UviTec™ Probes

Continuous water quality testing probe



Introduction

The titanium or stainless steel UviTec probe is compatible with either the UviTec Controller or UviTec Controller Pro and the probe mounting kit.

The probe comes with a mounting kit for attachment of the probe to a tank or channel wall and allow for easy removal of the probe from the tank for servicing.

The UviTec Probe Clean accessory provides automatic cleaning for UviTec submersible probe sensors to save time, lower maintenance and improve instrument performance. The system is compatible for use with compressed air or pressurized water, with an optional compressed air system that can be selected when compressed air is not available on-site.

This operating instruction applies to the probes that follow:

- BOD/COD,
- TOC,
- Multi-color,
- Chromium VI

For more information

Further publications for UviTec products are available for free download from: abb.com/wateranalysis, or by scanning this code:

Links and reference numbers for related documents:

	Search for/click:
UviTec probes – Commissioning instruction	CI/AUV400
UviTec probe BOD/COD – Data sheet	DS/AUV402
UviTec probe Chromium VI – Data sheet	DS/AUV403
UviTec probe Color – Data sheet	DS/AUV404
UviTec probe Multi-color – Data sheet	DS/AUV405
UviTec probe Nitrite – Data sheet	DS/AUV408
UviTec probe TOC – Data sheet	DS/AUV410
UviTec probe UV254 – Data sheet	DS/AUV411
UviTec probe Spectrum – Data sheet	DS/AUV412
UviTec probe UVT – Data sheet	DS/AUV413

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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 or important information about the product.

1.2 Safety precautions

⚠ WARNING

Electricity hazard

Do not service this probe without unplugging the power supply.

⚠ WARNING

Optical radiation

This probe contains a UV lamp, which emits light at UV wavelengths. Never look directly at the UV light, as it could cause permanent eye damage and burn unprotected skin.

⚠ CAUTION

Improper use of this device may cause injury.

Visually examine the probe before operation. If it seems broken or damaged in any way, do not use it. Contact ABB for a replacement.

Make sure that all responsible personnel carefully read this manual before installing or servicing the device.

Failure to properly install and maintain this device may impact its effectiveness and warranty.

1.3 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.

NOTICE

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

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



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

2 Probe menus

This section lists the UviTec Controller menus for probes, where measurement values and entries for configuration are displayed.

Some probes use the Cleaning system menu to enable and configure air purge of a probe's sight glass.

Table 1 lists the common names and the associated menu names for all UviTec probes.

2.1 Probe menus and common names

Table 1 Probe menus and common names

Common name	Menu	Description
UviTec UVT probe	S2000	Covers parameter: • UVT
UviTec Color probe	CA2000	Covers parameter: • Color
UviTec UV254 probe	MA2000	Covers parameter: • UV254
UviTec Multi-LED probes	SA2000	Covers parameters: • BOD/COD • TOC/DOC • Benzene • Multi-color • Chromium VI • High nitrite • High nitrate/nitrite • Permanganate
UviTec TSS probe	TA2000	Covers parameter: • TSS

2.2 UVT, Color, TSS probe menus

Table 2 UVT, Color, TSS probe menus

Menu	Menu type	Description
S2000		UVT probe
OutputData		
UVT	Number	Current UVT value displayed
UVA	Number	Current UVA value displayed
Counter	Number	Counter increments each time a measurement cycle has completed, typically around 10 to 12 seconds. If UVT or UVA value remains unchanged after multiple increases in the counter, see if Water UV and Lamp UV secondary values are changing. If they are static, the sensor is not measuring or is holding after an air purge.
Calibration		Calibration or zeroing of probe
Start :v		Initiate calibration
Mode :		Sensor is zeroed to UVA or UVT
UVA	Radio button	Select to zero the sensor for UVA
UVT	Radio button	Select to zero the sensor for UVT
CustomVal:	Value	A custom calibration for UVA or UVT derived from another device is entered here
Settings		
Set Warnings		
WaterHigh :	Number	Enter a number for Water High warning threshold
WaterLow :	Number	Enter a number for Water Low warning threshold
LampHigh :	Number	Enter a number for Lamp High warning threshold
LampLow :	Number	Enter a number for Lamp Low warning threshold
UVA High :	Number	Enter a number to generate a warning for a UVA value that you identify as being too high
UVALow :	Number	Enter a number to generate a warning for a UVA value that you identify as being too low
SetAlarms		
WaterHigh :	Number	Enter a number for Water High alarm threshold
WaterLow :	Number	Enter a number for Water Low alarm threshold
LampHigh :	Number	Enter a number for Lamp High alarm threshold

Menu	Menu type	Description
LampLow :	Number	Enter a number for Lamp Low alarm threshold
UVA High :	Number	Enter a number to generate an alarm for a UVA value that you identify as being too high
UVA Low :	Number	Enter a number to generate an alarm for a UVA value that you identify as being too low
Gain		
Water:	Number	Factory-set
Lamp:	Number	Factory-set
CorrCoef		Factory-set
Enbl T: v	Check box	Factory-set
Mult T: v	Check box	Factory-set
TCoef0	Number	Factory-set
TCoef1	Number	Factory-set
TCoef2	Number	Factory-set
Enbl R: v	Check box	Factory-set
Mult R: v	Check box	Factory-set
Mode	Drop list	Factory-set
UVA	Drop list	
UVT	Drop list	
Coef0 :	Number	Factory-set
Coef1 :	Number	Factory-set
Coef2 :	Number	Factory-set
Coef3 :	Number	Factory-set
MeasPeriod:	Number	Factory-set
Averaging:	Number	0: Disable running average on UVT and UVA values 1: Enable running average (default: 0)
FlashDurat:	Value	Factory-set
PathLength:	Number	Factory-set
Slave ID:	Number	Factory-set
Reset		
Confirm: ✓	Check box	Reset to factory settings
Secondary		Shows raw sensor values for the probe
Water UV :	Value	Raw UV sensor reading through water for most recent measurement
Lamp UV :	Value	Raw UV sensor reading through air for most recent measurement
WaterDark :	Value	Dark current for water
LampDark :	Value	Dark current for lamp

