VERTIV.

Liebert® XDU070

Operating and Maintenance Guide

Operating and Maintenance Guide

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages result from use of this information or for any errors or omissions.

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut off valves, where applicable, to reduce the amount of coolant fluid leakage and consequential equipment and building damage. Refer to local regulations and building codes relating to the application, installation, and operation of this product. The consulting engineer, installer and/or end user is responsible for compliance with all applicable laws and regulations relating to the application, installation, and operation of this product.

Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

TABLE OF CONTENTS

1 Important Safety Instructions

Save These Instructions

This manual contains important instructions that should be followed during operation and maintenance of the Vertiv™ Liebert® XDU070.

NOTICE

Some Control System menus may not be visible if the user is not logged in. Visibility also depends on the log in access level.

NOTICE

Information under Factory Configuration can be viewed with the Service and Engineer access codes. However, to make changes will require a further code that is available on request from Vertiv.

NOTICE

This method requires that the system operate under local conditions and initially causes the control loop to temporarily become unstable with wide temperature swing oscillations. It is important to ensure that this will not cause any damage to the equipment being cooled. Login at the Engineer level is required to make the necessary changes.

NOTICE

It is not necessary to fully drain the filter housing in order to clean the filter. Drain just enough fluid to ensure the level has dropped approximately a cupful in the filter housing.

NOTICE

It may be necessary to break the seal on the top flange of the filter housing by giving the cap flange a gentle tap on the side with a soft faced mallet.

NOTICE

Check the condition of the O-ring seal at the base of the filter screen and the face seal at the top before reassembling and replace if there are any signs of damage. When opening the valves, open the pump inlet valve initially until all the contained air is purged out of the filter housing through the automatic air-vent, before then opening the filter outlet valve. When the pump inlet valve is opened, the loss of system pressure will most likely automatically start the fill pump P3 to bring the system back to the operating pressure.

NOTICE

If this pump and hose have been used to remove PG-25 fluid, it is recommended that pump and hose are flushed through with plain water before coiling up and storing back inside the unit.

NOTICE

This equipment is required to be installed only in locations not accessible to the general public. Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications.

1.1 General

Mechanical and electrical equipment such as Coolant Distribution Units (CDUs) present potential mechanical and electrical hazards. All safety, installation, operation, and maintenance instructions must be adhered to. Any work on or use of the equipment must only be carried out by technically competent personnel who are fully trained. This product is designed to minimize all potential hazards by restricting access through unit casings, doors and covers while equipment is operational. Before carrying out maintenance work, ensure that:

1. Equipment is switched OFF.
2. Equipment and controls are disconnected from the electrical supply.
3. All rotating parts such as pumps and 3-way valves have come to rest.

If there is a doubt concerning safety, installation, operation, or maintenance instructions, consult Vertiv Support at 1-800-543-2378 for clarification and advice.

1.2 Installation and Handling

Installation and operation must be conducted in accordance with local and national regulations and normal codes of good practice. When moving or lifting the product, caution must be observed to ensure the safety of personnel. Use only appropriate lifting equipment.

WARNING! This product is supplied with a 21.7 psi (1.5 bar) nitrogen holding charge in the fluid circuit. This needs to be vented during the installation process. See the *Liebert® XDU070 Installation and Commissioning Guide* for more information.

1.3 Application

This product is to be used indoors only and must be only used for the application it was designed for. This product must not be used in a hazardous environment.

1.4 Warranty

Failure to comply with the Vertiv installation, maintenance and operation instructions may affect the reliability and performance of the unit and invalidate any warranty.

1.5 Electrical Connection

WARNING! This unit is powered by high voltage. Serious injury or death can occur. Power supplied to this product must be provided with an external means of isolation.

Electrical connections must be carried out in accordance with local and national regulations by a qualified electrician. Never make any electrical connections inside the unit or to the unit unless the electricity supply has been switched OFF at the disconnect (isolator).

1.6 Replacement Parts

Any parts replaced during maintenance or servicing must be the same specification as those being replaced and should only be obtained from Vertiv. The use of incorrect replacement parts may affect the operation or reliability of the unit and invalidate any warranty.

1.7 Waste Disposal

Any waste or single use materials must be disposed of in a responsible manner and in strict adherence to local and national environmental regulations. For details, consult local environmental agencies.

1.8 Documentation

Operation and maintenance , maintenance, and installation and commissioning documentation as well as maintenance and service records must always remain with the unit.

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2 Agency

2.1 Product Standards and Approvals

Vertiv products installed and operated in compliance with this document, the operation and maintenance guide and installation and commissioning guide conform to the Low Voltage directive 2014/35/EU, the EMC directive 2014/30/EU and the Pressure Equipment directive 2014/68/EU. As manufactured, Vertiv products are designed to comply with an IP21 rating. This product is cUL listed for the appropriate voltage models and certificates will be made available on request (cUL certificate pending).

2.2 ROHS 3 Compliance

The manufacturer certifies that all products manufactured are fully RoHS compliant in accordance with EU RoHS Directive EU 2015/863.

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3 Product Description

3.1 General

This document describes the physical and electrical characteristics of the Vertiv™ Liebert® XDU070 for operation and maintenance purposes.

The Liebert® XDU070 contains a secondary closed loop circuit that provides a supply of cooling fluid to IT equipment for direct cooling (cold plates at chip level).

The fluid circuit is a low pressure sealed system with the heat removed from the high heat density areas of IT equipment rejected to ambient air via a low pressure drop cooling coil heat exchanger, arranged in a V-format with fan assistance provided by 7 x axial fans.

The fluid circuit ensures that the cooling fluid in a data center environment.

- Can be kept to a minimum volume.
- Is closely controlled for flow, pressure, and temperature.
- Can be accurately maintained for fluid quality (with filtration included).

The primary cooling source will be the ambient air of the data center and final heat transfer will depend on the air temperature and flow rate.

3.2 Features and Benefits

- Fluid outlet 122°F (45°C), EAT 95°F (35°C), ambient air temperature 18°F (10°C) approach
- 26.4 gpm (100 l/m) flow rate
- 60 to 100kW capacity dependent on ambient operating conditions (approach), fan speed, and fluid type
- 1.5 inch hygienic outlet and inlet connections, PG25 working fluid
- Expansion tank and integrated air vents within fluid circuit
- Approved wetted materials for direct to chip applications
- Fan redundancy (N+1), pump redundancy and field replaceable
- Designed to ASHRAE Liquid Cooling Class W4
- Designed to ASHRAE Air Cooling Class A2 upper limits
- Integrated 50µ filters (with hot swap function)
- Max airflow approaching 7000 CFM
- Top and Bottom Fluid Connection, reserve liquid tank and integrated fill pump
- Ability to implement liquid cooling solutions without the need for a primary water supply or other related infrastructure.
- Easy installation, maintenance, and retrofit of pipework parts.
- Small footprint: 23.6-inch x 47.2-inch (600 mm x 1,200 mm)
- Black textured finish to blend in with computer room environment.
- International service team to provide professional and all in one services from installation to maintenance and troubleshooting.

3.3 Product Views

Figure 3.1 Front View of Vertiv™ Liebert® XDU070 (Doors and Side Panels Removed)

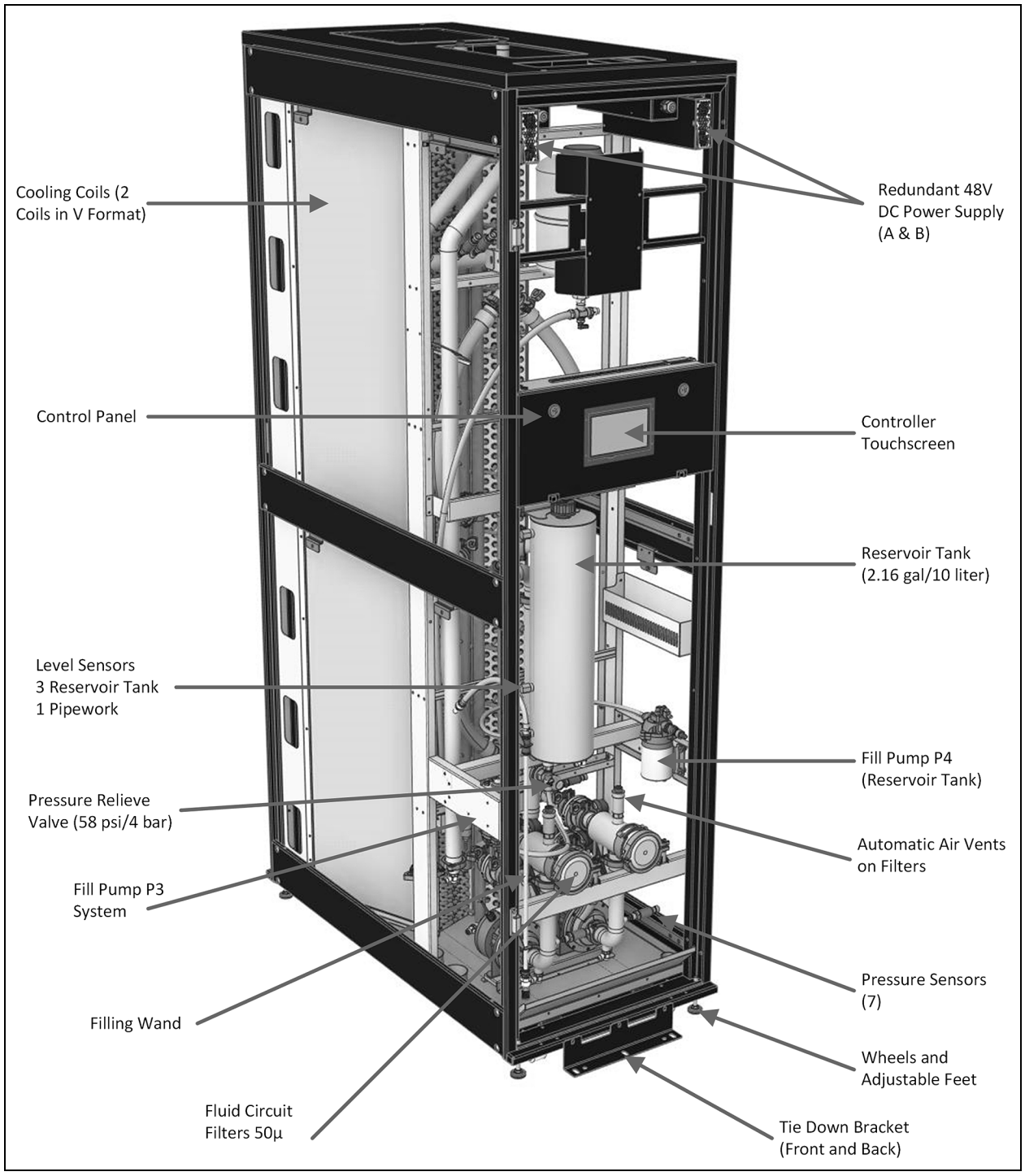
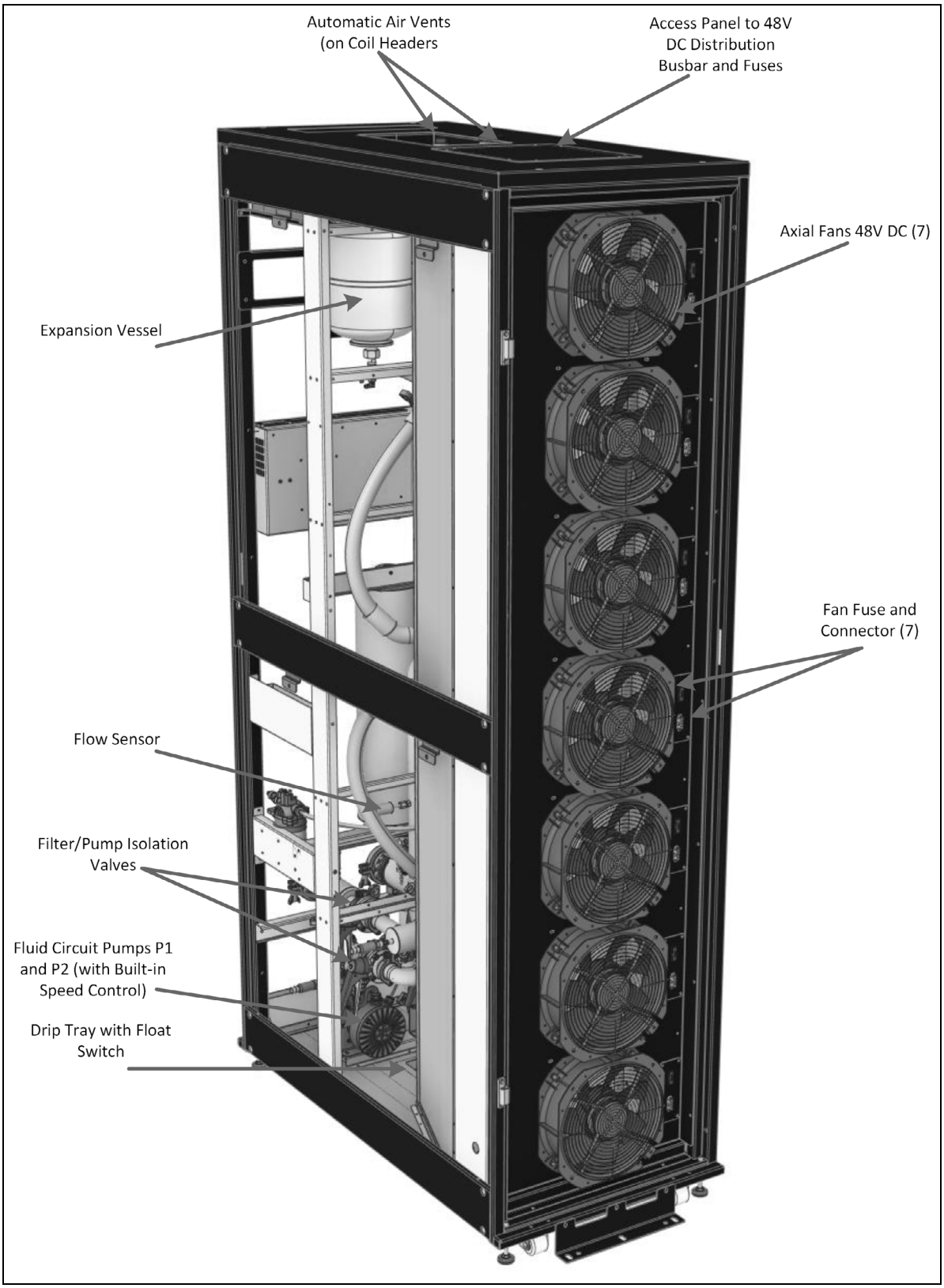


Figure 3.2 Rear View of XDU070 (Doors and Side Panels Removed)



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4 Operation

4.1 Controller Overview

The Vertiv™ Liebert® XDU070 controller is designed to monitor and control the supply of cooling fluid to IT equipment in unattended data center environments. Circuit cooling fluid is closely controlled to a defined temperature and at a controlled differential pressure (or flow rate), for optimum heat management.

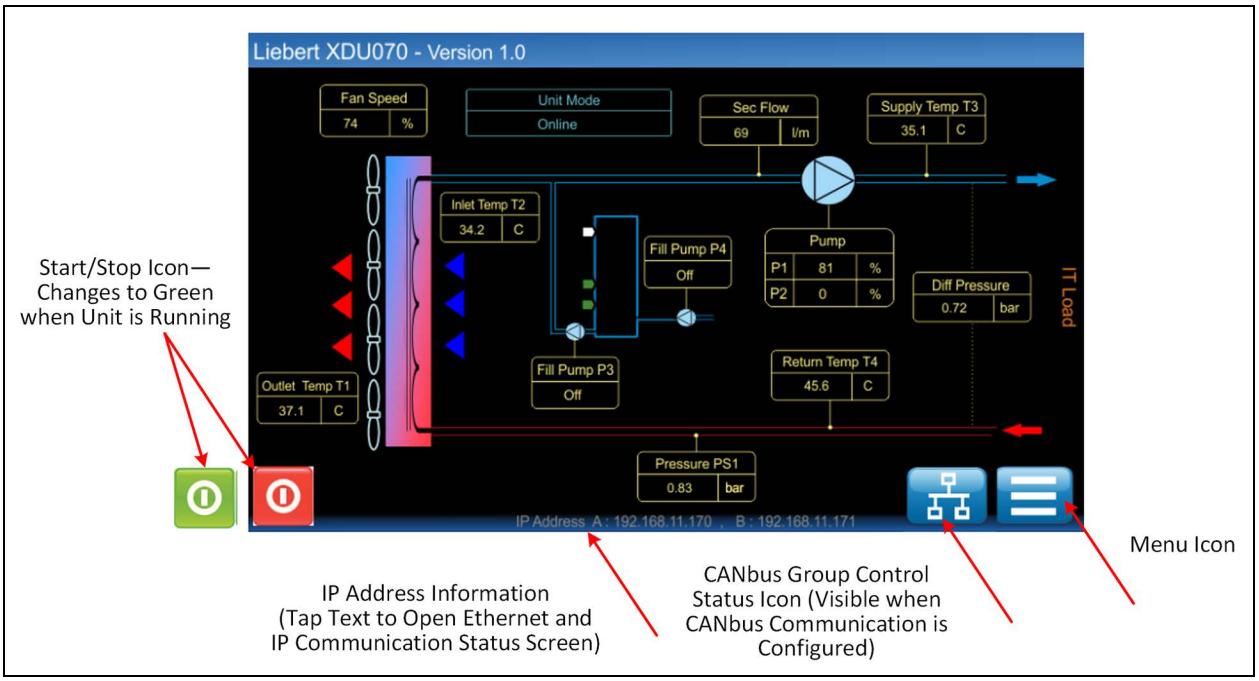
When power is first applied to the unit, the touchscreen illuminates. After a short initialization period during which the company logo is presented, the display defaults to the Home screen, as shown in Figure 4.1 below .

4.2 User Interface

4.2.1 Home Screen

The Home screen displays a schematic representation of the Liebert® XDU070, showing essential temperatures, pressures, flows etc. for both fluid and air path circuits. The product code identification, IP addresses, installed software version, and date/time are also shown.

