



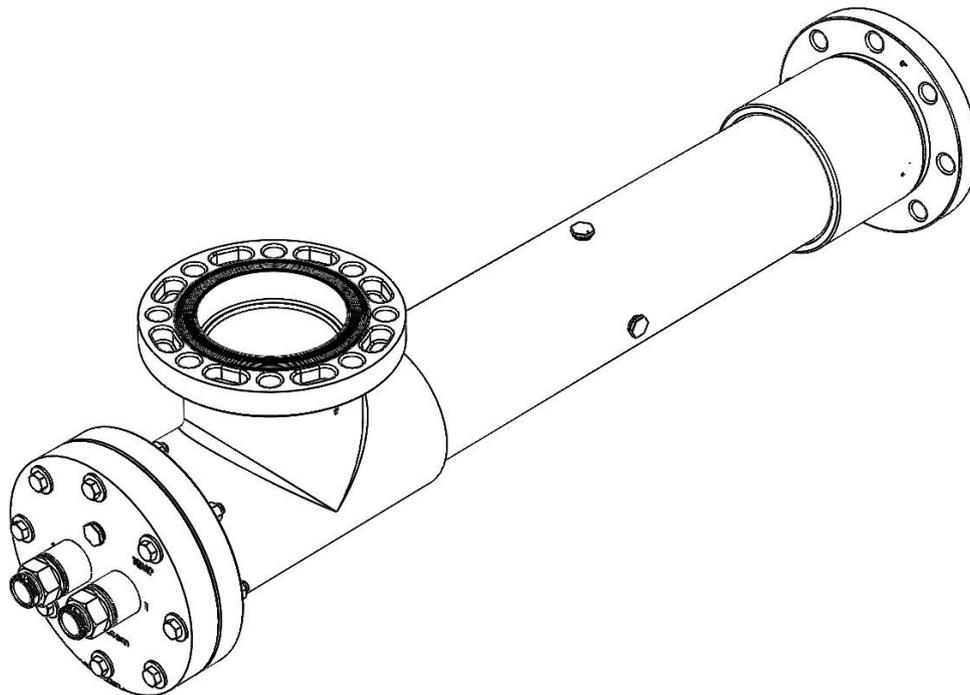
Pro-Tect™

HLH, HUH, ALH, and AUH UV Systems

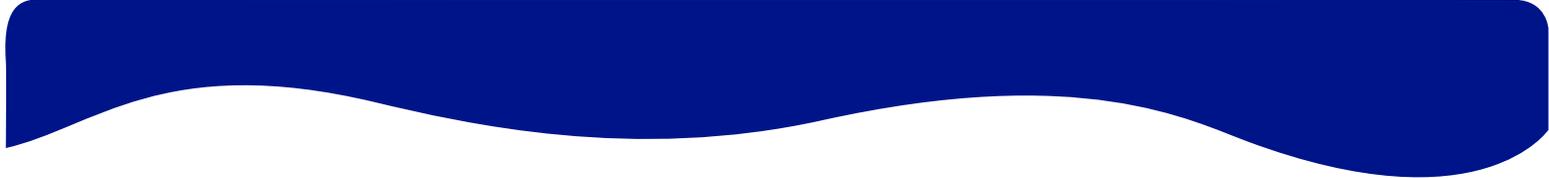
HMI Standard and HMI Pro Series Controls

Section 1: General Information and System Overview
User Manual: UOM0003.1

Edition R3



READ THIS MANUAL PRIOR TO INSTALLING, SETTING UP, OPERATING, SERVICING, OR MAINTAINING THIS UV TREATMENT SYSTEM



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Model #:

No. of Lamps / Part #: /

No. of Quartz Sleeves / Part #: /

Maximum Design Flow Rate:

UV System Serial #:

Model Description:

Max. Operating Pressure:

Input Power:

Short Circuit Current Rating: 2KVA RMS 277 VAC MAX

Power Supply: TYPE #2 ENCLOSURE

-  **WARNING:** DO NOT operate this equipment without reading and understanding the Operator's Manual thoroughly.
-  **WARNING:** Protect eyes and skin from direct exposure to UV Light. Also, allow UV lamps to cool before replacing.
-  **WARNING:** Dangerous Voltage can cause severe or fatal injury. Install this equipment in accordance with all local electrical codes. Disconnect power before attempting to service unit. See the Operator's Manual for proper procedures.
-  **WARNING:** Ensure that any trapped air is properly relieved from the vessel, failure to do so will affect the system's performance. DO NOT operate the UV system in no-flow situations.
-  **CAUTION:** This equipment (UV System) is designed for supplemental disinfection and should be used with registered or approved disinfection chemicals to impart residual concentrations.
-  **NOTE:** Replace UV lamps after 12,000 hours of continuous operation or as stated in the Operator's Manual. Replace the Quartz Sleeve Seals every 12,000 hours or when replacing the lamps. For reliable performance, use only genuine RK2 Systems UV lamps and replacement parts.

For Warranty, Repair and Replacement Part Requests:
 Please contact RK2 Systems, 760-746-7400 or e-mail us at
 Sales@rk2.com



PHONE: 760-746-7400
 FAX: 760-746-7460
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SECTION 1: GENERAL INFORMATION, VESSEL AND POWER SUPPLY ENCLOSURE (PSE) OVERVIEW

SECTION 1: GENERAL INFORMATION, VESSEL AND POWER SUPPLY ENCLOSURE (PSE) OVERVIEW 1-1

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1.1 General Information and System Specifications

This manual was written in order to provide you with the information required to install, operate, maintain, and service your Pro-Tect™ UV system. Please ensure that anyone performing work on, or with this system become familiar with the manual.

We strongly recommend that anyone performing work on, or with this system become very knowledgeable regarding the safety concerns detailed within this manual, and by the OSHA guidelines within your region.

This manual represents the most up to date information available at the time of production. This information does not hold a legally binding promise of performance or suitability for a specific application. The user of the UV system will be required to perform his/her own verifications and safety measures required in order to meet treatment targets and operational needs.

RK2 Systems accepts no responsibility for issues related to improper installation, lack of routine maintenance, use of non-OEM components, or non-OEM approved modifications of the UV system.

As we are continuously improving our products, RK2 reserves the right to change or modify our system in any way we deem appropriate without any obligation or notice required.

If assistance is ever required beyond what this manual can offer, please contact RK2 at:

760-746-7400
or
sales@rk2.com

All Pro-Tect™ UV systems are proudly built in the USA.

1.1.1 Lamp Recycling

RK2 Systems offers a “Hazardous Waste Disposal Service” for Mercury Vapor UV Lamps. This service is intended to provide our customers with disposal service in compliance with State and Federal standards. This service may be utilized by our customers who are environmentally responsible or legally required. Your RK2 Systems Sales Representative can assist you with this service.

1.1.2 Specifications

Table 1-1, the product specifications, are provided for your reference. Specifications are subject to change without notice. Please see RK2 website for updates.

Table 1-1: Product Specifications

UV Chamber	
UV chamber material	PVC, UV resistant
Flange type material	ANSI and Union
Maximum operating pressure under 95F, 35C (When over 95F contact RK2 Systems)	See Section 3, Table 3-7 System Pressure Ratings to 95 °F, 35 °C
Hydrostatic test pressure	1.5 x Maximum operating pressure
Maximum chamber temperature	120 °F, 49 °C
Maximum Flow Velocity at Inlet and Outlet Ports	5.0 ft./sec
UV Lamps and Sleeves	
Lamp type	See Section 3, Operation and Maintenance
Lamp bulb outside dia.	See Section 3, Operation and Maintenance
Lamp max. outside diameter	See Section 3, Operation and Maintenance
Lamp arc length	See Section 3, Operation and Maintenance
Lamp overall length	See Section 3, Operation and Maintenance
Sleeve nut torque	5 ft/lbs (hand tight)
Quartz sleeve material	Natural quartz, fully annealed. GE214 equivalent
Power Supply Enclosure	
Enclosure rating	Type 12 (optional 4x)
Enclosure material	PVC or FRP (dependent on model)
Maximum ambient temperature	100 °F, 38 °C
Enclosure mounting	Wall
Power supply voltage and current	As specified on PSE and Vessel Labeling
Ballast incoming power total harmonic distortion	Less than 5% in normal operation range

Table 1-1: Product Specifications, continued

Vessel Temperature Sensor	
Installed orientation	Highest point in UV vessel
Type	Thermal switch
Temperature setting	120 °F, 49 °C
UV intensity sensor (Optional)	
Type	Screw in, wetted
Wetted material	Virgin Teflon™
Number of sensors - DVGW	1 for every 10 lamps
Number of sensors - EPA	1 per UV reactor
Output	4-20 mA current loop (2-wire)
Spectral range	220-290 nm
Supply voltage power	24 VDC (12-30 VDC) from the power panel
Overall cable length	12' (optional extensions available)
Maximum operating temperature	120 °F, 49 °C
Ambient operating temperature	1 to 40 °C (34 to 104 °F)
Ambient storage temperature	-20 to 40 °C (-4 to 104 °F)
Ambient relative humidity	0 to 100%
Approvals	
UL	508A

1.1.3 Definitions and Terms

Table 1-2 below provides definitions of the terms used within this manual.

Table 1-2: Terms and Definitions

Term	Description
UV-C	Germicidal Range of the UV light spectrum (200 – 280 nm)
254nm	The predominant UV-C disinfection wavelength of LPHO and Amalgam Lamps in nanometers.
UV Intensity mW/cm ²	The amount of UV-C energy being imparted into the fluid from the lamp.
Minimum UV Intensity	Required value at end of lamp life (alarm threshold value) to maintain the minimum UV dose at a given flow rate and a given fluid UVT.
End of Lamp Life (EOLL)	Lamp has reached 80% of its original UV-C output EOLL is the UV-C output level where UV-C treatment systems are sized. Operating beyond EOLL does not guarantee minimum dose delivery. EOLL is typically between 9,000 and 12,000 hours depending on lamp type. Since you may not meet dose requirements beyond EOLL, it is strongly recommended to replace the lamp at this point.
Target Organism	Organisms of concern in the fluid being treated.
Target Dose mJ/cm ²	The Dose level required to achieve the amount of inactivation required of the target organism. Different organisms have differing Dose Responses to UV-C and therefore differing inactivation rates. Rates are expressed in logarithmic reductions that correspond to UV-C dose in mJ/cm ² .
Dose mJ/cm ²	UV-C dose corresponding to the required inactivation level of the target organism. Calculated via: UV-C Intensity x Time of exposure. UVT also affects dose.
Ultraviolet Transmittance (UVT)	The amount of UV-C light at 254nm that can pass through 1cm of the fluid being treated. Described in %UVT. The UV-C energy that is absorbed in that distance does not do disinfection 'work' and is considered lost energy. Effectively acts as a reduction in UV-C Intensity. Relatively low UVT fluids require more lamps than do High UVT fluids at the same flow rates and dose targets for this reason.

(Continued)

Table 1-2: Terms and Definitions, continued

Flow Rate	System flow rates, UV intensity and UVT determine the UV-C dose imparted on the target organism. Flow rate determines organism residence time within the UV-C treatment zone = Time.
Fouling	Build-up of minerals, scaling or biological material on quartz sleeves and/or sensors. Fouled lamp sleeves effectively reduce UV-C intensity and fouling directly reduces Dose.
TSS	Total Suspended Solids
Personal Protective Equipment (PPE)	Face Shield, Hard Hat, Safety Glasses, Rubber Gloves, Safety Shoes
Dynamic Water Pressure	Pressure in the UV Vessel generated by a pump or gravity head (elevated storage tank)
Static Water Pressure	Pressure in the UV System that is contained in a closed system. As water is non-compressible, relatively no energy is present if no air is trapped in the system. Note: air IS compressible and is a form of stored energy.
Power Supply Enclosure (PSE)	Where mains power enters the UV System. Where Controls Systems and Lamp Ballasts are located.
Vessel or Chamber	Where the UV lamps are situated. Configured with an 'L' or 'U' flow pattern.
Human Machine Interface (HMI) Pro Series Graphics Display	Screen used to operate and view system PLC inputs, outputs, status and data
UV-C Lamp	Device used to emit UV-C energy into the fluid being treated
Quartz Sleeve	Device that houses the UV-C lamp. Optimizes lamp temperature that is critical for optimum output. Protects lamp and isolates electrical connections.
UV-C Sensor	Optional device used to monitor general performance of the UV System. Measures UV-C intensity leaving the lamp-sleeve envelope and being transmitted through the treated fluid at a set water layer. Changes in Lamp Intensity AND Sleeve Fouling AND UVT will affect the UV-C Sensor output value.

(Continued)

Table 1-2: Terms and Definitions, Continued

Temperature Switch	Device used to protect system or device from overheating. Overheating may occur in a no-flow situation, or where air is entrapped in the UV System. Or where the Power Supply Enclosure overheats.
Bypass Valve	Manually or automatically operated valve(s) used to bypass water flow around the UV system during maintenance or service.
Reactor End Plate	Where the lamps and sleeves are inserted in the UV System.
Protective Interlock Cover (PIC)	Optional cover used to prevent tampering with lamp connections, lamps, and sleeves, while the system is powered. Required by some regulatory bodies.

1.1.4 Other Acronyms and Abbreviations

The following table defines the abbreviations and acronyms included in this manual.

Table 1-3: Acronyms and Abbreviations

Acronym/Abbreviation	Description
AC	Alternating Current
ALH	Amalgam lamp, 'L' flow configuration Housing
AUH	Amalgam lamp, 'U' flow configuration Housing
BPL	Ballast Power Level
CB	Controls Board
EMI	Electro Magnetic Interface
EOLL	End Of Lamp Life
GND	Ground
HMI	Human Machine Interface (System Control Display)
HLH	LP'H'O lamp, 'L' flow configuration Housing
HUH	LP'H'O lamp, 'U' flow configuration Housing
I/O	Input/output
PP	Power Panel
PSI	Pounds per Square Inch
PSE	Power Supply Enclosure
PVC	Poly Vinyl Chloride
RFI	Radio Frequency Interference
SCADA	System Control and Data Acquisition
UV	Ultraviolet
UVI	Ultraviolet Intensity
UVT	Ultraviolet Transmittance
VAC	Volts Alternating Current
VDC	Volts Direct Current

1.2 Safety Information

The information in this manual has been carefully checked and is believed to be accurate. However, the manufacturer assumes no responsibility for any inaccuracies that may be contained in this manual. In no event, will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, the manufacturer reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

Revised editions of this manual can be found on RK2's website.

IMPORTANT: READ THIS MANUAL!

The information in this manual is intended to protect you and anyone who operates, uses, services, maintains or installs a RK2 UV system. Please read and become familiar with this entire manual prior to physical contact with the UV system, either directly, remotely, or via a third party. Please pay attention to all danger, warning and caution statements in this manual. Failure to do so could result in serious personal injury, infrastructure damage or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual

1.2.1 Safety and Precautionary Labels

Read all labels and tags attached to the equipment and within this manual. Personal injury or damage to the equipment could occur if not observed. A reference table of symbols used on labels and tags is below, see Table 1-4.

Table 1-4: Safety and Precautionary Symbols

Symbol	Urgency	Description
	Warning	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	Important	READ AND OBEY ALL INFORMATION CONTAINED ON ALL UNIT LABELS. REMOVAL OF PRODUCT LABEL WILL VOID WARRANTY.
	Warning	Electrocution and/or Shock potential. Read and follow all instructions and standard safety procedures.
	Warning	UV-C light exposure potential. UV-C can cause serious harm to eyes and skin. Read and follow all instructions and standard safety procedures.
	Warning	Cutting or severing injury potential. Lamp and Sleeve quartz can be very dangerous if not handled properly or if system is not serviced following all instructions and standard safety procedures.
	Warning	High temperature surface or fluid may be present. Read and follow all instructions and standard safety procedures.
	Warning	UV System may be under pressure. Severe injury or death could result on working on vessel if not de-pressurized. Lock out source and de-pressurize prior to servicing. Read and follow all instructions and standard safety procedures.

(Continued)

Table 1-4: Safety and Precautionary Symbols, continued

	Caution	This symbol indicates that a risk of electrical shock and/or electrocution exists. All appropriate Lockout/Tagout procedures must be followed.
	Caution	UV-C Light Exposure Potential. UV-C can cause serious harm to eyes and skin. Wear protective clothing. Recommended UV rated face shield and UV rated safety glasses.
	Caution	Read and follow all instructions and standard safety procedures.
	Caution	Always lock out power panels prior to working on or maintaining system.
	Caution	Do not inhale or ingest. Prevent contact with skin and eyes. Follow MSDS safety recommendations.
	Caution	High Voltage present. Power panels and lamp connections have high voltage potentials when on. Read and follow all instructions and standard safety procedures. Always lock out power panels prior to working on or maintaining system.
	Caution	Lamps, Sleeves and Sensors are fragile. Damage can occur if not installed, handled, or shipped accordingly. Read and follow all instructions and standard safety procedures.
	Caution	This symbol indicates that the marked item is pressurized. Read and follow all instructions and standard safety procedures. DO NOT exceed unit PSI rating at any time. Maximum pressure rating is on product label.

(Continued)

Table 1-4: Safety and Precautionary Symbols, continued

	Caution	Crush hazard. Power panels and treatment units are heavy. Read and follow all instructions and standard safety procedures.
	Caution	Pinch hazard. Power panels and treatment units are heavy. Read and follow all instructions and standard safety procedures.
	Reference	Please read the appropriate referenced section in the manual.
	Recommendation	Wear Eye Protection.
	Recommendation	Do Not Touch. Fingerprints on Lamp bulbs can cause premature failure.
	Recommendation	Electro Static Discharge sensitive device. Observe industry standard precautions and procedures.

(Continued)

Table 1-4: Safety and Precautionary Symbols, continued

	Recommendation	<p>In order to conform to European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user.</p> <p>Note: For recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal. No equipment is to be returned without authorization. Local recycling programs may be used.</p>
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1.2.2 Hazard Information

Table 1-5 below contains general hazard information for the UV treatment system.

Table 1-5: Hazard Information

WARNING	Use Caution. Water and electricity can be a dangerous combination.
IMPORTANT	For your safety, the quartz sleeve and/or the UV lamp in this product may have been broken or damaged during shipping. It is ESSENTIAL that the unit be CAREFULLY INSPECTED BEFORE CONNECTING TO ELECTRIC POWER .
DANGER	If a lamp or lamp cable falls into the water, DO NOT REACH FOR IT! First make sure the system is unplugged and then retrieve it. If the internal electrical components of the unit get wet, unplug the unit immediately.
DANGER	If the unit shows any signs of a water leak, immediately unplug it from the power source.
DANGER	To avoid possible electric shock special care should be taken since water is employed in the use of the UV System. For each of the following situations, do not attempt repairs yourself. Call RK2 Systems at 760-746-7400 and ask to speak to someone in technical support.
DANGER	DO NOT operate this unit if it has a damaged cord or plug, if it is malfunctioning, or if it has been dropped or damaged in any manner.

1.3 Energy in a UV System and Potential Hazards

1.3.1 Remove Hazardous Energy and Hazardous Energy Sources

Before doing maintenance, service or repair:

- Identify the hazardous energy sources that must be removed in order to eliminate the risk of personal injury.

1.3.2 General Energy Hazard Guidelines

- Prior to shutdown, make sure no hazards will be created by shutting down the UV system.
- Shut down the UV system.
- Remove the hazardous static and dynamic energy sources in the UV system.
- Remove any stored hazardous energy from the UV system, such as water pressure, heat, or stored electrical energy.
- Remove any dynamic energy sources such as line power, and pump or water head energy.
- Apply Lockout/Tagout devices as necessary to prevent the unexpected release of hazardous energy during UV system inspection, maintenance, service or repair.
- Follow local Lockout/Tagout policies and procedures for both electrical and hydraulic systems.

DANGER

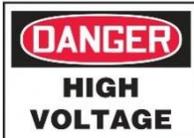
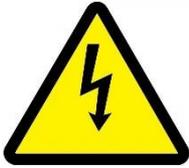
Only qualified personnel should conduct the tasks described in this manual.

Always remove power to the UV system using an isolating device, such as the PP mains fuse or breaker panel prior to servicing electrical equipment.

Always relieve static and dynamic system pressure from the UV system vessel prior to working on lamps, sleeves, or other sensors.

1.3.3 Hazardous Energy Sources

1.3.3.1 Electrical Energy



- Incoming mains electrical power to Fuse Panel, inside the Fuse Panel, and leaving the Fuse Panel
- Mains power coming into the Power Supply Enclosure (PSE) and connecting to the controls and lamp ballasts within the PSE
- High Voltage leaving the ballasts within the PSE and leaving the PSE
- Controls voltage within the PSE and leaving the PSE (below mains voltage)
- High Voltage at the Lamp Plug connector and within the lamp-sleeve envelope
- Low Voltage at the sensors on the treatment vessel.
- Stored energy in ballast and PSE capacitors

DANGER

Electric shock hazard.

High voltage is present in the Power Supply Enclosure and at the lamp plug/socket connector. Remove electrical power from the UV reactor before electrically or mechanically disconnecting a UV system lamp or other component.

Electricity may be stored in capacitors within the Power Supply Components. Allow 3 minutes' post shutdown to ensure dissipation.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to high voltage.

1.3.3.2 Hydraulic Energy



Systems may be pressurized either with static or flowing water. Although static water is not compressible injury could occur. Flowing pressure systems are considered stored energy systems can be very hazardous. Always isolate and depressurize systems prior to lamp, sleeve or sensor maintenance, service, or inspection.

If a sleeve nut is removed when there is dynamic water pressure inside the UV system, the lamp sleeve will eject from the end plate with enough force to cause personal injury.

If there is a crack in a lamp sleeve and water pressure has built up inside the sleeve, the UV lamp may eject from the UV system with enough force to cause personal injury when the lamp nut is removed. If water comes out of the Lamp Nut and plug during lamp removal, stop and remove the static and dynamic pressure sources and drain the water to be able to inspect the unit.



DANGER

Pressurized water may be a hazard.

Obey all site-specific safety protocols.

Always remove static AND dynamic water pressure from the UV reactor before doing any maintenance task.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to high water pressure or projectiles ejecting from the end plate.

When removing a lamp nut or sleeve nut, always stand to the side of the end plate of the UV reactor until the first lamp sleeve bolt cup nut is removed to avoid the potential for personal injury. Do this even when system has been depressurized as a secondary precaution.

1.3.3.3 UV-C Energy



UV-C is always exiting the lamp when the lamp is energized. During normal operation, this energy is shielded by the vessel and vessel components.



Never energize a UV-C lamp in air where the energy emitted can be imparted upon skin or eyes. Serious injury can occur.

Never Energize UV systems that are not installed into piping. Looking at the lamps through the Inlet/Outlet ports can cause burns and serious eye damage.



DANGER

UV-C light exposure is a hazard.

Unprotected exposure to the ultraviolet light from a UV lamp can cause severe burns to the eyes and skin.

Always remove power to the UV lamps before doing a maintenance task related to the lamps, sleeves, sensors or where the vessel must be internally inspected or worked on.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to UV light.

As secondary protection, wear a UV resistant face shield to protect your eyes and face from unexpected exposure to UV light.

Never look directly at energized UV lamps.

1.3.3.4 Thermal Energy



Lamps, ballasts and other electronics may be hot and could burn your skin if not given enough time to cool down. Ensure that components are electrically disconnected, locked out, and cool before performing maintenance.



Use the lockout-Tagout procedure as necessary in order to prevent burns.

WARNING: POTENTIAL FOR BURNS!

UV Lamps may be very hot when energized. In addition, lamp ballasts and other components may also become very hot when energized. Ensure that once components are de-energized, a sufficient cool down period is given. If hot components must be handled, use protective gear as required.

IMPORTANT

It is the Operators responsibility to fully understand this manual and what is required for the safe operation of this UV Treatment System!

1.4 Patents and Permissions

The UV System in this manual may be protected by one or more patents in the United States of America, Canada, and/or other countries. For a list of patents owned by RK2 Systems, go to www.rk2.com.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without written permission of RK2 Systems.

1.5 PRO-TECT™ System Overview

The Pro-Tect™ UV system is a pressurized UV light reactor that uses high-output amalgam UV lamps or Low Pressure High Output lamps in either 'L' or 'U' configurations, as shown in Figure 1-1 and Figure 1-2.

