Cray Chilled Door Operator Guide

Contents

About the Chilled Door Operator Guide

The *Cray Chilled Door Operator Guide* describes the Motivair® ChilledDoor® and CDU that are used with Cray® CS™ cluster supercomputers, Sonexion® storage systems, and other rack systems. It describes the control and monitoring systems, programming display, and set points and alarms. This guide also includes maintenance and operation procedures. A list of spare parts is included at the end of the document.

Document Revisions

H-2007 (Rev A)

> May 2017. Correction to the last sentence regarding the position of the white tab in this section: *Check the Valve Actuator*.

H-2007

> March 2016. Original version of the guide.

Scope and Audience

This document is written for service personnel who maintain Cray CS cluster supercomputers and Sonexion storage systems. It assumes the user has attended Cray hardware training courses or is experienced in maintaining HPC equipment.

Feedback

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Chilled-Water Door System

Cray® CS™ cluster supercomputers and Sonexion storage systems provide the option of using chilled-water doors to cool server/blade/switch/drive exhaust heat as it exits the rear of the rack. The chilled-water doors monitor the rack exhaust air temperature, ambient room temperature, the door outlet temperature, and other variables. This enables the chilled-water door system to actively adjust to changes at the rack level. The chilled-water door system is dynamic and able to provide the exact cooling capacity, airflow, and water flow for changing heat loads up to their rated capacity. The chilled-water doors are able to return air to the data center at or below the temperature of the air entering the racks.

The chilled door cooling system operates above the dew point of the data center. In the event the facility chilled water temperature is low enough to create condensation, a Cooling Distribution Unit (CDU) is required with the system. A CDU has pumps and a heat exchanger which takes the cold facility water and creates a warmer secondary water loop that flows to the chilled doors.

The Chilled Door® and CDU are supplied by Motivair Corporation. They are described in more detail in the following sections.
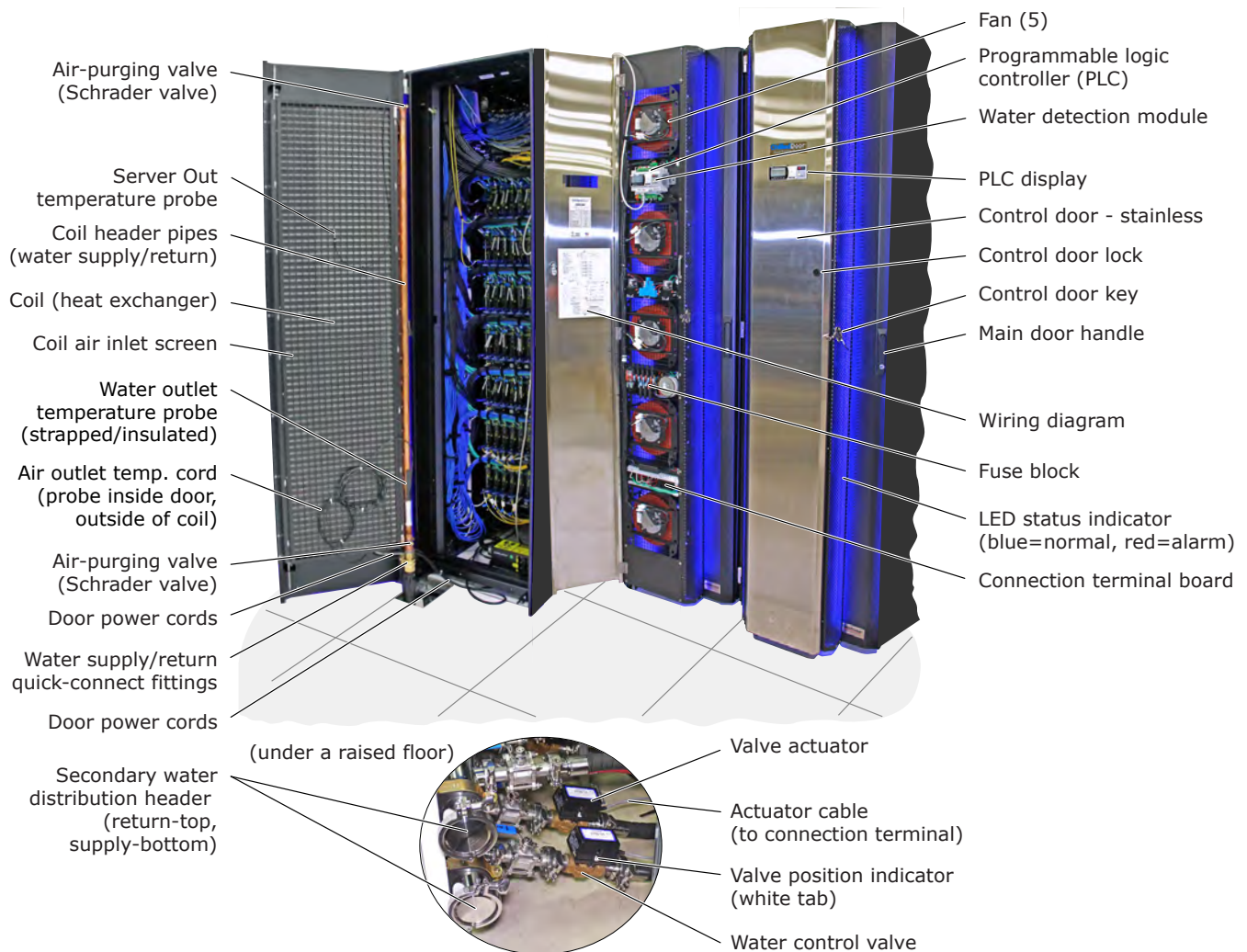
ChilledDoor

The ChilledDoor is equipped with variable speed EC (electronically commutated) fans, a chilled water coil (air-to-water heat exchanger), a water control valve, and an integrated programmable control system. The EC fans assist the rack device fans in moving air across the water coil. Chilled water flows through the coil, absorbing the heat. The water control valve modulates the water flow. Refer to the following figure.

The ChilledDoor has LED strips mounted inside and behind the mesh screening of the door. These LEDs provide a status indicator for the operation of the Chilled Door system. The LEDs light blue to indicate a normal operating system. They light red to indicate the ChilledDoor system is in an alarm state. Numerous temperature, pressure, and flow rate variables are constantly monitored and controlled by a custom programmable logic controller (PLC) to ensure that the Chilled Door is actively adjusting to conditions inside the data center and the rack.

The stainless steel door provides instant access to all electrical components and controls. It covers the door fans, PLC, and wiring/connection terminal block. The entire door opens to reveal the inlet face of the water coil. The flexible water connections to the coil are typically located at the bottom of the door for raised floor installations. Fans are hot-swappable in complete safety while the others remain fully operational with the ChilledDoor closed. Safety fuses and terminal connections are all easily accessible. A key lock entry system allows the ChilledDoor to be easily opened and closed safely and securely.

An optional water detection system is available. Refer to

Figure 1. ChilledDoor Components

Air-purging valve (Schrader valve)
Server Out temperature probe
Coil header pipes (water supply/return)
Coil (heat exchanger)
Coil air inlet screen
Water outlet temperature probe (strapped/insulated)
Air outlet temp. cord (probe inside door, outside of coil)
Air-purging valve (Schrader valve)
Door power cords
Water supply/return quick-connect fittings
Door power cords
Secondary water distribution header (return-top, supply-bottom)

Fan (5)
Programmable logic controller (PLC)
Water detection module
PLC display
Control door - stainless
Control door lock
Control door key
Main door handle
Wiring diagram
Fuse block
LED status indicator (blue=normal, red=alarm)
Connection terminal board

(under a raised floor)

Valve actuator
Actuator cable (to connection terminal)
Valve position indicator (white tab)
Water control valve

CDU

A Coolant Distribution Unit (CDU) is enclosed in a rack-type enclosure. It is designed for use with Motivair ChilledDoors.
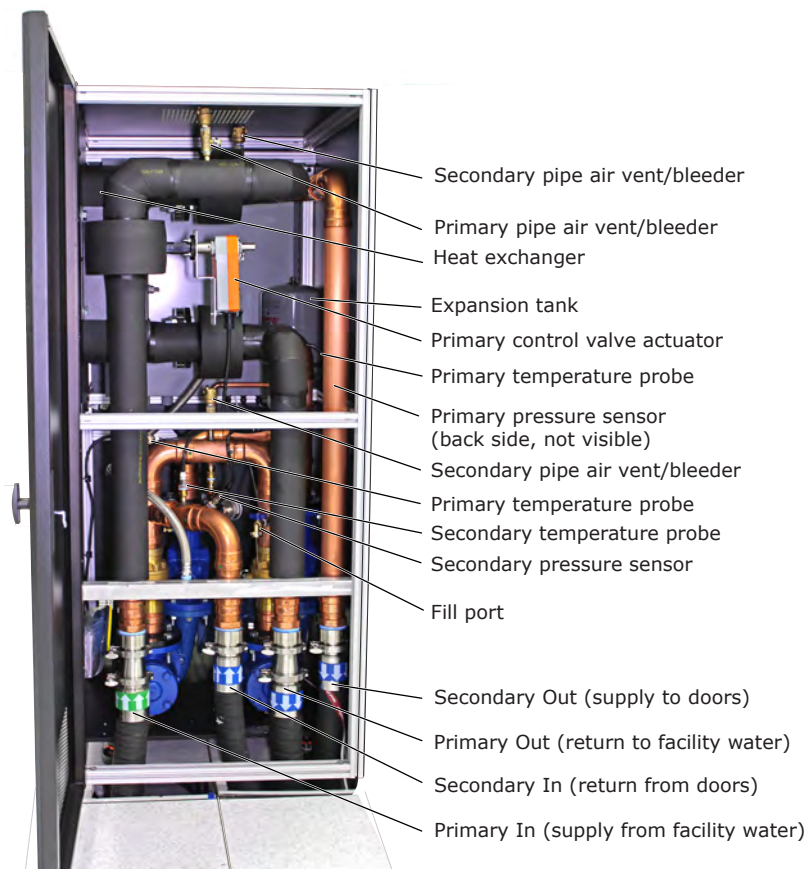
The CDU connects to a facility supplied cold water source (Primary loop). The CDU includes a heat exchanger (water-to-water) that transfers heat from a separate cooling loop (Secondary loop) to the ChilledDoors. Secondary loop flow and pressure is created by the CDU pumps and temperature is controlled by the primary water control valve. The Secondary loop is always controlled to operate above room dew point to avoid condensation on the ChilledDoor coils. Various set points and alarms can be monitored and controlled through the PLC display.

The CDU includes a stainless steel heat exchanger, primary and backup pumps, control panel, and all necessary piping, valves, and its own PLC control and alarm system with an optional water detection system. Components of the CDU are shown in the following figure.

Figure 2. CDU Components

Front View

Disconnect switches

PLC display with
LED-button keypad

Display cable
(to PLC controller)

PLC controller
(inside control panel)

Control panel cover

Humidity sensor

Front door handle

Leak detection strip
(ready for field install)

Secondary loop pumps

Rear View

Secondary pipe air vent/bleeder

Primary pipe air vent/bleeder

Heat exchanger

Expansion tank

Primary control valve actuator

Primary temperature probe

Primary pressure sensor
(back side, not visible)

Secondary pipe air vent/bleeder

Primary temperature probe

Secondary temperature probe

Secondary pressure sensor

Fill port

Secondary Out (supply to doors)

Primary Out (return to facility water)

Secondary In (return from doors)

Primary In (supply from facility water)

ChilledDoor Controller Display

Each ChilledDoor has a graphic display with a backlit screen and 6 button keypad as shown in the following figure. This display is used to display and control set points, alarms, temperatures, pressures, and other values of the supply and return water lines. The ChilledDoor display is similar to the CDU display.

The display provides two main sets of screens/menus:

● **Home Screen**. This is a menu style screen that displays current ChilledDoor readings and settings. It has three separate screens to scroll through to display all the current values.

● **Programming Menu**. This menu has three submenus to control the ChilledDoor system and modify alarm set points.