Figure 4.1 Control Home Screen



Pressing the Menu icon in the bottom left corner displays the Main menu screen.

4.2.2 Main Menu

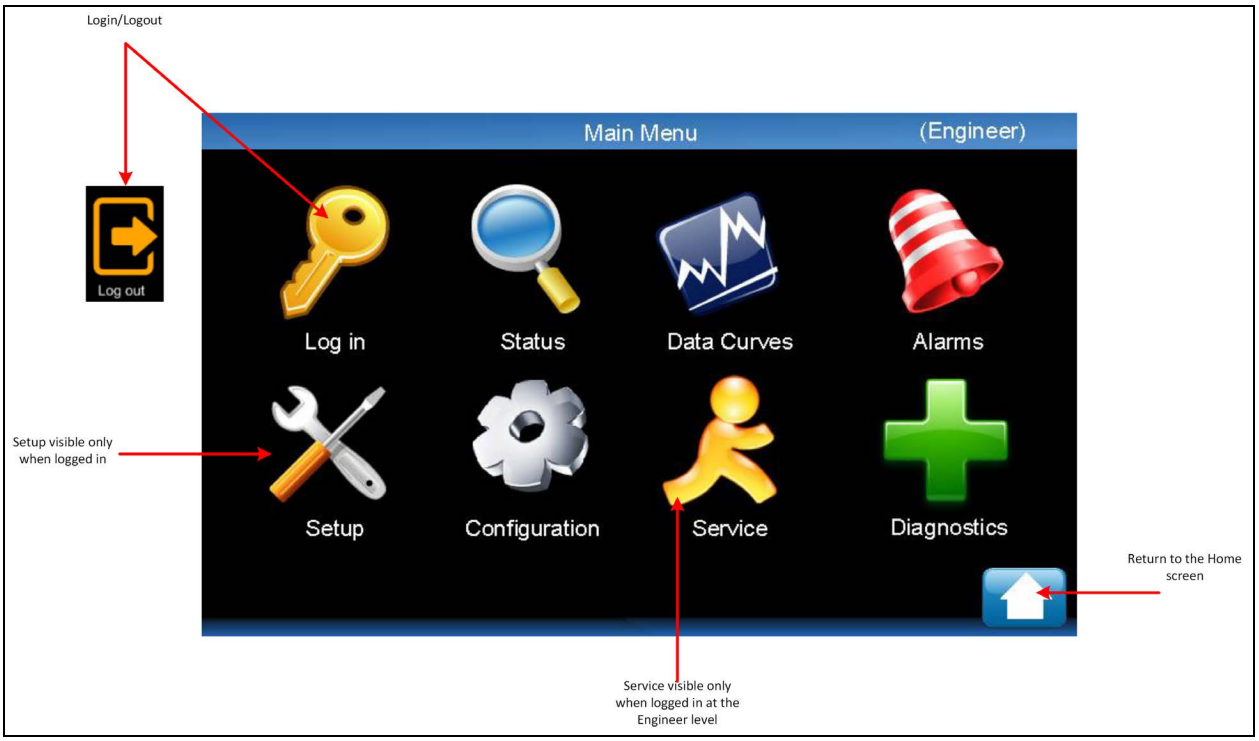
The main Menu screen displays sub-menus for an increased level of information and access to certain parameters.

NOTICE

Some Control System menus may not be visible if the user is not logged in. Visibility also depends on the login access level.

The touchscreen display is intuitive and users can easily navigate through the menus. The following explanations are provided for additional information or as a reference for when user is not in front of the unit.

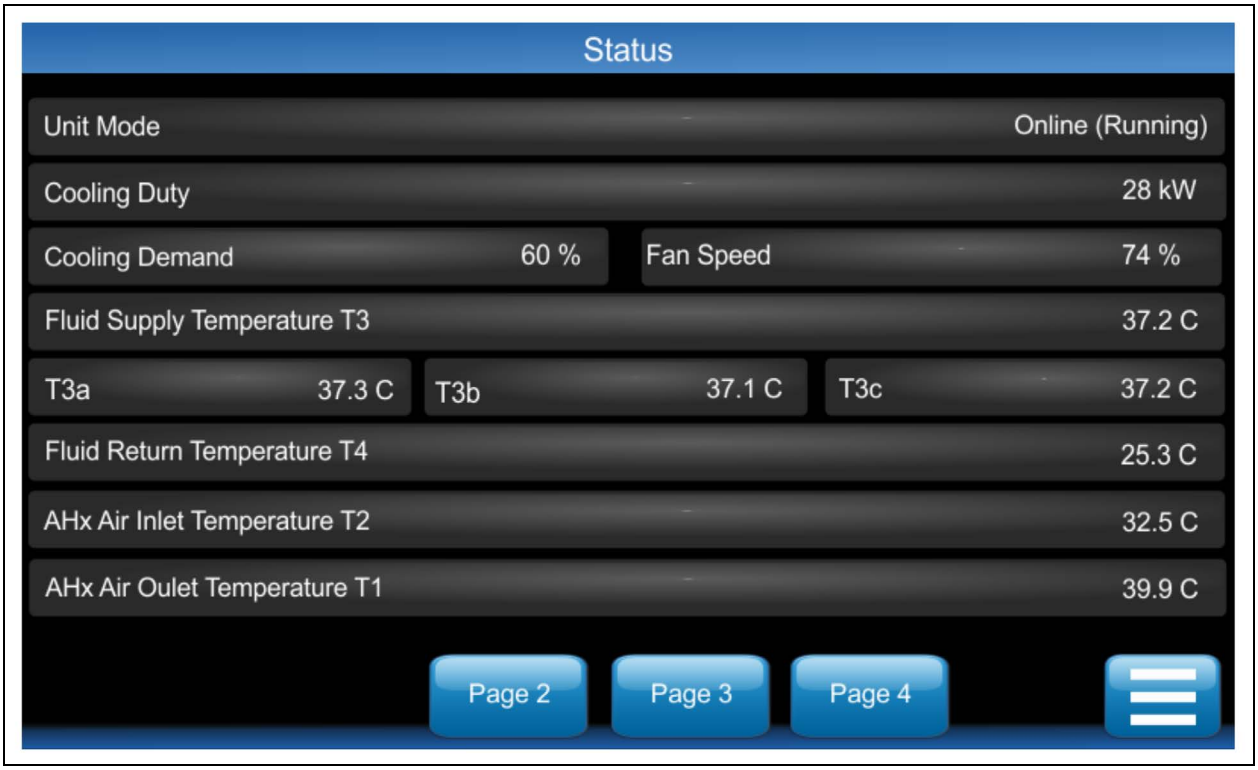
Figure 4.2 Main Menu



4.2.3 Status Screen

The Status screen displays comprehensive information on the operating condition of the Vertiv™ Liebert® XDU070 unit.

Figure 4.3 Control System Status Screen



There are four information pages within the Status screen. Details for each page are shown in the tables below.

Table 4.1 Status Screen Page 1

Item	Value
Unit Mode	• Standby • Online (Running) • Fault • Shutdown
Unit Cooling Duty	____ kW
Cooling Demand	____ %
Fluid Temperature Supply T3	____ °F
T3a	____ °F
T3b	____ °F
T3c	____ °F
Fluid Return Temperature T4	____ °F
Air Inlet Temperature T2	____ °F
Air Outlet Temperature T1	____ °F

Table 4.2 Status Screen Page 2

Item	Value
Pump 1 Speed	___%
Flow Rate	___gpm (___ /lm)
Fluid Return PS1	___psi (___ bar)
PS1a	___psi (___ bar)
PS1b	___psi (___ bar)
Fluid Supply PS2	___psi (___ bar)
PS2a	___psi (__ bar)
PS2b	___psi (__ bar)
Unit Differential Pressure (PS2-PS10	___psi (__ bar)
Pump Inlet Header Pressure PS4	___psi (___ bar)
Filter 1 Outlet Pressure PS3a	___psi (___ bar)
Filter 2 Outlet Pressure PS3b	___psi (___ bar)
Filter 1 Diff. Pressure	___psi (___ bar)
Filter 2 Diff. Pressure	___psi (___ bar)

Table 4.3 Status Screen Page 3

Item	Value
Pump 1 Hours Run	___ Hrs
Pump 2 Hours Run	___ Hrs
Fan Runtime 0 to 25%	___ Hrs
Fan Runtime 26 to 50%	___ Hrs
Fan Runtime 51 to 75%	___ Hrs
Fan Runtime 76 to 100%	___ Hrs
Elapsed Minutes	___ Mins
Controller Software Version	____
Unit Serial Number	CTCNxxxx

Table 4.4 Status Screen Page 4

Item	Value
Pump 1 Comms Status	___
Pump 2 Comms Status	___
Pump 1 Mode	___
Pump 2 Mode	___
Pump 1 Speed	___ rpm
Pump 2 Frequency	___ rmp
Pump 1 Voltage	___ v
Pump 2 Voltage	___ V
Pump 1 Current	___ A
Pump 2 Current	___ A
Pump 1 Temperature	___ F° (___C°)
Pump 2 Temperature	___ F° (___C°)
Drive 1 Temperature	___ F° (___C°)
Drive 2 Temperature	___ F° (___C°)

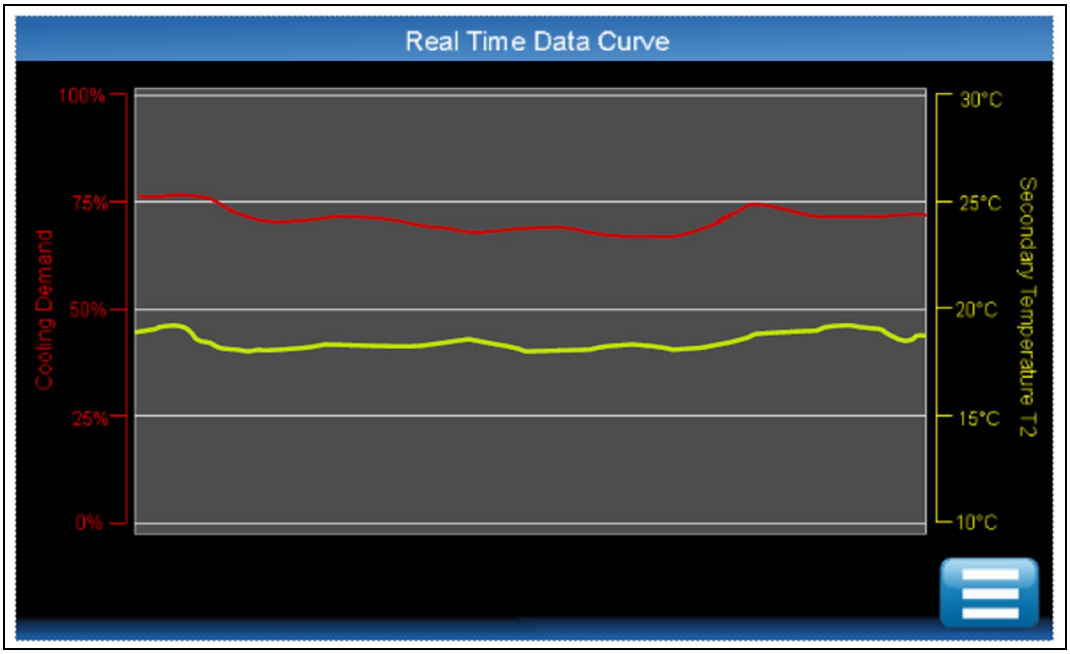
4.2.4 Data Curves

The Data Curves screen displays a graphical representation of two pieces of variable data:

- A red trace for Cooling (Fan Speed) Demand
- A yellow trace for Fluid Supply Temperature T3

Each of these data update in real time. Time span of display is 3 minutes.

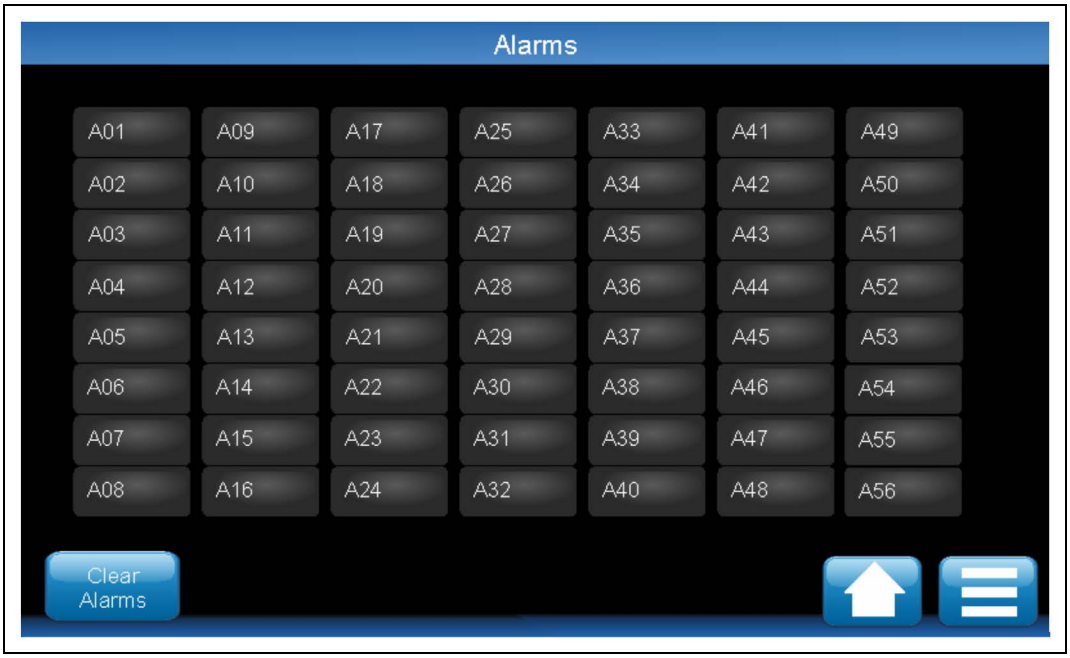
Figure 4.4 Data Curves Screen



4.2.5 Alarms Screen

The Alarm screen can be used to view new or active Alarms and to acknowledge these events. Refer to Troubleshooting Alarms on page 41 for a full list of Alarms and further information.

Figure 4.5 Alarms Screen

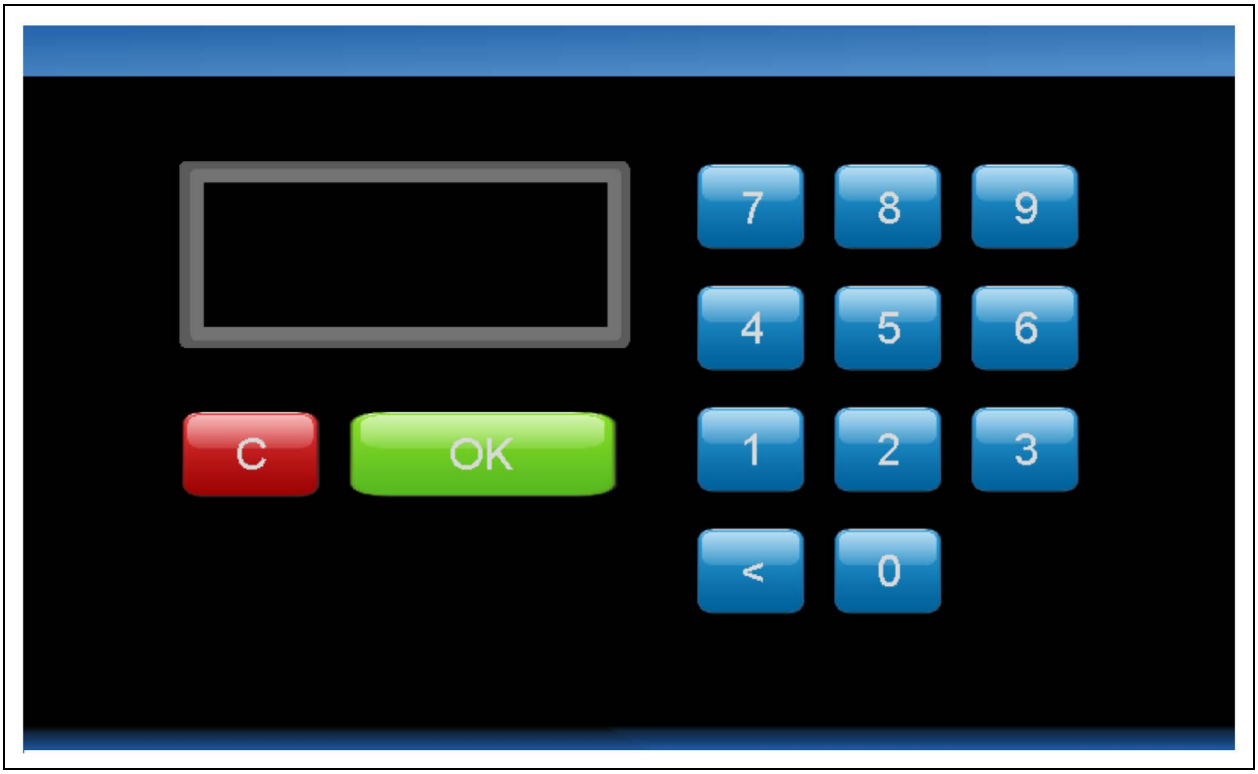


4.2.6 Login Screen

There are 4 levels of access, listed below.

- **No access code (User Level 1)** provides access to Login, Status, Data Curves and Alarm pages.
- **Code 1234 (User Level 2)** provides read only access to Setup, Configuration and Diagnostics menus.
- **Code 5699 (Service Level)** provides full read only access to everything and write access to select configuration and service features.
- **Code xxxx (Engineer Level)** provides full read/write access to all features.

Figure 4.6 Login Screen



NOTE: The Engineer login code is available from Vertiv Support.

Entering an invalid code results in an **Access Denied** message.

After you are logged in, the Logout icon replaces the Login icon on the Main Menu screen.

4.2.7 Setup Screen

The Setup screen is only visible after login.

Normally, you will not require access to the Setup Screen. Items within this screen are either set at the factory or during commissioning. However, you may need to make adjustments after site upgrades. Each option in the Setup screen is defined in **Table 4.5** below , **Table 4.6** on the facing page , **Table 4.7** on the facing page , **Table 4.8** on the facing page , **Table 4.9** on page 20 , **Table 4.10** on page 20 , **Table 4.11** on page 21 , **Table 4.12** on page 21 , and **Table 4.13** on page 21 .

