Installation, Operation, and Maintenance

Coolant Distribution Unit

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

April 2025

DC-SVX001A-EN

Introduction

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING — Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION — Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE — Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

Cancer and Reproductive Harm!

This product can expose you to chemicals including lead and bisphenol A (BPA), which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

⚠ WARNING

Electrical hazard!

Failure to follow instructions below could result in death or serious injury.

The TCDU must be disconnected from the power supply via a power switch. An emergency switch is also available to quickly interrupt the power connection.

⚠ WARNING

Rotating Components!

Failure to follow instructions below could result in death or serious injury.

Keep hands, clothing, and jewelry away from moving parts. Check the equipment for foreign objects before closing the doors and starting the equipment.

NOTICE

Pipe Damage!

Failure to follow instructions below could result in equipment damage.
External water piping must have adequate freeze protection and must be correctly applied based on local climatic conditions and best practices.

Copyright

Trademarks

Table of Contents

Model Number Description

Digit 1, 2, 3, 4 — Unit Model Number

TCDU = Trane Coolant Distribution Unit

Digit 5, 6, 7— Unit Capacity (MW)

010 = 1 MW

Digit 8 — Piping Orientation

B = Bottom piping
T = Top piping

Digit 9 — Valve Type

2 = Two-way valve with ePICV

3 = Three-way valve

Digit 10 — Telemetry

M = Modbus
R = Restful API
S = SNMP

Digit 11 — Shipping Crate

D = Domestic (within the United States)
I = International (outside the United States)

Digit 12 — Strainer size

A = 25 micron

Overview

The Trane Coolant Distribution Unit (TCDU)is a Coolant Distribution Unit optimized for direct-to-chip cooling applications in data centers. Intended to cater to the latest AI chips and servers, it features a compact design, efficient operation, and up to 1350 kW of cooling capacity, achieved through dual variable-speed drive (VSD) pumps and a high efficiency heat exchanger. The unit also consists of intelligent operations with remote firmware upgrade options and multiple redundancies for reliability. Additionally, it is equipped with advanced water filtration, improved flow rates, and connectivity options including RESTful API and MODBUS TCP/IP.

Industry-leading specifications developed by directly interfacing with many of the largest data center and chip manufacturing companies in the world.

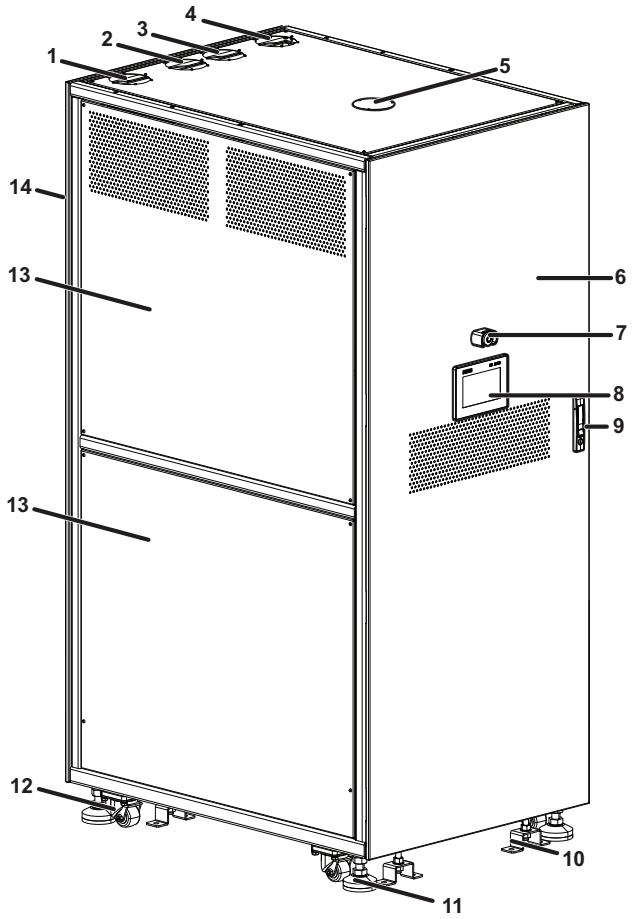
- Specifically for universal direct-to-chip applications
- Up to 1350 kW of cooling capacity
- Narrow approach temperature
- 900 mm standard IT cabinet
- High cooling capacity
- N+1 redundancy
- Intelligent operation and controls

The TCDU rejects heat of IT equipment as a direct-to-chip liquid cooling system. The TCDU is fed from a primary side, the facility water system (FWS), while the pumps inside the TCDU drive the secondary side, the technology cooling system (TCS). The TCDU also has a plated heat exchanger to exchange heat between the FWS and TCS.

System Overview

External Components

Figure 1. External components



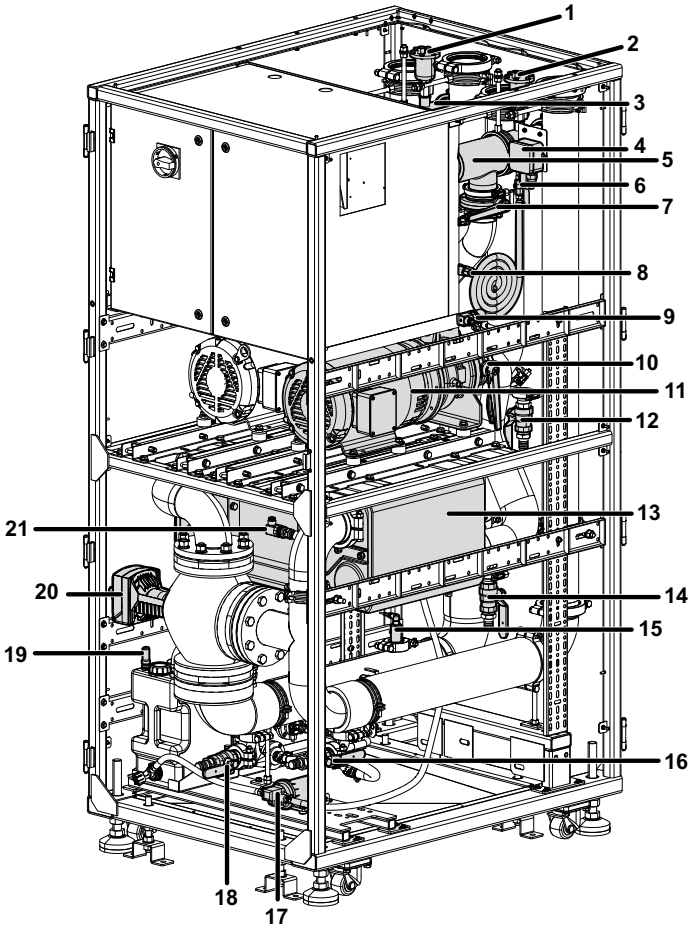
Note: *Top piping shown.*

Table 1. Component descriptions

Item	Description	Item	Description
1	Technology cooling system (TCS) return	8	HMI display
2	Facility water system (FWS) return	9	Door lock/handle
3	TCS supply	10	Anchor bolt brackets
4	FWS supply	11	Leveling feet
5	Top electrical entrance	12	Casters
6	Front door	13	Side panel
7	Emergency stop push-button	14	Rear door

Internal Components — 3–way Valve Option

Figure 2. Front right-side view

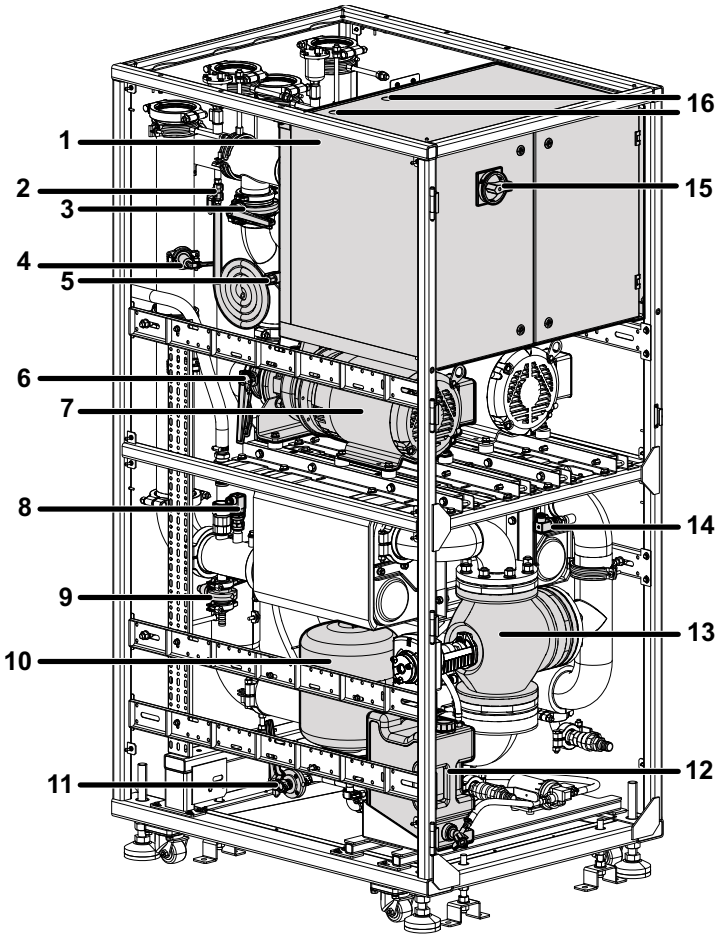


Note: *Top piping shown.*

Table 2. Component descriptions

Item	Description	Item	Description
1	TCS vent valve 1	12	TCS supply drain valve
2	TCS vent valve 2	13	Brazed plate heat exchanger
3	TCS supply filter 1	14	TCS return drain valve
4	Ambient humidity and temperature sensor	15	FWS return flow sensor
5	TCS supply filter 2	16	FWS supply drain valve
6	TCS supply drain ball valve 2	17	Refill pump
7	TCS pump 2 isolation valve	18	FWS return drain valve
8	TCS pump 2 pressure sensor	19	Reservoir air breather
9	TCS supply temperature sensor	20	3-way valve actuator
10	TCS pump 2 isolation valve	21	FWS supply temperature sensor
11	TCS pump 2		

Figure 3. Front left-side view

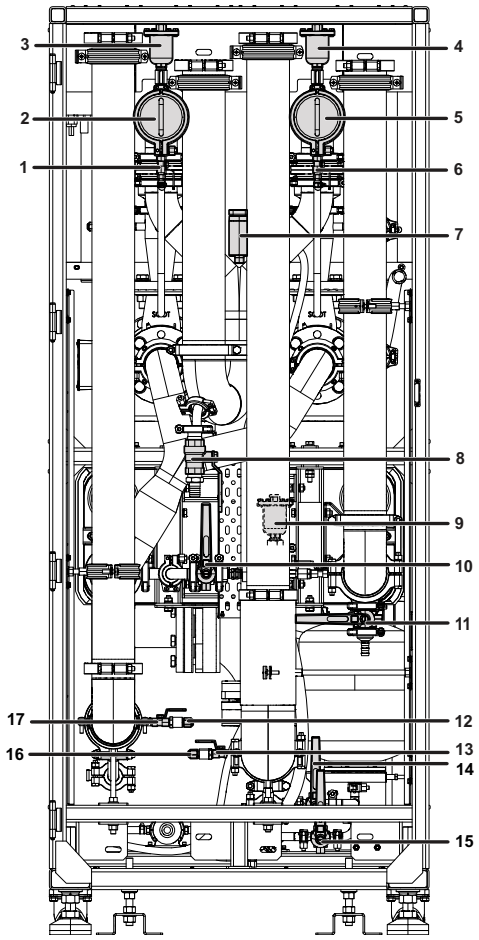


Note: *Top piping shown.*

Table 3. Component descriptions

Item	Description	Item	Description
1	Electrical panel	9	TCS return drain valve
2	TCS supply drain ball valve 1	10	Expansion tank
3	TCS supply pump 1 isolation valve	11	Expansion tank isolation valve
4	TCS return flow sensor	12	TCS coolant reservoir
5	TCS pump 1 pressure sensor	13	3-way valve
6	TCS pump 1 isolation valve	14	FWS supply temperature sensor
7	TCS pump 1	15	Power on/off switch
8	TCS return temperature sensor	16	Electrical cable inlets

Figure 4. Rear view — top piping

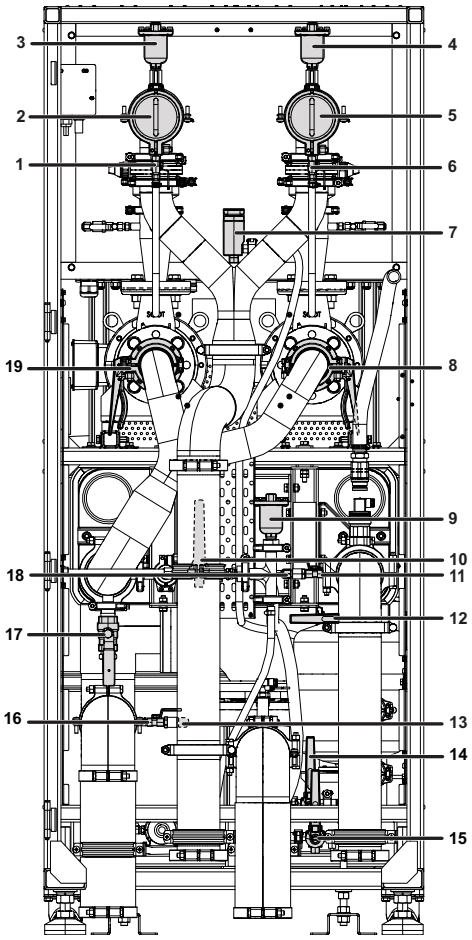


Note: *Top piping shown.*

Table 4. Component descriptions

Item	Description	Item	Description
1	Ball valve	10	TCS refill pump isolation valve
2	TCS supply filter	11	TCS return drain valve
3	TCS supply vent valve	12	FWS supply pressure sensor
4	TCS supply vent valve	13	FWS return pressure sensor isolation valve
5	TCS supply filter	14	Expansion tank drain valve
6	Ball valve	15	Expansion tank isolation valve
7	TCS pressure relief valve	16	FWS return pressure sensor
8	TCS supply drain valve	17	FWS supply pressure sensor isolation valve
9	TCS supply vent valve		

Figure 5. Rear view — bottom piping



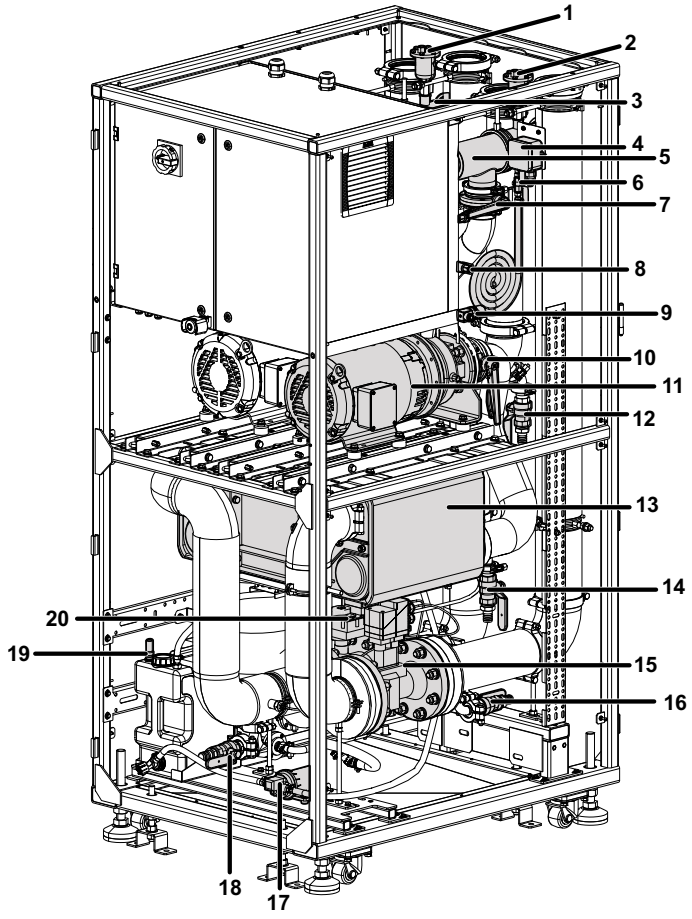
Note: *Top piping shown.*

Table 5. Component descriptions

Item	Description	Item	Description
1	TCS supply strainer drain valve	11	TCS return pressure sensor isolation valve
2	TCS supply filter	12	TCS return drain valve
3	TCS supply vent valve	13	FWS supply pressure sensor
4	TCS supply vent valve	14	Expansion tank drain valve
5	TCS supply filter	15	Expansion tank isolation valve
6	TCS supply strainer drain valve	16	FWS supply pressure sensor isolation valve
7	TCS pressure relief valve	17	TCS return drain valve
8	TCS pump 1 isolation valve	18	TCS return pressure sensor
9	TCS supply vent valve	19	TCS pump 2 isolation valve
10	TCS refill pump isolation valve		

Internal Components — 2–way PICV Option

Figure 6. Front right-side view

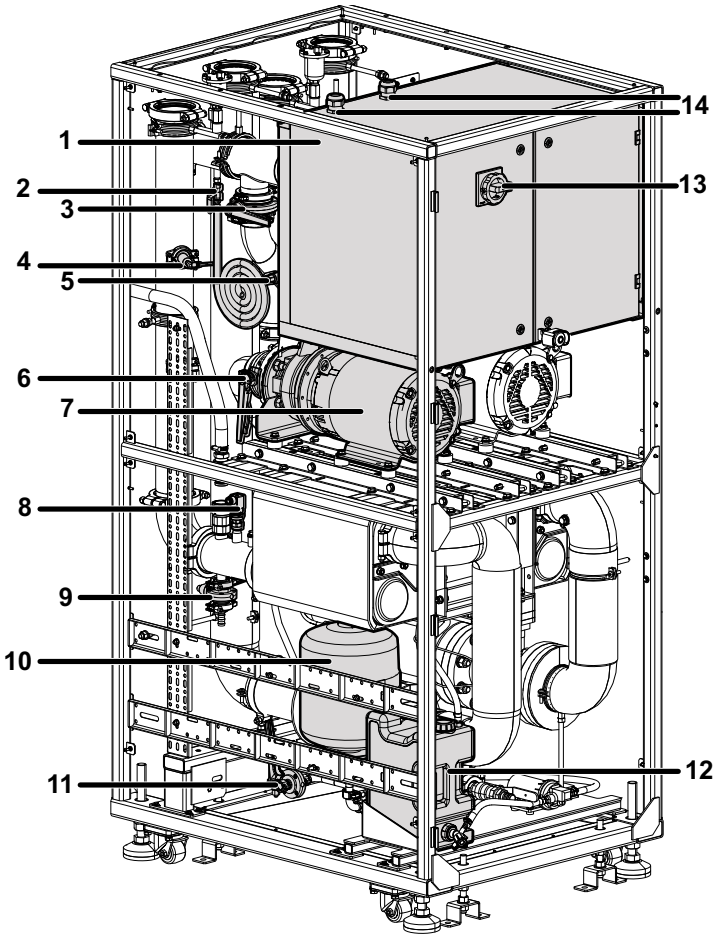


Note: *Top piping shown.*

Table 6. Component descriptions

Item	Description	Item	Description
1	TCS vent valve 1	11	TCS pump 2
2	TCS vent valve 2	12	TCS supply drain valve
3	TCS supply filter 1	13	Brazed plate heat exchanger
4	Ambient humidity and temperature sensor	14	TCS return drain valve
5	TCS supply filter 2	15	FWS 2-way PICV flow sensor and sensor terminal
6	TCS supply drain ball valve 2	16	FWS supply drain valve
7	TCS pump 2 isolation valve	17	Refill pump
8	TCS pump 2 pressure sensor	18	FWS return drain valve
9	TCS supply temperature sensor	19	Reservoir air breather
10	TCS pump 2 isolation valve	20	FWS 2-way PICV valve and controller

Figure 7. Front left-side view

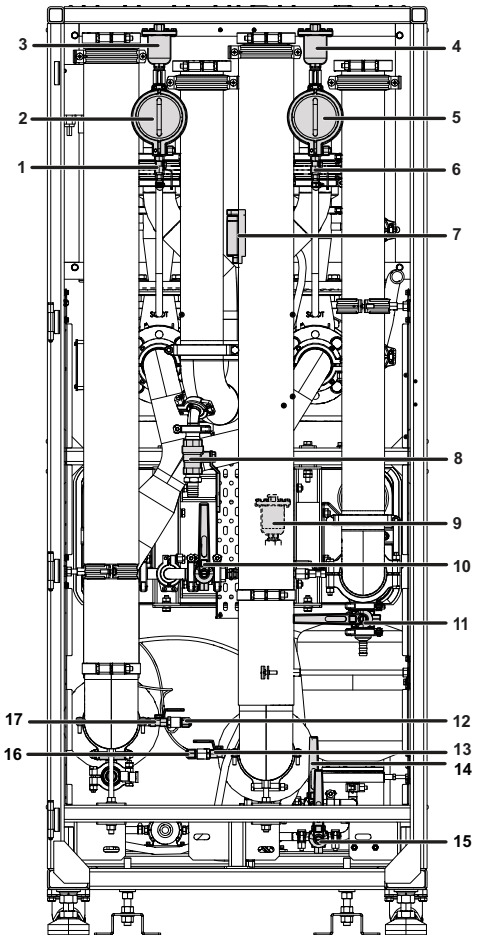


Note: *Top piping shown.*

Table 7. Component descriptions

Item	Description	Item	Description
1	Electrical panel	8	TCS return temperature sensor
2	TCS supply drain ball valve 1	9	TCS return drain valve
3	TCS supply pump 1 isolation valve	10	Expansion tank
4	TCS return flow sensor	11	Expansion tank isolation valve
5	TCS pump 1 pressure sensor	12	TCS coolant reservoir
6	TCS pump 1 isolation valve	13	Power on/off switch
7	TCS pump 1	14	Electrical cable inlets

Figure 8. Rear view — top piping

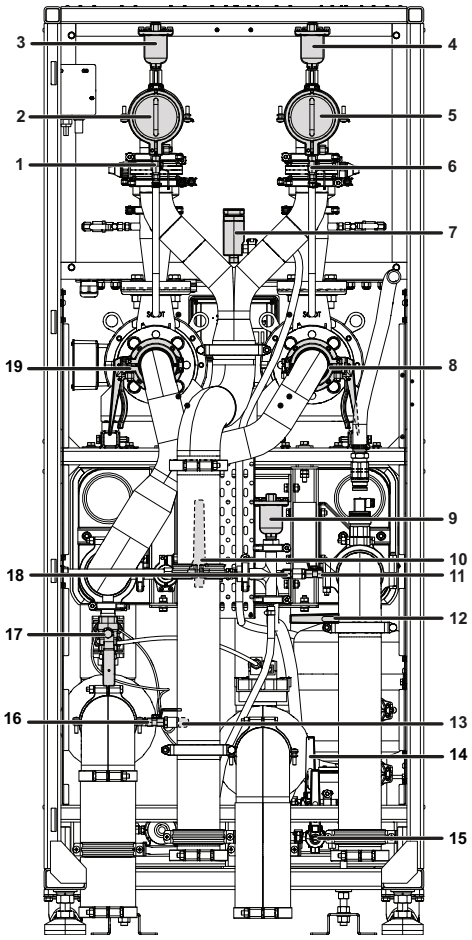


Note: *Top piping shown.*

Table 8. Component descriptions

Item	Description	Item	Description
1	Ball valve	10	TCS refill pump isolation valve
2	TCS supply filter	11	TCS return drain valve
3	TCS supply vent valve	12	FWS supply pressure sensor
4	TCS supply vent valve	13	FWS return pressure sensor isolation valve
5	TCS supply filter	14	Expansion tank drain valve
6	Ball valve	15	Expansion tank isolation valve
7	TCS pressure relief valve	16	FWS return pressure sensor
8	TCS supply drain valve	17	FWS supply pressure sensor isolation valve
9	TCS supply vent valve		

Figure 9. Rear view — bottom piping



Note: *Top piping shown.*

Table 9. Component descriptions

Item	Description	Item	Description
1	TCS supply strainer drain valve	11	TCS return pressure sensor isolation valve
2	TCS supply filter	12	TCS return drain valve
3	TCS supply vent valve	13	FWS supply pressure sensor
4	TCS supply vent valve	14	Expansion tank drain valve
5	TCS supply filter	15	Expansion tank isolation valve
6	TCS supply strainer drain valve	16	FWS supply pressure sensor isolation valve
7	TCS pressure relief valve	17	TCS return drain valve
8	TCS pump 1 isolation valve	18	TCS return pressure sensor
9	TCS supply vent valve	19	TCS pump 2 isolation valve
10	TCS refill pump isolation valve		

Pre-Installation

Inspection

Check carefully for shipping damage. If any damage is found, report it immediately, and file a claim against the transportation company.