The Power Supply Enclosure (PSE) provides the power for the water treatment system and controls the UV reactor through a basic controller or via microprocessor and Human Machine Interface (HMI) which is also known as a controller display. Refer to Section 1.5

UV System Safety features

The UV system has safety features that help to prevent personal injury:

- PSE panels are fully tested and UL 508a rated
- Non-Metallic polymer construction prevents shorting situations with vessel or panel
- Optional Service End Cap - The electrical power supplied to all lamp holders is turned off when the service end cap is removed

1.5.1 General System Features

- Two system configurations are available:
 - The 'L' inlet and outlet configuration. Flow enters reactor in parallel with lamps, maximizing disinfection efficiency. See Figure 1-1
 - OR
 - The 'U' inlet and outlet configuration. Flow enters reactor from one perpendicular port and exits the other. Compact system. See Figure 1-2
- A robust corrosion proof PVC design.
- Amalgam or LPHO (Low Pressure High Output) lamps; lifetime rated at 80% UV-C output at 12,000 hours.
- Single ended lamp design; provides ease of maintenance and smaller footprint required for installation.
- High quality quartz sleeves. These sleeves protect lamp and ensure optimal lamp operating temperatures and maximum UV-C transmittance to the water.
- The Pro-Tect UV treatment system has been designed for ease of maintenance.
- Various I/O port sizes.
- Various Control system options. HMI Standard or HMI Pro Series controls available.
- UL 508A listed Power Supply
- NEMA 12 Corrosion proof thermoplastic enclosure. NEMA 4x optionally available.

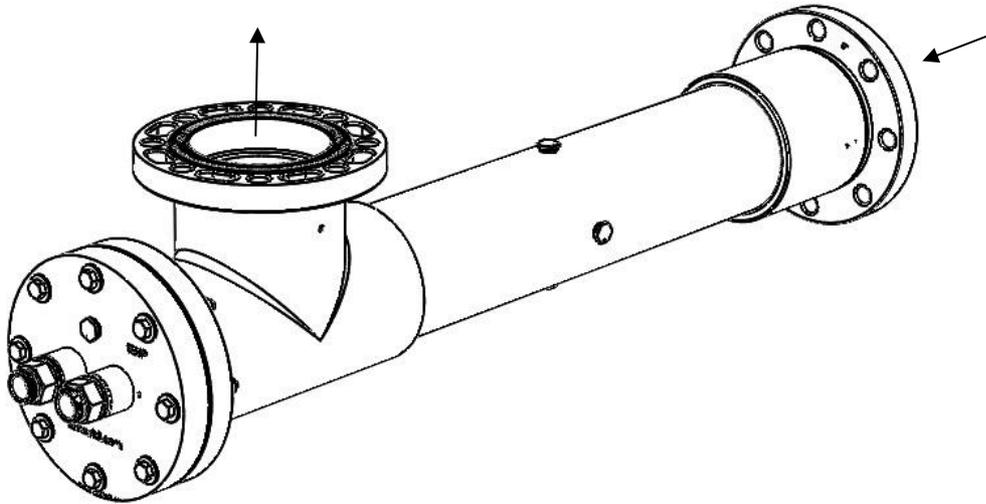


Figure 1-1: UV Reactor 'L' Flow Path

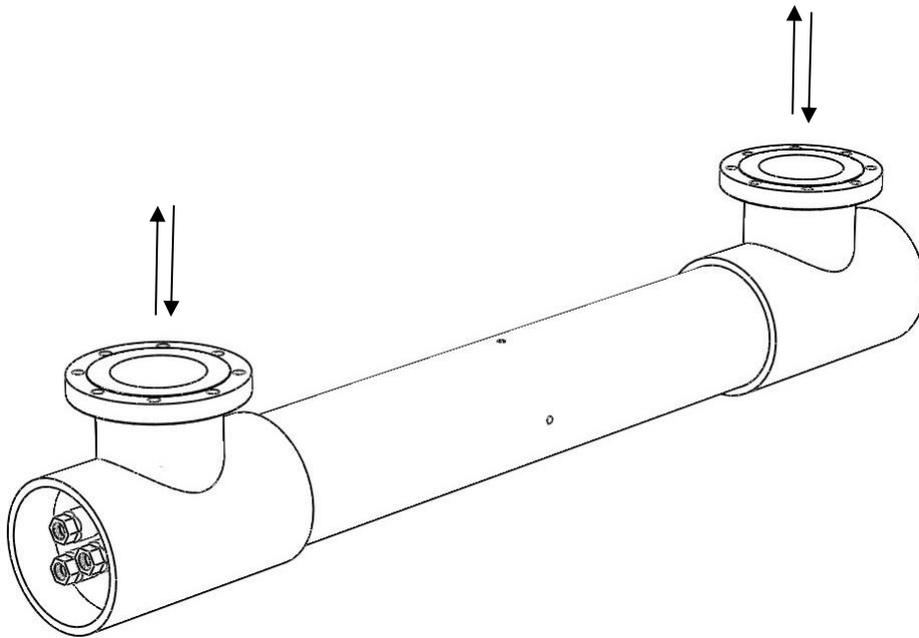


Figure 1-2: UV Reactor 'U' Flow Path

1.5.2 UV Treatment Vessel Overview

The Pro-Tect™ series of UV treatment systems are all designed and sized using the same methodology. Reactor size, port configuration, number of lamps, and port sizes are derived through a thorough understanding of your application. Prime considerations in designing your system are:

- Required Flow Rate
- Required UV-C Dose
- Application, Single Pass or Re-Circulation
- Water Quality, including:
 - UVT
 - Water temperature
 - Other such as TSS and Iron content
- Physical Environment, including:
 - Available space
 - Location
 - Piping
 - System Pressure

An example of a Pro-Tect™ UV treatment system is shown in Figure 1-3, and consists of the following components:

1. UV treatment vessel – The UV treatment vessel houses the lamp and sleeve assemblies.
2. Quartz sleeve – The quartz sleeve acts as barrier for the lamp, preventing it from coming in contact with the fluid being treated. The quartz sleeve is sized to ensure the lamp operates at optimum lamp temperature.
3. UV lamp (Not shown).
4. Endplate or Bulkhead Assembly - The lamp and quartz sleeve assemblies are inserted into the reactor and supported by the end plate.
5. Lamp Nut, Sleeve Nut and Seal - Secures the lamp and quartz sleeve in place.
6. Lamp support or 'Snowflake' - The lamp/sleeve assemblies are supported at the domed end of the sleeve by a component best described as a 'snowflake'.
7. Ports for Sensors, Air Bleeds, and Drains

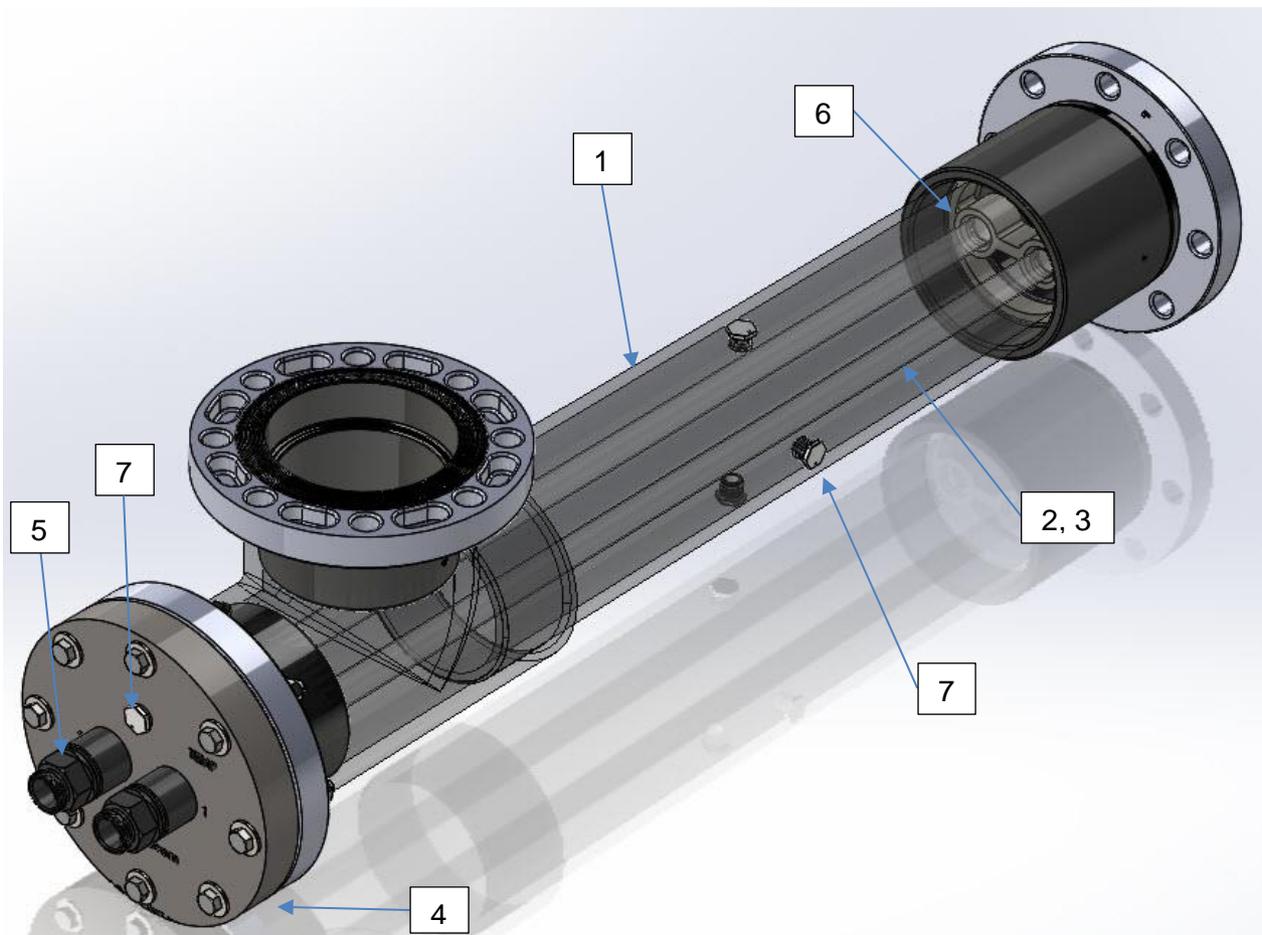


Figure 1-3: Pro-Tect™ System Vessel Components

On the side of the vessel multiple ports have been provided for various sensors, see Figure 1-4. Ports include:

1. Water Temperature Port (standard) Size $\frac{1}{2}$ " FNPT, location on the face of the bulhead plate.
2. Used as an Air Bleed port when required. Some vessels may have an additional port in this location.
3. UV-C Intensity Port Size $\frac{1}{2}$ " FNPT, location on side of unit
4. Service Port (Chemical Cleaning), Size $\frac{1}{2}$ " FNPT, Drain Port 4. is also Service Fill Port
5. Drain Port Size $\frac{1}{2}$ " FNPT, located at bottom of reactor
6. Air Bleed Port for vertical applications (System will have internal air bleed installed if vertical installation is specified at time of order)

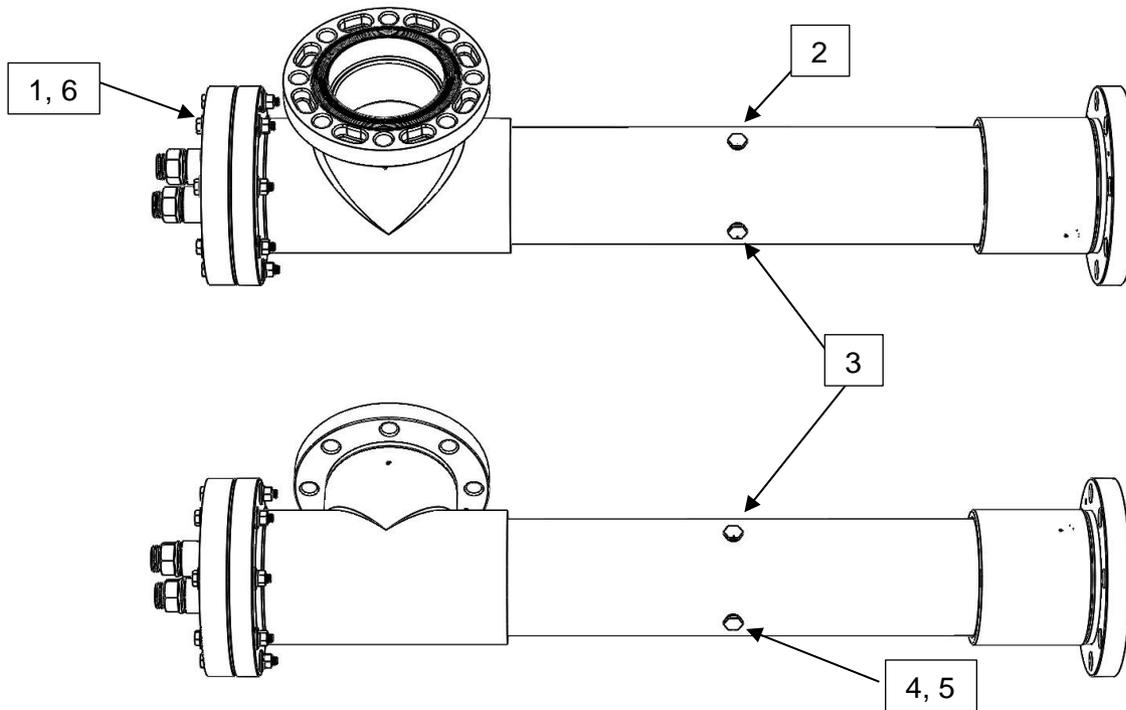


Figure 1-4: Picture is of vessel describing components SW

1.5.3 Power Supply Enclosure

The Pro-Tect™ Power Supply Enclosure contains the electrical and electronic equipment required to power up and your UV treatment system, be they outputs, such as lamps, and data (optional), or inputs, such as temperature sensors, or other optional devices such as UV Intensity Sensors.

1.5.3.1 HMI Pro Series Control Panel

Primary Components of the PLC Control Panel situated on the power supply enclosure, Figure 1-5, are:

1. RK2 Contact Information
2. HMI Display
3. System Label
4. Warning Label
5. Temperature Sensor Notice

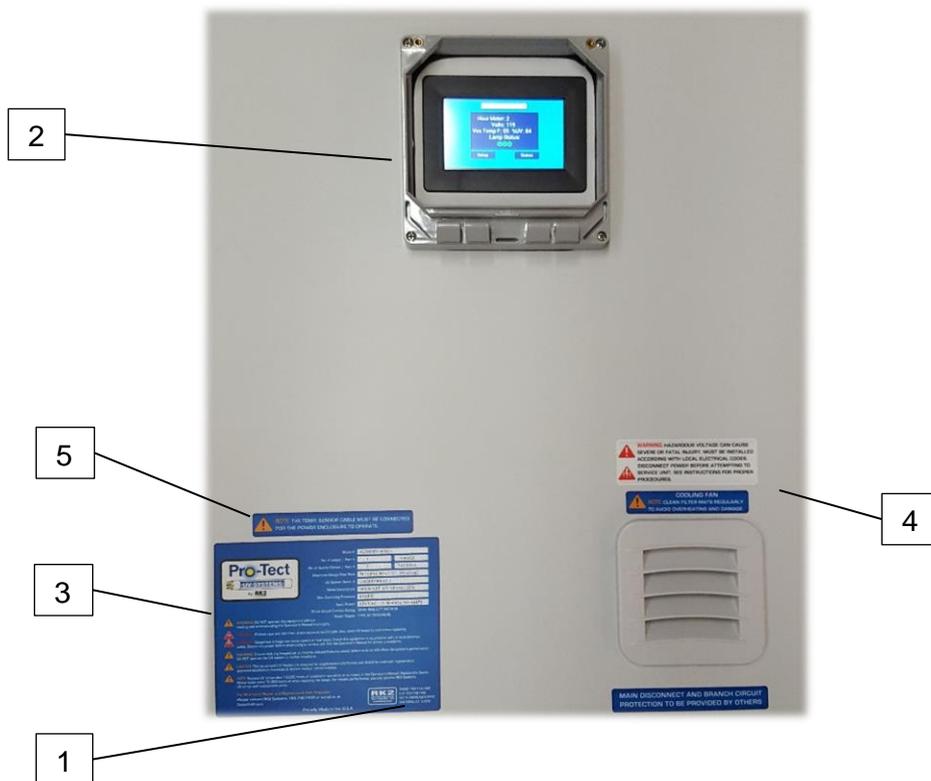


Figure 1-5: HMI Standard and Pro Series Control Panel, Standard HMI Screen Shown

1.5.3.3 Input and Output External Connections

Input and Output external connections of the Power supply enclosure are shown in Figure 1-66.



Figure 1-6: Input/Output Connections



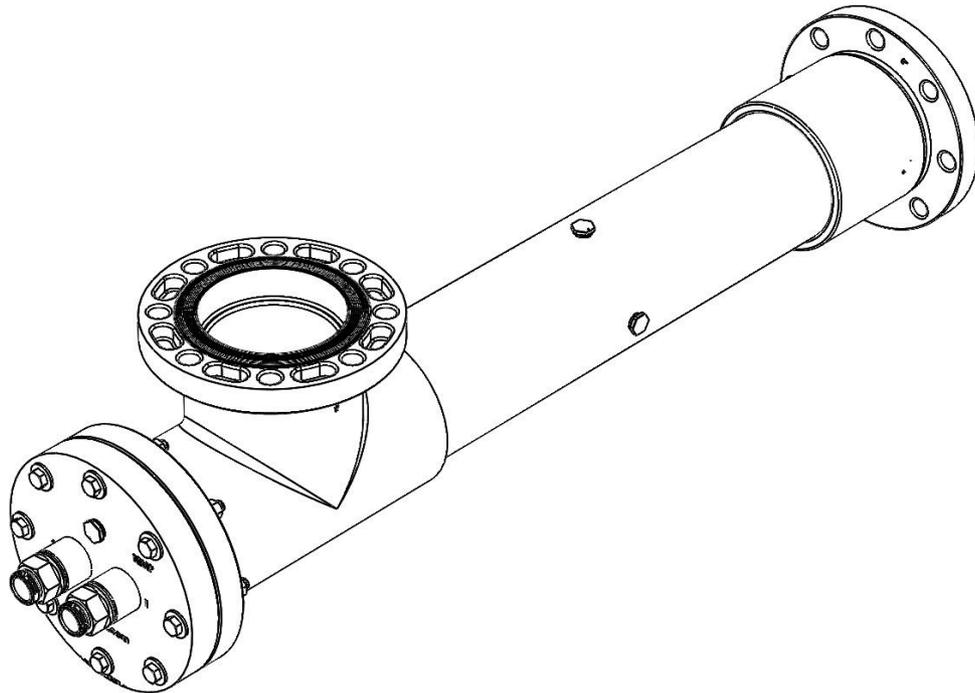
Pro-Tect™

HLH, HUH, ALH, and AUH UV Systems

HMI Standard and HMI Pro Series Controls

Section 2: System Installation and Commissioning
User Manual: UOM0003.2

Edition R3



READ THIS MANUAL PRIOR TO INSTALLING, SETTING UP, OPERATING, SERVICING, OR MAINTAINING THIS UV TREATMENT SYSTEM

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SECTION 1: GENERAL INFORMATION, VESSEL AND POWER SYSTEM ENCLOSURE OVERVIEW

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SECTION 3: OPERATION AND MAINTENANCE

SECTION 4: HMI STANDARD AND HMI PRO SERIES CONTROLS

2.1 System Installation

2.1.1 Reactor Orientation and Port Configurations

The Pro-Tect™ UV Treatment systems may be oriented in many ways. When your UV treatment system was ordered, you were asked about what orientation your unit would be situated. Based on your feedback, all labelling for sensor and drainage and air bleed ports was set in their proper locations. If the orientation has changed subsequent to your order, please contact RK2 regarding labelling changes.

Care must be taken during installation and operation to ensure air cannot become trapped within the treatment chamber. Trapped air can cause numerous issues such as lamp and vessel overheating and sensor function. If air entrapment is a concern, please contact RK2 for assistance.

Dependent on customer requirements, the vessels may be orientated as shown in Figure 2-1, Figure 2-3, and Figure 2-2.

UV systems must not be situated at the highest point of a piping run unless provision for automatic air removal is provided. If the event that automatic air removal is not provided, it is likely that overheating and possibly damage to the UV system will occur.

Horizontal installation requires the vessel outlet port to face upwards or be tilted sideways to within 90 degrees from vertical for both 'L' and 'U' configured systems. This range of orientation allows for trapped air to escape.

When horizontal, a 'U' shaped reactor can be run with either port acting as the outlet or inlet. When vertical, a 'U' shaped reactor must be installed with the outlet port at the end of the vessel near the lamp and sleeve endplate, at the top of the system.

In an 'L' configuration, the outlet port is always at the end of the vessel near the lamp and sleeve end plate, whether horizontal or vertical in orientation and the inlet is furthest away from the lamp/sleeve endplate. In an 'L' configuration inlet piping is in line with the reactor vessel chamber.

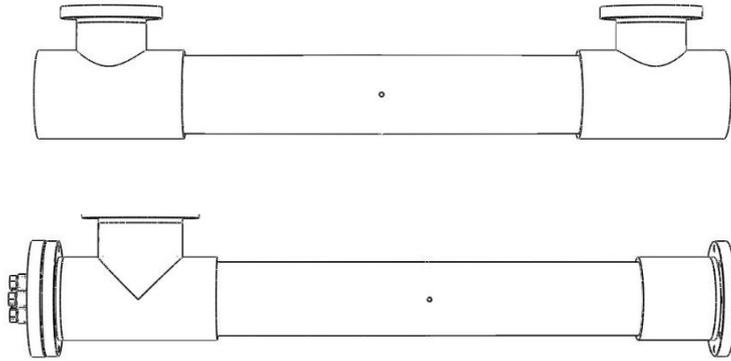


Figure 2-1: Vertical Outlet, Horizontal Orientation

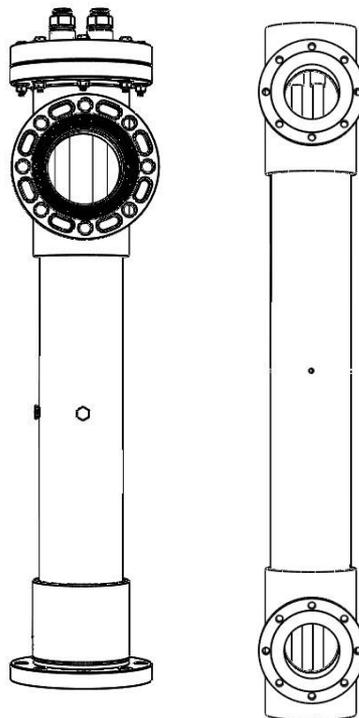


Figure 2-2: Outlet at Top, Vertical Orientation

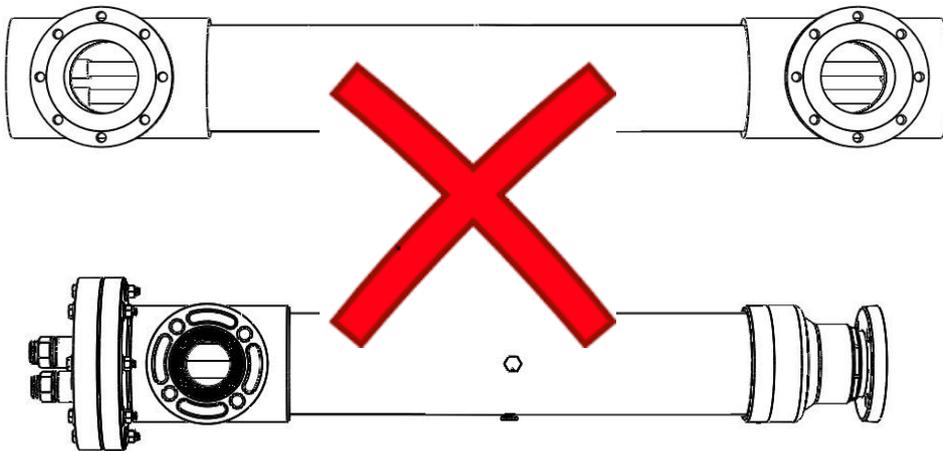
IMPORTANT

It is important not to orient the UV vessel in ways that will trap air. Please contact RK2 for special installation requirements.

