BALTIMORE
AIRCOIL COMPANY

TrilliumSeries™
Adiabatic Cooler - TRF

OPERATION & MAINTENANCE MANUAL

TrilliumSeries™ Adiabatic Cooler - TRF

OPERATION & MAINTENANCE MANUAL

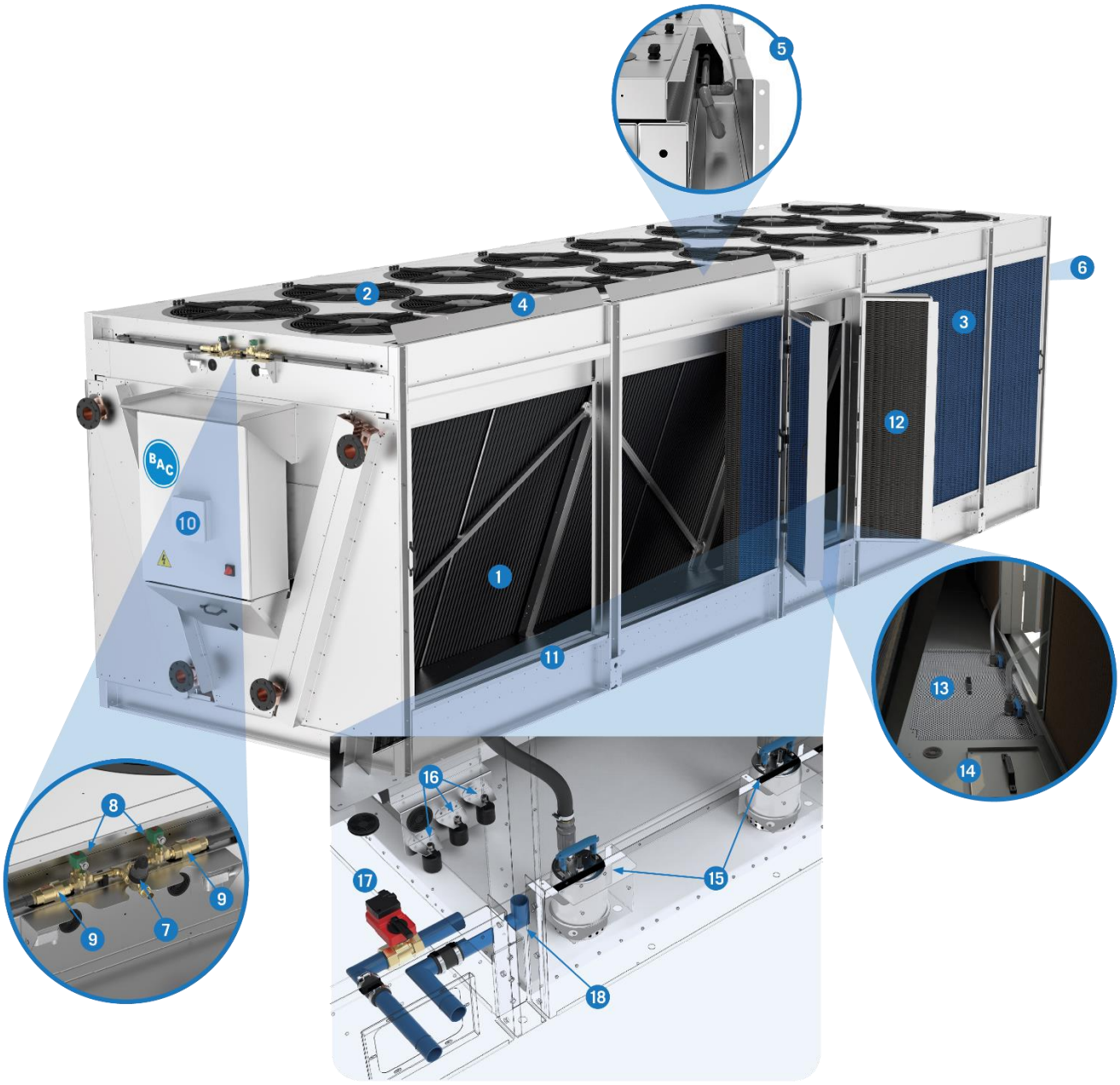
Contents

1. Recommended Maintenance Intervals

Inspect and clean as necessary [1]:	Start-Up	Monthly	Quarterly	Semi Annually	Annually
Inspect general condition of the unit and check unit for unusual noise or vibration	✓	✓			
Inspect sump	✓		✓		
Inspect water distribution system	✓		✓		
Clean sump strainers & recirculation pumps	✓		✓		
Inspect water level float switches	✓		✓		
Inspect adiabatic pre-cooler pads [2]	✓	✓			
Check operation of make-up valves and drain valve	✓		✓		
Inspect the pressure reducing valve					✓
Check operation of pumps	✓		✓		
Check operation of water level float switches					
Inspect coil	✓		✓		
Run coil clean maintenance mode			✓		
Inspect unit finish					✓
Inspect control panel ventilation filters [3]					✓
Mechanical equipment system [1]:	**Start-Up**	**Monthly**	**Quarterly**	**Semi Annually**	**Annually**
Check motor voltage and current	✓		✓		
Check general condition of the fan(s)	✓		✓		
Check fan cycling, smooth operation	✓	✓	✓	✓	✓

[1] Recommended service intervals are the minimum for typical installations. Harsh environmental conditions may dictate more frequent servicing.
[2] Do not attempt to remove the adiabatic pre-cooler pads wet to prevent excessive degradation.
[3] Refer to **Table 7** for minimum filter material replacement intervals.

2. Parts Map



1 Coils
2 Fans with Integrated EC Motor Kit
3 Adiabatic Pre-Cooler Pads
4 Water Distribution Inspection Cover
5 Upper Water Distribution System
6 Plenum Access (on opposite face, not shown)
7 Pressure Reducing Valve
8 Make Up Valve
9 Constant Flow Valve
10 Integrated Control Panel
11 Lower Water Collection Channel
12 Sump Access Door
13 Sump Strainer
14 Drain Valve Access Cover
15 Recirculation Pump
16 Float Switch
17 Drain Valve
18 Overflow

Recommended Spare Parts

BAC Factory Authorized Parts are manufactured to meet rigorous specifications and are guaranteed to fit your unit and perform as original equipment. BAC Factory Authorized Parts can be ordered through your local BAC Representative. Most BAC Representatives maintain a local inventory of commonly used parts. For a free unit inspection and a specific parts list for your serial number, contact your local BAC Representative today. Even with BAC's fast delivery capability, it is still recommended that certain essential and emergency repair part be maintained in your inventory to minimize any potential downtime.

Basic Recommended Spare Parts	Parts to Consider if Extended Downtime is a Concern
Recirculation Pump	Adiabatic Pre-Cooler Pad Kit
Float Switch	Fans with Integrated EC Motor Kit
Make-up Valve	
Pressure Reducing Valve	
Drain Valve	
Strainer	

3. Warnings and Cautions

Safety Precautions

- **DANGER**: Rotating equipment will cause severe personal injury or death to persons who come in contact. Adequate safeguards (including the use of protective enclosures where necessary) should be taken with this equipment both to safeguard the public from injury and to prevent damage to the equipment, its associated system, and the premises.
- **DANGER**: Risk of electrocution which will cause severe personal injury or death. Use appropriate lockout procedures. Do not perform any service on or near the unit without first ensuring the unit is de-energized.
- **DANGER**: Rotating equipment. Risk of serious injury or death. Never step on fan guard grill or subject the guard grill to load. Do not place any objects on the fan guard grill.
- **WARNING**: The TrilliumSeries™ Adiabatic Cooler controls are set up to periodically flush and drain the water system, thereby eliminating the need for water treatment. However, there may be unusual circumstances where chemicals or biological contaminants could be introduced into the recirculating water system, that could be harmful if inhaled or ingested. Wear appropriate respiratory protection, when exposed to the discharge air stream or to the mists produced by cleaning activities associated with the recirculating water system or adiabatic pre-cooler pads.
- **WARNING**: Do not walk on the top horizontal surface of the unit. It is not intended to be used as a walking surface or working platform. Risk of falling through the surface, resulting in physical injury or equipment damage.
- **WARNING**: Risk of electric shock. Live terminals and connections even with device switched off. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.
- **WARNING**: Transporting the fan. Injuries from tipping or slipping. Wear safety shoes and cut-resistant safety gloves. The fan is only to be transported in its original packaging. The fan is to be transported lying flat, i.e., the motor axis must be vertical. Secure the fan(s) e.g., with a lashing strip to stop anything from slipping or tipping.
- **CAUTION**: High temperature on fan motor electronics housing. Risk of burns. Ensure sufficient protection against accidental contact.
- **CAUTION**: Battery located in control panel PLC. Risk of explosion resulting in minor or moderate injury or damage to property. Do not recharge or open the battery.

Equipment Precautions

NOTICE

- Drain all water piping feeding the adiabatic pre-cooler to avoid stagnant water conditions.
- Water hammer is a common reason for pressure-reducing valve failures. Protective devices should be installed to absorb water hammer for systems with this risk.
- The adiabatic pre-cooler pads are made of flammable material and should be removed when performing hot work on or near the unit. No actions that generate sparks should be performed on or near the unit.
- Do not run the unit wet with the adiabatic pre-cooler pads out and the fans on (thereby getting the coils wet). Wet/dry cycling of the unit in this manner could shorten the coil life and void the warranty.
- To prevent excessive degradation, do not attempt to remove the adiabatic pre-cooler pads wet.
- Replace battery with R/C (BBCV2), Part. No. CR2032, rated 3V only. Use of another battery may present a risk of fire or explosion. Only use the battery type specified in **Table 6**.
- Scratches on the control panel PLC motherboard may cause the motherboard to fail. Be careful with the battery replacement lever and be sure to avoid scratching the motherboard.
- Changing the controller's parameters may result in an undesired operation of the unit, such as a hunting phenomenon, premature activation of pre-cooling (and increased water consumption) or delayed pre-cooling activation (fluid outlet temperatures exceeding the design temperature).
- Never use chloride or chlorine-based solvents such as bleach or muriatic (hydrochloric) acid to clean stainless steel. It is important to rinse the surface with warm water and wipe with a dry cloth after cleaning.
- Do not use steam, high-pressure water, or high-pressure air to clean any component.

4. General Information

Adiabatic Cooling

Adiabatic cooling uses evaporation to cool air before it passes through a finned heat exchanger. During adiabatic cooling, a wetted pad is used to cool the entering airstream. The pads are specially designed to retain water on the surface to ensure that it does not carry over to the finned coil, minimizing the risk of coil damage. The finned heat exchanger stays dry, protecting surfaces from scale and corrosion.

The use of a small amount of water to pre-cool the air entering the heat exchanger lowers the required airflow and fan power compared to air-cooled units, while also lowering the fluid temperature back to the system. In the most efficient adiabatic systems, the air is cooled close to the wet-bulb temperature. Such substantial depression of the air temperature results in a significant increase in dry cooling capacity and energy efficiency compared to dry-only designs. Once the ambient temperature begins to approach freezing, or during times of reduced load, the unit can be switched to operate in a dry-only mode, thus decreasing water usage.

Adiabatic heat rejection system controls are designed to be flexible, intelligent, and customer friendly, taking full advantage of the dual operating modes. At a customer-selected design point, such as a cooler ambient dry bulb and a lower heat load, the unit can turn off the recirculating water and switch to operation in dry mode. Additionally, the low volume recirculating water sump automatically drains when freezing temperatures are experienced, negating the need for sump heaters.

The recirculating design of an adiabatic heat rejection system consumes less water than an evaporative cooling tower and an adiabatic cooler with a “once through” design that sends water directly to the drain.

Methods of Operation

Adiabatic Operation

As illustrated in **Figure 1**, when the unit operates in adiabatic mode, either the make-up water connection or the recirculation pumps supply water over the adiabatic pre-cooler pads. Incoming air is humidified as it passes through the adiabatic pre-cooler pads, cooling the air down close to the ambient wet bulb temperature. This cooled air passes over the coil and cools the process fluid in the coil, which returns to the system. In the sump, pumps recirculate the water back over the pads. Part of the recirculated water is evaporated while the excess water assists in rinsing the adiabatic pre-cooler pads. The unit controls determine when the water is purged from the sump and new make-up water enters.

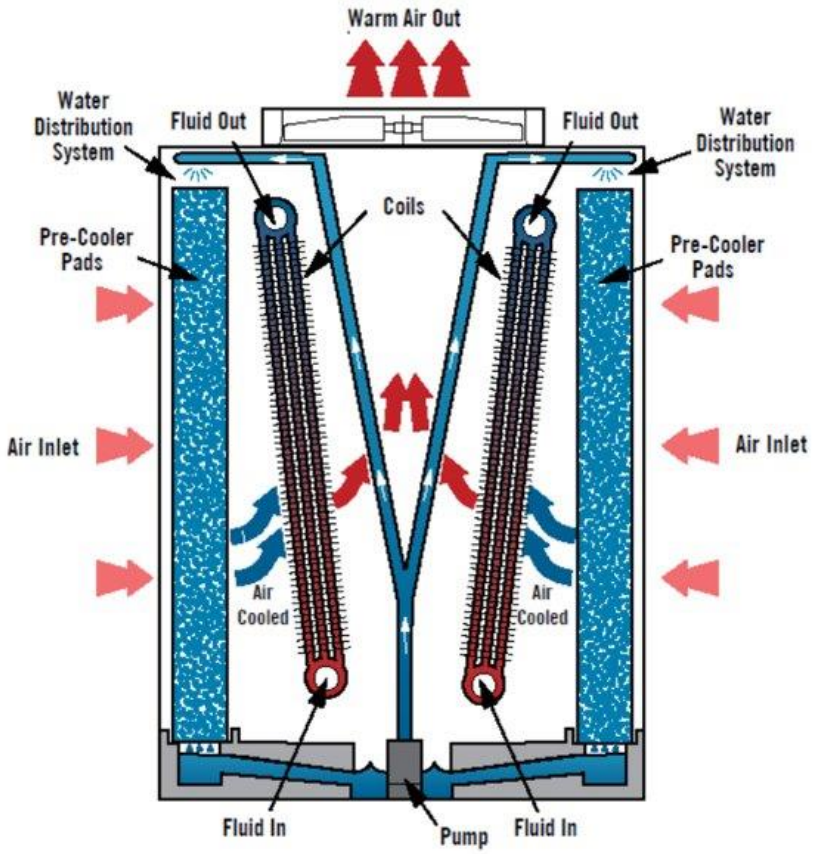


Figure 1. Adiabatic Operation

Dry Operation

As illustrated in **Figure 2**, when the unit operates in dry mode, ambient air cools the process fluid in the coils, which then returns to the system. The unit operates in dry mode when the ambient dry bulb temperature is less than the adiabatic switchpoint temperature.

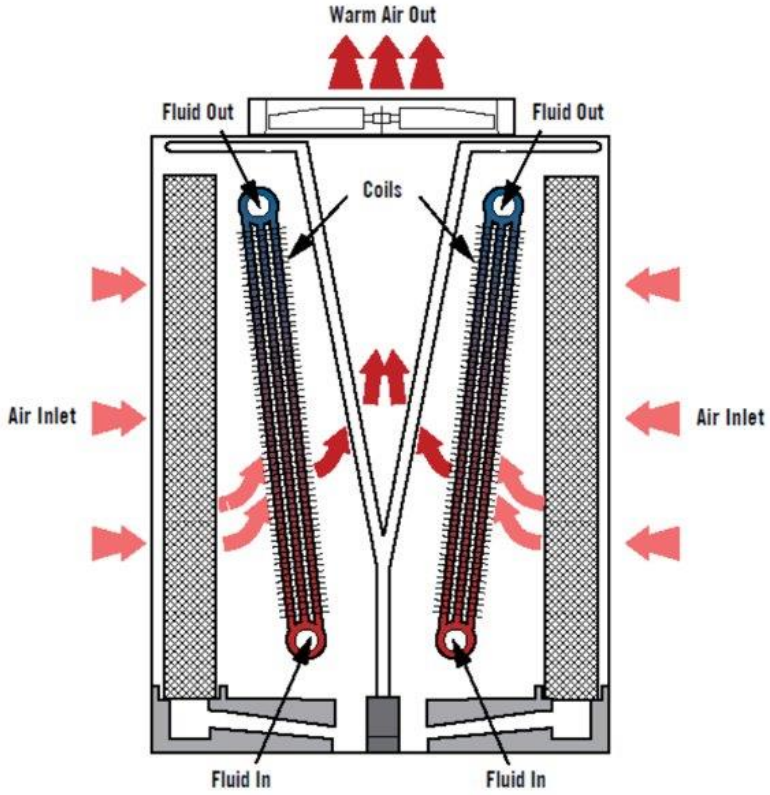


Figure 2. Dry Operation

Adiabatic Switchpoint

The adiabatic switchpoint temperature, also referred to as dry swtichpoint temperature, is the ambient dry bulb temperature at which the unit transitions from dry operation to adiabatic operation. Once the ambient temperature reaches the switchpoint, the recirculating pumps turn on to pre-cool the intake air.

Operating Modes

Default

Utilizes factory set operating parameters that balance water and energy savings. Refer to **Table 13** for more information.

Energy Saver

The unit is equipped with Energy Saver mode, which can be enabled at any time. This mode optimizes the operating parameters to save energy. Energy Saver mode will enter adiabatic operation more quickly than Default or Water Saver modes, resulting in lower fan power energy consumption. Refer to **Table 13** for more information.

Water Saver

The unit is equipped with Water Saver mode, which can be enabled at any time. This mode optimizes the operating parameters to save water. Water Saver mode will cause the unit to stay in dry operation longer than Default or Energy Saver modes, resulting in lower water consumption. Refer to **Table 13** for more information.

Load Limiting Modes

Night Quiet

Night Quiet load limiting mode will reduce sound levels of the unit overnight. When active, the Night Quiet feature limits the maximum fan speed and uses a Night Quiet specific dry switchpoint. This will allow the cooler to run adiabatically at lower outside air temperatures to maintain capacity. The Night Quiet feature can be activated on the touchscreen, through the BMS, or by a schedule, so that the user can define a start time on one day and a stop time on the next day. All times are in a 24-hour format.

Night Dry

Night Dry load limiting mode will prevent adiabatic operation of the unit overnight and can be activated by a schedule, so that the user defines a start time on one day and a stop time on the next day. All times shall be in 24-hour format.

Schedule Dry

Schedule Dry load limiting mode prevents adiabatic operation during the day and can be activated by a schedule, so that the user defines a start time on one day and a stop time on the same day. All times shall be in 24-hour format.

Maintenance Modes

Coil Clean

Coil Clean is a scheduled maintenance mode that will remove loose debris from the coil surface, ensuring maximum energy efficiency. Coil clean reverses fan rotation and airflow while opening the make-up and drain valve if the outside air temperature is greater than 40°F (4°C) to flush debris down the drain.

Pad Clean

Pad Clean is a scheduled maintenance mode that removes loose debris from the adiabatic pre-cooler pad surface, ensuring maximum energy efficiency. Pad clean will open the make-up and drain valves to flush the pads with clean water.

Complete Drain and Dry

Complete Drain and Dry is a scheduled maintenance mode that fully drains the sump and dries out the adiabatic pre-cooler pads.

Warranty

Please refer to the Terms and Conditions in the submittal package applicable to and in effect at the time of the sale/ purchase of these products.

5. Water Quality

Process Fluid Water Quality

To prevent excessive fouling and internal coil corrosion, the recirculating water quality should remain within the limits indicated in **Table 1**. A competent water treatment company should be consulted for the specific water treatment to be used that is suitable for all materials of construction used in the entire system. For higher pH levels, it is recommended to add a specific copper corrosion inhibitor such as TT or BZT with a target residual concentration of above 2 ppm (multiple dosages might be required).

Variable	Copper
pH	6.5 -10.5
Hardness (as CaCO3)	0-500 mg/l
Alkalinity (as CaCO3)	0-500 mg/l
Conductivity	< 3300 µS/cm
Chlorides	< 250 mg/l
Total suspended solids	< 10 mg/l
COD (chemical oxygen demand)	< 50 ppm

Table 1. Heat Exchanger Circulated Water Quality

Adiabatic Pre-Cooler Water Quality

⚠ WARNING: The TrilliumSeries™ Adiabatic Cooler controls are set up to periodically flush and drain the water system, thereby eliminating the need for water treatment. However, there may be unusual circumstances where chemicals or biological contaminants could be introduced into the recirculating water system, that could be harmful if inhaled or ingested. Wear appropriate respiratory protection, when exposed to the discharge air stream or to the mists produced by cleaning activities associated with the recirculating water system or adiabatic pre-cooler pads.

To control corrosion and scale, the water chemistry of the adiabatic pre-cooler water must be kept within BAC's water quality guidelines available at baltimoreaircoil.com. Material of construction for the TrilliumSeries™ Adiabatic Cooler – TRF is thermosetting hybrid polymer.

The primary water treatment control method for the adiabatic pre-cooler is to provide sufficient water to the pre-cooler medium to keep it flushed. If sufficient water is not provided to completely wet and flush the entire pre-cooler medium surface, deposits of minerals will occur. Adiabatic pre-cooler water quality should be of potable supply. In the case of non-treated water, the temperature should be kept below 68ºF (20ºC).

The sump will automatically drain when a maximum cycle of concentration is reached. The unit can also be set up to periodically drain the sump and dry the adiabatic pre-cooler pads. These features reduce the risk of microbiological contamination. Check your local codes and regulations for water treatment requirements.

The drained water may be suitable for non-potable use such as irrigation. Refer to local codes and regulations to determine allowable uses.

In applications where hard water is supplied to the unit, a water softener may extend the life of the adiabatic pre-cooler pads.

The adiabatic pre-cooler pads have been treated with an algaecide to minimize the potential for algae growth. In cases where excessive fouling is observed and is suspected to be interfering with the airflow, the adiabatic pre-cooler pads should be cleaned and/or changed more frequently.

Biological Control

The TrilliumSeries™ Adiabatic Cooler has been designed to minimize the risk of uncontrolled growth of algae, slimes, and other micro-organisms such as Legionella through:

1. Adjustable sump water retention time to mitigate standing water
2. Complete drying of the pre-cooling system after each adiabatic cycle
3. Complete draining of all water distribution piping installed on the unit after each adiabatic cycle

NOTICE: Drain all water piping feeding the adiabatic pre-cooler to avoid stagnant water conditions.

4. Use of potable water supply at temperatures of 68ºF (20ºC) or less, where Legionella is dormant
5. Aerosol free operation

When basic housekeeping practices, and the guidelines for operation and maintenance of this bulletin are followed, uncontrolled growth of micro-organisms will be avoided.

6. Cold Weather Operation

About Cold Weather Operation

The equipment can be operated in sub-freezing ambient conditions provided that the proper measures are taken. Listed below are general guidelines that should be followed to minimize the possibility of freeze-up. Customers in climates that reach below freezing temperatures should take necessary precautions to protect the water pipes from freezing. This may include installing a valve to prevent standing water in the pipes (supplied by a third-party vendor). It may be necessary to heat trace all exposed make-up water lines if the water cannot be shut off and external piping cannot be drained.

Coil Freeze Protection

For protection against coil freeze-up, recommended process fluid solutions are industrial grade inhibited ethylene glycol or propylene glycol solution. When the use of glycol is not practical, the system must be designed to meet the minimum temperature requirements.

Minimum Operation

When a glycol solution is not utilized, operate the system to maintain a minimum heat load on the process fluid so that the temperature of the fluid leaving the coil is not less than 50°F (10°C). To maintain the leaving fluid temperature at 50°F (10°C) when the process load is extremely light or off, apply an auxiliary heat load to the process fluid and adjust the flow to ensure that fluid leaving the coil maintains the minimum required temperature. **Table 2** lists the rate of heat loss per model number.

Model Number	# of Fans	Heat Loss Data (BTU/HR)[4]
TRF-1010N-C80XL17E	4	4,515,780
TRF-1010N-C80XS17E	4	4,437,940
TRF-1014N-C80XS26E	6	6,814,040
TRF-1014N-C80XM26E	6	6,739,300
TRF-1018N-C80XM34E	8	8,889,800
TRF-1018N-C80XD34E	8	8,740,240
TRF-1022N-C80XM43E	10	11,044,580
TRF-1022N-C80XD43E	10	10,888,320
TRF-1026N-C80XD51E	12	13,260,240
TRF-1026N-C80XQ51E	12	12,828,280
TRF-1030N-C80XD60E	14	15,634,340
TRF-1030N-C80XQ60E	14	15,187,740
TRF-1034N-C80XD68E	16	17,788,200
TRF-1034N-C80XQ68E	16	17,342,760
TRF-1038N-C80XD77E	18	19,935,680
TRF-1038N-C80XQ77E	18	19,488,920

Table 2. TRF Heat Loss Data

[4] Heat loss data based on 102°F (39°C) entering coil water, nominal unit flowrate (with water) and -10°F (-23°C) ambient air temperature with a 45MPH (72 km/hr) wind velocity. Fans and pump are off.

Emergency Coil Drain

Do not drain the coils as a regular method of freeze protection. Draining should only be used as an emergency method of freeze protection. Allowing the coils to freely drain via gravity is insufficient and cannot be relied upon to protect the coils from damage due to freezing. The use of compressed air or an air dryer must be used to ensure all fluid is removed from the coil.

Pre-Cooler Freeze Protection

The integrated controls are set to a default cold weather threshold temperature of 38°F (3.4°C). When the outside air temperature falls below the cold weather threshold temperature, the unit will automatically transition into dry mode of operation and the sump drain valve will open. The control panel will automatically disable adiabatic operation when the outside air temperature is below the cold weather threshold temperature.

Protection of Electrical Components

To protect the electrical components from cold weather, the electrical panel is equipped with a heater to prevent the temperature inside the panel from dropping below 40°F (4.4°C).

7. Component Information & Maintenance

DANGER: Rotating equipment will cause severe personal injury or death to persons who come in contact. Adequate safeguards (including the use of protective enclosures where necessary) should be taken with this equipment both to safeguard the public from injury and to prevent damage to the equipment, its associated system, and the premises.

DANGER: Risk of electrocution which will cause severe personal injury or death. Use appropriate lockout procedures. Do not perform any service on or near the unit without first ensuring the unit is de-energized.

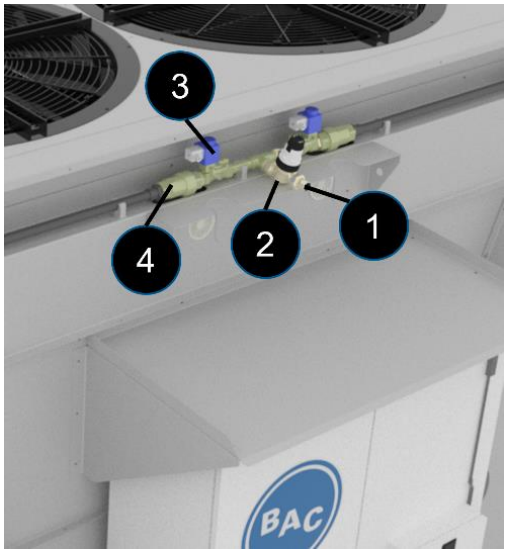
Make-Up Water

General

A minimum water flow must be distributed over the adiabatic pre-cooler pads during adiabatic operation. Make-up flow rates are listed in **Table 3**. Proper flow is preset using a pressure reducing valve and constant flow valve, as shown in **Figure 3**.

Model Number	# of Fans	Make-up Water Flow Rate	
		GPM	L/min
TRF-1010N-C80XX17E	4	5.3	20
TRF-1014N-C80XX26E	6	7.9	30
TRF-1018N-C80XX34E	8	10.6	40
TRF-1022N-C80XX43E	10	13.2	50
TRF-1026N-C80XX51E	12	15.9	60
TRF-1030N-C80XX60E	14	18.5	70
TRF-1034N-C80XX68E	16	21.2	80
TRF-1038N-C80XX77E	18	23.8	90

Table 3. Make-up Water Flow Rate per Model Number



1	Make-up water connection (qty. 1)
2	Pressure reducing valve (qty. 1)
3	Solenoid valve (qty. 2)
4	Constant flow valve (qty. 2)

Figure 3. Make-Up Water Connection Detail

Make-up Water Connection

Refer to the unit submittal package for specific water connection type, size, and location.

Pressure Reducing Valve

The adjustable pressure-reducing valve sets the make-up water pressure. The valve must be protected against freezing by heat tracing all exposed make-up water lines if the water cannot be shut off and external piping cannot be drained.

The pressure reducing valve is factory set at 45 psi (3 bar) for all TRF model numbers. To verify this setting, see the pressure setting indicator that is visible on both sides of the valve. An adjustment lock screw is located at the top of the set point knob. See **Figure 4** for details. Shut off isolation valves (this is typically done by others) before adjusting the pressure setting of the valve.

Inspect and clean the cartridge at least every 12 months. When checking, cleaning, or replacing the cartridge:

1. Shut off isolation valves (this is typically done by others).

2. Remove the cartridge shown in **Figure 5** and clean the stainless-steel filter.

3. Reinstall following same procedure.

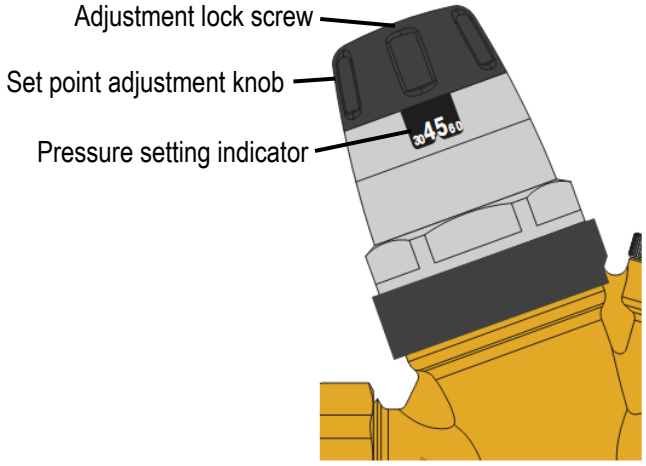


Figure 4. Pressure Reducing Valve

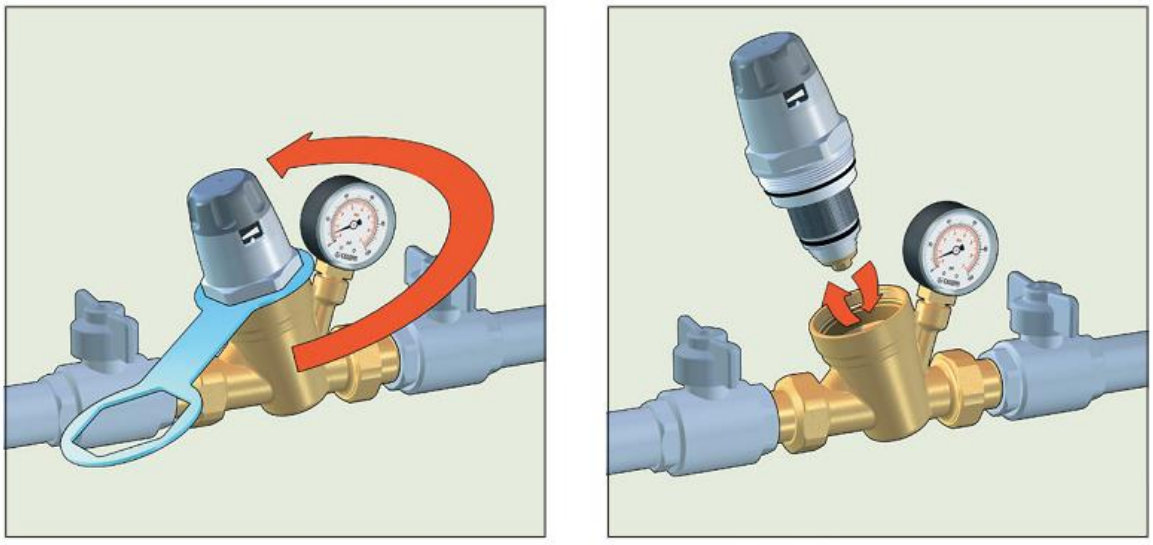


Figure 5. Removal of Self-Contained Cartridge

NOTICE: Water hammer is a common reason for pressure-reducing valve failures. Protective devices should be installed to absorb water hammer for systems with this risk.

Solenoid Valve

The solenoid valve is normally closed (fail closed) and slow closing to prevent water hammer. This device is not adjustable and does not have any service or maintenance requirements.

Constant Flow Valve

This device automatically sets the water flow rate. This device is not adjustable and does not have any service or maintenance requirements.

Adiabatic Pre-Cooler Pads

General

Adiabatic pre-cooler pads are saturated with water during adiabatic mode of operation. Adiabatic pre-cooler pads cool entering air before it reaches the coil. The pads have an integrated distribution section that accepts water sprayed unevenly on top surface and distributes it evenly across the pad. The air inlet face of the adiabatic pre-cooler pad is protected by a blue anti-stick coating that protects against algae growth and UV damage.

NOTICE: The adiabatic pre-cooler pads are made of flammable material and should be removed when performing hot work on or near the unit. No actions that generate sparks should be performed on or near the unit.

NOTICE: Do not run the unit wet with the adiabatic pre-cooler pads out and the fans on (thereby getting the coils wet). Wet/dry cycling of the unit in this manner could shorten the coil life and void the warranty.

Scaling and Fouling

Airborne debris is caught by the adiabatic pre-cooler pads, which act as air filters and protect the heat exchanger coil from fouling. During adiabatic mode of operation, the pads are rinsed by the recirculating water. The debris that is rinsed from the pads drains with the excess water. The adiabatic pre-cooler pads should be inspected monthly for the following:

- Signs of excessive fouling and scaling
- To ensure full and even wetting of the face area, while in adiabatic mode of operation

To maintain the adiabatic pre-cooler pads, enable the self-clean cycle for daily cleaning operation. Refer to section **Maintenance Menu** on **Page 63** for more details. If excessive dust, debris, scale, etc. has accumulated on the adiabatic pre-cooler pads, it is recommended to wash the pads by removing them from the unit and rinsing them using a standard garden hose at a downward angle. Continue rinsing until water flows freely to the other side. Never use a brush or a high-pressure hose for cleaning the adiabatic pre-cooler pads. Scale may deposit when the pads dry at the end of each adiabatic cycle. The rate of scaling will depend on:

- The number of adiabatic mode starts and stops
- Water quality
    - To reduce the amount of scaling on the adiabatic pre-cooler pads due to poor water quality, set a lower cycles of concentration drain value. Refer to the **Basin Water Quality Menu** on **Page 56** for more information.
- Poor air quality and airborne debris.

Adiabatic Pre-Cooler Pad Removal

NOTICE: To prevent excessive degradation, do not attempt to remove the adiabatic pre-cooler pads wet.

Removal of adiabatic pre-cooler pads has been designed as a tool-free operation for quick access for maintenance and to access the interior of the unit for inspection. To remove the adiabatic pre-cooler pads:

1. Remove the adiabatic pre-cooler pad wedge by removing two plastic knobs per wedge assembly. 4-fan units will have two pad wedges, 6-10 fan units will have four pad wedges, 12-fan units will have six pad wedges, and 14-18 fan units will have eight pad wedges. Refer to **Figure 6** for typical wedge locations.
2. Reposition the adiabatic pre-cooler pad wedge and grip both sides of the pad. Lift the pad directly up and then towards you.
3. Reinstall the adiabatic pre-cooler pads in the reverse order.
    a. Always re-install the adiabatic pre-cooler pads with the blue protective coating on the outside face. Always ensure that the re-distribution section of the pad is at the top of the unit per **Figure 7**.

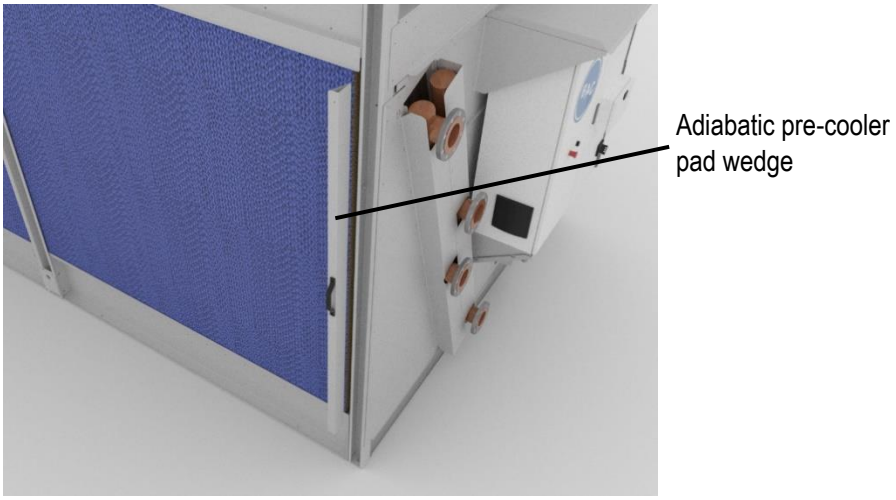


Figure 6. Adiabatic pre-cooler pad wedge

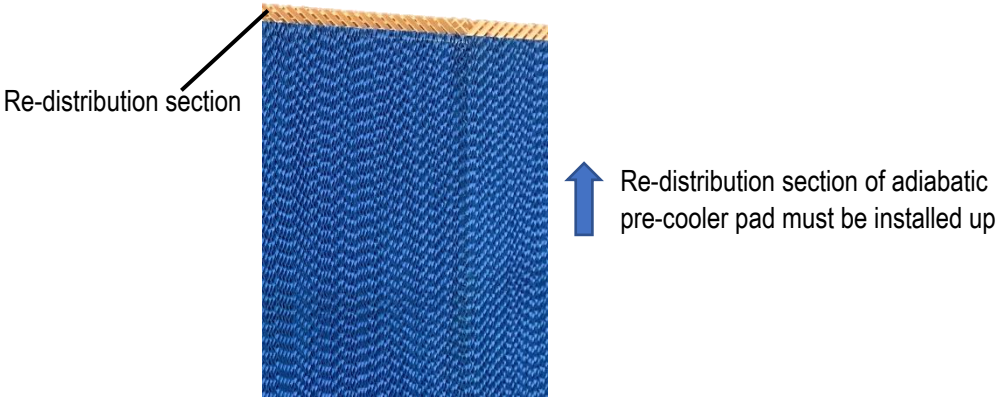


Figure 7. Re-distribution section of adiabatic pre-cooler pad

Water Distribution System

General

The water distribution system is composed of the upper water distribution channels, the lower water collection channels, and the sump.

