CoolChip CDU 100

Operation and Maintenance Guide

Product Rev A

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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.

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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.

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1 Important Safety Instructions

Save These Instructions

This manual contains important instructions that must be followed during operation and maintenance of the Vertiv™ CoolChip CDU 100.

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 representative for clarification and advice. See Technical Support and Contacts on page 65.

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. Only the appropriate lifting equipment must be used.

WARNING! This product is supplied with a 1.38 bar (20 psi) nitrogen holding charge in the fluid circuit. This needs to be vented during the installation process. See the Vertiv™ CoolChip CDU 100 Installation and Commissioning Guide SL- 71337 for more information.

1.3 Application

This product is to be used indoors only and must be used only for the application it was designed for in consultation with Vertiv.

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 documentation together with commissioning, maintenance, or 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 cULus listed for the appropriate voltage models and certificates will be made available on request (cULus certificate 60335-2-40).

2.2 RoHS 3 Compliance

Vertiv certifies that all products manufactured and supplied by Vertiv are fully RoHS compliant in accordance with EU RoHS Directives EU 2015/863.

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3 Product Description

3.1 General

This document describes the basic characteristics and operation of the Vertiv™ CoolChip CDU 100 and the required ongoing maintenance considerations.

The Vertiv™ CoolChip CDU 100 contains a secondary closed loop circuit that provides a supply of cooling fluid to IT equipment, either through indirect cooling (such as rack mounted rear door heat exchangers), or direct cooling (such as cold plates at chip level).

The secondary circuit loop is a low pressure sealed system with the heat removed from the high heat density areas of IT equipment rejected to an external cooled water source (primary circuit) through a low pressure drop plate heat exchanger.

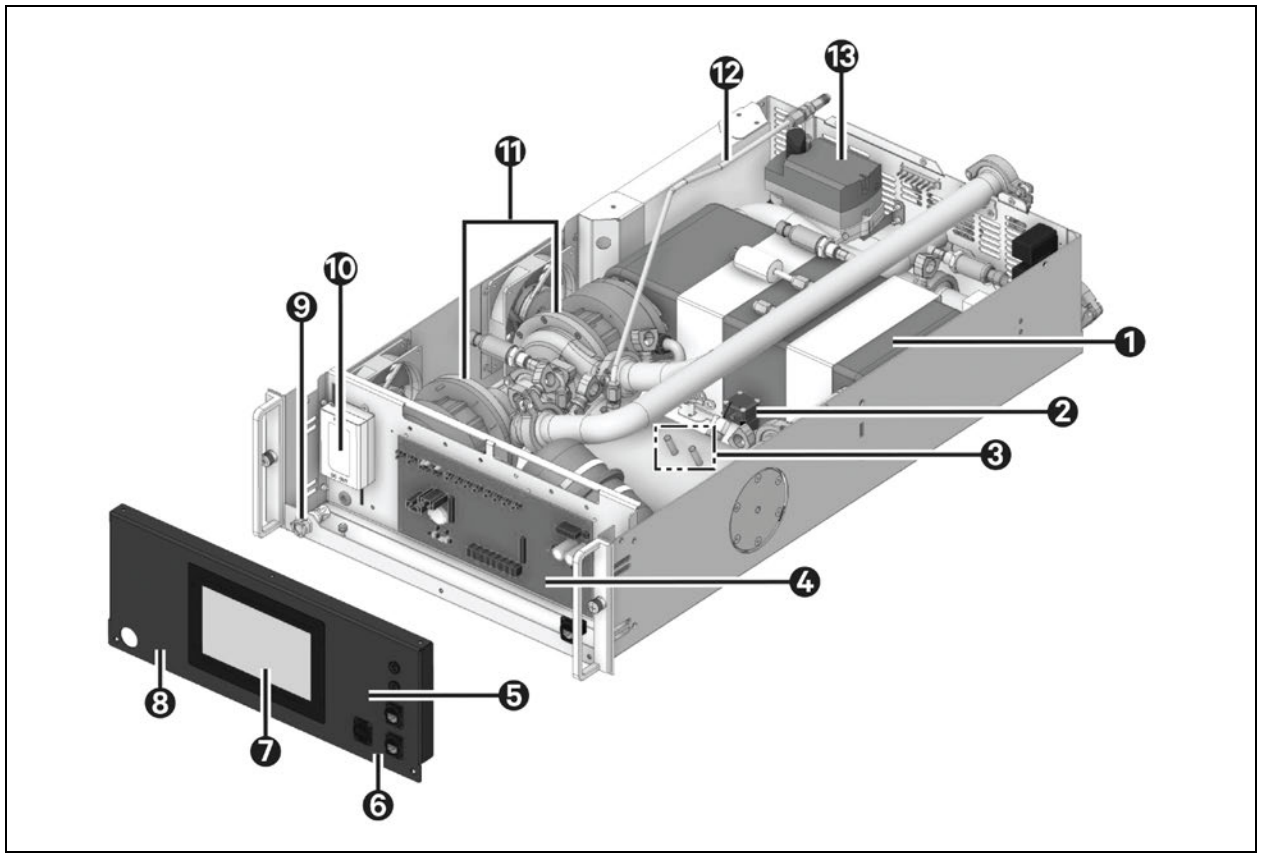
The secondary circuit ensures that the cooling fluid in a data center environment can be kept to a minimum volume, is closely controlled for flow, pressure and temperature (with condensation control) and can be accurately maintained for fluid quality (with filtration and additives).

The primary cooling source can be a chilled water system (either dedicated or from building system), fluid cooler, cooling tower or dry air cooler, depending on the desired secondary temperature and heat transfer duty.

Refer to Sections 4.6 and 4.7 of **Vertiv™ CoolChip CDU 100 Application and Planning Guide SL-71339** for more information.

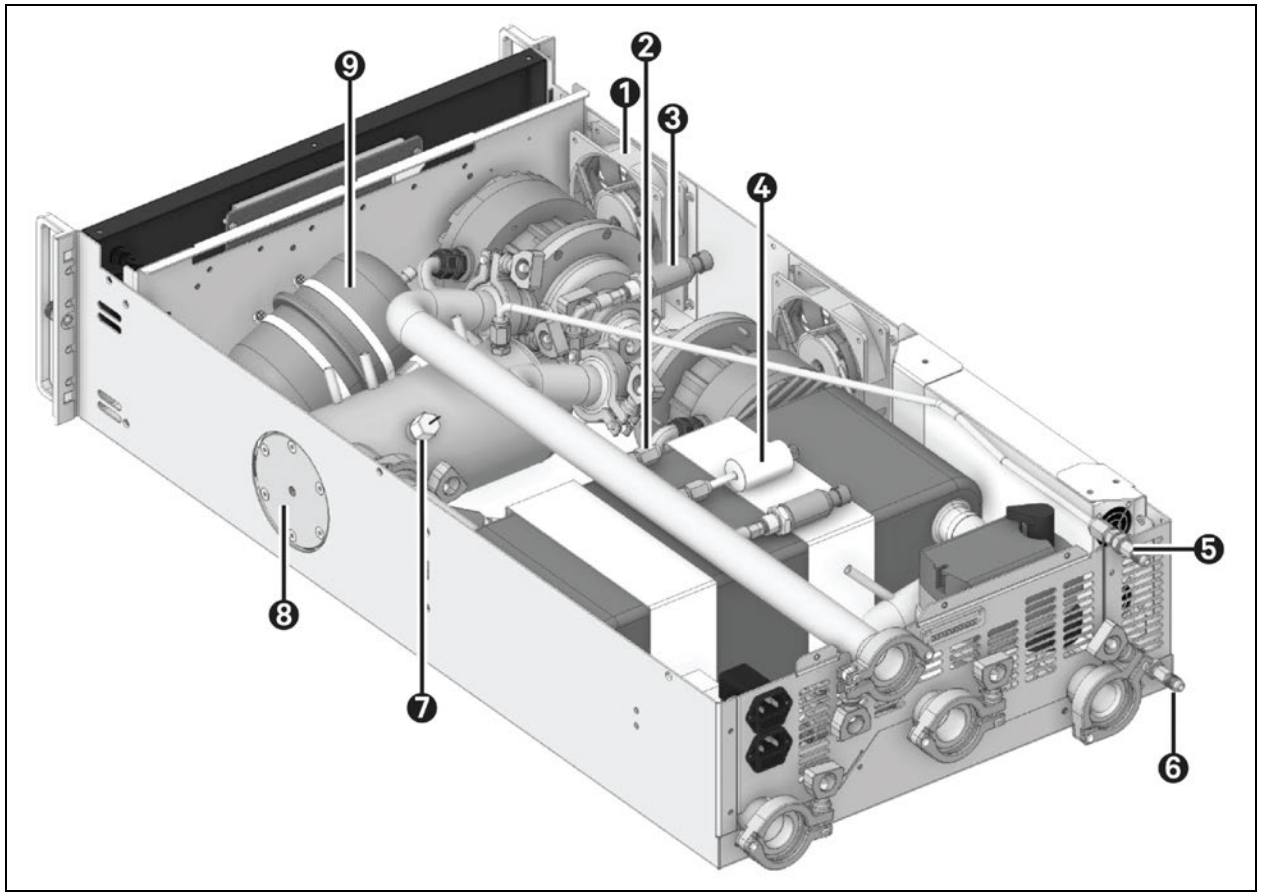
3.2 Product Views

Figure 3.1 Front View of Vertiv™ CoolChip CDU 100(Top Cover Panel Removed)



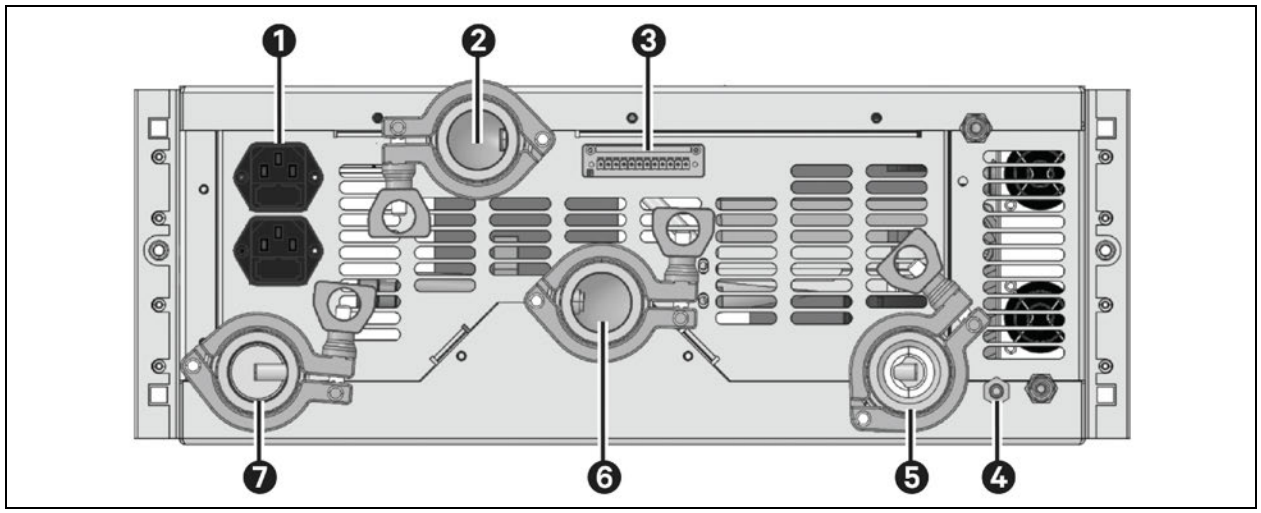
Item	Description
1	Plate heat exchanger
2	Fill pump
3	Temperature sensors
4	Control board
5	Alarm buzzer (no audible alarm, flashing bell on display screen)
6	Dual Ethernet (RJ45) and USB connection
7	Controller 7-inch touchscreen display
8	Removable fascia panel
9	Fill pump water connection
10	24 V DC power supply
11	Secondary circuit pumps
12	Pump 48 V DC power supply
13	Primary 3-way circuit control valve

Figure 3.2 Rear View of Vertiv™ CoolChip CDU 100 (Top Cover Panel Removed)



Item	Description
1	Cooling fans
2	Pressure relief valve
3	Pressure sensors
4	Secondary flow meter
5	Air vent purge
6	Reservoir/Secondary circuit drain
7	Level sensor
8	Secondary filter
9	Expansion vessel

Figure 3.3 Rear View of Vertiv™ CoolChip CDU 100 (Electrical and Hose Connections)



Item	Description
1	A and B 1-phase IEC—C14 power inlet connections (factory fitted fuses)
2	Secondary circuit supply
3	Connectors for external temperature/humidity sensor, external leak detection tape RS485 and CANbus Communications
4	Pressure relief valve outlet
5	Primary circuit returnn
6	Secondary circuit return
7	Primary circuit supply

3.2.1 Controls Wiring

Several sensor and communications options are available on the CDU 100:

At the rear panel:

- External temperature and humidity sensor (optional)
- External leak detection cable (optional)
- RS485 modem. Use Beldon 3106A or equivalent (1 pair + 1 shielded 22AWG).
- CANbus. Use Beldon 3106A or equivalent (1 pair + 1 shielded 22AWG). CANbus is used for communication between CDUs for group control

Table 3.1 Controls Wiring, Rear Panel

Pin#	Description
Pins 1, 2, 3	RRH & T Sensor
Pins 4,55	Leak Detection Cables
Pins 7, 8, 9	MODBUS RTU RS 485
Pines 10, 11, 12	CANBUS for Group Control

At the front panel:

- 2 Ethernet ports (RJ45)—Cat5e shielded cable

Figure 3.4 Controls Port Mapping (before July 2023)

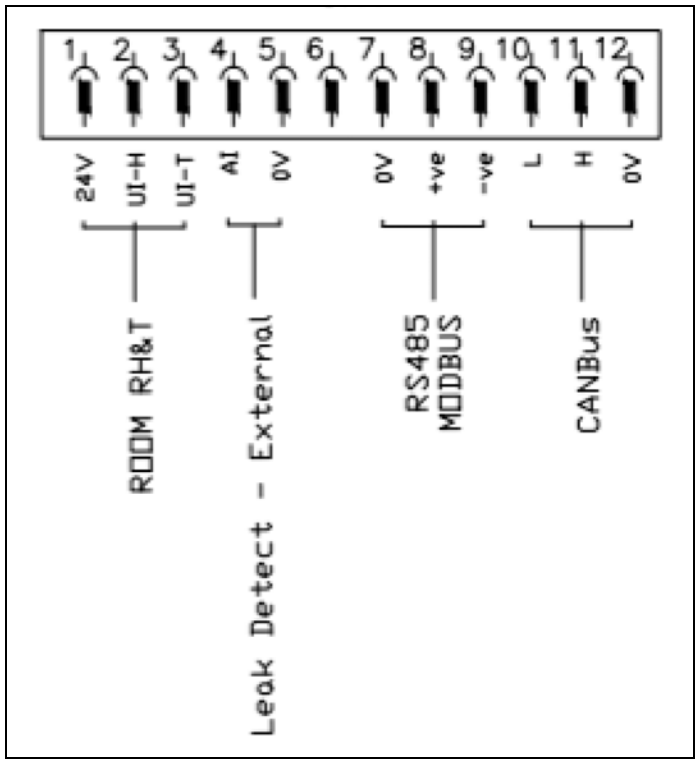
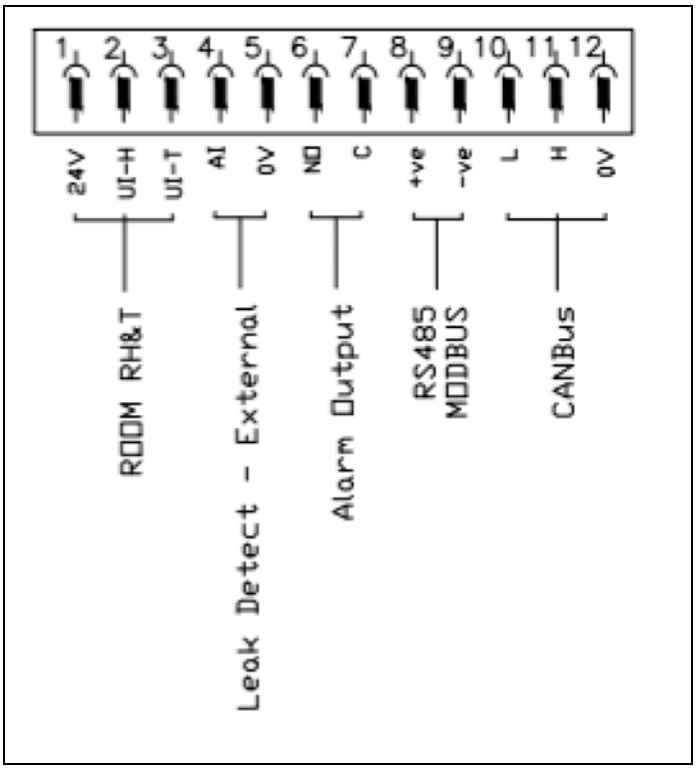


Figure 3.5 Controls Port Mapping (after July 2023)



4 Operation

4.1 Controller Overview

The Vertiv™ CoolChip CDU 100 controller is designed to monitor and control the supply of cooling fluid to IT equipment in unattended data center environments. Secondary circuit cooling fluid is closely controlled to a defined temperature and at a controlled differential pressure (or flow rate) for optimum heat management.

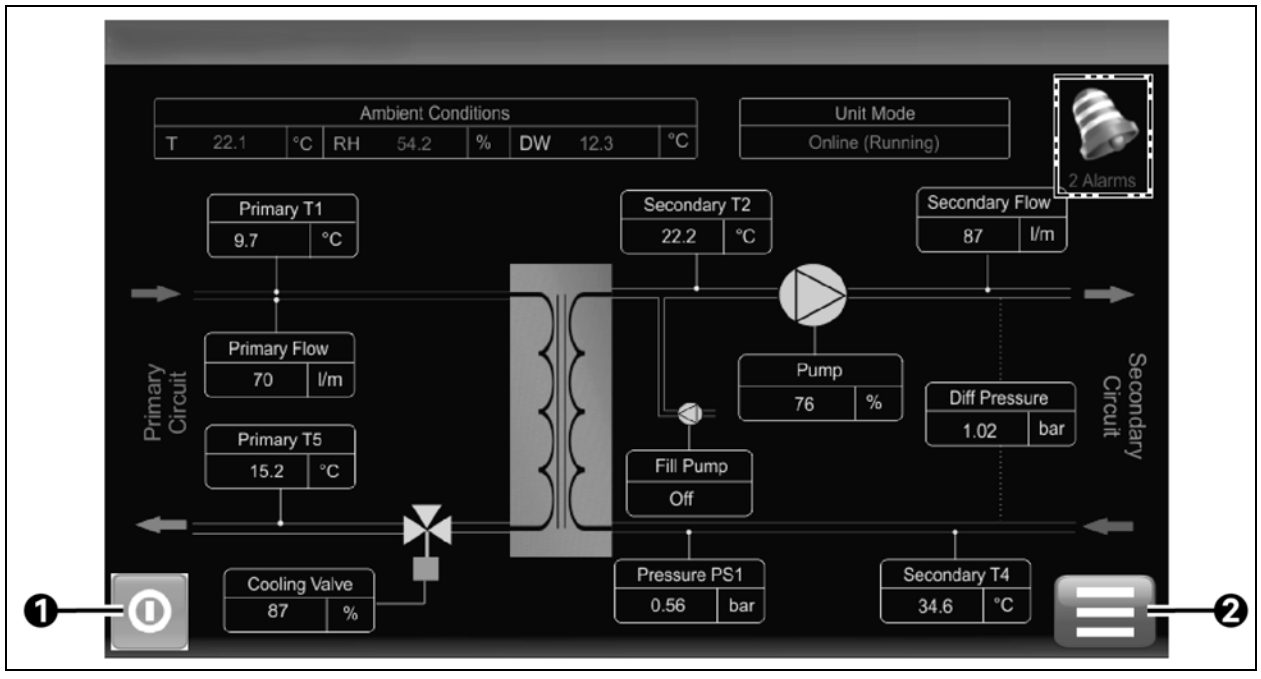
When power is first applied to the unit, the touchscreen will illuminate and the pump inverter drives will energize. After a short initialization period during which the company logo is presented, the display defaults to the Home screen, as shown in Figure 4.1 below.

4.2 User Interface

4.2.1 Home Screen

The Home screen displays a schematic representation of the Vertiv™ CoolChip CDU 100, showing essential temperatures, pressures, flows and more parameters for primary and secondary circuits. The product code identification, installed software version and date/time.

