BALTIMORE
AIRCOIL COMPANY

NXF Modular Hybrid Cooler

SOFTWARE INSTRUCTIONS

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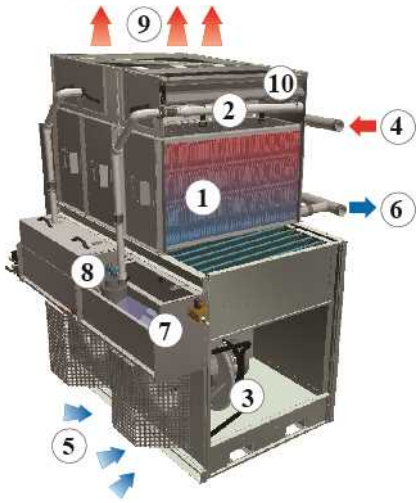
SOFTWARE INSTRUCTIONS

1 SCOPE

Operation

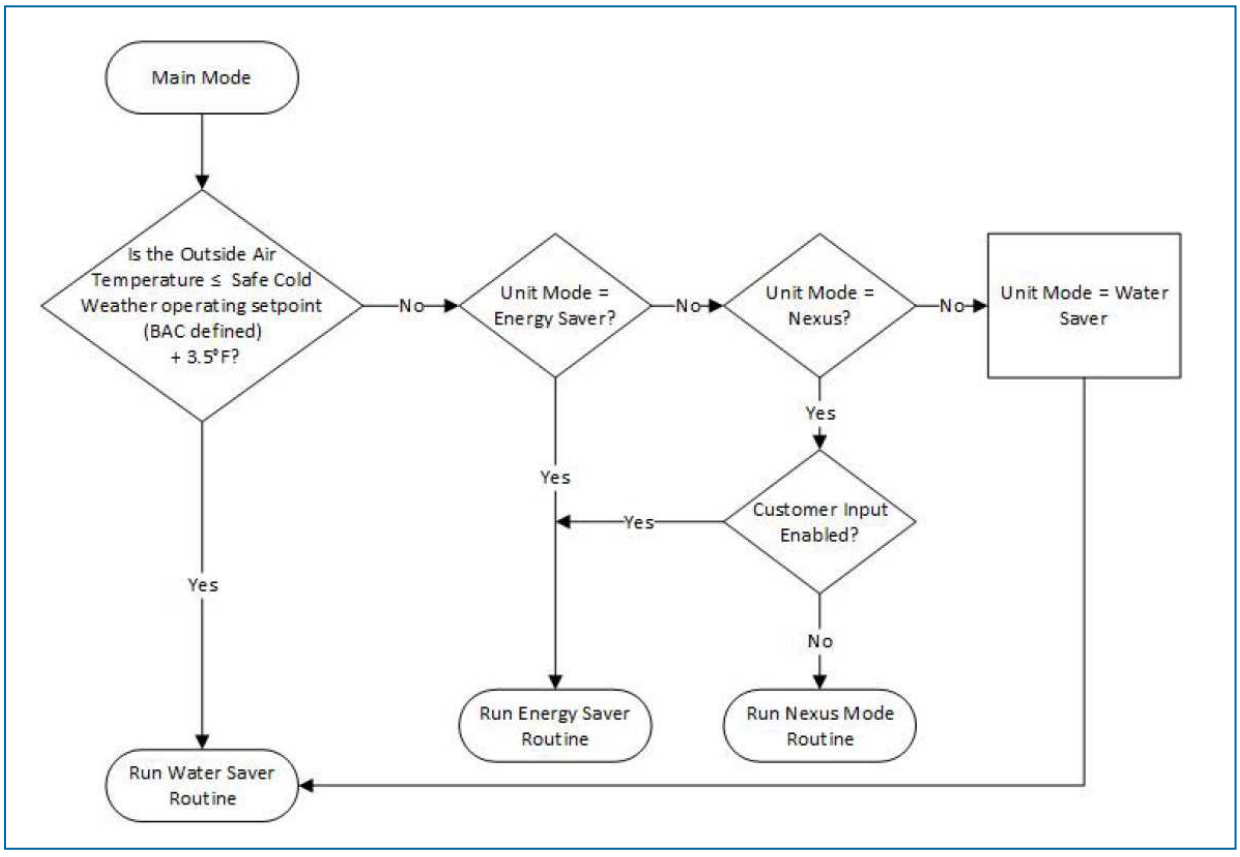
A Nexus™ Modular Hybrid Cooler consists of one or more modules, each with their own individual hCore™ Heat Exchanger (1), spray system (2) and EC Fan drive system (3). When a module works evaporatively, the warm process fluid (4) circulates through the hCore™ heat exchanger, which is wetted by the spray system. A the same time, the EC fan drive system(s) blows ambient air (5) upwards through the heat exchanger. A part of the spray water evaporates and cools the process fluid, which then exits the unit (6). The remaining spray water flows back into the sloping external sump (7), where it is collected. A spray water pump (8) recirculates the water up to the spray system. The warm saturated air (9) leaves the cooler through the drift eliminators (10), which remove water droplets from the air.



2 CONTROL LOGIC

Control mode summary

The following section describes the different control modes built into the logic. The iPilot^{TM} Control System has flexible settings to maximize the savings of water and energy. The control settings can be adjusted to prioritize water savings versus energy savings or vice versa.
The following chart outlines the selection of the operating modes based on the customer's selected mode and the ambient temperature:



iPilotTM Control System

ENERGY SAVER MODE

In energy saver mode, energy savings are maximized by leveraging the full power of evaporative cooling. During periods when ambient temperatures or loads from the building or process are relatively high, the Nexus Modulair Hybrid Cooler operates with all spray systems active across all modules. During off-design conditions, the EC fan system will automatically and intelligently reduce speed whenever possible. As the load is satisfied, the fans and spray pumps will cycle off.

When the heat rejection demand increases, each module turns on in sequence. Once all modules are turned on, all fans operate at a synchronised speed.

NEXUS MODE

In the revolutionary Nexus mode, you can prioritize water and energy savings to achieve the right balance of both. Your climate, cooling load profile and the rates you pay for water and energy will determine your specific settings, which can easily be re-adjusted as needed. You can specify the importance of water versus energy savings to automatically achieve the right balance for your specific situation.
When demand increases and calls for heat rejection, all fans ramp up simultaneously. Once all fans reach the maximum defined dry operating speed, a single pump will be enabled. Additional pumps will be activated to meet building load demand. Units operating in evaporative mode will modulate fan speed until they reach the maximum wet operating speed. In Nexus mode, the user can choose how to balance energy savings and water savings by adjusting the iPilotTM Control System by selecting a program setting from 1-7 with 1 being maximum energy savings while dry and 7 being maximum water savings.

WATER SAVER MODE

In Water saver mode, water savings are maximized by leveraging the dry efficiency of the hCore™ Heat Transfer Technology and operating without spray water. To meet increasing loads, the EC fan system will automatically and intelligently increase speed and the spray pumps will activate only when necessary (Winter Guard Disabled).

Within Water saver mode there are two options:

Winter Guard Disabled (Recommended): When demand increases and call for heat rejection, each pump will turn on when demand exceeds the capacity of the unit while running dry. This mode is recommended to ensure that heat load can be rejected by evaporative cooling when required. In cold climates, Nexus units located outdoors will require the make-up water line to be heat traced and a heater used in cold water basin. Consult the Software Instructions for more details.
Winter Guard Enabled: When demand increases and calls for heat rejection, all fans ramp up simultaneously, and all modules will only run dry. This mode is typically utilized when the make-up water line has been winterized/shutoff to the unit during cold weather and/or the load is greatly reduced during winter months.

FAN COMMUNICATION LOSS PROTOCOL

Communication from the EC fan system to the iPilot™ Control System is constantly monitored. In the unlikely event of a loss of fan signal for greater than 5 seconds, the fan motor's internal programming will run the fans at the last know speed. The iPilot™ Control System will also send an alarm notification regarding the loss of communication. The system emergency mode can be modified through the iPilot™ Control System emnu. See the Nexus Modulair Hybrid Cooler Software Instructions for more information.

Selection of Control mode

The iPilot™ Control System is designed to run in one of the three previously described modes. For all modes, the sequencing logic controls fan speed and pump operation based on a reference signal and a setpoint.