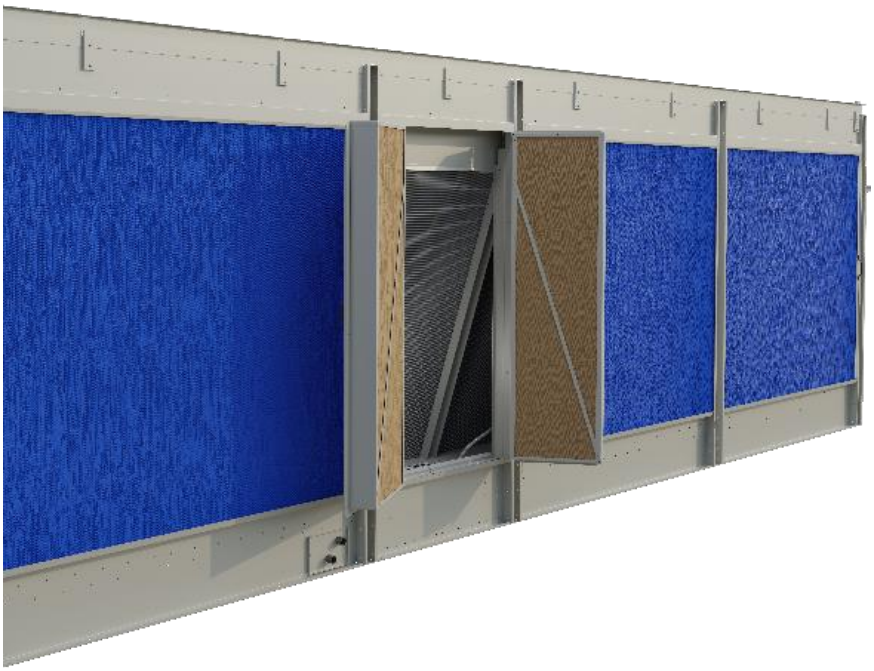


Figure 8. Sump access door

Sump Access Door

Two sump access doors are provided per unit, one per air inlet face. Refer to **Figure 8** for location of the sump access door. Always ensure the sump access door latch is engaged and secured before operating the unit, refer to **Figure 9** for details on engaging the sump access door latch. To secure the sump access door in an open position use the sump access door brackets shown in **Figure 10**. A removable pin should be inserted into the sump access door bracket to secure the sump access door in the open position.

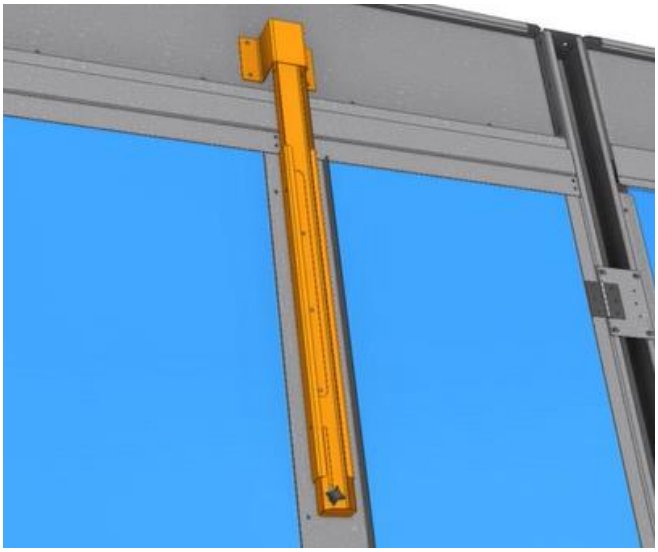


Figure 9. Sump access door latch engaged

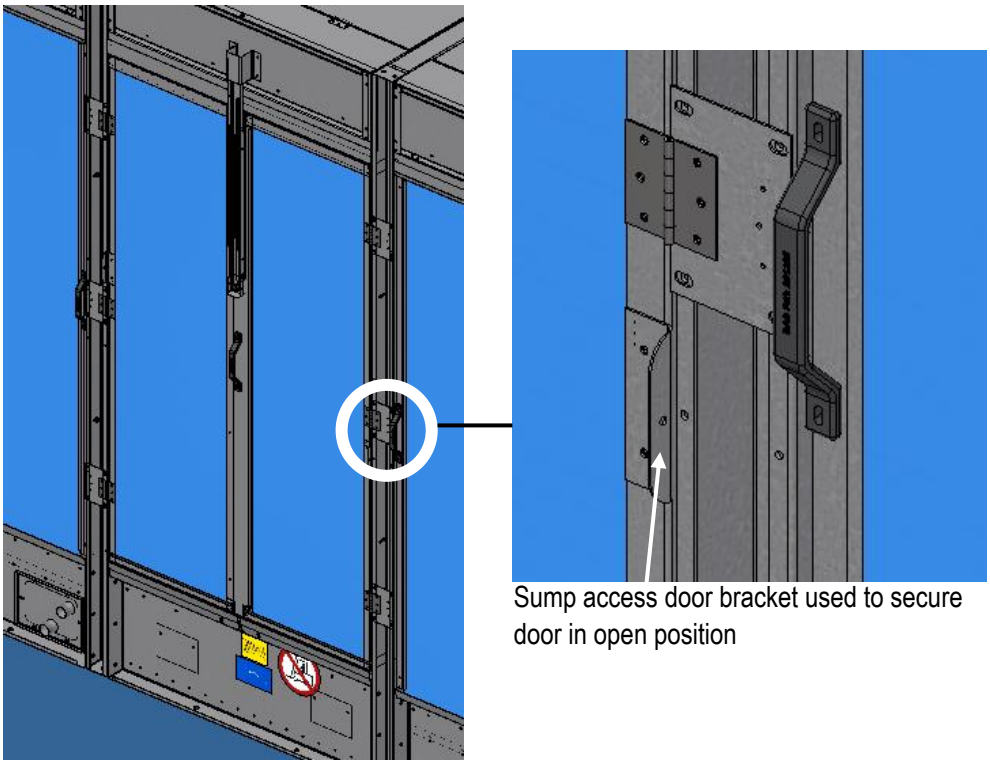


Figure 10. Sump access door bracket used to secure door in open position

Upper Water Distribution Channel

⚠ WARNING: Do not walk on the top horizontal surface of the unit. It is not intended to be used as a walking surface or working platform. Risk of falling through the surface, resulting in physical injury or equipment damage.

The upper water distribution channels are filled with water either by the make-up water connection or the recirculation pump. Water is then distributed over the adiabatic pre-cooler pads via a special hole pattern in the bottom of the upper water distribution channel. The upper water distribution channels require a specific water flow rate. At least quarterly and upon seasonal startup, inspect the upper water distribution channels for debris and ensure water distribution holes are not clogged. The upper water distribution channels can be inspected via the inspection covers that run the length of the unit on the air inlet faces as shown in **Figure 11**. Screws securing the inspection cover are for shipping purpose.

Figure 11. Upper water distribution channel inspection cover

Lower Water Collection Channel

The lower water collection channels collect water coming off the adiabatic pre-cooler pads and redirects it into the sump. At least quarterly and upon seasonal startup, inspect the lower water collection channels for debris. Removal of the adiabatic pre-cooler pads is required to inspect the lower water collection channels, refer to section **Adiabatic Pre-Cooler Pad Removal** on **Page 24**. Refer to **Figure 12** for location of the lower water collection channels.

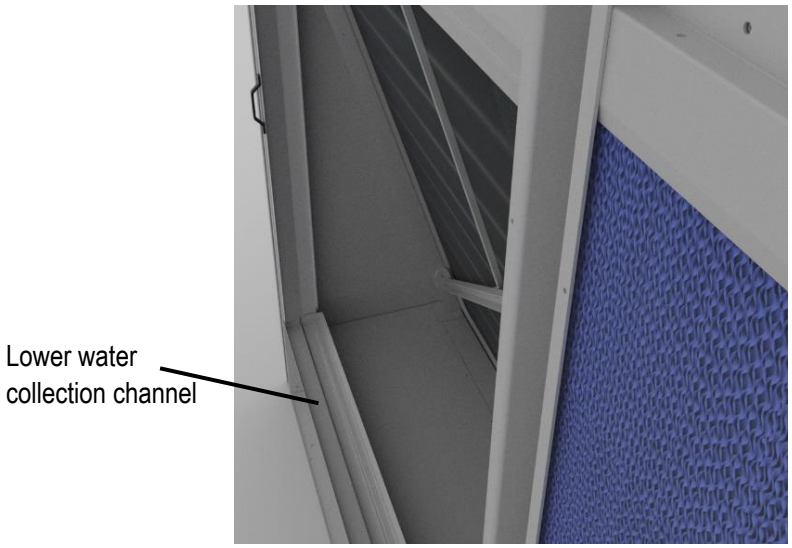


Figure 12. Lower water collection channel

Sump Strainer

A removable stainless-steel sump strainer is supplied for each air inlet face as shown in **Figure 13**. Do not operate the unit with the sump strainers removed. The sump strainers can be accessed via the sump access doors. To remove the sump strainer, remove all wingnuts securing the assembly and lift the assembly out of the unit using the grab handle. Ensure all wingnuts are reinstalled when reinstalling the sump strainer. At least quarterly and upon seasonal startup, remove and clean the sump strainers and replace, as necessary. Clean the sump strainer by removing all surface debris and ensuring the perforations are clear.

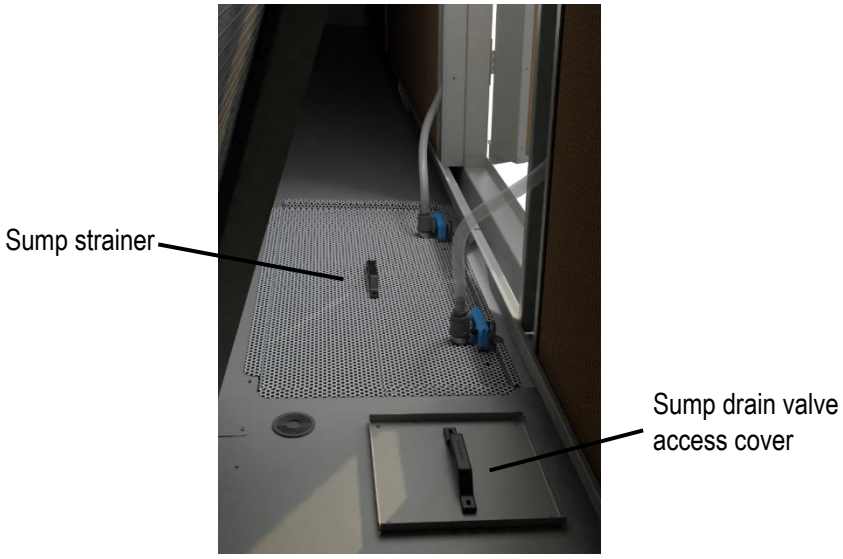


Figure 13. Sump strainer & sump drain valve access cover

Recirculation pump

Each unit is supplied with two 1/3 HP submersible recirculation pumps as shown in **Figure 14**. Each pump recirculates water to one air inlet face. Both pumps are located on the same side of the unit and can be accessed via the sump access door. Never lift or carry the pump by the electrical cord, use the pump handle to install/remove pump. At least quarterly and upon seasonal startup, clean the pump by removing debris from the bottom strainer portion of the pump.

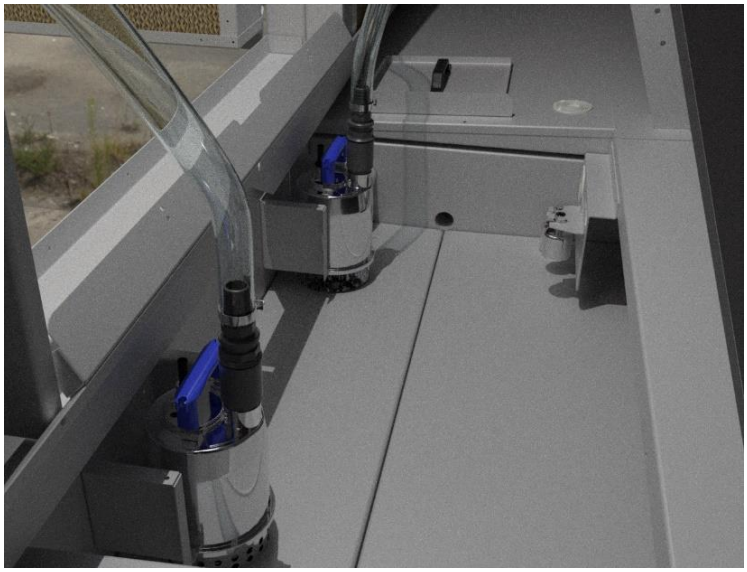


Figure 14. Submersible recirculation pumps

Sump Water Level Float Switches

Three industrial grade stainless steel float switches maintain the water level in the sump between a minimum and maximum level in order to ensure sufficient water is available for a proper wetting of the adiabatic pre-cooler pads. All switches are factory set at the correct level. Each unit is supplied with three sump water level float switches as shown in **Figure 15**. At least quarterly and upon seasonal startup, inspect to confirm that each float is free to move and not coated with any substance. Clean each float switch as needed. This can be done without disturbing the installation by wiping the float and stem to remove any buildup.

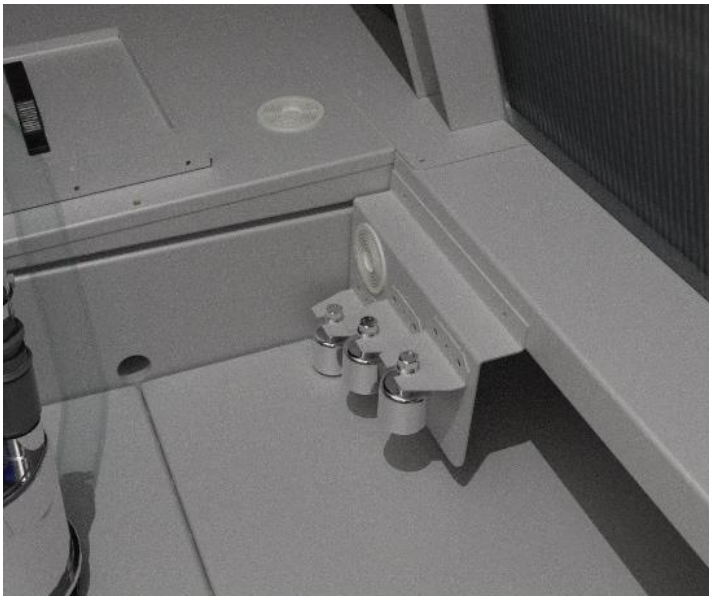


Figure 15. Sump water level float switches

Sump Drain Valve

The sump drain valve is normally open (fail open). The sump drain valve can be accessed from underneath the unit as shown in **Figure 16** or via the sump drain valve access cover shown in **Figure 13**. The sump drain valve access cover is secured with plastic knobs. Always ensure the plastic knobs are reinstalled after replacing the sump drain valve access cover. This device is not adjustable and does not have any service or maintenance requirements.

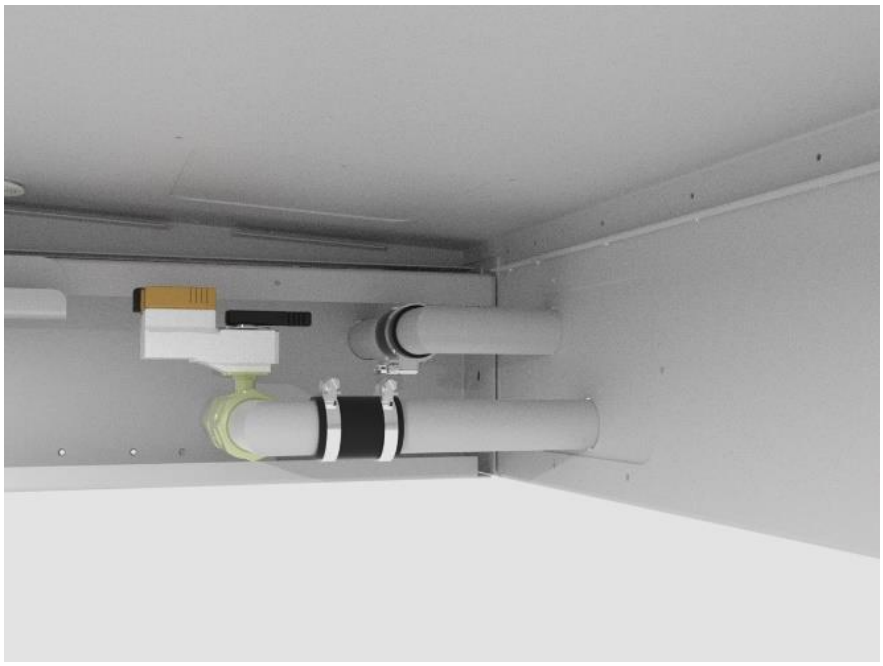


Figure 16. Sump drain valve viewed from underneath the unit

Fan and Motor

General

This unit utilizes electronically commutated (EC) axial fan and motor assemblies with integrated speed controller and guard grill. Fans must rotate without obstruction in the direction indicated by arrows on the equipment. If the unit control type is customer input the fans will stop when the input signal is within the signal range listed in **Table 4**. Fans must be started up and operated at full speed for at least three hours once a month to move the bearings and allow any condensate that may have ingressed to evaporate.

Signal Type	0 RPM Fan Speed Signal Range
4-20mA	4mA – 4.8mA
0-10V	0V – 0.05V
10-0V	10V – 9.95V
BMS 0-100%	0% - 5%

Table 4. Input Signal Zero Fan Speed Signal Range

DANGER: Rotating equipment. Risk of serious injury or death. Never step on fan guard grill or subject the guard grill to load. Do not place any objects on the fan guard grill.

WARNING: Risk of electric shock. Live terminals and connections even with device switched off. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.

WARNING: Transporting the fan. Injuries from tipping or slipping. Wear safety shoes and cut-resistant safety gloves. The fan is only to be transported in its original packaging. The fan is to be transported lying flat, i.e., the motor axis must be vertical. Secure the fan(s) e.g., with a lashing strip to stop anything from slipping or tipping.

CAUTION: High temperature on fan motor electronics housing. Risk of burns. Ensure sufficient protection against accidental contact.

Fan and Motor Removal & Installation

The following procedure is for field removal and installation of a fan and motor assembly.

1. Turn off power on the unit.
    a. Turn power off at the main breaker and follow lock out/tag out procedures.
    b. Before disconnecting any power wires, use a multi-meter to verify that there is no voltage.
2. Remove the fan cover plate by removing the four fasteners as shown in **Figure 17**.

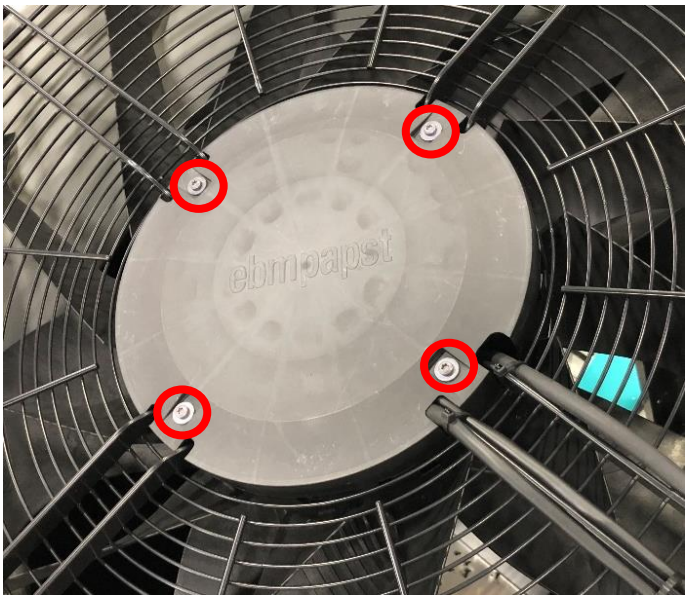


Figure 17. Fan Cover Plate

3. Remove the terminal box cover by removing the four fasteners as shown in **Figure 18**.

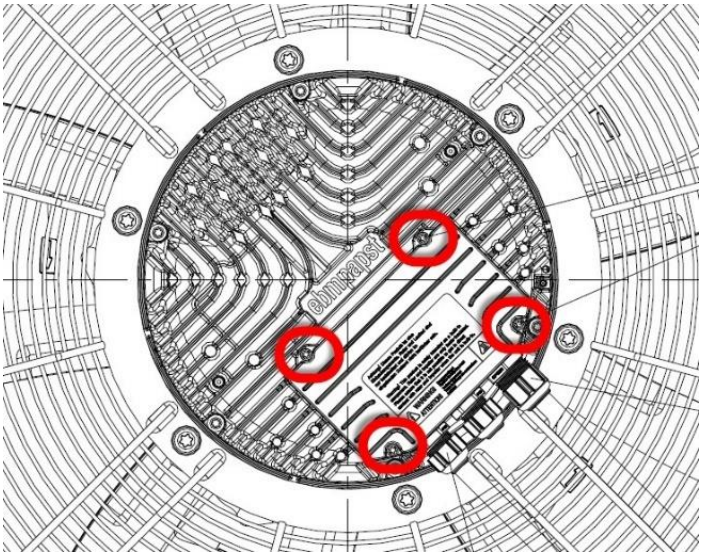


Figure 18. Terminal Box Cover

4. Remove caps from the cable glands. Label and remove wiring from terminal blocks shown in **Figure 19**. Carefully tag these wires properly to ensure that they are connected at the same location on the new fan. These wires carry polarity sensitive signals.

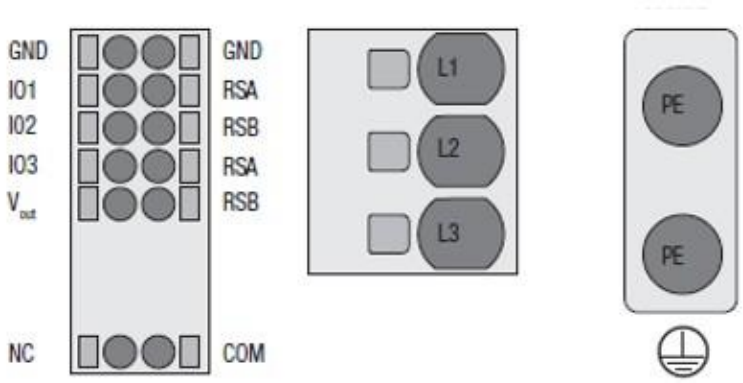


Figure 19. Terminal Block Diagram

5. Remove wires from terminal box and cable glands. Cut zip cable ties securing wiring to fan assembly.
6. Remove the (8) 9/16" bolts securing the fan and motor assembly to the fan deck as shown in **Figure 20**.

Figure 20. Fan Deck Fasteners

7. Lift the fan and motor assembly up and out of the fan deck. If a lifting device is utilized, lift the assembly via the support channels as shown in **Figure 21**. Be sure to rig the assembly to ensure no damage to the guard grill will occur during lift.

Figure 21. Fan and Motor Assembly Lift

8. Lift the new fan and motor assembly into position ensuring mounting holes are aligned.
9. Reinstall the (8) 9/16" bolts to secure the fan and motor assembly to the fan deck as shown in **Figure 20**.
10. Remove the fan cover plate and terminal box cover shown in **Figure 17** and **Figure 18** respectively. Remove caps from the cable glands.
11. Wire terminal blocks shown in **Figure 19** following the wire labels created in **Step 4**. Refer to **Table 5** for more information on connection designations. Only strip the cable as far as necessary, ensuring that the cable glands are sealed and there is no strain on the connections. Recommended stripped lengths (inside terminal box) are shown in **Figure 22**, (1) supply line (2) control and relay line.

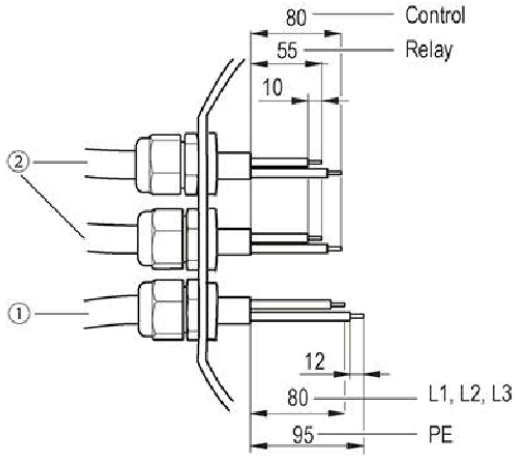


Figure 22. Recommended Stripped Lengths (Inside Terminal Box) (1) Supply Line (2) Control and Relay Line

Conn.	Designation	Function/assignment
CONN1	L1, L2, L3	Power supply, phase, see nameplate for voltage range
PE	PE	Protective earth
CON2	RSA	RS485 interface for MODBUS, RSA; SELV
CON2	RSB	RS485 interface for MODBUS, RSB; SELV
CON2	GND	Reference ground for control interface, SELV
CON2	IO1	Function parameterizable Factory setting: Digital input - high active, function: Disable input, SELV - inactive: Pin open or applied voltage < 1.5 VDC - active: applied voltage 3.5-50 VDC Reset function: Triggering of error reset on change of state from "enabled" to "disabled"
CON2	IO2	Function parameterizable Factory setting: Analog input 0-10 V / PWM, Ri=100 kΩ, function: Set value Characteristic curve parameterizable, SELV
CON2	IO3	Function parameterizable Factory setting: Analog output 0-10 V, max. 5 mA, function: Fan modulation level Characteristic curve parameterizable, SELV
CON2	Vout	Voltage output 3.3-24 VDC ±5%, Pmax=800 mW, voltage parameterizable Factory setting: 10 VDC short-circuit-proof, supply for external devices, SELV alternatively: 15-50 VDC input for parameterization via MODBUS without line voltage
CON2	COM	Status relay, floating status contact, common connection, contact rating 250 VAC / 2 A (AC1) / min. 10 mA, reinforced insulation on supply side and on control interface side
CON2	NC	Status relay, floating status contact, break for failure
	LED	green: status = good, ready for operation orange: status = warning red: status = failure
	P1-IN	Input characteristic curve
	P3-OUT	Output characteristic curve

Table 5. Legend for Internal Motor Terminal Strip

12. Using zip cable ties secure cables to the fan and motor support channels. Ensure the cable is routed in a U-shape as shown in **Figure 23**.

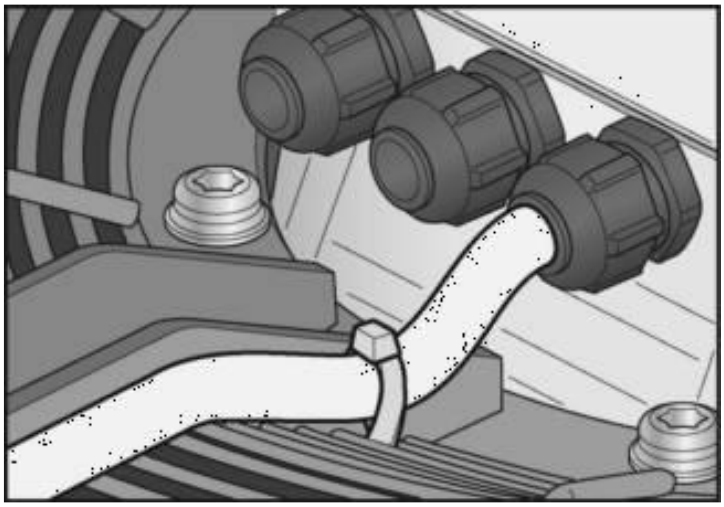


Figure 23. Fan and Motor Assembly Cable Routing

13. Reinstall cable gland caps with a tightening torque of 4 ± 0.6 Nm. Make sure all cable glands not in use are fitted with dummy plugs. Cable diameter minimum 4 mm, maximum 10 mm. Proper installation of cable gland caps is critical to maintain weatherproof rating of the unit. If the above procedure is not followed, damage due to water ingress will occur.

14. Inspect the terminal box cover gasket and reinstall the terminal box cover with a tightening torque of 1.5 ± 0.2 Nm as shown in **Figure 18**. Proper installation of the terminal box cover is critical to maintain weatherproof rating of the unit. If the above procedure is not followed, damage due to water ingress will occur.

15. Reinstall the fan cover plate with a tightening torque of 3 ± 0.3 Nm as shown in **Figure 17**.

16. Follow section **Readdress New Fan** on **Page 92**

Finned Coil Heat Exchanger

Refer to the unit submittal package for the finned coil heat exchangers maximum allowable working pressure (MAWP). Finned coil heat exchanger types will vary depending on the model and design. Proper finned coil heat exchanger maintenance should be followed regardless of coil type. The finned coil heat exchanger should be inspected quarterly; it is susceptible to corrosion and entrapment of airborne particulates (coil fouling). The speed of coil fouling can be reduced, and the service lifetime of the coil can be extended, if the adiabatic pre-cooler pads are always kept in place to act as air filter.

- To keep the coils in optimum condition, ensure that Self-Clean Cycles are enabled. Refer to section **Maintenance Menu** on **Page 63** for more details.
- To inspect the coil, the adiabatic pre-cooler pads must be removed, refer to section **Adiabatic Pre-Cooler Pad Removal** on **Page 24.**
- Inspect the coil surface. Any corrosion, damage, or obstructions must be corrected.
- To manually clean the coils, use a standard garden hose. Never use a brush or pressure washer. First, rinse the outside surface dust and dirt into the water collection gutters and the sump. Continue to rinse until the water easily flows to the inside of the unit and into the sump. Do not use harsh chemicals or extreme water pressure.
- Additional cleaning steps that can be used to dislodge clogged coils include high pressure air, vacuum/Shop-Vac®, or a mild detergent such as Nu Calgon Cal-Green MX coil cleaner (use per manufacturer's instructions).
- The sump and water collection gutters should be cleaned immediately after cleaning the coil to avoid clogging the pump and drain valves.
- Coated coils: Inspect coil coating. To touch up blemished areas, use a Red Epoxy Repair Kit.
- Re-install the adiabatic pre-cooler pads per section **Adiabatic Pre-Cooler Pad Removal** on **Page 24**.

Control Panel

Thermostat Settings

The control panel is equipped with a heater fan and a ventilation fan for maintaining temperatures required for the proper function of electronics. The heater fan thermostat dial should be set to 55°F (13°C), use the thermostat dial shown in **Figure 24**. The ventilation fan thermostat dial should be set to 90°F (32°C), use the thermostat dial shown in **Figure 25**.

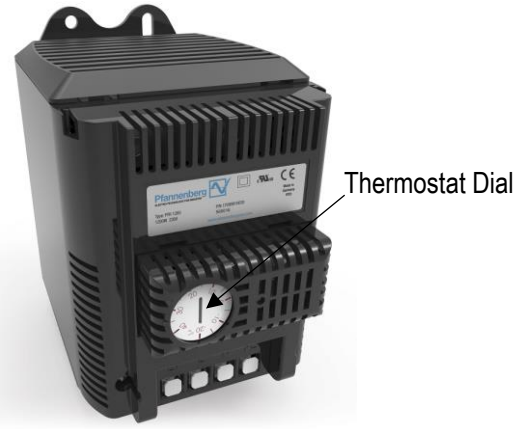


Figure 24. Control Panel Heater Thermostat Dial

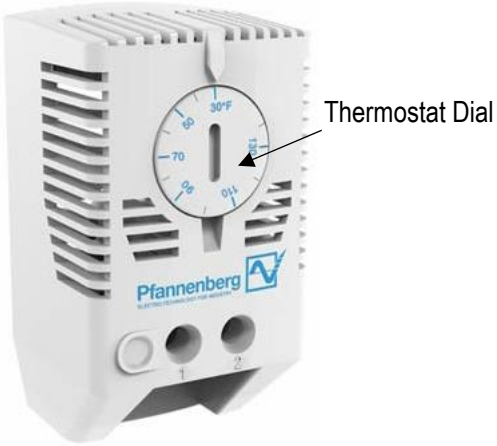


Figure 25. Control Panel Ventilation Fan Thermostat Dial

Programmable Logic Controller (PLC)

Only the manufacturer may repair the PLC device. If a repair should be necessary, contact your local BAC Representative.

Replacing the PLC battery

CAUTION: Battery located in control panel PLC. Risk of explosion resulting in minor or moderate injury or damage to property. Do not recharge or open the battery.

NOTICE: Replace battery with R/C (BBCV2), Part. No. CR2032, rated 3V only. Use of another battery may present a risk of fire or explosion. Only use the battery type specified in **Table 6**.

NOTICE: Scratches on the control panel PLC motherboard may cause the motherboard to fail. Be careful with the battery replacement lever and be sure to avoid scratching the motherboard.

Battery type	Electrical properties at 68°F (20°C)		Dimensions		
	Nominal voltage	Nominal capacity	Diameter	Height	Weight
CR2032	3.0 V	225 mAh	20.0 mm	3.20 mm	3.1 g

Table 6. Technical Data of PLC Battery

It is recommended to replace the battery every 5 years. The motherboard battery is a CR2032 lithium-metal cell. It is used to supply power to the clock integrated on the motherboard. If the battery is depleted or missing, the date and time are displayed incorrectly. Refer to **Table 6** to for replacement battery information. To change the battery, proceed as follows:

1. Before working on the PLC establish electrostatic discharge (ESD) protection to prevent damage to the device through electrostatic discharge. The replacement of device components without ESD protection can lead to functional impairment and destruction of the device. To gain access to the battery and the storage medium remove the cover on the left-hand side of the device by removing the two Torx TX6 screws as shown in **Figure 26**. With the cover removed the battery and storage media are shown in **Figure 27**.

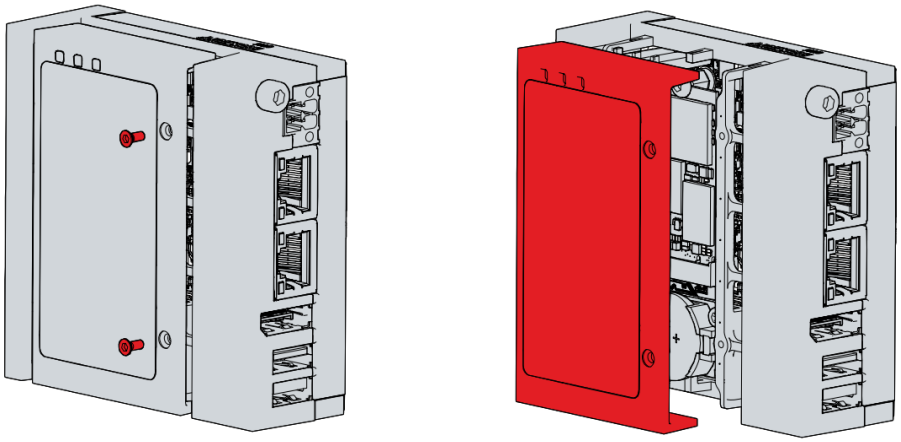


Figure 26. Access to battery and storage media

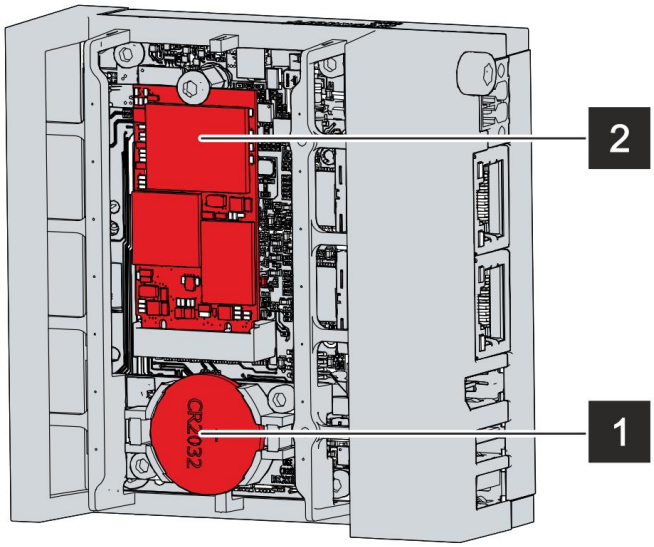


Figure 27. Battery (1) and Storage Media (2)

2. Place a lever made of non-electrically conductive material on the negative pole of the battery holder below the battery.
3. Lift the battery side out of the holder. The battery is now in an inclined position as shown in **Figure 28**.

