ARMSTRONG

Design Envelope

Integrated Tower Controller

Installation and operating instructions

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CONTENTS

Armstrong Integrated Tower Controllers, are completely factory-assembled, tested, and shipped to the job site as integral units ready to receive incoming power supply. These instructions describe the procedures to be followed during installation, commissioning and operation to ensure optimum performance and reliability. When contacting the factory for assistance, please provide the unit Serial Number and other pertinent data.

1 INSTALLATION INSTRUCTIONS

INCOMING SUPPLY

The incoming power supply should be brought in through the bottom of the panel adjacent to the main terminals. Note that this is the only electrical connection required at the panel.

The power supply voltage is 115VAC/1/60.

Note: The control system does not support power interruption. If the operation is critical, it is up to the user to provide a ups (not included) capable of minimum 400 VA.

FIELD DEVICES INSTALLATION INSTRUCTIONS

Before attempting to start configuring the ITC Controller using the Operator Interface (HMI – touch-screen), make sure the entire field installed devices such as temperature sensors, flow sensors, tower fan communication wires are properly installed and wired to the DE ITC Controller as per wiring diagram PTC00105M0-810.

BUILDING AUTOMATION SYSTEM (BAS) CONNECTION

The DE ITC Controller is provided with an RS 485 serial port (terminals 807, 808 & 809, see page 36) for Modbus RTU or BACnet MSTP and an Ethernet port (use any available port on the panel router) for Modbus TCP or BACnet IP in order to communicate to the BAS. Select the desired protocol and its parameters on the BAS settings screen.

ENVIRONMENTAL LIMITS

Operation temperature range: 0°C - 45°C (32°F - 113°F) (must not be exposed to direct sunlight)

Operation humidity range: (10% - 85%) non-condensing

Ambient air temperature for storage: 0°C - 60°C (32°F - 140°F)

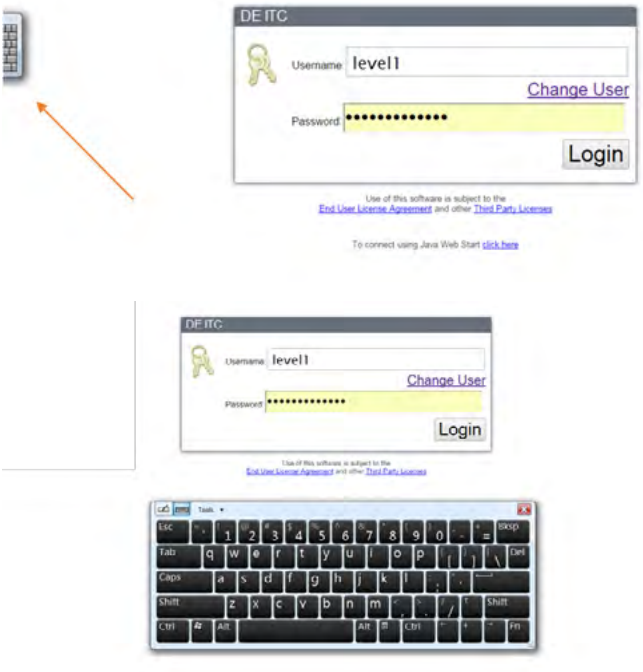
Note: All electrical wiring should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

2 USER INTERFACE OVERVIEW

LOGIN SCREEN

Upon power on, manually logout or timeout, the DE ITC shows the login screen

Touching the top left edge of the screens displays the virtual keyboard call up icon. Touch on it or drag it to the center to open the virtual keyboard.



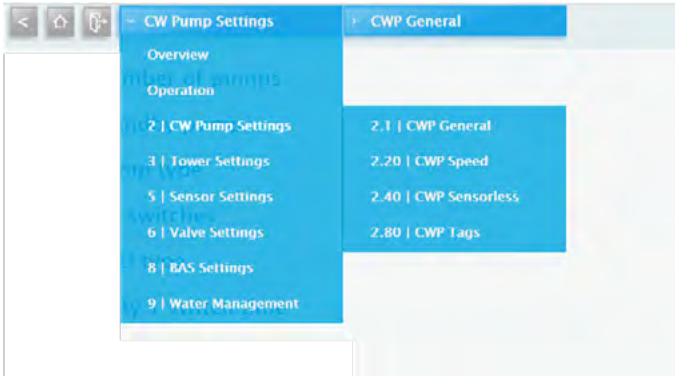
To login enter one of the following user/passwords (case sensitive). To change user click on the Change User link.

USER	PASSWORD
Level0	Armstrong23
Level1	Armstrong94

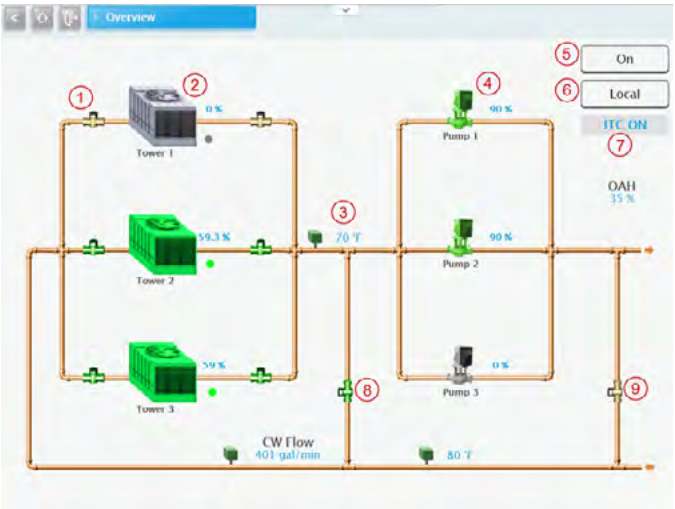
HEADER

The header is common to all screens. The following are its elements:

1 Back. Goes to previous viewed screen
2 Home. Brings up the System Overview screen
3 Logout. Logs the current user out, it brings the DE ITC login screen (see 1.1)
4 Dropdown menu. Touch/click to show the navigation menu (see picture below)
5 Dropdown submenu. Some of the selections on the dropdown menu have one more level. Touch/click to select
6 Alarms. The red icon indicates an alarm in the system, touch it to bring the Alarms screen



SYSTEM OVERVIEW



This Screen provides an overview of the entire system operating conditions. The screen shot above shows a specific plant configuration with 3 towers and equal number of pumps, however the screen dynamically adjusts to the selected configuration.

These are the main components on the screen:

1 Isolation valve icons
   A Indicate status of valve:
      - Grey: valve closed
      - Green: valve open
      - Red: Valve in alarm
   B Touching the icon opens the popup window (see **PAGE 7**)
   C If there are no isolation valves in the system (either inlet, outlet or both) the icons can be disabled via parameters 6.51 & 6.52 (see **PAGE 26**).
2 Cooling tower icons
   A Indicate status of tower fan:
      - Grey: fan not running
      - Green: fan running
      - Red: Fan in alarm
   B Fan speed feedback (in %) is shown on the side
   C Tower tag is shown below and it is configurable via parameters 3.80 to 3.84 (see **PAGE 22**)
   D Touching the icon opens the valve control popup window (see **PAGE 8**)
   E If circulator pump feedback is enabled (parameter 3.7 on **PAGE 19**), a dot appears on the right side of the tower. It indicates the status of the circulator pump:
      - Grey: pump off
      - Green: pump running
      - Red: pump in alarm
3 Sensors. The following sensors are shown on their approximate locations on the piping: LTWT, ETWT, OAT (if enabled via parameter 5.38), Humidity (if enabled via parameter 5.31). Note: Flow is obtained from sensorless readout of DE pumps.
4 Pump icons
   A Indicate status of pump
      - Grey: pump off
      - Green: pump running
      - Red: pump in alarm
   B Speed feedback (in %) is shown on the side
   C Pump tag is shown below and it is configurable via parameters 2.80 to 2.84 (see **PAGE 18**)
   D Pump mode: if the pump is in Off or in Hand, it is shown on the side. In Auto nothing is shown

5 DE ITC On/Off button
   - A Touching the button toggles between On and Off
   - B In the Off position, the DE ITC commences a normal stop sequence. All equipment will stop operating
   - C In the On position, the DE ITC is enabled to start, the actual start of the plant depends on other conditions (see Local/Remote button below)

6 DE ITC Local/Remote button
   - A Touching the button toggles between Local and Remote
   - B In the Local position, the DE ITC is enabled to start as soon as the ITC On/Off button is in the On position or:
     - As soon as the DE ITC On/Off button is in the On position and the current time and data are within the scheduler program (if the scheduler option is enabled parameter 7.28) or:
     - As soon as the DE ITC On/Off button is in the On position and the current OAT is within the allowed range (OAT function should be enabled on parameters 7.25, 7.26 & 7.27) or:
     - A combination of the previous two if both functions are enabled

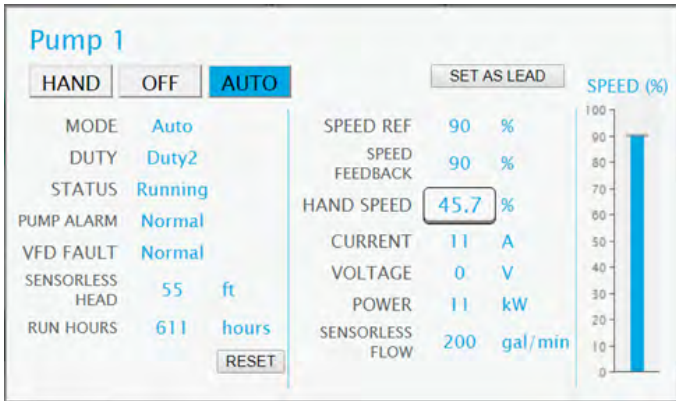
7 DE ITC status indicator
   - A Show if DE ITC is ON or OFF