To choose in which mode the unit should operation, follow this procedure:

1. From the main menu, select A. User Menu
2. Set your operating mode, run authorization, and the leaving fluid setpoint

Operating conditions	E02
Operating mode	Energy saver/Nexus/Water Saver
Run authorization	ON / OFF
Leaving PfFl setpoint	xx ° C

"Operating mode": Select the operating mode from Energy Saver, Nexus, Water Saver

"Run authorization": Activate or deactivate the unit. This variable can either be set directly in this screen or via BMS variable.

"Leaving process fluid setpoint": Set the required leaving process fluid temperature setpoint.

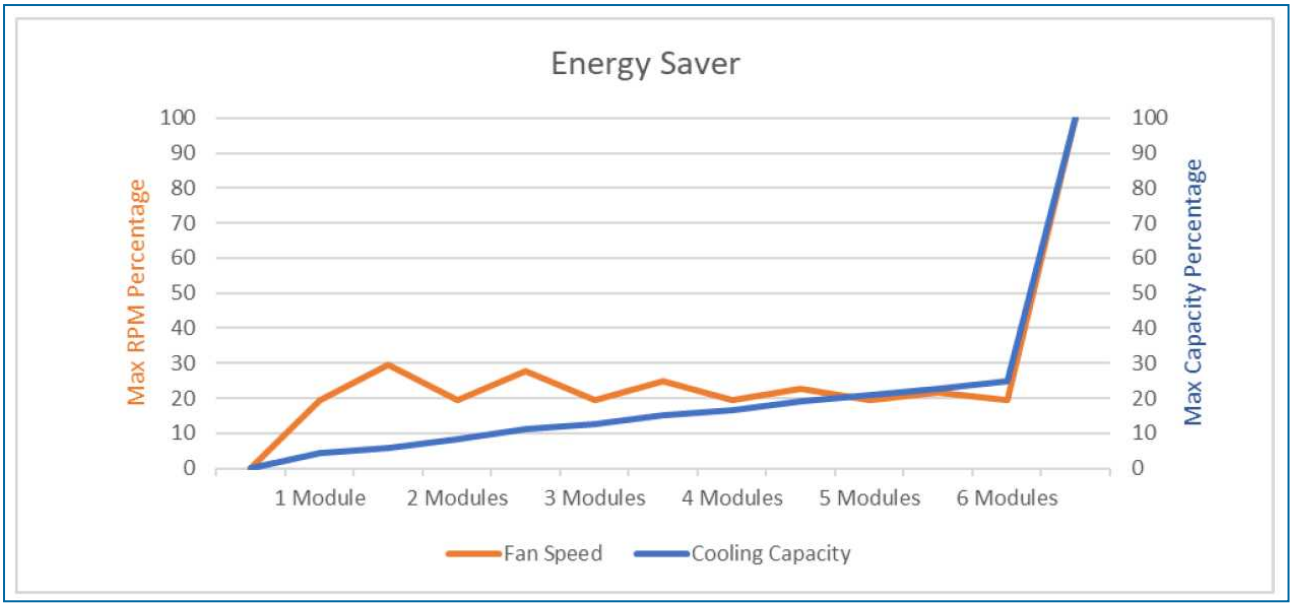
See the Nexus Modulair Hybrid Cooler Software Instructions for comprehensive iPilot™ Control System user instructions.

Sequence of operation overview

A complete overview of customer-defined inputs involved in each sequence can be found in the Nexus Modulair Hybrid Cooler Software Instructions.

Module staging

Module Transition Speed: The iPilot™ Control System intelligently determines when a new module should become operational depending on the load requirements. This decision is based on the fan speed of the operating modules. As more modules become operational, this transition speed decreases to maintain a consistent power consumption until all the modules are operating. An example of the module staging is shown below:



Energy Saver mode

Starting from "off" with no cooling demand:

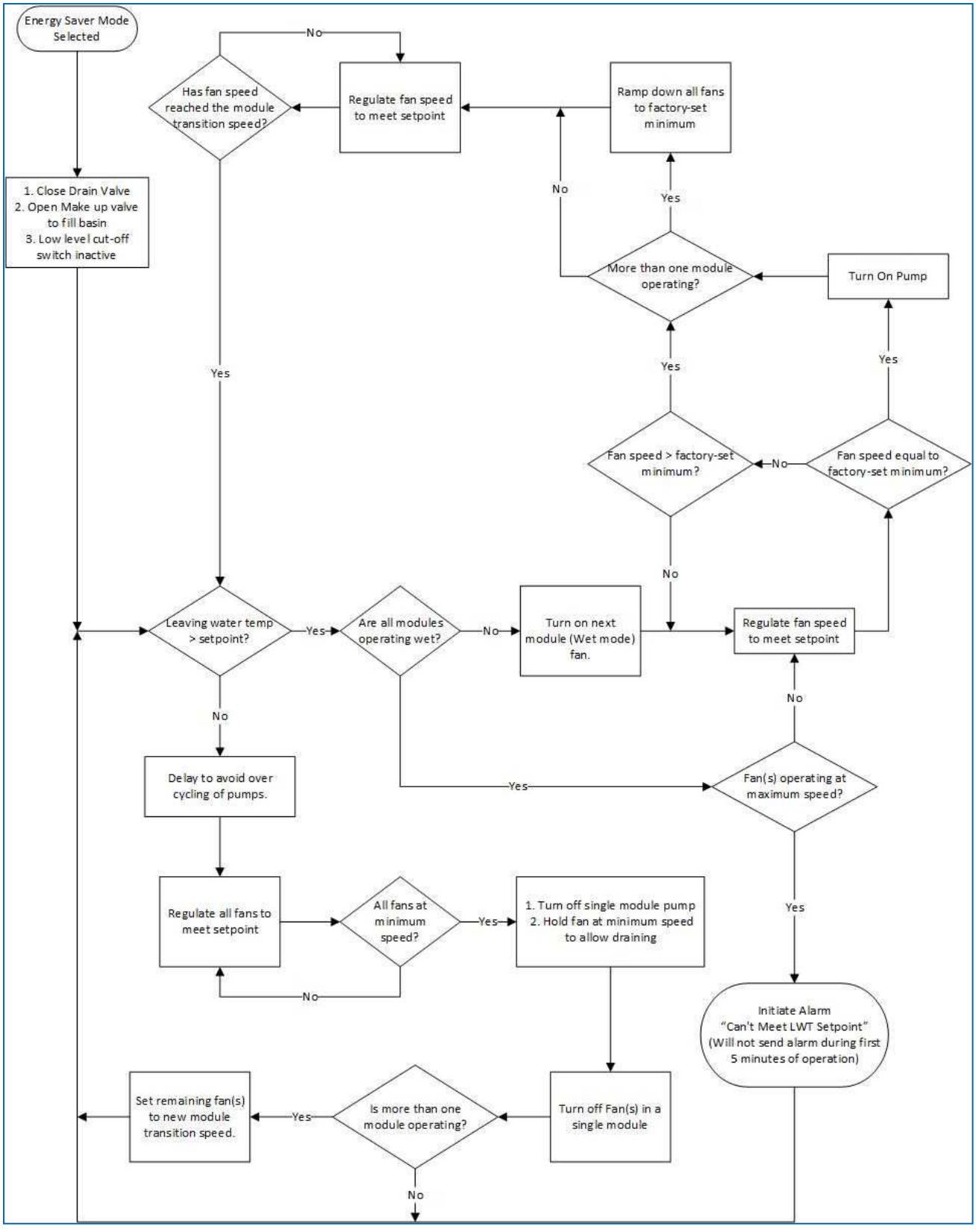
- As demand increases, the fan(s) in one module turns on.
- When fan(s) in that first module reaches the minimum speed*, the pump in that module turns on (all other module are off)
- When fan(s) in that first wet module reach the iPilotTM Control System's defined dry to wet transition speed, fan(s) and pump in a second module turn on, and all fans go to the minimum speed
- This sequence continues until all modules are running wet. All fans will then adjust at the same speed to further maximize energy savings.

* The minimum fan speed is defined by BAC and maximizes energy savings.

Starting from "on" under 100% load on design day:

- All pumps and fans are turned on.
- As demand drops, all fans ramp down together.
- Once all fans reach the minimum speed, one of the modules turns off (fan and pump), and operating fans adjust accordingly.
- If demand drops enough where the minimum speed is reached again, another module turns off and all remaining fans adjust appropriately.
- This continues until one module is capable of maintaining performance or no cooling capacity is required.

