ChloroStar™ Cell

Free and total chlorine cell



Introduction

Drinking water, cooling water and industrial water are usually disinfected with chlorine and chlorine dioxide. The level of disinfectant in this type of water must be carefully controlled, because improper chlorine levels can lead to poor disinfection or undesirable by-products and piping corrosion.

The ChloroStar Cell allows the automatic control of chlorine dosages with the AWT420 Universal Input Module (UIM), allowing advanced features such as full audit trail capability and integrated Bluetooth® for direct communication to your smart device.

The cell can measure either free or total chlorine, depending on the buffers installed.

For more information

Further publications for the ChloroStar Cell are available for free download from: abb.com/wateranalysis or by scanning this code:

Links and reference numbers for related ChloroStar Cell documents:

	Search for/click:
ChloroStar Cell - Data Sheet	DS/ACL410
ChloroStar Cell - Commissioning Instruction	CI/ACL410
AWT420 transmitter - Operating Instruction	OI/AWT420

Contents

1 Health and safety . . . 3
1.1 Document symbols . . . 3
1.2 Safety precautions . . . 3
1.4 Product symbols . . . 3
1.5 Product recycling and disposal (Europe only) . . . 3
1.6 Information on RoHS Directive 2011/65/EU (RoHS II) . . . 3

2 Cyber security . . . 4

3 System overview . . . 4

4 Installation . . . 5
4.1 Siting requirements . . . 5
4.2 Sampling requirements . . . 5
4.3.1 Install the cell with the Free Chlorine Reagent Feeder option . . . 6
4.3.2 Install the measuring cell with the Total Chlorine Reagent Feeder option . . . 6

5 Commissioning the ChloroStar Cell . . . 7
5.1 Electrical connections . . . 7
5.2 Buffer feeder mains power . . . 7
5.3 Sensor setup . . . 7

6 Use of reagent feeder assembly . . . 10
6.1 pH buffer requirements . . . 10
6.2 Measurement of total chlorine . . . 10
6.3 Transmitter control of buffer pump . . . 10

7 Sensor setup menus . . . 11

8 Calibration . . . 12
8.1 Calibrate menu . . . 12
8.2 Calibration menu options . . . 13
8.3 PV span calibration . . . 14
8.4 PV zero calibration . . . 15
8.5 Sample calibration . . . 16
8.6 Temperature calibration . . . 18

9 Maintenance . . . 19
9.1 Maintenance schedule . . . 19
9.2 Periodic functional check . . . 19
9.3 Cleaning/replacing the electrodes . . . 19
9.4 Peristaltic tubing replacement . . . 20

10 Diagnostic messages . . . 21
10.1 S(n): ADC failure . . . 21
10.2 S(n): NV failure . . . 21
10.3 S(n): Temperature failure . . . 21
10.4 S(n): Calibration failed . . . 21
10.5 S(n): PV out of limits . . . 21
10.6 S(n): Process temp out of limits . . . 22
10.7 S(n): Internal temp out of limits . . . 22
10.8 S(n): Manual temperature compensation active 22
10.9 S(n): Calibrating . . . 22
10.10 S(n): Recovery . . . 22
10.11 pH drift . . . 22

11 Troubleshooting . . . 23
11.1 Unstable or fluctuating reading . . . 23
11.2 No reading . . . 23
11.3 High zero point . . . 23
11.4 Low response time/low slope . . . 23

12 Spares . . . 24

1 Health and safety

1.1 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' indicates operator tips, particularly useful information or important information about the product or its further uses. **'Note'** does not indicate a dangerous or harmful situation.

1.2 Safety precautions

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

⚠ WARNING

Installation, operation, maintenance and servicing must be performed:

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

1.3 Safety standards

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

1.4 Product symbols

Symbols that may appear on this product are shown below:

⎓ Direct current supply only.


This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.


This symbol indicates the need for protective eye wear.


This symbol indicates the need for protective hand wear.


Recycle separately from general waste under the WEEE directive.

1.5 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.

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



ABB, Automation, Measurement & Analytics, UK, fully supports the objectives of the RoHS II directive. All in-scope products placed on the market by Measurement & Analytics UK on and following the 22nd of July 2017, will be compliant to the RoHS directive, 2011/65/EU.

2 Cyber security

This product is designed to be connected to and to communicate information and data via a network interface. It is the operator's 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). The operator shall establish and maintain any appropriate measures (such as but not limited to the installation of, firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.), to protect the product, 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 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.

3 System overview

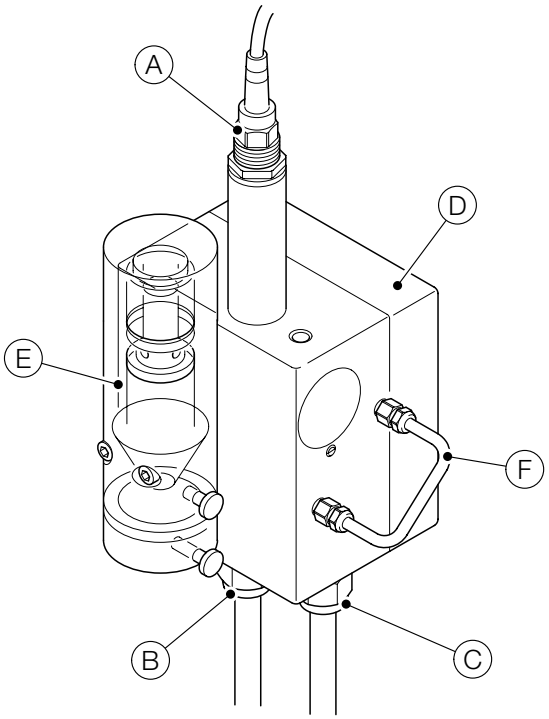


Figure 1 ChloroStar Cell components

Table 1 ChloroStar Cell component descriptions

Part	Description
A	pH sensor (Compatible with all PG13.5 pH sensors, such as ABB 100E sensor)
B	Inlet (⅜ in)
C	Outlet (⅜ in)
D	Regulator assembly
E	Cell assembly
F	Buffer input

4 Installation

4.1 Siting requirements

Install the ChloroStar Cell in a clean, dry, well-ventilated location providing easy and safe access for operators to maintain and calibrate the analyzer. The location must also comply with the requirements that follow:

- It must be free of vibrations
- The cell must not be exposed to direct sunlight
- It should be as far as possible from rotating or electrical communication devices
- The transmitter should be located near to the cell in order to be able to conduct the periodic calibration.

Note.
Install the ChloroStar Cell at a height that gives easy access during calibration and cleaning. Make sure that there is a clearance of 203 mm (8 in) all around the measuring cell, to allow easy access for removal and maintenance. Refer to Figure 2 for the dimensions of the ChloroStar Cell.