Figure 4.1 Control System Home Screen



Item	Description
1	Start/Stop icon. Changes to red when unit is in standby
2	Menu icon. Displays the Main Menu screen

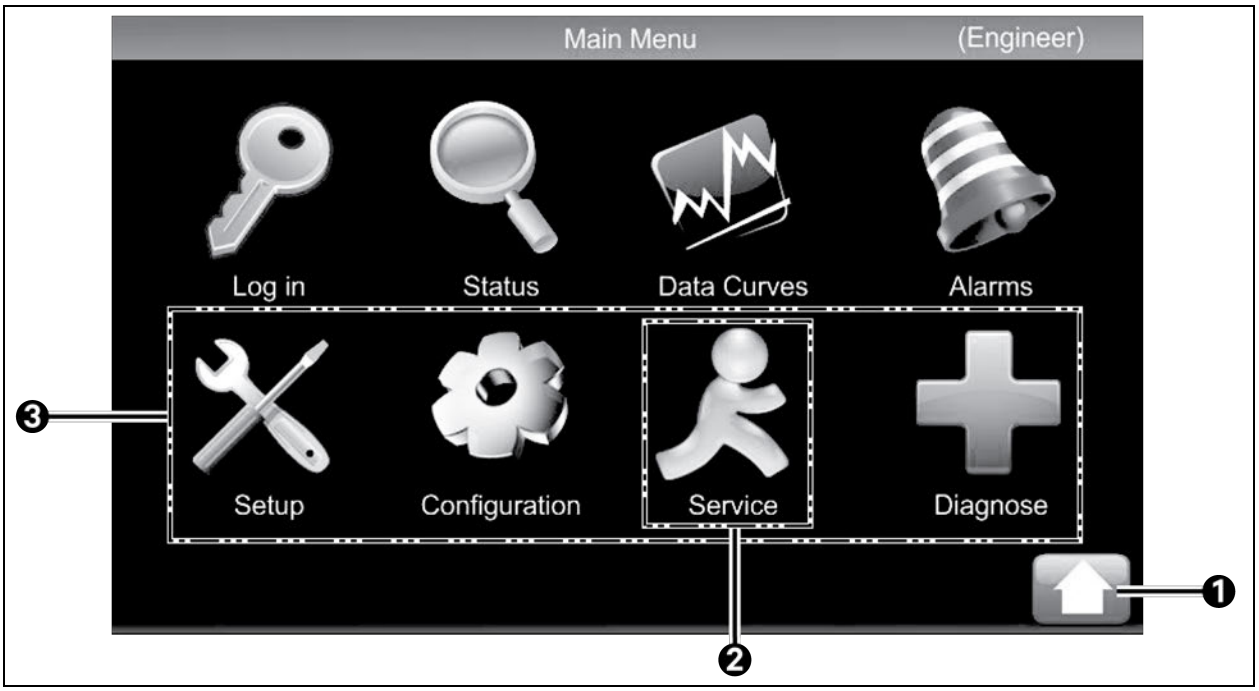
4.2.2 Main Menu

The Main Menu screen displays submenus for an increased level of information and modification of some parameters.

NOTE: Some control system menus may not be visible if the user is not logged in. Visibility will also depend on the login access level used.

The touchscreen display has been designed to be intuitive and for easy navigation. Figure 4.2 below provides an explanation of the elements in the Main Menu screen.

Figure 4.2 Control System Main Menu Screen



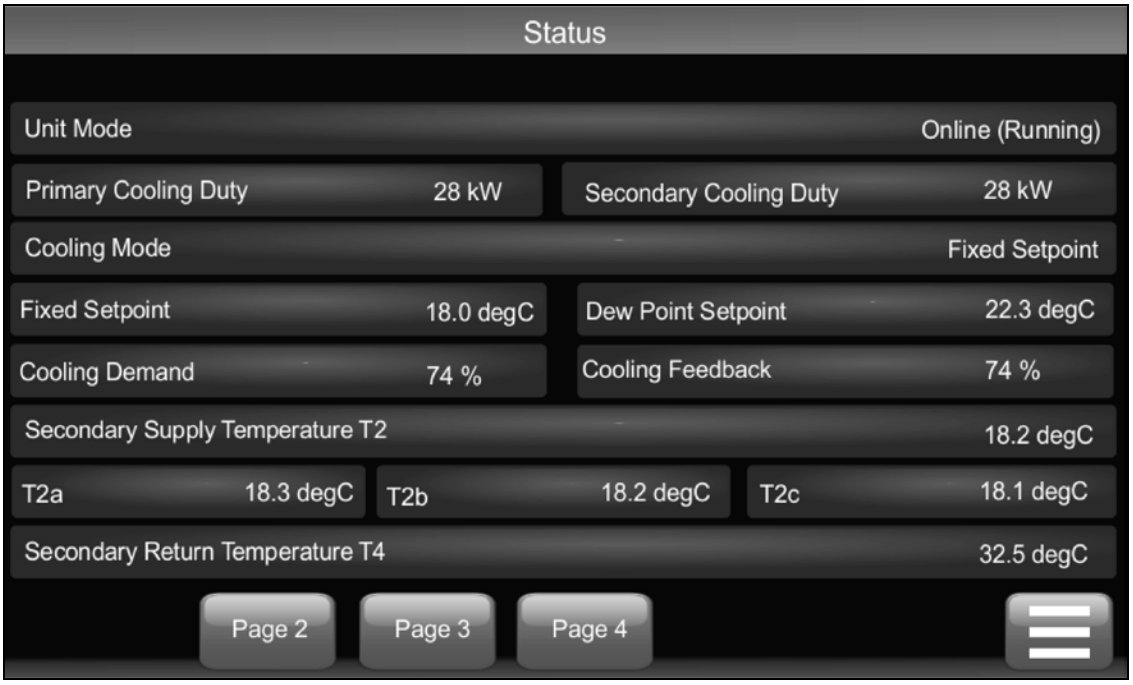
Item	Description
1	Return to Home screen
2	Service. Only visible when logged in at service or engineer level
3	Setup. Only visible when logged in

4.2.3 Status Screen

The Status screen displays comprehensive view only information on the operating condition of the Vertiv™ CoolChip CDU 100 unit.

NOTE: Information is not given for options that have not been configured.

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 Table 4.1 below.

Table 4.1 Status Screen—Page 1

Item	Value
Unit Mode	• Standby • Online (running) • Fault • Shutdown
Unit Cooling Duty	__kW
Cooling Mode	• Off • Fixed setpoint • DW override
Fixed Setpoint	___°C / ___°F
Dew Point Setpoint	___°C / ___ °F
Cooling Demand	__%
Valve Demand/Feedback	__%
Secondary Return Temperature T2	___°C / ___°F

Table 4.1 Status Screen—Page 1 (continued)

Item	Value
T2a	___°C / ___°F
T2b	___°C / ___°F
T2c	___°C / ___°F
Secondary Return Temperature T4	___°C / ___°F

Table 4.2 Status Screen—Page 2

Item	Value
Primary Supply Temperature T1	___°C / ___°F
Primary Return Temperature T5	___°C / ___°F
Primary Flow Rate	__l/m
Primary Duty	--kW
Ambient Temperature	___°C / ___°F
Ambient RH	__%
Dew Point	____°C / ___°F

Table 4.3 Status Screen—Page 3

Item	Value
Secondary Flow Rate	_ _ l/m
Secondary Return Pressure PS1	_ _ bar
Pump Inlet Pressure PS2	_ _ bar
Secondary Supply Pressure PS3	_ _ bar
Unit Differential Pressure (PS3-PS1)	_ _ bar
Filter Differential Pressure (PS1-PS2_	_ _ bar
Pump 1 Speed	_ _ %
Pump 2 Speed	_ _ %

Table 4.4 Status Screen—Page 4

Item	Value
Pump 1 Hours Run	__hrs
Pump 2 Hours Run	__hrs
Valve Runtime 0 to 25%	__hrs

Table 4.4 Status Screen—Page 4 (continued)

Item	Value
Valve Runtime 26 to 50%	__hrs
Valve Runtime 51 to 75%	__hrs
Valve Runtime 76 to 100%	__hrs
Elapsed Minutes	__minutes
Controller Firmware Version	2.1b5 (example)
Serial Number	CTCN_____ (example provided, variable by manufacturing location)
Controller Hardware Revision	5.xB
SD Card Detect	Present
SD Card File System Status	OK
SD Card Used Space	_.__%

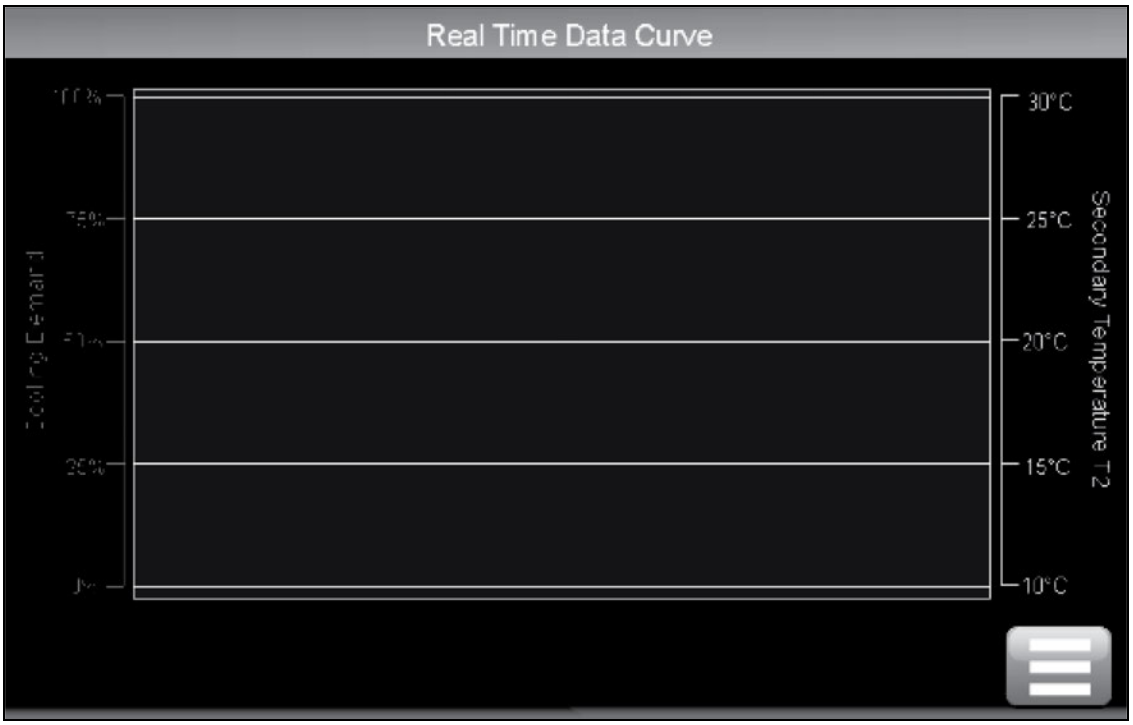
Table 4.5 Status Screen—Page 5

Item	Value
Pump 1 Comms Status	
Pump 1 Mode	
Pump 1 Speed	__rpm
Pump 1 Voltage	V
Pump 1 Current	A
Pump 1 Temperature	___°C / ___°F
Drive 1 Temperature	___°C / ___°F
Drive 1 FW Version	
Pump 2 Comms Status	
Pump 2 Mode	
Pump 2 Speed	__rpm
Pump 2 Voltage	V
Pump 2 Current	A
Pump 2 Temperature	___°C / ___°F
Drive 2 Temperature	___°C / ___°F
Drive 2 FW Version	

4.2.4 Data Curves Screen (Real Time Update)

The Data Curves screen displays a graphical representation of two pieces of variable data. A red trace for cooling (control valve) demand and a yellow trace for Secondary Supply Temperature T2, both of which will update in real time. The time span of display is 3 minutes.

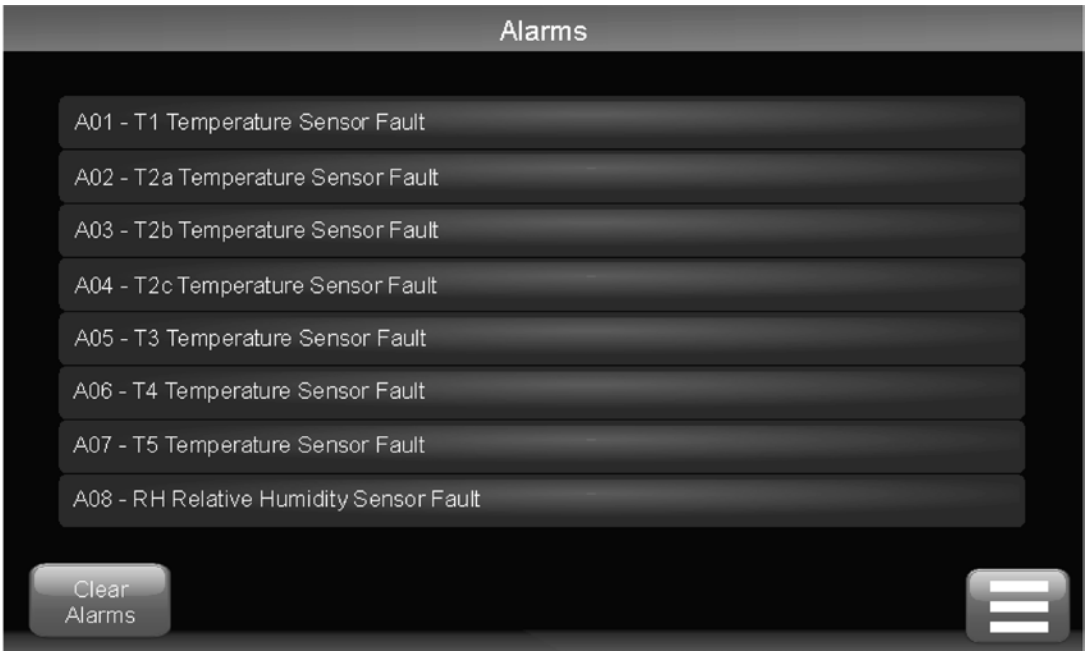
Figure 4.4 Control System Data Curves Screen



4.2.5 Alarm Screen

The Alarm screen can be used to view new or active alarms and to acknowledge these events. Refer to 45 for a full list of alarms and further information.

Figure 4.5 Control System Alarms Screen



4.2.6 Login Screen

The Login screen provides further access to information and the ability to adjust various parameters and settings when logged in at the service or engineer level.

- 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 xxxx (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.
- Code xxxx (+Engineer Level) enter after Engineer Level code for Factory Setup.

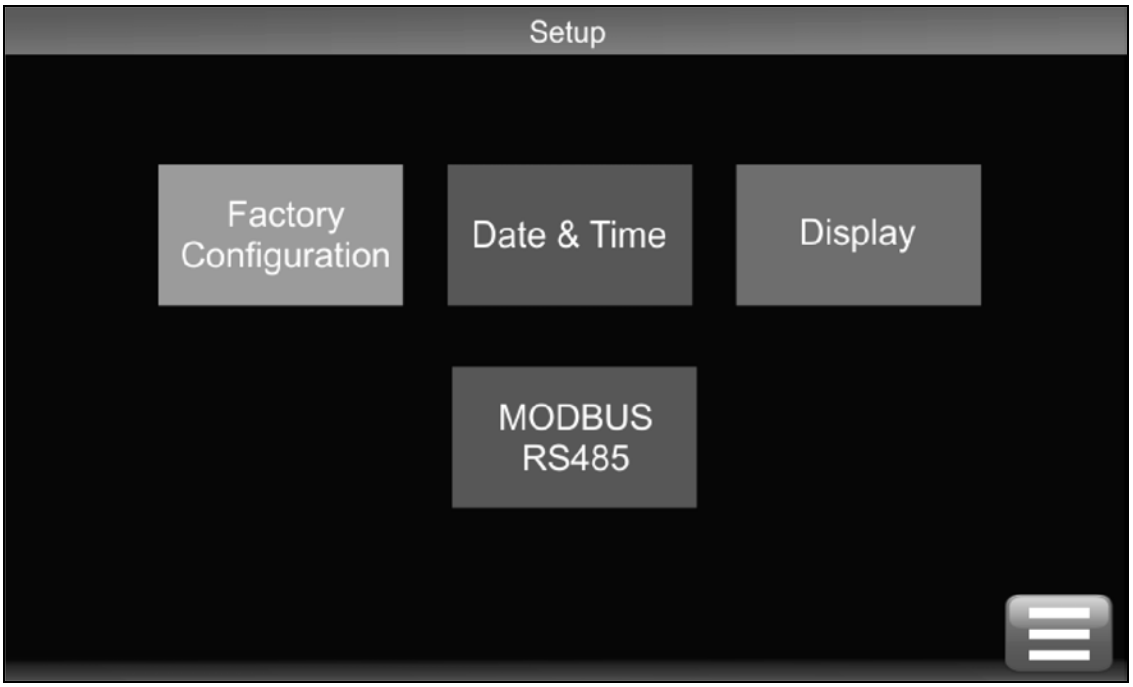
Figure 4.6 Control System Login Screen

Login codes are available on request from Vertiv. Entering an invalid code results in an Access Denied Message.

4.2.7 Setup Screen

The Setup screen is visible after logging in. Normally, you will not require to use the Setup screen because items modified here are set at the factory or during commissioning. There may be times you need to make adjustments following a site upgrade

Figure 4.7 Setup Screen



NOTE: Information under Factory Configuration can be viewed with the service and engineer access codes. A separate code from Vertiv is required to change items under Factory Configuration.

Table 4.6 Setup Screen—Factory Configuration

ID	Title	Description	Description
—	Serial Number	Select according to unit nameplate	CTCN01190 (example)

Table 4.7 Setup Screen—Date and Time (Page 1)

ID	Title	Description	Default	Range	Unit
	Date	Adjust date	—	dd/mm/yyyy	—
P021	Date Format	Select preferred format	yyyy/mm/dd	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	—	—
P023	NTP Synchronization	Network Time protocol synchronization	Disabled	Enabled Disabled	—

Table 4.7 Setup Screen—Date and Time (Page 1) (continued)

ID	Title	Description	Default	Range	Unit
P024	NTP Server IP Address	IP address of the NTP Server	0.0.0.0	—	—
P025	Time Zone Offset	Level Sensor response time, prior to alarm	00:00	-12 to 12	Hours
P026	NTP Sync Interval	Interval between NTP synchronizations	23	1 to 168	Hours

Table 4.8 Setup Screen—Date and Time (Page 2)

ID	Title	Description	Default	Range	Unit
P027	Logging Verbose Level	—	2	0—None 1—Failure 2—Failure and change 3—All	—

Table 4.9 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	Minutes
P031	Backing Period	Elapsed time before screen dims	10	0 to 60	Minutes
P032	Temperature Units	Select required temperature display units	—	—	°C
P033	Pressure Units	Select required pressure display units	—	—	bar
P034	Flow Rate Units	Select required fow rate display units	—	—	l/m

Table 4.10 Setup Screen—IP Connectivity

ID	Title	Description	Default	Range	Unit
P040	Interface A Enabled	Set to active or not	Enabled	Enabled Disabled	—
P041	Interface B Enabled	Set to active or not	Enabled	Enabled Disabled	—

Table 4.11 Setup Screen—IP Connectivity (Interface A)

ID	Title	Description	Default	Range	Unit
P050	MAC Address	View MAC address	_ _:_ _:_ _:_ _:_ _:_ _	Read only	—
P051	DHCP	Select as required	Disabled	Enabled Disabled	—
P052	IP Address	View IP address	_ _ _._ _ _._ _ _._ _ _	—	—
P053	Subnet Mask	Set subnet Mask	255.255.255.0	Configurable	—
P054	Default Gateway	Set gateway address	0.0.0.0	Configurable	—
P055	Preferred DNS Server	Set DNS address	0.0.0.0	Configurable	—
P056	Alternative DNS Server	Set DNS address	0.0.0.0	Configurable	—

Table 4.12 Setup Screen—IP Connectivity (Interface B) Submenu

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

Table 4.13 Setup Screen —Modbus and BACnet

ID	Title	Description	Default	Range	Unit
P073	Serial Protocol	Set required address	MODBUS RTU	—	—
P071	Baud Rate	Set required baud rate	9600	9600 to 38400	—

Table 4.14 Setup Screen—Modbus and BACnet (MODBUS)

ID	Title	Description	Default	Range	Unit
P070	MODBUS RTU Address	Set required address	1	1 to 243	—
P072	MODBUS Write Access	Write access to coils and holding registers	Yes	No Yes	—

Table 4.15 Setup Screen—Modbus and BACnet (BACnet)

ID	Title	Description	Default	Range	Unit
P074	Protocol	—	None	—	—
P075	Instance Number	—	600	0 to 4194302	—
P076	MSTP MAC Address	—	1	1 to 127	—
P077	MSTP Max Masters	—	127	1 to 127	—
P078	MSTP Info Frames	—	1	1 to 100	—
P079	Units	—	—	—	SI

Table 4.16 Setup Screen—Group Control

ID	Title	Description	Default	Range	Unit
P081	CDU Address	Unit address	1	1 to 4	—
P082	Number of CDUs in Group	Number of CDUs in group	1	1 to 4	—
P083	Number of Run CDUs	Number of run CDUs	1	1 to 4	—
P085	Rotation Frequency	Unit rotation frequency	Weekly	Weekly Monthly Never	—
P086	Rotation Day of Week	Rotation day	Monday	Sunday to Saturday	—
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	2500	50 to 10000	msecs.
P090	Unit Transmit Period	Set required unit transmit period	200	20 to 1000	msecs.