NOTICE

Information under Factory Configuration can be viewed with the Service and Engineer access codes. However, to make changes will require a further code that is available on request from Vertiv.

Figure 4.7 Setup Screen

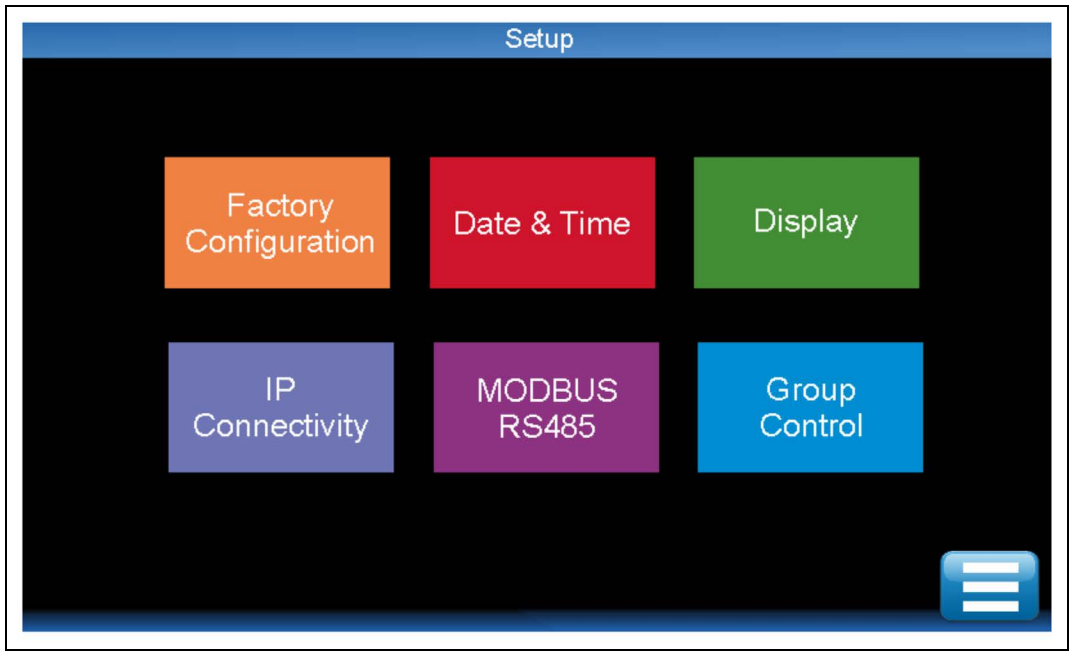


Table 4.5 Setup Screen: Factory Configuration

ID	Title	Description	Range
P001	Unit Serial Number	Select according to unit nameplate	CTCNxxxxxx
P002	Fan Model	Select fan type fitted (0 = EBM, 1 = Belong)	0 or 1

Table 4.6 Setup Screen: Date and Time

ID	Title	Description	Default	Range	Unit
	Date	Adjust date	—	dd/mm/yyyy	—
P021	Date Format	Select preferred format	dd/mm/yyyy	dd/mm/yyyy mm/dd/yyyy yyyy/mm/dd	—
	Time	Adjust time (24 hour clock)	—	hh:mm:ss	—
P022	Daylight Saving	Select the required daylight saving scheme	None	None Europe/UK N. America	—
P023	NTP Synchronization	Select if NTP synchronization is required or not.	Disabled	Disable Enable	—
P024	NTP Server IP Address	IP address of the NTP Server	0.0.0.0	Configurable	—
P025	Time Zone Offset	Select according to location	0.0	-12 to +12	Hrs
P026	NTP Sync Interval	Interval between NTP synchronizations	23	1 to 168	Hrs

Table 4.7 Setup Screen: Display

ID	Title	Description	Default	Range	Unit
P030	Screen Saver / Logout Period	Elapsed time before screen saver launches or display auto logs out	30	0 to 60	Mins.
P031	Backlight Period	Elapsed time before screen dims	10	1 to 60	Mins.
P032	Temperature Units	Select required temperature display units	°C	°F, °C	—
P033	Pressure Units	Select required pressure display units	bar	bar, psi	—
P034	Flow Rate Units	Select required fow rate display units	l/m	l/m, g/m	—

Table 4.8 Setup Screen: IP Connectivity

ID	Title	Description	Default	Range	Unit
P040	Interface A Enabled	Set to active or not (see below for sub-menu details)	Enabled	Enabled Disabled	—
P041	Interface B Enabled	Set to active or not (see below for sub-menu details)	Enabled	Enabled Disabled	—

Table 4.9 Setup Screen: IPv4 Connectivity (Interface A) Sub-menu

ID	Title	Description	Default	Range	Unit
P050	MAC Address	View MAC address	_ _:_ _:_ _:_ _:_ _:_ _	Read only	—
P051	IPv4		Enabled	Enabled Disabled	—
P052	DHCP	Select as required	Disabled	Enabled Disabled	—
P053	Subnet Mask	Set subnet Mask	255.255.255.0	Configurable	—
P055	Default Gateway	Set gateway address	0.0.0.0	Configurable	—
P056	Preferred DNS Server	Set DNS address	0.0.0.0	Configurable	—
P057	Alternative DNS Server	Set DNS address	0.0.0.0	Configurable	—

Table 4.10 Setup Screen: IPv6 Connectivity (Interface A) Sub-menu

ID	Title	Description	Default	Range	Unit
P1201	IPv6		Disabled		
P1202	SLAAC	Select as required	Disabled	Enabled Disabled	—
P1203	DHCPv6	Select as required	Disabled	Enabled Disabled	—
P060	MAC Address	View MAC address	_ _:_ _:_ _:_ _:_ _:_ _	Read only	—
P061	IPv4		Enabled	Enabled Disabled	—
P062	DHCP	Select as required	Disabled	Enabled Disabled	—
P063	IP Address	Set IP address	192.168.11.171	Configurable	—
P064	Subnet Mask	Set subnet mask	255.255.255.0	Configurable	—
P065	Default Gateway	Set gateway address	0.0.0.0	Configurable	—
P066	Preferred DNS Server	Set DNS address	0.0.0.0	Configurable	—
P067	Alternative DNS Server	Set DNS address	0.0.0.0	Configurable	—

Table 4.11 Setup Screen: IPv6 Connectivity (Interface B) Sub-menu

ID	Title	Description	Default	Range	Unit
P1211	IPv6		Disabled		—
P1212	SLAAC	Select as required	Disabled	Enabled Disabled	—
P1213	DHCPv6	Select as required	Disabled	Enabled Disabled	—

Table 4.12 Setup Screen: Modbus

ID	Title	Description	Default	Range	Unit
P070	Modbus Slave Address	Set required address	1	1 to 247	—
P071	Baud Rate	Set required baud rate	9600	9600 to 38400	—
P072	Write Access	Write access to coils and holding registers	No	No Yes	—

Table 4.13 Setup Screen: Group Control

ID	Title	Description	Default	Range	Unit
P081	Unit Address	Unit address	1	1 to 4	—
P082	Number of Units in Group	Number of units in group	1	1 to 4	—
P083	Number of Run Units	Number of run units	1	1 to 4	—
P085	Rotation Frequency	Unit rotation frequency	Weekly	Weekly Monthly Never	—
P086	Rotation Day of Week	Rotation day	Mon.	Sun. to Sat.	—
P087	Rotation Time of Day - Hours	Rotation hours	10	00 to 23	Hrs
P088	Rotation Time of Day - Minutes	Rotation minutes	00	00 to 59	Mins
P089	Unit Receive Timeout Period	Set require unit receive timeout	3000	50 to 10000	MSecs
P090	Unit Transmit Period	Set required unit transmit period	100	20 to 1000	MSecs

4.2.8 Configuration Screen

The Configuration screen is visible only after login and is used to set specific parameters and control functions.

NOTE: Parameter IDs that are shown in red in the tables for the Configuration Screen are accessible only with the Engineer login code.

Figure 4.8 Configuration Screen

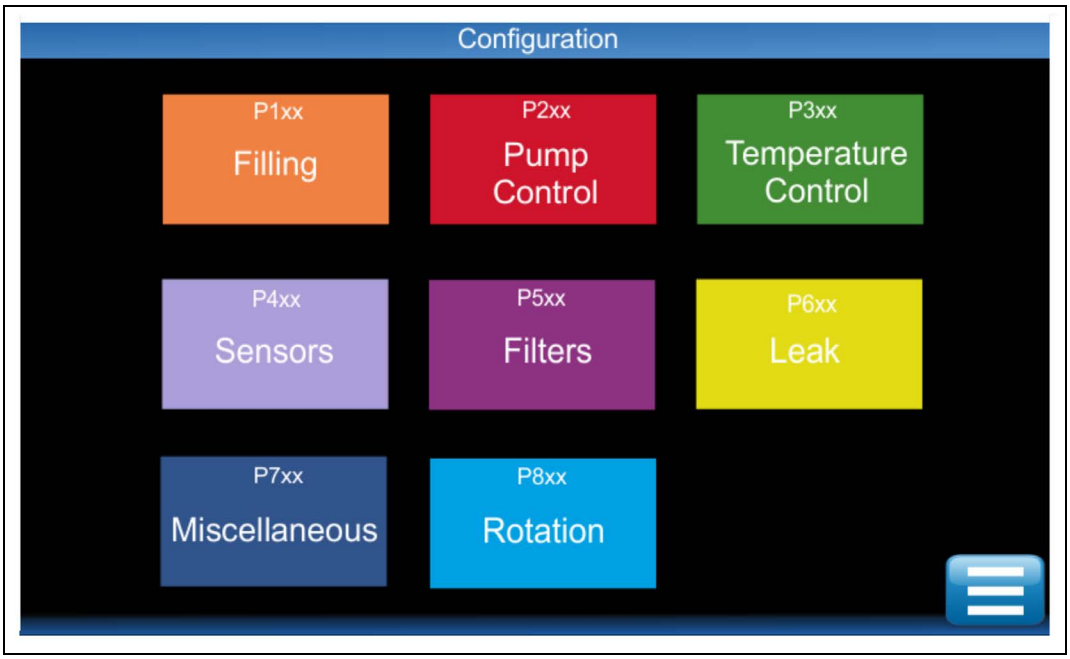


Table 4.14 Configuration Screen: Filling

ID	Title	Description	Default	Range	Unit
P101	Fill Pressure	Start threshold for fill pump	0.8	4.4 to 145 (0.3 to 1.0)	psi (Bar)
P102	Fill Hysteresis	Stop hysteresis for fill pump	0.2	1.5 to 7.3 (0.1 to 0.5)	psi (Bar)
P104	Level Sensor Delay	Level sensor response time, prior to alarm	1	1 to 6	Secs
P105	Fill Start Delay Period	Delay prior to pump start after initiate signal	10	1 to 600	Secs
P107	Group Fill	Group Fill – any individual unit calls for unit fill results in all units in the group switching on their fill pump (0 = disabled, 1 = enabled)	0 (disabled)	0 (disabled) 1 (enabled)	—

Table 4.15 Configuration Screen: Pump Control

ID	Title	Description	Default	Range	Unit
P201	Control Type	Pump speed flow or diff. pressure (DP) controlled	Flow	Flow or DP	—
P202	Flow Setpoint	Set the required fluid flow rate	25	25 to 150	l/m
P203	Differential Pressure Setpoint	Set the required fluid DP	0.65	0.1 to 3.0	Bar
P204	Low Flow %	Low flow alarm threshold (% of flow setpoint)	90	10 to 95	%
P205	Low DP %	Low DP alarm threshold (% of	90	10 to 95	%

Table 4.15 Configuration Screen: Pump Control (continued)

ID	Title	Description	Default	Range	Unit
		DP setpoint)			
P206	Low Flow/DP Delay	Time delay prior to low flow/DP alarm	100	1 to 300	Secs
P207	Minimum Pump Speed	Set minimum pump running speed	15	10 to 70	%
P209	Maximum Pump Speed	Set maximum pump running speed	100	25 to 100	%
P210	Pump Changeover Delay	Pump changeover period (change from P1 to P2 or P2 to P1)	250	50 to 500	Msec
P211	Over-pressure Setpoint	Maximum system pressure, prior to alarm	2.7	29 to 58 (2.0 to 4.0)	psi (Bar)
P212	Over-pressure Action	Alarm only, shutdown and alarm	Alarm	Alarm Alarm and shutdown	—
P213*	Start-up Speed	Initial pump start fixed speed (0 = Auto)	0	0 to 100	Secs
P215*	Loop Refresh Period	Scan period for pump speed control loop	10	1 to 120	Secs
P216*	Maximum Control Pressure	Maximum pump speed control loop pressure	4.0	15 to 116 (1.0 to 8.0)	psi (Bar)
*Parameter ID's are only accessible with the Engineer log-in code.					

Table 4.16 Configuration Screen: Temperature Control

ID	Title	Description	Default	Range	Unit
P301	Temperature Setpoint	Set required fluid temperature setpoint	86 (30.0)	50 to 131 (10.0 to 55.0)	°F (°C)
P302*	PID – Control Period	Scan period for fan speed control	1	1 to 30	Secs
P303*	PID – Proportional Band	Proportional band	53.6 (12.0)	33.8 to 77 (1.0 to 25.)	°F (°C)
P304*	PID – Integral Reset	Integral reset time	18	0 to 999	Secs
P305*	PID – Derivative	Derivative reset time	5	0 to 999	Secs
P306	Minimum Fan Speed	Set minimum fan running speed	20	0 to 50	%
P307	Maximum Fan Speed	Set maximum fan running speed	100	40 to 100	%
P308	Fan Fixed Speed	Fan speed in event of 3 x T3 sensor failure	100	1 to 100	%
P309	Fan Alarm Delay	Delay prior to alarm following fan fault	10	0 to 60	Secs

Table 4.16 Configuration Screen: Temperature Control (continued)

ID	Title	Description	Default	Range	Unit
P310	Fluid Low Temp Diff.	Low temp alarm offset below setpoint	35.6 (2.0)	33.8 to 50 (1.0 to 10.0)	°F (°C)
P311	Fluid High Temp Diff	High temp alarm offset above setpoint	35.6 (2.0)	33.8 to 50 (1.0 to 10.0)	°F (°C)
P312	Fluid Temp Reset Hysteresis	Low/High temp. alarm reset point	33.8 (1.0)	32.9 to 41 (0.5 to 5.0)	°F (°C)
*Parameter ID's are only accessible with the Engineer log-in code.					

Table 4.17 Configuration Screen: Sensors

ID	Title	Description	Default	Range	Unit
P401*	Fluid T3 Temp. Diff.	Alarm threshold T3a/b/c temperature differential	33.8 (1.0)	32.18 to (0.1 to 10)	°F (°C)
P402	Fluid T3 Period	Time delay before T3a/b/c differential alarm	30	0 to 120	Secs
P403	Fluid PS1 Press. Diff.	Alarm threshold PS1a-PS1b pressure differential	0.2	1.5 to 145 (0.1 to 1.0)	psi (Bar)
P404	Fluid PS1 Period	Time delay before PS1a-PS1b differential alarm	30	0 to 120	Secs
P405	Coolant	Set secondary loop coolant type.	PG25	Water, PG25	—
*Parameter ID's are only accessible with the Engineer log-in code.					

Table 4.18 Configuration Screen: Filters

ID	Title	Description	Default	Range	Unit
P504	Fluid Filter Dirty Setpoint	Differential pressure alarm threshold for filter dirty	0.5	3 to 145 (0.2 to 1.0)	psi (Bar)
P505	Fluid Filter Dirty Hysteresis	Alarm reset from threshold	0.1	1.5 to 7.3 (0.1 to .05)	psi (Bar)
P506	Fluid Filter Dirty Delay Period	Time delay prior to alarm	60	10 to 600	Secs

Table 4.19 Configuration Screen: Leak

ID	Title	Description	Default	Range	Unit
P601	Leak Detection – Drip Tray	Alarm only or shutdown and alarm	Alarm	Alarm Alarm+S/D	—
P602	Leak Detection – Rope	Alarm only or shutdown and alarm	Alarm	Alarm Alarm+S/D	—
P603	Rope Threshold	Set sensitivity of leak rope	50	1 to 65	kohm

Table 4.19 Configuration Screen: Leak (continued)

ID	Title	Description	Default	Range	Unit
P604	Rope Delay Period	Time delay prior to alarm	10	5 to 60	Secs
P605	Leak Detection – Unit	For when both drip tray and rope leak detections are activated. Alarm only or alarm and shutdown	Alarm	Alarm Alarm+S/D	—

Table 4.20 Configuration Screen: Miscellaneous

ID	Title	Description	Default	Range	Unit
P701*	Manual Override Period	Time delay before controls revert to Auto mode	15	0 to 120	Mins
P702*	Alarm Delay	Alarm suppression on start-up	20	1 to 120	Mins
P703*	Post Power Failure Options	Action to be taken following a power failure once power is restored	Run	Run Standby	—
P704*	Data Logging Interval	Interval between data being logged to SD card (0 = 60s, 1 = 30s, 2 = 10s, 3 = 5s)	0	0, 1, 2, 3	—
P705*	Display Lockout	Lockout following failed login	No	No Yes	—
*Parameter ID's are only accessible with the Engineer log-in code.					

Table 4.21 Configuration Screen: Rotation

ID	Title	Description	Default	Range	Unit
P801	Frequency	Frequency of pump changeover	Weekly	Never Weekly Monthly	—
P802	Day of Week	Set day of changeover	Mon.	Sun. to Sat.	—
P803	Time of Day - Hours	Time of changeover (hour)	10	00 to 23	—
P804	Time of Day - Minutes	Time of changeover (min)	00	00 to 59	Mins

4.2.9 Service Screen

The Service screen is visible only after login using the Service or Engineer login codes. The Service screen can be used to set some parameters and to assist in commissioning.

NOTE: Parameter IDs that are shown in red in the tables for the Service Screen are accessible only with the Engineer login code.