Menu	Menu type	Description
CalUV_W :	Value	Raw UV sensor reading through water for calibrated value
CalUV_L :	Value	Raw UV sensor reading through air for calibrated value
CalDark_W :	Value	Dark current for water – calibrated value
CalDark_L :	Value	Dark current for lamp – calibrated value
HumidLed :	Value	Relative humidity in path length assembly of probe, %
HumidSns :	Value	Relative humidity in probe assembly of probe, %
t Board :		Temperature of circuit board in probe assembly, °C
t UV LED :		Temperature of UV LED in path length base assembly, °C
t Sense :		Temperature of sensor in path length base assembly, °C
DeviceInfo		
FW vers :	Number	Firmware version currently in use
HW vers :	Number	Hardware version currently in use
Reg vers :	Number	Register map version currently in use

...2 Probe menus

2.3 Multi-wave and Multi-LED probe menus

Table 3 Multi-wave and Multi-LED probe menus

Menu	Menu type	Description
SA2000		SA Series probe (Models SA2020, SA2040, and SA2100)
Output Data		
QPar1 :	Value	Displays the current value of quality parameter 1
QPar2 :	Value	Displays the current value of quality parameter 2
%T1 :	Value	Transmittance of LED1
%T2 :	Value	Transmittance of LED2
%T3 :	Value	Transmittance of LED3
%T4 :	Value	Transmittance of LED4
Abs1 :	Value	Absorbance of LED1
Abs2 :	Value	Absorbance of LED2
Abs3 :	Value	Absorbance of LED3
Abs4 :	Value	Absorbance of LED4
Counter :	Value	Counter increments each time a measurement cycle has completed, typically around 10to 12 seconds. If transmittance or absorbance value remains unchanged after multiple increases in the counter, see if Water UV and Lamp UV secondary values are changing. If they are static, the sensor is not measuring or is holding after an air purge
Calibration		Calibration or zeroing of sensor probe
Start :	Check box	Initiate calibration
-Mode :	Drop list	Sensor is zeroed to transmittance or absorbance
%T		Select to zero the sensor for transmittance
Abs		Select to zero the sensor for absorbance
CustomVal:		A custom calibration for transmittance or absorbance derived from another device is entered here
1:	Value	Enter the custom calibration for LED 1 here
2:	Value	Enter the custom calibration for LED 2 here
3:	Value	Enter the custom calibration for LED 3 here
4:	Value	Enter the custom calibration for LED 4 here
Settings		
QualityParams		
Param1		
Enable:	Check box	
Offset:	Value	Factory-set
Coef1:	Value	Factory-set
Coef2:	Value	Factory-set
Coef3:	Value	Factory-set
Coef4:	Value	Factory-set
Param2		
Enable:	Check box	
Offset:	Value	Factory-set
Coef1:	Value	Factory-set
Coef2:	Value	Factory-set
Coef3:	Value	Factory-set
Coef4:	Value	Factory-set
SetWarnings		
Abs High :	Value	Enter a number to generate a warning for an absorbance value that you identify as being too high
%T Low :	Value	Enter a number to generate a warning for a transmittance value that you identify as being too low
WaterHigh :	Value	Enter a number for Water High warning threshold
WaterLow :	Value	Enter a number for Water Low warning threshold
LampHigh :	Value	Enter a number for Lamp High warning threshold
LampLow :	Value	Enter a number for Lamp Low warning threshold
SetAlarms		
Abs High :	Value	Enter a number to generate an alarm for an absorbance value that you identify as being too high
%T Low :	Value	Enter a number to generate an alarm for a transmittance value that you identify as being too low
WaterHigh :	Value	Enter a number for Water High alarm threshold
WaterLow :	Value	Enter a number for Water Low alarm threshold
LampHigh :	Value	Enter a number for Lamp High alarm threshold
LampLow :	Value	Enter a number for Lamp High alarm threshold
Enable LED		Bring LEDs online
LED1 :	Check box	Check selection to bring LED1 online

Menu	Menu type	Description
LED2 :	Check box	Check selection to bring LED2 online
LED3 :	Check box	Check selection to bring LED3 online
LED4 :	Check box	Check selection to bring LED4 online
Gain		
Water1 :	Value	Factory-set
Lamp1 :	Value	Factory-set
Water2 :	Value	Factory-set
Lamp2 :	Value	Factory-set
Water3 :	Value	Factory-set
Lamp3 :	Value	Factory-set
Water4 :	Value	Factory-set
Lamp4 :	Value	Factory-set
FlashDuration		
1:	Value	Factory-set
2:	Value	Factory-set
3:	Value	Factory-set
4:	Value	Factory-set
CorrCoef		
Enbl T :	Check box	Factory-set
Mult T :	Check box	Factory-set
1Coef0 :	Value	Factory-set
1Coef1 :	Value	Factory-set
1Coef2 :	Value	Factory-set
2Coef0 :	Value	Factory-set
2Coef1 :	Value	Factory-set
2Coef2 :	Value	Factory-set
3Coef0 :	Value	Factory-set
3Coef1 :	Value	Factory-set
3Coef2 :	Value	Factory-set
4Coef0 :	Value	Factory-set
4Coef1 :	Value	Factory-set
4Coef2 :	Value	Factory-set
Enbl R :	Check box	
Mult R :	Check box	
1RCoef0 :	Value	Factory-set
1RCoef1 :	Value	Factory-set
1RCoef2 :	Value	Factory-set
1RCoef3 :	Value	Factory-set
2RCoef0 :	Value	Factory-set
2RCoef1 :	Value	Factory-set
2RCoef2 :	Value	Factory-set

Menu	Menu type	Description
2RCoef3 :	Value	Factory-set
3RCoef0 :	Value	Factory-set
3RCoef1 :	Value	Factory-set
3RCoef2 :	Value	Factory-set
3RCoef3 :	Value	Factory-set
4RCoef0 :	Value	Factory-set
4RCoef1 :	Value	Factory-set
4RCoef2 :	Value	Factory-set
4RCoef3 :	Value	Factory-set
MeasPeriod:	Value	
Averaging:	Value	0: Disable running average on transmittance and absorbance values 1: Enable running average (default: 0)
Filter:	Check box	
Pathlength:	Value	
Slave ID:	Number	
-Reset		
Confirm ✓	Check box	Reset to factory settings
Secondary		Shows raw sensor values for the probe
Led1(325nm)		
Water UV :		Raw UV sensor reading through water for most recent measurement
Lamp UV :		Raw UV sensor reading through air for most recent measurement
WaterDark :		Dark current for Water
LampDark :		Dark current for Lamp
CalUV_W :		Raw UV sensor reading through water for calibrated value
CalUV_L :		Raw UV sensor reading through air for calibrated value
CalDark_W :		Dark current for water – calibrated value
CalDark_L :		Dark current for lamp – calibrated value
Led2(255nm)		
Water UV :		Raw UV sensor reading through water for most recent measurement
Lamp UV :		Raw UV sensor reading through air for most recent measurement
WaterDark :		Dark current for Water
LampDark :		Dark current for Lamp