4.2.8 Configuration Screen

NOTE: This screen is only available once logged in.

The Configuration screen is used to set specific parameters and control functions.

Figure 4.8 Control System Configuration Screen

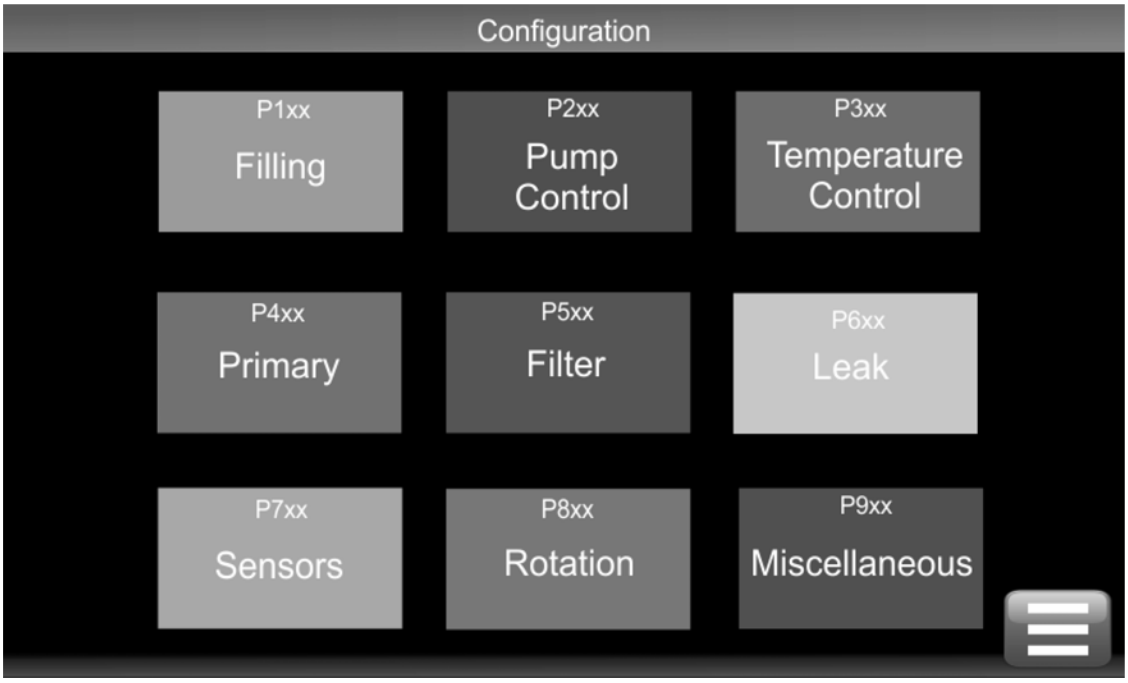


Table 4.17 Configuration Screen - Filling

ID	Title	Description	Default	Range	Unit
P101	Fill Pressure	Start threshold for fill pump	0.8	0.3 to 1.0	Bar
P102	Fill Hysteresis	Stop hysteresis for fill pump	0.2	0.1 to 0.5	Bar
P103	Fill Pump Run Period	Time for level sensor to make, or fill pressure to be satisfied, prior to alarm (when unit is online)	1	1 to 15	Minutes
P104	Level Sensor Delay	Level sensor response time, prior to alarm	1	1 to 6	Seconds
P105	Fill Start Delay Period	Delay prior to pump start after initiate signal	10	1 to 60	Seconds
P106	Fill Warning Delay Period	Delay prior to check make up alarm activated	5	0 to 60	Seconds
P107	Manual Fill Control	Select manual or automatic fill pump control	0	0—Automatic 1—Manual	—

Table 4.18 Configuration Screen—Pump Control (Page 1)

ID	Title	Description	Default	Range	Unit
P201	Control Type	Select pump speed controlled by flow or DP	Flow	Flow or DP	—
P202	Flow Setpoint	Set the required secondary flow rate	100	5 to 130	l/m
P203	Differential Pressure Setpoint	Set the required secondary differential pressure (DP)	1.0	0.1 to 4.0	Bar
P204	Low Flow %	Low flow alarm threshold (% of flow setpoint)	90	50 to 95	%
P205	Low DP %	Low DP alarm hysteresis	90	50 to 95	%
P206	Low Flow/DP Delay	Time delay prior to low flow/DP alarm	100	1 to 300	Seconds
P207	Minimum Pump Speed	Set minimum pump speed (10% per firmware)	10	10 to 70	%
P208	Maximum Pump Speed	Set maximum pump running speed	98	25 to 100	%

Table 4.19 Configuration Screen—Pump Control (Page 2)

ID	Title	Description	Default	Range	Unit
P209	Over-pressure Setpoint	Maximum system pressure, prior to alarm (4.0 bar/58 psi PRV)	4	2.0 to 7.0	Bar
P210	Over-pressure Action	Alarm only or shutdown and alarm	Alarm	Alarm or Alarm + shutdown	—
P211*	Startup Speed	Initial pump start fixed speed (0 = Auto)	0	0 to 100	%
P212*	Startup Period	Initial start speed hold period, prior control loop taking over	0	0 to 100	Seconds
P213*	Loop Refresh Period	Scan period for pump speed control loop	10	1 to 120	Seconds
P214*	Maximum Control Pressure	Maximum pump speed control loop pressure	4.0	1.0 to 8.0	Bar
P215*	Cooling Fan Run On Period	The period of time the fan will run on for after the unit is switched to standby	1	0 to 60	Minutes
* Parameter IDs are only accessible with the engineer login code.					

Table 4.20 Configuration Screen—Temperature Control (Page 1)

ID	Title	Description	Default	Range	Unit
P301	Temperature Setpoint	Set required secondary temperature setpoint	45.0	10.0 to 55.0	°C
P302	Control Mode	Select from Fixed Setpoint or fixed setpoint with dewpoint override	Fixed SP	—	—
P303	Dewpoint Offset	Minimum offset of setpoint from dewpoint temperature.	3.0	1.0 to 5.0	°C
P304	Secondary Low Temp Differential	Low temperature alarm offset below setpoint	2.0	1.0 to 10.0	°C
P305	Secondary High Temp Differential	High temperature alarm offset above setpoint	2.0	1.0 to 10.0	°C

Table 4.20 Configuration Screen—Temperature Control (Page 1) (continued)

ID	Title	Description	Default	Range	Unit
P306	Secondary Temp Reset Hysteresis	Low/High temperature alarm reset point	1.0	0.5 to 5.0	°C
P307	Secondary High Temp Setpoint DW	High temperature alarm offset above setpoint when dewpoint or ambient tracking	20.0	15.0 to 25.0	°C
P309*	PID - Control Period	Scan period for control valve positioning	1	1 to 30	Seconds
* Parameter IDs are only accessible with the engineer login code.					

Table 4.21 Configuration Screen—Temperature Control (Page 2)

ID	Title	Description	Default	Range	Unit
P310*	PID - Proportional Band	Proportional band	12.0	1.0 to 25.0	°C
P311*	PID - Integral Reset	Integral reset time	18	0 to 999	Seconds
P312*	PID - Derivative	Derivative reset time	5	0 to 999	Seconds
P313	Demand/Actual Error	Control valve demand to feedback error for alarm	10	0 to 50	%
P314	Valve Check Period	Scan period for control valve position monitoring	15	1 to 120	Minutes
P315*	Valve Runtime	Control valve motor run time for control loop	40	10 to 180	Seconds
P316	Valve Minimum Position	Set the minimum valve position for control	0	0 to 80	%
P317	Valve Maximum Position	Set the maximum valve position for control	100	40 to 100	%
* Parameter IDs are only accessible with the engineer login code.					

Table 4.22 Configuration—Primary

ID	Title	Description	Default	Range	Unit
P401	Primary Flow Delay	Time delay prior to low flow alarm	5	1 to 120	Seconds
P402	Primary Low Temperature Setpoint	Low temp alarm threshold	4	2 to 40	°C
P403	Primary High Temperature Setpoint	High temp alarm threshold	30	6 to 60	°C
P404	Primary Temperature Reset Hysteresis	Low/High alarm reset from threshold	1	0.5 to 5.0	°C

Table 4.23 Configuration—Filter

ID	Title	Description	Default	Range	Unit
P504	Secondary Filter Dirty Setpoint	Differential pressure alarm threshold for filter dirty	0.2	0.2 to 1.0	Bar
P505	Secondary Filter Dirty Hysteresis	Alarm reset from threshold	0.1	0.1 to 0.5	Bar
P506	Secondary Filter Dirty Delay Period	Time delay prior to alarm	60	5 to 7200	Seconds

Table 4.24 Configuration—Leak Detection

ID	Title	Description	Default	Range	Unit
P601	Leak Detection Operation	Alarm only, or shutdown and alarm	Alarm	Alarm or Alarm+S/D	—
P602	Internal Threshold	Set sensitivity of leak tape	50	1 to 65	kohms
P603	Internal Delay Period	Time delay prior to alarm	10	5 to 60	Seconds
P604	Leak Detection Operation - Primary External	Alarm only, or shutdown and alarm	Alarm	Alarm or Alarm+S/D	—
P605	External Threshold	Polarity of digital signal from leak device	50	1 to 65	kohms
P606	External Delay Period	Alarm only, or shutdown and alarm	10	5 to 60	Seconds

Table 4.25 Configuration—Sensors

ID	Title	Description	Default	Range	Unit
P701	Secondary T2 Temperature Differential	Alarm threshold T2a/b/c temperature differential	1	0.1 to 10	°C
P702	Secondary T2 Period	Time delay before T2a/b/c differential alarm	1	0 to 120	Seconds
P703	PS1 Scaling	Set measurement range.	2	0—0 to 30 bar 1—0 to 15 bar 2— 1 to 8 bar 3—0 to 6.89 bar 4—0.69 to 6.89 bar	—
P704	PS2 Scaling	Set measurement range.	2	0—0 to 30 bar 1—0 to 15 bar 2— 1 to 8 bar 3—0 to 6.89 bar 4—0.69 to 6.89 bar	—
P705	PS3 Scaling	Set measurement range.	2	0—0 to 30 bar 1—0 to 15 bar 2— 1 to 8 bar 3—0 to 6.89 bar 4—0.69 to 6.89 bar	—

Table 4.26 Configuration—Rotation

ID	Title	Description	Default	Range	Unit
P801	Frequency	Unit rotation frequency	Weekly	Water or Water-Glycol	—
P802	Day of the week	Rotation day	Monday	Sunday to Saturday	—
P803	Time of Day - Hours	Rotation hours	8	0 to 23	Hours
P804	Time of Day - Minutes	Rotation minutes	40	0 to 59	Minutes

Table 4.27 Configuration—Miscellaneous (Page 1)

ID	Title	Description	Default	Range	Unit
P901	Manual Override Period	Time delay before controls revert to Auto mode	15	0 to 120	Minutes
P902	Alarm Delay	Alarm suppression on startup	20	1 to 120	Minutes
P903	Post Power Failure Options	Action to be taken following a power failure once power is restored	Standby	Run, Standby	—
P904	Room RH and T Sensor	Fitted or not	No	No or Yes	—
P905	Data Logging Interval	time interval between loggings	0	0—60 Seconds 1—30 Seconds 2—10 Seconds 3—5 Seconds	
P906	Temperature Alarm Delay	Delay set to Alarms	10	0 to 120	Seconds
P907	Alarm Output Scheme	Alarm Outputs	0	0 to 1	%
P908	Display lockout following failed log ins	Displaying of lockouts in case of failed logins	No	No or Yes	

Table 4.28 Configuration—Miscellaneous (Page 1)

ID	Title	Description	Default	Range	Unit
P910	Secondary Loop Coolant Type	Coolant type in secondary loop	Water	Water or Water-Glycol	—
P911	Primary Loop Coolant Type	Coolant type in primary loop	Water	Water or Water-Glycol	—

4.2.9 Service Screen

NOTE: This screen is only available once logged in.

The Service screen (accessible only with service and engineer login codes) can be used to set some parameters and to assist in commissioning.

Figure 4.9 Control System Service Screen

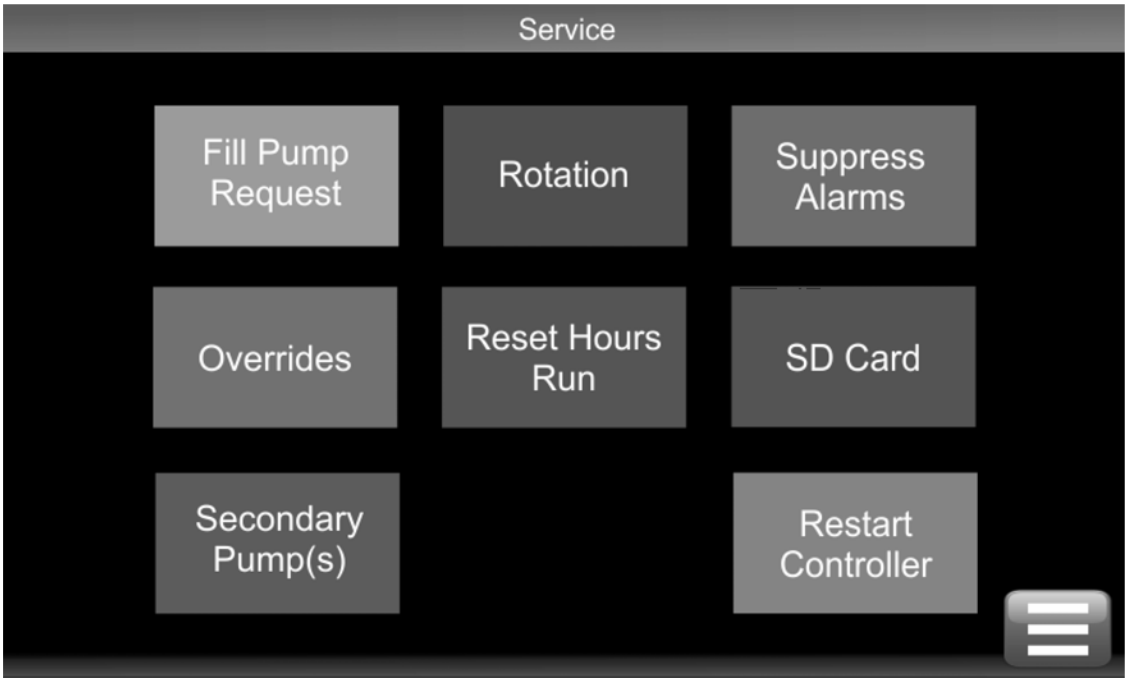


Table 4.29 Service—Pump Request

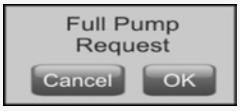
Screen Prompt	Explanation
	This fill function is used at commissioning only and will allow the fill pump to run without any time limit. Fill pump will still switch off automatically when unit reaches required static pressure.

Table 4.30 Service—Rotation

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

Table 4.31 Service—Suppress Alarms

Screen Prompt	Explanation
	Resets the alarm delay timer (normally only activated during startup) to stop nuisance alarms breaking through during manual operation.

Table 4.32 Service—Overrides

ID	Title	Description	Default	Range	Unit
S101	Pump 1 Speed	Set pump 1 speed (0%—no override)	0	1 to 100	%
S102	Pump 1 Speed	Set pump 2 speed (0%—no override)	0	1 to 100	%
S103	Cooling Valve	Set control valve position	0	1 to 100	%
S104	Fill Pump P3	Switch fill pump on	Auto (1)	Auto (1) Man (0)	—
S105	Alarm	Switch alarm output on or off	Auto (1)	Auto (1) Man (0)	—

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 for troubleshooting purpose.

Table 4.33 Service—Reset Hours Run

Screen Prompt	Explanation
	Resets the pump and valve run hours to zero. • S201—Pump 1 Run Hours • S202—Pump 2 Run Hours

Table 4.34 Service—SD Card

ID	Title	Description	Default	Range	Unit
—	File System Status	Shows the status of the system	OK	—	—
—	Card Detect	Shows the cards presence	Present	—	—
—	Used Space	Shows the amount of space used by SD Card	0.59	0 to 100	%

Table 4.35 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 Service Out of Service	—
S402	Pump 1 Speed	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 4.36 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	1 to 100	%
S303	Pump 2 Speed	Set pump 1 speed	0	1 to 100	%
S304	Cooling Valve	Switch cooling valve on or off	Off	On Off	—
S305	Fill Pump P3	Switch fill pump on or off	Off	On Off	—
S306	Alarm	Switch alarm output on or off	Off	On Off	—
S307	Cooling Fan	Switch cooling fan on or off	Off	On Off	—

4.2.10 Diagnostic Screen

NOTE: This screen is only available after you are logged in.

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 Control System Diagnostic Screen

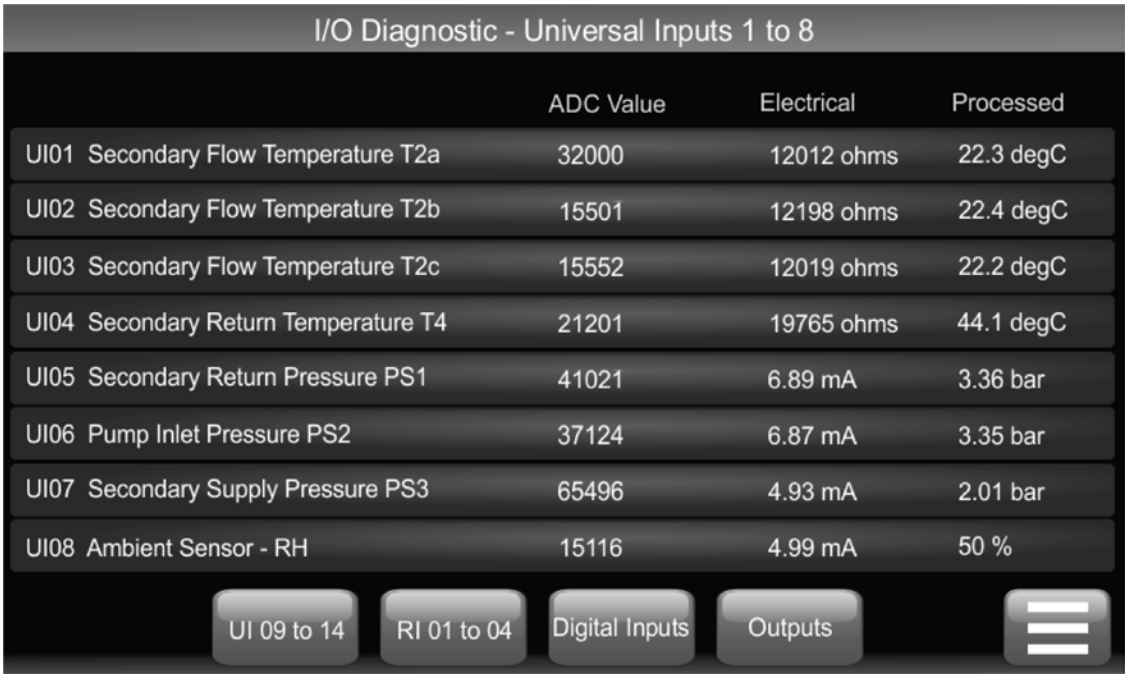


Table 4.37 I/O Diagnostics—Universal Inputs 1 to 8

ID	Description	ADC Value	Electrical		Processed	
UI01	Secondary Flow Temperature T2a	0	0	Ohms	0.00	°C
UI02	Secondary Flow Temperature T2b	0	0	Ohms	0.00	°C
UI03	Secondary Flow Temperature T2c	0	0	Ohms	0.00	°C
UI04	Secondary Return Temperature T4	0	0	Ohms	0.00	°C
UI05	Secondary Return Pressure PS1	0	0.00	mA	0.00	bar
UI06	Pump Inlet Pressure PS2	0	0.00	mA	0.00	bar
UI07	Secondary Supply Pressure PS3	0	0.00	mA	0.00	bar
UI08	Room Sensor - RH	0	0.00	mA	0.00	%

Table 4.38 I/O Diagnostics—Universal Inputs 9 to 14

ID	Description	ADC Value	Electrical		Processed	
UI09	Ambient Sensor - Temperature T3	0	0.00	mA	0.00	°C
UI10	Primary Flow Temperature T1	0	0.00	mA	0.00	°C
UI11	Primary Flow Rate	0	0.00	mA	0	l/m
UI12	Secondary Flow Rate	0	0.00	mA	0	l/m
UI13	Control Valve Feedback	0	0.00	V	0.00	%
UI14	Primary Return Temperature T5	0	0	Ohms	0.00	°C

Table 4.39 I/O Diagnostics—Resistive Inputs 1 to 4

ID	Description	ADC Value	Electrical		Processed	
RI01	-	0	0	ohms	—	—
RI02	Leak Tape - External	0	0	ohms	0	°C
RI03	Leak Tape - Internal (field supplied)	0	0	ohms	2	°C
RI04	-	0	0	ohms	0	°C

Table 4.40 I/O Diagnostics—Digital Inputs 1 to 6

ID	Description	State
DI01	Optical Level Sensor	1
DI02	—	0
DI03	—	0
DI04	—	0
DI05	—	0
DI06	—	0

Table 4.41 I/O Diagnostics - Digital and Analogue Outputs

ID	Description	Processed
DO01	Fill Pump	0
DO05	Pump Cooling Fan	1
DO03	Alarm Output	0
AO04	Cooling Valve	100%

4.2.11 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 4.11 Control System 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 13), then press the *green ON* button, see **Figure 4.12** below.