Figure 4.9 System Service Screen

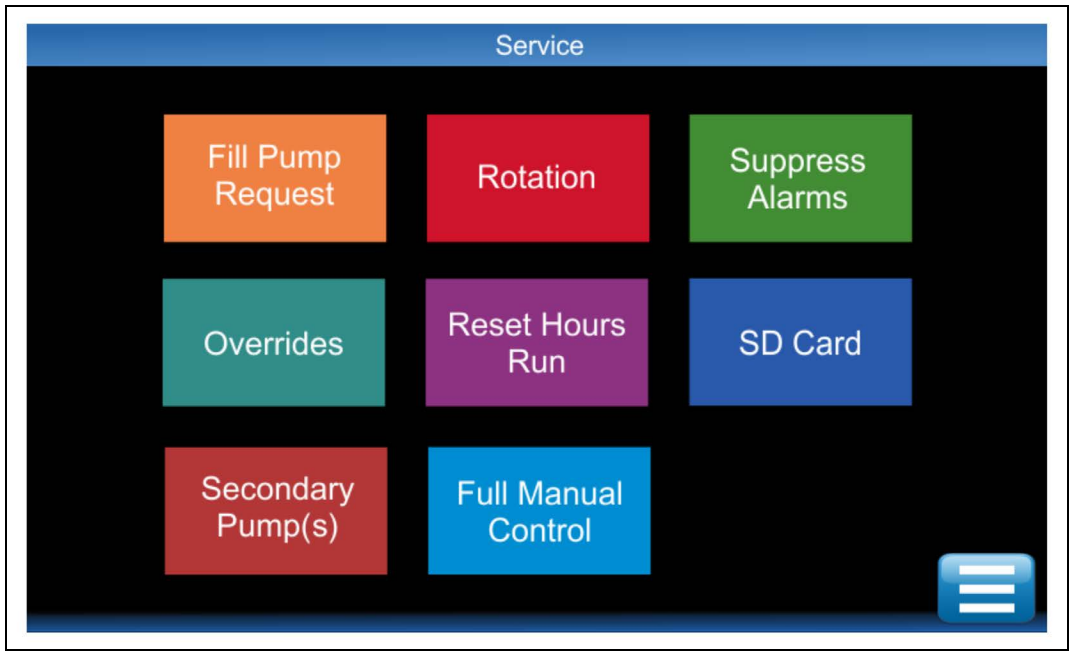


Table 4.22 Service: Fill Pump Request

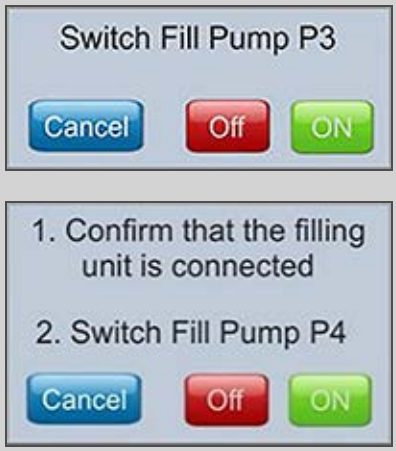
Screen Prompt	Explanation
	The Pump Fill function is used during commissioning only. This allows the fill pumps to run without any time limit. Fill pumps will still switch Off automatically or when the reservoir tank is full.

Table 4.23 Service: Rotation

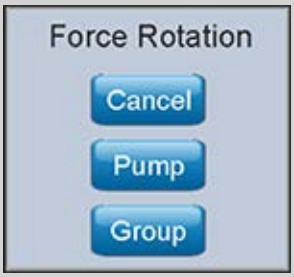
Screen Prompt	Explanation
	The Rotation function is used to force a pump change over at an unscheduled time or to force a unit change over when Group Control is active.

Table 4.24 Service: Suppress Alarms

Screen Prompt	Explanation
	The Suppress Alarms function resets the delay timer to stop nuisance alarms breaking through during manual operation. The alarm delay timer is normally activated during start-up.

Table 4.25 Service: Overrides

ID	Title	Description	Default	Range	Unit
S101	Pump 1 Speed	Set pump 1 speed (0% = no override)	0	0 to 100	%
S102	Pump 2 Speed	Set pump 2 speed (0% = no override)	0	0 to 100	%
S103	Unit Fill Pump P3	Switch unit fill pump on	Auto	Auto Man.	—
S104	Reservoir Tank Fill Pump P4	Switch reservoir fill pump on	Auto	Auto Man.	—
S105	Fan Speed	Set fan speed (0% = no override)	0	0 to 100	%

Overrides allows for manual control of some functions of the unit for a limited time period (default is 15 minutes) while the unit is running in automatic mode. This function is provided to troubleshoot. See the Installation and Commissioning manual for more information. If an override is issued while the CDU is not in automatic mode, the override is ignored and the value is automatically set to the default (15 minutes).

Table 4.26 Service: Reset Hours Run

ID	Title	Description	Default	Range	Unit
S201	Pump 1 Run Hours	Set pump 1 run hours to zero	—	—	Hrs
S202	Pump 2 Run Hours	Set pump 2 run hours to zero	—	—	Hrs

Table 4.27 Service: SD Card

Screen Prompt	Explanation
	This function is used to control access to the SD card. Select Unmount to safely remove the SD card. Select Mount following the insertion of the SD card.

Table 4.28 Service: Secondary Pumps

ID	Title	Description	Default	Range	Unit
S401	Pump 1 Service Status	Allows pump to be set for in service or out of service. Selecting Out of Service prevents running during maintenance.	In Service	In Services Out of Service	—
S402	Pump 2 Service Status	Allows pump to be set for in service or out of service. Selecting Out of Service prevents running during maintenance.	In Service	In Service Out of Service	—

Table 4.29 Service: Full Manual Control

ID	Title	Description	Default	Range	Unit
S301	Full Manual Control	Allows full manual control of all functions	Disabled	Disabled Enabled	—
S302	Pump 1 Speed	Set pump 1 speed	0	0 to 100	%
S303	Pump 2 Speed	Set pump 2 speed	0	0 to 100	%
S304	Unit Fill Pump P3	Switch unit fill pump on	Off	Off On	—
S305	Reservoir Tank Fill Pump P4	Switch reservoir fill pump on	0	0 to 100	%
S307	Fan Tacho Multiplex	Set fan TACHO Multiplex changeover relay	Off	Off On	—

Full Manual Control provides the ability to control all function s of the unit manually for a limited time period. Selecting Full Manual Control causes the unit to switch off, and the controller is in dumb mode. Manual override requests are possible only when S301 is set to Enabled. If S301 is not set to enabled, commands are automatically reset to default.

4.2.10 Diagnostic Screen

The Diagnostic Screen provides raw information and conversion factors for all Universal Inputs, Resistive Inputs, Digital Inputs, Digital Outputs, and Analog Outputs.

Figure 4.10 Diagnostic Screen

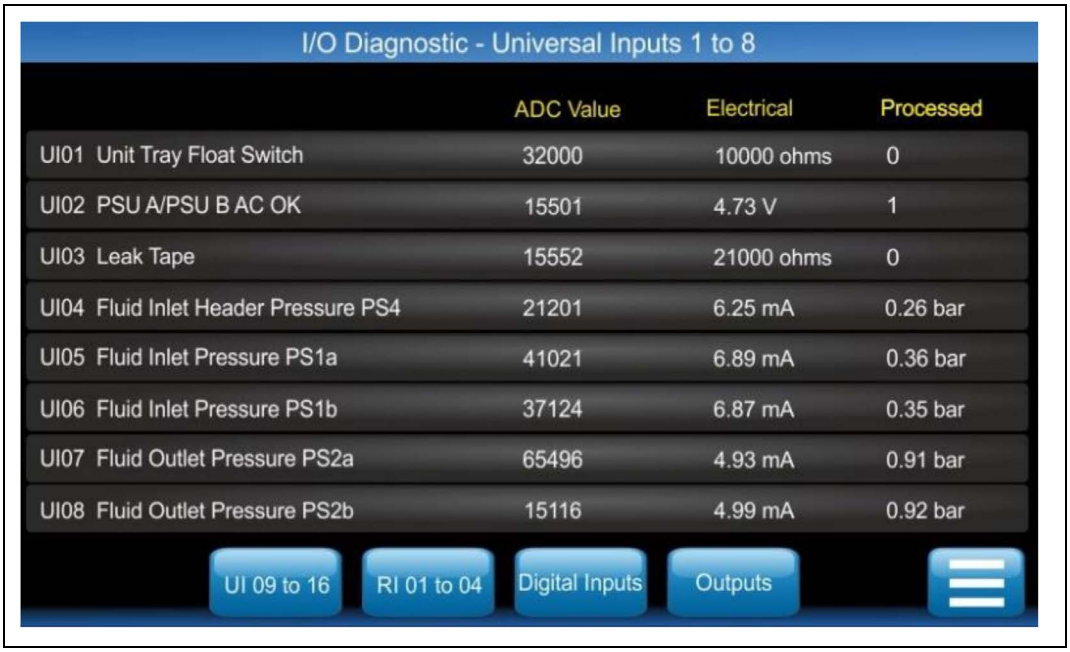


Table 4.30 Diagnostics: Universal Inputs 1 to 8

ID	Description	ADC Value	Electrical	Processed
UI01	Unit Tray Float Switch	0	0.00 ohms	0
UI02	PSU A/PSU B AC OK	0	0.00 V	0
UI03	Leak Tape	0	0.00 ohms	0
UI04	Fluid Inlet Header Pressure PS4	0	0.00 mA	0.00 psi (0.00 bar)
UI05	Fluid Inlet Pressure PS1a	0	0.00 mA	0.00 psi (0.00 bar)
UI06	Fluid Inlet Pressure PS1b	0	0.00 mA	0.00 psi (0.00 bar)
UI07	Fluid Outlet Pressure PS2a	0	0.00 mA	0.00 psi (0.00 bar)
UI08	Fluid Outlet Pressure PS2b	0	0.00 mA	0.00 psi (0.00 bar)

Table 4.31 Diagnostics: Universal Inputs 9 to 14

ID	Description	ADC Value	Electrical	Processed
UI09	Reservoir Tank High Level	0	0.00 ohms	0
UI10	Reservoir Tank Low Level	0	0.00 ohms	0
UI11	Reservoir Tank Very Low Level	0	0.00 ohms	0
UI12	Fluid Flow Sensor	0	0.00 mA	0 l/m
UI13	Fluid Filter 1 Outlet Pressure PS3a	0	0.00 mA	0.00 bar

Table 4.31 Diagnostics: Universal Inputs 9 to 14 (continued)

ID	Description	ADC Value	Electrical	Processed
UI14	Fluid Filter 2 Outlet Pressure PS3b	0	0.00 ohms	0.00 bar
UI15	XDU070 Air Exit Temperature T1	0	0.00 ohms	0.00 bar
UI16	XDU070 Air Inlet Temperature T2	0	0.00 ohms	0

Table 4.32 Diagnostics: Resistive Inputs 1 to 4

ID	Description	ADC Value	Electrical	Processed
RI01	Fluid Supply Temperature T3a	0	0 ohms	32°F (0°C)
RI02	Fluid Supply Temperature T3b	0	0 ohms	32°F (0°C)
RI03	Fluid Supply Temperature T3c	0	0 ohms	32°F (0°C)
RI04	Fluid Return Temperature T4	0	0 ohms	32°F (0°C)

Table 4.33 Diagnostics: Digital Inputs 1 to 6

ID	Description	State
DI01	Unit Fluid Level Sensor 1	open
DI02	Unit Fluid Level Sensor 2	open
DI03	Fan 1 and 2 Speed Feedback	1 or 0
DI04	Fan 3 and 4 Speed Feedback	1 or 0
DI05	Fan 5 and 6 Speed Feedback	1 or 0
DI06	Fan 7 Speed Feedback	1 or 0

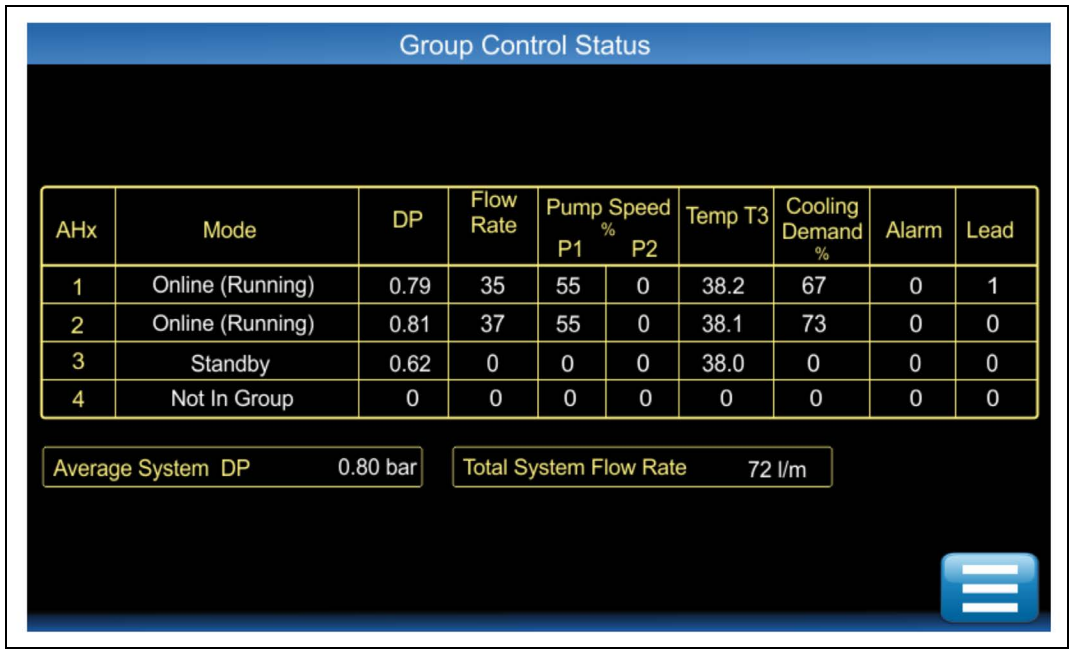
Table 4.34 Diagnostics: Digital and Analog Outputs

ID	Description	State
DO02	Unit Fill Pump P3	Off
DO03	PSU Status Multiplex	Off
DO05	Reservoir Tank Fill Pump P4	Off
DO06	Fan TACHO feedback Multiplex	Off
AO01	Fan Speed	%

4.2.11 Group Status Screen

The CANbus status screen provides information on other XDU070s connected to the CANbus network and configured to operate in group control

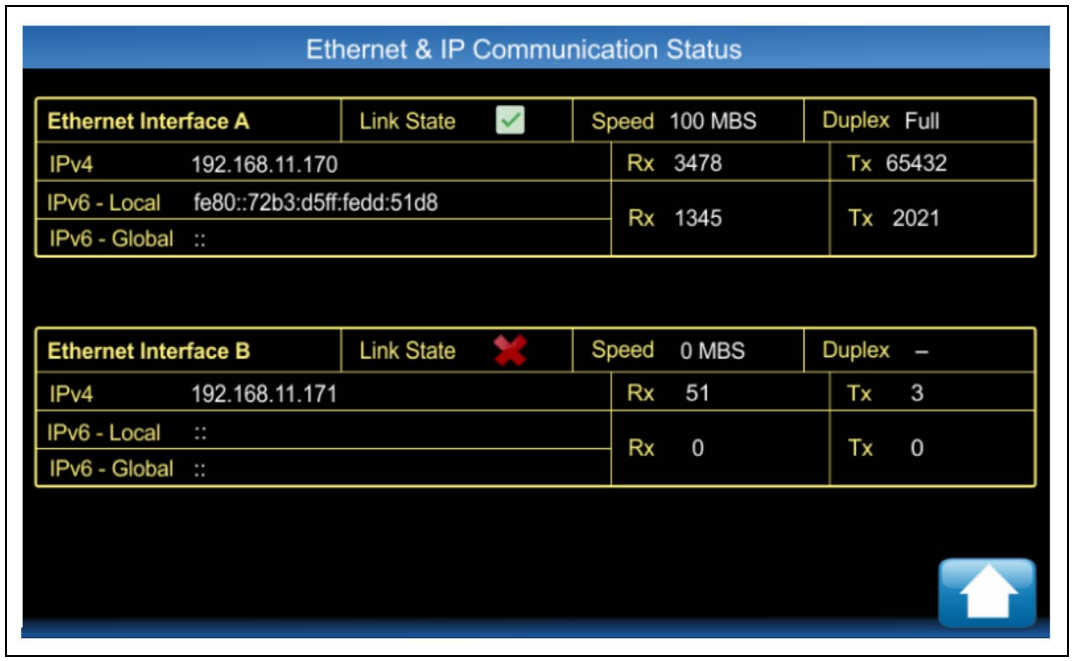
Figure 4.11 Group Control Status Screen



4.2.12 Ethernet and IP Communication Screen

The Ethernet and IP Communication screen provides status on the Ethernet link, speed, and duplex status as well as the IPv4 and IPv6 address details and message counts for Ethernet interface A and B.

Figure 4.12 Ethernet and IP Communication Status Screen



4.2.13 Calibration Screen

The touchscreen will enter calibration mode if the screen is pressed 20 times within a 4 second interval. To complete calibration follow the on screen instructions.

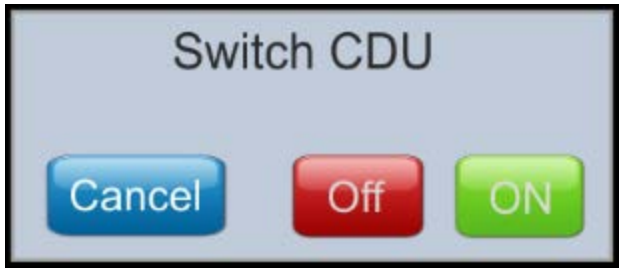
Figure 4.13 Calibration Screen

4.3 Automatic Operation

After commissioning, the unit will be ready to run in automatic mode – press the Start/Stop icon button on the display 'Home' screen (see Home Screen on page 11), then select the ON button as below.

After the unit is commissioned, it is ready to run in automatic mode. Press the Start/Stop button on the Home screen and select ON from Switch CDU.

Figure 4.14 Switch CDU



4.3.1 Fluid Circuit Operation

When the ON button is pressed, the Start/Stop icon on the Home screen changes from red to green. When the fluid level and static pressure are healthy, either the main pump P1 or P2 will start to increase in speed. (The pump with the least run hours will start to increase in speed.) Animated arrows show on the Home screen for fluid and air circuits to signify that the unit is operational. Both pump speed and fan speed as a percentage of maximum are displayed.