During winter conditions (ambient temp 1,7 C°) the iPilotTM Control System will automatically turn off pumps to avoid freezing.



Energy saving sequence of operation

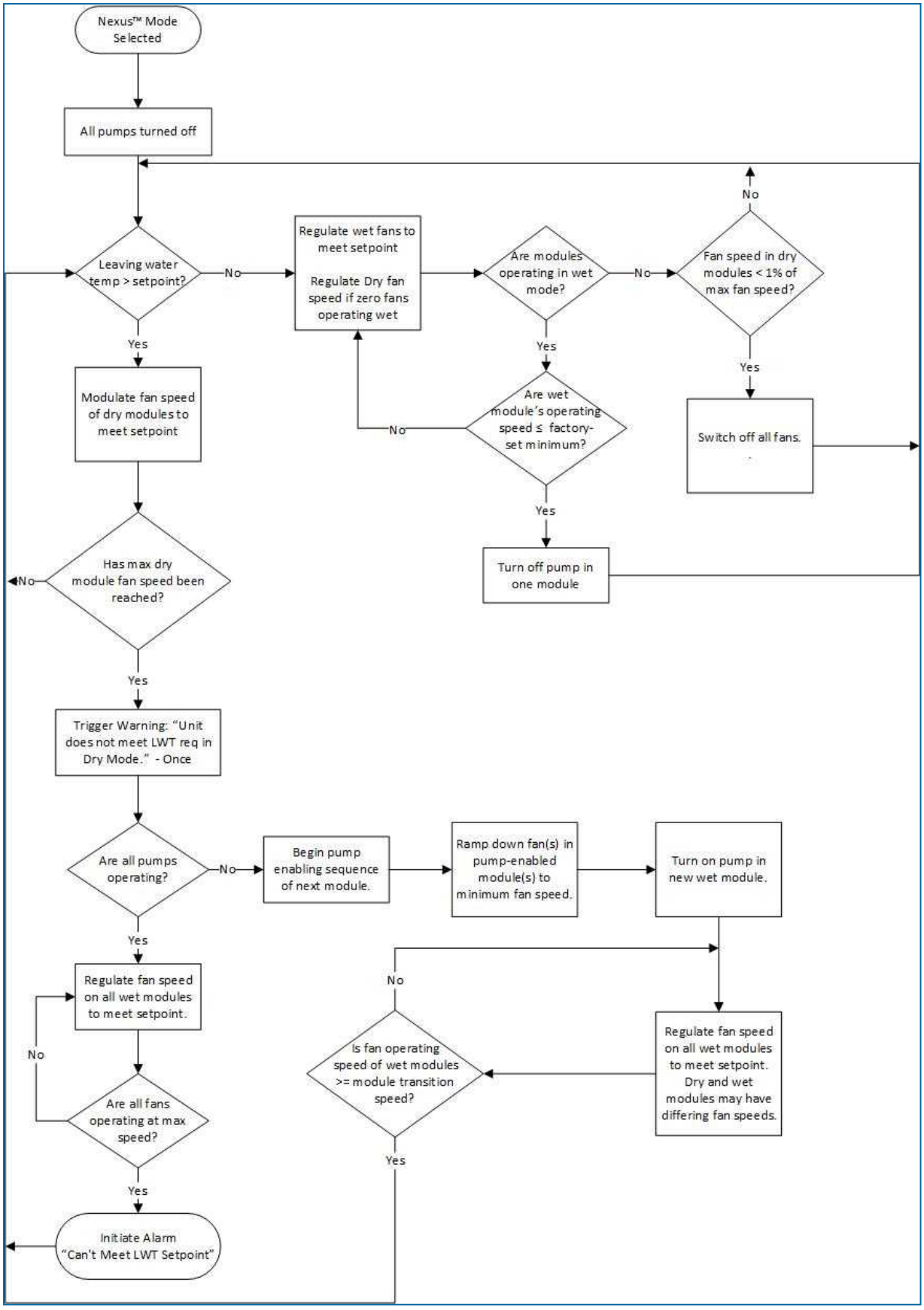
Nexus Mode

At start-up, pumps remain off, all fans operate in unison for maximum energy savings:

- All fans modulate to meet leaving water temperature setpoint (customer defined).
- If demand increases and allf ans are at maximum dry operation speed, the pump in one of the modules turns on and that module's fan speed reduces to the minimum speed*.
- After one module is operating wet, the maxium dry fan speed limiation (defined by the customer) now determines when the next module will begin to operate wet. This is shown as a 1-7 scale in the control menu. This is how the customer can tune their energy saving and water saving to the exact amount depending on their needs.
- The higher your setting (7 = MAX), the more water is saved by using more capacity from the modules operating dry. As the setting is lowered (1 = MIN), more of the load is transferred to the modules operating wet, thus increasing energy savings.
- As demand further increases, pump in a second module turns on an all the modules running wet go to the minimum speed*. From there, all fans in modules operating wet adjust to meet leaving water setpoint.
- This sequence continues until cooling load drops and modules revert to dry operation to meet customer's setpoint.

* The minimum fan speed is defined by BAC and maximizes energy savings.

During winter conditions (ambient temp 1,7 C°) the iPilotTM Control System will automatically turn off pumps to avoid freezing.



Nexus mode sequence of operation

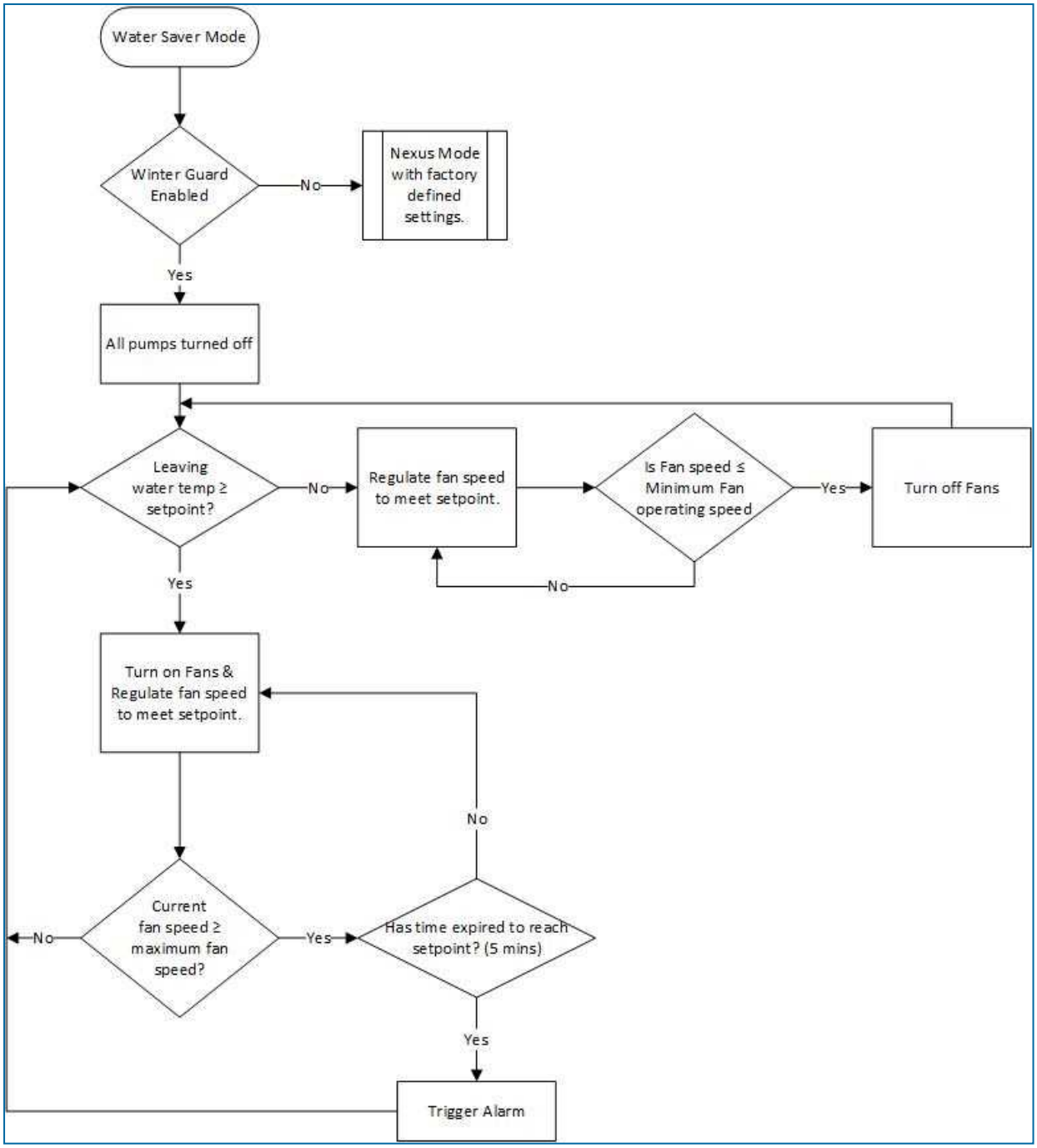
Water saver mode

At start-up, pumps remain off, all fans turn on together with no minimum speed to operate dry only.