Transporting the Packaged Equipment

Use a fork lift rated for the weight of the packaged equipment, 2204 lb (1000 kg), to transport the TCDU to the installation location. The maximum tip angle while transporting the unit is 20 degrees.

Unpacking the Equipment

⚠ CAUTION

Heavy Object!

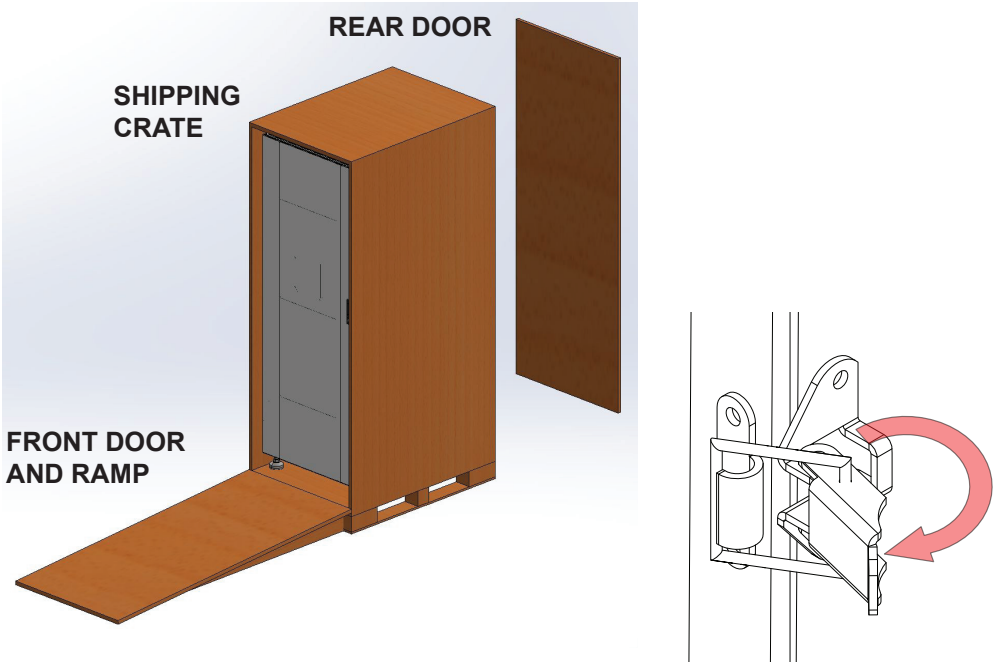
Failure to follow instructions below could result in severe injury and equipment damage. Two people are required to unpack and move the TCDU.

Required Tools

- Socket wrench with 24-mm (M16) socket
- 32-mm (M24) open-ended wrench

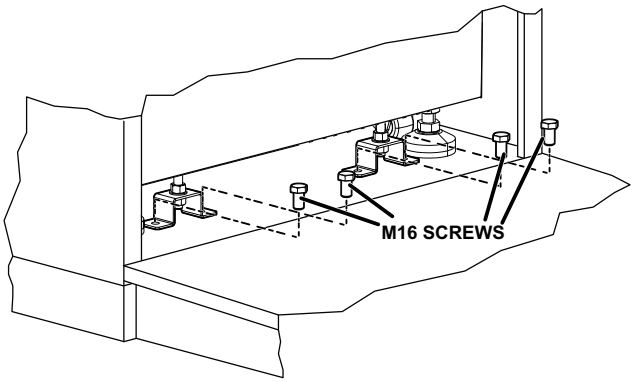
Unpacking Instructions

Figure 10. Shipping crate



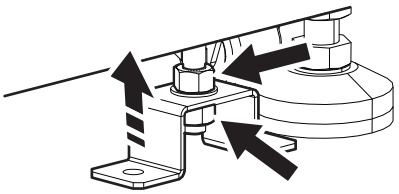
1. Open the butterfly locks securing the ramp in place and lower the ramp to the floor.
2. Open the butterfly locks securing the rear panel and remove the rear panel.
3. Remove the packing foam from around the equipment.
4. Use a 24-mm (M16) socket wrench to remove the four (4) M16 screws securing the front and rear anchor bolt brackets to the crate.

Figure 11. M16 screws



5. Use a 24-mm (M16) open-ended wrench to loosen the hex nuts and raise the anchor brackets so they do not interfere with movement of the unit. Re-tighten the hex nuts to secure the brackets in place.

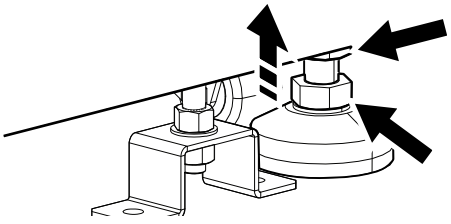
Figure 12. Hex nuts



6. Use a 32-mm (M24) open-ended wrench to lift each leveling foot high enough so the unit can be rolled out of the shipping crate.

Note: *Do not allow the unit to roll out of the crate unassisted if the floor is not level.*

Figure 13. Lift each leveling foot



7. Use two people to roll the TCDU down the ramp to the floor.

Moving the Unpacked Equipment

The TCDU can be moved short distances to its installation location via casters on the bottom of the unit.

Site Considerations and Preparation

Room Preparation:

- Confirm the TCDU installation location has level flooring and the flooring can support the weight of the unit.
- Confirm the installation location is free from vibration and will not transfer vibration.
- Confirm the site has adequate ventilation.

- Confirm that there will be sufficient clearance on the front and rear sides of the unit for operation and maintenance: a minimum of 35.4 in. (900 mm).
- Installation location is in a location with restricted access.
- Confirm the site is prepared in accordance with the site design.
- If bottom piping is being installed, make sure there is sufficient clearance beneath the floor for the piping (at least 20 in. [500 mm]).

Specifications

Weights and Dimensions

Table 10. Weights and dimensions

Specifications	Data
Equipment Width	35.4 in. (900 mm)
Equipment Depth	48.9 in. (1242 mm)
Equipment Height	86.6 in. (2200 mm)
Shipping Width	39.4 in. (1000 mm)
Shipping Depth	55.1 in. (1400 mm)
Shipping Height	96.5 in. (2450 mm)
Dry Weight	1984 lb (900 kg)
Operating Weight	2425 lb (1100 kg)
Shipping Weight	2204 lb (1000 kg)

Electrical Specifications

Table 11. Electrical specifications

Specifications	Data
Input Voltage Rating	380–480VAC, 3-Phase, 3P+E
Input Frequency	50/60 Hz
System FLA[(a)]	47 A
System Current Rating	63A

[(a)] Full load amps

Piping Specifications

Table 12. Piping specifications

Specifications	Data
FWS Facility-Side Connection	4-in. / DN100 Tri-Clamp
TCS Facility-Side Connection	4-in. / DN100 Tri-Clamp

Sound Specifications

Table 13. Sound specifications

Specifications	Data
Noise (Sound power level at 3 m)	65 dBA

Installation

Components

Bottom piping: two piping sections (Only for bottom piping configurations).

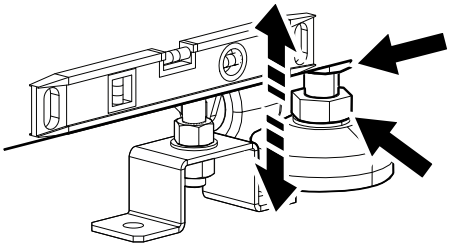
Required Tools

- Socket wrench with a 16-mm socket
- 24-mm (M16) open-ended wrench
- 17-mm (M10) open-ended wrench
- Hex wrench set
- Anti-seize lubricant

Stabilizing the TCDU

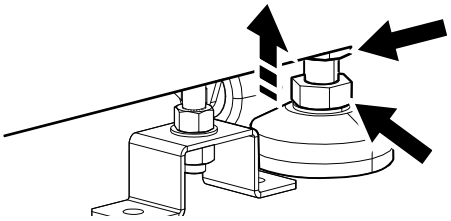
1. Adjust the feet of the TCDU until the unit is level and stable.

Figure 14. Level TCDU



2. The unit may be secured to the floor, if required, with bolts suitable for the floor and the provided anchor bolt mounting brackets: two on the front and two on the rear.

Figure 15. Secure to floor

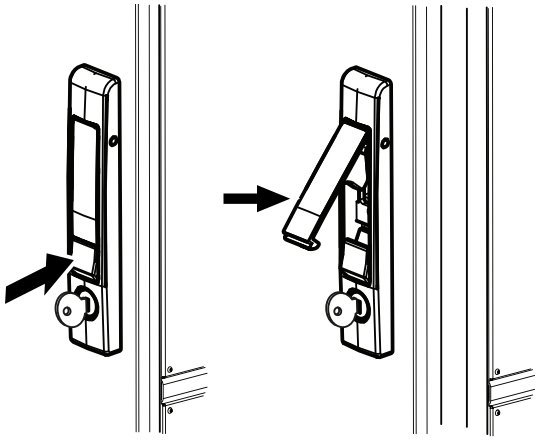


Opening the Front and Rear Doors

Note: *The keys for the front and rear doors are supplied in a bag tied to the inside of the front door.*

1. Use the provided key to unlock the door.
2. Press in the button located at the bottom of the door. The latch will extend from the handle and the door will open.

Figure 16. Unlock door



Piping Installation

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear PPE and follow proper handling guidelines could result in death or serious injury.

Always wear appropriate personal protective equipment in accordance with applicable regulations and/or standards to guard against potential electrical shock and flash hazards.

⚠ WARNING

Safety Hazard!

Failure to follow instructions below could result in death or serious injury.

Installation and servicing of this equipment should only be performed by qualified and trained personnel who have been specially trained in the installation of air conditioning equipment.

Confirm proper installation of piping, leak checking, fluid chemistry, and fluid maintenance.

NOTICE

Pipe Damage!

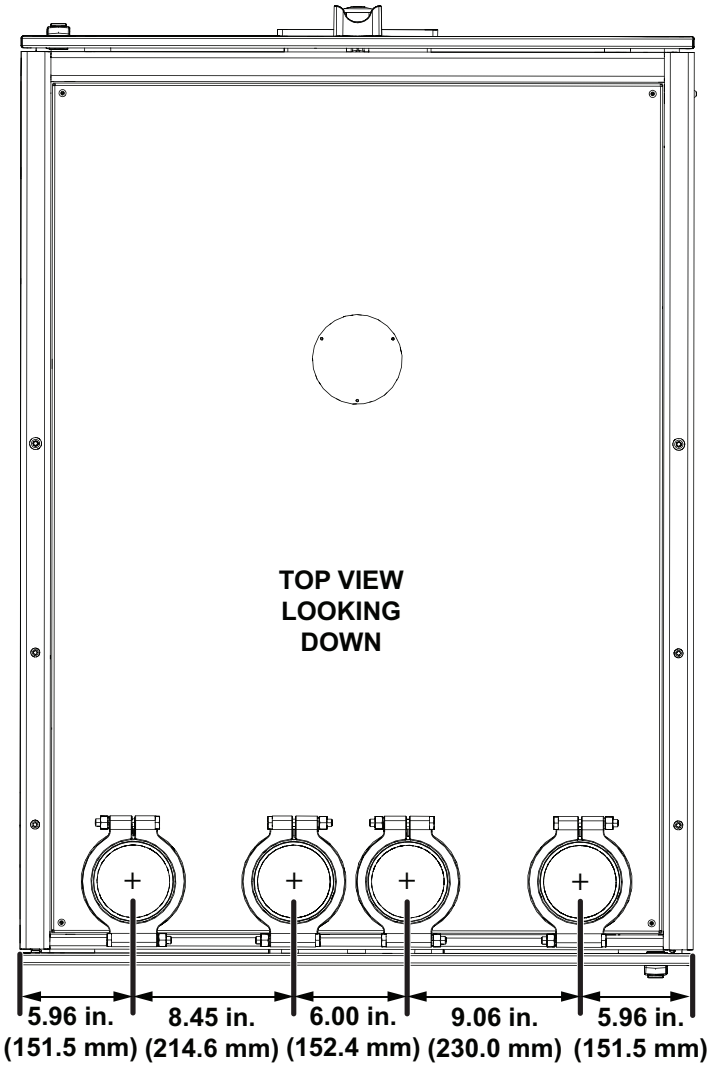
Failure to follow instructions below could result in equipment damage.

External water piping must have adequate freeze protection and must be correctly applied based on local climatic conditions and best practices.

There are two connection options available: the installation configuration should have been specified during ordering of the TCDU.

Top Piping Connections

Figure 17. Top piping access dimensions



Bottom Piping Connections

Figure 18. Bottom piping connections

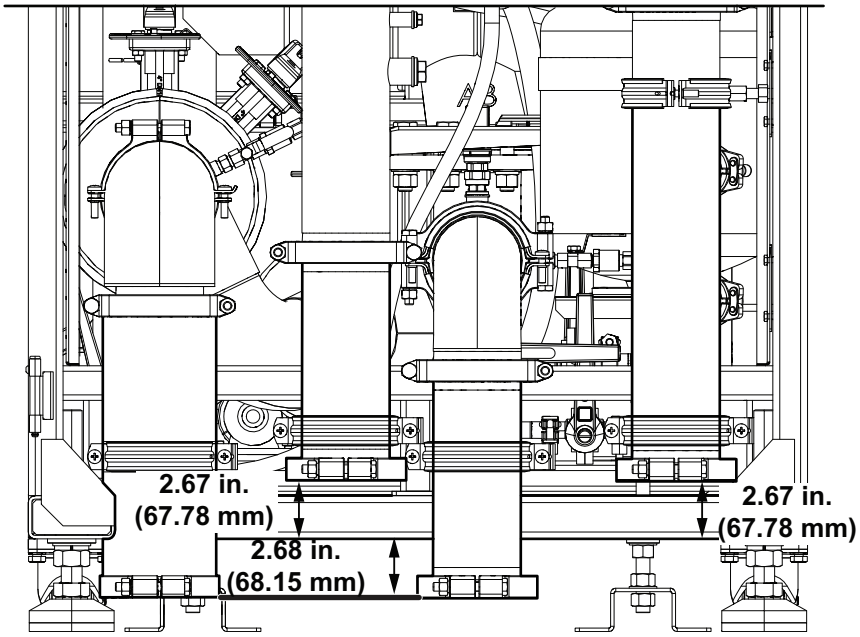
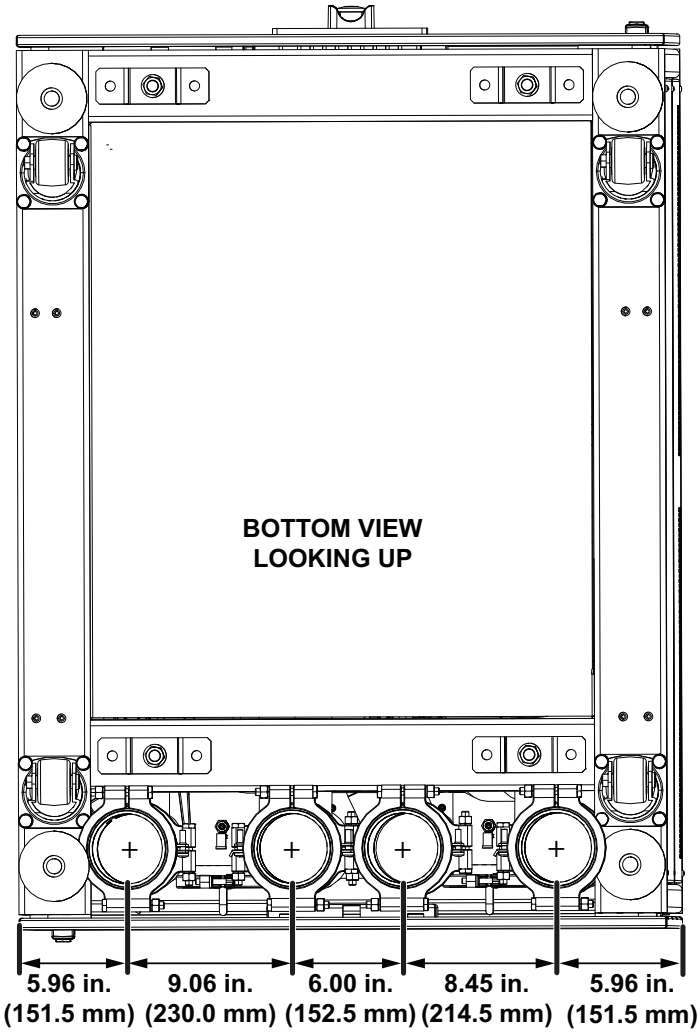


Figure 19. Bottom piping access dimensions



Circuit Specifications

Table 14. Circuit specifications

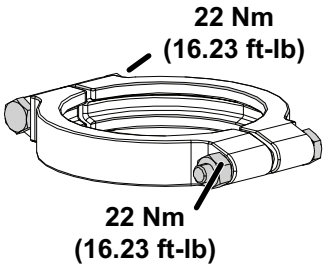
Specifications	
Facility Water System (FWS)	4-inch DN100 Tri-clamp connection
FWS Circuit Fluid Volume	31.4 gal (119 L)
Technology Cooling System (TCS)	4-inc DN100 Tri-clamp connection
TCS Circuit Fluid Volume	20.9 gal (79 L)

FWS Water Circuit Piping Connection

Installation procedure:

1. Remove and store the covers that protect the tri-clamp connections. Internal piping is already installed.
2. For external piping, install the provided seal and tri-clamp connection and tighten the lock nut with a torque wrench. The bolt size is M10.
3. Apply anti-seize lubricant to the threads then tighten the clamps to 22 Nm (16.23 ft-lb) of torque.

Figure 20. Tighten clamps

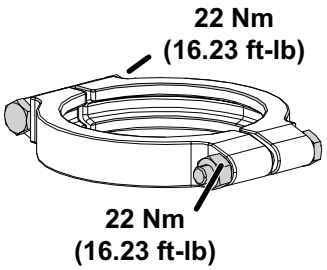


TCS Water Circuit Piping Connection

Installation procedure:

1. Remove and store the covers that protect the tri-clamp connections. Internal piping is already installed.
2. For external piping, install the provided seal and tri-clamp connection and tighten the lock nut with a torque wrench. The bolt size is M10.
3. Apply anti-seize lubricant to the threads then tighten the clamps to 22 Nm (16.23 ft-lb) of torque.

Figure 21. Tighten clamps



Electrical and Communication Connection

⚠ WARNING

Conform to All Applicable National, State, and Local Electrical Codes!

Failure to follow all applicable codes could result in an arc flash event, electrocution, explosion, or fire, which could result in death or serious injury.

Users MUST conform to all applicable national, state, and local electrical codes during the electrical installation and servicing of this product.

⚠ WARNING

Electrical Shock, Fire, or Explosion Hazard!

Failure to follow instructions below could result in serious injury, death, or property damage.

- **Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.**
- **This equipment must be installed and serviced by qualified personnel only.**
- **Turn off all power supplying this equipment before working on or inside the equipment.**
- **Replace all devices, doors, and covers before turning on power to this equipment.**
- **Always use a properly rated voltage sensing device to confirm power is off.**

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

Circuit Breaker

If the TCDU will be supplied with electricity from the consumer; the respective manufacturer specifications must be observed.

Table 15. Circuit breaker specifications

Fuse Protection Provided By the Customer	Circuit Breaker Nominal Current (In)
10 / 16 / 20 / 25	25
35	40
50 / 63	63
80	80
100 / 125	125
150	150

Electrical Connections

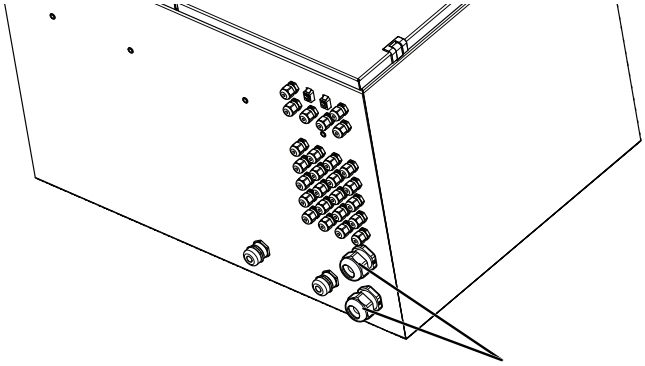
The electrical panel is capable of top power connections or bottom power connections. The default connection is a top power connection. The top of the electrical panel has two (2) PG29 cable glands installed by default while the bottom of the electrical panel has two (2) end caps installed.

The PG29 cable glands allow for installation of 3P+E wiring with wire sizes ranging from 16 to 25 mm2.

Top Power Connection

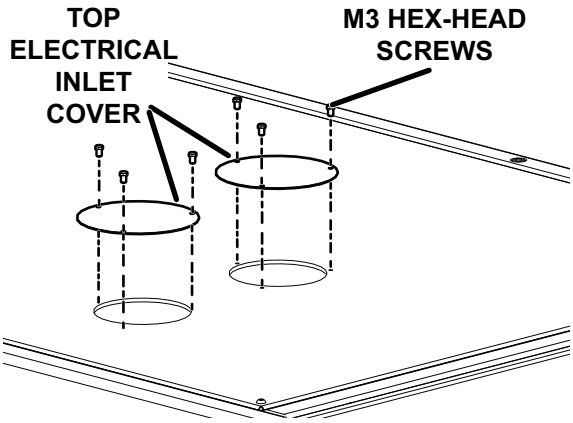
1. Cable glands installed on the underside of the electrical panel by default. For a top power connection, these cable glands need to be relocated to the top connection locations.

Figure 22. Cable glands (default position)



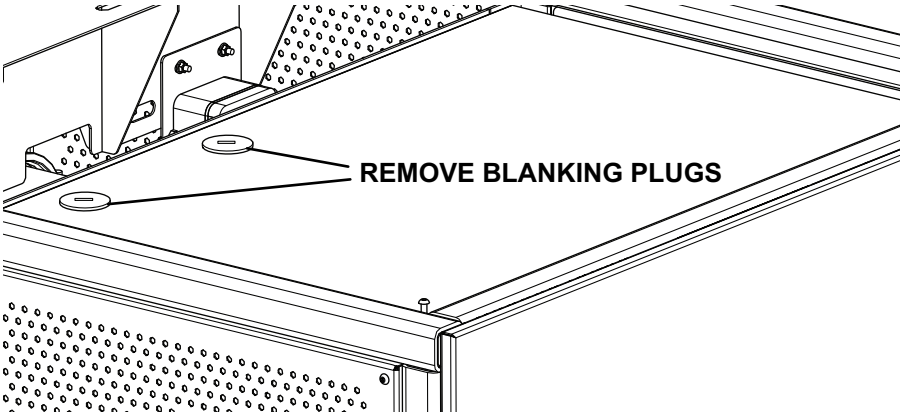
2. For top power connections, remove the M3 screws securing the top electrical cover on top of the TCDU.