8 Tower bypass valve icon
   - A Indicates status of valve:
     - Grey: valve closed
     - Green: valve open more than 5%
     - Red: Valve in alarm
   - B Touching the icon opens the valve control popup window (see **PAGE 8**)
   - C If there is no tower bypass valve in the system the icon can be disabled via parameter 6.60 (see **PAGE 27**)

9 Distribution bypass valve icon
   - A Indicates status of valve:
     - Grey: valve closed
     - Green: valve open more than 5%
     - Red: Valve in alarm
   - B Touching the icon opens the valve control popup window (see **PAGE 8**)
   - C If there is no distribution bypass valve in the system the icon can be disabled via parameter 6.70 (see **PAGE 28**)

PUMP CONTROL SCREEN

This popup screen provides control of pumps. One screen per pump

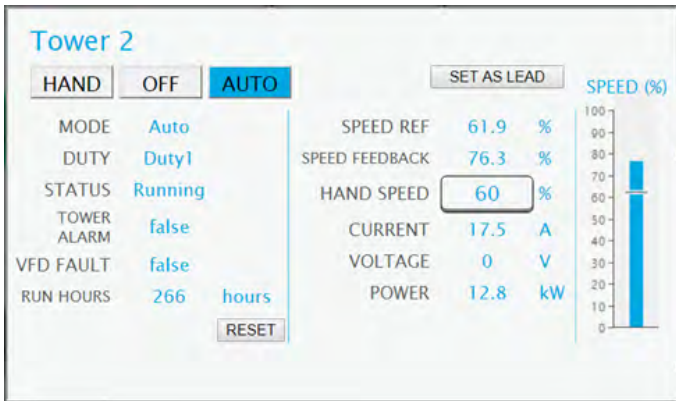


FIELD	MEANING
MODE	Indicates pump current mode HAND, OFF or AUTO. (NA means pumps is not enabled)
DUTY	Displays the pump duty status Duty1, Duty2, Duty3 etc. or Stand-by if selected. If the pump is Off or in Alarm NA is displayed
STATUS	Displays Pump status (Running/Off/Alarm)
PUMP ALARM	Displays Normal or Alarm to indicate the pump status
VFD FAULT	Displays Normal or Fault to indicate the VFD status
SENSORLESS HEAD	Displays pump head obtained from sensorless calculation
RUN HOURS	Indicates the pump total running time since the last reset and can be reset by pressing the **Reset** button.
SPEED REF	Displays the reference speed sent to the VFD in % value of pump full speed
SPEED FEEDBACK	Displays the pump actual speed feedback from the VFD in % value of pump full speed
HAND SPEED	When in **Hand** mode, enter the desired speed in the **Hand Speed** box
CURRENT	Displays pump current in Amps
VOLTAGE	Displays pump AC Voltage
POWER	Displays pump power in kWs
SENSORLESS FLOW	Displays pump flow obtained from sensorless calculation
SPEED GRAPH	Controller output speed (Reference speed sent to the VFD) is displayed in % value of pump full speed in the bar graph. Pump actual speed (Feedback from the VFD) is displayed in % value of pump full speed in the bar graph

BUTTON	FUNCTION
HAND	Sets the pump in Hand mode
OFF	Sets the pump in Off mode
AUTO	Sets the pump in Auto mode
SET AS LEAD	Press to set the pump as lead pump, also referenced as Duty1. The other pumps in the ITC will rearrange themselves as Duty2, Duty3, etc. or Stand-by if selected

COOLING TOWER CONTROL SCREEN

This popup screen provides control of tower and their fans. One screen per tower



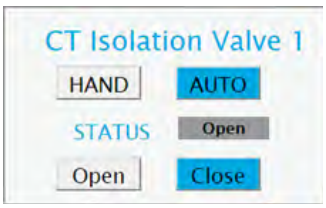
FIELD	MEANING
MODE	Indicates fan current mode HAND, OFF or AUTO. (NA means pumps is not enabled)
DUTY	Displays the tower duty status Duty1, Duty2, Duty3 etc. or Stand-by if selected. If the fan is Off or in Alarm NA is displayed
STATUS	Displays Fan status (Running/Off/Alarm)
TOWER ALARM	Displays Alarm or False to indicate tower status
VFD FAULT	Displays Fault or False to indicate the VFD status
RUN HOURS	Indicates the pump total running time since the last reset and can be reset by pressing the **Reset** button.
SPEED REF	Displays the reference speed sent to the VFD in % value of fan full speed
SPEED FEED-BACK	Displays the fan actual speed feedback from the VFD in % value of fan full speed
HAND SPEED	When in **Hand** mode, enter the desired speed in the **Hand Speed** box

FIELD	MEANING
CURRENT	Displays fan current in Amps
VOLTAGE	Displays fan AC Voltage
POWER	Displays fan power in kWs
SPEED GRAPH	Controller output speed (Reference speed sent to the VFD) is displayed in % value of fan full speed in the bar graph. Fan actual speed (Feedback from the VFD) is displayed in % value of fan full speed in the bar graph

BUTTON	FUNCTION
HAND	Sets the pump in Hand mode
OFF	Sets the pump in Off mode
AUTO	Sets the pump in Auto mode
SET AS LEAD	Press to set the pump as lead pump, also referenced as Duty1. The other pumps in the ITC will rearrange themselves as Duty2, Duty3, etc.

COOLING TOWER ISOLATION VALVES CONTROL SCREENS

These popup screens provide control of the tower isolation valves, there is one screen per valve (inlet and outlet). If the valves are not present (see parameters 6.55 & 6.56 on **PAGE 26**) the valves don't appear on the overview screen and these popup screens are not available.



FIELD	MEANING
STATUS	Indicates the position of the valve or if it is in alarm

BUTTON	FUNCTION
HAND	Sets the valve in Hand mode, the user controls its position
AUTO	Sets the valve in Auto mode, the DE ITC controls its position
OPEN	When in Hand, hitting this button sends the command to open the valve
CLOSE	When in Hand, hitting this button sends the command to close the valve

BYPASS VALVE CONTROL SCREENS

These popup screens provide control of the bypass valves, there is one screen per valve (tower and distribution). If the valves are not enabled (see parameters 6.60 & 6.70 on **PAGE 27** & **PAGE 28**) the valves don't appear on the overview screen and these popup screens are not available.

FIELD	MEANING
POSITION FEEDBACK	Indicates the position of the valve in percentage, this is obtained from a transmitter. If said transmitter is not available it can be disabled via parameters 5.36 & 5.41 on **PAGE 24**, in that case this field shows the valve command directly.

BUTTON	FUNCTION
HAND	Sets the valve in Hand mode, the user controls its position
AUTO	Sets the valve in Auto mode, the DE ITC controls its position
HAND COMMAND	Allows the user enter the desired valve position in percentage when the valve is in Hand mode

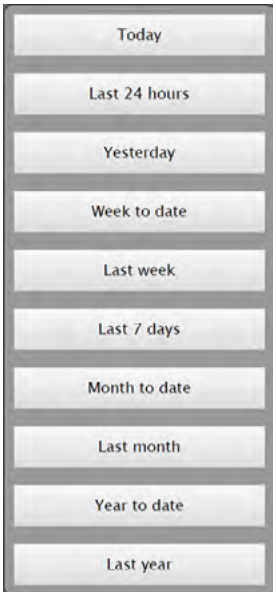
3 OPERATION

ALARMS

FIELD	MEANING
Description	Displays descriptions of active alarms, for more details see **PAGE 9**
Timestamp	Indicates the time when the alarm fired. Alarms are displayed in chronological order with the most recent at the top

BUTTON	FUNCTION
Reset alarms	Resets all active alarms and clears the list if there are no more active alarms

ALARM HISTORY SCREEN



FIELD	MEANING
Description	Displays descriptions of alarms in the history, for more details of each alarm see **PAGE 9**
Timestamp	Indicates the time when the alarm fired. Alarms are displayed in chronological order with the most recent (of the selected period) at the top
Cleared	Indicates the time when the alarm was cleared or if it is still active

BUTTON	FUNCTION
Filter	Opens the history period selection menu, select an option and only the history corresponding to that period will be displayed. The options are: Today/Last 24 Hours/Yesterday/ Week to Date/Last Week/Last 7 Days/Month to Date/Last Month/Year to Date/Last Year. When first accessing the alarm history screen the period defaults to Today.