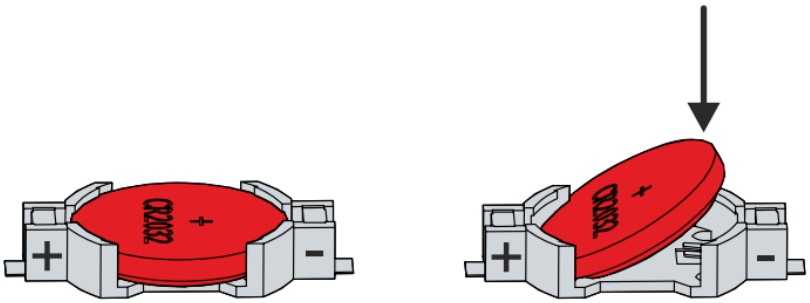


Figure 28. PLC Battery Change

4. Remove the battery completely from the battery holder.
5. Insert the new battery with the correct polarity back into the inclined position on the positive pole of the battery holder. The correct polarity is shown in **Figure 28**.
6. Push the protruding side of the battery into the battery holder as shown in **Figure 28**.
7. To dispose of the battery, remove it, tape off the poles and put it in the battery disposal.

Control Panel Ventilation

The control panel is equipped with intake and exhaust filters. Only original filter mats must be used for the operation of filter fans and outlet filters. Minimum filter material replacement intervals are shown in **Table 7**.

Ambient Conditions	Fluted Filter
Coarse particles	min. 1 time per year
Dust-laden / spray mist	min. 3 times per year
Very high oil content	min. 2 times a month
Without corresponding loads	min. 1 time per year

Table 7. Minimum Filter Material Replacement Intervals

8. Control Logic

The controller controls the fan speed based on the actual fluid outlet temperature and the standard or free cooling set point, ensuring a minimum electrical consumption and noise level. The PLC will operate as described in **Figure 29**. The process fluid temperature set point and the adiabatic switchpoint are adjustable via the Setpoint menu. The PLC continuously measures the fluid output temperature via a temperature sensor installed in the fluid out pipe, and the ambient temperature via a temperature sensor that is factory installed on the unit. The PLC is pre-programmed and ready for operation. However, depending on the size of the installation, you may need to adjust the pre-programmed parameters during start-up.

NOTICE: Changing the controller's parameters may result in an undesired operation of the unit, such as a hunting phenomenon, premature activation of pre-cooling (and increased water consumption) or delayed pre-cooling activation (fluid outlet temperatures exceeding the design temperature).

Sequence of Operation Diagram

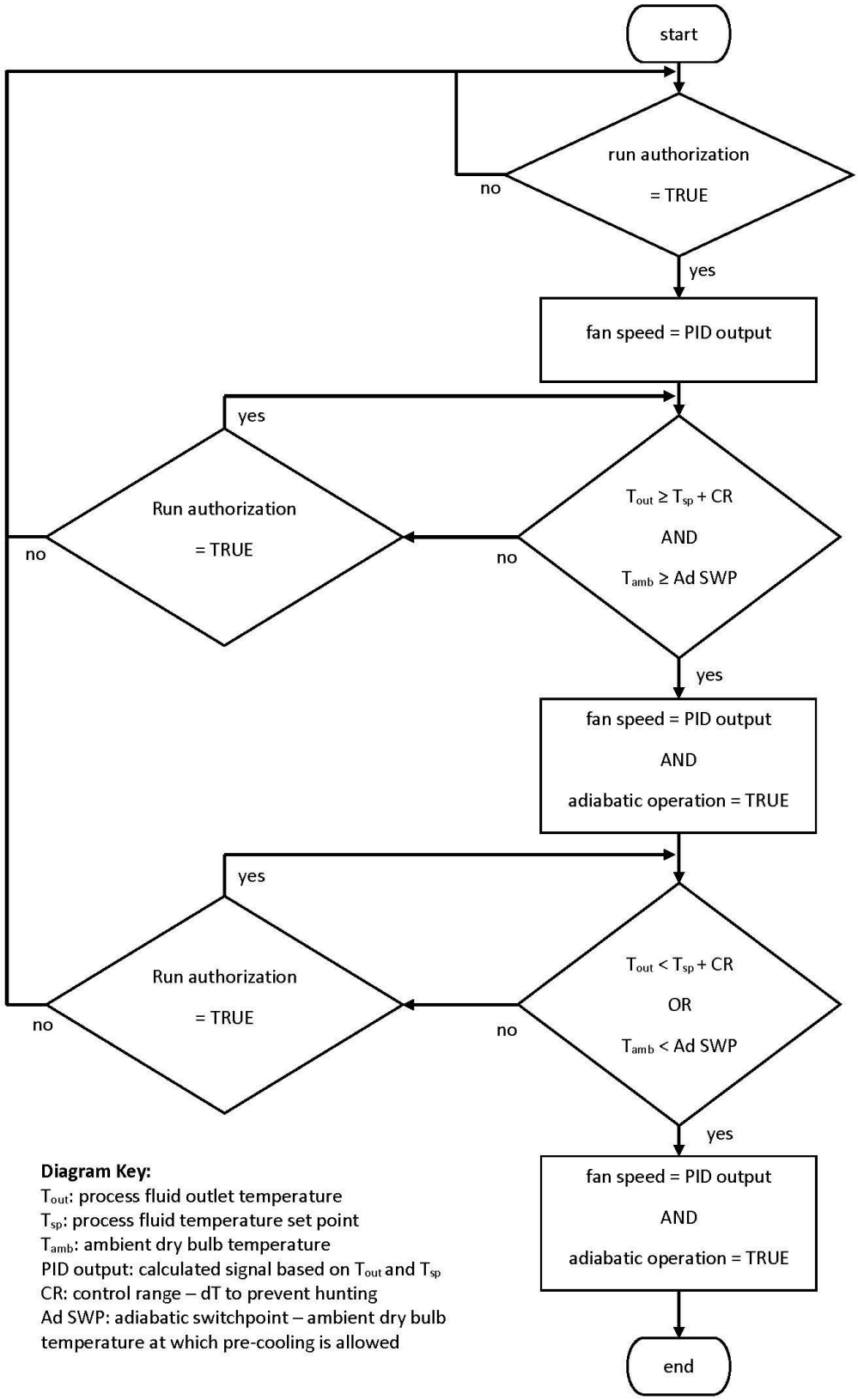


Figure 29. Sequence of Operation Diagram

9. User Interface

Home Menu

The screen or Human Machine Interface (HMI) home menu is shown in **Figure 30**. The home menu displays leaving fluid temperature or customer input command, leaving fluid temperature setpoint or customer input command, control mode, fan command, and system messages. In addition to all unit and fan alarms, the system messages box can show the messages shown in **Table 8**.

Pressing the "run authorization" button in the upper left-hand corner will toggle the run authorization, turning the unit on or off. Pressing the icons near the bottom of the screen will navigate to their respective menus below.

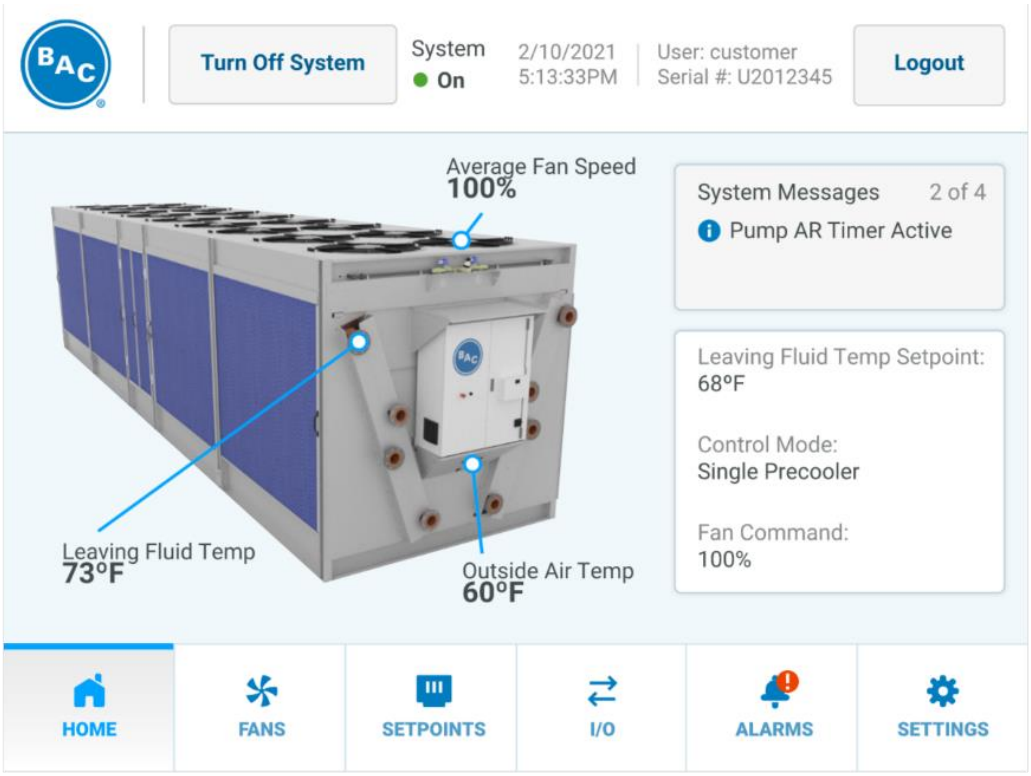


Figure 30. Home Menu

Message Text	Description
Cycle of Concentration Drain	After a set value is reached, the sump is drained to flush out a build-up of excess minerals.
Pump X Anti-Recycle (AR) Timer Active	A timer to prevent excessive on/off cycling of the adiabatic pre-cooler circulation pumps
Water Usage Disabled	Indicates if the unit is restricted from entering adiabatic operation
Night Quiet Mode Active	Indicates if night quiet mode is active
Night Dry Mode Active	Indicates if night dry mode is active
Schedule Dry Mode Active	Indicates if scheduled dry mode is active
Emergency Mode Active	Indicates if the emergency mode is active. During this mode, the fan speed is no longer controlled by the PLC but rather fixed at a predefined level.

Table 8. System Messages

Access Levels

Multiple access levels are present within the software. By pressing the “Logout” button in the upper right corner of the screen as shown in **Figure 30** a user can enter the login screen as shown in **Figure 31**. A password is required to access each level other than user. Access level usernames and passwords are shown in **Table 9.** Pressing the back button in the top right-hand corner will return the user to the home menu.

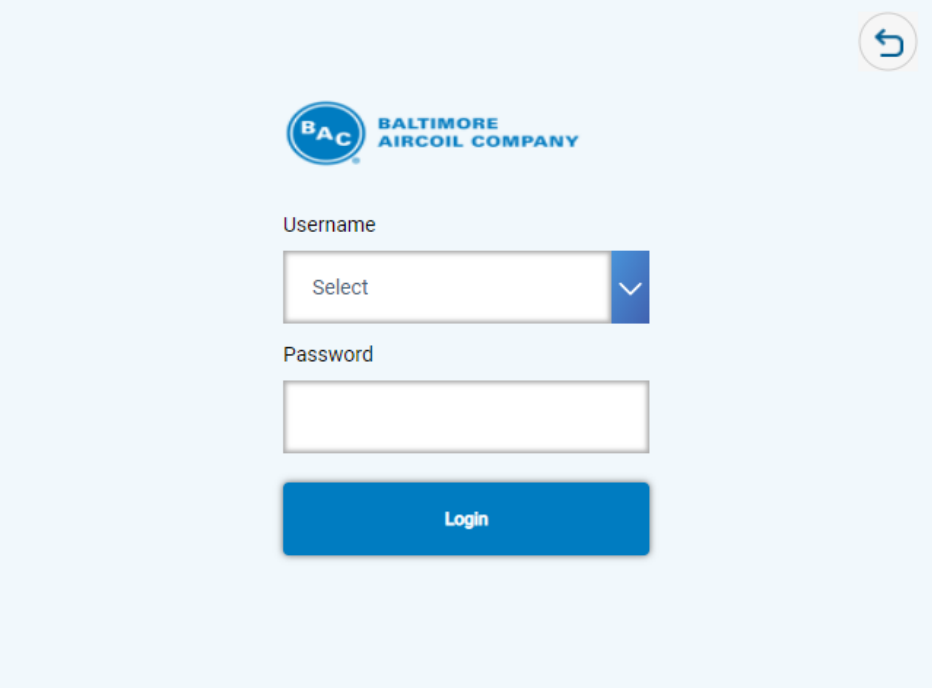


Figure 31. Login Screen

Access Level	Username	Password
User	n/a	n/a
Technician	Tech	4734

Table 9. Access Levels and Passwords

Overview Menu

The HMI is divided into 4 sections as shown in **Figure 32**.

1. HMI header (top)

2. Main menu (bottom),

3. Sub menu (left)

4. Information section (right)

Menu and sub menu names are shown in **Table 10**.

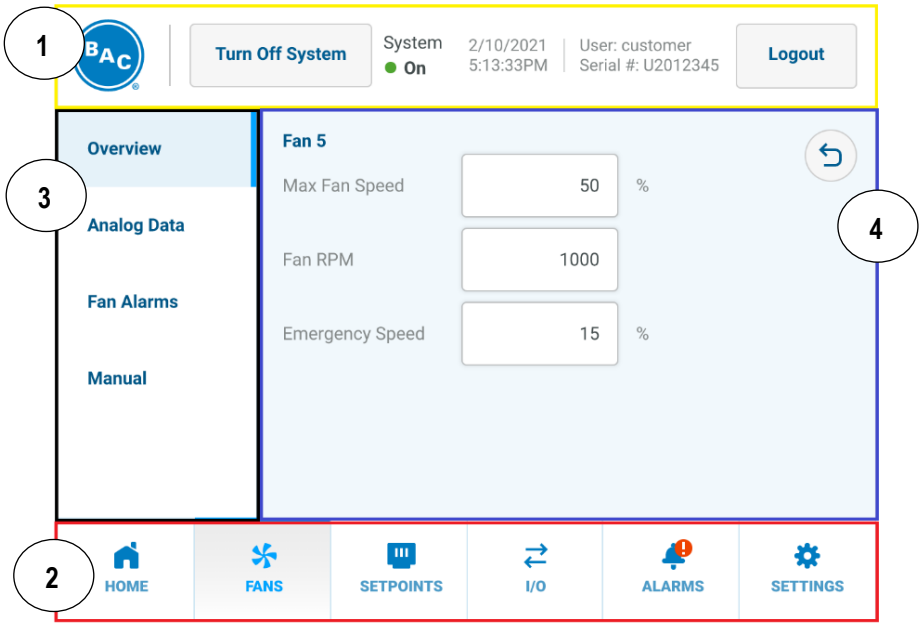


Figure 32. Typical HMI Screen Layout

Main Menu	Sub Menus
Home	
Fans	Overview, Analog Data, Fan Alarms, Manual
Setpoints	Leaving Fluid Control, Basin Water Quality, Load Limiting, Maintenance
Input/Output (I/O)	Temperatures, Make Up, Pumps, Basin Water Level, Starts and Hours, Manual
Alarms	
Settings	Setup, Software Version, Technician

Table 10. Menu and Sub Menu Names

When selecting a menu option that requires data entry, a screen will appear as shown in **Figure 33**. Pressing the “OK” button will modify the writable menu option with the value at the top. Pressing the “Cancel” button returns the user to the previous menu. Pressing the backspace key will delete the one’s place number.

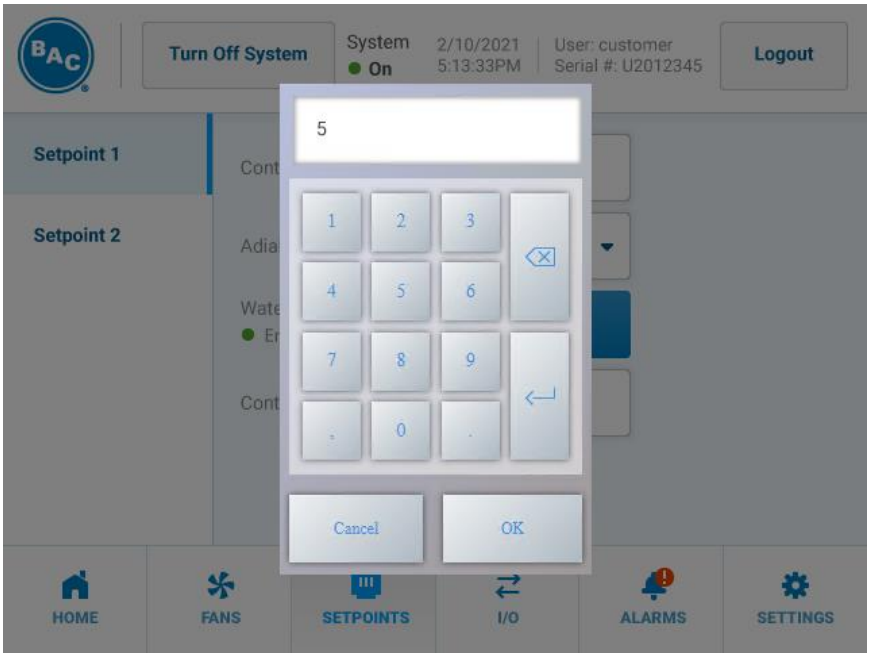


Figure 33. Data Entry Menu

Fan Menu

Figure 34 shows the fan menu. The color of the dot in each fan icon reflects that fan's status: Good (green), Alarm (red), Offline (blue). Fan X's status will show as "Good" when there are no active fan alarms. Fan X's status will show as "Alarm" when any fan alarm is active. Fan X's status will show as Offline when there has not been a response from Fan X in 150 milliseconds.

Pressing on an individual fan takes the user to that fan's specific menu. Pressing on the unit diagram on the left displays the All Fans menu as shown in **Figure 35**. While in the All Fans menu all writable settings will affect all available fans and all readable parameters will be the average reading from of all available fans.

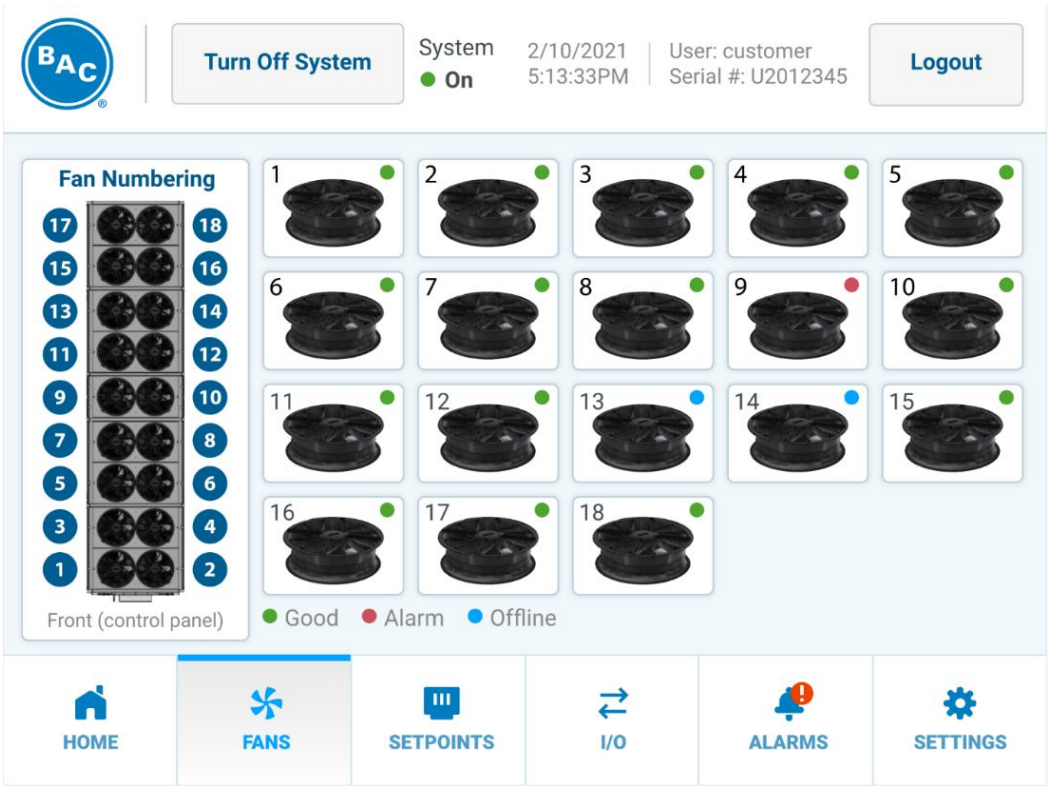


Figure 34. Fan Menu

All Fans Menu

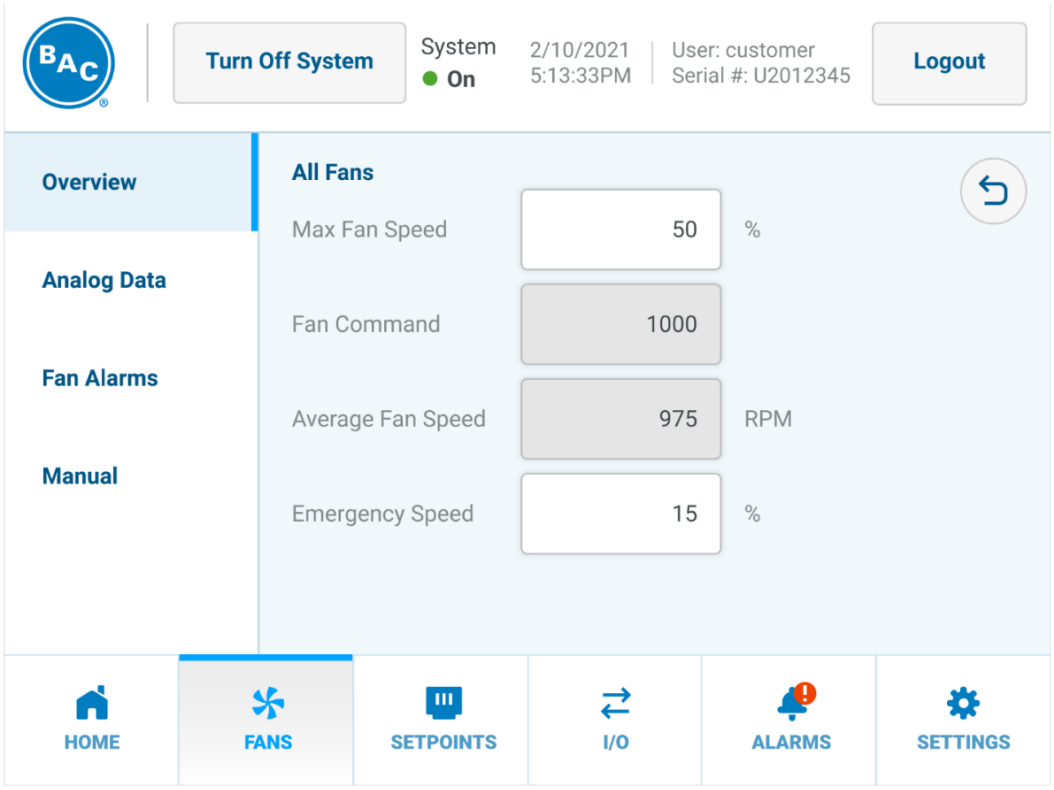


Figure 35. All Fans Menu, Overview

Parameter	Description
Max Fan Speed	Maximum fan speed for all fans as a % of total fan speed.
Fan Command	Read only
Average Fan Speed	Read only
Emergency Speed	Speed at which all fans will run in case of loss of communication

Table 11. All Fans Menu, Overview Parameters

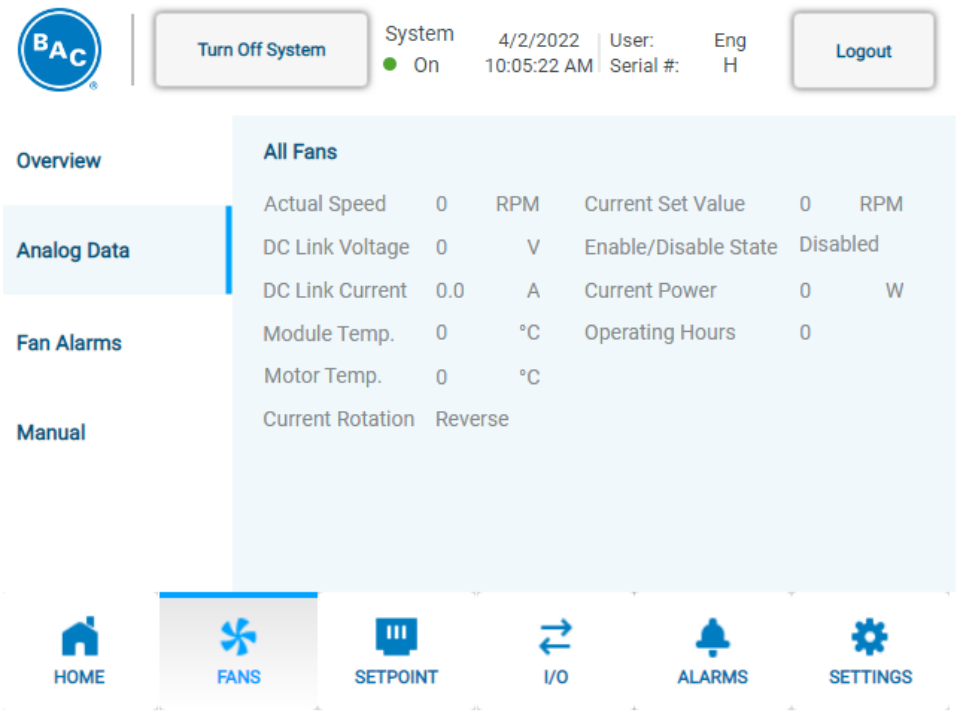


Figure 36. All Fans Menu, Analog Data

The Analog Data (shown in **Figure 36**) displays fan data averaged across all available fans. Fan Alarms (shown in **Figure 37**) displays all possible fan alarms. A green dot indicates the alarm is not active. A red dot indicates the alarm is active. Pressing the "Previous" or "Next" buttons allows the user to view an additional page of fan alarms.

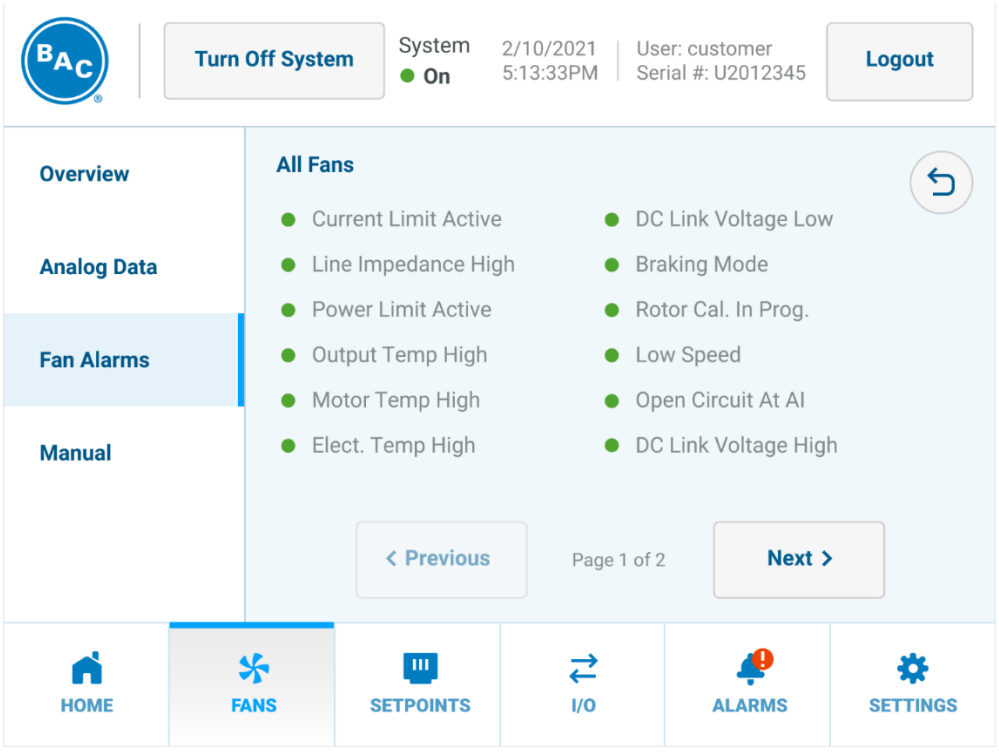


Figure 37. All Fans Menu, Fan Alarms

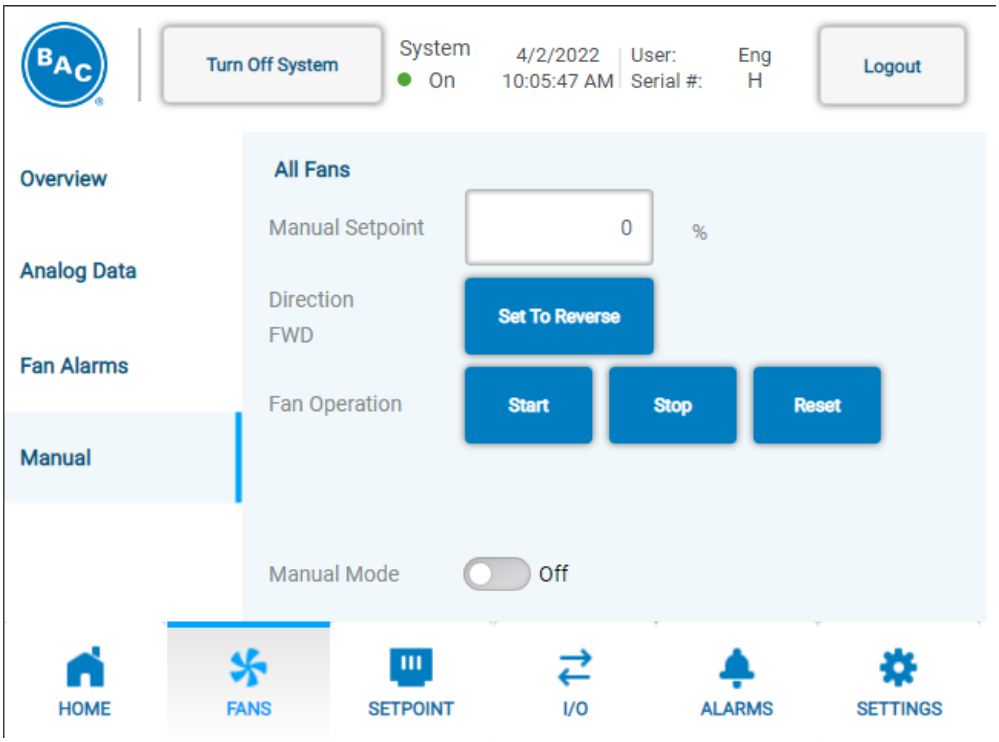


Figure 38. All Fans Menu, Manual

The Manual menu shown in **Figure 38** is only visible with Technician access level. Refer to **Table 9. Access Levels and Passwords** on **Page 45**. Setting the All Fans Manual Mode to Enable transitions the control state to Manual. The Manual menu allows a user to override the fan speed, fan rotation direction, and start, stop, or reset all fans.

Fan X Menu

Pressing on Fan X in the Fan Overview menu shown in **Figure 34** brings the user to the Fan X Overview tab shown in **Figure 39**. Analog Data menu reflects **Figure 36** and Fan Alarms menu reflects **Figure 37** however information displayed on these menus is per fan.

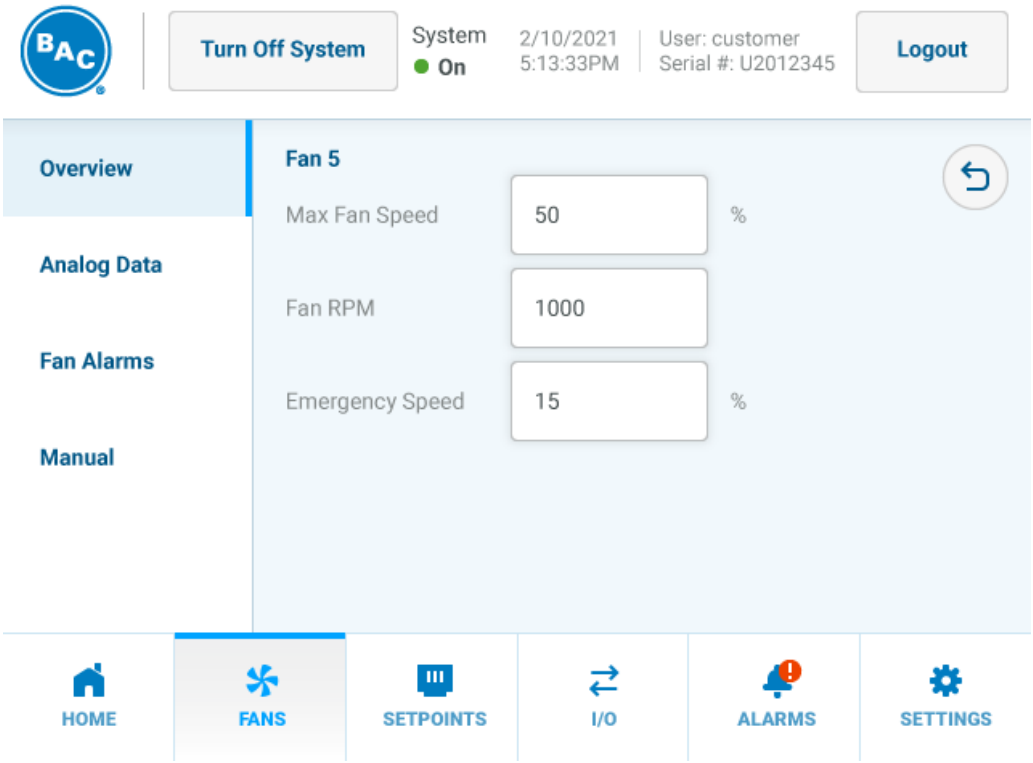


Figure 39. Fan X Menu, Overview

The Manual menu shown in **Figure 40** is only visible with Technician access level. Refer to **Table 9. Access Levels and Passwords** on **Page 45**. Setting the Fan X Manual Mode to Enable will not transition the control state to Manual. The Manual menu allows a user to override the fan speed, fan rotation direction, start, stop or reset a fan as well as read out the fan Modbus address.

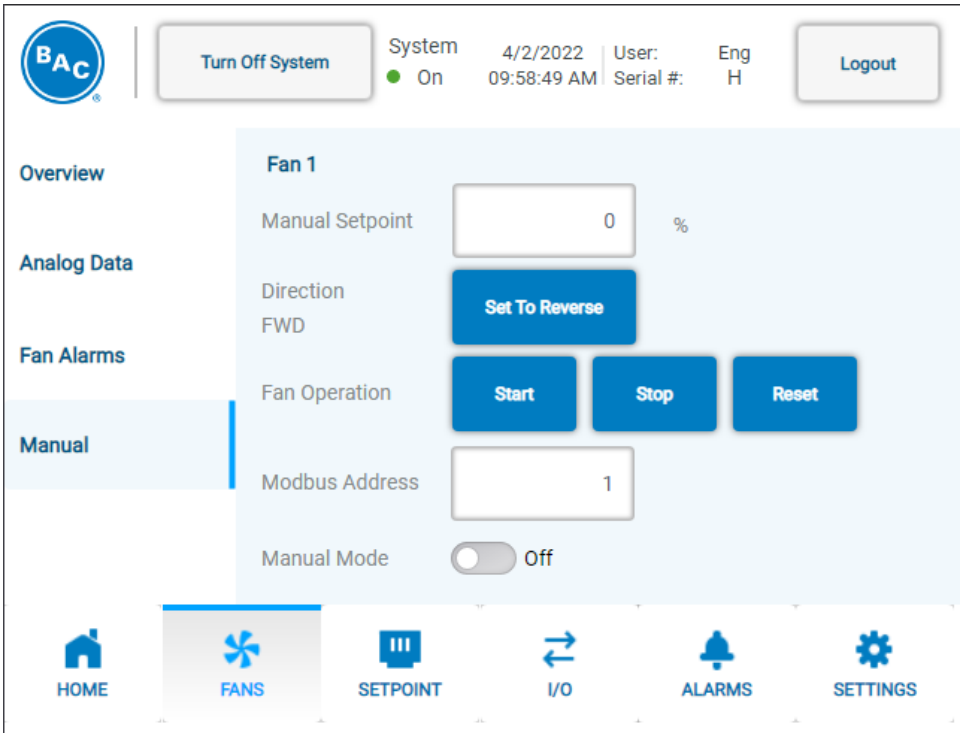


Figure 40. Fan X Menu, Manual

Setpoints

Leaving Fluid Control & Customer Input Control Menu

With the parameters that can be set in this menu, the user can finetune the behavior of the unit. The Leaving Fluid Control tab shown in **Figure 41** is only visible if the Control Type is Leaving Fluid Control. The Customer Input Control tab shown in **Figure 42** is only visible if the Control Type is Customer Input. The Customer Input Control mode allows the user to provide an analog input signal to control the unit's capacity between 0% and 100%. **Table 12** lists the parameters available in Setpoints menu, Leaving Fluid Control and Customer Input Control.