Figure 3. ChilledDoor Controller Display (sleep mode screen)

Alarm
- Display and clear active alarm messages

Program/Main Menu
- Go to Programming Menu (Main menu)

Return
- Go to Home Screen (first screen)
- When entering a value, move cursor left

Down
- Scroll up to previous screen or menu item
- Go to next value/choice for selected parameter

Up
- Scroll down to next screen or menu item
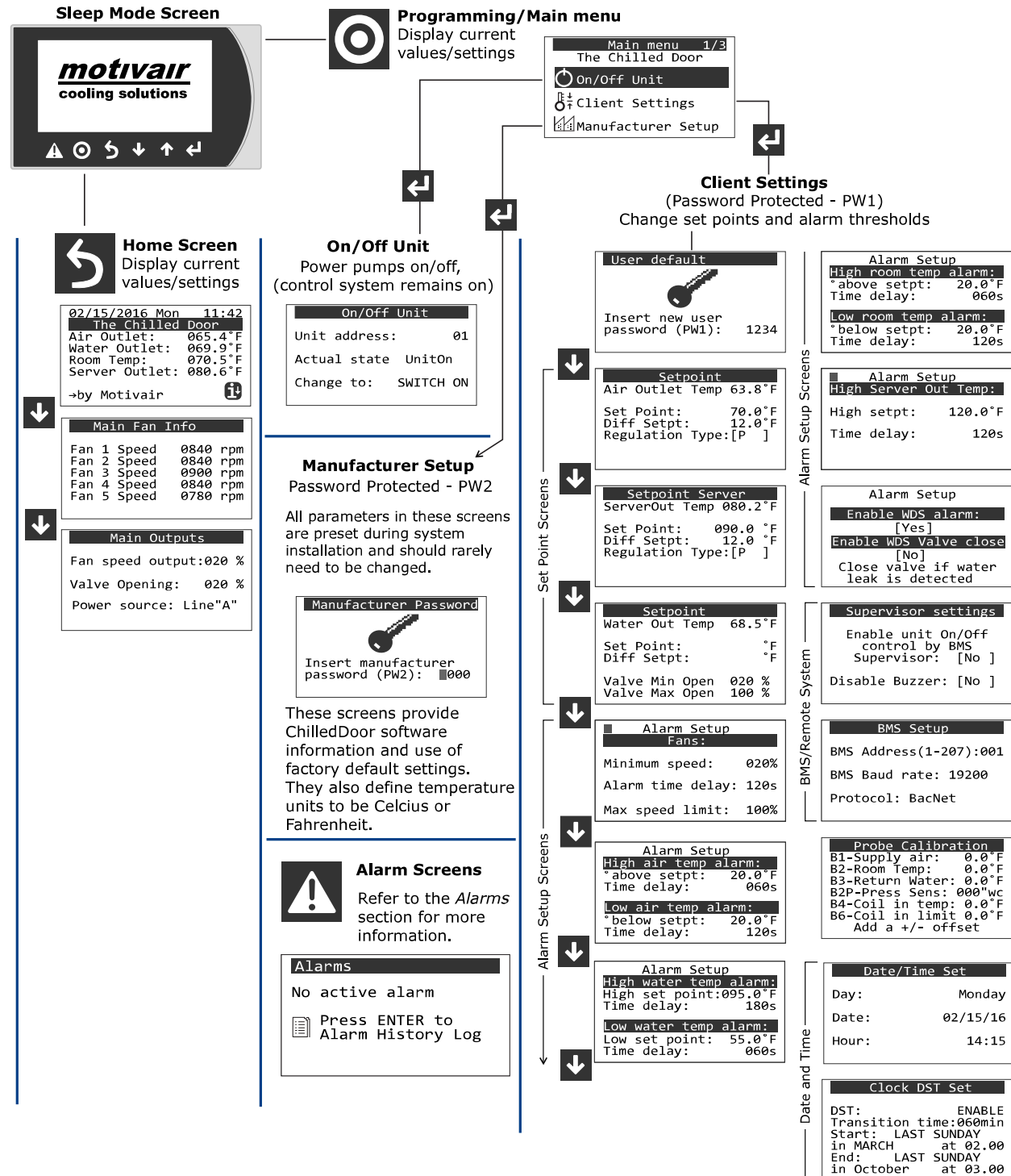- Go to previous value/choice for selected parameter

Enter
- Confirm/save selected menu item/parameter
- In Programming Menus, move cursor from the home (top left) position to the next parameter.
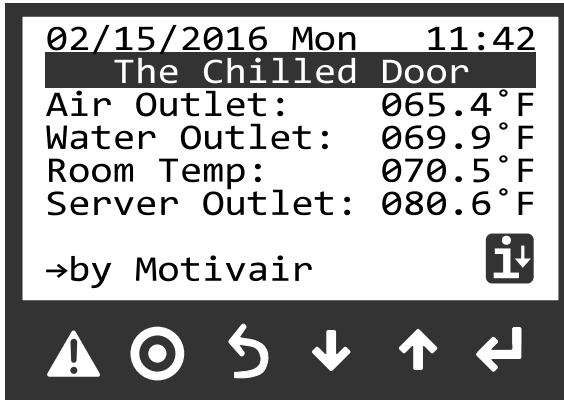
ChilledDoor Screen and Menu Map

The following figure provides a quick reference of the screens and menus in the ChilledDoor display system. Detailed descriptions of the screens are included on the following pages.

Figure 4. ChilledDoor Screen and Menu Map

Sleep Mode Screen

motivair
cooling solutions

Programming/Main menu
Display current values/settings

```
      Main menu    1/3
    The Chilled Door
  On/Off Unit
  Client Settings
  Manufacturer Setup
```

Home Screen
Display current values/settings

```
02/15/2016 Mon   11:42
     The Chilled Door
Air Outlet:     065.4°F
Water Outlet:   069.9°F
Room Temp:      070.5°F
Server Outlet: 080.6°F
→by Motivair
```

```
     Main Fan Info

Fan 1 Speed   0840 rpm
Fan 2 Speed   0840 rpm
Fan 3 Speed   0900 rpm
Fan 4 Speed   0840 rpm
Fan 5 Speed   0780 rpm
```

```
     Main Outputs

Fan speed output:020 %

Valve Opening:   020 %

Power source: Line"A"
```

On/Off Unit
Power pumps on/off,
(control system remains on)

```
       On/Off Unit

Unit address:        01

Actual state  UnitOn

Change to:    SWITCH ON
```

Manufacturer Setup
Password Protected - PW2

All parameters in these screens are preset during system installation and should rarely need to be changed.

```
   Manufacturer Password

   Insert manufacturer
   password (PW2):  ■000
```

These screens provide ChilledDoor software information and use of factory default settings. They also define temperature units to be Celcius or Fahrenheit.

Alarm Screens

Refer to the *Alarms* section for more information.

```
 Alarms

No active alarm

   Press ENTER to
   Alarm History Log
```

Client Settings
(Password Protected - PW1)
Change set points and alarm thresholds

```
  User default




  Insert new user
  password (PW1):   1234
```

Set Point Screens

```
       Setpoint
Air Outlet Temp 63.8°F

Set Point:       70.0°F
Diff Setpt:      12.0°F
Regulation Type:[P  ]
```

```
    Setpoint Server
ServerOut Temp 080.2°F

Set Point:     090.0 °F
Diff Setpt:    12.0  °F
Regulation Type:[P  ]
```

```
       Setpoint
Water Out Temp  68.5°F

Set Point:          °F
Diff Setpt:         °F

Valve Min Open  020 %
Valve Max Open  100 %
```

Alarm Setup Screens

```
■   Alarm Setup
        Fans:

Minimum speed:     020%

Alarm time delay: 120s

Max speed limit:  100%
```

```
     Alarm Setup
High air temp alarm:
°above setpt:    20.0°F
Time delay:       060s
Low air temp alarm:
°below setpt:    20.0°F
Time delay:       120s
```

```
     Alarm Setup
High water temp alarm:
High set point:095.0°F
Time delay:       180s
Low water temp alarm:
Low set point:  55.0°F
Time delay:       060s
```

Alarm Setup Screens

```
     Alarm Setup
High room temp alarm:
°above setpt:    20.0°F
Time delay:       060s
Low room temp alarm:
°below setpt:    20.0°F
Time delay:       120s
```

```
■    Alarm Setup
High Server Out Temp:

High setpt:    120.0°F

Time delay:       120s
```

```
    Alarm Setup
  Enable WDS alarm:
       [Yes]
Enable WDS Valve close
       [No]
  Close valve if water
  leak is detected
```

BMS/Remote System

```
   Supervisor settings

  Enable unit On/Off
   control by BMS
   Supervisor:  [No ]

Disable Buzzer: [No ]
```

```
      BMS Setup

BMS Address(1-207):001

BMS Baud rate: 19200

Protocol: BacNet
```

```
    Probe Calibration
B1-Supply air:   0.0°F
B2-Room Temp:    0.0°F
B3-Return Water: 0.0°F
B2P-Press Sens: 000"wc
B4-Coil in temp: 0.0°F
B6-Coil in limit 0.0°F
   Add a +/- offset
```

Date and Time

```
     Date/Time Set

 Day:          Monday

 Date:       02/15/16

 Hour:          14:15
```

```
     Clock DST Set
DST:           ENABLE
Transition time:060min
Start:  LAST SUNDAY
in MARCH      at 02.00
End:    LAST SUNDAY
in October    at 03.00
```

ChilledDoor Home Menu Screens

The three screens that make up the Home Menu are described below. Scroll up or down to view these screens by pressing the up and down arrow buttons. Press the Return button at any time to display the first screen.
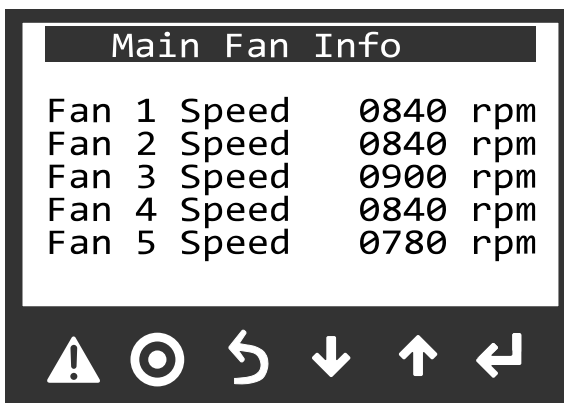
```
02/15/2016 Mon   11:42
      The Chilled  Door
Air Outlet:     065.4°F
Water Outlet:   069.9°F
Room Temp:      070.5°F
Server Outlet: 080.6°F

→by Motivair
```

Home Menu. Press ↩ to display this screen.

The first of three screens in the Home Menu.

This screen displays the temperature readings of the ChilledDoor.

Press ↓ to go to the next screen.

Air Outlet:	Air temperature exiting the door into the room
Water Outlet:	Return water temperature leaving the door/coil
Room Temp:	Air temperature entering the rack (Ambient temperature of the room)
Server Outlet:	Air temperature entering the door/coil

```
      Main Fan Info

Fan 1 Speed    0840 rpm
Fan 2 Speed    0840 rpm
Fan 3 Speed    0900 rpm
Fan 4 Speed    0840 rpm
Fan 5 Speed    0780 rpm
```

The speed of each of the fans in the ChilledDoor.

Fan 1 is at the top.

```
        Main Outputs

Fan speed output:020 %

Valve Opening:   020 %

Power source: Line"A"
```
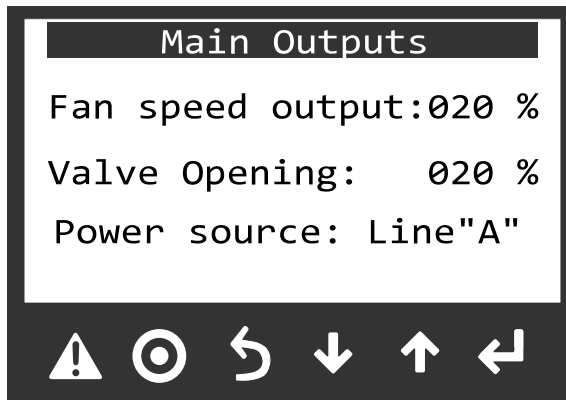
Percent Power Output

These percentages are the power output percentage to the fans and the chilled water valve.

The fan speed modulates to maintain the Server Outlet Temperature set point.

The valve modulates to control the Air Outlet Temperature set point.

Press ⊙ to go to the Programming Menu.

ChilledDoor Programming Menu Screens

The screens that make up the programming menus are described below.

On-Off Unit Submenu

```
        Main menu    1/3
     The Chilled Door
  ⏻ On/Off Unit
  Client Settings
  Manufacturer Setup
```
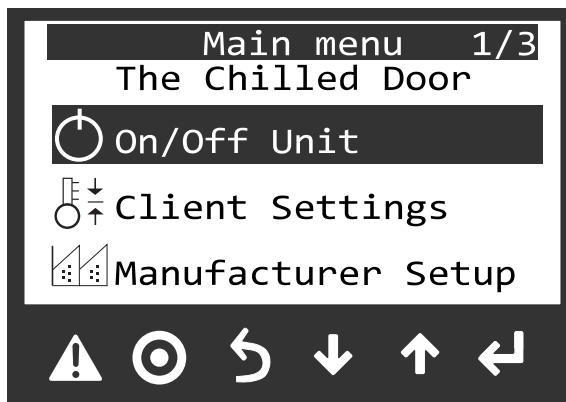
Programming/Main menu. (Three submenus)

• Press ⊙ to display this screen.

• Use the ⬇ and ⬆ buttons to highlight one of the submenus, then press the ↵ button to confirm your selection.

• When in one one the submenu screens, press the ↵ button to move the cursor from the home (top left) position to the next parameter.

```
        On/Off Unit

Unit address:          01

Actual state   UnitOn

Change to:    ▮SWITCH ON
```

⚠ ◉ ↩ ⬇ ⬆ ↵

```
        On/Off Unit

Unit address:          01

Actual state   UnitOn

Change to:    SWITCH OFF
```

⚠ ◉ ↩ ⬇ ⬆ ↵

```
02/15/2016 Mon    13:33
     The Chilled Door
Air Outlet:      065.4°F
Water Outlet:    069.9°F
Room Temp:       070.5°F
Server Outlet:   080.6°F
 Unit off by
 keyboard
```

⚠ ◉ ↩ ⬇ ⬆ ↵
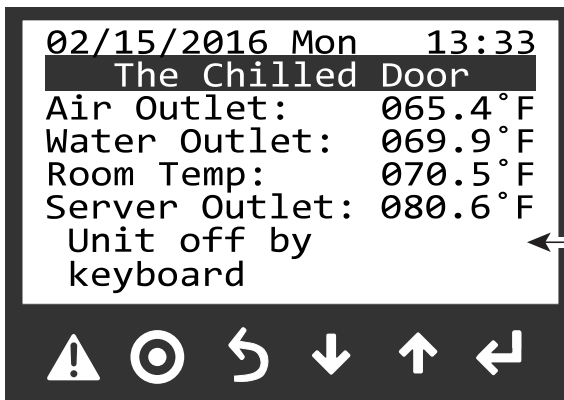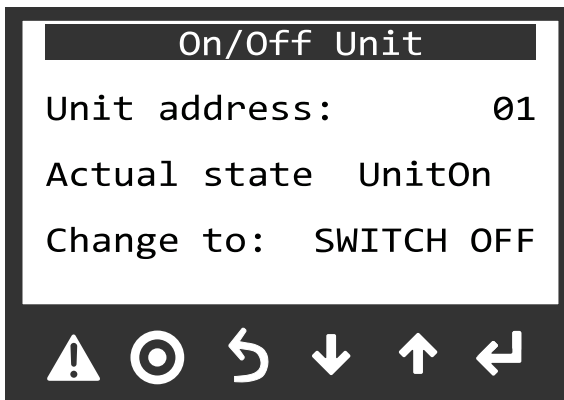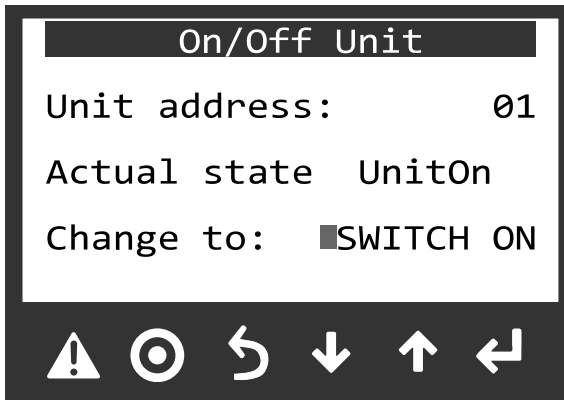
To Shutdown the ChilledDoor

1. Press [↵] to move the cursor to the Change to line.

2. Then press the [⬇] or [⬆] buttons to change the selection to SWITCH OFF as shown in the next screen.

3. Press [↩] to go to the Home Screen.

4. Check that the ChilledDoor is powered off (Unit off).

   NOTE: In this mode, the fans and actuator valve shutdown, but the control system and the blue LED lights remain powered on.