FLUID LEVEL

- If the fluid level switch that is located upstream of the pump inlet header is not made, signifying insufficient water, then neither pump P1 or P2 will run.
- If the fluid level sensor registers no fluid for a period of no more than 1 second, an alarm, A26—Level Sensor No Fluid Detected, is generated. If the unit differential pressure (DP) or flow rate is more than 50% of setpoint, then the unit will continue to run. If DP or flow drops below 50% of setpoint, then the unit will stop and a alarm, A25—Insufficient Fluid, is generated. This is a latched alarm and it will not be possible to restart the unit until after the even is manually cleared.

The system pressure at the Vertiv™ Liebert® XDU070 inlet (PS1) is continuously monitored to ensure that the system is always pressurized. See Table 4.2 on page 14 .

STATIC PRESSURE

- When the pump is running, a low system pressure below the default of 0.8 bar (12 psi) at PS1 does not stop the main pump from running. After a 10 second (default) delay, it raises the PS1 pressure to a default of 1.0 bar (15 psi). At this point, the fill pump stops. If the reservoir tank very low sensor is activated while fill pump P3 is running, an A15—Reservoir Tank Empty alarm is generated. Fill pump P3 stops. This is a latched alarm and must be manually cleared but does not stop the unit from running.
- If the inlet pressure drops to 0.2 bar (3 psi—set, non-adjustable) below the fill pump activation threshold for more than 1 minute (set, non-adjustable), an A24—System Low Pressure event is generated. Fill Pump activation threshold has a default value of 0.6 bar, 9 psi.

Figure 4.15 on page 35 , Figure 4.16 on page 36 , and Figure 4.17 on page 37 show the unit pressure/level monitoring and fill pump control during initial start-up of the unit after commissioning (from a unit offline condition) and during normal running (unit online).

Pump flow/pressure performance (pump speed) can be controlled through either a flow or differential pressure control loop depending on Configuration (Configuration - Pump Control).

FLOW CONTROL

Monitors the secondary flow with a calorimetric flow meter. On start-up, the control loop increases the pump speed in stages until the flow matches the demand setpoint.

DP CONTROL

Monitors the secondary differential pressure with sensors on the supply and return connections of the Liebert® XDU070. On start-up, the control loop increases the pump speed in stages until the DP matches the DP setpoint.

The pump control loop has a default scan time of 10 seconds to avoid control oscillation.

- If Pump 1 fails to reach 90% (default) of the DP/flow demand in the default time period of 100 seconds, it is assumed there is a pump flow/pressure fault. The pump ramps down to a stop. Pump 2 is initialized. At the same time an A33–Pump 1 Low Flow alarm is generated.

- If Pump 2 also fails to reach 0% (default) of the DP/flow demand in within the time limit, a A34–Pump 2 Low Flow alarm is generated.
- The unit then continues to operate with Pump 2 until faults are investigated and alarms are manually cleared.
- The above assumes Pump 1 is the initial operating pump. The reserve would apply if Pump 2 was the operating pump.

During normal healthy running for run/standby pump operation the pumps operate on a duty sharing cycle. For example, every 7 days (default) the operational pump will ramp down to a stop and the standby pump will then start and continue operating for the next 7 days. Changeover default time is set at 10:00 am on a Monday morning and the complete changeover sequence takes approximately 0.25 seconds (default).

NOTICE

Each time the unit is stopped and re-started, it selects the initial operating pump that has the lowest accrued run time hours.

The fluid circuit temperature is monitored close to the Vertiv™ Liebert® XDU070 supply connection. Three temperature sensors are positioned here to give extended component redundancy (T3a, T3b & T3c). The controller takes an average between all 3 readings as its input value.

- If the difference between the sensors exceeds a default of 33.8°F (1°C). then an A28 (A29 or A30)—Secondary Temp T3a (T3b or T3c) Diff Out of Limits alarm is raised after a default 30 second delay. Then control then only reads and averages the two remaining healthy sensors.
- If any of the T3 temperature sensors go open circuit, then an A03 (A04 or A 05)—T3a (T3b or T3c) Secondary Temperature Sensor Fault alarm is raised with no time delay and the control only reads and averages the two remaining healthy sensors.

Figure 4.15 Vertiv™ Liebert® XDU070 Pressure and Level Flow Chart (Initial Start-up)

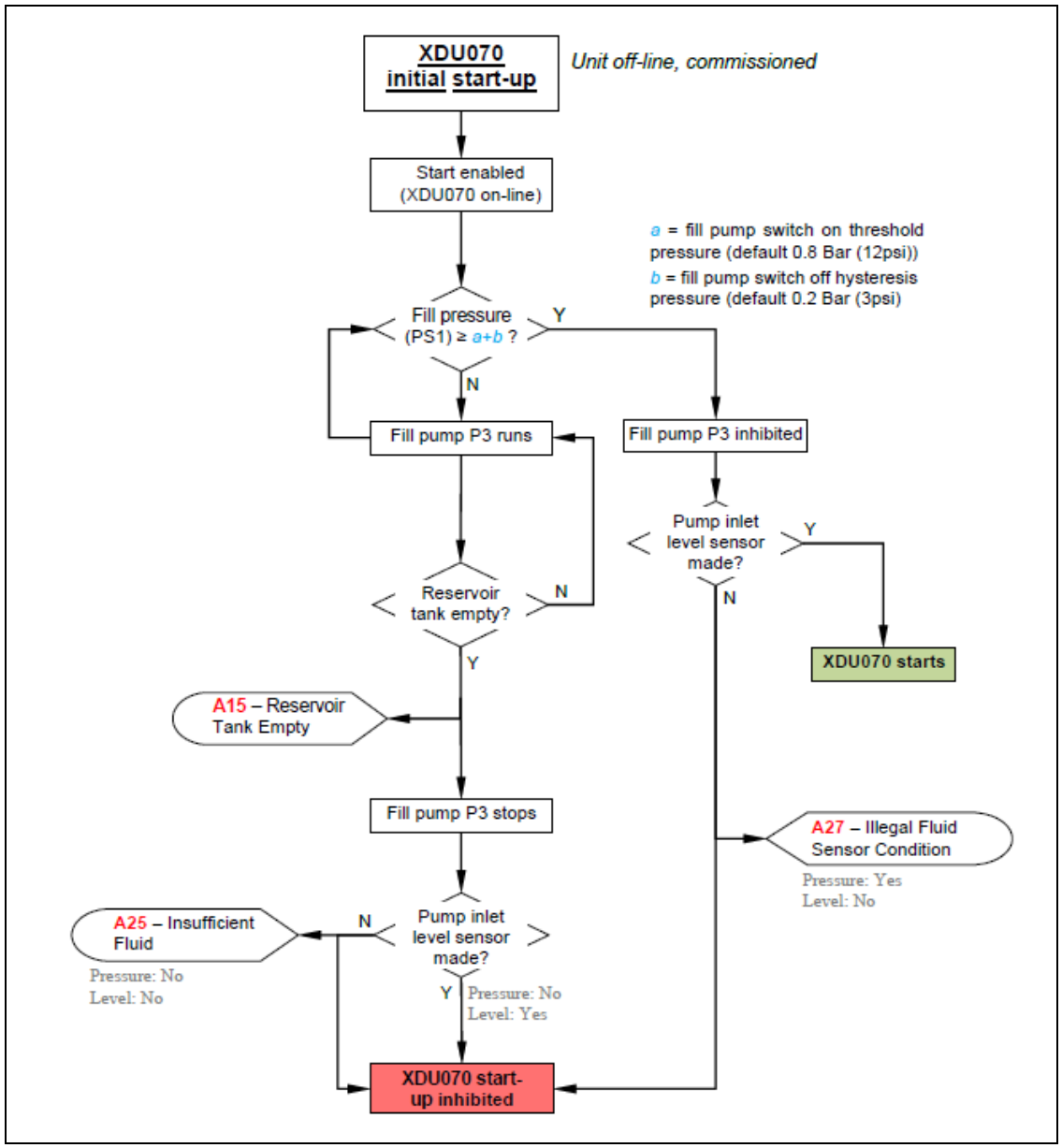


Figure 4.16 Vertiv™ Liebert® XDU070 Fill Pressure and Level Flow Charge (When Running)

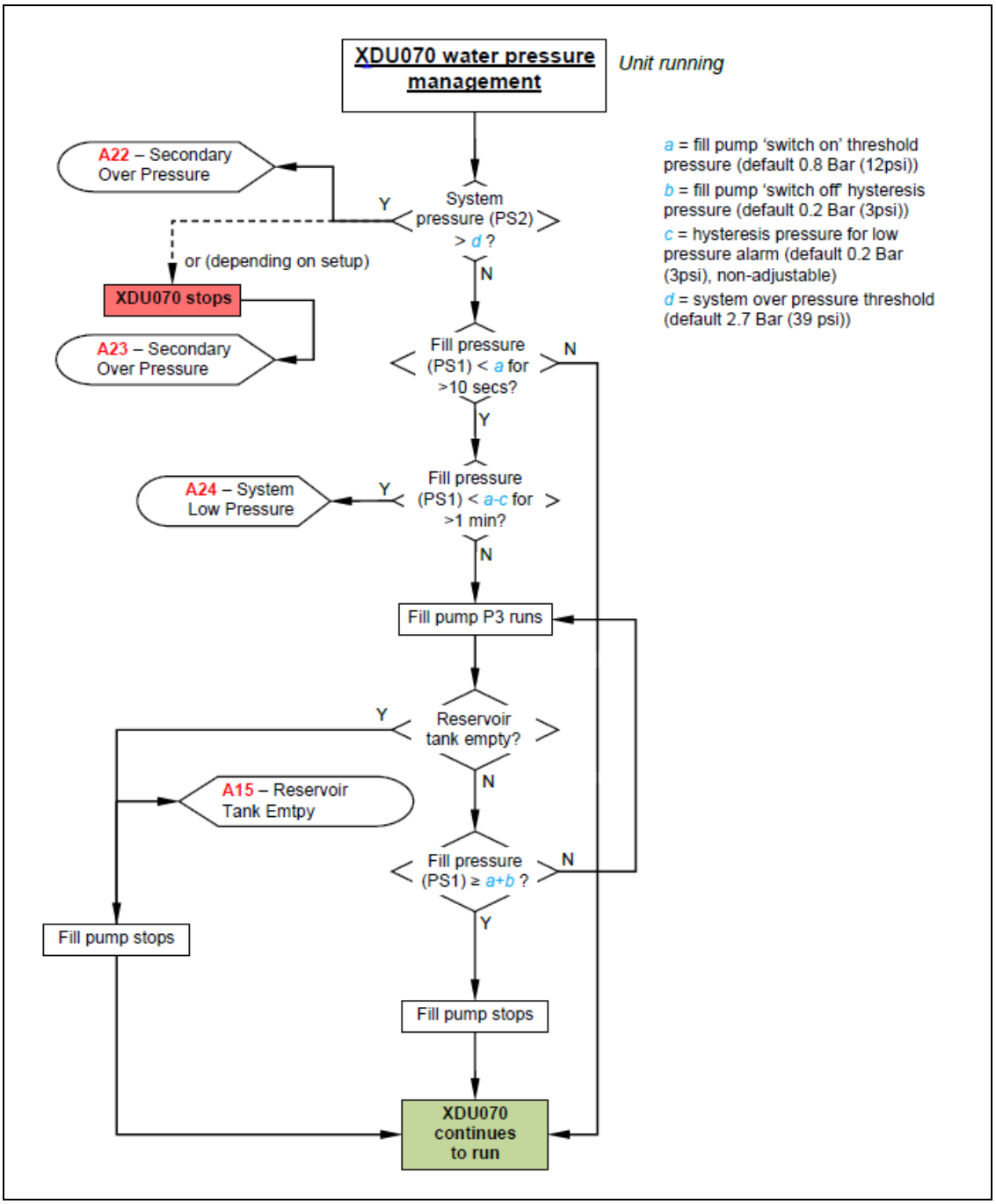
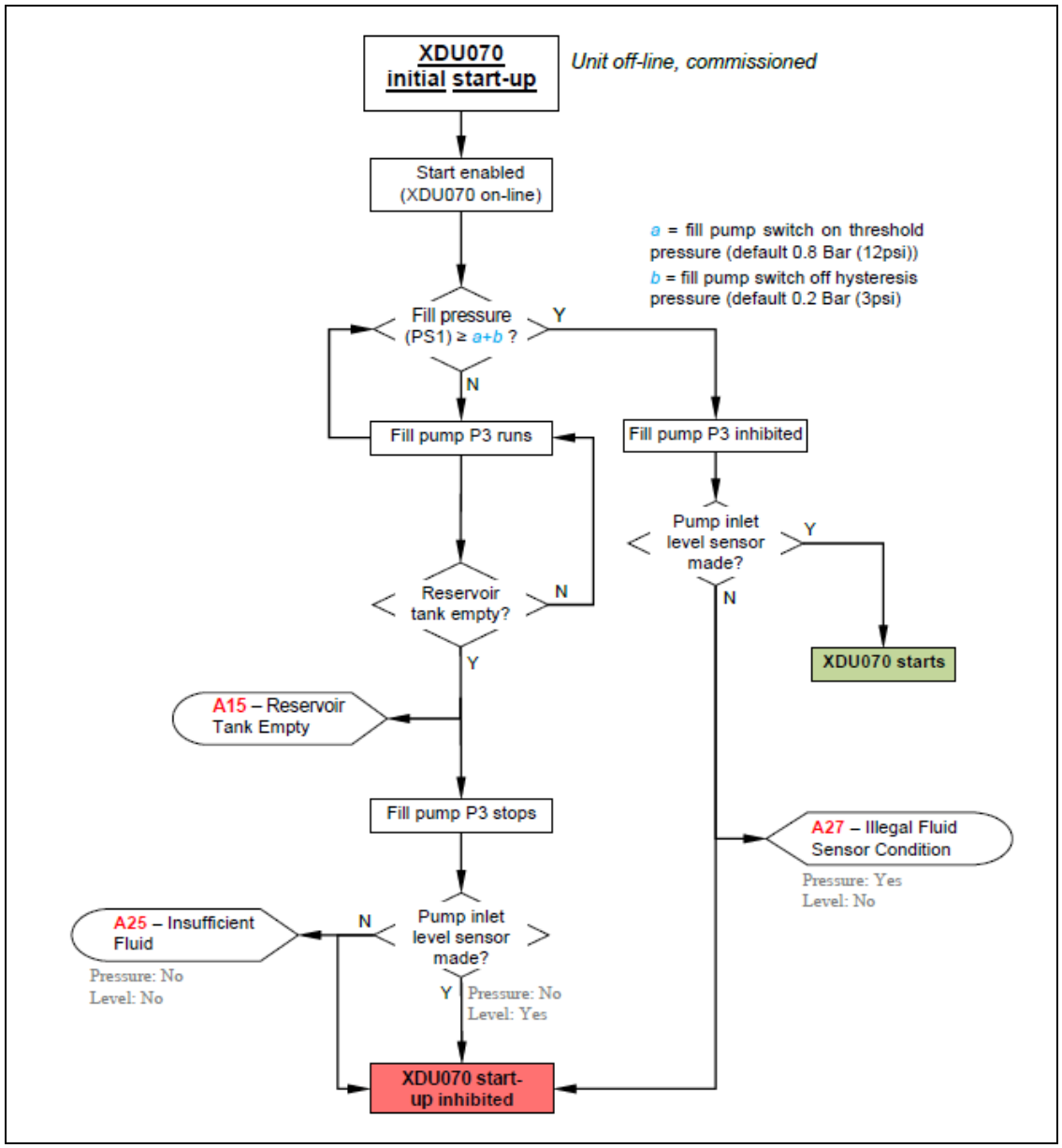


Figure 4.17 Vertiv™ Liebert® XDU070 Water Level Management (When Running)



Temperature sensor (T4) monitors the fluid circuit return temperature and is used in conjunction with the flow rate to calculate the heat transfer duty.

The fluid temperature should correspond to the desired set point. The default fixed setpoint is 86°F (30°C). It is used by the control loop to regulate the speed of the air path fans to achieve and maintain the setpoint. The fan speed demand can be monitored on the Home screen or page 1 of the Status screen (Cooling Demand).

High and low temperature alarms are set at a default value of 35.6°F (2°C) either side of set point (floating with set point), with a default hysteresis of 33.8°F (1°C).

- The high and low temperature alarms are ignored for a period of 20 minutes (default) on start-up to allow the system time to settle without generating nuisance alarms.

- If the secondary temperature deviates by more than 35.6°F (2°C) below setpoint for 2 minutes or more, a A19—Fluid Low Temp alarm is generated. This alarm will remain until the temperature rises above the hysteresis value.
- If the secondary temperature deviates by more than 35.6°F (2°C) (default) above setpoint for 2 minutes or more, a A20—Fluid High Temp alarm is generated. This alarm remains until the temperature falls below the hysteresis value.

Pressure sensors PS3a sensor and PS3b relative to unit discharge pressure sensor PS2 monitor the filter differential pressures and give a pre-warning of potential filter clogging.

- If the differential pressure exceeds 0.5 bar (7 psi) for Filter 1, then an A46 —Fluid Filter 1 Dirty alarm is generated.
- If the differential pressure exceeds 0.5 bar (7 psi) for Filter 2, then an A47—Fluid Filter 2 Dirty alarm is generated.

Fluid flow rate is monitored with a calorimetric flow meter in the pump discharge pipework. The flow can be read on the Home screen or on page 3 of the Status screen.

NOTICE

Flows below 2.3 US gpm (12 l/m) are outside the range of the flow sensor and are not displayed.

4.3.2 Air Path Circuit Operation

The ambient air temperature T2 is monitored at the inlet to the Vertiv™ Liebert® XDU070 cabinet. The nominal 45kW cooling performance of the Liebert® XDU070 has been designed on an ambient temperature between 77 and 95°F (25 and 35°C) with a 18°F (10°C) approach temperature difference to the fluid outlet temperature.