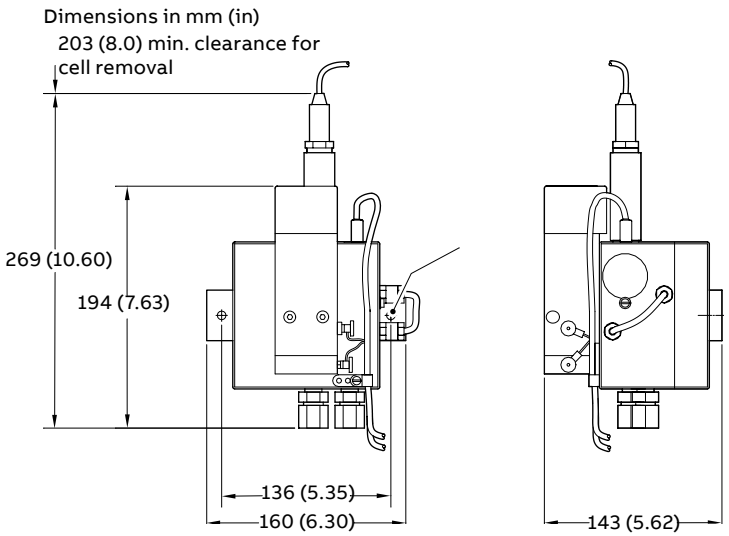


Figure 2 ChloroStar Cell dimensions

4.2 Sampling requirements

The selection of a good, representative sampling point is important to obtain optimum performance from the analyzer. To reduce sample dead time, locate the analyzer as near to the sampling point as possible. The sample must also conform to the following conditions:

- Sample flow must be continuous, with a minimum flow rate of 50 L/h (13.2 galUS/h).
- Sample temperature must be between 2 to 50 °C (36 to 122 °F).
- Samples must not contain particles exceeding 100 µm in size. Above these levels, an external filter must be fitted to the sample lines.
- Sample pressure must be more than 0.5 bar (7.2 psi) and less than 4.0 bar (58.01 psi).
- Sample must be free of air bubbles and thoroughly mixed.

4.3 Mounting the ChloroStar Cell

Figure 3 identifies the main components of the measuring cell.

1. Attach the cell to the wall with the mounting screws provided, through the designated mounting holes.
2. Install the cell with the **No Reagent Feeder** option as follows:
   - **a** Attach the shunt tubing assembly (Figure 3, (A)) to the two fittings located on the right side of the measuring cell assembly.
   - **b** Install the rectangular mounting bracket to the back of the measuring cell with the screws provided.

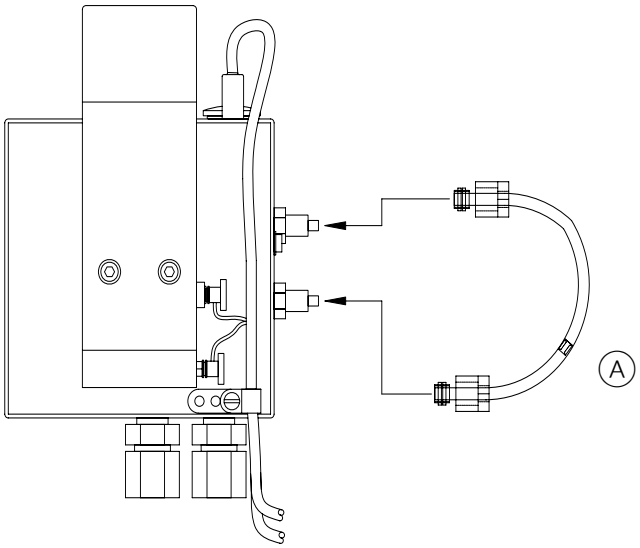


Figure 3 ChloroStar Cell tubing connection

…4 Installation

…4.3 Mounting the ChloroStar Cell

4.3.1 Install the cell with the Free Chlorine Reagent Feeder option

1 Install the tubing (Figure 4, (A)) free chlorine – pH-controlled.

2 Keep the shunt tube **(**Figure 4 (A)**)** in the event that the application changes and the reagent feeder becomes unnecessary.

3 Install the square mounting bracket, furnished with the reagent feeder panel, to the back of the measuring cell with the screws provided.

4 Fasten the rectangular mounting bracket and cell to the reagent feeder panel with the provided screws.

5 Remove the tubing assembly from the supplied 30.2 L (8 galUS) reagent container.

6 Insert the weighted end of the tubing assembly into the container and connect the other end to the barb on the inlet side of the peristaltic pump

4.3.2 Install the measuring cell with the Total Chlorine Reagent Feeder option

1 Install the tubing (Figure 4, (B)) total chlorine – pH-controlled.

2 Install the square mounting bracket, furnished with the reagent feeder panel, to the back of the measuring cell with the screws provided.

3 Fasten the rectangular mounting bracket and cell to the reagent feeder panel with the provided screws.

4 Remove the tubing assemblies from each of the reagent containers.

5 Insert the weighted ends of the tubing assemblies into the containers and connect the other ends to the barbs on the inlet side of the peristaltic pump.

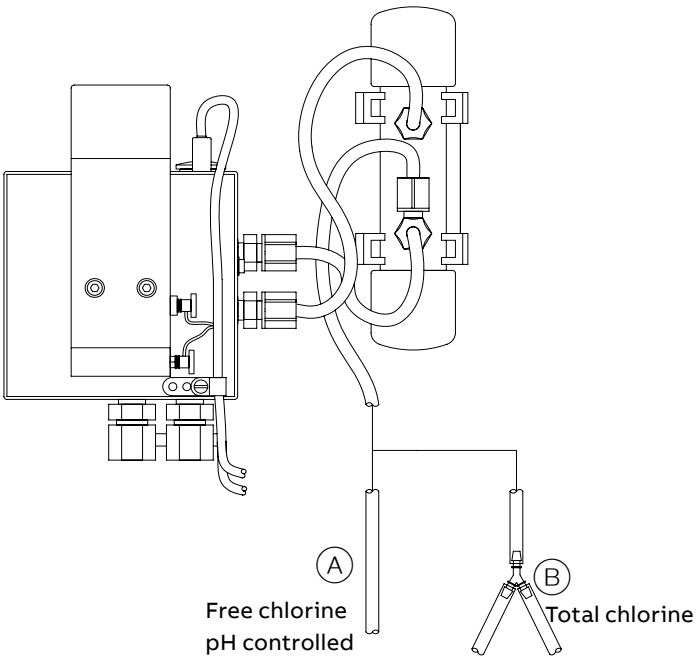


Figure 4 ChloroStar Cell tubing connection

5 Commissioning the ChloroStar Cell

5.1 Electrical connections

The ChloroStar Cell is compatible with the Universal Input Module (UIM) on the AWT420.

Note. The optional pH sensor may be attached to an AWT420.

1 Connect the Cell to the AWT420 UIM. Refer to the wiring instructions in Table 2 and Figure 5.

Table 2 ChloroStar Cell wiring instructions

Wire color	Location
Green	1 IN+
White	2 IN-
White	5 RTD1
Red	6 RTD2
Yellow/Green	7 SHIELD
Black	8 RTD3

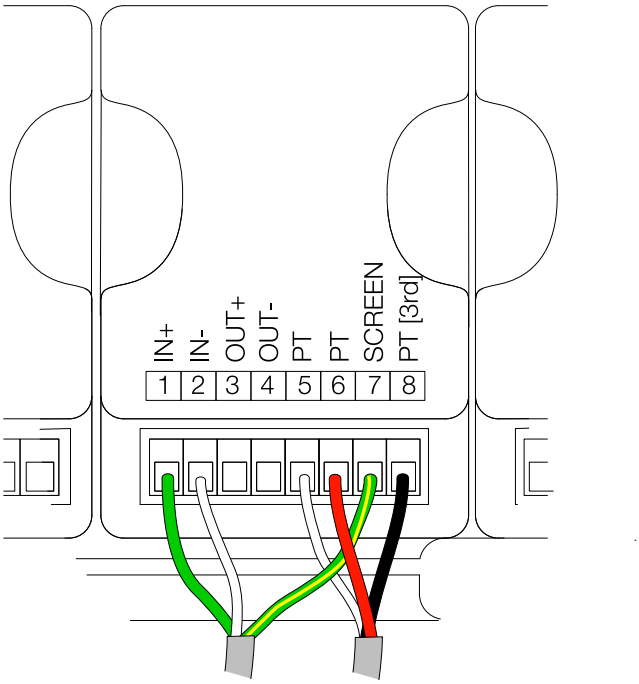


Figure 5 Wiring location of ChloroStar Cell to the AWT420 UIM

5.2 Buffer feeder mains power

⚠ WARNING

Only qualified personnel are permitted to do the steps in this section. Unqualified personnel can cause injury to themselves and/or others.