Figure 4.12 Switch CDU

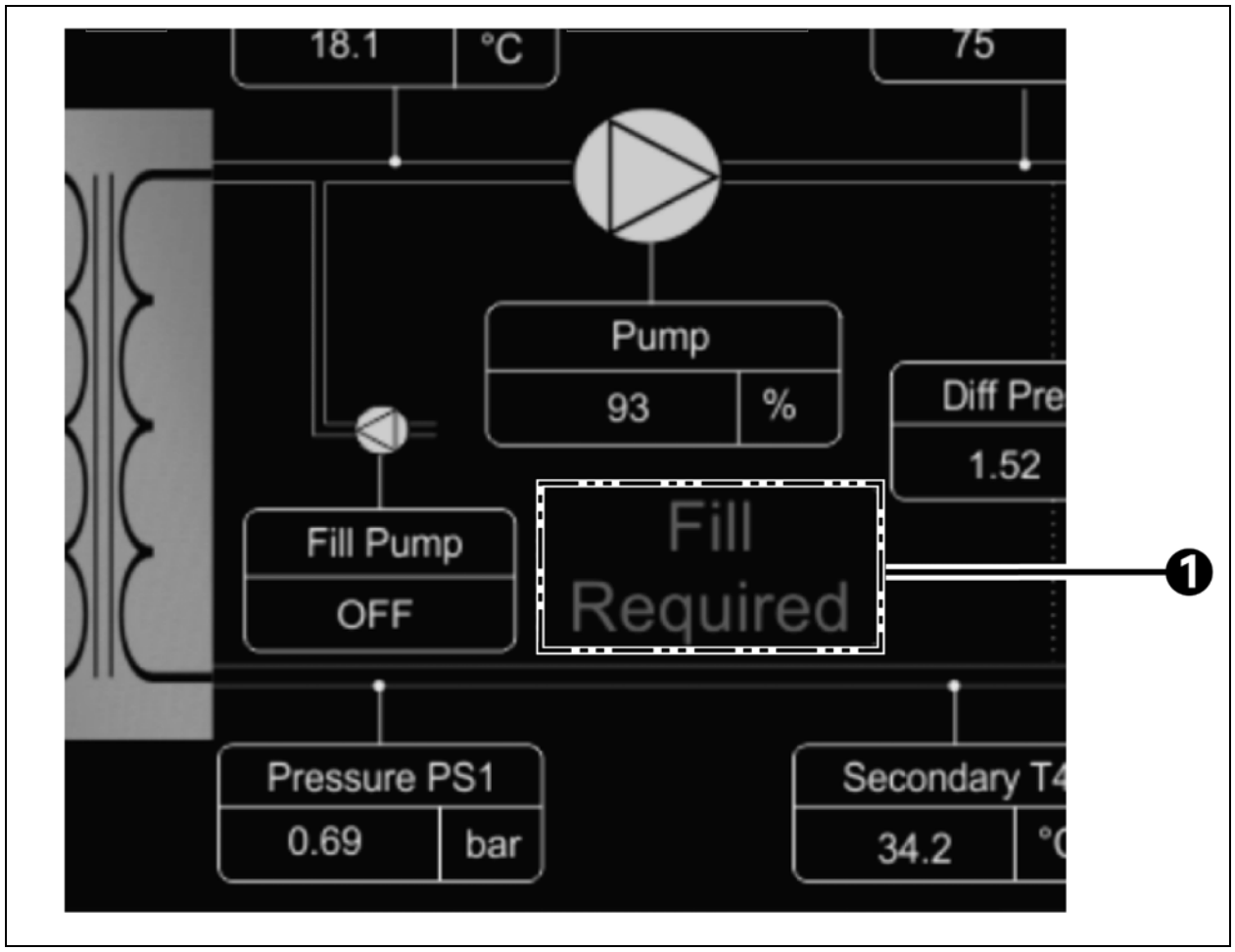
4.3.1 Secondary Circuit Operation

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 pump starts to increase in speed, arrows are displayed on the Home screen for primary and secondary 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 is not made or insufficient water is signified, then the pump will not be permitted to run and a Fill Pump Required request will be raised. See Figure 4.13 below.

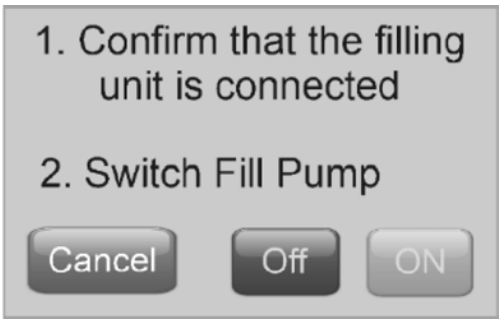
Figure 4.13 Fill Required Request



Item	Description
1	Fill Pump Required Request

- Press the fill pump required request icon, connect the filling unit (if not already connected) and then press *green ON* button.

Figure 4.14 Pump Request Button



- If the level switch has not activated within 1 minute of the fill pump operation, the fill pump will automatically stop, and an A16 - Insufficient fluid Level alarm will be triggered. This is a latched alarm and the system will not restart the unit until the event has been manually cleared.

The system pressure at the Vertiv™ CoolChip CDU 100 inlet (PS1) is continuously monitored to ensure that the system is always pressurized. See Status Screen—Page 3 on page 16.

Static Pressure

- Once the unit is running, a low system pressure below the default 0.8 bar (12 psi) at PS1 will not stop the pump from running, but will initialize a fill pump request (after a default 10 second delay) to raise the PS1 pressure to a default of 1.0 bar (15 psi), at which point the fill pump will stop. If fill pump has been running for more than 5 seconds, an A30 - Check fluid Makeup Level alarm will also be generated. If the fill pump runs for more than 1 minute (default) and PS1 pressure has still not reached 1.0 bar (15 psi), then the fill pump will stop and an A15 - fluid Makeup Empty alarm will be triggered. This is a latched alarm and will need to be manually cleared, but will not stop the unit from running.
- If inlet pressure drops to 0.2 bar (3 psi) (set, non-adjustable) below fill pump activation threshold of 0.6 bar (9 psi), if default value, for more than 1 minute (set, non-adjustable), an A31 - System Low Pressure event will be triggered.

on the next page, 4.3.1 on the previous page, and Figure 4.17 on page 40 show the unit pressure/level monitoring and fill pump control during initial startup of the unit after commissioning (from a unit offline condition) and during normal running (unit online).

Figure 4.15 Pressure and Level Flow Chart (Initial Startup)

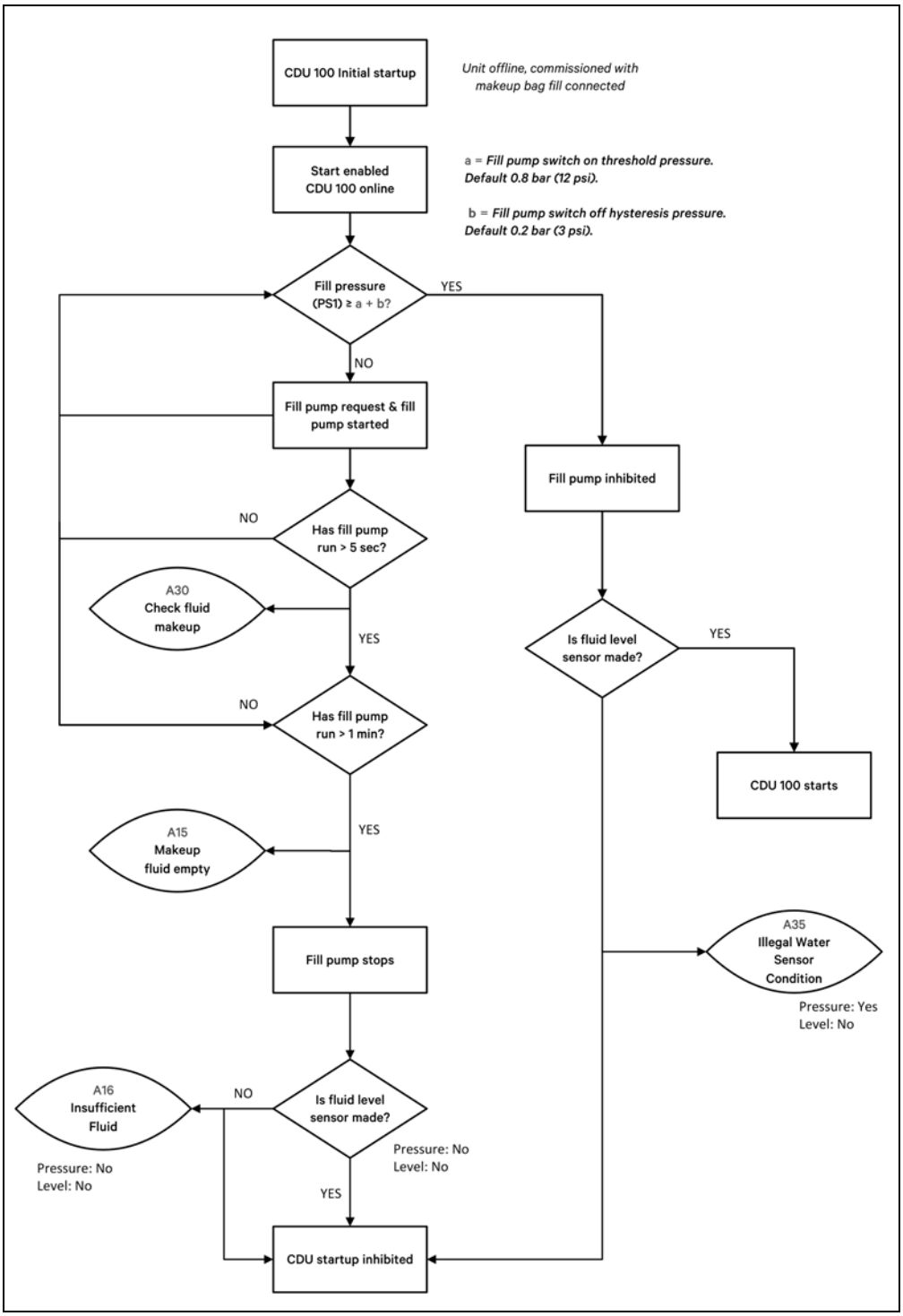


Figure 4.16 Fill Pressure and Level Flow Charge (When Running)

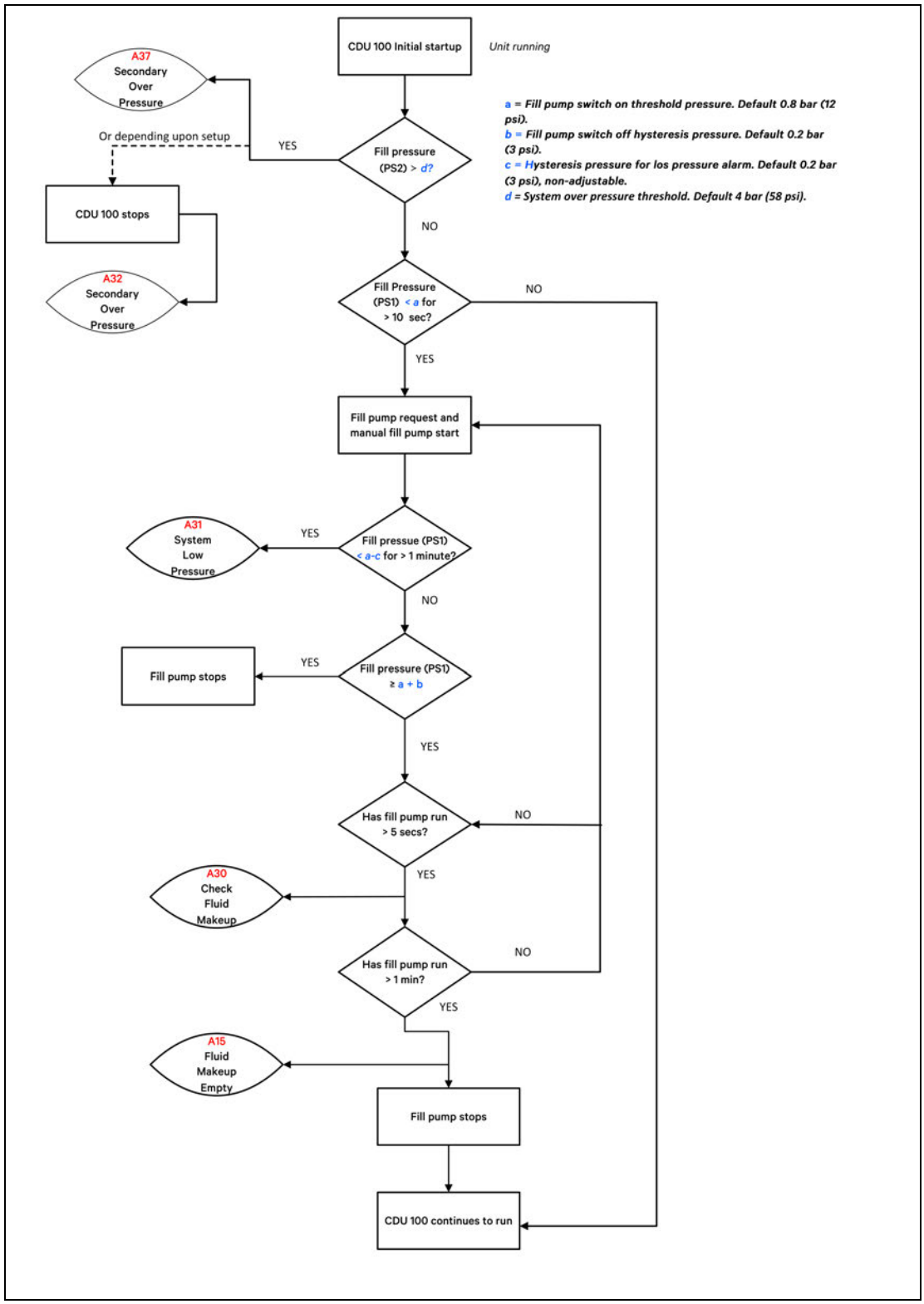
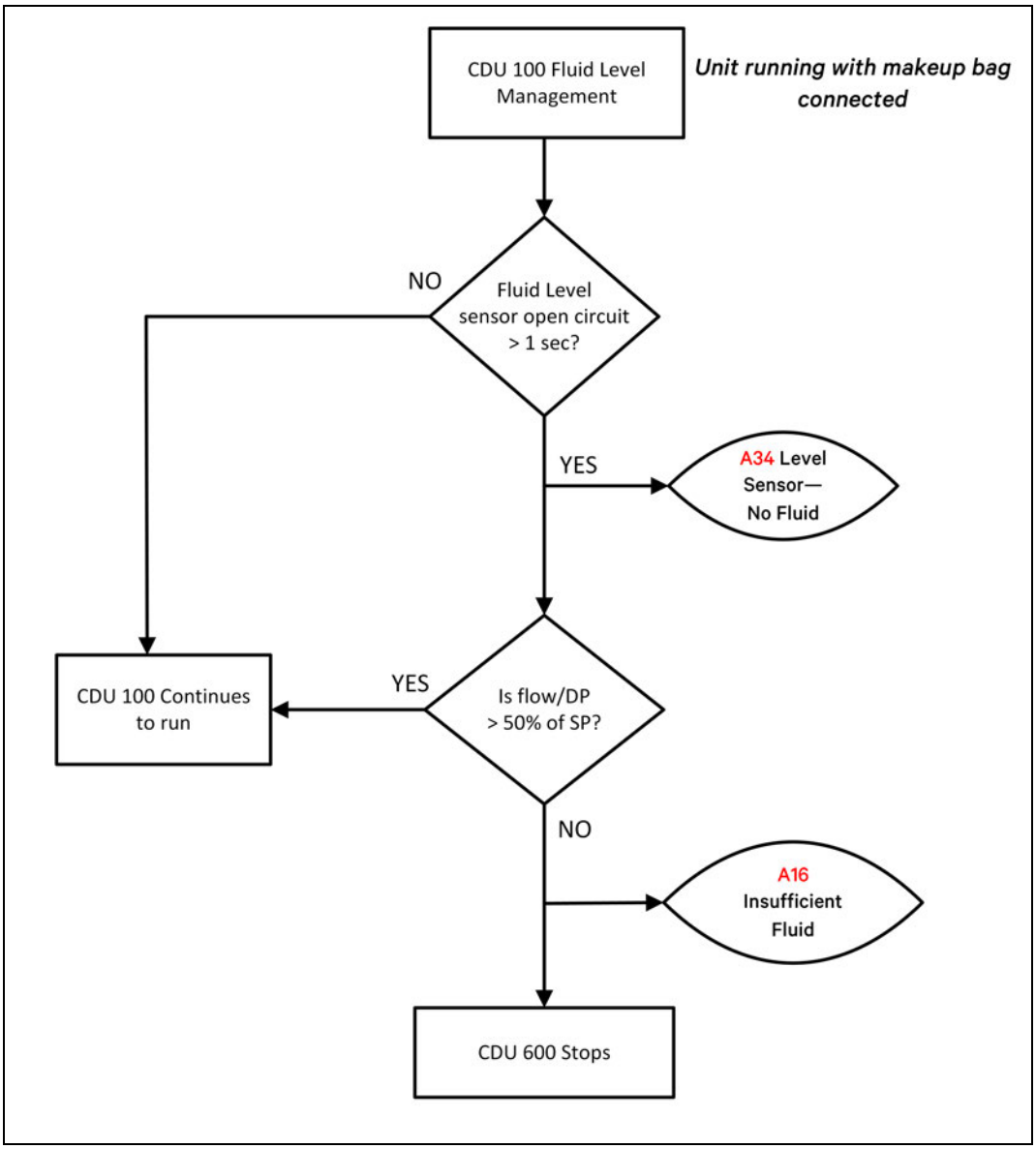


Figure 4.17 Water Level Management (When Running)



Pump flow/pressure performance (pump speed) can be controlled through either a flow or differential pressure control loop depending on configuration (see Table 4.18 on page 26).

DP Control

Monitors secondary differential pressure with sensors on the supply and return connections of CoolChip CDU 100. During startup, 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 fails to reach 90% (default) of the DP demand in the default time period of 100 seconds, it is assumed there is a pump flow/pressure fault .and an A17 - Pump Fault alarm will be generated.
- The unit then continues to operate pump until faults are investigated and alarms are manually cleared.

The secondary water temperature is monitored at the central reservoir tank position. Three temperature sensors are positioned here to give extended component redundancy (T2a, T2b and T2c). The controller takes an average between all 3 readings as its input value.

- If the difference between the sensors exceeds a default 1.0 °C (2 °F), then an A40 (A41 or A42) - Secondary Temp T2a (T2b or T2c) Diff Out of Limits alarm will be raised (after a default 30 second delay) and the controller will only read and average the two remaining healthy sensors.
- If any of the T2 temp. sensors go open circuit, then an A02 (A03 or A04) - T2a (T2b or T2c) Secondary Temperature Sensor Fault alarm will be raised (no time delay) and the controller will only read and average the two remaining healthy sensors.

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

Fixed SP Control Mode

The secondary temperature should correspond to the desired setpoint. The default fixed setpoint is 18 °C (65 °F) and is used by the control loop to regulate the primary water control valve position to achieve and maintain the setpoint. The control valve position can be monitored on the Home screen or page 1 of the Status screen (Cooling Demand/Feedback).

High and low temperature alarms are set at a default value of 2 °C (4 °F) either side of setpoint (floating with setpoint) when either Fixed SP or Fixed SP + Dew Point Offset control mode is selected from Configuration - Temperature Control screen, with a default hysteresis of 1 °C (2 °F).

NOTE: Dew Point Offset control will require the installation of an optional ambient temperature/humidity sensor.

- If the secondary temperature deviates by more than 2 °C (4 °F) below setpoint for 2 minutes or more, an A24 - Secondary Fluid Low Temp alarm is generated. This alarm remains present until the temperature rises above the hysteresis value.
- If the secondary temperature deviates by more than 2 °C (4 °F) (default) above setpoint for 2 minutes or more, an A25 - Secondary Fluid High Temp alarm is generated. This alarm remains present until the temperature falls below the hysteresis value.
- 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.