Figure 23. Remove screws



3. The top of the electrical panel has two holes with two blanking plugs used to install two PG29 cable glands. Remove the blanking plugs on top of the electrical panel, and remove the cable glands located at the bottom of the electrical panel.

Figure 24. Remove blanking plugs



4. Install the cable glands in place of the blanking plugs on top of the electrical panel, and install the blanking plugs on the bottom where the cable glands were located. Alternatively, two PG29 conduit fittings (Field Supplied) could be used instead of the cable glands.

Figure 25. Install cable glands

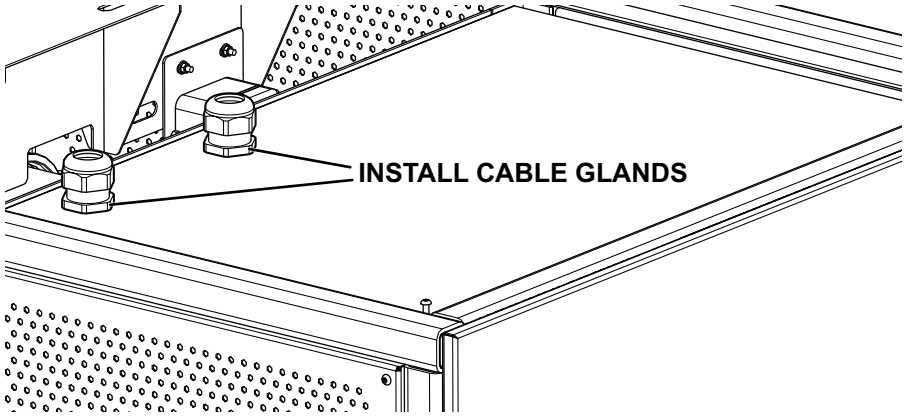
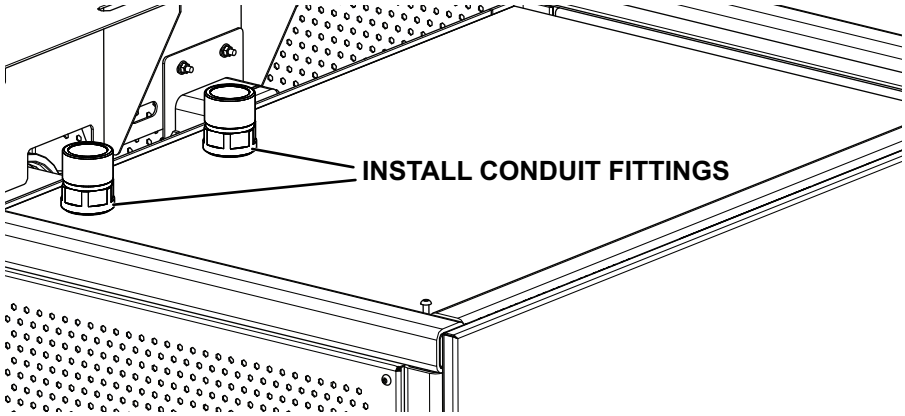


Figure 26. Install conduit fittings



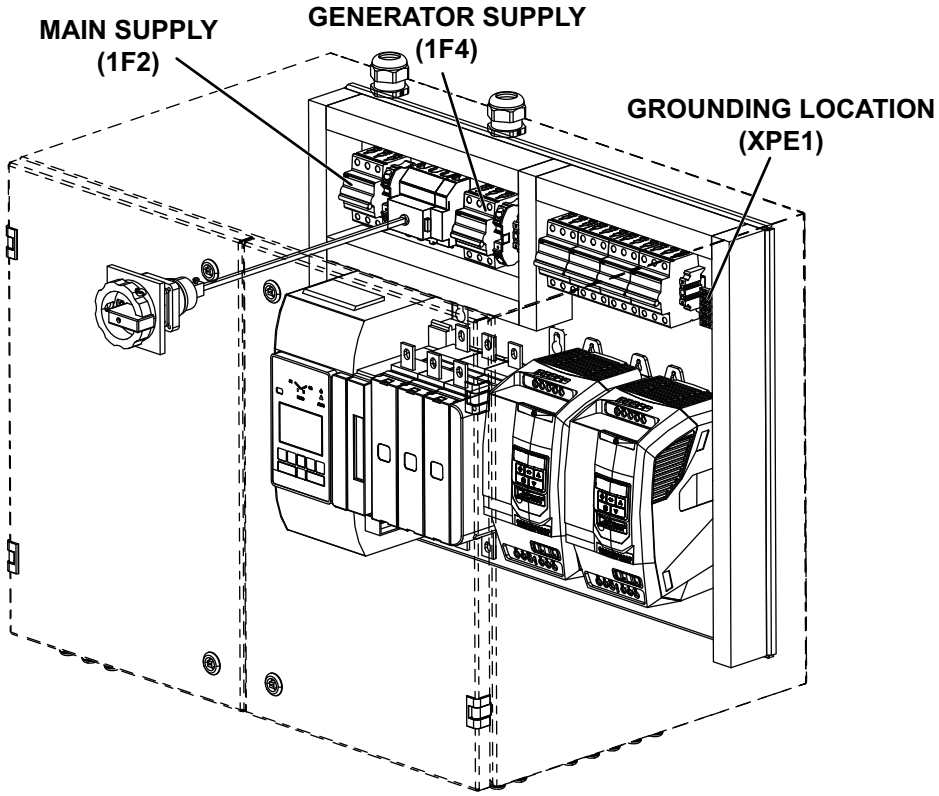
5. Insert the power cable through the cable gland located on top of the TCDU. Tighten the cable glands.
6. Carefully guide the cable into the electrical panel.

Note: *ETL versions and CE versions of the electrical panel contain different components, so not all components are shown below.*

7. If there are two power feeds, the main supply should connect to 1F2 while the generator supply should connect to 1F4. If there is only single power feed, the main supply should connect to 1F2.

ETL Version Power Connection (Top Connection)

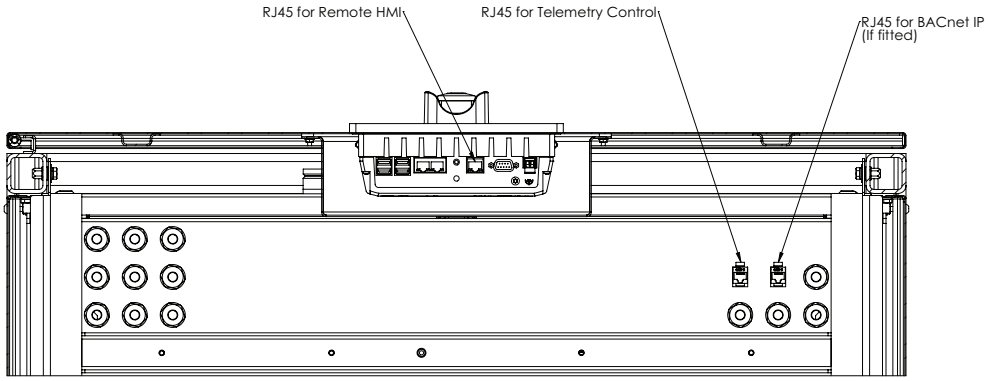
Figure 27. ETL version power connection (top connection)



Network and Communication Connections

Network and communication connections are available as shown below.

Figure 28. Network and communication connections

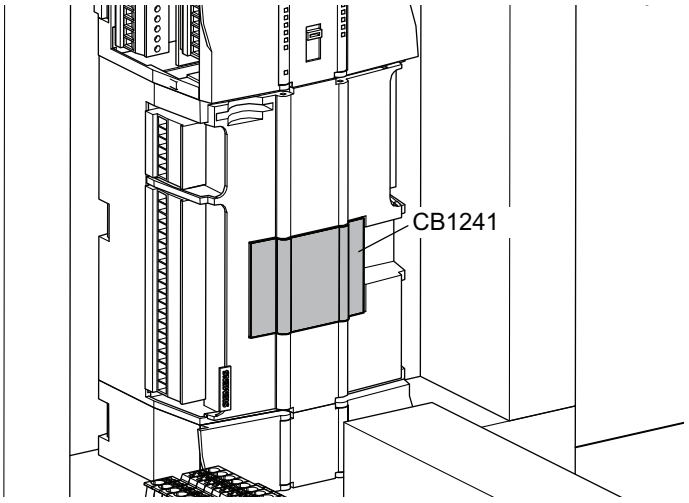


Note: *Bottom view looking up*

RS485 Connection for Group Control

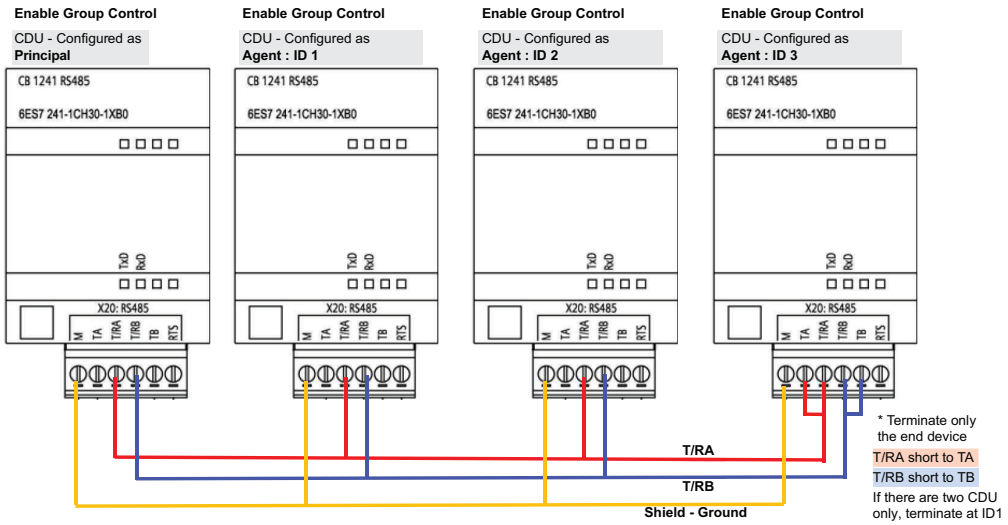
The RS485 connection needs to be made between the Principal TCDU and Agent TCDUs in a daisy-chain connection. The connection should be made to the CB 1241 module of the PLC on the left side of the electrical panel.

Figure 29. CB1241 module



The last module at the end of the daisy-chain connection should enable termination by shorting T/RA to TA and T/ RB to TB. A shield and twisted pair cable like Belden 3105A should be used.

Figure 30. TCF pump control-group controls as agents



Filling the Cooling Circuits

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

Confirm correct concentration of anti-corrosion or antifreeze agents in the system circuit to avoid component damage (for example, to the seals). Low concentration may lead to corrosion. When using anti-corrosion or antifreeze agents, comply with the information provided by the manufacturer concerning the area of application, compatibility with other materials, and minimum/maximum mixing ratios.

To protect the components against corrosion and frost damage, the TCDU water circuits must be filled with an anti-corrosion and anti-freezing agent. Contaminants in the circuits, pump faults, and air remaining in the closed system due to non-complete purging could cause frost damage. A biocide is also required to protect the piping from biological issues.

Note: *Antifreeze may not be necessary depending on geographical location.*

If ethylene glycol / propylene glycol is used as the anti-corrosion and anti-freeze agent, please observe the following points:

- Do not mix anti-corrosion and antifreeze agents of different manufacturers. Document the name and type of the anti-corrosion and antifreeze agent that is used.
- For filling the system circuit with anti-corrosion and antifreeze agents, it is recommended to pre-mix the formula in advance in a separate tank (refer to Product Specification for information concerning the quantities).
- Comply with the concentration that is specified in the information provided by the anti-corrosion and antifreeze agent manufacturer.

Note: *Comply with the information given on the manufacturer Safety Data Sheet (SDS).*

Excessive use of antifreeze and corrosion inhibitors places a burden on the environment.

- Use environmentally friendly anti-freeze and corrosion inhibitors.
- Do not spill antifreeze and anti-corrosion inhibitors into the soil, down drains, or into waterways.
- Keep containers tightly closed. Make sure to close empty containers and those that are currently being used after the work is finished.

- Used antifreeze and corrosion inhibitors must be disposed of in an environmentally responsible way and compliant with local and national regulations.

Figure 31. 3–way valve front

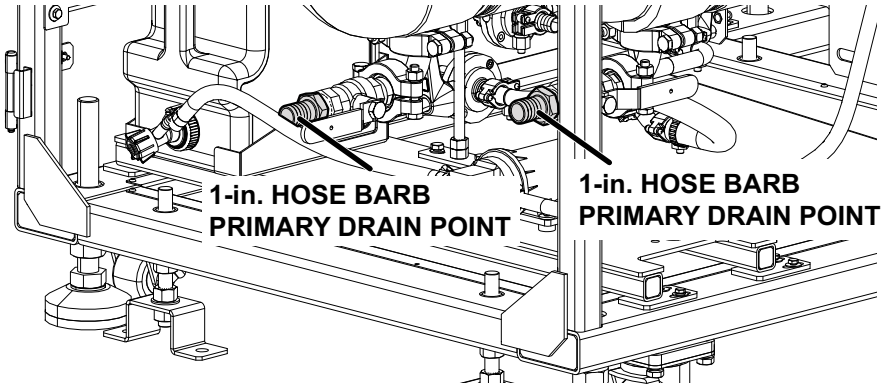
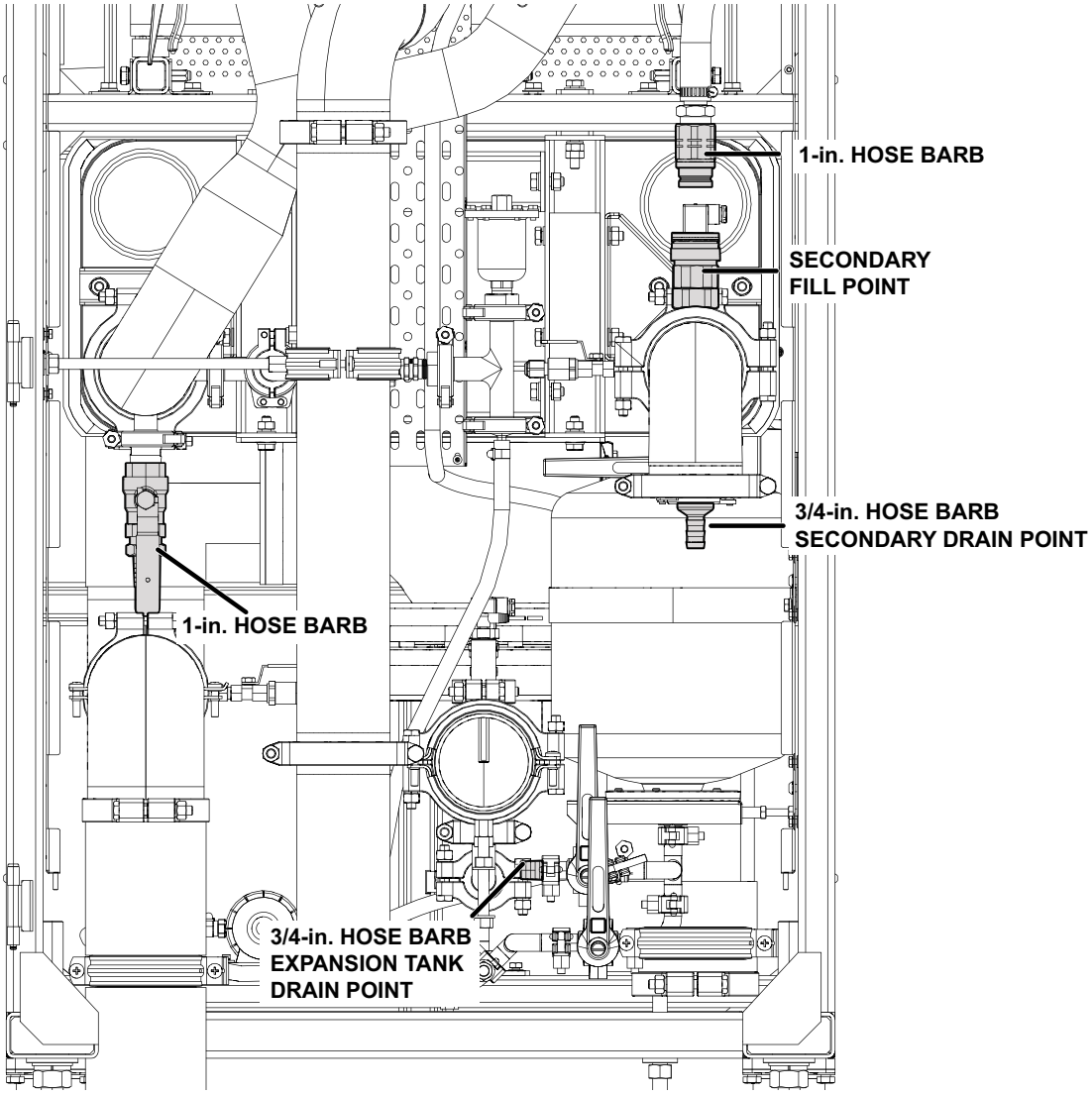


Figure 32. 3–way valve rear (bottom piping)



Note: *Some piping not shown for clarity.*

Figure 33. 2–way PICV front

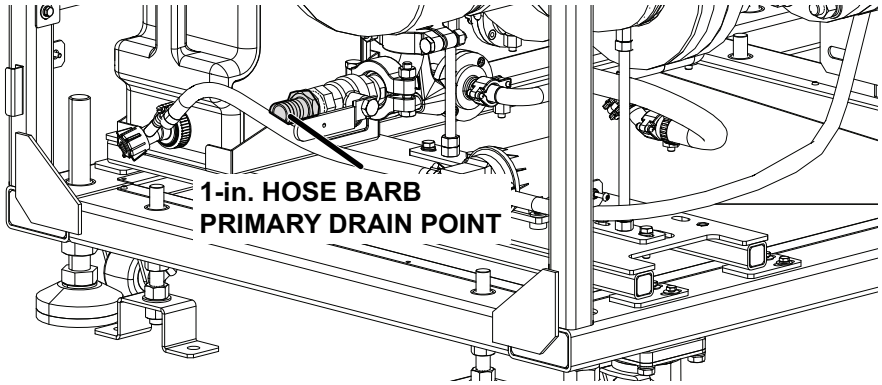
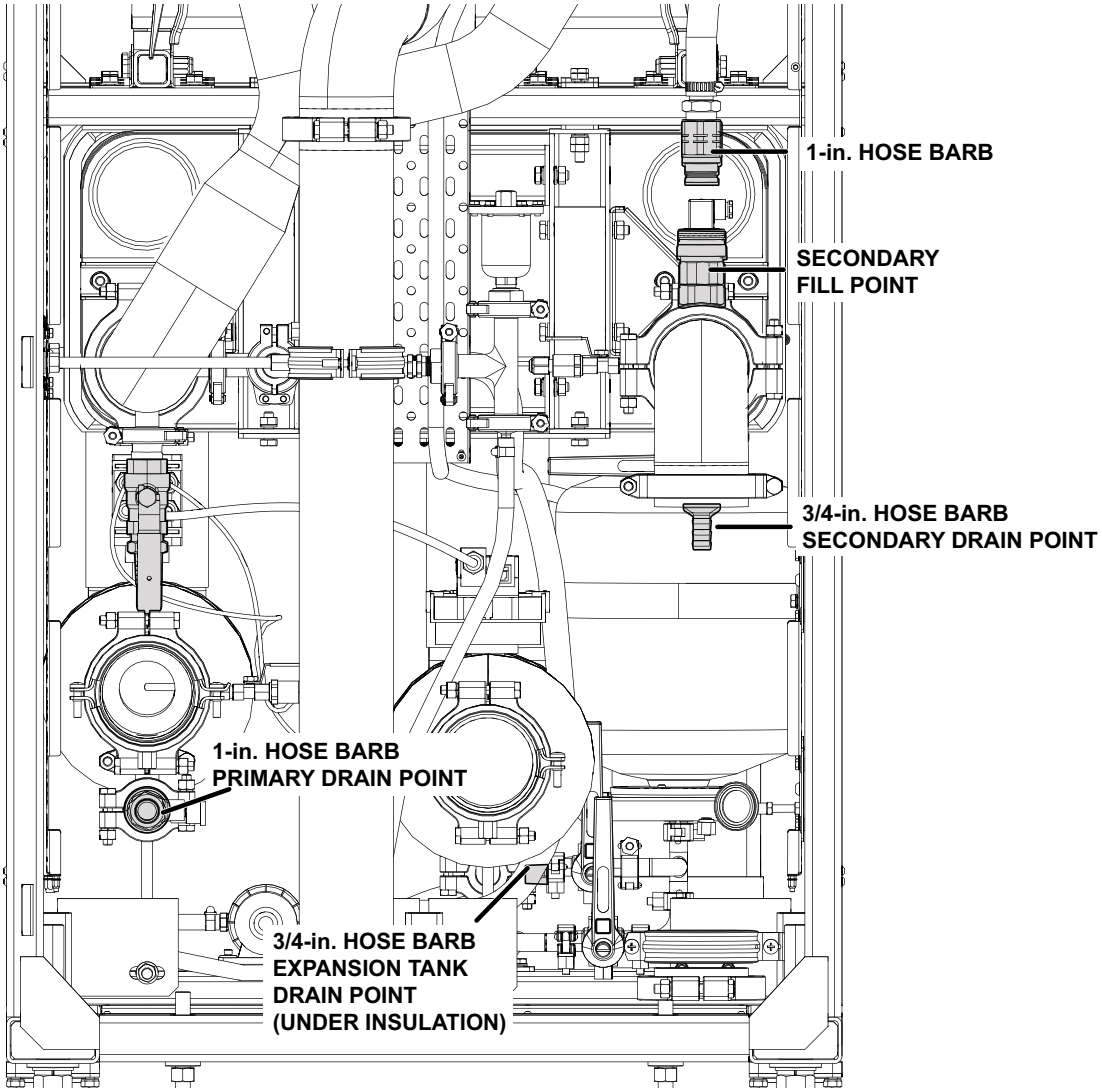


Figure 34. 2–way PICV rear (bottom piping)



Note: *Some piping not shown for clarity.*

Figure 35. 3–way valve / 2–way PICV rear (top piping, additional drain)

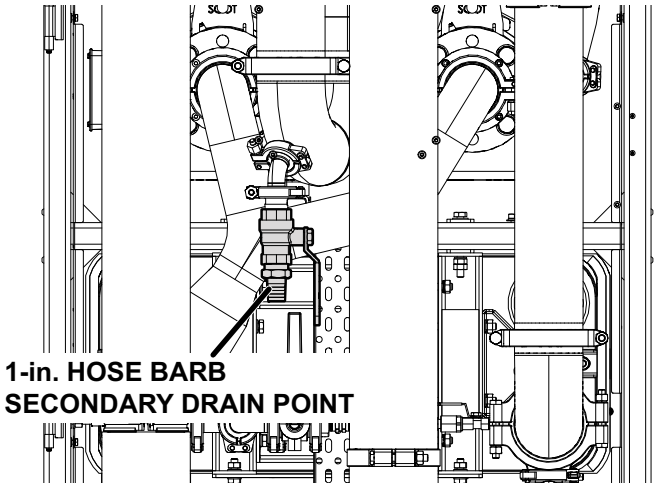
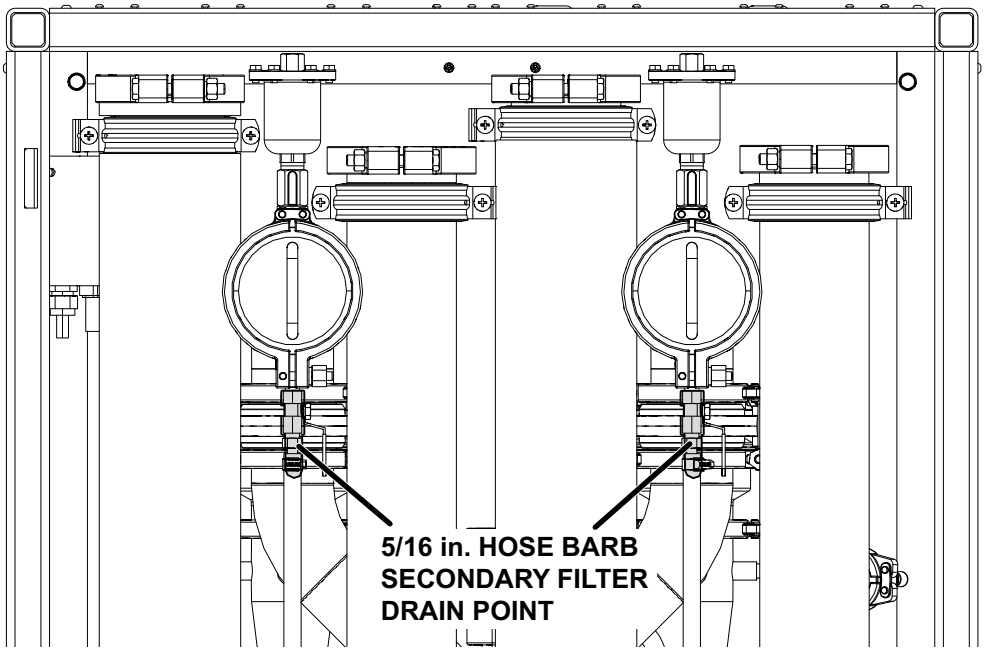


Figure 36. 3–way valve / 2–way PICV TCS strainer drain point



FWS Water Circuit

Water Specifications

Table 16. Water specifications

Contaminant	Allowed Level	
Water Quality	pH	7 – 9
Glycol	%	50 maximum
Sulphides	ppm	<10
Sulphates	ppm	<100
Chloride	ppm	<50
Colonies	CFU/ml	<1000

Table 16. Water specifications (continued)

Contaminant	Allowed Level	
Total Hardness CA CO3	ppm	<200
Residues after evaporation	ppm	<500
Turbidity	NTU	<20

FWS Circuit Filling Procedure

Fill the FWS water circuit with the selected medium per the Product Specification via the FWS supply connectors and the customer-provided medium supply system. Vent the system thoroughly during the filling process; this is performed on the customer side.

