **Collection Complete** and press the ◤ key to proceed confirm selection.



4 Use the key to edit the **New Process** setting.

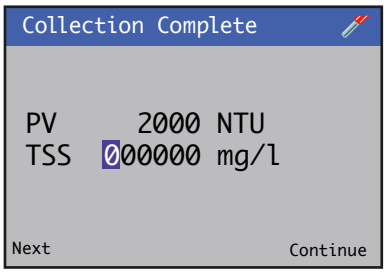
Use the /keys to select **Yes/No** and press the key to confirm selection.

If the sensor is installed in a new process or if the calibration needs to be reset then select **Yes**.

To retain the details of the previous calibrations then select **No** (adaptive calibration to fine tune the existing calibration).

5 Press the key to proceed to the next step.

The **Collection Complete** screen is displayed:



6 The Collection Complete screen shows:

PV: Turbidity recorded when the sample was taken.

TSS: Use the /and keys to enter the suspended solids value measured in the laboratory and press the key to confirm changes.

A new calibration coefficient is calculated.

The calibration is now complete.

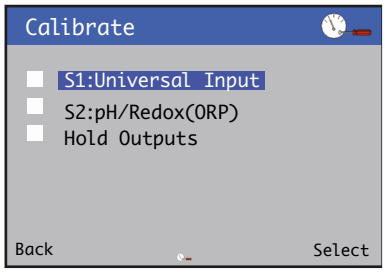
...14 Calibration procedures

Universal Input Module

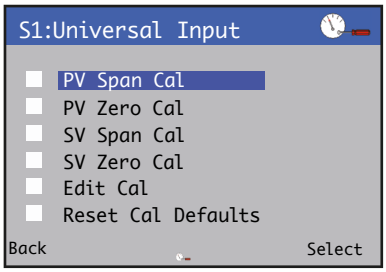
Menu	Comment	Default
PV Span Cal	Refer to "PV Span Calibration" on page 80	100 %
PV Zero Cal	Refer to "...14 Calibration procedures" on page 82	0
SV Span Cal	Refer to "PV Span Calibration" on page 80	100 %
SV Zero Cal	Refer to "...14 Calibration procedures" on page 82	0
Edit Cal		
PV Slope	Edit the PV slope value	
PV Offset	Edit the PV offset value	
SV Slope	Edit the SV slope value	
SV Offset	Edit the SV offset value	
Scheduled Zero Cal	Refer to "Scheduled Zero Cal" on page 80	
Reset Cal to Defaults	Resets the slope and offset values to the default values	

PV Span Calibration

1 At the **Calibrate** level, press the key.
The **Calibrate** menu is displayed:

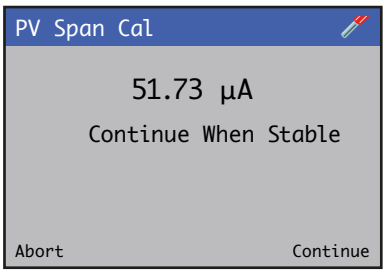


2 Select the sensor to be calibrated, then press the key to confirm.
The sensor calibration menu is displayed:

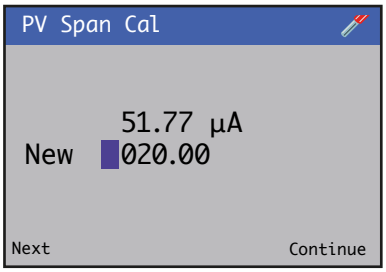


3 Select **PV Span Cal**, then press the key to confirm.

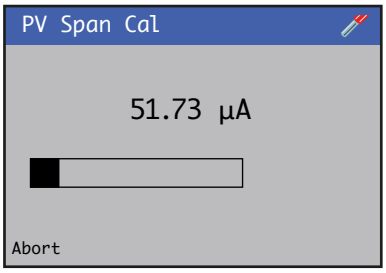
4 Wait for the displayed value to become stable, then press the key to start the calibration and continue to the next step.
Press the key to abort the calibration.
The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.



5 The new PV reading is displayed.
Use the / and keys to set the new PV reading, then press the key to confirm the changes.
The picture below shows the current, but voltage, resistance, temperature, and frequency are similar:

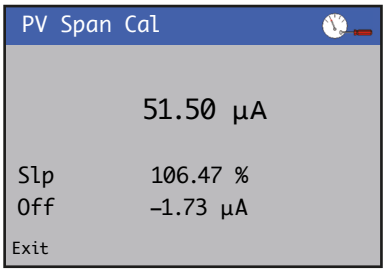


6 The **PV Span Calibration** process screen is displayed.
The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.
Note. The calibration can be canceled at any time by pressing the key.



7 On completion, the result screen is displayed.

- If the calibration passes, the slope and offset values are displayed.
- If the calibration fails, the reason for the failure is displayed. The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.



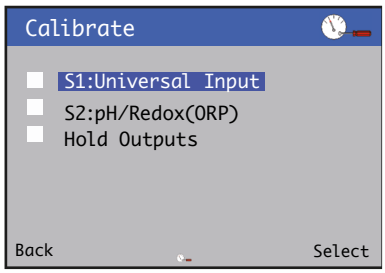
Note. When an ACL410 is installed, the calibration slope may be a very large number. This is due to the nature of the measurement and is not a concern for the measurement accuracy.

...14 Calibration procedures

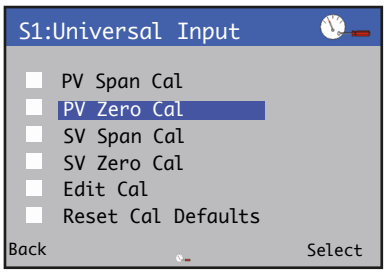
...Universal Input Module

PV Zero Calibration

1 At the **Calibrate** level, press the key.
The **Calibrate** menu is displayed:

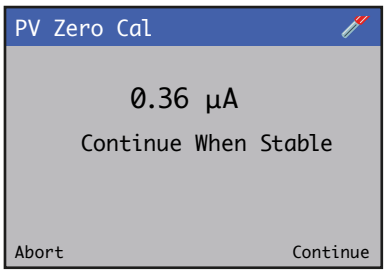


2 Select the sensor to be calibrated, then press the key to confirm. The sensor calibration menu is displayed:

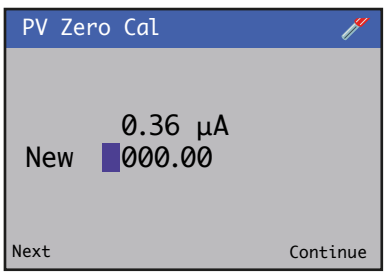


3 Select **PV Zero Cal**, then press the key to confirm.

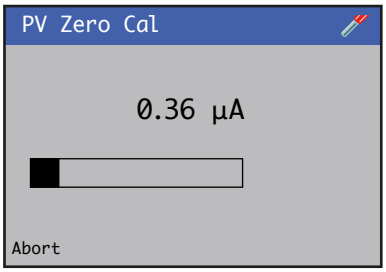
4 Wait for the displayed value to become stable, then press the key to start the calibration and continue to the next step.
Note. Press the key to abort the calibration.
The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.