Notes.

- The buffer feeder pump requires a single-phase power source. The buffer feed motor can be wired to either a 110 V AC or 230 V AC supply as appropriate.
- All models require a cable and plug to be fitted before use.

1 Wire the buffer feed motor to either a 110 V AC or 230 V AC supply as appropriate.

2 Check that the voltage of the power source is correct before you make a connection to the power source.

Note. Make sure that the tubing connections have been attached as per step 3 (page 5).

5.3 Sensor setup

Refer to CI/ACL410.

1 If used with pH compensation, install the pH sensor into the ChloroStar Cell by screwing into the PG13.5 thread.

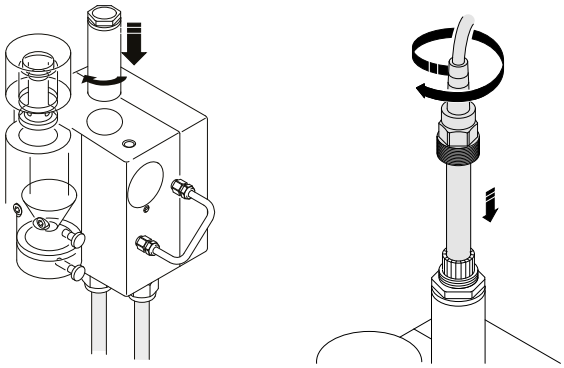


Figure 6 Install pH sensor to the ChloroStar Cell

2 If used with a buffer pump, install the tubing into the peristaltic pump as per Section 4.

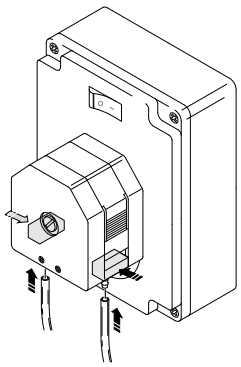


Figure 7 Installation of tubing to peristaltic pump

...5 Commissioning the ChloroStar Cell

...5.3 Sensor setup

3 If using with a buffer pump, connect the buffer pump to the power supply as per "5.2 Buffer feeder mains power" on page 7.

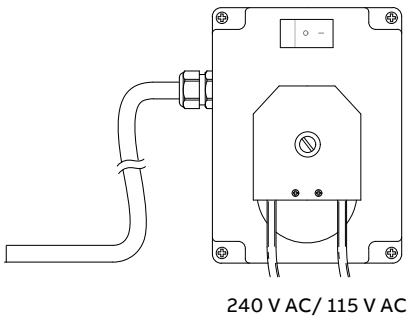


Figure 8 Connecting buffer pump to power supply

4 Twist and pull the cell body cover counterclockwise to open it. Pour one level spoon of corundum sand into the water in the cell.

⚠ CAUTION

Do not add more than one level spoon of corundum sand to the sensor body. Replace it completely or damage to the sensor body can occur.

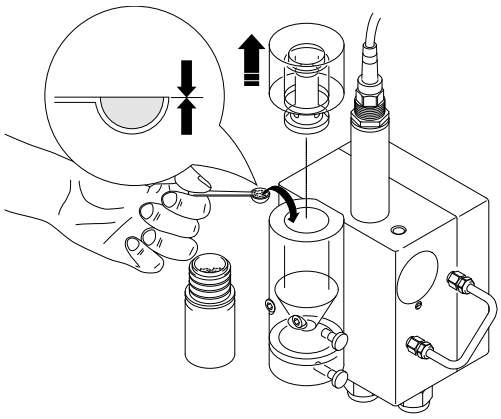


Figure 9 Addition of corundum sand to ChloroStar Cell

5 Replace the cell body cover.

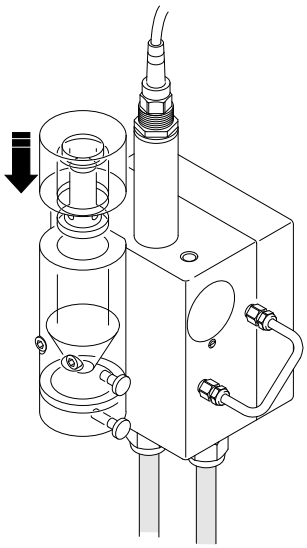


Figure 10 Installation of ChloroStar Cell sensor body cover

6 Start the water flow. Check that the flow rate through the cell is a minimum of 50 L/h (13.2 galUS/h). This is the correct water flow in order to keep the corundum sand working.

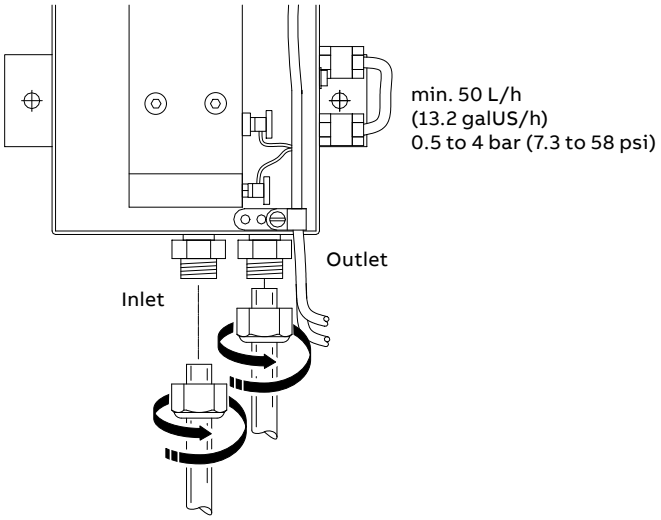
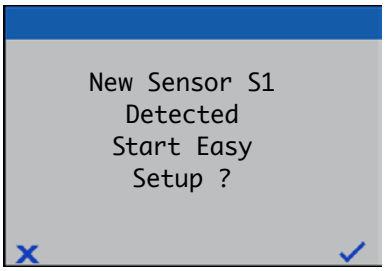
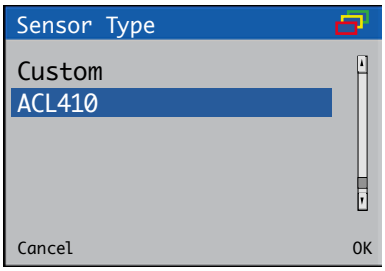


Figure 11 ChloroStar Cell flow rate check

7 Start the Easy Setup.



8 Configure the UIM sensor type to the **ACL410.**



9 If using the buffer pump:

To turn on the buffer pump, position the switch to the **ON** position.