It is the installer's responsibility to make sure the FWS water is filtered to a level of at least 250 micron (60 mesh).

TCS Coolant Circuit

Coolant Specifications

Table 17. Coolant specifications

Contaminant	Allowed Level	
Water Quality	pH	8 – 9.5
Glycol	%	50 maximum
Sulphides	ppm	<1
Sulphates	ppm	<10
Chloride	ppm	<5
Colonies	CFU/ml	<100
Total Hardness CA CO3	ppm	0
Conductivity	µS/cm	0.2 – 20
Residues after evaporation	ppm	<500
Turbidity	NTU	<20

TCS Circuit Filling Procedure Using an External Pump

When charging the unit for the first time, fill the TCS circuit with fluid per the Product Specifications. Confirm that the following conditions are met during the filling process:

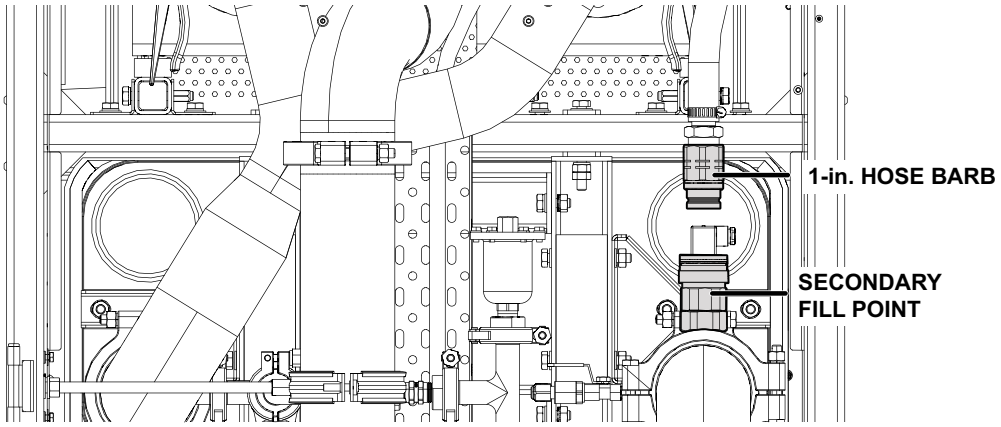
Notes: *This process uses an external fill pump.*

- *Use clean tools and personal protective clothing to protect against chemical splashes.*
- *Use clean auxiliary devices (e.g. pail, container).*

Perform the filling process as follows:

1. Open all shut-off valves or butterfly valves.
2. Open the vent valve manually to confirm proper venting of the system.
3. Connect an external fill pump on the suction side to a glycol or water/anti-corrosion agent mixture.
4. Connect the external fill pump discharge side to the male quick-connect of the TCS fill point.

Figure 37. Connect external fill pump



5. Connect the plug quick-connect to the receptacle quick-connect of the secondary fill point located on the TCS water circuit.
6. Power on the external fill pump until the necessary filling pressure is reached. For a startup test, a range of pressure from 1 barg to 2 barg is recommended.
7. Remove the plug quick-connect from the secondary fill point.
8. The system would still need to have sufficient venting but should do at commissioning. Initial system startup is performed by Trane service personnel or by the customer with commission manual.
9. Close the doors.

Pre-Startup Checklist

Purging Air from the Closed Circuits

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

Insufficient venting may damage the system. Air can remain trapped in the system and pumps may run dry if the highest venting point is not used. Install a vent valve at the highest point in the system.

Important: *For correct operation and operational reliability of the closed circuits, vent the entire system thoroughly during the start-up phase.*

Note: *Foam may form inside the system during start-up due to the additives (glycol, anti-corrosion agents, etc.). This foam has a tendency to entrap air bubbles in the circuit that subsequently cannot escape. This is why venting must be repeated for a certain period of time (if necessary for several days) depending on the specific on-site conditions.*

Pre-Start Checklist

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

- Confirm that the installed TCDU is suitable for site supply voltage.
- Confirm power is stable and per specifications mentioned in the product specifications for operation.
- Confirm the emergency stop button is released.
- Confirm the TCDU is filled with coolant.
- Confirm there are no system leaks.
- Confirm the status on the PLC is valid.
- Confirm the filter is not clogged and is in good condition.
- Confirm all panels, guards are installed.
- Confirm all safety devices are functioning properly.
- Confirm the area around the TCDU is free from tools, materials, or other pieces of equipment that had to be used.
- Confirm the workspace is clean and there are no spills or debris in the area.
- Confirm any require external peripheral alarms / sensors are correctly fitted.

Operation

Controller Overview

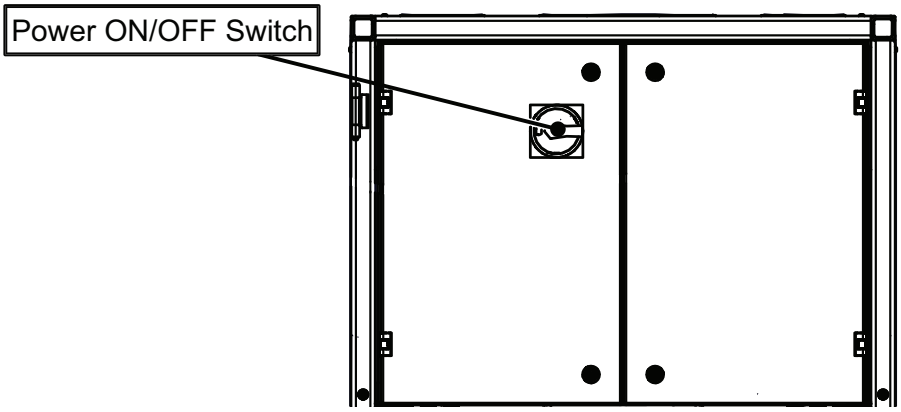
The Trane Coolant Distribution Unit contains a Programmable Logic Controller (PLC) to manage the flow of cooling fluid to IT equipment in typical data center environments. TCS circuit coolant pumps are tightly controlled in three possible modes for the best heat rejection:

- Differential pressure — The pumps operate in shifts or together to maintain a fixed differential pressure.
- Fixed flow rate — The pumps operate in shifts or together to maintain a set coolant flow rate.
- Fixed speed % setpoint — The pumps operate in shifts or together to maintain a fixed pump speed.

When the system is first powered on, the Human-Machine Interface (HMI) screen will illuminate, and the pump inverter drives will energize. After a short initialization period, the display will default to the Home screen.

Power on the System

Figure 38. Power switch



User Interface (3–Way Valve)

Using the Interface

The items outlined below will appear on various screens to operate and control the TCDU.

Figure 39. User interface (3–way valve)

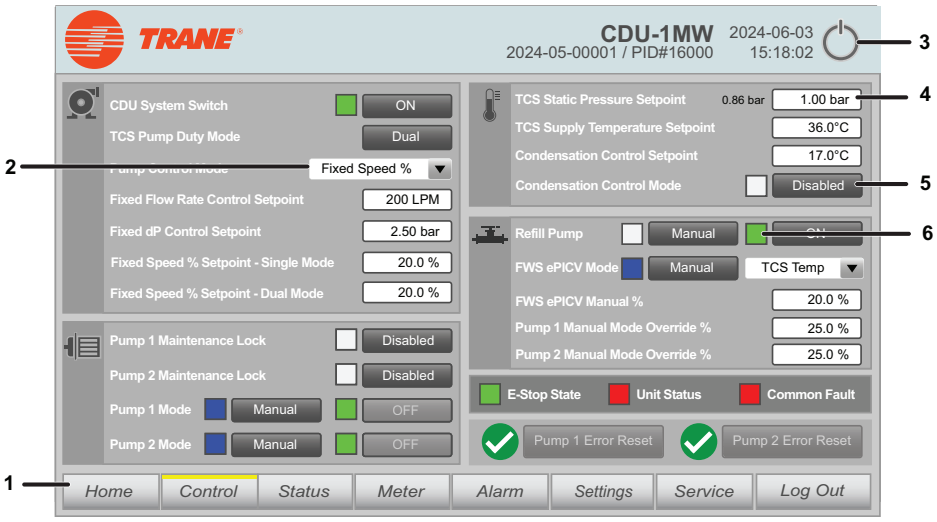


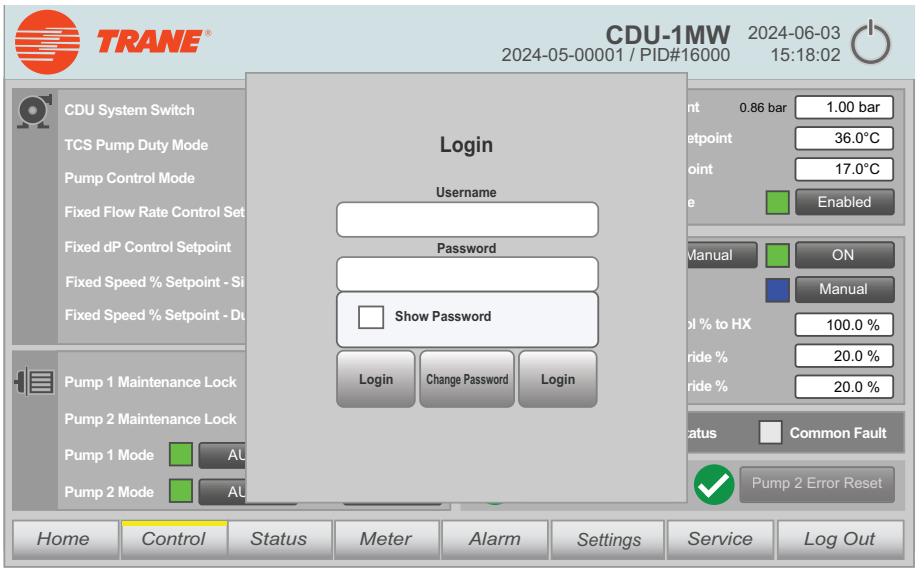
Table 18. User interface components

Item	Description	Usage
1	Menus	The menu buttons located at the bottom of the screen allow the user to switch between menus. A yellow bar located at the top of the menu button indicates the currently displayed menu.
2	Pull-down menus	Press the arrow on the menu to display the options. Press the desired option to select it.
3	Power button	Press the power button to close the PLC app. ***Note:*** *This is not recommended.*
4	Text fields	Press the field to open a keyboard on the screen to enter the desired value.
5	Buttons	The text on the buttons display the current status of the setting. Press the button to toggles between options for the setting.
6	Indicators	Indicators next to buttons provide more information about the status of the setting based on the color of the indicator: • Red: An alarm or fault that has occurred. • Blue Flashing: Manual mode is active. • Green: Status is active or the unit is operating in Auto mode.

Logging In

The bottom-right menu will allow user to Log Out if a user is currently logged into the TCDU. If a user presses a button or screen that would require access rights, the log in screen displays.

Figure 40. Log in screen



A window will open for users to enter their username and password. An option to change the user password is also available on this screen.

Home Screen

The Home screen displays the P&ID of the TCDU-1MW, showing all temperature, pressure, and flow rate readings for both FWS and TCS circuits. Additional information including the model number, serial number and date / time are also displayed.

Figure 41. 3–way valve option

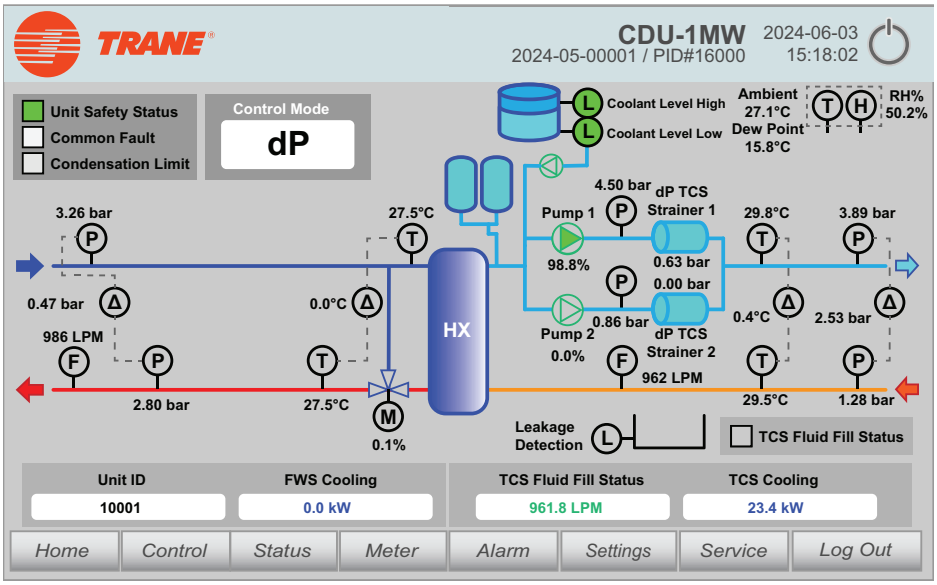
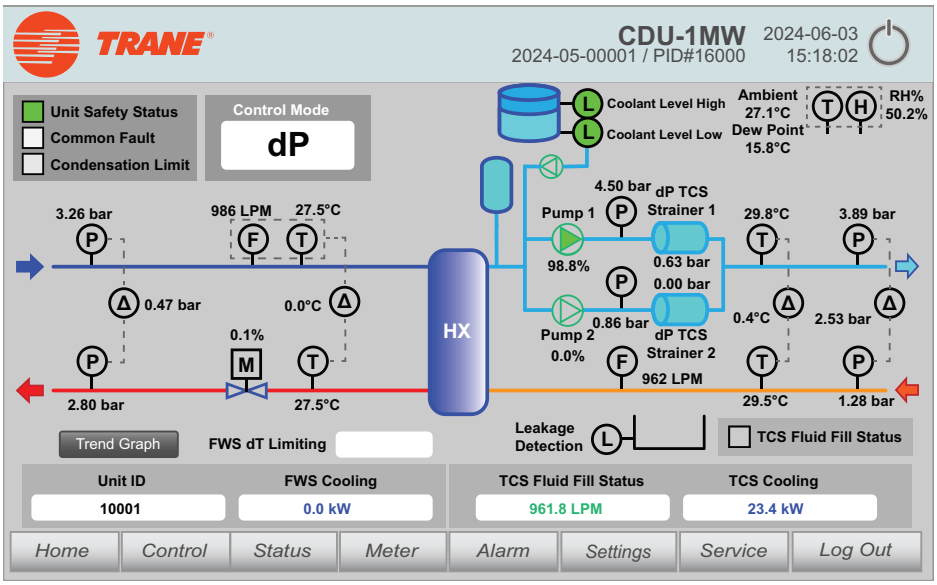


Figure 42. ePICV option



Control Screen

3–Way Valve Option

The Control screen displays control options and operating parameters.

Note: *Some Control items cannot be activated if the user is not logged in with an account with the proper access rights.*

Figure 43. Control screen (3–way valve option)

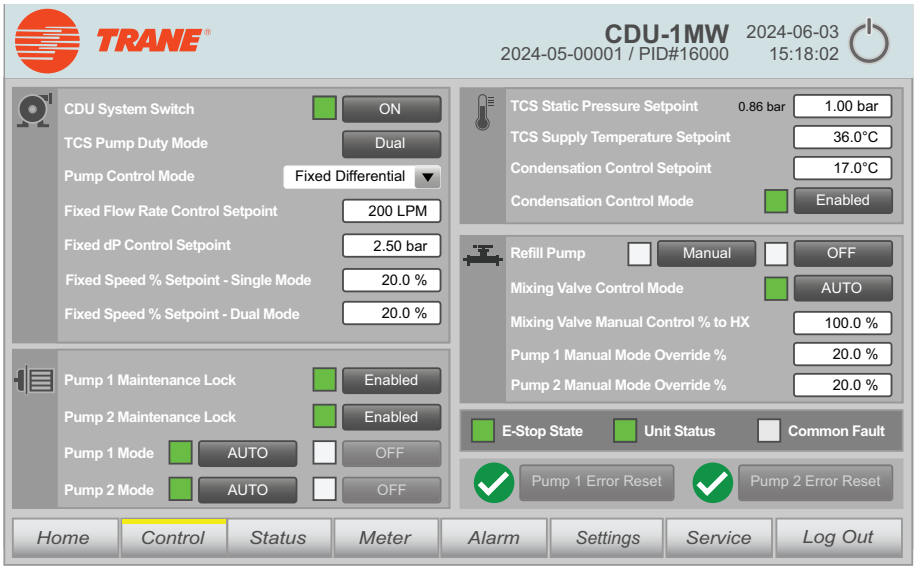


Table 19. 3–way valve Control screen options

Name	Description	Range/Options
TCDU System Switch	Only TCDU System Switch is ON, would allow the TCS Pumps to be turned ON through Auto or Manual Modes. If TCDU System Switch is OFF, then all TCS Pumps and Refill Pump would be turned OFF no matter the circumstances. The TCDU System Switch to Last State After Power Failure at Setting Tab control whether TCDU System Switch is ON after a power cycle.	• ON • OFF
TCS Pump Duty Mode	Selects whether to run one TCS pump alone or two TCS pumps together or in changeover mode. ***Note:*** *Changeover mode is where pump 1 runs for the length of time designated in Pump Duty Changeover Duration then switches to pump 2. Pump 2 will run for the Pump Duty Changeover Duration length of time then switch back, and so on.*	• Single • Dual
Pump Control Mode	Determines the control logic used for the system pumps.	• Fixed Differential — The pumps operate in shifts or together to maintain a fixed differential pressure. • Fixed Flow Rate — The pumps operate in shifts or together to maintain a fixed coolant flow rate. • Fixed Speed Percentage — The pumps operate in shifts or together to maintain a fixed pump speed.
Fixed Flow Rate Control Setpoint	Sets the target TCS pump flow rate when the Pump Control Mode is set to Fixed Flow Rate.	0–264 GPM (0–1000 LPM) Default:
Fixed dP Control Setpoint	Sets the target differential pressure drop when the Pump Control Mode is set to Fixed Differential.	0–130.5 psig (0–9 barg) Default:
Fixed Speed % Setpoint - Single Mode	Sets the target fixed pump speed for a single pump when the when the Pump Control Mode is set to Fixed Speed Percentage.	0–100% Default:
Fixed Speed % Setpoint - Dual Mode	Sets the target fixed pump speed for dual pumps when the when the Pump Control Mode is set to Fixed Speed Percentage.	0–100%
Pump Duty Changeover Duration	Sets the target TCS pump run time before changeover from TCS pump 1 to TCS pump 2 and vice versa. ***Note:*** *Only available in Auto mode.*	0–999 hours
Pump 1 / 2 Maintenance Lock	Enables or disables the automatic start-up of pumps. The status indicator indicates the following: • Green: Enabled • White: Disabled	• Enabled: Prevents the TCS pump from turning on (for example, use to deactivate the pump to change the pump strainer). • Disabled: The TCS pump will start if all conditions for operation are met.
Pump 1 / 2 Mode	Sets the operating mode of the pump. The status indicators indicate the following: • Green: The pump is operating in Auto mode. • Blue: The pump is operating in Manual mode. When the pump is set to Manual mode, the On/Off button becomes active. • Green: The pump is ON in Manual mode. • White: The pump is OFF in Manual mode.	• Auto: The TCS pump will control to the setpoint with PID feedback based on the settings for Pump Control Mode and TCS Pump Duty Mode. • Manual: The pump is manually controlled with the ON/OFF button that will now be active. The pump is manually operated at the percentage specified in Pump 1 Manual Mode Override % and Pump 2 Manual Mode Override % respectively.
TCS Static Pressure Setpoint	When the system is operating in Auto mode, this is the threshold at which the fill pump will fill the TCS circuit with coolant from the reservoir. While the pressure is lower than the threshold, the pump will fill coolant into the TCS circuit.	0–130.5 psig (0–9 barg) Default: 1.5 barg

Table 19. 3–way valve Control screen options (continued)

Name	Description	Range/Options
TCS Supply Temperature Setpoint	When the system 3-way Valve is operated in Auto mode, the 3-way Valve would be controlled to maintain the TCS Supply Temperature at the setpoint.	0–122°F (0–50°C)
Condensation Control Setpoint	The dew point temperature at which condensation control starts.	0–140°F (0–60°C)
Condensation Control Mode	When enabled, the TCS Supply Temperature Setpoint is set to higher than the dew point. Nothing will happen if the TCS Supply Temperature Setpoint is already higher than the dew point.	• Enabled: (Green) • Disabled: (White)
Refill Pump	Sets the operating mode of the fill pump. The status indicators indicate the following: • Green: The pump is operating in Auto mode. • White: The pump is operating in Manual mode. When the pump is set to Manual mode, the On/Off button becomes active. • Green: The pump is ON in Manual mode. • White: The pump is OFF in Manual mode.	• Auto: The fill pump will operate automatically based on the value given for TCS Static Pressure Setpoint. • Manual: The fill pump is manually controlled with the ON/OFF button that will now be active.
Mixing Valve Control Mode	• Green = The mixing valve is operating in Auto mode. • Blue = The mixing valve is operating in Manual mode.	• Auto: The flow of coolant out of the 3-way valve will be controlled based on TCS Supply Temperature Setpoint and Condensation Control Mode. • Manual: The flow of coolant out of the 3-way valve is manually controlled via the given open percentage of the valve.
Mixing Valve Manual Control % to HX	When 3-way Valve Control Mode is Manual, the user directly control the amount of coolant going into the brazed plate Heat Exchanger.	0–100%
Pump 1 Manual Mode Override %	When TCS Pump 1 is in Manual mode, then directly control the power of the TCS Pump 1.	0–100%
Pump 2 Manual Mode Override %	When TCS Pump 2 is in Manual mode, then directly control the power of the TCS Pump 2.	0–100%
E-Stop State	This indicates the current state of the emergency stop button. • Green: The e-stop is not activated and is ready to be used. • Red: The e-stop is activated (has been pressed).	N/A
Unit Status	This indicates whether any important alarm had appeared or E-stop switch had been pressed (even when the E-stop is cleaned). • Green: No critical alarm had appeared, and no E-stop switch had been pressed but not cleared. • Red: Important alarm had appeared in Alarm Tab or E-stop switch had been pressed but not cleared. Safety Reset in Alarm Tab could be used to reset the Unit Status to Green.	N/A
Common Fault	Indicate any warning had appeared.	N/A
Pump 1 Error Reset	If the inverter of the TCS pump 1 have any error, the button can be pressed to clear any error related to TCS pump 1.	N/A
Pump 2 Error Reset	If the inverter of the TCS pump 1 have any error, the button can be pressed to clear any error related to TCS pump 1.	N/A

ePICV Options

The Control screen displays control options and operating parameters.