5 The new PV reading is displayed.
Use the / keys to set the new PV reading, then press the key to confirm the changes.
The picture below shows the current, but the voltage, resistance, temperature, and frequency are similar.



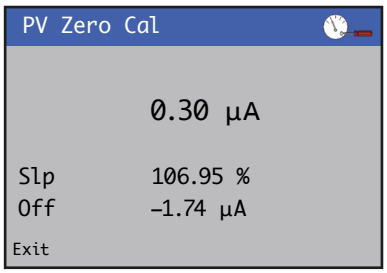
6 The PV Zero Cal process screen is displayed.
Note. The calibration can be canceled at any time during the process by pressing the key.
The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.



7 On completion, the result screen is displayed.

8 If the calibration passed, the slope and offset values are displayed.

- If the calibration failed, the reason for the failure is displayed.
- The picture below shows the current, but voltage, resistance, temperature, and frequency are similar.



SV Span and zero calibrations are similar to PV span and zero calibration.

Automatic zero calibration

Refer to OI/ACL410 for details.

Chlorine calibration

ACL410 calibration
Refer to OI/ACL410 for the calibration procedures.

ACL420 calibration
Refer to OI/ACL420 for the calibration procedures.

Dissolved oxygen calibration

Refer to OI/ADS420 for the calibration procedures.

15 Troubleshooting

Diagnostic messages

The transmitter is programmed to display NAMUR 107 diagnostic icons and messages to provide information on servicing requirements and any other conditions that develop during operation.

All diagnostic messages displayed on the transmitter are added to the transmitter's **Audit Log**. The following tables show icon types, diagnostic messages and possible causes/suggested remedial action.

Table 13 NAMUR 107 diagnostic icons

			
Failure	**Check function**	**Out of specification**	**Maintenance required**
Process value invalid due to malfunction in sensor or transmitter	Process value temporarily invalid due to specified action	Process value unreliable due to sensor operating outside specified range/limits	Process value valid – intervention required to correct operational conditions

AWT420 transmitter diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): Comms Error	Communications between transmitter and sensor have been lost. The likely cause is a poor/broken connection between the sensor/sensor module and the transmitter or a terminal fault in the sensor.	1. Inspect the transmitter and sensors ensuring that EZLink/sensor module is fitted correctly in the transmitter. 2. For EZLink sensors, ensure the sensor is connected and the wiring is intact between the transmitter and the sensor housing. 3. Perform a power cycle on the transmitter. 4. If **Comms Error** persists, contact local service organization.
	AO(n): Out of Range	The source assigned to the analog output is outside its programmed engineering range. The output is fixed at its electrical limits of 0 mA (under range) or 22 mA (overrange) until the source is within range.	Check the configuration of the analog output, ensuring that the **Source, Eng. High** and **Eng. Low** values are set according to the requirements and adjust if necessary.
	Memory Write Error	Transmitter configuration data is corrupt, or the transmitter's non-volatile memory is faulty. The device setup may be affected and changes to configuration may not be maintained after power cycle.	Cycle power to the transmitter. If **Memory Write Error** persists: 1. Check all configuration parameters and correct any errors. 2. Backup configuration to SD card 3. Reset to defaults via the bootloader. 4. Reload configuration from SD card 5. If **Memory Write Error** persists, contact local service organization
	S(n): PV Out of Range	The primary variable from the sensor is outside the range specified in Sensor Setup.	1. Check the process and adjust if necessary. 2. If the measured value is within the intended range of the process, adjust the **Range High** and **Range Low** in the **Sensor Setup** menu – see page 26.
	Simulation Active	Transmitter is in simulation mode: signal values are generated internally and do not reflect process conditions.	Contact local service organization.
	Inf. pH Invalid	The calculated (inferred) pH value is outside the accurate range for the specified solution. For Calculation Type = NH_3/NH_3 and NaCl the accurate range is 7.00 to 10.00 pH. For Calculation Type = NaOH/NaOH and NaCl the accurate range is 7.00 to 11.00 pH.	Check the process and the measured conductivity before, and after, the cation chamber. Adjust the process if necessary. Ensure that the cell constants and temperature compensation are set correctly for each sensor.
	Before Cat. High	Conductivity measured before the cation exchange chamber is above the user set limit. Inferred pH reading may be inaccurate.	Check the process and make any necessary adjustments. Ensure that the before cation sensor has been correctly setup and if necessary, adjust the limit.
	After Cat. High	Conductivity measured after the cation exchange chamber is above the user set limit. Inferred pH reading may be inaccurate.	Check the process and make any necessary adjustments. Ensure that the after cation sensor has been correctly setup and if necessary, adjust the limit.
	Clean (n) in progress	Cleaning cycle 1 (2) is in progress.	Diagnostic clears once cleaning cycle is complete.
	S(n): Write Error	Error writing configuration to sensor/sensor module.	1. Repeat previous configuration change. 2. If **Sensor Write Error** persists, cycle power to the transmitter. 3. Check the Sensor Setup and correct if necessary. 4. If **Sensor Write Error** persists, ensure that the sensor and the transmitter are compatible by upgrading the software on both via the bootloader. 5. Check the **Sensor Setup** and correct if necessary– see page 26. 6. If **Sensor Write Error** persists, contact local service organization.
	Alarm Active	One or more of the process alarms (1 to 8) is active.	Check the process and make any adjustments required. If the alarm condition has passed but the diagnostic remains active, acknowledge the alarm via the **Operator** menu.
	SD Nearly Full	SD card at 90 % capacity or higher.	Replace the SD card or free up space on current SD card by backing up/ uploading the files.
	SD Card Full	SD card is at capacity.	Replace the SD card or free up space on current SD card by backing up/ uploading the files.
	S(n): Low Flow	Low or no flow detected.	1. Make sure that there is a flow of fluid. 2. Examine the connections to the transmitter and the low flow sensor.