5. If the ChilledDoor needs to be completely powered off, unplug the two power cords from the extension cords at the bottom of the rack.

   The LED lights on the door receive power from only 1 of the 2 power cords, even though all the other door operations are redundant.

Client Settings Submenu
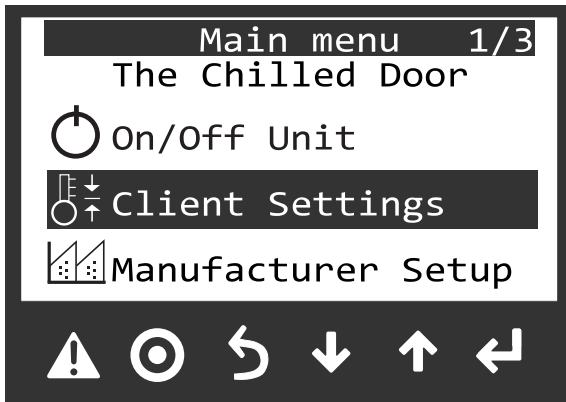
Client Settings menu.

The screens in this menu are used to change ChilledDoor set points and alarms. Set points for air and water temperatures and all alarm thresholds can be changed through the following screens.

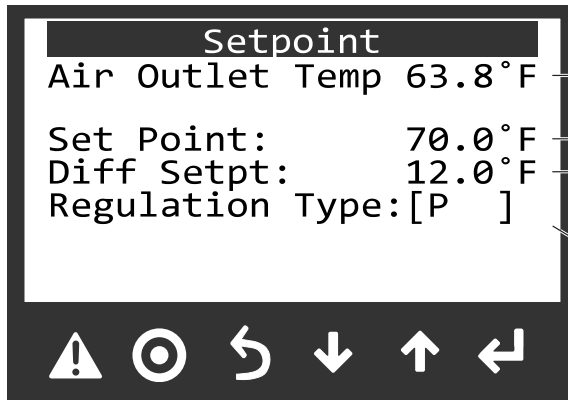• Select the `Client Settings` line as shown, and press the ⏎ button to go to the password screen.
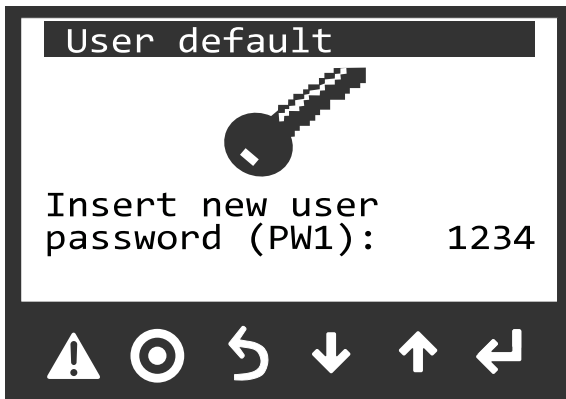
To Enter the Password
(Default password: 1234)

1. Press ⏎ to move the first digit of the password.

2. Press the ⬆ to select the correct number.

3. Press ⏎ to move to the second digit, etc.

The Setpoint screen is displayed next.

```
          Setpoint
Air Outlet Temp 63.8°F

Set Point:      70.0°F
Diff Setpt:     12.0°F
Regulation Type:[P  ]


  ⚠  ◎  ↩  ↓  ↑  ↵
```

Air Outlet Temperature Setpoint

Current temperature of the air exiting the ChilledDoor.

Desired temperature of the air exiting the ChilledDoor.

Temperature range for the control loop. The larger this number, the further the exit temperature can stray from set point
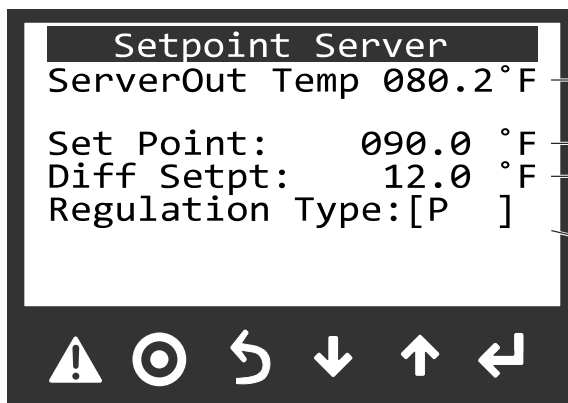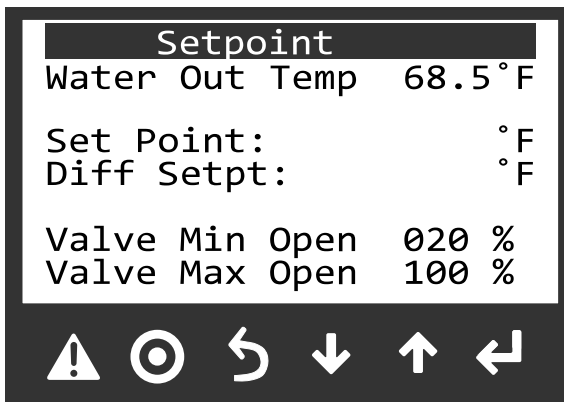
Regulation Type should always be set to P (Proportional)

To change settings:

1. Press ↵ to move the cursor to the desired parameter.

2. Use the ↓ and ↑ buttons to adjust the setting.

3. Move the cursor all the way off the screen before the ↓ and ↑ buttons will index to the next screen.

Press the ↵ button to move out of the menu.

* This parameter controls the `Valve Opening %` setting to maintain a constant air temperature at varying loads.

```
       Setpoint Server
ServerOut Temp 080.2°F

Set Point:     090.0 °F
Diff Setpt:    12.0  °F
Regulation Type:[P  ]


  ⚠  ◎  ↩  ↓  ↑  ↵
```

Server Outlet Temperature Set Point

Current temperature of the air entering the ChilledDoor.

Desired temperature of the air entering the ChilledDoor.

Temperature range for the control loop. The larger this number, the more the fan speeds can vary.

Regulation Type should always be set to P (Proportional).

* This parameter controls the `Fan speed output %` setting to maintain a constant Server Out air temperature at varying loads.

```
        Setpoint
Water Out Temp   68.5°F

Set Point:          °F
Diff Setpt:         °F

Valve Min Open   020 %
Valve Max Open   100 %
 ⚠  ◎  ↶  ↓  ↑  ↵
```

Set Points for Water Valve Opening and Closing Limits

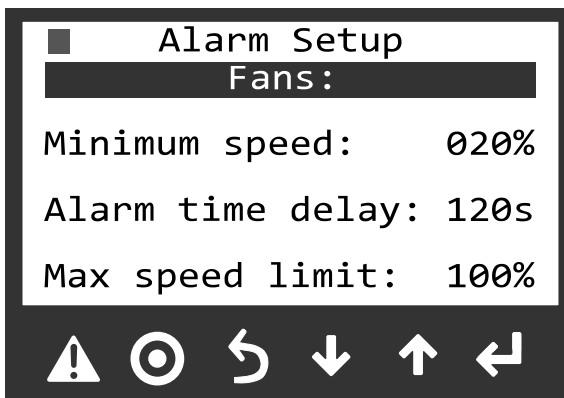— Current temperature of water leaving the ChilledDoor.

> These temperature set points are not used.

— Minimum open position is typically left at 20%.[1]

[1] This minimum prevents deadheading: When the discharge valve is closed and there is no other flow path available to the pump, the impeller keeps churning the same volume of liquid as it rotates inside the pump casing.
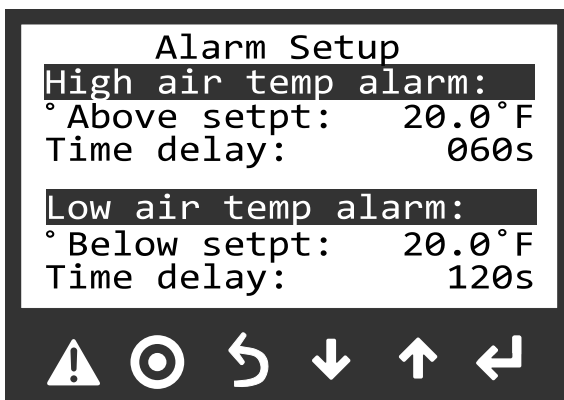
Alarm Setup Screens

The next six screens are used for setting alarm set points and time delays.

```
 ■      Alarm Setup
        Fans:

Minimum speed:     020%

Alarm time delay: 120s

Max speed limit:  100%
 ⚠  ◎  ↶  ↓  ↑  ↵
```
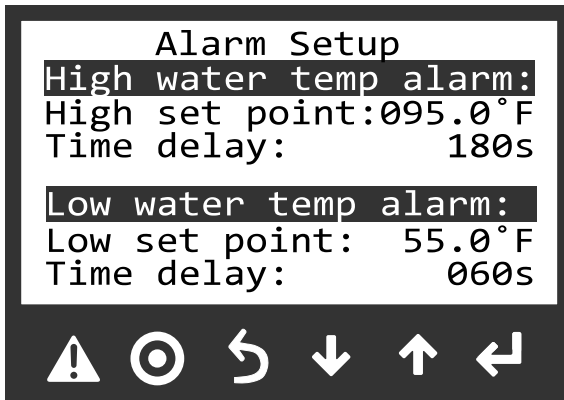
Fan Speed Alarm

The minimum and maximum speed limits for fan operation. The time delay is the number of seconds a fan can run at the minimum speed before an alarm is activated.
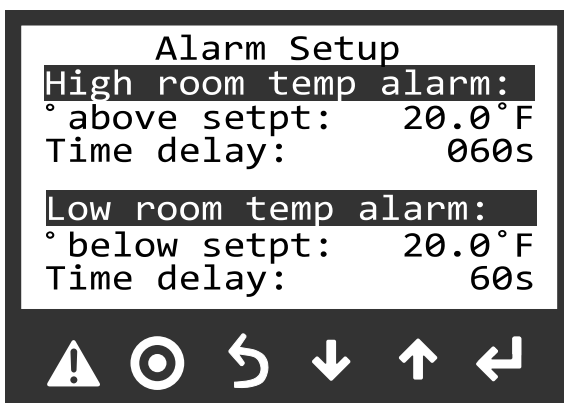
```
       Alarm Setup
High air temp alarm:
°Above setpt:    20.0°F
Time delay:       060s

Low air temp alarm:
°Below setpt:    20.0°F
Time delay:       120s
 ⚠  ◎  ↶  ↓  ↑  ↵
```

Outlet Air Temperature Alarms

An alarm is activated if the air temperature goes above or below the set point by the defined amount of degrees and stays at that temperature for the defined number of seconds.

```
        Alarm Setup
High water temp alarm:
High set point:095.0°F
Time delay:        180s

Low water temp alarm:
Low set point:   55.0°F
Time delay:        060s

⚠  ◉  ↶  ↓  ↑  ↵
```

Outlet Water Temperature Alarms

An alarm is activated if the water temperature goes above the high set point for the defined number of seconds. Or if the temperature goes below the low set point for the defined number of seconds.
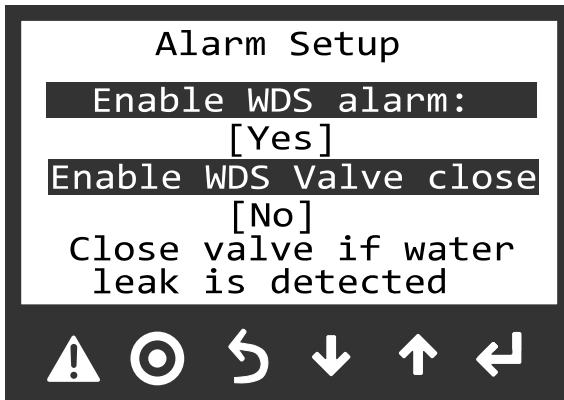
```
        Alarm Setup
High room temp alarm:
°above setpt:    20.0°F
Time delay:        060s

Low room temp alarm:
°below setpt:    20.0°F
Time delay:         60s

⚠  ◉  ↶  ↓  ↑  ↵
```