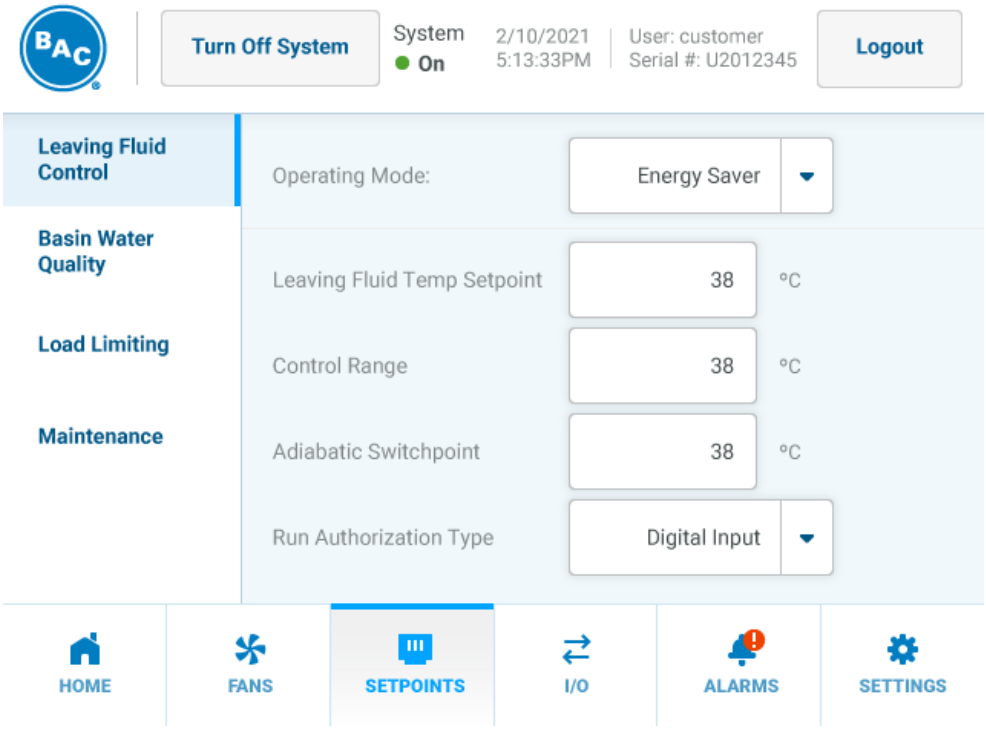


Figure 41. Setpoints Menu, Leaving Fluid Control

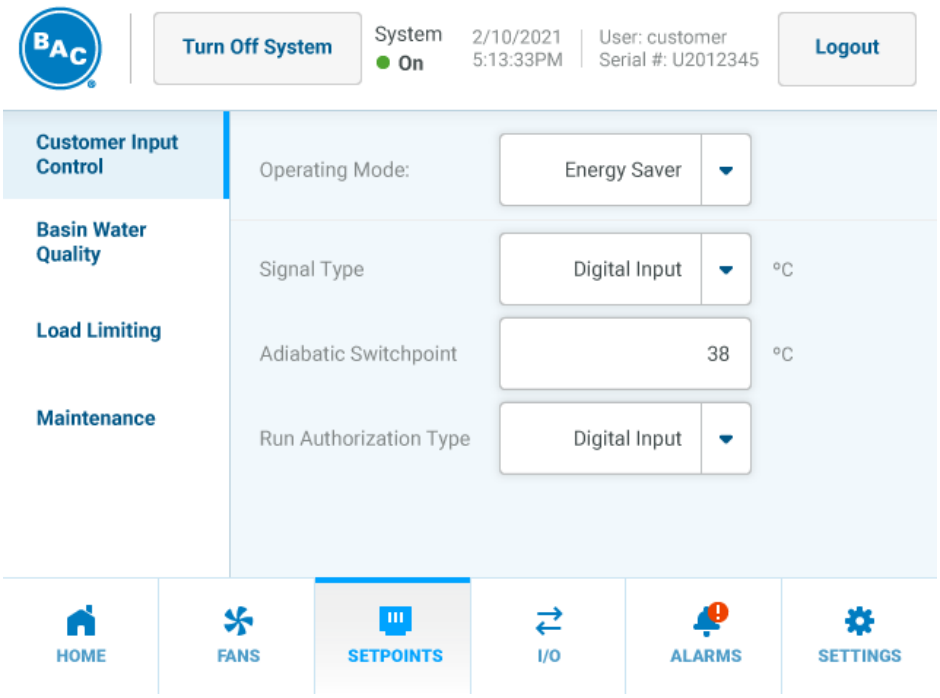


Figure 42. Setpoints Menu, Customer Input Control

Parameter	Description
Operating Mode: Default	Utilizes factory set operating variables that provides a balance of water and energy savings. See **Table 13. Operating Mode Parameters** for more information.
Operating Mode: Energy Saver	Energy Saver mode will enter adiabatic operation more quickly than Default or Water Saver Operating Modes resulting in lower fan power energy consumption. See **Table 13. Operating Mode Parameters** for more information.
Operating Mode: Water Saver	Water Saver mode will stay in dry operation longer than Default or Energy Saver Operating Modes resulting in lower water consumption. See **Table 13. Operating Mode Parameters** for more information.
Signal Type	Defines the type of input signal. This can be set to either 4-20mA, 0-10V, 10-0V or BMS 0-100%. The current signal is supplied to input card EL3014 channel 2 or contacts X7:27 and X7:28. The voltage signal is supplied to input card EL3174 channel 1 or contacts X7:17 and X7:18. The BMS signal refers to the "CIFanCMD" variable in **Table 66.**
Leaving Fluid Temp Setpoint	Set-point for the fluid outlet temperature
Control Range	Allowed offset in leaving fluid temperature set point before changing stages/operating modes. For example, allows leaving fluid temperature to rise above leaving fluid temp setpoint by this control range before changing to adiabatic mode.
Adiabatic Switchpoint	Ambient temperature at which adiabatic operation becomes possible. See **Adiabatic Switchpoint** on **Page 13** for more details.
Run Authorization Type	Source signal to switch the unit between stand-by and active. This can be set to either HMI, digital input or BMS. HMI refers to the button on the top left of the screen, digital input refers to input card EL1008 channel 6 or contacts X5:7 and X5:8 on the terminal strip, BMS refers to the "BMSrunEn" variable in **Table 66.** . The HMI button is always taken into account to enable the unit to run (also when the type is set to digital input or BMS).

Table 12. Setpoints Menu, Leaving Fluid/Customer Input Control Parameters

Parameter	Operating Mode		
	Default	Energy Saver	Water Saver
Control Range	3.6°F (2.0°C)	0.9°F (0.5°C)	10.0°F (5.5°C)
Adiabatic Switchpoint	X	lowers current setpoint by 10.0°F (5.5°C)	X
Stage Timer	120 seconds	60 seconds	300 seconds

Table 13. Operating Mode Parameters

Basin Water Quality Menu

The Basin Water Quality menu shown in **Figure 43** and **Figure 44** allows a user to adjust parameters shown in **Table 14**.

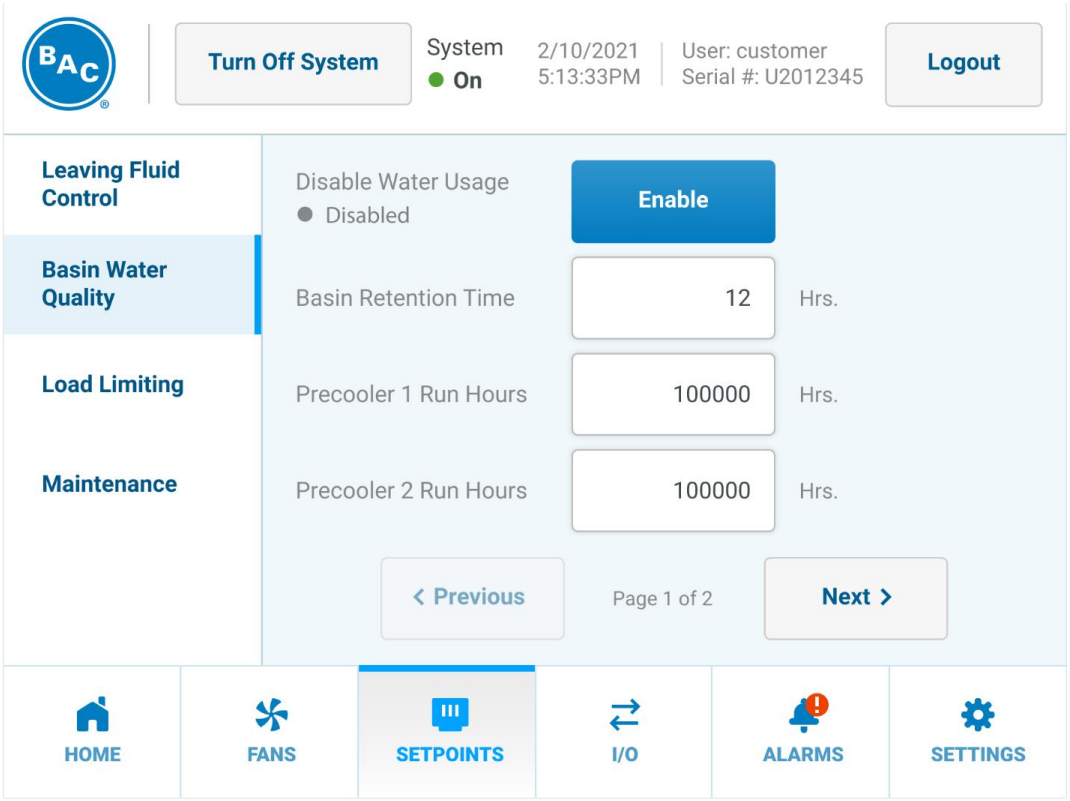


Figure 43. Setpoints Menu, Basin Water Quality Page 1 of 2

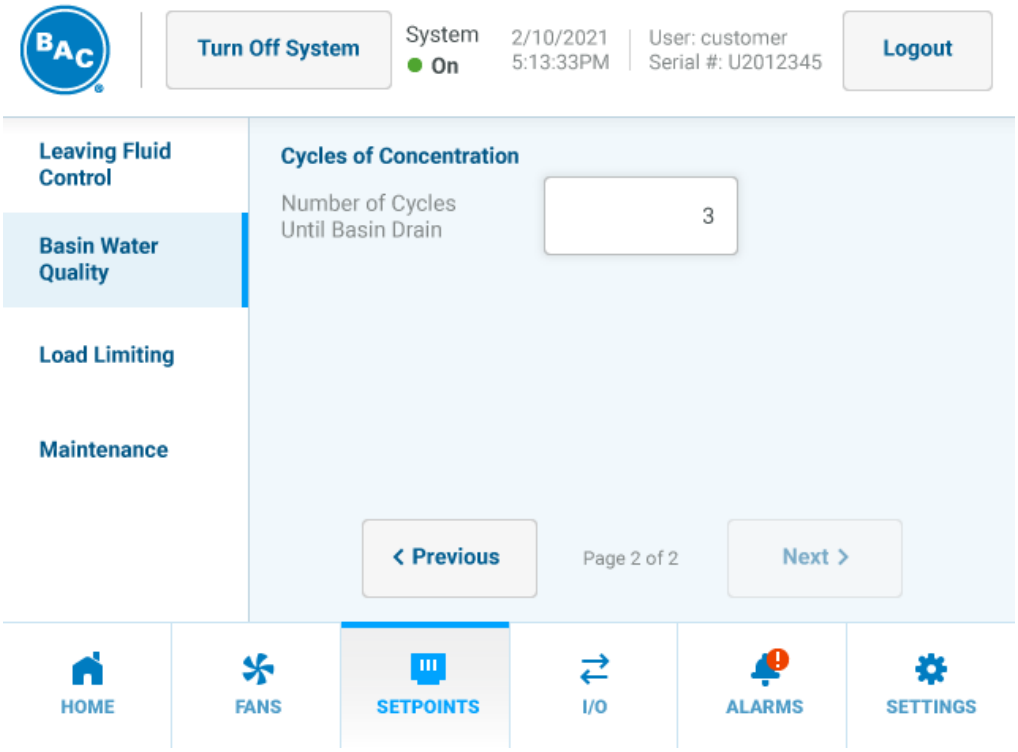


Figure 44. Setpoints Menu, Basin Water Quality Page 2 of 2

Parameter	Description
Disable Water Usage	Manually disable water usage (prevent adiabatic operation)
Basin Retention Time	Time after switch to dry operation before fully draining the water in the basin (sump). Low limit 1 hour, high limit 72 hours, default 24 hours.
Precooler X Run Hours	Number of adiabatic operating hours on each pre-cooler air inlet face
Number of Cycles Until Basin Drain	Number of cycles of concentration till basin (sump) drains and is replaced with make-up water. A cycle of concentration is defined as the basin water level starting at the High Level Float, down to the Mid Level Float, then back to the High Level Float. The loss of basin water is due to evaporation on the adiabatic pads. Low limit 3, high limit 10, default 3.

Table 14. Setpoints Menu, Basin Water Quality Parameters

Load Limiting Menu

Refer to section **Load Limiting Modes** on **Page 14** for more information. The Load Limiting menu includes

- Night Quiet load limiting mode shown in **Figure 45** and **Figure 46** with parameters listed in **Table 15**.
- Night Dry load limiting mode shown in **Figure 47** and **Figure 48** with parameters listed in **Table 16**.
- Schedule Dry load limiting mode shown in **Figure 49** and **Figure 50** with parameters listed in **Table 17**.

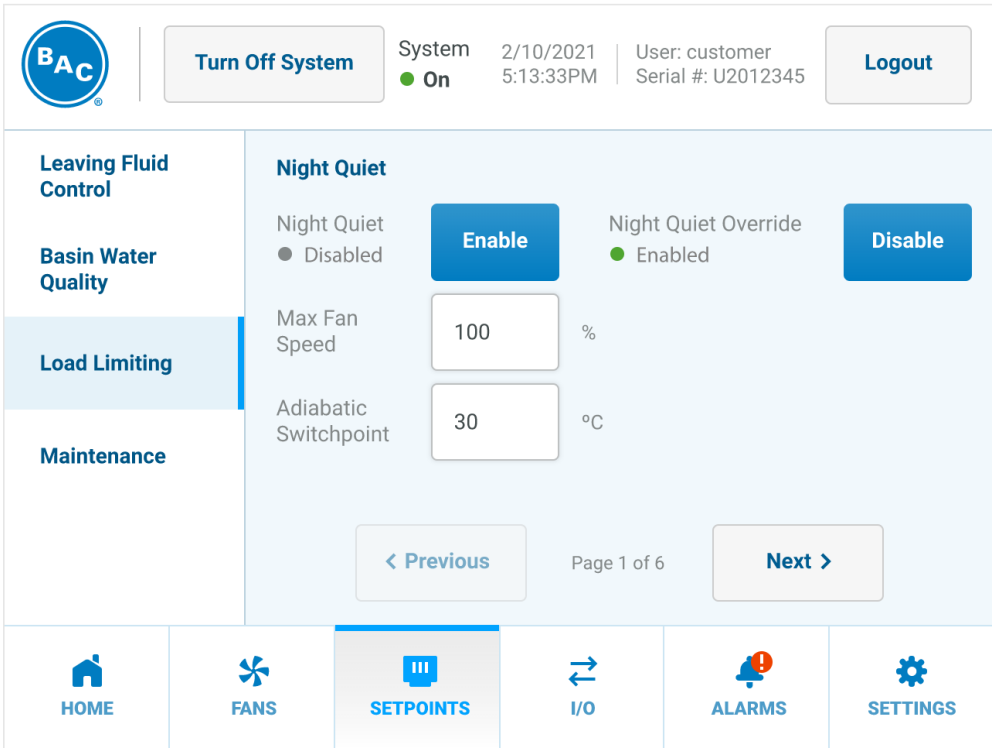


Figure 45. Setpoints Menu, Load Limiting Page 1 of 6

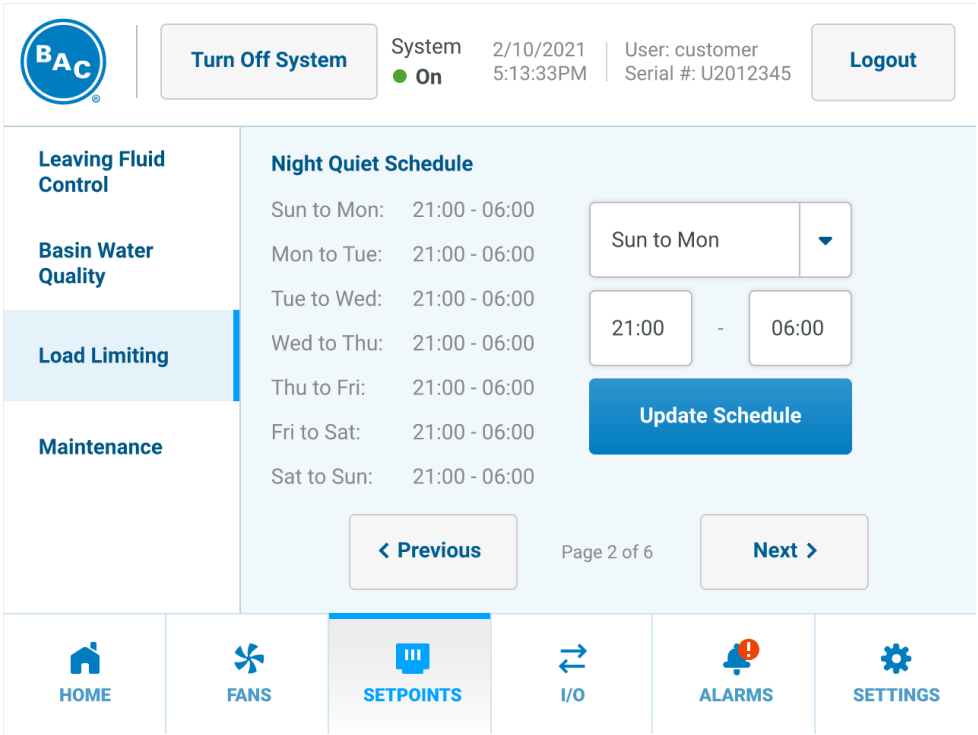


Figure 46. Setpoints Menu, Load Limiting Page 2 of 6

Parameter	Description
Night Quiet Enable/Disable	Allows use to either enable or disable the feature. If enabled, the “max fan speed” and “adiabatic switchpoint” parameters will become active during the times set in the schedule shown in **Figure 46**.
Max Fan Speed	Maximum fan speed that needs to observed when “night quiet” mode is active
Adiabatic Switchpoint	Reduced ambient temperature at which adiabatic operation becomes possible. This second (reduced versus the standard) adiabatic switchpoint allows adiabatic operation at lower ambient temperatures in order to make up for the lower available thermal performance due to the lower fan speed.
Night Quiet Override	If enabled, the “max fan speed” and “adiabatic switchpoint” parameters will become active regardless of the schedule shown in **Figure 46**. In addition to the on-screen button, the override can also be enabled with the “NightQuietOverride” variable in **Table 66.** .
Night Quiet Schedule	The schedule defines a start time on one day and a stop time on the next day. All times are in 24-hour format.

Table 15. Setpoints Menu, Load Limiting Night Quiet Parameters

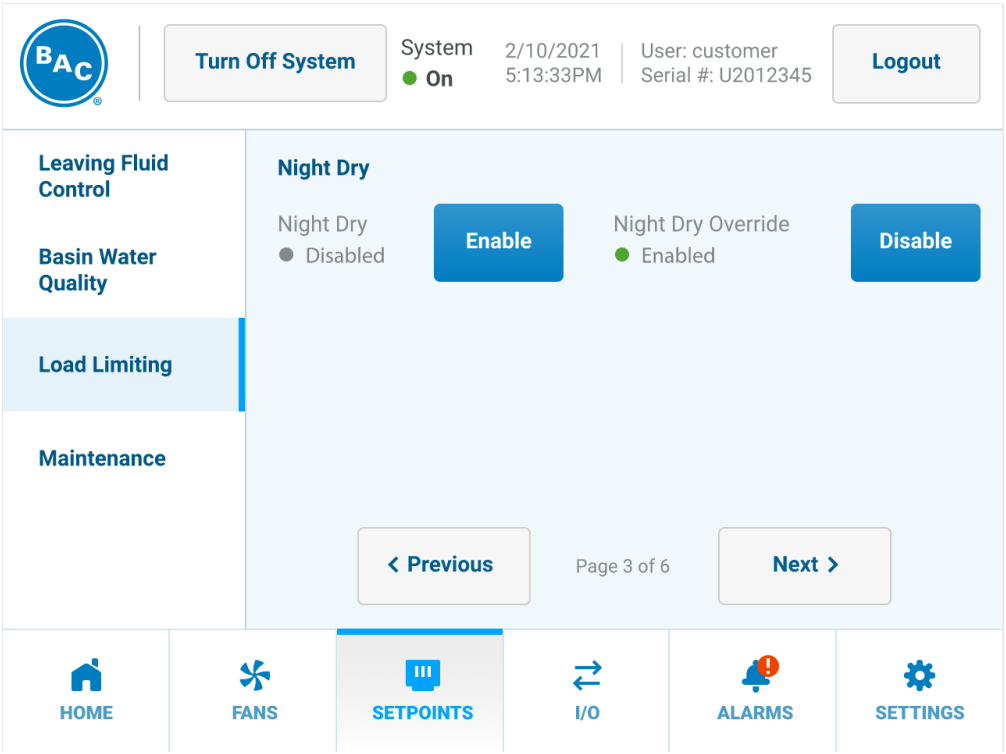


Figure 47. Setpoints Menu, Load Limiting Page 3 of 6

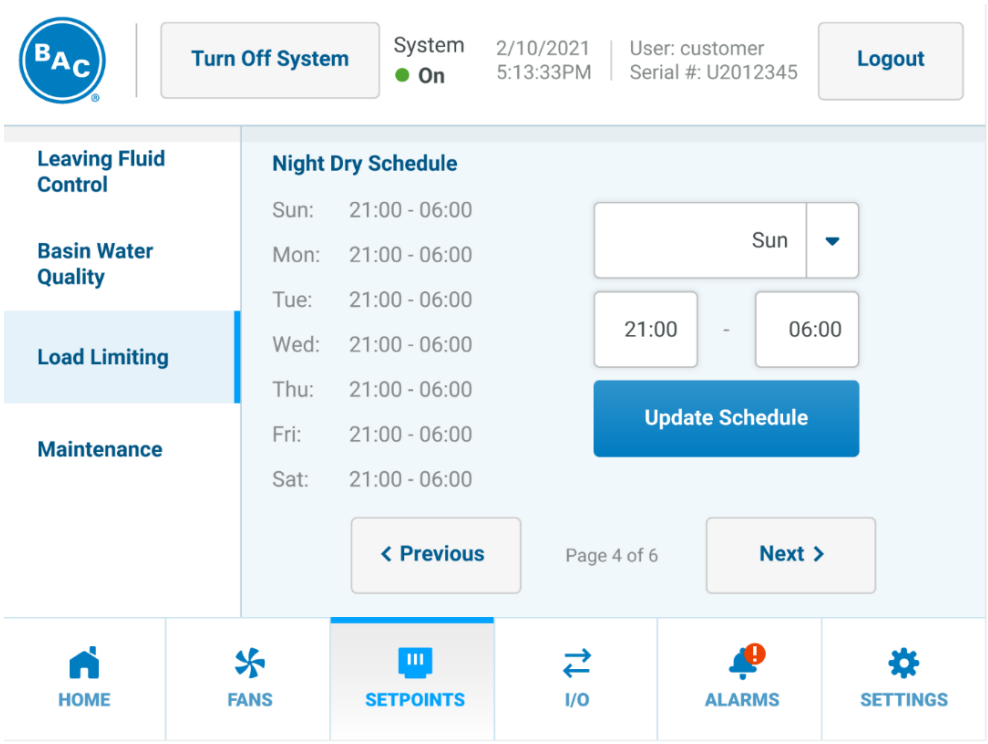


Figure 48. Setpoints Menu, Load Limiting Page 4 of 6

Parameter	Description
Night Dry Enable/Disable	Allows user to either enable or disable the feature. If enabled, no water will be used during the times set in the schedule shown in **Figure 48**.
Night Dry Override	If enabled, no water will be used regardless of the schedule shown in **Figure 48**. In addition to the on-screen button, the override can also be enabled with the "NightDryOverride" variable in **Table 66.** .
Night Dry Schedule	The schedule defines a start time on one day and a stop time on the next day. All times are in 24-hour format.

Table 16. Setpoints Menu, Load Limiting Night Dry Parameters

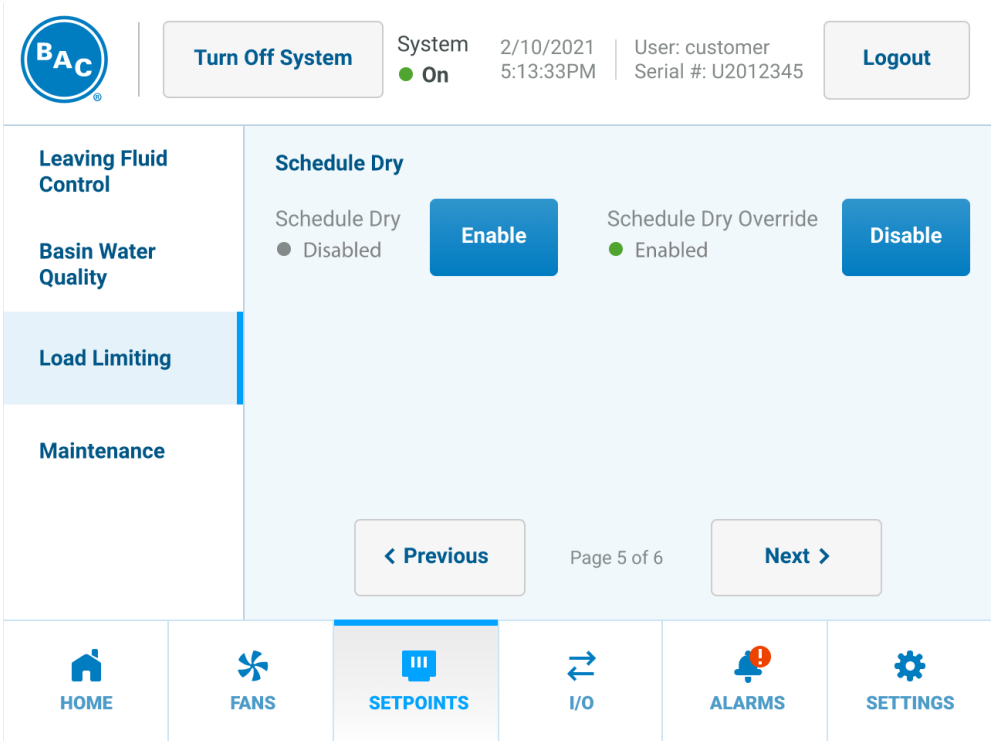


Figure 49. Setpoints Menu, Load Limiting Page 5 of 6

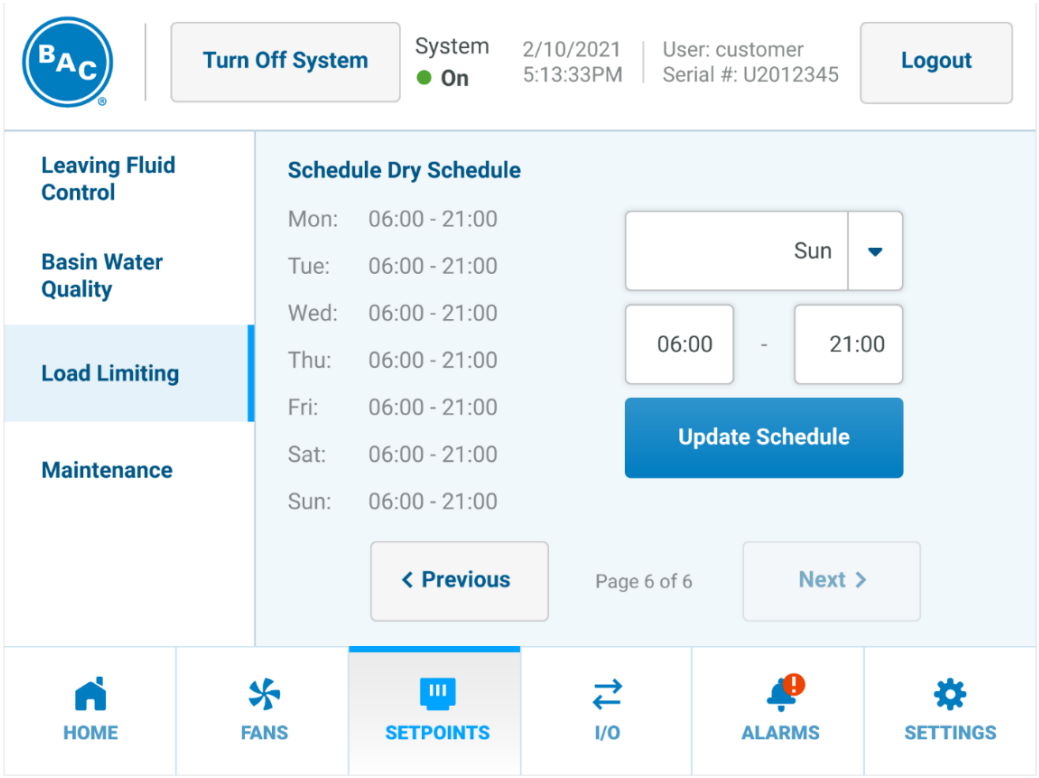


Figure 50. Setpoints Menu, Load Limiting Page 6 of 6

Parameter	Description
Schedule Dry Enable/Disable	Allows user to either enable or disable the feature. If enabled, no water will be used during the times set in the schedule shown in **Figure 50**.
Schedule Dry Override	If enabled, no water will be used regardless of the schedule shown in **Figure 50**. In addition to the on-screen button, the override can also be enabled with the "ScheduleDryOverride" variable in **Table 66.** .
Schedule Dry Schedule	The schedule defines a start time on one day and a stop time on the same day. All times are in 24-hour format.

Table 17. Setpoints Menu, Load Limiting Schedule Dry Parameters

Maintenance Menu

Refer to section **Maintenance Modes** on **Page 14** for more information. The Maintenance menu includes

- Coil Clean maintenance mode shown in **Figure 51** with parameters listed in **Table 18**.
- Pad Clean maintenance mode shown in **Figure 52** with parameters listed in **Table 19**.
- Complete Drain and Dry maintenance mode shown in **Figure 53** with parameters listed in **Table 20**.

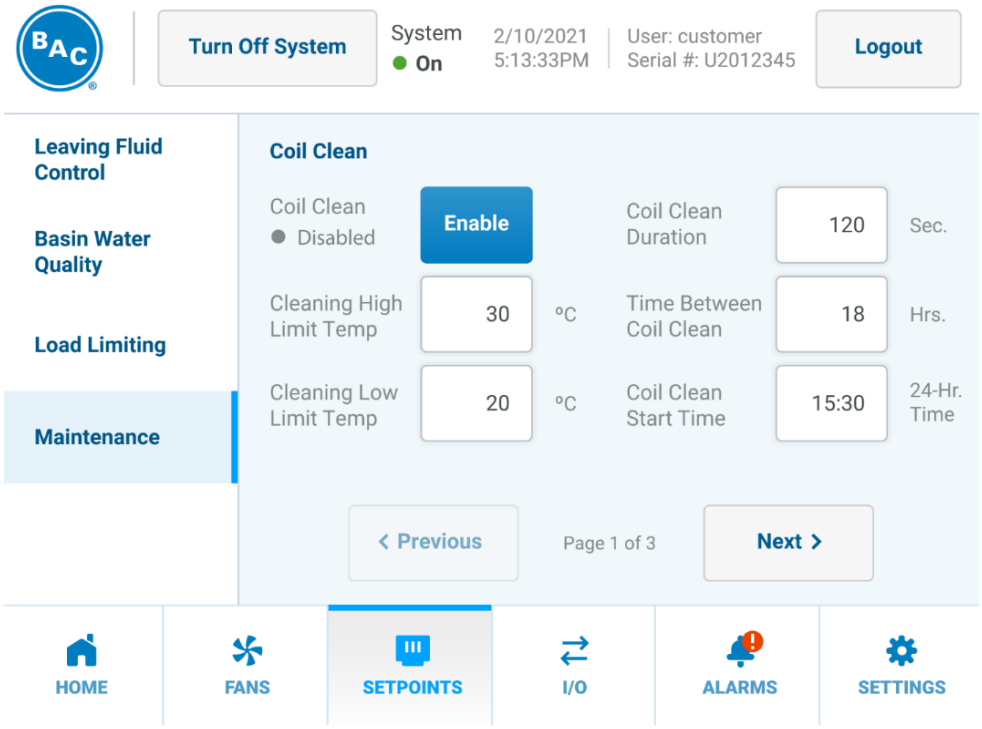


Figure 51. Setpoints Menu, Maintenance Page 1 of 3

Parameter	Description
Coil Clean Enable/Disable	Allows user to either enable or disable the feature. If enabled, the fans will do a daily cycle at a 100% fan speed in reverse direction at the time programmed.
Cleaning High Limit Temp	Maximum ambient temperature at which the coil cleaning cycle can start. Because the fans run in reverse, they will push warm ambient air over the coils in summer.
Cleaning Low Limit Temp	Minimum ambient temperature at which the coil cleaning cycle can start. Because the fans run at maximum fan speed, there would be an undercooling and/or coil freezing risk if allowed to become too low.
Coil Clean Duration	Time in seconds the coil cleaning cycle lasts
Time Between Coil Clean	Number of hours between coil cleaning cycles
Coil Clean Start Time	Time of the day when the coil cleaning cycle will start

Table 18. Setpoints Menu, Coil Clean Parameters

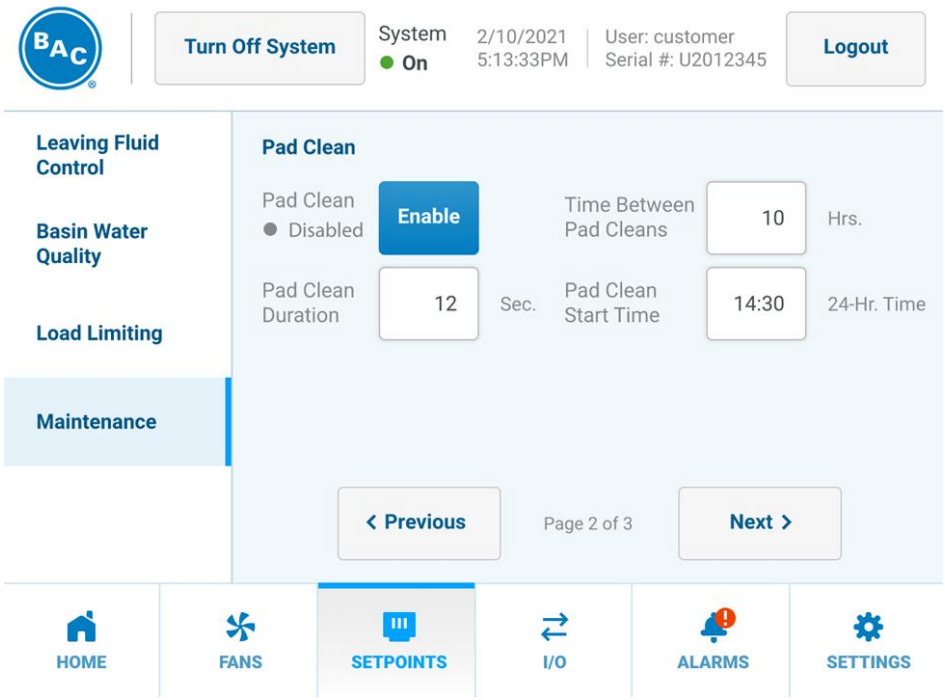


Figure 52. Setpoints Menu, Maintenance Page 2 of 3

Parameter	Description
Pad Clean Enable/Disable	Allows user to either enable or disable the feature. If enabled, the pads will be rinsed at the time programmed.
Pad Clean Duration	Time in seconds the pad cleaning cycle lasts.
Time Between Pad Cleans	Number of hours between pad cleaning cycles
Pad Clean Start Time	Time of the day when the pad cleaning cycle will start, preferably set in the afternoon to take advantage of the increased cooling effect during the warmest period of the day.