Fixed SP + Dew Point Offset Control Mode

In Fixed SP + Dew Point Offset control mode, the setpoint can be overridden by a Dew Point condition, where there is a risk of condensation occurring at the IT equipment. The room temperature and relative humidity are constantly monitored and used to calculate the anticipated dew point adjacent to the CDU (or wherever the room tempearture/humidity senor has been located).

- Dew Point Offset: When activated, this is displayed on the Home screen under the Unit Mode heading.

  With this cooling mode, the CDU operates as per the fixed setpoint mode unless the dewpoint temperature rises to within 3 °C (6 °F) of this setpoint. When this happens, dewpoint override will be activated and the controller will re-adjust the fixed setpoint to keep it at least 3 °C (6 °F) above the dewpoint.

Filter Clog

Pressure sensors PS1 and PS2 are used to monitor the differential pressure across the secondary circuit filter and give pre-warning of potential filter clogging.

- If the differential pressure exceeds 0.2 bar (3 psi) for Filter 1, then an A38 - Secondary Filter Dirty alarm is generated.

Secondary flow rate is monitored with a calorimetric flow meter at the secondary outlet from the CDU. The flow can be read on the Home screen or on page 3 of the Status screen.

NOTICE

Flows below 4 l/m (1 gpm) are outside the range of the flow sensor and will not be displayed.

Primary Circuit Operation

The primary water temperature (T1) is monitored at the inlet to the Vertiv™ CoolChip CDU 100 cabinet. The nominal cooling performance of the CDU has been calculated on a chilled water temperature between 4 and 10 °C (40 and 50 °F).

- If the primary temperature falls below default 4 °C (40 °F), an A22 - Primary Water Low Temp alarm is generated. This alarm remains present until the temperature rises above the default 1 °C (2 °F) reset hysteresis.
- If the primary temperature rises above default 11 °C (52 °F), an A23 - Primary Water High Temp alarm is generated. This alarm remains present until the temperature falls below the default 1 °C (2 °F) reset hysteresis.
- The high and low temperature alarms are ignored for a default 20 minute period on startup to allow the system time to settle without generating nuisance alarms.

The temperature PID control loop is operational when the Start/Stop button is pressed and the pump has ramped up to speed. If the secondary circuit temperature starts to rise above the setpoint, then the control valve starts to open to allow more primary cooling water through the heat exchanger. The control valve will modulate from 0% (full bypass) to 100% (full flow through heat exchanger). The valve position can be monitored on the Home screen or Status screen, page 1. The demand signal to the valve is compared to a position feedback signal every 15 minutes (default) to check the healthy operation of the valve.

- If the feedback signal is more than 10% (default) different than the demand signal (allowing for the drive time of the actuator to respond to load changes), then an A20 - Valve Fault event will be generated. The valve will continue to operate until fault is rectified.

The control valve is a drive open/spring return device. In the event the positioning signal is lost, it returns to a full bypass position (no cooling).

Primary flow rate is monitored with a calorimetric flow meter at the primary inlet to the CDU. The flow can be read on the Home screen or on page 2 of the Status screen.

NOTE: The flow meter only reads the total primary flow through the Vertiv™ CoolChip CDU 100 unit. It does not monitor the flow rate through the heat exchanger.

- A A21 - Primary Water Low Flow alarm is generated if: The A25 - Secondary Water High Temperature alarm is active, there is not a A23 - Primary Water High Temperature alarm present and the demand to the operational control valve is at 100%.
- A A33 - Primary No Flow alarm can also be generated if: The A25 - Secondary Water High Temperature event is active, there is also a A23 - Primary Water High Temperature alarm present and the demand to the operational control valve is at 100%.

NOTE: Flows below 2 l/m (0.5 gpm) are outside the range of the flow sensor and are not displayed.

4.4 Temperature Control Loop Adjustment

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

NOTE: The Ziegler-Nichols method requires system to be operating under typical load conditions and initially causes the control loop to temporarily become unstable with wide temperature swing oscillations. It is important to ensure that this does not cause any damage to the equipment being cooled. Login at engineering level will be required to make the necessary changes.

1. Set the Integral Reset Time and Derivative Reset Time (Configuration-Temperature Control screens P311 and P312) to 0 seconds.
2. Increase the Proportional Band (Configuration - Temperature Control screen P308) to a higher value from the default of 12 °C (54 °F) to 20 °C (68 °F).
3. Check that the secondary supply temperature (T2) stabilizes.

NOTE: Temperature stabilizes at a higher temperature than the current setpoint. This offset is 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 1 °C increments until the supply temperature (T2) starts to oscillate at a constant rate.
5. Measure the frequency of the oscillation time (peak to peak) in seconds (t).

4.4.1 PI Control

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

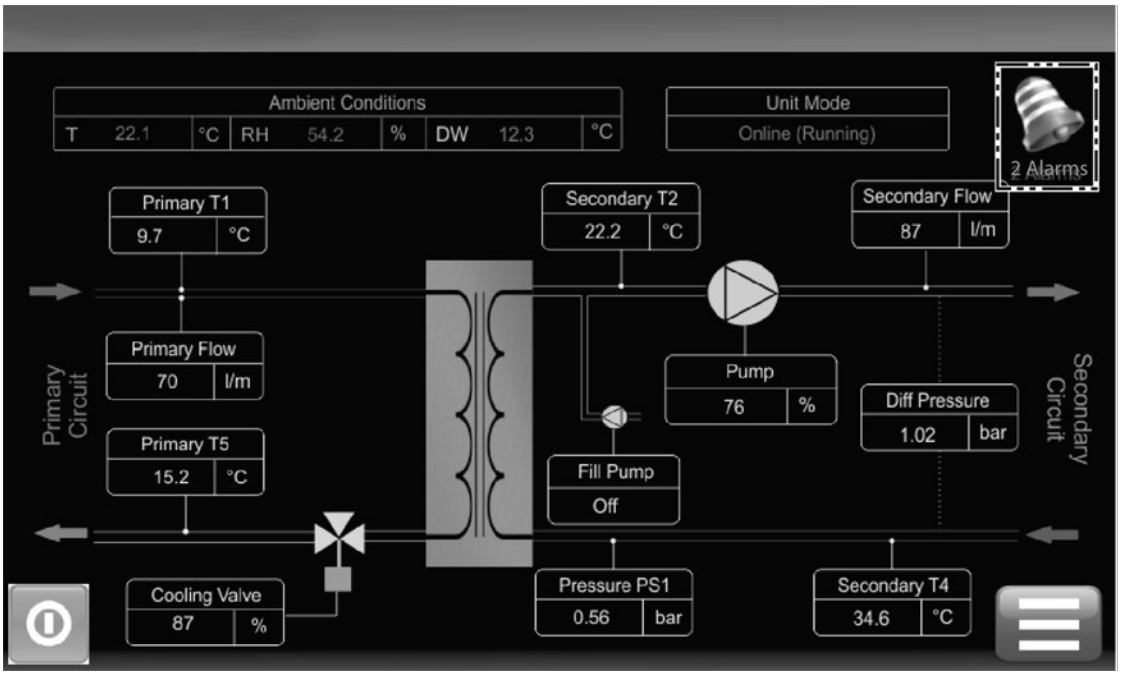
1. Set the Proportional Band to 2.2 x the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.83 x the oscillation time (t).
3. Leave the Derivative Reset Time at 0.

4.4.2 PID Control

For systems that see high or sudden changing heat loads, PID control is the preferred option.

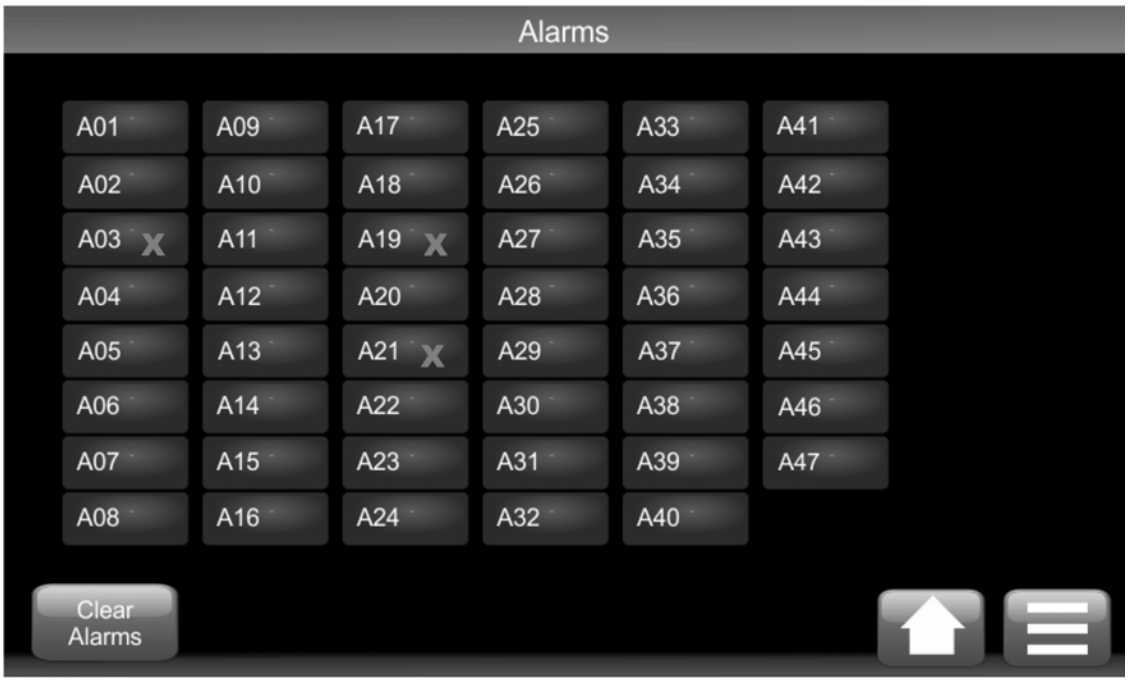
1. Set the Proportional Band to 1.67 x the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.5 x the oscillation time (t).
3. Set the Derivative Reset Time to 0.125 x the oscillation time (t).

4.5 Alarm Management



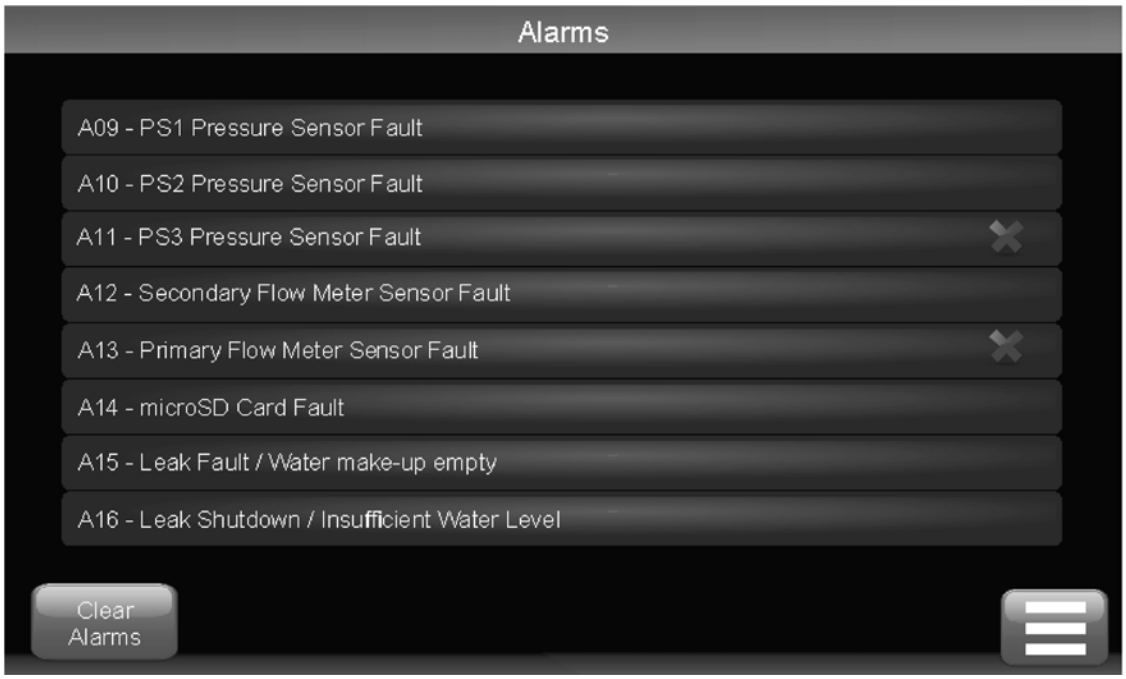
When an alarm occurs, a flashing alarm bell icon immediately break through at the top right corner of the Home screen, with the number of active alarms stated below.

Figure 4.18 Control Screen Alarm Indication



The alarm descriptions may be accessed by selecting the vertical columns where the alarms appear (as shown in Figure 4.19 on the facing page).

Figure 4.19 Control Screen Alarm identification



Access the alarm descriptions by selecting the columns where the alarms appear.

Some alarms 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 needs 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** above.

The self clearing and latching alarms are identified in Troubleshooting Alarms below.

All alarms are automatically logged in an Alarm Log file stored on the controller SD card with the time and date of generation.

4.6 Troubleshooting Alarms

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

IMPORTANT! Table 4.42 on the next page provides the full list of alarms. However, all are not necessarily active, depending on the unit configuration. For example, if the CDU has not been fitted and configured for a power meter, then the associated A39- Power Meter alarm is not active. Alarms that are indicated with an asterisk beside the code number may not be active depending upon unit configuration.

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 4.42 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 24 VDC is available at controller I/O board. If there are no LEDs showing on processor board then check I/O board 24 V fuse FS1. If LEDs are on, check for wiring faults between I/O board and display.					
A01	T1 Primary Temperature Sensor Fault	3	✓	—	—	—
Detail	Reading from off coil air temperature sensor T1 is outside the normal range of -5 °C to 74 °C (23 °F to 165 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A02	T2a Secondary Temperature Sensor Fault	3	✓	—	—	—
Detail	Reading from Secondary supply temperature sensor T2a is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A03	T2b Secondary Temperature Sensor Fault	3	✓	—	—	—
Detail	Reading from Secondary supply temperature sensor T2b is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A04	T2c Secondary Temperature Sensor Fault	3	✓	—	—	—
Detail	Reading from Secondary supply temperature sensor T2c is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor. A05*					
A05*	T3 Room Temperature Sensor Fault	3	✓	—	—	—
Detail	Reading from fluid supply temperature sensor T3 is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A06	T4 Secondary Temperature Sensor Fault	4	✓	—	—	—
Detail	Reading from fluid return temperature sensor T4 is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A07	T5 Primary Temperature Sensor Fault	4	✓	—	—	—
Detail	Reading from Primary return temperature sensor T5 is outside the normal range of 5 to 70 °C (41 to 158 °F) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A08	RH Relative Humidity Sensor Fault 3 ü	3	✓	—	—	—
Detail	Reading from Room humidity sensor RH is outside the normal range of 5 to 100% RH or disconnected. **NOTE: If in Fixed Setpoint + DW Offset mode, unit will revert to Fixed Setpoint mode - default 18 °C (65 °F).**					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A09	PS1 Secondary Pressure Sensor Fault	3	✓	—	—	—
Detail	Reading from Secondary return pressure sensor PS1 (Fill pressure) is outside the normal range of -1 to 8 bar (-15 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.**					

Table 4.42 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A10	**PS2 Secondary Pressure Fault**	3	✓	—	—	—
Detail	Reading from Secondary supply pressure sensor PS3 is outside the normal range of -1 to 8 bar (-15 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure PS1-PS2 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 motor.					
A11	**PS3 Pressure Sensor Fault**	2	✓	—	—	—
Detail	Reading from Secondary supply pressure sensor PS3 is outside the normal range of -1 to 8 bar (-15 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure PS3-PS1 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.					
A11	**Secondary Flow Meter Sensor Fault**	2	✓	—	—	—
Detail	Secondary flow meter output is below 4mA.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A12	**Primary Flow Meter Sensor Fault**	2	✓	—	—	—
Detail	Secondary flow meter output is below 4ma					
Action	Check sensor connections to the control board, check in-line connections, replace sensor. A13					
A13	**Primary Flow Meter Sensor Fault**	3	✓	—	—	—
Detail	Primary flow meter output is below 4ma					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A14	**Micro SD Card Fault**	3	✓	—	—	—
Detail	The SD card has either been removed or physically damaged.					
Action	Access control board, inspect to see if SD card is missing or damaged. Remove, attempt to retrieve any log files that may be on the SD card via laptop. Replace SD card with new formatted 32 GB SD card that contains the current firmware files.					
A15	**Fluid Makeup Empty**	2	✓	—	—	—
Detail	Fill pump has been running for more than 1 minute (default), with level sensor is made, but minimum system pressure level P101 has not been achieved. Also activated when level switch remains open and system pressure has not been achieved (accompanied by an A16 - Insufficient Water Level alarm).					
Action	Check the make up water container is full, tubes are free of air locks, container is properly connected, and fill pump is operational. Check system for leaks.					
A16	**Insufficient Fluid**	1	✓	—	—	—
Detail	On initial startup, if level sensor is not made, fill pressure has not been achieved, and fill pump has been running for more than 1 minute then unit will not start or shutdown immediately. While unit is running, this will be in conjunction with a A34 - Level Sensor - No Fluid Detected alarm (refer to A34 for detail). If level sensor is not made and flow of DP is < 50% of flow/DP setpoint, then unit will shutdown after a 1 second delay.					
Action	Check that fluid makeup 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.					

Table 4.42 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A17	**Pump Fault 1**	**2**	✓	—	—	—
Detail	Pump is drawing excessive current, or inverter has been subjected to over/under voltage. Alarm will only appear after inverter has gone into fault condition a second time (default), after first attempting a fault reset.					
Action	Force pump to run using the Auto Overrides function and measure the current drawn by the pump. If higher than the full load current on the motor data plate, then pump must be replaced. If current drawn is OK, then replace the inverter. Note any fault code on the inverter.					
A18	**Pump Fault 2**	**2**	—	✓	—	—
Detail	Pump is drawing excessive current, or inverter has been subjected to over/under voltage. Alarm will only appear after inverter has gone into fault condition a second time (default), after first attempting a fault reset.					
Action	Force Pump to run using the 'Auto Overrides' function and measure the current drawn by the pump. If higher than the full load current on the motor data plate, then pump must be replaced. If current drawn is OK, then replace the inverter - note any fault code on the inverter.					
A19	**Secondary Pump Flow Shutdown**	**1**	—	✓	—	—
Detail	Pump 1 has not reached the flow rate (or differential pressure) setpoint in the specified time limit (default 100 seconds).					
Action	Check that unit has been set for the correct system flow rate (or DP), check for system blockages, check inverter drive for faults.					
A20	**Valve Fault**	**2**	—	✓	—	—
Detail	Feedback signal from control valve is more than 10% (default) adrift from demand signal, sampled every 15 minutes (default) and allowing for 40 second (default) positioning time.					
Action	Check the wiring connections to the actuator. Try to set the actuator position manually using the Auto Overrides function. Check the voltage out and return signals. See 33					
A21	**Primary Fluid Low Flow**	**2**	—	✓	—	—
Detail	Will only activate when valve demand is at 100%, A25 - Secondary Fluid High Temp alarm is active, and Primary Fluid temperature is within specified limits. (A default 5 minute delay applies.)					
Action	Check operation of control valve. Check chilled fluid supply flow rate. Ensure system heat load does not exceed the CoolChip CDU100 capacity. Check that Primary flow is sufficient for heat load. Refer to**Vertiv™ CoolChip CDU100kW Application and Planning Guide SL-71339**.					
A22	**Primary Fluid Low Temperature**	**3**	✓	—	—	✓
Detail	Primary fluid temperature has dropped below the default 4 °C (40°F) threshold. Alarm will cancel when temperature rises to 5 °C (42 °F) or more. (A default 2 minute delay applies).					
Action	Check chilled water supply					
A23	**Primary Fluid High Temperature**	**2**	✓	—	—	✓
Detail	Primary fluid temperature has risen above the default 11 °C (52 °F) threshold. Alarm will cancel when temperature falls to 10 °C (50 °F) or less. (A default 2 minute. delay applies).					
Action	Check chilled water supply.					
A24	**Secondary Fluid Low Temperature**	**2**	✓	—	—	✓
Detail	Secondary fluid temperature has dropped by more than 2 °C (4 °F) below setpoint (default). Alarm will cancel when temperature rises to 1 °C (2 °F) below setpoint or higher. If Dew Point Offset is active, then this alarm will only activate when at or below dew point for a period of 3 minutes or more (default 2 minute delay applies).					
Action	Check operation of control valve,					
A25	**Secondary Fluid High Temperature**	**2**	✓	—	—	✓