Note: *Some Control items cannot be activated if the user is not logged in with an account with the proper access rights.*

Figure 44. Control screen (ePICV option)

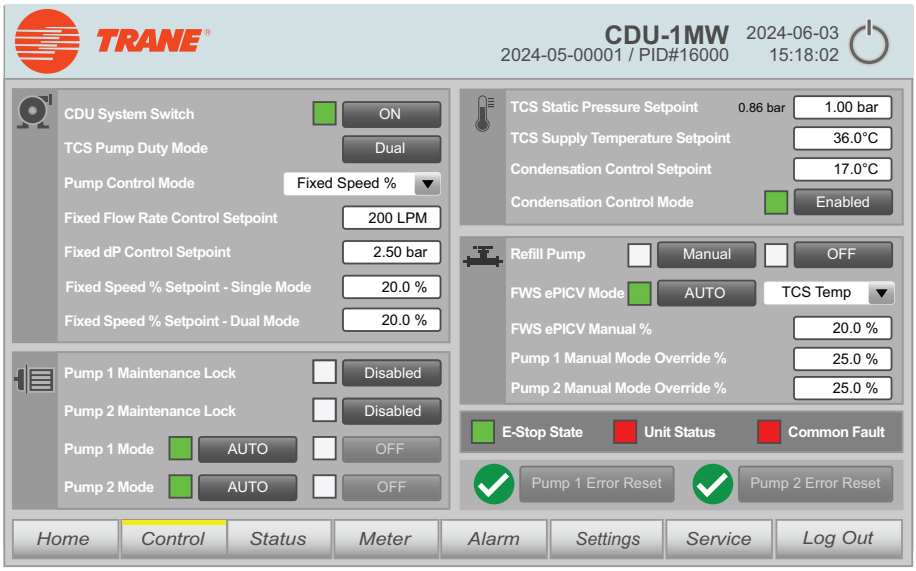


Table 20. ePICV Control screen options

Name	Description	Range/Options
TCDU System Switch	Only TCDU System Switch is ON, would allow the TCS Pumps to be turned ON through Auto or Manual Modes. If TCDU System Switch is OFF, then all TCS Pumps and Refill Pump would be turned OFF no matter the circumstances. The TCDU System Switch to Last State After Power Failure at Setting Tab control whether TCDU System Switch is ON after a power cycle.	• ON • OFF
TCS Pump Duty Mode	Selects whether to run one TCS pump alone or two TCS pumps together or in changeover mode. ***Note:*** *Changeover mode is where pump 1 runs for the length of time designated in Pump Duty Changeover Duration then switches to pump 2. Pump 2 will run for the Pump Duty Changeover Duration length of time then switch back, and so on.*	• Single • Dual
Pump Control Mode	Determines the control logic used for the system pumps.	• Fixed Differential — The pumps operate in shifts or together to maintain a fixed differential pressure. • Fixed Flow Rate — The pumps operate in shifts or together to maintain a fixed coolant flow rate. • Fixed Speed Percentage — The pumps operate in shifts or together to maintain a fixed pump speed.
Fixed Flow Rate Control Setpoint	Sets the target TCS pump flow rate when the Pump Control Mode is set to Fixed Flow Rate.	0–264 GPM (0–1000 LPM) Default:
Fixed dP Control Setpoint	Sets the target differential pressure drop when the Pump Control Mode is set to Fixed Differential.	0–130.5 psig (0–9 barg) Default:
Fixed Speed % Setpoint - Single Mode	Sets the target fixed pump speed for a single pump when the when the Pump Control Mode is set to Fixed Speed Percentage.	0–100% Default:

Table 20. ePICV Control screen options (continued)

Name	Description	Range/Options
Fixed Speed % Setpoint - Dual Mode	Sets the target fixed pump speed for dual pumps when the when the Pump Control Mode is set to Fixed Speed Percentage.	0–100%
Pump Duty Changeover Duration	Sets the target TCS pump run time before changeover from TCS pump 1 to TCS pump 2 and vice versa. ***Note:*** *Only available in Auto mode.*	0–999 hours
Pump 1 / 2 Maintenance Lock	Enables or disables the automatic start-up of pumps. The status indicator indicates the following: • Green: Enabled • White: Disabled	• Enabled: Prevents the TCS pump from turning on (for example, use to deactivate the pump to change the pump strainer). • Disabled: The TCS pump will start if all conditions for operation are met.
Pump 1 / 2 Mode	Sets the operating mode of the pump. The status indicators indicate the following: • Green: The pump is operating in Auto mode. • Blue: The pump is operating in Manual mode. When the pump is set to Manual mode, the On/Off button becomes active. • Green: The pump is ON in Manual mode. • White: The pump is OFF in Manual mode.	• Auto: The TCS pump will control to the setpoint with PID feedback based on the settings for Pump Control Mode and TCS Pump Duty Mode. • Manual: The pump is manually controlled with the ON/OFF button that will now be active. The pump is manually operated at the percentage specified in Pump 1 Manual Mode Override % and Pump 2 Manual Mode Override % respectively.
TCS Static Pressure Setpoint	When the system is operating in Auto mode, this is the threshold at which the fill pump will fill the TCS circuit with coolant from the reservoir. While the pressure is lower than the threshold, the pump will fill coolant into the TCS circuit.	0–130.5 psig (0–9 barg) Default: 1.5 barg
TCS Supply Temperature Setpoint	When the system 3-way Valve is operated in Auto mode, the 3-way Valve would be controlled to maintain the TCS Supply Temperature at the setpoint.	0–122°F (0–50°C)
Condensation Control Setpoint	The dew point temperature at which condensation control starts.	0–140°F (0–60°C)
Condensation Control Mode	When enabled, the TCS Supply Temperature Setpoint is set to higher than the dew point. Nothing will happen if the TCS Supply Temperature Setpoint is already higher than the dew point.	• Enabled: (Green) • Disabled: (White)
Refill Pump	Sets the operating mode of the fill pump. The status indicators indicate the following: • Green: The pump is operating in Auto mode. • White: The pump is operating in Manual mode. When the pump is set to Manual mode, the On/Off button becomes active. • Green: The pump is ON in Manual mode. • White: The pump is OFF in Manual mode.	• Auto: The fill pump will operate automatically based on the value given for TCS Static Pressure Setpoint. • Manual: The fill pump is manually controlled with the ON/OFF button that will now be active.
FWS ePICV Mode	• Green = The mixing valve is operating in Auto mode. • Blue = The mixing valve is operating in Manual mode.	• Auto: The flow of coolant out of the 3-way valve will be controlled based on TCS Supply Temperature Setpoint and Condensation Control Mode. • Manual: The flow of coolant out of the 3-way valve is manually controlled via the given open percentage of the valve.
FWS ePICV Manual %	When FWS ePICV Mode is Manual, the setpoint directly control the ePICV.	0–100%
Pump Manual % P1: / P2:	When TCS Pump 1 / 2 is in Manual mode, then directly control the power of the TCS Pump 1 / 2 (P1 / P2).	0–100%

Table 20. ePICV Control screen options (continued)

Name	Description	Range/Options
E-Stop State	This indicates the current state of the emergency stop button. • Green: The e-stop is not activated and is ready to be used. • Red: The e-stop is activated (has been pressed).	N/A
Unit Status	This indicates whether any important alarm had appeared or E-stop switch had been pressed (even when the E-stop is cleaned). • Green: No critical alarm had appeared, and no E-stop switch had been pressed but not cleared. • Red: Important alarm had appeared in Alarm Tab or E-stop switch had been pressed but not cleared. Safety Reset in Alarm Tab could be used to reset the Unit Status to Green.	N/A
Common Fault	Indicate any warning had appeared.	N/A
Pump 1 Error Reset	If the inverter of the TCS pump 1 have any error, the button can be pressed to clear any error related to TCS pump 1.	N/A
Pump 2 Error Reset	If the inverter of the TCS pump 1 have any error, the button can be pressed to clear any error related to TCS pump 1.	N/A

Status Screen

3–way Valve Option

The Status screen displays cooling status information on the operating condition of the TCDU. This screen is informational and has no configurable settings. Values on this screen may be highlighted in yellow or orange and color is corresponding to the 4.3.8.2 Severity Monitoring Threshold Screen (3-Way Valve).

- Yellow highlight: The value is within a warning range; the system will still run.
- Orange highlight: The value is within an alarm range; the system will still run for most alarm except Pump 1 / 2 Over-pressure alarm. For Pump 1 / 2, if the pressure reading is over Alarm High threshold, the system will shutdown.

Figure 45. Status screen (3–way valve)

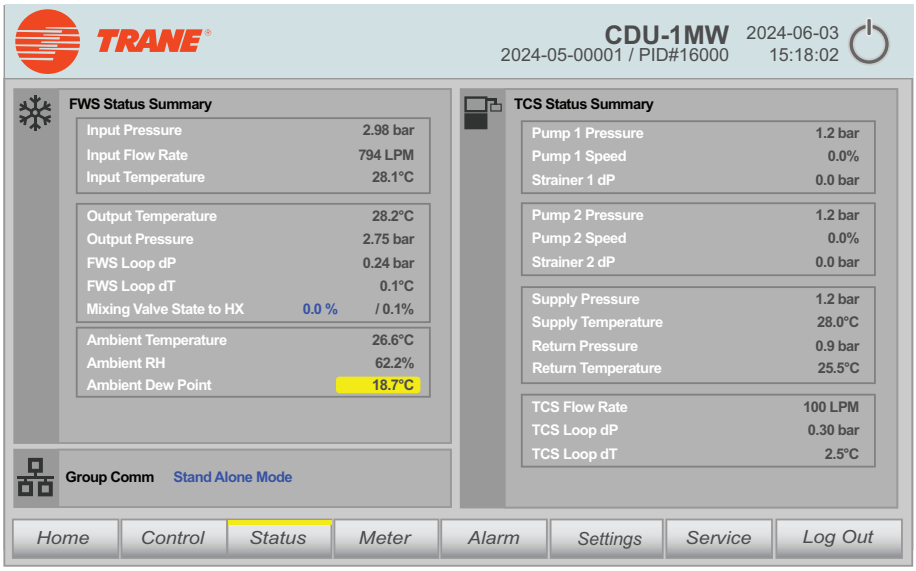


Table 21. 3–way valve Status screen options

Name	Description
FWS Status Summary	
Input Pressure	The pressure reading of the coolant from the FWS supply pressure sensor.
Input Flow Rate	The coolant flow rate from the FWS flow sensor.
Input Temperature	The temperature of the coolant entering the system from the FWS supply temperature sensor.
Output Temperature	The temperature of the coolant leaving the system from FWS return temperature sensor.
Output Pressure	The pressure reading of the coolant from the FWS return pressure sensor.
FWS Loop dP	The difference in pressure of the coolant between the FWS supply pressure sensor and the FWS return pressure sensor.
FWS Loop dT	The difference in temperature of the coolant between the FWS supply temperature sensor and the FWS return temperature sensor.
FWS ePICV %	The open percentage of the valve sending coolant into the brazed plate heat exchanger.
Ambient Temperature	The temperature of the surrounding air from the ambient temperature and humidity sensor.
Ambient RH	The relative humidity of the surrounding air from the ambient temperature and humidity sensor.
Ambient Dew Point	The dew point (the temperature the air needs to be to achieve 100% humidity) of the ambient air. If the value is highlighted in yellow, it is within the range to trigger a high or low warning. If the value is highlighted in orange, it is within the range to trigger a high or low alarm.
Group Comm	Stand Alone Mode: No group control: each TCDU operates independently. Group Control: Group Control.
TCS Status Summary	
Pump 1 Pressure	The current pressure of TCS pump 1.
Pump 1 Speed	The current operating speed of TCS pump 1.
Strainer 1 dP	The differential pressure across the TCS supply strainer.
Pump 2 Pressure	The current pressure of TCS pump 2.
Pump 2 Speed	The current operating speed of TCS pump 2.
Strainer 2 dP	The differential pressure across TCS supply strainer 2.

Table 21. 3–way valve Status screen options (continued)

Name	Description
Supply Pressure	The pressure reading of the coolant from the TCS supply pressure sensor.
Supply Temperature	The temperature of the coolant from the TCS supply temperature sensor.
Return Pressure	The pressure reading of the coolant from the TCS return pressure sensor.
Return Temperature	The temperature of the coolant from the TCS return temperature sensor.
TCS Flow Rate	The coolant flow rate from the TCS supply flow sensor.
TCS Loop dP	The difference in pressure of the coolant between the TCS supply pressure sensor and the TCS return pressure sensor.
TCS Loop dT	The difference in temperature of the coolant between the TCS supply temperature sensor and the TCS return temperature sensor.

ePICV Option

The Status screen displays cooling status information on the operating condition of the TCDU. This screen is informational and has no configurable settings. Values on this screen may be highlighted in yellow or orange and color is corresponding to the 4.3.8.2 Severity Monitoring Threshold Screen (3-Way Valve).

- Yellow highlight: The value is within a warning range; the system will still run.
- Orange highlight: The value is within an alarm range; the system will still run for most alarm except Pump 1 / 2 Over-pressure alarm. For Pump 1 / 2, if the pressure reading is over Alarm High threshold, the system will shutdown.

Figure 46. Status screen (ePICV)

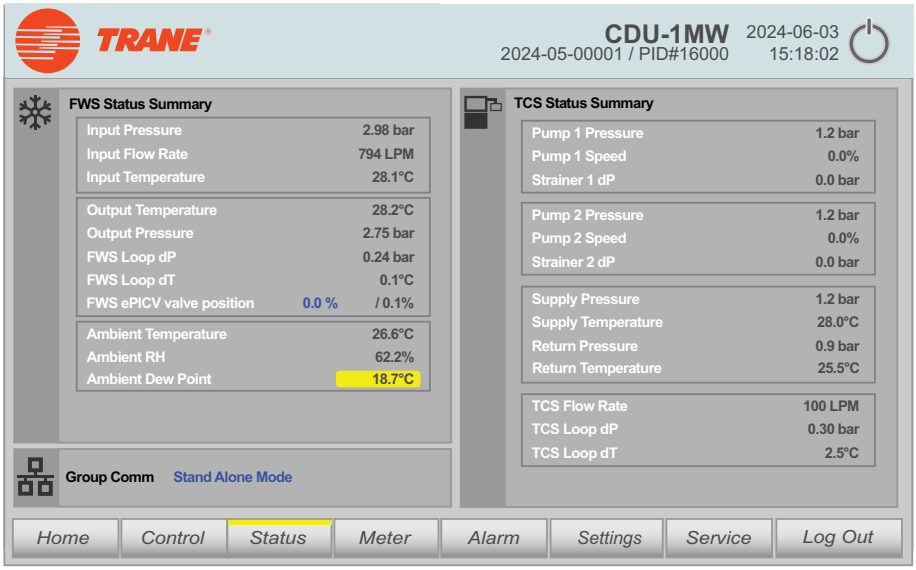


Table 22. ePICV option screen options

Name	Description
FWS Status Summary	
Input Pressure	The pressure reading of the coolant from the FWS supply pressure sensor.
Input Flow Rate	The coolant flow rate from the FWS flow sensor.
Input Temperature	The temperature of the coolant entering the system from the FWS supply temperature sensor.

Table 22. ePICV option screen options (continued)

Name	Description
Output Temperature	The temperature of the coolant leaving the system from FWS return temperature sensor.
Output Pressure	The pressure reading of the coolant from the FWS return pressure sensor.
FWS Loop dP	The difference in pressure of the coolant between the FWS supply pressure sensor and the FWS return pressure sensor.
FWS Loop dT	The difference in temperature of the coolant between the FWS supply temperature sensor and the FWS return temperature sensor.
FWS ePICV %	The open percentage of the valve sending coolant into the brazed plate heat exchanger.
Ambient Temperature	The temperature of the surrounding air from the ambient temperature and humidity sensor.
Ambient RH	The relative humidity of the surrounding air from the ambient temperature and humidity sensor.
Ambient Dew Point	The dew point (the temperature the air needs to be to achieve 100% humidity) of the ambient air. If the value is highlighted in yellow, it is within the range to trigger a high or low warning. If the value is highlighted in orange, it is within the range to trigger a high or low alarm.
Group Comm	Stand Alone Mode: No group control: each TCDU operates independently. Group Control: Group Control.
TCS Status Summary	
Pump 1 Pressure	The current pressure of TCS pump 1.
Pump 1 Speed	The current operating speed of TCS pump 1.
Strainer 1 dP	The differential pressure across the TCS supply strainer.
Pump 2 Pressure	The current pressure of TCS pump 2.
Pump 2 Speed	The current operating speed of TCS pump 2.
Strainer 2 dP	The differential pressure across TCS supply strainer 2.
Supply Pressure	The pressure reading of the coolant from the TCS supply pressure sensor.
Supply Temperature	The temperature of the coolant from the TCS supply temperature sensor.
Return Pressure	The pressure reading of the coolant from the TCS return pressure sensor.
Return Temperature	The temperature of the coolant from the TCS return temperature sensor.
TCS Flow Rate	The coolant flow rate from the TCS supply flow sensor.
TCS Loop dP	The difference in pressure of the coolant between the TCS supply pressure sensor and the TCS return pressure sensor.
TCS Loop dT	The difference in temperature of the coolant between the TCS supply temperature sensor and the TCS return temperature sensor.

Meter Screen

The Meter screen displays settings related to the VFDs and pumps.

Figure 47. Meter screen

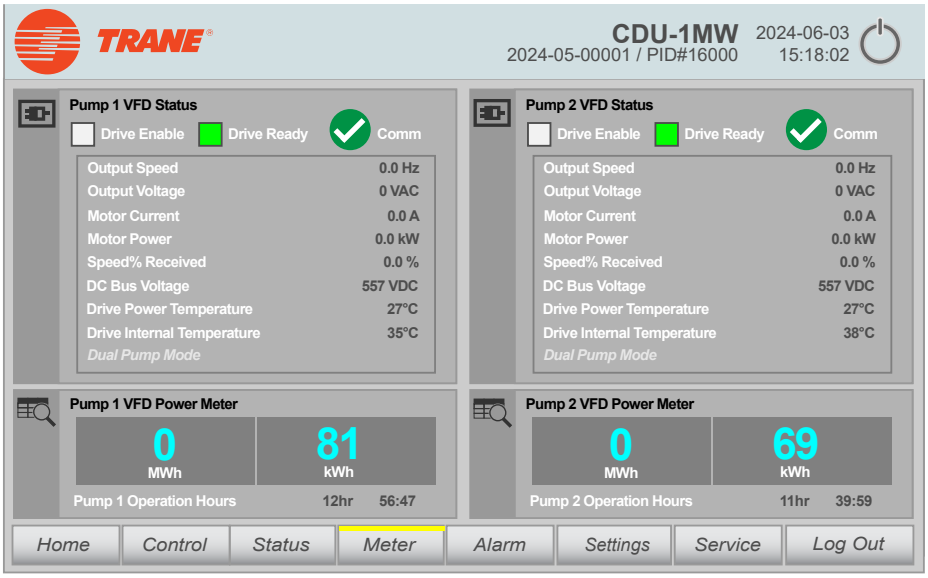


Table 23. Meter screen options

Name	Description
Pump 1/2 VFD Status	
Drive Enable	• Green = The motor is enabled to run. • White = The motor is disabled.
Drive Ready	• Green = The VFD is ready to run the motor. • White = The VFD is not ready to run the motor.
Comm	• Green Tick = The PLC is in communication with the VFD. • Red Cross = Communication has been lost.
Output Speed	The motor operating frequency from the VFD (Hz).
Output Voltage	The motor operating voltage from the VFD (VAC).
Motor Current	The motor operating current (A).
Motor Power	The motor operating power (kW).
Speed% Received	Motor operating percentage (could be different from the PLC setting)
DC Bus Voltage	The DC bus voltage at the VFD (VDC).
Drive Power Temperature	The temperature of the VFD heatsink.
Drive Internal Temperature	The internal temperature of the VFD.
Dual Pump Mode or Pump Session	Displays whether the pump is running in dual or single pump mode.
Pump 1/2 VFD Power Meter	
MWh / kWh	The power consumption of the pump during the listed operation hours.
Pump 1/2 Operated Hours	Displays the days, hours, minutes, and seconds that the pump has been operated.

Alarm Screen

The Alarm screen displays new, active, and past alarms.

The following are the possible statuses for alarms:

- Raised: A critical or warning alarm is active but has not been cleared nor acknowledged by the user.
- RaisedCleared: A critical or warning alarm was active but has been cleared by the user. The user can only clear an alarm if the condition that caused the alarm no longer persists.
- RaisedAcknowledged: A critical or warning alarm was active but has been acknowledged by the user. The user can acknowledge an alarm if the condition that caused the alarm still persists.

A yellow highlight indicates a warning alarm while a red highlight indicates a critical alarm.

Note: *See "Alarm List," p. 97 for a list of alarms.*

The Alarm screen also displays an indicator for E-Stop State and Unit Status (see "E-Stop State and Unit Status Reset," p. 54). The alarm ID can be used to cross reference the alarm in the list of alarms.