Table 19. Setpoints Menu, Pad Clean Parameters

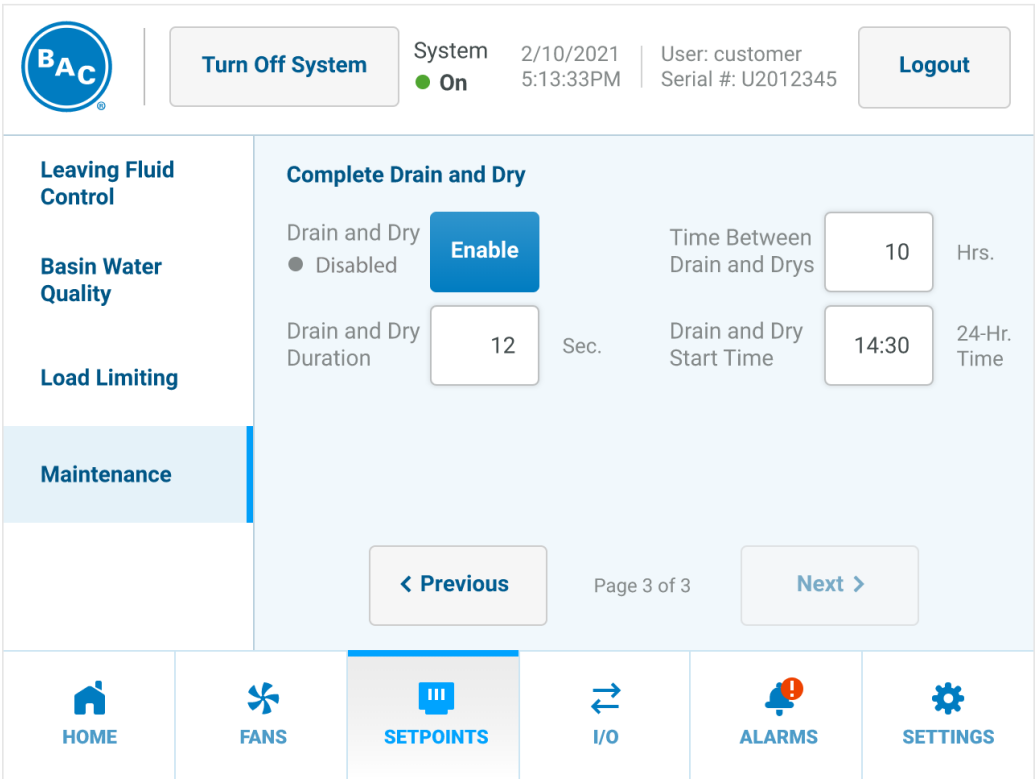


Figure 53. Setpoints Menu, Maintenance Page 3 of 3

Parameter	Description
Drain and Dry Enable/Disable	Allows user to either enable or disable the feature. If enabled, the fans will do a daily cycle at a 100% fan speed at the time programmed.
Drain and Dry Duration	Time in seconds the drain and dry cycle lasts.
Time Between Drain and Dry	Number of hours between pad drain and dry cycles.
Drain and Dry Start Time	Time of the day when the drain and dry cycle will start.

Table 20. Setpoints Menu, Complete Drain and Dry Parameters

Technician Menu

The Technician menu shown in **Figure 54** is only visible with Technician access level. Refer to **Table 9. Access Levels and Passwords** on **Page 45**. Technician menu parameters are shown in **Table 21**. Note that changing the PI (proportional and integration) parameters or stage time may result in a hunting phenomenon.

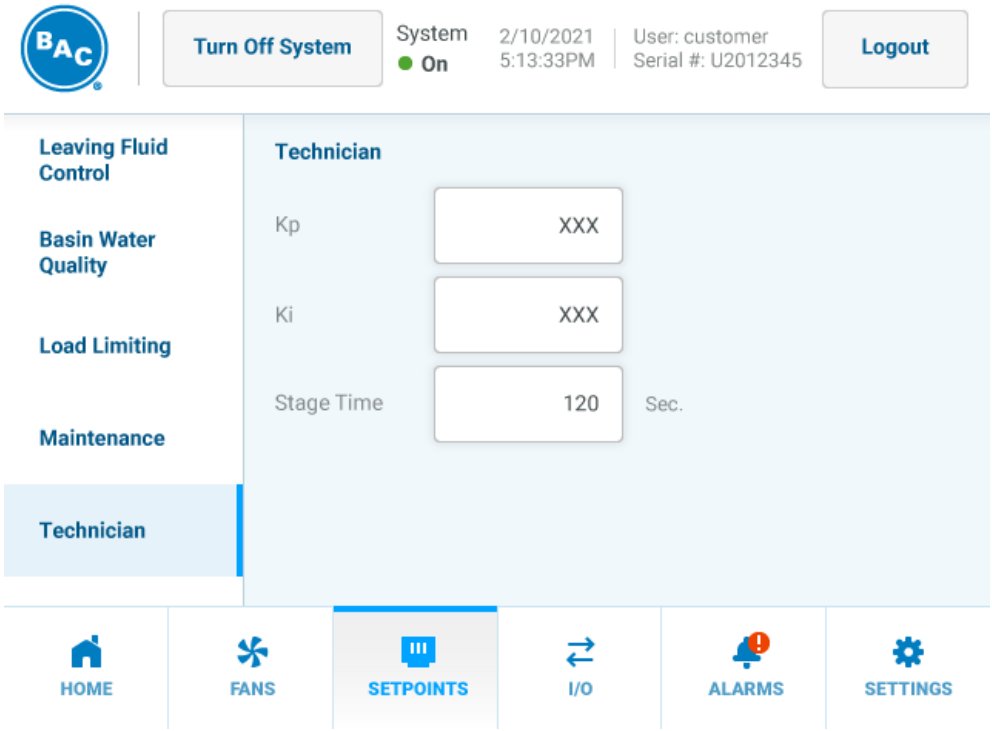


Figure 54. Setpoints Menu, Technician

Parameter	Description
Kp	Set the value for the proportional band of the fan speed PI controller
Ki	Set the value for the integration time of the fan speed PI controller
Stage Time	Time to switch between different operating modes

Table 21. Setpoints Menu Technician Parameters

Input & Output

With the parameters that can be set in this menu, the user can view the status of all available inputs and outputs. In addition, some output signals can be forced in a certain position to overrule the default programming.

Temperatures Menu

Temperature menu is shown in **Figure 55** and **Figure 56** with parameters listed in **Table 22. Figure 56** only appears if the Precool Temp Sensor option is provided on the unit.

Figure 55. I/O Menu, Temperature Page 1 of 2

Figure 56. I/O Menu, Temperature Page 2 of 2

Parameter	Description
Leaving Fluid Temp	Process fluid temperature
Outside Air Temp	Ambient dry bulb temperature
Precool X Temp	Depressed dry bulb temperature behind the adiabatic pre-cooler section.

Table 22. I/O Menu, Temperature Parameters

Make Up Menu

Make Up menu is shown in **Figure 57** with parameters listed in **Table 23**.

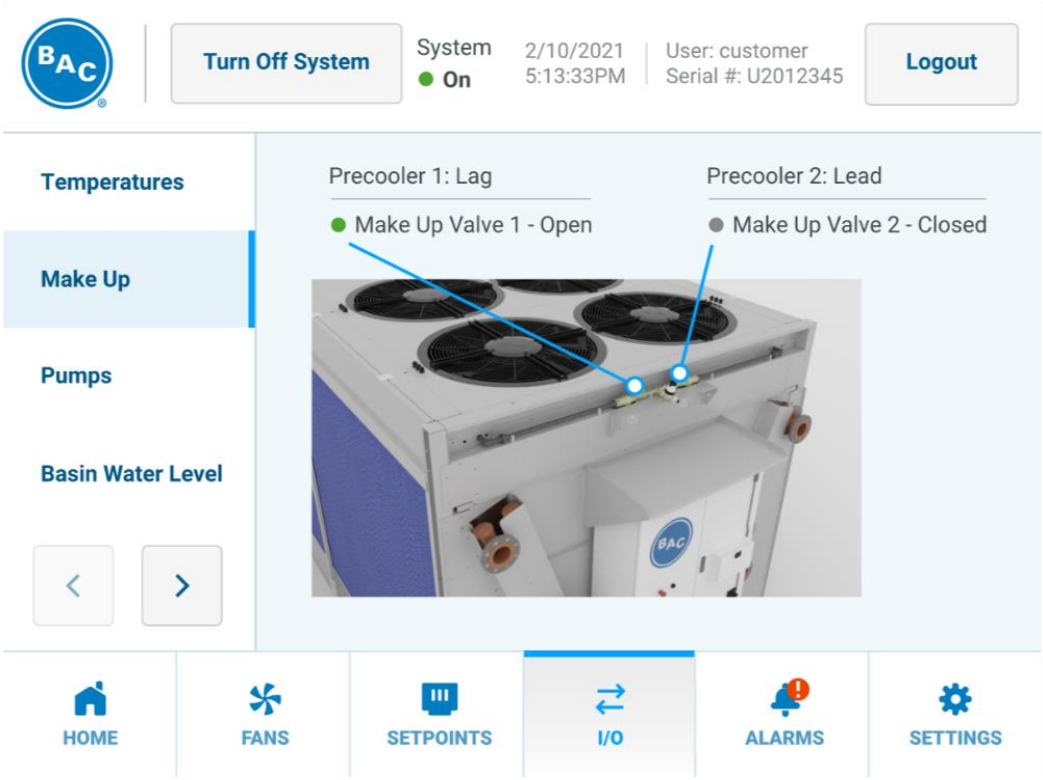


Figure 57. I/O Menu, Make Up

Parameter	Description
Precooler X	Indication if the makeup valves are open or closed.

Table 23. I/O Menu, Make Up Parameters

Pumps Menu

Pumps menu is shown in **Figure 58** with parameters listed in **Table 24**.

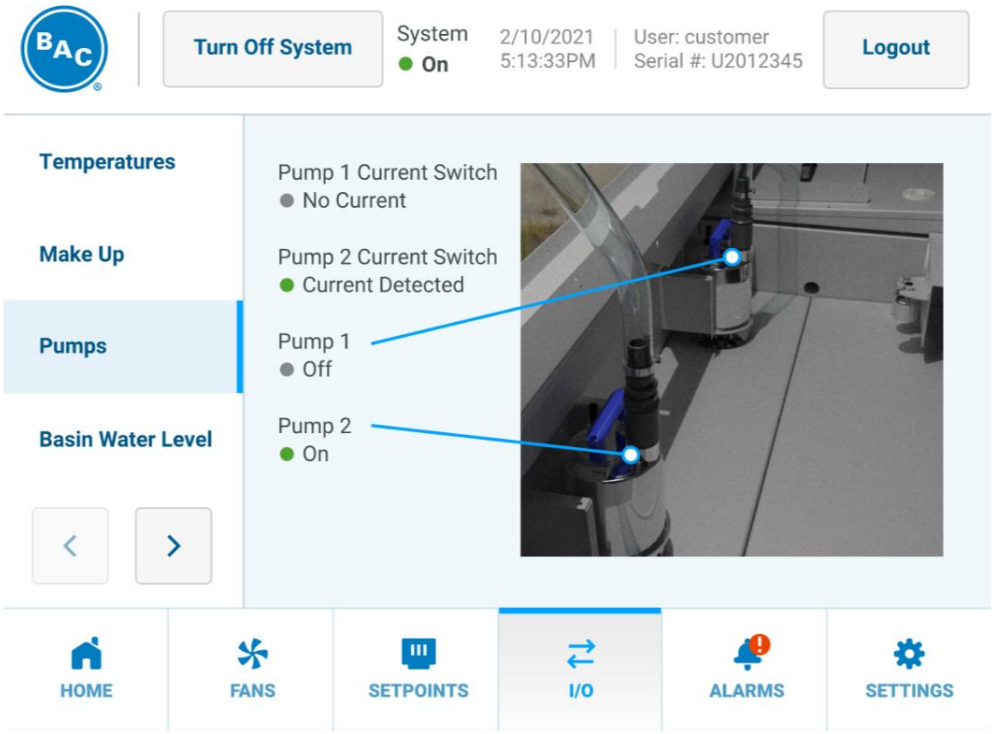


Figure 58. I/O Menu, Pumps

Parameter	Description
Pump X Current Switch	Indication if the pump is properly running (current detected) or not (no current). The current switch gives an indication of electrical current.
Pump X	Indication if the pump is On or Off.

Table 24. I/O Menu, Pumps Parameters

Basin Water Level Menu

Basin Water Level menu is shown in **Figure 59** with parameters listed in **Table 25**.

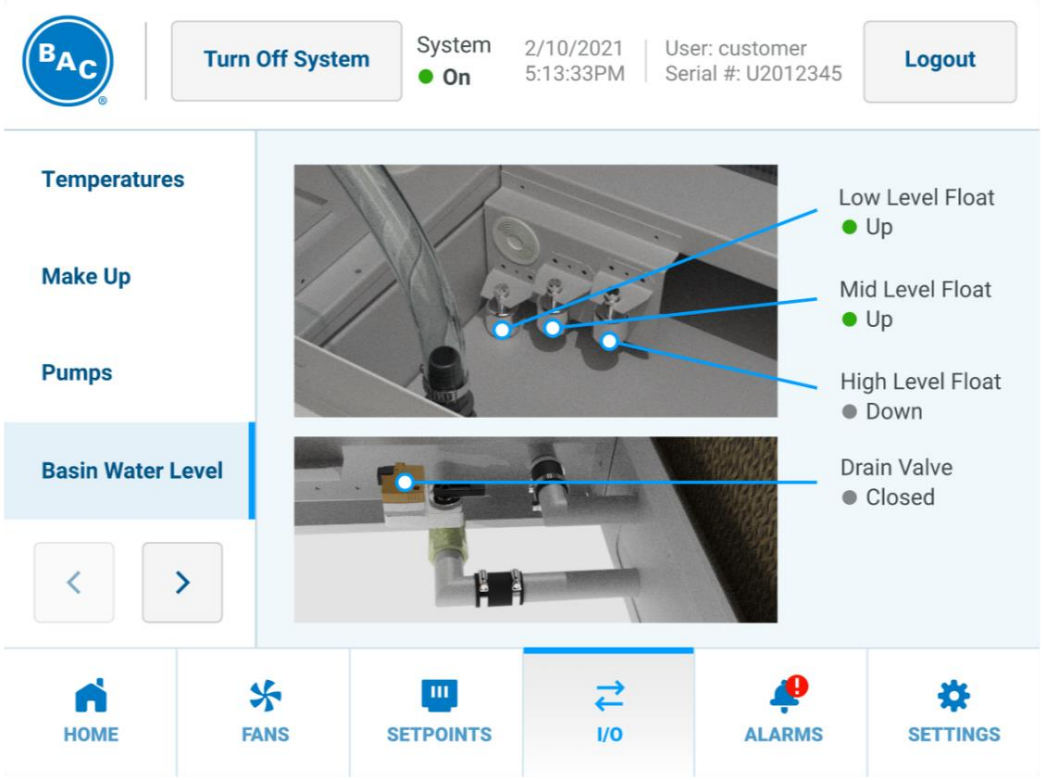


Figure 59. I/O Menu, Basin Water Level

Parameter	Description
Low/Mid/High Level Float	Status indication of the sump water level float switch. Green dot with description "Up" indicates water level is at or above specified level. Gray dot with description "Down" indicated water level is at or below specified level.
Drain Valve	Indication if the valve is open (water draining from the sump) or closed (keeping water in the sump)

Table 25. I/O Menu, Basin Water Level Parameters

Starts and Hours Menu

The Starts and Hours menu is shown in **Figure 60** through **Figure 62** with parameters listed in **Table 26**. Here, the number of starts and operating hours can be reviewed. Pressing the "Reset" button resets the starts and hours for the corresponding device. A reset can only be done with Technician level access. Refer to **Table 9. Access Levels and Passwords** on **Page 45**.

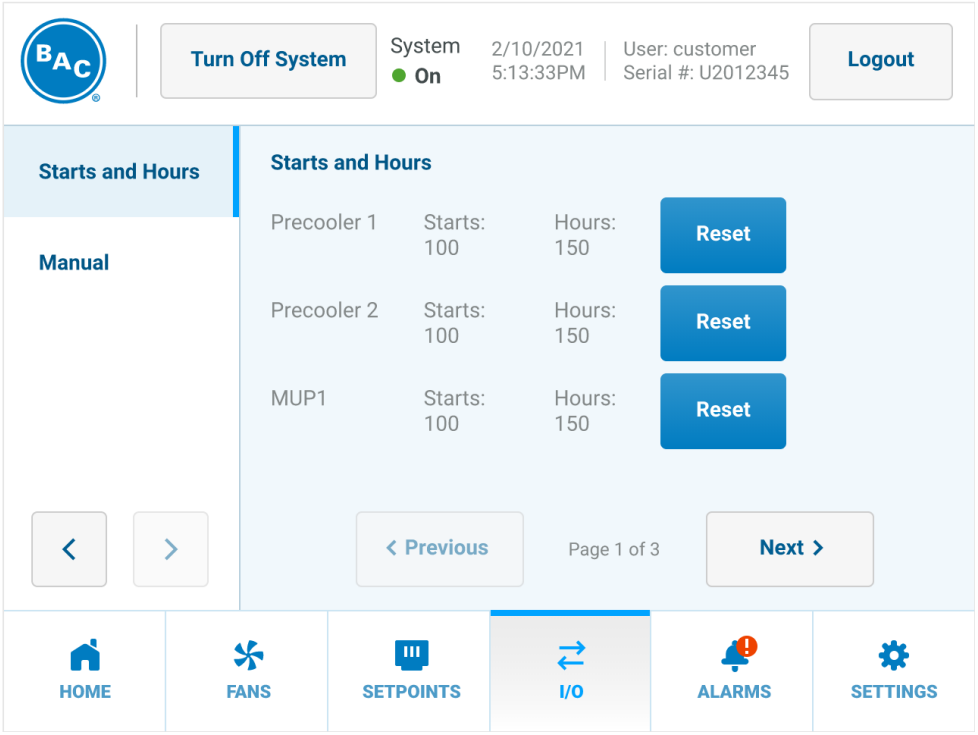


Figure 60. I/O Menu, Starts and Hours Page 1 of 3

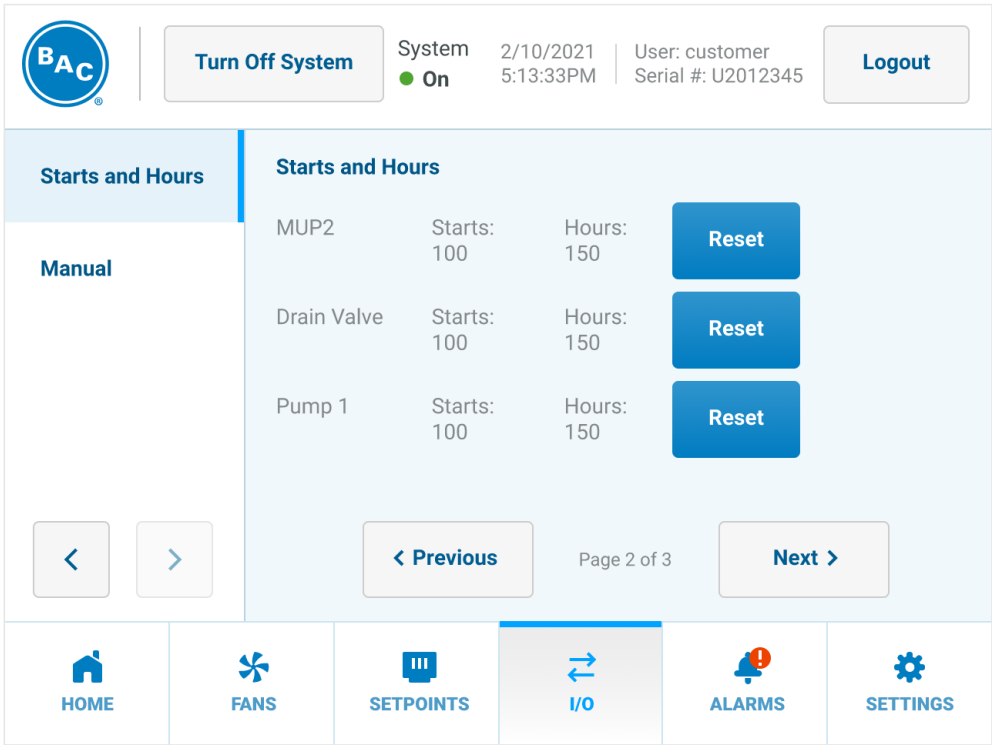


Figure 61. I/O Menu, Starts and Hours Page 2 of 3

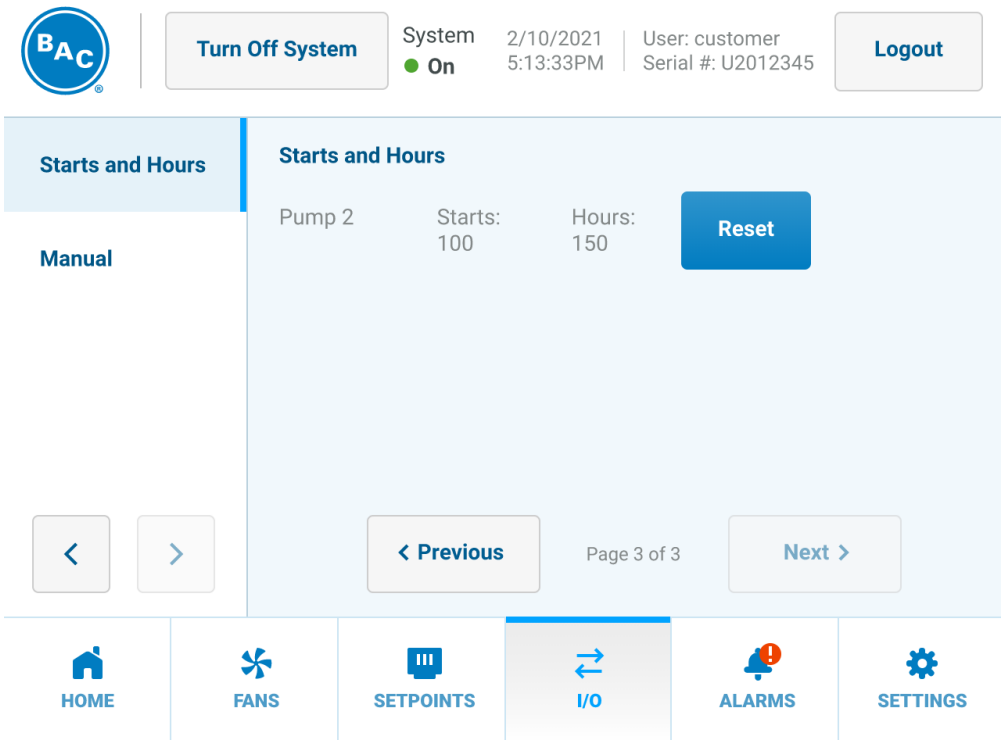


Figure 62. I/O Menu, Starts and Hours Page 3 of 3

Parameter	Description
Precooler X	Number of starts and operating hours the unit is in adiabatic operation.
MUPX	Number of starts and operating hours for each make up valve.
Drain Valve	Number of starts and operating hours for drain valve.
Pump X	Number of starts and operating hours for each pump.

Table 26. I/O Menu, Starts and Hours Parameters

Manual Menu

The Manual menu will display only with Technician level access. Refer to **Table 9. Access Levels and Passwords** on **Page 45**. The Manual menu is shown in **Figure 63** and **Figure 64** with parameters listed in **Table 27**. In this menu, the position of a number of digital outputs can be overruled. Each digital output manual mode must be set to On in order to override the applicable value.

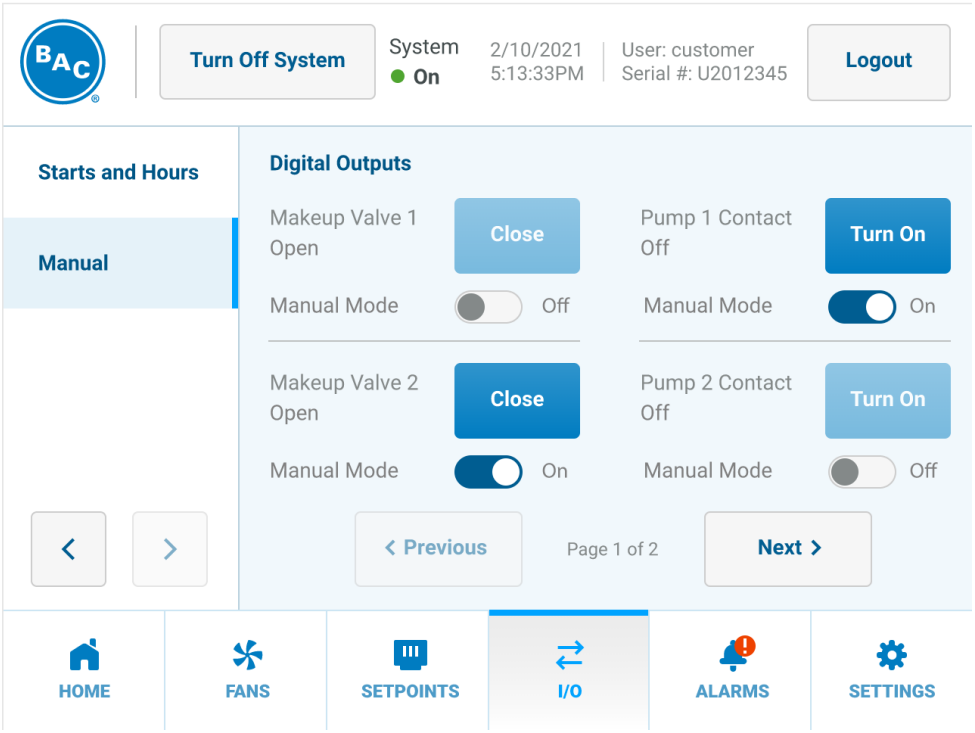


Figure 63. I/O Menu, Manual Page 1 of 2

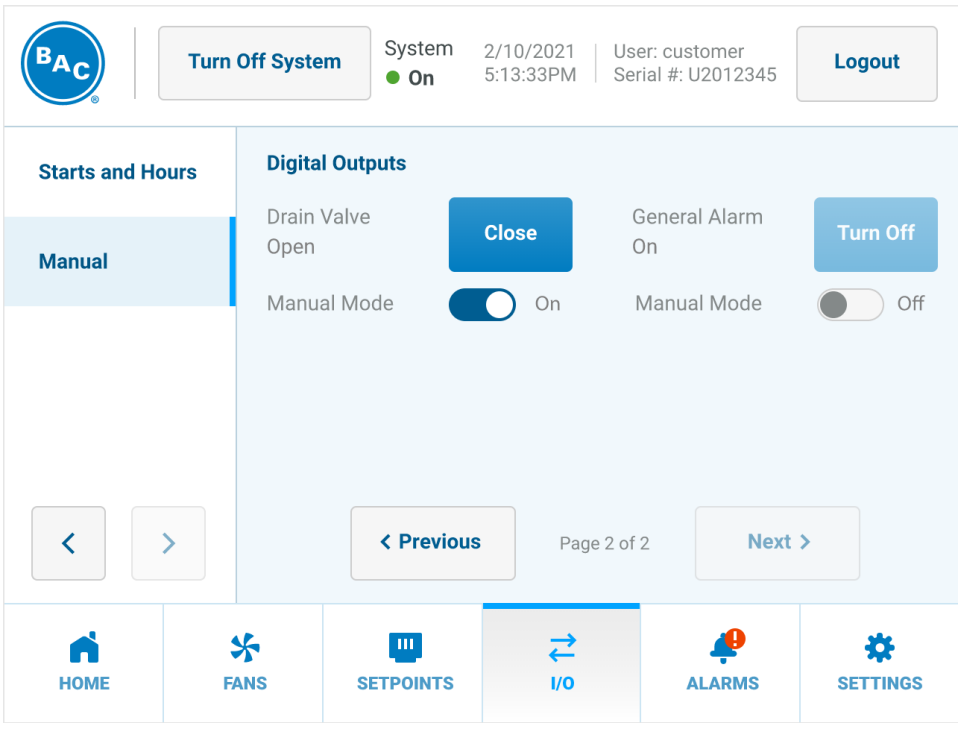


Figure 64. I/O Menu, Manual Page 2 of 2

Parameter	Description
Makeup Valve X	Force either make-up valve on or off.
Pump X Contact	Force either pump on or off.
Drain Valve	Force the drain valve open or closed.
General Alarm	Force the general alarm contact on or off.

Table 27. I/O Menu, Manual Parameters

Alarms

This menu allows a user to read and clear alarms. The alarm menu is shown in **Figure 65** with parameters listed in **Table 28**. All active alarms are displayed with a red font; inactive alarms are displayed in a black font. For a detailed overview of the different alarms, see **Section 11. Alarms & Troubleshooting** on **Page 100**.

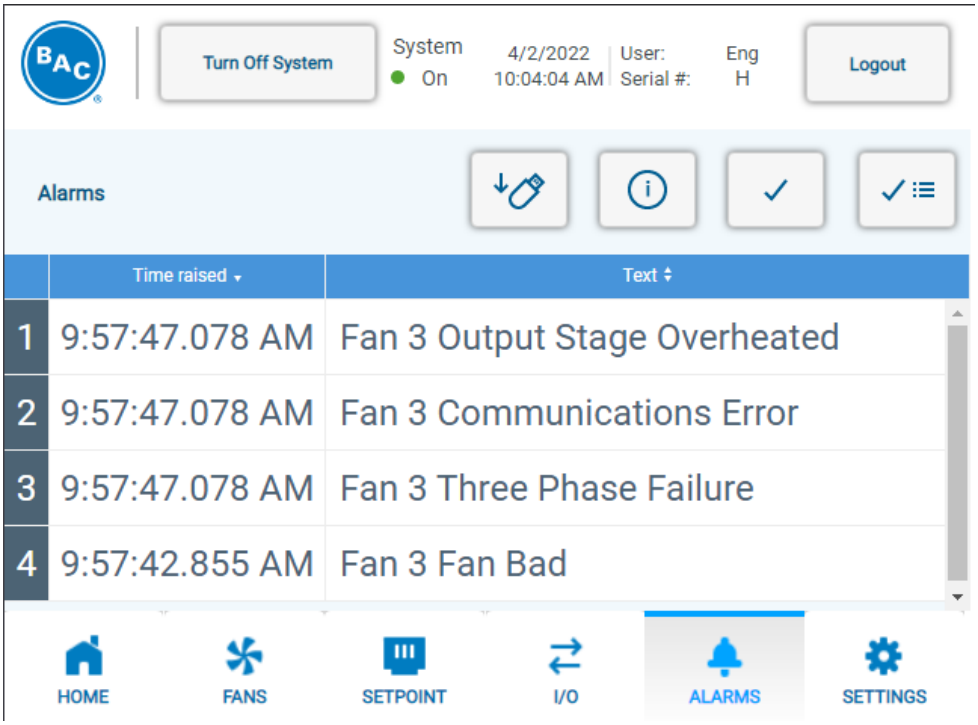


Figure 65. Alarms Menu

Parameter	Description
Download to USB 	Pressing the Download button will verify if a portable USB storage device is present in the USB bulkhead located inside the HMI enclosure and download the alarm log (a progress bar will indicate the status of the process).
Information 	Pressing the Information button will display the alarm detail page of the selected alarm as shown in **Figure 66**.
Acknowledge Current 	Pressing the 'single checkmark' will clear the selected alarm.
Acknowledge All 	Pressing the 'multi-checkmark' will clear all active alarms and change the text from a red to a black font. A pop-up window will ask for a confirmation first.

Table 28. Alarm Menu Parameters

Alarm Details Page

Figure 66 is an example of the Alarm Details page. All possible alarms are listed in **Table 38** through **Table 63**. There are 3 buttons on the left-hand side labeled Trigger Criteria, Release Criteria, and Troubleshooting. Pressing any of these buttons displays the respective information in the table for each alarm. Pressing the "Back" button returns the user to the Alarms menu

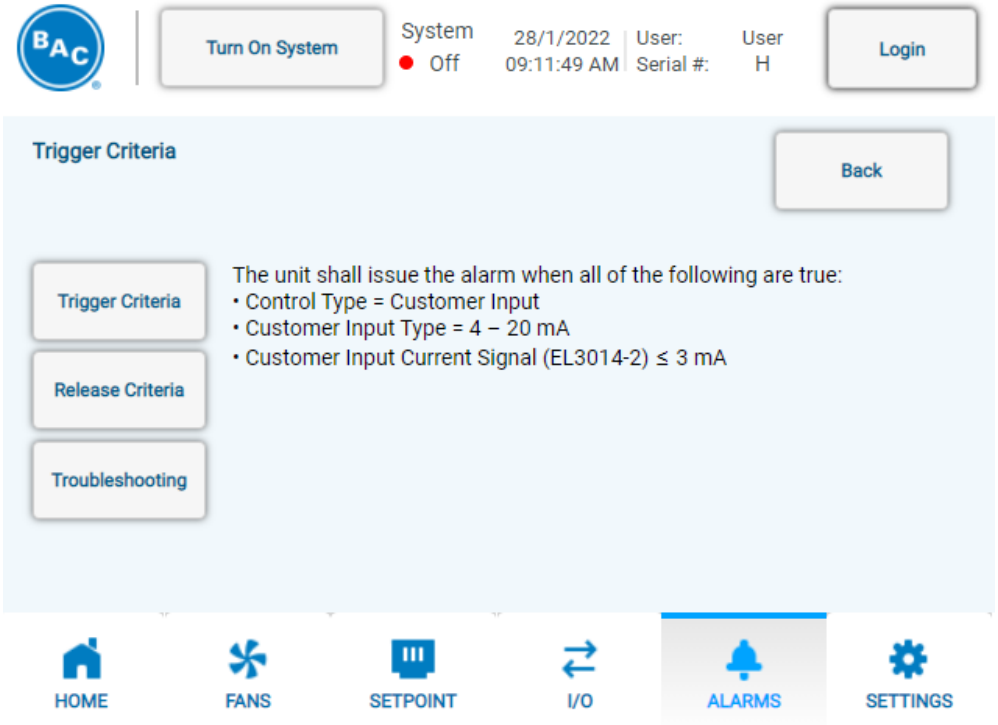


Figure 66. Alarms Menu, Alarm Details Page

Settings

With the parameters that can be set in this menu, the user can configure the behavior of the unit.

Setup Menu

The Setup menu is shown in **Figure 67** through **Figure 69** with parameters listed in **Table 29**.