Please inform RK2 if you plan to install the unit in a vertical orientation!

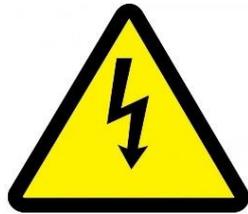
Figure 2-3: Horizontal Outlet, Horizontal Orientation

Note: This Orientation is not recommended if port size is smaller than the chamber diameter as trapped air can cause overheating!



2.1.2 Power Supply Enclosure (PSE) Installation

WARNING	Ensure that all local codes and procedures are followed.
WARNING	Ensure that all Lockout/Tagout procedures are used.



2.1.3 Parts and Required Equipment: PSE Installation

Supplied:

- Enclosure Mounting Hardware
- Power Supply

Owner Provided:

- Set of Slot and Phillips Head Screwdrivers
- Wrench
- Pliers
- Wall Struts or Braces
- Personal Safety Equipment
- Teflon™ Thread Tape

2.1.4 PSE Installation Procedure

Use the supplied enclosure hardware, Figure 2-4, if the Power Supply Enclosure (PSE) is to be mounted on a wall.

Mount the Power Supply Enclosure close to the UV Vessel so that the lamp cables reach between the Power Supply Enclosure and the UV Vessel when properly routed. Stock length lamp cables are 15 feet long.

The PSE, should be mounted so that the HMI screen is visible to the operator during normal maintenance walkabouts. This screen will relay vital information to the operator such as Alarm conditions in addition to regular operational information. The location used for mounting the Power Supply Enclosure should be as dry and cool as possible.



Figure 2-4: PSE Mounting Hardware

The Power Supply Enclosure should be installed in a location that provides sufficient weather protection when placed outdoors. It is recommended that the NEMA 12 enclosure have both sun and precipitation shielding present. Sufficient space near the cooling fans intake and exhaust must be provided.

The Power Supply Enclosure must be supplied with the correct operating voltage and current as specified on the Power Supply Enclosure labeling.

The UV System is equipped with an equipment-grounding conductor and corresponding grounding lug. The grounding lug must be installed and grounded in accordance with all local codes and ordinances. Improper connection of the grounding conductor can result in electrocution and/or property damage. Have a qualified electrician or service personnel determine whether or not the equipment is properly grounded if in question.

Input power to the Power Supply Enclosure components is switched on and off using the enclosure's External On/Off switch (depicted in Figure 2-5).



Figure 2-5: Power Supply Enclosure Switch.

WARNING	Failure to supply the UV System with the correct power (voltage, current, quality) can damage the ballasts, HMI, PLC, sensors and other electrical hardware
WARNING	Use only a well-ground electrical circuit.
IMPORTANT	Power to the Power Supply Enclosure is provided and controlled by the customer supplied On/Off panel which incorporates its own fuse or breaker electrical protection.
NOTE	All UV control enclosures that utilize HMI/PLC controls must be mounted with attention to other devices that emit, or are suspected of emitting, any EMI & RFI noise. Any sensors used in conjunction with HMI/PLC controls must use industry standard procedures to avoid EMI & RFI noise issues.

2.2 UV Treatment Vessel Installation

WARNING	Equipment is heavy. Take care to prevent pinch or crush injuries.
WARNING	Pressure may be present in piping or in vessel during commissioning.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



2.2.1 UV Treatment Vessel Installation: Parts and Required Equipment

Supplied:

- Vessel Mounting Brackets
- Power Supply

Owner Provided:

- Set of Slot and Phillips Head Screwdrivers
- Socket Set
- Adjustable Wrenches
- Lifting Equipment with Slings
- Personal Safety Equipment
- Required Isolation Valves
- Plumbing Components
- Optional Bypass Kit

2.2.2 UV Treatment Vessel Installation Considerations

UV Treatment Systems must be installed downstream from mechanical filtration. This eliminates the possibility of debris entering the UV treatment vessel. Debris can potentially damage the quartz sleeves and UV lamps.

Install inlet and outlet isolation valves (to be supplied by customer). These valves are required so that the UV vessel can be isolated from the piping system during lamp and sleeve maintenance.

Install UV vessel mounting brackets if required (to be supplied by customer).

NOTE: Exceeding the design maximum flow limit of the reactor can be detrimental to the systems components. If treatment or non-treatment flow rates exceeds the disinfection flowrate contact RK2 in order to determine if you are within safe operational limits.

NOTE: Exceeding the design pressure rating of the UV system can seriously damage the system and/or cause flooding. See Section 3, Operation and Maintenance for the pressure rating of your system, or see the label affixed to your system vessel.

IMPORTANT	The installation of the UV system must be carried out in accordance with local regulations and codes.
NOTE	Exceeding the design maximum flow limit of the reactor can be detrimental to the systems components. If treatment or non-treatment flow rates exceeds the disinfection flowrate contact RK2 in order to determine if you are within safe operational limits.
NOTE	Exceeding the design pressure rating of the UV system can seriously damage the system and/or cause flooding. See Section 3, Operation and Maintenance for the pressure rating of your system, or see the label affixed to your system vessel.

2.2.3 System Footprint and Clearances for Maintenance:

For Single Ended UV systems, both the lamp and sleeve are maintained from one end of the reactor. Clearance is needed at this end of the reactor so that lamps and sleeves can be removed during time of installation, service and inspection. See Figure 2-6. The space required for lamp and sleeve removal will be specified in the vessel layout drawing provided by RK2.

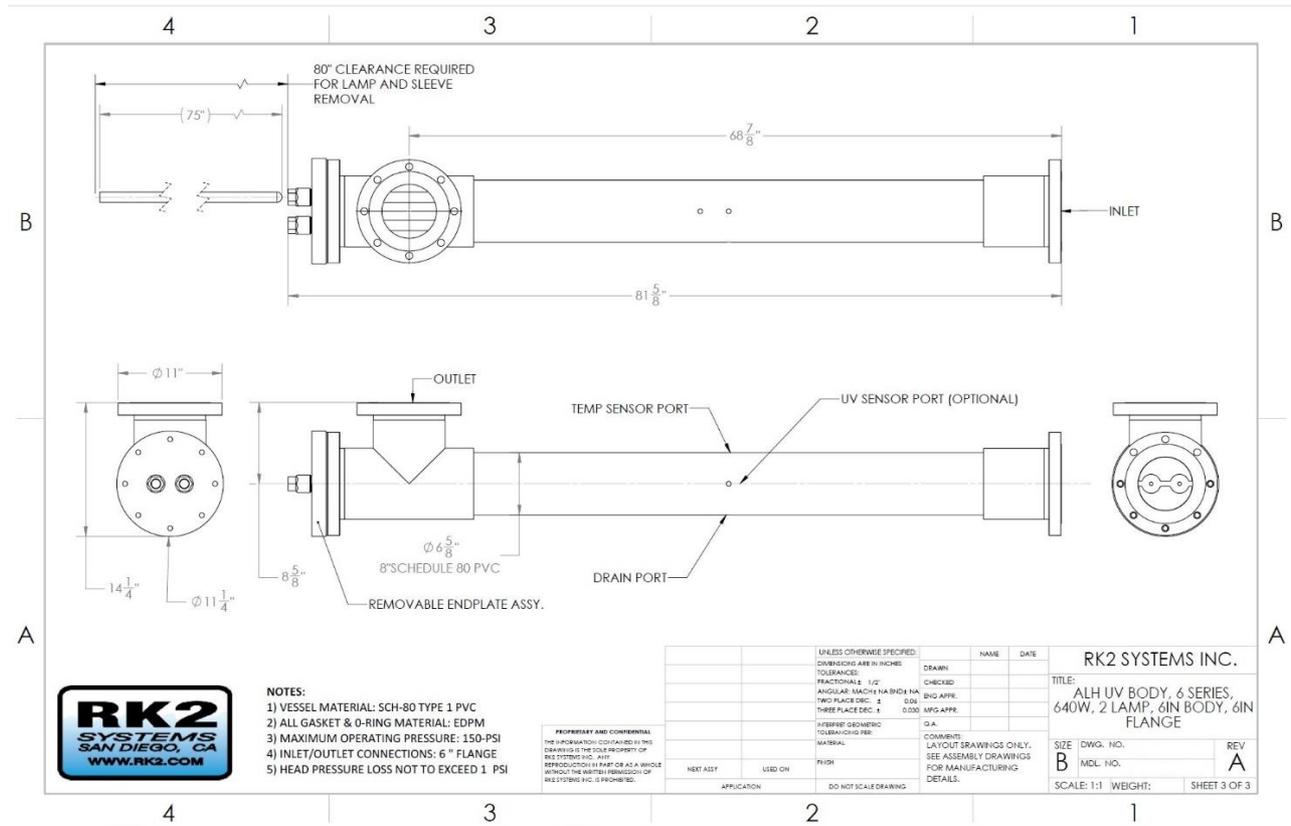


Figure 2-6: Example Layout Drawing Showing Lamp and Sleeve Maintenance Clearance Requirements

2.2.4 General UV Vessel Installation Notes

Failure to remove trapped air can result in rupture or heat damage to the vessel. Please ensure that methods of removing trapped air are present.

Note: Trapped Air in vertical installations **must** be addressed. Overheating of the unit could occur if this is not done.

If installed with a bypass or isolated using valves, an automatic air bleed system is required. Failure to remove trapped air can result in rupture or heat damage to the vessel.

Models equipped with inlet/outlet raised flanges require mating pipe flanges of the appropriate size along with the required flange gasketing (to be customer supplied). Depending on port type ordered further fabrication to the customers piping system may be required.

All Flange Bolts to be torqued as per

Flange Size	Torque Value (Non-Lubricated Threads)
0.5" to 1.5" Flange	12 ft. • lbs.
2.0" to 4.0" Flange	25 ft. • lbs.
5.0" Flange	30 ft. • lbs.
6.0" to 8.0" Flange	40 ft. • lbs.
10" Flange	64 ft. • lbs.
12" Flange	95 ft. • lbs.
14" to 24" Flange	40 ft. • lbs.

Table

2-1

Table 2-1: Flange Bolt Torque Values

Vessel to be supported by mounting brackets when possible to minimize stress on the I/O flanges and chamber. Mounting brackets must be used on vessels over 10" in diameter.

Isolation Valves are highly recommended for vessel removal and for the chemical cleaning procedure. Ball valves, or other valve types that do not induce turbulence, are recommended as they do not present a turbulent flow to the UV treatment system when fully open. It is highly recommended to install the ball valves directly into the inlet/outlet ports of the vessel. If using turbulent valve types, it is recommended to place the valves 5 pipe diameters away from the I/O ports.

If this installation arrangement is not possible, install the UV vessel so that chemical cleaners or freshwater rinse water may be drained completely from the vessel without contaminating the process water.

UV Systems with vessel diameters larger than 10" are typically shipped without the quartz sleeves being installed. Please install as per Section 2.3 after installing the vessel.

The vessel is equipped with a 0.5" NPT female threaded drain port for installation of the Drain Valve Assembly. The assembly is to always be installed at the lowest of the provided ports. Teflon™ Tape must be used on the threads when installing the drain valve assembly to prevent leakage.

The vessel will be equipped with a temperature sensor and optionally a UV Intensity Sensor. Sensors must be installed in the recommended location. Use Teflon™ Tape on the threads to create a reliable seal for all sensors. Sensors should be threaded into their respective vessel ports prior to connection to the power supply enclosure to avoid cable twisting.

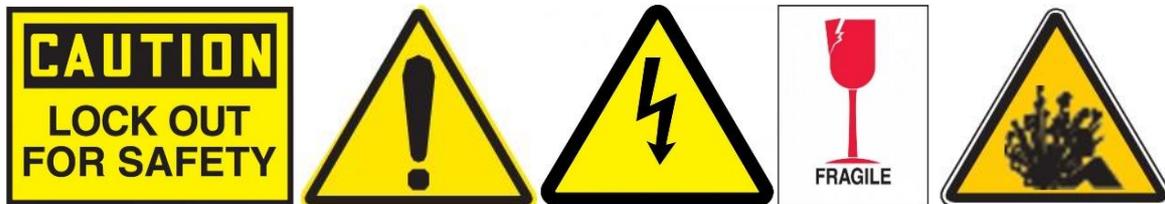
2.3 Quartz Sleeve Installation

Quartz sleeves are installed and removed during system startup, during system maintenance and for cleaning purposes. At this point of the system setup, sleeve installation is required.

Please See Section 3: Operation and Maintenance, User Manual: UOM0003.3 for Sleeve Installation Procedures.

2.4 UV Intensity Sensor, Temperature Sensor, Drain and Air Bleed Installation

WARNING	Pressure may be present in piping or in vessel.
WARNING	Sensors are fragile. Handle with care.
WARNING	Ensure that all Lockout/Tagout procedures are used.



2.4.1 Sensor installation, and Drain and Air Bleed Installation: Parts and Required Equipment

Supplied:

- Temperature Sensor
- Port adapter
- UV Intensity Sensor

Owner Provided:

- Drain Valve Assembly
- Air Bleed Assembly (If not installed internally at time of purchase)
- Teflon™ sealant tape
- Adjustable Wrench
- Cotton or silicone gloves
- Personal Safety Equipment
- Wire Cutters

When installing the Temperature and UV Intensity Sensors into their respective port locations use Teflon sealant tape to properly seal the sensor threads and adapter threads, [Figure 2-7](#).



Figure 2-7: Sealant tape on fittings

DO NOT connect the sensor cables to the power supply until after they are installed into the vessel to minimize cable twist and potential damage. If the cable becomes twisted during the installation process, untwist it before proceeding.

2.4.2 Temperature Sensor and Optional UV Intensity Sensor Installation

Figure 2-8: Temperature Sensor Location, shows the sensor port in the vessel bulkhead.

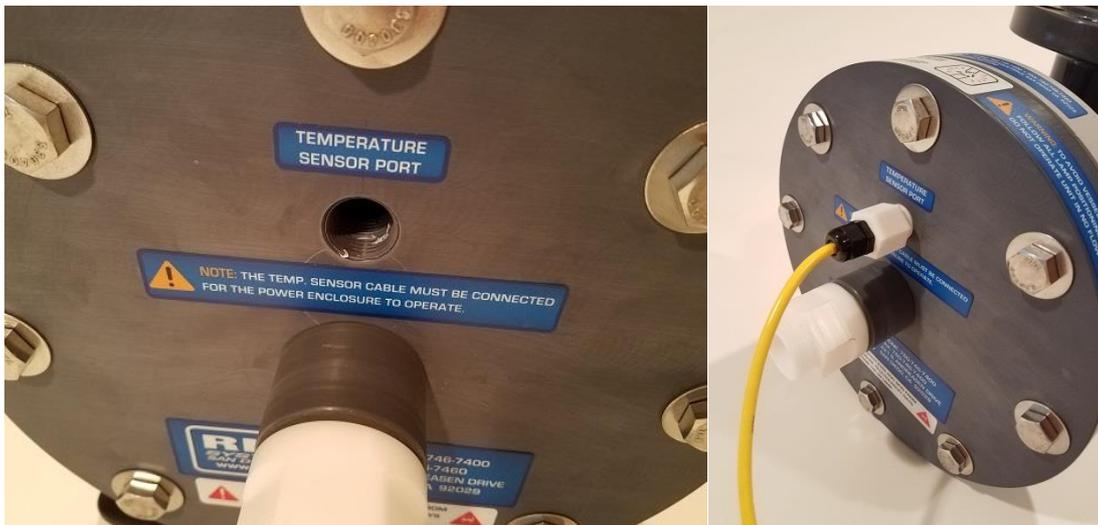


Figure 2-8: Temperature Sensor Location

Wrap the threads of the external Teflon sleeve of the Temperature Sensor with Teflon™ sealant tape. Care must be taken as the material is soft and easily damaged from overtightening.

Insert the sensor using the provided Teflon™ sealant tape and tighten.

Figure 2-9: UV Intensity Sensor Location shows the sensor port in the treatment vessel.



Figure 2-9: UV Intensity Sensor Location

Wrap the threads of the external Teflon sleeve of the UV Intensity Sensor with Teflon™ sealant tape. Care must be taken as the material is soft and easily damaged from overtightening.



Figure 2-10: Connecting the Sensor

Attach the sensor cables to their respective connection points located on the bottom of the Power Supply Enclosure (Figure 2-10).

WARNING	Sensor cables should be isolated from other electrical devices, lamp power cables, and power cables to prevent electrical interference. When running cables please ensure that they are placed in raceways separate from power or lamp cables.
NOTE	The supplied sensor cables are approximately 20' long. If you find that you require a greater length you can purchase cable extensions. Please contact RK2.
NOTE	A Temperature Sensor Cable connection interruption will automatically shut down the system. Ensure all connections are sound.

2.4.3 Drain and Air Bleed Vents

The Drain Assemblies (Optional) and Air Vents (Optional) port locations are located as labeled if the vessel has been installed in a horizontal orientation. Teflon™ sealant tape is used to properly seal the fittings if NPT.

If the vessel is oriented vertically a drain port will be required on the piping and the low end (inlet) of the system. An internal air bleed will be provided on a vertically oriented system to prevent trapped air at the top of the reactor.

Venting of outlet piping may be required, particularly if the outward piping turns downward right after the UV system.

Note: If vertical installation is required and was not specified at time of system order, please contact RK2. Air entrapment can cause overheating and subsequent component damage!

2.5 Vessel Leak Testing

WARNING	Pressure will be present in piping or in vessel.
WARNING	Water may leak onto floor, platforms, etc. Clean up any spills to prevent slipping and possible injury.
WARNING	Quartz Sleeves are fragile and can be easily broken. Broken sleeves can be dangerous. Handle with care.
WARNING	Ensure that all Lockout/Tagout procedures are used.
IMPORTANT	Leakage into the lamp and sleeve zone can damage lamps. Ensure this test is completed prior to installing the UV lamps.
NOTE	Always use clean cotton or silicone gloves when handling lamps. Oils and acids from skin can contaminate the lamp bulb and may significantly shorten lamp life.
NOTE	The Sleeve Nut and Seal must be inspected annually at a minimum.



2.5.1 Vessel Leak Testing: Parts and Required Equipment

Owner Provided:

- Personal Safety Equipment
- Paper towels and other spillage cleanup tools

2.5.2 Vessel Leak Test Procedure

The vessel leakage test is required any time the vessel liquid boundary layer is broken, be it via commissioning, or via routine maintenance or repair.

This leakage test will help the operator identify a potential quartz sleeve assembly seal failure. During normal UV system operation, a quartz sleeve assembly failure can result in extensive damage to the UV lamp, quartz sleeve and ballast.

IMPORTANT	Failure to perform and document a successful vessel leak test could lead to conditions that may void the product warranty.
NOTE	All Pro-Tect™ systems are tested for leak tightness at the factory, however it is YOUR responsibility to ensure leak tightness at the time of installation, and beyond.

- 1) The Vessel Leak Test is to be performed with the Quartz Sleeves, Sensors, and applicable Air Bleed and Drain Ports installed.
- 2) For each Sleeve Nut, slide a rolled-up piece of paper towel approximately 4 inches into the port (Figure 2-11). Ensure that the rolled paper towel is tight enough and large enough to prevent slippage into the sleeve in a vertically oriented reactor. A leaking Sleeve Nut will become apparent by wetting the paper towel during the leak test.



Figure 2-11: Leak Test Setup

- 3) Confirm that all system piping connections and valves are in the correct position for testing.
- 4) Slowly fill the with vessel with water, and bleed off any trapped air via the optional Air Bleed or by other methods. Methods may include a manual air bleed valve at a high point in the vessel, or manual air bleed valves at points higher than the vessel that are placed in the piping.
- 5) Pressurize the system to maximum operating pressure and isolate from dynamic system pressure.
- 6) Let the pressurized system sit for 15 minutes. If fitted with a pressure gauge, look for significant pressure drop that may signify a leak.

Note that a pressure drop may signify a leak in a system isolation valve, not the UV vessel. Inspect all sensor and other ports, and the Sleeve Nut zones, for leakage. If leakage is detected, remove process flow and pressure prior to correcting leak.

- 7) If Static Pressure Test is satisfactory:
- 8) Open flow valves and increase flow to maximum flow rating.
- 9) Run the system with process flow present for 15 minutes then inspect all sensor and other ports, and the Sleeve Nut zones, for leakage.
- 10) If leakage is detected, remove process flow and pressure prior to correcting leak.

IMPORTANT

Do not overtighten connectors or Sleeve Nuts! If leakage persists after a proper tightening sequence has been used, with all components installed correctly, please contact your Pro-Tect™ team at RK2.

2.6 UV Lamp Installation

UV-C treatment lamps are installed and removed during system startup, during system maintenance and when required for replacement. At this point of the system setup, UV-C lamp installation is required.

Please See Section 3: Operation and Maintenance, User Manual: UOM0003.3 for UV-C Lamp Installation Procedures.

2.7 Commissioning

WARNING	Water Hammer (Shock), air entrapment or cavitation caused by improper valve openings, excessive flow velocities, and air trapped in the piping or UV system can damage lamps, sleeves and UV system components. Ensure that proper flow regimes are established for the UV system.
WARNING	Trapped air and/or a no-flow condition in the UV vessel can damage lamps, and polymer components due to overheating.



2.7.1 General Commissioning Procedure

- 1) Ensure that all personnel operating this UV system have thoroughly reviewed these instructions prior to operating the UV system.
- 2) Clean and remove all dirt/debris from power supply enclosure, vessel and installation area.
- 3) Inspect all plumbing and electrical connections to ensure safe start-up.
- 4) Inspect the lamp and sleeve mounting on the vessel endplate. Ensure that all components have been properly installed.
- 5) Inspect Sleeve Nuts confirming that they are tight.
- 6) Inspect Power Supply Enclosure
- 7) Ensure that it has been installed properly and input power is in accordance with local ordinances and codes.
- 8) If a multiphase panel, ensure that the phases are correct.
- 9) Inspect all sensors ensuring that the probes are properly installed in the vessel and cable adapters are properly connected to their respective Power Supply Enclosure ports.
- 10) Verify that a successful Vessel Leak Test has been completed and documented.
- 11) Use the commissioning checklist provided in Table 2-2: Commissioning Checklist, to ensure proper operation of your UV Treatment System.