The temperature PID control loop will be operational from when the Start/Stop button is pressed and the main pump has ramped up to speed. If the fluid circuit temperature starts to rise above the set point, then cooling fan speed will increase to allow more air flow through the cooling coils. The fan speed will modulate from 20% (default minimum) to 100% (maximum air flow). The fan speed can be monitored on the Home screen or page 1 of the Status screen. The fan speed demand signal is constantly compared to the speed feedback signal from each fan to check the healthy operation.

- If the feedback signal is significantly different from the demand signal, then a A35—Fan 1 Fault through to a A41—Fan 7 Fault event will be generated, depending on which fan has failed.

The cooling fan speed is controlled with multiple 0-10v signals from the controller for enhanced redundancy as:

- Analogue output A01 for fans 1 and 2
- Analogue output A01 for fans 3 and 4
- Analogue output A01 for fans 5 and 6
- Analogue output A01 for fan 7

4.3.3 Temperature Control Loop Adjustment

In most applications, the default PID settings in the controller gives good overall temperature control. If it is found necessary to change this, then it is recommended that the Zeigler-Nichols manual tuning method be used.

NOTICE

This method requires that the system operate under local conditions and initially causes the control loop to temporarily become unstable with wide temperature swing oscillations. It is important to ensure that this will not cause any damage to the equipment being cooled. Login at the Engineer level is required to make the necessary changes.

1. Set the Integral Reset Time and Derivative Reset Time (Configuration—Temperature Control screens P309 and P310) to 0 seconds.
2. Increase the Proportional Band (Configuration – Temperature Control screen P308) to a higher value from the default of 54°F (12°C) to 68°F (20°C).
3. Check that the secondary supply temperature (T3) stabilizes.

NOTE: Temperature will stabilize at a higher temperature than the current setpoint. This offset will be eradicated once the integral reset time is added back in.

4. If the temperature control is unstable, raise the Proportional Band to a higher value until the temperature stabilizes. Otherwise gradually decrease the Proportional Band in 33.8°F (1°C) increments until the supply temperature (T3) starts to oscillate at a constant rate.
5. Measure the frequency of the oscillation time (peak to peak) in seconds (t).

4.3.4 PI Control

For systems that have reasonably steady or slow changing heat loads, PI control only should be sufficient.

1. Set the Proportional Band to 2.2X the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.83X the oscillation time (t).
3. Leave the Derivative Reset Time at 0.

4.3.5 PI Control

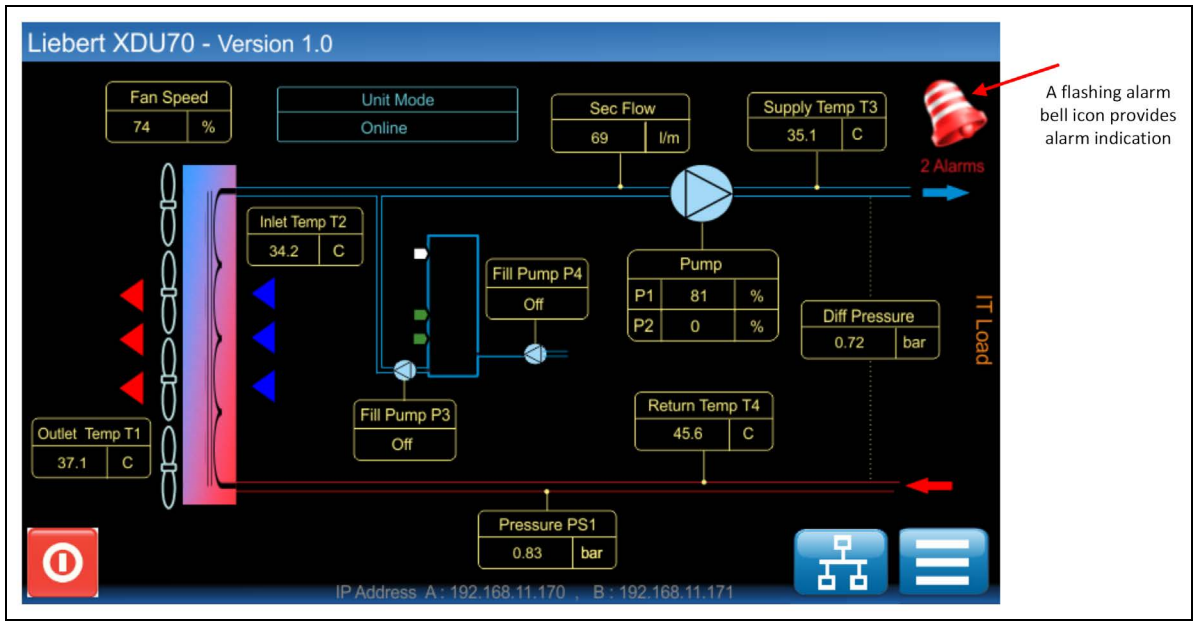
For systems that have reasonably steady or slow changing heat loads, PI control only should be sufficient.

1. Set the Proportional Band to 2.2X the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.83X the oscillation time (t).
3. Leave the Derivative Reset Time at 0.

4.4 Alarm Management

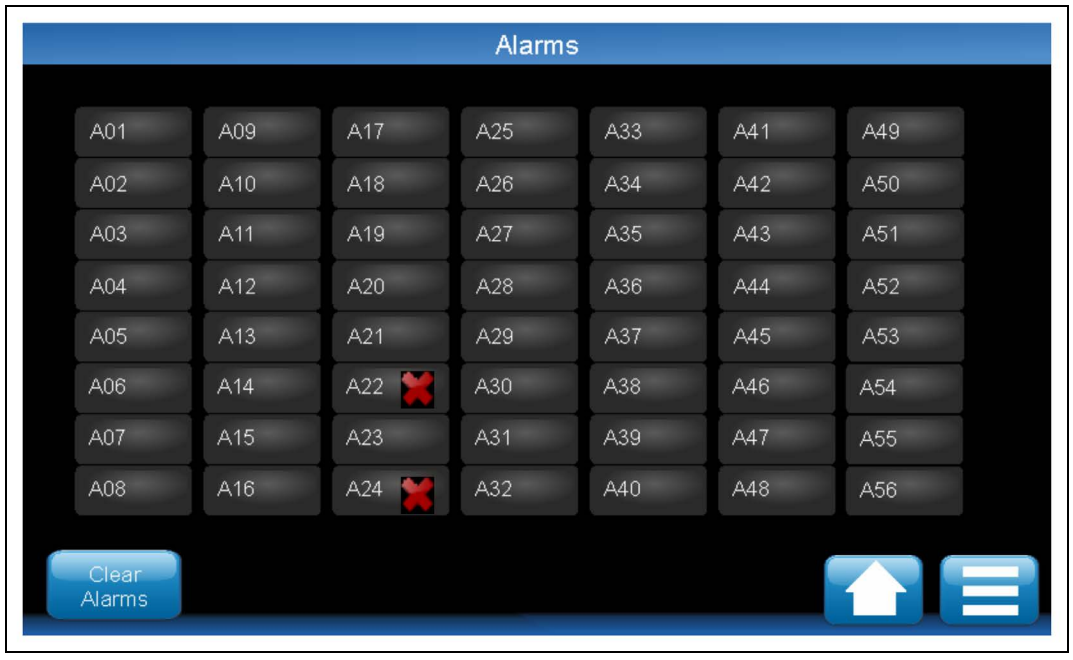
When an alarm occurs, a flashing alarm bell icon immediately breaks through at the top right-hand corner of the Home screen, with the number of active alarms stated below.

Figure 4.18 Control Screen Alarm Indication



Pressing the Alarm Bell icon brings up the Alarm page as shown below. This page identifies the alarms that are active.

Figure 4.19 Control Screen Active Alarms



Access the alarm descriptions by selecting the columns where the alarms appear. See Control Screen Active Alarms above .

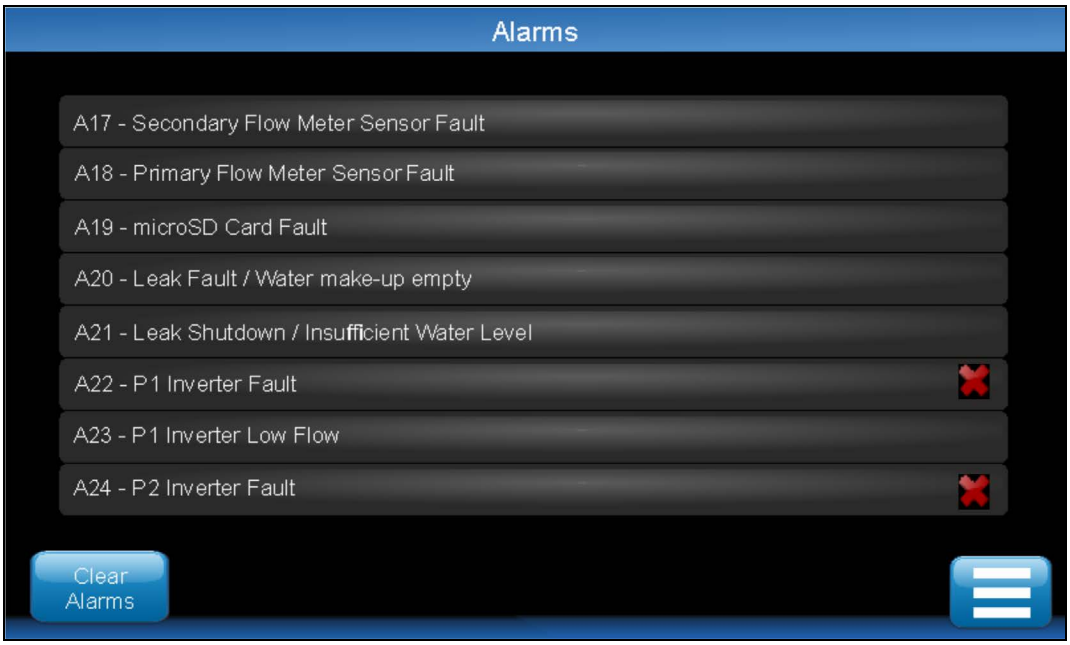
Some alarms will self-clear if the condition is transient. For example, a temperature goes over an alarm threshold then comes back to a healthy condition or when a fault has been rectified such as when a faulty sensor has been replaced.

Latching alarms will need to be cleared manually while logged on at the Service level or higher by pressing Clear Alarms as shown in **Figure 4.18** on the previous page and **Figure 4.19** on the previous page

Self-clearing and latching alarms are identified in Troubleshooting Alarms below .

All alarms are automatically logged in am Alarm Log file stored on the controller SD card. Alarms are stored with the time and date they were generated.

Figure 4.20 Control Screen Alarm Identification



4.5 Troubleshooting Alarms

Alarms are events which may cause the unit to shut down and must be investigated immediately.

Severity classifications are:

1. Unit shutdown. Shutdown IT immediately.
2. Urgent alarm. Immediate investigation required, prepare to shutdown IT, if required.
3. Non-urgent alarm. Investigate within 4 working days.
4. Information only. Respond at the next availability or at PPM.

These severity classifications are suggested only, customers may wish to assign their own ratings.

Table 4.35 Code Severity Classifications

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
---	**No display**	3	---	---	---	---
Detail	Display not illuminated. Power failure on display board or controller I/O board.					
Action	Open upper electrical panel door to check that 24v DC is available at controller I/O board. If there are no LEDs showing on processor board then check I/O board 24v fuse FS1. If LEDs are on, check for wiring faults between I/O board and display.					
A01	**T1 Temperature Sensor Fault**	4	✓	---	---	---
Detail	Reading from coil air-off temperature sensor T1 is outside the normal range of 23°F to 165°F (-5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A02	**T2 Temperature Sensor Fault**	4	✓	---	---	---
Detail	Reading from coil air-on temperature sensor T2 is outside the normal range of 41°F to 165°F (5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A03	**T3a Temperature Sensor Fault**	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3a is outside the normal range of 41°F to 165°F (5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A04	**T3b Temperature Sensor Fault**	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3b is outside the normal range of 41°F to 165°F (5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A05	**T3c Temperature Sensor Fault**	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3b is outside the normal range of 41°F to 165°F (5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A06	**T4 Temperature Sensor Fault**	3	✓	---	---	---
Detail	Reading from fluid return temperature sensor T4 is outside the normal range of 41°F to 165°F (5°C to 74°C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A07	**PS1a Pressure Sensor Fault**	3	✓	---	---	---
Detail	Reading from fluid return pressure sensor PS1a (Fill pressure) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **Note: for DP control, if system differential pressure is not valid, then pump speed will remain at last known demand**.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A08	**PS1b Pressure Sensor Fault**	2	✓	---	---	---
Detail	Reading from fluid return pressure sensor PS1b (Fill pressure) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **Note: for DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					

Table 4.35 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A09	**PS2a Pressure Sensor Fault**	**2**	✓	**---**	**---**	**---**
Detail	Reading from secondary supply pressure sensor PS2a is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **Note: for DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A10	**PS3a Pressure Sensor Fault**	**3**	✓	---	---	---
Detail	Reading from fluid filter outlet pressure sensor PS3a (Pump 1 inlet) is outside the normal range of -1 to 8 bar (-14.5 to 116 PSI) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A11	**PS3b Pressure Sensor Fault**	**3**	✓	---	---	---
Detail	Reading from fluid filter outlet pressure sensor PS3b (Pump 2 inlet) is outside the normal range of -1 to 8 bar (-14.5 to 116 PSI) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A12	**Flow Sensor Fault**	**4**	✓	---	---	---
Detail	Fluid flow sensor output is below 4mA.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A13	**Micro SD Card Fault**	**3**	✓	---	---	---
Detail	The SD card has either been removed or physically damaged.					
Action	Replace the SD card					
A14	**Reservoir Tank Fluid Required**	**2**	✓	---	---	---
Detail	Fluid level in the reservoir tank has dropped to the low level sensor.					
Action	Use external fluid source and engage filling wand and pump P4 to refill the reservoir tank.					
A15	**Reservoir Tank Empty**	**2**	✓	---	---	---
Detail	Fluid level in the reservoir tank has dropped to the very low level sensor and unit fill pump P3 operation is inhibited.					
Action	Use external fluid source and engage filling wand and fill pump P4 to refill the reservoir tank					
A16	**Pump 1 Fault**	**2**	---	✓	---	---
Detail	Pump 1 is drawing excessive current, or speed controller has been subjected to over/under voltage. Alarm will only appear after speed controller has gone into fault condition, Pump 2 will then run.					
Action	Replace Pump 1.					
A17	**Pump 2 Fault**	**2**	---	✓	---	---
Detail	Pump 2 is drawing excessive current, or speed controller has been subjected to over/under voltage. Alarm will only appear after speed controller has gone into fault condition, Pump 1 will then run.					
Action	Replace Pump 2.					

Table 4.35 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A18	**Fluid Pump Shutdown**	1	---	✓	✓	---
Detail	An A16/A17 – Pump Fault and/or an A31/A32 – Pump Comms Fault has been generated					
Action	Check running current of pumps, check speed controllers for faults. Faults will need to be rectified & alarms cleared before unit can be started again.					
A19	**Fluid Low Temperature**	2	✓	---	---	---
Detail	Fluid temperature has dropped by more than 35.6°F (2°C) above set point (default). Alarm will cancel when temperature falls to 33.8°F (1°C) above set point or lower (default 2 minute delay applies).					
Action	Check operation of fans & amount of load on the system.					
A20	**Fluid High Temperature**	2	✓	---	---	---
Detail	Fluid temperature has risen by more than 35.6°F (2°C) above set point (default). Alarm will cancel when temperature falls to 33.8°F (1°C) above set point or lower (default 2 minute delay applies).					
Action	Check operation of fans and amount of load on the system.					
A21	**Fluid Detected – Drip Tray**	2	---	✓	✓	---
Detail	Level float switch in cabinet drip tray has detected a substantial water leak.					
Action	Identify and repair the leak.					
A22	**Fluid Over Pressure (Alarm)**	2	---	✓	---	---
Detail	Pressure at PS2 has increased above the set value of 2.7 bar (39 psi) (default). This alarm is only active if unit has been configured for alarm only. See **Table 4.15** on page 22					
Action	Most likely cause will be excessive heat build-up in the system. Check for High Temp alarms, check bladder in expansion vessel has not ruptured, relieve pressure at drain point. Remove expansion vessel and replace if required.					
A23	**Fluid Over Pressure (Shutdown)**	1	---	✓	✓	---
Detail	Pressure at PS2 has increased above the set value of 2.7 bar (39 psi) (default). This alarm is only active if unit has been configured for alarm + shutdown. See **Table 4.15** on page 22 .					
Action	Most likely cause will be excessive heat build-up in the system. Check for High Temp alarms, check bladder in expansion vessel has not ruptured, relieve pressure at drain point. Remove expansion vessel and replace if required.					
A24	**System Low Pressure**	2	---	✓	---	---
Detail	Pressure at PS1 has dropped more than 0.2 bar (3PSI) (set, non-adjustable) below fill pump activation threshold for more than 1 minute (applicable when unit is running in automatic/on-line mode).					
Action	Ensure fill pump hoses are free of air locks, reservoir tank has sufficient fluid is properly connected and fill pump P3 is operational. Check system for leaks.					
A25	**Insufficient Fluid Level**	2	---	✓	---	---
Detail	**On Initial Start-up** – if level sensor is not made, fill pressure has not been achieved and reservoir very low level sensor is not registering fluid, then unit will not start. **While Unit is Running** – This will be in conjunction with a 26—Level Sensor—No Water Detected alarm. If level sensor is not made and flow or DP is < 50% of flow/DP setpoint, then unit will shutdown after a 1 second delay					
Action	Ensure fill pump hoses are free of air locks, reservoir tank has sufficient fluid is properly connected and fill pump P3 is operational. Check system for leaks. Check auto air vents are open.					