Figure 48. Alarm screen

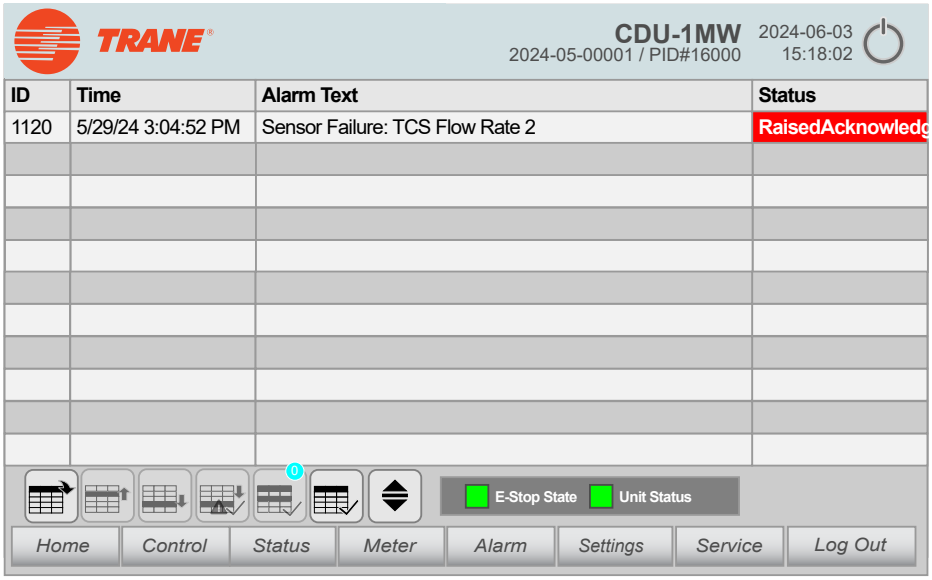


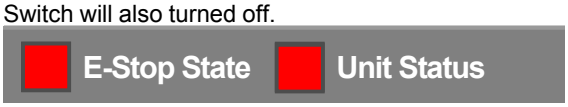
Table 24. Alarm screen

Button	Name	Description
	First line	The first of the currently active alarms is selected. This button is only operable if the Show recent function is disabled.
	Previous line	The previous alarm with regard to the selected alarm is selected. This button is only operable if the Show recent function is disabled.
	Next line	The next alarm with regard to the selected alarm is selected. This button is only operable if the Show recent function is disabled.
	Single acknowledgment	Acknowledgment of a selected, visible single alarm. If using multiple selection, the selected alarms that require single acknowledgment are not acknowledged. A counter in the corner shows how many alarms have not been acknowledged. The counter includes all connected servers but no strainers.
	Group acknowledgment	Acknowledges all active, visible alarms that require acknowledgment in the alarm window unless these require single acknowledgment. If using the multiple selection, all marked alarms are acknowledged even if the alarms are hidden.
	Show recent	Defines whether it is always the latest alarm that is selected in the alarm control. Button not pressed: The Show recent function is active. • The current alarms are always displayed first in the alarm control. • The visible area of the alarm control moves automatically if necessary. • Alarms cannot be selected individually or sorted by column. Button pressed: The Show recent function is paused.

E-Stop State and Unit Status Reset

When the indicators next to E-Stop State and Unit Status are green, the e-stop is ready for operation and the TCDU will operate normally.

If the e-stop button is activated, both indicators will turn red and the pumps will stop. TCDU System Switch will also turned off.



Check and clean the cause of e-stop button being pressed. After the e-stop button has been physically reset, the E-Stop State indicator will return to green, but the Unit Status will remain red and the pumps will remain off.

Press the TCDU System Switch button at the Control Screen to reset the Unit Status and return the unit to operation.

Settings Screen

3–Way Valve Option

The Settings screen is where users can configure TCDU system properties, change the display units, adjust fluid parameters, and enable or disable the data log and group mode.

Figure 49. Setting screen (3–way valve option)

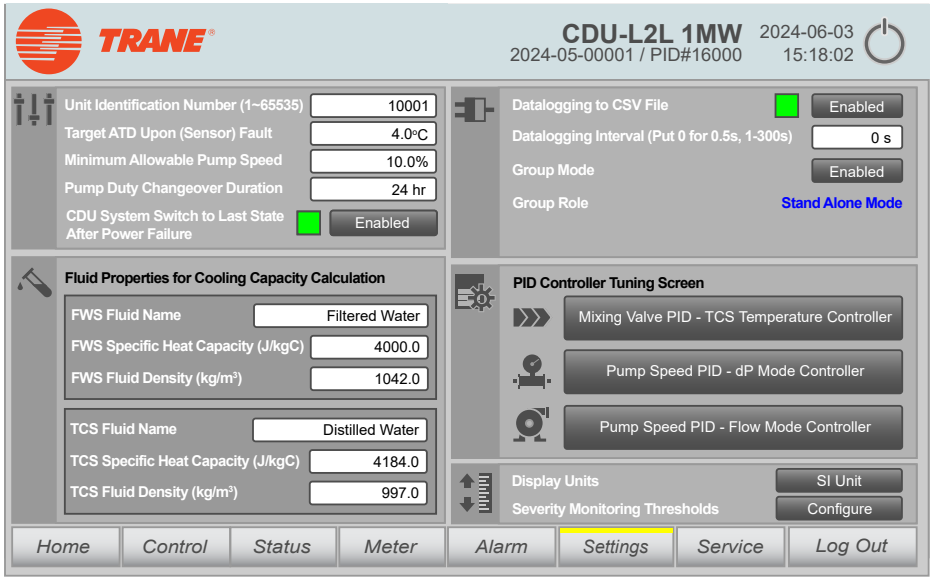


Table 25. Setting options (3–way valve option)

Name	Description	Range/Options
Unit Identification Number (1–65535)	The unique identification number assigned to this TCDU.	1 – 65535
Target ATD Upon (Sensor) Fault	This is the system ATD target when a sensor fails.	
Minimum Allowable Pump Speed	The minimum speed allowed for the pumps.	
Pump Duty Changeover Duration	Sets the target TCS pump run time before changeover from TCS pump 1 to TCS pump 2 and vice versa. NOTE: Only available in Auto mode.	0–999 hours

Table 25. Setting options (3–way valve option) (continued)

Name	Description	Range/Options
TCDU System Switch to Last State After Power Failure	Sets whether the TCDU remember its Last Run state after Power Failure or Power Interruption. If enabled: TCDU System remember and resume its last run state. That is TCDU System Switch is powered OFF. If disabled: TCDU System will not restore its last run state until the TCDU System Switch is powered ON.	• Enabled • Disabled
Fluid Properties for Cooling Capacity Calculation		
FWS Fluid Name	The type of fluid used in the facility water system.	This is manually entered by the user.
FWS Specific Heat Capacity (J/ kgC)	The specific heat capacity of fluid used in the facility water system.	This is manually entered by the user.
FWS Fluid Density (kg/m³)	The density of fluid used in the facility water system.	This is manually entered by the user.
TCS Fluid Name	The type of fluid used in the technology cooling system.	This is manually entered by the user.
TCS Specific Heat Capacity (J/ kgC)	The specific heat capacity of fluid used in the technology cooling system.	This is manually entered by the user.
TCS Fluid Density (kg/m³)	The density of fluid used in the technology cooling system.	This is manually entered by the user.
Datalogging to CSV File	Enables or disables storing data from the unit in a CSV file.	• Enabled • Disabled
Datalogging Interval	The frequency of logging data to the CSV file.	0 for 0.5 second 1–300 seconds
Group Mode	If enabled, then the system would operate in Group Control mode. Otherwise would be operated as standalone mode.	• Enabled • Disabled
Group Role	When Group Control mode is activated, then the TCDU could operate as either Principal or Agent.	• Principal • Agent
Display Units	Press to toggle the measurement system used for readings and settings.	• SI Units • Imperial
PID Controller Tuning Screen		
See “PID Controller Tuning Screens ,” p. 58 for information on these settings.		

ePICV Option

The Settings screen is where users can configure TCDU system properties, change the display units, adjust fluid parameters, and enable or disable the data log and group mode.

Figure 50. Setting screen (ePICV option)

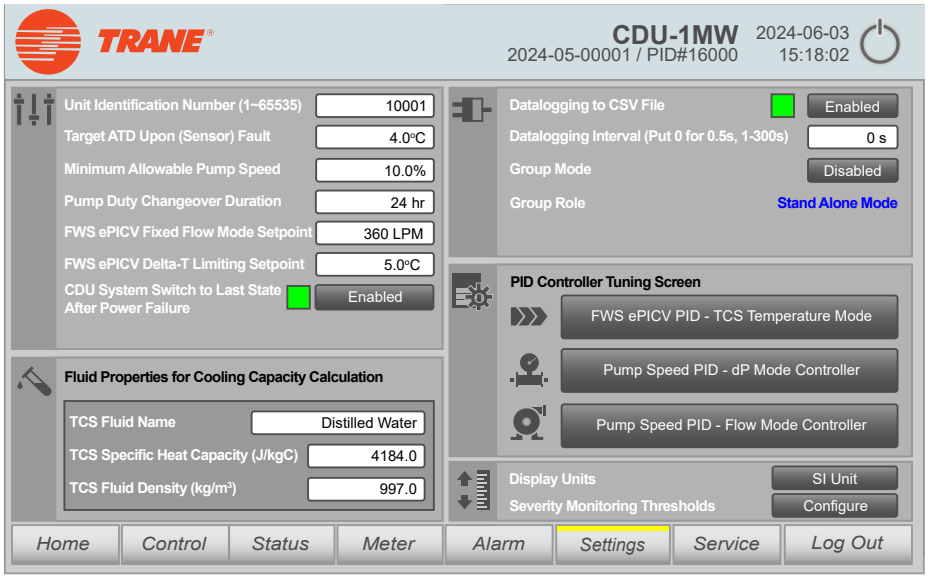


Table 26. Setting options (ePICV option)

Name	Description	Range/Options
Unit Identification Number (1–65535)	The unique identification number assigned to this TCDU.	1 – 65535
Target ATD Upon (Sensor) Fault	This is the system ATD target when a sensor fails.	
Minimum Allowable Pump Speed	The minimum speed allowed for the pumps.	
Pump Duty Changeover Duration	Sets the target TCS pump run time before changeover from TCS pump 1 to TCS pump 2 and vice versa. NOTE: Only available in Auto mode.	0–999 hours
FWS ePICV Fixed Flow Mode Setpoint	When FWS ePICV Mode is Auto and Flow, the setpoint directly control the ePICV.	95–317 GPM (360–1200 LPM)
FWS ePICV Delta-T Limiting Setpoint	When FWS ePICV Mode is Auto and Energy, the setpoint directly control the ePICV	2-30C
TCDU System Switch to Last State After Power Failure	Sets whether the TCDU remember its Last Run state after Power Failure or Power Interruption. If enabled: TCDU System remember and resume its last run state (for example TCDU System Switch is powered OFF). If disabled: TCDU System will not restore its last run state until the TCDU System Switch is powered ON.	• Enabled • Disabled
Minimum Allowable Pump Speed	The minimum speed allowed for the pumps.	
Fluid Properties for Cooling Capacity Calculation		
TCS Fluid Name	The type of fluid used in the technology cooling system.	This is manually entered by the user.
TCS Specific Heat Capacity (J/ kgC)	The specific heat capacity of fluid used in the technology cooling system.	This is manually entered by the user.
TCS Fluid Density (kg/m³)	The density of fluid used in the technology cooling system.	This is manually entered by the user.
Datalogging to CSV File	Enables or disables storing data from the unit in a CSV file.	• Enabled • Disabled
Datalogging Interval	The frequency of logging data to the CSV file.	0 for 0.5 second 1–300 seconds
Group Mode	If enabled, then the system would operate in Group Control mode. Otherwise would be operated as standalone mode.	• Enabled • Disabled

Table 26. Setting options (ePICV option) (continued)

Name	Description	Range/Options
Group Role	When Group Control mode is activated, then the TCDU could operate as either Principal or Agent.	• Principal • Agent
Display Units	Press to toggle the measurement system used for readings and settings.	I • SI Units • Imperial
PID Controller Tuning Screen		
See "PID Controller Tuning Screens ," p. 58 for information on these settings.		

Severity Monitoring Threshold Screen

The Severity Monitoring Threshold screen allows users to set thresholds for when alarms and warnings are triggered.

Figure 51. Severity Monitoring Threshold screen

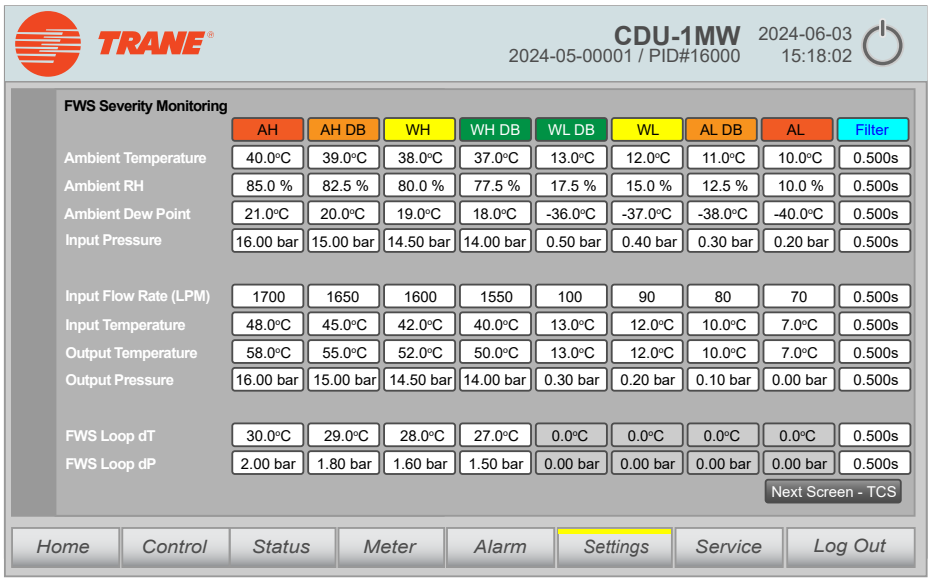


Table 27. Severity Monitoring Threshold screen codes

Code	Description	Meaning
AH	Alarm High	Trigger the alarm when the value is greater than the AH.
AH DB	Alarm High Dead Band	The alarm for AH will still be active as long as the value is greater than the AH DB.
WH	Warning High	Trigger the warning when the value is greater than the WH.
WH DB	Warning High Dead Band	The warning for WH will still be active as long as the value is greater than the WH DB.
WL DB	Warning Low Dead Band	The warning for WL will still be active as long as the value is lower than the WL DB.
WL	Warning Low	Trigger the warning when the value is lower than the WL.
AL DB	Alarm Low Dead Band	The alarm for AL will still be active as long as the value is lower than the AL DB.

Table 27. Severity Monitoring Threshold screen codes (continued)

Code	Description	Meaning
AL	Alarm Low	Trigger the alarm when the value is lower than the AL.
Strainer	Delay time	Values must remain in the alarm or warning range or the alarm clearing range for the length of time provided in this setting before triggering or clearing.

PID Controller Tuning Screens

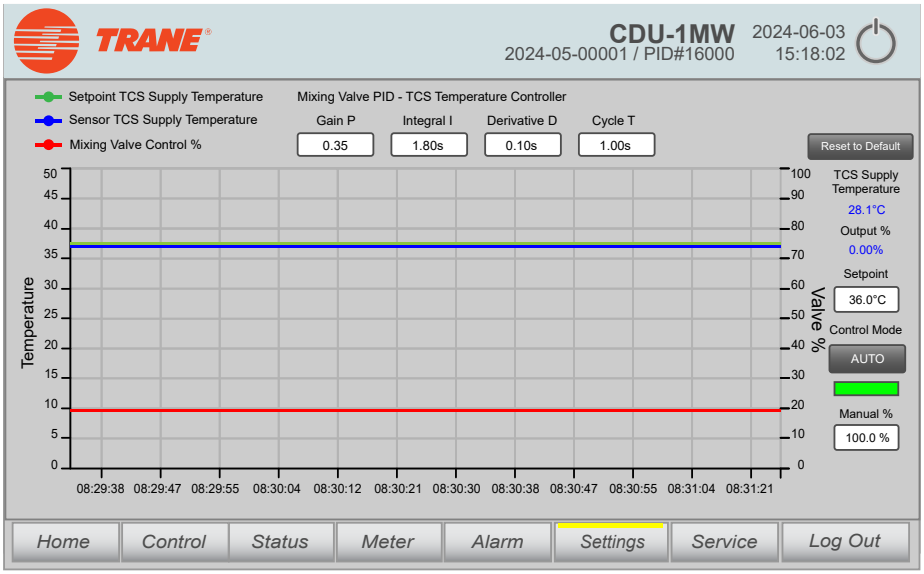
3–way Valve PID Settings

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.
PID control setting should only be changed by trained and qualified personnel.

Figure 52. Mixing valve PID - TCS temperature controller



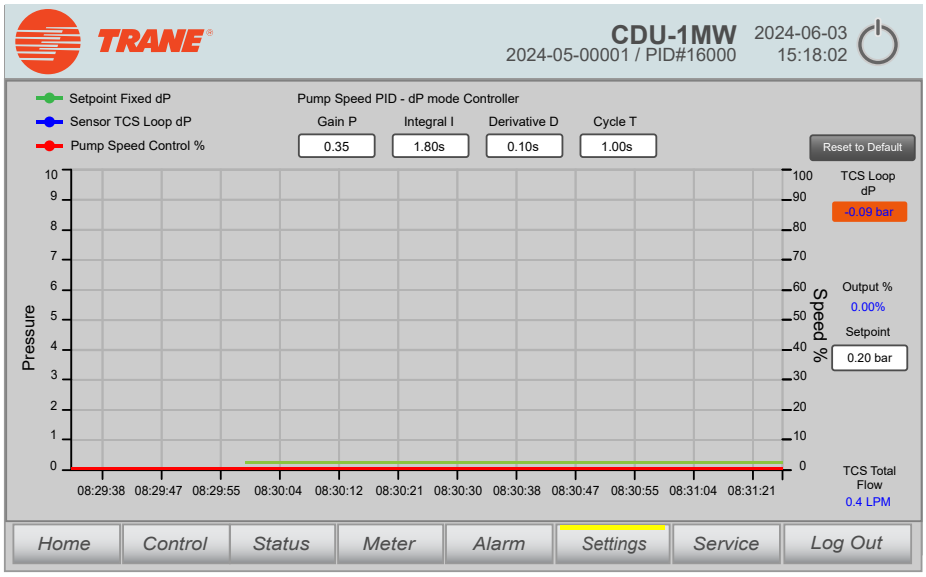
The left Y-axis measures temperature and is used with the Setpoint TCS Supply Temperature (green) line and the Sensor TCS Supply Temperature (blue) line. The right Y-axis measures the valve opening percentage and is used with the Mixing Valve Control % (red) line.

In Fixed Differential control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the opening percentage of the valve.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Supply Temperature: The current TCS supply temperature.

- Output %: The current opening percentage of the 3-way valve that pump coolant into the brazed plate heat exchanger.
- Setpoint: The required temperature for the fluid leaving the TCDU (TCS Supply Temperature Setpoint).
- Control Mode: Press the Control Mode button to change between Manual and Auto mode.
- Manual %: The PID can be overridden by manually entering a open percentage of the 3-way valve when the Control Mode is Manual.

Figure 53. Pump speed PID - dP mode controller

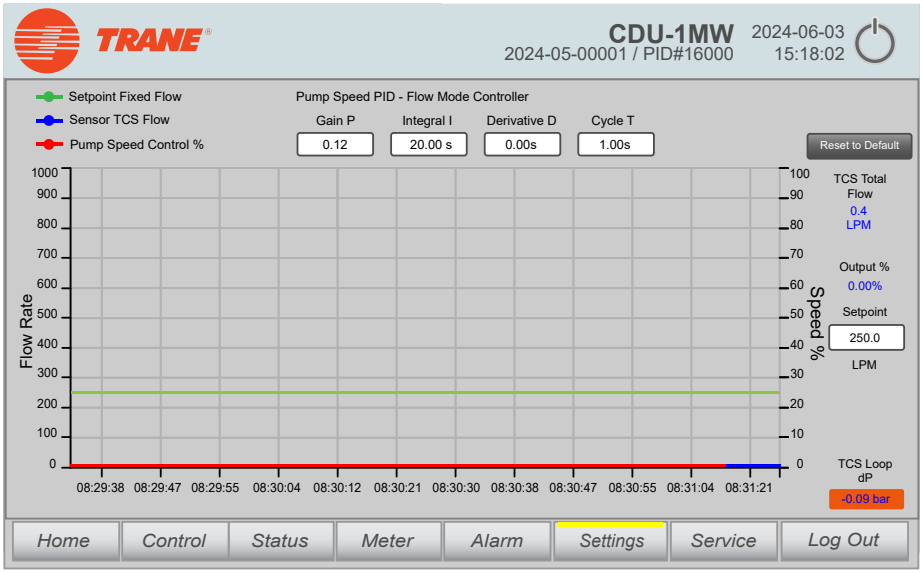


The left Y-axis measures pressure and is used with the Setpoint Fixed dP (green) line and the Sensor TCS Loop dP (blue) line. The right Y-axis measures the speed percentage and is used with the Pump Speed Control % (red) line.

In Fixed Speed % control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the speed of the pump.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Loop dP: The current differential pressure in the TCS circuit.
- Output %: The current speed of the pump.
- Setpoint: The required TCS differential pressure for the fluid, which is the Fixed dP Control Setpoint.
- TCS Total Flow: The current flow rate of the TCS circuit.

Figure 54. Pump speed PID - flow mode controller



The left Y-axis measures pressure and is used with the Setpoint Fixed dP (green) line and the Sensor TCS Loop dP (blue) line. The right Y-axis measures the speed percentage and is used with the Pump Speed Control % (red) line.

In Fixed Flow Rate control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the flow rate of the pump.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Total Flow: The current flow rate of the TCS circuit.
- Output %: The current speed of the pump
- Setpoint: The required flow rate for the fluid leaving the TCDU, which is the Fixed Flow Rate Control Setpoint.
- TCS Loop dP: The current differential pressure in the TCS circuit.

ePICV PID Settings

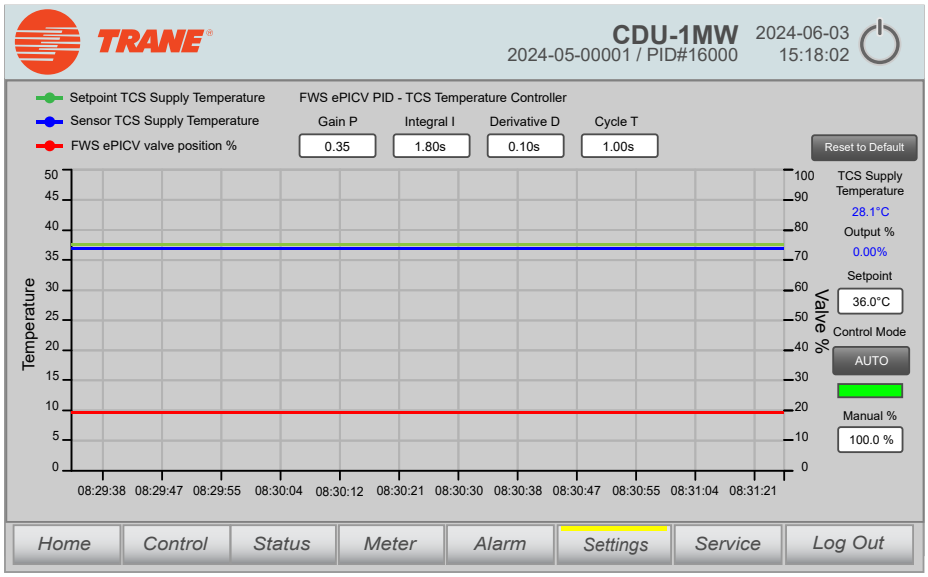
NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

PID control setting should only be changed by trained and qualified personnel.