Room Air Temperature Alarms

These alarm settings are for the air temperature entering the front of the rack.

```
■      Alarm Setup
High Server Out Temp:

High setpt:     120.0°F

Time delay:        120s


⚠  ◉  ↶  ↓  ↑  ↵
```
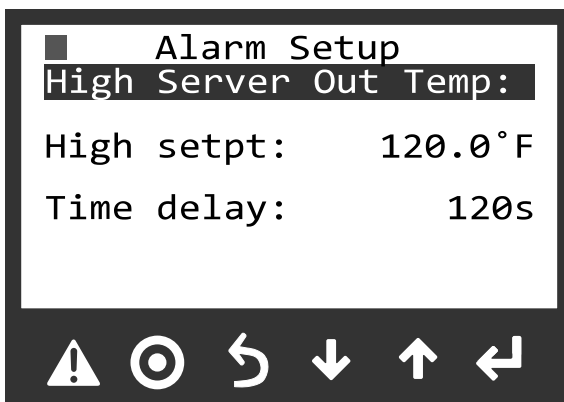
Server Outlet Air Temperature Alarm

This alarm setting is for the air temperature entering the door/coil.

```
        Alarm Setup

    Enable WDS alarm:
          [Yes]
  Enable WDS Valve close
          [No]
   Close valve if water
    leak is detected

   ⚠  ◉  ↶  ↓  ↑  ↵
```
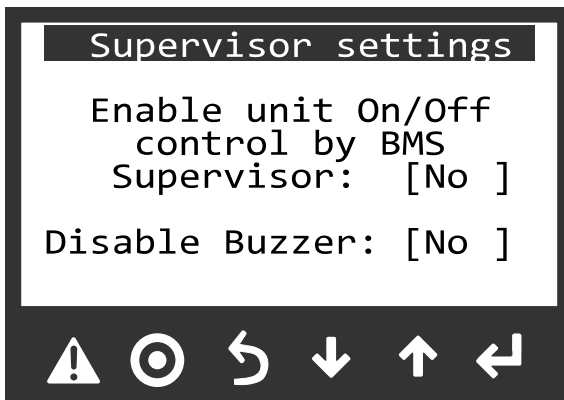
Water Detection Sensor Alarm

Every door can be equipped with a water detection strip. Typically, 1 out of every 4 or 5 doors has a leak strip wired into it.

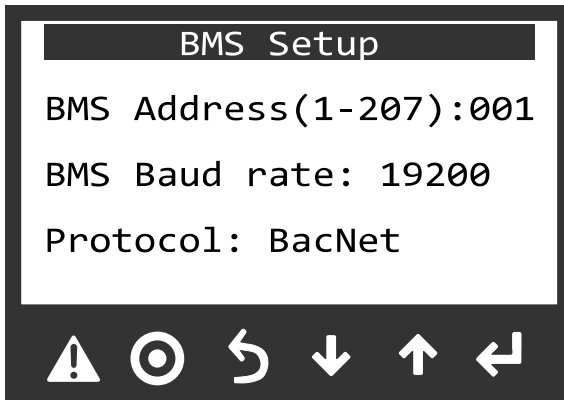This screen instructs PLC to monitor the strip if one is connected.

Refer to the *Water Sensor Strip* section for more information.

```
    Supervisor settings

    Enable unit On/Off
      control by BMS
     Supervisor:  [No ]

   Disable Buzzer: [No ]

   ⚠  ◉  ↶  ↓  ↑  ↵
```

Door Networked to a Remote Automation System

These supervisor settings are used if the ChilledDoor is networked to a remote automation system.

These first setting enables on/off control through a Building Management System (BMS) or remote automation system. Setting this to No provides a safety layer to prevent accidentally turning the system On/Off through the BMS.
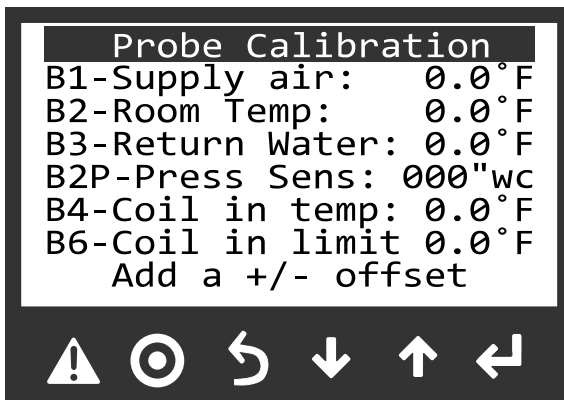
```
┌─────────────────────────────┐
│        BMS Setup            │
│                             │
│  BMS Address(1-207):001     │
│                             │
│  BMS Baud rate: 19200       │
│                             │
│  Protocol: BacNet           │
│                             │
│   ⚠  ◉  ↺  ↓  ↑  ↵          │
└─────────────────────────────┘
```

This screen is used to define the BMS communications protocol: BacNet, Modbus, or Lon.

The Baud rate is fixed based on the selected protocol. The BMS address is only used for the Modbus protocol.

BMS Not Reading Pressure/Temperature:

If pressure and temperature values are displaying only as zeros when setting up remote monitoring through the pCOWeb interface card, it be because the interface card is not set up correctly in the PLC controller.

Verify the user/client parameters are set to "pcoweb" and the baud rate is set to 19200. Sometimes when a protocol is changed, the controller doesn't recognize the new setting. If this happens, set the protocol to a different setting, and then change it back to the preferred setting to get the controller to recognize it.
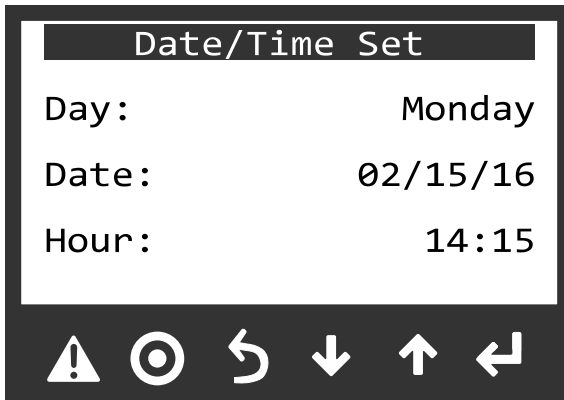
```
┌─────────────────────────────┐
│     Probe Calibration       │
│ B1-Supply air:    0.0°F     │
│ B2-Room Temp:     0.0°F     │
│ B3-Return Water: 0.0°F      │
│ B2P-Press Sens: 000"wc      │
│ B4-Coil in temp: 0.0°F      │
│ B6-Coil in limit 0.0°F      │
│     Add a +/- offset        │
│   ⚠  ◉  ↺  ↓  ↑  ↵          │
└─────────────────────────────┘
```

Probe and Transducer Calibration

This screen is used to calibrate temperature and pressure readings. This screen is typically not used.
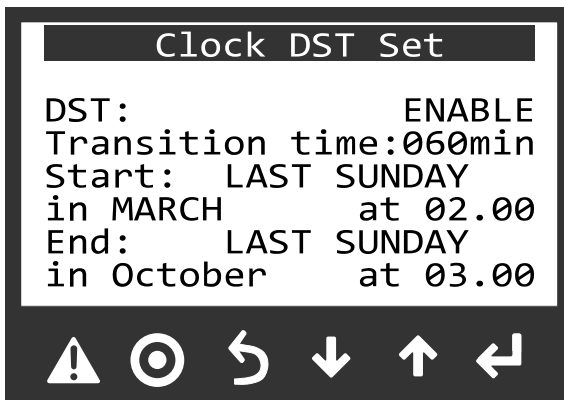
Calibrating a probe requires use of a calibrated testing instrument to take a sample measurement to determine the amount of offset necessary (+/-) to obtain an accurate measurement from the probe. The offset must then be entered and saved.

Replacement temperature probes and pressure transducers are listed in the *Spare Parts List* at the end of this document.

```
        Date/Time Set

Day:              Monday

Date:           02/15/16

Hour:              14:15


  ⚠  ◎  ↶  ↓  ↑  ↵
```

Date and Time Settings

The next two screens are used to set date and time for displaying on the Home Screen and in the Alarm History log.

```
        Clock DST Set

DST:               ENABLE
Transition time:060min
Start:   LAST  SUNDAY
in MARCH       at 02.00
End:      LAST  SUNDAY
in October      at 03.00

  ⚠  ◎  ↶  ↓  ↑  ↵
```

This is the last screen in the Programming menu. It is used for setting Daylight Savings time.

Manufacturer Setup Submenu

```
        Main menu    1/3
     The Chilled Door

  ⏻ On/Off Unit

  ⏿ Client Settings

  🏭Manufacturer Setup

  ⚠  ◎  ↶  ↓  ↑  ↵
```
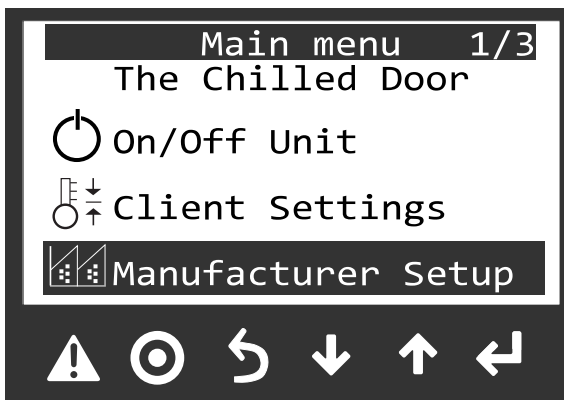
Manufacturer Setup Menu

This menu provides high-level software and hardware settings and other information that rarely need to be changed.
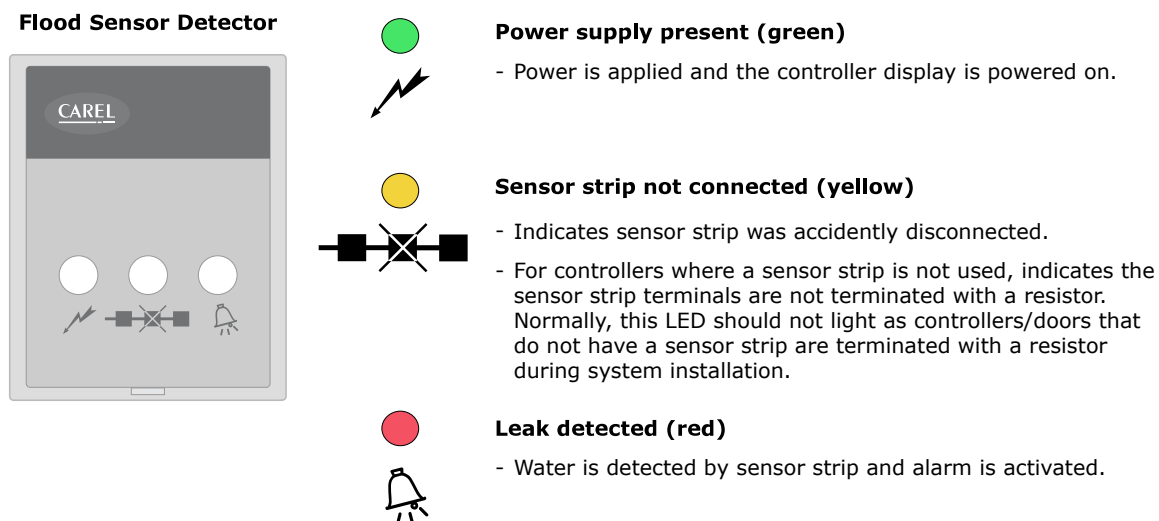
All parameters in this menu are preset during system installation. This menu is protected by a separate password.

Water Detection System

The Water Detection System (WDS) is an optional device that consists of an electronic controller module and a water sensor strip. The WDS is designed to detect the presence of water and then signal the alarm. All chilled-water doors include a WDS controller module next to the controller display, even if the WDS option is not used. The WDS module is installed on the DIN rail of the PLC next to the graphics display.

There are three LEDs on the front panel of the WDS module (Flooding Sensor Detector) that indicate the operating status of the device.

Figure 5. WDS Status LEDs

Flood Sensor Detector

Power supply present (green)
- Power is applied and the controller display is powered on.

Sensor strip not connected (yellow)
- Indicates sensor strip was accidently disconnected.
- For controllers where a sensor strip is not used, indicates the sensor strip terminals are not terminated with a resistor. Normally, this LED should not light as controllers/doors that do not have a sensor strip are terminated with a resistor during system installation.

Leak detected (red)
- Water is detected by sensor strip and alarm is activated.

Water Sensor Strip

The water sensor strip (grey-red) is made from polyester fiber and contains two stainless steel electrodes. The sensor strip can detect water along the entire length of the strip. If an alarm is activated, and the water is no longer present, the strip can be reused after it dries without needing to be replaced.

The water sensor strip and wiring is installed during system installation under the raised floor below the doors. The strip is secured to the floor using a suitable non-conductive adhesive (Silicone) at the low point around the piping and hoses. The WDS kit includes 10 ft. of sensor tape and 10 ft. of lead wire for routing back through the lower raceway to the customer connections terminal strip inside the door. Wires from this terminal strip are connected to the appropriate terminals of the PLC terminal block.

WDS Alarm Setup

The alarm setup for the WDS option must be enabled through a PLC display menu as shown below. For example, if water is detected by the water sensor strip, the alarm LED on the WDS module will light red. However, the chilled-water door does not go into an alarm state (the door LEDs don't change from blue to red and an ALARM alert is not shown on the display) unless the WDS Alarm is enabled on the PLC graphics display.