Table 4.42 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Detail	Secondary fluid temperature has risen by more than 2 °C (4 °F) above setpoint (default). Alarm will cancel when temperature falls to 1 °C (2 °F) above setpoint or lower. If Dew Point Offset is active, then this alarm will activate at a pre-set default value of 20 °C (70 °F). (A default 2 minute delay applies.)					
Action	Check operation of control valve					
A26	**Secondary Fluid High Temperature**	2	✓	—	—	✓
Detail	Secondary fluid temperature has risen by more than 2 °C (4 °F) above setpoint (default). Alarm will cancel when temperature falls to 1 °C (2 °F) above setpoint or lower. If Dew Point Offset is active, then this alarm will activate at a pre-set default value of 20 °C (70 °F). (A default 2 minute delay applies.)					
Action	Check operation of control valve.					
A26	**Fluid Detected (Internal Leak)**	1	—	✓	✓ (or —)	—
Detail	Leak tape in unit drip tray has detected a substantial water leak. Event may be set for Alarm Only (default) or Alarm + Unit Shutdown.					
Action	Identify and repair the leak. **NOTE: A leak of this magnitude that does not bring up any other alarms, would most likely be from the Primary circuit.**					
A27	**Secondary Over Pressure (Alarm)**	2	—	✓	—	—
Detail	Pressure at PS3 has increased above the set value of 4 bar (58 psi) (default). This alarm is only active if unit has been configured for alarm only, see Table 4.18 on page 26					
Action	Most likely cause is excessive heat build-up in the system or a breach between Primary and Secondary circuits within the plate heat exchanger. Check for High Temp alarms, check bladder in expansion vessels has not ruptured, relieve pressure at drain point. Remove heat exchanger and replace.					
A28	**Water Detected (External Primary Leak)**	1	—	✓	✓ **(or —)**	
Detail	The water detection tape installed under the floor to the Primary circuit (if fitted, optional extra) has detected a substantial water 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 any other alarms, would most likely be from the Primary circuit.**					
A30	**Check Fluid Makeup Level**	2	—	✓	—	—
Detail	Fill pump has run for more than 5 seconds. Fill pump will run when pressure at PS1 drops fill below the activation threshold, default 0.8 bar (12 psi) for more than 10 seconds, while unit is running in automatic/on-line mode. **This is a user settable alarm from 5 to 50 seconds. Work with Vertiv Serivces to determine the acceptable time that the fill pump can run.**					
Action	Check amount of fluid in make up container and re-fill if necessary with treated fluid. Check system for any sign of leakage.					
A31	**System Low Pressure**	2	—	✓	—	—
Detail	Pressure at PS1 has dropped more than 0.2 bar (3 psi) (set, non-adjustable) below fill pump activation threshold for more than 1 minute (set, non-adjustable), applicable when unit is running in automatic/on-line mode..					
Action	Check amount of fluid in make up container and re-fill if necessary. Ensure fill pump hoses are free of air locks, container is properly connected and fill pump is operational. Check system for leaks.					
A32	**Secondary Over Pressure (Alarm + Shutdown)**	1	✓	—	✓	—

Table 4.42 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Detail	Pressure at PS2 has increased above the set value of 4 bar (58 psi) (default). This alarm is only active if unit has been configured for alarm + shutdown only, see **Table 4.18** on page 26					
Action	Most likely cause is excessive heat build-up in the system or a breach between Primary and Secondary circuits within the plate heat exchanger. Check for High Temp alarms, check bladder in expansion vessels has not ruptured, relieve pressure at drain point. Remove heat exchanger and replace.					
A33	**Primary Fluid No Flow**	**2**	—	✓	—	—
Detail	Activates only when Valve Demand is at 100%, A32 - Secondary Water High Temp and A30 - Primary High Temp alarms are active. (A default 5 minute delay applies).					
Action	Check that the chiller or facility water supply is operational and fault free.					
A34	**Level Sensor–No Fluid Detected**	**2**	✓	—	—	—
Detail	While Unit is Running: If level sensor is open circuit for more than 1 second, this alarm will be raised., provided that flow or DP (depending on control function set) is >50% of flow/DP setpoint. If flow/DP is below this threshold, then an A16 - Leak Shutdown/Insufficient Water alarm will be raised and unit will shutdown after a 1 second delay. Refer to A16 for detail.					
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.					
A35	**Illegal Fluid Sensor Condition**	**2**	✓	—	—	—
Detail	On Initial Startup: if fill pressure has been achieved, but level sensors are not made.					
Action	Replace level sensors					
A36	**Group Control Network Fault**	**2**	✓	—	—	—
Detail	Not currently implemented.					
Action	N/A					
A37	**Group Control Insufficient Units**	**2**	✓	—	—	—
Detail	Not currently implemented.					
Action	N/A					
A38	**Secondary Filter Dirty**	**2**	✓	—	—	—
Detail	Differential pressure across Secondary filter is greater than 0.2 bar (3 psi), indicating that the filter must be cleaned. Default 60 second delay applies.					
Action	Clean filter screen as described in 59.					
A40	**Secondary Temp T2a Diff Fault**	**3**	✓	—	—	—
Detail	Difference between Secondary temperture sensor T2a is more than default 1 °C (2 °F) adrift from T2b and T2c for a period of 30 seconds (default) or more. Controller will read the average of T2b and T2c only.					
Action	Check T2b sensors against **Figure 4.20** on page 52 and replace if faulty.					
A41	**Secondary Temp T2b Diff Fault**	**3**	✓	—	—	—
Detail	Difference between Secondary temp. sensor T2b is more than default 1 °C (2 °F) adrift from T2a and T2c, for a period of 30 seconds (default) or more. Controller will read the average of T2a and T2c only.					
Action	Check T2b sensors against **Figure 4.20** on page 52 and replace if faulty..					

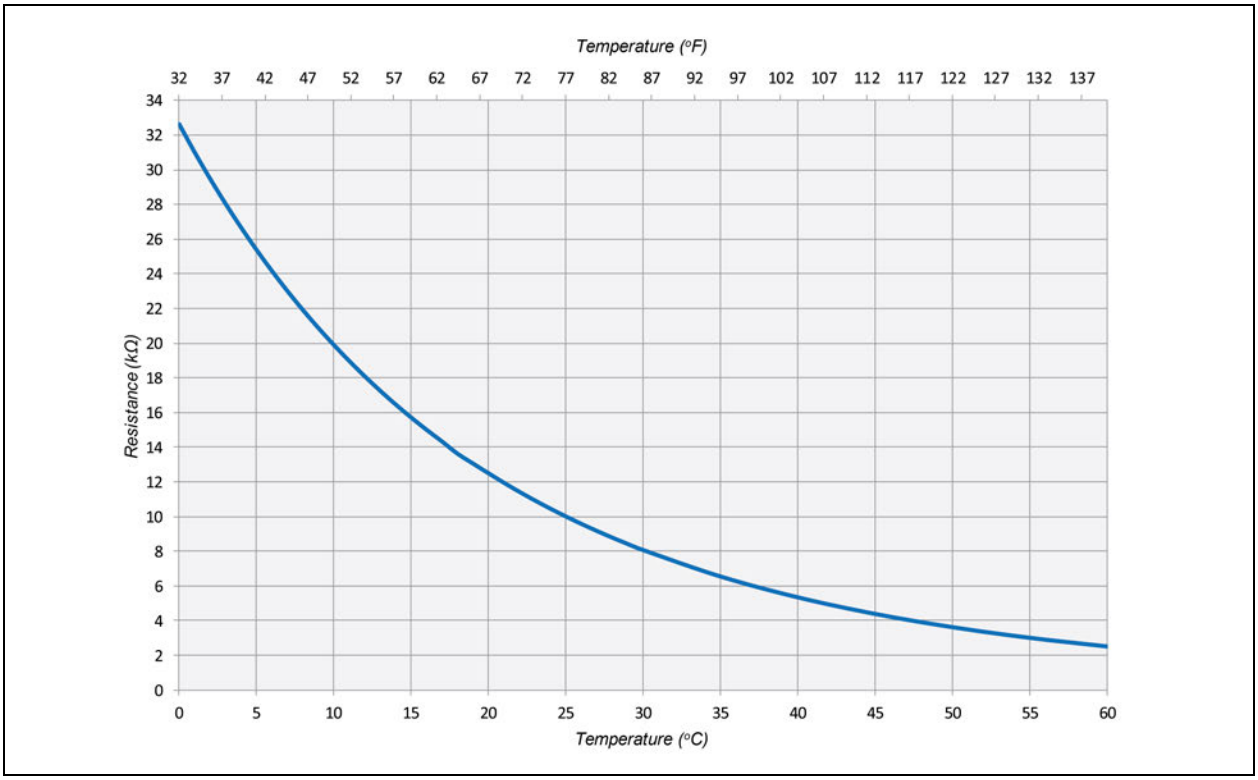
Table 4.42 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A42	Secondary Temp T2c Diff Fault	3	✓	—	—	—
Detail	Difference between Secondary temp. sensor T2c is more than default 1 °C (2 °F) adrift from T2a and T2b, for a period of 30 seconds (default) or more. Controller will read the average of T2a and T2b only.					
Action	Check T2c sensors against Figure 4.20 on the next page and replace if faulty..					
A43	Pump 1 Communication 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.					
A44	Pump 2 Communication 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 and connections. Replace pump.					
A45	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 seconds). Pump 1 will then stop and Pump 3 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).					
A46	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 seconds). 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).					
A47	Micro SD Card Full	2	✓	—	—	—
Detail	MicroSD card has reached capacity.					
Action	Replace card.					
*Alarm may not be active depending upon unit configuration.						

4.7 Temperature Sensor Graph

Figure 4.20 belowmay be used to check the validity of any of the temperature sensors used in the unit or the remote room sensor.

Figure 4.20 Temperature Sensor Resistance Graph

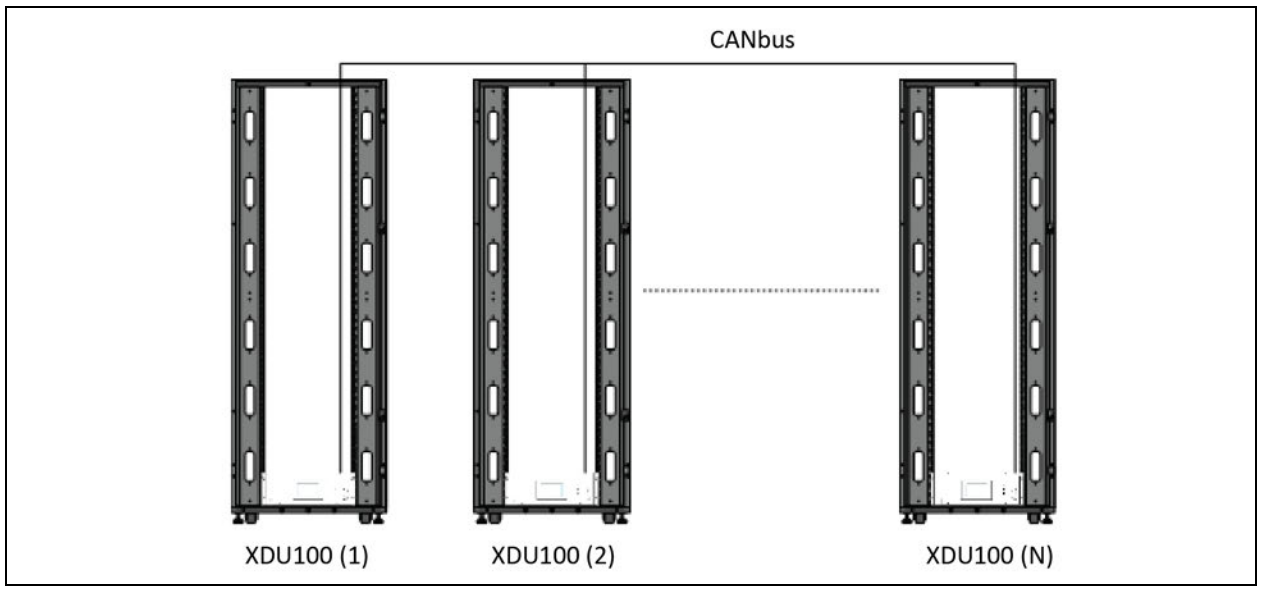


4.8 Group Control

This section should only be considered if there are more than one Vertiv™ CoolChip CDU 100 units installed per system.

Groups of up to 4 Vertiv™ CoolChip CDU 100s can be connected using a high speed, robust twisted pair CANbus network in order to provide coordinated control in larger installation and N+X redundancy.

Figure 4.21 Vertiv™ CoolChip CDU 100 Group Control



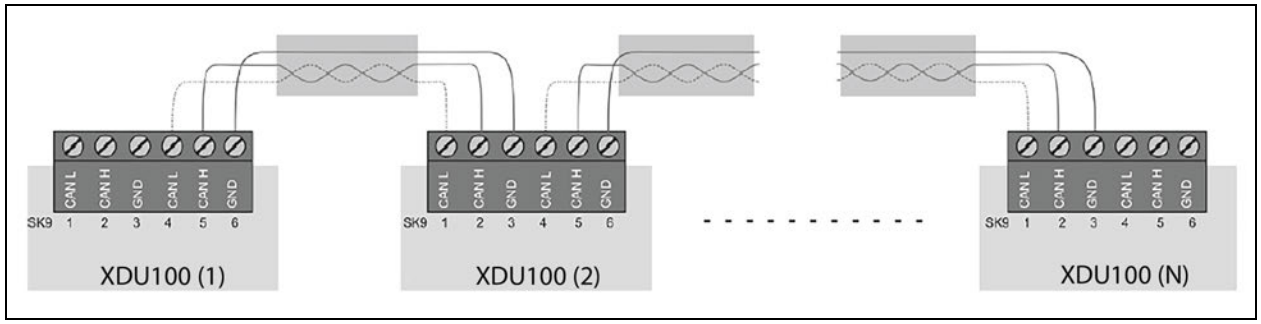
4.8.1 Group Control—Network Cabling

CANbus is used for communication between CoolChip CDU 100 units for group control. CANbus always requires at least 3 conductors: 2 signal wires (CAN Hand CAN L) and a 1 signal return path.

The CoolChip CDU 100 provides 2 CAN H, 2 CAN L and two ground terminals on sockets SK9, 1, 2 and 3 for In and terminals 4, 5 and 6 for Out.

Beldon 3106A, or equivalent (1 pair+1, shielded 22 AWG) is the recommended cable type to be used and pre-configured cable assemblies are provided with each unit if required.

Figure 4.22 Group Control Wiring Configuration

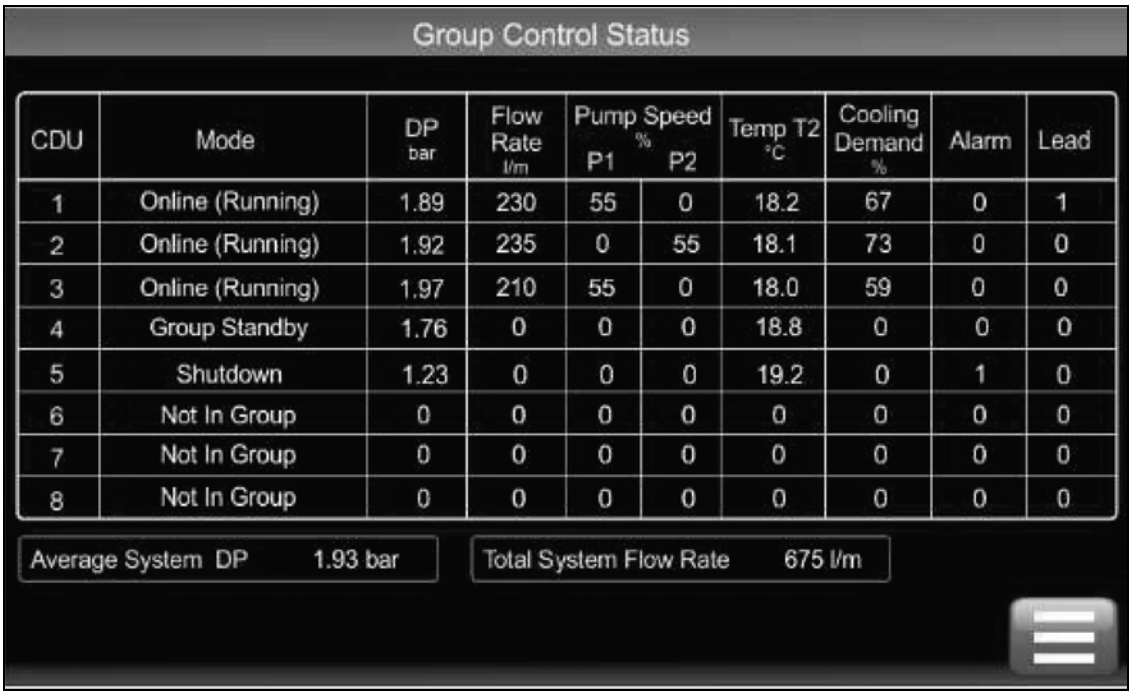


Units become self organizing when in group control. The lead unit is automatically selected which coordinates the running state of each unit in group based on:

- Configured level of redundancy
- System pressure requirements
- Alarm conditions

Changes to the group settings or system settings can be made via any CoolChip CDU 100 touchscreen user interface at any time and are automatically synced across the network.

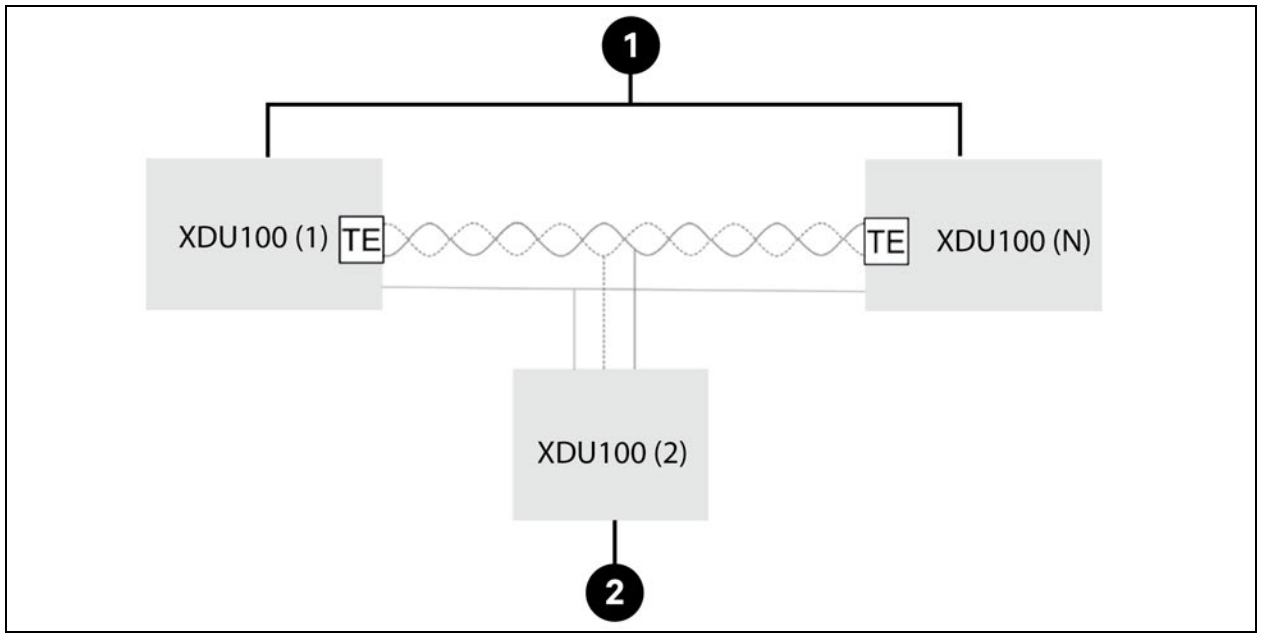
Figure 4.23 Group Control Status Screen



4.8.2 Group Control—Network Termination Resistors

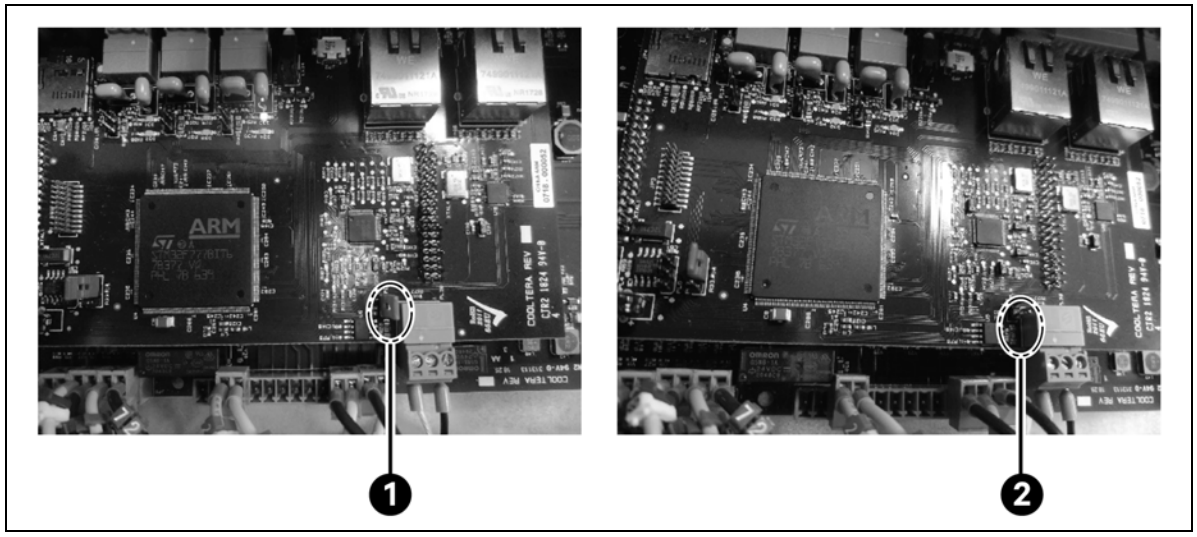
The CoolChip CDU 100 controller includes an onboard 120 ohm resistor which can be activated by fitting a hardware jumper. If only one CoolChip CDU 100 unit is installed, the resistor does not require activation. For a two unit installation, both units should have the termination resistors enabled. For three units and above, units 1 and n should have the termination resistors enabled, while units between should be disabled. Failure to disable the middle resistors could result in intermittent communications. See Figure 4.24 on the facing page and Figure 4.25 on the facing page for the location of the jumper to enable/disable the termination resistor (the jumper is fitted by default and must be removed if not required).