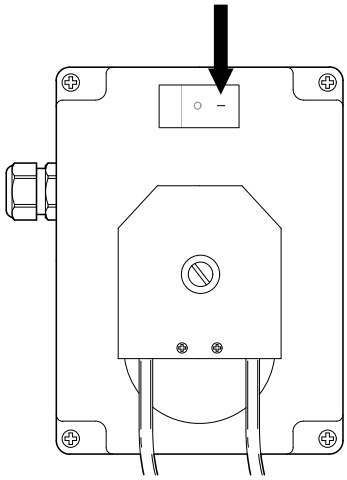
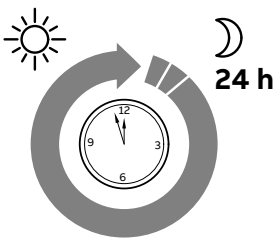


Figure 12 Buffer pump switch to ON position

10 Wait for 24 hours before starting the calibration. The working surfaces of the electrodes require time for stabilization.



6 Use of reagent feeder assembly

Measurements of total chlorine require a reagent to be added. Sometimes a reagent buffer is also needed for free chlorine measurements. For chlorine dioxide measurements, the reagent feeder is not necessary.

6.1 pH buffer requirements

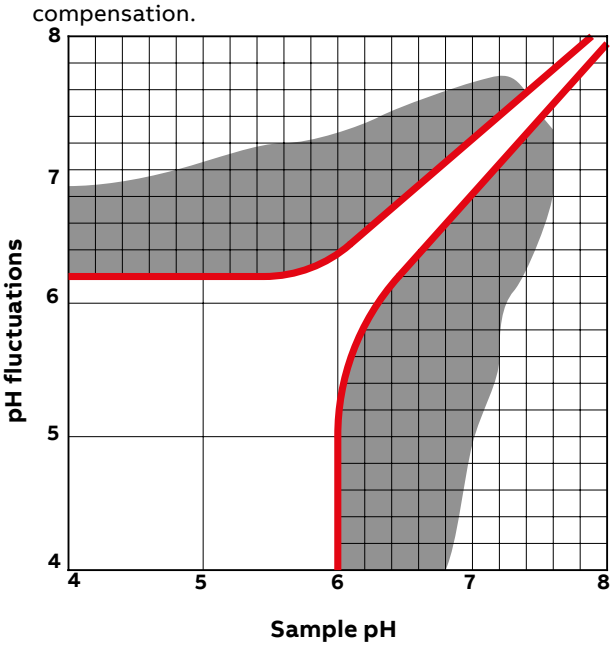
Figure 13 identifies allowable pH fluctuations in the sample.

Normally, the measurement of free chlorine with this analyzer does not require any sample conditioning. However, when the sample pH is fluctuating or it is very high, pH compensation may need to be enabled, or a pH buffering solution may be required.

When the pH increases over 6.0, the allowable fluctuations decreases to approximately 0.5 pH units or less. The higher the pH value the lower the allowable fluctuations.

In such cases, and always when the sample pH is over 7.5, a special additive is required for pH control. ABB supplies the complete reagent feeder system, enabling you to dose the correct amount of buffer solution.

Refer to OI/AWT420 for details on configuring the UIM for pH compensation.



Legend:

- No hatching = No reagent/compensation required
- Gray = pH compensation required
- Squares = pH buffers required

Figure 13 Allowable pH fluctuations in the sample, as a function of the pH value of the sample.

6.2 Measurement of total chlorine

The measuring cell allows total chlorine measurements by simply conditioning the sample with reagents.

The reagent feeder for total chlorine is supplied with two 30.2 L (8 galUS) containers. Each container is marked as **"Acetic Acid"** and **"Potassium Iodide and Sodium Hydroxide"**.

To fill the containers with the prepared solution, do as follows:

1 Fill the **Acetic Acid** container with the selected buffer solution.

2 Fill the **Potassium Iodide and Sodium Hydroxide** container with the solution as follows:

   a Fill with sodium hydroxide solution.

   b Add the required quantity of potassium iodide (Table 3).

   c Mix the solution by stirring with a PVC or polyethylene rod.

Table 3 Potassium iodide volume requirements

Range (ppm)	Potassium iodide (g/10 L)
0 to 0.25	25 (0.88 oz)
0 to 0.50	50 (1.76 oz)
0 to 1.0	100 (3.52 oz)
0 to 2.0	200 (7.05 oz)
0 to 5.0	500 (1.10 lb)
0 to 10.0	1,000 (2.20 lb)

6.3 Transmitter control of buffer pump

The buffer pump power may be controlled through the relays in the AWT420 transmitter. See OI/AWT420 for full details on the relay configuration.

The buffer pump should be wired through the transmitter (refer to Figure 8). The buffer pump can then be enabled/disabled from the **Operator** page.
Note. The buffer pump can also be controlled by the switch located on the front of the unit.

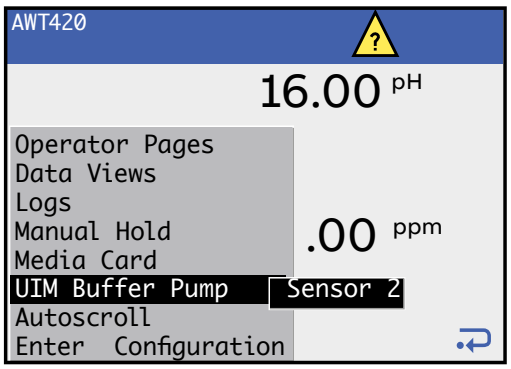


Figure 14 AWT420 Transmitter operator page

7 Sensor setup menus

Table 4 ChloroStar Cell setup menus

Menu	Sub menu	Comment	Default
Tag		Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the **Operator Pages**.	Tag 1
Sensor Type		Select sensor type: • Custom / ACL410 **Note**. If a change is made, the I/O sources are reset.	Custom
PV Options			
	Measurement type	Chlorine, and Chlorine Dioxide.	Chlorine
	Unit	Select the chlorine units: ppm, mg/L, Custom	ppm
	Custom Unit	Enter a user-defined 6-character unit to be displayed next to the chlorine value. **Note**. Only available if Chlorine Units = **Custom**.	ppm
	Range High	Set the span value used in Chart and Bar graph views.	20 ppm
	Range Low	Set the zero value used in Chart and Bar graph views.	0 ppm
	Filter Duration	Limited from 0 to 900 seconds	0 s
	Temp. Compensation	Set the temperature compensation: **None**, **Manual**, **Automatic**	Automatic
	Manual Temperature	Set the manual temperature value to use. **Note**. Only displayed if Temp. Compensation is set to manual.	25
	pH Compensation	Select pH compensation: **Enabled**, **Disabled**	Disabled
	pH Drift Alarm Enable	Enables the pH drift alarm functionality: **Enabled**, **Disabled**	Disabled
	pH Drift Alarm Trip	Limited 0 to 14.00 pH	5 pH
	pH Drift Alarm Cal	The current pH reading after a successful ACL410 calibration. Read only. **Note**. The pH drift alarm is calculated based on the following equations: Current pH reading > (pH drift alarm cal + pH drift alarm trip) OR current pH reading < (pH drift alarm cal - pH drift alarm trip). If either is true, a pH drift alarm diagnostic will be deemed **active**, and an entry will be placed in the diagnostic log. The pH drift alarm is not calculated while in calibration.	7 pH
Reset to Defaults		Select to reset all sensor setup parameters to the default values.	