Figure 6. WDS Alarm Setup

```
        Alarm Setup

   Enable WDS alarm:
          [Yes]
Stop Pump on WDS alarm
          [Yes]
```

Water Detection System Alarm

The water detection system (WDS) alarm setup uses an On/Off parameter to enable the alarm function and define the action the pump should take.

Setting `Enable WDS alarm` to Yes instructs the PLC to monitor the water detection strip.

A strip is included with every CDU, but they are typically wired only to the doors. Refer to the *Water Detection System* section for more information.

CDU Controller Display

The CDU has a graphic display with a backlit screen and 6 button keypad as shown in the following figure. This display is used to display and control CDU set points, alarms, temperatures, pressures, and other values of the supply and return water lines. The CDU display is similar to the ChilledDoor display.

The display provides two main sets of screens/menus:

● **Home Screen**. This is a menu style screen that displays current CDU readings and settings. It has five separate screens to scroll through to display all the current values.

● **Programming Menu**. This menu has three submenus to control the CDU system and modify alarm set points.

All the screens and menus are described in detail in the following section. Refer to the CDU Screen and Menu Map.

Figure 7. CDU Controller Display (sleep mode screen)

Alarm
(Flashes red when there is an active alarm)
- Display and clear active alarm messages

Program/Main Menu
- Go to Programming Menu (Main menu 1/3)

Escape/Return
- Go to Home Screen (first screen)
- When entering value, move cursor left

Up
- Scroll up to previous screen or menu item
- Go to next value/choice for selected parameter

Enter
- Confirm selected menu item/parameter
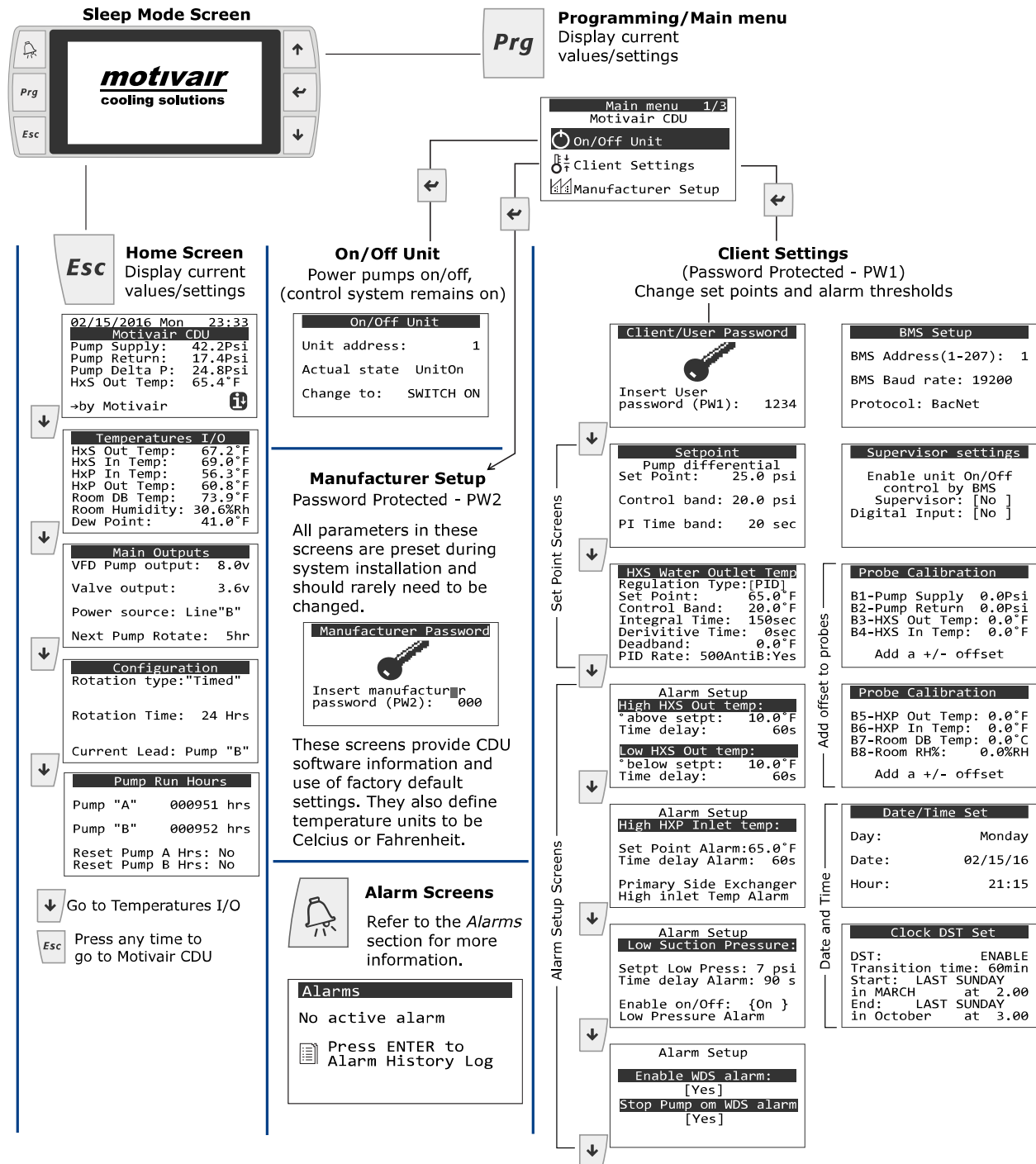- In Programming Menus, move cursor from the home (top left) position to the next parameter.

Down
- Scroll down to next screen or menu item
- Go to previous value/choice for selected parameter
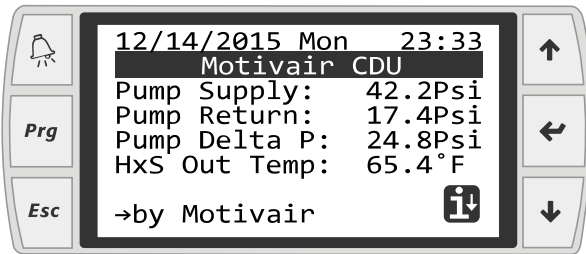
CDU Screen and Menu Map

The following figure provides a quick reference of the screens and menus in the CDU display system. Detailed descriptions of the screens are included on the following pages.

Figure 8. CDU Screen and Menu Map

Sleep Mode Screen

motivair
cooling solutions

Prg

Programming/Main menu
Display current
values/settings

```
        Main menu    1/3
         Motivair CDU
 On/Off Unit
 Client Settings
 Manufacturer Setup
```

Esc

Home Screen
Display current
values/settings

```
02/15/2016 Mon    23:33
      Motivair CDU
Pump Supply:    42.2Psi
Pump Return:    17.4Psi
Pump Delta P:   24.8Psi
HxS Out Temp:   65.4°F

→by Motivair
```

```
      Temperatures I/O
HxS Out Temp:    67.2°F
HxS In Temp:     69.0°F
HxP In Temp:     56.3°F
HxP Out Temp:    60.8°F
Room DB Temp:    73.9°F
Room Humidity: 30.6%Rh
Dew Point:       41.0°F
```

```
       Main Outputs
VFD Pump output:  8.0v

Valve output:     3.6v

Power source: Line"B"

Next Pump Rotate:  5hr
```

```
       Configuration
Rotation type:"Timed"

Rotation Time:  24 Hrs

Current Lead: Pump "B"
```

```
      Pump Run Hours

Pump "A"    000951 hrs

Pump "B"    000952 hrs

Reset Pump A Hrs: No
Reset Pump B Hrs: No
```

Go to Temperatures I/O

Esc Press any time to
go to Motivair CDU

On/Off Unit
Power pumps on/off,
(control system remains on)

```
      On/Off Unit

Unit address:        1

Actual state  UnitOn

Change to:   SWITCH ON
```

Manufacturer Setup
Password Protected - PW2

All parameters in these
screens are preset during
system installation and
should rarely need to be
changed.

```
   Manufacturer Password



Insert manufacturer
password (PW2):    000
```

These screens provide CDU
software information and
use of factory default
settings. They also define
temperature units to be
Celcius or Fahrenheit.

Alarm Screens

Refer to the *Alarms*
section for more
information.

```
Alarms

No active alarm

   Press ENTER to
   Alarm History Log
```

Client Settings
(Password Protected - PW1)
Change set points and alarm thresholds

```
   Client/User Password



Insert User
password (PW1):   1234
```

```
         BMS Setup

BMS Address(1-207):  1

BMS Baud rate: 19200

Protocol: BacNet
```

Set Point Screens

```
        Setpoint
    Pump differential
Set Point:      25.0 psi

Control band: 20.0 psi

PI Time band:   20 sec
```

```
   Supervisor settings

  Enable unit On/Off
    control by BMS
  Supervisor: [No ]
Digital Input: [No ]
```

```
  HXS Water Outlet Temp
Regulation Type:[PID]
Set Point:       65.0°F
Control Band:    20.0°F
Integral Time:  150sec
Deritivive Time:  0sec
Deadband:         0.0°F
PID Rate: 500AntiB:Yes
```

Add offset to probes

```
   Probe Calibration

B1-Pump Supply   0.0Psi
B2-Pump Return   0.0Psi
B3-HXS Out Temp: 0.0°F
B4-HXS In Temp:  0.0°F

  Add a +/- offset
```

Alarm Setup Screens

```
      Alarm Setup
High HXS Out temp:
°above setpt:    10.0°F
Time delay:        60s
Low HXS Out temp:
°below setpt:    10.0°F
Time delay:        60s
```

```
   Probe Calibration

B5-HXP Out Temp: 0.0°F
B6-HXP In Temp:  0.0°F
B7-Room DB Temp: 0.0°C
B8-Room RH%:     0.0%RH

  Add a +/- offset
```

Date and Time

```
      Alarm Setup
High HXP Inlet temp:

Set Point Alarm:65.0°F
Time delay Alarm:  60s

Primary Side Exchanger
High inlet Temp Alarm
```

```
      Date/Time Set

Day:           Monday

Date:         02/15/16

Hour:            21:15
```

```
      Alarm Setup
 Low Suction Pressure:

Setpt Low Press: 7 psi
Time delay Alarm: 90 s

Enable on/Off:  {On }
Low Pressure Alarm
```

```
      Clock DST Set

DST:           ENABLE
Transition time: 60min
Start:  LAST SUNDAY
in MARCH      at  2.00
End:    LAST SUNDAY
in October     at  3.00
```

```
      Alarm Setup

 Enable WDS alarm:
        [Yes]
Stop Pump om WDS alarm
        [Yes]
```

CDU Home Menu Screens

The five screens that make up the Home Menu are described below. Scroll up or down to view these screens by pressing the up and down arrow buttons. Press the Esc button at any time to display the first screen.
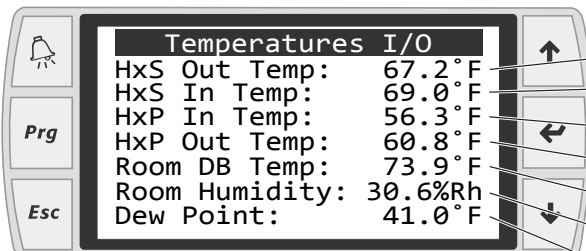
```
12/14/2015 Mon    23:33
          Motivair CDU
Pump Supply:     42.2Psi
Pump Return:     17.4Psi
Pump Delta P:    24.8Psi
HxS Out Temp:    65.4°F

→by Motivair
```

Home Menu. Press ⎋ to display this screen.

The first of five screens in the Home Menu.

The Home Menu displays pressure and temperature from each of the CDU probes. This series of screens also displays pump speed, control valve position, power source, and the pump rotation schedule.

Press ↓ to go to the next screen.

```
      Temperatures I/O
HxS Out Temp:    67.2°F
HxS In Temp:     69.0°F
HxP In Temp:     56.3°F
HxP Out Temp:    60.8°F
Room DB Temp:    73.9°F
Room Humidity: 30.6%Rh
Dew Point:       41.0°F
```

Used for monitoring and alarm functions

Repeats the Secondary loop supply (Out) temperature
Secondary loop return (In) temperature
Primary loop supply (In) temperature
Primary loop supply (Out) temperature
Room dry bulb (DB) temperature
Room relative humidity (Rh)
Room dew point [1]

HxP = Heat Exchanger Primary loop
HxS = Heat Exchanger Secondary loop

[1] Data center humidity is monitored to ensure the Secondary loop temperature remains above the dew point. This is necessary to prevent condensation on the coils inside the ChilledDoors. The CDU automatically adjusts Secondary loop out (HxS Out) temperature to stay 3°F above room dew point.

```
        Main Outputs
VFD Pump output:    8.0v

Valve output:       3.6v

Power source: Line"B"

Next Pump Rotate:   5hr
```
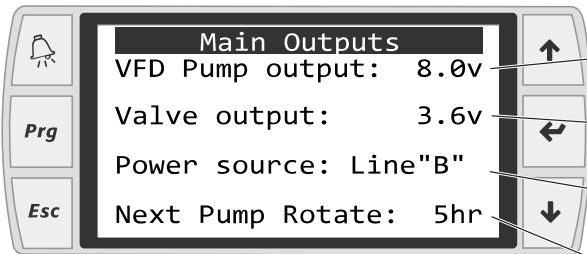
Variable-frequency drive (VFD) pump speed on a 0-10 V scale.[2]

Primary control valve position on a 0-10 V scale.[3]

Power source currently being used.

Pump rotation schedule. Number of hours before the CDU switches to using the other secondary loop pump.

[2] As the pressure difference between the `Pump Supply` and `Pump Return` changes (`Pump Delta P`), the voltage output to the pump changes. This causes the pump speed to increase/decrease in order to maintain flow volume to the doors, based on the set points and inputs from probes. The pump runs at the proper speed needed to maintain the pump differential pressure set point.