…2 Probe menus

…2.3 Multi-wave and Multi-LED probe menus

…Table 3 Multi-wave and Multi-LED probe menus

Menu	Menu type	Description
CalUV_W :		Raw UV sensor reading through water for calibrated value
CalUV_L :		Raw UV sensor reading through air for calibrated value
CalDark_W :		Dark current for water – calibrated value
CalDark_L :		Dark current for lamp – calibrated value
Led3(860nm)		
Water UV :		Raw UV sensor reading through water for most recent measurement
Lamp UV :		Raw UV sensor reading through air for most recent measurement
WaterDark :		Dark current for Water
LampDark :		Dark current for Lamp
CalUV_W :		Raw UV sensor reading through water for calibrated value
CalUV_L :		Raw UV sensor reading through air for calibrated value
CalDark_W :		Dark current for water – calibrated value
CalDark_L :		Dark current for lamp – calibrated value
Led4(280nm)		
Water UV :		Raw UV sensor reading through water for most recent measurement
Lamp UV :		Raw UV sensor reading through air for most recent measurement
WaterDark :		Dark current for Water
LampDark :		Dark current for Lamp
CalUV_W :		Raw UV sensor reading through water for calibrated value
CalUV_L :		Raw UV sensor reading through air for calibrated value
CalDark_W :		Dark current for water – calibrated value
CalDark_L :		Dark current for lamp – calibrated value
HumidLed:		Relative humidity in path length assembly of sensor probe, %
HumidSns:		Relative humidity in probe assembly of sensor probe, %
tBoard:		Temperature of circuit board in probe assembly, °C
t UV LED:		Temperature of UV LED in path length base assembly, °C
t Sense:		Temperature of sensor in path length base assembly, °C
StopMeasure:		
DeviceInfo:		
Serial# :	Number	Factory-set
Wave1 nm:	Value	Wavelength of LED1 in nm
Wave2 nm:	Value	Wavelength of LED2 in nm
Wave3 nm:	Value	Wavelength of LED3 in nm
Wave4 nm:	Value	Wavelength of LED4 in nm
FW vers:	Number	Firmware version currently in use
HW vers:	Number	Hardware version currently in use
Reg vers:	Number	Register map version currently in use.

3 Calibration

The probe must be calibrated before accurate transmittance or absorbance data can be read.

3.1 Calibration with RO or DI water

1 Remove the probe from the tank by lifting the probe arm off the mounting bracket.

2 Put the probe into a chemical cleaning bath for 10 to 15 minutes to remove any dirt or debris built up on the exterior.

3 If necessary, manually scrub the probe to ensure all dirt is removed from the quartz windows and crevices.

Note:
Dirt or debris on the probe will contaminate the DI or RO water for calibration.

4 Rinse the probe twice with potable water to remove the chemical solution. Do a final rinse with DI or RO water.

5 Put the probe into a tub or bucket of DI or RO water.

• If you use a UviTec Controller:
The LCD display on the UviTec Controller will display a transmittance or absorbance reading.

• If you use a UviTec Controller Pro:
The probe **Summary** tab will show transmittance and absorbance as UVT and UVA values.

Note:
When absorbance values are greater than zero, the probe can be cleaned. If values continue to be greater than zero after cleaning, the probe should be re-zeroed.

3.2 Calibration with UviTec Controller

1 Press the **Zero** button.
The Calibration menu appears (expanded at right).

2 Check Abs (absorbance) under Mode.

3 Scroll to CustomVal and press **Enter**.

4 Enter values of 0.0 for 1: through 4:.

5 Scroll to Start and press **Enter**.
A check mark is placed against the field indicating the calibration has started. When calibration is completed, the check mark disappears.

The probe has now been calibrated to DI water. Remove the probe from the DI water tank and re-secure the probe arm onto the mounting bracket.

3.3 Calibration with UviTec Controller Pro

1 Go to the **Summary > Data** tab and view UVA-1 through UVA-4 values. They should be at 0.0 (100 % UVT).

2 Go to the **Configuration > Settings** tab.

3 Ensure that UVA is selected under **Calibration Mode**.

4 Enter the value of 0.0 for LED-1 through LED-4 and click **Apply**.

5 Leave the probe in the bucket for 10 to 15 minutes to stabilize the internal and external temperature of the probe. If the probe temperature is not stabilized, errors can occur in calibration.

6 Press **Start Calibration**.
The probe will calibrate itself to 0.0 in UVA mode. When the calibration is complete, the **Start Calibration** button will return to its original appearance.

The probe has now been calibrated to DI water. Remove the probe from the DI water tank and secure the probe arm onto the mounting bracket.

4 Parameter calibration

The UviTec water quality monitoring systems come with a starter global calibration for operation out of the box. Site-specific adjustments to the calibration are recommended for certain water quality parameters, such as aggregate parameters (e.g., BOD, COD, TOC, TSS).

The purpose of the site-specific calibration adjustments is to ensure that the correlation accounts for the site-specific water quality characteristics, such as changing organics composition, providing higher measurement accuracy.

The calibration phases are summarized in Table 4:

Table 4 Calibration phases

Phase	Description
Sample collection scheduling	Review site-specific information that will aid in determining optimal schedule for grab sample collection.
System performance validation	After installation, we recommend to run the system for 2 days to evaluate raw data and confirm good system performance
Grab sample collection	An initial set of 7 to 10 grab samples are collected using the collection schedule and sent to a lab for analysis. Data is forwarded to ABB.
Correlation development and implementation	ABB develops a custom correlation between raw absorbance data measured by the sensor and lab data. A custom correlation file is uploaded to the system controller.
Correlation validation	A second set of 3 to 5 grab samples validates the accuracy of the correlation.
Audit	The correlation is audited for continuous and long-term improvement of calibration and system performance.