Figure 4.24 CANbus Network Termination Resistors



Item	Description
1	Units with termination enabled
2	Units with termination disabled

Figure 4.25 CANbus Network Termination Resistors



Item	Description
1	Jumper fitted = Termination resistor activated
2	Jumper not fitted = Termination resistor not activated

4.8.3 Group Control—Network Addresses

Each CoolChip CDU 100 must be given a unique address. A CoolChip CDU 100 network addresses should be allocated to each unit in ascending order, starting from 1.

The CoolChip CDU 100 network address is configured via Setup screen > Unit Address (P081). Configure each CoolChip CDU 100 so that it is aware of the other CoolChip CDU 100 devices on the network:

- Enter the total number of CoolChip CDU 100 units in the networked system via Setup screen > Group Control > Number of Units in Group (P082)
- Enter the number of run units via Setup screen > Group Control > Number of Run Units (P083)

4.8.4 Group Control—Start Sequence from Power Up

1. Power is available when the controller is active.
2. POST (power on system test) and Firmware initializes in less than 1 second—CANbus network activity and RS485 communications with inverters will be established within the 1 second period.
3. When the controller is initialized, it looks for messages from the other CoolChip CDU 100s in the Group. Messages from CDUs are transmitted asynchronously every 100 milliseconds, so within 200 milliseconds messages will have been exchanged and the group demand shared.
4. When the group demand is shared, the inverters will be driven to the group demand instantly via RS485 Modbus RTU communication from the controller.
5. The inverters are programmed with 2 seconds ramp up period (2 seconds to 100%), so if the group demand is typically at 65% to 75%, ramp up will take 1.5 seconds. This ramp up period is designed to prevent a secondary discharge pressure over shoot on CoolChip CDU 100 (or pump) restart. It is also configurable via the F002 acceleration time parameter on the inverter.
6. Total startup time in Group Control mode is 1 second + 200 milliseconds + 1.5 seconds = 2.7 seconds to the required pump speed, pressure, and flow rate.

4.8.5 Group Control—Controls

When in group control, the lead CoolChip CDU 100 modulates its pump speed to maintain a differential pressure setpoint. The differential pressure setpoint default is an average over all the individual running CoolChip CDU 100 differential pressure readings. This can be changed to the differential pressure over all Vertiv™ CoolChip CDU 100 in the group in Seh1p/Group Control/P094 regardless if they are running. All CoolChip CDU 100 units work in parallel and set their pump speeds to be identical with that of the lead CoolChip CDU 100.

Each CoolChip CDU 100 modulates its own primary (facility) fan speeds to maintain a group wide IT supply fluid temperature setpoint. Each CoolChip CDU 100 also locally regulates temperature using the average of its individual temperature sensors.

4.8.6 Group Control—Unit Rotation and Standby Units

Unit rotation can be configured to be weekly, monthly, or never in the Setup screen under Group Control. Upon rotation, one of the standby units is switched on and one of the duty units is switched off. For example, if units 1, 2, 3, and 4 are running and 5 and 6 are off, after rotation units 2, 3, 4, and 5 will run while 1 and 6 off.

In the event that the load exceeds the capacity of the running units and there are standby units, the standby units will not kick in automatically. The configured number of duty units is selected based the max load. If this max load increases, then additional load has been added and the operator should increase the configured number of duty units.

4.8.7 Group Control—Failure Offset

Failure mode enable standby pumps to start in 75 ms and a 2 second ramp up when a CoolChip CDU 100 in the group is taken offline. This is to seamlessly maintain system differential pressure if a unit is lost without over/undershoots.

The failure offset is applicable only when a group of three or more CoolChip CDU 100 units are configured in N, meaning all CoolChip CDU 100 units are set to run with no CoolChip CDU 100 redundancy. Additionally, they are configured to activate the standby pump when an Vertiv™ CoolChip CDU 100 failure or power-off occurs. The pump reduction (or failure) offset is applied to the system pump speed when there is a CoolChip CDU 100 failure (shutdown) or the unit is switched off. Starting the standby pumps in the running Vertiv™ CoolChip CDU 100s will result in more pumps running than when all CDUs are healthy and operational. To avoid spikes in differential pressure, P217 failure Pump Speed offset is applied to the system pump speed at the time of the CDU failure. P217 should be determined at commissioning.

4.8.8 Group Control—Failure Modes

When there is communication failure between units, a new lead CoolChip CDU 100 will be established for each new grouping of units. When communication is re-established, the original lead CoolChip CDU 100 will take control. See Figure 4.26 below. If only the lead CoolChip CDU 100 loses communication, the next CoolChip CDU 100 will take over the lead role. When the previous lead CoolChip CDU 100 communication is re-established, it will not take over the lead role again. See Figure 4.27 on the next page.

Figure 4.26 General Communication Failure

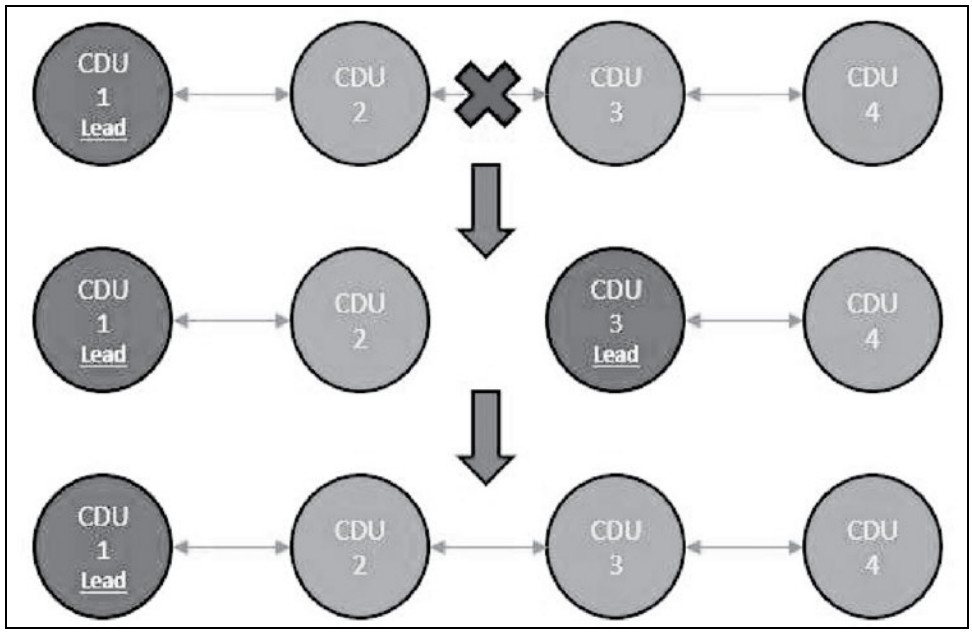
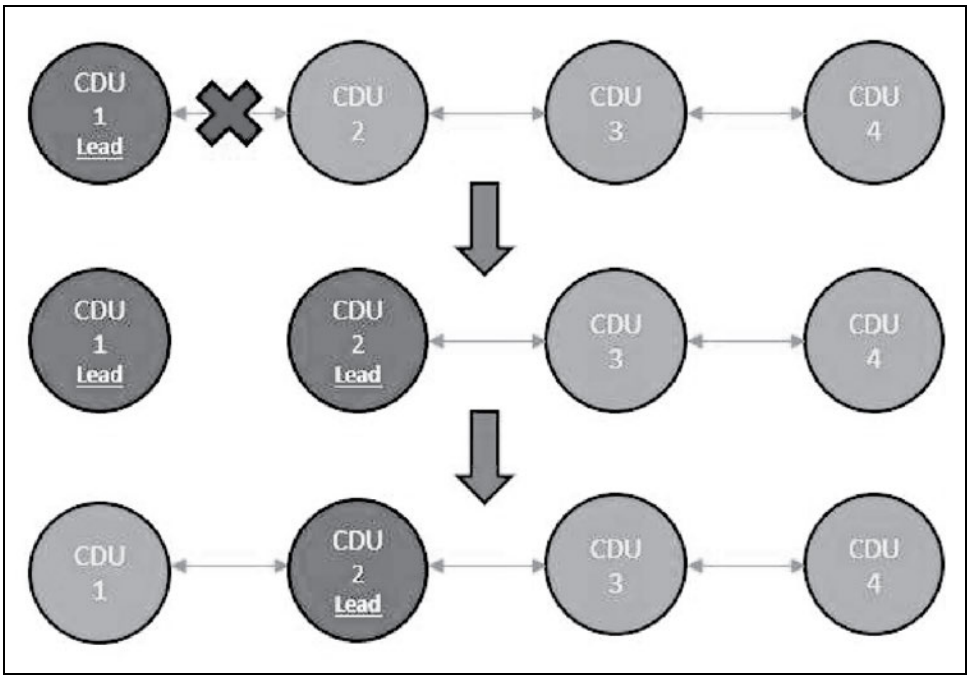


Figure 4.27 Lead Communication Failure



In the event of a sensor failure, all sensors related to control (PS1, PS2 and T2) are redundant at the Vertiv™Vertiv™ CoolChip CDU 100 level, so a single sensor failure will not impact the operation or the status of the Vertiv™ CoolChip CDU 100. So, if the lead Vertiv™ CoolChip CDU 100 does have a sensor failure it will not result in a change of lead.

5 Maintenance

5.1 General

The Vertiv™ Vertiv™ CoolChip CDU 100 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 representative.

5.2 Fluid Specifications

Primary Circuit

The Vertiv™ CoolChip CDU 100 is designed for use with a facility supply of plain water or up to 20% glycol/water. A 20% glycol concentration will give protection to approx. -9 °C (16 °F). If a higher concentration of glycol is used, then the cooling capacity of the unit may have to be de-rated (contact manufacturer for advice).

Secondary Circuit

The secondary circuit must be filled with particulate free deionized fluid treated with suitable corrosion inhibitors and biocides.

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

5.3 Planned Maintenance

Planned maintenance services must be carried out in 3 months, 6 months, and 12 months in the first year after the commissioning. After the first year, the planned maintenance service is twice every year, with an interval of 6 months.

Planned maintenance services first 3 months

- Check Vertiv™ CoolChip CDU 100 valve operation, with necessary parameter adjustment
- Check valve demand and feedback
- Check for any current alarms, correct and clear
- Download historic alarm and event logs (refer to manufacturer for instructions)
- Check T2a, T2b and T2c difference less than 1.0 °C
- Check all temperature sensors with calibrated temperature sensor
- Check all temperature and pressure sensors are securely fixed with no leakage
- Check primary pipework is securely connected with no leakage
- Check primary pipework thermal insulation
- Check the maximum flow rate of primary circuit, and adjust if necessary
- Check the primary supply temperature
- Check the primary pressure
- Remove and clean secondary filter if necessary
- Check secondary (manifold and hose) is securely connected with no leakage
- Check the normal secondary flow rate

- Check the Vertiv™ Vertiv™ CoolChip CDU 100 manual air vent is clear of air
- Check the expansion vessel static pressure is healthy
- Test the fill pump operation with override function
- Check the sync date and time
- Check firmware status and upgrade if necessary
- Take coolant sample and have tested for correct levels of inhibitors and biocides, if applicable

Planned Maintenance services first 6 months (in addition to 3 month maintenance)

- Simulate the Vertiv™ CoolChip CDU 100 switch off, using backup Vertiv™ CoolChip CDU 100 or parallel operation to meet the performance requirement
- Check the leakage detection
- Check remote communication functions correctly if applied

Planned Maintenance services in 12 months (in addition to 3 and 6 months maintenance)

- Check drain points
- Check all the cable connections and terminals
- Check the rack heat load and the secondary flow rate setting
- Override primary valve from 0% to 100%
- Override pump inverter from 0% to 100%
- Visual and audio check the pump bearings when running
- Record current of pump
- Record pump run times
- Record valve run times

Planned maintenance services in every 24 months and after

- Drain the fluid and re-commission the secondary circuit, if necessary. Replace only with DEI fluid that has the correct treatment additives
- Change the secondary filter, if necessary

5.4 Filter Removal and Cleaning

The filter removal and cleaning process for the Vertiv™ CoolChip CDU 100 is below.

1. Disconnect the unit from power using the proper lockout tagout procedures.
    a. Make sure that the customer has removed load from the rack to protect IT equipment.
2. Isolate the unit on the primary and secondary circuit.
3. Place spill kit absorbent pads around components of the units and flooring to catch spilled fluid.
4. Wear proper personal protective equipment.
5. Connect the Schrader depressor end of a refrigerant hose to the 1/4" SAE flare Schrader drain valve located at the bottom of the unit circled in red inFigure 5.1 on the facing page.
6. Ensure the other end is in external containment to catch fluid. See Figure 5.2 on page 62.
7. Using the Schrader valve circled in yellow in Figure 5.1 on the facing page, depress the Schrader core to vent air as needed and allow fluid to drain from the unit.

Figure 5.1 Schrader Valve Locations

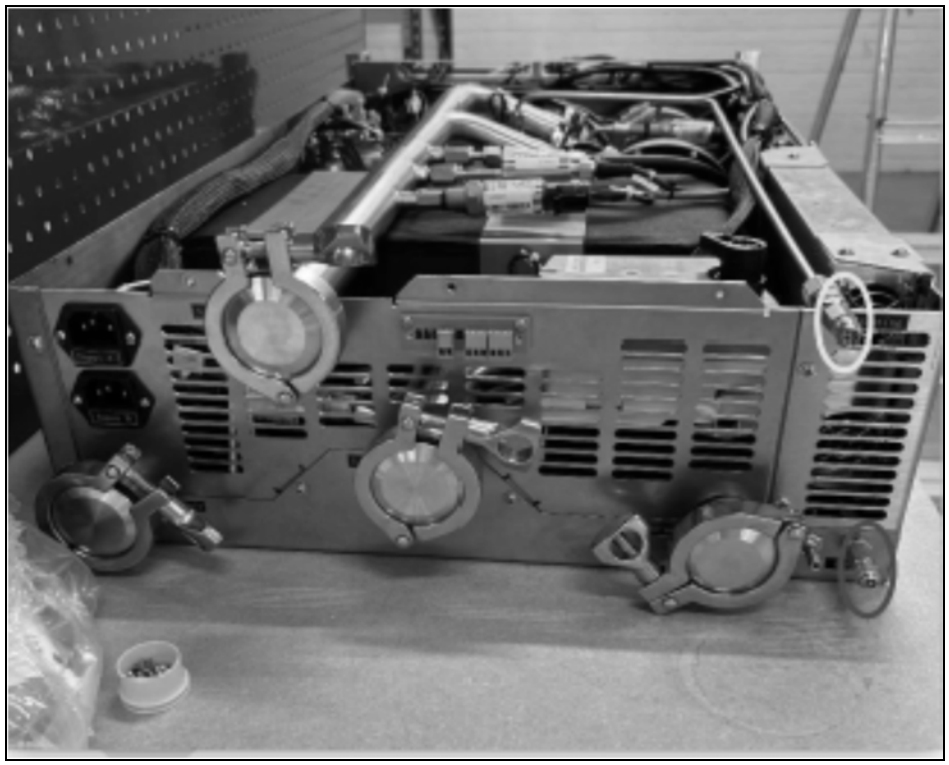
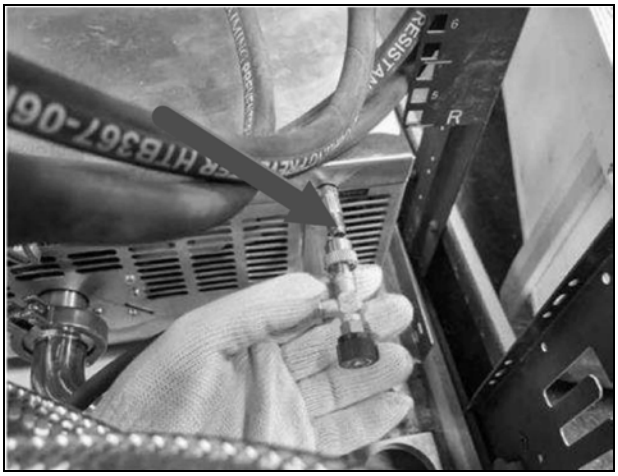


Figure 5.2 End in External Containment

Figure 5.3 Depressing the Schrader Valve



8. Fluid will run into the external containment.
9. Drain until fluid stops running out of the tubing so that the filter can be removed for cleaning.
10. When fluid has stopped running out of tubing, slide the unit forward to gain access to the filter on the right-hand side.

NOTE: This requires significant flexibility in the primary and secondary tubing. If the unit cannot be moved forward enough to gain access to the filter due to tubing or other site specifics, the unit will need to be removed from the rack.

11. Remove the primary and secondary hygienic flange fittings or quick connect fittings. (This depends upon the site.)
    a. Fluid will drain out of the unit if quick connects are not use.

Figure 5.4 Fluid Draining, Removing Primary Hygienic Fitting

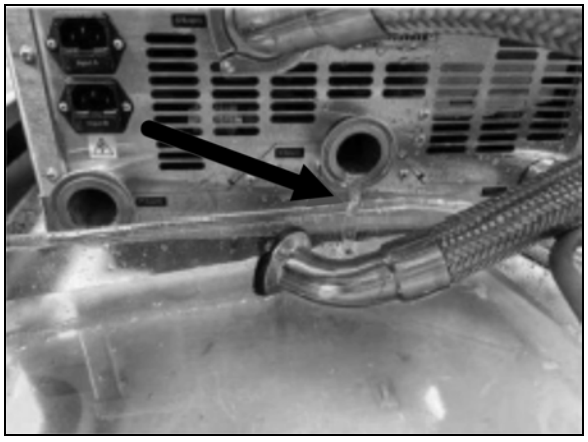


Figure 5.5 Fluid Draining, Removing Secondary Hygienic Fitting

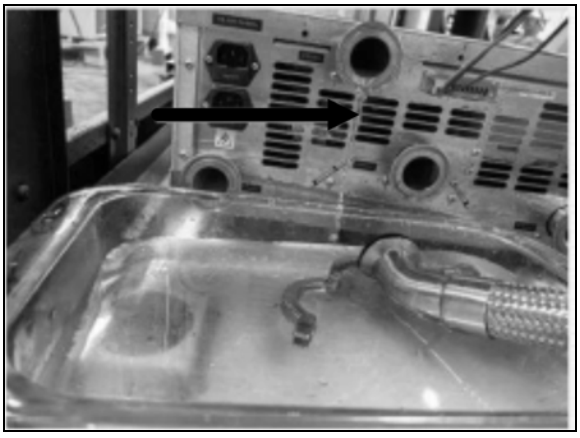
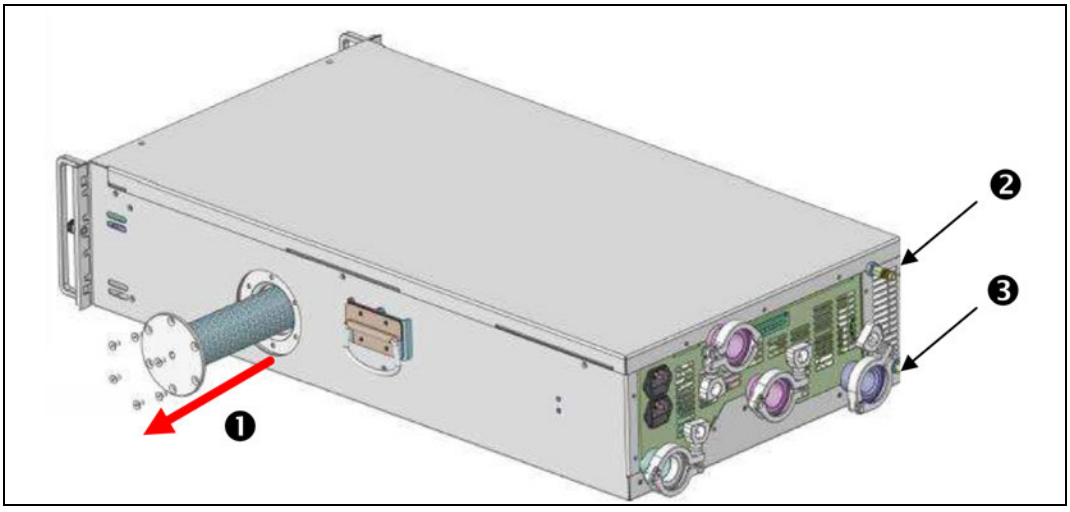


Figure 5.6 Unit in Rack

12. After access to the filter is gained, remove the screws from the filter housing so the filter can be removed and cleaned. There may be residual fluid left in the filter housing, so make sure to place an absorbent pad under the unit to catch dripping fluid

Figure 5.7 Removing the Filter



Item	Description
1	Retaining screws and filter
2	Secondary circuit vent point
3	Secondary circuit drain point

13. Place the filter in the external containment and take filter of out white space. Clean filter in the designated cleaning area.
14. Rinse the filter with purified water meeting water quality guidelines outlined in ASHRAE TC 9.9 Datacom Encyclopedia or approved PG solution.
15. Do not clean with a wire brush.
16. Do not leave filter housing open to air. Place a clean cover over filter housing opening.
17. Inspect filter for damage and replace if necessary.
18. Let the filter drip dry or rinse filter off with fluid that is being used in the cooling loop before reinstalling the filter.
19. Install filter back into the filter house, assuring proper orientation and gasket placement.
20. Open the secondary supply isolation and allow the fluid to refill unit. Depress the valve on the Schrader vent to remove air as needed.
21. Ensure there are no leaks after refilling the unit.
22. Slide the unit back into the rack and open all remaining primary and secondary circuit isolation to re-introduce the unit to the system.
23. Restore power to the unit.
24. Turn the unit on and clear any alarms that may have been generated due to filter cleaning.
25. Verify that the unit is running properly.
26. Properly bag up any spill kit items that may have absorbed any fluid.
27. Clean up and store any spill kit items that have not been used in the spill kit.