[3] As the temperature of water leaving the pump changes (`HxS Out`), the voltage output to the actuator valve changes. This causes the valve on the Primary loop to modulate (open/close) in order to maintain water temperature going to the doors, based on the set points and inputs from probes.

```
        Configuration
Rotation type:"Timed"


Rotation Time:   24 Hrs


Current Lead: Pump "B"
```
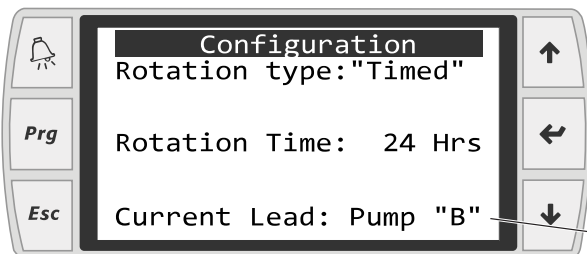
Pump Rotation Configuration

To enable manual pump switching and rotation by hours or timed pump switching for a specific day and time each week.

The pump that will operate first.

```
       Pump Run Hours

Pump "A"      000951 hrs

Pump "B"      000952 hrs

Reset Pump A Hrs: No
Reset Pump B Hrs: No
```
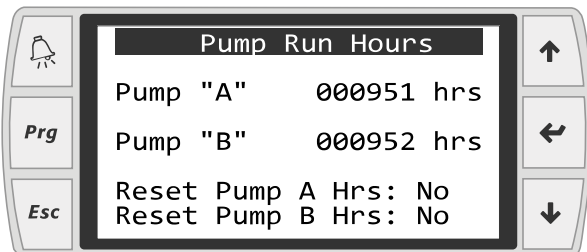
Pump Runtime Log

The number of hours each of the Secondary loop pumps have run.

No - the counters keep adding to the total hours
Yes - restarts the counter to 0 (zero).

CDU Programming Menu Screens

The screens that make up the programming menus are described below.

On-Off Unit Submenu

```
        Main menu    1/3
        Motivair CDU
   🕐 On/Off Unit
   🔀 Client Settings
   🏭 Manufacturer Setup
```
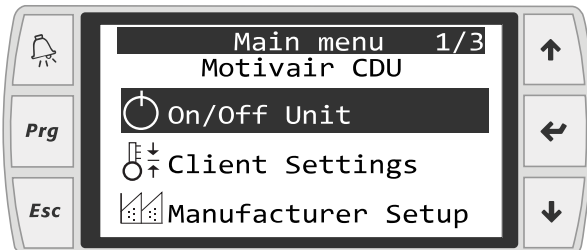
Programming/Main menu. (Three submenus)

• Press `Prg` to display this screen.

• Use the ⬇ and ⬆ buttons to highight one of the submenus, then press the ↵ button to confirm your selection.

• When in one one the submenu screens, press the ↵ button to move the cursor from the home (top left) position to the next parameter.

```
        On/Off Unit

Unit address:          1

Actual state  UnitOn

Change to:  ▌SWITCH ON
```
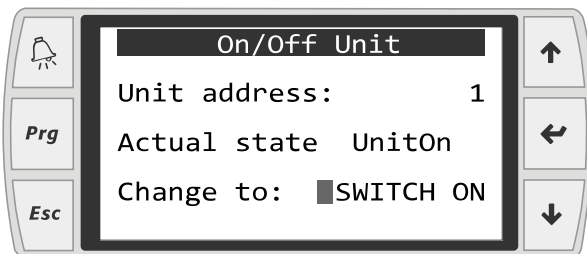
To Shutdown the CDU Pumps

1. Press ↵ to move the cursor to the `Change` to line.

2. Then press the ⬇ or ⬆ buttons to change the selection to `SWITCH OFF` as shown in the next screen.

```
        On/Off Unit

Unit address:          1

Actual state  UnitOn

Change to:  SWITCH OFF
```

3. Press `Esc` to go to the Home Screen.

```
02/15/2016 Mon    23:33
        Motivair CDU
Pump Supply:    42.2Psi
Pump Return:    17.4Psi
Pump Delta P:   24.8Psi
HxS Out Temp:   65.4°F
 Unit off by
 keyboard
```
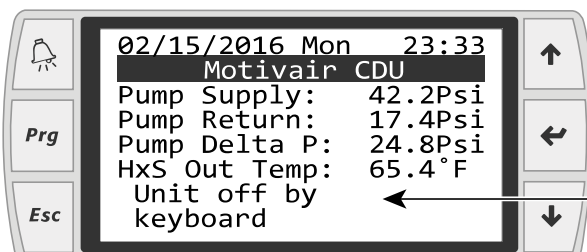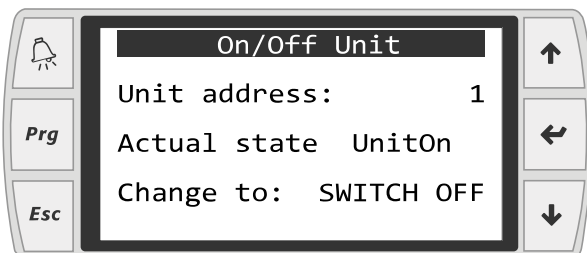
4. Check that the CDU is powered off (`Unit off`).

NOTE: In this mode, the pumps shutdown, but the control system remains powered up and active.

5. If the CDU needs to be completely powered off, turn both of the disconnect switches on the control panel cover to the off position.

Client Settings Submenu
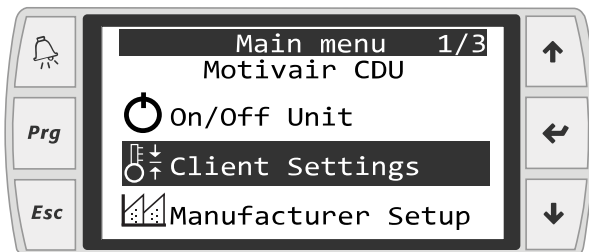
Client Settings menu.

The screens in this menu are used to change CDU set points and alarms. Set points for Primary and Secondary loop temperatures, differential pump pressure, and all alarm thresholds can be changed through the following screens.

• Select the `Client Settings` line as shown, and press the ⏎ button to go to the `Client/User Password` screen.
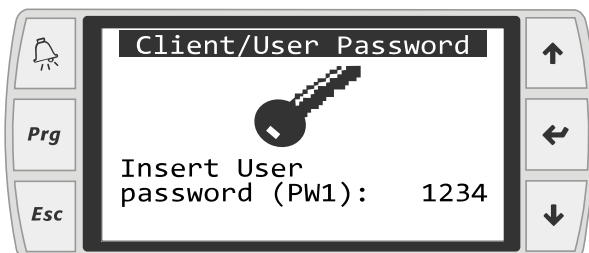
To Enter the Password
(Default password: 1234)

1. Press ⏎ to move the first digit of the password.
2. Press ↑ to select the correct number.
3. Press ⏎ to move to the second digit, etc.

The Setpoint screen is displayed next.
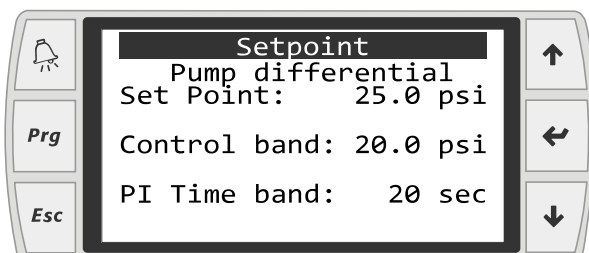
Pump Differential Set Point

Set Point - This is the difference between the pump supply and return pressures. The current pressure difference is provided as `Pump Delta P` on the Home Menu.

Control band and PI Time band - these values should rarely need to be changed.

```
   HXS Water Outlet Temp
Regulation Type:[PID]
Set Point:       65.0°F
Control Band:    20.0°F
Integral Time:  150sec
Derivitive Time:  0sec
Deadband:         0.0°F
PID Rate: 500AntiB:Yes
```
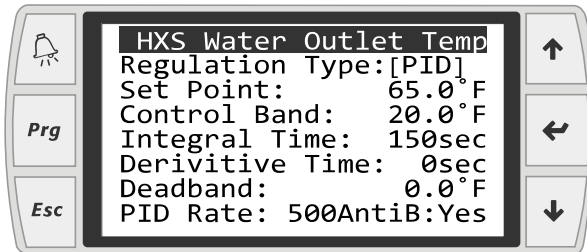
Secondary Water (HXS) Temperature Control

The HXS outlet temperature set point is a PID loop setup (default). The set point and other parameters can be adjusted on this screen.

The temperature set point varies depending on the facility water temperature (primary) and the rack/door configuration. The CDUs typically operate in PID mode and the variables are set during system installation.

The Regulation Type (control mode) can be changed from Proportional-Integral-Derivative (PID) to Proportional (P) control if needed.

Alarm Setup Screens

The next four screens are used for setting alarm set points and time delays.

```
          Alarm Setup
High HXS Out temp:
°above setpt:    10.0°F
Time delay:         60s

Low HXS Out temp:
°below setpt:    10.0°F
Time delay:         60s
```
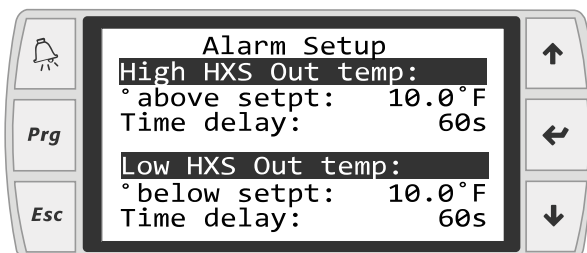
Secondary Water Temperature Alarms

An alarm is activated if the water temperature goes above or below the set point by the defined amount of degrees and stays at that temperature for the defined number of seconds.

```
          Alarm Setup
High HXP Inlet temp:

Set Point Alarm:65.0°F
Time delay Alarm:  60s

Primary Side Exchanger
High inlet Temp Alarm
```
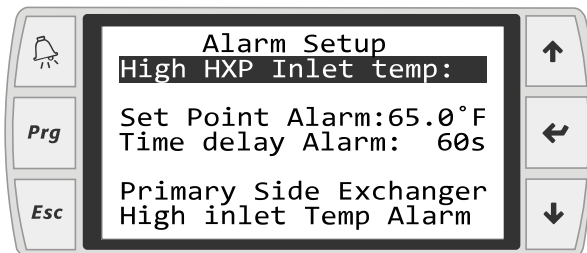
Primary Water High Temperature Alarm

This Primary In (supply) high temperature alarm will be activated if the water reaches the set point temperature and stays at that temperature for the defined number of seconds.

```
          Alarm Setup
  Low Suction Pressure:

Setpt Low Press: 7 psi
Time delay Alarm: 90 s

Enable on/Off:  {On }
Low Pressure Alarm
```
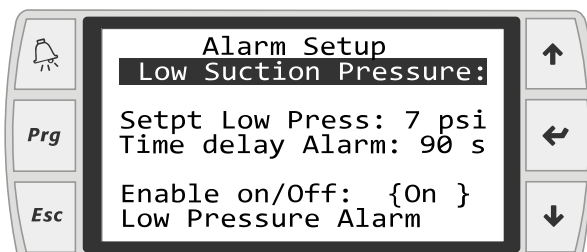
Low Suction Pressure (Secondary Loop Return)

This set point should be 7 psi.

If this alarm activates, plans need to be made to add water to the secondary loop. Instructions for adding water can be found later in this document.
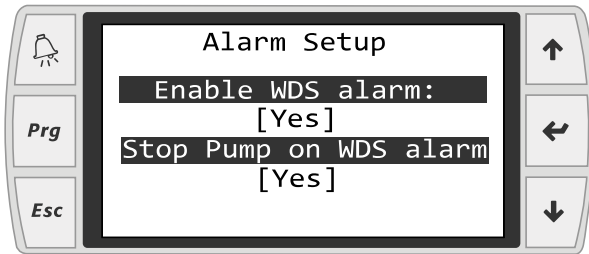
```
        Alarm Setup

  Enable WDS alarm:
        [Yes]
Stop Pump on WDS alarm
        [Yes]
```

Water Detection System Alarm

The water detection system (WDS) alarm setup uses an On/Off parameter to enable the alarm function and define the action the pump should take.

Setting `Enable WDS alarm` to Yes instructs the PLC to monitor the water detection strip.

A strip is included with every CDU, but they are typically wired only to the doors. Refer to the *Water Detection System* section for more information.

```
   Supervisor settings

  Enable unit On/Off
    control by BMS
   Supervisor: [No ]
Digital Input: [No ]
```
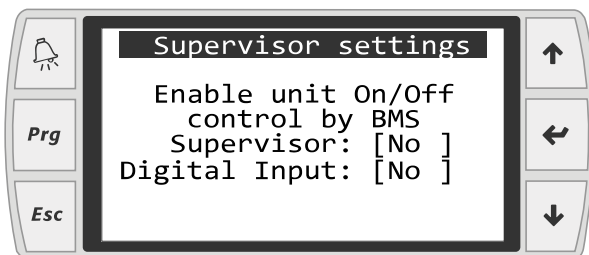
CDU Networked to a Remote System

These supervisor settings are used when the CDU is networked to a remote system.

These setting provide a safety layer to prevent accidentally turning the system On/Off through a Building Management System (BMS) or remote automation system.

To use these functions they must be set to Yes.
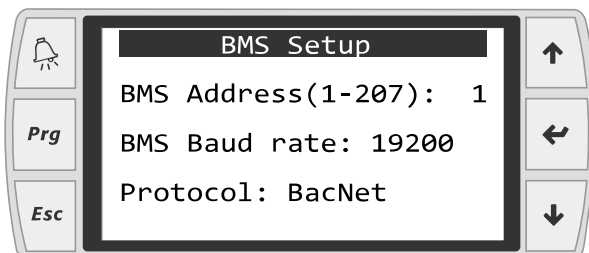
```
        BMS Setup

BMS Address(1-207):  1

BMS Baud rate: 19200

Protocol: BacNet
```

This screen is used to define the BMS communications protocol: BacNet, Modbus, or Lon.