4.1 Collect information about the site

Collect information about your site that will aid in determining a schedule for grab sample collection. The goal during this phase is to develop an optimal collection schedule that captures the variations in water quality that occur at a given site over time. This ensures a robust and more complete model allowing for more accurate results.

Table 5 provides items to consider, if applicable, about a site prior to developing a sample collection schedule.

Table 5 Site information

Item	Description
Expected range	What is the historical minimum, maximum and average values expected for the given water quality parameter calibration (e.g., BOD, COD)? Have trends been identified as to when these min. and max. values occur? If known, a plant should aim to collect samples that capture the full expected range.
Seasonality	Does water quality vary with season? Often seasonal changes cannot be captured during initial calibration; however, future sample collection should be considered for calibration improvements over a longer span of time.
Product lines/batch cycles	Does the plant produce multiple products? Manufacturing plants with multiple product lines or batch cycles should aim to collect a sample for each line or cycle.
Matrix changes	Are there activities that occur at the plant that may cause a composition or background change? (e.g., process water changes, chemical dosage changes etc.)
Temperature ranges	Are there significant variations in water temperature? Temperature may affect sensor performance and should be considered.

Note:
If the questions above are unknown for a given site, either a collection schedule based on the UviTec sensor data or a collection schedule that spans over several days with samples taken at different times throughout the day is recommended.

5 Validate system performance

Before sampling occurs, the system is left to run for approximately two days. This allows for raw data to be collected and reviewed to validate the sensor's operational status as well as ensure there are no problems with installation. There are two methods in which validation can occur.

5.1 Automatic system performance validation with Liquid Ai services

With Liquid Ai™ data services, a remote connection is available to collect data from the UviTec Controller. Therefore, there is no on-site involvement required during this phase with Liquid Ai services. When ABB has validated your system's performance, go to Section "6 Collect a grab sample" on page 13.

5.2 Manual export from UviTec Controller

This procedure is only necessary if you do not have remote access with Liquid Ai service. Raw data is exported manually from the UviTec Controller by the client and emailed to ABB.

5.2.1 Export UviTec Controller data via USB

1 To export the data a USB stick is needed. Make sure the file system of the USB is FAT32.

2 Insert the USB into USB port located on the main control circuit board inside the UviTec Controller.



Figure 1 UviTec Controller USB port

3 Go to menu Exportlog.

4 There are two options in which you can export data, either for a certain time period (step 5) or to capture all data (step 6).
Go to the step for your selected export data preference.

5 To export data for a certain time period, leave as Mode:From-to:



Figure 2 Exportlog

a Select a specific From-To time period to capture data for export. The data format is YYYY/MM/DD and time is on the 24-hour clock.

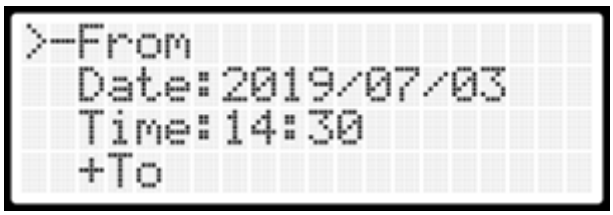


Figure 3 From-To date range

b Put a check mark at Start export. A message Time left, min: N will be displayed. N is approximate number of minutes left till export is complete.



Figure 4 Start export

c Wait for the check mark and message Time left to disappear, which will signify that the export is complete and the log file has been written to USB. The naming of the log file has the following format: SSS_MMDD.csv, where:

SSS – is last three digits of the serial number of the UviTec Controller.
MM – is the month when export period begins.
DDD – is the day when export period begins.
.CSV – is the file extension.

d Remove the USB stick from the USB port. To view the data file it is recommended to open with Microsoft® Excel® or Open Office Calc. The data structure of the exported log file consists of headers, values, date and time of when values were logged. Go to "Collect a grab sample" on page 13.

...5 Validate system performance

...5.2 Manual export from UviTec Controller

...5.2.1 Export UviTec Controller data via USB

6 To export all data:

Note:
It can take more than an hour to copy the data to the USB stick.

a Select the All mode, which captures all data logged (on the Controller) onto the USB stick.

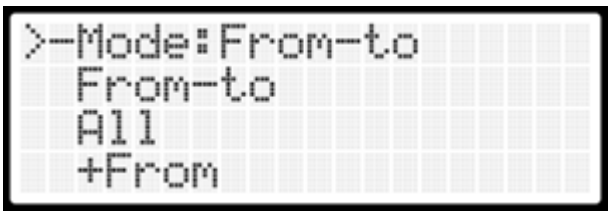


Figure 5 Export all data

b Select Start export.
A message Exporting will be displayed.

c The estimated export time is displayed. The message disappears when the exporting is done.
The naming of the log file has the following format: LOG_ ALL.csv.

d Remove the USB stick from the USB port. To view the data file, it is recommended to open with Microsoft Excel or Open Office Calc. The data structure of the exported log file consists of headers, values, date and time of when values were logged.

5.2.2 Export UviTec Controller Pro data via USB

1 Go to the **Configuration > Export** page.

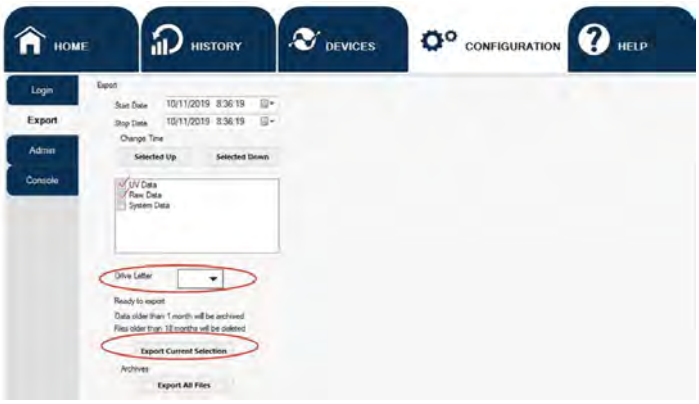


Figure 6 Export window

2 Select the start and stop dates and times for the period over which data is to be analyzed. Make sure that the date range is correct (mm/dd/yyyy).