Figure 55. FWS valve PID – TCS temperature mode

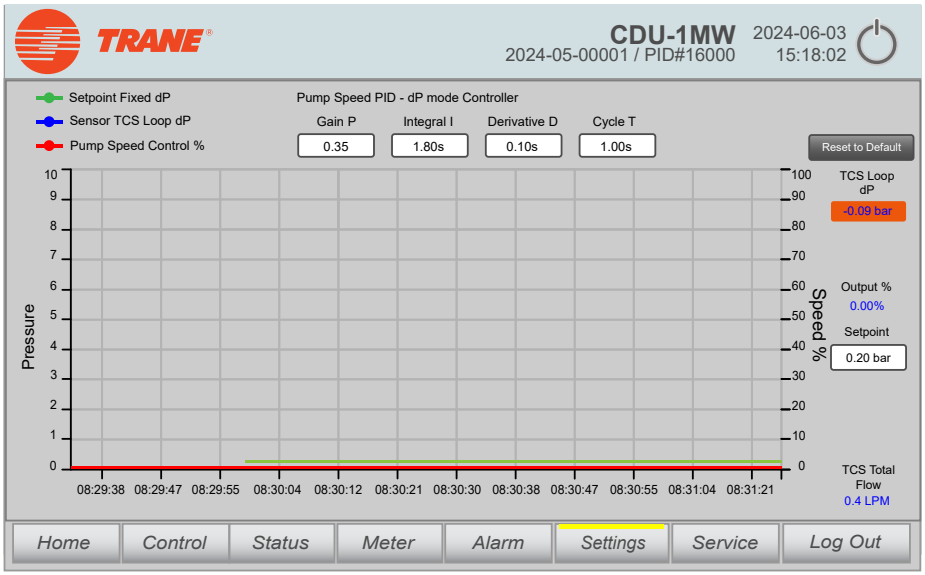


The left Y-axis measures temperature and is used with the Setpoint TCS Supply Temperature (green) line and the Sensor TCS Supply Temperature (blue) line. The right Y-axis measures the valve opening percentage and is used with the FWS Valve Control % (red) line.

In TCS Temperature control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the opening percentage of the valve.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Supply Temperature: The current TCS supply temperature.
- Output %: The current opening percentage of the ePICV that pump coolant into the brazed plate Heat Exchanger.
- Setpoint: The required temperature for the fluid leaving the TCDU. TCS Supply Temperature Setpoint.
- Control Mode: Press the Control Mode button to change between Manual and Auto mode.
- Manual %: The PID can be overridden by manually entering a open percentage of the ePICV when the Control Mode is Manual.

Figure 56. Pump speed PID – dP mode controller

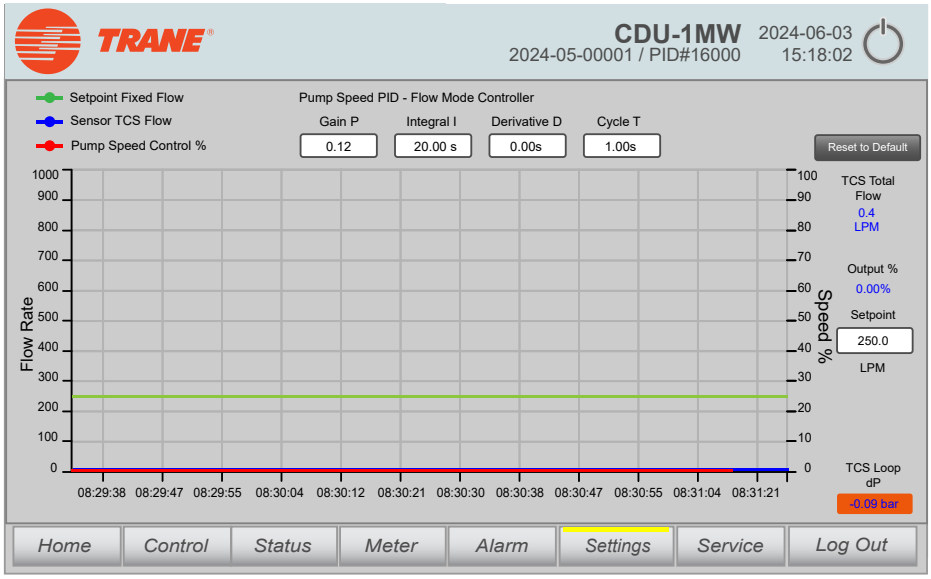


The left Y-axis measures pressure and is used with the Setpoint Fixed dP (green) line and the Sensor TCS Loop dP (blue) line. The right Y-axis measures the speed percentage and is used with the Pump Speed Control % (red) line.

In Fixed Speed % control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the speed of the pump.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Loop dP: The current differential pressure in the TCS circuit.
- Output %: The current speed of the pump.
- Setpoint: The required TCS differential pressure for the fluid, which is Fixed dP Control Setpoint.
- TCS Total Flow: The current flow rate of the TCS circuit.

Figure 57. Pump speed PID – flow mode controller



The left Y-axis measures pressure and is used with the Setpoint Fixed dP (green) line and the Sensor TCS Loop dP (blue) line. The right Y-axis measures the speed percentage and is used with the Pump Speed Control % (red) line.

In Fixed Flow Rate control mode, the Proportional (gain) plus Integral plus Derivative (PID) loop controls the flow rate of the pump.

- Gain P: The proportional multiplier (gain) adjusts for the difference between the measured value and the setpoint.
- Integral I: The integral multiplier adjusts for the error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.
- Derivative D: The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.
- Cycle T: Reaction time of the system.
- Reset to Default: Press the Reset to Default button to reset the values to factory defaults.
- TCS Total Flow: The current flow rate of the TCS circuit.
- Output %: The current speed of the pump
- Setpoint: The required flow rate for the fluid leaving the TCDU, which is the Fixed Flow Rate Control Setpoint.
- TCS Loop dP: The current differential pressure in the TCS circuit.

Service Screen

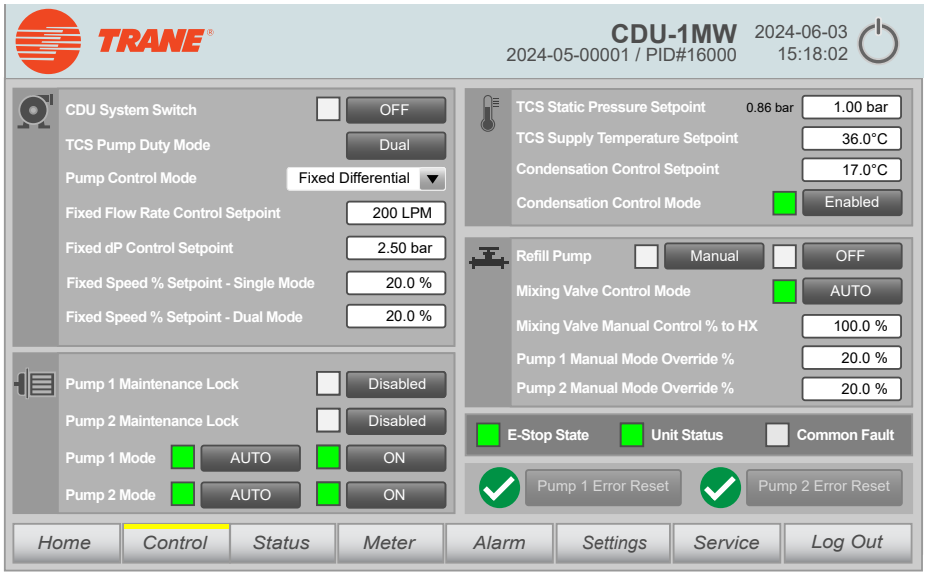
The Service screen is only accessible if the user is logged in with a username that has permissions to access this screen.

3-Way Valve Automatic Operation

Automatic TCS Pump Operation

After commissioning, the TCDU will be ready to run in Auto mode. If Pump 1 Maintenance Lock and / or Pump 2 Maintenance Lock is Enabled, the maintenance lock of the respective pump needs to be disabled in order to power on the pump (Control screen).

Figure 58. Automatic TCS pump operation



Check the following condition is set before removing the maintenance lock:

1. The Pump Control Mode has been selected from one of the following with the subsequent settings configured:
   a. Differential Pressure
   - Fixed dP Control Setpoint is set between 1.5 psi – 65.2 psi (0.1 bar to 4.5 bar).
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: The two pumps operate together.
     – If both pumps run at their minimum percentage for longer than one minute, the system will change to operating only one pump.
     – While running a single pump in dual mode, if the pump runs at higher than 80% for longer than one minute, the system will change to operating both pumps again.

   b. Fixed Flow Rate
   - Fixed Flow Rate Control Setpoint is set between 48 GPM – 343 GPM (180 LPM – 1300 LPM).
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: The two pumps operate together.
     – If the Fixed Flow Rate Control Setpoint is set lower than 95 GPM (360 LPM), only one pump will be operated in changeover mode.

   c. Fixed Speed % Setpoint - Single Mode / Dual Mode
   - Fixed Speed % Setpoint - Single Mode / Dual Mode is set between 20% and 100%.
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: Two pumps are operating together.
2. Set the Maintenance Lock for the pump to Disabled.
3. In Automatic operation, the system protects against dry run by checking that the TCS return pressure is at least higher than the Alarm Low (AL) value. Otherwise, the system will not power on the pumps.

The TCS pump(s) will now operate automatically based on the given settings.

Automatic 3-Way Valve Operation

1. If Mixing Valve Control Mode is set to **Auto** and Group Mode has not been activated,
   a. The system will check if Condensation Control Mode is activated, and if the TCS Supply Temperature Setpoint is lower than the current dew point calculated by the current ambient temperature and relative humidity:
      i. If Condensation Control Mode is activated, the TCS Supply Temperature Setpoint is set 1.8° F (1°C) above the current dew point.
      ii. If Condensation Control Mode is not activated, the TCS Supply Temperature Setpoint will be used directly.
   b. The 3-way valve will then control its opening to the brazed plate heat exchanger such that the TCS supply temperature will meet the setpoint in PID control.

Automatic Refill Pump Operation (3-Way Valve)

Figure 59. Automatic refill pump operation (3–way valve)

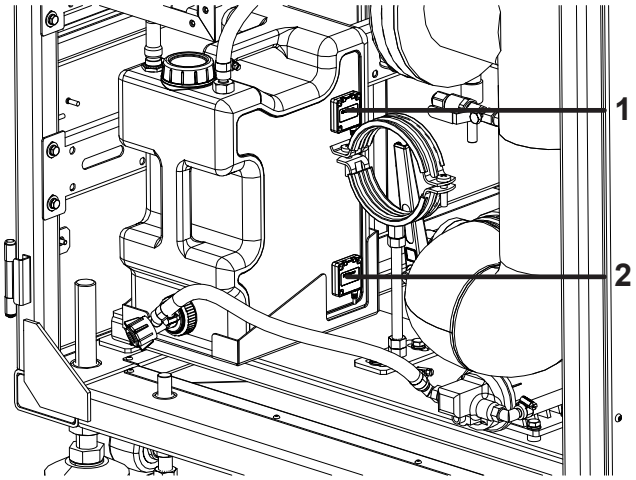


Table 28. Automatic refill pump operation (3–way valve) description

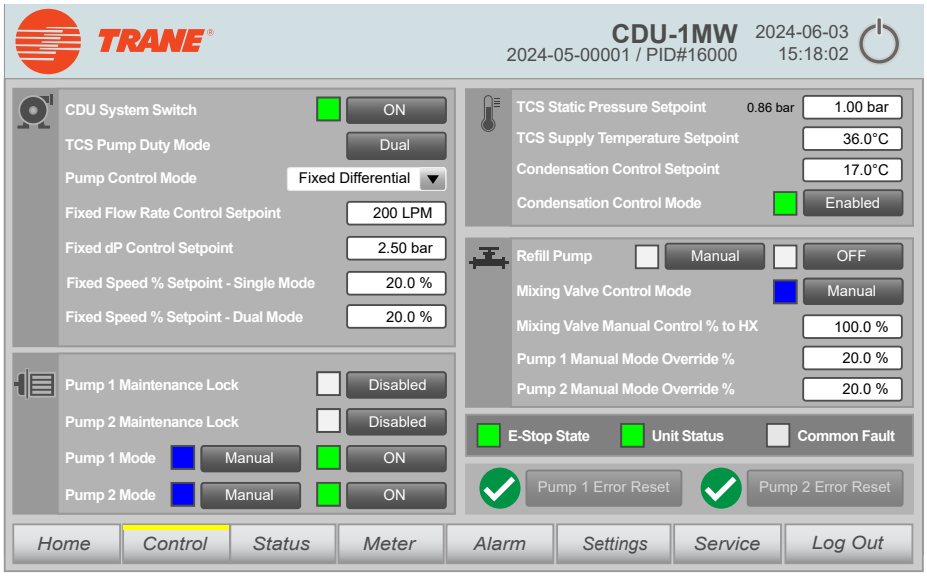
Item	Description
1	Coolant level high sensor
2	Coolant level low sensor

1. The system first checks the TCS return pressure. The TCS Return Pressure is shown to the left of the value for TCS Static Pressure Setpoint.

   a. If the TCS return pressure sensor is working and the reading is lower than the TCS Static Pressure Setpoint for more than 10 seconds, the refill pump is turned on to draw coolant from the reservoir into the TCS circuit.
   b. The reservoir needs to be filled with enough coolant (above the coolant low level sensor) for the refill pump to operate.

3-Way Valve Manual Operation

Figure 60. 3–way valve manual operation



Manual TCS Pump Operation

If Pump 1 / 2 Mode is set to Manual, TCS pump 1 / 2 can also be controlled manually by Pump 1 / 2 Manual Mode Override %.

Manual 3-Way Valve Operation

If Mixing Valve Control Mode is set to Manual, the amount of coolant going into brazed plate heat exchanger can also be controlled manually by Mixing Valve Control Mode.

Manual Refill Pump Operation

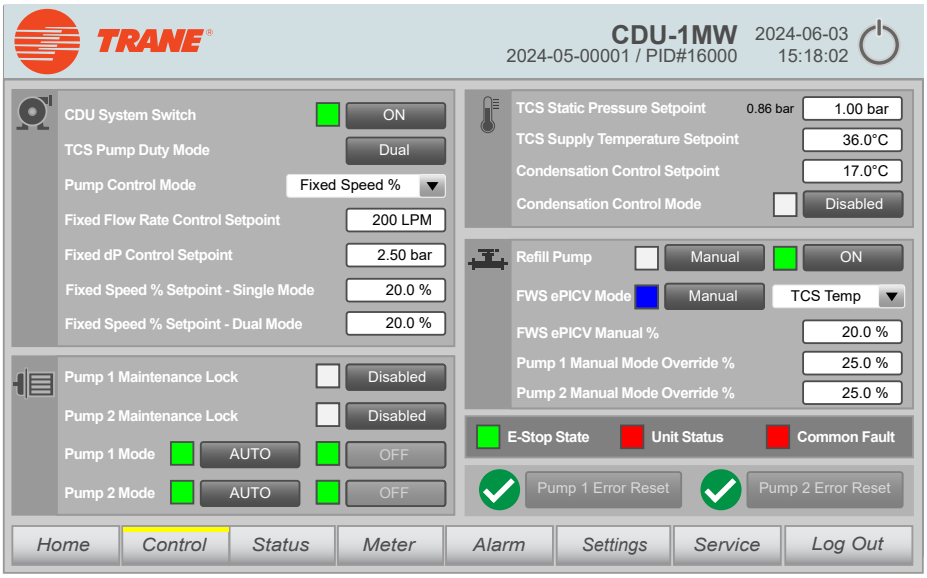
If Refill Pump is set to Manual, the refill pump can be manually controlled to power ON / OFF.

ePICV Automatic Operation

Automatic TCS Pump Operation

After commissioning, the TCDU will be ready to run in Auto mode. If Pump 1 Maintenance Lock and / or Pump 2 Maintenance Lock is Enabled, the maintenance lock of the respective pump needs to be disabled in order to power on the pump (Control screen). Pump 1 / 2 Maintenance Lock are disabled by default.

Figure 61. Automatic TCS pump operation



During the commissioning, the correct Pump Control Mode should already been selected, otherwise, please confirm the following:

1. The Pump Control Mode has been selected from one of the following with the subsequent settings configured:
   a. Differential Pressure
   - Fixed dP Control Setpoint is set between 1.5 psi – 65.2 psi (0.1 bar to 4.5 bar).
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: The two pumps operate together.
     – If both pumps run at their minimum percentage for longer than one minute, the system will change to operating only one pump.
     – While running a single pump in dual mode, if the pump runs at higher than 80% for longer than one minute, the system will change to operating both pumps again.

   b. Fixed Flow Rate
   - Fixed Flow Rate Control Setpoint is set between 48 GPM – 343 GPM (180 LPM – 1300 LPM).
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: The two pumps operate together.
     – If the Fixed Flow Rate Control Setpoint is set lower than 95 GPM (360 LPM), only one pump will be operated in changeover mode.

   c. Fixed Speed % Setpoint - Single Mode / Dual Mode
   - Fixed Speed % Setpoint - Single Mode / Dual Mode is set between 20% and 100%.
   - Single Mode: The two pumps operate in shifts, switching pump operation at the specified changeover interval (0 – 999 hours).
   - Dual Mode: Two pumps are operating together.
2. Set the Maintenance Lock for the pump to Disabled.
3. In Automatic operation, the system protects against dry run by checking that the TCS return pressure is at least higher than the Alarm Low (AL) value. Otherwise, the system will not power on the pumps.

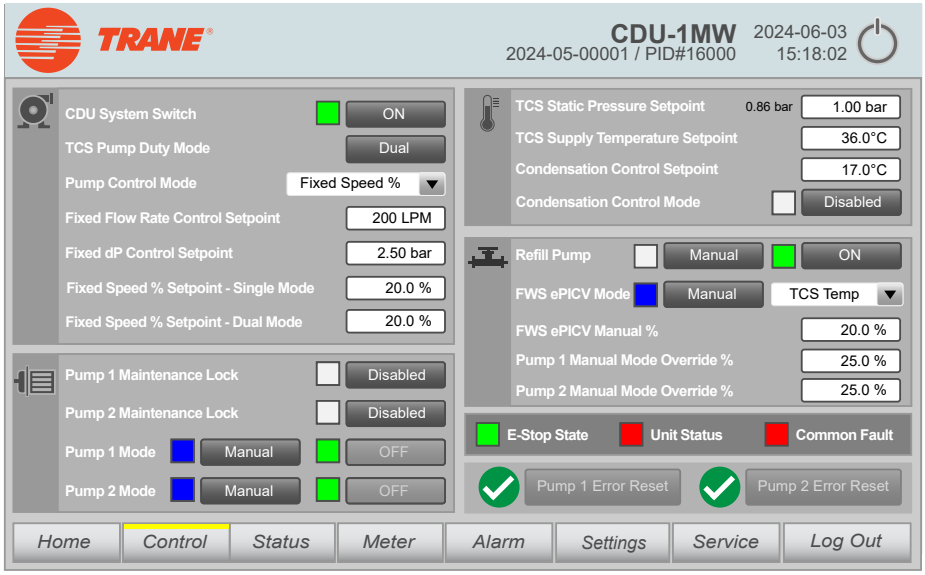
The TCS pump(s) will now operate automatically based on the given settings.

Automatic 2-Way ePICV Operation

1. Regardless of whether the FWS ePICV Mode is set to Auto and/or Group Mode:
   a. The system will check if Condensation Control Mode is activated. If the TCS Supply Temperature Setpoint is lower than the current dew point calculated by the current ambient temperature and relative humidity, this will override all modes:
      i. If Condensation Control Mode is activated, the TCS Supply Temperature Setpoint is set 1.8° F (1°C) above the current dew point. If the TCS Supply Temperature is low enough to trigger this logic, it will override all modes.
      ii. If Condensation Control Mode is not activated, then system will operate at the mode that is set by the user.
   b. The system will check if TCS Temp, Fixed Flow, or Energy is selected if the system is running in Auto mode:
      i. If TCS Temp is selected, the ePICV will control its opening to the brazed plate heat exchanger such that the TCS supply temperature will meet the setpoint TCS Supply Temperature Setpoint in PID control. The FWS Delta T will have no effect in this mode.
      ii. If Fixed Flow is selected, the ePICV will control its opening to the brazed plate heat exchanger such that the FWS Flow Rate will meet the setpoint FWS ePICV Fixed Flow Mode Setpoint in PID control. However, if the FWS Delta T is smaller than the FWS Delta T Setpoint, then the ePICV will reduce its flow rate to meet the FWS Delta T Setpoint. There is a minimum flow rate of 95 gpm (360 lpm) in Fixed Flow mode.
      iii. If Energy is selected and the FWS Delta T is smaller than the FWS Delta T Setpoint, then the ePICV will reduce its flow rate to meet the FWS Delta T Setpoint. There is a minimum flow rate of 95 gpm (360 lpm) in Energy mode.

ePICV Manual Operation

Figure 62. ePICV manual operation



Manual TCS Pump Operation

If Pump 1 / 2 Mode is set to Manual, TCS pump 1 / 2 can also be controlled manually by Pump 1 / 2 Manual Mode Override %.

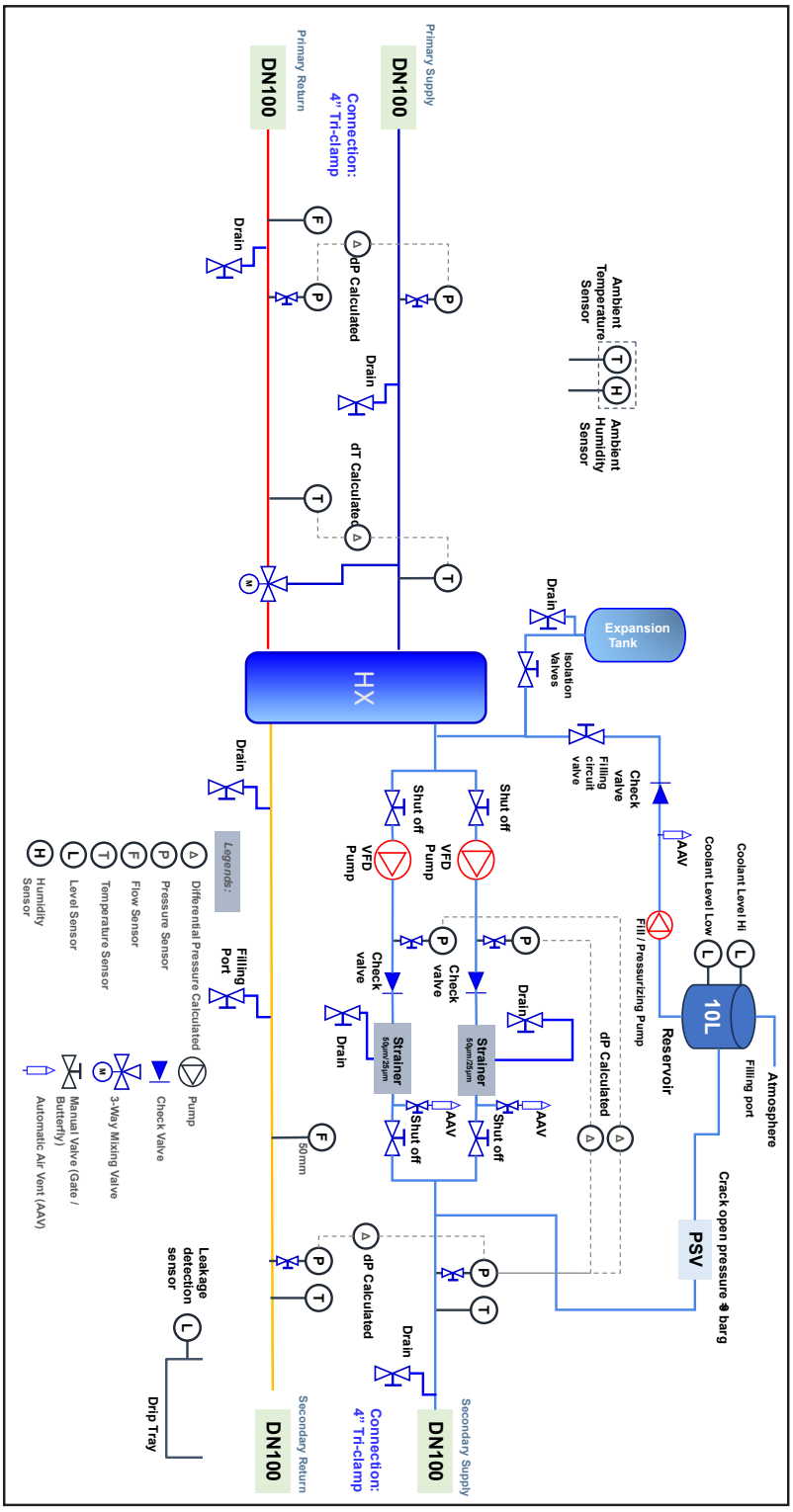
Manual ePICV Operation

If FWS ePICV Mode is set to Manual, the amount of coolant going into brazed plate heat exchanger can also be controlled manually by FWS ePICV Manual %.