...15 Troubleshooting

2-electrode conductivity diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): ADC Failure	Failure of the analog to digital converter in the sensor/sensor module	Cycle power to the transmitter. If **Sensor ADC Failure** persists, contact local service organization.
	S(n): Memory Failure	Sensor configuration data is corrupt, or the sensor's non-volatile memory is faulty. The sensor configuration may be affected and changes may not be maintained after power cycle.	Cycle power to the transmitter. If **Sensor Memory Failure** persists, check all configuration parameters for all sensors and correct any errors. Save the configuration to SD card or via Bluetooth app. Reset the sensor to defaults from the **Sensor Setup** menu and reload the saved configuration. If **Sensor Memory Failure** persists, contact local service organization.
	S(n): PT Failure	The measurement taken from the temperature sensor is invalid indicating that the temperature sensor has failed, or the associated connections are either open-circuit or short-circuit.	Visually inspect the sensor/temperature sensor for signs of damage. A damaged sensor must be replaced. Check wiring to sensor module terminals 5 to 8. If **Process Temperature Failure** persists, contact local service organization.
	S(n): PV Failure	A primary variable reading cannot be obtained from the conductivity sensor.	Check the wiring of the sensor to the sensor module (terminals 1 to 4). Visually inspect the sensor for signs of damage. Cycle power to the transmitter. If **PV Failure** persists, contact local service organization.
	S(n): Calibrating	Sensor calibration is in progress.	Diagnostic clears once calibration is complete.
	S(n): Recovery	Recovery diagnostic is active during the period between completion of a sensor calibration and the sensor being ready to make accurate measurements.	Diagnostic clears once recovery is complete.
	S(n): Cal Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated and the previous values continue to be applied.	Visually inspect sensor for signs of damage or dirt and clean if necessary. Check that sensor is fully submerged in the solution. Repeat calibration, if **Calibration Failed** persists, consider replacing the sensor.
	S(n): PV Out of Limits	Process value (PV) measured is outside the specified limits of the sensor. Refer to the sensor data sheet to determine the operating range.	Check the process and the position of the sensor. If **PV Out of Limits** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions
	S(n):Process Temp Out of Range	Solution temperature is outside the measurement range of the sensor. Refer to the sensor data sheet to determine the temperature range.	Ensure that the solution temperature is within the sensor measurement limits. Check the process and reduce the effect of any potential heat sources. If **Process Temperature Out of Range** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate temperature range. Contact local service organization for potential solutions.
	S(n):Internal Temp Out of Range	The sensor module measurement circuitry is operating at a temperature outside its recommended range. This may cause the measurements to be inaccurate.	Ensure that the ambient temperature of the transmitter containing the sensor module is within its operating range. –10 to 75 °C [14 to 167 °F] If **Internal Temperature Out of Range** persists, contact local service organization.
	S(n): Polarization	Sensor readings indicate that a polarization charge has built up in the 2-electrode conductivity sensor. When a charge builds up in the sensor, the effective area of the electrode is decreased, causing the measurement to be inaccurate.	Check process. Visually inspect the sensor and clean if necessary. Check sensor wiring. If **Sensor Polarization** is a persistent problem, a 4-electrode conductivity sensor may be more suitable for the process, contact local service organization.

4-electrode conductivity diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): ADC Failure	Failure of the analog to digital converter in the sensor/sensor module.	Cycle power to the transmitter. If **Sensor ADC Failure** persists, contact local service organization.
	S(n): Memory Failure	Sensor configuration data is corrupt, or the sensor's non-volatile memory is faulty. The sensor configuration may be affected and changes may not be maintained after power cycle.	Cycle power to the transmitter. If **Sensor Memory Failure** persists, check all configuration parameters for all sensors and correct any errors. Save the configuration to SD card or via Bluetooth App. Reset the sensor to defaults from the **Sensor Setup** menu and reload the saved configuration. If **Sensor Memory Failure** persists, contact local service organization.
	S(n): PT Failure	The measurement taken from the temperature sensor is invalid indicating that the temperature sensor has failed, or the associated connections are either open-circuit or short-circuit.	Visually inspect the sensor/temperature sensor for signs of damage. A damaged sensor must be replaced. Check wiring to sensor module terminals 5 to 8. If **Process Temperature Failure** persists, contact local service organization.
	S(n): PV Failure	A primary variable reading cannot be obtained from the conductivity sensor.	Check the wiring of the sensor to the sensor module (terminals 1 to 4). Visually inspect the sensor for signs of damage. Cycle power to the transmitter. If **PV Failure** persists, contact local service organization.
	S(n): Calibrating	Sensor calibration is in progress.	Diagnostic clears once calibration is complete.
	S(n): Recovery	Recovery diagnostic is active during the period between completion of a sensor calibration and the sensor being ready to make accurate measurements.	Diagnostic clears once recovery is complete.
	S(n): Cal Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated and the previous values continue to be applied.	Visually inspect sensor for signs of damage or dirt and clean if necessary. Check that sensor is fully submerged in the solution. Repeat calibration, if **Calibration Failed** persists, consider replacing the sensor.
	S(n): PV Out of Limits	Process value (PV) measured is outside the specified limits of the sensor. Refer to the sensor data sheet to determine the operating range.	Check the process and the position of the sensor. If **PV Out of Limits** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions
	S(n):Process Temp Out of Range	Solution temperature is outside the measurement range of the sensor. Refer to the sensor data sheet to determine the temperature range.	Ensure that the solution temperature is within the sensor measurement limits. Check the process and reduce the effect of any potential heat sources. If **Process Temperature Out of Range** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate temperature range. Contact local service organization for potential solutions.
	S(n):Internal Temp Out of Range	The sensor module measurement circuitry is operating at a temperature outside its recommended range. This may cause the measurements to be inaccurate.	Ensure that the ambient temperature of the transmitter containing the sensor module is within its operating range. –10 to 75 °C [14 to 167 °F] If **Internal Temperature Out of Range** persists, contact local service organization.
	S(n): Polarization	Sensor readings indicate that the 4-electrode conductivity sensor is dirty, i.e. foreign material has collected in the sensor. This causes measurement inaccuracy and eventual degradation of the sensor.	Remove the sensor from the process and visually inspect, remove any foreign material and clean with a neutral solution. If **Dirty Sensor** diagnostic persists, contact local service organization.

...15 Troubleshooting

pH diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): ADC Failure	Failure of the analog to digital converter in the sensor/sensor module.	Cycle power to the transmitter. If **Sensor ADC Failure** persists, contact local service organization.
	S(n): Memory Failure	Sensor configuration data is corrupt, or the sensor's nonvolatile memory is faulty. The sensor configuration may be affected, and changes may not be maintained after power cycle.	Cycle power to the transmitter. If **Sensor Memory Failure** persists, check all configuration parameters for all sensors and correct any errors. Save the configuration to SD card or via Bluetooth app. Reset the sensor to defaults from the **Sensor Setup** menu and reload the saved configuration. If **Sensor Memory Failure** persists, contact local service organization.
	S(n): Broken Glass	Impedance measurement across glass tip of sensor has changed significantly, suggesting a broken glass electrode.	Check the sensor electrode visually for signs of damage. If the sensor appears intact, power cycle the instrument and allow 5 minutes for the signal to settle. If the **Broken Glass** persists then contact local service organization.
	S(n): Reference Failure	The measurement taken from the reference electrode is invalid indicating that the reference electrode in the sensor has failed. The **Reference Failure** diagnostic indicates that the sensor has reached the end of its serviceable life and must be replaced.	Check the sensor electrode visually for signs of damage. If the sensor appears intact, power cycle the instrument and allow 5 minutes for the signal to settle. If the **Reference Failure** persists then the sensor must be replaced, contact local service organization.
	S(n): PT Failure	The measurement taken from the temperature sensor is invalid indicating that the temperature sensor has failed, or the associated connections are either open-circuit or short-circuit.	Visually inspect the sensor/temperature sensor for signs of damage. A damaged sensor must be replaced. EZLink digital sensors: Cycle power to the transmitter. Analog sensors: Check wiring to sensor module terminals 5 to 8. If **Process Temperature Failure** persists, contact local service organization
	S(n): Calibrating	Sensor calibration is in progress.	Diagnostic clears once calibration is complete
	S(n): Cal Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated and the previous values continue to be applied.	Visually inspect sensor tip for signs of damage or dirt and clean if necessary. Check that sensor tip is fully submerged in the solution. Ensure that the correct buffer solutions have been selected in the transmitter. Ensure that the buffer solutions have been correctly made up. Repeat calibration, if **Calibration Failed** persists, this may indicate that the sensor has reached the end of its serviceable life and must be replaced.
	S(n): PV Out of Limits	Process value (PV) measured is outside the specified limits of the sensor. Refer to the sensor data sheet to determine the operating range.	Check the process and the position of the sensor. If **PV Out of Limits** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions

...pH diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): Process Temp Out of Range	Solution temperature is outside the measurement range of the sensor. Refer to the sensor data sheet to determine the temperature range.	Ensure that the solution temperature is within the sensor measurement limits. Check the process and reduce the effect of any potential heat sources. If **Process Temperature Out of Range** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate temperature range. Contact local service organization for potential solutions.
	S(n): Reference Warning	The measurements taken from the reference electrodes indicate that the reference electrodes are becoming contaminated (Reference Poisoning). This is an early indication that the reference measurement is likely to fail, at which point the sensor has reached the end of its serviceable life and requires replacement.	Visually inspect sensor tip for signs of damage or dirt and clean if necessary. Contact local service organization to order a new sensor.
	S1: Slope Low	The pH sensor is reaching the end of its serviceable life. A pH sensor degrades over time. As this happens the slope calculated by a calibration procedure gradually decreases. A **Low Slope Limit** is configured in **Sensor Setup** – see page 26. If the slope calculated by a calibration procedure is less than **Low Slope Limit,** the calibration fails. If the slope calculated by a calibration procedure is within 20 % of the **Low Slope Limit,** the **Low pH Slope** diagnostic is activated indicating that the sensor is reaching the end of its serviceable life and soon requires replacement.	1. Visually inspect sensor tip for signs of damage or dirt and clean if necessary. 2. Check that sensor tip is fully submerged in the solution. 3. Ensure that the buffer solutions have been made up accurately and have been correctly selected in the transmitter. 4. Repeat calibration, if Low pH Slope persists then this indicates that the sensor is reaching the end of its serviceable life.
	S(n): Ambient Temp Out of Range	The electronics in the head of the probe are exposed to temperatures outside the recommended operating range.	Move the sensor to a location where the ambient temperature within the operating range. If **Ambient Temperature Out of Range** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions.
	S(n): Ref. Blocked	The measurement taken from the reference electrode indicates that the reference electrode is blocked. This warning may also occur if the probe is not properly immersed in solution.	Visually inspect sensor tip for signs of damage or dirt and clean if necessary. Ensure pH probe is submersed in solution. If **Reference Blocked** persists, contact local service organization.
	S(n): Out of Solution	Sensor readings indicate that the sensor is not properly immersed in process solution.	Visually inspect the sensor for signs of damage and clean the tip if necessary. Check that the sensor is properly immersed in the process solution. If **Out of Solution** persists, contact local service organization.
	S(n): Low Electrolyte	The electrolyte level (in the pH sensor) is low.	If compatible, top up the electrolyte reservoir with liquid electrolyte. Otherwise contact local service organization.

...15 Troubleshooting

Turbidity diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n) Memory Failure	Sensor configuration data is corrupt, or the sensor's non-volatile memory is faulty. The sensor configuration may be affected and changes may not be maintained after power cycle.	Cycle power to the transmitter. If Sensor Memory Failure persists, check all configuration parameters for all sensors and correct any errors. Save the configuration to SD card or via Bluetooth App. Reset the sensor to defaults from the Sensor Setup menu and reload the saved configuration. If Sensor Memory Failure persists, contact local service organization.
	S(n) ADC Failure	Failure of the analog to digital converter in the sensor/sensor module.	Cycle power to the transmitter. If **Sensor ADC Failure** persists, contact local service organization.
	S(n) Wiper Failed	The wiper has failed to wipe. Sensor becomes soiled. Measurement quality is affected due to inadequate cleaning.	Visually inspect the sensor and clean any obstructions/blockages.
	S(n) Calibrating	Sensor calibration is in progress.	Diagnostic clears once calibration is complete.
	S(n) Recovery	Recovery diagnostic is active during the period between completion of a sensor calibration and the sensor being ready to make accurate measurements.	Diagnostic clears once recovery is complete.
	S(n) Clean Inhibited	Automatic cleaning with the wiper is inhibited by configuration. The quality of the Turbidity/Suspended Solids measurement is affected and the sensor lifespan may be reduced.	Perform a Manual Clean from the operator menu. Set the Wiper Clean Frequency.
	S(n): PV Out of Range	Check Function.	Check Function.
	S(n): PV Out of Limits	Process value (PV) measured is outside the specified limits of the sensor. Refer to the sensor data sheet to determine the operating range.	Check the process and the position of the sensor. If PV Out of Limits is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions.
	S(n) Cal Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated and the previous values continue to be applied.	Ensure that the sensor is clean: If available, initiate a Manual Clean from the Operator menu, or clean manually. If using formazine standards, ensure that the solutions have been correctly made up. **Note**: Formazine preparations settle in the solution, shake the solution well prior to the calibration. Repeat calibration, if Calibration Failed persists, consider replacing the sensor.
	S(n) Replace Wiper	The wiper blade on the turbidity sensor is reaching the end of its expected useful life. Measurement quality may be affected due to inadequate cleaning.	Replace wiper and Reset Sensor Lifetime in Sensor Setup.
	S(n) Replace Wiper	The wiper blade on the turbidity sensor has reached the end of its expected useful life. Measurement quality may be affected due to inadequate cleaning.	Replace wiper and Reset Sensor Lifetime in Sensor Setup.