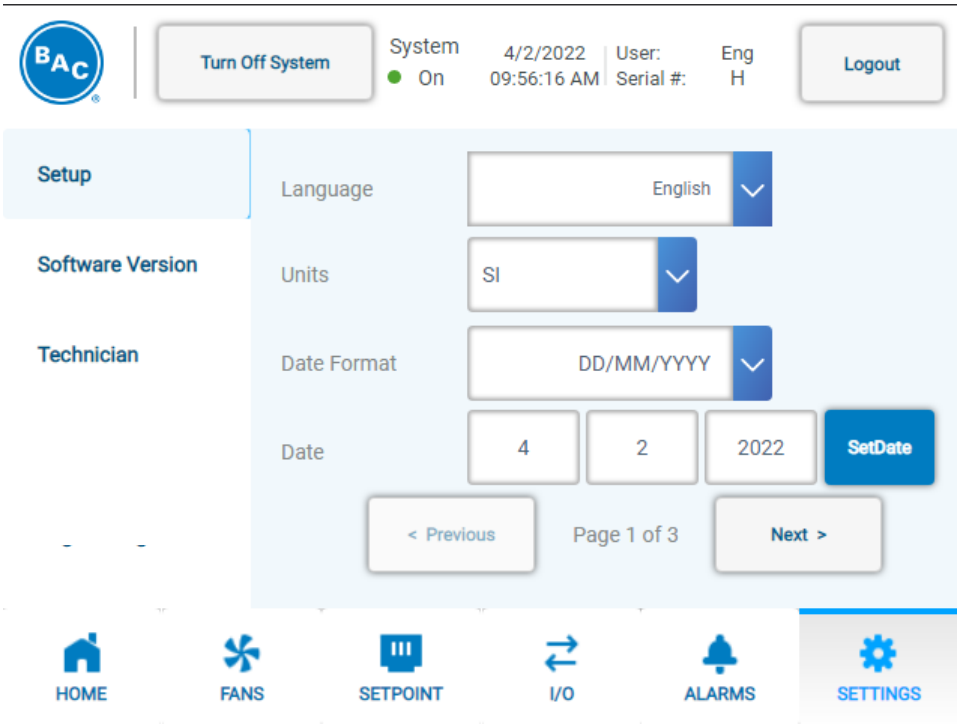


Figure 67. Settings Menu, Setup Page 1 of 3

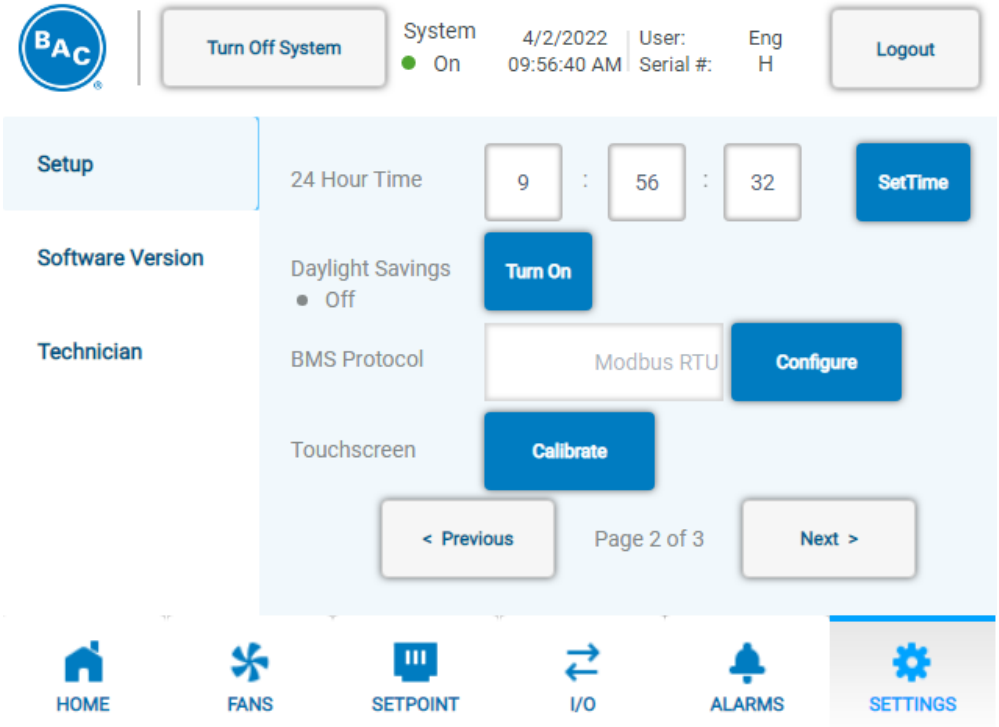


Figure 68. Settings Menu, Setup Page 2 of 3

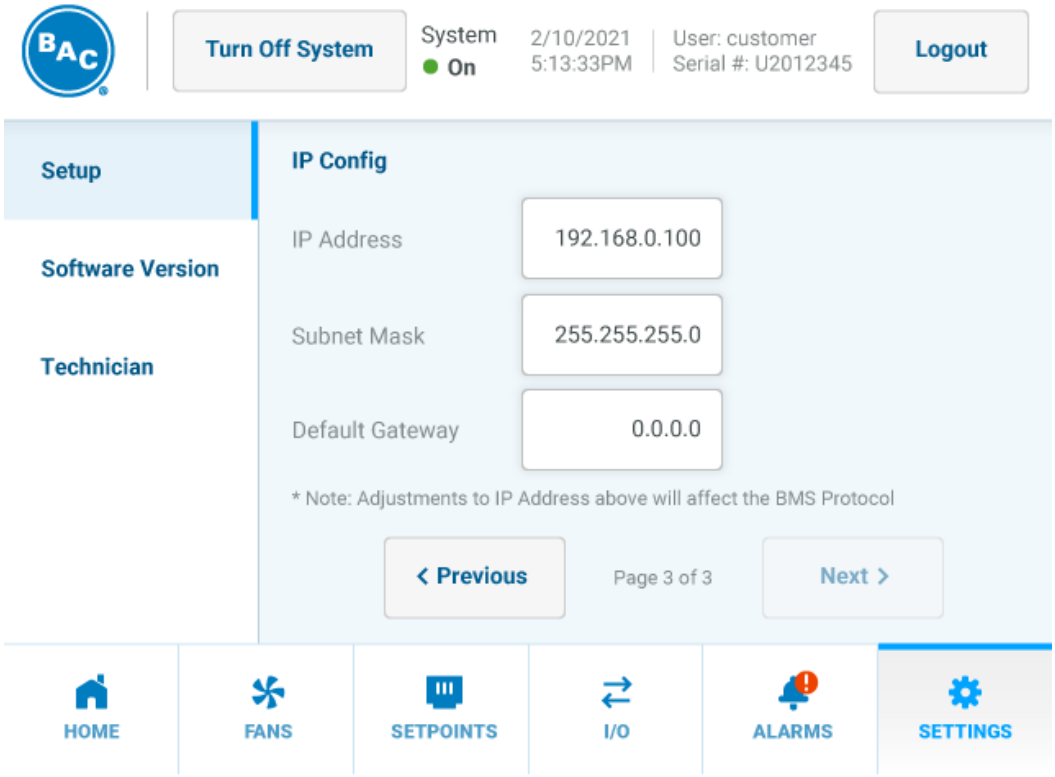


Figure 69. Settings Menu, Setup Page 3 of 3

Parameter	Description
Language	Determines the interface language.
Units	Determines the units of measurements for the different variables. This can be set to either SI or imperial.
Date Format	Determines in what order the day, month and year are shown. This can be set at MM/DD/YYYY, DD/MM/YYYY or YYYY/MM/DD.
Date	Allows user to change the current date (in the format chosen above).
24 Hour Time	Allows user to change the current time.
Daylight Savings	Enable or disable daylight savings time.
BMS Protocol	Select and configure the BMS bus system. Options are Modbus RTU, BACnet MSTP, BACnet IP & Modbus TCP. Pressing the "Configure" button displays the corresponding BMS Protocol Settings menu as shown in **Figure 70** through **Figure 77**
Touchscreen	Pressing the "Calibrate" button above displays the touchscreen calibration screen and allow the user to calibrate the resistive touchscreen.
IP Address	Sets the correct value (in IPv4 format).
Subnet Mask	Sets the correct value (in IPv4 format).
Default Gateway	Sets the correct value (in IPv4 format).

Table 29. Settings Menu, Setup Parameters

Modbus RTU Setup

Selecting BMS Protocol Modbus RTU from the Setup menu shown in **Figure 68** and pressing the "Configure" button displays the Modbus RTU setup menu shown in **Figure 70** and **Figure 71** with parameters listed in **Table 30**.

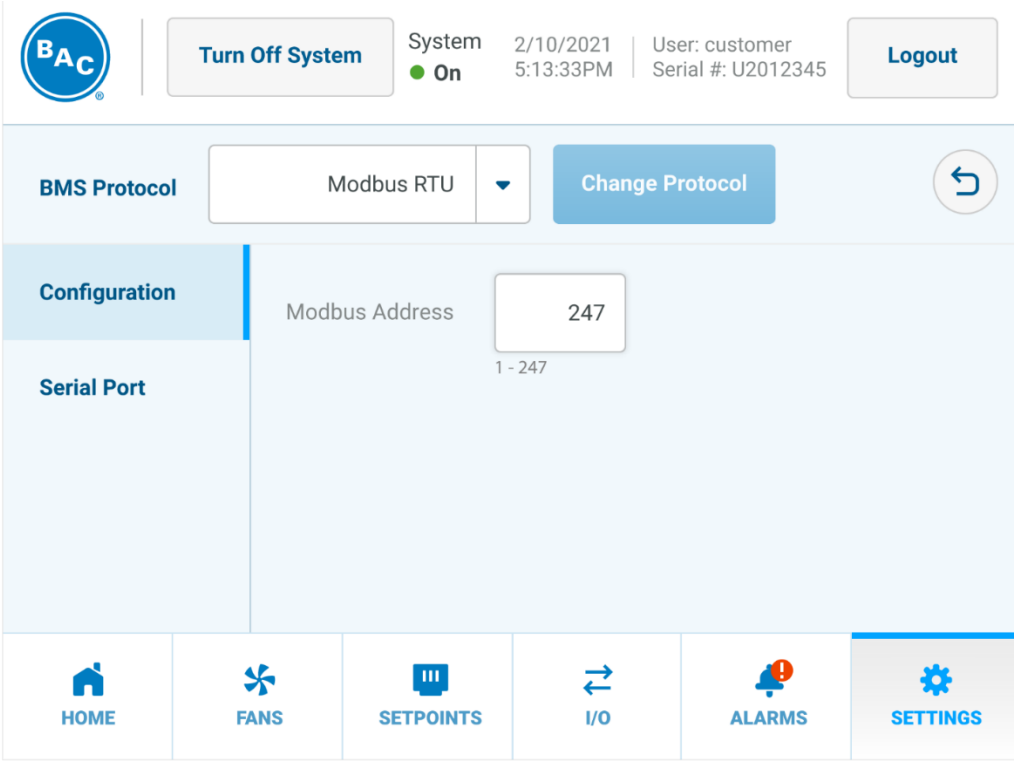


Figure 70. Settings Menu, Modbus RTU Configuration

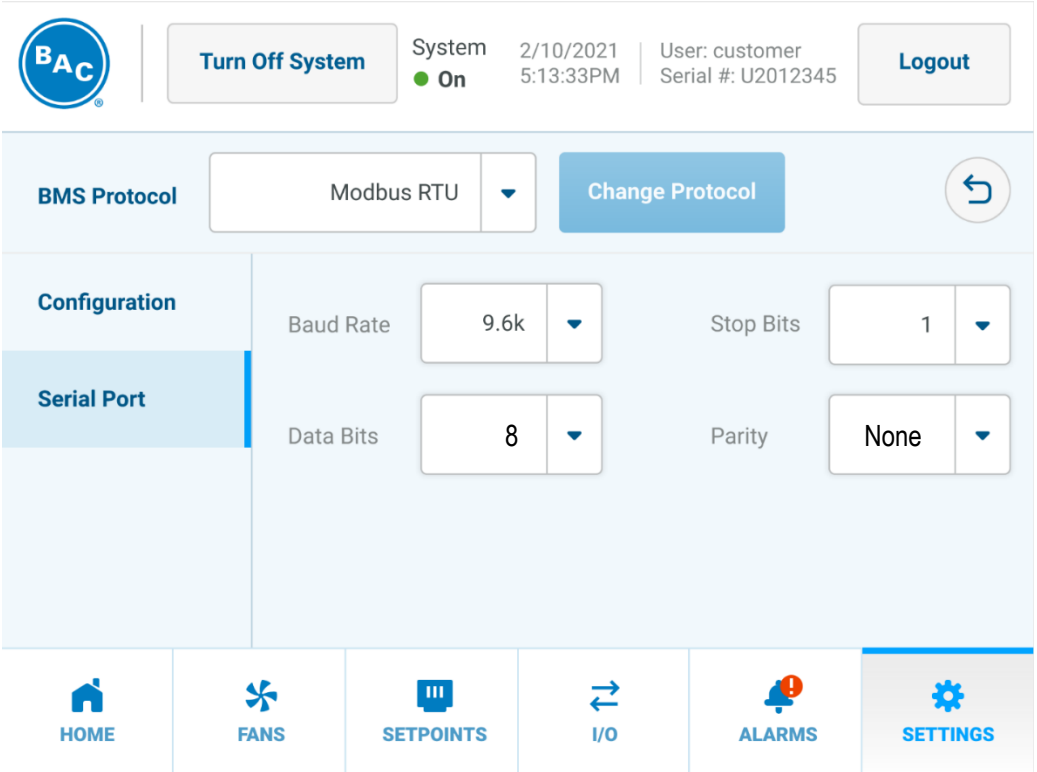


Figure 71. Settings Menu, Modbus RTU Serial Port

Parameter	Description
Modbus Address	Sets the units' network address
Baud Rate	Set the appropriate baud rate. Possible values (in kbps) are 9.6, 19.2, 38.4, 57.6 or 115.2
Data Bits	The number of data bits is always 8
Stop Bits	The number of stop bits always 1
Parity	The parity is always none

Table 30. Settings Menu, Modbus RTU Parameters

BACnet MSTP Setup

Selecting BMS Protocol BACnet MSTP from the setup menu shown in **Figure 68** and pressing the "Configure" button displays the BACnet MSTP setup menu shown in **Figure 72** and **Figure 73** with parameters listed in **Table 31**.

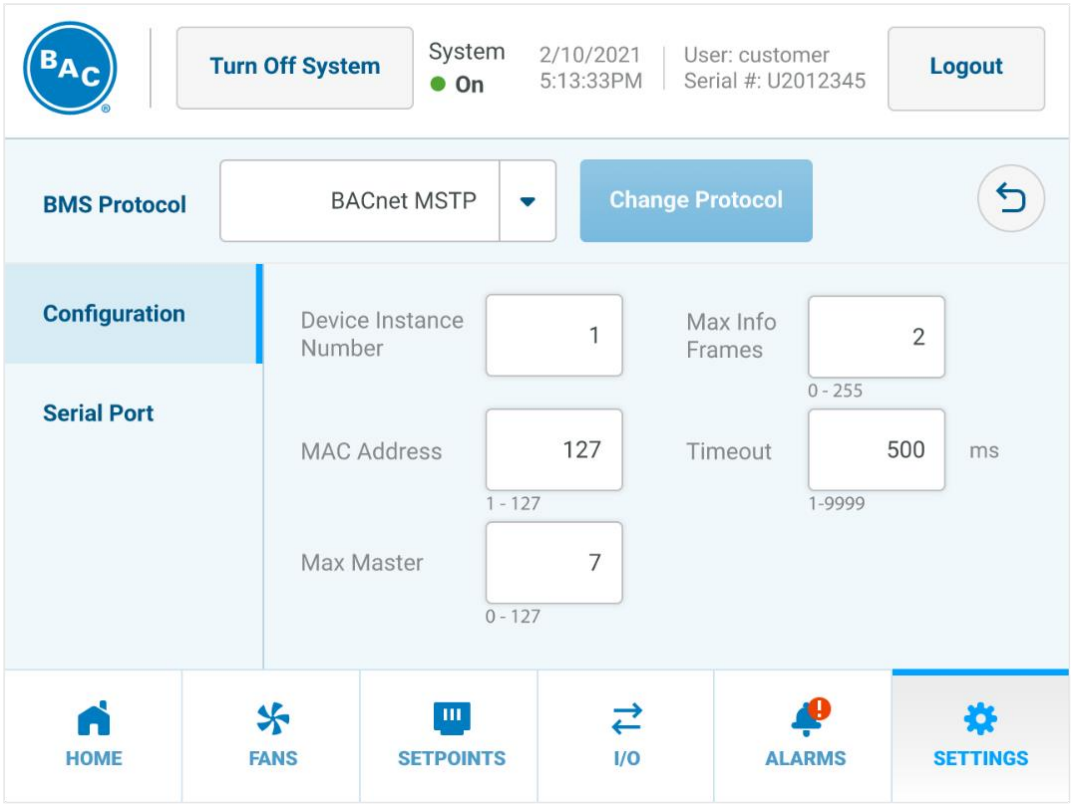


Figure 72. Settings Menu, BACnet MSTP Configuration

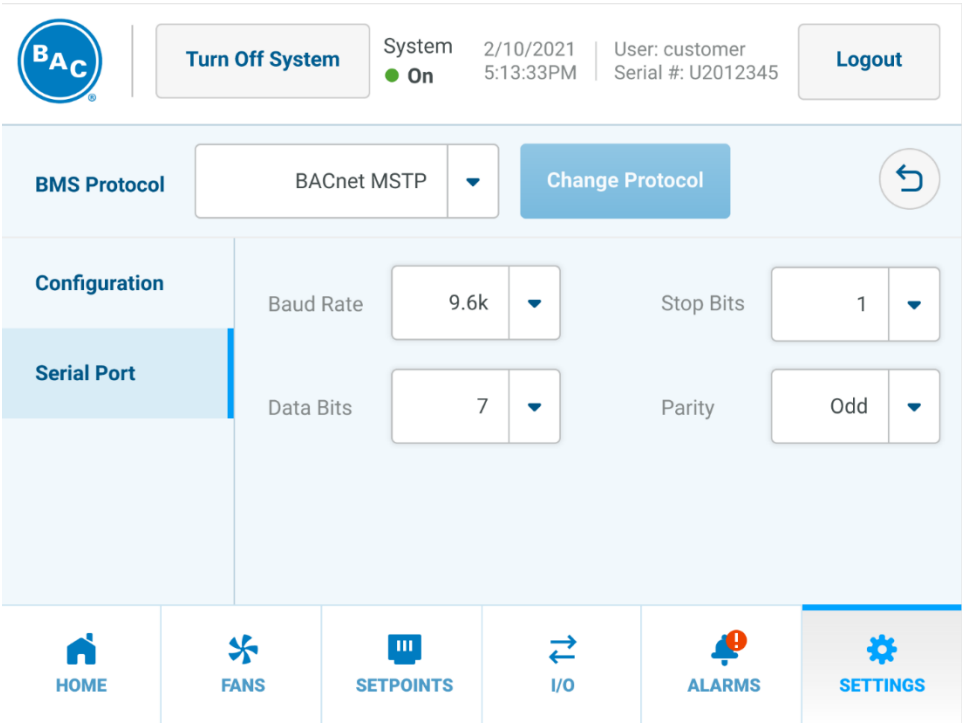


Figure 73. Settings Menu, BACnet MSTP Serial Port

Parameter	Description
Device Instance Number	Sets the correct value.
MAC Address	Sets the correct value.
Max Master	Sets the correct value.
Max Info Frames	Sets the correct value.
Timeout	Sets the correct value.
Baud Rate	Set the appropriate baud rate. Possible values (in kbps) are 9.6, 19.2, 38.4, 57.6 or 115.2.
Data Bits	The number of data bits is always 8.
Stop Bits	The number of stop bits always 1.
Parity	The parity is always odd.

Table 31. Settings Menu, BACnet MSTP Parameters

Modbus TCP Setup

Selecting BMS Protocol Modbus TCP from the setup menu shown in **Figure 68** and pressing the "Configure" button displays the Modbus TCP setup menu shown in **Figure 74** and **Figure 75** with parameters listed in **Table 32**.

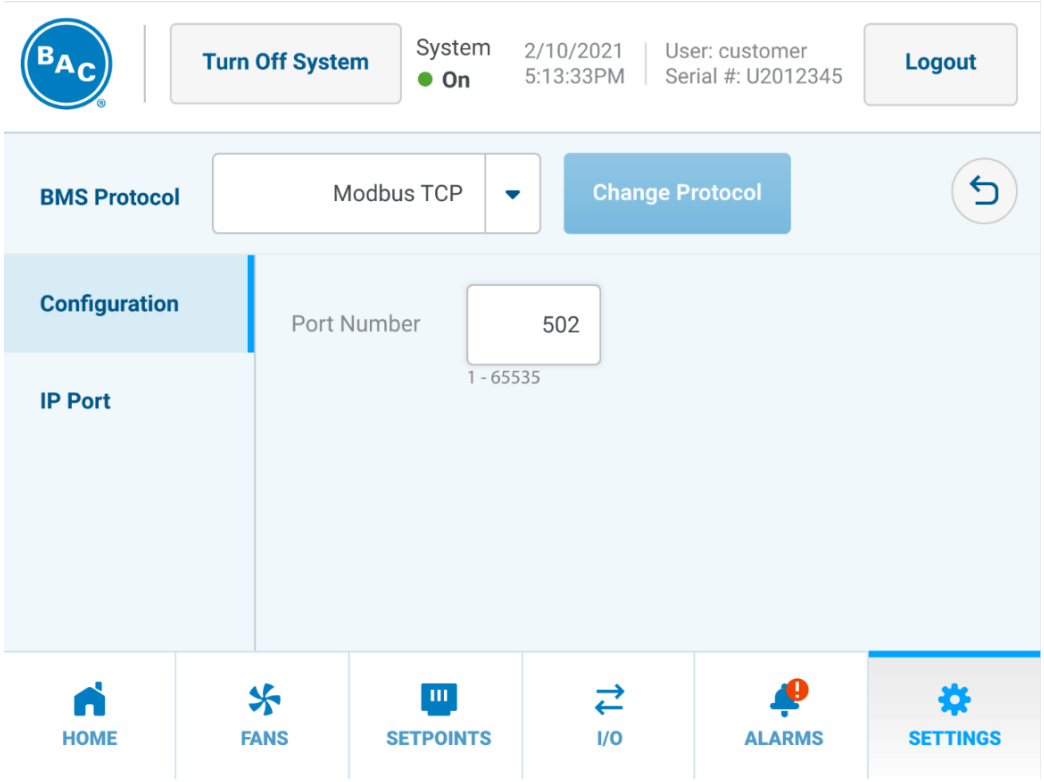


Figure 74. Settings Menu Modbus TCP Configuration

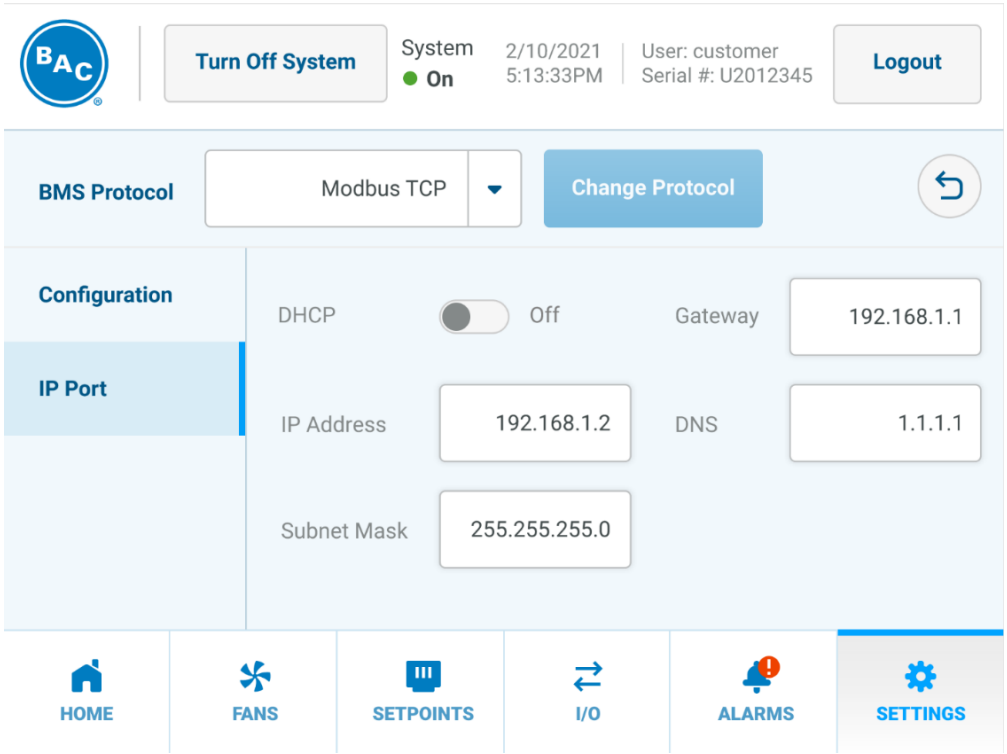


Figure 75. Settings Menu, Modbus TCP IP Port

Parameter	Description
Port Number	Sets the correct value.
DHCP	Enable to get address assigned automatically.
IP Address	Sets the correct value (in IPv4 format).
Subnet Mask	Sets the correct value (in IPv4 format).
Gateway	Sets the correct value (in IPv4 format).
DNS	Sets the correct value (in IPv4 format).

Table 32. Settings Menu, Modbus TCP Parameters

BACnet IP Setup

Selecting BMS Protocol BACnet IP from the setup menu shown in **Figure 68** and pressing the "Configure" button displays the BACnet IP setup menu shown in **Figure 76** and **Figure 77** with parameters listed in **Table 33**.

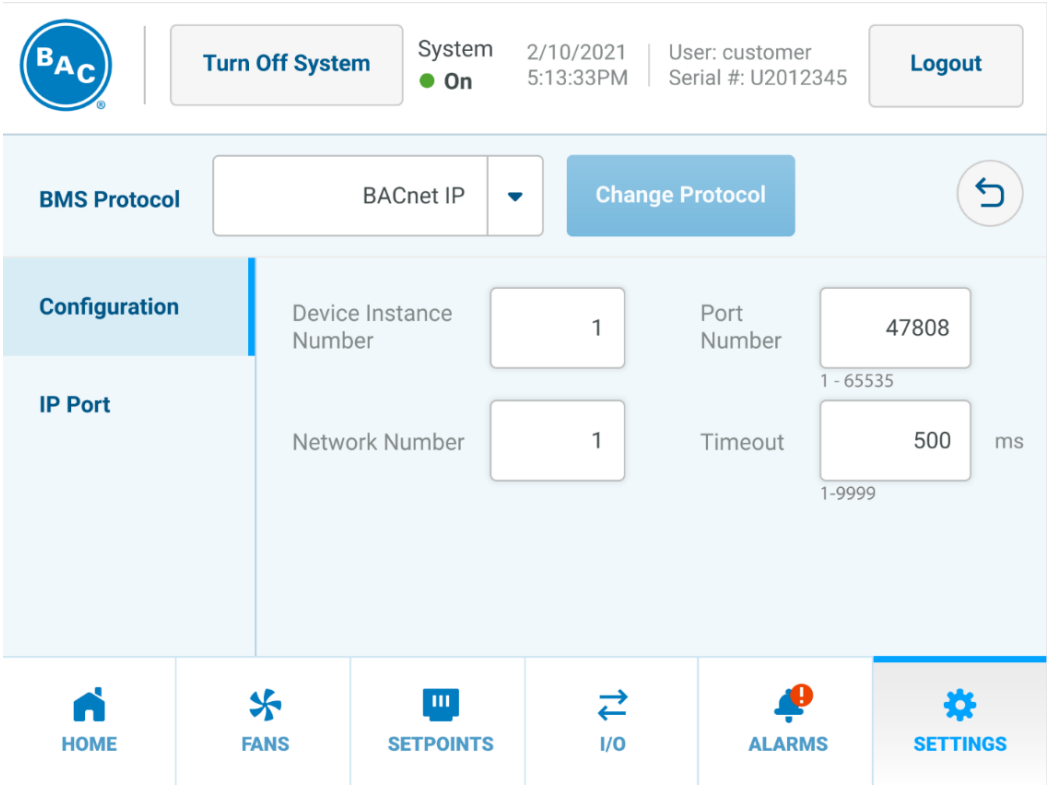


Figure 76. Settings Menu, BACnet IP Configuration

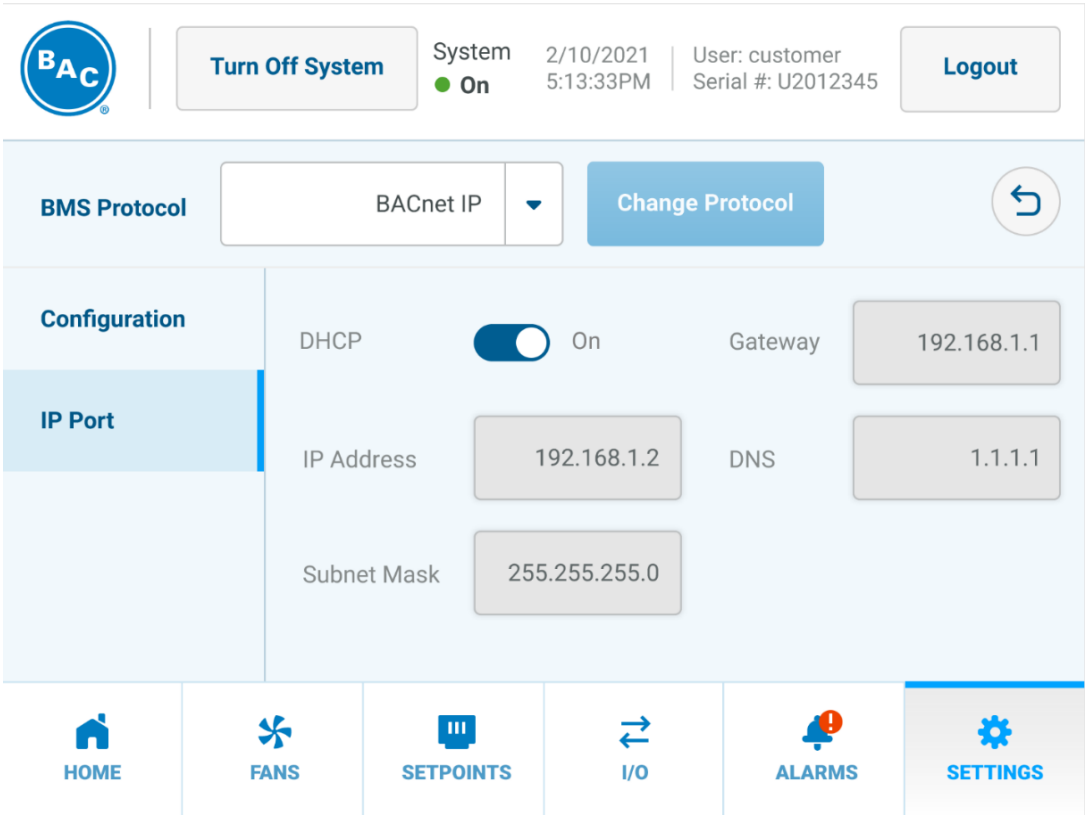


Figure 77. Settings Menu, BACnet IP IP Port

Parameter	Description
Device Instance Number	Sets the correct value.
Network Number	Sets the correct value.
Port Number	Sets the correct value.
DHCP	Enable to get address assigned automatically.
IP Address	Sets the correct value (in IPv4 format).
Subnet Mask	Sets the correct value (in IPv4 format).
Gateway	Sets the correct value (in IPv4 format).
DNS	Sets the correct value (in IPv4 format).

Table 33. Settings Menu, BACnet IP Parameters

Software Version Menu

The Software Version menu is shown in **Figure 78** through **Figure 80** with parameters listed in **Table 34**.

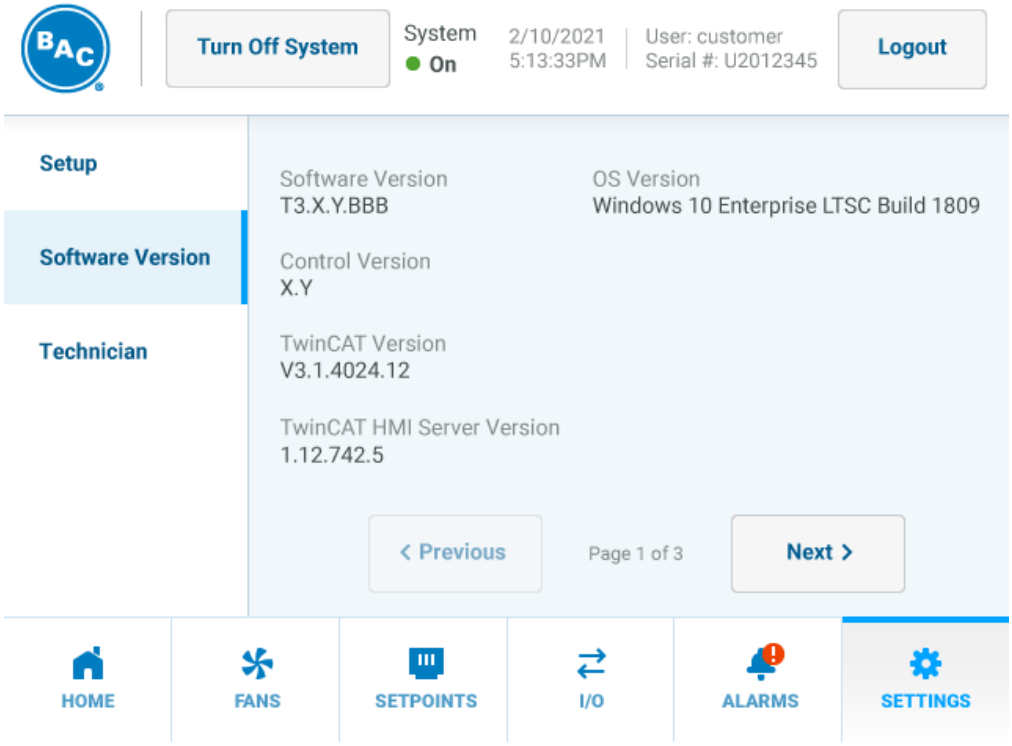


Figure 78. Settings Menu, Software Version Page 1 of 3

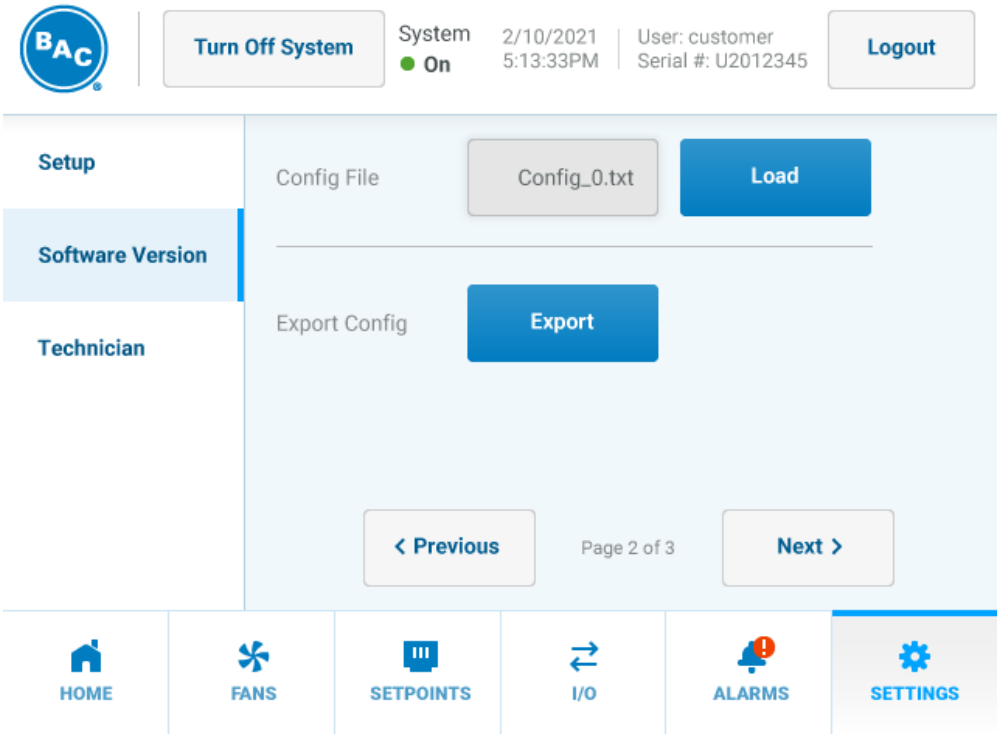


Figure 79. Settings Menu, Software Version Page 2 of 3

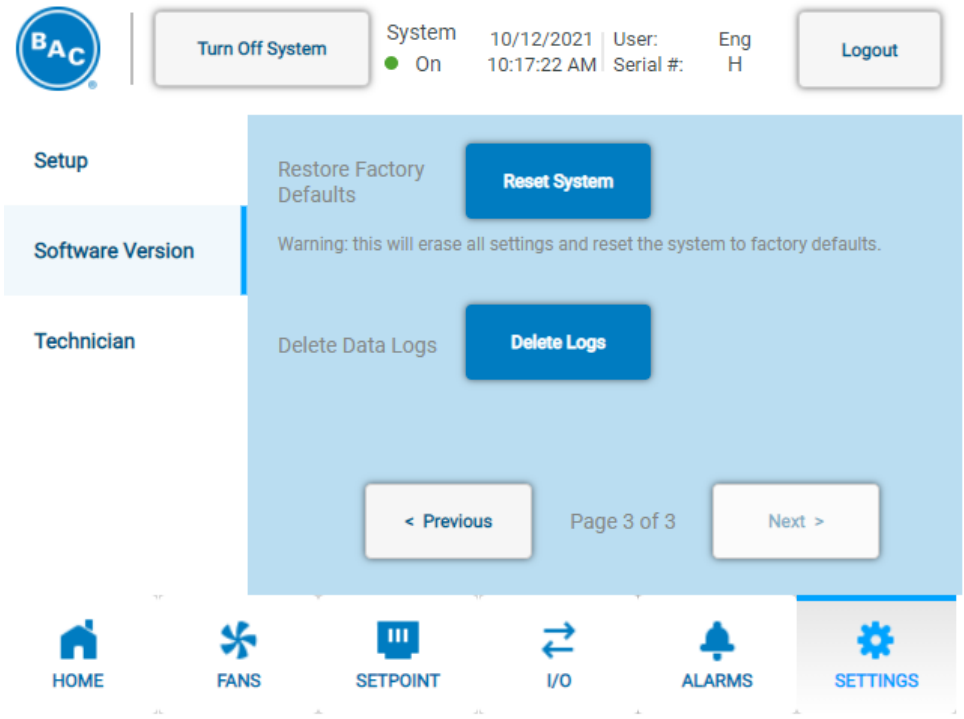


Figure 80. Settings Menu, Software Version Page 3 of 3

Parameter	Description
Software Version	Indicates the current version.
Control Version	Indicates the current version.
TwinCAT Version	Indicates the current version.
TwinCAT HMI Server Version	Indicates the current version.
OS Version	Indicates the current version.
Config File	Load a config file from a USB storage device. The file needs to be a text file stored as “E:\BAC\Config\...”
Export Config	Export the current settings.
Restore Factory Defaults	Reset all settings to the factory defaults. All custom settings will be removed. A Manufacturing password is required for this action. Contact your local BAC Representative for assistance.
Delete Data Logs	Pressing the “Delete Logs” button erases all data logging files. The Technician password is required. Refer to **Table 9. Access Levels and Passwords** on **Page 45**.

Table 34. Settings Menu, Software Version Parameters

Technician Menu

The Technician menu is only displayed and accessible with Technician access level. Refer to **Table 9. Access Levels and Passwords** on **Page 45**. The Technician menu is shown in **Figure 81** and **Figure 82** with parameters listed in **Table 35**.