In this mode, there are two options:

- Winter Guard Enabled: All modules always run dry and the spray pumps remain off, whether the units meet the head load demand or not. This is for absolute protection from freezing the hCoreTM Heat Transfer Technology
- Winter Guard Disabled: This is exactly the same as Nexus mode witht he only exception being the customer can not tune the maximum allowable fan speed. For modules operating dry this remains as 100%.

By default, Winter Guard option will be disabled for Water saver mode. During winter conditions (ambient temperature 1,7°C) the iPilotTM Control System will automatically switch to Winter Guard Enabled option (all modules operating dry, all the time) to avoid freezing and reduce maintenance associated with winterizing the unit, and increase operational reliability.



Water saver sequence of operation

Cold weather operation

The iPilotTM Control System has been designed to protect the equipment during freezing conditons. All spray pumps will turn off below 1,7°C ambient temperature, and the equipment will automatically operate in the Water saver mode with Winter Guard Enabled.

When the optional basin heaters are not included:

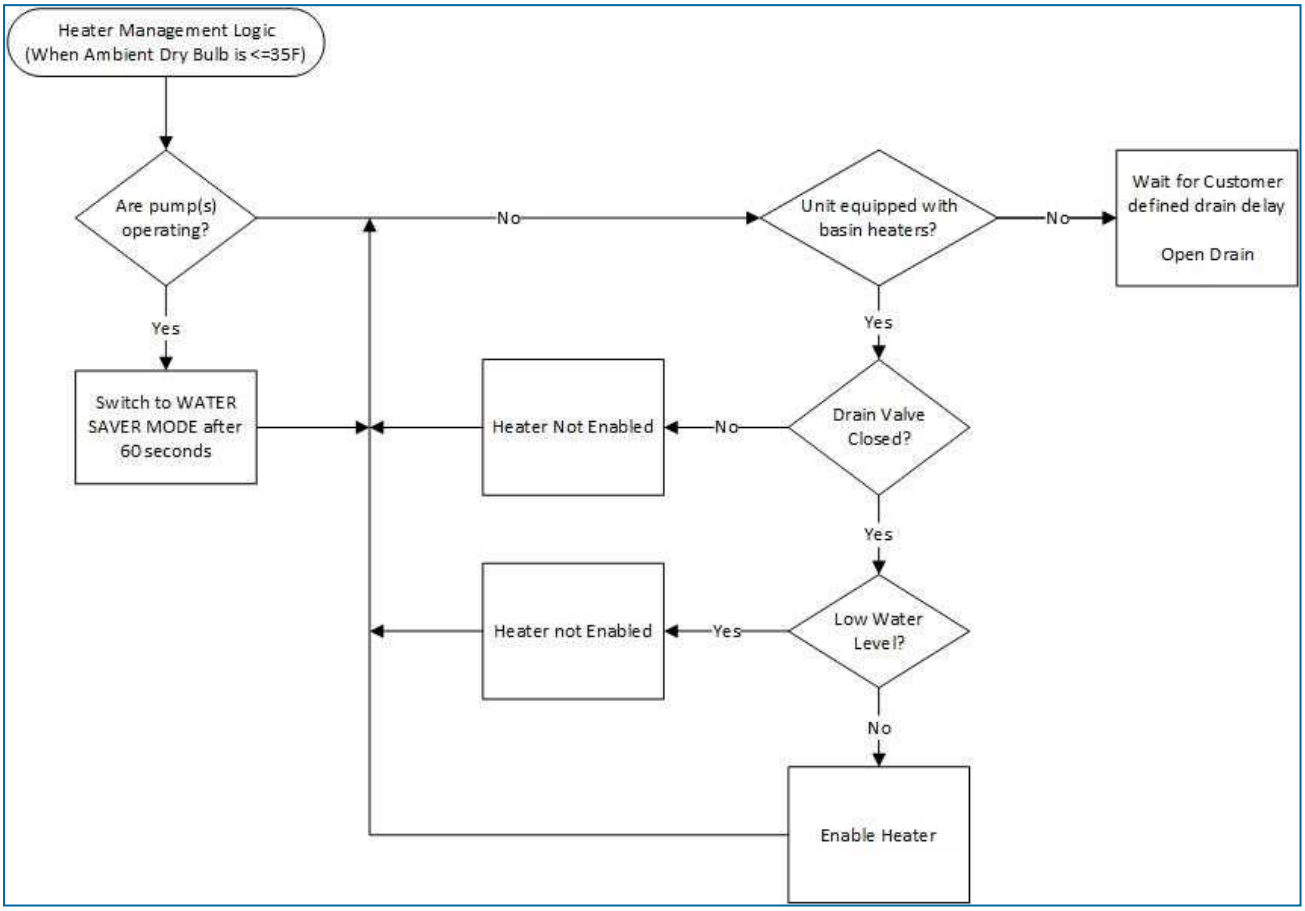
1. Once ambient temperature drops below 1,7°C, water will remain in the basin for 1 hour and then the water will be drained.
2. The solenoid make-up valve will remain closed until the ambient temperature is above 1,7°C and when evaporative cooling is required.

When optional basin heater(s) are included, the basin heater(s) turn on when the following conditions are met:

1. Spray water basin temperature drops below 4,4°C.

2. Spray pumps are off.
3. Sufficient water level in the basin.

When the ambient temperature remains below 4,4°C, water will remain in the basin for the duration of the user-defined time-based drain.



Cold weather heater management sequence of operation

Water Management Logic

Periodic bleed

Bleed is set to occur at a consistent interval for a defined length of time. Both the interval between bleeding and the length of bleed time is customer-defined within the iPilotTM Control System menu. Periodic bleed can be disabled though (not recommended).

Conductivity bleed

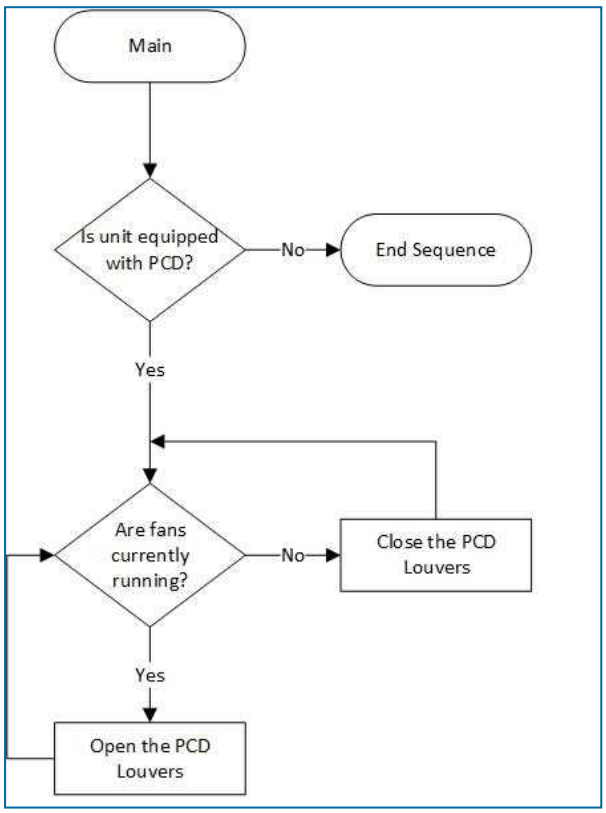
Bleed is based on the customer-defined conductivity level. Bleeding will stop once the conductivity reaches the customer-defined differential value. For example, if the customer conductivity setpoint is 3000 mircoohms/cm, and the differential is set at 500 microohms/cm, then the bleed would begin once the conductivity reaches 3000 and stop once it is reduced to 2500. The configurable range of setpoint is 2000-4000 microohms/cm.