TSS diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): ADC Failure	Failure of the analog to digital converter in the sensor/sensor module.	Cycle power to the transmitter. If **Sensor ADC Failure** persists, contact local service organization.
	S(n): Memory Failure	Sensor configuration data is corrupt, or the sensor's non-volatile memory is faulty. The sensor configuration may be affected and changes may not be maintained after power cycle.	Cycle power to the transmitter. If **Sensor Memory Failure** persists, check all configuration parameters for all sensors and correct any errors. Save the configuration to SD card or via Bluetooth App. Reset the sensor to defaults from the Sensor Setup menu and reload the saved configuration. If **Sensor Memory Failure** persists, contact local service organization.
	S(n): PV Failure	A primary variable reading cannot be obtained from the turbidity sensor because the LED is not illuminating the sample.	Ensure that the sensor is clean: If available, initiate a **Manual Clean** from the **Operator** menu, otherwise remove the sensor from the process and clean manually. Cycle power to the transmitter. If **PV Failure** persists, contact local service organization.
	S(n): Wiper Failed	The wiper has failed to wipe. Sensor becomes soiled. Measurement quality is affected due to inadequate cleaning.	Visually inspect the sensor and clean any obstructions/blockages.
	S(n): Calibrating	Sensor calibration is in progress.	Diagnostic clears once calibration is complete.
	S(n):Recovery	Recovery diagnostic is active during the period between completion of a sensor calibration and the sensor being ready to make accurate measurements.	Diagnostic clears once recovery is complete.
	S(n): Clean Inhibited	Automatic cleaning with the wiper is inhibited by configuration. The quality of the Turbidity/Suspended Solids measurement is affected and the sensor lifespan may be reduced.	Perform a **Manual Clean** from the operator menu. Set the **Wiper Clean Frequency**.
	S(n): Cal Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated and the previous values continue to be applied.	Ensure that the sensor is clean: If available, initiate a **Manual Clean** from the **Operator** menu, or remove the sensor from the process and clean manually. If using formazine standards, ensure that the solutions have been correctly made up. **Note**: Formazine preparations settle in the solution, shake the solution well prior to the calibration. Repeat calibration, if **Calibration Failed** persists, consider replacing the sensor.

…15 Troubleshooting

…TSS diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): PV Out of Limits	Process value (PV) measured is outside the specified limits of the sensor. Refer to the sensor data sheet to determine the operating range.	Check the process and the position of the sensor. If **PV Out of Limits** is consistently active it may be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. Contact local service organization for potential solutions.
	S(n): Internal Temp Out of Range	Internal temperature of the turbidity sensor is outside its recommended operating range. This may cause the measurements to be inaccurate.	Reposition the sensor to avoid extreme temperatures. Ensure that the ambient temperature of the sensor is within its operating range. 0 to 60 °C [32 to 140 °F]. If **Internal Temperature Out of Range** persists, contact local service organization.
	S(n): Excess Light	The turbidity sensor determines turbidity using Nephelometric detection, by measuring the amount of light scattered by the sample at 90° from the direction of illumination. Excessive ambient light can interfere with this and result in inaccurate readings.	Shade the sensor, or if possible move the sensor to a location where it is not affected by ambient light.
	S(n): Service Due	The turbidity sensor requires servicing. The sensor performance degrades over time and servicing is required to maintain accuracy.	Contact local service organization.
	S(n): Replace Wiper	The wiper blade on the turbidity sensor is reaching the end of its expected useful life. Measurement quality may be affected due to inadequate cleaning.	Replace wiper and Reset Sensor Lifetime in **Sensor Setup**.
	S(n): Replace Wiper	The wiper blade on the turbidity sensor has reached the end of its expected useful life. Measurement quality may be affected due to inadequate cleaning.	Replace wiper and **Reset Sensor Lifetime** in **Sensor Setup.**
	S(n): Service Overdue	The turbidity sensor requires servicing. The sensor performance degrades over time and servicing is required to maintain accuracy.	Contact local service organization.
	S(n): LED Expired	This LED in the sensor has reached the end of its expected lifespan, and so is likely to fail.	Contact local service organization.

Universal Input Module diagnostics

NAMUR icon	Diagnostic message	Cause	Recovery action
	S(n): ADC Failure	Failure of the analog-to-digital converter in the sensor/sensor module.	1. Cycle the power to the transmitter. 2. If the failure continues, contact the local service organization.
	S(n): NV Failure	The sensor configuration data is corrupt, or the sensor's nonvolatile memory is faulty. The sensor configuration may be affected, and changes may not be maintained after power cycle.	1. Cycle the power to the transmitter. 2. If the failure continues, check all configuration parameters for all sensors, and correct any errors. 3. Save the configuration to SD Card or via the Bluetooth app. 4. Reset the sensor to defaults from the **Sensor Setup** menu. 5. Reload the saved configuration. 6. If the failure continues, contact the local service organization.
	S(n): Temperature Failure	The measurement taken from the temperature sensor is invalid. This indicates that the temperature sensor failed, or the related connections are open-circuit or short-circuit. This will be active if the temperature input is outside -40 to 200 °C (only applies if PV Type = temperature, or, SV Type = Temperature and if Temperature Compensation = Custom Auto only).	1. Visually examine the sensor/temperature sensor for signs of damage. 2. Replace the sensor if it is damaged. 3. Examine the wiring to the sensor module terminals. 4. If the failure continues, contact the local service organization.
	S(n): Calibration Failed	The most recent sensor calibration has failed, calibration coefficients have not been updated, and the previous values continue to be applied.	1. Visually examine the sensor for signs for damage or dirt, and clean it if necessary. 2. Make sure that the sensor is fully submerged in the solution. 3. Do the calibration again. 4. If the failure continues, it might be necessary to replace the sensor.
	S(n): PV Out of Limits	Active if the PV is outside the electrical limits. This is fixed for all input types, and not based on configurable electrical ranges. Voltage and current cannot detect negative inputs.	1. Check the process and the position of the sensor. 2. If PV Out of Limits is consistently active, it might be necessary to replace the sensor with an alternative sensor with a wider, or more appropriate operating range. 3. Contact the local service organization for possible solutions.
	S(n): SV Out of Limits	Active if the SV is out of the electrical limits. This is fixed for all input types, and not based on configurable electrical ranges. Voltage and current cannot detect negative inputs. This diagnostic will not be used is SV Type = temperature, or, PV Type = temperature.	1. Check the process and position of the sensor. 2. If SV Out of Limits is consistently active, it might be necessary to replace the sensor with an alternative with a wider, or more appropriate operating range. 3. Contact the local service organization for possible solutions.
	S(n): Process Temp Out of Limits	Active if the temperature is outside the electrical range.	1. Make sure that the solution temperature is within the electrical range. 2. Check the process and reduce the effect of any possible heat sources. 3. If Process Temperature Out of Limits is consistently active, it might be necessary to replace the sensor with an alternative with a wider, or more appropriate temperature range. 4. Contact the local service organization for possible solutions.
	S(n): Internal Temp out of limits	The sensor module measurement circuitry is operating at a temperature outside its recommended range.	1. Make sure that the ambient temperature of the transmitter that contains the sensor module is within its operating range. 2. If the Internal Temperature Out Of Limits persists, contact the local service organization.
	S(n): Overcurrent	Too much power drawn from the power output pins 3 & 4.	1. Examine the wiring.
	pH drift	pH reading exceeded +/- pH drift limit.	1. Investigate the source of the pH drift. **Note**. Recalibrating the chlorine sensor will also recalibrate the pH drift alarm calculation.
	S(n): In Manual Temp Mode	Active if Temperature Compensation = Custom Manual only.	–
	S(n): Calibrating	Sensor calibration in progress.	Diagnostic clears when the calibration is complete.
	S(n): Recovery	Active during the period between completion of a sensor calibration and the sensor being ready to make measurements.	Diagnostic clears when the recovery is complete.