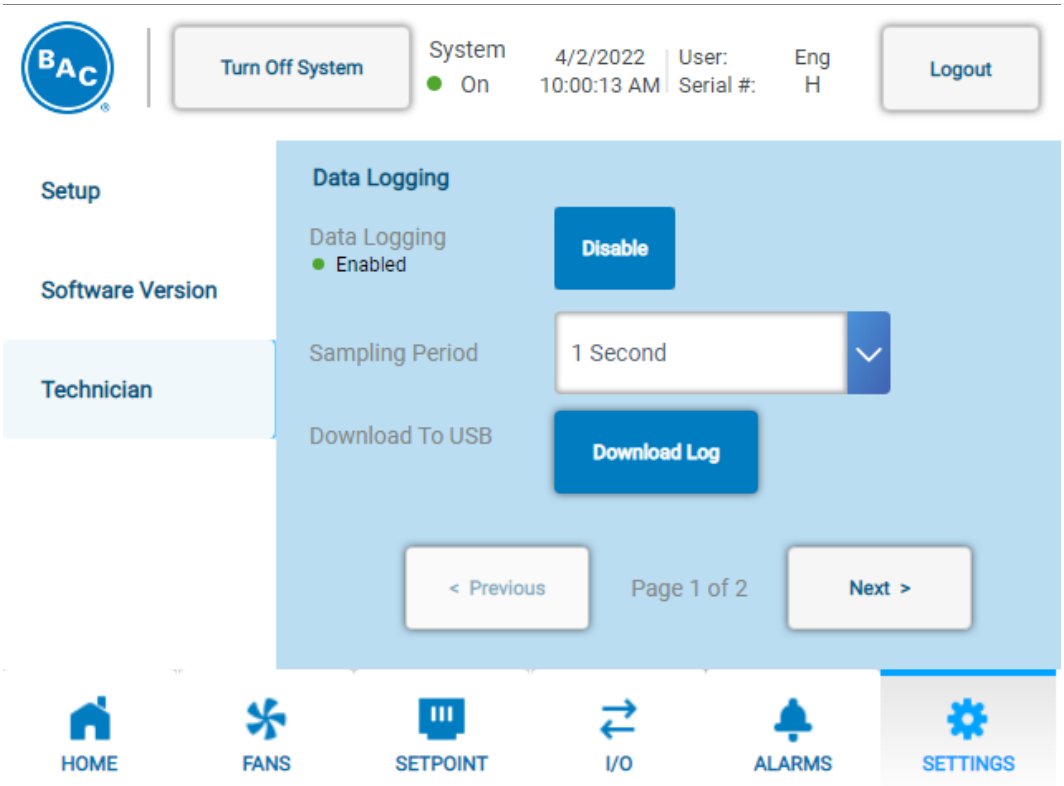


Figure 81. Settings Menu, Technician Page 1 of 2

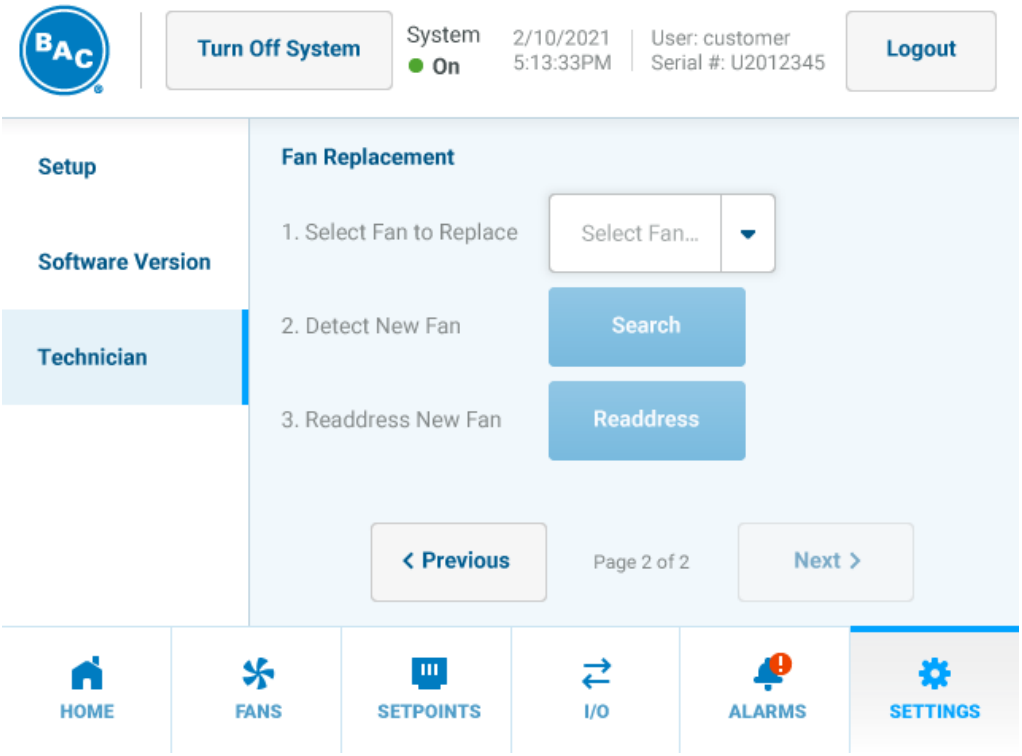


Figure 82. Settings Menu, Technician Page 2 of 2

Parameter	Description
Data Logging	Allows user to enable or disable the feature. If enabled, all statuses will be logged at regular intervals (see sampling period).
Sampling Period	Interval at which all statuses are stored to the log (if enabled).
Download to USB	Export to log file to a USB storage device.
Select Fan to Replace	Choose the address that needs to be programmed into the new fan.
Detect New Fan	Search for the address of the new fan.
Readdress New Fan	Set the correct address in the new fan.

Table 35. Settings Menu, Technician Parameters

Data Logging Retrieval

Onboard data logging records and stores data listed in **Table 36** which can be loaded onto a portable USB storage device in a comma separated value (CSV) file. The sampling period is determined by the Sampling Period shown in **Figure 81** and listed in **Table 35**. This information can be used for troubleshooting or energy modeling purposes. Data logging can be enabled/disabled via the Technician menu shown in **Figure 81**. To retrieve data logging information:

1. Insert a portable USB storage device into the USB bulkhead located inside the HMI enclosure.
2. Navigate to Settings menu, Technician Page 1 of 2 shown in **Figure 81**. Press "Download Log". A loading bar will appear and display the current progress of the file downloads until complete.

Table 36. Data Logging Parameters

Variable Name	Description
TimeStamp	Time Stamp in HHMMSS format
LFT	Leaving Fluid Temperature [°C] in tenths precision
LFTsetp	Leaving Fluid Temperature Setpoint [°C] in tenths precision
CtrlRange	Control Range [°C] in tenths precision
OAT	Outside Air Temperature [°C] in tenths precision
AdiabaticSP	Adiabatic Swithpoint [°C] in tenths precision
LLF	Low Level Float Status 0 = Water Level below Float 1 = Water Level above Float
MLF	Mid Level Float Status 0 = Water Level below Float 1 = Water Level above Float
HLF	High Level Float Status 0 = Water Level below Float 1 = Water Level above Float
PumpXCS	Pump X Current Switch 0 = No Current Detected 1 = Current Detected
FanSpdCmd	Fan Speed Command [% max fan speed] in tenths precision
FanSpdCmdRPM	Fan Speed Command [RPM] in x1 format
ActlFanSpdRPM	Average Actual Fan Speed Feedback [RPM] in tenths precision
FanDirection	Fan Direction 0 = Forward 1 = Reverse
MUPX	Make Up Valve X Command 0 = Closed 1 = Open
DrainVlv	Drain Valve Command 0 = Open 1 = Closed
CoCdrainActive	Cycles of Concentration Drain Active 0 = CoC Drain is inactive 1 = CoC Drain is active

Table 36. Data Logging Parameters	
Variable Name	**Description**
NumCoCs	Number of Cycles of Concentration till Basin drain
CoCcount	Cycles of Concentration Count Number of Cycles of concentration that have occurred since the last drain
BasinRetentionTime	Basin Retention Time [hours] The amount of time in Dry mode that the unit will hold the basin water before dumping.
PumpXCmd	Pump X Command 0 = Off 1 = On
PumpXARTactive	Pump X Anti-Recycle Timer Active 0 = Pump 1 AR timer is inactive 1 = Pump 1 AR timer is active
RunAuthType	Run Authorization Type 0 = Undefined 1 = HMI 2 = DI 3 = BMS
HMIRunAuth	HMI Run Authorization Status 0 = Off 1 = On
DIrunAuth	Digital Input Run Authorization Status (MATLAB RemoteRunEn) 0 = Off 1 = On
BMSrunAuth	BMS Run Authorization Status 0 = Off 1 = On
DisableWater	Disable Water Usage via HMI or BMS (NO) 0 = Water Usage Allowed 1 = Water Usage Not Allowed
DisableWaterDI	Disable Water Usage DI (NO) 0 = Water Usage Allowed 1 = Water Usage Not Allowed
NightDryEn	Night Dry Enable 0 = Night Dry is not active 1 = Night Dry is active via BMS, HMI, or Schedule
ScheduleDryEn	Schedule Dry Enable 0 = Schedule Dry is not active 1 = Schedule Dry is active via BMS, HMI, or Schedule
NightQuietEn	Night Quiet Active 0 = Inactive 1 = Active
NightQuietLim	Night Quiet Limit [% max fan speed]
NightQuietAdiaSP	Night Quiet Adiabatic Switchpoint [°C]
UnitMode	Control State (from State Machine)
PrecoolerXStatus	Precooler X status 0 = Lead 1 = Lag

Table 36. Data Logging Parameters	
Variable Name	**Description**
UnitAlarmCode	Unit Alarm Code (see **Table 64. Unit Alarm Codes**)
FanAlarmCode	Fan Alarm Code (see **Table 65. Fan Alarm Codes**)
GeneralAlarmDO	General Alarm DO 0 = No Alarm Active 1 = Alarm Active
AvgFanActlSpd	Average Fan Speed Feedback [RPM] in tenths precision
AvgFanPwr	Average Fan Power [kW] in tenths precision
AvgFanCurr	Average Fan Current [A] in tenths precision
PrecoolerXStarts	Precooler X number of starts
PrecoolerXHrs	Precooler X run hours
PumpXStarts	Pump X number of starts
PumpXHrs	Pump X run hours [hours]
MUPXstarts	Make Up Valve X starts
MUPXhrs	Make Up Valve X run hours [hours]
DrainVlvStarts	Drain Valve starts
DrainVlvHrs	Drain Valve run hours [hours]
FanXHrs	Fan X run hours [hours]

Table 36. Data Logging Parameters

Readdress New Fan

Replacement fans must be readdressed prior to unit operation. Refer to section **Fan and Motor Removal & Installation** on **Page 32** for instructions on removing and installing fans. Each fan needs to be assigned a unique address, starting with "1,2,3,…". Replacement fans are pre-programmed with a default Modbus address of 247. Only one new fan should be readdressed at a time. To address a newly installed fan:

1. Log in as Technician. Refer to **Table 9. Access Levels and Passwords** on **Page 45**.
2. Navigate to Settings menu, Technician Page 2 of 2 as shown in **Figure 82**.
3. Use the dropdown menu titled "Select Fan to Replace" to select the correct fan number. Refer to **Figure 83** to identify the correct fan number.
4. After selecting the fan that has been replaced, press the "Search" button. "Searching for Fans…" will be displayed to the left of the Search button.
5. When the new fan has been detected, a green checkmark icon will appear as shown in **Figure 84**. Press the "Readdress" button. Next press the "Readdress Fan" button to confirm readdress. The selected fan will be readdressed.

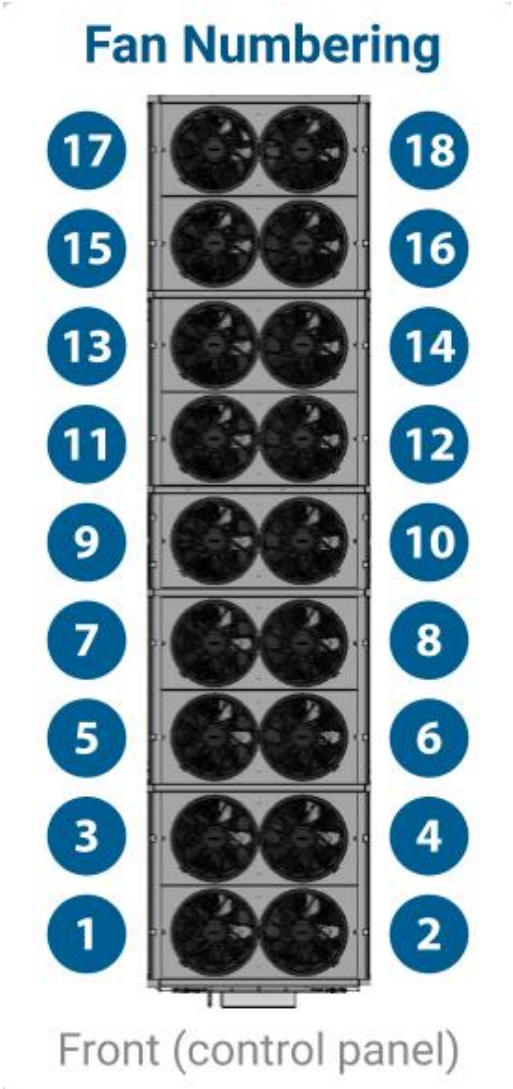


Figure 83. Fan Numbering Plan View

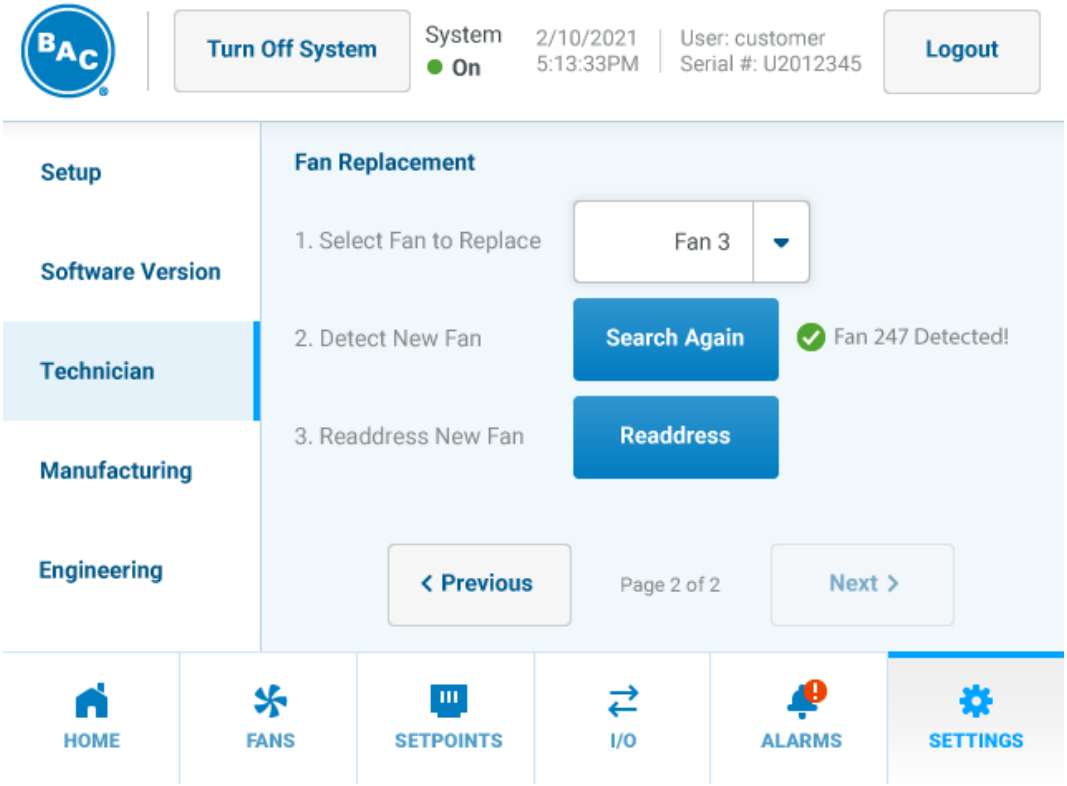


Figure 84. Settings Menu, Technician Page 2 of 2 Fan Detect

Headless HMI

The control panel is equipped with a headless HMI feature allowing a user to view the HMI on an external device. Follow the below instructions to utilize the headless HMI feature.

1. Navigate to Settings menu, Setup Page 3 of 3 as shown in **Figure 69**.
    a. Note the IP Address shown on the screen.
2. Connect a RJ45 cable from an external device to the control panel via the bulkhead at the bottom on the control panel.
3. On the external device open a web browser and enter the IP Address followed by ":1011".
4. Allow TwinCAT HMI to load and go to the Home Screen.

10. Unit Operation & Storage

TrilliumSeries™ Adiabatic Products are shipped fully wrapped. If the unit is going to remain in outdoor storage in excess of three months prior to installation, remove the stretch wrap and follow the prolonged outdoor storage recommendations listed in the TrilliumSeries™ Adiabatic Cooler – TRF Rigging & Assembly Instructions available at BaltimoreAircoil.com. If you start-up the unit within three months of delivery, follow the instructions below:

General

- Use appropriate lockout procedures. Do not perform any service on or near the unit without first ensuring the unit is de-energized
- Verify the unit has been installed according to the TrilliumSeries™ Adiabatic Cooler – TRF Rigging & Assembly Instructions available at BaltimoreAircoil.com.

Corrosion Protection

BAC products are constructed of corrosion-resistant materials. Materials listed below are used in the equipment construction:

- **Galvanized Steel Components:** Inspect the galvanized steel components for blemishes or corrosion. Wire brush and recoat the affected areas with a cold galvanizing compound such as zinc rich compound (ZRC).
- **Thermosetting Hybrid Polymer Components:** Inspect the galvanized steel components protected with the thermosetting hybrid polymer for scratches, scrapes, or blemishes. Cosmetically touch up these areas with color matched paint.
- **Stainless Steel Components:** Inspect stainless steel components for signs of blemishes or corrosion. See section Long Term Care of Stainless Steel for cleaning and care instructions.

Long Term Care of Stainless Steel

When the percentage of chromium in steel exceeds 10.5%, it is called stainless steel. The chromium in the steel reacts with the oxygen in the air to form a chromium-oxide surface layer, also called the passivation layer that provides the corrosion resistance in stainless steel. BAC takes precautions to prevent cross-contamination, processing galvanized and stainless-steel parts separately. Also, stainless steel brushes are used to clean welds on stainless parts and care is taken to avoid scratching parts during processing. Organic cleaners are used to clean the finished product prior to shipping.

While stainless steel itself does not rust so long as the chromium-oxide surface layer is intact, it is not immune to contamination from its surroundings. Some common sources of surface contamination are:

- Dirt and soil
- Shop oil or grease that may carry other contaminants such as metal chips
- Machining or welding galvanized steel at the jobsite may cause debris to embed itself into the stainless steel

These contaminants can deposit on the surface and scratch the passivation layer or prevent it from re-forming. They can also get trapped underneath the passivation layer and reduce corrosion resistance.

Recommended Stainless Steel Cleaning Procedure

NOTICE: Never use chloride or chlorine-based solvents such as bleach or muriatic (hydrochloric) acid to clean stainless steel. It is important to rinse the surface with warm water and wipe with a dry cloth after cleaning.

Stainless steel needs to be cleaned regularly to maintain the corrosion resistance as well as to maintain the overall aesthetics of the stainless steel. It is simple to clean most contaminants off the surface of stainless steel. Most dirt and soil can be cleaned with a clean cloth, warm water, and mild detergent. For persistent dirt, a little vinegar can be added in the cleaning water. It is important to always rinse the surface with warm water and wipe with a dry cloth after any cleaning, whether mild or aggressive.

- Fingerprints, mild stains, or grease spots can be cleaned using organic solvents such as acetone, methyl or ethyl alcohol, or mineral spirits. Stainless steel wipes or glass cleaners commonly available in stores may also be used.
- Occasionally the surface of stainless steel can get iron chips or shavings embedded in it from having galvanized steel machined or welded in the vicinity. The iron chips can start to rust, reducing the corrosion resistance of the stainless steel, and stain the surface giving the impression that the stainless steel is rusting. These types of contaminants require more aggressive cleaning. Mild abrasives such as Scotch-Brite™ products may be used where aesthetic considerations are not important followed by solvent cleaning with organic solvents as described above. It is important to rinse the surface with warm water and wipe with a dry cloth after cleaning.
- If the iron chips are not removed with the Scotch-Brite™ products, electro-chemical cleaning may be required. Contact your local BAC Representative for more information on commercially available equipment for electrochemical cleaning in the field.

Inspection

- Conduct external inspection of the equipment. Check for leaks, corrosion, and any structural damage.
- Conduct internal inspection of the equipment. Check for anything unusual such as structural or mechanical component damage.
- Inspect the pump(s), make-up valve(s), and drain valve. Remove any construction debris from inside the valves/sump.
- Thoroughly inspect the fan(s) for any mechanical or physical damage.
- Check that the float switches move freely.
- Inspect the water distribution system.

Cleaning

- Remove all dirt and debris from the fan guard(s).
- Inspect and clean the water distribution system.
- Clean all mechanical components, such as the fan and motor.
- Flush the sump to remove any accumulated dirt and debris.
- Remove, clean, and replace the sump strainers.
- Flush the piping supply water to the unit for at least 5 minutes to remove flux shavings and other construction debris.
- If necessary, clean the coil.
- If necessary, clean the adiabatic pre-cooler pads.
- After installation, remove any steel shavings from inside the unit. This will prevent shavings from rusting onto the surface of the thermosetting hybrid polymer, which may affect the coating's integrity over extended time.

Start-up

Control Panel

1. Verify the correct voltage to the control panel with a meter.
2. Before power has been provided to the unit, turn all breakers to the On position inside the control panel.
3. Close the control panel and ensure locks have been fully engaged by rotating 90 degrees on each bolt.
4. Remove any materials from the sump and ensure the sump access doors are closed and secured.
5. Turn on breaker or other power supply that supplies power to the unit.
6. Turn the control panel main disconnect switch to the On position.

Control Settings

7. Open the HMI cover and wait for the screen to show the home menu in **Figure 30**.
8. Navigate to Settings menu, Setup Page shown in **Figure 67** and **Figure 68**. Confirm correct Language, Date and Time are selected. If applicable, configure BMS protocol. Refer to **Table 37** for applicable BMS protocol setup page number.

BMS Protocol	Page Number
Modbus RTU	79
BACnet MSTP	80
Modbus TCP	82
BACnet IP	83

Table 37. BMS Protocol Setup Page Numbers

9. If unit is configured as a self-contained unit, navigate to Setpoints menu, Leaving Fluid Control as shown in **Figure 41**. Set appropriate Operating Mode, Leaving Fluid Temp Setpoint, Control Range, Adiabatic Switchpoint and Run Authorization Type. Refer to **Table 12** for parameter descriptions.
10. If unit is configured for a customer control signal, navigate to Setpoints menu, Customer Input Control as shown in **Figure 42**. Set appropriate Operating Mode, Signal Type, Adiabatic Switchpoint, and Run Authorization Type. Refer to **Table 12** for parameter descriptions.
11. Navigate to Fans menu shown in **Figure 34**. Press the unit icon on the left of the screen to enter the All Fans menu as shown in **Figure 35**. Set the appropriate Max Fan Speed and Emergency Fan Speed. Refer to **Table 11** for parameter descriptions.
12. Navigate to Alarms menu shown in **Figure 65**. Confirm there are no active alarms.

Component Operation

13. Press “Logout” in the upper right corner of the screen to navigate to the Login Screen as shown in **Figure 31**. Log in as Technician. Refer to **Table 9. Access Levels and Passwords** on Page **45**.
14. Navigate to Fans menu, Manual as shown in **Figure 38**.
    - Enter a Manual Setpoint of 100%.
    - Use the radio button to turn Manual Mode to On.
    - In the upper left corner of the screen press “Turn On System”.
15. Navigate to Fans menu as shown in **Figure 34**. Press on the picture of each fan and navigate to Analog Data menu to obtain data for each fan. Verify the fan status and actual speed of each fan.

16. Navigate to Fans menu, Manual as shown in **Figure 38**.
    - Use the radio button to turn Manual Mode to Off.
17. Verify the make-up water connection is on and verify the pressure reducing valve is properly set to 45 psi (3 bar) by viewing the pressure setting indicator visible on both sides of the valve. Refer to Section Pressure Reducing Valve on **Page 21** for more details.
18. Navigate to I/O menu, Manual Page 2 of 2 as shown in **Figure 64.**
    - Use the radio button to turn drain valve manual mode to On.
    - Press the blue button to close the drain valve.
19. Navigate to I/O menu, Page 1 of 2 as shown in **Figure 63.**
    - Use the radio buttons to turn make-up valve 1 and 2 manual mode to On.
    - Press the blue button to open make-up valve 1 and 2.
    - Wait for water to fill the sump. Before proceeding, visually confirm the water level has reached the high float switch shown in **Figure 15**.
    - Use the radio buttons to turn make-up valve 1 and 2 manual mode to Off.
    - Use the radio buttons to turn pump 1 and 2 manual mode to On.
    - Press the blue button to turn pump 1 and 2 On.
    - Verify adiabatic pre-cooler pads are being wetted on both sides of the unit.
    - Press the blue button to turn pump 1 and 2 Off.
    - Use the radio buttons to turn pump 1 and 2 manual mode to Off.
20. Navigate to I/O menu, Manual Page 2 of 2 as shown in **Figure 64.**
    - Press the blue button to open the drain valve.
    - Use the radio button to turn drain valve manual mode to Off.
21. Press “Logout” in the upper right corner to log out as Technician.

Extended Shutdown

Perform the following services whenever the unit is shutdown in excess of three days:

NOTICE: Do not use steam, high-pressure water, or high-pressure air to clean any component.

- Disconnect, lock-out, and tag-out the unit.
- Close the shut-off valve in the make-up water line (supplied by others) and drain the sump and all exposed water piping. Heat trace all exposed make-up water lines if the water cannot be shut off and external piping cannot be drained.
- To minimize the risk of biological contamination during shutdown, it is recommended the entire system be drained.
- Coils must be empty and closed off. For extended shutdown periods coils should be charged with nitrogen at 15 psig in the field and capped by adding a welded cap. Upon start-up, the coil connections will require cutting.
- Insert desiccant bags into the control panel to absorb moisture. Seal the control panel for storage
- Clean all debris, such as leaves and dirt, from the interior and exterior of the unit.
- Clean and flush the water distribution system and sump.
- Leave sump drain valve open so rain and melting snow will drain from the unit.
- Clean the sump strainer and re-install.
- Cover the fan discharge to keep out dirt and debris.
- Inspect the protective finish on the unit. Clean and refinish as required.
- Start-up and operate fan motors at full speed for at least three hours once a month to move the bearings and allow any condensate that may have ingressed to evaporate

11. Alarms & Troubleshooting

All the possible alarms as well as troubleshooting recommendations are listed in **Table 38** through **Table 63**. Unit alarm codes are listed in **Table 64** and fan alarm codes are listed in **Table 65**.

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Pump X Contact is On for 10 consecutive seconds • Pump X Current Switch is False for 3 consecutive seconds
Release Criteria	The unit will release the alarm when any of the following are true: • Pump X Contact is Off • Pump X Contact is On AND Pump X Current Switch is True
Troubleshooting	• Check Pump X and wiring • Check Pump X Current Switch and wiring
General Alarm DO	True
Effect	If this alarm occurs 3 times, Pump X will be locked out and the alarm must be cleared via the HMI.

Table 38. Pump X No Current Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when the following is true: • 3 Pump X No Current Alarms have occurred
Release Criteria	The unit will release the alarm when the following is true: • Pump X Lockout is cleared
Troubleshooting	• Check Pump X and wiring • Check Pump X Current Switch and wiring
General Alarm DO	True
Effect	Pump X will be locked out from starting.

Table 39. Pump X Lock Out Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when any of the following are true: • Control Type = LFT Ctrl AND Fluid Type = Water AND Leaving Fluid Temperature ≤ 10 °C for 3 consecutive seconds • Control Type = LFT Ctrl AND Fluid Type = Glycol AND Leaving Fluid Temperature ≤ 7.2 °C for 3 consecutive seconds
Release Criteria	The unit will release the alarm when any of the following are true: • Control Type = LFT Ctrl AND Fluid Type = Water AND Leaving Fluid Temperature > 13 °C for 3 consecutive seconds • Control Type = LFT Ctrl AND Fluid Type = Glycol AND Leaving Fluid Temperature > 10.2 °C for 3 consecutive seconds • Control Type ~= LFT Ctrl
Troubleshooting	• Check Leaving Fluid Temperature sensor installation • Check Leaving Fluid Temperature sensor and wiring
General Alarm DO	True
Effect	Emergency Flag = True

Table 40. Low Leaving Fluid Temperature Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Low Level Float = False for 5 consecutive minutes • Drain Valve = Closed
Release Criteria	The unit will release the alarm when the following is true: • Low Level Float = True for 3 consecutive seconds
Troubleshooting	• Check Low Level Float and wiring • Check Drain Valve and wiring
General Alarm DO	True
Effect	N/A

Table 41. Low Water Basin Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when following is true: • High Level Float = True for 5 consecutive minutes
Release Criteria	The unit will release the alarm when following is true: • High Level Float = False for 3 consecutive seconds
Troubleshooting	• Check High Level Float • Check High Level Float wiring • Check Make Up Valve 1 and wiring • Check Make Up Valve 2 and wiring • Check Drain Valve and wiring • Check Drain Valve Piping
General Alarm DO	True
Effect	N/A

Table 42. High Basin Water Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Drain Valve = Open • Low Level Float = True for 45 consecutive minutes
Release Criteria	The unit will release the alarm when the following is true: • Low Level Float = False for 3 consecutive seconds
Troubleshooting	• Check Low Level Float and wiring • Check Drain Valve and wiring
General Alarm DO	True
Effect	N/A

Table 43. Drain Valve Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Make Up Valve X = Open • Drain Valve = Closed • Low Level Float = False for 6 minutes
Release Criteria	The unit will release the alarm when the following is true: • Low Level Float = True for 3 consecutive seconds
Troubleshooting	• Check Make Up Valve X • Check Low Level Float and wiring • Check Drain Valve and wiring
General Alarm DO	True
Effect	N/A

Table 44. Make Up X Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Make Up 1 Alarm is Active • Make Up 2 Alarm is Active
Release Criteria	The unit will release the alarm when any of the following are true: • Low Level Float = True for 3 consecutive seconds • Drain Valve = Open
Troubleshooting	• Check Make Up Valve 1 • Check Low Level Float and wiring • Check Drain Valve and wiring • Check Make Up Valve 2 • Check Low Level Float and wiring • Check Drain Valve and wiring
General Alarm DO	True
Effect	N/A

Table 45. Water Supply Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Control Type = LFT Ctrl • Leaving Fluid Temperature > 90 °C OR • Leaving Fluid Temperature < -50 °C OR • EL3208-0010 Channel 1 cable break detected
Release Criteria	The unit will release the alarm when any of the following are true: • Control Type != LFT Ctrl • Leaving Fluid Temperature ≤ 87 °C • Leaving Fluid Temperature ≥ -47 °C • EL3208-0010 Channel 1 cable break undetected
Troubleshooting	• Check Leaving Fluid Temperature sensor installation • Check Leaving Fluid Temperature sensor and wiring
General Alarm DO	True
Effect	Emergency Flag = True

Table 46. Leaving Fluid Temperature Sensor Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when any of the following are true: • Outside Air Temperature < -30 °C for 3 consecutive seconds • Outside Air Temperature > 60 °C for 3 consecutive seconds • EL3208-0010 Channel 2 cable break detected
Release Criteria	The unit will release the alarm when any of the following are true: • Outside Air Temperature ≥-27 °C for 3 consecutive seconds AND Outside Air Temperature ≤ 57 °C for 3 consecutive seconds • EL3208-0010 Channel 2 cable break is not detected
Troubleshooting	• Check Outside Air Temperature sensor installation • Check Outside Air Temperature sensor and wiring
General Alarm DO	True
Effect	Disable Water = True

Table 47. Outside Air Temperature Sensor Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when the following is true: • All fans time out Modbus communications
Release Criteria	The unit will release the alarm when the following is true: • Any fan regains Modbus communications
Troubleshooting	• Check E-Stop button • Check Fan Modbus wiring between control panel and fan 1
General Alarm DO	True
Effect	Disable Water = True

Table 48. All Fans Offline/E-Stop Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when any of the following are true: • Low Level Float = False for 60 consecutive seconds • Mid Level Float = True • High Level Float = True
Release Criteria	The unit will release the alarm the following is true: • Low Level Float = True for 3 consecutive seconds
Troubleshooting	• Check Low Level Float Switch • Check Low Level Float Switch wiring
General Alarm DO	True
Effect	N/A

Table 49. Low Level Float Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when any of the following are true: • Low Level Float = True • Mid Level Float = False for 60 consecutive seconds • High Level Float = True
Release Criteria	The unit will release the alarm when the following is true: • Mid Level Float = True for 3 consecutive seconds
Troubleshooting	• Check Mid Level Float Switch • Check Mid Level Float Switch wiring
General Alarm DO	True
Effect	N/A

Table 50. Mid Level Float Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Control Type == Customer Input • Customer Input Type = 4 – 20 mA • Customer Input Current Signal (EL3014-2) ≤ 3 mA
Release Criteria	The unit will release the alarm when any of the following are true: • Control Type != Customer Input AND Customer Input Type = 4 – 20 mA AND Customer Input Current Signal (EL3014-2) > 3 mA • Control Type ~= Customer Input • Customer Input Type ~= 4 – 20 mA
Troubleshooting	• Check Customer Input wiring • Verify proper software set up
General Alarm DO	True
Effect	Emergency Mode = Active

Table 51. Low Customer Input Current Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Control Type == LFT Control • LFT > 85.0 °C
Release Criteria	The unit will release the alarm when any of the following are true: • Control Type != LFT Control AND LFT <= 82 °C • Control Type != LFT Control
Troubleshooting	• Check fluid temperatures elsewhere in the loop • Check leaving fluid temperature sensor
General Alarm DO	True
Effect	N/A

Table 52. High Leaving Fluid Temperature Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X times out Modbus communications
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X regains Modbus communications
Troubleshooting	Check Fan X's circuit breaker in control panel
General Alarm DO	True
Effect	N/A

Table 53. Fan X Offline Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 MSB bit 5 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 MSB bit 5 = 0
Troubleshooting	Check power supply to unit
General Alarm DO	True
Effect	N/A

Table 54. Fan X DC-link Undervoltage Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 MSB bit 3 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 MSB bit 3 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 55. Fan X Position Sensor Calibration Error Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 MSB bit 1 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 MSB bit 1 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 56. Fan X Speed Limit Exceeded Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 8 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 8 = 0
Troubleshooting	Inspect Fan X and ensure there are no obstructions
General Alarm DO	True
Effect	N/A

Table 57. Fan X Motor Blocked Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 7 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 7 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 58. Fan X Motor Hall Sensor Error Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 6 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 6 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 59. Fan X Motor Overheating Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 5 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 5 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 60. Fan X Fan Bad (General Error) Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 4 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 4 = 0
Troubleshooting	• Check Fan X communication wiring • Check Fan X communication shielding
General Alarm DO	True
Effect	N/A

Table 61. Fan X Communication Error Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 3 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 3 = 0
Troubleshooting	Contact your BAC Representative for support
General Alarm DO	True
Effect	N/A

Table 62. Fan X Output Stage Overheating Alarm

Parameter	Condition
Trigger Criteria	The unit will issue the alarm when all the following are true: • Number of Fans ≥ Fan X • Fan X Modbus Address D011 LSB bit 1 = 1
Release Criteria	The unit will release the alarm when any of the following are true: • Number of Fans < Fan X • Fan X Modbus Address D011 LSB bit 1 = 0
Troubleshooting	• Check power supply to unit • Contact BAC Support
General Alarm DO	True
Effect	N/A

Table 63. Fan X Phase Failure Alarm

Unit Alarm Codes

Unit Alarm codes listed in **Table 64** are enumerations porting a number code to a specific alarm. These codes are used in the Data logging and BMS communications to effectively communicate active alarms.

Alarm Code	Unit Alarm
0	No Alarm
1	Pump 1 No Current
2	Pump 1 Lock Out
3	Pump 2 No Current
4	Pump 2 Lock Out
5	Low Leaving Fluid Temperature
6	Low Basin Water
7	High Basin Water
8	Drain Valve Alarm
9	Make Up 1 Alarm
10	Make Up 2 Alarm
11	Water Supply Alarm
12	Leaving Fluid Temperature Sensor Alarm
13	Outside Air Temperature Sensor Alarm
14	All Fans Offline/E-Stop Alarm
15	Low Level Float Alarm
16	Mid Level Float Alarm
17	Low Customer Input Current
18	High Leaving Fluid Temperature

Table 64. Unit Alarm Codes

Fan Alarm Codes

Fan Alarm codes listed in **Table 65** are enumerations porting a number code to a specific alarm. These codes are used in the Data logging and BMS communications to effectively communicate active alarms.