Periodic drain

Basin is set to completely drain at the customer-defined interval. Default is 24 hours. Periodic drain can also be disabled (not recommended).

Postitive closure damper operation

For units equipped with a positive closure damper (PCD), the iPilotTM Control System will not allow the PCD to close if the fans are in operation.



Positive closure damper sequence of operation

Controller

The controller with built-in display:

User interface keys and functions

	**Alarm**	This button illuminates red when an alarm is present. Pressing the button will display the alarm description.
	**Prg**	Displays all the main submenus.
	**Esc**	Bringing the menu back to the previous screen.
	**Up and down**	Scroll through the options.
	**Enter**	Accepts changes made.

Main menu's

USER MENU

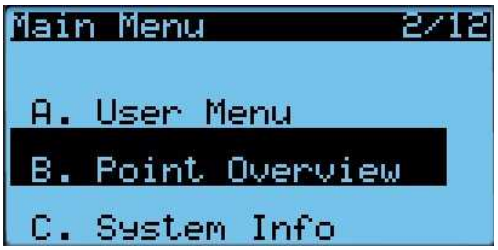
Key system parameters can be defined in this menu, including leaving process fluid set point, language, unit and BMS configuration.

See additional information in "User Menu (E)" on page 20

POINT OVERVIEW

Components and subcomponents can be tested in manual mode during start-up and troubleshooting.

See additional information in "Point overview menu (V)" on page 24.

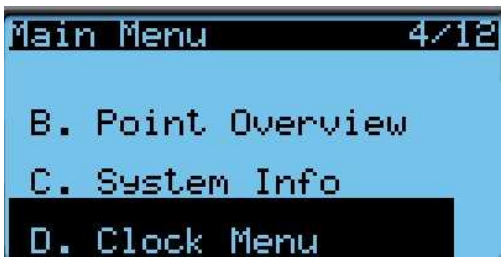


SYSTEM INFORMATION

Software information and OS version can be retrieved.

CLOCK MENU

This is to setup system time, date and time zone for different regions.



ALARM LOGS

System alarm and warning information can be retrieved.

Inputs and outputs

A detailed overview of the specific in- ad outputs for your unit can be found in the wiring diagram in the submittal package.

DESCRIPTION OF THE USED INPUT TERMINALS:

Terminal	Input type	Function
V1	NTC sensor	Fluid outlet temperature measurement
V2	NTC sensor	Ambient temperature measurement
ID1	Dry contact from BMS	Remote start/stop
U4	Conductivity sensor	Cold water basin conductivity measurements
U5	Analog input (0-10 V or 4-20 mA)	Customer input, to control fan speed

DESCRIPTION OF THE USED OUTPUT TERMINALS:

Terminal	Output type	Function
NO7	Dry contact: (O: no alarm / C: alarm)	General alarm

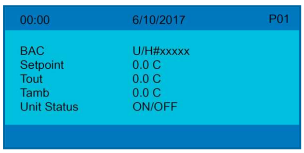
Menu overview

Menu	Screen reference	Function
Main loop	P	Readout: • Unit status (ON/OFF) • Fluid outlet and ambient temperature • Fan speed
User	E	Set: • Run Authorization • Language, Unit of Measure • Operating mode • Leaving water temperature setpoint • PI parameters • Time delay on alarm messages • BMS communication settings • Conductivity based bleed • Time based bleed and drain The standard password for the User Menu is “0000”.
Point overview	V	Readout input status (Temperatures, conductivity sensors, pumps, level switches, etch) and troubleshoot wiring and components in Manual mode: • Pump(s) • Fan(s) • Drain/make-up electronic valve • Alarm export • Data log export • Heaters (optional)
System info	S	Readout the software and bios version.
Clock menu	C	Set the system time and date.
Alarm logs	Record	Alarm and warning history from the user interface.
Manufacturer	Various	**This menu is password protected and accessible by authorized personnel only.**
Maintenance	Various	**This menu is password protected and accessible by authorized personnel only.**

Main Loop (P)

The screens in the Main Loop Menu are read-only and cannot be edited.

Screen P01

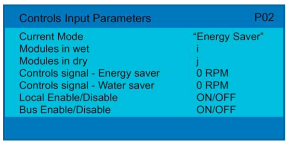


Main screen with general information:

- Date and time.
- The unit serial number (read only)
- "**Setpoint**": the active setpoint for the fluid outlet temperature.
- "**Tout**": the measured fluid outlet temperature.
- "**Tamb**": the measured ambient temperature.
- The unit status: "**ON**" or "**OFF**".

Note *When unit status is ON the equipment is enabled to respond to any heat rejection requirement.*

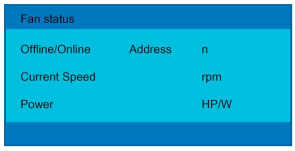
Screen P02



Overview of all inputs:

- "**Current mode**": shows current operating mode, example "Energy saver", "Water Saver", "Nexus"
- "**Modules in wet mode**":number of modules operating wet
- "**Modules in dry mode**":number of modules operating dry
- "**Control signal - Energy saver**": fan speed - energy saver mode
- "**Control signal - Water saver**": fan speed - water saver mode
- "**Local Enable/Disable**": the status of the remote start/stop (dry contact between terminals 21A en 23).
- "**BUS En/Dis**": the status of the BMS controlled variable "**Run authorization**" (refer to screen E02).

Screen P03-P14



EC fan system information screens:

- “**Fan status**”: "Online" or "Offline" and fan address: "Addr:01 and soon"
- “**Fan speed**”: actual fan operating speed
- "**Power**": average power per fan
-

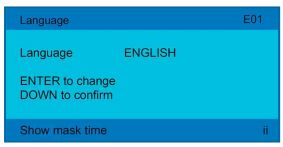
Note *PO3-P14, for maximum 12 fans on NXF-0603-x*

Note *In case an EC fan system shows the status "Offline", check the power supply and the Modbus communication wiring to the fan. Also, make sure that the fan(s) are addressed correctly.*

User Menu (E)

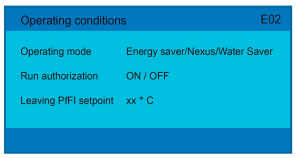
The screens in the User Menu are editable. The standard password is “0000”.

Screen E01



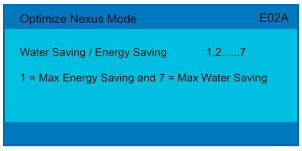
- “**Language**”: sets the controller language to English, Italian, French, Dutch, Spanish or German.
- “**Unit system**”: sets the unit of measure of controls to US, UK, CANADA, LONDON, SI.
- "**Site**": BAC job number (starts with "H") for the job site reference.

Screen E02



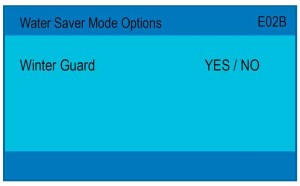
- “**Operating mode**”: select the operating mode from Energy saver, Nexus, Water saver
- “**Run authorization**”: activate or deactivate the unit. This variable can either be set directly in this screen or via a BMS variable. Refer to .
- “**Leaving PrFI Setpoint**”: set the required leaving process fluid temperature setpoint.

Screen E02A



For Nexus mode selection on E02, water and energy savings can be optimized from dry to wet with "1" corresponding to maximum energy savings and "7" corresponding to maximum water savings.

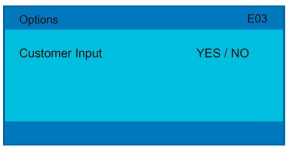
Screen E02B



Water saver mode is further divided in to two categories:

- **Winter Guard Disabled (default)**: Modules are allowed to switch to wet operation as needed.
- **Winter Guard Enabled**: Modules always operate dry.