3 Select the check boxes beside **UV Data & Raw Data**.

4 Insert a USB stick into one of the USB ports on the bottom of the UviTec Controller Pro.



Figure 7 UviTec Controller Pro USB ports

5 Select the drive that corresponds to the USB stick (circled in Figure 6).

6 Click **Export Current Selection**.
The data is saved to a file within a sub-folder of **Logs**. For example, if saved in May, the file is in sub-folder 5.
File format is yyyy_mm_dd_hr_mm_to_yyyy_mm_dd_hr_ mm_ parameter.csv.

7 Remove the USB stick and email the exported file with the serial number of the UviTec Controller Pro to uvitec.service@ca.abb.com, Subject: “Serial Number” – Site Information.

6 Collect a grab sample

6.1 Laboratory protocol

Before starting to collect samples, ask the laboratory that is receiving your samples what sample volume is required for analysis of each parameter and any specific handling instructions required to preserve the samples for analyses.

6.2 Data recording

It is good practice to create a spreadsheet file before sampling to record the sample ID, date collected, and time collected on-site.

	A	B	C	D	E
1	Sample ID	Date Collected	Time Collected	Lab BOD (mg/L)	Lab COD (mg/L)
2	1	Oct. 15, 2020	9:03 AM		
3	2	Oct. 15, 2020	4:38 PM		
4	3				
5	4				

Figure 8 Sample spreadsheet

6.3 Collect a sample

Use the schedule developed to plan your sample collection.



Figure 9 Collecting samples

6.3.1 Collect a sample (UviTec Controller)

1 Take samples directly from the water nearest to the probe monitoring location to get the best representation of water passing through to probe.

2 Record the date and time from the UviTec Controller to populate your spreadsheet file. In the UviTec Controller menu, expand the System settings menu, scroll down to Date&Time. Click Enter to show the clock.

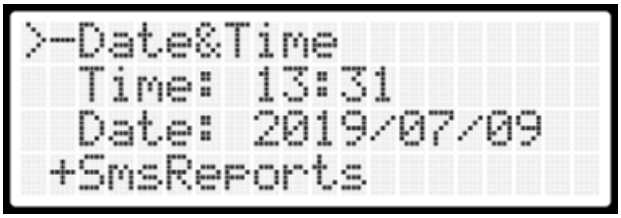


Figure 10 UviTec Controller clock

3 Label the sample jar with the sample ID, date and time.

4 If grab samples are being shipped off-site to a lab, make sure that they are refrigerated during transportation. Use a small cooler with ice packs to preserve the sample during shipping.

5 Use tape to keep the sample lids closed and pack the cooler with bubble wrap or paper to avoid spills or leaks during transport. Make sure that the refrigerated samples are tested by a lab within 48 hours of collection, or within the time window specified by the laboratory doing the analyses.

6 Repeat steps 1 thru 5 following the sample collection schedule until you have collected 7 to 10 samples.

7 If you do not have Liquid Ai services with a remote connection, raw data must be exported from the Controller for the time period when the sampling took place.

8 Send the raw data export file from the controller and the spreadsheet file with sample IDs, data collected, time collected and lab results to uvitec.service@ca.abb.com, Subject: “Serial Number” – Calibration Samples. (Copy the serial number from the inside edge of the front door of the Controller into the subject line.).

6.3.2 Collect a sample (UviTec Controller Pro)

1 Go to the **Home/Maintenance** page on the UviTec Controller Pro. Locate **Sampling Mode** at the top of the page. Place **Sampling Mode** to On (see Figure 11), this will disable any cleaning cycle from occurring during sampling period; however, sampling mode will not engage if any system alarms are present. They need to be resolved before continuing.



Figure 11 Home/Maintenance page

2 Take samples directly from the water nearest to the probe monitoring location to get the best representation of water passing through to probe.

...6 Collect a grab sample

...6.3 Collect a sample

...6.3.2 Collect a sample (UviTec Controller Pro)

3 Record the date and time from the UviTec Controller Pro to complete your spreadsheet. The date and time clock are on the bottom right-hand corner of the UviTec Controller Pro screen.

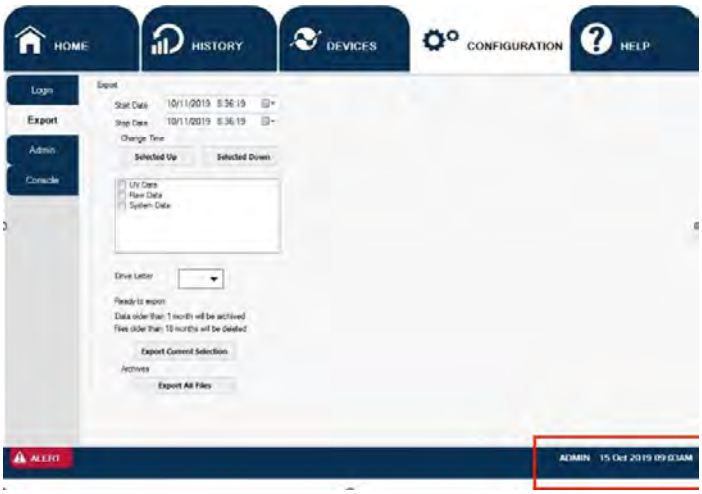


Figure 12 Date and time

4 Label the sample jar with the sample ID, date and time.

5 If grab samples are being shipped off-site to a lab, make sure that they stay refrigerated during transportation. Use a small cooler with ice packs to preserve the sample during shipping.

6 Use tape to keep the sample lids closed, and pack the cooler with bubble wrap or paper to avoid spills or leaks during transport. Make sure that the refrigerated samples are tested by a lab within 48 hours of collection, or within the time window specified by the laboratory doing the analyses.

7 Set **Sampling Mode** on the **Home > Maintenance** page to Off.

8 Do steps 1 thru 7 again at the next scheduled sample collection interval until you have collected 7 to 10 samples.

9 If you do not have Liquid Ai services with a remote connection, raw data must be exported from the controller for the time period when the sampling took place.

