



GUARDTEC



Operation and Installation Manual GuardTec

Model GT-1.0



Table of Contents

1 – Safety Precautions	6
1.1 – Safety Conventions	6
1.2 – Safety Instructions	6
2 – Introduction	8
2.1 – GuardTec Design Overview	8
2.2 – Process Flow Diagrams (possible configurations)	9
2.2.1 – Pulsar® Precision and Pulsar® Acid Plus with GuardTec	9
2.2.2 – Pulsar® Precision DUO and Acid Dosing Pump with GuardTec	10
2.2.3 – Pulsar® Precision 30 and Pulsar® pH Control with GuardTec	11
3 – Components Overview	12
3.1 – Electrical Components	12
3.1.1 – Power Supply, HEP-100-24	12
3.1.2 – GuardTec Controller	12
3.1.3 – Flow Cell	13
3.1.4 – Pulsar® Precision Feeder Control Module	13
3.1.5 – PCM (Pump Control Module)	13
3.1.6 – VCM (Valve Control Module)	14
3.2 – Non-Electronic Equipment	14
4 – Pre-installation Instructions	15
4.1 – Prepare the Site	15
4.2 – Gather Equipment for Feeder Installation	15
4.2.1 – Essential Equipment Supplied by Others	15
4.2.2 – COTS Tools	15
4.2.3 – PPE	15
4.3 – Pre-Installation Checklist	16
5 – Installation Instructions	17
5.1 – Wall Mounting	17
5.2 – Water Sampling Recirculation Line	17
5.3 – Equipment Connection to GuardTec	18
5.3.1 – Connecting Pulsar® feeders	18
5.3.2 – Pulsar® Precision (New Installation)	18
5.3.3 – Pulsar® Precision (Retrofit Installation)	19
5.3.4 – Booster Pump	20
5.3.5 – Pulsar® Precision 30 Feeder	21
5.3.6 – Pulsar® Acid Plus Feeder	22
5.3.7 – Pulsar® pH Control	22
6 – Chemistry Sensors & Post-Installation Instructions	23
6.1 – Water Chemistry Sensors	23
6.1.1 – Prime Flow Cell Recirculation Loop	23
6.1.2 – pH and ORP Sensor Preparation	24
6.1.3 – Post-Installation Checklist	25
7 – System Powerup & Setup	26
7.1 – System Startup	26
7.1.1 – Power Up the GuardTec	26
7.1.2 – Initial Setup Screens	26
8 – Operation Instructions	31
8.1 – pH Control, Acid Feeder Setup and Operation	31
8.1.1 – pH Control Setup	31
8.1.2 – Acid Feeder Setup	32
8.2 – ORP Control, Chlorine Feeder Setup and Operation	33

8.2.1 — ORP Control Setup	33
8.2.2 — Chlorine Feeder Setup	34
8.3 — FAC Control, Chlorine Feeder Setup and Operation	35
8.3.1 — FAC Control Setup	35
8.3.2 — Chlorine Feeder Setup	36
8.4 — Booster Pump	37
8.4.1 — Booster Pump Setup	37
8.4.2 — Booster Pump Diagnostic	37
8.5 — CRS (Crypto Remedial System)	38
8.5.1 — CRS Feeder Setup	38
8.5.2 — CRS Status	38
8.6 — Integrated Flow Meter	38
8.6.1 — Visual Flow Indication	38
8.6.2 — Dosing Lock out	39
8.6.3 — Sample Water Temperature	39
8.7 — Alarm Screen	39
9 — Maintenance	40
9.1 — GuardTec Controller	40
9.1.1 — GuardTec Battery	40
9.1.2 — GuardTec M12 Connectors	40
9.2 — Equipment Modules	40
9.3 — Sensors	40
9.3.1 — pH and ORP Sensor Storage	40
9.3.2 — FAC Sensor Storage	40
9.3.3 — Sensor Cleaning	41
9.4 — Flow Cell	41
9.4.1 — Cleaning the Main Flow cell	41
9.4.2 — Cleaning the Flow Meter and Flow Cell Outlet	41
10 — Operation & System Status Notifications	42
10.1 — Normal Operation Notifications	42
10.2 — Alarms & System Notifications	43
11 — Appendix	47
11.1 — Requirements and Specifications	47
11.1.1 — Requirements for Product Installation and Operation	47
11.1.2 — Product Specifications	48
11.2 — Assembly Drawings	50
11.2.1 — Complete Assembly	50
11.2.2 — Assembly Layout and Dimensions	51
11.2.3 — Back Assembly	52
11.3 — Module Enclosures and Dimensions	54
11.3.1 — HCE Feeder Module	54
11.3.2 — Valve Control Module	54
11.3.3 — Pump Control Module	55
11.4 — Manual Feed Rate Settings for Pulsar® Precision Feeders	56
11.4.1 — Pool Feed Rate in Manual Mode	56
11.4.2 — Spa Feed Rate in Manual Mode	56
11.5 — Parts List	57
11.5.1 — Flow Cell Assembly	57
11.5.2 — GuardTec System Assembly	57
11.5.3 — Modules	58
11.5.4 — Accessories	58
12 — Limited Warranty	59

List of Figures

Figure 1. GuardTec Installation with Pulsar® Precision and Pulsar® Acid Plus	9
Figure 2. GuardTec Installation with Pulsar® Precision DUO and Acid Dosing Pump	10
Figure 3. GuardTec Installation with Pulsar® Precision 30 and Pulsar® pH Control	11
Figure 4. GuardTec Device in Enclosure	12
Figure 5. Power Supply	12
Figure 6. GuardTec Controller	12
Figure 7. Flow Cells	13
Figure 8. HCE Feeder Module	13
Figure 9. Pulsar Module	13
Figure 10. Valve Control Module	14
Figure 11. Enclosure Assembly Rear View	14
Figure 12. UV Shield Isolated and Installed	14
Figure 13. Mounting Plate	17
Figure 14. Enclosure Assembly	17
Figure 15. Self-Mounting Screws Installation, Bottom View	19
Figure 16. Self-Mounting Screws Installation, Top View	19
Figure 17. Feeder Module Mounted on Hopper	19
Figure 18. Level Switch Lead Wire to M12 Connector Cable	20
Figure 19. Feeder Module Cable Connections	20
Figure 20. Port Plugs Installed	23
Figure 21. Sensor Installation	24
Figure 22. Integrated Flow Meter	38
Figure 23. Exploded-view Drawing	50
Figure 24. GuardTec Assembly Dimensions	51
Figure 25. Enclosure Assembly Drawing	52
Figure 27. Rear View Without Mounting Plate and Power Supply	53
Figure 28. Rear View Without Mounting Plate, Exploded View	53
Figure 29. Mounting Plate Bolt Hole Locations	53
Figure 30. Feeder Module Enclosure	54
Figure 31. Valve Control Module Enclosure	54
Figure 32. Pump Control Module Enclosure	55

List of Tables

Table 1. Pre-installation Checklist	16
Table 2. Post-Installation Checklist	25
Table 3. Operation Status	42
Table 4. Alert Status	43
Table 5. Clearances and Weight	47
Table 6. Electrical	47
Table 7. Environmental Conditions	47
Table 8. Cable Length and Equipment Distances	47
Table 9. Material Specifications	48
Table 10. Sensor Specifications	48
Table 11. GuardTec Specifications	49
Table 12. Communications Specifications	49
Table 13. Main Assembly Parts List	50
Table 14. Pools: Feed Solenoid On/Off Time vs Available Chlorine Delivery Rate (lbs/day)	56
Table 15. Spas: Feed Solenoid On/Off Time vs Available Chlorine Delivery Rate (lbs/day)	56
Table 16. Flow Cell Spare Parts	57
Table 17. GuardTec System Parts	57
Table 18. System Modules	58
Table 19. GuardTec Accessories	58

1 — Safety Precautions

▲ Danger, ▲ Warning, ▲ Caution, and Note statements are used throughout this manual to emphasize important safety information. The statements are defined below.

1.1 — Safety Conventions

 **Danger:** Indicates a hazardous situation which, if not avoided, will result in death or severe injury.

 **Warning:** Indicates a potentially hazardous situation which, if not avoided, can result in personal injury.

 **Caution:** Indicates a potentially hazardous situation which, if not avoided, can result in minor personal injury or equipment damage.

Note: Information that may assist in completing a task correctly or for maintaining the machine in good operating condition.

IMPORTANT SAFETY INSTRUCTIONS
READ AND FOLLOW ALL INSTRUCTIONS
SAVE THESE INSTRUCTIONS

1.2 — Safety Instructions

When using this electrical equipment, basic safety precautions should always be followed, including the following

-  a. **WARNING:** To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.
- b. A wire connector is provided on this unit to connect a minimum 8 AWG [8.4 mm²] solid copper conductor between this unit and any metal equipment, metal enclosures of electrical equipment, metal water pipe, or conduit within 5 feet [1.5 m] of the unit.
-  c. **DANGER:** Risk of injury.
 - i. Replace damaged cord immediately.
 - ii. Do not bury cord.
 - iii. Connect to a grounded, grounding type receptacle only.

 **Danger:** All wiring connections, fusing, grounding, inspection, and maintenance of wiring must be performed by a licensed electrician in accordance with the National Electric Code (NEC), Occupational Safety and Health Act (OSHA) in the United States, and all local electrical codes. Failure to properly install and wire this product can result in property damage, serious injury, or death, and may affect warranty coverage.

 **Warning:** Test the flow sensor regularly to ensure proper operation of the float (up and down the column) during flow and no flow conditions. During a no flow condition, the float should drop, and the screen should display a "Low Flow" message and chemical feed should be halted. If the float does not drop in a no flow condition, plumbing corrections may be needed. Also refer to Section 9.4.2 for flow meter cleaning instructions.

Warning: Always take and record manual water chemistry readings from an independent test method in conformance with local Health Department requirements. Although automated controllers are a great aid in maintaining healthy water quality, controllers are not a substitute for manual water testing with an accurate test kit.

Warning: NSF 50 certification is void if dosing timeout is disabled.

Warning: Do not install in locations accessible to the public.

Warning: Risk of electrical shock. Ensure power is disconnected before wiring or servicing.

Warning: A green colored terminal or a terminal marked G, GR, Ground, Grounding, or the symbol  is located inside the supply terminal box or compartment. To reduce the risk of electric shock, this terminal must be connected to the grounding means provided in the electric supply service panel with a continuous copper wire equivalent in size to the circuit conductors supplying this equipment.

Caution: Limit use in direct sunlight as much as possible.

Caution: Do not install near sources of electromagnetic interference (EMI) such as variable frequency drives or big AC and DC electric motors, SCR heater controllers, power lines, etc. EMI can adversely affect the instrumentation signals and impact the measurement readings of the pH, ORP, and FAC sensors. EMI mitigation and troubleshooting is specific to the application and installation site.

Caution: MAINTAIN WATER CHEMISTRY IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS (ATTENTION: LA TENUEUR DE L'EAU EN MATIÈRES DISSOUTES DOIT ÊTRE CONFORME AUX DIRECTIVES DU FABRICANT).

Caution: For indoor use only.

2 — Introduction

The GuardTec is a Pool Chemistry Controller providing complete automation and control of your chlorine and acid feeders. Using the GuardTec in conjunction with Pulsar® calcium hypochlorite and acid feed equipment provides optimal control of chemical dosing and tracking. The GuardTec is designed for easy installation and operation with an intuitive touchscreen user interface, automatic equipment identification using modules, and backlit flow cell for easy alarm notification.

2.1 — GuardTec Design Overview

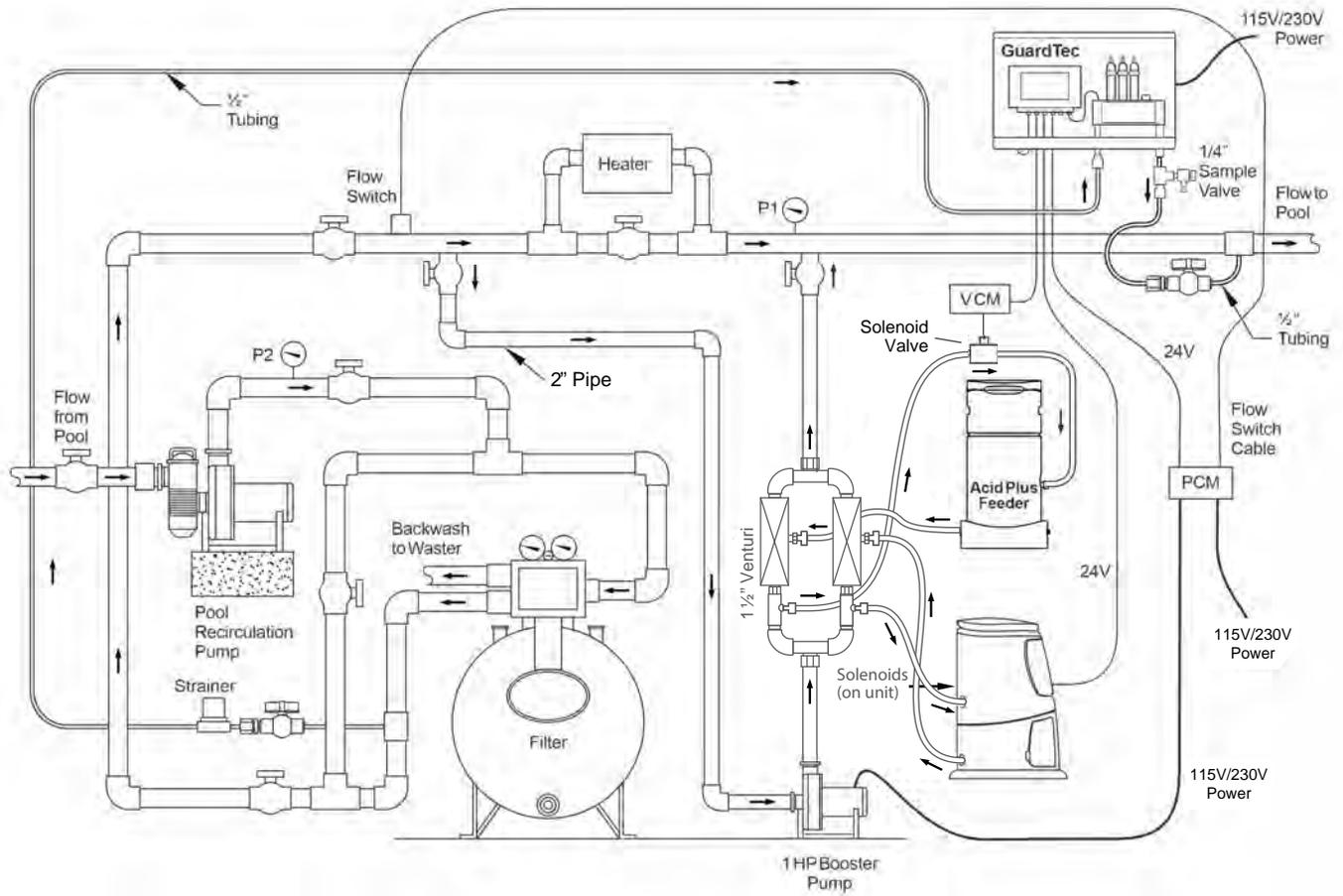
The GuardTec is designed to be a modular system that can be configured for different pool and spa applications without any invasive rewiring. The overall system is comprised of different modules, each having a printed circuit board programmed with a unique identity established once ordered. When the modules are connected to any available M12 connector on the GuardTec, it is recognized and subsequently controlled according to its identity with minimal user setup required. This type of connection provides the benefit of logging and tracking when a feeder or booster pump was installed and placed in service as well as triggering alarms if the equipment is accidentally disconnected or if a cable is kinked or cut and short circuited. For example, if a pH probe is connected to the flow cell to any available connection, the GuardTec will know it is a pH probe and use it appropriately without any further setup requirements.

The GuardTec system and modules are designed to operate using 24V DC power, with the exception of the Pump Control Module. An external water-resistant 100 Watt power supply converts the facility AC voltage (98V to 306V AC) to 24V DC for use by the GuardTec and all connected modules. All modules are connected to the GuardTec by M12 cables. Using a 24V DC connection allows equipment to be installed over 100 feet away from the main wall mounted GuardTec controller.