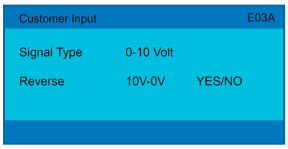
Screen E03



Options Enable / Disable

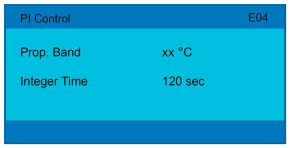
- "**Customer input**": Analog input to control fan/fan speed

Screen E03A



Once the customer input signal is enabled, type of signal can be defined as 0-10V or 4-20mA.
Reverse signal - Yes/No

Screen E04

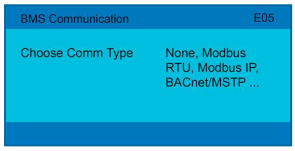


PI-parameters: Determine the reaction speed to changes in fluid outlet temperature

- "**Prop. Band**": sets value for the proportional band of the PI controller.
- "**Integer Time**": sets the value for the integration time of the PI controller.

> ***Note*** *Make the unit react faster (slower) to changes in fluid outlet temperature by decreasing (increasing) the proportional band and integration time.*

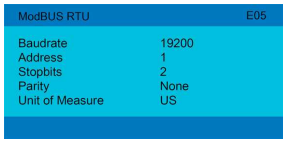
Screens E05



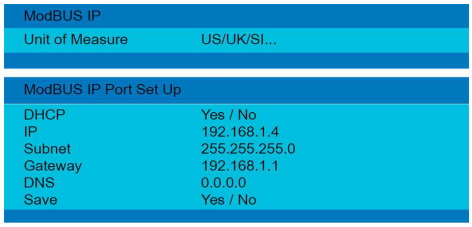
BMS communication: Enable / disable and define communication typepre-cooler temperature and fan speed switchpoints and time delays:

- "**Choose Comm Type**" : None, Modbus RTU, Modbus IP, BACnet/MTSP, BACnet/IP
- "BMS On/Off Control": No/Yes

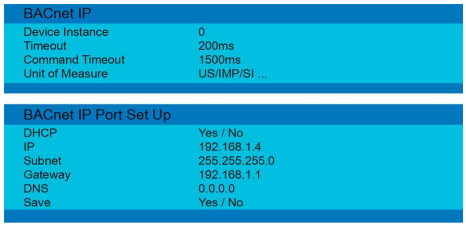
Screens E05 - Configure options for Modbus RTU



Screens E05 - Configure options for BACnet MSTP



Screens E05 - Configure options for BACnet IP

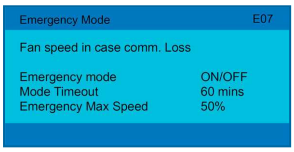


Screens E06

Alarm detection delays:

- **“Alarm delay”**: time delay for EC fan alarms and warnings.
- **“Sensor alarm delay"**: time delay for alarms from the fluid outlet temperature and ambient sensor.
- **“Network comm. loss delay**: time delay for the loss of communication between units (only available for BMS and Customur Input Modes).

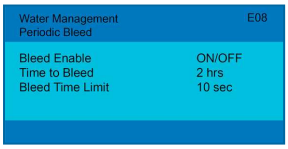
Screens E07



EC fan emergency mode management:
Enable the EC fan emergency mode to select a fixed fan speed when the Modbus communication between the PLC and the EC fans is lost.
In case the EC fan emergency mode is disabled, the fan(s) will continue to operate at the last known fan speed.

- “**Emergency mode**: “**ON**” or “**OFF**”: enable or disable the EC fan mode.
- “**Mode Timeout**”: time delay before the EC fan emergency mode activates.
- “**Emergency Max speed**”: 50% of max. allowable speed (adjustable)

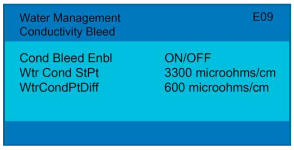
Screen E08



Water management - Periodic bleed:

- “**Bleed enable**”: ON/OFF
- **"Bleed cycle"**: frequency of bleed
- **"Bleed Time Limit"**: duration of bleed

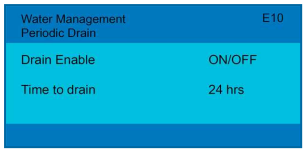
Screen E09



Water management - Conductivity based bleed:

- **"Cond Bleed Enbl"**: ON/OFF
- **"Wtr Cond StPt"**: Threshold value at which bleed starts
- **"WtrCondPtDiff"**: Differential value at which bleed stops (setpoint - differential)

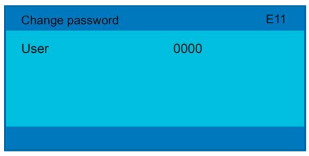
Screen E10



Water management - Periodic bleed:

- “**Drain enable**”: ON/OFF
- **"Drain cycle"**: time to drain

Screen E11

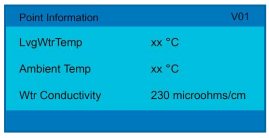


Set and change the user password.

Point overview menu (V)

The screens in the Point overview menu are developed to troubleshoot and test different components in Manual mode.

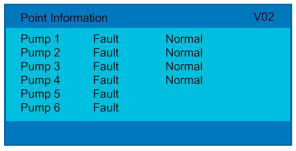
Screen V01



Show operating values (read only)

- Leaving process fluid temperature
- Ambient temperature
- Water conductivity

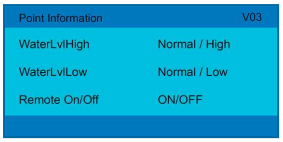
Screen V02



Screen shows pump status based on unit configuration.

Example *Unit configured for 4 modules and all pumps are normal.*

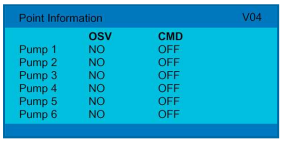
Screen V03



Screen shows the basin water level switch status and remote dry contact status (read only)

- "**WaterLvlHigh**" : High level switch
- "**WaterLvlow**" : Low level switch
- "**Remote On/Off**" : Remote dry contact

Screen V04

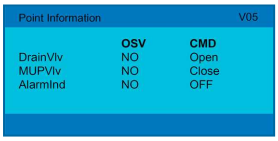


Pump status and testing in manual mode (Read/Write)

- "**OSV**" : Our of status value (manual mode), for testing pump and pump wiring turn ON the OSC status on the pump.
- "**CMD**" : Command, when the system is live (not in manual mode) this should show "ON".

Note | *For V04-V06: To run the system in live mode, ensure that all pump OSV statuses are "NO".*

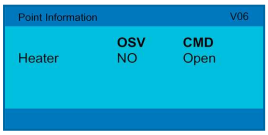
Screen V05



Drain and make-up testing in manual mode (Read/Write)

- "**OSV**" : Our of status value (manual mode) - to test heater and corresponding wiring, turn ON the OSV status on the heater. Ensure that heater control panel is turned ON.
- "**CMD**" : Command, when the system is live (not in manual mode) - This will show the current state of the component.

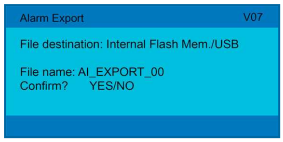
Screen V06



Heater and heater wiring testing in Manual Mode (Read/Write). The screen will only be available if the heater option is purchased on the product.

- "**OSV**" : Our of status value (manual mode) - for testing heater and corresponding wiring, turn ON the OSV status on the heater. Ensure that heater control panel is turned ON.
- "**CMD**" : Command, when the system is live (not in manual mode) - This will show the current state of the component.

Screen V07

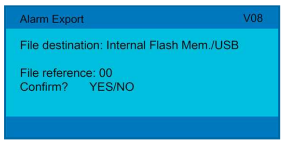


Exporting system Alarm/Warning

- **File destination**: specify destination
- **File name**: AI_EXPORT_00
- **Confirm**: YES/NO

> ***Note*** *For V07-V08: For exporting the file to USB, switch off the main disconnect on the control panel and the main door, and insert the USB into the controller. Close and lock the panle main door, turn ON the main disconnect and export the file. Follow same procedure to remove the USB from the controller.*

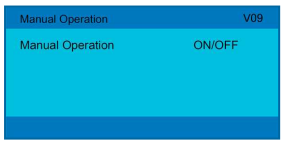
Screen V08



Exporting system data log history

- **"File destination"** : specify destination
- **"File reference"** : 00
- **"Confirm"** : YES/NO

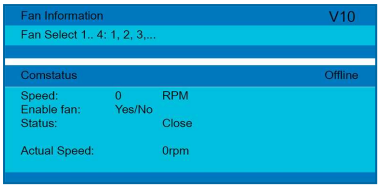
Screen V09



The entire system can be take offline by enabling manual mode from this screen.
In live or manual mode, follow system/components safety protocols.