10 Send the raw data export file from the controller and the spreadsheet file with sample IDs, data collected, time collected and lab results to uvitec.service@ca.abb.com, Subject: “Serial Number” – Calibration Samples. (Copy the serial number from the inside edge of the front door of the Controller Pro into the subject line.)

6.4 Correlation development and implementation

ABB uses the raw data from the sensor and matching time-stamped lab data emailed from the client to develop a site-specific calibration that will be used in place of the global calibration. When the new calibration is developed, it is implemented either automatically or manually.

6.5 Automatically with Liquid Ai services

With Liquid Ai data services, a remote connection is available to upload the custom correlation file to the UviTec Controller automatically. Therefore, there is no on-site involvement during this phase with Liquid Ai services. When ABB notifies you that a file has been uploaded, the system is considered calibrated.

6.6 Manual upload to UviTec Controller

Contact ABB for instructions on manually updating the correlation file with the UviTec Controller or UviTec Controller Pro.

6.7 Validate the correlation

The goal of the calibration process is to minimize error between the data measured by the UviTec systems and the data from the lab. For ABB and the client to validate the new calibration, a second set of grab samples are recommended. To validate the calibration:

1 Collect three to five grab samples following the instructions outlined in "Collect a sample" on page 13. If you do not have a remote connection with Liquid Ai services, the displayed water quality value on the controller at the given time/date will also need to be recorded (e.g., 525 mg/L BOD, 940 mg/L COD etc.).

2 Send the time stamped water quality values from the UviTec system and the laboratory results to uvitec.service@ca.abb.com Subject: “Plant Name” – Audit Samples. Please provide the serial number as well.

ABB validates the calibration. If satisfactory, the calibration process is complete. The additional data points are incorporated into the custom calibration to improve the calibration model and make it more robust. In applications where water quality shows high variability, ongoing updates to the calibration can be performed over time to improve accuracy and performance under all site-specific water quality conditions. In some cases, if the results are not satisfactory, additional samples and calibration adjustments might be necessary.

6.8 Audit the calibration

Audit the calibration regularly to maintain the relevance of the calibration because changes can occur at the plant over the longer term, for example:

- Raw water quality changes.
- Plant operational changes.
- New process chemicals added, or cleaning chemicals being used.
- New products added to manufacturing process.
- New water treatment system installed.

Collect the audit samples following the instructions in section "Collect a grab sample" on page 13.

Send audit sample results to ABB for evaluation. This enables ABB to make continuous improvements to the calibration over time, leading to increased accuracy and robustness.

Audit sample frequency will vary from plant to plant. The frequency might be higher when initially checking a new calibration. Over the long-term, audit samples may coincide with regularly scheduled testing to minimize disruption.

7 Maintenance

7.1 Maintenance schedule

Table 6 Maintenance schedule

Frequency	Task
Monthly	1. Remove the probe from the process and remove accumulated debris. 2. Clean windows if necessary
Monthly	1. Validate the probes reading with a UviTec UV254 field meter grab sample. 2. Recalibrate the probe.

7.2 Cleaning

Probe cleaning is performed automatically with compressed air to keep the optical windows clean and free of fouling. Occasionally, the windows may need to be manually cleaned.

The default intake purge time is 4 seconds is recommended with a purge frequency of once an hour.

A monthly cleaning of the probe body is recommended to remove build-up of material around the probe body.

7.3 Automatically clean the probe

To keep the optical windows clean and free of fouling, automatic compressed air or pressurized water cleaning of the probe is performed at regular intervals during operation by the UviTec Probe Clean.

The automatic cleaning settings are configured through the UviTec Controller or UviTec Controller Pro.

Refer to the appropriate cleaning system manuals for further instructions.

7.4 Manually clean the probe

Manual cleaning of the probe body and windows is required for routine maintenance.

Requirements

Table 7 Cleaning requirements

Part number	Description	Quantity
—	Clean water	As required
—	Cleaning solution (Refer to Table 8)	As required
—	Bucket/container for probe body	1
—	Sponge/brush	1
—	Lint-free cloth (e.g., J-Cloth®)	1

Table 8 Chemical cleaning solutions

Solution	Fouling agents
Lactic acid <20 % solution (CLR®)	Removes mineral scaling, oil and grease
Sulfamic acid <10 % solution (Lime-A-Way®)	Removes mineral scaling, oil and grease
Phosphoric acid <30 % solution (Hagesan® Blue)	Removes mineral scaling, oil and grease
Citric acid <20 % solution	Removes mineral scaling, oil and grease
Acetic acid (20 % solution)	Removes mineral scaling, oil and grease
Sulfuric acid (10 % solution)	Removes mineral scaling, oil and grease
Hydrochloric acid (10 to 20 % solution) (Oxall Plus)	Removes biofilm, oil and grease
Sodium hypochlorite <6 % solution	Removes oil, grease, and biofilm
Glass cleaner (Windex®)	Removes oil and grease

Note:
The preferred cleaning solution recommendation is to start with CLR or similar product (lactic acid) or other acid-based solutions. Only use other types of cleaning solutions if acid-based solutions do not work.

Procedure

1. Stop the power to the system.
2. Remove the probe from the water by lifting the probe arm off the wall mount.
3. Put the probe in a bucket of clean tap water with a mild household dish-washing liquid for 5 to 10 minutes.
4. If necessary, manually scrub the probe body with a brush or sponge to remove visible build up. Do not clean the optical windows at this time.
5. Remove the probe from the bucket and carefully put it on a flat surface.

Note:
Multi-wave probes with path lengths of 0.5, 1, and 2 mm come with a special cleaning tool. Refer to "Cleaning tool" on page 17 for more information. For these probes, do not do steps 6 and 7.

6 Use a soft, lint free cloth (i.e. J-Cloth) soaked in cleaning solution (refer to Table 8) to clean the optical windows.

7 Use the cloth to apply pressure to the optical window, vigorously floss back and forth alternating between the two windows for a minimum of two minutes. Alternatively, a cotton swab, cleaning brush, or pipe cleaner can be used on the optical windows.

7.5 Frequency of manual cleaning

For routine maintenance, it is recommended to manually clean the probe weekly as a starting point. The optimal cleaning frequency will vary depending on the application, water type, and installation point.