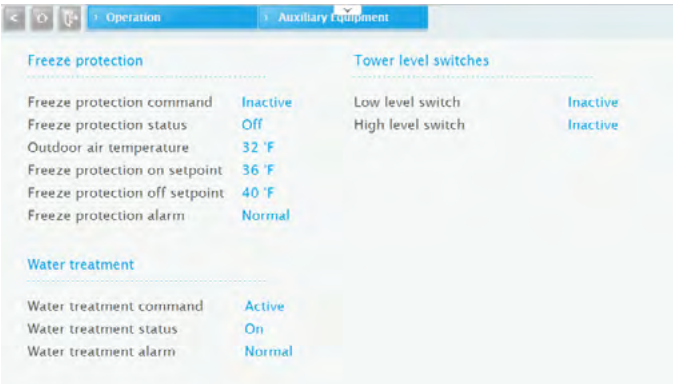
LIST OF ALARMS

ALARM	DESCRIPTION	POSSIBLE CAUSES
Sensor Alarm	There is a sensor alarm in the system	
CWP n No Run Feedback Alarm	The PLC didn't detect the pump run feedback after commanding the pump to start. This alarm auto-resets every 5 minutes	• VFD not configured for serial control • VFD not in AUTO at the local panel • Impeller is stuck
CWP n VFD Fault Alarm	The pump VFD is reporting a fault. This alarm auto-resets every 5 minutes	• VFD over current or other problem. Check VFD local display
CWP n Communication Alarm	The IPC does not have communication with the pump VFD. This alarm auto-resets every 30 seconds	• Not proper VFD selected (parameter 2.6) • VFD not configured for serial communication • Loose or broken wire from VFD • Damaged serial port on Jace
Leaving Tower Water Temperature Transmitter Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Entering Tower Water Temperature Transmitter Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Outdoor Air Temperature Transmitter Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Outdoor Air Humidity Transmitter Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Tower Bypass Valve Feedback Sensor Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Distribution Bypass Valve Feedback Sensor Alarm	The PLC detects a signal out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter

ALARM	DESCRIPTION	POSSIBLE CAUSES
Fan n No Run Feedback Alarm	The PLC didn't detect the cooling tower fan run feedback after commanding the fan to start. This alarm auto-resets every 5 minutes	• VFD not configured for serial control • VFD not in AUTO at the local panel
Fan n VFD Fault Alarm	The cooling tower fan VFD is reporting a fault. This alarm auto-resets every 5 minutes	• VFD over current or other problem. Check VFD local display
Fan n Communication Alarm	The IPC does not have communication with the cooling tower fan VFD. This alarm auto-resets every 30 seconds	• Not proper VFD selected (parameter 3.21) • VFD not configured for serial communication • Loose or broken wire from VFD • Damaged serial port on Jace
Cooling Tower Inlet Isolation Valve n Open Feedback Alarm	The valve is not at the open position after the corresponding delay expires	• There is a problem with valve position limit switch • The valve is not operating • Loose or broken wire from limit switch or to valve actuator • Damaged digital input or output
Cooling Tower Inlet Isolation Valve n Close Feedback Alarm	The valve is not at the close position after the corresponding delay expires	• There is a problem with valve position limit switch • The valve is not operating • Loose or broken wire from limit switch or to valve actuator • Damaged digital input or outpu
Cooling Tower Low Level Alarm	Cooling tower water level is low, this is a critical alarm	• There is a water leak • Makeup water system not working • Damaged digital input • If low level switch is not required, disable parameter 3.5
Cooling Tower High Level Alarm	Cooling tower water level is high	• Blow down system not working • Damaged digital input • If high level switch is not required, disable parameter 3.6
Cooling Tower Outlet Isolation Valve n Open Feedback Alarm	The valve is not at the open position after the corresponding delay expires	• There is a problem with valve position limit switch • The valve is not operating • Loose or broken wire from limit switch or to valve actuator • Damaged digital input or output
Cooling Tower Outlet Isolation Valve n Close Feedback Alarm	The valve is not at the close position after the corresponding delay expires	• There is a problem with valve position limit switch • The valve is not operating • Loose or broken wire from limit switch or to valve actuator • Damaged digital input or output
Water Treatment No Feedback Alarm	The water treatment system didn't send confirmation of operation within 30 seconds of being commanded to start	• The water treatment system is not enabled • Loose or broken wire • Damaged digital input or output • If feedback is not required, disable parameter 9.3
Freeze Protection No Feedback Alarm	The freeze protection system didn't send confirmation of operation within 30 seconds of being commanded to start	• The freeze protection system is not enabled • Loose or broken wire • Damaged digital input or output • If feedback is not required, disable parameter 9.5
c.pCOe n Offline Alarm. Critical Alarm! DE ITC unable to control plant	The IO card n is not responding. This is a critical alarm as the DE ITC is not able to obtain current information about sections of the plant nor it is able to issue commands	• Loose or broken wire • Damaged IO card • Incorrect DIP switch address on the card

ALARM	DESCRIPTION	POSSIBLE CAUSES
Emergency Stop Alarm	The emergency stop button has been pressed. All equipment is stopped	• Check Estop button if present • If no Estop button is required, place a jumper between terminals 517 & 518
Tower Bypass Valve Position Alarm	The position of the tower bypass valve differs from the commanded position more than the allowed tolerance	• Check wiring from valve feedback (signal should be VDC) • Verify valve receives and follows command • Damaged analog input • If feedback is not required, disable parameter 5.36
Distribution Bypass Valve Position Alarm	The position of the distribution bypass valve differs from the commanded position more than the allowed tolerance	• Check wiring from valve feedback (signal should be VDC) • Verify valve receives and follows command • Damaged analog input • If feedback is not required, disable parameter 5.41
Tower n Circulator Pump No Run Feedback Detected Alarm	The circulator pump of tower n didn't send of operation within 30 seconds of being commanded to start	• The circulator pump feedback is not enabled • Loose or broken wire • Damaged digital input or output • If feedback is not required, disable parameter 3.7

AUXILIARY EQUIPMENT



This screen provides information about the status of the auxiliary equipment. The following are its sections:

Freeze protection

- Command
  - **Inactive:** The DE ITC is not commanding the freeze protection to operate
  - **Active:** The DE ITC is commanding the freeze protection to operate
- Status
  - **Off:** DE ITC is not receiving run feedback from the freeze protection
  - **On:** DE ITC is receiving run feedback from the freeze protection
- Outdoor air temperature
  - Current OAT sensor reading
- Freeze protection on setpoint
  - Shows the current OAT setpoint to turn on freeze protection (this is parameter 9.6)
- Freeze protection off setpoint
  - Shows the current OAT setpoint to turn off freeze protection (this is parameter 9.7)
- Alarm
  - **Normal:** no freeze protection alarm
  - **Alarm:** the DE ITC did not receive fun feedback from the freeze protection

Water treatment

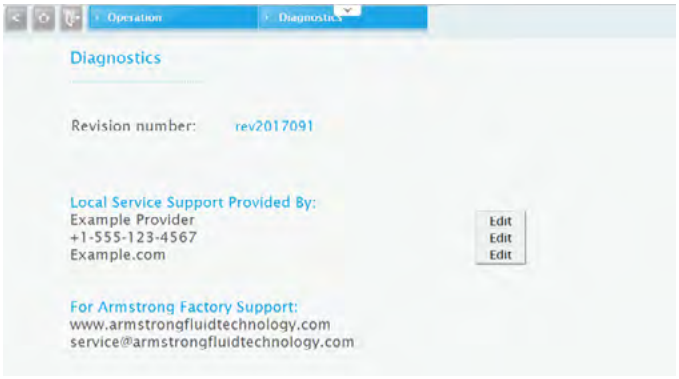
- Command
  - **Inactive:** The DE ITC is not commanding the water treatment to operate
  - **Active:** The DE ITC is commanding the water treatment to operate
- Status
  - **Off:** DE ITC is not receiving run feedback from the freeze protection
  - **On:** DE ITC is receiving run feedback from the freeze protection
- Alarm
  - **Normal:** no water treatment alarm
  - **Alarm:** the DE ITC did not receive fun feedback from the water treatment

Tower level switches

- Low level switch
  - Inactive: The tower water level is not low
  - Active: The tower water level is low. This is a critical condition and generates an alarm, however the DE ITC keeps running all equipment

- High level switch
  - **Inactive:** The tower water level is not high
  - **Active:** The tower water level is high. This is a somewhat critical condition and generates an alarm, however the DE ITC keeps running all equipment

DIAGNOSTICS



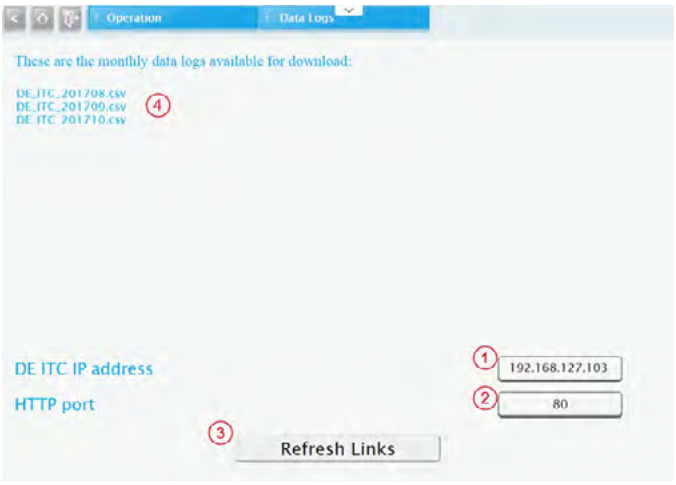
This screen provides information about the software revision and contact for service.

- Indicates the current revision installed
- Contact of the local service support representative. The Name, phone and web address of the local supplier are editable by pressing the corresponding Edit

BUTTONS

- Factory support contact

DATA LOGS



This screen allows the user to retrieve the DE ITC data logs. The data logs are csv files that are created at the end of the month, the name of the file reflects its date, for example: DE_ITC_201710.csv is the data log corresponding to October 2017.

The DE ITC stores 12 months of data, the oldest data logs are lost when reaching the limit.

The following are the elements on the page:

1 DE ITC IP address: Contains the IP address of the DE ITC controller. The default is 192.168.127.103 and it does not need to be changed if connecting directly to the router inside panel or to the ethernet port on the side.

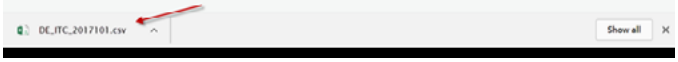
If connecting to the DE ITC remotely, enter in this field the external IP address of the controller. If in doubt enter the address on navigation bar of the browser (see below)

2 HTTP port: Indicates the port for HTTP data transferring. The default is 80 and generally it does not need to be changed. If connecting remotely, it is possible that a firewall will block traffic on this port, in that case contact the IT department for the authorized port. Optionally can be changed to 8080.