8 Calibration

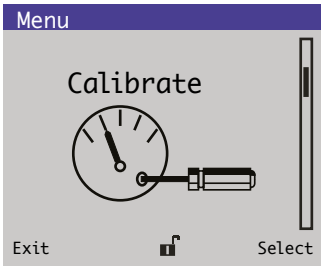
This section describes how to calibrate the Chlorostar Cell and involves measuring the cell's sensitivity to chlorine concentration by performing a grab sample analysis using the EZTest 100 handheld chlorine calibrator – OI/AWQ101.

Calibrations are initiated via the Cal prompt displayed on Operator pages or via the **Calibrate** and **Advanced** menu items on the **Access Level** page. Refer to the transmitter operating instructions OI/AWT420 for all transmitter menu options.

Note.

- Do not perform a calibration until the cell and transmitter are installed and ready for operation.
- Before performing a calibration, set the currents, outputs and alarms to Hold (enabled via the Operator Menu/Manual Hold function).
- After calibration and cell replacement, reset the currents outputs and alarms. Refer to "8.1 Calibrate menu".

8.1 Calibrate menu



Used to calibrate the sensor.

Note. **Calibrate** menus are sensor-specific.

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

8.2 Calibration menu options

Table 5 ChloroStar sensor calibration menus

Menu	Comment	Default
S1: ACL410	Select the chlorine cell to calibrate	
PV Span Cal	Select to perform a 1-point calibration in chlorinated solution. Refer to "8.3 PV span calibration" on page 14	
PV Zero Cal	Select to perform a 1-point calibration in dechlorinated solution. Refer to "8.4 PV zero calibration" on page 15	
Sample Collection	Select to perform the sample collection routine to record the active current measured by the sensor Refer to "Sample calibration" on page 16	
Collection Complete	Select to perform the collection complete routine to update the calibration coefficients based on a lab measurement Refer to "Sample calibration" on page 16	
Temperature Cal	Select to perform a temperature calibration. Refer to "8.6 Temperature calibration" on page 18	
Edit Cal	Select to manually edit the calibration coefficients	
PV Slope	Edit the slope value: • Valid slope values range from 20 to 500 %	100 %
PV Offset	Edit the offset value: • Valid offset values are ±5 mg/L	0 mg/L
Temp Slope	Edit the temperature slope value: • Valid slope values range from 20 to 500 %	100 %
Temp Offset	Edit the temperature offset value: • Valid offset values are ±50 °C	0 °C
Scheduled Zero Cal*	Select to configure the schedules calibration	
Calibration Frequency	Select the Calibration Frequency: • Off / 4 hours / 8 hours / 12 hours / 1 day / 2 days / 4 days / 8 days / 12 days / 1 month / 2 months	Off
Next Calibration	Set the date and time of the next calibration	—
Delay Time	Set the delay time between 1 and 30 minutes	1 min
Recovery Time	Set the recovery time between 1 and 30 minutes	1 min
Inlet Valve	Source relay assigned Calibration Filter Inlet	None
Outlet Valve	Source relay assigned Calibration Filter Outlet	None
Reset Cal Defaults	Select to reset the calibration values back to defaults	
Hold Outputs	Enable/disable the **Hold Outputs** function If enabled, the current outputs and alarm functions are held during calibrations	Enabled

* Scheduled zero calibration functionality for use with customer-supplied carbon filtration system.

...8 Calibration

8.3 PV span calibration

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

1 Prepare the equipment to take a grab sample. This includes the EZTest 100 handheld chlorine calibrator, and the selected tablets or powders for the type of measurement (free/total chlorine) and the expected range. For more information on selecting the reagents, refer to OI/AWQ101.

2 Take a grab sample from the process.
Note. The correct level is when the bottom of the concave meniscus is at the 10 mL level.

3 Fill the cell to the 10 mL level.
Note. The correct level is when the bottom of the concave meniscus is at the 10 mL level.

4 Place the cell in the EZTest 100 handheld calibrator.



5 Power on the unit, then select the method that is being used, and perform the zero measurement.



6 Empty the cell.

7 Add the selected reagent (powder or tablet) to the cell. Crush the reagent if it is necessary.

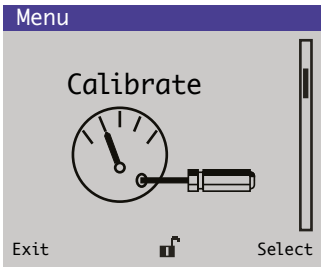


8 Fill the cell with the sample up to the line.

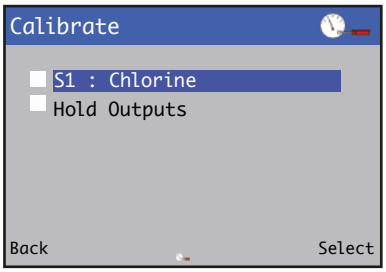
9 Place the cell in the EZTest 100 handheld calibrator, and press the **Test** button to take a measurement.

10 Record the result of the chlorine measurement.

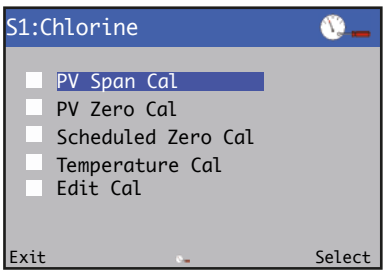
11 On the transmitter, navigate to the **Calibrate** menu:



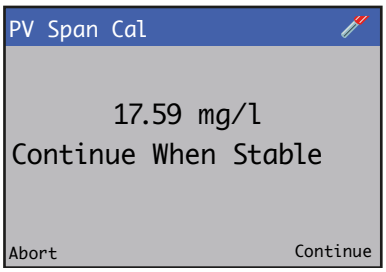
12 Select the sensor to calibrate:



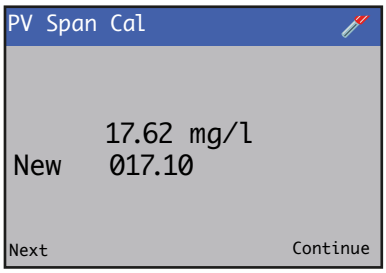
13 Select PV span calibration:



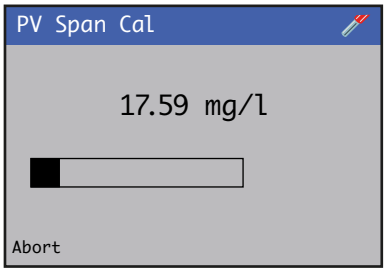
14 Wait for the reading to become stable.



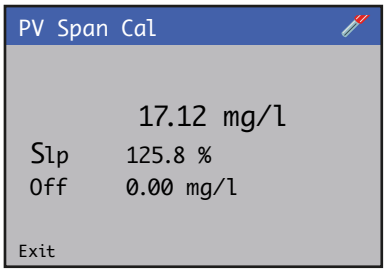
15 Use the ▲/▼ keys to enter the new PV reading reported in the EZTest 100 handheld calibrator, then press the ◢ key to confirm the changes:



16 The PV Span calibration process screen is displayed:



17 Wait for the progress bar to update and for the calibration to complete. The updated calibration information will be displayed on the screen, and added to the calibration log:



8.4 PV zero calibration

A zero calibration can be performed if the sensor reports a nonzero value when in a dechlorinated sample.
The process is the same as the "8.3 PV span calibration" on page 14, but the offset will be adjusted instead of the span.