To determine if the frequency of manual cleaning is adequate for your site, visually examine the probe optical windows for signs of fouling, or monitor the raw data once the instrument is in operation for signs of drifting between cleaning.

The figures that follow show the effects of cleaning on the raw data. Figure 13 shows an effective cleaning frequency where minimal drift occurs between manual cleanings.

Figure 14 shows an upward trend, indicating the sensor is drifting and manual cleaning frequency must be increased.

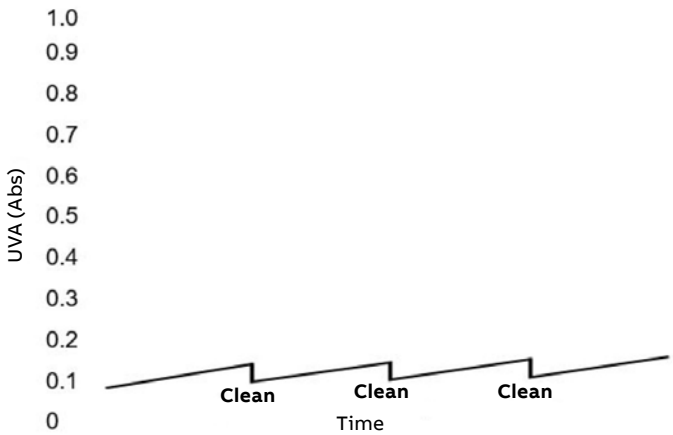


Figure 13 UVA mode – effective cleaning

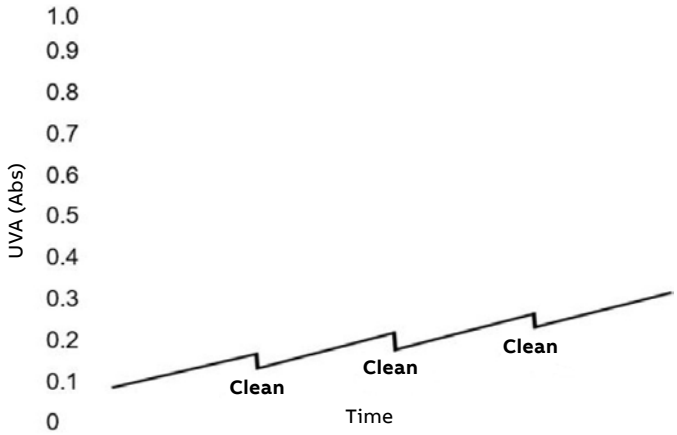


Figure 14 UVA mode – inadequate cleaning

7.6 Cleaning tool

NOTICE

Each cleaning tool is engraved with a path length. The incorrect blade for your probe could cause inadequate cleaning and damage to the measurement windows of the probe.

The cleaning tool is for use with all UviTec probes that use absorbance or transmittance-based measurement methods and have a measurement path length of 0.5, 1, or 2 mm.

Refer to Section 7.8 to check the path length of your probe.

The cleaning tool ensures cleaning is quick and effective by providing a convenient way to clean the narrow gap between the measurement windows.

...7 Maintenance

...7.6 Cleaning tool

7.6.1 Supplied tools



Figure 15 Cleaning tool



Figure 16 Everyday J-Cloths

Note:
Use everyday J-Cloths with the cleaning tool. Heavy duty J-Cloths and other thick cloths can prevent the blade of the cleaning tool from going into the probe's measurement gap.

7.7 Clean the probe with the cleaning tool

1 Wrap the J-cloth around the blade of the cleaning tool.

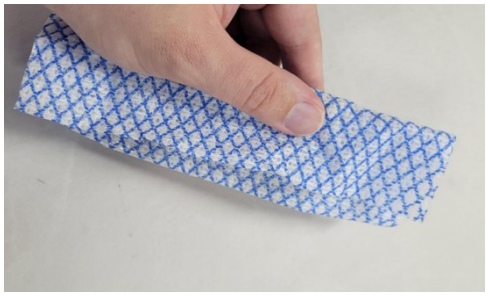


Figure 17 J-cloth around the cleaning tool blade

2 Soak the bottom of the J-cloth wrapped around the blade with the cleaning solution.

3 Insert the cleaning tool in the window gap, and use an up and down movement to clean it.

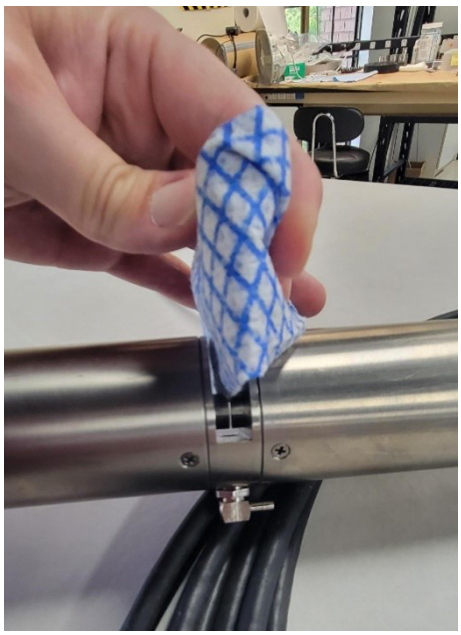


Figure 18 Cleaning the window of the probe

4 Repeat the cleaning process as necessary, and when completed, fully rinse the cleaning tool.

5 Go to step 8 in "Manually clean the probe" on page 16.

7.8 Check the path length of your probe

7.8.1 Check the path length of your probe (UviTec Controller)

1 Press **Menu**.

2 Using the ▲ and ▼ buttons, navigate to SA-X > Settings > Pathlength.

3 This menu listing displays the path length of the Multi-Wave Probe.

7.8.2 Check the path length of your probe (UviTec Controller Pro)

1 Go to Devices > SA-X Probe (tab name may vary based on exact model) > Configuration > Sensor.

2 The path length in mm is shown at the bottom-left of this screen.

8 Raw sensor data

8.8.1 Raw sensor data (UviTec Controller)

Expand the SA2000 menu (depending on model) as shown below to reveal Water, Lamp, Humidity, and Temperature data under the Secondary menu:

```
SA-X2000
        Secondary
                Led1 through Led4
                        Water UV – raw sensor reading
                        through water
                        Lamp UV – raw sensor reading
                        through air (reference
                        position)
                Humidity and Temperature: readings
                within probe body.
```

8.8.2 Raw sensor data (UviTec Controller Pro)

Raw sensor values are displayed on the device page under the device's Summary tab. Temperature and humidity are in the Data sub-tab, while Water and Lamp values are under the Raw and Ratio Data sub-tab.