Table 4.35 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A26	**Unit Level Sensor – No Fluid Detected**	**2**	---	✓	---	---
Detail	**While Unit is Running only** – if unit Level Sensor is open circuit for more than 1 second. then this alarm will be raised, providing flow or DP (depending on control function set) is >50% of flow/DP setpoint. If flow/DP is below this threshold, then an A25—Insufficient Fluid Level alarm will be raised and unit will shutdown after a 1 second delay.					
Action	Check that water make-up container is properly connected (or filling wand is fully immersed, if used). Check system for leaks. Check there is no trapped air in fill pump hoses and system is fully vented. Check auto air vents are open.					
A27	**Illegal Fluid Sensor Condition**	2	---	✓	---	---
Detail	**On Initial Start-up** – if fill pressure has been achieved, but unit level sensor is not made.					
Action	Ensure circuit is fully vented. Replace level sensor.					
A28	**Secondary Temp T3a Diff Fault**	2	✓	---	---	---
Detail	Difference between Secondary temp. sensor T3a is more than default 33.8°F (1°C) adrift from T3b and T3c, for a period of 30 seconds (default) or more. Controller will read the average of T3b and T3c only.					
Action	Check T3a sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 48 and replace if faulty.					
A29	**Secondary Temp T3b Diff Fault**	2	✓	---	---	---
Detail	Difference between Secondary temp. sensor T3b is more than default 33.8°F (1°C) adrift from T3a and T3c, for a period of 30 seconds (default) or more. Controller will read the average of T3a & T3c only.					
Action	Check T3b sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 48 and replace if faulty.					
A30	**Secondary Temp T3c Diff Fault**	2	✓	---	---	---
Detail	Difference between Secondary temp. sensor T3c is more than default 35.6°F (2°C) adrift from T3a and T3b, for a period of 30 seconds (default) or more. Controller will read the average of T3a and T3b only.					
Action	Check T3c sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 48 and replace if faulty.					
A31	**Pump 1 Communications Fault**	2	✓	---	---	---
Detail	Controller unable to communicate with Pump 1 speed controller. Pump 1 will stop and Pump 2 will then run.					
Action	Check all cables and connections. Replace pump.					
A32	**Pump 2 Communications Fault**	2	✓	---	---	---
Detail	Controller unable to communicate with Pump 2 speed controller. Pump 2 will stop and Pump 1 will then run					
Action	Check all cables & connections. Replace pump					
A33	**Pump 1 Low Flow**	2	---	✓	---	---
Detail	Pump 1 has not reached the differential pressure (or flow rate) setpoint and is running at 100% in the specified time limit (default 30 secs). Pump 1 will then stop and Pump 2 will run.					
Action	Check that unit has been set for the correct system flow rate (or DP), check for system blockages, check speed controller for faults, check non-return valve on Pump 2 is not sticking open. Reduce flow setting (or DP).					
A34	**Pump 2 Low Flow**	2	---	✓	---	---
Detail	Pump 2 has not reached the differential pressure (or flow rate) setpoint and is running at 100% in the specified time limit (default 30 secs). Pump 2 will then stop and Pump 1 will run.					
Action	Check that unit has been set for the correct system flow rate (or DP), check for system blockages, check speed controller for faults, check non-return valve on Pump 1 is not sticking open. Reduce flow setting (or DP).					

Table 4.35 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A35	**Fan 1 Fault**	2	✓	---	---	---
Detail	Fan 2 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A36	**Fan 2 Fault**	2	✓	---	---	---
Detail	Fan 2 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A37	**Fan 3 Fault**	2	✓	---	---	---
Detail	Fan 3 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A38	**Fan 4 Fault**	2	✓	---	---	---
Detail	Fan 4 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A39	**Fan 5 Fault**	2	✓	---	---	---
Detail	Fan 4 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A40	**Fan 6 Fault**	2	✓	---	---	---
Detail	Fan 6 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A41	**Fan 7 Fault**	2	✓	---	---	---
Detail	Fan 7 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A42	**Group Control – Network Fault**	2	✓	---	---	---
Detail	Comms failure between units on network.					
Action	Check wiring and terminations					
A43	**Group Control – Insufficient Units Available**	2	✓	---	---	---
Detail	Group control cannot bring a redundant unit on-line because it's either in a fault condition, has locally been put into standby mode, or has a comms. failure					
Action	Check status of redundant unit, check wiring and terminations					
A44	**PS1 Difference Out of Limits**	3	✓	---	---	---
Detail	Difference between secondary return pressure sensors PS1a and PS1b is more than 0.2 bar (3 psi), (default) for a period of 30 seconds (default) or more. Controller will continue to read just the higher of the 2 values.					
Action	Replace sensor with the lower reading.					

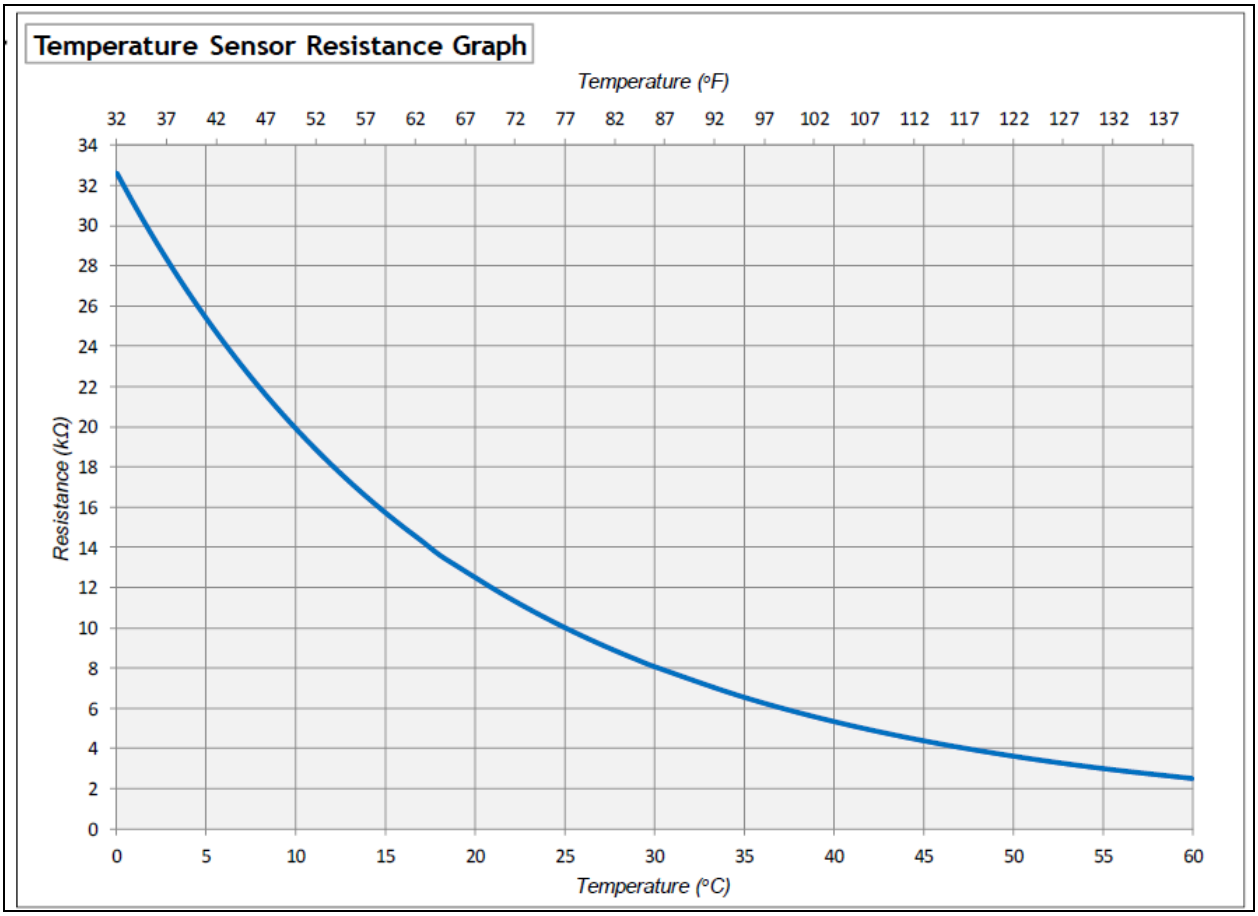
Table 4.35 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A45	**Fluid Detected - Rope**	**2**	**---**	✓	✓	**---**
Detail	The water detection rope installed around perimeter of unit drip tray has detected a fluid leak. Alarm may be set for Alarm Only (default), or Alarm + Unit Shutdown.					
Action	Identify and repair leak. **Note: a leak of this magnitude that does not bring up other alarms will most likely be from the primary chilled water circuit.**					
A46	**Pump 1 Filter Dirty**	**3**	✓	**---**	**---**	**---**
Detail	Differential pressure across pump 1 filter is greater than 0.5 bar (7 psi), indicating that the filter should be cleaned. Default 60 second delay applies.					
Action	Identify and repair leak. **Note: a leak of this magnitude that does not bring up other alarms will most likely be from the primary chilled water circuit.**					
A47	**Pump 2 Filter Dirty**	**3**	✓	**---**	**---**	**---**
Detail	Differential pressure across pump 2 filter is greater than 0.5bar (7 psi), indicating that the filter should be cleaned. Default 60 second delay applies.					
Action	Clean filter screen as described in the Maintenance section.					
A48	**PSU A - AC Fault**	**3**	✓	**---**	**---**	**---**
Detail	PSU failed due to fault on the AC input					
Action	Check the incoming MCB status, check AC site supply, check wiring & terminations. Replace PSU.					
A49	**PSU B - AC Fault**	**3**	✓	**---**	**---**	**---**
Detail	PSU failed due to fault on the AC input.					
Action	Check the incoming MCB status, check AC site supply, check wiring and terminations. Replace PSU.					
A50	**PS2b Pressure Sensor Fault**	**3**	✓	**---**	**---**	**---**
Detail	Reading from Secondary supply pressure sensor PS2b is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **Note: for DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A51	**PS2 Difference Out of Limits**	**3**	✓	**---**	**---**	**---**
Detail	Difference between secondary supply pressure sensors PS2a and PS2b is more than 0.2 bar (3 psi), (default) for a period of 30 seconds (default) or more. Controller will continue to read just the higher of the 2 values.					
Action	Replace sensor with the lower reading.					
A52	**PS4 Pressure Sensor Fault**	**3**	✓	**---**	**---**	**---**
Detail	Reading from pump inlet header pressure sensor PS4 is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					

4.6 Temperature Sensor Graph

Figure 4.21 below may be used to check the validity of the 10K thermistor used in the unit.

Figure 4.21 Temperature Sensor Resistance Graph



5 Maintenance

5.1 General

The Vertiv™ Liebert® XDU070 should be cleaned on a regular basis and checked for leaks and malfunctions. Maintenance should only be carried out by personnel qualified to work on this type of equipment. For information on Maintenance or Service Support, contact Vertiv Support.

5.2 Fluid Specifications

The fluid circuit should be filled with PG-25.

Failure to use the recommended cooling fluid may result in decreased system performance and reliability due to corrosion, scaling, fouling and microbiological growth which may invalidate the warranty.

5.3 Planned Preventative Maintenance

Planned maintenance services should be carried out every 6 months following installation and commissioning.

5.3.1 Special Tools/Equipment

- Surface temperature measurement device
- Air temperature measurement device
- Clamp-on ammeter
- Drain tube (supplied with unit)
- Fluid sample kit (for fluid analysis)
- Micro-SD card reader and computer

5.3.2 Visual Checks for Damage and Leakage

- Pipework and hoses
- All temperature, level, flow and pressure sensors
- Expansion vessels and Schrader valves
- Auto air vents and screw cap
- Drain valves
- Pump clamped connections
- Pipe clamped connections
- Cooling coil pipework and connections
- Presence of dust or potential clogging of heat exchanger coils surface
- Check running pump for abnormal noise
- Record any damage to unit

5.3.3 General Settings

- Record unit serial number on maintenance check list.
- Record values from controller display home page.

5.3.4 Controller Checks

Setpoints and alarm actions, group control, download logs.

- Check the sync date and time of the units, (NTP may or may not be enabled)
- Check for any current alarms, take appropriate action as detailed in this guide
- Download complete contents of folder with name of product serial no. from micro SD card. This folder contains historic alarm log, system log, parameter log, and data log files
- Record parameters from the parameter log file that have been changed from default since commissioning. (Signified by an asterisk adjacent to parameter ID in log file). Verify with customer why values have changed from commissioned value.

5.3.5 Communication Checks

Check with customer that remote communications function correctly with no reported issues.

5.3.6 Sensor Checks

- Check all fluid and air temperature sensors consistent with surface and air temperature measurement device readings.
- Check pressure and flow sensor readings are consistent with other units in the group (if multiple units) and with commissioned values.

5.3.7 Fluid Checks

- Take secondary circuit fluid sample as directed by fluid management partner and sent to approved lab. for analysis and report recommendations.
- Take action on any previous fluid report recommendations.
- Check supplementary filling operation with manual override if not automatically engaged when taking fluid sample.
- Check make-up reservoir tank is full, properly connected and breather cap is functional.
- Record fluid filter DP readings (PS3a and PS3b difference with PS2), Isolate, remove, and clean fluid filters if necessary, and record new readings.

5.3.8 Functional Checks

- May require unit shutdown. Check with customer before continuing.
- Check controller, display and security gateway (if fitted) firmware status and upgrade, if necessary.
- Carry out audible/visual checks on operational pump.
- Override operational pump speed to 100% and record temperature, current, and voltage from Status screen (ensure PS2 does not exceed high pressure alarm setpoint).
- Override redundant pump speed to 100% and record temperature, current, and voltage from Status screen, then set override back to 0%.
- Override fan speed to 100% and record current draw for each fan (clamp-on ammeter).
- Check all the cable connections and terminals for signs of damage/loose wire connection.

5.4 Fluid Filter Service

This the unit has twin (redundant) pumps and the filter of each pump can be cleaned while the unit is running provided the pump of the filter to be cleaned is put into out-of-service state via the Service menu (screen refs. S410/S402).

Figure 5.1 Servicing Fluid Filters Demonstrated on Pump B Filter, Steps 1 and 2

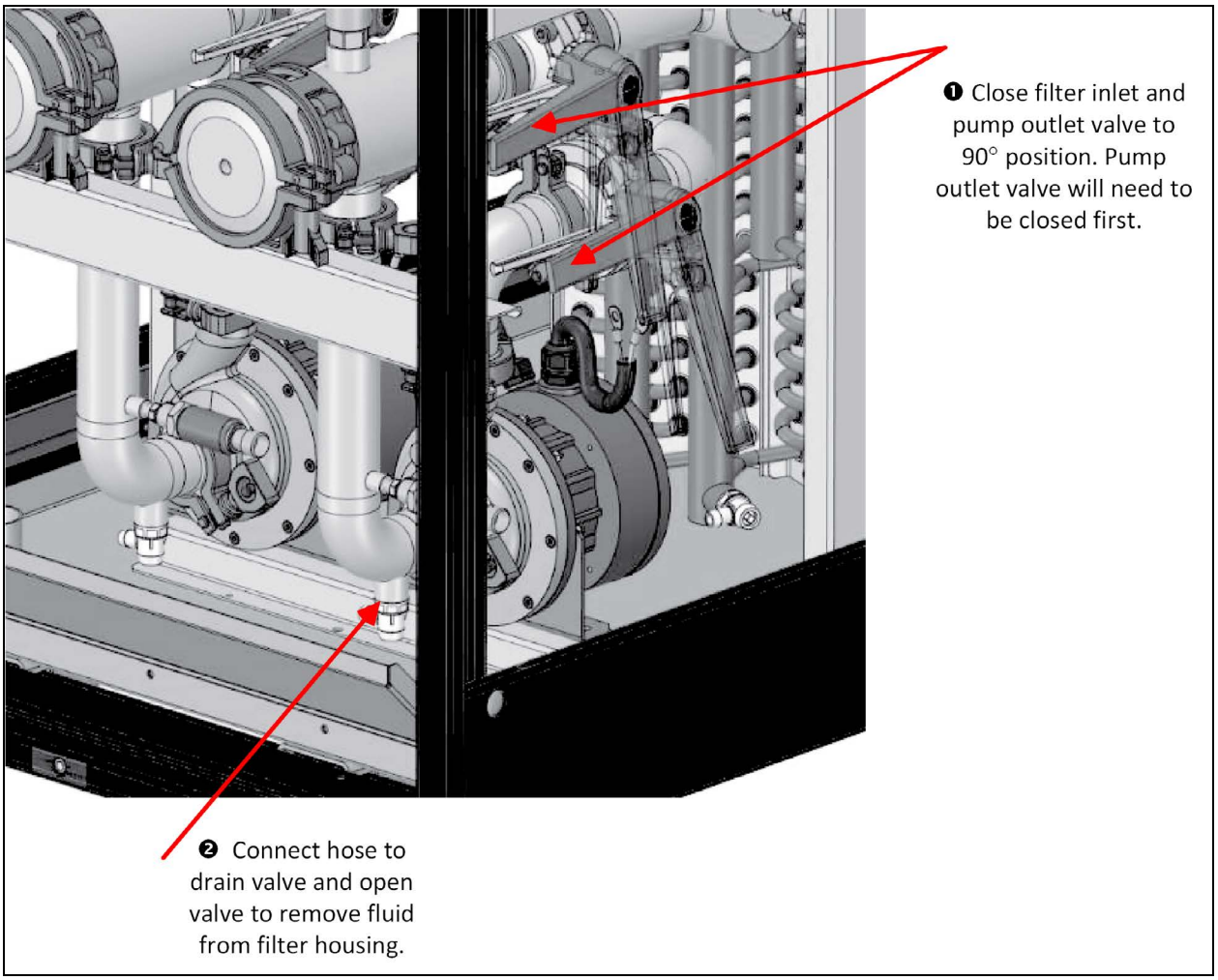
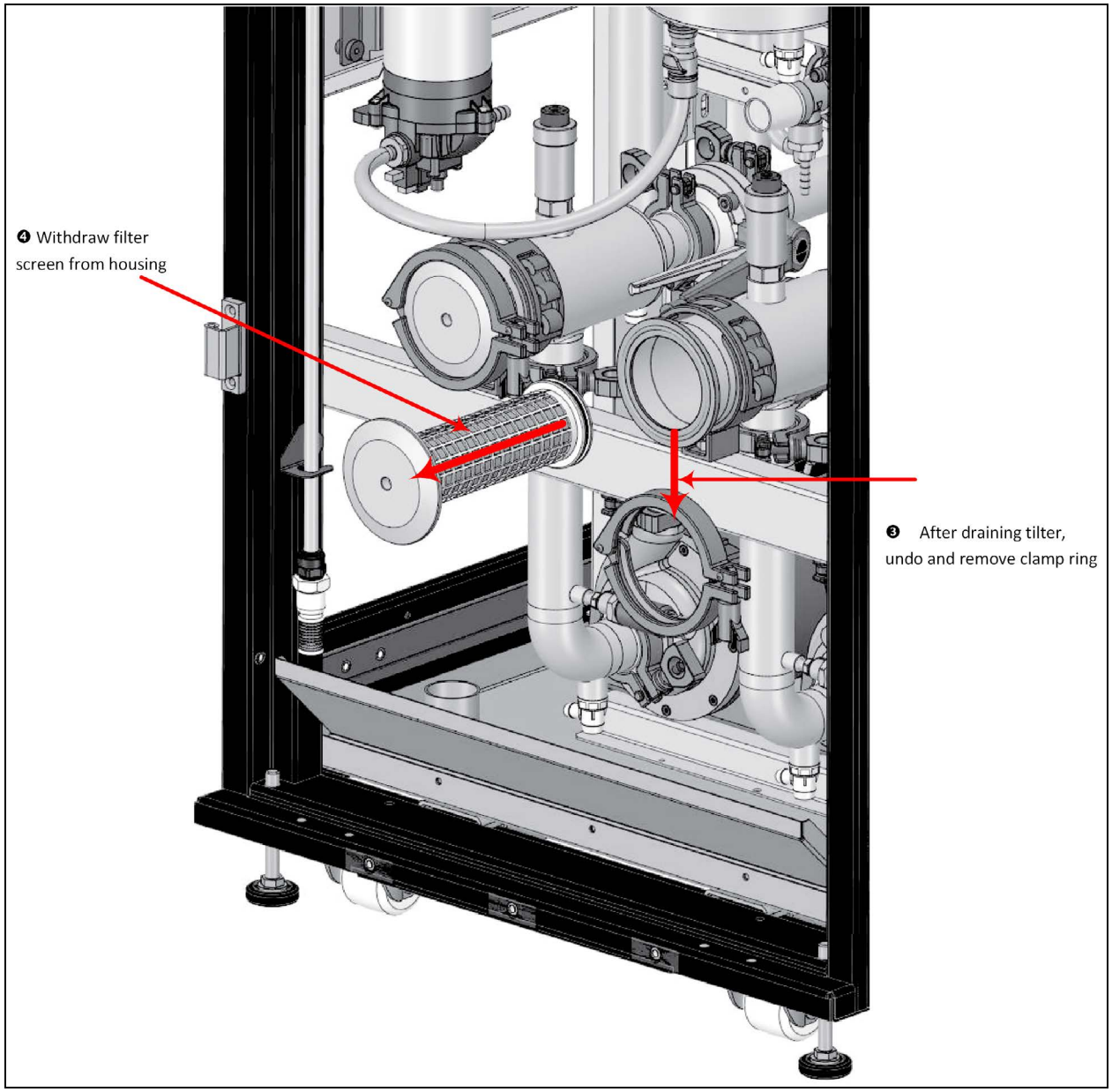