> ***Note*** *To operate system in live mode, ensure that all manual operation is disabled and OSV status on all the components on all other screens is "NO".*

Screen V10

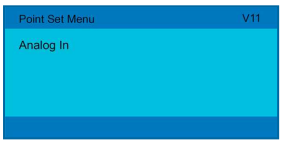


To test fan(s) in manual mode:

- Switch system to manual mode from screen V09
- Select fan
- On the next screen specify fan operating speed
- Click Esc to come out of the screen
- Once the testing is done switch of the fan by entereing "0" speed

In live or manual mode, follow system/components safety protocols.

Screen V11

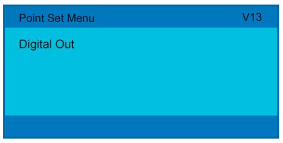


This screen is set in the factory and locked.

Screen V12

This screen is set in the factory and locked.

Screen V13

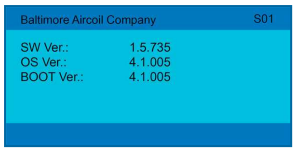


This screen is set in the factory and locked.

System Information (S)

The screens in System Information are read only and cannot be edited.

Screen S01



- "**SW Ver.**": Current software version
- "**OS Ver.**": Operating system version
- "**BOOT Ver.**": Current boot version

Screen S02

- "**Board type**": Controller type
- "**Board size**": Controller size
- "**Board temp**": 32C
- "**Ret mem writes**": Number of memory write
- "**Main task**": 200 ms 5.0cps

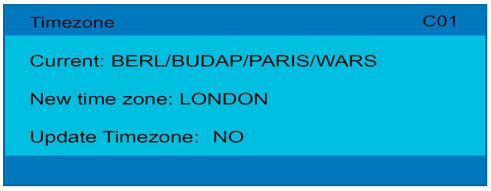
Clock Menu (C)

The screens in the Clock Menu are editable.

Screen C01

- "**Format**": Change the date format
- "**Date**": 00:00:00
- "**Hour**": 00:00:00
- "**Day**": Day

Screen C02



- "**Current**": Current time zone
- "**New time zone**": 00:00:00
- "**Update time zone**": Yes/No

Alarm Logs (Record)

The screens in the Alarm Logs are editable.

Screen Record:01

- "**Alarm number**": Alarm number
- "**Time**": Time of alarm
- "**Date**": Date of alarm
- "**Alarm type**": Alarm description
- "**Event**": Start/Operation

NXF

5 ALARMS AND WARNINGS

iPilot™ control system alarm descriptions

The iPilotTM control system has been designed with alarms and notifications to provide operating status and ensure that the equipment is operating properly.

Alarm/Warning	Type	Edge	Description	Comments
AI_retain	User reset	Positive	Error in the number of retain memory writings	Alarm
AI_Err_retain_write	User reset	Positive	Error in retain memory writings	Alarm
AI_Offline_EBM_n	Auto reset	Positive	Offline EBM n	Alarm
AI_PhaseFault_EBM_n	User reset	Positive	Phase failure EBM n	Alarm
AI_MotBlocked_EBM_n	User reset	Positive	Motor blocked EBM n	Alarm
AI_MotSuperHeating_EBM_n	User reset	Positive	Motor superheat. EMB n	Alarm
AI_IntCircSuperHeat_EBM_n	User reset	Positive	Intern. circ.superheat. EBM n	Alarm
AI_CommunicationErr_EBM_n	User reset	Positive	Communic. error EBM n	Alarm
AI_CableBreak_EBM_n	Auto reset	Positive	Cable break EBM n	Alarm
AI_IceProtection_EBM_n	Auto reset	Positive	Ice protection EBM n	Alarm
AI_HeatMotStopped_EBM_n	Auto reset	Positive	Heating: motor stop EBM n	Alarm
AI_EnergySavingMode	Auto reset	Positive	Cannot maintain temp in ES mode	Notification
AI_DryWetModeDryAlm	Auto reset	Positive	Cannot maintain temp in DW dry mode	Notification
AI_DryWetModeWetAlm	Auto reset	Positive	Cannot maintain temp in DW wet mode	Notification
AI_DryMode	Auto reset	Positive	Cannot maintain temp in dry mode	Notification
AI_WaterHighLvl	Auto reset	Positive	Water high level	Notification
AI_WaterLowLvl	Auto reset	Positive	Water low level	Alarm
AI_AmbientTempLow	Auto reset	Positive	Ambient temp low	Notification
AI_ColdWeatherActive	Auto reset	Positive	Cold weather program activated	Notification
AI_LvgWaterTempHigh	Auto reset	Positive	Temp high limit	Notification
AI_LvgWaterTempLow	Auto reset	Positive	Leaving water temp low limit	Notification
AI_BasinWaterTempHigh	Auto reset	Positive	Basin water temp high limit	Notification
AI_BasinWaterTempLow	Auto reset	Positive	Basin water temp low limit	Notification
AI_WtrCondSensorHigh	Auto reset	Positive	Water conductivity sensor high limit	Notification

Alarm/Warning	Type	Edge	Description	Comments
AI_LWT_ProbeErr	Auto reset	Positive	LWT probe error	Alarm
AI_OAT_ProbeErr	Auto reset	Positive	Outside air temp probe error	Alarm
AI_CustomerInputErr	Auto reset	Positive	Customer input error	Alarm
AI_FlowSwitch	Auto reset	Positive	Flow switch alarm	Alarm
AI_PumpmFault	User reset	Positive	Pump m fault	Alarm
AI_FanCritical	User reset	Positive	Single cell critical alarm - check cell	Alarm

Troubleshooting guide

Problem	Possible cause	Solution
Fan does not run	No power to the fans	Cycle power on/off the unit.
		Confirm that power is applied to the unit at the main disconnect.
		Confirm that power is applied to each fan by checking terminals.
		Check all terminals for tightness.
		Check power wires at fan housing.
		Check all terminal at Modbus module for tightness.
	Fan internal fault	Check for the fan alarm on the controls HMI for fan internal fault
	Control signal issue	Check with a meter the control voltage at terminal V-10V or mA depending on control signal.
		Ensure a fan speed control signal is being sent to the unit.
Fan spins backwards	Fan is off/faulty.	Turn the unit off. Allow all fans to stop completely. Check all breakers and power connections. Restart the unit and ensure all fans are operational and make sure the fan spins in the right direction. If it does not contact your local BAC representative.
Fan does not respond to the control signal	Communications fault	Ensure the communications cable is connected to the controller on port J26.
		Ensure the communications cable is not cut or damaged.
		Ensure the communications able is properly connected at the fan motor.

Problem	Possible cause	Solution
No spray water or pump does not run	Incorrect setpoint	Check the leaving process fluid temperature setpoint on the controller and the operating mode. The spray pump will only run when the ambient temperature is above 1,7°C). For additional details see "Cold Weater Operation" in the Software Instructions
	No water supply	Ensure water is being supplied to the solenoid make-up valve.
		Inspect solenoid make-up valves, and clean as required.
		Check mechanical make-up valve and float assembly by manually raising and lowering the float.
	Pump fault	Check pump voltage, and confirm that pump operates correctly in the manual mode.
	Pump strainer fault	Clean the pump strainer quarterly.
	Water distribution system clogged	Clean the spray branches and the nozzles, see the Software Instructionsfor more details.
Low performance	Not performing maintenance intervals	Inspect the water distribution system, EC fan systemand process fluid flow.
	Equipment is not operating	Ensure that leaving fluid temperature setpoint is at the desired value. Ensure that the system is not in manual mode and OSV (out of status value) status for all the components is "NO". Refer to the iPilotTM Control System in the Software Instructions for more details.
Scale formation on hCoreTM Heat Transfer Technology	Hard water	Ensure that conductivity setpoint is at the desired value. Ensure that the system is not in manual mode and OSV (out of status value) status for all the components is "NO". Refer to the iPilotTM Control System in the Software Instructions for more details.
		Increase the frequency or duration of bleed by adjusting it in either time-based bleed or conductivity-based bleed mode.
	Faulty drain valve	Ensure the drain valve opens and closes 100% in response to the iPilotTM Control System
Unit does not run in any operating mode or system does not go live	BMS communication	Ensure the BMS wiring and configuration
	Manuals mode is enabled. Components OSV status is "YES".	Turn off the manual mode. Ensure OSV (out of status value) status for all the components is "NO".