Table 2-2: Commissioning Checklist

Item	Description	Completed Y/N	Date of Completion
	Power Supply Enclosure		
1	PSE Physical Inspection Complete		
1.1	External Fuse/Breaker Panel installed. Meets power requirements as specified on System Label		
1.2	PSE Bolted to Floor/Wall Adequate Maintenance and operational clearances Adequate Protection from the environment		
1.3	Power Connected, Phase Check (If Applicable) Power Quality within established parameters Grounding Complete		
1.4	EMI and RFI within Parameters		
2	UV Vessel		
	Clearance Provided for unit installation and for lamp and sleeve Maintenance		
	Vessel supported to be able to withstand unit, piping, water weight and system vibration due to pumps		
	UV Vessel Isolation Valves Installed		
	Flange Gaskets Installed		
	Flange Bolts Torqued to Specification		
	Optional Bypass Kit Installed		

(Continued)

Table 2-2: Commissioning Checklist, Continued

3	Sleeves, Sensors, Drains and Air Bleed		
	Quartz Sleeves Installed		
	Temperature Sensor Installed at vessel AND panel		
	Optional UV Intensity Sensor Installed at vessel AND panel		
	Drain Port Assembly Installed		
	Optional Air Bleed Installed		
4	Vessel Leak Test		
	Static Leak Test Successfully Completed (Pressurized, Isolated, sit for 15 minutes, inspect)		
	Dynamic Leak Test Successfully Completed (Pressurized with System flow, sit for 15 minutes inspect)		
	Lamps		
	Installed Correctly and at proper depth in sleeve		
	Power Up (Vessel Filled with Water, No Trapped Air, Water Flow)		
	On/Off Power Switch Operational		
	Lamp Hour Meter Zeroed		
	All Lamp Status Lights Bright		



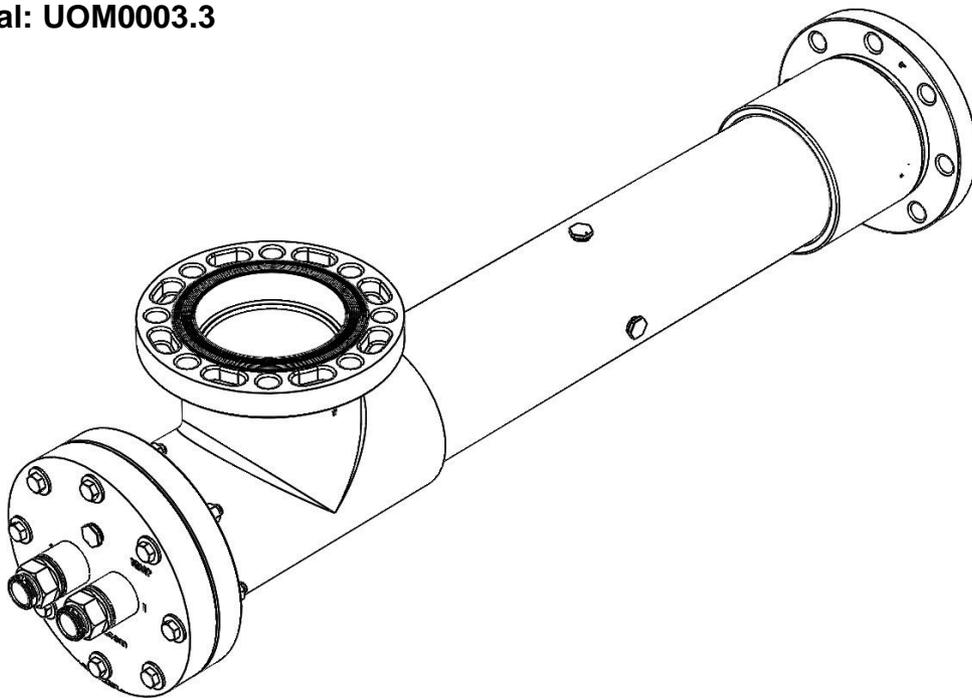
Pro-Tect™

HLH, HUH, ALH, and AUH UV Systems

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Section 3: Operation and Maintenance
User Manual: UOM0003.3

Edition R3



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SECTION 3: OPERATION AND MAINTENANCE

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SECTION 4: HMI STANDARD AND HMI PRO SERIES CONTROLS

3.1 Scheduled Maintenance

Scheduled maintenance and inspections, in addition to ensuring adequate disinfection performance, can dramatically extend the life of your UV treatment system and can prevent reliability issues. Suggested frequencies for scheduled maintenance and inspections are provided in Table 3-1: Scheduled Maintenance and Inspections.

Table 3-1: Scheduled Maintenance and Inspections

System component	Maintenance requirement	Daily	1 Month	6 Months	Annually	12,000 hours	As Needed
HMI Controls, Lamps and Ballasts	Inspect Controls: <ul style="list-style-type: none"> - Confirm Controls are functioning correctly - Confirm that all lamps and ballasts are functioning correctly. - Replace UV Lamp if required - Replace Ballast as required - Check Lamp Hour Meter – <ul style="list-style-type: none"> o Order new lamps if required. Note, 1 month is approximately 720 hours. o Replace at EOLL 	X					X
UV Vessel and Piping	Visual check for leaks	X					
All	Inspection for Corrosion or Damage of Vessel, PSE and all cabling.		X				
Quartz Sleeves and Sealing O-rings	<ul style="list-style-type: none"> - Inspect a representative sample (10%) of lamp sleeves. - Inspect sleeve for fouling, i.e. the sleeve is not clear. If sample is fouled, remove and clean ALL quartz sleeves. - Inspect sleeve nut O-rings for UV decay. Replace ALL sleeve nut O-rings if some are suspect. - Remove any condensation present inside the quartz sleeves. - Visually inspect quartz sleeves for physical damage, i.e. cracks, grooves. Replace if damaged. Damage typically occurs near the open or domes ends, but may occur in the middle portion of the sleeve if debris was introduced into the flow stream or if severe water hammer occurred. Note: Replace quartz sleeve O-rings any time a sleeve is replaced.			X			

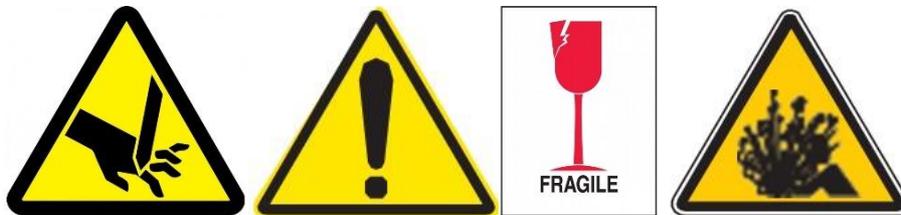
Table 3-1: Scheduled Maintenance and Inspections, Continued

<i>System component</i>	<i>Maintenance requirement</i>	<i>Daily</i>	<i>1 Month</i>	<i>6 Months</i>	<i>Annually</i>	<i>12,000 hours</i>	<i>As Needed</i>
PSE Air Filter	Cooling Fan Filter Mat cleaning/replacement (monthly, more frequently in dusty environments)		X		X		
Lamp Inspection	Inspect the UV lamps, connectors and lamp pins Look for burning, corrosion, or signs of overheating Look for frayed or discolored components or wires Look for cracks or damage to the lamp bulb or end caps.				X		
Lamp Replacement	Replace all the UV lamps when EOLL (end-of-lamp-life) alarm occurs. Reset hour meter after new lamps have been installed.					X	
UV Intensity Sensor	Clean the UV Intensity sensor			X			
	Replace the UV Intensity sensor						X

3.2 System Maintenance Procedures

3.2.1 Quartz Sleeve Installation and Removal

WARNING	Pressure may be present in piping or in vessel during commissioning.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



Quartz sleeves are installed and removed during system startup, during system maintenance and for cleaning purposes. Permanently fouled sleeves can also block UV-C and reduce system performance. Always replace permanently discolored, gouged, etched, cracked or broken sleeves.

Quartz Sleeve Installation and Removal: Parts and Required Equipment

Supplied:

- Quartz Sleeves (Initial Installation Only)
- Sleeve Seals (Initial Installation Only)
- Sleeve Nuts

Owner Provided:

- Adjustable Wrenches
- Cotton or silicone gloves
- Personal Safety Equipment
- Quartz Sleeves as required
- Sleeve Seals at time of sleeve cleaning or replacement

3.2.2 Quartz Sleeve Installation Procedure

- 1) Apply water (wet) or a small amount of water-soluble lubricant such as Ideal Industries Clear Glide to the domed-end of the quartz sleeve ONLY. Lubricating will aid in inserting the domed-end of the quartz sleeve into the vessel's internal quartz sleeve coupler "port".
- 2) Carefully slide the quartz sleeve into the vessel endplate, leaving approximately 3"-12" of the quartz sleeve protruding. The domed end of the sleeve goes in first. Elevate the domed-end of the quartz sleeve slightly by gently pushing down on the retaining nut to assist in guiding the domed-end of the quartz sleeve into its corresponding sleeve support. The sleeve support is at the far end of the vessel and supports the domes end of the sleeve. Figure 3-1: Install Quartz Sleeves into the Reactor.

NOTE

Take care not to get any lubricant into the open end of the sleeve as this can damage the lamps.



Figure 3-1: Install Quartz Sleeves into the Reactor

- 3) Ensure that the sleeve O-ring or rectangular rubber seal is over the open end of the quartz sleeve, approximately 0.5" from the end of the sleeve. See Figure 3-2: Fitting the Sleeve Seal.

- 5) Snug the assembly (Sleeve Nut, O-ring and Quartz Sleeve) onto the endplate into the UV vessel. See Figure 3-4: Installing the Sleeve Assembly.



Figure 3-4: Installing the Sleeve Assembly

- 6) Lightly thread the Sleeve Nut onto the threaded insert in the vessel endplate in a clockwise direction. Do not tighten. Inspect the open end of the Sleeve Nut. The O-ring or Rubber Seal should be seen, and the Quartz Sleeve should be resting on the inner shoulder of the Sleeve Nut as depicted in Figure 3-5: Installed Sleeve, Seal and Sleeve. Adjust if required.



Figure 3-5: Installed Sleeve, Seal and Sleeve

- 7) Tighten the Sleeve Nut. It is recommended that only hand tightening be used, however very light tightening with a wrench or socket may be done. Tighten down until snug only! (5 ft/lb).

WARNING	Do NOT Overtighten.
NOTE	Over tightening can break the Sleeve Nut, the endplate Threaded Insert and potentially the Quartz Sleeve.



Figure 3-6: Tightening the Sleeve Nut

- 8) Fill the system with water and bleed any air trapped in the system as per Section 2, Installation and Commissioning.
- 9) Leak Test the system as per Section 2 Installation and Commissioning.
- 10) The quartz sleeve is now properly assembled.

3.2.3 Quartz Sleeve Removal Procedure

DANGER	Ensure that the UV Vessel is Depressurized and Drained prior to undertaking this work! Failure to do so could result in serious injury or even death due to ejected quartz sleeves!
DANGER	Ensure Lockout/Tagout procedure is undertaken for valving and pumps if required to prevent inadvertent pressurization of unit.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



Please see Lamp Removal if lamps have not yet been removed. See Section.3.2.4 Lamp Installation/Replacement Procedure.

Quartz sleeves are installed and removed during system startup, during system maintenance and for cleaning purposes. Permanently fouled sleeves can also block UV-C, preventing it from getting to the water, and thereby reducing system performance. Always replace permanently discolored, gouged, etched, cracked or broken sleeves.

For a typical application, it is recommended that the Quartz Sleeve(s) be removed, inspected and cleaned every 6 months, however the treated water at each site may be significantly different with regards to sleeve fouling potential. If your water quality is relatively poor, more frequent cleaning may be required. If your water is of very high quality, an annual cleaning cycle may be appropriate. Talk to your RK2/Pro-Tect™ support team to determine the best sleeve maintenance cycle for your application.

Quartz Sleeve Removal Required Equipment:

- Adjustable Wrenches
- Rubber, Latex, Cotton or Silicone gloves
- Personal Safety Equipment

Quartz Sleeve Removal Procedure

- 1) Using the External ON/OFF Switch, and isolate the UV system from its electrical source. This may require unplugging, or the use of a switch panel.



Figure 3-7: Power Off to PSE: Main Panel

- 2) Use a Lockout/Tagout procedure to ensure the UV system cannot be energized accidentally.
- 3) Hydraulically isolate the UV Vessel from the plant piping to ensure pump pressure cannot accidentally be present in the vessel. It is recommended that a Pump and Valve lockout procedure be used. Depressurize and drain the vessel completely.



Figure 3-8: Valve Lockout or Pump Lockout

- 4) If the lamps have yet to be removed, remove the UV Lamp(s) as per Section 3.2.4 Lamp Installation/Replacement Procedure

- 5) Loosen the Sleeve Nut either by hand or with a wrench or socket. Remove the Sleeve Nut.



Figure 3-9: Sleeve Nut Removal

- 6) Wearing rubber, latex, cotton or silicone gloves gently slide the Quartz Sleeve out of the reactor while inspecting for cracks, discoloration, or any other damage. See Figure 3-10: Supporting the Lamp During Removal DO NOT use pliers, forceps or tools to remove the sleeve. Damage to the Quartz Sleeve likely will occur! If the sleeve is damaged take care to not cause personal injury to yourself or others.

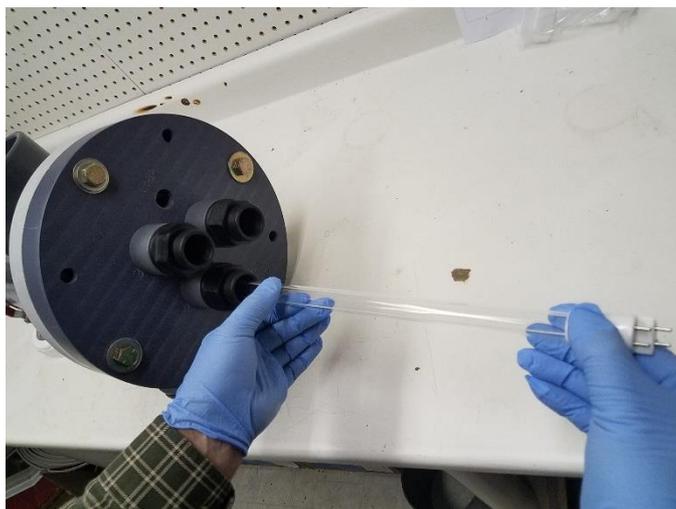


Figure 3-10: Supporting the Lamp During Removal

- 7) Discard old Quartz Sleeve O-rings and replace with new ones.

- 8) Place quartz sleeve on a safe level surface that has stops to prevent rolling to avoid breakage. See Figure 3-11: Paper to protect sleeve and object placed on table to prevent sleeve rolling.



Figure 3-11: Paper to protect sleeve and object placed on table to prevent sleeve rolling

- 9) Repeat removal process until all Quartz Sleeves are ready for final inspection and/or cleaning.
- 10) Inspect the quartz sleeves for:
- Cracks, scratches, chips, fractures or other physical damage. If there is physical damage to the lamp sleeves, remove all the lamp sleeves for inspection and replace as required.
 - Excessive fouling or scaling build-up.
- 11) If required, clean the quartz sleeve(s) as described in Section 3.2.5 Cleaning of Quartz Sleeves and Sensors.
- 12) If required, replace any discolored, damaged, cracked, or chipped quartz sleeves. Use new O-rings.

3.2.4 Lamp Installation/Replacement Procedure

DANGER	High voltage is present at the lamp plugs when the lamp ballasts are energized. De-Energize UV System and Lamps prior to disconnecting a lamp plug from a UV lamp. Ensure that all electrical Lockout/Tagout procedures are used.
WARNING	Assume that the UV treatment system is under pressure. Pressure may be present in piping or in vessel. Do not stand in line with lamp and sleeve when replacing.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.
WARNING	Ensure that all Lockout/Tagout procedures are used.
WARNING	Read Isopropyl Alcohol MSDS and follow storage, use and handling precautions.
WARNING	DO NOT operate UV Lamp(s) outside of the vessel. UV light may cause severe burns/irritation/damage to eyes and skin.
WARNING	UV Lamps may be hot, handle with care.
NOTE	If lamp bulbs ARE touched with bare hands or fouled gloves, they can be cleaned with Isopropyl Alcohol. Failure to clean lamps can lead to shortened lamp life.
NOTE	Always use clean rubber, latex, cotton or silicone gloves when handling lamps. Oils and acids from skin can contaminate the lamp bulb and may significantly shorten lamp life.
NOTE	If lamp bulbs ARE touched with bare hands or fouled gloves, they can be cleaned with Isopropyl Alcohol. Failure to clean lamps can lead to shortened lamp life.



Frequency

UV lamps must be replaced after 12,000 hours of continual use (manufacturer's suggested useful lamp life rating) or when a lamp does not light. If equipped with the optional HMY Standard or HMI Pro Series controls, a low UV intensity sensor reading may be indicative of low lamp output. See Troubleshooting Section 3.3.

UV-C Lamp Installation Parts and Required Equipment

- UV Lamp(s) (Provided by RK2 for Initial Installation Only)
- Adjustable Wrenches
- Cotton or silicone gloves
- Personal Safety Equipment
- Wire Cutters
- Isopropyl Alcohol rated gloves
- Isopropyl Alcohol

3.2.4.1 Lamp Installation Procedure

IMPORTANT	Mandatory Vessel Leak Test MUST be performed prior to installing UV Lamps! See Section 2, Installation and Commissioning.
NOTE	Always use clean cotton or silicone gloves when handling lamps. Oils and acids from skin can contaminate the lamp bulb and may significantly shorten lamp life.

- 1) If a UV intensity sensor is present, ensure that the lamp Teflon rings are not in the field of view of the sensor. Either slide the rings away from the center of the lamp or remove them by snipping them with wire cutters. A Teflon ring in the sensor path may contribute to false low UV Intensity readings.

- 2) Holding the UV lamp with 2 hands, gently slide the lamp into the sleeve while ensuring that no side load is placed on the lamp, see Figure 3-12: Lamp Sliding in using two hands, with gloves. The electrical connection pins will be protruding from the reactor.

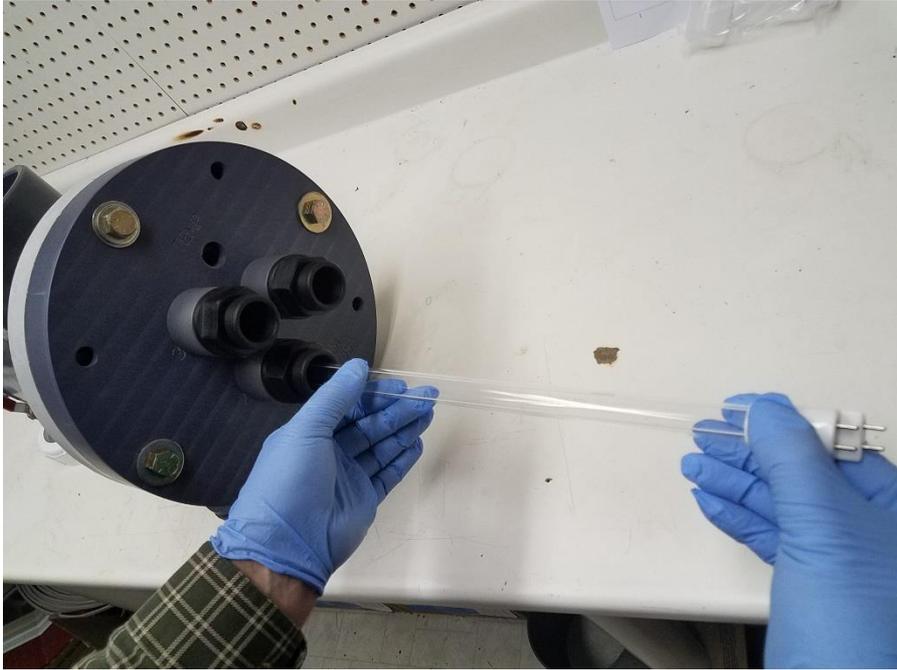


Figure 3-12: Lamp Sliding in using two hands, with gloves

- 3) Ensure that the lamp cable is crimped into location with the crimp sleeve in the lamp cable crimp sleeve. Ensure that the sealing o-ring is in place. See Figure 3-13: Cable Crimp, Crimp Sleeve and O-Ring in Place.

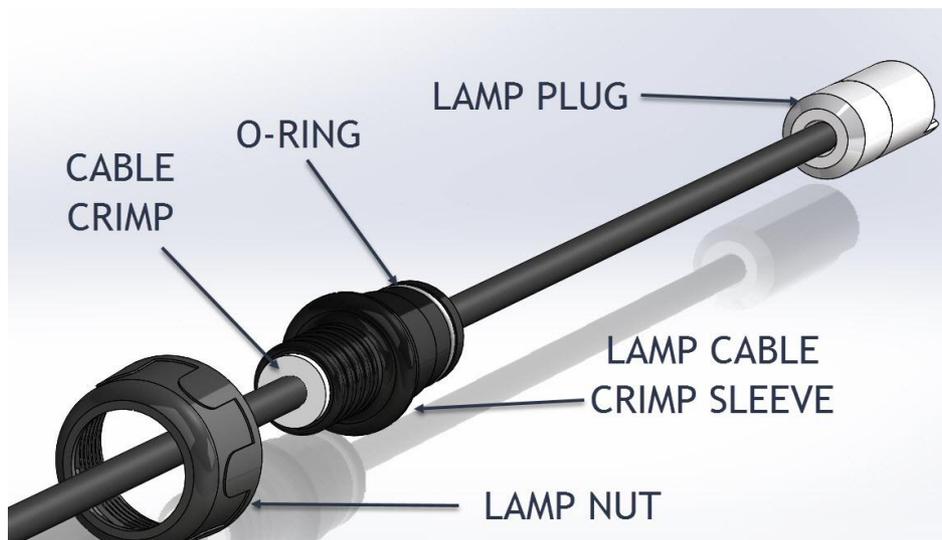


Figure 3-13: Cable Crimp, Crimp Sleeve and O-Ring in Place

- 4) With six inches of the UV lamp protruding from the sleeve, attach the lamp cable 4-Pin Connector on to the four pins on the ceramic lamp base.
- 5) Rotate the lamp so that the lamp amalgam spots (not applicable to HO series lamps) face downward. The spots are silver or gold in color and are located inside the lamp quartz.
- 6) Slide the remainder of the lamp with cable through the Sleeve Nut and into the Quartz Sleeve. With the lamp now inside the quartz sleeve, gently continue to push the lamp (with connected lamp cable) into the quartz sleeve until the crimp sleeve is seated in the Sleeve Nut. This will position the lamp properly inside the UV treatment system ensuring maximum disinfection performance, and will also prevent damage to the vessel endplate and its corresponding components. See Figure 3-14: Cable Crimp Sleeve in Sleeve Nut.

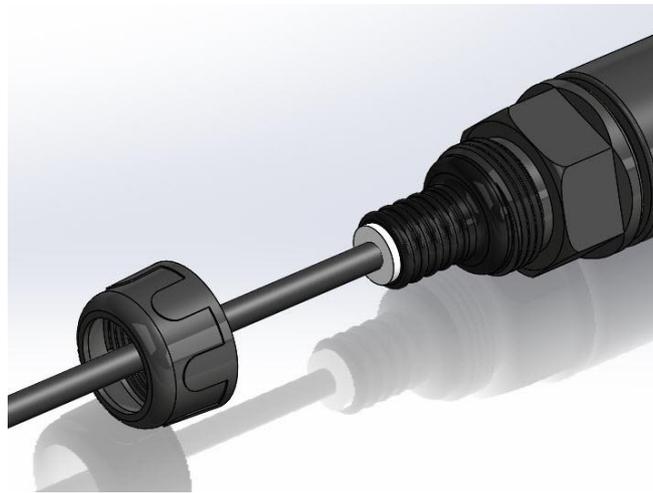


Figure 3-14: Cable Crimp Sleeve in Sleeve Nut

Note: If the crimp ring is missing from the crimp sleeve or loose, replace and match inner cable length with a known good lamp, or contact RK2 for the proper length.

IMPORTANT

Leaving a lamp plug connection within the bulkhead zone components may cause damage to your UV treatment system!

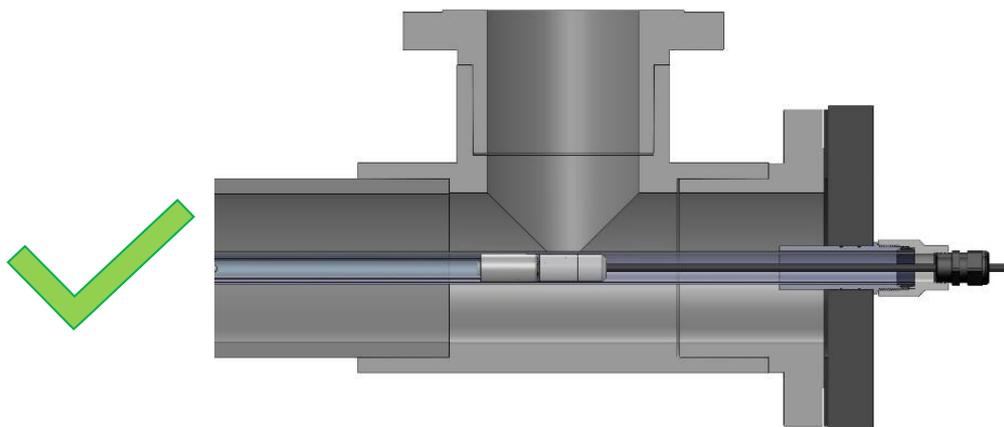


Figure 3-15: Proper Lamp Position

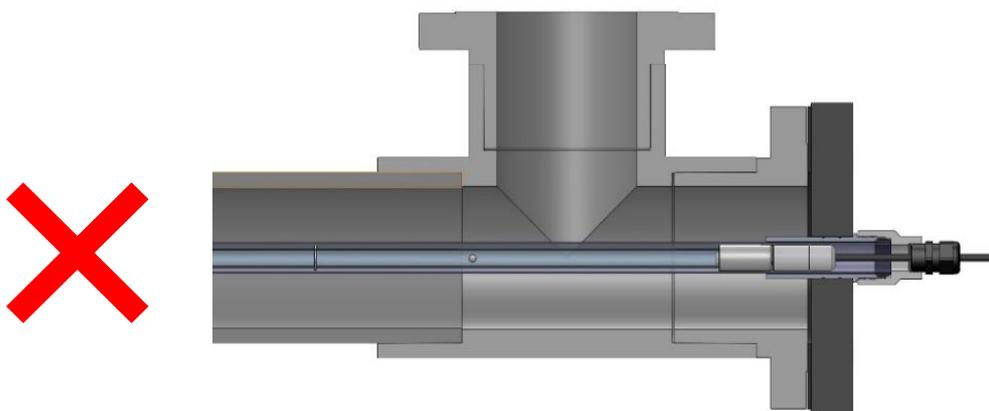


Figure 3-16: Improper Lamp Position

- 7) With the UV lamp in its correct position inside the quartz sleeve, thread the Lamp Nut onto the Sleeve Nut and tighten to 3-5lb/ft. Ensure that the lamp crimp sleeve does not rotate; it is important to keep the amalgam spots facing downward to ensure maximum lamp life.