2.2 – Process Flow Diagrams (possible configurations)

2.2.1 – Pulsar® Precision and Pulsar® Acid Plus with GuardTec

Figure 1. GuardTec Installation with Pulsar® Precision and Pulsar® Acid Plus

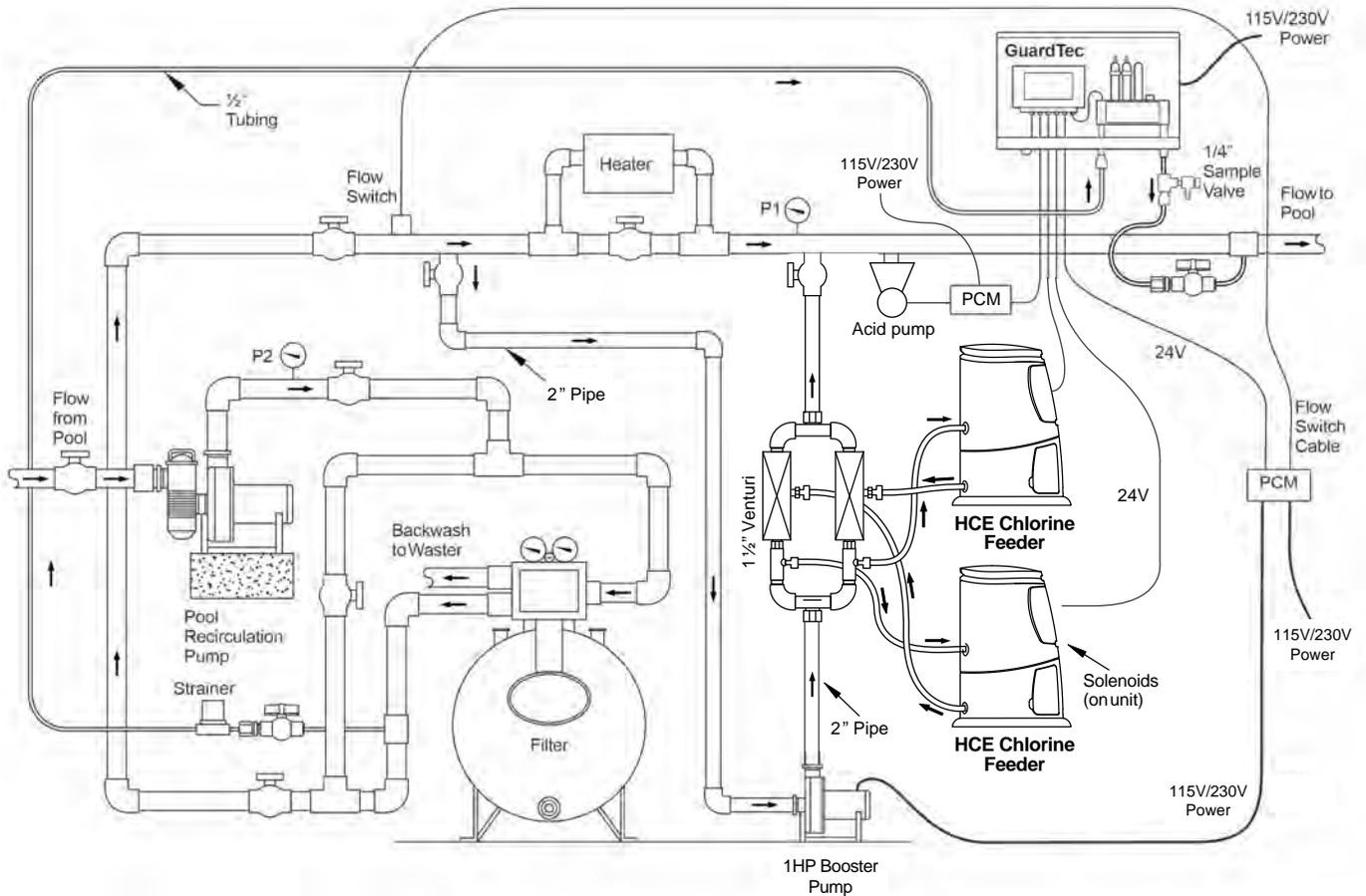


Note: Minimal pressure differential is needed to provide the very low flow rate of 0.12 to 0.42 gpm [0.378 lpm to 1.51 lpm] needed for the flow cell. The schematic represents just one of many possible inlet and outlet locations and discretion should be exercised based on actual site conditions and layout.

Note: Up to 2 chlorine feeders can be connected to the GuardTec for tandem operation.

2.2.2 — Pulsar® Precision DUO and Acid Dosing Pump with GuardTec

Figure 2. GuardTec Installation with Pulsar® Precision DUO and Acid Dosing Pump



Note: Minimal pressure differential is needed to provide the very low flow rate of 0.12 to 0.42 gpm [0.378 lpm to 1.51 lpm] needed for the flow cell. The schematic represents just one of many possible inlet and outlet locations and discretion should be exercised based on actual site conditions and layout.

Note: Up to 2 chlorine feeders can be connected to the GuardTec for tandem operation.

3 — Components Overview

3.1 — Electrical Components

3.1.1 — Power Supply, HEP-100-24

- Input: 90 – 305V AC, 1.2A/115V AC or 0.55A/230V AC
 - IEC connection to accept international power cables
- Output: 24V DC, 4A
- High efficiency up to 93%
- IP 65 rated
- UL / EAC / CB / CE / PFC certifications

3.1.2 — GuardTec Controller

- Provides main system control and operation logic of modules and connected equipment
- Ethernet connection for network and internet connectivity via Modbus TCP and MQTT communications protocols
- USB Micro type B for local firmware updates and diagnostics
- 7" color LCD Touch Screen Display and user interface
- Designed to IP 65 specifications
- 6 x M12 connectors
 - A. (1) 24V DC power input from power supply
 - B. (5) 24V DC and data input/output for feed equipment and flow cell

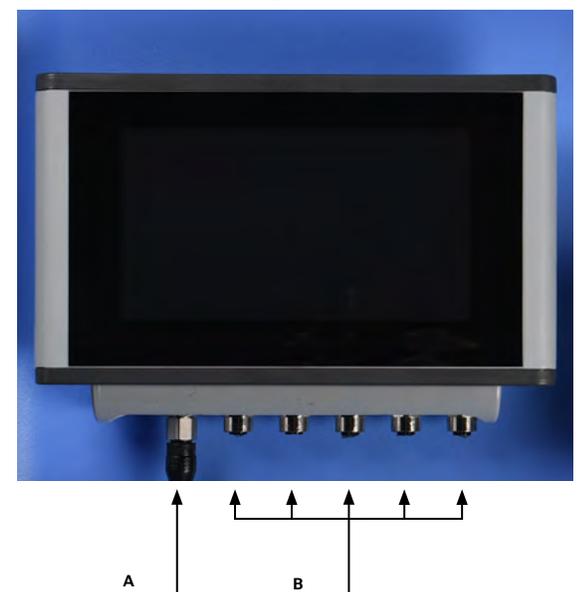
Figure 4. GuardTec Device in Enclosure



Figure 5. Power Supply



Figure 6. GuardTec Controller



3.1.3 — Flow Cell

- Used to connect the pH, ORP, and FAC sensors and send their data to the GuardTec controller.
- Each sensor connected to this module include a memory chip that stores information about the sensor, including calibration and serial number, time, and date the sensor was first installed. This allows any available sensor to be plugged into any connector and be ready for use by the system.
- Integrated flow meter regulates internal flow rate for optimal use by the FAC sensor and stops chemical dosing if no or low flow is sensed.
- LCD backlighting with full RGB color spectrum for normal operating condition and visual fault/alarm notification
- Designed to IP 65 specifications.

Note: The pH and ORP sensors should not be stored for a period longer than 6 months.



Figure 7. Flow Cells

3.1.4 — Pulsar® Precision Feeder Control Module

- Pump Control Module may come pre-installed in the Pulsar® Precision feeder.
- Designed to IP 65 and NEMA 1, 2, 4, 4x, 12 and 13 specifications
- Provides 24V DC power to feed and wash solenoid valves as well as high level switch
- Printed circuit board provides feeder name, install date and time, solenoids mA draw, and level switch condition (closed or open)

Figure 8. HCE Feeder Module



3.1.5 — PCM (Pump Control Module)

- Used to control the following:
 - Pulsar® Booster Pump
 - Pulsar® CRS Pump
 - Pulsar® pH Control Pump
- Mechanical relay, 120 / 240V AC, 50/60 Hz, 20A service
- Auxiliary relay, dry contact (Not currently used, for future implementation)
- Designed to IP 66/67
- UL 508 listed
- Installed cable for flow switch connection for pool pump interlock
- Comes wired with 115V power plug. Customer installed wiring for booster pump and 230V service
- Printed circuit board provides install date and time, AC power on/off, flow switch flow/no flow and booster pump active/idle status
- Wall mounting capable

Figure 9. Pulsar Module



3.1.6 — VCM (Valve Control Module)

- Used for the following:
 - Pulsar® Precision 30 - 24V DC feed valve
 - Pulsar® Acid Plus - 24V DC feed valve
- Designed to IP 66/67 and NEMA 4x, and 12 specifications
- Printed circuit board provides feeder name, install date and time, solenoids mA draw
- Wall mounting capable

Figure 10. Valve Control Module



3.2 — Non-Electronic Equipment

- a. LDPE enclosure with aluminum sheet metal mounting plates for easy wall mounting
- b. Acrylic window, recommended for UV protection (optional)
- c. PVC Flow cell plumbing installation kit, ½" schedule 40

Figure 11. Enclosure Assembly Rear View



Figure 12. UV Shield Isolated and Installed



4 — Pre-installation Instructions

4.1 — Prepare the Site

Before installing equipment, ensure that:

1. The site has all electrical connections installed. All electrical lines should be secured to meet site safety procedures and to prevent tripping over electrical lines.

 **Danger:** All wiring connections, fusing, grounding, inspection, and maintenance of wiring must be performed by a licensed electrician in accordance with the National Electric Code (NEC), Occupational Safety and Health Act (OSHA) in the United States, and all local electrical codes. Failure to properly install and wire this product can result in property damage, injury, or death, and may affect warranty coverage.

2. Site meets criteria noted in 11.1 — Requirements and Specifications.

4.2 — Gather Equipment for Feeder Installation

Assemble these products in preparation for installation:

- GuardTec components - overview on page 12.
- Essential equipment supplied by others
- Commercial off-the-shelf (COTS) tools
- Personal Protective Equipment (PPE)

4.2.1 — Essential Equipment Supplied by Others

- Plumber's tape
- 1/2" OD polyethylene tubing or PVC piping (non-metallic)
- 1/2" ball valves
- 3/16" Bolts (Qty 4 wall mounting bolts for concrete or wood)
- Non-metallic fittings

4.2.2 — COTS Tools

- Drill
- 11/16" drill bit and 1/2" NPT tap
- Saddle clamps (optional)
- Pipe wrenches or gas pliers
- Tubing cutters
- Saw (to cut PVC pipe if necessary)

4.2.3 — PPE

- Safety glasses
- Rubber gloves (if handling chemical feeder)
- Apron (if handling chemical feeder)

4.3 – Pre-Installation Checklist

Table 1. Pre-installation Checklist

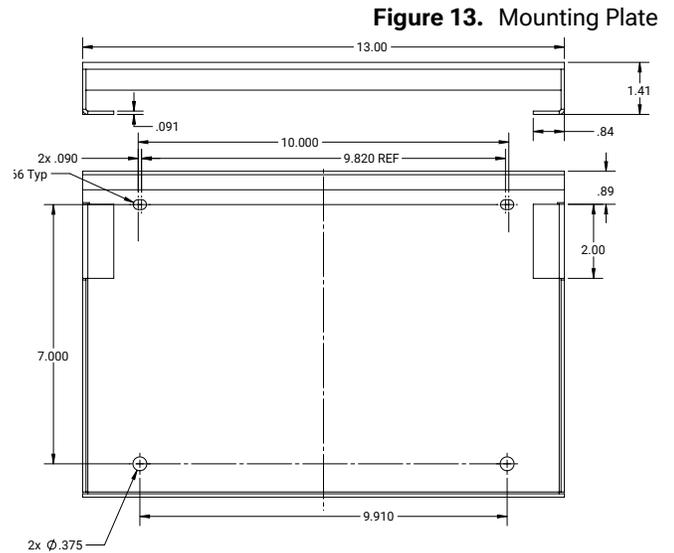
Item No	Check	Completed?
1	Is a licensed electrician available to perform necessary electrical wiring of the booster pump?	
2	Does the site meet all criteria noted in 11.1 – Requirements and Specifications?	
3	Is a dedicated 115V/15A GFCI provided for booster pump power connection?	
4	Has a wall location been identified for wall mounting and does it meet recommended clearances?	
5	Have feeder equipment location been determined and are they within the maximum distances from the GuardTec stated in 11.1 – Requirements and Specifications?	
6	Is all essential equipment supplied by others on hand?	
7	Are all COTS tools and other equipment on hand?	
8	Is all PPE on hand?	

5 — Installation Instructions

5.1 — Wall Mounting

⚠ Caution: Do not install near sources of electromagnetic interference (EMI) such as variable frequency drives or big AC and DC electric motors, SCR heater controllers, power lines, etc. EMI can adversely affect the instrumentation signals and impact the measurement readings of the pH, ORP, and FAC sensors.

1. Locate desired position on a wall based on recommended clearances listed in 11.1 — Requirements and Specifications.
2. Using the hole dimensions of the mounting plate in Figure 13, mark the locations of the (4) 1/4" mounting holes for securing the mounting plate to the wall.
3. Use (4) 3/16" bolts appropriate for your wall (concrete, wood, etc) to secure the mounting plate to the wall.
4. Hook the top of the GuardTec enclosure backplate over the mounting plate.
5. Install the security screws on the bottom of each side of the enclosure as illustrated in Figure 14.



5.2 — Water Sampling Recirculation Line

For best chemical dosing results, your water sample should be a good representation of the water from your pool or spa. The following information provides recommendations for sample and return line installation to the GuardTec flow cell.

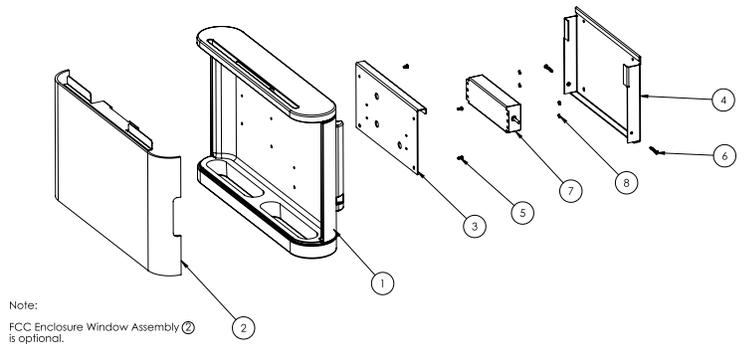
- Due to the low flow requirement of the FAC sensor, between 0.1 gpm and 0.4 gpm, minimal pressure differential is needed to provide motive flow through the flow cell.
- The flow cell uses 1/2" tubing and fittings, except for the included 1/4" sampling valve
- Reference the process flow diagrams in section 2.3 for flow cell sample loop installation guidance.
- A minimum of 3 psi is required for sufficient flow through the flow cell

Pressure filter applications

- Sample line to flow cell inlet
 - ◇ Install immediately after the filter for clean filtered water to protect the sensors
 - ◇ Install on the pool pump discharge if additional pressure differential is needed
 - ◇ Install prior to any chemical injection points
 - ◇ An inline strainer, included in the installation kit, is recommended to be installed for additional protection of the integrated flow meter and chemistry sensors
- Return line from flow cell outlet
 - ◇ Can be installed anywhere downstream of devices such as heater, UV system, Ozone, etc. to maximize pressure differential

Vacuum filter applications

Figure 14. Enclosure Assembly



- Sample line to flow cell inlet
 - ◇ Install on the pool pump discharge
 - ◇ Install prior to any chemical injection points
 - ◇ An inline strainer, included in the installation kit, is recommended to be installed for additional protection of the integrated flow meter and chemistry sensors
- Return line from flow cell
 - ◇ Can be installed anywhere downstream of devices such as heater, UV system, Ozone, etc. to maximize pressure differential
- The following fittings should be installed as part of the flow cell inlet and outlet installation
 - Ball valves for isolating the flow cell for maintenance purposes. The inlet ball valve can also be used for throttling flow rate to the flow cell
 - 1/2" strainer for additional protection from debris (included)
 - 0 – 1 gpm variable area flow meter (optional)
 - 1/2" needle valve at inlet of flow cell for easier and more precise flow control (optional)

5.3 — Equipment Connection to GuardTec

Note: Connect all electrical cables to the GuardTec prior to initial power up of the controller.

Note: Reference 2.2 — Process Flow Diagrams (possible configurations) for installation guidance.

5.3.1 — Connecting Pulsar® feeders

The GuardTec uses M12 cables and low voltage data connections to communicate with your Pulsar® feeder equipment. Using low voltage connections provides flexibility to place your Pulsar® equipment including the booster pump at greater distances from your controller. Maximum distances are provided in the cable lengths section of 4.1.1. M12 cables are connected to the data connector on each module.

5.3.2 — Pulsar® Precision (New Installation)

Note: This step is for connecting the Guardtec controller to a new Pulsar® Precision feeder. Follow installation instructions in the Pulsar® Precision feeder Installation and Operation (I&O) Manual to properly install your feeder and booster pump.

Parts required:

- Additional M12 data cable(s) (if required for increased length), part # 889144

Once the feeder is in the desired location and installed per the Pulsar® Precision I&O manual, connect the provided M12 cable to any of the four available connectors on the GuardTec

- An M12 cable is pre-connected to the Precision feeder module and comes out of the back of the hopper of the feeder.
- Multiple cables can be connected to increase length as necessary for proper cable routing and placement of both the feeder and GuardTec controller.
- Up to 2 Pulsar® Precision feeders can be connected to the GuardTec for simultaneous operation.

5.3.3 — Pulsar® Precision (Retrofit Installation)

Note: This step is for retrofitting an existing Pulsar® Precision feeder for use with the GuardTec system. This step assumes all other feeder installation steps from the I&O manual have already been accomplished.

Parts required:

- 73313 - Pulsar® Precision GuardTec Retrofit Kit; comes with the following parts:
 - 73326, Pulsar® Precision Feeder Module
 - 73337, Feeder Solenoid Cables (2) - 9.84 in [250 mm]
 - 73334, Level Switch Connector Cable - 6.89 in [178 mm]
 - 889144, M12 data Cable - 9.84 ft [3 m]
 - 76361, Module mounting screws (pack of 4)
 - 73346, Booster Pump Control

- Small Philips screwdriver

- Wire Crimper

1. Remove the junction box with all connected cables from the front of the feeder.
 - a. Remove the junction box top cover and disconnect the gray level switch cable from terminal blocks 1 and 4.
 - b. Loosen the cable gland and completely remove the level switch cable from the junction box.
 - c. Using a screwdriver, disconnect the DIN connector from both solenoid valves.
 - d. With the solenoid cables and main feeder cable still connected to the box, unscrew the two mounting screws of the junction box and completely remove it from the feeder.
 - e. After the junction box with feeder cable and solenoid cables is removed from the feeder, only the level switch cable should remain.
2. Mount the Pulsar® Precision feeder module (73326) to the front of the feeder. The new module is wider than the old junction box and will not align exactly with the brass inserts on the feeder (you will not be using the inserts to mount the module). Refer to Figure 15 for module size difference and mounting location.
 - a. Remove the top cover from the module to expose the mounting holes inside of the module, Figure 16.
 - b. With connectors facing outward center the module closer to the 1/2" pipe than the previous junction box. The right brass insert should be slightly exposed after placing the module near the pipe.
 - c. Use the self-tapping screws to mount the module to the feeder. All (4) screws can be used but at least (2) screws should be used diagonally for a secure mount.
3. Once module is securely fastened to the feeder, put on the top cover, and tighten screws, Figure 17.
4. Proceed with connecting the M12 cables to the module using Figure 19 as a guide.