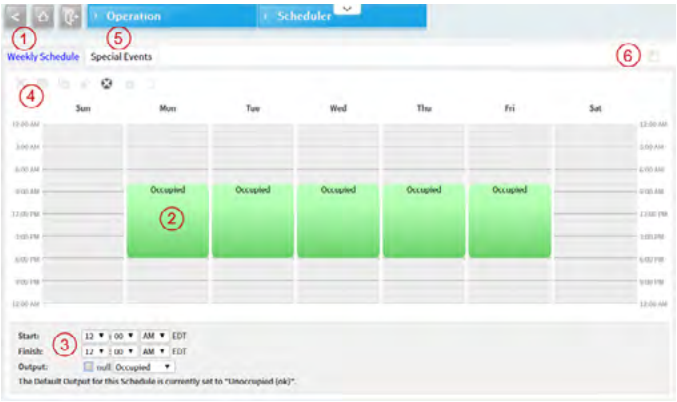
3 Refresh Links button: Press this button to display the latest list of data logs

4 List of available data logs. The last part of the name indicates the date of the log, for example DE_ITC_201710.csv is the data log corresponding to October 2017.

Touch on the name of the file to start the download process. If using Chrome as browser (recommended), when the file is downloaded it will appear at the bottom left of the browser window



SCHEDULER



Use this page to configure the DE ITC scheduler. Note: The scheduler has to be enabled via parameter 7.28, otherwise the changes don't take effect.

There are two tabs on the scheduler: Weekly Schedule & Special Events

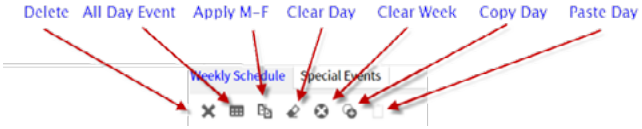
Weekly Schedule Tab (①)

Use the Weekly Schedule tab in the Scheduler view to enter regular **normal schedule events** that repeat from week to week, based on the day of the week and the time of day. Once entered, events appear as green colored blocks (②) with the label **Occupied**, while unscheduled (default) time is not assigned a color.

To add a new event simply click in a day at the approximate event start time, and drag down to define the start and finish time, as shown here.

While the event is selected you can click on the Start and Finish dropdown lists located in the lower left corner to adjust start and finish times (③).

The tool set (④) has the following options available:



Delete: Deletes the selected event.

All Day Event: Marks the whole day as Occupied

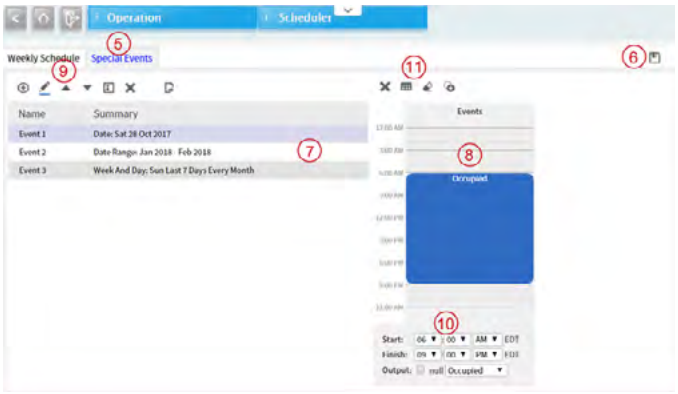
Apply M-F: Copies all events in the selected day to Mon, Tue, Wed, Thu, and Fri (and overwrites any existing events on those days).

Clear Day: Clears all events in the selected day.

Clear Week: Clears all events in the entire weekly schedule.

Copy Day: Copies all events in the selected day, to use with paste day option.

Paste Day: Appears only if copy day option was used first. Copies all events into selected day.



Special Events Tab (⑤)

Special events apply to weekly schedules only, and are considered any exception to the (normal) weekly schedule. Special events can be **one-time** only event changes or recurring event changes, such as holidays.

The Special Events tab is comprised of the Special Events table (⑦), and a 24-hour time pane (⑧). The Special Events table shows a listing of all existing schedules by name and summary. At the top of the table, controls are provided for adding, editing, or deleting schedules (⑨). In addition, Up and Down links are provided for sorting schedules in order of priority (in case of schedule overlaps). Schedules at the top have the highest priority.

A newly-created special event has no events defined. With the special event selected, click in the right-side events column and enter events as necessary. Start, finish, and output controls (⑩) (⑪) work the same as in the Weekly Schedule tab.

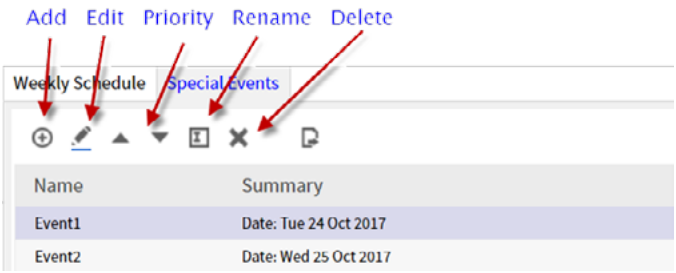
Note: You must specify events for any special event to occur. Where nothing is scheduled, the special event relinquishes control back to any lower-priority schedule events, and finally **intermingles** with the weekly schedule. To completely override the weekly schedule, configure a special event for the entire day.

Special event priorities

All special events take priority over regular weekly events. Among special events, you define relative priorities by the order of listing in the Special Events table, as follows:

- Highest priority is at top of list. Events in this special event, when active, always occur.
- Lowest priority is at bottom of list. Events occur only if not overlapped by other special events active during the same period.

Change a special event's priority by selecting it and using the priority arrow buttons, as shown in the following image.



Options may include the following:

Add: Add a new special event

Edit: Edit day(s) selection criteria (but not changing special event type).

Rename: Rename selected special event.

Priority (up): Move special event up in priority list.

Priority (down): Move special event down in priority list (same as using Priority button).

Delete: Removes selected special event from the schedule component (same as using Delete button).

After configuration of the Scheduler is done, press the Save icon (⑥) on the top right of the screen.

TRENDS

Use this page to display trends of the main variables in the system.

The list on the left side (①) shows the trends available for display. Touch the variable you want to display and it will be added on the chart area (②) and auto scaled.

You can choose up to 5 trends at the same time.

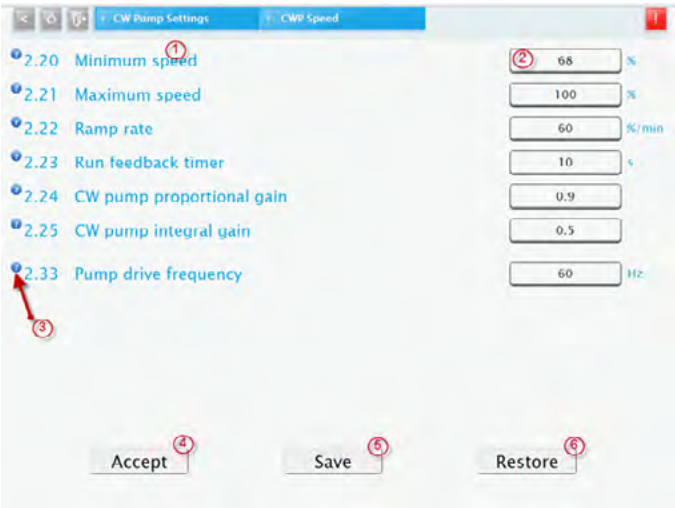
To remove a trend, touch on its name again.

Touching the filter icon (③) opens the time range menu for the trends, the options are:

- Today
- Last 24 hours
- Yesterday
- Month to date
- Everything

4 SETTINGS SCREENS

EXPLANATION

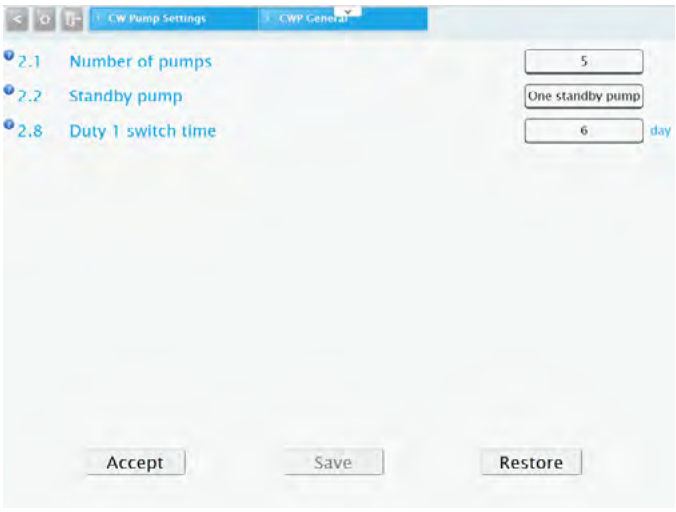


The settings screens are used to configure the DE ITC. Every setting screen has the following features/buttons in common.