...15 Troubleshooting

Chlorine diagnostics

For ACL410 diagnostics, refer to OI/ACL410.
For ACL420 diagnostics, refer to OI/ACL420.

Dissolved oxygen diagnostics

For dissolved oxygen diagnostics, refer to OI/ADS420.

Appendix A PID control

Enables simple PID control of pH and conductivity sensor channels (control of other signals [turbidity, dissolved oxygen etc.] is not required).

Control functionality is available for both channels of the AWT420 transmitter.

Conductivity channels are configurable for reverse or direct-acting control. pH channels are configurable for reverse-acting, direct-acting or dual (Acid/Base) control:

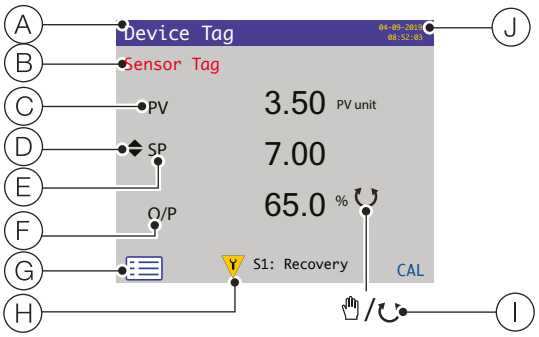
- a reverse-acting controller generates a single control output
- a direct-acting controller generates a single control output
- a dual-acting controller generates 2 control outputs

Control outputs are configurable for **Analog, Time Proportioning** or **Pulse Frequency** output. Analog control outputs can be assigned to any of the available analog outputs.

Time proportioning control outputs can be assigned to any of the available relays or digital outputs and pulse frequency control outputs can be assigned to any of the available relays or digital outputs.

Operator pages

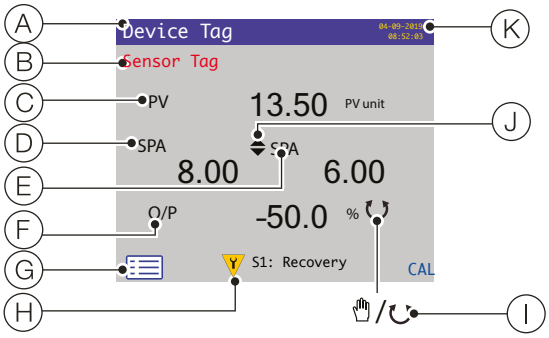
Reverse or direct-acting control



(A) Instrument tag
(B) Sensor-specific tag
(C) Primary value and units
(D) Adjustable parameter icon (using ▲/▼ keys).
(E) Setpoint
(F) Control output percentage
(G) Status bar icons
(H) Diagnostic icon/diagnostic message – see page 84
(I) Icon: Auto/Manual control
(J) Time and date

Figure 19 Operator page – reverse or direct-acting control

Dual-acting (Acid and Base) control



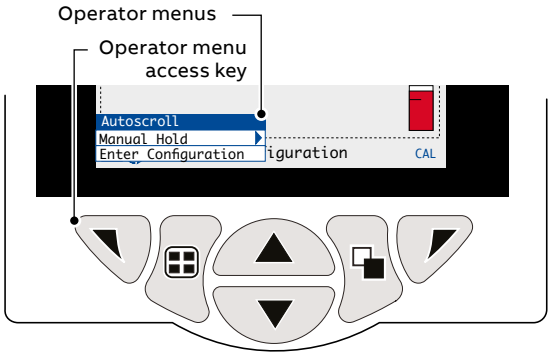
(A) Instrument tag
(B) Sensor-specific tag
(C) Primary Value & units
(D) SPA: Acid control setpoint.
(E) SPB: Base control setpoint
(F) Control output percentage
(G) Status bar icons
(H) Diagnostic icon/diagnostic message – see page 84
(I) Icon: Auto/Manual control
(J) Adjustable parameter icon (using ▲/▼ keys).
(K) Time and date

Figure 20 Operator page – dual-acting (Acid and Base) control

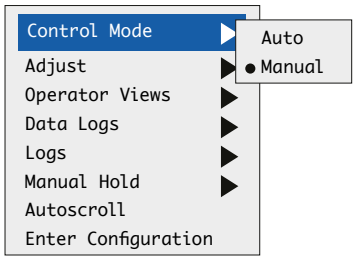
...Appendix A PID control

Operator menus

The following menu options available from the **Operator page/ Start** menu enable selection of the **Control Mode** and adjustment of **Setpoints** or **Output**:

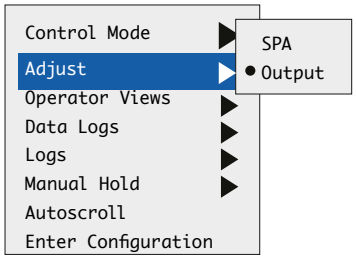


Control Mode



Use the ▲/▼ keys to toggle/select **Auto** or **Manual** mode.

Setpoint/Output adjustment – direct or reverse-acting controller (1 setpoint)

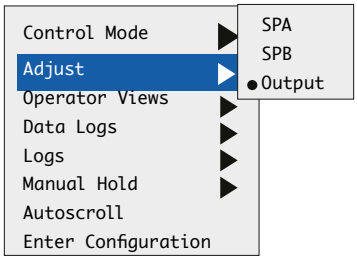


Use the ▲/▼ keys to toggle/select **SPA*** or **Output** mode.

Output mode enabled only if **Control Mode/Manual** is selected.

*SPA = acid setpoint

Setpoint/Output adjustment – dual-acting controller 92 setpoints)



Use the ▲/▼ keys to toggle/select **SPA***, **SPB**** or **Output** mode.

Output mode enabled only if **Control Mode/Manual** is selected.

*SPA = acid setpoint
**SPB = base setpoint

Figure 21 PID control: Control Mode/Setpoint/Output menus

Control action

Reverse-acting control

- Single control output
- P, P+I, P+I+D or P+D
- Output increases as **Process Value** deviates below **Setpoint**
- Output is zero if **Process Value** is greater than **Setpoint***
- Proportional band is positioned below **Setpoint**

*Enabled only if **Control Mode/Manual** is selected – see Figure 21.

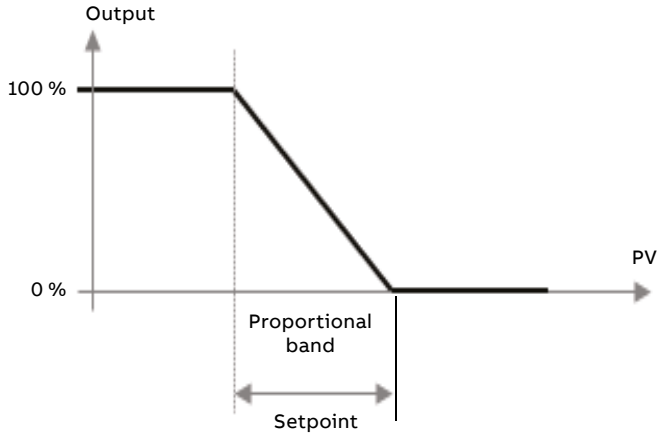


Figure 22 Reverse-acting control

Direct-acting control

- Single control output
- P, P+I, P+I+D or P+D
- Output increases as **Process Value** deviates above **Setpoint**
- Output is zero if **Process Value** is less than **Setpoint***
- Proportional band is positioned above **Setpoint**

*Enabled only if **Control Mode/Manual** is selected – see Figure 21.