Fan Number																		Fan Alarm
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Fan Alarm Code																		
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No Fan Alarm
1	12	23	34	45	56	67	78	89	100	111	122	133	144	155	166	177	188	Fan X Offline
2	13	24	35	46	57	68	79	90	101	112	123	134	145	156	167	178	189	Fan X DC-link Undervoltage
3	14	25	36	47	58	69	80	91	102	113	124	135	146	157	168	179	190	Fan X Position Sensor Cal Error
4	15	26	37	48	59	70	81	92	103	114	125	136	147	158	169	180	191	Fan X Speed Limit Exceeded
5	16	27	38	49	60	71	82	93	104	115	126	137	148	159	170	181	192	Fan X Motor Blocked
6	17	28	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	Fan X Hall Sensor Error
7	18	29	40	51	62	73	84	95	106	117	128	139	150	161	172	183	194	Fan X Motor Overheating
8	19	30	41	52	63	74	85	96	107	118	129	140	151	162	173	184	195	Fan X Fan Bad (General Error)
9	20	31	42	53	64	75	86	97	108	119	130	141	152	163	174	185	196	Fan X Communication Error
10	21	32	43	54	65	76	87	98	109	120	131	142	153	164	175	186	197	Fan X Output Stage Overheating
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	Fan X Phase Failure

Table 65. Fan Alarm Codes

12. BMS Communication

BACnet IP & Modbus TCP

BACnet IP and Modbus TCP shall be connected via the RJ45 bulkhead at the bottom on the control panel.

Modbus RTU Communications, Points List

Table 66. Modbus RTU Communications, Points List

Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Year	Current Year in YYYY format	R	A			30001
Month	Current Month in MM format	R	A			30002
Day	Current Day in DD format	R	A			30003
Hour	Current Hour in HH format	R	A			30004
Minute	Current Minute in MM format	R	A			30005
Second	Current Second in SS format	R	A			30006
LFT	Leaving Fluid Temperature in x10 format [°C]	R	A			30007
LFTsetp	Leaving Fluid Temperature Setpoint in x10 format [°C]	W	A	4.4	50	42049
CtrlRange	Control Range in x10 format [°C]	W	A	0.5	5.5	42050
AdiabaticSP	Adiabatic Switchpoint in x10 format [°C]	W	A	5	50	42051
OAT	Outside Air Temperature in x10 format [°C]	R	A			30008
BMSrunEn	BMS Run Enable 0 = Off 1 = On	W	B			2849
RunStatus	Trillium Run Status 0 = Not Running 1 = Running	R	B			12401
WaterDisable	Water Usage Disable. Forces the unit into dry mode 0 = Water Usage Enabled 1 = Water Usage Disabled	W	B			2850
FanSpdCmd	Fan Speed Command in x10 format [% max fan speed]	R	A			30009
ActlFanSpd	Average Fan Speed Feedback in x10 format [%]	R	A			30010
ActlFanSpdRPM	Average Fan Speed Feedback in x10 format [RPM]	R	A			30011

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
CIFanCMD	Customer Input Fan Command (0.0 -100.0) [% Max Fan Speed] in x10 format Only valid if configured for Customer Input mode, type BMS	W	A	0	100	42052
OpMode	Operating Mode 0 = Undefined 1 = Default 2 = Energy Saver 3 = Water Saver	W	A	1	3	42053
UnitMode	Control State (from State Machine) 0 = Undefined 1 = Off 2 = Manual 3 = Dry 4 = Single Precooler 5 = Dual Precooler 6 = Coil Clean 7 = Pad Cleaning 8 = Drain and Dry 9 = Wet Coil Clean 10 = Emergency	R	A			30012
Precooler1Status	Precooler 1 status 0 = Lead 1 = Lag	R	B			12402
Precooler2Status	Precooler 2 status 0 = Lead 1 = Lag	R	B			12403
Pump1cmd	Pump 1 Command 0 = Off 1 = On	R	B			12404
Pump2cmd	Pump 2 Command 0 = Off 1 = On	R	B			12405
Pump1status	Pump 1 Status 0 = No Pump Current Detected 1 = Pump Current Detected	R	B			12406
Pump2status	Pump 2 Status 0 = No Pump Current Detected 1 = Pump Current Detected	R	B			12407
MUP1cmd	Make Up Valve 1 Command 0 = Closed 1 = Open	R	B			12408
MUP2cmd	Make Up Valve 2 Command 0 = Closed 1 = Open	R	B			12409

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
DrainValveCmd	Drain Valve Command 0 = Open 1 = Closed	R	B			12410
LLF	Low Level Float Status 0 = Water Level below Float 1 = Water Level above Float	R	B			12411
MLF	Mid Level Float Status 0 = Water Level below Float 1 = Water Level above Float	R	B			12412
HLF	High Level Float Status 0 = Water Level below Float 1 = Water Level above Float	R	B			12413
Precooler1Starts	Precooler 1 number of starts	R	A			30013
Precooler1Hrs	Precooler 1 run hours	R	A			30014
Precooler2Starts	Precooler 2 number of starts	R	A			30015
Precooler2Hrs	Precooler 2 run hours	R	A			30016
Precooler1Temp	Precooler 1 Temperature in x10 format [°C]	R	A			30126
Precooler2Temp	Precooler 2 Temperature in x10 format [°C]	R	A			30127
EFT	Entering Fluid Temperature in x10 format [°C]	R	A			30128
OARH	Outside Air Relative Humidity in x10 format [%]	R	A			30129
Pump1Starts	Pump 1 number of starts	R	A			30017
Pump1Hrs	Pump 1 run hours [hours]	R	A			30018
Pump1ARtimer	Pump 1 Anti-Recycle Timer 0 = Inactive 1 = Active	R	B			12414
Pump2Starts	Pump 2 number of starts	R	A			30019
Pump2Hrs	Pump 2 run hours [hours]	R	A			30020
Pump2ARtimer	Pump 2 Anti-Recycle Timer 0 = Inactive 1 = Active	R	B			12415
MUP1starts	Make Up Valve 1 starts	R	A			30021
MUP1hrs	Make Up Valve 1 run hours [hours]	R	A			30022
MUP2starts	Make Up Valve 2 starts	R	A			30023
MUP2hrs	Make Up Valve 2 run hours [hours]	R	A			30024
DrainVlvStarts	Drain Valve starts	R	A			30025

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
DrainVlvHrs	Drain Valve run hours [hours]	R	A			30026
BasinRetentionTime	Basin Retention Time [hours] The amount of time in Dry mode that the unit will hold the basin water before dumping.	R	A	6	72	30027
NumCoCs	Number of Cycles of Concentration till Basin drain	R	A	1	10	30028
NightDryOverride	Night Dry Feature Override 0 = Auto 1 = Override	W	B			2851
NightDrySunStart	Night Dry Schedule Sunday Start time in HHMM format	W	A	0	2359	42055
NightDryMonStop	Night Dry Schedule Monday Stop time in HHMM format	W	A	0	2359	42056
NightDryMonStart	Night Dry Schedule Monday Start time in HHMM format	W	A	0	2359	42057
NightDryTueStop	Night Dry Schedule Tuesday Stop time in HHMM format	W	A	0	2359	42058
NightDryTueStart	Night Dry Schedule Tuesday Start time in HHMM format	W	A	0	2359	42059
NightDryWedStop	Night Dry Schedule Wednesday Stop time in HHMM format	W	A	0	2359	42060
NightDryWedStart	Night Dry Schedule Wednesday Start time in HHMM format	W	A	0	2359	42061
NightDryThuStop	Night Dry Schedule Thursday Stop time in HHMM format	W	A	0	2359	42062
NightDryThuStart	Night Dry Schedule Thursday Start time in HHMM format	W	A	0	2359	42063
NightDryFriStop	Night Dry Schedule Friday Stop time in HHMM format	W	A	0	2359	42064
NightDryFriStart	Night Dry Schedule Friday Start time in HHMM format	W	A	0	2359	42065
NightDrySatStop	Night Dry Schedule Saturday Stop time in HHMM format	W	A	0	2359	42066
NightDrySatStart	Night Dry Schedule Saturday Start time in HHMM format	W	A	0	2359	42067
NightDrySunStop	Night Dry Schedule Sunday Stop time in HHMM format	W	A	0	2359	42068
ScheduleDryOverride	Schedule Dry Feature Override 0 = Auto 1 = Override	W	B			2852
ScheduleDrySunStart	Schedule Dry Schedule Sunday Start time in HHMM format	W	A	0	2359	42069
ScheduleDrySunStop	Schedule Dry Schedule Sunday Stop time in HHMM format	W	A	0	2359	42070
ScheduleDryMonStart	Schedule Dry Schedule Monday Start time in HHMM format	W	A	0	2359	42071

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
ScheduleDryMonStop	Schedule Dry Schedule Monday Stop time in HHMM format	W	A	0	2359	42072
ScheduleDryTueStart	Schedule Dry Schedule Tuesday Start time in HHMM format	W	A	0	2359	42073
ScheduleDryTueStop	Schedule Dry Schedule Tuesday Stop time in HHMM format	W	A	0	2359	42074
ScheduleDryWedStart	Schedule Dry Schedule Wednesday Start time in HHMM format	W	A	0	2359	42075
ScheduleDryWedStop	Schedule Dry Schedule Wednesday Stop time in HHMM format	W	A	0	2359	42076
ScheduleDryThuStart	Schedule Dry Schedule Thursday Start time in HHMM format	W	A	0	2359	42077
ScheduleDryThuStop	Schedule Dry Schedule Thursday Stop time in HHMM format	W	A	0	2359	42078
ScheduleDryFriStart	Schedule Dry Schedule Friday Start time in HHMM format	W	A	0	2359	42079
ScheduleDryFriStop	Schedule Dry Schedule Friday Stop time in HHMM format	W	A	0	2359	42080
ScheduleDrySatStart	Schedule Dry Schedule Saturday Start time in HHMM format	W	A	0	2359	42081
ScheduleDrySatStop	Schedule Dry Schedule Saturday Stop time in HHMM format	W	A	0	2359	42082
NightQuietOverride	Night Quiet Feature Override 0 = Auto 1 = Override	W	B			2853
NightQuietLim	Night Quiet Limit in x10 format [% max fan speed]	W	A	0	100	42083
NightQuietAdiaSP	Night Quiet Adiabatic Switchpoint in x10 format [°C]	W	A	5		42084
NightQuietSunStart	Night Quiet Schedule Sunday Start time in HHMM format	W	A	0	2359	42085
NightQuietMonStop	Night Quiet Schedule Monday Stop time in HHMM format	W	A	0	2359	42086
NightQuietMonStart	Night Quiet Schedule Monday Start time in HHMM format	W	A	0	2359	42087
NightQuietTueStop	Night Quiet Schedule Tuesday Stop time in HHMM format	W	A	0	2359	42088
NightQuietTueStart	Night Quiet Schedule Tuesday Start time in HHMM format	W	A	0	2359	42089
NightQuietWedStop	Night Quiet Schedule Wednesday Stop time in HHMM format	W	A	0	2359	42090
NightQuietWedStart	Night Quiet Schedule Wednesday Start time in HHMM format	W	A	0	2359	42091
NightQuietThuStop	Night Quiet Schedule Thursday Stop time in HHMM format	W	A	0	2359	42092
NightQuietThuStart	Night Quiet Schedule Thursday Start time in HHMM format	W	A	0	2359	42093

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
NightQuietFriStop	Night Quiet Schedule Friday Stop time in HHMM format	W	A	0	2359	42094
NightQuietFriStart	Night Quiet Schedule Friday Start time in HHMM format	W	A	0	2359	42095
NightQuietSatStop	Night Quiet Schedule Saturday Stop time in HHMM format	W	A	0	2359	42096
NightQuietSatStart	Night Quiet Schedule Saturday Start time in HHMM format	W	A	0	2359	42097
NightQuietSunStop	Night Quiet Schedule Sunday Stop time in HHMM format	W	A	0	2359	42098
PadCleanOverride	Pad Cleaning Override Use this point to force a pad clean cycle 0 = Disable 1 = Override	W	B			2854
CoilCleanOverride	Coil Cleaning Override Use this point to force a coil clean cycle 0 = Disable 1 = Override	W	B			2855
DrainDryOverride	Complete Drain and Dry Override Use this point to force a drain and dry cycle 0 = Disable 1 = Override	W	B			2856
NightDryEn	Night Dry feature Enable 0 = Disabled 1 = Enable	W	B			2857
ScheduleDryEn	Schedule Dry feature Enable 0 = Disabled 1 = Enable	W	B			2858
NightQuietEn	Night Quiet feature Enable 0 = Disabled 1 = Enable	W	B			2859
AlarmCode	Unit Alarm Code See **Table 64. Unit Alarm Codes**	R	A			30029
FanAlarmCode	Fan Alarm Code See **Table 65. Fan Alarm Codes**	R	A			30030
AvgFanActlSpd	Average Fan Speed Feedback in x10 format [RPM]	R	A			30031
AvgFanPwr	Average Fan Power in x10 format [kW]	R	A			30032
AvgFanCurr	Average Fan Current in x10 format [A]	R	A			30033
Fan1status	Fan 1 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30034

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Fan1ActlSpd	Fan 1 Speed Feedback in x10 format [RPM]	R	A			30035
Fan1Pwr	Fan 1 Power in x10 format [kW]	R	A			30036
Fan1Curr	Fan 1 Current in x10 format [A]	R	A			30037
Fan1Hrs	Fan 1 run hours [hours]	R	A			30038
Fan2status	Fan 2 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30039
Fan2ActlSpd	Fan 2 Speed Feedback in x10 format [RPM]	R	A			30040
Fan2Pwr	Fan 2 Power in x10 format [kW]	R	A			30041
Fan2Curr	Fan 2 Current in x10 format [A]	R	A			30042
Fan2Hrs	Fan 2 run hours [hours]	R	A			30043
Fan3status	Fan 3 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30044
Fan3ActlSpd	Fan 3 Speed Feedback in x10 format [RPM]	R	A			30045
Fan3Pwr	Fan 3 Power in x10 format [kW]	R	A			30046
Fan3Curr	Fan 3 Current in x10 format [A]	R	A			30047
Fan3Hrs	Fan 3 run hours [hours]	R	A			30048
Fan4status	Fan 4 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30049
Fan4ActlSpd	Fan 4 Speed Feedback in x10 format [RPM]	R	A			30050
Fan4Pwr	Fan 4 Power in x10 format [kW]	R	A			30051
Fan4Curr	Fan 4 Current in x10 format [A]	R	A			30052
Fan4Hrs	Fan 4 run hours [hours]	R	A			30053
Fan5status	Fan 5 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30054
Fan5ActlSpd	Fan 5 Speed Feedback in x10 format [RPM]	R	A			30055
Fan5Pwr	Fan 5 Power in x10 format [kW]	R	A			30056

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Fan5Curr	Fan 5 Current in x10 format [A]	R	A			30057
Fan5Hrs	Fan 5 run hours [hours]	R	A			30058
Fan6status	Fan 6 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30059
Fan6ActlSpd	Fan 6 Speed Feedback in x10 format [RPM]	R	A			30060
Fan6Pwr	Fan 6 Power in x10 format [kW]	R	A			30061
Fan6Curr	Fan 6 Current in x10 format [A]	R	A			30062
Fan6Hrs	Fan 6 run hours [hours]	R	A			30063
Fan7status	Fan 7 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30064
Fan7ActlSpd	Fan 7 Speed Feedback in x10 format [RPM]	R	A			30065
Fan7Pwr	Fan 7 Power in x10 format [kW]	R	A			30066
Fan7Curr	Fan 7 Current in x10 format [A]	R	A			30067
Fan7Hrs	Fan 7 run hours [hours]	R	A			30068
Fan8status	Fan 8 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30069
Fan8ActlSpd	Fan 8 Speed Feedback in x10 format [RPM]	R	A			30070
Fan8Pwr	Fan 8 Power in x10 format [kW]	R	A			30071
Fan8Curr	Fan 8 Current in x10 format [A]	R	A			30072
Fan8Hrs	Fan 8 run hours [hours]	R	A			30073
Fan9status	Fan 9 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30074
Fan9ActlSpd	Fan 9 Speed Feedback in x10 format [RPM]	R	A			30075
Fan9Pwr	Fan 9 Power in x10 format [kW]	R	A			30076
Fan9Curr	Fan 9 Current in x10 format [A]	R	A			30077
Fan9Hrs	Fan 9 run hours [hours]	R	A			30078

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Fan10status	Fan 10 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30079
Fan10ActlSpd	Fan 10 Speed Feedback in x10 format [RPM]	R	A			30080
Fan10Pwr	Fan 10 Power in x10 format [kW]	R	A			30081
Fan10Curr	Fan 10 Current in x10 format [A]	R	A			30082
Fan10Hrs	Fan 10 run hours [hours]	R	A			30083
Fan11status	Fan 11 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30084
Fan11ActlSpd	Fan 11 Speed Feedback in x10 format [RPM]	R	A			30085
Fan11Pwr	Fan 11 Power in x10 format [kW]	R	A			30086
Fan11Curr	Fan 11 Current in x10 format [A]	R	A			30087
Fan11Hrs	Fan 11 run hours [hours]	R	A			30088
Fan12status	Fan 12 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30089
Fan12ActlSpd	Fan 12 Speed Feedback in x10 format [RPM]	R	A			30090
Fan12Pwr	Fan 12 Power in x10 format [kW]	R	A			30091
Fan12Curr	Fan 12 Current in x10 format [A]	R	A			30092
Fan12Hrs	Fan 12 run hours [hours]	R	A			30093
Fan13status	Fan 13 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30094
Fan13ActlSpd	Fan 13 Speed Feedback in x10 format [RPM]	R	A			30095
Fan13Pwr	Fan 13 Power in x10 format [kW]	R	A			30096
Fan13Curr	Fan 13 Current in x10 format [A]	R	A			30097
Fan13Hrs	Fan 13 run hours [hours]	R	A			30098

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Fan14status	Fan 14 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30099
Fan14ActlSpd	Fan 14 Speed Feedback in x10 format [RPM]	R	A			30100
Fan14Pwr	Fan 14 Power in x10 format [kW]	R	A			30101
Fan14Curr	Fan 14 Current in x10 format [A]	R	A			30102
Fan14Hrs	Fan 14 run hours [hours]	R	A			30103
Fan15status	Fan 15 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30104
Fan15ActlSpd	Fan 15 Speed Feedback in x10 format [RPM]	R	A			30105
Fan15Pwr	Fan 15 Power in x10 format [kW]	R	A			30106
Fan15Curr	Fan 15 Current in x10 format [A]	R	A			30107
Fan15Hrs	Fan 15 run hours [hours]	R	A			30108
Fan16status	Fan 16 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30109
Fan16ActlSpd	Fan 16 Speed Feedback in x10 format [RPM]	R	A			30110
Fan16Pwr	Fan 16 Power in x10 format [kW]	R	A			30111
Fan16Curr	Fan 16 Current in x10 format [A]	R	A			30112
Fan16Hrs	Fan 16 run hours [hours]	R	A			30113
Fan17status	Fan 17 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30114
Fan17ActlSpd	Fan 17 Speed Feedback in x10 format [RPM]	R	A			30115
Fan17Pwr	Fan 17 Power in x10 format [kW]	R	A			30116
Fan17Curr	Fan 17 Current in x10 format [A]	R	A			30117
Fan17Hrs	Fan 17 run hours [hours]	R	A			30118

Table 66. Modbus RTU Communications, Points List						
Variable	Description	R/W	Data Type	Low Limit	High Limit	Modbus RTU Registers
Fan18status	Fan 18 status 0 = Disabled/Offline 1 = Normal 2 = Alarm	R	A			30119
Fan18ActlSpd	Fan 18 Speed Feedback in x10 format [RPM]	R	A			30120
Fan18Pwr	Fan 18 Power in x10 format [kW]	R	A			30121
Fan18Curr	Fan 18 Current in x10 format [A]	R	A			30122
Fan18Hrs	Fan 18 run hours [hours]	R	A			30123

Table 66. Modbus RTU Communications, Points List

BACnet Communications, Points List

Table 67. BACnet Communications, Points List					
Point Name	**Description**	**Data Type**	**Low Limit**	**High Limit**	**BACnet Address**
Year	Current Year in YYYY format	Float			AI1
Month	Current Month in MM format	Float			AI2
Day	Current Day in DD format	Float			AI3
Hour	Current Hour in HH format	Float			AI4
Minute	Current Minute in MM format	Float			AI5
Second	Current Second in SS format	Float			AI6
LFT	Leaving Fluid Temperature [°C]	Float			AI7
LFTsetp	Leaving Fluid Temperature Setpoint [°C]	Float	4.4	50	AV1
CtrlRange	Control Range [°C]	Float	0.5	5.5	AV2
AdiabaticSP	Adiabatic Switchpoint [°C]	Float	5	50	AV3
OAT	Outside Air Temperature [°C]	Float			AI8
BMSrunEn	BMS Run Enable 0 = Off 1 = On	Bool			BV1
RunStatus	Trillium Run Status 0 = Not Running 1 = Running	Bool			BV2
WaterDisable	Water Usage Disable. Forces the unit into dry mode 0 = Water Usage Enabled 1 = Water Usage Disabled	Bool			BV3
FanSpdCmd	Fan Speed Command [% max fan speed]	Float			AI9
ActlFanSpd	Average Fan Speed Feedback [%]	Float			AI10
ActlFanSpdRPM	Average Fan Speed Feedback [RPM]	Float			AI11
CIFanCMD	Customer Input Fan Command (0.0 -100.0) [% Max Fan Speed] Only valid if configured for Customer Input mode, type BMS	Float	0	100	AV4
OpMode	Operating Mode 1 = Undefined 2 = Default 3 = Energy Saver 4 = Water Saver	UDINT	1	3	MSV1
UnitMode	Control State (from State Machine) 1 = Undefined 2 = Off 3 = Manual 4 = Dry 5 = Single Precooler 6 = Dual Precooler 7 = Coil Clean 8 = Pad Cleaning 9 = Drain and Dry 10 = Wet Coil Clean 11 = Emergency	UDINT			MSO1

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Precooler1Status	Precooler 1 status 1 = Lead 2 = Lag	UDINT			MSO2
Precooler2Status	Precooler 2 status 1 = Lead 2 = Lag	UDINT			MSO3P
Pump1cmd	Pump 1 Command 0 = Off 1 = On	Bool			BV4
Pump2cmd	Pump 2 Command 0 = Off 1 = On	Bool			BV5
Pump1status	Pump 1 Status 0 = No Pump Current Detected 1 = Pump Current Detected	Bool			BV6
Pump2status	Pump 2 Status 0 = No Pump Current Detected 1 = Pump Current Detected	Bool			BV7
MUP1cmd	Make Up Valve 1 Command 0 = Closed 1 = Open	Bool			BV8
MUP2cmd	Make Up Valve 2 Command 0 = Closed 1 = Open	Bool			BV9
DrainValveCmd	Drain Valve Command 0 = Open 1 = Closed	Bool			BV10
LLF	Low Level Float Status 0 = Water Level below Float 1 = Water Level above Float	Bool			BI1
MLF	Mid Level Float Status 0 = Water Level below Float 1 = Water Level above Float	Bool			BI2
HLF	High Level Float Status 0 = Water Level below Float 1 = Water Level above Float	Bool			BI3
Precooler1Starts	Precooler 1 number of starts	Float			AI12
Precooler1Hrs	Precooler 1 run hours	Float			AI13
Precooler2Starts	Precooler 2 number of starts	Float			AI14
Precooler2Hrs	Precooler 2 run hours	Float			AI15
Precooler1Temp	Precooler 1 Temperature [°C]	Float			AI19
Precooler2Temp	Precooler 2 Temperature [°C]	Float			AI20
EFT	Entering Fluid Temperature [°C]	Float			AI21
OARH	Outside Air Relative Humidity [%]	Float			AI22
Pump1Starts	Pump 1 number of starts	Float			AV5
Pump1Hrs	Pump 1 run hours [hours]	Float			AV6

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Pump1ARtimer	Pump 1 Anti-Recycle Timer 0 = Inactive 1 = Active	Bool			BV11
Pump2Starts	Pump 2 number of starts	Float			AV7
Pump2Hrs	Pump 2 run hours [hours]	Float			AV8
Pump2ARtimer	Pump 2 Anti-Recycle Timer 0 = Inactive 1 = Active	Bool			BV12
MUP1starts	Make Up Valve 1 starts	Float			AV9
MUP1hrs	Make Up Valve 1 run hours [hours]	Float			AV10
MUP2starts	Make Up Valve 2 starts	Float			AV11
MUP2hrs	Make Up Valve 2 run hours [hours]	Float			AV12
DrainVlvStarts	Drain Valve starts	Float			AV13
DrainVlvHrs	Drain Valve run hours [hours]	Float			AV14
BasinRetentionTime	Basin Retention Time [hours] The amount of time in Dry mode that the unit will hold the basin water before dumping.	Float	6	72	AV15
NumCoCs	Number of Cycles of Concentration till Basin drain	Float	1	10	AV16
NightDryOverride	Night Dry Feature Override 0 = Auto 1 = Override	Bool			BV13
NightDrySunStart	Night Dry Schedule Sunday Start time in HHMM format	Float	0	2359	AV17
NightDryMonStop	Night Dry Schedule Monday Stop time in HHMM format	Float	0	2359	AV18
NightDryMonStart	Night Dry Schedule Monday Start time in HHMM format	Float	0	2359	AV19
NightDryTueStop	Night Dry Schedule Tuesday Stop time in HHMM format	Float	0	2359	AV20
NightDryTueStart	Night Dry Schedule Tuesday Start time in HHMM format	Float	0	2359	AV21
NightDryWedStop	Night Dry Schedule Wednesday Stop time in HHMM format	Float	0	2359	AV22
NightDryWedStart	Night Dry Schedule Wednesday Start time in HHMM format	Float	0	2359	AV23
NightDryThuStop	Night Dry Schedule Thursday Stop time in HHMM format	Float	0	2359	AV24
NightDryThuStart	Night Dry Schedule Thursday Start time in HHMM format	Float	0	2359	AV25
NightDryFriStop	Night Dry Schedule Friday Stop time in HHMM format	Float	0	2359	AV26
NightDryFriStart	Night Dry Schedule Friday Start time in HHMM format	Float	0	2359	AV27
NightDrySatStop	Night Dry Schedule Saturday Stop time in HHMM format	Float	0	2359	AV28
NightDrySatStart	Night Dry Schedule Saturday Start time in HHMM format	Float	0	2359	AV29
NightDrySunStop	Night Dry Schedule Sunday Stop time in HHMM format	Float	0	2359	AV30
ScheduleDryOverride	Schedule Dry Feature Override 0 = Auto 1 = Override	Bool			BV14
ScheduleDrySunStart	Schedule Dry Schedule Sunday Start time in HHMM format	Float	0	2359	AV31

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
ScheduleDrySunStop	Schedule Dry Schedule Sunday Stop time in HHMM format	Float	0	2359	AV32
ScheduleDryMonStart	Schedule Dry Schedule Monday Start time in HHMM format	Float	0	2359	AV33
ScheduleDryMonStop	Schedule Dry Schedule Monday Stop time in HHMM format	Float	0	2359	AV34
ScheduleDryTueStart	Schedule Dry Schedule Tuesday Start time in HHMM format	Float	0	2359	AV35
ScheduleDryTueStop	Schedule Dry Schedule Tuesday Stop time in HHMM format	Float	0	2359	AV36
ScheduleDryWedStart	Schedule Dry Schedule Wednesday Start time in HHMM format	Float	0	2359	AV37
ScheduleDryWedStop	Schedule Dry Schedule Wednesday Stop time in HHMM format	Float	0	2359	AV38
ScheduleDryThuStart	Schedule Dry Schedule Thursday Start time in HHMM format	Float	0	2359	AV39
ScheduleDryThuStop	Schedule Dry Schedule Thursday Stop time in HHMM format	Float	0	2359	AV40
ScheduleDryFriStart	Schedule Dry Schedule Friday Start time in HHMM format	Float	0	2359	AV41
ScheduleDryFriStop	Schedule Dry Schedule Friday Stop time in HHMM format	Float	0	2359	AV42
ScheduleDrySatStart	Schedule Dry Schedule Saturday Start time in HHMM format	Float	0	2359	AV43
ScheduleDrySatStop	Schedule Dry Schedule Saturday Stop time in HHMM format	Float	0	2359	AV44
NightQuietOverride	Night Quiet Feature Override 0 = Auto 1 = Override	Bool			BV15
NightQuietLim	Night Quiet Limit [% max fan speed]	Float	0	100	AV45
NightQuietAdiaSP	Night Quiet Adiabatic Switchpoint [°C]	Float	5		AV46
NightQuietSunStart	Night Quiet Schedule Sunday Start time in HHMM format	Float	0	2359	AV47
NightQuietMonStop	Night Quiet Schedule Monday Stop time in HHMM format	Float	0	2359	AV48
NightQuietMonStart	Night Quiet Schedule Monday Start time in HHMM format	Float	0	2359	AV49
NightQuietTueStop	Night Quiet Schedule Tuesday Stop time in HHMM format	Float	0	2359	AV50
NightQuietTueStart	Night Quiet Schedule Tuesday Start time in HHMM format	Float	0	2359	AV51
NightQuietWedStop	Night Quiet Schedule Wednesday Stop time in HHMM format	Float	0	2359	AV52
NightQuietWedStart	Night Quiet Schedule Wednesday Start time in HHMM format	Float	0	2359	AV53
NightQuietThuStop	Night Quiet Schedule Thursday Stop time in HHMM format	Float	0	2359	AV54

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
NightQuietThuStart	Night Quiet Schedule Thursday Start time in HHMM format	Float	0	2359	AV55
NightQuietFriStop	Night Quiet Schedule Friday Stop time in HHMM format	Float	0	2359	AV56
NightQuietFriStart	Night Quiet Schedule Friday Start time in HHMM format	Float	0	2359	AV57
NightQuietSatStop	Night Quiet Schedule Saturday Stop time in HHMM format	Float	0	2359	AV58
NightQuietSatStart	Night Quiet Schedule Saturday Start time in HHMM format	Float	0	2359	AV59
NightQuietSunStop	Night Quiet Schedule Sunday Stop time in HHMM format	Float	0	2359	AV60
PadCleanOverride	Pad Cleaning Override Use this point to force a pad clean cycle 0 = Disable 1 = Override	Bool			BV16
CoilCleanOverride	Coil Cleaning Override Use this point to force a coil clean cycle 0 = Disable 1 = Override	Bool			BV17
DrainDryOverride	Complete Drain and Dry Override Use this point to force a drain and dry cycle 0 = Disable 1 = Override	Bool			BV18
NightDryEn	Night Dry feature Enable 0 = Disabled 1 = Enable	Bool			BV19
ScheduleDryEn	Schedule Dry feature Enable 0 = Disabled 1 = Enable	Bool			BV20
NightQuietEn	Night Quiet feature Enable 0 = Disabled 1 = Enable	Bool			BV21
AlarmCode	Unit Alarm Code incremented by 1	UDINT			MSO4
FanAlarmCode	Fan Alarm Code incremented by 1	UDINT			MSO5
AvgFanActlSpd	Average Fan Speed Feedback [RPM]	Float			AI16
AvgFanPwr	Average Fan Power [kW]	Float			AI17
AvgFanCurr	Average Fan Current [A]	Float			AI18
Fan1status	Fan 1 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO6
Fan1ActlSpd	Fan 1 Speed Feedback [RPM]	Float			AV61
Fan1Pwr	Fan 1 Power [kW]	Float			AV62
Fan1Curr	Fan 1 Current [A]	Float			AV63
Fan1Hrs	Fan 1 run hours [hours]	Float			AV64

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Fan2status	Fan 2 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO7
Fan2ActlSpd	Fan 2 Speed Feedback [RPM]	Float			AV65
Fan2Pwr	Fan 2 Power [kW]	Float			AV66
Fan2Curr	Fan 2 Current [A]	Float			AV67
Fan2Hrs	Fan 2 run hours [hours]	Float			AV68
Fan3status	Fan 3 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO8
Fan3ActlSpd	Fan 3 Speed Feedback [RPM]	Float			AV69
Fan3Pwr	Fan 3 Power [kW]	Float			AV70
Fan3Curr	Fan 3 Current [A]	Float			AV71
Fan3Hrs	Fan 3 run hours [hours]	Float			AV72
Fan4status	Fan 4 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO9
Fan4ActlSpd	Fan 4 Speed Feedback [RPM]	Float			AV73
Fan4Pwr	Fan 4 Power [kW]	Float			AV74
Fan4Curr	Fan 4 Current [A]	Float			AV75
Fan4Hrs	Fan 4 run hours [hours]	Float			AV76
Fan5status	Fan 5 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO10
Fan5ActlSpd	Fan 5 Speed Feedback [RPM]	Float			AV77
Fan5Pwr	Fan 5 Power [kW]	Float			AV78
Fan5Curr	Fan 5 Current [A]	Float			AV79
Fan5Hrs	Fan 5 run hours [hours]	Float			AV80
Fan6status	Fan 6 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO11
Fan6ActlSpd	Fan 6 Speed Feedback [RPM]	Float			AV81
Fan6Pwr	Fan 6 Power [kW]	Float			AV82
Fan6Curr	Fan 6 Current [A]	Float			AV83
Fan6Hrs	Fan 6 run hours [hours]	Float			AV84
Fan7status	Fan 7 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO12
Fan7ActlSpd	Fan 7 Speed Feedback [RPM]	Float			AV85

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Fan7Pwr	Fan 7 Power [kW]	Float			AV86
Fan7Curr	Fan 7 Current [A]	Float			AV87
Fan7Hrs	Fan 7 run hours [hours]	Float			AV88
Fan8status	Fan 8 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO13
Fan8ActlSpd	Fan 8 Speed Feedback [RPM]	Float			AV89
Fan8Pwr	Fan 8 Power [kW]	Float			AV90
Fan8Curr	Fan 8 Current [A]	Float			AV91
Fan8Hrs	Fan 8 run hours [hours]	Float			AV92
Fan9status	Fan 9 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO14
Fan9ActlSpd	Fan 9 Speed Feedback [RPM]	Float			AV93
Fan9Pwr	Fan 9 Power [kW]	Float			AV94
Fan9Curr	Fan 9 Current [A]	Float			AV95
Fan9Hrs	Fan 9 run hours [hours]	Float			AV96
Fan10status	Fan 10 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO15
Fan10ActlSpd	Fan 10 Speed Feedback [RPM]	Float			AV97
Fan10Pwr	Fan 10 Power [kW]	Float			AV98
Fan10Curr	Fan 10 Current [A]	Float			AV99
Fan10Hrs	Fan 10 run hours [hours]	Float			AV100
Fan11status	Fan 11 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO16
Fan11ActlSpd	Fan 11 Speed Feedback [RPM]	Float			AV101
Fan11Pwr	Fan 11 Power [kW]	Float			AV102
Fan11Curr	Fan 11 Current [A]	Float			AV103
Fan11Hrs	Fan 11 run hours [hours]	Float			AV104
Fan12status	Fan 12 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO17
Fan12ActlSpd	Fan 12 Speed Feedback [RPM]	Float			AV105
Fan12Pwr	Fan 12 Power [kW]	Float			AV106
Fan12Curr	Fan 12 Current [A]	Float			AV107
Fan12Hrs	Fan 12 run hours [hours]	Float			AV108

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Fan13status	Fan 13 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO18
Fan13ActlSpd	Fan 13 Speed Feedback [RPM]	Float			AV109
Fan13Pwr	Fan 13 Power [kW]	Float			AV110
Fan13Curr	Fan 13 Current [A]	Float			AV111
Fan13Hrs	Fan 13 run hours [hours]	Float			AV112
Fan14status	Fan 14 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO19
Fan14ActlSpd	Fan 14 Speed Feedback [RPM]	Float			AV113
Fan14Pwr	Fan 14 Power [kW]	Float			AV114
Fan14Curr	Fan 14 Current [A]	Float			AV115
Fan14Hrs	Fan 14 run hours [hours]	Float			AV116
Fan15status	Fan 15 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO20
Fan15ActlSpd	Fan 15 Speed Feedback [RPM]	Float			AV117
Fan15Pwr	Fan 15 Power [kW]	Float			AV118
Fan15Curr	Fan 15 Current [A]	Float			AV119
Fan15Hrs	Fan 15 run hours [hours]	Float			AV120
Fan16status	Fan 16 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO21
Fan16ActlSpd	Fan 16 Speed Feedback [RPM]	Float			AV121
Fan16Pwr	Fan 16 Power [kW]	Float			AV122
Fan16Curr	Fan 16 Current [A]	Float			AV123
Fan16Hrs	Fan 16 run hours [hours]	Float			AV124
Fan17status	Fan 17 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO22
Fan17ActlSpd	Fan 17 Speed Feedback [RPM]	Float			AV125
Fan17Pwr	Fan 17 Power [kW]	Float			AV126
Fan17Curr	Fan 17 Current [A]	Float			AV127
Fan17Hrs	Fan 17 run hours [hours]	Float			AV128
Fan18status	Fan 18 status 1 = Disabled/Offline 2 = Normal 3 = Alarm	UDINT			MSO23
Fan18ActlSpd	Fan 18 Speed Feedback [RPM]	Float			AV129

Table 67. BACnet Communications, Points List					
Point Name	Description	Data Type	Low Limit	High Limit	BACnet Address
Fan18Pwr	Fan 18 Power [kW]	Float			AV130
Fan18Curr	Fan 18 Current [A]	Float			AV131
Fan18Hrs	Fan 18 run hours [hours]	Float			AV132

Table 67. BACnet Communications, Points List

TrilliumSeries™ Adiabatic Cooler - TRF

OPERATION & MAINTAINANCE MANUAL

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