1. Parameter number and name
2. Parameter value. If no white button appears, the parameter is read only (check that you are logged in with the proper credentials).
3. Hover mouse pointer over (or touch) the ? symbol next to a parameter to obtain help about said parameter
4. **Accept:** The IPC accepts the changes made to the setup. It changes from grayed out to bold when a change was made
5. **Save:** When Logged-in in Level 2, save current parameters on the screen as default
6. **Restore:** When Logged-in in Level 1 or 2, restore current parameters on the screen as default

CW PUMP SETTINGS

CWP GENERAL



2.1 NUMBER OF PUMPS

RANGE	FUNCTION
1–5	Indicates how many condenser pumps are installed in the system. To be configured on site

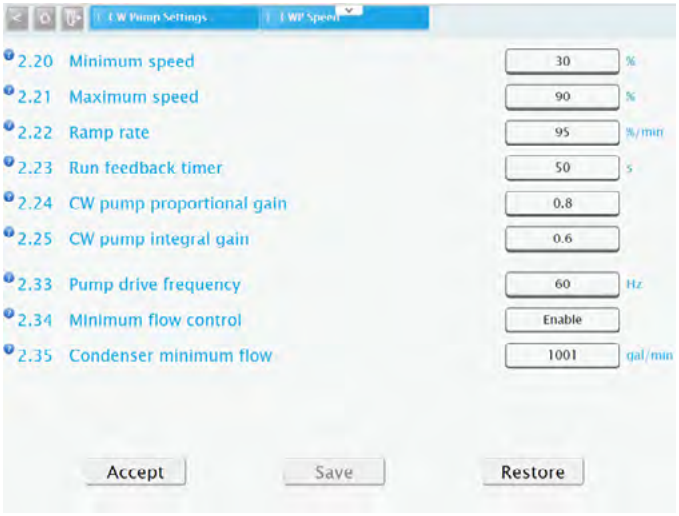
2.2 STANDBY PUMP

OPTIONS	FUNCTION
No Standby Pump	All pumps in the system are duty. In a dedicated system this parameter is meaningless
One Standby Pump	One of the pumps in the system will be assigned as standby, it will only operate if a duty pump fails and there is no other duty pump to replace it.
None	Default

2.8 DUTY 1 SWITCH TIME

RANGE	FUNCTION
1–999 Days	Indicates how often the lead (Duty 1) pump will rotate among the duty pumps
7	Default

CWP SPEED



2.20 MINIMUM SPEED

RANGE	FUNCTION
0.0–100.0%	The minimum speed the pumps will be allowed to run in Auto or Hand mode
30.0%	Default

2.21 MAXIMUM SPEED

RANGE	FUNCTION
0.0–100.0%	The maximum speed the pumps will be allowed to run in Auto or Hand mode
100.0%	Default

2.22 RAMP RATE

RANGE	FUNCTION
0–100	Dictates the rate at which pumps increase their speed from 0% to 100% or decrease their speed from 100% to 0%
20%	Default

2.23 RUN FEEDBACK TIMER

RANGE	FUNCTION
0–999 sec	Time until feedback alarm is generated if pump run feedback is not detected
30 sec	Default

2.24 CW PUMP PROPORTIONAL GAIN

RANGE	FUNCTION
0–9999	Determines the pump speed control PID loop gain. Larger values correspond to a more responsive controller
0.05	Default

2.25 CW PUMP INTEGRAL GAIN

RANGE	FUNCTION
0–9999	Determines the pump speed control PID loop integral time. Larger values correspond to more iterations and reduction of steady state error.
0.05	Default

2.33 PUMP DRIVE FREQUENCY

RANGE	FUNCTION
0–9999 Hz	This is the maximum frequency the drive is set to run at
60 Hz	Default

2.34 MINIMUM FLOW CONTROL

OPTIONS	FUNCTION
Disable	The DE ITC does not maintain minimum flow. Pumps follow demand.
Enabled	The DE ITC maintains the minimum flow given by parameter 2.35. If the total flow falls below this value, the pumps increase their speed gradually
Disable	Default

2.35 CONDENSER MINIMUM FLOW

RANGE	FUNCTION
0–9999	Defines the minimum flow the system can operate at. If parameter 2.34 is set to Enable, the pumps will modulate their speed to maintain this minimum flow to be configured on site

2.42 CWP HEAD BEP

RANGE	FUNCTION
0–999	Pump head at the best efficiency point of the pump to be configured on site

2.43 CWP FLOW BEP

RANGE	FUNCTION
0–9999	Pump flow at the best efficiency point of the pump to be configured on site

2.61 CWP ZERO FLOW HEAD

RANGE	FUNCTION
0–999	Pump at zero flow. It is used to determine the system control curve to be configured on site

2.62 CWP DESIGN HEAD

RANGE	FUNCTION
0–999	Pump design head. It is used to determine the system control curve to be configured on site

2.63 CWP DESIGN FLOW

RANGE	FUNCTION
0–999	Pump design head. It is used to determine the system control curve to be configured on site

2.64 CWP SENSORLESS ADJUST

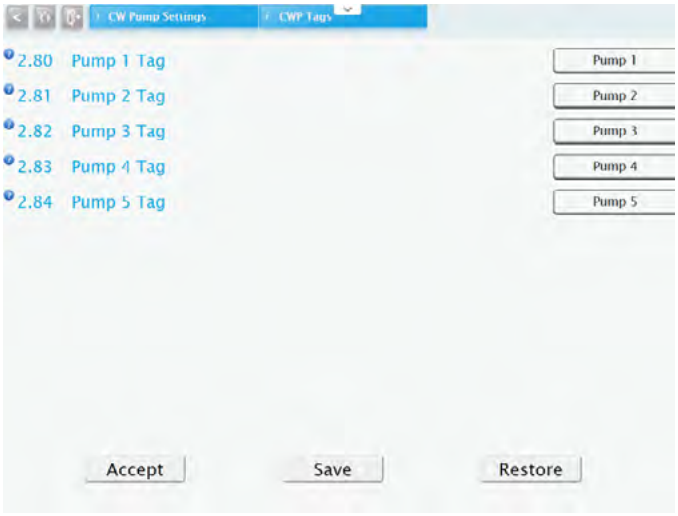
RANGE	FUNCTION
0–100	Factor that compensates for errors in the sensorless mapping of the pump
30	Default

2.65 CWP STAGING DEADBAND

RANGE	FUNCTION
0–100	Deadband around the best efficiency point to eliminate excessive staging
5	Default

2.66 CWP STAGING TIMER

RANGE	FUNCTION
0–999 min	Timer to adjust the staging frequency. The longer the timer the less frequent the staging, can help avoid unstable conditions
1 min	Default



2.80 PUMP 1 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies condenser water pump 1 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Pump 1	Default

2.81 PUMP 2 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies condenser water pump 2 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Pump 2	Default

2.82 PUMP 3 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies condenser water pump 3 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Pump 3	Default

2.83 PUMP 4 TAG

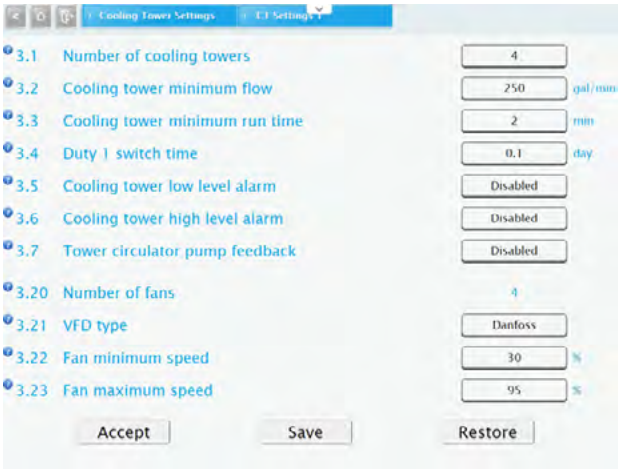
OPTIONS	FUNCTION
NA	Enter the tag that identifies condenser water pump 4 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Pump 4	Default

2.84 PUMP 5 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies condenser water pump 5 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Pump 5	Default

COOLING TOWER SETTINGS

CT SETTINGS 1



3.1 NUMBER OF COOLING TOWERS

RANGE	FUNCTION
1–5	Indicates how may cooling towers are installed in the system. To be configured on site

3.2 COOLING TOWER MINIMUM FLOW

RANGE	FUNCTION
1–9999	Minimum flow required for each cooling tower to run properly To be configured on site

3.3 COOLING TOWER MINIMUM RUN TIME

RANGE	FUNCTION
1–9999 min	Minimum time a cooling tower must run before it can be shut off
1 min	Default

3.4 DUTY 1 SWITCH TIME

RANGE	FUNCTION
1–9999 Day	Time before the duty 1 cooling tower is rotated to another tower
1 Day	Default

3.5 COOLING TOWER LOW LEVEL ALARM

OPTIONS	FUNCTION
Enabled	The DE ITC monitors the cooling tower water low level switch. An alarm is triggered and the plant is shutdown when active
Disabled	The DE ITC does not monitor the cooling tower water low level switch
Disabled	Default

3.6 COOLING TOWER HIGH LEVEL ALARM

OPTIONS	FUNCTION
Enabled	The DE ITC monitors the cooling tower water high level switch. An alarm is triggered
Disabled	The DE ITC does not monitor the cooling tower water high level switch
Disabled	Default

3.7 TOWER CIRCULATOR PUMP FEEDBACK

OPTIONS	FUNCTION
Enabled	The DE ITC monitors the circulator pump run feedback, an alarm is triggered if it is not detected and the corresponding tower is take out of the rotation
Disabled	The DE ITC does not monitor the circulator pump run feedback
Disabled	Default

3.20 NUMBER OF FANS

RANGE	FUNCTION
1–5	This value is automatically determined by the system configuration based on the number of cooling towers To be configured onsite

3.21 VFD TYPE

OPTIONS	FUNCTION
Danfoss	Serial communication to Danfoss FC-102 drive
ABB	Serial communication to ABB ACH550 drive
Yaskawa	Serial communication to Yasgawa E7 drive
Danfoss	Default

NOTE: The IPC9521 default communication configuration is: Modbus RTU, 19200 baud, no parity, 8 bits 1 stop. Contact Armstrong for a different configuration