8.8.3 Lamp numbers

Value	Condition	Issue/action
Less than 2,000	New lamp	Lamp may be faulty, possibly damaged during shipping
2,000 to 3,000	Ideal range of values	No action

8.8.4 Water numbers

Value	Condition	Issue/action
50 to 3,500	Ideal range of values	No action

8.8.5 Temperature and humidity

The internal temperature should be kept below 50 °C (122 °F). The system will alarm if this temperature is reached. If this happens, it may indicate the probe should be moved to a cooler location.

Humidity should be kept below 25 % humidity especially when the sample water is cold, because condensation can form on the probe window that can severely affect accuracy.

9 Alarms

These alarms apply to Color, Dual-wavelength, Multi-wave, TSS and UV254 probes. UVA and UVT are replaced with Abs and %T.

9.1 Humidity

Diagnostic message

Humidity

Cause
Ingress of water to the probe body. The humidity alarm is tripped when the humidity level in the probe is more than 25 % relative humidity.

Recovery action
1 Remove the probe from the water and contact ABB for assistance.

9.2 Lamp High

Diagnostic message

Lamp High

Cause
The LED output is too high.

Recovery action
1 Contact ABB for assistance.

9.3 Lamp Low

Diagnostic message

Lamp Low

Cause
The LED output is too low and out of measurement range.

Recovery action
1 The LED is nearing the end of its life or the sensor is not reading the LED output value correctly.

9.4 No response/Communication

Diagnostic message

No Response/Communication

Cause
The Controller cannot communicate with the probe.

Recovery action
1 Visually examine the cable and the probe to look for damage between the probe and the Controller.

2 Turn off the power and make sure that all wiring is correct and secure.

9.5 Sensor Comm

Diagnostic message

Sensor Comm

Cause
Internal communication problem.

Recovery action
1 Contact ABB for assistance.

9.6 Temperature

Diagnostic message

Temperature

Cause
Internal temperature of the probe body has exceeded 50 °C 122 °F).

Recovery action
1 Move the probe to the a cooler location.

9.7 Water High

Diagnostic message

Water High

Cause
Water value is beyond the high end of the measurement range. The absorbance value could be incorrect.

Recovery action
1 Contact ABB for assistance.

9.8 Water Low

Diagnostic message

Water Low

Cause
The water value is beyond the low end of the measurement range. The LED is blocked or obscured. This alarm can occur when high absorbance exists due to the quality of the water.

Recovery action
1 Remove the probe from the water.

2 Make sure that the probe window and sensor are free from any debris that could interfere with the measurement.

9.9 Abs Low

Diagnostic message

Abs Low

Cause

The absorbance measurement has exceeded the alarm level for the low end of the expected measurement range.

Recovery action

1 Change the set point.

9.10 Abs High

Diagnostic message

Abs High

Cause

The absorbance measurement has exceeded the alarm level for the high end of the expected measurement range. Fouling may be present.

Recovery action

1 Change the set point.

10 Warnings

These warnings apply to Color, Dual-wavelength, Multi-wave, TSS and UV254 probes. UVA and UVT are replaced with Abs and %T.

10.1 Lamp High

Diagnostic message

`Lamp High`

Cause
The LED output has reached a high warning threshold. The LED output is too high.

Recovery action
1 Contact ABB for assistance.

10.2 Lamp Low

Diagnostic message

`Lamp Low`

Cause
The LED output has reached a low warning threshold. The LEDs are nearing the end of their life or the LED sensor is not reading the LED output value correctly.

Recovery action
1 Contact ABB for assistance.

10.3 Water High

Diagnostic message

`Water High`

Cause
The water value has reached a high warning threshold.

Recovery action
1 Contact ABB for assistance.

10.4 Water Low

Diagnostic message

`Water Low`

Cause
The water value has reached a low warning threshold.

Recovery action
1 Change the path length of the sensor.

2 Clean the probe.

10.5 Temperature

Diagnostic message

`Temperature`

Cause
The internal temperature of the probe body is equal to or higher than 45 °C (113 °F).

Recovery action
1 The probe body has exceeded the maximum operating temperature of 45 °C (113 °F).

10.6 %T Low

Diagnostic message

`%T Low`

Cause
The transmittance measurement has exceeded the warning level for the low end of the expected measurement range. Fouling may be present.

Recovery action
1 Change the set point.

10.7 Abs High

Diagnostic message

`Abs High`

Cause
The absorbance measurement has exceeded the warning level for the high end of the expected measurement range. Fouling may be present.

Recovery action
1 Change the set point.

11 Parts and accessories

Table 9 Parts and accessories

Product name	Description	Part number
UviTec Controller	Standard	3KXA300301V
UviTec Controller Pro	Pro (external on-door model)	3KXA300302V
UviTec pole mounting kit I	No pole included	3KXA300000U0031
UviTec pole mounting kit II	1.5 m (5 ft) pole included	3KXA300000U0032
UviTec pole mounting kit III	3 m (10 ft) pole included	3KXA300000U0033
Tri-clamp	Stainless steel clamp for mounting probe in line with process pipe	3KXA300000U0034
Chain mount	Stainless steel chain for mounting probe in open channel	3KXA300000U0035
Cleaning tool – 2 mm	For cleaning the measurement windows on the Multi-wave probe with 2mm path length	S-248172
Cleaning tool – 1 mm	For cleaning the measurement windows on the Multi-wave probe with 1 mm path length	S-248171
Cleaning tool – 0.5 mm	For cleaning the measurement windows on the Multi-wave probe with 0.5 mm path length	S-248170

Trademarks

- CLR is a registered trademark of Jelmar, LLC.
- Excel is a registered trademark of Microsoft Corporation in the United States and/or other countries.
- J-Cloth is a registered trademark of Berry Global, Inc.
- Lime-A-Way is a registered trademark of Reckitt Benckiser Lime-A-Way BV.
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OI/AUV400-EN Rev. A 06.2025