5.5 Spare Parts

Contact Vertiv for spare parts requirements.

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: Submittal Drawings

Submittal drawings referenced in this document are listed below and are presented in the order as mentioned within this document. on the following pages.

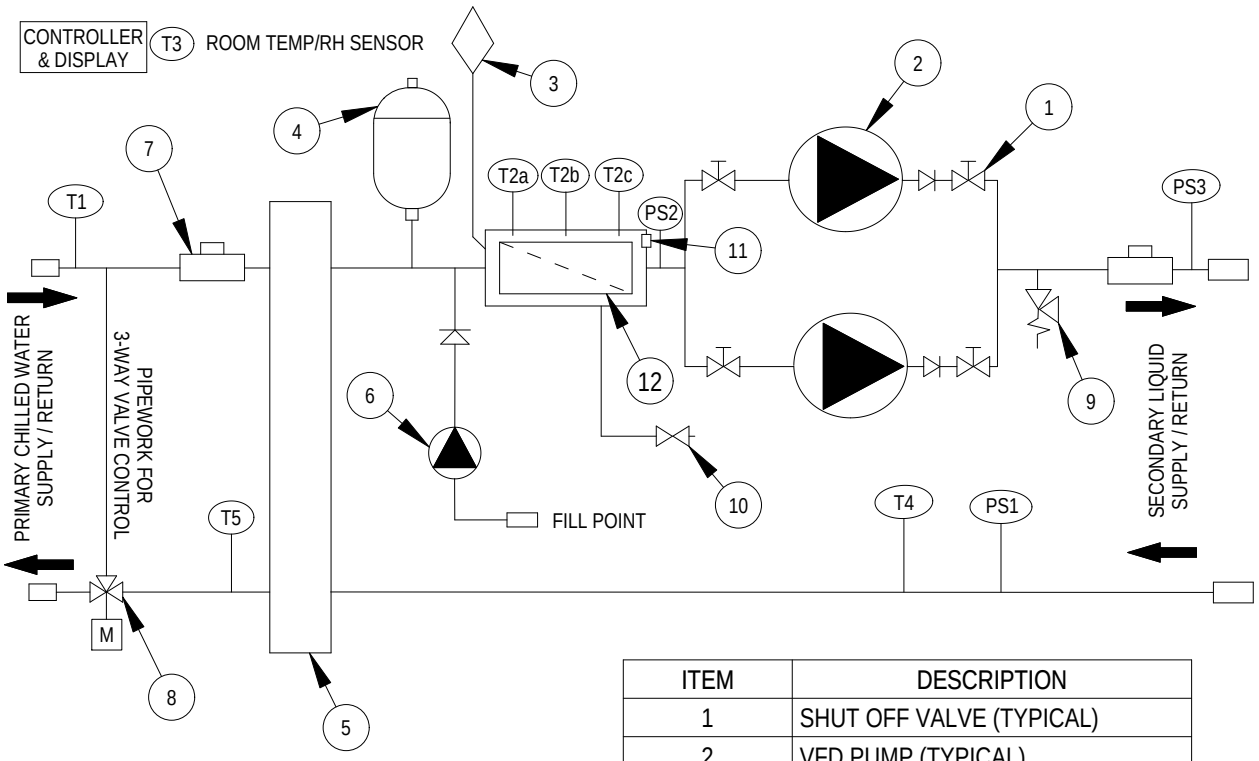
Table B.1 Submittals

Submittal Number	Title
20000221	Vertiv™ CoolChip CDU 100 Piping Schematic 100kW Unit

COOLCHIP CDU

PIPING SCHEMATIC
100 kW UNIT

Front and sides of rack must be perforated to accommodate and allow for fan airflow.



FACTORY PIPING

T## TEMPERATURE SENSOR (FACTORY PROVIDED)

PS## PRESSURE SENSOR (FACTORY PROVIDED)

ITEM	DESCRIPTION
1	SHUT OFF VALVE (TYPICAL)
2	VFD PUMP (TYPICAL)
3	AUTO AIR VENT
4	EXPANSION TANK
5	BRAZED PLATE HEAT EXCHANGER
6	FILL PUMP
7	FLOW METER (TYPICAL)
8	3-WAY COOLING CONTROL VALVE
9	RELIEF VALVE
10	DRAIN VALVE
11	WATER LEVEL SENSOR
12	FILTER

NOTES:

1. Arrangement Diagram representation shown. Do not use for specific connection locations.
2. For each CoolChip CDU unit, a separate 500 micron filter is required in the facility chilled water supply from the chilled water source. The filter is field supplied and installed.
3. Unit isolation valves are required in the field piping of facility and secondary fluid connections to facilitate service. The isolation valves are field supplied and installed.

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Appendix C: Notes

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Appendix D: Disposal Information

NOTE: 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. Approved lifting gear and power tools must be used and access to the work area must be restricted to authorized personnel.

The following steps are a guide only and must 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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Appendix E: Vertiv™ CoolChip CDU 100 BACNet Object List

E.1 Binary Values

Table E.1 Binary Values

Instance Number	Object Name
200	Unit Common Alarm
201	Alarm A01: T1 Temperature Sensor Fault
202	Alarm A02: T2a Temperature Sensor Fault
203	Alarm A04: T2c Temperature Sensor Fault
204	Alarm A04: T2c Temperature Sensor Fault
205	Alarm A05: T3 Temperature Sensor Fault
206	Alarm A06: T4 Temperature Sensor Fault
207	Alarm A07: T5 Temperature Sensor Fault
208	Alarm A08: RH Relative Humidity Sensor Fault
209	Alarm A09: PS1 Pressure Sensor Fault
210	Alarm A10: PS2 Pressure Sensor Fault
211	Alarm A11: PS3 Pressure Sensor Fault
212	Alarm A12: Secondary Flow Meter Sensor Fault
213	Alarm A13: Primary Flow Meter Sensor Fault
214	Alarm A14: MicroSD Card Fault
215	Alarm A15: Fluid Makeup Empty
216	Alarm A16: Insufficient Fluid Level
217	Alarm A17: Pump 1 Fault
218	Alarm A18: Pump 2 Fault
219	Alarm A19: Sec Pump Shutdown
220	Alarm A20: Valve Fault
221	Alarm A21: Primary Fluid Low Flow
222	Alarm A22: Primary Fluid Low Temp
223	Alarm A23: Primary Fluid High Temp
224	Alarm A24: Secondary Fluid Low Temp
225	Alarm A25: Secondary Fluid High Temp
226	Alarm A26: Fluid Detected (Internal Leak)
227	Alarm A27: Sec Over Pressure
228	Alarm A28: Fluid Detected (External Leak)

Table E.1 Binary Values (continued)

Instance Number	Object Name
229	Alarm A29: n/u
230	Alarm A30: Check Fluid Makeup Level
231	Alarm A31: System Low Pressure
232	Alarm A32: Secondary Over-pressure
233	Alarm A33: Primary Fluid No Flow
234	Alarm A34: Level Sensor – No Fluid Detected
235	Alarm A35: Illegal Fluid Sensor Condition
236	Alarm A36: Group Control Network Fault
237	Alarm A37: Group Control Insufficient Units Available
238	Alarm A38: Secondary Filter Dirty
239	Alarm A39: n/u
240	Alarm A40: Secondary Temperature T2a Diff Fault
241	Alarm A41: Secondary Temperature T2b Diff Fault
242	Alarm A42: Secondary Temperature T2c Diff Fault
243	Alarm A43: Pump 1 Communication Fault
244	Alarm A44: Pump 2 Communication Fault
245	Alarm A45: Pump 1 Low Flow
246	Alarm A46: Pump 2 Low Flow
247	Alarm A47: SD Card Full
248	Status: Fill Required

For all binary value objects, the present value conveys an alarm status.

- A value of 1 indicates the presence of an alarm condition.
- A value of 0 indicates the health (no alarm) condition.'

E.2 Multi-state Values

Table E.2 Multi-state Values

Instance Number	Object Name	Data Values
100	Unit Mode	0 = Not configured 1 = Tank filling 2 = Shutdown—network 3 = Full manual control 4 = Standby 5 = Online (running) 6 = Online (filling) 7 = Filling 8 = Shutdown—fault 9 = Group standby
101	Group Control Mode	1 = Standalone 2 = Primary 3 = Secondary 3 = Independent (due to network fault)

E.3 Analog Values

NOTE: Units of measurement (SI or Imperial) are configurable via Setup > Modbus and BACnet > BACnet > P079 Units.

RO: Read only

RW: Read write

Table E.3 Analog Values

Instance Number	Object Name	Units	Access
0	Pump 1 Speed	%	RO
1	Pump 2 Speed	%	RO
2	Control Valve (Cooling) Demand	%	RO
3	Control Valve Feedback	%	RO
4	Primary Supply Temperature T1	C / °F	RO
5	Secondary Supply Temperature T2a	C / °F	RO
6	Secondary Supply Temperature T2b	C / °F	RO
7	Secondary Supply Temperature T2c	C / °F	RO
8	Secondary Supply Temperature T2	C / °F	RO
9	Room Temperature T3	C / °F	RO

Table E.3 Analog Values (continued)

Instance Number	Object Name	Units	Access
10	Room Relative Humidity RH	% RH	ROS
11	Dew Point DW	C / °F	RO
12	Secondary Return Temperature T4	C / °F	RO
13	Secondary Return Pressure PS1	Bar/PSI	RO
14	Pump Inlet Pressure PS2	Bar/PSI	RO
15	Secondary Supply Pressure PS3	Bar/PSI	RO
16	Secondary Differential Pressure (PS3 – PS1)	Bar/PSI	RO
17	Filter Differential Pressure (PS1 – PS2)	Bar/PSI	RO
18	Primary Flow Rate	lpm/US gpm	RO
19	Secondary Flow Rate	lpm/US gpm	RO
20	Secondary Duty	kW	RO
21	Temperature Setpoint	C / °F	RO
22	System (Group) Average Secondary Differential Pressure	Bar/PSI	RO
23	System (Group) Total Secondary Flow Rate	lpm/US gpm	RO
24	Primary Return Temperature T5	C / °F	RO
25	Primary Duty	kW	RO
26	Number of Active Alarms	—	RO
27	P301 Cooling Setpoint	C / °F	RW
28	P203 DP Setpoint	Bar/PSI	RW
29	P202 Flow Setpoint	lpm/US gpm	RW

Appendix F: Vertiv™ CoolChip CDU 100 MODBUS Register Table

F.1 Discrete Inputs

Table F.1 Discrete Inputs

Register Number	Description	RM060 Alarm Code
1	Alarm (0 = Inactive, 1 = Active)	—
2	Alarm: T1 Temperature Sensor Fault	A01
3	Alarm: T2a Temperature Sensor Fault	A02
4	Alarm: T2b Temperature Sensor Fault	A03
5	Alarm: T2c Temperature Sensor Fault	A04
6	Alarm: T3 Temperature Sensor Fault	A05
7	Alarm: T4 Temperature Sensor Fault	A06
8	Alarm: T5 Temperature Sensor Fault	A07
9	Alarm: RH Relative Humidity Sensor Fault	A08
10	Alarm: PS1 Pressure Sensor Fault	A09
11	Alarm: PS2 Pressure Sensor Fault	A10
12	Alarm: PS3 Pressure Sensor Fault	A11
13	Alarm: Secondary Flow Meter Sensor Fault	A12
14	Alarm: Primary Flow Meter Sensor Fault	A13
15	Alarm: microSD Card Fault	A14
16	Alarm: Fluid Makeup empty	A15
17	Alarm: Insufficient Water Level	A16
18	Alarm: Pump 1 Fault	A17
19	Alarm: Pump 2 Fault	A18
20	Alarm: Sec Pump Flow Shutdown	A19
21	Alarm: Valve Fault	A20
22	Alarm: Primary Fluid Low Flow	A21
23	Alarm: Primary Fluid Low Temperature	A22
24	Alarm: Primary Fluid High Temperature	A23
25	Alarm: Secondary Fluid Low Temperature	A24
26	Alarm: Secondary Fluid High Temperature	A25
27	Alarm: Fluid Detected (Internal Leak)	A26
28	Alarm: Sec Over Pressure	A27
29	Alarm: Fluid Detected (External Leak)	A28

Table F.1 Discrete Inputs (continued)

Register Number	Description	RM060 Alarm Code
30	Not used	
31	Alarm : Check Fluid Makeup Level	A30
32	Alarm : System Low Pressure	A31
33	Alarm : Secondary Over-pressure	A32
34	Alarm : Primary Fluid No Flow	A33
35	Alarm : Level Sensor – No Fluid Detected	A34
36	Alarm : Illegal Fluid Sensor Condition	A35
37	Alarm : Group Control Network Fault	A36
38	Alarm : Group Control Insufficient Number Of Units	A37
39	Alarm : Secondary Filter Dirty	A38
40	Not Used	
41	Alarm : Sec Temp T2a Diff Fault	A40
42	Alarm : Sec Temp T2b Diff Fault	A41
43	Alarm : Sec Temp T2c Diff Fault	A42
44	Alarm : Pump 1 Communications Fault	A43
45	Alarm : Pump 2 Communications Fault	A44
46	Alarm : Pump 1 Low Flow	A45
47	Status : Fill Required	—
48	Alarm : SD Card Full	A47
49 [1]	Alarm : Pump 2 Low Flow	A46

[1] Available on firmware, versions 1.2 and above.

Access to the Discrete Inputs table is provided by MODBUS function code 02 -- Read Input.

For all discrete input registers which may contain an alarm status, a value of 1 indicates the presence of the alarm condition. A value of 0 indicates the healthy (no alarm) condition.

F.2 Input Registers

Table F.2 Input Registers

Register Number	Description	Units	Scaling	Data Type
1	Mode: 0 = Not configured 1 = Shutdown—remote start/stop 3 = Full manual control 4 = standby 5 = Online 6 = Filling 7 = Shutdown—fault 9 = Group standby 10 = Online—maximum cooling mode	N/A	1	Unsigned
2	Group Control Mode: 0 = Standalone 1 = Primary 2 = Secondary 3 = Independent (due to network fault)	N/A	1	Unsigned
3	Pump 1 Speed	%	1	Unsigned
4	Pump 2 Speed	%	1	Unsigned
5	Control Valve (Cooling) Demand	%	1	Unsigned
6	Control Valve Feedback	%	1	Unsigned
7	Primary Temperature T1	°C/°F	0.1	Signed
8	Secondary Supply Temperature T2a	°C/°F	0.1	Signed
9	Secondary Supply Temperature T2b °C	°C/°F	0.1	Signed
10	Secondary Supply Temperature T2c			
11	Secondary Supply Temperature T2	°C/°F	0.1	Signed
12	Room Temperature T3	°C/°F	0.1	Signed
13	Room Relative Humidity RH	% RH	0.1	Unsigned
14	Dew Point DW	°C/°F	0.1	Signed
15	Secondary Return Temperature T4	°C/°F	0.1	Signed
16	Primary Return Temperature T5	°C/°F	0.1	Signed
17	Secondary Return Pressure PS1	Bar/psi	0.01	Signed
18	Pump Inlet Pressure PS2	Bar/psi	0.01	Signed
19	Secondary Supply Pressure PS3	Bar/psi	0.01	Signed
20	Unit Differential Pressure (PS3 – PS1)	Bar/psi	0.01	Signed

Table F.2 Input Registers (continued)

Register Number	Description	Units	Scaling	Data Type
21	Secondary Filter Differential Pressure (PS1 – PS2)	Bar/psi	0.01	Signed
22	Primary Flow Rate	lpm/US gpm	1	Unsigned
23	Secondary Flow Rate	lpm/US gpm	1	Unsigned
24	Secondary Duty	kW	1	Unsigned
25	Primary Duty	kW	1	Unsigned
26	Temperature Setpoint	°C/°F	0.1	Signed
27	Software Version	—	—	Unsigned

Access to the Input Register table is provided by MODBUS function code 04 -- Read Input Registers.

F.3 Coils

Table F.3 Coils

Register Number	Description
1	Remote Shutdown: • To switch on the CDU, write OFF • To switch off the CDU, write ON

Read access to the Coil table is provided by MODBUS function code 01 -- Read Coil Status.

Write access to the Coil table is provided by MODBUS function code 05 -- Write Single Coil,

F.4 Holding Registers

Table F.4 Holding Registers

Register Number [2]	Description	Units	Scaling	Data Type
1	Secondary Temperature Setpoint (P301)	°C/°F	0.1	Unsigned
2	Secondary DP Setpoint (P203)	Bar/psi	0.l	Unsigned
3	Secondary Flow Setpoint (P202)	lpm/US gpm	1	Unsigned

[2] Available on firmware versions 2.0 and above.

By default, the holding register table is read-only. Read-write access may be enabled via the PO72 Write Access parameter, accessible via the touchscreen interface.

Read access to the Holding Register table is provided by MODBUS function code 03 -- Read Holding Registers.

For write access, MODBUS function code 06 -- Present Single Register is supported.

An attempt to write a holding register value when read-only access is active will result in an exception code being returned.

Appendix G: Accessing and Downloading Log Files (Remote Log Retrieval)

```
C:\dev\xdu\100>ssh adminA@169.254.75.221 "getconfig"
adminA@169.254.75.221's password:
Unit Serial Number : FWTEST0123
Firmware Version : 3.0b10
Target Hardware : Rev 5.xB (STM32F746 MCU, Internal ADC)

Interface A
-----------
      IP Address : 169.254.75.221
      Subnet Mask : 255.255.255.0
      Default Gateway : 0.0.0.0
      DNS Server 1 : 0.0.0.0
      DNS Server 2 : 0.0.0.0
      MAC Address : 70-B3-D5-DD-61-52
      Hostname : CTCN15247-A

C:\dev\xdu\100>sftp adminA@169.254.75.221:"/FWTEST0123/FWTEST0123_AlarmLog.txt"
adminA@169.254.75.221's password:
Connected to 169.254.75.221.
Fetching /FWTEST0123/FWTEST0123_AlarmLog.txt to FWTEST0123_AlarmLog.txt
FWTEST0123_AlarmLog.txt    100% 7703    67.8KB/s 00:00

C:\dev\xdu\100>sftp adminA@169.254.75.221:"/FWTEST0123/FWTEST0123_SysLog.txt"
adminA@169.254.75.221's password:
Connected to 169.254.75.221.
Fetching /FWTEST0123/FWTEST0123_SysLog.txt to FWTEST0123_SysLog.txt
FWTEST0123_SysLog.txt100%    100%77KB    102.0KB/s 100% 00:00

C:\dev\xdu\100>sftp adminA@169.254.75.221:"/FWTEST0123/FWTEST0123_Parameters.txt"
adminA@169.254.75.221's password:
Connected to 169.254.75.221.
Fetching /FWTEST0123/FWTEST0123_Parameters.txt to FWTEST0123_Parameters.txt
FWTEST0123_Parameters.txt   100% 5633 47.4KB/s 00:00
```

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