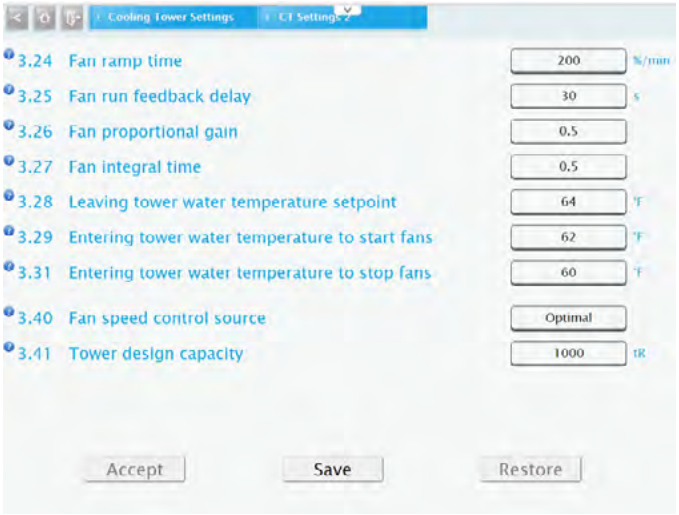
3.22 FAN MINIMUM SPEED

RANGE	FUNCTION
0–100%	Minimum allowed speed of the cooling tower fans
30%	Default

3.23 FAN MAXIMUM SPEED

RANGE	FUNCTION
0–100%	Maximum allowed speed of the cooling tower fans
100%	Default

CT SETTINGS 2



3.24 FAN RAMP TIME

RANGE	FUNCTION
0–100	Dictates the rate at which fans increase their speed from 0% to 100% or decrease their speed from 100% to 0%
20%/min	Default

3.25 FAN RUN FEEDBACK DELAY

RANGE	FUNCTION
1–999 sec	Length of time system will wait for a run feedback before triggering an alarm
30 sec	Default

3.26 FAN PID GAIN

RANGE	FUNCTION
1–999	Determines fan speed control PID loop gain. Larger values correspond to a more responsive controller
0.05	Default

3.27 FAN PID TI

RANGE	FUNCTION
1–999	Determines fan speed control PID integral time. Larger values correspond to more iterations and a reduction of steady state error
0.5	Default

3.28 LEAVING TOWER WATER TEMPERATURE SET POINT

RANGE	FUNCTION
1–999	Design leaving tower water temperature set point To be configured on site

3.29 ENTERING TOWER WATER TEMPERATURE TO START FANS

RANGE	FUNCTION
1–999	Minimum water temperature entering the cooling tower before cooling tower fans start operating To be configured on site

3.31 ENTERING TOWER WATER TEMPERATURE TO STOP FANS

RANGE	FUNCTION
1–999	Temperature at which to stop the fans from operating to prevent freezing To be configured on site

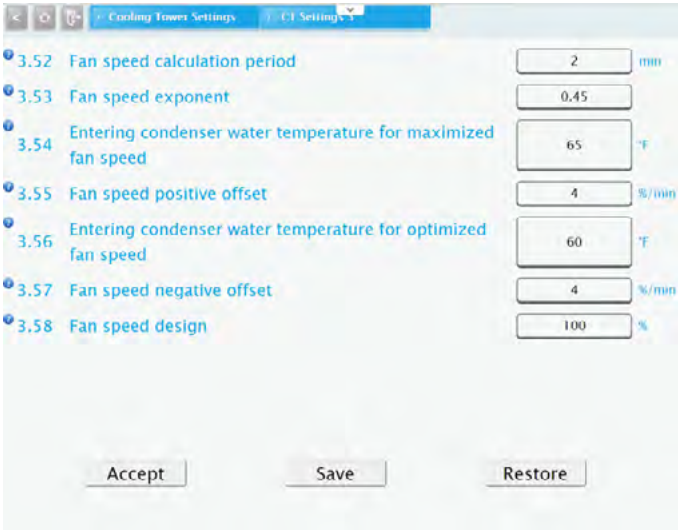
3.40 FAN SPEED CONTROL SOURCE

OPTIONS	FUNCTION
LTWT control	The fan speed is modulated based on the leaving tower water temperature PID loop
External	The fan speed is controlled by an external optimization source
Optimal	The fan speed is controlled by internal optimization
LTWT	Default

3.41 TOWER DESIGN CAPACITY

RANGE	FUNCTION
0–9999 tR	Rated capacity in tons of all installed towers To be configured on site

CT SETTINGS 3



3.52 FAN SPEED CALCULATION PERIOD

RANGE	FUNCTION
1–999 min	Time period utilized to calculate fan speed, longer times produce smoother response. However this timer should be no more than 80% of 3.51.
2 min	Default

3.53 FAN SPEED EXPONENT

RANGE	FUNCTION
1–0	Determines fan speed characteristics. Contact Armstrong Fluid Technologies for more information.
0.45	Default

3.54 ENTERING CONDENSER WATER TEMPERATURE FOR MAXIMIZED FAN SPEED

RANGE	FUNCTION
1–999	When the entering condenser water temperature exceeds this value, the fan speed will be ramped up to maximum in increments given by parameter 3.55.
85°F	Default

3.55 FAN SPEED POSITIVE OFFSET

RANGE	FUNCTION
0–30 %/min	Offset in percentage by minute to be added to the calculated fan speed.
6 %/min	Default

3.56 ENTERING CONDENSER WATER TEMPERATURE FOR OPTIMIZED FAN SPEED

RANGE	FUNCTION
0–999	If fan speed is being increased (as per 3.54), when the entering condenser water temperature falls below this value, the fan speed will be ramped down to optimized in decrements given.
82°F	Default

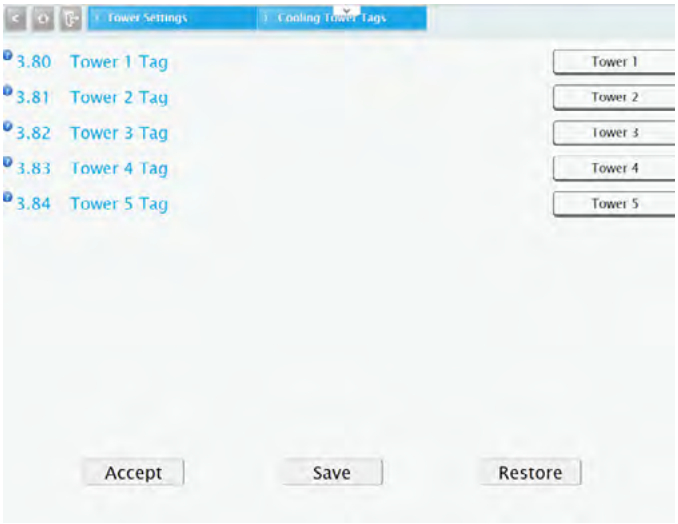
3.57 FAN SPEED NEGATIVE OFFSET

RANGE	FUNCTION
0–30 %/min	Offset in percentage by minute to be subtracted from the calculated fan speed.
4 %/min	Default

3.58 FAN SPEED DESIGN

RANGE	FUNCTION
0–100 %	Indicates fan speed at design day.
100%	Default

COOLING TOWER TAGS



3.80 TOWER 1 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies tower 1 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Tower 1	Default

3.81 TOWER 2 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies tower 2 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Tower 2	Default

3.82 TOWER 3 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies tower 3 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Tower 3	Default

3.83 TOWER 4 TAG

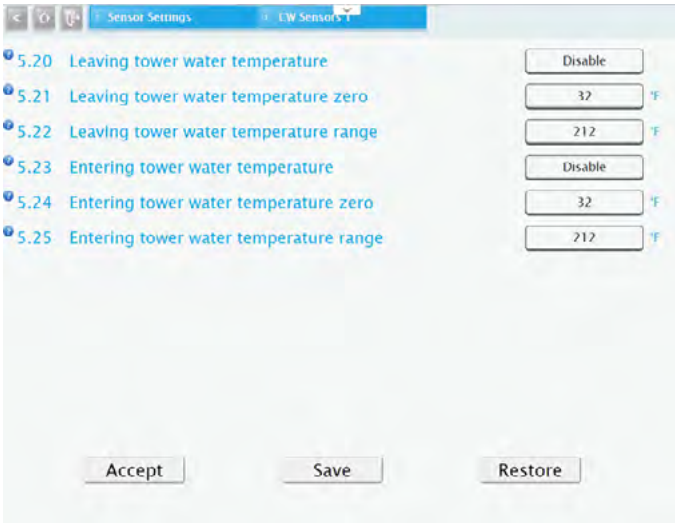
OPTIONS	FUNCTION
NA	Enter the tag that identifies tower 4 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Tower 4	Default

3.84 TOWER 5 TAG

OPTIONS	FUNCTION
NA	Enter the tag that identifies tower 5 in order to display it on the screens. **NOTE:** There is limited space on the screens, the system automatically wraps text but short tags are recommended
Tower 5	Default

SENSOR SETTINGS

CW SENSORS 1



5.20 LEAVING TOWER WATER TEMPERATURE

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Enable	Default

5.21 LEAVING TOWER WATER TEMPERATURE ZERO

RANGE	FUNCTION
−999 to 999	Range of the sensor in engineering units. This value corresponds to the sensor's 4mA output
32	Default

5.22 LEAVING TOWER WATER TEMPERATURE RANGE

RANGE	FUNCTION
−999 to 999	Range to the sensor in engineering units. This value corresponds to the sensor's 20mA output
212	Default