6 BMS COMMUNICATION

Communication table

Point description	Variable	ModBUS Address	BACnet ID	Datatype	Read / Write	Comment
No of cells	No_Cells	30901	1401	INT	R	1..6
No of pump running	No_PumpsRnng	30906	1406	INT	R	1..6
Fluid temp	LWtrTemp.PVal	30121	1501	REAL	R	°F/°C
Outside temp	OutTemp.PVal	30123	1502	REAL	R	°F/°C
Conductivity sensor	WtrCondSensor.PVal	30125	1503	REAL	R	µΩ/cm
Average fan speed (dry)	ActlFanSpeed	30201	1504	REAL	R	rpm (Nexus mode, Water saver mode)
Average fan speed (wet)	ActlFanSpeedWet	30205	1506	REAL	R	rpm (Nexus mode, Energy saver mode, Water saver mode)
Average fan power (dry)	FanCurrPwrDry	30203	1505	REAL	R	Watts/hp (Nexus mode, Water saver mode)
Average fan power (wet)	FanCurrPwrWet	30207	1519	REAL	R	Watts/hp (Nexus mode, Energy saver mode, Water saver mode)
Fan speed 1..12	ActlFanSpeedInfo[1..12]	30911.. 30934	1507..1518	REAL	R	rpm (2 registers each)
Fan power 1..12	EBMpapstFan_x_ Mng.BMSCurrentPower	30951.. 30974	1521..1532	REAL	R	Watts/hp (2 registers each)
Fan status 1..12	EbmpabstFan_x_Mng. Online_ EBM_1	10201.. 10212	1201..1212	BOOL	R	Online / Offline
Common alarm fan 1..12	AI_CommonAlm_Fanx. Active	10301.. 10312	1221..1232	BOOL	R	Normal / Fault
Remote input	Remote.PV	10221	1213	BOOL	R	On / Off
Modules operating (wet)	UnitLogic.No_EvapCell	30903	1403	UINT	R	Number of modules operating wet
Modules operating (dry)	UnitLogic.NO_DryCell	30904	1404	UINT	R	Number of modules operating dry
Operation mode	BMSModeSW	40906	1701	UINT	R / W	Nexus mode / Energy saver mode / Water saver mode
Conductivity setpoint	UnitLogic.BMSWtrCond-StPt	40907	1602	REAL	R / W	µΩ/cm (default per BAC water quality guidelines)
Conductivity differential setpoint	UnitLogic.BMSWtrCond-DiffStPt	40909	1603	REAL	R / W	µΩ/cm, increase (decrease) value to decrease (increase) frequency of bleed
Conductivity enable	BMS_WMCondEnble	902	1302	BOOL	R / W	Enable / disable conductivity-based bleed
Fluitd temp setpoint	BMSLWTStPt	40911	1601	REAL	R / W	Leaving process fluid setpoint
Unit status	UnitStatus	30907	1402	DINT	R	On / Off
BAC unit number	BACUnitNo	30905	1405	UDINT	R	Uxxx
Water management time bleed enable	BMS_WMTmBleedEnble	903	1303	BOOL	R / W	Enable / disable time-based bleed

Point description	Variable	ModBUS Address	BACnet ID	Datatype	Read / Write	Comment
Water management time drain enable	BMS_WMDrainEnble	904	1304	BOOL	R / W	Enable / disable time-based drain
Water management time bleed	BMS_WMTimeBleed	40913	1702	UINT	R / W	Hrs, frequency of time-based bleed
Water management time bleed limit	BMS_WMTimeBleedLmt	40914	1703	UINT	R /W	Min, duration of time-based bleed
Water management time drain	BMS_WMTimeDrain	40915	1704	UINT	R / W	Hrs, frequency of time-based drain
BMS unit command	OnOffUnitMng.BMSOnOff	901	1301	BOOL	R / W	Enables BMS communication
Customer input enable	BMS_CustomerEnable	905	1305	BOOL	R / W	Enables equipment operation via BMS communication
Customer input type	Inputs.BMS_Cust_Typ	906	1306	BOOL	R / W	0..10V or 4..20mA
Customer input reverse	Inputs.BMS_Cust_Typ_Rev	907	1307	BOOL	R / W	10V..0V
PCD alarm	AI_PCDHoodAlm	10353	1253	BOOL	R	Alarm for PCD fault
Nexus max speed limitation	BMSNexusLmt	40916	1705	UINT	R / W	Max. allowable speed for modules operating dry; decrease (increase) for energy (water) savings
Water saver winter guard enable	BMSWinterGuard	911	1311	BOOL	R / W	Enable (disable) to allow (disallow) wet operation to meet demand
Pump Status 1..6	PumpX.PVal	10801.. 10806	1801..1806	BOOL	R	On / Off
Pump Fault 1..6	AI_PumpXFault.Active	10807.. 10812	1807..1812	BOOL	R	Alarm for pump fault
Unit of measure BMS	BMS_UnitofMeasure	40922	1710	USINT	R / W	Unit of measure
Alarm reset	AlarmMng.AlrmResBy-Bms	912	1312	BOOL	R / W	Manual reset of alarms
Energy saver mode message	AI_EnergySavingMode.Active	10341	1241	BOOL	R	Heat load cannot be met
Nexus mode dry message	AI_DryWetModeDryAlm.Active	10342	1242	BOOL	R	Heat load cannot be met when all modules operate dry
Nexus mode wet message	AI_DryWetModeWetAlm.Active	10343	1243	BOOL	R	Heat load cannot be met when all modules operate wet
Water saver mode message	AI_DryMode.Active	10344	1244	BOOL	R	Heat load cannot be met when all modules operate wet
Water high level message	AI_WaterHighLvl.Active	10345	1245	BOOL	R	Water level is too high
Water low level message	AI_WaterLowLvl.Active	10346	1246	BOOL	R	Water level is too low
Cold weather active alarm	AI_ColdWeatherActive.Active	10348	1248	BOOL	R	Equipment has switched to dry mode (below 1.7°C, when operating wet)
Leaving water temp high message	AI_LvgWaterTempHigh.Active	10349	1249	BOOL	R	Leaving water temperature is above 48.9°C
Leaving water temp low alarm	AI_LvgWaterTempLow.Active	10350	1250	BOOL	R	Leaving water temperature is below 0°C
Single cell critical message	AI_FanCritical.Active	10352	1252	BOOL	R	One module is operating to maintain required heat rejection

7 FURTHER ASSISTANCE & INFORMATION

More information

REFERENCE LITERATURE

- Eurovent 9-5 (6) Recommended Code of Practice to keep your Cooling System efficient and safe. Eurovent/Cecomaf, 2002, 30p.
- Guide des Bonnes Pratiques, Legionella et Tours Aéroréfrigérantes. Ministères de l'Emploi et de la Solidarité, Ministère de l'Economie des Finances et de l'Industrie, Ministère de l'Environnement, Juin 2001, 54p.
- Voorkom Legionellose. Minsterie van de Vlaamse Gemeenschap. December 2002, 77p.
- Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems. Health & Safety Commission. 2000, 62p.
- Hygienische Anforderungen an raumlufttechnische Anlagen. VDI 6022.

INTERESTING WEBSITES

Baltimore Aircoil Company	www.BaltimoreAircoil.com
BAC Service website	www.BACservice.eu
Eurovent	www.eurovent-certification.com
European Working Group on Legionella Infections (EWGLI)	EWGLI
ASHRAE	www.ashrae.org
Uniclima	www.uniclima.fr
Association des Ingénieurs et techniciens en Climatique, Ventilation et Froid	www.aicvf.org
Health and Safety Executive	www.hse.gov.uk

ORIGINAL DOCUMENTATION

This manual is originally made in English. Translations are provided for your convenience. In the event of discrepancies, the English original text shall prevail over the translation.

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