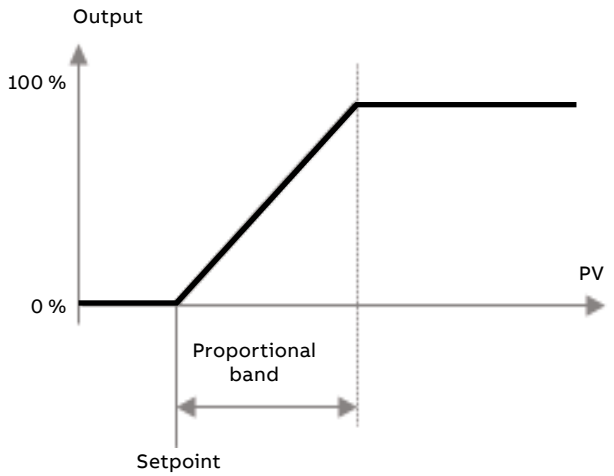


Figure 23 Direct-acting control

Dual-acting control

- Two control outputs (**Base Output** and **Acid Output**)
- P or P+I (Base Controller)
- **Base Output** increases as **Process Value** deviates below **Base Setpoint**
- **Base Output** is zero if **Process Value** is greater than **Base Setpoint**
- **Base** proportional band is positioned below **Base** setpoint
- P or P + I (**Acid Controller**)
- **Acid Output** increases as **Process Value** deviates above **Acid Setpoint**
- **Acid Output** is zero if **Process Value** is less than **Acid Setpoint**
- **Acid** proportional band is positioned above **Acid Setpoint**

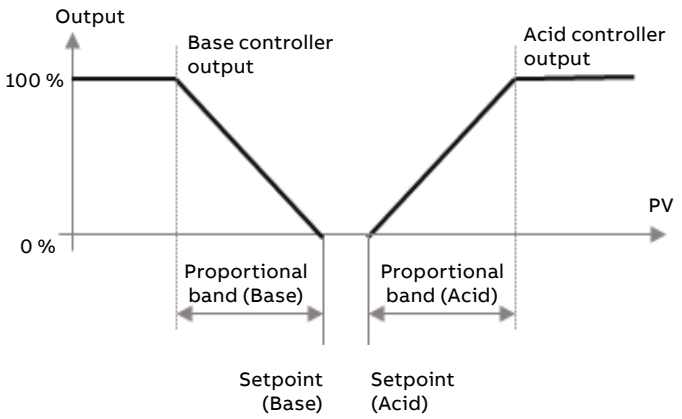


Figure 24 Dual-acting control

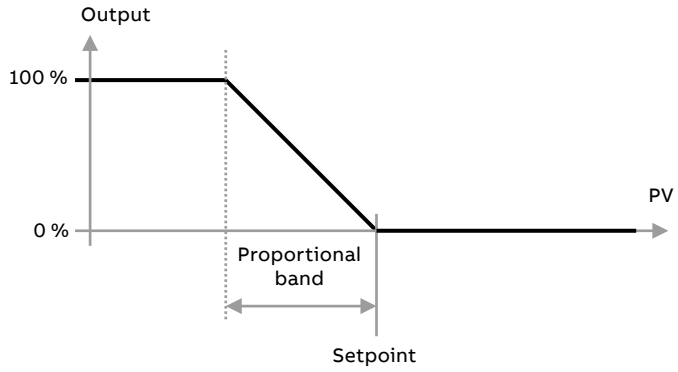
Manual Reset (proportional band offset)

A **Manual Reset** value* is available on **Reverse** or **Direct-acting** controllers when the integral term is disabled (i.e., **Control Type** is configured for **P**, or **P+D**).

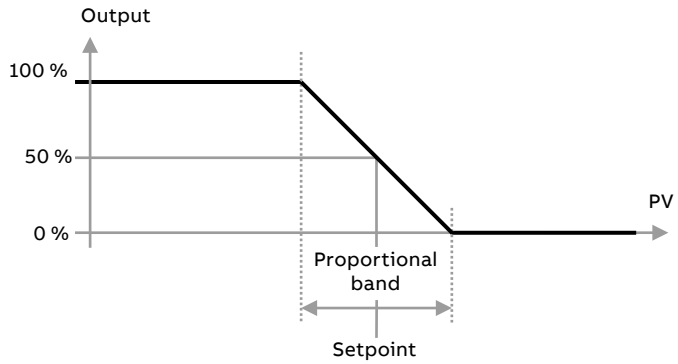
When the process variable is equal to the control setpoint, the output value is equal to the **Manual Reset** value – this effectively changes the position of the proportional band.

* By default the manual reset value is zero.

Manual Reset = 0 %



Manual Reset = 50 %



Manual Reset = 100 %

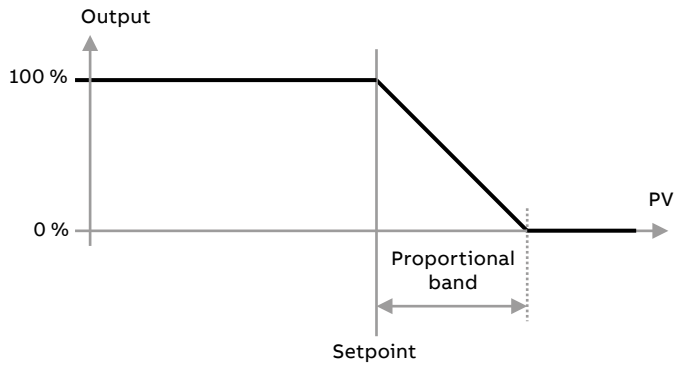


Figure 25 Manual Reset (proportional band offset)

…Appendix A PID control

Output type

Analog output
Analog control outputs can be assigned to any of the available analog outputs:

- the control output (0 to 100 %) is scaled linearly between the electrical range low (0.00 to 22.00 mA) and the electrical range high (0.00 to 22.00 mA) to generate a current output level
- electrical range low and electrical range high values can be set in the analog output configuration

Note. **Engineering range**, **Output type** and failure mode configuration parameters normally associated with an analog output are not required when a control output is assigned as the analog output source.