3.2.4.2 Lamp Removal Procedure

- 1) Using the External ON/OFF Switch, isolate the UV system from its electrical source. This may require unplugging, or the use of a switch panel.
- 2) Use a Lockout/Tagout procedure to ensure the UV system cannot be energized accidentally.
- 3) Locate the Lamp and Sleeve Nuts.
- 4) Loosen the Lamp Nut. See Figure 3-17: Loosen Lamp Nut.

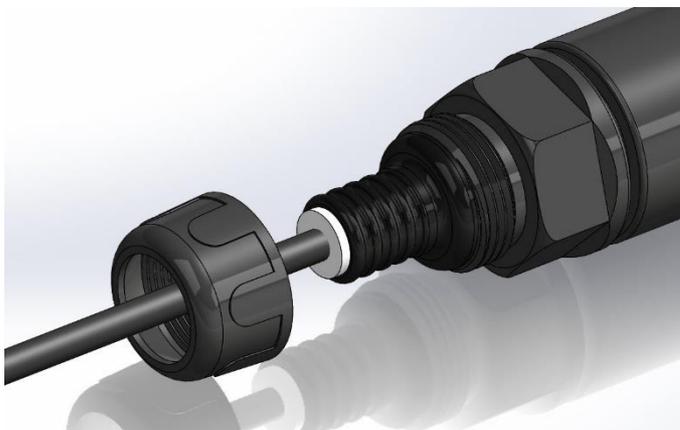


Figure 3-17: Loosen Lamp Nut

- 5) Slide the lamp cable, Lamp Nut, Lamp Plug and Lamp out of the vessel until approximately 4" to 12" of the lamp is exposed. Disconnect the lamp plug from the lamp by grasping the lamp end and plug firmly and pulling apart. Care must be taken not to damage the map, plug, and sleeve. See Figure 3-18: Unplugging the Lamp.



Figure 3-18: Unplugging the Lamp

- 6) **Note:** When disconnecting, or connecting, UV lamps mounted vertically use caution. Avoid dropping lamps into, and breaking, the quartz sleeve dome.
- 7) With the lamp disconnected from the 4-Pin Connector, carefully slide the lamp out of the quartz sleeve and place in a safe location to avoid breakage. Figure 3-19: Protective Paper, Anti-Rolling Device



Figure 3-19: Protective Paper, Anti-Rolling Device

- 8) Inspect the lamp pins for:
 - Evidence of overheating i.e. scorching
 - Moisture, i.e. fog or droplets
 - Loose, displaced or bent pins
- 9) Inspect the UV lamp to see if:
 - UV lamp is burned out, i.e. broken or burned filaments, extremely black bulb
 - The quartz lamp bulb is discolored
 - Replace lamp if the pins or lamp have been damaged.

3.2.5 Cleaning of Quartz Sleeves and Sensors

WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.
WARNING	General Risk dues to caustic and acidic cleaning agent. Always wear your Personal Protective gear as described in the product related MSDS sheets.



Cleaning in General

Fouling of quartz sleeves and sensor windows will occur in most UV treatment systems over a period of time. As mentioned elsewhere within this document, the cleaning schedule required can vary with each installation and application. It is recommended that a 6-month cleaning cycle be initiated at first, then subsequently lengthen or shorten the interval based on experience with your Pro-Tect™ system, in your application.

Organic and inorganic particulate will eventually become affixed to the surface of the quartz sleeves and sensor windows thereby reducing their ability to transmit UV-C light. Even visually clear sleeves may block the very short wavelength UV-C light. Fouled sleeves reduce the disinfection ability of your UV system. If in doubt, clean your sleeves.

Water quality changes (lower UVT), or aged lamps (reduced UV-C output) can also reduce system treatment capabilities.

Please be aware that such a decrease also may be caused by ageing of the UV lamps or changes in the water quality (UV transmission). Repeat of visual inspections of the UV Sensor or of some example quartz sleeves will help to determine the necessary cleaning intervals needed. The removal of this build-up (calcium, etc.) can be carried out with a cleaning pump. A cleaning agent based upon phosphoric acid like citric acid or commercially available cleaners such as Lime-A-Way or CLR may be used. Materials within the vessel chamber are highly resistant against these chemicals.

3.2.5.1 Manual Quartz Sleeve Cleaning

Manual Quartz Sleeve Required Parts and Equipment

- Quartz Sleeves
- Caustic and acidic rated gloves
- Cleaning Agent (dish detergent, soporific or muriatic acid)
- Acid-Proof Bucket
- Clean Cloth
- Acid-Proof Drop Cloth
- Clean Cotton or Silicone Gloves
- Freshwater
- MSDS Sheet
- Personal Protective Equipment

FIRST AID MEASURES

General Risk dues to caustic cleaning agent. Always wear your Personal Protective gear as described in the product related MSDS sheets.

In case of skin exposure to cleaning agent, remove by washing with soap and water immediately.

In case of eye exposure to cleaning agent, wash eyes for several minutes with water and contact a physician immediately. In case of ingestion of cleaning agent contact physician immediately.

For typical applications, it is recommended that the Quartz Sleeve(s) be removed, inspected and cleaned every 6 months, however the treated water at each site may be significantly different with regards to sleeve fouling potential. If your water quality is relatively poor, more frequent cleaning may be required. If your water is of very high quality, an annual cleaning cycle may be appropriate. Talk to your RK2/Pro-Tect™ support team to determine the best sleeve maintenance cycle for your application.

Manual Quartz Sleeve Cleaning Procedure

- 1) Inspect quartz sleeve and clean as needed with a soft, clean cloth and mild dish detergent.
- 2) While wearing your product appropriate Personal Protective Equipment, use muriatic or soporific acid or Lime-A-Way®¹ to dissolve/clean fouling such as calcium deposits.
- 3) For more engrained fouling, soak the lamp sleeves in the mild acidic solution to loosen the build-up. Note: Keep the interior of the lamp sleeve clean and dry. Moisture can cause deposits to form when the lamps are turned on.
- 4) Rinse quartz sleeve thoroughly with clean freshwater.
- 5) See Section 3.2.2 Quartz Sleeve Installation Procedure for quartz sleeve installation. Use a mild acidic solution and a lint-free cloth to wipe down the outside of the lamp sleeves to remove all solid particles.
- 6) Rinse the outside of the sleeve thoroughly with clean water. Keep the inside of the sleeve clean and dry. Moisture can cause deposits to form when the lamps are turned on.

¹ Lime-A-Way is a registered trademark of Ecolab.

3.2.5.2 Manual UV Intensity Sensor Cleaning

Clean the UVI sensor when:

- Scheduled as part of maintenance
- When a UV Intensity alarm occurs

Prior to cleaning the sensor:

- Shut off the system power and use Lockout/Tagout devices and procedures as necessary.
- Hydraulically isolate the UV Vessel from the plant piping system, and remove the water pressure in the UV vessel and drain.
- Lockout/Tagout valves, pumps, and remote-control devices as required.

Manual UV Intensity Sensor Cleaning Required Equipment

- Isopropyl Alcohol
- Cotton Swabs
- Clean Lint Free Cloth
- Clean Cotton or Silicone Gloves
- Fresh water
- Teflon Tape
- MSDS Sheet
- Personal Protective Equipment
- Refer to Section 3.4 for replacement part numbers.

UV Intensity Sensor Removal Procedure:

- 1) Disconnect the UV Intensity Sensor Plug from the PSE.
- 2) Remove the UV Intensity sensor from the UV Vessel.
- 3) Put on clean cotton gloves.
- 4) Loosen the UV Intensity sensor. Take care not to twist the cable.
- 5) Pull the UV Intensity sensor out of the sensor port.

UV Intensity Sensor Window Cleaning

- 1) Use a clean swab and isopropyl alcohol to wipe the sensor window.
- 2) Dry the sensor window with a lint-free cloth or a new dry cotton swab.
- 3) Inspect the sensor cable, sensor and sensor window for damage or cracks. Look for moisture inside the sensor. Replace if required.

3.2.6 UV Sleeve and Sensor Cleaning, In-Vessel Procedure

DANGER	Make sure that the UV Vessel is Depressurized and Drained prior to undertaking this work! Failure to do so could result in serious injury or even death due to ejected quartz sleeves!
DANGER	Make sure that the Lockout/Tagout procedure is undertaken for valving and pumps to prevent inadvertent pressurization of unit.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.
WARNING	General Risk due to caustic and acidic cleaning agent. Always wear your Personal Protective gear as described in the product related MSDS sheets.



UV Sleeve and Sensor Cleaning, In-Vessel, Parts and Equipment Required

- Cleaning Agents:
- Dish detergent
- Acid cleaning agent based upon phosphoric acid (>25%) or commercially available cleaners such as: Lime-A-Way or CLR in a sufficient quantity to fill the vessel
- Acid-Resistant Transfer Pump
- Acid-Resistant Hose (used to transfer the cleaner from the container to the UV vessel)
- Acid Resistant Fittings to connect to vessel
- Acid-Resistant Bucket
- Acid-Resistant Drop Cloth
- Clean Cotton and Acid-Resistant Gloves
- Rinse water
- MSDS Sheet
- Personal Protective Equipment

IMPORTANT

Ensure all sleeves and sensors are installed and that the UV system has been leak tested as per this manual.

UV Sleeve and Sensor Cleaning, In-Vessel Procedure

- 1) Isolate the system electrical power, and use appropriate Lockout/Tagout procedures.
- 2) Isolate the UV vessel from the system piping using the required isolation valves and drain the vessel completely. Use appropriate Lockout/Tagout procedures for the valving and pumps.
- 3) Ensure that the work area is clean, and lay acid resistant drop cloths under the unit to be cleaned.
- 4) Put on all PPE required for safety.
- 5) Locate a port at a high point of the vessel (Air Bleed for vertical systems, Top Auxiliary NPT port, etc.). Connect a hose and route this back to the storage device to be used for spent cleaning solution.



Figure 3-20: Upper Auxiliary Port, and Lower Drain Port

- 6) Connect the acid transfer pump piping to the vessel's water drain valve. Place an acid resistant valve between the acid transfer pump and the UV Vessel. This valve will assist in draining of the system of water and cleaning fluid as required, and will minimize spills.
- 7) Transfer cleaning solution via the transfer pump into the unit until a small amount of overflow comes out of the upper port and return line. Turn off Acid Pump once cleaning solution is seen to exit the overflow (high point) drain hose. Close inlet valve between acid pump and UV Vessel.
- 8) Allow the acid to remain in the vessel for 30 minutes.
- 9) Disconnect the acid transfer pump's vessel feed hose from the transfer pump and use this hose to drain the acid from the UV vessel through the vessel's drain valve and into the acid resistant storage container.
- 10) Once the acid has been drained from the UV vessel and the cleaning procedure completed, rinse the vessel chamber thoroughly to avoid process water from coming in contact with the cleaning agent. The rinse water may be taken from a water tap with the help of a hose and filled and drained through the unit's drain valve port and auxiliary port.
- 11) Neutralize cleaning to be discarded with bases such as sodium hydroxide solution, sodium carbonate solution. Ensure you are following all relevant accident prevention rules and local regulations.

3.2.7 Cooling Fan Filter Mat Replacement/Cleaning

For the purpose of keeping the electronics within the Power Supply Enclosure clean, cool, and dust free, the PSE cooling fan is equipped with a Filter Mat. Depending on the environment, the rate at which the filter becomes fouled can vary. The recommended interval of inspection is monthly, and annually it is recommended that the filter be replaced. Adjust as required, based on the environment that the equipment is in.

A clogged Filter Mat reduces air circulation in and out of the enclosure, potentially allowing electrical hardware to over-heat.

A damaged or removed Filter Mat can allow unfiltered air to enter the PSE and thereby allow dust and dirt to enter sensitive electronics. This dust and dirt can cause overheating and short circuiting. If damaged, replace the Filter Mat.

Cooling Fan Filter Mat Replacement/Cleaning, Parts and Equipment Required

- Slotted Screwdriver
- Spare Filter Matt PN U156001
- Compressed Air Supply
- Dish Detergent
- Safety Glasses

Cooling Fan Filter Mat Replacement/Cleaning, Procedure

Remove Cooling Fan cover to access Filter Mat, See Figure 3-21.



Figure 3-21: Filter Mat Location

- 1) Remove Cooling Fan Filter Mat
- 2) Remove dust from mat by blowing it out with compressed air or washing it out with soap and water. See Figure 3-22.



Figure 3-22: Show blowing matt out with air PIC

- 3) Dry mat completely before reinstallation or use new replacement filter mat.
- 4) Place Cooling Fan Filter Mat into fan.
- 5) Replace fan cover.

3.3 Troubleshooting Guide

A trouble shooting guide is provided in Table 3-2 below.

Table 3-2: Trouble Shooting Guide

Trouble Condition	Check, Inspect	Solution
UV system will not function with the PSE ON/OFF Switch in the "On" position	Input Power Availability; External Fuse/Breaker Panel Wiring Temperature Switch Protection Energized: No Flow Situation (Hot Water) No Water in Vessel Air Trapped in Vessel Cable Plug is Interrupted/Defective Input Voltage is lower than the Factory Set Threshold (PLC models) Vessel Lamp Cap is not installed, or switch or cabling is defective (Optional) Remote Control not enabling startup (Optional) Remote Jumper removed	Check Power Connections and Availability Inspect Vessel Remedy no flow/ no water situation Ensure all entrapped air is removed Test Switch (Qualified Personnel Only) Check Input Power Quality Check Lamp Cap and Switch, Test if required (Qualified Personnel Only) Check Remote Connections Ensure Jumper is in place

(Continued)

Table 3-2: Trouble Shooting Guide, Continued

Trouble Condition	Check, Inspect	Solution
UV Lamp Does Not Light or Indicator LED on PSE DIM.	Defective UV Lamp Water entry into quartz sleeve Contamination (greases, oils, water, etc.) Defective Ballast Non-OEM lamp Poor Power Quality Overheating due to inoperable cooling fan or plugged filter or broken filter (dirt in ballast) Faulty Lamp Plug or cabling Defective Indicator or dirty indicator connection	Replace Lamp Fix source of leak Remove source of contamination Replace Ballast Replace non-OEM lamps with OEM lamps Check incoming Power Quality Check and if required, Remedy PSE High Temperature Issues. Replace/Repair Lamp Cables or Plugs (Qualified Personnel Only) Repair LED Indicator or Indicator Connection (Qualified Personnel Only)
UV Intensity too low (UV Intensity Sensor required to determine)	Lamp past EOLL (End Of Lamp Life) Fouled Quartz Sleeves Reduced water UVT Faulty UV Sensor Defective Lamp or Ballast	Replace Lamp Clean Sleeves Check Water UVT Replace Sensor Identify burned out lamps or ballasts, replace as required

(Continued)

Table 3-2: Trouble Shooting Guide, Continued

Trouble Condition	Check, Inspect	Solution
Enclosure Overheating	PSE Air Filter Plugged Cooling Fan non-operational Thermal switch failure Ambient Air Temperature over 145° F Excessive Sun Load on PSE	Clean Air Filter Check power to fan, if adequate, replace Fan Test Thermal Switch. Replace if required Cool down Ambient Air or enclose PSE and provide cooler air Shade PSE
Indicator Light on PSE OFF	Defective Ballast LED or LED connection failure	Replace Ballast If using non-OEM lamps, replace with OEM lamps Test Indicator LED's and Connections. Replace/Repair as required.
Water leaking from Sleeve Nut Zone	Loose Sleeve Nut Incorrect or damaged O-Ring or Sleeve Seal Cracked or Broken Quartz Sleeve Lamp left out of unit (Open Lamp Port) in hot humid air with very cold process water around sleeves	Properly tighten Sleeve Nut Replace O-ring or seal Replace Sleeve. Check other sleeves for possible damage Close ports when lamp not installed Dry sleeve if condensation is accumulated in sleeve

3.4 Replacement Parts

Pro-Tect™ UV treatment systems are available in two port formats, 'U' and 'L'. Each of these flow formats have 2 types of lamps available. The lower powered lamps are the LPHO version, which are sometimes described as 'HO' lamps, and there are also the higher powered amalgam lamps. Both lamp types come in various lengths and power ratings. LPHO lamps use 25mm diameter quartz sleeves, while Amalgam lamps use 28mm diameter quartz sleeves.

Pro-Tect systems are also available with various port types, sizes, and control options. As every unit is somewhat unique, it is important that when contacting RK2 regarding replacement parts, you have ready the unit's:

Serial Number

Model Number

These can be found on the system labels which are affixed to the Power Supply Enclosure and the UV Vessel.

3.4.1 Common Part Numbers and Recommended Spares Quantities

Table 3-3: Replacement Part Numbers and Recommended Quantity on Hand

Part Description	Part Number	Recommended Spares Quantity on Hand
Temperature Sensor	U158001	1
Temp. Sensor Ext. Cable	U154001-010	As required
Sleeve Nut – 25mm (LPHO)	U120000	2 of Pertinent Size
Sleeve Nut – 28mm (Amalgam)	U120001	
Quartz Sleeve O-Ring – 25mm	U003003-318	= Number of Vessel Lamps
Quartz Sleeve Gasket – 28mm	U003006	
UV Lamp - LPHO 80w	U240000-H80W739A	= Number of System Lamps
UV Lamp - LPHO 150w	U240000-H150W1450A	
UV Lamp - Amalgam 130w	U240001-A130W767A	
UV Lamp - Amalgam 320w	U240001-A320W1483A	
Quartz Sleeve	Table 3-5: HLH AND ALH Series Quartz Sleeve & UV Lamp Matrix and Table 3-6: HUH AND AUH Series Quartz Sleeve & UV Lamp Matrix	2
Ballast – LPHO 80	U150000-120, U150000-230	2
Ballast – LPHO 150w	U150001-120, U150001-230	
Ballast – Amalgam 130w	U150002-120, U150002-230	
Ballast – Amalgam 320w	U150003-120, U150003-230	

3.4.2 Lamp and Sleeve General Dimensions

Table 3-4: Lamp and Sleeve General Dimensions

Lamp PN	Sleeve PN	Max. Lamp Dia.	Quartz Dia.	Nominal Length in Inches	Nominal Length in mm	Arc Length in mm
U240000-H80W739A	-	18.7mm Nom.	15mm	33.2	843	739
U240000-H150W1450A	-	18.7mm Nom.	15mm	61.2	1554	1450
U240001-A130W767A	-	23.5mm Nom.	19mm	33.6	854	767
U240001-A320W1483A	-	23.5mm Nom.	19mm	61.6	1564	1483
-	U200000-25MM1181D	-	25mm	46.5	1181	NA
-	U200000-25MM1290D	-	25mm	50.8	1290	NA
-	U200000-25MM1397D	-	25mm	55.0	1397	NA
-	U200000-25MM1905D	-	25mm	75.0	1905	NA
-	U200000-28MM1181D	-	28mm	46.5	1181	NA
-	U200000-28MM1290D	-	28mm	50.8	1290	NA
-	U200000-28MM1397D	-	28mm	55.0	1397	NA
-	U200000-28MM1905D	-	28mm	75.0	1905	NA

3.4.3 HLH AND ALH Series Quartz Sleeve & UV Lamp Matrix

Table 3-5: HLH AND ALH Series Quartz Sleeve & UV Lamp Matrix

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
HLH4/LPHO	6"	2"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HLH4/LPHO	6"	3"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HLH4/LPHO	6"	4"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HLH6/LPHO	6"	2"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HLH6/LPHO	6"	3"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HLH6/LPHO	6"	4"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
ALH4 / Amalgam	6"	2"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
ALH4 / Amalgam	6"	3"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
ALH4 / Amalgam	6"	4"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
ALH4 / Amalgam	6"	6"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
ALH4 / Amalgam	8"	3"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
ALH4 / Amalgam	8"	4"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
ALH4 / Amalgam	8"	6"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
ALH4 / Amalgam	8"	8"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
ALH4 / Amalgam	10"	4"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
ALH4 / Amalgam	10"	6"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
ALH4 / Amalgam	10"	8"	55"	U200000-28MM1397D	130	-	U240001-A130W767A
ALH4 / Amalgam	10"	10"	55"	U200000-28MM1397D	130	-	U240001-A130W767A
ALH6 / Amalgam	6"	2"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	6"	3"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	6"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	6"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	8"	3"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	8"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	8"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
ALH6 / Amalgam	8"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	10"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	10"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	10"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	10"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	12"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	12"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	12"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	12"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	14"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	14"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	14"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	14"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
ALH6 / Amalgam	14"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	16"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	16"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	16"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	16"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	16"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	18"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	18"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	18"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	18"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	18"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	20"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	20"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
ALH6 / Amalgam	20"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	20"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	20"	20"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	24"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	24"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	24"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	24"	20"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
ALH6 / Amalgam	24"	24"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

3.4.4 HUH AND AUH Series Quartz Sleeve & UV Lamp Matrix

Table 3-6: HUH AND AUH Series Quartz Sleeve & UV Lamp Matrix

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
HUH4 / LPHO	6"	2"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HUH4 / LPHO	6"	3"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HUH4 / LPHO	6"	4"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HUH4 / LPHO	6"	6"	46.5"	U200000-25MM1181D	80	U240000-H80W739A	-
HUH4 / LPHO	8"	3"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	8"	4"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	8"	6"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	8"	8"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	10"	4"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	10"	6"	50.8"	U200000-25MM1290D	80	U240000-H80W739A	-
HUH4 / LPHO	10"	8"	55"	U200000-25MM1397D	80	U240000-H80W739A	-
HUH4 / LPHO	10"	10"	55"	U200000-25MM1397D	80	U240000-H80W739A	-

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
HUH6 / LPHO	6"	2"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	6"	3"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	6"	4"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	6"	6"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	8"	3"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	8"	4"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	8"	6"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	8"	8"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	10"	4"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	10"	6"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	10"	8"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
HUH6 / LPHO	10"	10"	75"	U200000-25MM1905D	150	U240000-H150W1450A	-
AUH4 / Amalgam	6"	2"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
AUH4 / Amalgam	6"	3"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
AUH4 / Amalgam	6"	4"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
AUH4 / Amalgam	6"	6"	46.5"	U200000-28MM1181D	130	-	U240001-A130W767A
AUH4 / Amalgam	8"	3"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	8"	4"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	8"	6"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	8"	8"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	10"	4"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	10"	6"	50.8"	U200000-28MM1290D	130	-	U240001-A130W767A
AUH4 / Amalgam	10"	8"	55"	U200000-28MM1397D	130	-	U240001-A130W767A
AUH4 / Amalgam	10"	10"	55"	U200000-28MM1397D	130	-	U240001-A130W767A
AUH6 / Amalgam	6"	2"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	6"	3"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
AUH6 / Amalgam	6"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	6"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	8"	3"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	8"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	8"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	8"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	10"	4"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	10"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	10"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	10"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	12"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	12"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	12"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
AUH6 / Amalgam	12"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	14"	6"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	14"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	14"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	14"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	14"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	16"	8"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	16"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	16"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	16"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	16"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	18"	10"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	18"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

Series	Vessel Dia.	Port Size	Quartz Sleeve Length	Quartz Sleeve Part number	UV Lamp Watts	UV Lamp LPHO Part Number	UV Lamp Amalgam Part Number
AUH6 / Amalgam	18"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	18"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	18"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	20"	12"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	20"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	20"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	20"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	20"	20"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	24"	14"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	24"	16"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	24"	18"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	24"	20"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A
AUH6 / Amalgam	24"	24"	75"	U200000-28MM1905D	320	-	U240001-A320W1483A

3.4.5 System Pressure Ratings

Table 3-7: System Pressure Ratings to 95 °F, 35 °C

System Pressure Ratings up to 95F or 35C Please talk to RK2 Engineering for temperatures higher than this.	
ALH Series	
UV Vessel Nominal Diameter in Inches	Maximum Pressure Rating in PSI
6	150
8	130
10	110
12	90
14	50
16	50
18	50
20	50
24	50
AUH Series	
UV Vessel Nominal Diameter in Inches	Maximum Pressure Rating
6	50
8	50
10	50
12	50

3.4.6 Service Centers And Product And Component Returns

Your retailer or distributor may not be an authorized service or repair center! If trouble develops, DO NOT take the unit back to your retail store. Instead, call RK2 Systems at 760-746-7400 to discuss the problem. Then, if necessary, we will issue you an RMA (Return Merchandise Authorization) number so you may return the unit to us for proper service. After being given an RMA number carefully pack the unit to avoid shipping damage. The return address will be provided to you when you receive your RMA number.