...8 Calibration

8.5 Sample calibration

The sample calibration feature may be used to perform a calibration with sample analysis off site.

To do the sample calibration:

1 Perform a sample collection routine in the transmitter.

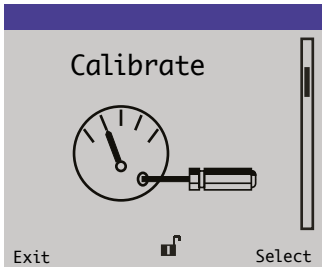
2 Collect a sample from the grab sample port on the flow cell.

3 Analyze sample for chlorine concentration (may use handheld calibrator or offline lab analysis).

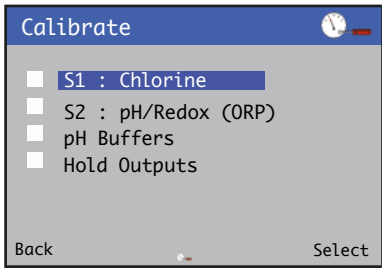
4 Perform the collection complete routine to update calibration coefficients in the sensor.

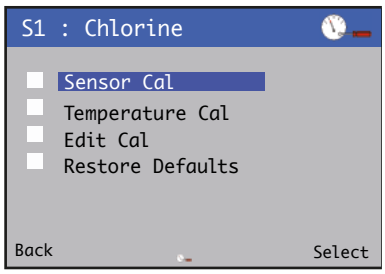
To do the sample collection routine:

1 On the transmitter, navigate to the **Calibrate** menu:

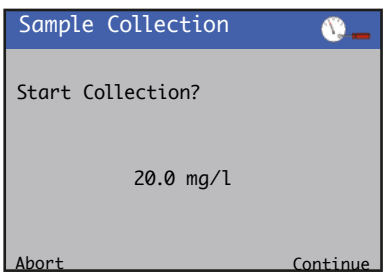


2 Select the sensor to calibrate:

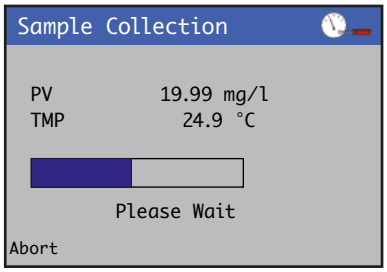


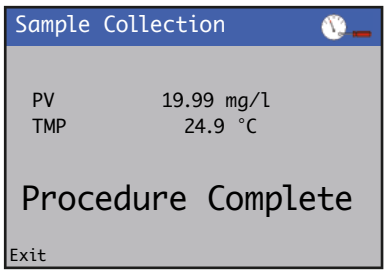


3 Select sample collection and wait for the reading to become stable and then press the **Continue** button:



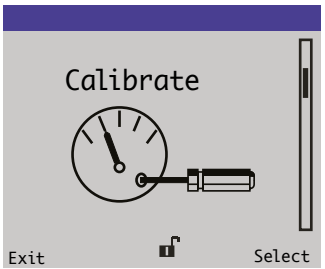
4 Wait for the routine to finish while the analyzer records the current being measured by the sensor:



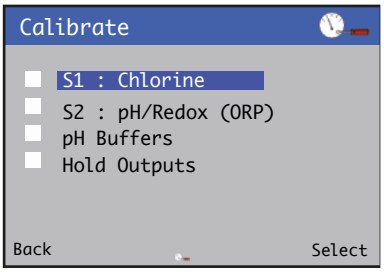


To do the collection complete routine:

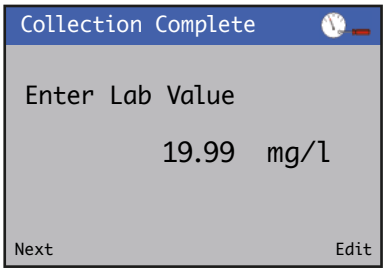
1 On the transmitter, navigate to the calibrate menu:



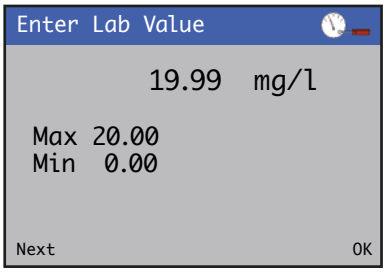
2 Select the sensor to calibrate:



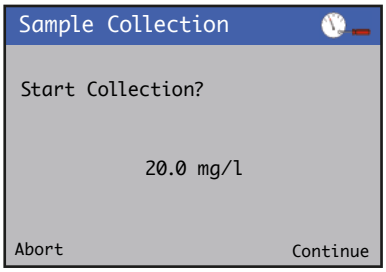
3 Select Collection Complete and then press the **Edit** button:



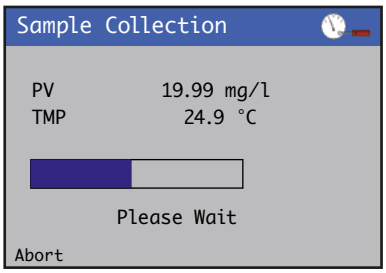
4 Use the ▲/▼ keys to enter the new PV reading reported from the analysis , then press **Next** to confirm the changes:



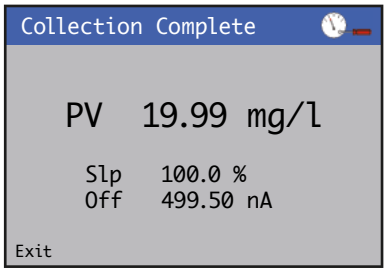
5 The **Sample collection** screen is displayed to start collection. Press **Continue** to confirm the changes:



6 Wait for the progress bar to update and for the calibration to complete. The updated calibration information will be displayed on the screen, and added to the calibration log:



7 The **Collection complete** process screen is displayed:



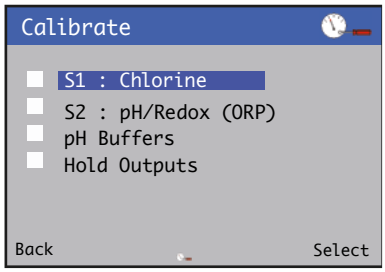
...8 Calibration

8.6 Temperature calibration

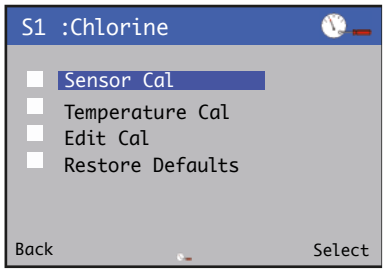
Note. The calibration can be canceled at any time during the process by pressing the **Abort** key.