The Baud rate is fixed based on the selected protocol. The BMS address is only used for the Modbus protocol.

```
      Probe Calibration

B1-Pump Supply  0.0Psi
B2-Pump Return  0.0Psi
B3-HXS Out Temp: 0.0°F
B4-HXS In Temp:  0.0°F

     Add a +/- offset
```

```
      Probe Calibration

B5-HXP Out Temp: 0.0°F
B6-HXP In Temp:  0.0°F
B7-Room DB Temp: 0.0°C
B8-Room RH%:    0.0%RH

     Add a +/- offset
```
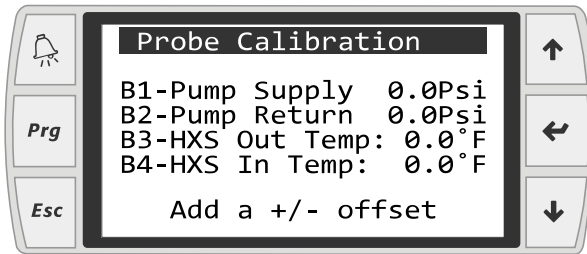
Probe and Transducer Calibration

The next two screens are used to calibrate temperature/pressure readings.

Calibrating a probe requires use of a calibrated testing instrument to take a sample measurement to determine the amount of offset necessary (+/-) to obtain an accurate measurement from the probe. The offset must then be entered and saved into one of these screens.

Replacement temperature probes and pressure transducers are listed in the *Spare Parts List* at the end of this document.

```
       Date/Time Set

Day:           Monday

Date:        02/15/16

Hour:          14:15
```

Date and Time Settings

The next two screens are used to set date and time for displaying on the Home Screen and in the Alarm History log.

```
       Clock DST Set

DST:           ENABLE
Transition time: 60min
Start:   LAST SUNDAY
in MARCH      at  2.00
End:     LAST SUNDAY
in October    at  3.00
```

This is the last screen in the Programming menu. It is used for setting Daylight Savings time.

Manufacturer Setup Submenu

```
     Main menu    1/3
       Motivair CDU
  ⏻ On/Off Unit
  ⌁ Client Settings
  ▦ Manufacturer Setup
```
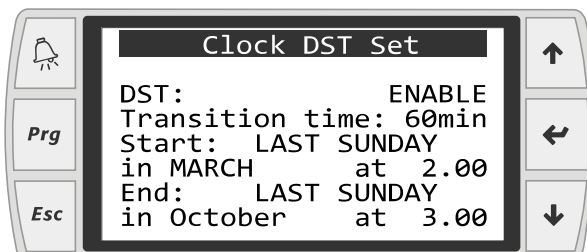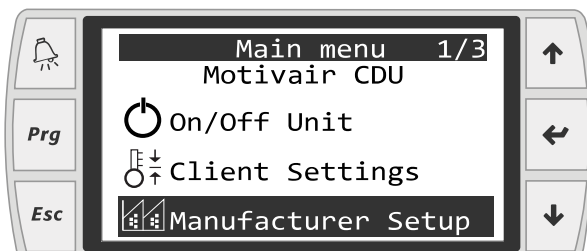
Manufacturer Setup Menu

This menu provides high-level software and hardware settings and other information that rarely need to be changed.

All parameters in this menu are preset during system installation. This menu is protected by a separate password.

Alarms

The operation of the alarm screen systems for both the CDU and ChilledDoor are explained below. Alarms signal a problem or issue with the system. Refer to the Alarm Troubleshooting section for information on alarm causes and suggestions for resolving issues.
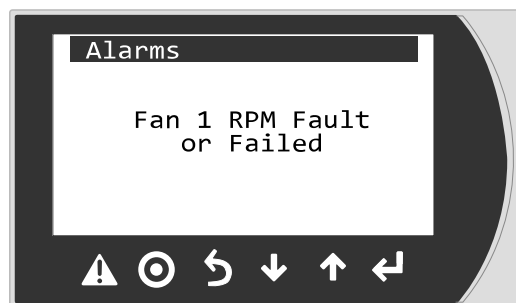
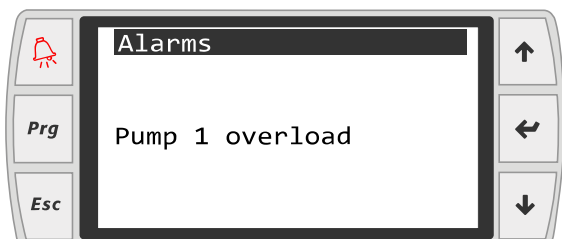*Figure 9. Alarm Screen Operation*

CDU Display	ChilledDoor Display

- These ALARM screens appear when any alarm is triggered.

- Press 🔔 | ⚠ once to display the current alarm.

Continued below

Alarm Screen Operation (continued)

CDU Display   **ChilledDoor Display**

- Press [bell] ‖ [warning] __again__ to acknowledge and clear the alarm (if the alarm condition is no longer present).
- The "No active alarm" screen is displayed and provides access to the Alarm History log.

- If the alarm condition has not been cleared, the alarm screen will redisplay the same alarm message.

```
Alarms
No active alarm
   Press ENTER to
   Alarm History Log
```

```
Alarms
No active alarm
   Press ENTER to
   Alarm History Log
```
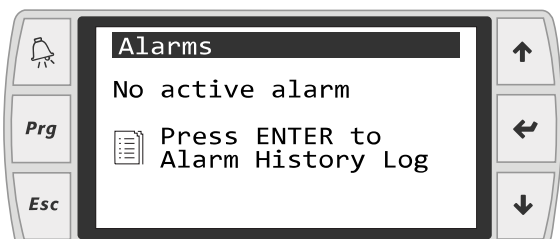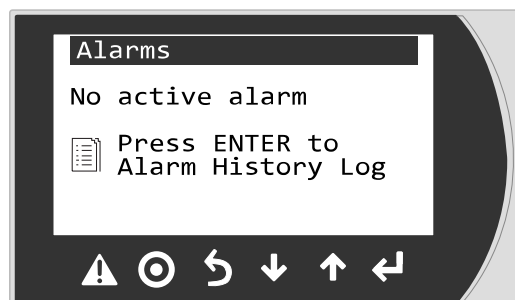
- Press [enter] ‖ [enter] to enter the alarm log.

- A log entry is created and stored for every alarm. The log records the alarm number sequence 001, 2, 3…, time, date, and the alarm description.

```
Alarm History      E01
N°001 14:34   02/15/16

Pump A overload
```

```
Alarm History      E01
N°001 14:34   02/15/16

Fan #1 Fault
```
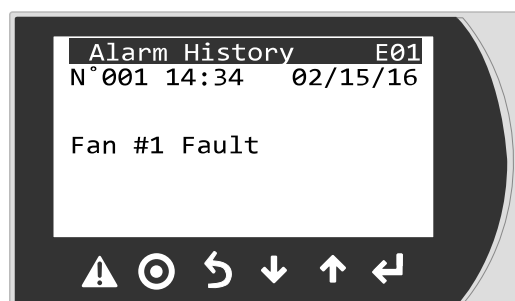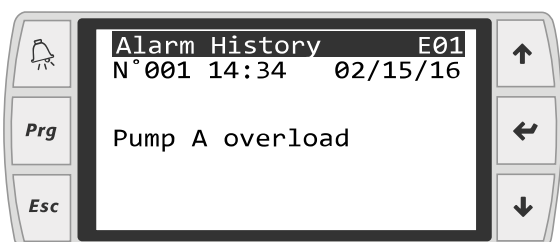
Troubleshooting Alarms

This table shows alarm messages and the event that triggered each a recommended action.

Table 1. Alarm Events and Corrective Actions

Alarm Message	Event and Check/Corrective Action
ChilledDoor and CDU	
| ```
    WDS alarm

Water Detected by WDS
``` | **Event:**<br>● Water on sensor or open sensor circuit.<br>**Check:** |

Alarm Message	Event and Check/Corrective Action
	● Check for leak or wet sensor strip. ● Check for open circuit wire or end resistor.
Probe Bx fault or disconnected	**Event:** All probe alarms are triggered by a failed or disconnected probe (electrically open or shorted). **Check:** ● Check probe connection to PLC connector. ● Replace probe.
Clock Board fault or not connected	**Event:** Failed clock board. **Action:** ● Replace PLC.
ChilledDoor	
Fan 1-5 RPM Fault or Failed	**Event:** Fan RPM reading dropped below 50% of minimum fan speed set point and remained low for the alarm time delay period. **Check:** ● Fan not turning - check F3 fuse and Molex plug. ● Swap out fan with known good spare fan. ● Fan turning - check fan # wiring and input connector at PLC. ● Check fan Molex plug connection at fan motor. ● To test PLC input, swap input tach wire with known good input. Replace fan or PLC per results.
High Return Water Temperature	**Event:** Outlet water temperature is higher than the alarm set point and exceeds the delay time. **Check:** ● Building primary chilled water supply too warm. ● Insufficient chilled water pump/flow to doors. ● CWV valve restricting flow or stuck. ● Room temperature too high causing overload of chilled door coil capacity.

Alarm Message	Event and Check/Corrective Action
High Room Air Temperature Low Room Air Temperature	**Event:** Data room temperature is higher/lower than the set point +/- the alarm differential set point also exceeding the delay time. **Check:** ● High room temperatures are caused by insufficient cooling by the chilled coolant loop or other room cooling sources. ● Low room temps are due to low load operation or over cooling by other room located cooling units.
High Server Outlet Temperature	**Event:** Outlet server temperature is higher than the alarm set point. **Check:** ● Low or no air flow from ChilledDoor fans. ● Excessive server loads or very high room temperature.
High Supply Air Temperature	**Event:** Outlet air temperature higher than the set point + the alarm differential set point also exceeds the delay time. (Example: 75°F + 10°F = 85°F). **Check:** ● Check chilled coolant supply loop flow and temperature for min 65F. ● Check 24V power or failed actuator/valve. ● Check PLC 0-10V output to CWV (10V = 0% open). ● Check loop or door coil for trapped air (re-vent).
Low Supply Air Temperature	**Event:** Outlet air temperature lower than the set point. **Action:** ● Check chilled coolant supply loop temperature for temperature too low. ● Check minimum valve % set point too high for low load.
Low Return Water Temperature Condensation Warning	**Event:** Outlet water temperature lower than the alarm set point. **Action:** ● Check chilled coolant supply loop temperature for below 50°F. ● Water probe in a too low ambient (underfloor).
CDU	

Alarm Message	Event and Check/Corrective Action
`High HXS out temperature`	**Event:** Secondary loop supply outlet temperature exceeded set point. **Action:** ● Check primary HXP inlet temp is below 55°F. ● Check cooling valve actuator is open (10 VDC signal to actuator). ● Check pump pressures and flow for both primary and secondary loops.
`Low HXS out temperature`	**Event:** Secondary loop supply outlet temperature below set point. **Action:** ● Check valve minimum position setting at 0% (default). ● Check if actuator/cooling valve failed to open. ● Check probe B3 calibration/accuracy.
`B1/B2 pressure fault`	**Event:** Pressure transducer failed, is out of range, or is disconnected. **Action:** ● Check probe connection to PLC connector and connection at the transducer. ● Replace probe transducer. ● Replace PLC.
`High HXP in temperature`	**Event:** Primary loop supply inlet water temperature exceeded set point. **Action:** ● Check if building primary chilled water supply is too warm. ● Check if building chilled water pump/flow stopped. ● Check if primary two-way valve was closed for an extended time.
`VFD Pump fault`	**Event:** Alarm originated in VFD pump and opening alarm contacts. **Action:** ● Check VFD screen alarm code or history. ● Consult VFD pump manual.
`High Dew Point Temperature`	**Event:** Room dew point has increased to within 2°F of set point. **Action:** ● Set point will be reset + 3°F above dew point.

Alarm Message	Event and Check/Corrective Action
	● Lower room humidity levels - vapor barrier.
`Pump A/B low flow`	**Event:** Pressure differential across pump dropped 50% below set point and exceeded time delay of 10 sec during running mode. **Action:** ● Check VFD screen for power/display or alarm. ● Check pump/VFD overload switch. ● Check pumps rotation direction and operation. ● Check for loop flow blockage/all valves closed. ● Check for loss of system pressure/water/air.
`Low Suction Pressure`	**Event:** Suction pressure fell below alarm set point 5 psi for 90 sec. **Action:** ● Check for loss of system pressure/water/air. ● Check for closed suction isolation valve.
`Pump 1/2 overload`	**Event:** The VFD alarm was triggered. **Action:** ● Check VFD screen alarm code or history. ● Consult VFD pump manual.

Maintenance

The following procedures are included in this section:

- Routine System Monitoring
- Add Water to a CDU
- Bleed Air From a ChilledDoor

Routine Inspection

The following items should be checked at regular intervals.

ChilledDoors

- Check all ChilledDoors for active alarms. Attempt to acknowledge/reset any alarm. If an alarm persists, evaluate troubleshooting steps in *Troubleshooting Alarms* on page 31.
- Verify `Supply Air` and `Server Outlet` temperatures are within their normal ranges.

CDU

- Check the PLC display for active alarms. Attempt to acknowledge/reset any alarm. If an alarm persists, evaluate troubleshooting steps in *Troubleshooting Alarms* on page 31.
- Verify CDU pressures and water temperatures are within in their normal ranges.
- Add water to secondary loop if required

Add Treated Water to CDU

Equipment Needed:

- Treated water supply (drum or 5 gallon container)
- Transfer pump (manual)
- Feed pump (manual)

Instructional Video

An instructional video of this procedure is available: *Add Treated Water to CDU*.

Procedure

1. Find the fill port inside the back of the CDU.

Fill port

2. Use the transfer pump to add treated water to the feed pump.

   Lightly pump/pulse the transfer pump so treated water slowly flows into the feed pump.

Transfer pump

Feed pump

3. After you have enough water in the feed pump, disconnect the transfer pump supply hose to the feed pump.
4. Screw the fill port cap on to the feed pump.

Pump plunger

Pressure-relief vent
(spring loaded)

Fill port cap

Discharge hose/tube

Discharge valve

Hose connector

5. Open the feed pump discharge valve and slowly pump all the air out of the hose.

6. Connect the feed pump hose connector to the CDU fill port.

7. Add treated water to the CDU.

    a. Make sure the feed pump fill port cap is closed.

    b. Open the CDU fill port and the pump discharge valve.

    c. Start pumping the feed pump to overcome pressure in the loop and begin adding treated water.

    d. If alone, occasionally close the CDU fill port and check the `Pump Return` pressure on the PLC display. Add treated water until the pressure is between `14` and `18 psi`.

Pump the feed pump and slowly add water.

Add water until Pump Return pressure is between 14-18 psi.