Figure 15. Self-Mounting Screws Installation, Bottom View

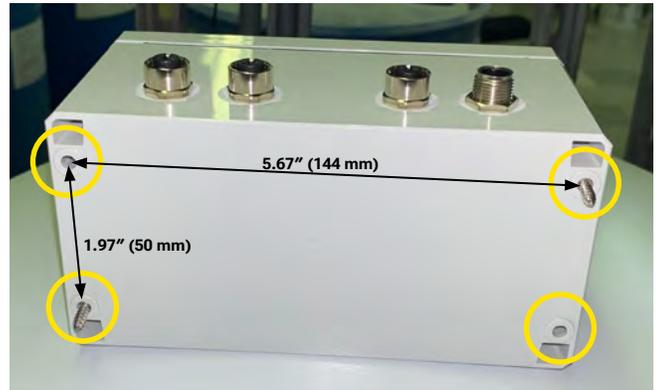


Figure 16. Self-Mounting Screws Installation, Top View

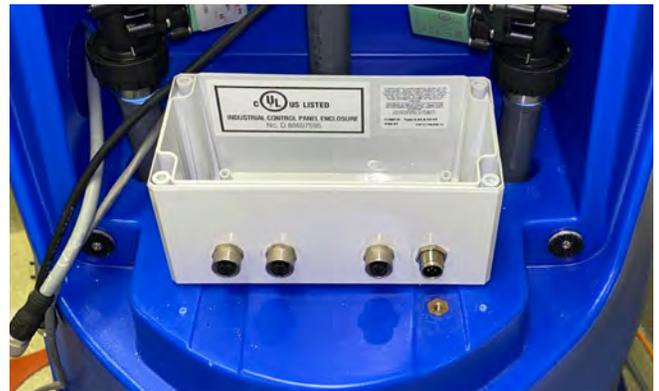


Figure 17. Feeder Module Mounted on Hopper



- **M12 Cable Connections**

- High Level Switch: 73334
 - Feed Valve: 73337
 - Wash Valve: 73337
 - Data Cable 3m: 889144
- First, connect the feeder high level switch cable (73334) to the high level switch lead wires using a wire crimper as shown in Figure 18. *(Confirm the connection is secure by gently tugging on the lead wires to ensure they do not separate).*
 - Level switch Black wire to black wire of 73334
 - Level switch Red wire to blue wire of 73334
 - Once both wires are crimped together, connect the M12 end to the High Level Switch connector as shown in Figure 19.
 - Connect both solenoid valve cables (73337)
 - Connect the M12 end of the solenoid valve cable (73337) to the Feed valve connector on the module and the DIN connector end to the feed solenoid valve as shown in Figure 19.
 - Connect the M12 end of solenoid valve cable (73337) to the wash valve connector on the module and the DIN connector end to the wash solenoid valve as shown in Figure 19.
 - Send the 3m data cable (889144) through the feeder hopper from front to back *(same holes used for old gray electrical cable)*. Connect the data cable to the module as shown in Figure 19.

Figure 18. Level Switch Lead Wire to M12 Connector Cable

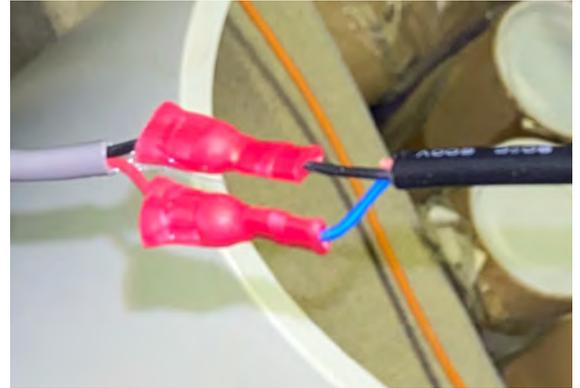
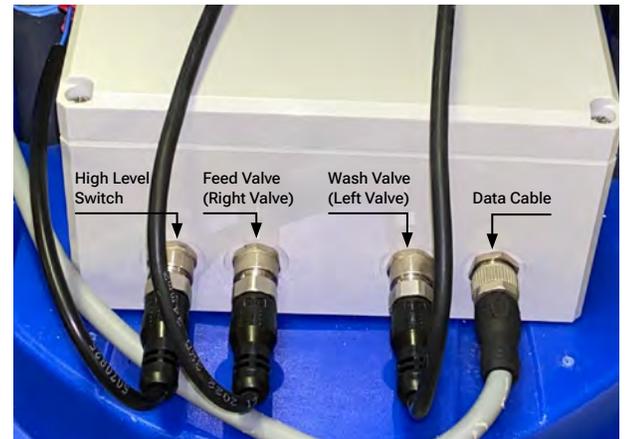


Figure 19. Feeder Module Cable Connections



5.3.4 — Booster Pump

Note: Follow installation instructions in the Pulsar® Precision feeder I&O Manual. The main difference in installation steps will be connecting the pump to the PCM for power.

Parts required:

- 73346 - Booster pump PCM
 - 889144 - M12 data cable(s)
- Electrical cable - 12 AWG or bigger

1. Find desired location for the PCM.

Note: The Booster Pump PCM is housed in an IP 67 / NEMA 4X rated enclosure and can withstand water splashing when properly tightened and can be wall mounted

Note: Wall mounting is accessible through the inside of the enclosure

2. Using a certified electrician, connect the booster pump to the PCM using the electrical cable.

Warning: Risk of dangerous or fatal electrical shock. Be sure that the PCM isn't yet connected to power before working on wiring, wiring connections, or the motor. Re-install the motor end cover and all other wiring covers before connecting to power.

Note: It is recommended to hard wire the booster pump to the PCM for safety purposes. This reduces accidental wiring hazards and disconnections

Note: Use Ground Fault Circuit Interrupter (GFCI) as a master on-off switch for each PCM.

3. Connect the orange flow switch cable to the flow switch installed in the pool recirculation line.
4. Connect the Booster pump PCM data connector to the GuardTec using the M12 Data cable
 - a. M12 cable female end connects to PCM and male end connects to Guardtec.
5. Connect the power cable to a dedicated 120 / 240 V, 15A GFCI outlet.

5.3.5 — Pulsar® Precision 30 Feeder

Note: Follow installation instructions in the Pulsar® Precision 30 feeder I&O Manual. The main difference in installation steps will be the connection of the solenoid valve to the GuardTec controller using the Pulsar® Precision 30 VCM

Parts required:

- 73343 - Pulsar® Precision 30 VCM
 - 889144 - M12 data cable(s)
 - 73336 - M12 x DIN solenoid cable

1. Find desired location for the VCM

Note: The Pulsar® Precision 30 VCM is housed in an IP 66/67 rated enclosure and can withstand water splashing and be wall mounted

Note: Wall mounting is accessible through the inside of the enclosure

2. Connect Pulsar® Precision 30 VCM to solenoid valve using M12 x DIN solenoid cable.
 - DIN connector to solenoid valve
 - M12 connector feed connector on VCM
3. Connect VCM to GuardTec using M12 data cable
 - a. M12 female end connects to VCM and male end connects to Guardtec.
 - Data connector on VCM to available connector on GuardTec.

5.3.6 — Pulsar® Acid Plus Feeder

Note: Follow installation instructions in the Pulsar® Acid Plus user guide. The main difference in installation steps will be the connection of the solenoid valve to the GuardTec controller using the Pulsar® Acid Plus VCM

Parts required:

- 73345 - Pulsar® Acid Plus VCM
 - 889144 - M12 data cable(s)
 - 73336 - M12 x DIN solenoid cable

1. Follow the steps in connecting the Pulsar® Precision 30 Feeder in Section 5.3.5.

5.3.7 — Pulsar® pH Control

Note: Follow installation instructions in the Pulsar® pH Control user guide. The main difference in installation steps will be the connection of Stenner pump to the GuardTec controller using the Pulsar® pH Control PCM

Parts required:

- 73347 - Pulsar® pH Control PCM
 - 889144 - M12 data cable(s)

1. Find desired location for the PCM

Note: The Booster Pump PCM is housed in an IP 67 / NEMA 4X rated enclosure and can withstand water splashing and can be wall mounted

Note: Wall mounting is accessible through the inside of the enclosure

2. Plug Stenner pump into PCM extension cable
3. Connect the Booster pump PCM data connector to the GuardTec using the M12 Data cable
4. Connect the power cable to a dedicated to 115V outlet

6 — Chemistry Sensors & Post-Installation Instructions

6.1 — Water Chemistry Sensors

Note: It is recommended that all electrical cable connections to the GuardTec be made prior to initial power up of the controller.

6.1.1 — Prime Flow Cell Recirculation Loop

Note: At this stage, you should not have yet removed the (4) port plugs that come pre-installed in the flow cell.

1. Open the ½" inlet and outlet ball valves of your flow cell sampling loop and allow water to flow through the system.
2. Inspect port plugs and fitting connections for leaks. If leaking at port plug(s), O-rings may not be well seated in grooves. Shut the inlet and outlet valves, depressurize the flow cell by opening the sampling valve and releasing water, then remove leaking port plug and reseal it correctly so that O-rings do not roll out of grooves (you may need to wet the O-rings with water in order to provide some lubrication to help push into the ports). Shut sampling valve.
3. Open inlet and outlet valves to re-pressurize the flow cell. Inspect to confirm there is no more leaking at the port plug(s).

Figure 20. Port Plugs Installed



Note: During initial priming, there will be entrained air bubbles in the flow cell. This is natural. The following steps will help purge the air pockets from the parts of the flow cell that may cause interference with the FAC sensor. The pH and ORP sensors are less sensitive to entrained air.

Note: Keep M12 connector caps installed in unused connectors during priming and air purging steps. This will protect the connectors from exposure to water internally.

4. Once the flow cell is full of water, shut the ball valves to isolate the system again.
5. Open the 1/4" sampling ball valve on the outlet of the flow cell and allow pressure to dissipate. Shut the sampling valve.
6. Remove all four port plugs from the top of the flow cell by turning them counterclockwise and pulling them up from the flow cell.
7. Very slowly crack open the inlet ball valve to the flow cell. This will cause water to slowly rise through each sensor port.
8. Once water reaches near the top of each port, shut the ball valve.

6.1.2 — pH and ORP Sensor Preparation

1. Remove the buffer solution bottle from the lower end of the sensors
2. Immerse the lower end of the sensors into distilled water or a pH buffer for 30 minutes.

Note: Step 2 hydrates the pH bulb and/or reference junction for optimum performance (not applicable for measuring ORP electrodes)

6.1.2.1 — Install Sensors in Flow Cell

3. Connect each of the sensor cables to any of the available (4) connectors on the top of the flow cell. (The left most connector is dedicated for communicating with the GuardTec controller)
 - a. Remove the black M12 connector caps from the connectors used for the sensor cables.
4. Gently wet the sensor O-rings with water to provide some lubrication to help with inserting into the flow cell ports.
5. Slowly Insert a sensor into the available port closest to the corresponding connector the cable is connected to. Ensure the sensor is inserted all the way so that the tabs are flushed with the top of the flow cell. There should not be any O-rings showing in this position.
6. Once inserted, turn the sensor clockwise so that it locks into place. See Figure 21.
7. Once all available sensors are installed, re-install the port plug(s) in the remaining open flow cell port(s) and be sure to also turn it clockwise so that it locks into place (water should have come out of the top of the flow cell. Dry it up using a rag.)
8. Once all sensors and port plugs are installed, open the inlet and outlet ball valves to allow water to flow through the flow cell. Inspect the entire recirculation loop for leaks and tighten fittings, as necessary. (If the main pool pump is on and pool pipes are not isolated, there should be indication of flow through the integrated flow meter on the flow cell – the float should rise)
9. If any sensors are leaking at the ports, shut the valves to isolate the flow cell, depressurize by opening the sampling valve, and remove the sensor. The O-ring may have rolled out of the O-ring groove. Fix O-ring and redo steps 3 to 5 to confirm there is no more leaks.
10. If there is still some leaking at the sensor, a small amount of plumber's tape can be used to cover the O-rings to help secure them in place prior to inserting into the ports.
11. The M12 connector caps removed from the flow cell should be used on the unused controller M12 connectors after installation is completed. This will prevent corrosion of the connectors over time.

Caution: Do not forget to install the blank connector caps in the unused M12 connectors. This protects the unused connectors from the environment to prevent corrosion over time.

Caution: Ensure the sensors are locked in place with the tab on the bottom of the sensor secured underneath the flow cell recess. The double O-rings on the sensors provide the watertight seal and locking mechanism secures it against upward pressure so the sensor is not dislodged to allow leaks.

Figure 21. Sensor Installation



6.1.3 — Post-Installation Checklist

Table 2. Post-Installation Checklist

#	Check	Completed?
1.	Has the flow cell been fully primed per section 6.1.1 and 6.1.2?	
2.	Are all electrical cables secured and not a tripping hazard?	
3.	If using a booster pump, is a dedicated 115/230V/15A GFCI provided for power connection?	
4.	Does the booster pump motor plug line up to the correct voltage supply?	
5.	If using a pH Control PCM, is the pump connected to the PCM and the PCM to 115V power?	
6.	Are all sensor cables connected to the flow cell connectors?	
7.	Are all installed sensors and port plugs in the locked position to prevent leaks or dislodging?	
8.	Are all fittings and unions tightened to prevent leaks?	
9.	Have steps been performed to purge and reduce entrained air in the flow cell, section 6.1.1?	
10.	Are all M12 data cables connected to the data connector on each applicable module?	
11.	Are the black M12 connector caps installed in the unused M12 connectors on the controller and flow cell?	

7 — System Powerup & Setup

7.1 — System Startup

Note: Before starting up the equipment, ensure that 6.1.3 — Post-Installation Checklist has been completed.

7.1.1 — Power Up the GuardTec

After completing the post-installation checklist:

1. Plug in the main power cable of the GuardTec to the appropriate power receptacle. The entire system with all connected equipment will boot up.
2. Follow all onscreen instructions to set up the GuardTec.

7.1.1.1 — Ready to Connect

1. If no equipment has ever been configured on the controller, the main dashboard will display a list of connected equipment followed by a “Ready to Connect” button. A minimum set of equipment is required for the button to display, including a pH and ORP sensor, a chlorine feeder, and an acid feeder.
2. Confirm all expected equipment is connected to the controller with M12 cables.
3. Pressing the Ready to Connect button will configure all available equipment and display the main dashboard accordingly.



7.1.2 — Initial Setup Screens

Note: All information entered is automatically saved once the ↵ Enter button is pressed.

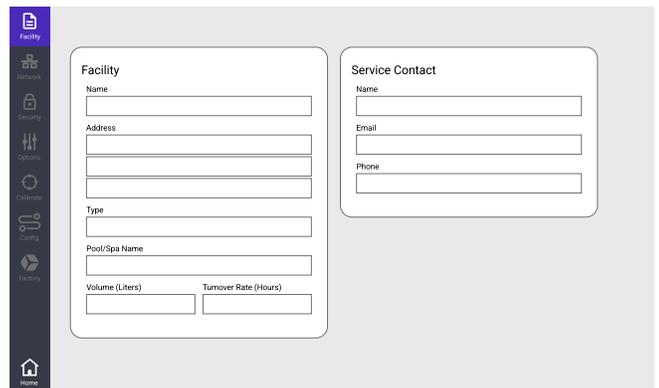
Note: Special characters are toggled using the ⇧ Shift button.

7.1.2.1 — Facility

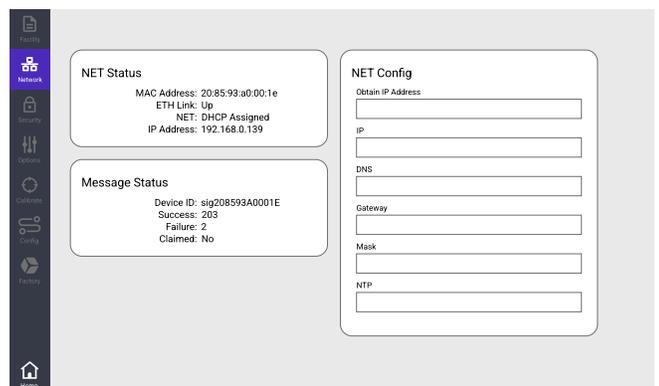
- Enter site information specific for each body of water to be controlled (i.e. Competition pool; wave pool; Kiddie pool)
- Pool volume and turnover rate used for increased PID precision
- Service contact used for contact information access

7.1.2.2 — Network

- Provides network information when connected to the internet using an Ethernet cable.
- The unique device ID to connect the GuardTec to the remote monitoring platform is found in the Message Status box.
- Alternatively, the device ID can be found in the NET Status box by combining the letters **sig** with the MAC Address.
 - e.g. MAC Address: **20:85:93:a0:00:1E** is device ID **sig208593A0001E**
- **Success:** This is the number of successful data uploads to the remote monitoring platform once a connection is made



The screenshot shows the 'Facility' setup screen. It features a vertical navigation bar on the left with icons for Facility, Network, Security, Settings, Calibrations, Tools, and Reports. The main content area is divided into two columns. The left column is titled 'Facility' and contains input fields for Name, Address, Type, Pool/Spa Name, Volume (Liters), and Turnover Rate (Hours). The right column is titled 'Service Contact' and contains input fields for Name, Email, and Phone.



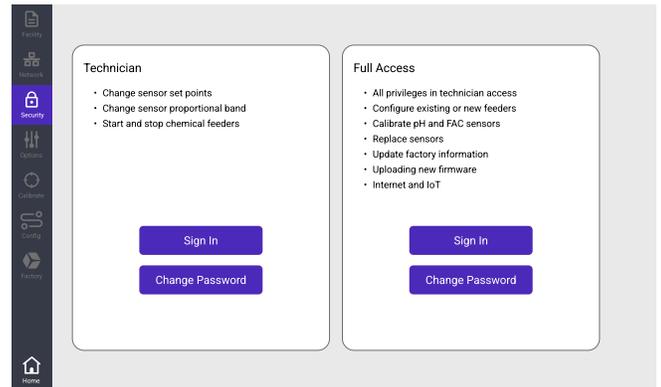
The screenshot shows the 'Network' setup screen. It features the same vertical navigation bar as the Facility screen. The main content area is divided into two columns. The left column is titled 'NET Status' and displays the following information: MAC Address: 20:85:93:a0:00:1e, ETH Link: Up, NET: DHCP Assigned, and IP Address: 192.168.0.139. Below this is a 'Message Status' box showing Device ID: sig208593A0001E, Success: 203, Failure: 2, and Claimed: No. The right column is titled 'NET Config' and contains input fields for Obtain IP Address, IP, DNS, Gateway, Mask, and NTP.