Please, Do Not Return Any Product or Part without an RMA Number!

3.4.7 Customer Feedback

We take your comments about our products very seriously. Please take a few moments to answer these questions and return this form with your product registration.

1. Thoughts on our product?

2. Was Packaging and Shipping Satisfactory? Yes No Other

3. Did you receive all of the parts and instructions with the unit? Yes No Description

4. Does this Product Manual satisfy your needs? Yes No Description

5. Are you satisfied with the product quality? Yes No Description

6. Are you satisfied with the product's performance? Yes No Description

7. Are you satisfied with the ease of Installation and Maintenance? Yes No Description

8. Would you recommend our products to someone else? Yes No Description

10. Where did you purchase the unit?

11. What is the Application?

12. Other Concerns or Comments

SERVICE NOTES:



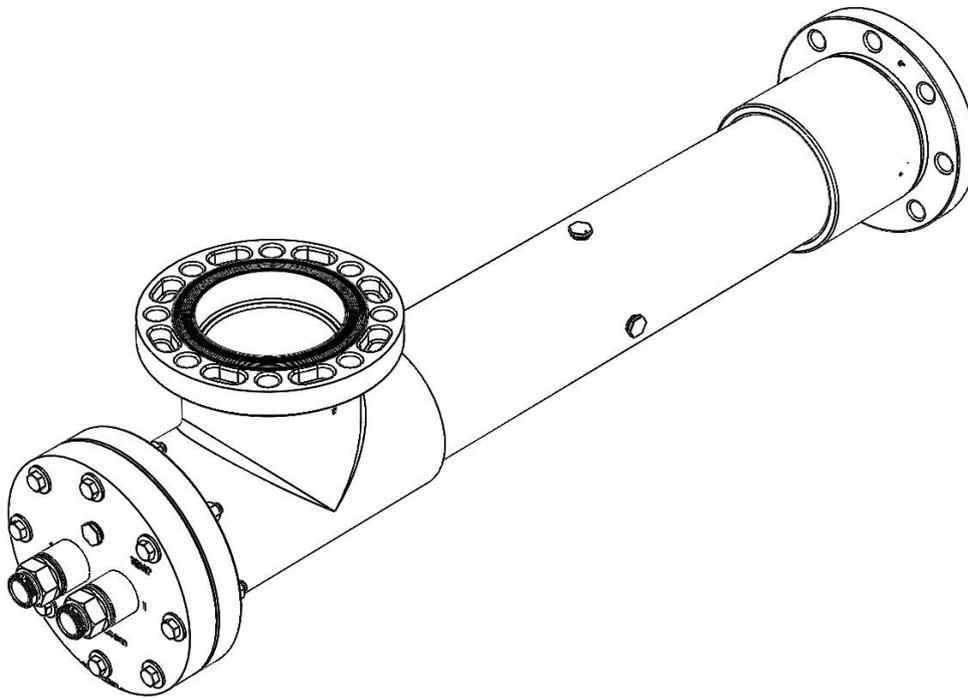
Pro-Tect™

HLH, HUH, ALH, and AUH UV Systems

HMI Standard and HMI Pro Series Controls

Section 4: HMI Standard and HMI Pro Series Controls
User Manual: UOM0003.4

Edition R3



READ THIS MANUAL PRIOR TO INSTALLING, SETTING UP, OPERATING, SERVICING, OR MAINTAINING THIS UV TREATMENT SYSTEM

SECTION 4: HMI STANDARD AND HMI PRO SERIES CONTROLS

SECTION 1: GENERAL INFORMATION, VESSEL AND POWER SYSTEM ENCLOSURE OVERVIEW

SECTION 2: SYSTEM INSTALLATION AND COMMISSIONING

SECTION 3: MAINTENANCE

SECTION 4: HMI STANDARD AND HMI PRO SERIES CONTROLS

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4.1 CONTROLS STARTUP AND OPERATION

4.1.1 Operation

Operation of the UV system may only be carried out by authorized and trained personnel. The personnel responsible for the operation of this system must read and understand this manual in its entirety and strictly comply with all relevant rules for accident prevention and local health and safety regulations.

Your UV Treatment System is controlled via a HMI (Human Machine Interface) screen located on the front of the power supply enclosure.

4.1.2 Power Supply Enclosure Operating Modes

- 1) Operation of the control system is initiated by using the external ON/OFF Switch located on the outside of the UV system Power Supply Enclosure. With the switch turned “On” the HMI/PLC controls will function, and power will be supplied to the lamp ballasts, lamps, and sensors. See Figure 4-1: External PSE ON/OFF Switch in the OFF position.
- 2) With the Main Power ON/OFF Switch in the “OFF” position, power is cut-off from the entire UV system.
- 3) When the HMI screen is illuminated this indicates that the Power Supply Enclosure is energized.
- 4) Energizing of the PSE occurs when the remote breaker/Fuse panel is turned on, and when the PSE panel’s ON/OFF Switch (B) is switched to the “On” position.



Figure 4-1: External PSE ON/OFF Switch in the OFF position

4.2 CONTROLS HMI INTERFACE DESCRIPTION



Figure 4-2: HMI Home Screen

Pro-Tect HMI Standard and HMI Pro Series controls have many standard features that will enable you to simply and quickly monitor and control your UV treatment system.

The following is a list of the HMI/PLC Control System screens and capabilities:

Incoming AC Voltage Monitor (Standard AND Pro Series)

Incoming AC voltage used to power the UV Treatment system and the system controls is monitored to ensure values are within allowed maximums and minimums. If the incoming voltage value exceeds the acceptable range, an alarm will be generated and an alarm will appear on the HMI screen. The acceptable voltage range is between 95 to 140 VAC for 120V rated systems, or 210 to 270 VAC for 220v and 230v rated systems.

Total Operation Hour Meter (Standard AND Pro Series)

System operational hours are recorded. Elapsed Total System Time is counted when the unit is powered and in operation. The hour meter may be reset by the user as required by using the appropriate setup screen. The hour meter will roll over at 65536 hours if not reset prior to reaching this number.

Lamp Status & Lamp Life Monitor (Standard AND Pro Series)

The PLC system constantly monitors the function of each individual lamp. If during operation a lamp is determined to be non-functioning, an alarm will be generated, and the alarm screen will be displayed on the HMI screen. The alarm screen will also indicate which lamp(s) is not functioning. The alarm may be reset but will again be initiated in 24 hours, and every 24 hours after that, until the lamp is replaced, and the individual lamp reset procedure is completed.

The lamp hours for each individual lamp in the UV system are stored in the EEPROM memory. This type of memory prevents data loss in the event of power failure, or power removal. As with the Total Operation Hour Meter, the lamp's hour meters will roll over at 65536 if not reset properly when lamp life duration has expired or when the lamps are changed. It is HIGHLY recommended that lamp hour meters be reset when lamps are replaced.

Pro-Tect lamps have a useful lamp life of 12,000 hours. Beyond this point the lamps will still function, however UV-C output will have dropped to the point that meeting your treatment target cannot be ensured. To guarantee that your treatment application is within the design parameters, an alarm will sound if a lamp exceeds the rated lifetime. This alarm may also be reset, but will recur every 72 hours or until the lamp hour meter is reset when the lamp is replaced.

Power Supply Enclosure Temperature Monitor (Standard AND Pro Series)

All Pro-Tect systems incorporate a temperature sensor mounted inside the unit's power supply enclosure. This sensor helps the operator to ensure that the PSE's internal temperature does not exceed operational requirements. Overheating of components within the PSE can reduce lifetime, or in extreme cases, cause component failure. In the event that the units power supply enclosures internal temperature exceeds 145 degrees F, the systems PLC controller will shut the lamp field off and initiate an alarm. The unit's controller must be powered off to reset the system and to restore lamp field operation.

UV Intensity Sensor Monitor (Pro Series Only)

This option includes a UV intensity sensor, and UV Intensity display and calibration screens on the HMI. UV sensors are placed to see the Number 1 lamp position. The UV sensor is then calibrated to a 100% 'As new' value with:

- A new lamp aged to 100 hours
- A clean sleeve
- Water quality at the UVT value as used in system sizing for the specified installation.

The calibration screen will subsequently display a value representing a percentage of the maximum UV Intensity observed during calibration. A button on the screen will allow setting of the 100% calibration value when in the calibration screen.

Remote On/Off (Pro Series Only)

A discrete (dry) input circuit is provided to allow for either “Remote on” or Remote/Local” control of the UV Treatment System. Located inside the main control enclosure there are two terminal blocks (brown). For remote on/off capability these terminals would be wired to an external dry switch capable of handling 120-volt AC @ 1-amp.

Note: to use this option the jumper must be removed and replaced by the users own external dry switch.

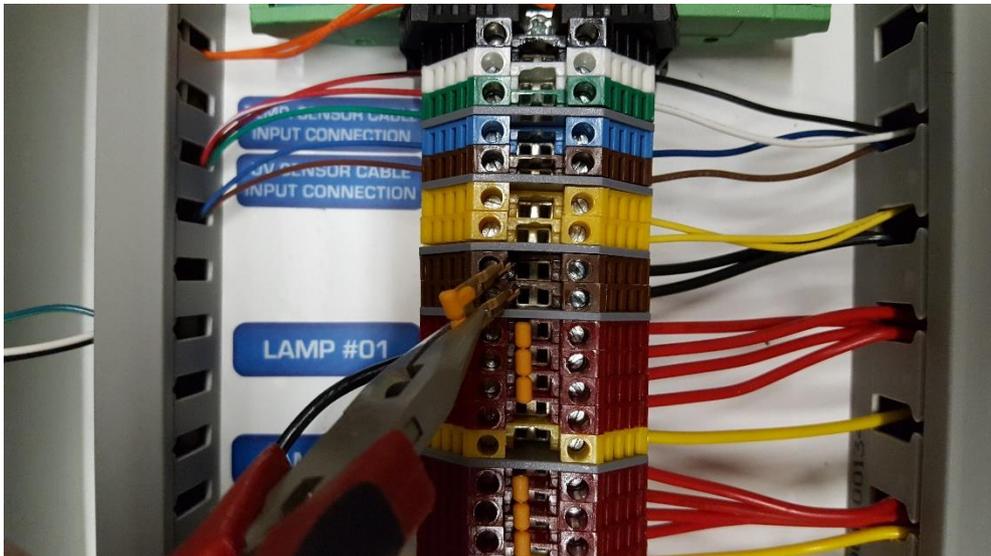


Figure 4-3: Removing Jumper for Remote System Operation

4.3 DISPLAY AND FUNCTION

4.3.1 HMI/PLC Initialization



Figure 4-4: System Startup Screen

This screen is displayed during system startup.

4.3.2 HMI Main Screen



Figure 4-5: HMI Main Screen

The main screen will appear after initialization has completed. The Total System Hours, Input Voltage, Vessel Water Temperatures and UV Intensity value (Pro Series Only) are displayed here. In addition, the Lamp's Status indicators are present on this screen.

Lamp Status Color Coding:

- Green** - Lamp is on
- Yellow** - Lamp is out, the alarm has been acknowledged
- Red** - Lamp is out, the alarm has not been acknowledged
- Blue** - Lamp has reached its 12,000 hour end of lamp life (EOLL). Status will be Blue before and after alarm acknowledgement.

Note: The 'Setup' and 'Status' screen change pushbuttons take you to their respective screens.

4.3.3 Setup Screen

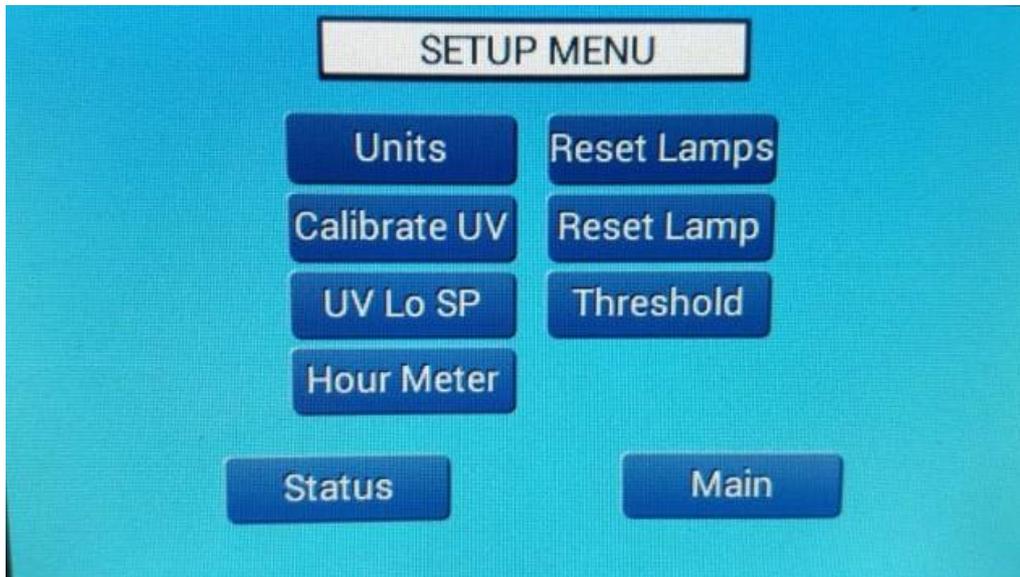


Figure 4-6: Setup Screen

This screen is used to navigate to control screens using the screen change pushbuttons. Setup items have user settable parameters.

Units

Select between Imperial and Metric Units

Calibrate (the) UV (Intensity Sensor), (Pro Series Only)

Calibrate the UV Intensity Sensor Value

UV Lo SP (Pro Series Only)

UV Intensity Low Alarm setpoint. A UV reading below this number will trigger an Alarm

Hour Meter

Reset the System Master Hour counter

Reset Lamps

Used to reset ALL the lamp hour life counters at the same time

Reset Lamp

Allows a user to reset individual lamp hour counters

Threshold

This adjustable value sets the point at which a lamp will indicate on/off based on lamp current draw

4.3.4 Setting the Units

Press 'Enter' to select either **Metric** or **Imperial** Units.

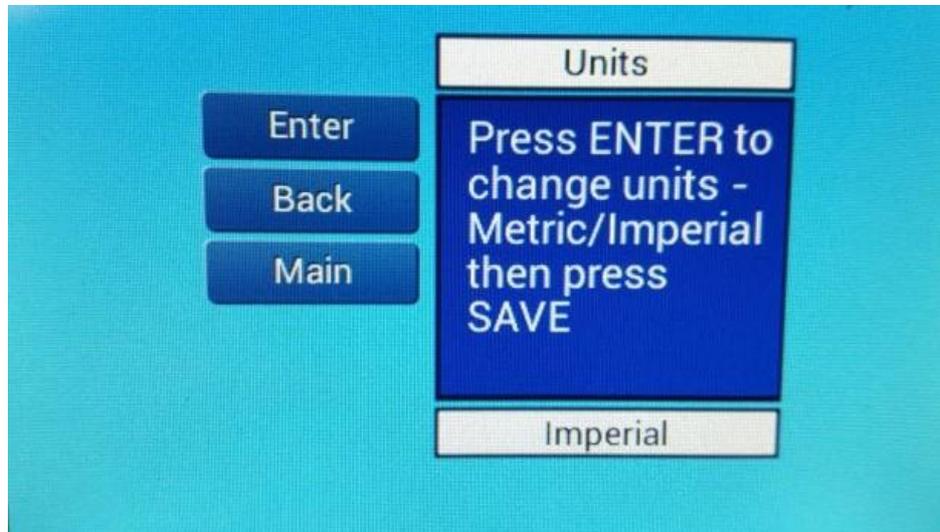


Figure 4-7: Metric and Imperial Units Screen

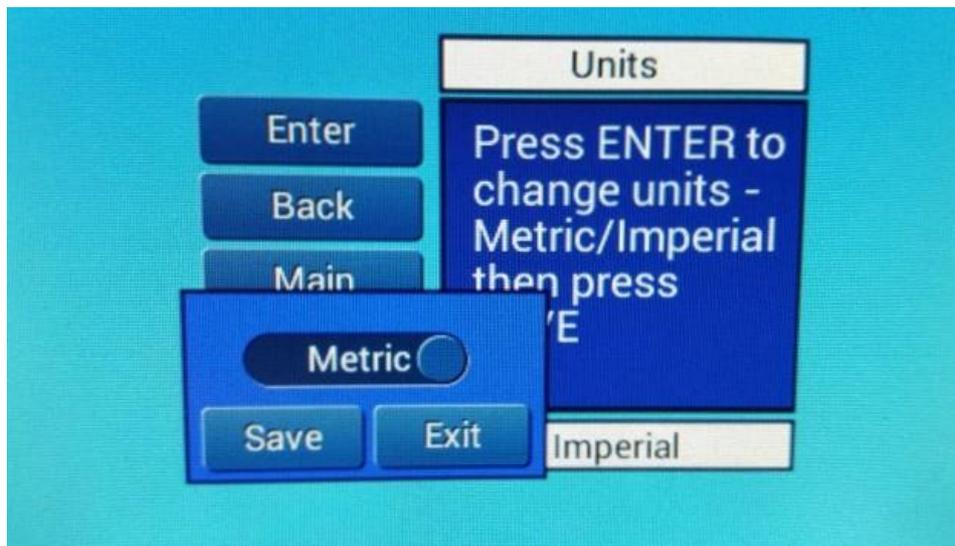


Figure 4-8: Metric and Imperial Units - Saving Selection Screen

After pressing **Enter**, use the slider to select **Metric** or **Imperial** when the pop-up menu appears. Press **Save** to complete the selected unit type or **Exit** to leave without updating.

4.3.5 UV Intensity Sensor Calibration

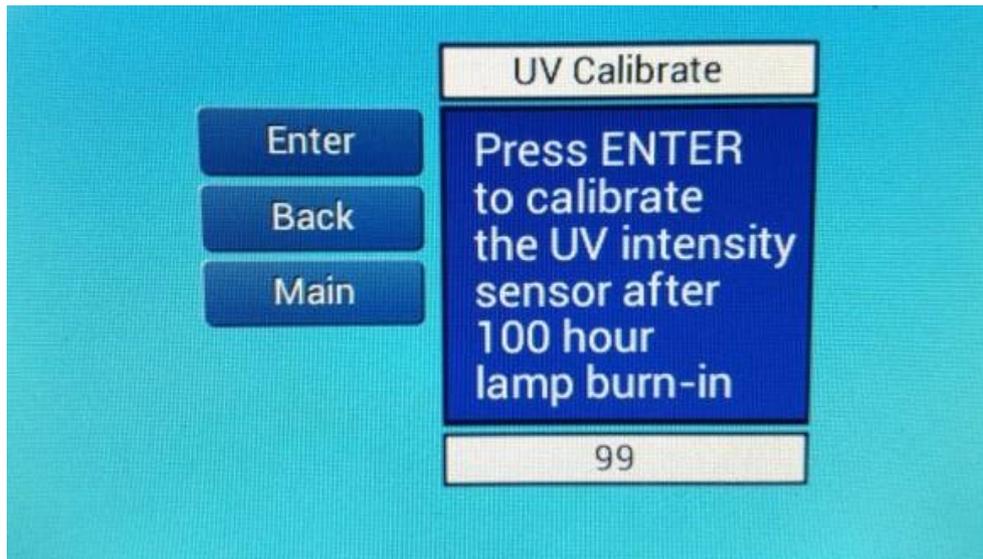


Figure 4-9: UV Intensity Sensor Calibration Screen

The UV Intensity Sensor display value should be calibrated:

- After ALL new Number 1 lamps have been operated for 100 hours
- With ALL lamp sleeves in clean as new condition
- With a clean sensor window
- With the system filled and operating with the water quality (% UVT) of the same as was specified at the time of order.

The operator should confirm that the PLC is receiving a valid signal from the UV Intensity Sensor prior to calibrating. The sensor input reading can be viewed on the 'UV Status Screen'.

Note: It is very important that you calibrate the UV Intensity Sensor ONLY when the above conditions are met. If calibrating with aged lamps, poor water quality, fouled lamp sleeve(s) or a fouled sensor window or any combination of these will give a false positive value of UV intensity. This false positive value will not allow you to detect true issues that can affect disinfection performance such as:

- Low lamp output (aged lamps, defective lamps, non-functioning lamps)
- Fouled lamp sleeves
- Fouled sensor windows
- Poor water quality; i.e. failed upstream filtration

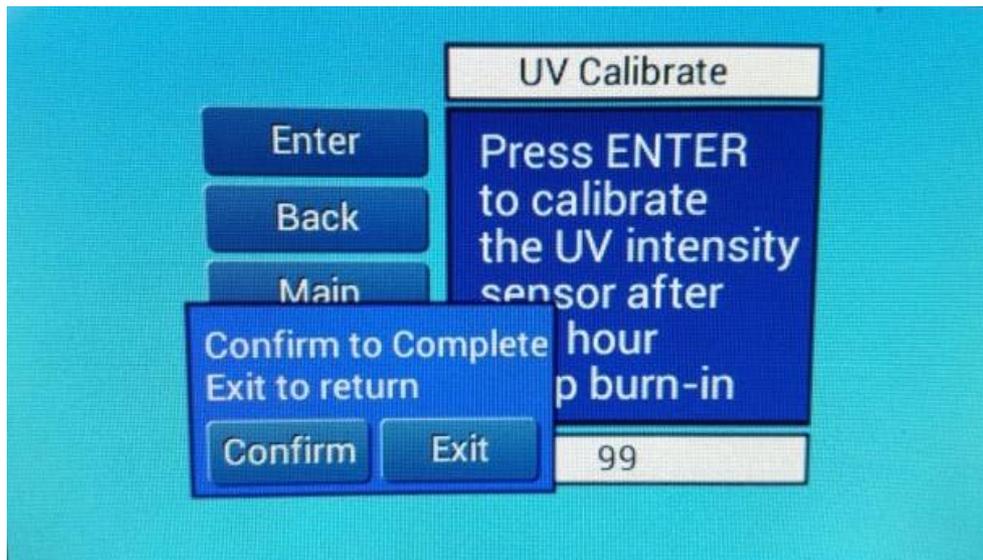
UV Intensity Sensor Calibration - Cont.

Figure 4-10: UV Intensity Sensor Calibration – Confirming Calibration Screen

Press **Confirm** to complete the process, or **Exit** to abort. The sensor is now calibrated to 100%.