```
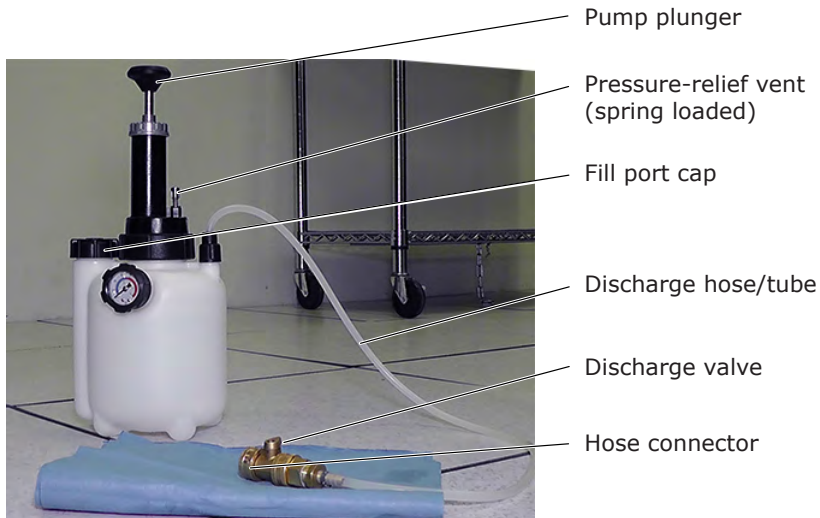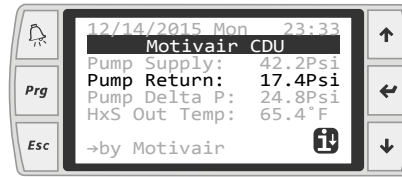          12/14/2015 Mon    23:33
                Motivair CDU
          Pump Supply:     42.2Psi
          Pump Return:     17.4Psi
          Pump Delta P:    24.8Psi
          HxS Out Temp:    65.4°F
  Prg
  Esc     →by Motivair
```

8. After enough treated water is added to the CDU:

    a. Close the CDU fill port and the feed pump discharge valve.

    b. Press the pressure-relief vent to release pressure in the pump tank.

    c. Disconnect the feed pump hose connector from the CDU port.

    d. Replace the cap on the CDU fill port.

    e. Empty any remaining treated water from the feed pump back into the main treated water container.

9. If the CDU pressure becomes too high and water needs to be returned to the feed pump:

    a. Connect the feed pump hose connector to the CDU fill port.

    b. Open the feed pump and fill port valves.

    c. Press the pressure-relief vent to release pressure and allow water to flow back into the pump tank.

    d. When done, close the valves, disconnect the feed pump from the CDU, and discard the water.

Bleed Air from a ChilledDoor

The following procedure describes how to release air that may be trapped in the ChilledDoor or to lower water pressure from a ChilledDoor.

During filling and venting, the system pressure needs to be constantly monitored and maintained to provide pressure to purge air from the closed loop while also avoiding over-pressurization of the system.

ChilledDoors that are bottom feed, use a 1/4" Schrader bleed valve at the top of each door to purge air. Top feed ChilledDoors use valves in the customer piping at the highest point of the water supply loop.

Equipment Needed:

*   Treated water collection/bleed bag
*   Refrigeration charging hose with shut-off valve

Procedure

1. Remove the safety cap from the Schrader vent on the top of the coil header pipe.

Charging hose with shut-off valve

Schrader valve
(with safety cap)

2. Place the end of the refrigeration charging hose without the shut-off valve into a bucket/bleed bag to catch the water that may escape while venting the coil header.

3. Attach the valve end of the hose to one of the Schrader vents.

As the charging hose connector is screwed onto the valve, air will begin to vent out.

Water will spray or spit into the bucket during this procedure.

4. Once there is a constant stream of water (no air) leaving the hose, disconnect the hose.

5. If water drips from the Schrader valve, reattach the hose and disconnect it again to reseat the Schrader valve.

6. If air remains in the coil it will cause a splashing or gurgling sound. If this happens, repeat the bleeding procedure on the other Schrader valve.

Check Water Control Valve Operation

Daily Automatic Calibration Process

On initial power-up of the ChilledDoor, the capacitors take about 60 seconds to charge. Once they are charged, the water control valve performs a calibration process and drives its actuator valve through one full cycle to calibrate its position and exercise the valve cartridge. This calibration process takes approximately 60 seconds. If

anything interferes with the calibration process, the red LED will flash rapidly and the actuator will not respond to control signals.

Check the Valve Actuator

During normal operation, the LED should be lit a solid red. The red LED blinks to indicate the valve was not able to complete its daily calibration process. If the LED is blinking, unplug power to the ChilledDoor and wait 60 seconds. Then plug it back in. The valve should go through a calibration cycle with the valve position indicator (white tab) moving up and down. It will then reposition to the operating position set by the PLC. If the white tab doesn't return to its normal position, the valve actuator may need to be replaced. Check the `Main Output` screen on the PLC display for the `Valve Opening` value which is typically set to `20%`and compare it to the approximate position of the white tab.

Valve actuator

Valve position indicator
(up = closed, down = open)

Operation LED (red)

Actuator cable


```
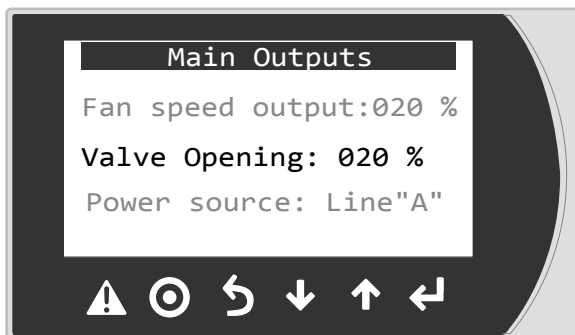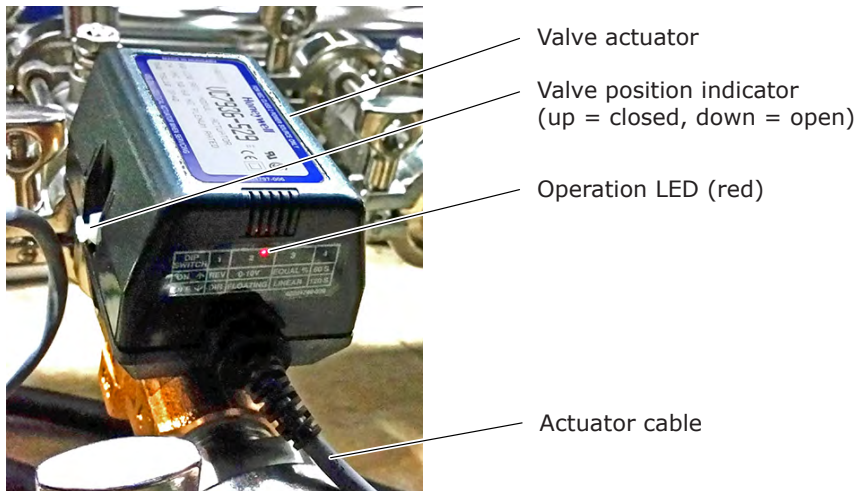        Main Outputs
Fan speed output:020 %

Valve Opening: 020 %

Power source: Line"A"
```

Compare this 20% valve opening to the approximate position of the white tab on the valve actuator. The white tab should be between the middle and all the way up (fully closed).

Motivair ChilledDoor and CDU Spare Parts

Cray P/N	Vendor P/N	Part
101093000	SPKC002310	Cable, 6.6 ft. Transducer
101030700	3-BC8259	Coil, Motivair M12 ChilledDoor(R)
101030714	3-PCOXCON0B0	Connector, Plug-In Screw
101219700	4-S90CONN000	Connector, phone 6 wire, 5 ft.
101220400	4V-XTRM10A22T	Contactor, 12 A IEC 460 V coil
101220300	4V-XTCE009B10C	Contactor, 12 A IEC 480 VAC non-rev 1NO 3P (Motivair 5 HP CDU)
101222500	4V-XTRM10A22T	Contactor, 12 A IEC 480 VAC non-rev 1NO 3P (Motivair 7.5 HP CDU)
101030713	3-PCOX000DB0	Controller, PCO compact, with built-in display
101221800	3-FLOE000010	Controller module, flood/leak detection
101223200	4-PCO3000AM0	Controller, medium board, 4 MB flash
101220000	4V-OT25F3	Disconnect, 25 A non-fused
101223300	4-PGD1000FX0	Display board, white LED + buzzer flush remote mount
101221100	4V-CIMR-JU4A0009BAA	Drive, variable speed 460 V 7.5 hp (for Motivair 5 hp CDU)
101222800	4-CIMR-JU4A0011BAA	Drive, variable speed 460 V 7.5 hp (for Motivair 7.5 hp CDU)
101030710	3-EMAF-230-BM	Fan Assy, 230 V, black frame
101221300	4V-11611151055	Fan, cooling cabinet
101221200	4V-FS22801-12-B	Filter, line EMC C3 (for Motivair 5 hp CDU)
101223000	4V-FS22801-16-B	Filter, line EMC C3 (for Motivair 7.5 hp CDU)
101030704	3-S2138	Fitting, strain relief, 3/8" NPT (requires 101030703 nut)
101221600	3-HKP-HH-R	Fuse holder, 1.25 x .25
101030706	3-ABC15	Fuse, 15 A 250V 1.25" x .25"
101030707	3-AGC2	Fuse, 2 A 250 V 1.25" x .25"
101030708	3-AGC3.5	Fuse, 3.5 A 250 V 1.25" x .25"
101220800	4V-LP-CC-1.5	Fuse, 1.5 A CC
101220900	4V-FNM001	Fuse, midget 1 A
101221000	4V-FNM005	Fuse, midget 5 A

Cray P/N	Vendor P/N	Part
101030702	3-5FHAR	Harness, 5-Fan (Rev B)
101282100	CL2875/215 Booster Pack	Kit, booster pack CL2875/215 (used to boost chemistry in CDU water loops. SS of 2 in L5 & L1
101092500	E3-7-1	Key, door
101030709	3-DOOR KEY	Key, tri-key, for chilled door
101220200	4V-XTPR016BC1	Motor protector, manual, 6.3-10 A
101030703	3-911370	Nut, Strain Relief, 3/8" NPT (requires 101030704 fitting)
101030712	3-NTC060WH00	Probe, temperature
101221700	3-NTC015WH00	Probe, temperature
101092200	4-JM184 5.25	Pump, 5.25" impeller, BN-CM seal, 5 hp, 3/60/208-230/460V
101281200	Z3110002	Pump, transfer, 115 V
101222300	4-JM-184 5.88	Pump, 5.88" impeller, model 53F SF, 2.5" X 2.5" flange, BN-CM seal, 3/60/230/460V, 3500 RPM.
101030701	3-40.51.7.012.000	Relay, PCB plug-in, 12 V DC
101030711	3-MY3-AC24	Relay, 3PDT, 24 V
101030705	3-95.05SPA	Relay, base/socket with retaining clip
101220500	4V-D65PAR480	Relay, phase monitor
101093500	CM00009107	Sensor Kit, Water Detection, CDU
101221900	3-CM00009107	Sensor Kit, Water Detection, Door
101093100	NTC060WH00	Sensor, temperature (15 ft.) [for ChilledDoor water out and room air in]
101223100	4-DPWC110000	Sensor, dew point, 4-20 mA, remote wall mount, 5 hp/7.5 hp CDU
101030715	4-THERMOWELL	Thermowell
101092800	SPKT0021C0	Transducer, SS 316L 4-20MA, -0.5BAR to 7BAR
101030716	3-Y236301	Transformer, 63 VA, Toroidial
101220700	4V-MT0150J	Transformer, 150 VA, 460-120-24
101222000	3-DPTA-20-P25B	Transmitter, differential pressure, -0.25", 4-20 mA
101221400	4-AFX24-MFT-X1	Valve actuator, butterfly (used with 4-F665HDU 2.5" butterfly valve)
999-00185A	3-VC7936-AR1100	Valve, control, 2-Way, 24 V, 50/60 Hz (with 10 ft. non-plenum cable)
101221500	3-VC7936-AR110016	Valve, control, 2-Way, 24 V, 50/60 Hz (with 16 ft. plenum cable)
100948800	WTCI5A	Water, treated, 5 gallons