- **Failure:** This is the number of failed data upload attempts made to the remote monitoring platform. This usually occurs with the loss or interruption of internet connectivity.

Note: The device ID is case-sensitive. The **sig** part of the ID is always lowercase while any letters the MAC address are uppercase when used in the device ID.

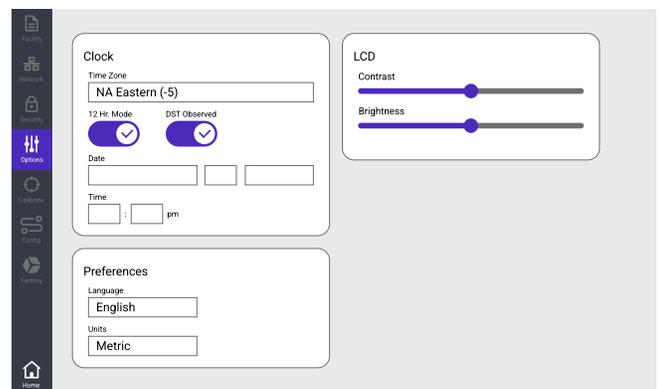
7.1.2.3 – Security

- Create Technician and Full Access passcodes for security and safety
- Default passcodes:
 - Technician: **tech**
 - Full Access: **full**
- Once passcodes are created, they must be entered for operational access of functions listed on the screen.
- Passcodes timeout after 30 minutes. Re-enter passcode for access to applicable features.



7.1.2.4 – Options

- Setup time zone, date, time, and daylight savings time
 - If connected to the internet, the date and time updates automatically based on location, but the time zone will still need to be set.
- Enter language preference
 - Choose between English, French, Spanish, and Portuguese
- Enter unit preference
 - Choose between volume and temperature units
- Adjust screen brightness and contrast

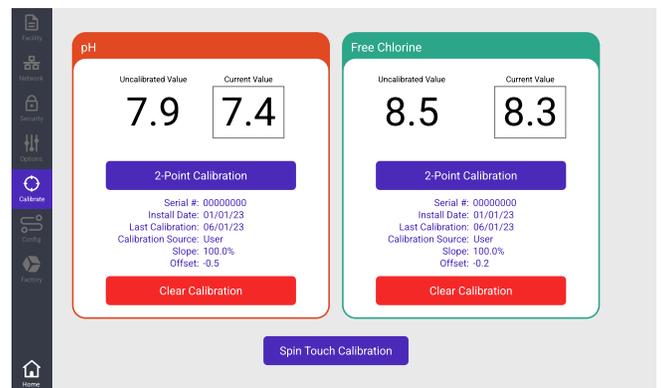


7.1.2.5 – Calibrate

This screen provides options for calibrating both the connected pH and FAC (Free Available Chlorine) sensors. The screen shows both the uncalibrated and current calibrated values of the sensors. The current calibrated value of each sensor is displayed on the main operational dashboard.

A 1-point calibration to adjust the zero-mV offset can be performed for both the pH and FAC sensors. For added precision over the measurement range of the sensor, A 2-point calibration can also be performed on the pH sensor to adjust the offset and the slope of the sensor. Over time, the calibrated values of the pH and FAC sensors will continue to deviate from the raw uncalibrated sensor values. The speed at which this happens depends on many variables including electrode aging, chemicals and contaminants in the process water, storage time and quality between use. When the calibrated sensor diverges from the uncalibrated values greater than a preset amount, notifications will be displayed to indicate time to replace the sensors. In addition to replacing the pH sensor based on actual sensor performance, we recommend replacing the sensor at least every two years for optimal performance.

A WaterLink® Spin Touch® photometer can also be used to upload data directly to the GuardTec using a Bluetooth connection. Once data is uploaded, options will be available to save and use the data to perform a 1-point calibration of the pH and FAC sensors.



pH Sensor 1 Point Calibration

1. Press the pH current value and enter the new pH value from the manual test performed
2. Once entered, the new current value will be displayed on the main dashboard
3. If the new pH value is beyond the acceptable mV threshold, notifications will be displayed for possible sensor replacement

pH Sensor 2 Point Calibration

Note: pH 4 and pH 7 buffer solutions are required for a proper 2-point calibration

1. Press the pH 2-Point Calibration button to access the 2-point calibration screen
2. Follow the onscreen instructions to perform the calibration
3. When completed, the new calibrated value will be displayed as the current value and on the main dashboard

FAC 1-point calibration

1. Press the FAC current value and enter the new Free Chlorine (PPM) value from the manual test performed
2. Once entered, the new current value will be displayed on the main dashboard

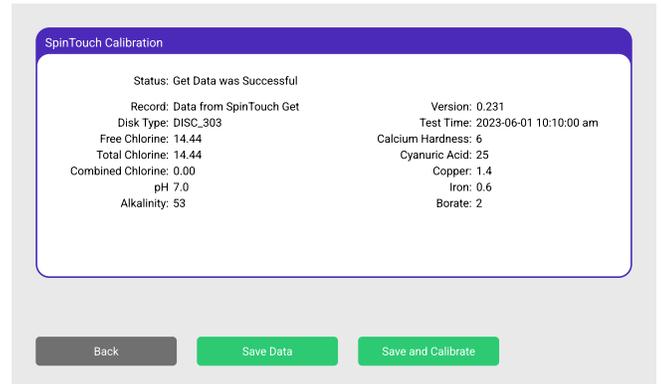
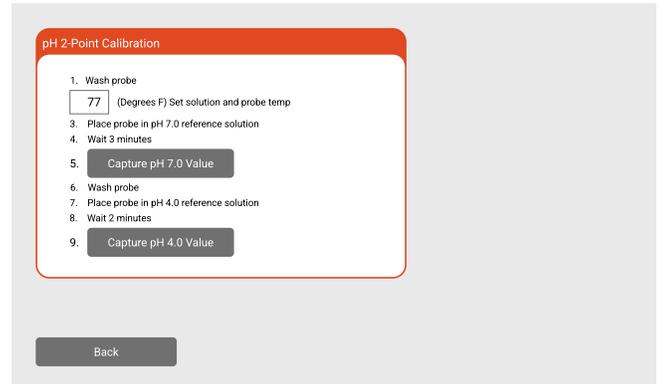
Spin Touch® Calibration

Note: The GuardTec will connect to only one Spin Touch® at a time. If multiple Spin Touch® units are available, only power up the unit requiring connection

Note: Refer to the Waterlink® Spin Touch® manual for detailed instructions on operating the Spin Touch®.

1. On the GuardTec calibration screen, press the Spin Touch® Calibration button to start scanning for a nearby active SpinTouch
2. Once a Spin Touch® is detected, the connection will be made automatically and the status “waiting for user to press Spin Touch® button” will be displayed
3. On the SpinTouch, press the  Bluetooth transfer button
4. After a couple of seconds, the results from the last run test on the Spin Touch® will be uploaded to the GuardTec and “Get Data was Successful” will be displayed as the status
 - Perform steps 1 through 4 again if data upload is not successful
5. Once uploaded, press the Save Data or Save and Calibrate button
 - **Save Data** – Saves the most recent uploaded results to the GuardTec local memory. The last 50 most recent uploads can be saved and viewed
 - **Save and Calibrate** – Saves the most recent uploaded results to the GuardTec local memory and performs a 1-point calibration of the pH and FAC sensors with the pH and free chlorine values
- Sensor manufacturing information
 - Serial number
 - First install date
 - Last calibration date
 - Calibration source: User manually entered or Uploaded from Spin Touch® Lab

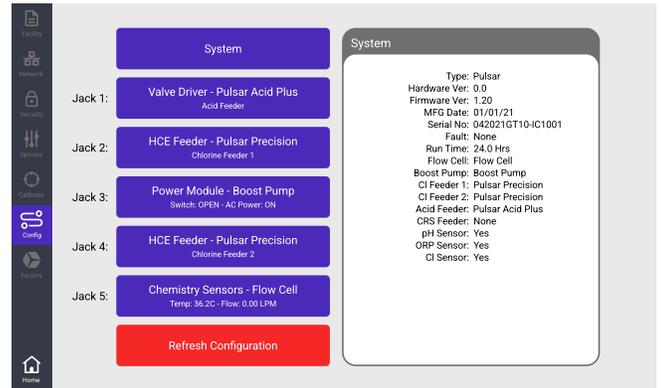
Note: pH and FAC sensors come pre-calibrated for immediate use, however calibration on first use may still be necessary due to storage time prior to use and sensor to sensor variation.



7.1.2.6 – Configuration

The configuration screen displays all connected equipment and modules including chlorine and acid feeders, booster pump, flow cell and sensors.

- Each module displayed can be pressed to bring up detailed information for that module
 - Jack 1 through 5 are the GuardTec connectors from left to right (not including the input power on the left most connector)
1. Confirm that all the connected equipment shown on the screen.
 - a. Ensure the expected names of each feeder are displayed on the appropriate jack, i.e. Jack 1
 - b. If a different module is displayed from what is supposed to be connected, take a note of what it is and contact your dealer for problem resolution
 2. If all the equipment displayed are correct, press **Refresh Configuration**. This action updates the system configuration so that the GuardTec knows what is supposed to be connected and what to control and monitor during normal operation.
 - a. Any deviation from this “known” configuration (i.e. inadvertent cable disconnection, wrong module connected etc.) will generate an alarm notification and if necessary, stop system operation.
 3. Once the system is configured correctly, normal operating parameters for chlorine and pH control can be set
 4. Any permanent changes to the system, (i.e. removal or addition of a module) requires pressing the **Refresh Configuration** button and power cycling the controller (unplug power cord for 10 seconds) to update the expected configuration of the system for normal operation.



Note: During startup and normal operation, the GuardTec controller automatically recognizes a connected module, however it will not automatically monitor or control it until the system configuration is intentionally updated by pressing **Refresh Configuration** to acknowledge that the connected equipment is supposed to be there.

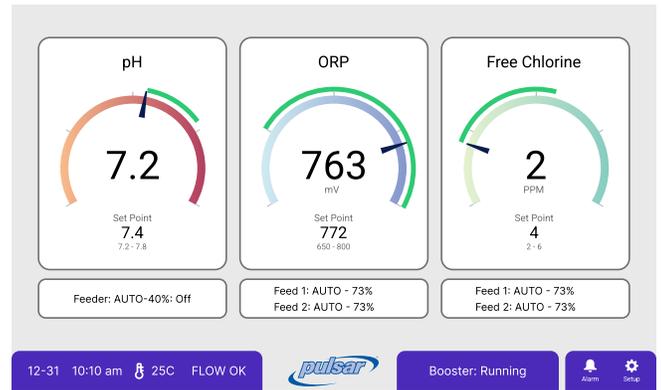
Note: If a connected module is intentionally removed or swapped in the system due to a permanent change in feeder setup, A factory reset may be necessary. After performing a factory reset, all information in the facility, security and options screens need to be reentered for the system.

7.1.2.7 – Home

The home screen displays the main user dashboard for user monitoring and operation.

The connected sensors take up much of the screen real estate for simple visual notification of pool water conditions, user-established set points and normal operating ranges.

- Each sensor card is a button that opens that sensor settings screen.
- Below each sensor card is a feeder card showing feeder status and operating condition. Each feeder card is a button that opens that feeder's settings screen.



Feed: Off	Feeder is turned off and will not feed
Feed: Auto – Idle	Feeder is on auto and is proportionally controlled pH/ORP/FAC setpoint is reached and feeder is idle
Feed: Auto – On/Off	Feeder is on auto and is proportionally controlled pH/ORP/FAC is below or above setpoint and feeder is in a proportionally controlled feed cycle Percentage displays approximate on/off feed timing
Feed: Manual – On/Off	Feeder is in manual mode pH/ORP/FAC sensors are disregarded and feeder feeds according to selected output setting

The bottom of the screen displays (from left to right):

- Date and time
- Flow cell water temperature
- Flow status through flow cell
- CRS system button (if connected)
 - Displays CRS status and opens the CRS settings screen
- Booster pump button (if connected)
 - Displays booster status and opens booster pump settings and diagnostic screen
- Alarm button – opens the alarm screen
- Setup button – opens the main menu navigation screen

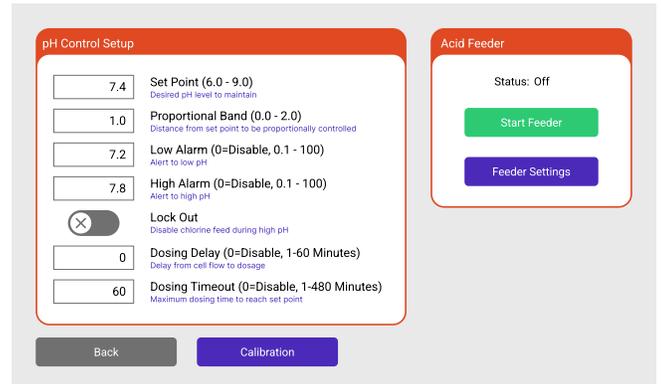
8 — Operation Instructions

8.1 — pH Control, Acid Feeder Setup and Operation

8.1.1 — pH Control Setup

1. From the main dashboard, press anywhere on the pH dial to pull up the pH sensor setup screen
2. Enter the parameters as required under the pH Control Setup screen

- a. Set Point:** pH level to maintain. The allowable adjustment ranges from 6.0 to 9.0 pH, however an actual range of 7.2 to 7.8 pH is recommended
 - i. When the pH value goes above the set point, the GuardTec triggers the connected acid feeder to feed based on the defined proportional band.
 - ii. When the pH value reaches set point or below, the GuardTec stops the pH acid feed.
- b. Proportional Band:** This is the distance from the pH setpoint to be proportionally controlled. The GuardTec uses a full dynamic PID (proportional-integral-derivative) algorithm to control the dosage as the setpoint is achieved.
 - i. The proportional band algorithm uses both the pool volume and turnover rate as key variables to increase the precision in the response. Ensure that those variables are set correctly based on the pool or spa being controlled.
 - ii. pH Proportional Band range is from 0.1 to 2.0 pH. Set this to 0.0 to operate in on/off mode.
 - iii. Example: If the pH setpoint is 7.2 and the proportional band is set to 0.8, at a pH of 8.0 or above, the acid feeder will feed at 100% output. As the pH drops to 7.8, the acid feeder output decreases to 75%. As the pH drops to 7.4 the feeder output decreases to 50% and so on. Percent output is equal to on/off time
 - iv. The proportional band setting is meant to be adjusted as needed based on the application (pool type, size, and design), feeder output, and user preference.
- c. Low Alarm:** When the setpoint goes below this user defined pH value, the GuardTec displays a notification above the pH dial. The notification is displayed for the duration that the pH is below the alarm value and automatically disappears when the pH reaches or goes above this value.
 - i. User should check the system and confirm that the feeder and controller are operating appropriately and the acid feeder is not feeding.
- d. High Alarm:** When the setpoint goes above this user defined pH value, the GuardTec displays a notification above the pH dial. The notification is displayed for the duration that the pH is above the alarm value and automatically disappears when the pH reaches or goes below this value.
 - i. User should check the system to confirm that the feeder and controller are operating appropriately.
 - ii. Ensure the acid feeder has acid and is not running empty.
- e. Lockout:** when this feature is turned on, the chlorine feeder is disabled when the pH rises above the pH high alarm. This feature is important especially when using calcium Hypochlorite that increases pH. Chlorine feeder operation is re-enabled once the pH drops under the pH high alarm value.
- f. Dosing Delay:** This is the flow on feed delay. If on, when a no flow event, or any event that interrupts normal operation occurs through the flow cell or controller, the controller will wait the specified number of minutes before resuming feed operation when flow is reestablished. Set this time to allow sensors to stabilize and reflect more accurate values with flow as well as time to complete any maintenance activities prior to dosing chemical.
- g. Dosing Timeout:** This is the maximum time allowed to reach the pH setpoint. If the pH setpoint is not reached during this



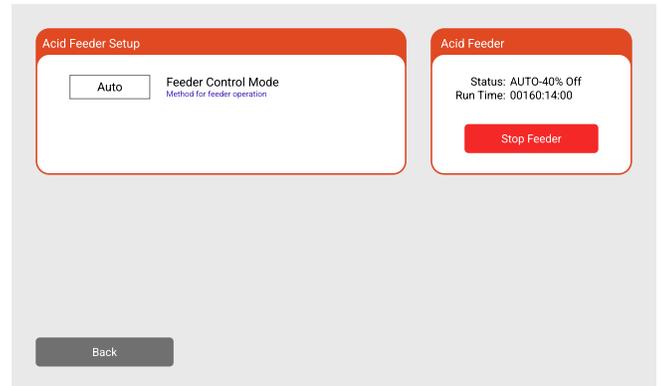
user defined time, a notification is displayed on the GuardTec and acid dosing is disabled.

- i. User intervention is required for this alarm to restart operation.
- ii. Inspect the feeder and ensure the feeder has acid and is not running empty. After confirming feeder status and correcting as needed, press on the feeder button, then press the reset timer button to restart normal dosing operation.

Warning: NSF 50 certification is void if dosing timeout is disabled.

8.1.2 — Acid Feeder Setup

1. From the main pH Control Setup screen, press the Feeder Setup button within the Acid Feeder block. This will take you to the feeder setup screen
 - a. Alternatively, if on the main dashboard, press the feeder button below the pH dial. This will take you directly to the feeder setup screen
2. Choose the feeder mode for feeder operation
 - a. **OFF:** Disable acid feeder. It will not feed despite pH control settings
 - b. **Auto:** Acid feeder will feed in auto proportional (PID) feed control based on pH setpoint and proportional band settings
 - c. **Manual:** Acid feeder will feed manually regardless of pH Control settings.
 - i. Select the manual output setting desired based on pool pH level.
 - ii. Manual percentage corresponds to feeder on time. Only the 100% on time option is available for the acid feeder.
 - iii. In the manual setting, once feeder is started, it will continue to feed until it is stopped.