4.3.6 Setting the Low Intensity Setpoint Value

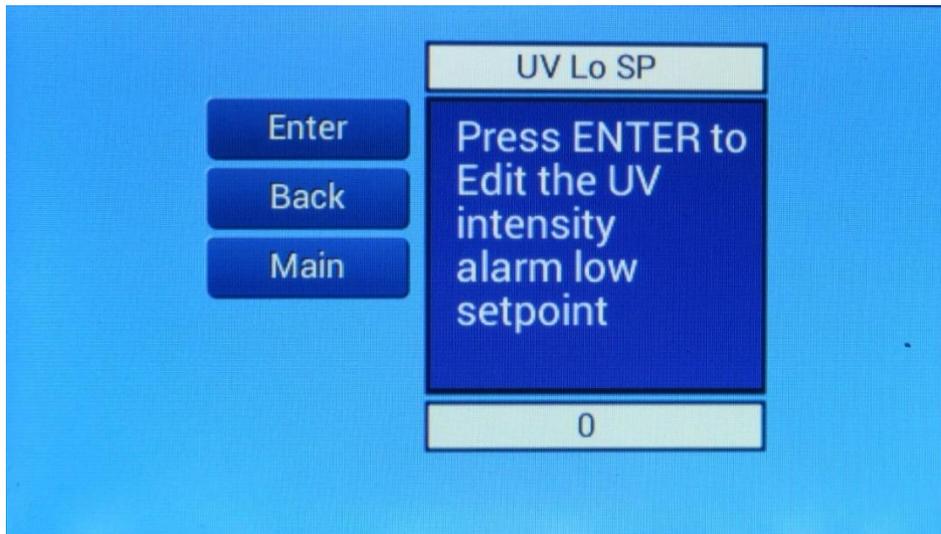


Figure 4-11: Low UV Intensity Setpoint Value Screen

Press **Enter** to reset the UV Low Intensity Alarm Setpoint Value

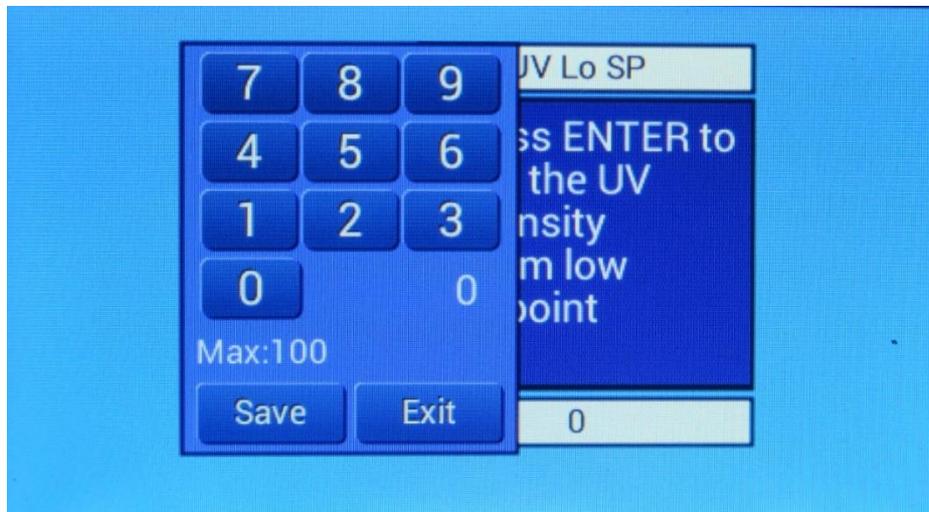


Figure 4-12: Selecting and Saving the UV Intensity Setpoint Value

The low alarm setpoint value is typically set at 80%. Please contact RK2 systems for a value other than this.

4.3.7 Completing a Master System Hour Meter Reset

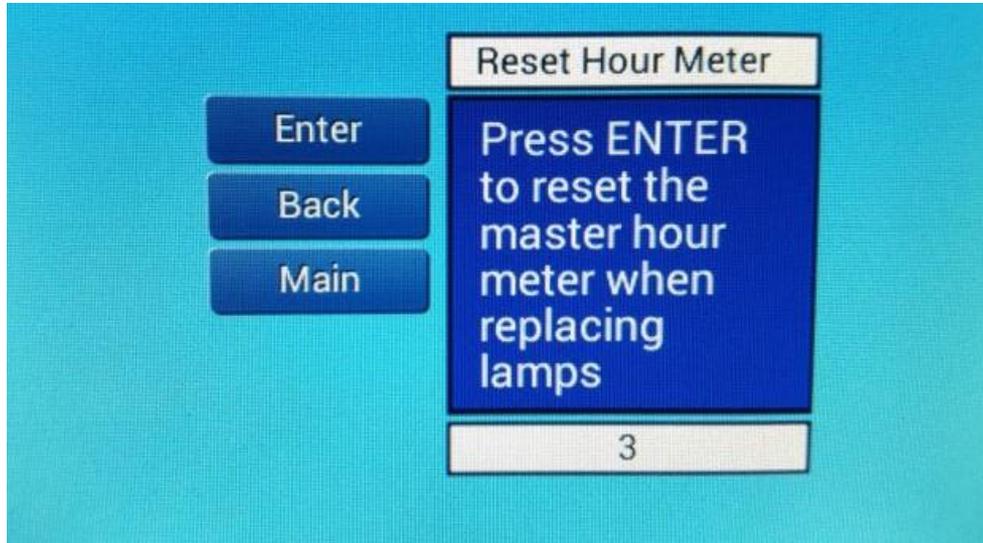


Figure 4-13: System Master Hour Reset Screen

Press **Enter** to reset Master System Hour Meter.

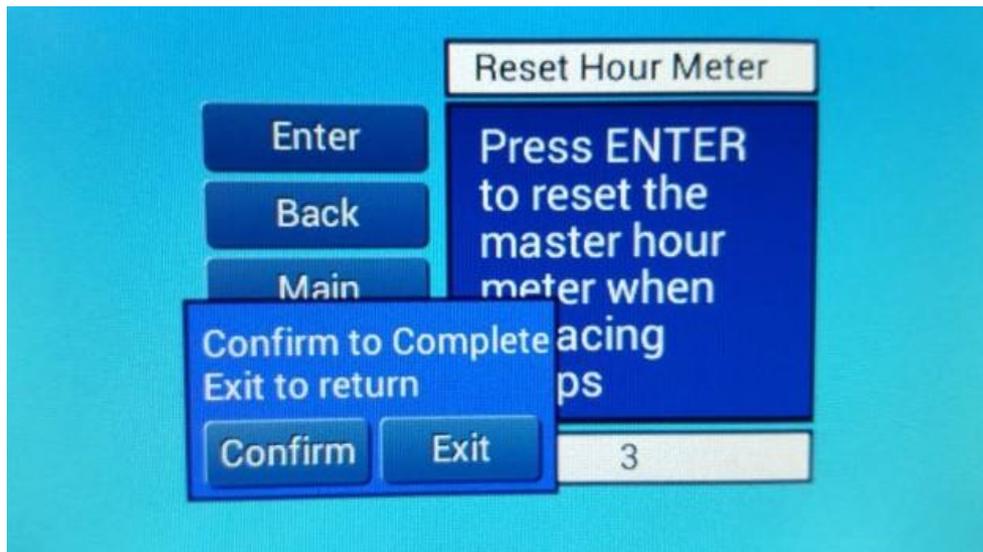


Figure 4-14: Confirming Master Hour Meter Reset

Press **Confirm** to complete the resetting of the hours or **Exit** to abort reset.

4.3.8 Completing a Lamp Hour Reset, All Lamps

Press **Enter** to reset lamp hours of ALL lamps after lamps have been changed as a complete set.

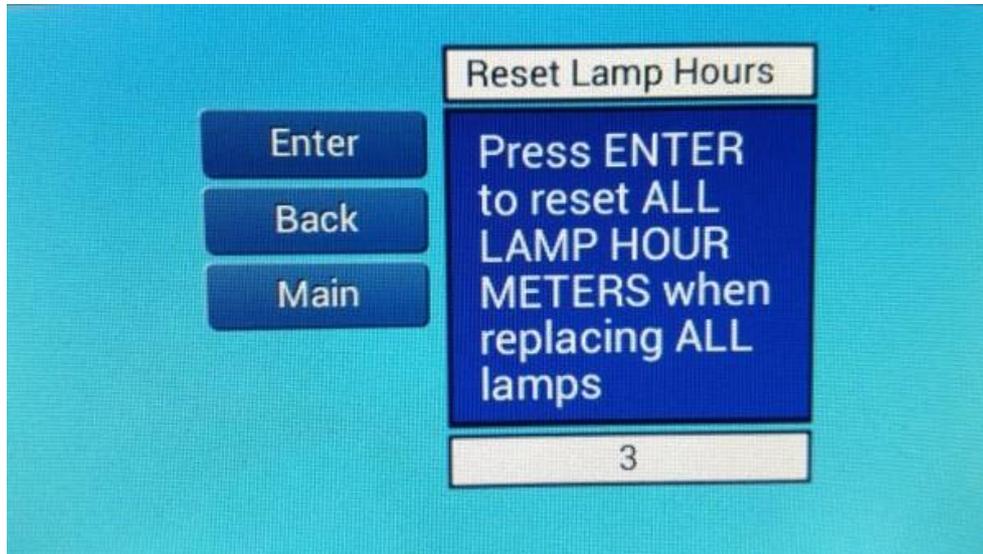


Figure 4-15: Screen for Lamp Hour Reset - ALL Lamps

Note: The number '3' shown represents the system hours.



Figure 4-16: Confirmation of ALL Lamp Hours Reset

Press **Confirm** to complete the resetting of the hours or **Exit** to abort reset.

4.3.9 Completing a Lamp Hour Reset, Individual Lamps



Figure 4-17: Individual Lamp Hour Reset Screen

Press **Enter** to reset the lamp hours of INDIVIDUAL lamps after replacing with new.

Number **4** shown represents the lamp number selected by the operator. Lamp numbering starts at '1' and goes to 'N' which is the maximum number of lamps in the treatment system.

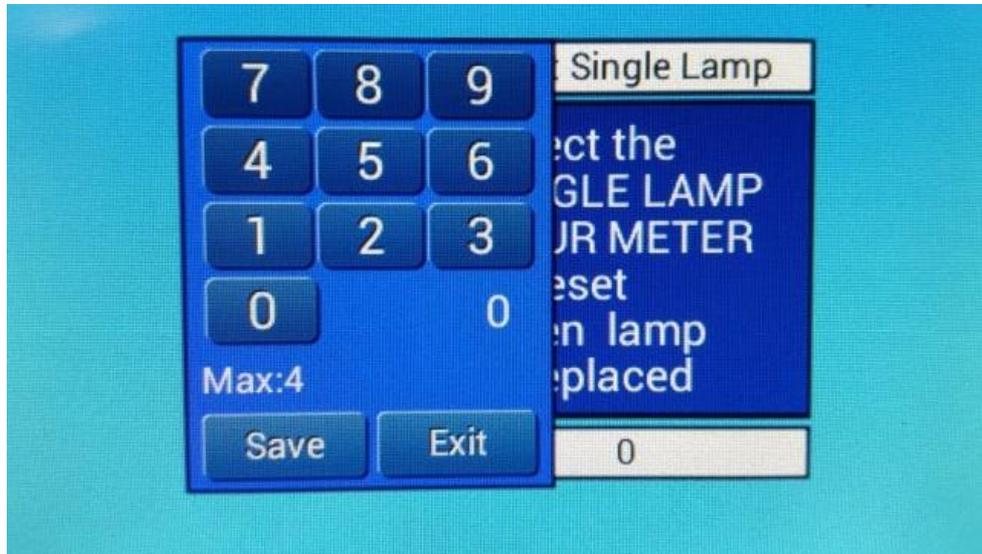


Figure 4-18: Selecting and Saving Individual Lamp Hour Reset

Press **Save** to complete each lamp reset, then **Exit** to leave screen when finished.

4.3.10 Setting the Lamp On/Off Sensor Threshold Value

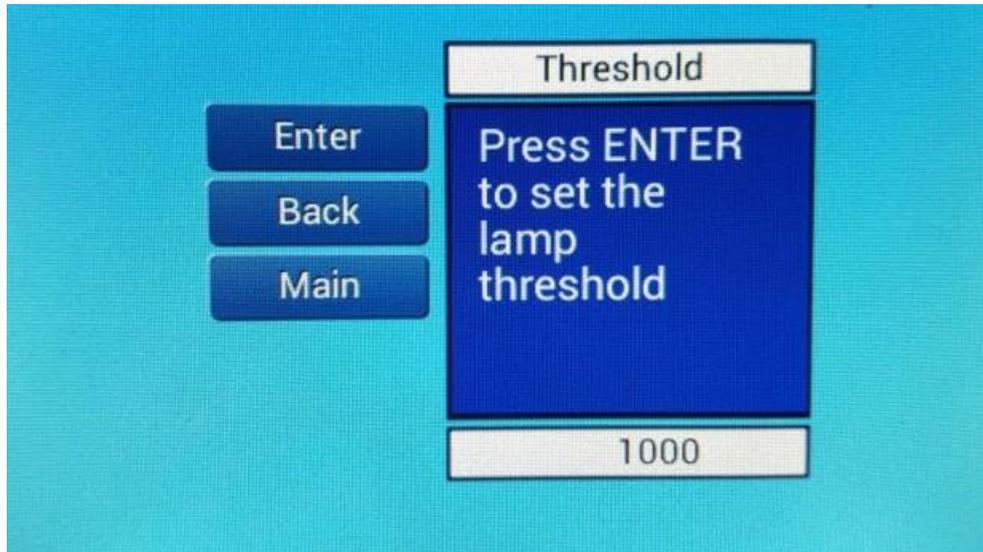


Figure 4-19: Screen for Setting the Lamp On/Off Threshold Value

Press **Enter** to adjust the ON/OFF detection point of each lamp current sensor.

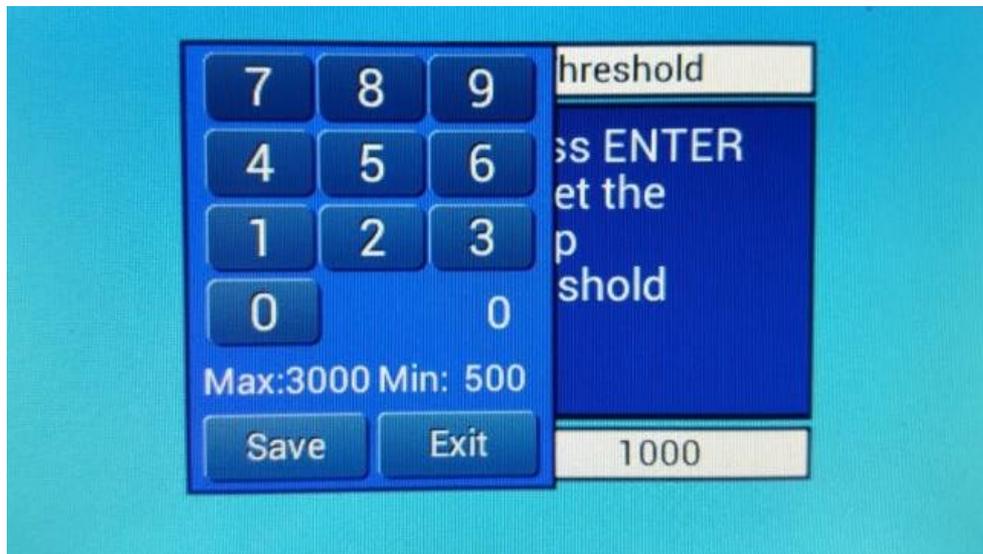


Figure 4-20: Saving the Lamp On/Off Threshold Value

This value represents the lamp's current sensor trigger point that determines whether or not the lamp is considered on, or off. The value is factory set, but is made available to the operator in the event a change is required. It is not recommended that the operator change this value without first consulting RK2 Systems.

Press **Save** to select the new Threshold value, then **Exit** to leave screen when finished.

4.3.11 Seeing the System Status via the Status Menu

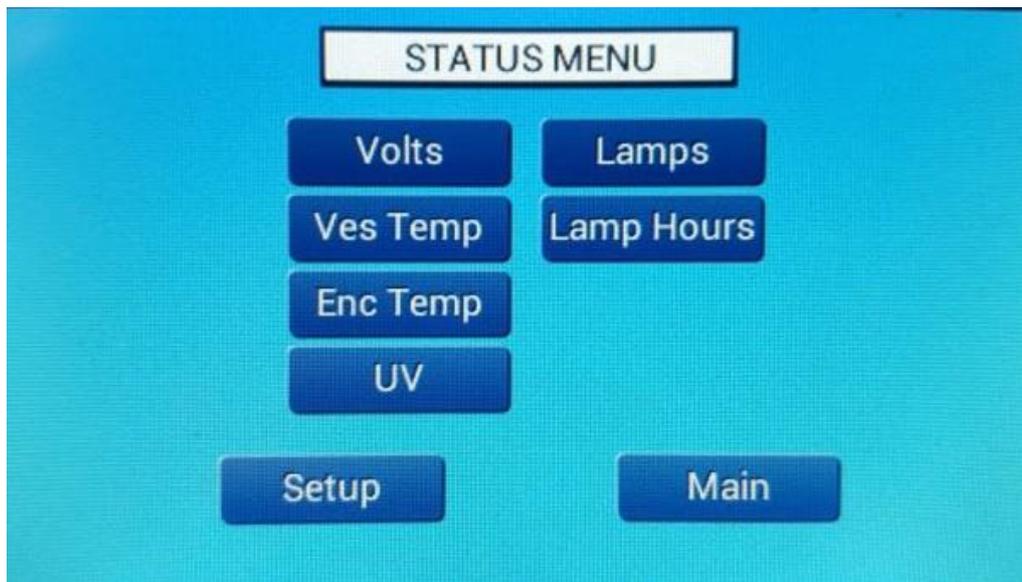


Figure 4-21: System Status Menu Screen

The 'Status Menu' provides information to the operator of various important system operational parameters.

4.3.12 Status Menu

4.3.12.1 Current PSE Input Voltage and Min-Max Alarm Setpoints

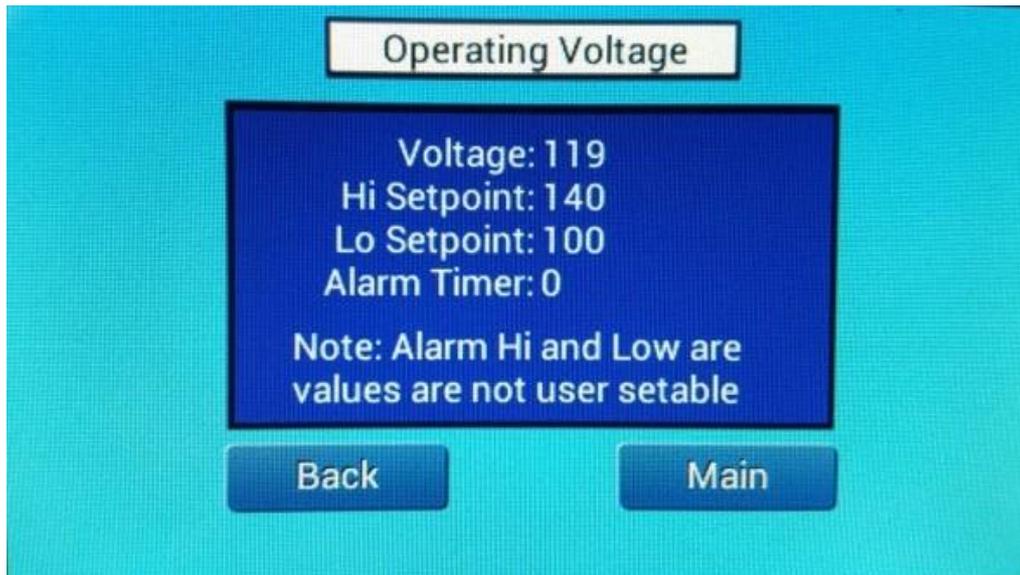


Figure 4-22: Current PSE Input Voltage and Min-Max Voltage Alarm Setpoints Screen

- Voltage:** Displays current input AC voltage
- Hi Setpoint:** High AC Input Alarm setpoint. This is 140VAC for 120V units, and 270VAC for 230V units.
- Low Setpoint:** Low AC Input Alarm setpoint. This is 100VAC for 120V units, and 205VAC for 230V units.
- Alarm Timer:** The amount of time in minutes that the voltage has exceeded the High or Low Setpoint. Time before an alarm will occur is factory set at 5 minutes.

4.3.12.2 Current Vessel Water Temperature and Max. Temperature Alarm Setpoint

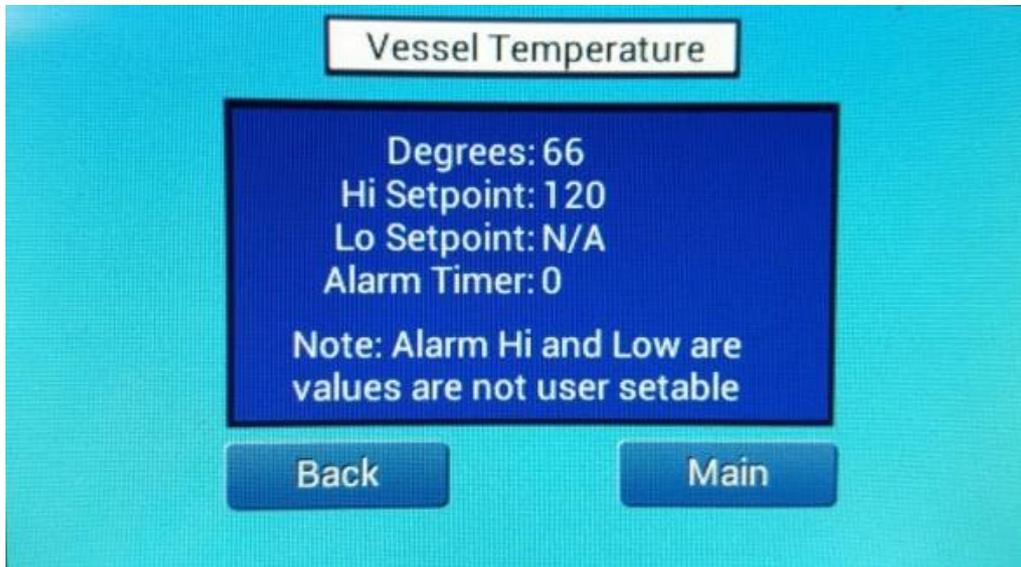


Figure 4-23: Current Vessel Water Temperature and Max. Temperature Alarm Setpoint Screen

- Degrees:** Water temperature inside the treatment vessel.
- Hi Setpoint:** High temperature alarm setpoint for water temperature inside the treatment vessel.
The factory set alarm value is 120 F (49 C).
- Lo Setpoint:** Not Applicable for this Alarm type.
- Alarm Timer:** The amount of time in minutes (continuous) that the vessel water temperature can exceed the High Setpoint before an alarm will occur is 1 minute. If the alarm is triggered, the actual time that the system was in alarm will be shown here. Once the alarm is acknowledged the timer will reset.
The value shown for the Alarm Timer represents the number of minutes the unit is outside the range. It will reset to zero when acknowledged.