To do the temperature calibration:

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

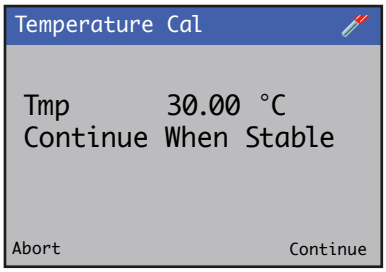


2 Use the / keys to select the sensor to be calibrated, and press the key to confirm selection.
The sensor calibration menu is displayed:

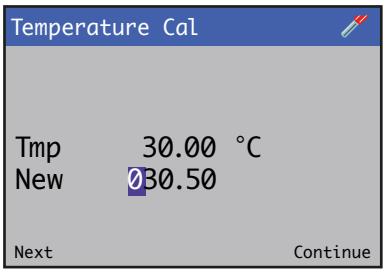


3 Press the / keys to select **Temperature Cal** and press the key to confirm selection.

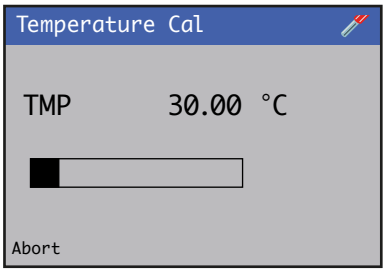
4 Wait for the displayed value to become stable, then press the key to start the calibration and proceed to the next step.



5 The new PV reading is displayed.
Use the / and keys to set the new temperature, then press the key to confirm the changes.

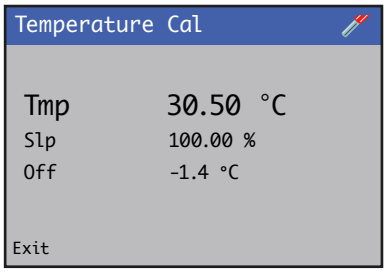


6 The temperature calibration process screen is displayed:



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.



9 Maintenance

⚠ CAUTION

Ensure water flow is stopped before performing maintenance on the ChloroStar Cell.

9.1 Maintenance schedule

Table 6 Maintenance schedule

Maintenance task	Interval
Periodic functional check	Weekly
Cleaning/replacing electrodes	Process dependent
Peristaltic tubing replacement	3 months

9.2 Periodic functional check

Check the measuring cell once a week to maintain the best measurement accuracy. Calibrate as required.

9.3 Cleaning/replacing the electrodes

If sensitivity of the cell decreased too much, it is possible that the copper electrode is damaged. To replace the electrodes:

1 Remove both signal leads (A) at the cell (B).

2 Pull the gold electrode fitting (C) in the cell (B) down to expose the entire electrode chamber.

3 Flush the open cell (B) with demineralized water to make sure that all corundum sand is removed. Sand prevents good O-ring sealing, so must be removed completely.

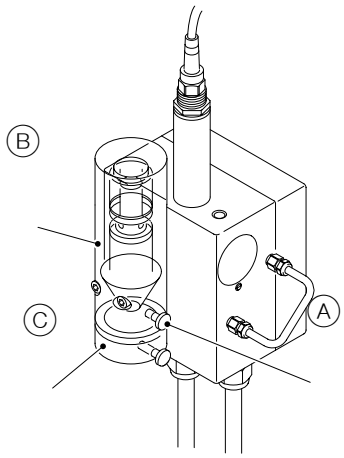


Figure 15 ChloroStar Cell diagram

4 Gently clean the gold electrode (E) with a cotton swab and a detergent that does not leave a residue.

5 Rinse the electrode (E) with demineralized water.

6 Remove the knurling nut (A) on the cell body (B).

7 Remove the holding screw from the copper electrode (D).

8 Remove the copper electrode (D) by lightly tapping on a soft surface.

9 Check the condition of the copper electrode (D). Excessive grooving or wear to the copper electrode indicates replacement is necessary.

NOTICE

Make sure that the electrode is clean and has a uniform shiny copper appearance.

10 Clean the electrode (D) with a non-chlorinated cleanser or a mild abrasive pad.

11 Install the copper electrode (D).

12 Install the gold electrode (E).

13 Add the correct amount of corundum sand (refer to Figure 9 on page 8).

14 Start the sample flow.

15 Check that the sealing surfaces and mating parts are free from sand.

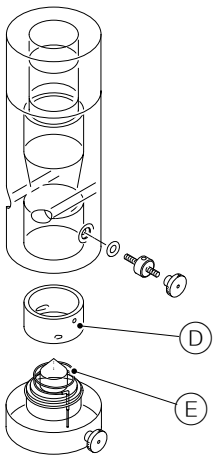


Figure 16 ChloroStar Cell electrodes view

...9 Maintenance

9.4 Peristaltic tubing replacement

Change the peristaltic pump tubing every three months.
To replace the peristaltic pump tubing:

1. Carefully remove the pickup tubing from the reagent bottles.
2. Set the pickup tubing into a container of tap water.
3. Let the pump (C) run for 15 minutes.
   Note. Do not replace the pump tubing without first purging with water.
4. Disconnect power from the reagent feeder (D). (This can also be performed via the AWT420 transmitter).
5. After the power is removed, gently press on the sides of the clamp plate (F) and pull up.

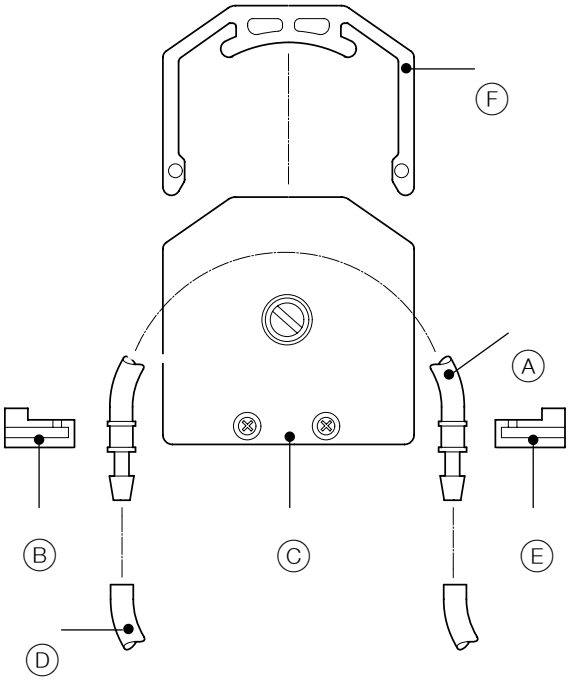


Figure 17 Peristaltic tubing replacement

6. Gently pull the two retaining blocks (B) and (E) from both sides of the pump and remove the tubing assembly (A).
7. Discard the old tubing assembly (A).
8. Install the new tubing assembly (A) into the retaining blocks (B) and (E) and clamp the plate (F).
9. Insert the pickup tubing in the reagent bottles.
10. Connect the power.

10 Diagnostic messages

This section describes sensor-specific icon types, diagnostic messages and possible causes/suggested remedial action.

Table 7 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

For transmitter-specific diagnostic messages, refer to the transmitter operating instruction OI/AWT420.

10.1 S(n): ADC failure

Diagnostic message

 S(n): ADC failure

Cause
Failure of the analog-to-digital converter in the sensor/sensor module.

Recovery action
1 Cycle power to the sensor.

2 If the failure persists, contact the local service organization.

10.2 S(n): NV failure

Diagnostic message

 S(n): NV failure

Cause
The sensor configuration data is corrupt, or the sensor's nonvolatile memory is faulty. The sensor's configuration might be affected, and changes might not be kept after power cycle.

Recovery action
1 Cycle the power to the transmitter.

2 If the failure persists, check all configuration parameters for all sensors, and correct any errors. Save the configuration to SD™ Card or via the Bluetooth® app.

3 Reset the sensor to the defaults from the **Sensor Setup** menu, and reload the saved configuration.

4 If the failure persists, contact the local service organization.

10.3 S(n): Temperature failure

Diagnostic message

 S(n): Temperature failure

Cause
The measurement taken from the temperature sensor is invalid, indicating that the temperature sensor failed, or the related connections are open circuit or short circuit.