Warning: In manual mode, there is no fail safe for turning off the feeder automatically if the pH level goes below the allowable range.

3. Once feeder mode is chosen, press the Start Feed button to start the manual feed
 - a. If the Start Feed button has already been pressed, the feeder will automatically start feeding in the mode that has just been selected.
 - b. Press the Stop Feed button to stop the feed
4. Press the back button to go back to the main operational dashboard.

8.2 – ORP Control, Chlorine Feeder Setup and Operation

8.2.1 – ORP Control Setup

1. From the main dashboard, press anywhere on the ORP dial to pull up the pH sensor setup screen
2. Enter the parameters as required under the pH Control Setup screen

a. Set Point: ORP level to maintain. The allowable adjustment ranges from 500 to 1000 mV

i. When the ORP value goes below the set point, the GuardTec triggers the connected chlorine feeder to feed based on the defined proportional band.

ii. When the ORP value reaches set point or above, the GuardTec stops the chlorine feed.

b. Proportional Band: This is the distance from the ORP setpoint to be proportionally controlled. The GuardTec uses a full dynamic PID (proportional-integral-derivative) algorithm to control the dosage as the setpoint is achieved.

i. The proportional band algorithm uses both the pool volume and turnover rate as key variables to increase the precision in the response. Ensure that those variables are set correctly based on the pool or spa being controlled.

ii. ORP Proportional Band range is from 1 to 500 mV. Set this to 0 to operate in on/off mode.

iii. Example: If the ORP setpoint is 700 mV and the proportional band is set to 100 mV, at an ORP value of 600 mV or below, the chlorine feeder will feed at 100% output. As the ORP value increases to 625 mV, the chlorine feeder output decreases to 75%. As the ORP value increases to 650 mV, the chlorine feeder output decreases to 50% and so on. Percent output is equal to on/off time

Note: The Pulsar® Precision feeder max output is capped at 73% for overflow protection.

iv. The proportional band setting is meant to be adjusted as needed based on the application (pool type, size, and design), feeder output, and user preference.

c. Low Alarm: When the setpoint goes below this user defined ORP value, the GuardTec displays a notification above the ORP dial. The notification is displayed for the duration that the ORP is below the alarm value and automatically disappears when the ORP reaches or goes above this value.

i. User should check the system and confirm that the feeder and controller are operating appropriately, and the chlorine feeder is feeding chlorine.

d. High Alarm: When the setpoint goes above this user defined ORP value, the GuardTec displays a notification above the ORP dial. The notification is displayed for the duration that the ORP is above the alarm value and automatically disappears when the ORP reaches or goes below this value.

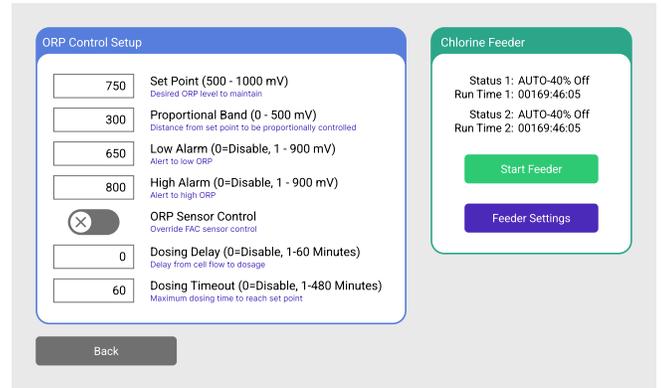
i. User should check the system to confirm that the feeder and controller are operating appropriately.

ii. Ensure the chlorine feeder is not feeding.

e. ORP Sensor Control: If both the FAC and ORP sensors are connected, the FAC sensor defaults as the main control for the chlorine feeder. Turning on the ORP Sensor Control feature overrides the FAC and allows the ORP sensor to control the chlorine feeder.

f. Dosing Delay: This is the flow on feed delay. If on, when a no flow event, or any event that interrupts normal operation occurs through the flow cell or controller, the controller will wait the specified number of minutes before resuming feed operation when flow is reestablished. Set this time to allow sensors to stabilize and reflect more accurate values with flow as well as time to complete any maintenance activities prior to dosing chemical.

g. Dosing Timeout: This is the maximum time allowed to reach the ORP setpoint. If the ORP setpoint is not reached during



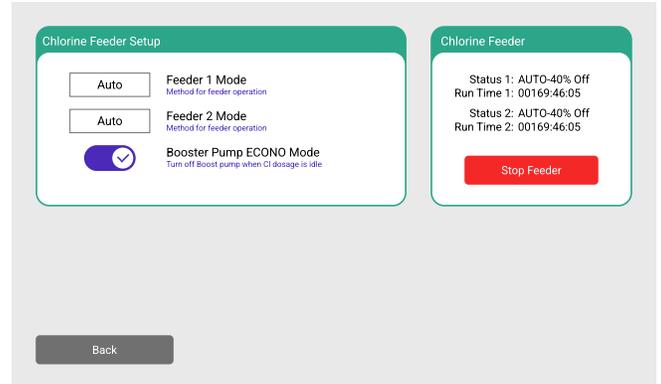
this user defined time, a notification is displayed on the GuardTec and chlorine dosing is disabled.

- i. User intervention is required for this alarm to restart operation.
- ii. Inspect the feeder and ensure the feeder has chlorine (calcium hypochlorite) and is not running empty.
- iii. After confirming feeder status and correcting as needed, press on the feeder button, then press the reset timer button to restart normal dosing operation.

Warning: NSF 50 certification is void if dosing timeout is disabled.

8.2.2 — Chlorine Feeder Setup

1. From the main ORP Control Setup screen, press the Feeder Setup button within the Chlorine Feeder block. This will take you to the feeder setup screen
 - a. Alternatively, if on the main operation dashboard, press the feeder button below the ORP dial. This will take you directly to the feeder setup screen
2. Choose the feeder mode for feeder operation
 - a. **OFF:** Disable chlorine feeder. It will not feed despite ORP control settings
 - b. **Auto:** Chlorine feeder will feed in auto proportional (PID) feed control based on ORP setpoint and proportional band settings
 - c. **Manual:** Chlorine feeder will feed manually regardless of ORP Control settings.
 - i. Select the manual output setting desired based on pool chlorine level. Refer to Section 11.4 to select the desired manual setting for Pulsar® Precision feeders.
 - ii. Manual percentage corresponds to feeder on time. The higher the percentage, the longer the feeder on time, the higher the feeder output.
 - iii. In the manual setting, once feeder is started, it will continue to feed until it is stopped.



Warning: In manual mode, there is no fail safe for turning off the feeder automatically if the ORP level goes above the allowable range.

Caution: If a second chlorine feeder is connected for increased chlorine output, both feeder modes will need to be selected. Each feeder will operate in accordance with its feeder mode so they should both be set to the exact same feeder mode especially if auto operation is desired.

Note: Note: If a second chlorine feeder is installed for redundancy, the second feeder can be set to “off” mode to disable it until such time that it is needed.

3. Once feeder mode is chosen, press the Start Feed button to start the manual feed
 - a. If the Start Feed button has already been pressed, the feeder will automatically start feeding in the mode that is selected.
 - b. Press the Stop Feed button to stop the feed
4. Booster Pump ECONO mode: Select to turn on or off economy mode for the booster pump
 - a. If on, the booster pump will turn off 10 minutes after the last feeder command.
 - b. If off, the booster pump will always be on during normal operation.
5. Press the back button to go back to the main operational dashboard.

8.3 – FAC Control, Chlorine Feeder Setup and Operation

8.3.1 – FAC Control Setup

1. From the main dashboard, press anywhere on the FAC dial to pull up the pH sensor setup screen
2. Enter the parameters as required under the pH Control Setup screen

a. Set Point: FAC level to maintain. The allowable adjustment ranges from 1 to 10 PPM

i. When the FAC value goes below the set point, the GuardTec triggers the connected chlorine feeder to feed based on the defined proportional band.

ii. When the FAC value reaches set point or above, the GuardTec stops the chlorine feed.

b. Proportional Band: This is the distance from the FAC setpoint to be proportionally controlled. The GuardTec uses a full dynamic PID (proportional-integral-derivative) algorithm to control the dosage as the setpoint is achieved.

i. The proportional band algorithm uses both the pool volume and turnover rate as key variables to increase the precision in the response. Ensure that those variables are set correctly based on the pool or spa being controlled.

ii. FAC Proportional Band range is from 0.1 to 2.0 PPM. Set this to 0.0 to operate in on/off mode.

iii. Example: If the FAC setpoint is 3 PPM and the proportional band is set to 2.0 PPM, at an FAC value of 1.0 PPM or below, the chlorine feeder will feed at 100% output. As the FAC value increases to 1.50 PPM, the chlorine feeder output decreases to 75%. As the ORP value increases to 2 PPM, the chlorine feeder output decreases to 50% and so on. Percent output is equal to on/off time

Note: The Pulsar® Precision feeder maximum output is capped at 73% for overflow protection.

iv. The proportional band setting is meant to be adjusted as needed based on the application (pool type, size, and design), feeder output, and user preference.

c. Low Alarm: When the setpoint goes below this user defined FAC value, the GuardTec displays a notification above the FAC dial. The notification is displayed for the duration that the FAC is below the alarm value and automatically disappears when the FAC reaches or goes above this value.

i. User should check the system and confirm that the feeder and controller are operating appropriately, and the chlorine feeder is feeding chlorine.

d. High Alarm: When the setpoint goes above this user defined FAC value, the GuardTec displays a notification above the FAC dial. The notification is displayed for the duration that the FAC is above the alarm value and automatically disappears when the FAC reaches or goes below this value.

i. User should check the system to confirm that the feeder and controller are operating appropriately.

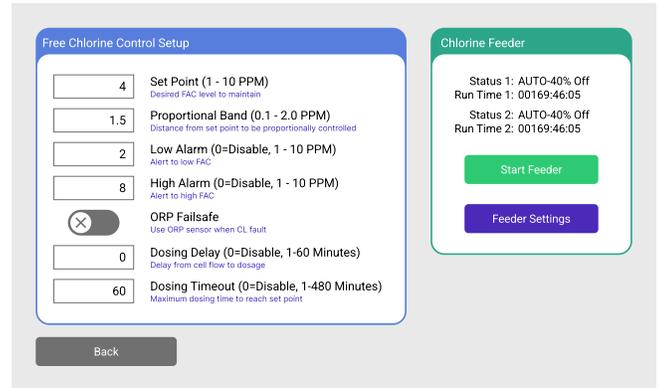
ii. Ensure the chlorine feeder is not feeding.

e. Dosing Delay: This is the flow on feed delay. If on, once a no flow event occurs through the flow cell, the controller will wait the specified number of minutes before resuming feed operation when flow is reestablished. Set this time to allow sensors to stabilize and reflect more accurate values with flow as well as time to complete any maintenance activities prior to dosing chemical.

f. Dosing Timeout: This is the maximum time allowed to reach the FAC setpoint. If the FAC setpoint is not reached during this user defined time, a notification is displayed on the GuardTec and chlorine dosing is disabled.

i. User intervention is required for this alarm to restart operation.

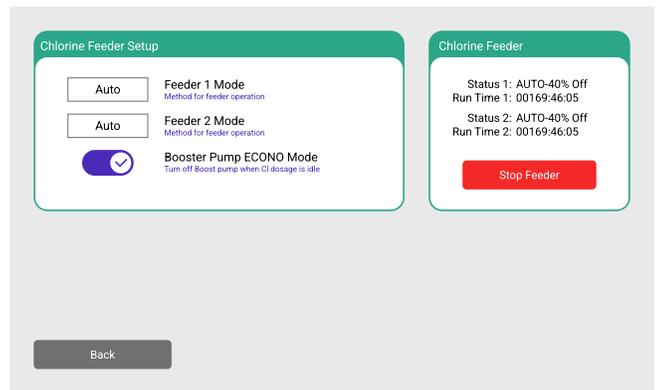
ii. Inspect the feeder and ensure the feeder has chlorine (calcium hypochlorite) and is not running empty.



 **Warning:** NSF 50 certification is void if dosing timeout is disabled.

8.3.2 — Chlorine Feeder Setup

- From the main FAC Control Setup screen, press the Feeder Setup button within the Chlorine Feeder block. This will take you to the feeder setup screen
 - Alternatively, if on the main operation dashboard, press the feeder button below the FAC dial. This will take you directly to the feeder setup screen
 - Choose the feeder mode for feeder operation
 - OFF:** Disable chlorine feeder. It will not feed despite FAC control settings
 - Auto:** Chlorine feeder will feed in auto proportional (PID) feed control based on FAC setpoint and proportional band settings
 - Manual:** Chlorine feeder will feed manually regardless of FAC Control settings.
 - Select the manual output setting desired based on pool chlorine level. Refer to Section 11.4 to select the desired manual setting for Pulsar® Precision feeders.
 - Manual percentage corresponds to feeder on time. The higher the percentage, the longer the feeder on time, the higher the feeder output.
 - In the manual setting, once feeder is started, it will continue to feed until it is stopped.
- Warning:** In manual mode, there is no fail safe for turning off the feeder automatically if the FAC level goes above the allowable range.
- Caution:** If a second chlorine feeder is connected for increased chlorine output, both feeder modes will need to be selected. Each feeder will operate in accordance with its feeder mode so they should both be set to the exact same feeder mode especially if auto operation is desired.
- Note:** If a second chlorine feeder is installed for redundancy, the second feeder can be set to “off” mode to disable it until such time that it is needed.
- Once feeder mode is chosen, press the Start Feed button to start the manual feed
 - If the Start Feed button has already been pressed, the feeder will automatically start feeding in the mode that has just been selected.
 - Press the Stop Feed button to stop the feed
 - Booster Pump ECONO mode:** Select to turn on or off economy mode for the booster pump
 - If on, the booster pump will turn off 10 minutes after the last feeder command.
 - If off, the booster pump will always be on during normal operation.
 - Press the back button to go back to the main operational dashboard.



8.4 – Booster Pump

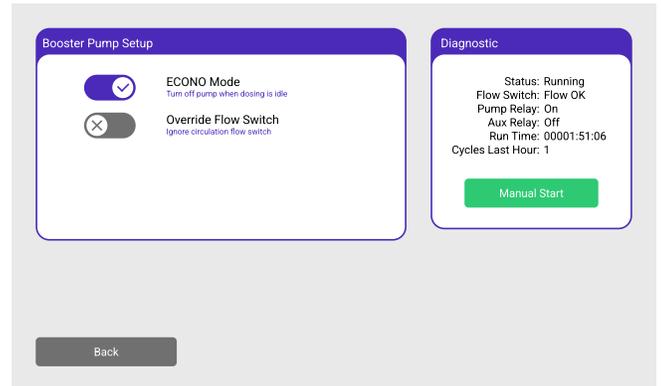
When a booster pump module is connected to the GuardTec, the booster pump status button can be pressed to go to the booster pump screen for additional options. These options will be used for information and troubleshooting.

Booster: Idle



8.4.1 – Booster Pump Setup

- **ECONO Mode:** Select to turn on or off economy mode for the booster pump
 - This mode can also be selected from the chlorine feeder setup screen.
 - If on, the booster pump will turn off 10 minutes after the last feeder command.
 - If off, the booster pump will always be on during normal operation.
- **Override Flow Switch:** Select to override the pump flow switch. This should only be used to troubleshoot the flow switch and if there is **100% certainty** that there is water flowing through the pool recirculation piping.
 - If on, the GuardTec will ignore the flow switch and allow the booster pump to power on if all electrical connections were properly made



Warning: Overriding the flow cell without positive confirmation of flow in the pool piping will cause the booster pump to run dry and overheat within a few seconds.

Caution: The booster pump warranty is voided if the flow switch override button is used. Solenis recommends replacing the flow switch if it failed before using the booster pump. Refer to feeder Installation and Operation manual for proper flow switch placement and troubleshooting.

8.4.2 – Booster Pump Diagnostic

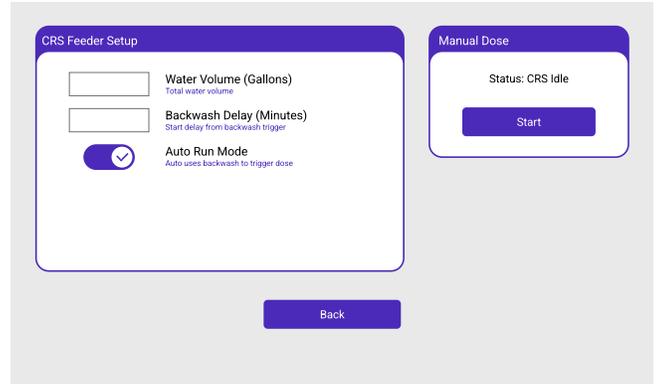
- **Status:** Displays the current booster pump condition, idle or running
- **Flow Switch:** Displays whether flow switch is registering Flow OK or No Flow through the pool recirculation piping
- **Pump Relay:** Displays if the pump relay in the PCM is making contact to allow the pump to be powered on. If all electrical connections are properly made, when the pump relay is on, the booster pump should power on and running.
- **Aux Relay:** Displays if the aux relay in the PCM is making contact. (Aux relay is a dry contact for future system functionality. It is not currently used in this version of the GuardTec firmware.)
- **Run Time:** accumulated time that the booster pump is running from initial configuration. (The time restarts if the booster pump is removed from the configuration screen)
- **Cycles Last Hour:** how many times the booster pump powered on and off within the last hour
- **Manual Start:** press this button to manually start the pump from an off condition
 - This button should only be used for troubleshooting purposes.
 - This button will not be available if the flow switch displays No Flow.