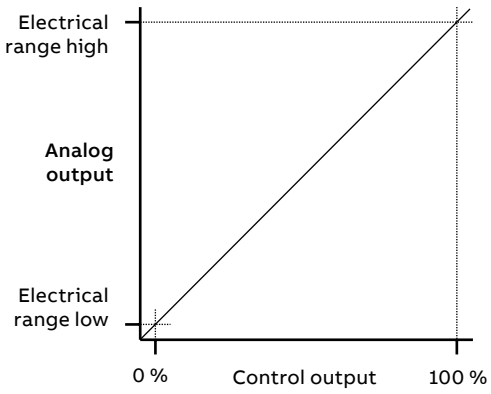


Figure 26 Analog output

Time proportioning output
Time proportioning control outputs can be assigned to any of the available relays or digital outputs:

- the control output (0 to 100 %) is scaled linearly between 0 seconds and the configured cycle time (1.0 to 300.0 s) to generate an ON period
- the relay or digital output is energized for the ON period. The relay or digital output is de-energized for the remainder of the cycle time

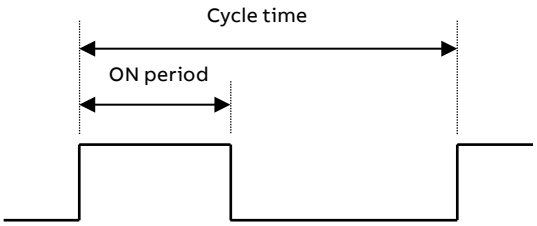


Figure 27 Analog output

Pulse frequency output

Pulse frequency control outputs can be assigned to any of the available relays or digital outputs:

- the control output (0 to 100 %) is scaled linearly between 0 and the configured pulse frequency (1 to 120 pulses per minute) to generate a number of pulses per minute
- the relay or digital output is energized for 300 mS. The 300 mS pulse is repeated at the calculated rate. i.e., the time between pulses is reduced as the output increases
- the calculated rate is recalculated every second

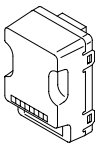
Appendix B Spares

Sensor module assemblies

AWT420 pH/ORP PCB upgrade/spares kit

Part number

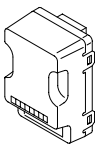
3KXA877420L0014



AWT420 2-electrode conductivity PCB upgrade/spares kit

Part number

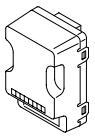
3KXA877420L0013



AWT420 4-electrode conductivity PCB upgrade/spares kit

Part number

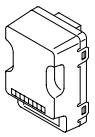
3KXA877420L0011



AWT420 Turbidity PCB upgrade/spares kit

Part number

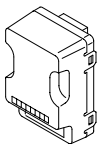
3KXA877420L0016



AWT420 Universal Input Module upgrade/spares kit

Part number

3KXA877420L0019

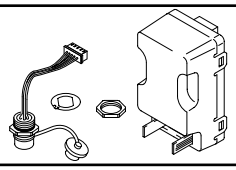


EZLink module assemblies

AWT420 EZLink PCB upgrade/spares kit

Part number

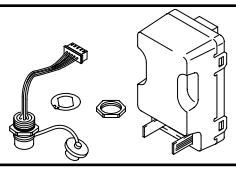
3KXA877420L0015



AWT420 EZLink HazLoc PCB upgrade/spares kit

Part number

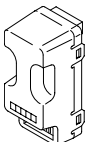
3KXA877420L0018



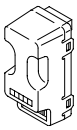
…Appendix B Spares

Communications module assemblies

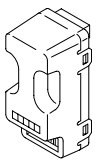
AWT420 HART PCB upgrade/spares kit

Part number	
3KXA877420L0051	

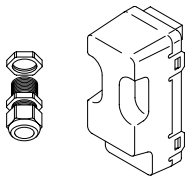
AWT420 Profibus PCB upgrade/spares kit

Part number	
3KXA877420L0052	

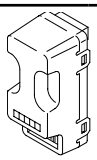
AWT420 Modbus PCB upgrade/spares kit

Part number	
3KXA877420L0054	

AWT420 Ethernet PCB upgrade/spares kit

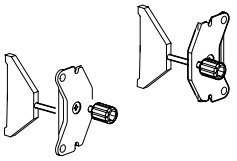
Part number	
3KXA877420L0065	

AWT420 analog output PCB upgrade/spares kit

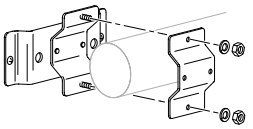
Part number	
3KXA877420L0056	

Mounting kits

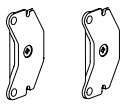
Panel-mount kit

Part number		
3KXA877210L0101	Panel-mount kit, including fixings, flanges, clamps and seal	

Pipe-mount kit

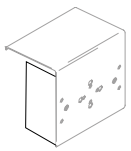
Part number		
3KXA877210L0102	Pipe-mount kit, including pipe-mount adapter plate, brackets and fixings (excludes pipe)	

Wall-mount kit

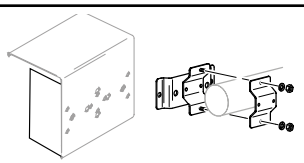
Part number		
3KXA877210L0105	Wall-mount kit	

Weathershield kits

Weathershield kit

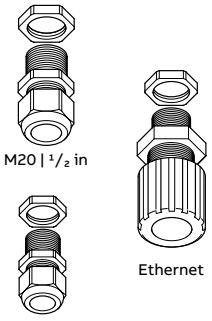
Part number	
3KXA877210L0103	

Weathershield and pipe-mount kit

Part number	
3KXA877210L0104	

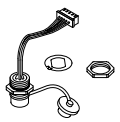
Gland packs

Standard cable glands

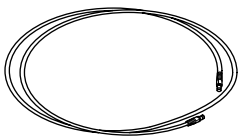
Part number		
3KXA877420L0111	M20 (qty. 5), M16 (qty. 2)	
3KXA877420L0112	½ in NPT (qty. 5), M16 (qty. 2)	
3KXA877420L0113	M20 (qty. 4), M16 (qty. 2) Ethernet (qty. 1)	
3KXA877420L0114	½ in NPT (qty. 4), M16 (qty. 2) Ethernet (qty. 1)	
3KXA877420L0115	Ethernet gland (qty. 1)	
3KXA877420L0116	Ex-E gland pack (5 × M20, 2 × M16)	
3KXA877420L0117	Ex-E gland pack (5 × ½ in NPT, 2 × M16)	
3KXA877420L0118	Ex-E gland pack (4 × M20, 2 × M16, 1 × Ethernet)	
3KXA877420L0119	Ex-E gland pack (4 × ½ in NPT, 2 × M16, 1 × Ethernet)	

EZLink connectors/cables

EZLink and EZLink HazLoc connector assembly

Part number	
3KXA877420L0066	

EZLink extension cable assembly

Part number	**Description**	
AWT4009010	1 m (3.3 ft)	
AWT4009050	5 m (16.4 ft)	
AWT4009100	10 m (32.8 ft)	
AWT4009150	15 m (49.2 ft)	
AWT4009250	25 m (82.0 ft)	
AWT4009500	50 m (164.0 ft)	
AWT4009000	100 m (328.0 ft)	

Acknowledgements

Notes

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/measurement

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