5.23 ENTERING TOWER WATER TEMPERATURE

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Enable	Default

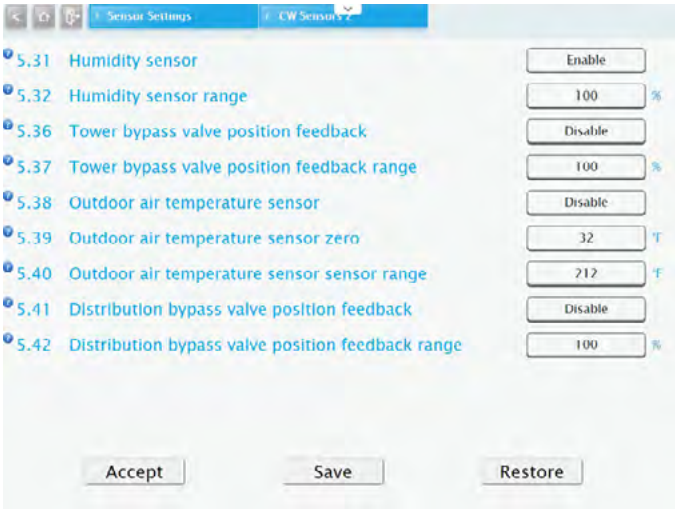
5.24 ENTERING TOWER WATER TEMPERATURE ZERO

RANGE	FUNCTION
−999 to 999	Range of the sensor in engineering units. This value corresponds to the sensor's 4mA output
32	Default

5.25 ENTERING TOWER WATER TEMPERATURE RANGE

RANGE	FUNCTION
−999 to 999	Range to the sensor in engineering units. This value corresponds to the sensor's 20mA output
212	Default

CW SENSORS 2



5.31 HUMIDITY SENSOR

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Disable	Default

5.32 HUMIDITY SENSOR RANGE

RANGE	FUNCTION
0–100%	Range of the sensor in engineering units. This value corresponds to the sensor's 20mA output
100%	Default

5.36 TOWER BYPASS VALVE POSITION FEEDBACK

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Disable	Default

5.37 TOWER BYPASS VALVE POSITION FEEDBACK RANGE

RANGE	FUNCTION
0–100%	Range of the sensor in engineering units. This value corresponds to the transmitter's 20mA or 10 VDC output
100%	Default

5.38 OUTDOOR AIR TEMPERATURE SENSOR

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Enable	Default

5.39 OUTDOOR AIR TEMPERATURE ZERO

RANGE	FUNCTION
–999 to 999	Range of the sensor in engineering units. This value corresponds to the sensor's 4mA output
32	Default

5.40 OUTDOOR AIR TEMPERATURE SENSOR RANGE

RANGE	FUNCTION
–999 to 999	Range of the sensor in engineering units. This value corresponds to the sensor's 20mA output
212	Default

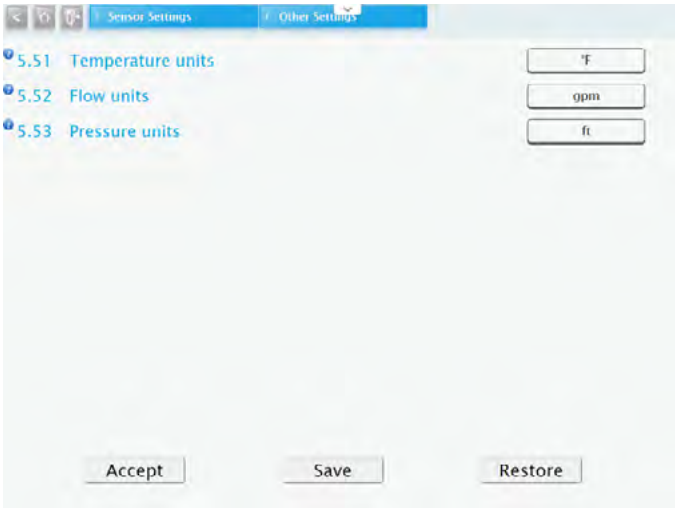
5.41 DISTRIBUTION BYPASS VALVE POSITION FEEDBACK

OPTIONS	FUNCTION
Enable	Sensor is enabled
Disable	Sensor is disabled
Disable	Default

5.42 DISTRIBUTION BYPASS VALVE POSITION FEEDBACK RANGE

RANGE	FUNCTION
0–100 %	Range of the sensor in engineering units. This value corresponds to the transmitter's 20mA or 10 VDC output
100%	Default

OTHER SETTINGS



5.51 TEMPERATURE UNITS

OPTIONS	FUNCTION
°F	Selects °F as the sensor's engineering units
°C	Selects °C as the sensor's engineering units
°F	Default

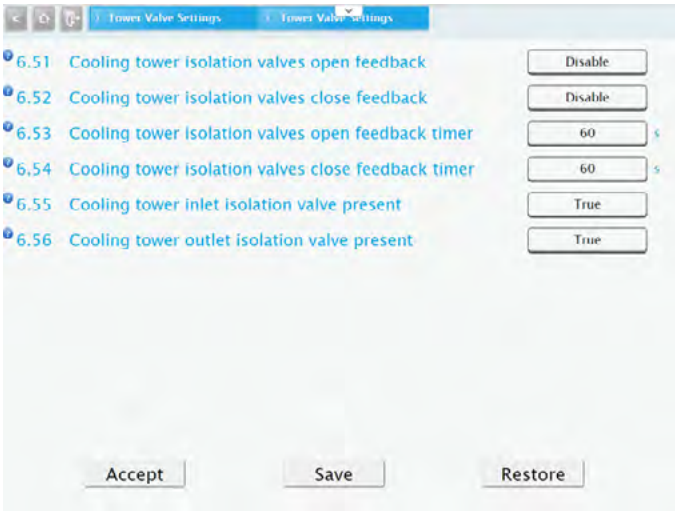
5.52 FLOW UNITS

OPTIONS	FUNCTION
gpm	Selects gpm as the sensor's (or pump sensorless feedback) engineering units
l/s	Selects lps as the sensor's (or pump sensorless feedback) engineering units
m^3/hr	Selects m^3/hr as the sensor's (or pump sensorless feedback) engineering units
gpm	Default

5.53 PRESSURE UNITS

OPTIONS	FUNCTION
psi	DP sensors (or pump sensorless feedback) in psi are used
ft	DP sensors (or pump sensorless feedback) in ft are used
Kpa	DP sensors (or pump sensorless feedback) in kpa are used
m	DP sensors (or pump sensorless feedback) in m are used
bar	DP sensors (or pump sensorless feedback) in bar are used
ft	Default

TOWER VALVE SETTINGS



6.51 COOLING TOWER ISOLATION VALVES OPEN FEEDBACK

OPTIONS	FUNCTION
Enable	Digital inputs are utilized as valve open feedback
Disable	No digital inputs are utilized as valve open feedback. The valves are considered open when they are commanded to do so
Enable	Default

6.52 COOLING TOWER ISOLATION VALVES CLOSE FEEDBACK

OPTIONS	FUNCTION
Enable	Digital inputs are utilized as valve close feedback
Disable	No digital inputs are utilized as valve close feedback. The valves are considered closed when they are commanded to do so
Disable	Default

6.53 COOLING TOWER ISOLATION VALVES OPEN FEEDBACK TIMER

RANGE	FUNCTION
0–999 sec	Time the ITC waits for the isolation valve open feedback to be detected before issuing and isolation valve alarm
120 sec	Default

6.54 COOLING TOWER ISOLATION VALVES CLOSE FEEDBACK TIMER

RANGE	FUNCTION
0–999 sec	Time the ITC waits for the isolation valve close feedback to be detected before issuing an isolation valve alarm
120 sec	Default

6.55 COOLING TOWER INLET ISOLATION VALVE PRESENT

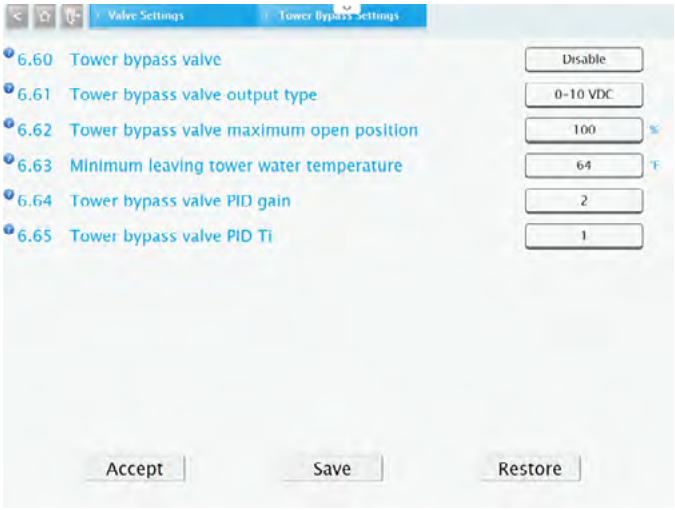
OPTIONS	FUNCTION
True	Inlet valves are present
False	Inlet valves are not present
True	Default

6.56 COOLING TOWER OUTLET ISOLATION VALVE PRESENT

OPTIONS	FUNCTION
True	Inlet valves are present
False	Inlet valves are not present
False	Default

VALVE SETTINGS

TOWER BYPASS SETTINGS



6.60 TOWER BYPASS VALVE

OPTIONS	FUNCTION
Enable	There is a tower bypass valve installed in the system
Disable	There is no tower bypass valve installed
Disable	Default

6.61 TOWER BYPASS VALVE OUTPUT TYPE

OPTIONS	FUNCTION
0–10 VDC	Selects 0 VDC as valve fully closed command
2–10 VDC	Selects 2 VDC as valve fully closed command
0–10 VDC	Default

6.62 TOWER BYPASS VALVE MAXIMUM OPEN POSITION

RANGE	FUNCTION
0–100 %	Maximum open position of the tower bypass valve
100%	Default

6.63 MINIMUM LEAVING TOWER WATER TEMPERATURE

RANGE	FUNCTION
–999 to 999	Minimum water temperature leaving the towers (could be the temperature entering chillers or heat pumps). At this temperature the bypass valve starts to modulate in order to prevent the temperature to fall below this setpoint To be configured on site