8.5 – CRS (Crypto Remedial System)

When a CRS module is connected to the GuardTec, the CRS status button can be pressed to go to the CRS Feeder Setup Screen

8.5.1 – CRS Feeder Setup

- **Water Volume:** This is the volume in gallons (liters) of the pool, spa or water feature the CRS is applied to. (This should match what was entered in the facilities menu screen).
- **Backwash Delay:** Once the backwash flow switch senses flow in the backwash line, the delay timer will begin to allow all backwash maintenance routines to be completed and the backwash line to be placed back to normal operation. Once this time is up, the CRS pump will start injecting CRS into the piping leading into the sand filter.
- **Auto Run Mode:** Select for GuardTec to monitor CRS backwash flow switch for flow.
 - If on, CRS injection is automated with backwash evolution.
 - If off, the CRS requires manual operation when dosing is needed.



8.5.2 – CRS Status

- CRS status is displayed in this area. CRS status is as follows:
 - CRS Idle
 - Backwash delay
 - Running
- Start or stop CRS manual dosing when Auto Run Mode is off

8.6 – Integrated Flow Meter

The inlet of the flow cell is designed with an integrated flow meter comprised of a float rising on a titanium rod within a variable area column. This flow meter is of a typical rotameter design and measures the volumetric flow rate of the water flowing through the vertical column. As the float rises, sensors identify the float's position within the column and translates the position into the actual flow rate in gallons per minute [liters per minute] and displays a flow status on the GuardTec screen. Total flow rate range of the flow meter is 0 - 0.5 gpm [0 – 1.89 L] with a precision of 0.01 gpm [0.03 L]

8.6.1 – Visual Flow Indication

The flow meter is primarily designed to function mechanically just as any other variable area flow meter. When there is flow through the pool recirculation piping where the flow cell sampling loop is plumbed, the float will rise giving visual indication of flow whether the GuardTec is connected to power or not. Using the inlet ball valve or throttling valve, the inlet flow rate can be adjusted.

Figure 22. Integrated Flow Meter



8.6.2 — Dosing Lock out

The GuardTec is programmed to recognize a “No Flow” condition and stop all chemical dosing to prevent overdosing in an isolated pipe. During operation, the GuardTec will display three different flow conditions as listed below.

FLOW OK	The flow rate through the flow cell is in the ideal range to achieve the flow velocity for optimal performance of the FAC sensor.	<ul style="list-style-type: none">• 0.12 – 0.42 gpm• All sensor monitoring operates as normal.• Chemical dosing operates as normal
FLOW HIGH	The flow rate is above the upper limit of range for optimal FAC sensor performance. Throttle the inlet ball valve to reduce the flow back to the acceptable range.	<ul style="list-style-type: none">• The FAC will still work but the chlorine PPM measurements may be impacted.• pH and ORP sensor monitoring operate as normal• Chemical dosing operates as normal
FLOW LOW	The flow rate is below the lower limit of range for flow safety factor and for optimal FAC performance. Check pool system and confirm there is flow.	<ul style="list-style-type: none">• All sensor monitoring is stopped• All chemical dosing is stopped
FLOW NA	Flow cell is missing or disconnected from the GuardTec.	<ul style="list-style-type: none">• Reconnect the flow cell cable

Note: To provide an increased level of safety, the lower limit of the flow rate to stop chemical dosing is set to 25% of the full flow range, or approximately 0.12 gpm. If the float drops below the 0.12 gpm threshold, there may still be flow in the pool recirculation piping. Check pool piping to confirm flow and adjust flow cell inlet valve if needed.

8.6.3 — Sample Water Temperature

The integrated flow meter also doubles as a temperature sensor. The temperature sensor measures the water temperature of the representative water sample through the flow cell. The temperature is provided in the selected unit, °F or °C, and is displayed in the lower left-hand corner of the screen.

8.7 — Alarm Screen

The alarm screen records and displays all alarms and notifications triggered over time. The list displays the date and time the event or condition occurred, the description of the event or condition, and the date and time when the event or condition was automatically or actively recovered. The alarm screen displays over 500 notifications with the most recent notification listed at the top and the oldest listed at the bottom. Scroll down through the list to view older notifications.

9 — Maintenance

9.1 — GuardTec Controller

9.1.1 — GuardTec Battery

The only maintenance required on the GuardTec is replacing the battery after some time. The GuardTec controller's battery will need replacing after the following periods

- After 10 years of normal use
- After a total of 3 years of extended de-energized time.
 - Example: If the controller is powered down for 6 months each year, the battery will need to be replaced after 6 years.

The main indication of a dead battery on non-internet connected controllers is having to reset the clock after a power failure for time stamps to work. If it is Internet connected, the GuardTec will attempt to set its clock on power up and every few days, using the Internet.

If the battery needs to be replaced, contact your sales rep for servicing directions.

9.1.2 — GuardTec M12 Connectors

No maintenance other than replacing the battery is required with proper use in accordance with the installation and operation instructions in this manual. However, if malfunctioning is suspected, this may be due to corrosion of the M12 connectors exposed to the environment over time. Periodically inspect any unused connectors for corrosion since they will be exposed to the environment. Contact your sales rep for servicing directions.

9.2 — Equipment Modules

No maintenance is required with use in accordance with the installation and operation instructions in this manual. However, if malfunctioning is suspected, this may be due to corrosion of the M12 connectors or internal printed circuit board due to prolonged exposure to the environment during setup or troubleshooting. Periodically inspect any unused connectors for corrosion. If the modules are left uncovered for any prolonged period, inspect the printed circuit board and internal electronic parts for any corrosion. Contact your sales rep for servicing directions.

 **Caution:** All connectors on the GuardTec, flow cell, and modules should either be connected with a cable (fully screwed in) or covered with a male threaded M12 cap to prevent corrosion.

9.3 — Sensors

9.3.1 — pH and ORP Sensor Storage

Fill the refillable buffer solution bottle with KCl 3M solution. Immerse the sensors into the buffer solution bottle prior to storing the sensors for the off season.

Note: The sensors should not be stored longer than 6 months

9.3.2 — FAC Sensor Storage

The FAC sensor does not need to be placed in a buffer solution for long term storage. Place the sensor in a box protected from the atmosphere.

9.3.3 — Sensor Cleaning

The sensors are susceptible to coating by many substances and the response time can deteriorate as a result. If they are mechanically intact, they can often be restored to normal performance by one of the following procedures.

General Cleaning:

1. Soak the sensor tip in 1:10 dilution of household laundry bleach to make an approximate 0.1-0.5% liquid detergent solution in hot water. Stir vigorously for 15 minutes.
2. Place sensor tip under warm, running tap water for 15 seconds.
3. Soak the sensor tip in storage solution for at least 10 minutes before use.
 - **For salt deposits:** Dissolve the deposit by immersing the sensor tip in 0.1 M (1%) HCl for five minutes, followed by immersion in 0.1M (1%) NaOH for five minutes, and thorough rinsing with distilled water.
 - **For oil/grease films:** Wash sensor tip in a little detergent and water. Rinse electrode tip with distilled water. If the film is known to be soluble in a particular organic solvent, rub the bulb gently with this solvent using a tissue or soft cloth. Acetone or isopropyl alcohol are often used to remove films.
 - **For clogged reference junction (pH/ORP):** Heat a diluted KCl solution to 60-80 °C. Place the sensor tip into the heated KCl solution for approximately 10 minutes. Allow the sensor to cool while immersed in some unheated KCl solution.
 - **Coated/abraded (for platinum ORP):** Soak in aqua regia HCl concentrated/HNO₃ concentrated (1/1) for 5 minutes.

Note: HCL and HNO₃ are hazardous chemicals and cleaning procedures should only be performed by a qualified person.

9.4 — Flow Cell

The flow cell may be removed from the GuardTec enclosure for periodic cleaning. Access fasteners from the back of the enclosure for removal. Ensure steps to protect the flow cell connectors are not skipped. Exposing unprotected connectors to pool water may cause corrosion.

9.4.1 — Cleaning the Main Flow cell

1. Remove the port plugs and sensors from the main sensor ports and connectors. Place M12 Sensor caps on all M12 sensor connectors.
2. Use regular or distilled water to rinse out the main flow cell flow path.
3. Vigorously shake the flow cell to help loosen contaminants from the internal surface of the flow cell.
4. Empty water and contaminants from the flow cell and repeat steps 2 and 3 until visibly clean
5. If oil or grease films can be seen, some mild detergent and water can be used. Be sure to rinse the soapy water completely out before completion
6. Use a 3/8" hex key or gas pliers to unthread the outlet top cap if debris can be seen in the flow cell outlet. Perform steps 2 through 5 to clean. Ensure the O-ring is installed. Replace top cap and tighten.

9.4.2 — Cleaning the Flow Meter and Flow Cell Outlet

The following steps should be taken if the flow meter or flow cell outlet is visibly contaminated with debris or the flow rate through the flow cell is compromised indicating possible flow blockage.

1. Use a 3/8" hex key or gas plier to unthread the flow meter or outlet top cap.
2. Remove the float and titanium rod being careful not to lose or misplace the parts.
3. Use regular or distilled water to rinse out the flow meter or outlet
4. Empty water and contaminants from outlets and repeat steps 2 and 3 until visibly clean
5. If oil or grease films can be seen, some mild detergent and water can be used. Be sure to rinse the soapy water completely out before completion

10 — Operation & System Status Notifications

The following tables list notifications displayed on the GuardTec and their associated flow cell light status and color; i.e. flashing red or steady blue. Refer to the tables for system status and troubleshooting.

The flow cell can be used for system status notification by referencing the color code with the operation or alarm status description. Understanding the flow cell colors provides quick visual identification of what your system and feeders are currently doing from across the room. User interventions required for certain conditions will be listed in the User Action Required column. For troubleshooting the chemical feeders, refer to the feeder installation and operations manual.

10.1 — Normal Operation Notifications

Table 3. Operation Status

#	Operation/Notification	STEADY BLUE Normal Operation (no alarms)
1	Chemical Dosage Active – chlorine / acid / CRS	●
2	Chemical Dosage Idle	●
3	Chemical Dosage Standby due to feeder priority	●
4	Chemical Dosage disabled - chlorine/acid feeder mode Off	●
5	Chemical Dosage disabled - chlorine/acid feeder is stopped	●
6	HCE feeder is in wash mode	●
7	CRS is in backwash delay mode	●

10.2 — Alarms & System Notifications

Table 4. Alert Status

#	Alarm Notification on Screen	Condition Description	User Action Required	FLOW CELL COLOR CODE	
				STEADY BLUE Normal operation	FLASHING RED Cannot feed chemicals
1	Booster not configured	Booster pump is required for feeder operation	Connect booster pump module to GuardTec and press the refresh configuration button		*
2	Booster missing	Booster pump module is disconnected from GuardTec	Reconnect booster pump module to GuardTec and configure system		*
3	Booster no AC power	No power to booster pump	Ensure module is connected to 115/230V power and power cable is properly terminated in module enclosure		*
4	Booster module high temp	Upper temperature limit of pump module exceeded	Remove pump module from direct sunlight or excessive ambient temperature		*
5	Flow Cell not configured	Flow cell is not configured in GuardTec	Connect the flow cell and press the configure button		*
6	Flow Cell is missing	Flow cell is disconnected or stopped communicating with GuardTec	Reconnect the flow cell to GuardTec or contact your sales rep for service options		*
7	Flow Cell MCU high temp	Upper temperature limit of flow cell exceeded	Remove flow cell from direct sunlight or excessive ambient temperature		*
8	Flow Cell low or no flow	Insufficient flow through flow cell	<ul style="list-style-type: none"> Check pool recirculation pump or piping and confirm flow If there should be flow, adjust inlet/outlet ball valve to increase flow If there is still no flow, blockage may exist, refer to cleaning instructions in Section 9.4 		*
9	Flow Cell high flow	Flow rate too high for FAC sensor	Adjust inlet ball valve to reduce flow	●	
10	Flow Cell Sensor not fault	Flow meter stopped communicating with GuardTec	Contact sales rep for service options		*
11	pH Sensor missing	pH sensor is disconnected or stopped communicating with flow cell	Reconnect the pH sensor to the flow cell or contact sales rep for service options		*
12	pH Sensor Expired	pH sensor use life has expired	Replace sensor for optimal performance	●	

13	pH Sensor high limit	pH value is above pH upper range	<ul style="list-style-type: none"> • Ensure that acid feeder is dosing • Ensure acid feeder is not empty • Check solenoid feed valve for failure (stuck closed) • Reduce proportional band to increase feeder output 	●	
14	pH Sensor low limit	pH value is below pH lower range	<ul style="list-style-type: none"> • Ensure that acid feeder is NOT dosing • If using any system with an acid pump, confirm that the power cable is connected to the feeder module and not directly to power • If using Pulsar® Acid Plus, check solenoid valve for failure (stuck open) 	●	
15	pH Dosing timeout	Setpoint has not been reached within specified time period, acid dosing is stopped	<ul style="list-style-type: none"> • Confirm acid feeder is not empty • Check for chemical leaks or blockage to injection point. • Check acid feeder is connected to GuardTec • Reduce proportional band to increase feeder output 		*
16	ORP Sensor is missing	ORP sensor is disconnected or stopped communicating with flow cell	Reconnect the ORP sensor to the flow cell or contact sales rep for service options		*
17	ORP Sensor Expired	ORP sensor use life has expired	Replace sensor for optimal performance	●	
18	ORP Sensor above high limit	ORP value is above ORP upper range	<ul style="list-style-type: none"> • Ensure that chlorine feeder is NOT dosing • Check solenoid feed valve for failure (stuck open) • If using a bleach pump, check that the power cable is connected to the feeder module and not directly to power 	●	
19	ORP Sensor below low limit	ORP value is below ORP lower range	<ul style="list-style-type: none"> • Confirm chlorine feeder is not empty • Check solenoid feed valve for failure (stuck closed) • Reduce proportional band to increase feeder output 	●	
20	ORP Dosing timeout	Setpoint has not been reached within specified time period, acid dosing is stopped	<ul style="list-style-type: none"> • Confirm chlorine feeder is not empty • Check for chemical leaks or blockage to injection point. • Check chlorine feeder is connected to GuardTec • Reduce proportional band to increase feeder output 	●	
21	FAC Sensor is missing	ORP sensor is disconnected or stopped communicating with flow cell	Reconnect the ORP sensor to the flow cell or contact sales rep for service options		*
22	FAC Sensor Expired	FAC sensor use life has expired	Replace sensor for optimal performance	●	
23	FAC Sensor above high limit	ORP value is above ORP upper range	<ul style="list-style-type: none"> • Ensure that chlorine feeder is NOT dosing • Check solenoid feed valve for failure (stuck open) • If using a bleach pump, check that the power cable is connected to the feeder module and not directly to power 	●	
24	FAC Sensor below low limit	ORP value is below ORP lower range	<ul style="list-style-type: none"> • Confirm chlorine feeder is not empty • Check solenoid feed valve for failure (stuck closed) • Reduce proportional band to increase feeder output 	●	

25	FAC Dosing timeout	Setpoint has not been reached within specified time period, acid dosing is stopped	<ul style="list-style-type: none"> Confirm chlorine feeder is not empty Check for chemical leaks or blockage to injection point. Check chlorine feeder is connected to GuardTec Reduce proportional band to increase feeder output 	●	
26	CL Feeder-1 missing	Chlorine feeder is disconnected or stopped communicating with the GuardTec	Reconnect the chlorine feeder or contact the sales rep for service options		**
27	CL Feeder-1 high level	A high level condition exists in the discharge tank	<ul style="list-style-type: none"> Check the discharge valve and tubing from the feeder for blockage Verify the booster pump and venturi are operating Refer to the Pulsar® Precision user manual for more troubleshooting 		**
28	CL Feeder-1 feed valve open/short	Feed solenoid operational error due to possible short	<ul style="list-style-type: none"> Inspect feed solenoid for proper operation Feed solenoid may have failed shut or open; Replace solenoid 		**
29	CL Feeder-1 wash valve open/short	Wash solenoid operational error due to possible short	<ul style="list-style-type: none"> Inspect wash solenoid for proper operation Wash solenoid may have failed shut or open; Replace solenoid 	●	
30	CL Feeder-1 MCU high temp	Upper temperature limit of CL feeder module exceeded	Remove CL feeder from direct sunlight or excessive ambient temperature		**
31	CL Feeder-1 no power	Insufficient voltage sent from GuardTec	Contact sales rep for service options		**
32	CL Feeder-2 is missing	Chlorine feeder is disconnected or stopped communicating with the GuardTec	Reconnect the chlorine feeder or contact the sales rep for service options		**
33	CL Feeder-2 high level	A high level condition exists in the discharge tank	<ul style="list-style-type: none"> Check the discharge valve and tubing from the feeder for blockage Verify the booster pump and venturi are operating Refer to the Pulsar® Precision user manual for more troubleshooting 		**
34	CL Feeder-2 feed valve open/short	Feed solenoid operational error due to possible short	<ul style="list-style-type: none"> Inspect feed solenoid for proper operation Feed solenoid may have failed shut or open; Replace solenoid 		**
35	CL Feeder-2 wash valve open/short	Wash solenoid operational error due to possible short	<ul style="list-style-type: none"> Inspect wash solenoid for proper operation Wash solenoid may have failed shut or open; Replace solenoid 	●	
36	CL Feeder-2 MCU high temp	Upper temperature limit of CL feeder module exceeded	Remove CL feeder from direct sunlight or excessive ambient temperature		**
37	CL Feeder-2 no power	Insufficient voltage sent from GuardTec	Contact sales rep for service options		**
38	pH Feeder is missing	Acid feeder is disconnected or stopped communicating with the GuardTec	Reconnect the acid feeder or contact the sales rep for service options		**
39	pH Feeder feed valve open/short	Feed solenoid operational error due to possible short	<ul style="list-style-type: none"> Inspect feed solenoid for proper operation Feed solenoid may have failed shut or open; Replace solenoid 		**

40	pH Feeder-2 Module high temp	Upper temperature limit of pH feeder module exceeded	Remove pH feeder from direct sunlight or excessive ambient temperature	*
41	pH Feeder no AC power	pH control module not connected to power	<ul style="list-style-type: none"> Reconnect module to power Contact sales rep for service options 	*
42	CRS Feeder is missing	Acid feeder is disconnected or stopped communicating with the GuardTec	Reconnect the acid feeder or contact the sales rep for service options	*
43	CRS Feeder Module high temp	Upper temperature limit of CRS feeder module exceeded	Remove CRS feeder from direct sunlight or excessive ambient temperature	*
44	CRS Feeder no AC power	CRS control module not connected to power	<ul style="list-style-type: none"> Reconnect module to power Contact sales rep for service options 	*

11 — Appendix

11.1 — Requirements and Specifications

11.1.1 — Requirements for Product Installation and Operation

Table 5. Clearances and Weight

Recommended Wall Clearance – GuardTec Assembly	30" W x 20" H x 8" D [76.2 cm x 50.8 cm x 20.3 cm]
Recommended Clearance	Pump Control Module: 11" L x 7" W x 3" D [27.9 cm x 17.8 cm x 7.6 cm] Valve Control Module: 7" L x 5" W x 4" D [17.8 cm x 12.7 cm x 10.2 cm]
Weight for Wall Mounting (before plumbing)	13 lbs

Table 6. Electrical

Power Supply Input	120/240 VAC, 1.2/0.55 A, 50/60 Hz, Single Phase
Power Supply Output	24 VDC, 4 A, 96 W
GuardTec Input	24 VDC
Pump Module Input	120 / 240 V, 15 A (GFCI dedicated), 50/60 Hz Note: 240 V needs customer supplied power cord
Pump Module Output	120 / 240 V, 15 A, 50/60 Hz Mechanical Relay, 14AWG to Booster pump (customer supplied)
Valve Control Module Input /Output	24 VDC

Table 7. Environmental Conditions

Ventilation	Well ventilated area. Refer to local codes for specific ventilation requirements.
Operating Ambient Temperature	-4°F to 158°F [-20°C to 70°C]
Best Used Temperature	40°F to 120°F [4.4°C to 48.9°C]
Indoor Use	Provide cover/shelter. Keep away from direct sunlight. Use optional UV shield for direct sunlight protection.