4.3.12.3 Current PSE Internal Temperature and Max. Temperature Alarm Setpoint

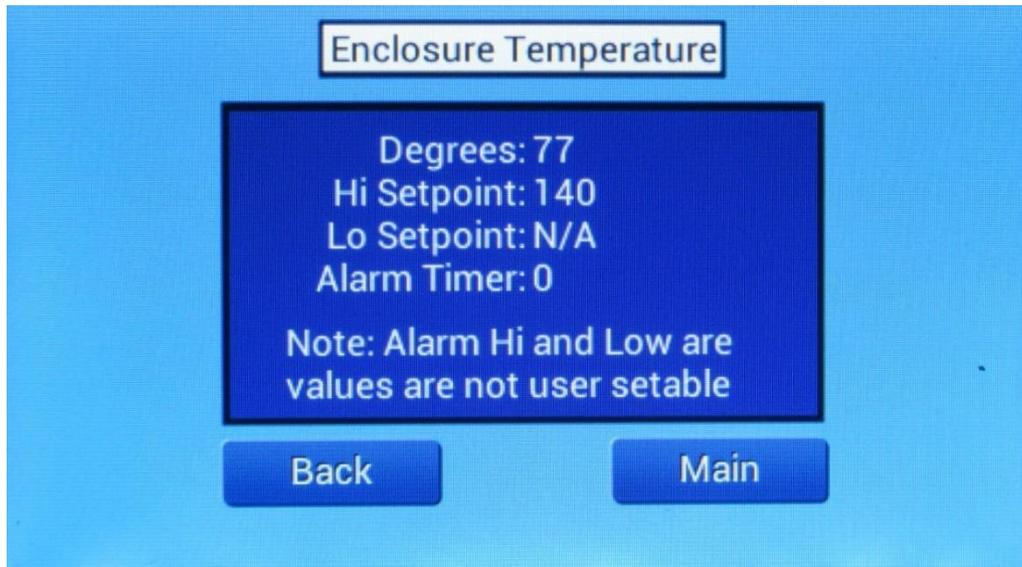


Figure 4-24: Current PSE Internal Temperature and Max. Temperature Alarm Setpoint Screen

Degrees:	Temperature inside the PSE enclosure.
Hi Setpoint:	The highest allowable temperature inside the PSE. Factory set at 140 F (60 C)
Lo Setpoint:	Not Applicable for this Alarm type.
Alarm Timer:	<p>The amount of time in minutes (continuous) that the PSE internal temperature can exceed the High Setpoint before an alarm will occur is 1 minute. If the alarm is triggered, the actual time that the system was in alarm will be shown here. Once the alarm is acknowledged the timer will reset.</p> <p>The value shown for the Alarm Timer represents the number of minutes the unit is outside the range. It will reset to zero when acknowledged.</p>

4.3.12.4 Current UV Intensity Sensor Status and Low UV Intensity Alarm

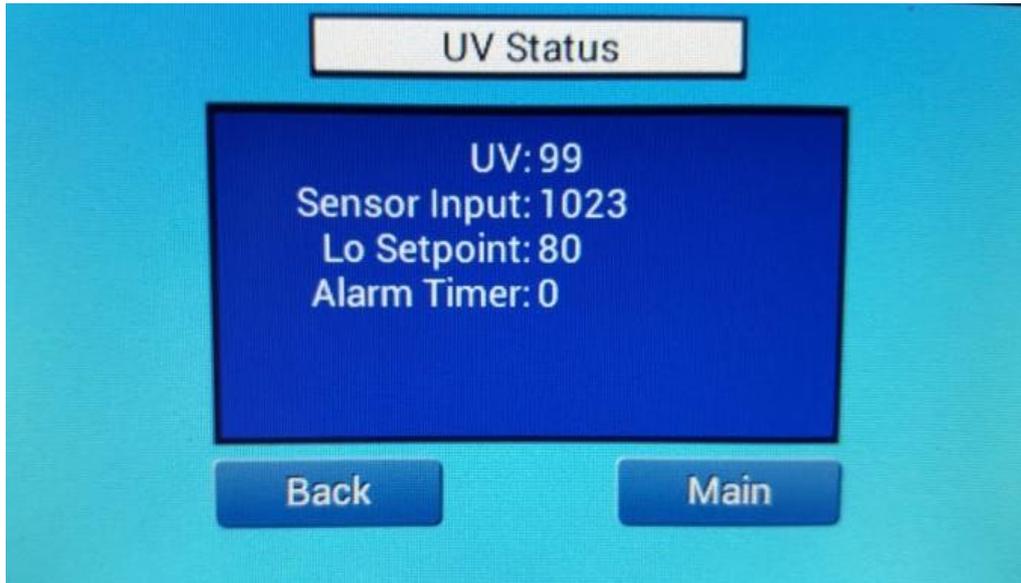


Figure 4-25: Current UV Intensity Sensor Status and Low UV Intensity Alarm Screen

UV: UV sensor scaled display value in percentage (%).

This is the value that is set to 100% with a 100-hour burned in lamps, cleaned as new lamp sleeves, a clean UV Intensity Sensor window and with the system filled and operating with the water quality (% UVT) the same as was specified at the time of order.

Sensor Input: This value represents the raw un-scaled output value of the UV sensor into the processor.

While this value does not correlate to actual system performance in your UV system directly, it is helpful for troubleshooting purposes. The range of output of the UV Sensor is 0-1023. A value of 1023 represents a maximum UV Sensor output of 5VDC. For appropriate resolution and sensitivity, a number greater than 675 with new lamps, clean sleeves and appropriate water quality water is recommended. If this number is significantly lower than 675 when calibrating your UV intensity sensor, please check your water quality, sensor window for fouling, and lamp sleeves for fouling or damage.

Lo Setpoint: This user settable setpoint is the point where a UV Low Intensity Alarm would be triggered. This value is set under the 'Setup' menu. The default value is 80%.

Alarm Timer: The amount of time in minutes (continuous) that the UV Intensity can fall below the Low Setpoint value before an alarm will occur is 5 minutes. If the alarm is triggered, the actual time that the system was in alarm will be shown here. Once the alarm is acknowledged the timer will reset.

4.3.12.5 Current Individual Lamp Status



Figure 4-26: Current Individual Lamp Status Screen

Lamp Status: This screen displays the current On/Off status of lamps 1 through to the maximum number of lamps in your system.

Color Coding:

- Green** - Lamp is on
- Yellow** - Lamp is out, the alarm has been acknowledged
- Red** - Lamp is out, the alarm has not been acknowledged
- Blue** - Lamp has reached it's 12,000 hour end of lamp life (EOLL).

When the user acknowledges a 'Lamp Out' alarm, an internal 24 hour timer is initiated. If the lamp is not replaced within 24 hours the alarm will resound. Replacing the lamp in question resets the lamp timer and reverts the status color to Green.

Replacing the lamp clears the alarm and sets the color back to green.

4.3.12.6 Viewing Current Individual Lamp Hours



Figure 4-27: Viewing Current Individual Lamp Hours Screen

Lamp Hours: The current accumulated operational hours of each individual system lamp are displayed here.

Note: Pro-Tect lamps have a useful lamp life of 12,000 hours. Beyond this point the lamps will still function; however UV-C output will have dropped to the point that meeting your treatment target cannot be ensured.

Contact RK2 to acquire the correct replacement lamps for your UV Treatment System.

4.3.12.7 Testing Individual Lamp Hours Display



Figure 4-28: Testing Individual Lamp Hours Display Screen

Testing:

This screen does not show actual lamp hours, but instead shows the threshold sensor values used to determine whether a lamp is considered to be on or off by the PLC. Pressing **Test** displays the actual individual lamp On/Off Figure 4-19: Screen for Setting the Lamp **On/Off** Threshold Value.

For a lamp to read ON the value lamp must read LESS THAN the set using the Figure 4-19: Screen for Setting the Lamp **On/Off** Threshold Value, but NOT ZERO. For a lamp to read OFF, the value must be greater than the set Figure 4-19: Screen for Setting the Lamp **On/Off** Threshold Value, OR ZERO.

Example:

If you have a situation where a lamp is reading 'Off' when it is known to be 'On' then you can correct the problem by adjusting the lamp Figure 4-19: Screen for Setting the Lamp **On/Off** Threshold Value setpoint.

- When in the '**Lamp Hours**' **Screen** observe the lamp in question and press the **Test** button.
- The numbers will change as the individual lamp threshold sensor readings are taken.
- Wait for the values to stabilize and record the highest value observed for each lamp.

If any values are greater than the Figure 4-19: Screen for Setting the Lamp **On/Off** Threshold Value set for the corresponding lamp, it is then required to increase the setpoint value to correct the false reading. It is important to make sure the lamp reads Off when unplugged if this value is changed. When the lamp is unplugged, a reading greater than the threshold, OR zero, will show a 'Lamp Off' condition.

Note: **Threshold setpoint values** are factory set and should not require operator adjustment. Please contact RK2 if you believe that 'Threshold' values should be modified.

4.4 ALARM SCREENS

4.4.1 Alarm: Remote Start in Open Condition

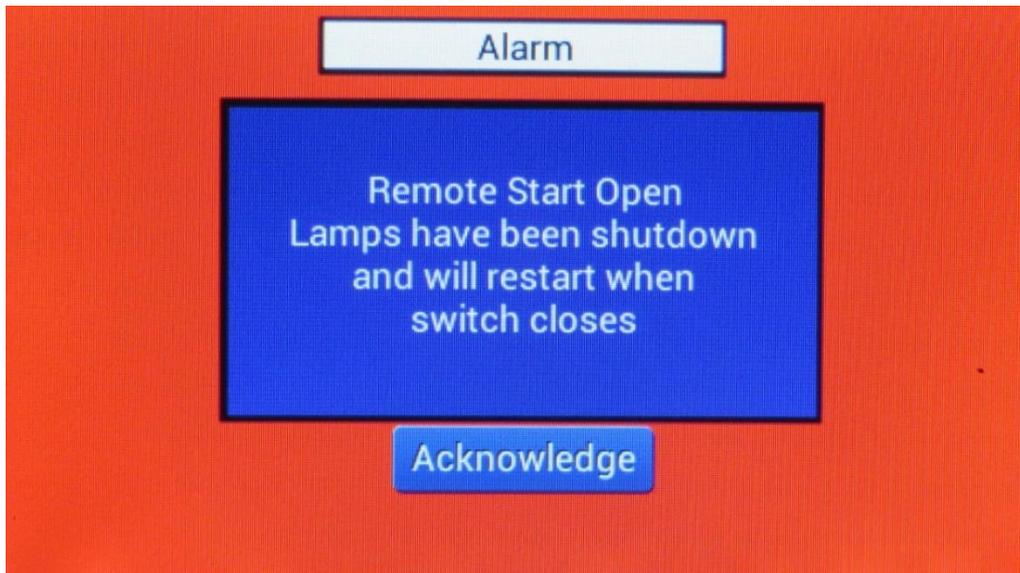


Figure 4-29: Alarm Screen: Remote Start in Open Condition

The alarm screen will alternately flash Red/Yellow when any Alarm occurs.

Remote Start Open (Pro Series Only):

If the 'Remote Start' option is being used the lamps will shut off when the remote switch is opened. If this does occur, the alarm screen will display the 'Remote Start Open' alarm. The lamps will remain off until the remote switch closes, at which time the display will return to the 'Main' screen. Alarm stays on until the operator either closes the remote switch to energize the lamps, or turns off PSE power.

Pressing **Acknowledge** to cancel and reset the Alarm is ineffective for this alarm currently.

4.4.2 Alarm: Input Voltage Value Outside of Allowable Range



Figure 4-30: Alarm Screen: Input Voltage Value Outside of Allowable Range

The **Input Voltage** has exceeded the High Setpoint, or has been below the Low Setpoint value (Shown) for longer than the allotted time.

Press **Acknowledge** to cancel and reset the Alarm for 5 minutes.

The lamp ballasts cannot be operated outside of the predetermined input voltage range.

This Alarm will cause the Lamp Field to turn off.

A power cycle (System input power cycled OFF then ON) will be required to restart the lamps.

4.4.3 Alarm: PSE Enclosure Internal Temperature Limit Exceeded



Figure 4-31: Alarm Screen: PSE Enclosure Internal Temperature Limit Exceeded

The **Power Supply Enclosure (PSE) Temperature** has exceeded the High Setpoint value for longer than the allotted time.

Press **Acknowledge** to cancel and reset the Alarm. Acknowledging the Alarm will reset the timer.

This Alarm will cause the Lamp Field to turn off.

A power cycle (System input power cycled OFF then ON) will be required to restart the lamps.

4.4.4 Alarm: Vessel Internal Temperature Limit Exceeded



Figure 4-32: Alarm Screen: Vessel Internal Temperature Limit Exceeded

The **Vessel Internal Water Temperature** has exceeded the High Setpoint value for longer than the allotted time.

Press **Acknowledge** to cancel and reset the Alarm. Alarm cannot be reset if temperature is still being exceeded.

This Alarm will cause the Lamp Field to turn off.

A power cycle (System input power cycled OFF then ON) will be required to restart the lamps.

4.4.5 Alarm: Vessel Water Temperature Sensor Missing/Disconnected

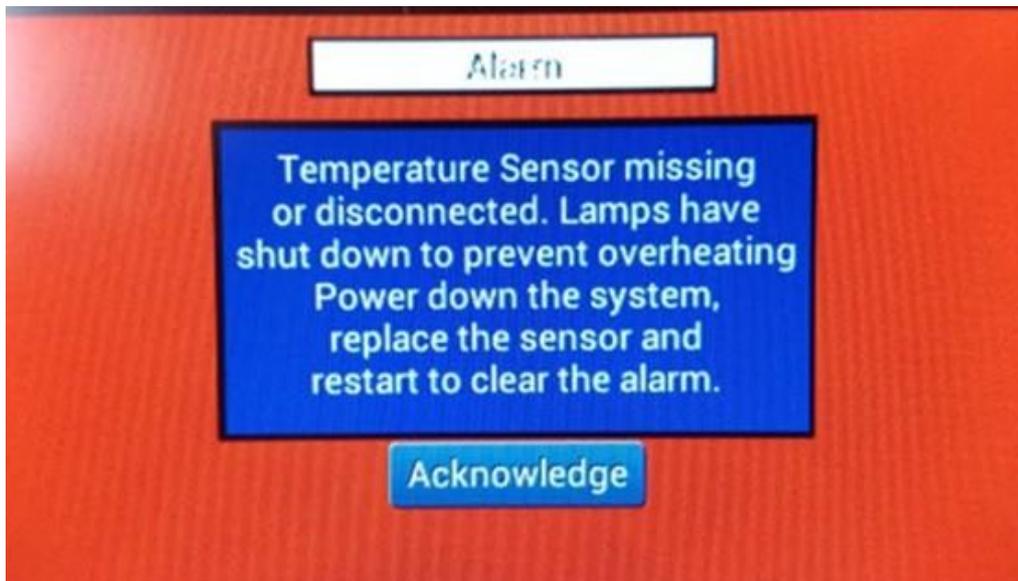


Figure 4-33: Alarm Screen: Vessel Water Temperature Sensor Missing/Disconnected

Vessel Water Temperature Sensor Non-functional, Missing, or Disconnected.

Press **Acknowledge** to cancel and reset the Alarm. Alarm cannot be reset if sensor is still missing and/or disconnected.

The system will not operate without a properly connected temperature sensor.

This Alarm will cause the Lamp Field to shut off as significant system damage can occur if the system is operated above the setpoint value.

Air entrapped in the vessel can also cause over temperature of the UV vessel.

A power cycle will be required to restart the lamps.

4.4.6 Alarm: Low UV-C Intensity (Pro Series Only)

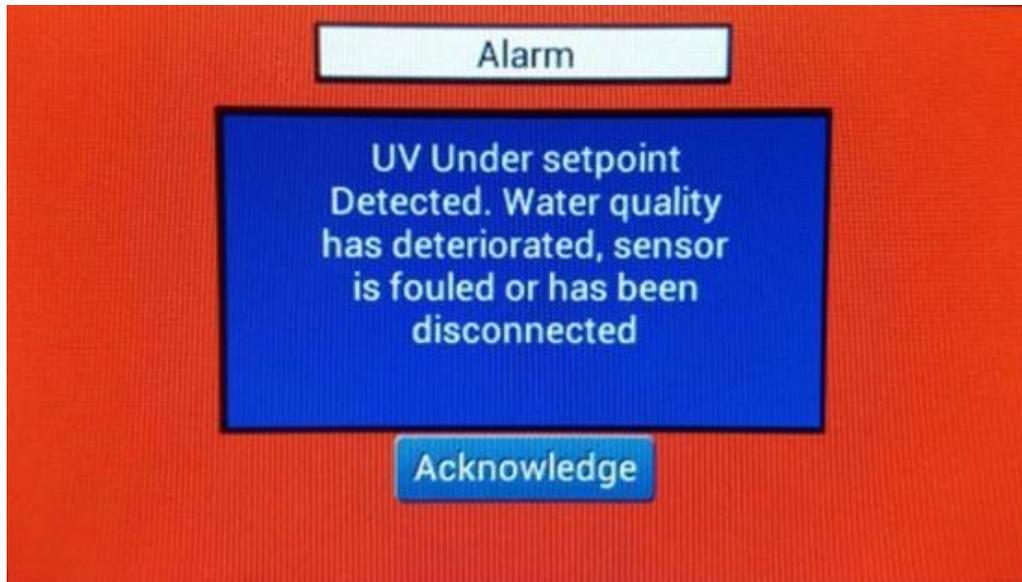


Figure 4-34: Alarm Screen: Low UV-C Intensity (Pro Series Only)

The **UV Intensity** has dropped below the Alarm Setpoint for longer than the allowable maximum time.

Press **Acknowledge** to cancel and reset the Alarm.

A low UV Intensity value may be due to:

- Poor water quality (UVT)
- Fouled quartz sleeve(s)
- Degradation of lamp(s) UV-C output
- Inoperable lamp(s)
- Improperly installed UV Intensity Sensor
- Faulty sensor wiring or a faulty UV Intensity Sensor

4.4.7 Alarm: Lamp Failure

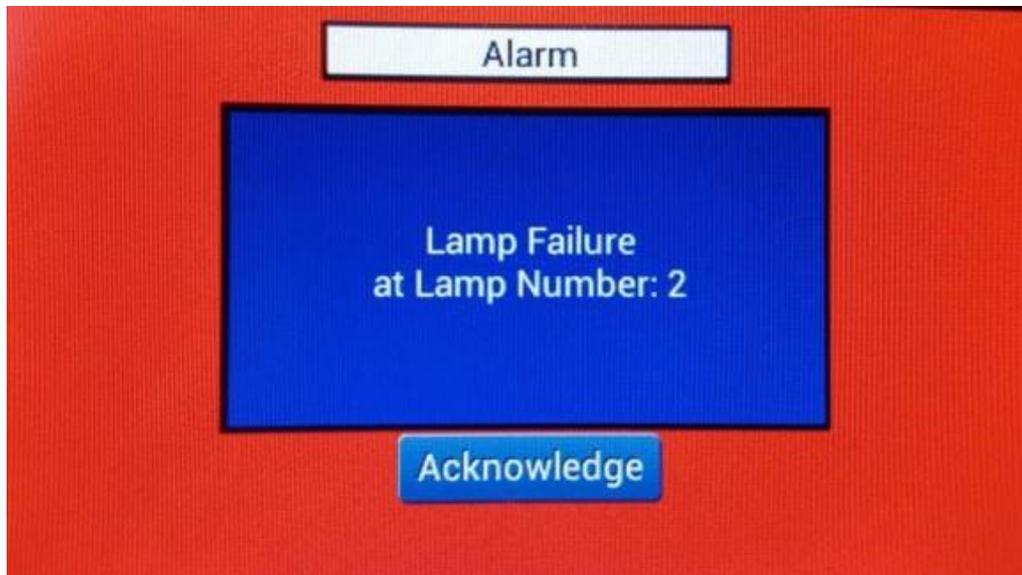


Figure 4-35: Alarm Screen: Lamp Failure

This Alarm indicates that a **Lamp Failure** has occurred.

Press **Acknowledge** to cancel and reset the Alarm.

When this alarm is acknowledged, a 24-hour timer is set to allow the operator sufficient time to replace the lamp in question.

If the lamp is replaced or re-energizes, the alarm will self-clear.

4.4.8 Alarm: Lamp Hours Exceed EOLL

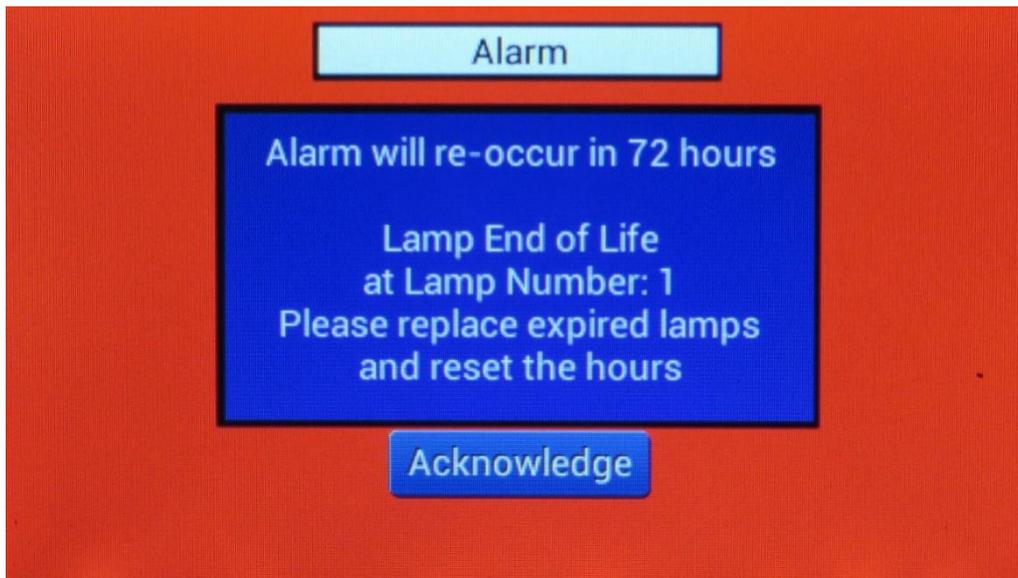


Figure 4-36: Alarm Screen: Lamp Hours Exceed EOLL

This Alarm indicates that the 12,000 hour **Lamp Lifetime** has been exceeded.

Press **Acknowledge** to cancel and reset the Alarm.

When this alarm is acknowledged, a 72-hour timer is set to allow the user sufficient time to replace the lamp in question.

If the lamp is replaced or re-energizes, the alarm will self-clear.

4.5 System Startup and Shutdown

WARNING	Do not operate the UV system until the UV reactor is completely filled with water. Ensure ALL air is bled from the reactor. Failure to do so may cause system overheating and subsequent damage.
WARNING	To prevent lamp and vessel overheating, and temperature alarm conditions water level and flow within the reactor must be maintained at all times when lamps are in operation. Follow all provided site specific procedures regarding manual or automatic operation of the UV treatment system.
WARNING	Ensure that at least one pressure relief path is available in a situation where one or more UV lamps are energized and no flow is present.

4.5.1 Local Startup and Shutdown

IMPORTANT	Ensure that the UV System(s) are totally filled with water, with no air pockets, prior to system startup.
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For Both Manual and Remote Startups, ensure that:

- The UV reactor is fully assembled—all cables, UV lamps, temperature sensors and if present, the UV sensor are fully installed.
- The service end cap is correctly installed.
- There are no water leaks coming from the UV vessel.
- The air vent is operating correctly (optional).
- Drainage or water bypass procedures are obeyed until disinfection starts.

IMPORTANT

If a warmup no flow period is required, ensure that flow valves are opened, and flow is in vessel within 5 minutes of lamp start.

4.5.1.1 Local Startup Procedure:

1. Ensure that there is water in every UV vessel in the UV train (if applicable).
2. Ensure that the UV system is in powered mode with a lit HMI screen.
3. Turn on UV System with main power switch, then with the PSE power switch.
4. When warming is complete, open the flow control valves if that has not been done.
5. Check HMI screen for Lamp and Ballast function.
6. Carefully check (but do not touch) the top of the UV reactor for heat build-up. The surface temperature of the UV reactor will be higher than the temperature of the water in the UV chamber if there is an air pocket at the top of the UV reactor. Remove air from UV reactor using the air vent if required.
7. The online system is ready to treat water.
8. Document start-up date, time and lamp hours.

4.5.1.2 Local Shutdown Procedure:

1. If remotely operated, shut off with that device(s).
2. Manually shut power off power at PSE.
3. Lockout/Tagout as required.
4. Isolate chamber.
5. Depressurize stored energy.
6. If removing sleeves or sensors, drain reactor below sleeve or sensor port.

IMPORTANT

When refilling, you must bleed all air out of the system, as per initial startup procedures, refer to Section 2.

IMPORTANT

Ensure that the UV System(s) are totally filled with water, with no air pockets, prior to system startup.

4.5.2 Remote Operation: Plant PLC and HMI Standard/HMI Pro Series Controls

The UV system is optionally configured to enable on/off remote control of the system by a plant PLC or Programmable Logic Controller. The mode for this is called 'REMOTE'. To operate the Pro-Tect™ system remotely, the factory installed jumper must be removed. The indicated brown terminals are then used to remotely switch the unit off and on. The owner supplied external switching device must be capable handling 120/230v AC at 60HZ.

The plant PLC will initiate startup once it receives a flow or pump signal, which indicates that that flowing water is present.

4.5.2.1 Remote Startup Procedure: Plant PLC and HMI Standard/HMI Pro Series Controls

1. Ensure that the UV system is in powered mode; HMI screen on.
2. The plant operator then fills the UV trains with water.
3. The plant operator then starts the UV lamps for warmup.
4. When warming is complete, the plant opens the flow control valves.
5. Carefully check (but do not touch) the top of the UV reactor for heat build-up. The surface temperature of the UV reactor will be higher than the temperature of the water in the UV chamber if there is an air pocket at the top of the UV reactor. Remove air from UV reactor using the air vent if required.
6. The online system is ready to treat water.
7. Document start-up date, time and lamp hours.

IMPORTANT

If a warmup no flow period is required, ensure that flow valves are opened, and flow is in vessel within 5 minutes of lamp start.

4.5.2.2 Remote Shutdown Procedure:

1. If remotely operated, shut off with that device(s).
2. Manually shut power off power at PSE.
3. Lockout/Tagout as required.
4. Isolate chamber.
5. Depressurize stored energy.
6. If removing sleeves or sensors, drain reactor below sleeve or sensor port.

IMPORTANT

When refilling you must bleed all air out of the system, as per initial startup procedures, refer to Section 2.