Recovery action
1 Visually examine the sensor/temperature sensor for signs of damage. Replace the damaged sensor.

2 Examine the wiring to the sensor module terminals.

3 If the failure persists, contact the local service organization.

10.4 S(n): Calibration failed

Diagnostic message

 S(n): Calibration failed

Cause
The most recent sensor calibration has failed, calibration coefficients have not been updated, and the previous values continue to be applied.

Recovery action
1 Visually examine the sensor for signs of 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 persists, contact the local service organization.

10.5 S(n): PV out of limits

Diagnostic message

 S(n): PV out of limits

Cause
The measured process value is out of specification of the sensor.

Recovery action
1 Change the process value of the sample to a value that is within the sensor's operating range, and recalibrate the sensor.

...10 Diagnostic messages

10.6 S(n): Process temp out of limits


S(n): Process temp out of limits

Cause
Solution temperature is outside the measurement range of the sensor. Refer to the sensor data sheet to determine the temperature range.

Recovery action
1. Make sure that the solution temperature is in the sensor measurement limits.
2. Check the process and reduce the effect of any potential heat sources.
3. If this diagnostic is consistently active, it might be necessary to replace the sensor with an alternative that has a wider or more appropriate temperature range.
4. Contact the local service organization for possible solutions.

10.7 S(n): Internal temp out of limits

Diagnostic message


S(n): Internal temp out of limits

Cause
The sensor module measurement circuitry is operating at a temperature outside its recommended range. This might cause measurements to be inaccurate.

Recovery action
1. Make sure that the ambient temperature of the transmitter that contains the sensor module is within its operating temperature range.
2. If the failure persists, contact the local service organization.

10.8 S(n): Manual temperature compensation active

Diagnostic message


S(n): Manual temperature compensation active

Cause
Temperature compensation mode has been configured to manual mode

Recovery action
The diagnostic is cleared if manual temperature compensation is turned off.

10.9 S(n): Calibrating

Diagnostic message


S(n): Calibrating

Cause
Sensor calibration in progress

Recovery action
This diagnostic clears when the calibration is complete.

10.10 S(n): Recovery

Diagnostic message


S(n): Recovery

Cause
Active during the period between completion of a sensor calibration, and the sensor being ready to make measurements.

Recovery action
This diagnostic clears when the calibration is complete.

10.11 pH drift

Diagnostic message


pH drift

Cause
pH reading exceeded +/- pH drift limit.

Recovery action
1. Investigate the source of the pH drift.
   Note.
   Recalibrating the chlorine sensor will also recalibrate the pH drift alarm calculation.

11 Troubleshooting

This section describes common reasons for cell malfunctions and gives possible solutions.

11.1 Unstable or fluctuating reading

Causes	Recovery actions
Copper electrode corroded or dirty	Clean/replace copper electrode
Incorrect amount of corrundum sand	Clean the electrodes and add the correct quantity of corundum sand
Broken or loose wires	Secure the connections, replace PT100 or cell cable assemblies
Excessive air bubbles in sample	Change sampling location
Faulty PT100	Replace PT100 cable assembly
Sample pressure or flow rate not sufficient	Ensure sample pressure & flow rate are within specification
Calibration incorrect	Perform sensor calibration

11.2 No reading

Causes	Recovery actions
Electrode conditioning is not complete	Wait approximately 24 hours for cell to polarize upon commissioning
Faulty cable/connection	Replace the extension cable and check all connections

11.3 High zero point

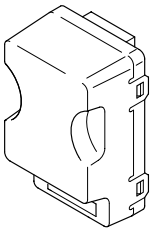
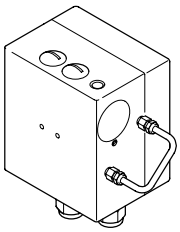
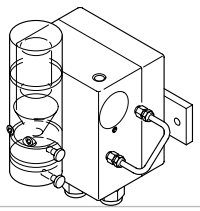
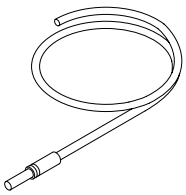
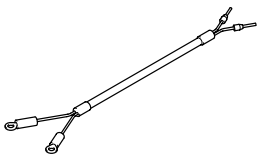
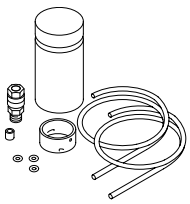
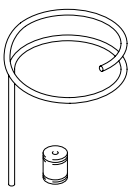
Causes	Recovery actions
The water sample is not chlorine free	Replace zero calibration point with chlorine free sample
Interfering substances in the sample	Polish the electrode

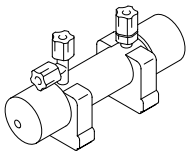
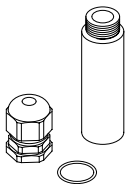
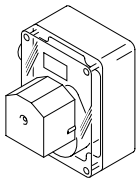
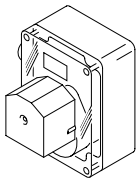
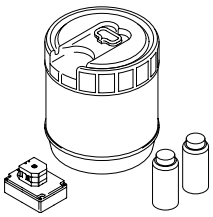
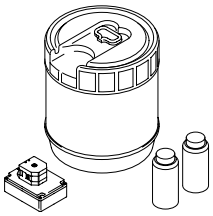
11.4 Low response time/low slope

Causes	Recovery actions
The copper and/or gold electrodes are fouled	Clean or replace the electrodes
Incorrect level of sand	Empty cell and replaces with required level of sand
Insufficient conditioning	Re-polarize the sensor for 24 hours
Low flow-rate/pressure	Make sure the flow rate and pressure are within specification and stable

Note.
If the failure persists, contact the local service organization.

12 Spares

Part number	Description	
3KXA877420L0019	Universal Input Module	
3KXA843400L0035	Regulator assembly	
3KXA843400L0036	ChloroStar Cell assembly	
3KXA843400L0041	PT100 with cable 3 m (9.8 ft) – Standard	
3KXA843400L0042	Cell signal cable 3 m (9.8 ft)	
3KXA843400L0073	ChloroStar Cell Maintenance Kit	
3KXA843400L0074	Replacement gold electrode kit	

Part number	Description	
3KXA843400L0076	ChloroStar Cell mixer assembly	
3KXA843400L0077	Reagent bottle & tubing kit	
3KXA843400L0078	ChloroStar Cell pH ORP PG13.5 upgrade kit	
3KXA843400L0087	Buffer pump 230 V	
3KXA843400L0088	Buffer pump 110 V	
3KXA843400L0089	Buffer pump upgrade kit 230 V	
3KXA843400L0090	Buffer pump upgrade kit 110 V	

Trademarks

- Bluetooth is a registered trademark of Bluetooth SIG, Inc.
- Plexiglas is a registered trademark of Röhm GmbH
- ChloroStar is a registered trademark of ABB Limited.
- EZLink is a trademark of ABB Limited.
- SD is a trademark of SD-3C.

Notes

Notes

ABB Ltd.
Oldends Lane
Stonehouse
Gloucestershire
GL10 3TA
United Kingdom

abb.com/measurement

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

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB AG. Copyright© 2026 ABB All rights reserved

OI/ACL410-EN Rev. B 02.2026