Table 8. Cable Length and Equipment Distances

M12 Data Cable Length	9.84 ft [3 m]
Flow Cell	500 ft
Pump Control Module (booster or dosing pumps)	500 ft
Valve Control Module (Pulsar® Acid Plus or Pulsar® Infinity)	500 ft
Pulsar® Precision Feeder	175 ft

11.1.2 — Product Specifications

Table 9. Material Specifications

Enclosure Housing	LLDPE
Mounting Plates	Aluminum 5052/H32
GuardTec,	Polycarbonate, UV stabilized
Flow Cell	Polycarbonate, UV stabilized, optically clear
Modules, Connectors	Polycarbonate with flame proof certification, M12 and liquid tight cord grips
Sensors / O-rings	Polycarbonate / Viton
UV Shield (Optional)	Acrylic, transparent UV stabilized, .220 in thick
Cable Connectors	316 SS
Sampling Ball Valve	PVC

Table 10. Sensor Specifications

Flow Cell Sensor Connections	(4) total, M12 female
Integrated Flow Meter Range	0.01 – 0.50 gpm
Integrated Temperature Sensor Range / Resolution	-4°F to 185°F [-20°C to 85°C] / 1° F or C
pH Range, Resolution	0 to 11 pH, 0.1 pH units
pH Offset (in pH 7 buffer)	± 0.5 pH at 77°F (25°C)
Slope (pH 7 to pH 4 buffer)	93 to 102% at 77°F (25°C)
pH Response Time	± 0.1 pH unit in 30 seconds at 77°F (25°C)
ORP Range, Resolution	-2000 to +2000 mV, 1 mV
ORP Response Time	30 seconds 95% at 77°F (25°C)
FAC Range	0 to 20 ppm
FAC Response Time	30 seconds
Shipping cap (pH,ORP)	10 ml soaker bottle
Shipping Cap Solution	4M KCL/pH 4 Buffer (50/50)
pH Replacement Recommendation for optimal performance	±0.89 pH offset, or less than 93% pH slope, or 24 months
ORP Replacement Recommendation for optimal performance	24 months
FAC Replacement Recommendation	Approximately 3–5 years

Table 11. GuardTec Specifications

Feed Control Options	On/Off, PID, Manual
Equipment I/O	(5) total: (4) x feeder and pump modules, (1) x flow cell
LCD Type, Size, Resolution, Display Color	Capacitive Touchscreen, 7-inch, 800 X 480 RGB, 262K

Table 12. Communications Specifications

USB Port	Micro USB, for Firmware updates
Ethernet Port	RJ45 for CAT 5 & 6 Ethernet Cable, 10/100/1000 Base-T
Communication Protocol	Modbus TCP, MQTT
Equipment Connectors	5 pin M12, male and female

11.2 — Assembly Drawings

11.2.1 — Complete Assembly

Figure 23. Exploded-view Drawing

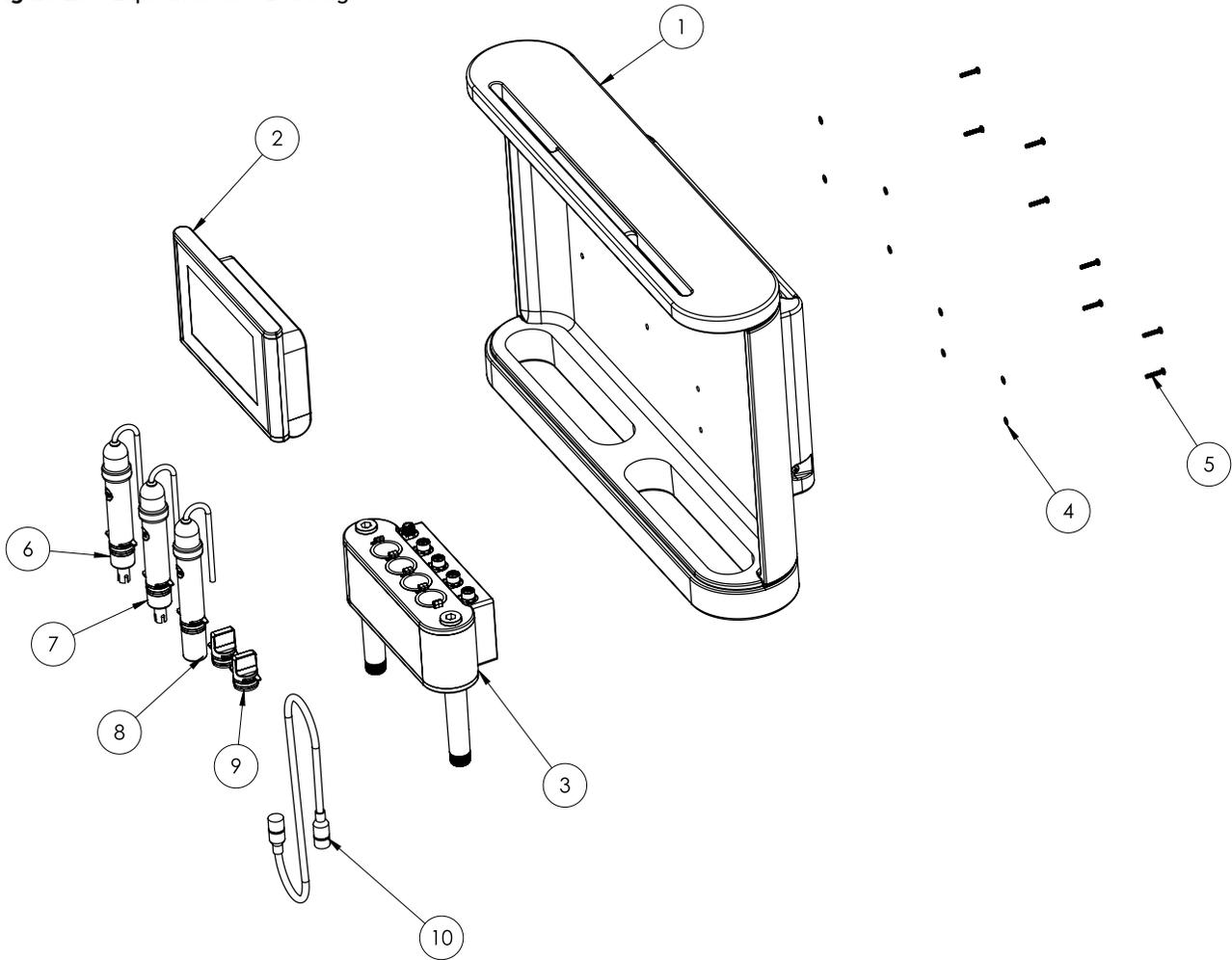
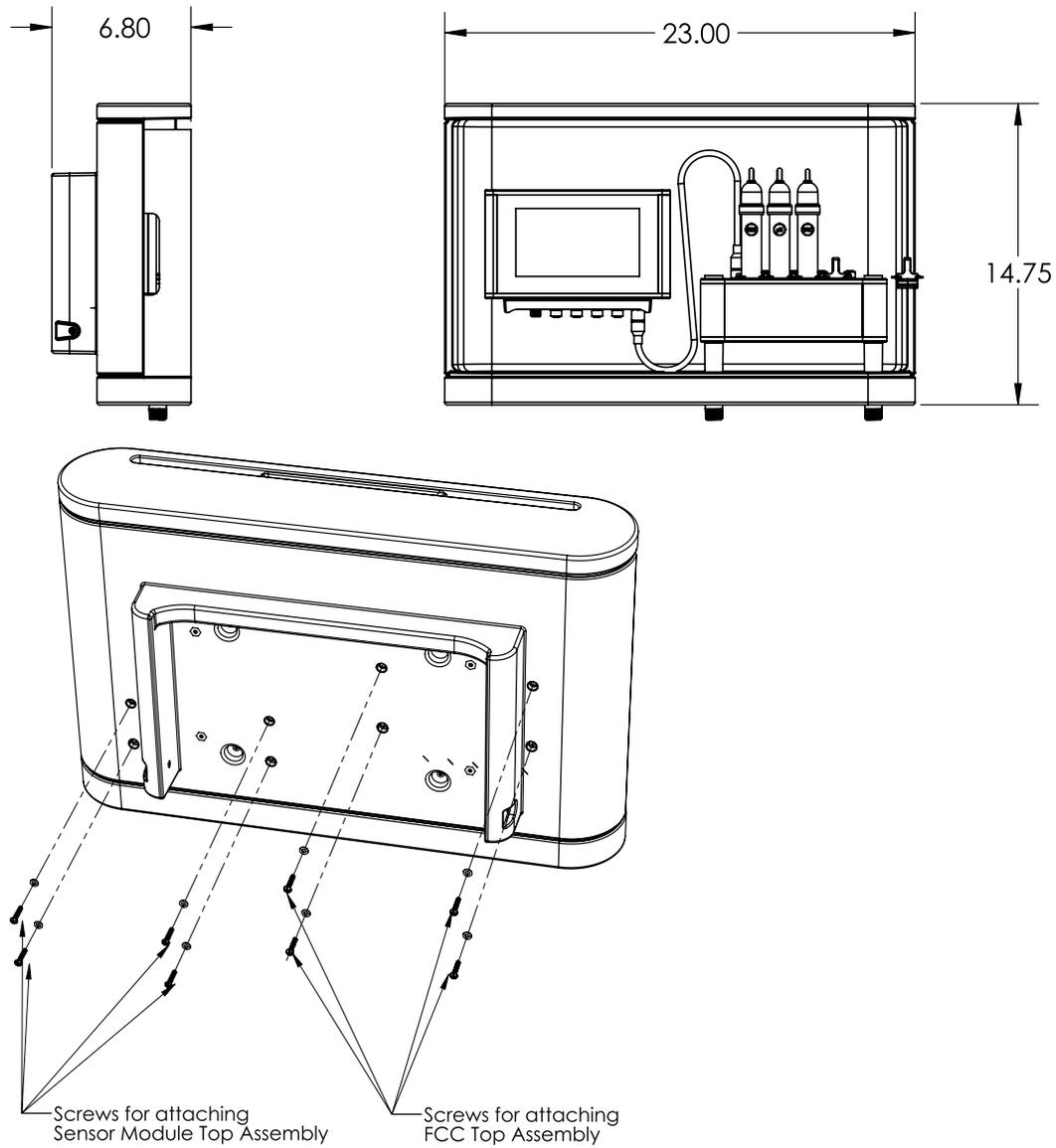


Table 13. Main Assembly Parts List

#	Description	Part Number	Vendor	QTY
1	FCC Enclosure Top Assembly	73304	Solenis	1
2	FCC Top Assembly	73392	Solenis	1
3	Sensor Module Top Assembly	73393	Solenis	1
4	Washer No. 6 SS	McM# 90107A007	McMaster-Carr	8
5	Screw 6-32 x .750 PnHd SS	McM# 91735A151	McMaster-Carr	8
6	Sensor Tube Assembly ORP	73395	Solenis	1
7	Sensor Tube Assembly pH	73394	Solenis	1
8	Sensor CL Assembly	73396	Solenis	1
9	Sensor Port Plug Assembly	73355	Solenis	4
10	Flow Cell Data Cable	889145	Solenis	1

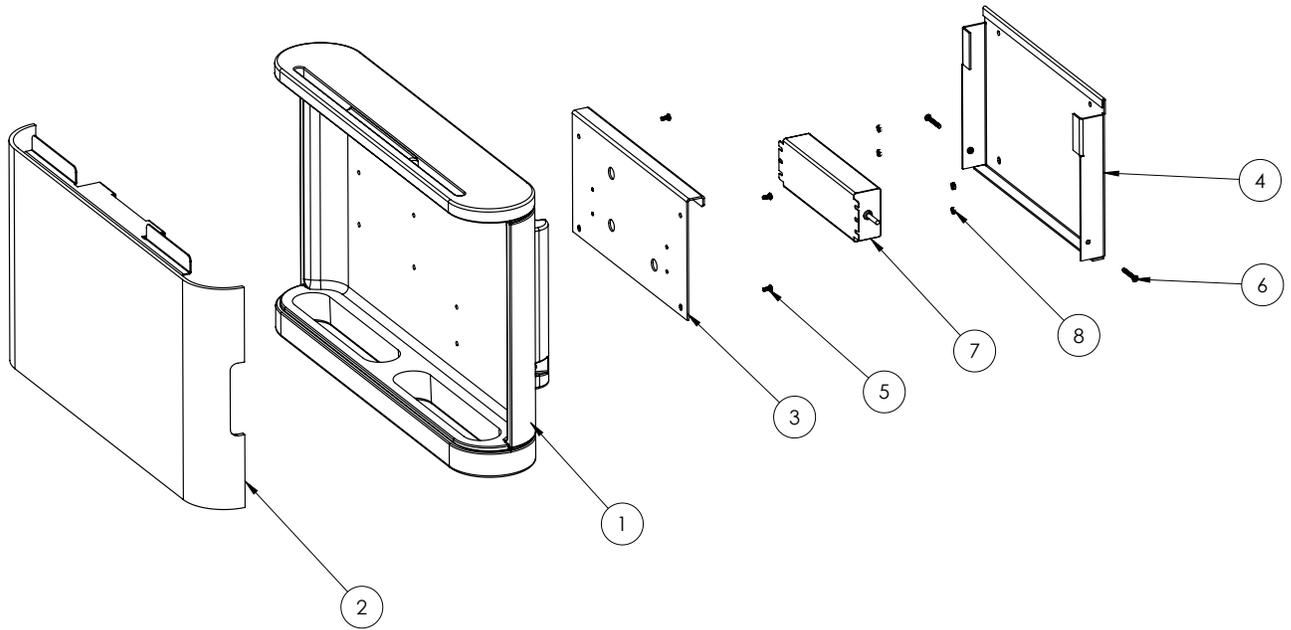
11.2.2 — Assembly Layout and Dimensions

Figure 24. GuardTec Assembly Dimensions



11.2.3 — Back Assembly

Figure 25. Enclosure Assembly Drawing



#	Description	Part Number	Vendor	QTY
1	FCC Enclosure Housing w/ Inserts	73304	Solenis	1
2	FCC Enclosure Housing Window Assembly	73354	Solenis	1
3	FCC Enclosure Backplate w/ Inserts	Part of 73353	Solenis	1
4	FCC Enclosure Mounting Plate w/ Inserts	Part of 73353	Solenis	1
5	Screw 8-32 x .375in PnHd SS	McM# 91735A192	McMaster-Carr	4
6	Screw 8-32 x 1.25in SS PnHd	McM# 91772A201	McMaster-Carr	2
7	100W Power Supply Meanwell HEP-100-24A	73340	Solenis	1
8	Hex Nut 6-32 SS	McM# 91841A007	McMaster-Carr	4