Figure 5.2 Servicing Fluid Filters Demonstrated on Pump B Filter, Steps 3 and 4



The secondary filters may be removed and cleaned using this procedure:

1. Close isolation valves located on pump inlet and filter of the filter to be serviced. See **Figure 5.1** on the previous page demonstrated on Pump A Filter. Valve handles should be 90° anti-clockwise for Pump A Filter and 90° clockwise if Pump B filter.
2. Drain fluid from filter using drain valve at base of filter housing using the drain valve key and drain hose provided.

NOTICE

It is not necessary to fully drain the filter housing in order to clean the filter. Drain just enough fluid to ensure the level has dropped approximately a cupful in the filter housing.

3. Once drained, undo the clamp ring at the top of the filter housing, then withdraw the cap and filter screen (including automatic air vent) vertically out from the top of the filter housing.

NOTICE

It may be necessary to break the seal on the top flange of the filter housing by giving the cap flange a gentle tap on the side with a soft faced mallet.

4. The filter screen may now be washed under a running tap however, if possible, a high-pressure water jet is preferable for more effective cleaning. Care must be taken not to damage the delicate filter mesh.

NOTICE

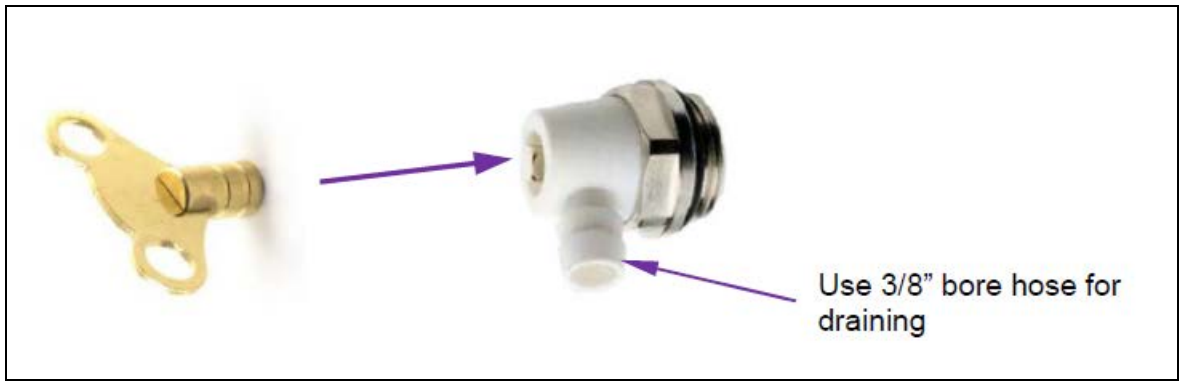
Check the condition of the O-ring seal at the base of the filter screen and the face seal at the top before re-assembling and replace if there are any signs of damage. When opening the valves, open the pump inlet valve initially until all the contained air is purged out of the filter housing through the automatic air-vent, before then opening the filter outlet valve. When the pump inlet valve is opened, the loss of system pressure will most likely automatically start the fill pump P3 to bring the system back to the operating pressure.

5.5 Unit Draining

5.5.1 Fluid Circuit Drain Points

There a 7 drain valve locations around the fluid circuit. Each drain valve can be operated with the drain valve key supplied with the unit. A 1 m length of 3/8" drain hose is also supplied to route each drain valve into a suitable collection receptacle. See Figure 5.4 on the next page for drain valve locations.

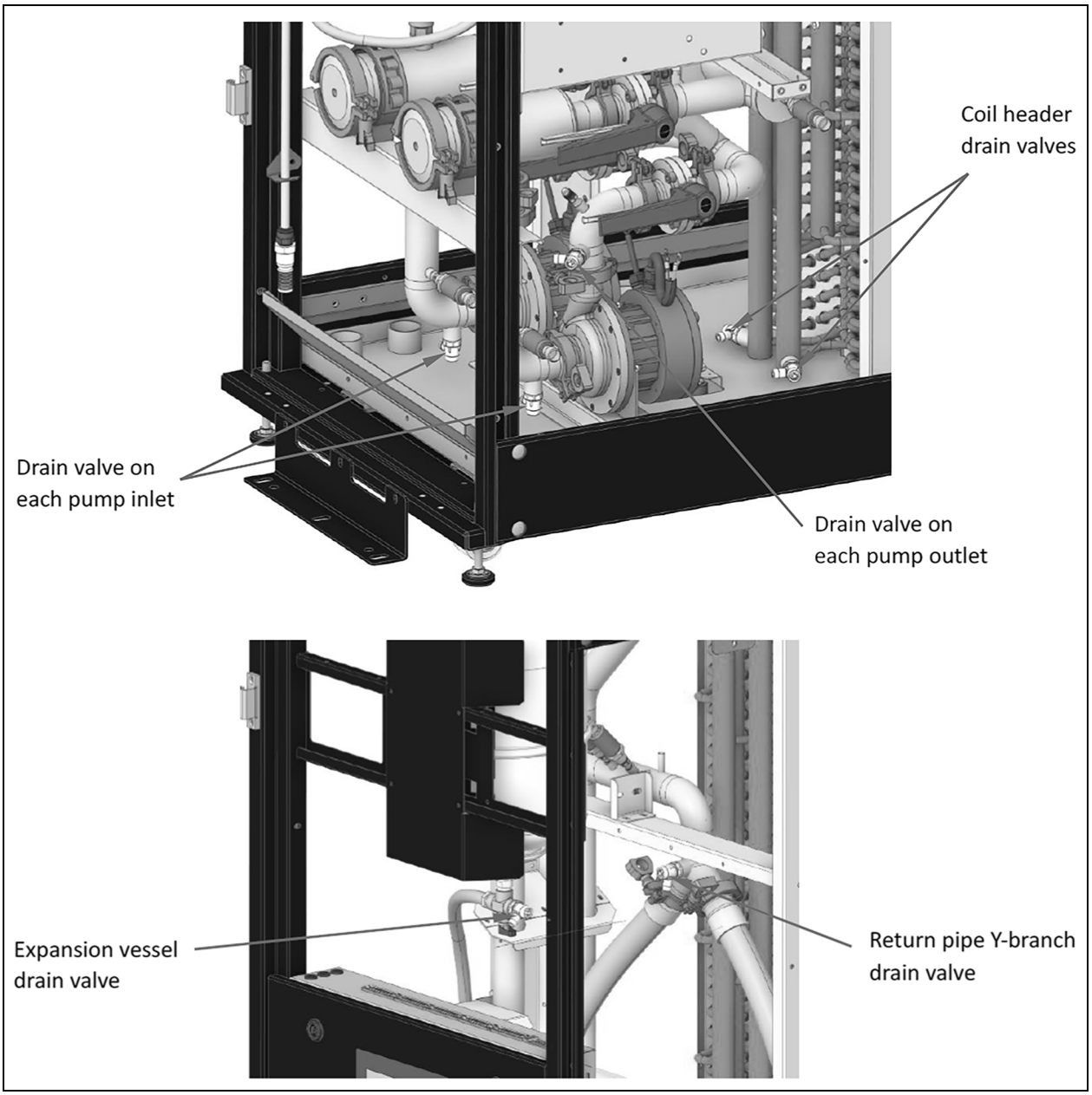
Figure 5.3 Drain Valves



Valve locations are:

- 1 the base of each coil inlet header tube (total 2 off)
- 1 on the inlet of each pump/filter outlet (total 2 off)
- 1 at the outlet of each pump (total 2 off)
- 1 at the Y-branch of the return pipe
- 1 at the expansion vessel

Figure 5.4 Drain Valve Locations



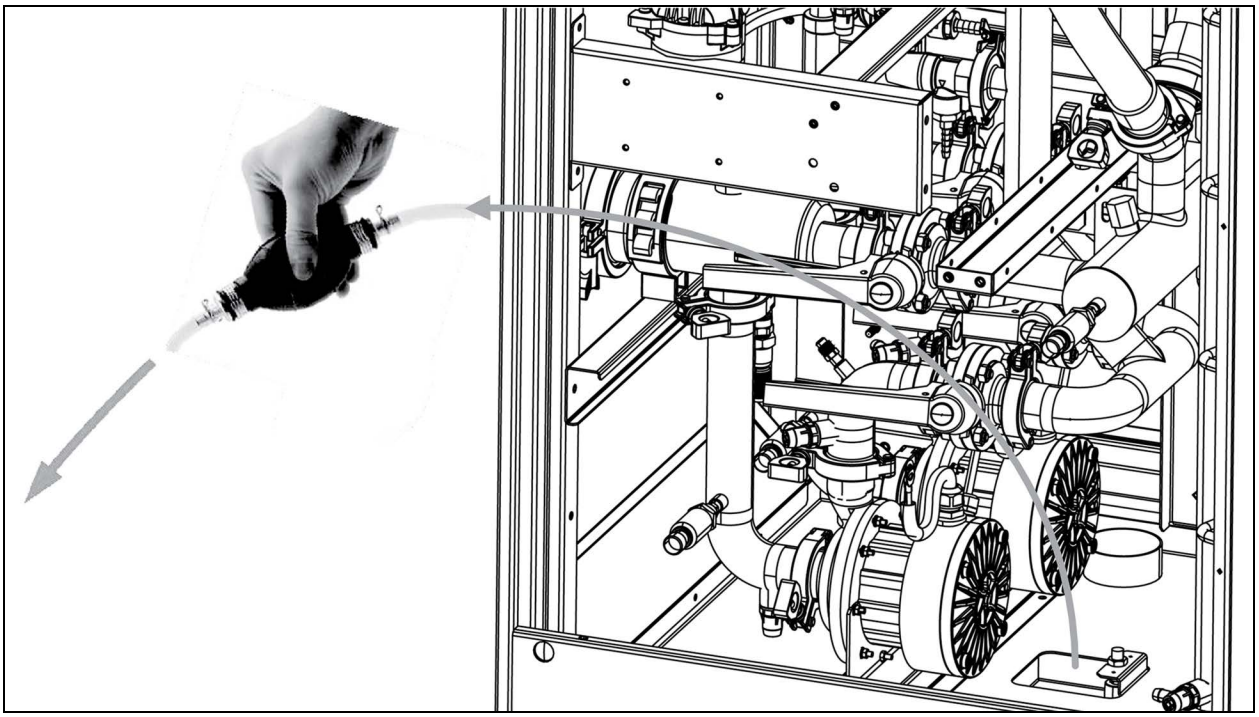
5.5.2 Drip Tray Hand Pump

In the event of a minor leak that leaves fluid in the drip tray sump area, a small hand pump is provided with pre-attached hose to enable this fluid to be easily removed, as shown in Figure 5.5 on the facing page . Observe the flow direction arrow on the side of the pump bellows to ensure flow is in the correct direction before use.

NOTICE

If this pump and hose has been used to remove PG-25 fluid, it is recommended that pump and hose are flushed through with plain water before coiling up and storing back inside the unit.

Figure 5.5 Drip Tray Hand Pump



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Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2378

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH 43082

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong

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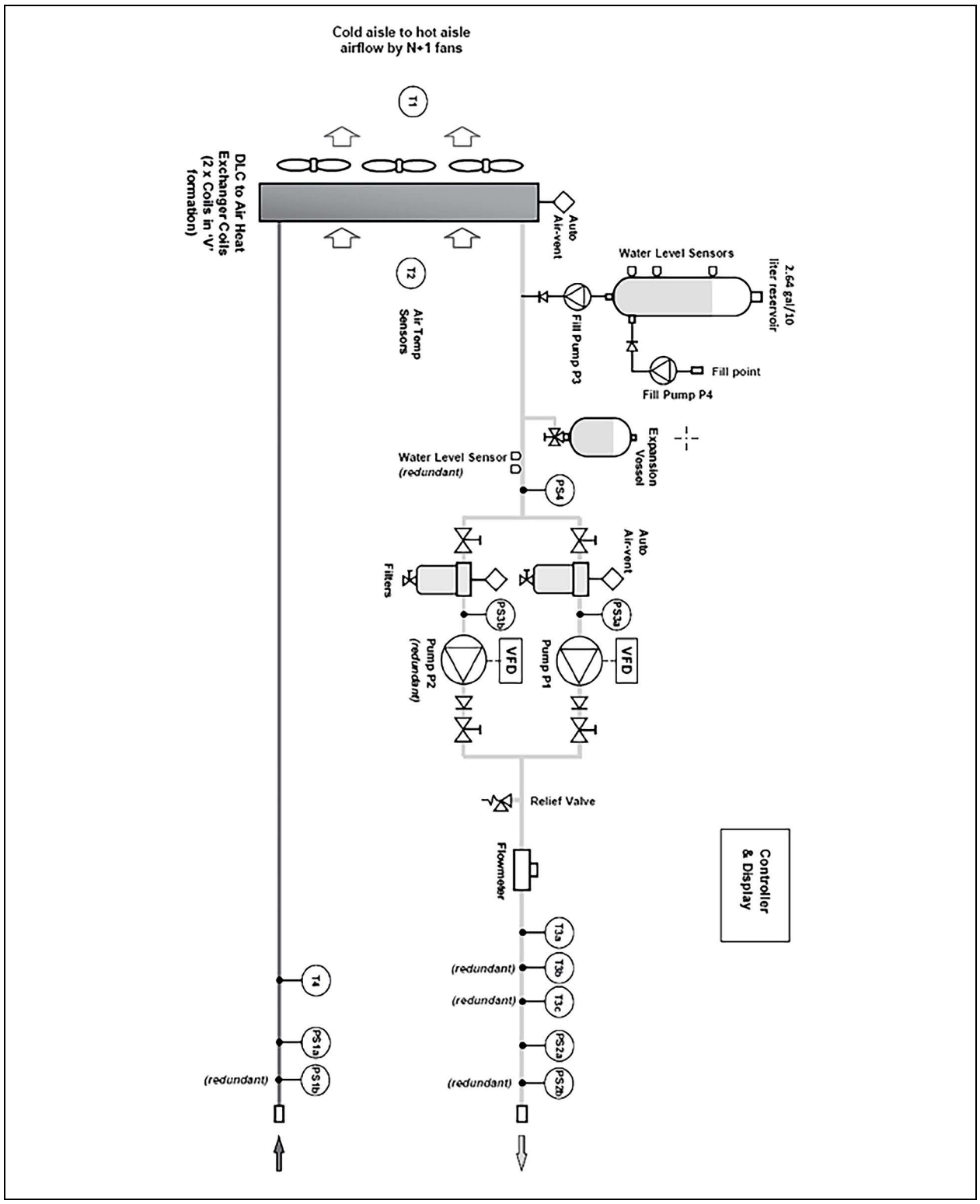
Appendix B: Piping Schematic

Figure B.1 Piping Schematic



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Appendix C: Notes

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Appendix D: Disposal Procedure

Waste materials must be disposed of in a responsible manner in line with environmental regulations.

Decommissioning and disposal of this product should be undertaken by qualified personnel in adherence to local and national safety regulations, particularly for protection of lungs, eyes, and skin from chemicals, dust etc. Approved lifting gear and power tools should be used and access to the work area must be restricted to authorized personnel. The following steps are a guide only and should be adjusted to take into account local site conditions:

1. Disconnect unit from electrical supply.
2. Drain and dispose of any heat transfer fluid through an approved recycling facility.
3. Remove unit to an approved recycling facility.

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