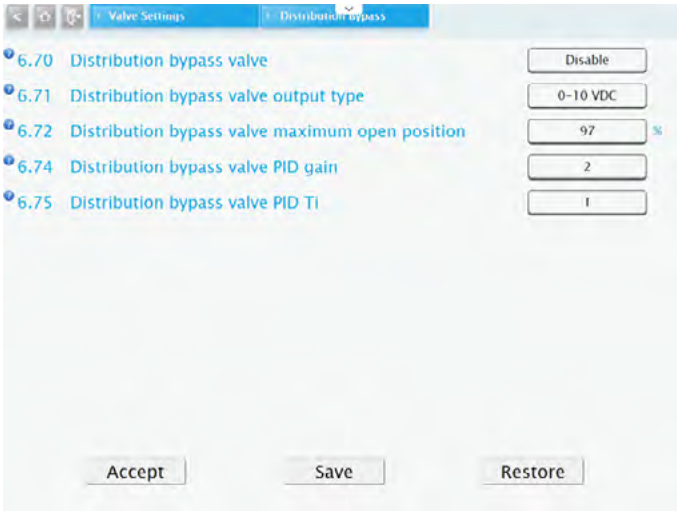
6.64 TOWER BYPASS VALVE PID GAIN

RANGE	FUNCTION
0–9999	Determines valve control PID loop gain. Larger values correspond to a more responsive controller
0.05	Default

6.65 TOWER BYPASS VALVE PID TI

RANGE	FUNCTION
0–9999	Determines valve control PID integral time. Larger values correspond to more iterations and a reduction of steady state error
0.5	Default

DISTRIBUTION BYPASS



6.70 DISTRIBUTION BYPASS VALVE

OPTIONS	FUNCTION
Enable	There is a Distribution bypass valve installed in the system
Disable	There is no Distribution bypass valve installed
Disable	Default

6.71 DISTRIBUTION BYPASS VALVE OUTPUT TYPE

OPTIONS	FUNCTION
0–10 VDC	Selects 0 VDC as valve fully closed command
2–10 VDC	Selects 2 VDC as valve fully closed command
0–10 VDC	Default

6.72 DISTRIBUTION BYPASS VALVE MAXIMUM OPEN POSITION

RANGE	FUNCTION
0–100 %	Maximum open position of the Distribution bypass valve
100%	Default

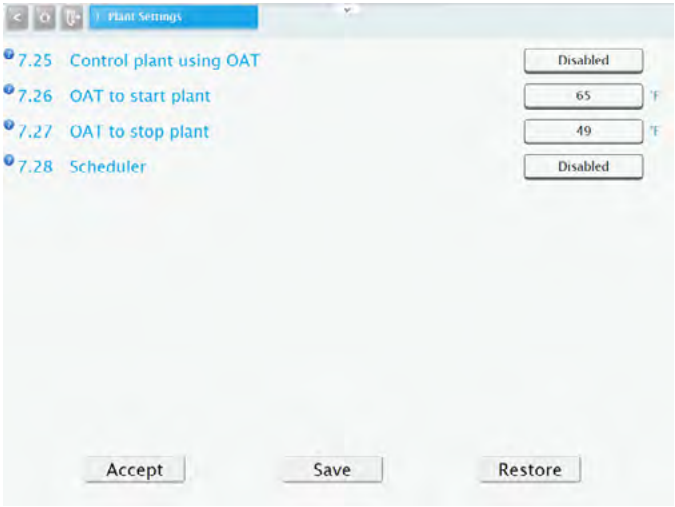
6.74 DISTRIBUTION BYPASS VALVE PID GAIN

RANGE	FUNCTION
0–9999	Determines valve control PID loop gain. Larger values correspond to a more responsive controller
0.5	Default

6.75 DISTRIBUTION BYPASS VALVE PID TI

RANGE	FUNCTION
0–9999	Determines valve control PID integral time. Larger values correspond to more iterations and a reduction of steady state error
0.05	Default

PLANT SETTINGS



7.25 CONTROL PLANT USING OAT

OPTIONS	FUNCTION
Enable	The ITC will respond based on OAT, see parameters below
Disable	The ITC will not use OAT
Disable	Default

7.26 OAT TO START PLANT

RANGE	FUNCTION
0–999.9 °F	The ITC will start running when the OAT rises above this temperature To be configured on site

7.27 OAT TO STOP PLANT

RANGE	FUNCTION
0–999.9 °F	The ITC will stop running when the OAT drops below this temperature To be configured on site

7.28 SCHEDULER

OPTIONS	FUNCTION
Enable	The ITC will follow the scheduler to start and stop. When Enabled, a button to jump to the Scheduler screen (**PAGE 13**) appears
Disable	The ITC will ignore any scheduled starts and stops
Disable	Default

BAS SETTINGS

8.1 PROTOCOL

OPTIONS	FUNCTION
N/A	No BAS protocol selected
Modbus RTU	Selects Modbus RTU
BACnet IP	Selects BACnet IP
BACnet MS/TP	Selects BACnet MS/TP
Modbus TCP	Selects Modbus TCP
N/A	Default

8.2 BAUD RATE

OPTIONS	FUNCTION
9600	Selects 9600 as baud rate. Only applies to Modbus and BACnet MS/TP protocols
19200	Selects 19200 as baud rate. Only applies to Modbus and BACnet MS/TP protocols
38400	Selects 38400 as baud rate. Only applies to Modbus and BACnet MS/TP protocols
76800	Selects 76800 as baud rate. Only applies to Modbus and BACnet MS/TP protocols To be configured on site

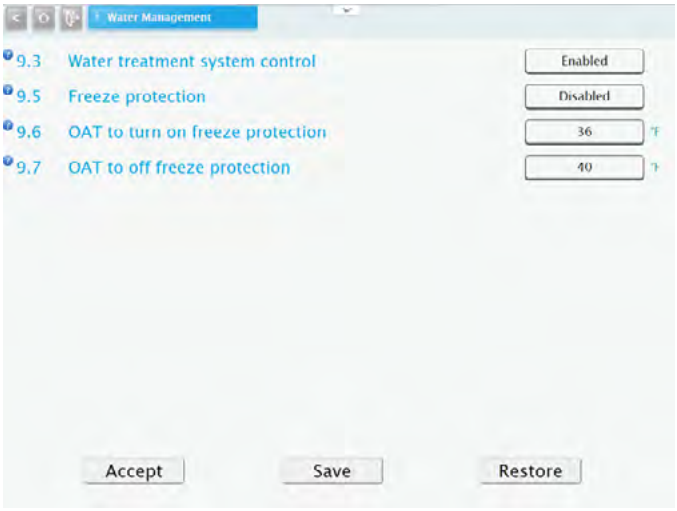
8.3 ADDRESS

RANGE	FUNCTION
0–127	Selects the ITC BAS address. Only applies to Modbus and BACnet MS/TP protocols To be configured on site

8.4 BACNET DEVICE ID

RANGE	FUNCTION
1–99999	Selects the BACnet device ID. Only applies to BACnet protocols To be configured on site

WATER MANAGEMENT



9.3 WATER TREATMENT SYSTEM CONTROL

OPTIONS	FUNCTION
Enable	Water system control (pulse pure or similar) is started when the pumps are active (contact on terminals 635 & 636 closes). The ITC will monitor for feedback (feedback connected on terminals 529 & 530), if not detected within 30 seconds, and alarm is raised
Disable	Water system control feedback is not monitored
Disable	Default

9.5 FREEZE PROTECTION

OPTIONS	FUNCTION
Enable	Freeze protection is started when the OAT is within the range set by parameters 9.6 & 9.7. The ITC will monitor for feedback (feedback connected on terminals 525 & 526), if not detected within 30 seconds, and alarm is raised
Disable	Freeze protection feedback is not monitored
Disable	Default

9.6 OAT TO TURN ON FREEZE PROTECTION

RANGE	FUNCTION
0-100	Temperature to turn freeze protection on To be configured on site

9.7 OAT TO TURN OFF FREEZE PROTECTION

RANGE	FUNCTION
0-100	Temperature to turn freeze protection off To be configured on site

DE ITC CONTROL SYSTEM SERVICE LIFECYCLE

MANUFACTURER'S SUGGESTED MAINTENANCE SCHEDULE AND COMPONENT LIFE			YEAR AFTER INSTALLATION									
			1	2	3	4	5	6	7	8	9	10
Software and Settings	**Maintenance**	**Included in Annual Service Plan**										
All Firmware	As required by manufacturer	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Optimization logic & control programming	As Service Packs as released by Armstrong	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Data logs backup and storage	Semi-annually at minimum	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alarm and parameter backup and storage	Semi-annually at minimum	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Panels & PC/Touchscreen												
Integrated pc & Touchscreen	Replace pc & Touchscreen	Included with a 5 Year Plan - otherwise extra					✓					
PLCs	Check and confirm voltage	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PLCs and associated components	Replace	Extra - if beyond warranty										✓
Power Supply	Check and confirm voltage	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Power Supply	Replace on failure	Extra - if beyond warranty										
Panel integrity (gasket, terminals, glands...)	Inspect and repair as needed	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Panel filter (when included)	Inspect and clean as needed	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sensors												
Tower Water Temperature Sensors	Confirm Accuracy	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tower Water Temperature Sensors	Full calibration	Extra			✓			✓			✓	
Bypass Valve position sensors	Confirm Accuracy	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bypass Valve position sensors	Full calibration	Extra			✓			✓			✓	
Outdoor Air Temperature/ Humidity Sensor	Confirm Accuracy	Included	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NOTES:

- As with any system the component life expectancy varies according to usage and operating conditions.
- Components operating inside of clean and weather controlled environment will typically last longer than components exposed to the elements or otherwise operating in dirty environments.
- Component life expectancy also varies according to the power quality (absence of harmonic distortion) and consistency of voltage supplied to the device.

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