Figure 27. Rear View Without Mounting Plate and Power Supply

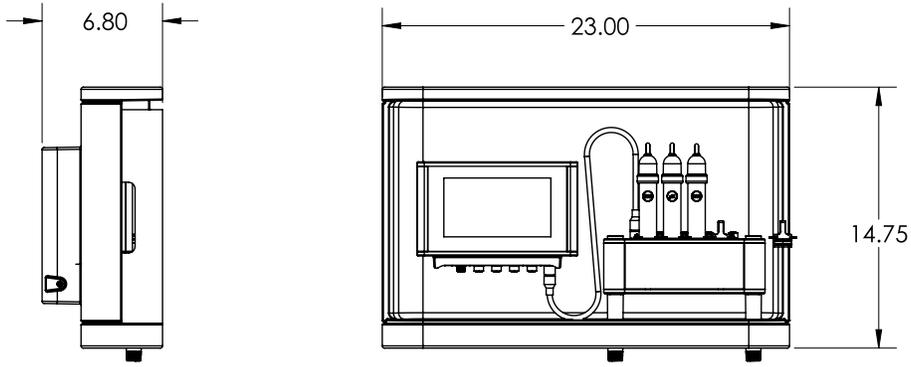


Figure 28. Rear View Without Mounting Plate, Exploded View

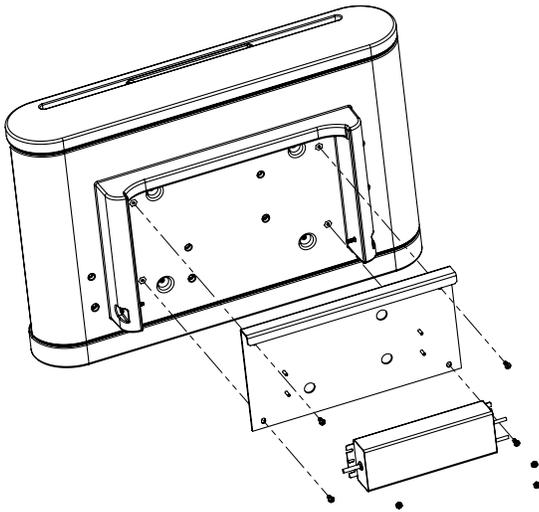
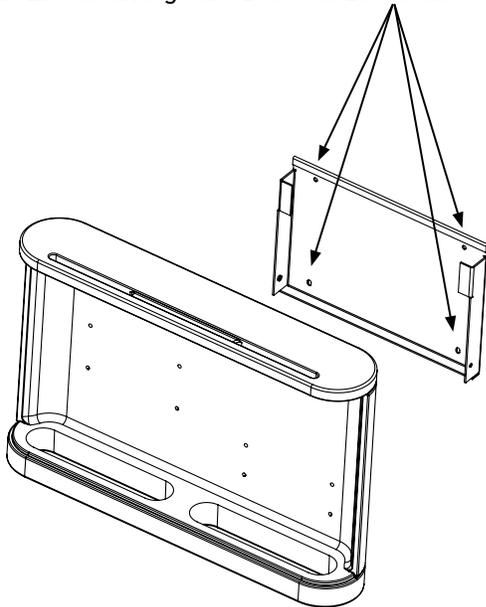


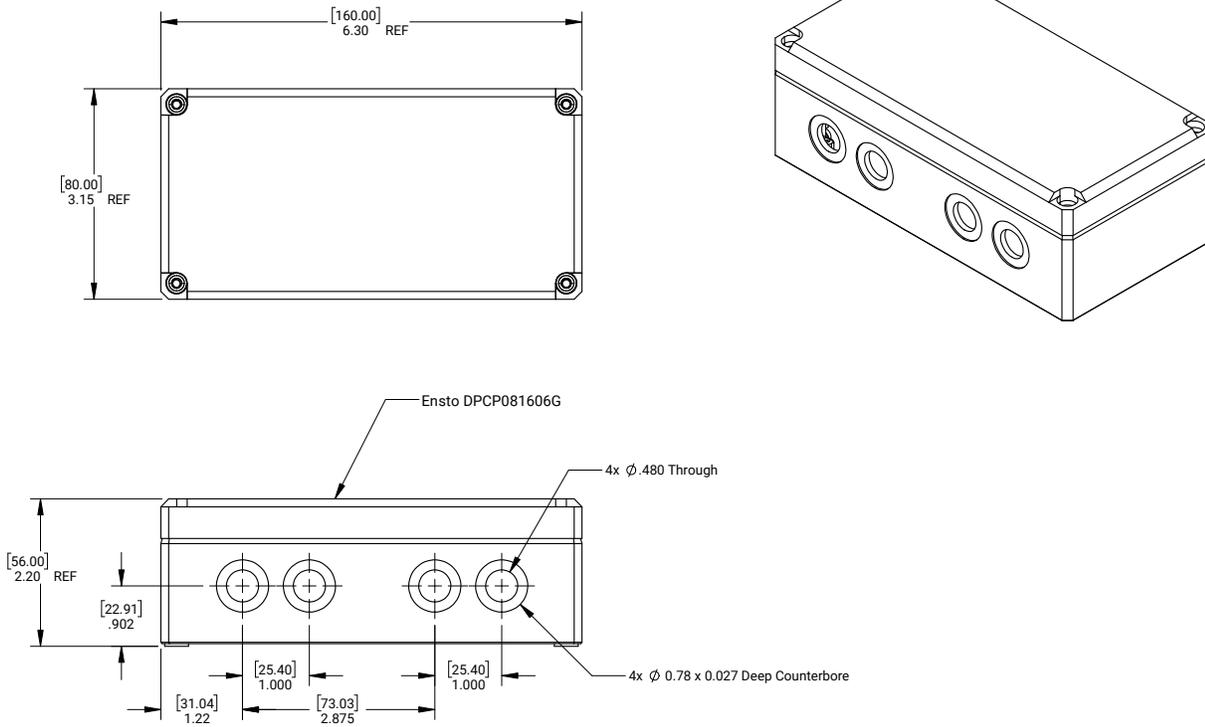
Figure 29. Mounting Plate Bolt Hole Locations



11.3 — Module Enclosures and Dimensions

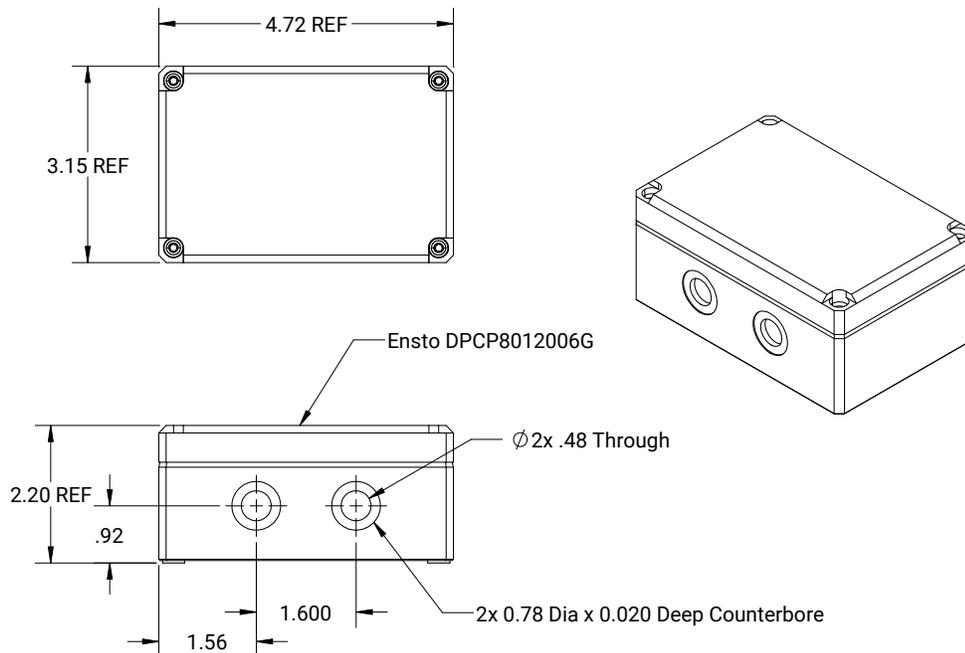
11.3.1 — HCE Feeder Module

Figure 30. Feeder Module Enclosure



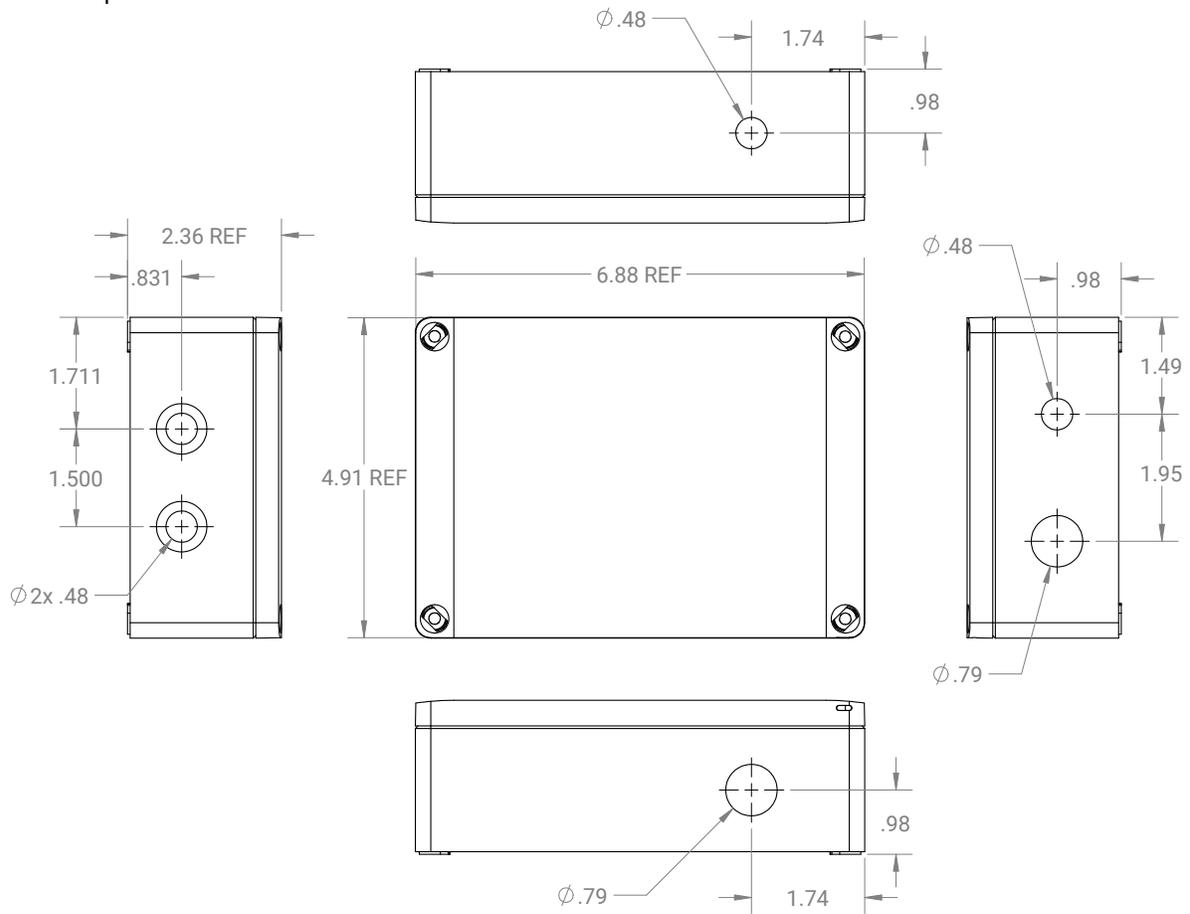
11.3.2 — Valve Control Module

Figure 31. Valve Control Module Enclosure



11.3.3 — Pump Control Module

Figure 32. Pump Control Module Enclosure



11.4 — Manual Feed Rate Settings for Pulsar® Precision Feeders

11.4.1 — Pool Feed Rate in Manual Mode

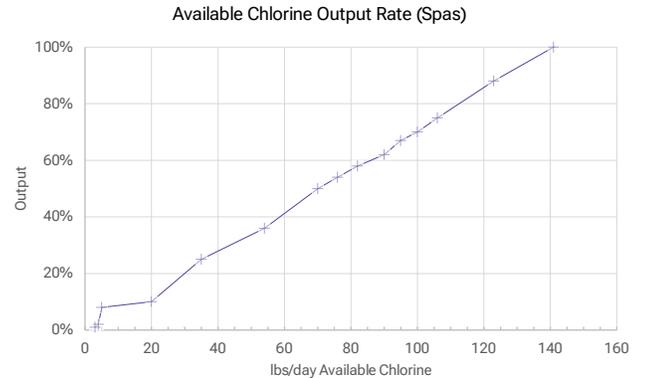
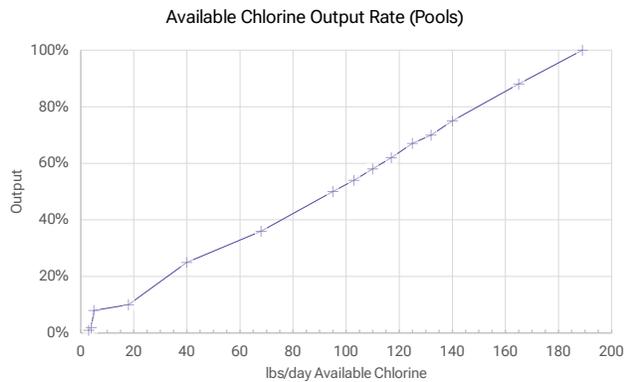
Table 14. Pools: Feed Solenoid On/Off Time vs Available Chlorine Delivery Rate (lbs/day)

Output Setting	On/Off (sec)	Lbs/day of Av Cl.	Feeder Output
74%	44/16	189	100%
63%	38/22	165	88%
53%	32/28	140	75%
50%	30/30	132	70%
45%	27/33	125	67%
42%	25/35	117	62%
37%	22/38	110	58%
32%	19/41	103	54%
27%	16/44	95	50%
22%	13/47	68	36%
18%	11/49	40	25%
15%	9/51	18	10%
10%	6/54	5	8%
7%	4/56	4	2%
3%	2/58	3	1%

11.4.2 — Spa Feed Rate in Manual Mode

Table 15. Spas: Feed Solenoid On/Off Time vs Available Chlorine Delivery Rate (lbs/day)

Output Setting	On/Off (sec)	Lbs/day of Av Cl.	Feeder Output
74%	44/16	141	100%
63%	38/22	123	88%
53%	32/28	106	75%
50%	30/30	100	70%
45%	27/33	95	67%
42%	25/35	90	62%
37%	22/38	82	58%
32%	19/41	76	54%
27%	16/44	70	50%
22%	13/47	54	36%
18%	11/49	35	25%
15%	9/51	20	10%
10%	6/54	5	8%
7%	4/56	4	2%
3%	2/58	3	1%



11.5 – Parts List

Note: All part numbers are Solenis part numbers unless otherwise stated

11.5.1 – Flow Cell Assembly

Table 16. Flow Cell Spare Parts

Part	Description	Part Number
1	Flow Cell Assembly (without port plugs, sensors or mounting screws)	73393
1A	Flow Meter Float	73323
1B	pH Sensor	73394
1C	ORP Sensor	73395
1D	Flow Cell Data Cable	889145
1E	Port Plug with O-Rings	73355

11.5.2 – GuardTec System Assembly

Table 17. GuardTec System Parts

Part	Description	Part Number
2	GuardTec System	73363
2A	GuardTec Controller	73392
2B	Flow Cell Assembly	73393
2C	GuardTec and Flow Cell to Enclosure, Mounting Screws	McMaster # 91735A151
2D	GuardTec and Flow Cell to Enclosure, washers	McMaster # 90107A007
2E	Enclosure for Mounting, Blue	73304
2F	Enclosure Mounting Plates Set	73353
2G	Meanwell Power Supply, 100W	73340
2H	American Power Cord for Power Supply	73341
2I	O-rings for Port Plugs and Sensors	McMaster # 9464K74
2J	M12 connector caps	73399
2K	Tee, 1/2"	71912
2L	Reducing Bushing	73181
2M	Sampling Valve for Flow Cell	73391
2N	Inline Strainer Assembly	79812

11.5.3 — Modules

Table 18. System Modules

Part	Description	Part Number
3	Feeder Modules	
3A	Pulsar® Precision Feeder Module	73326
3B	Pulsar® Precision 30 Feeder Module	73343
3C	Pulsar® Acid Plus Feeder Module	73345
4	Pump Control Modules	
4A	Booster Pump Module	73346
4B	Pulsar® pH Control Module	73347
4C	Generic Acid Pump Control Module	73356
4D	Pulsar® CRS Control Module	73349
5	Feeder Retrofit Kit	
5A	Pulsar® Precision GuardTec Retrofit Kit	73313

11.5.4 — Accessories

Table 19. GuardTec Accessories

Part	Description	Part Number
6	Pulsar® Precision	
6A	Pulsar® Precision Module Solenoid Cable, M12 x DIN Form B	73337
6B	Level switch connector cable	73334
6C	Feeder Module Mounting Screws	76361
7	Pulsar® Precision 30 / Pulsar® Acid Plus	
7A	VCM Solenoid Cable, M12 x DIN Form A	73336
8	Pump Control Module	
8A	Flow Switch Cable, M12 x Leads, 10m	73272
8B	Flow Switch Cable Extension, M12 x M12, 10m	79663
8C	Flow Switch 24VAC/DC, SS ½"NPT (SC050R)	79669
8D	M12 Connector Cap	73399
8E	Small Cable Gland Blank, ¼" OD PVC Rod, Cut to 1-1/4" L	McMaster Part # 8745K41
9	Data Cable for GuardTec Connection	
9A	Modules Data Cable, 3m	889144
10	UV Shield	
10A	GuardTec UV Cover	73354

12 — Limited Warranty

The GuardTec Controller system including associated modules and chemistry sensors is warranted against any manufacturing defects in material or workmanship for a period of 12 months after installation or 18 months after shipping from Solenis, whichever is earlier. This warranty applies only to the original end-user.

THESE WARRANTIES EXCLUDE ALL OTHER WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, ORAL OR WRITTEN, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Service

For warranty service, contact the authorized GuardTec Dealer in your area. Any defective part(s) covered by this warranty will be repaired or replaced, at the discretion of Solenis. Replacement may be with either new or reconditioned parts.

Exclusions

This warranty does not cover damage or failure due to accidents, fire, flood, or other acts of God. Nor does it cover damage or failure due to abuse, misuse, abnormal or improper use, neglect, improper maintenance or storage, alterations or modifications by anyone other than Solenis (unless specifically approved in writing by Solenis), repairs by anyone other than an authorized Dealer, or ordinary wear and tear excepted.

Any transportation to and from an authorized GuardTec Dealer is your responsibility.

NEITHER SOLENIS NOR ITS DEALERS SHALL BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCT. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF REVENUES, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, BUSINESS INTERRUPTION, OR LOSS OF PROPERTY (REAL OR PERSONAL). NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST PRINCIPAL MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED. YOU UNDERSTAND AND AGREE THAT THE FOREGOING LIABILITY LIMITATIONS ARE ESSENTIAL AND THAT IN THE ABSENCE OF SUCH LIMITATIONS THE MATERIAL AND ECONOMIC TERMS WOULD BE SUBSTANTIALLY DIFFERENT.

Note: No modifications may be made to the Controller without prior written approval from Solenis. Unauthorized modifications void any warranty.

For information, contact Solenis at (800) 478-5727.

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