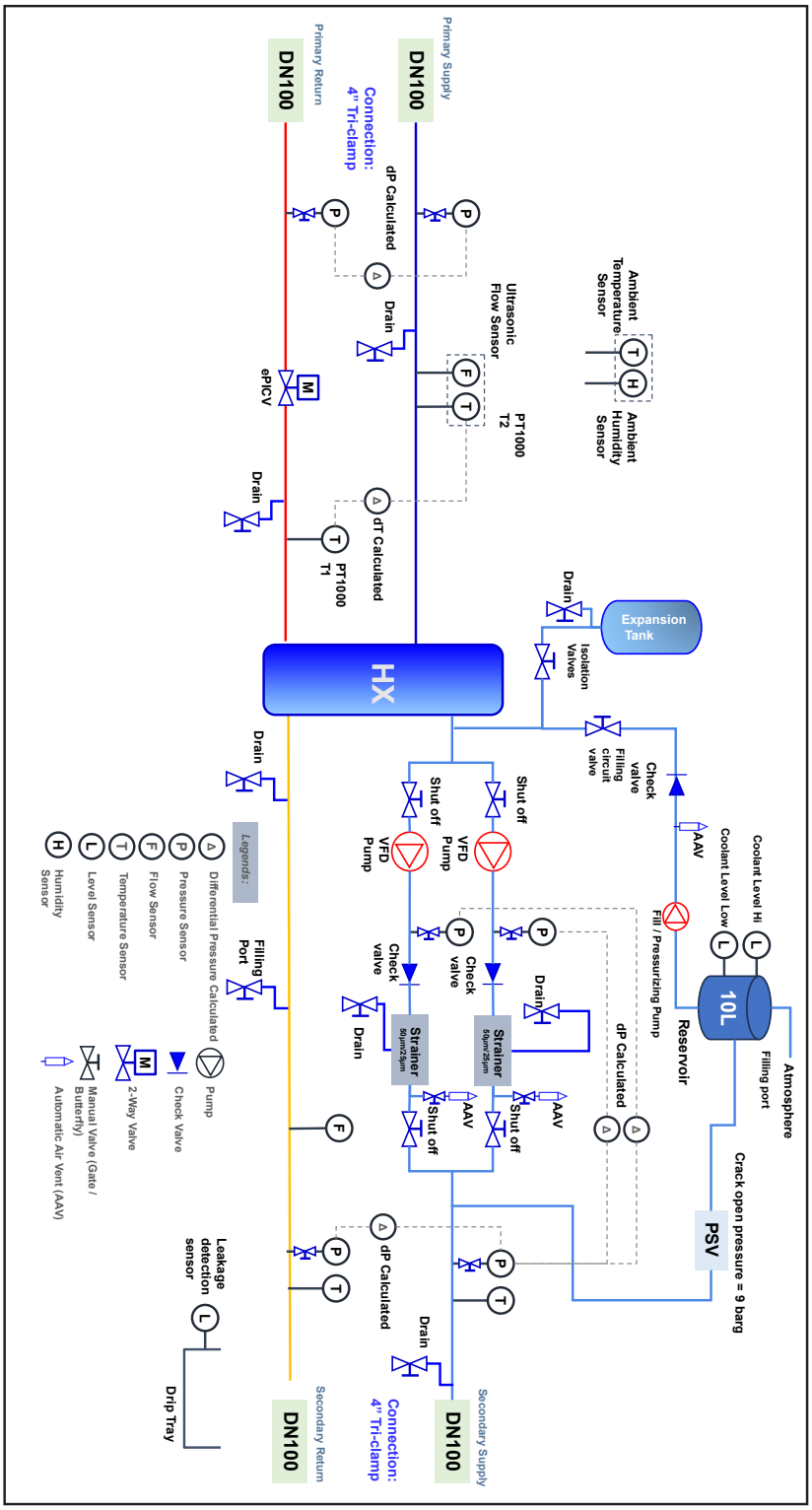
Manual Refill Pump Operation

If Refill Pump is set to Manual, the refill pump can be manually controlled to power ON / OFF.

P&ID Diagram (3-Way Valve)



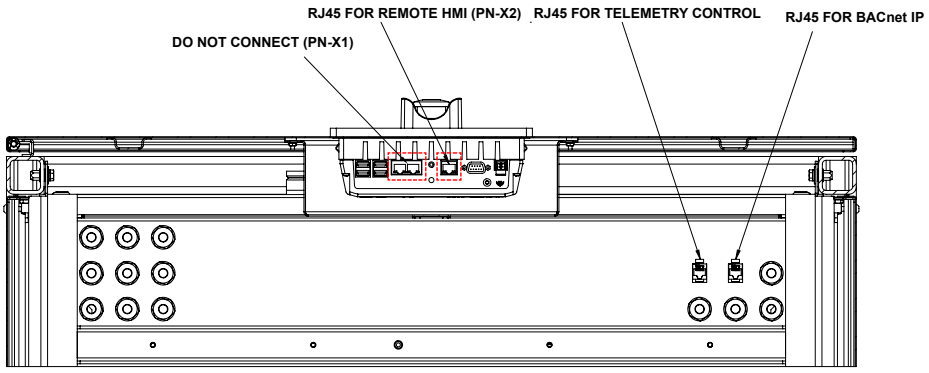
P&ID Diagram (ePICV)



Network Settings

Remote HMI Connection

Figure 63. Network connection



The RJ45 for remote HMI connection (PN-X2) is used for external communication. This is used for external communication via SmartClient (VNC), HMI web server. The IP address can be configured by DHCP or fixed IP to connect to an outside network. PN-X1 is the connection between the HMI and the PLC, and is used for internal communication only.

The HMI can be accessed from PN-X2 in two ways:

- DHCP is the default method
- Fixed IP (recommended method)

Configure DHCP or fixed IP

1. Login to the HMI using the administrator account.
2. Press Show Control Panel to access the control panel.
3. Go to Network and Internet > Network Settings.
4. Press the “PN-X2” button to change only the PN-X2 setting.

Important: *NEVER change the PN-X1 setting!*

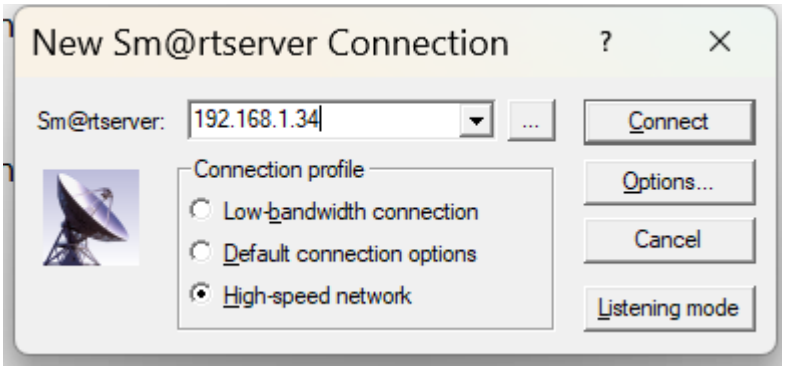
   a. To use the DHCP option, select “Obtain an IP address via DHCP.
   b. To use the static IP, select “Specify an IP address” then input a static IP (e.g., 192.168.0.14) and subnet mask accordingly (e.g. 255.255.255.0).

5. Press the “Start Runtime” button on the top-left to exit the Control Panel.
6. Connect a PC to the PN-X2 interface. The IP address of the PC can be anything in the same domain as the HMI IP address (set via either static IP or DHCP).

Remove Control using SmartClient

1. Use Siemens SmartClient software to connect to the IP configured.

Figure 64. SmartClient



2. When successful, then the user would able to remote control the system. Note that the user would still require to login at the HMI if the remote action require additional access right.

Telemetry Control Connection

The RJ45 for Telemetry Control is used for ModBus TCP communication, DataLog download, and ModBus TCP interface.

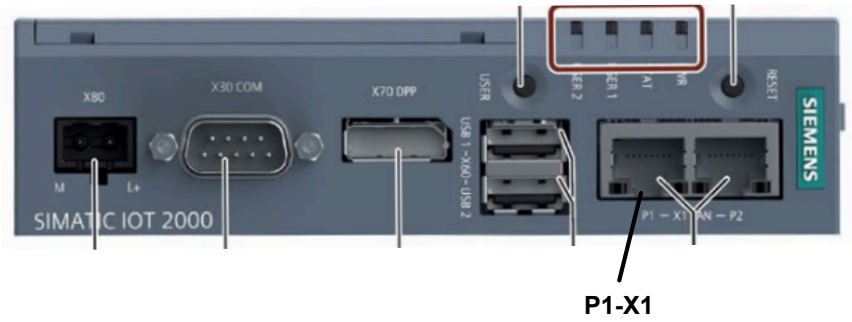
The Telemetry Control can be accessed in two ways:

- DHCP (default method)
- Fixed IP

Change Network Interface from DHCP to Fixed IP

1. Use a telnet software application (for example., putty) on a PC through port 22 to connect to the P1-X1 of the IOT2050 module inside the electrical panel (default IP address is 192.168.2.40).

Figure 65. P1–X1



2. Login with the provided username and password.

Note: *The username and password will be provided separately to customer and not provided in the manual.*

3. After logging in to SSH, enter the command **sudo nmtui**. Using **sudo** executes the command with admin privileges, so the password will need to be re-entered.
4. In the NetworkManager TUI menu, select **Edit a connection**.
5. Select **eno2-connection** and use the arrow keys to select **Edit...**.
6. Use an arrow key to change IPv4 CONFIGURATION to Manual and press **Show** to change the IP address and gateway setting.
7. Select **OK**, then **Back**, then **Quit**, and then **OK** to save and exit.
8. Reboot the IOT2050 module by executing the command **sudo reboot**.

9. After rebooting, the new IP address will be activated.

Modbus TCP Interface

The ModBus TCP Interface is available through the RJ45 for Telemetry Control. The ModBus TCP port is opened at 503. For a full list of ModBus registers, refer to “Modbus TCP Register List,” p. 105.

RESTful API

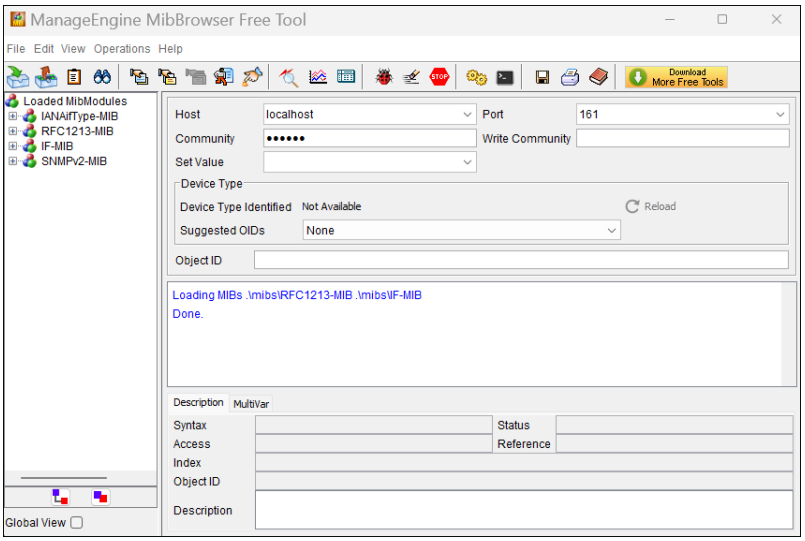
The RESTful API is available at the RJ45 for Telemetry Control. Some of the RESTful API is available only for read without access rights control, while some of the RESTful API is available for write with access right control. For a full list of RESTful APIs, please refer to “RESTful API Table (ePICV) ,” p. 112.

Simple Network Management Protocol (SNMP)

Note: *The TCDU supports SNMPv3 only: the user must have a Management Information Base (MIB) program that support SNMPv3. MibBrowser for SNMP communication is recommended.*

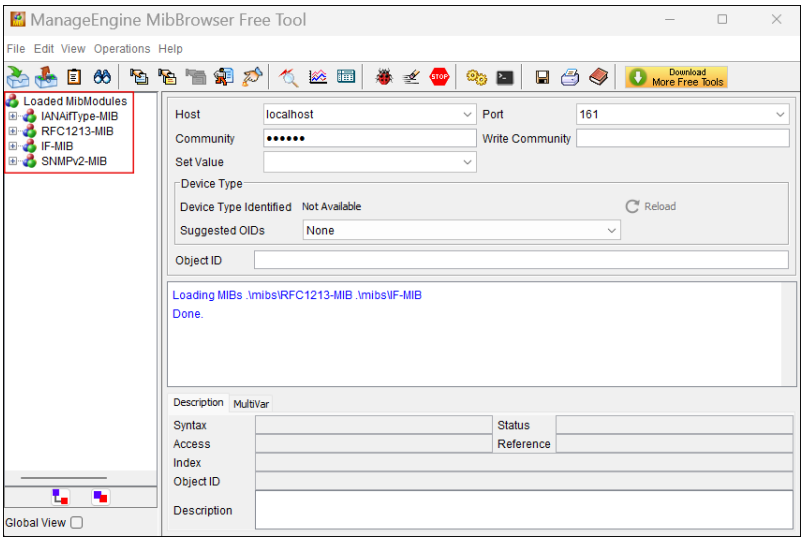
1. When a user executes the MibBrowser, make sure there is sufficient access rights.

Figure 66. MibBrowser



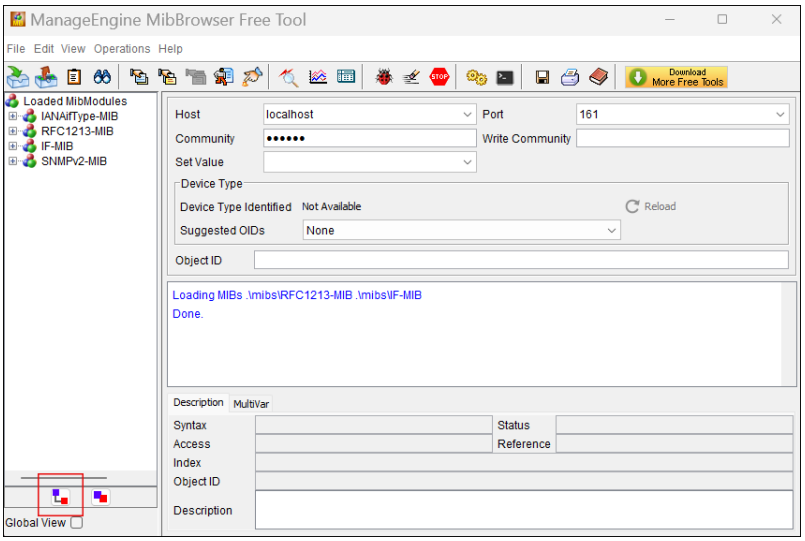
2. A MIB table file for reading the TCDU will be provided by Trane: contact the Trane sales office for the SNMP MIB table file. Press  to remove the default MIB program and then press  to load the Trane provided MIB table file.

Figure 67. MIB table



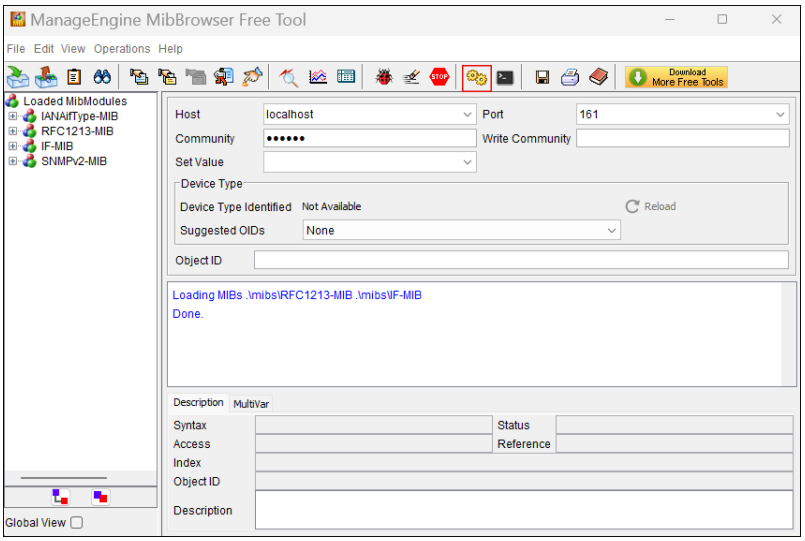
3. Press  at the bottom to expand the MIB table list.

Figure 68. Expand MIB table list



4. Press  to select the SNMP Version > v3, and press the **Add** button to add new user data.

Figure 69. Add new user data



5. Input the following information:

Note: *Passwords are provided separately to the customer.*

   a. **Target Host** address: Default IP address is 192.168.2.40.

   b. **User name**: snmpv3

   c. **Security Level**: Auth, Priv

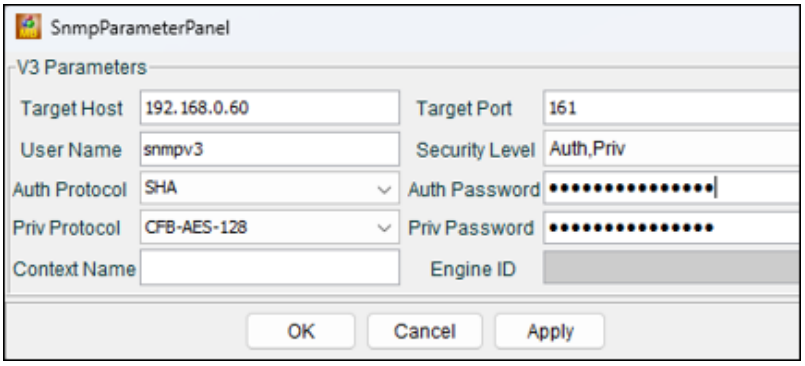
   d. **Auth Protocol**: SHA

   e. **Priv Protocol**: CFB-AES-128

   f. **Auth Protocol**: SHA password

   g. **Priv Protocol**: AES password

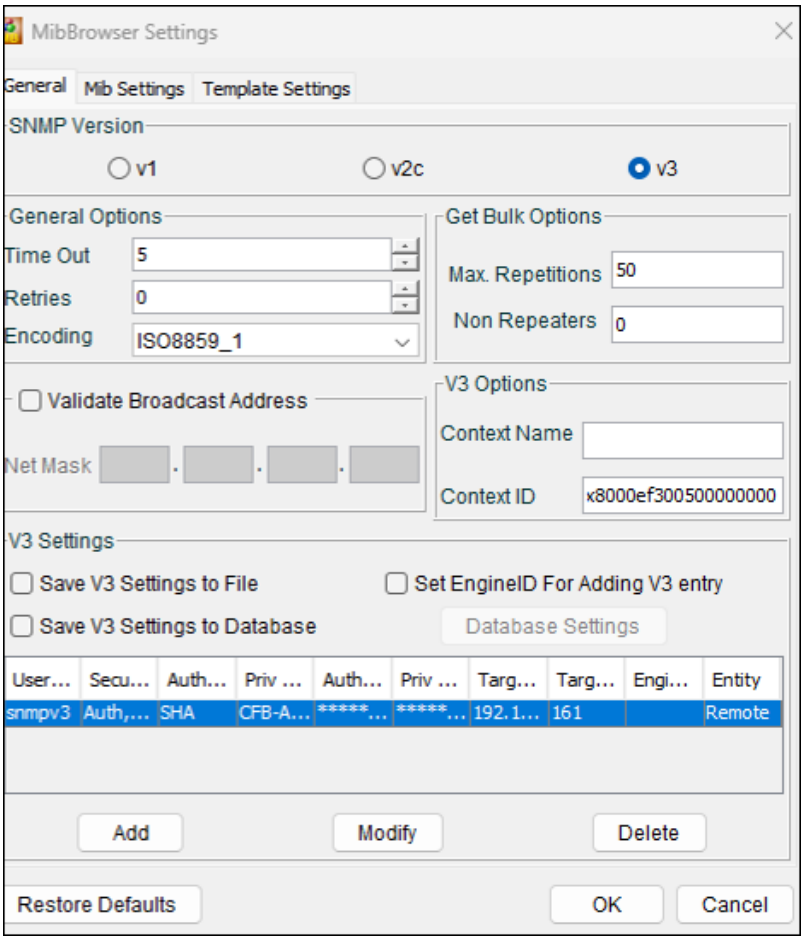
Figure 70. SNMP parameter panel



6. Press the **OK** button to close SnmpParameterPanel then press the **OK** button again to close MibBrowser settings.

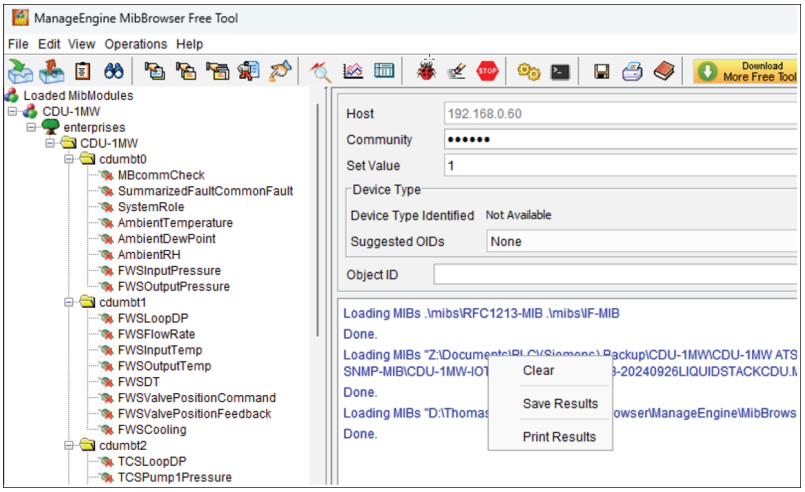
   The next page will start to connect with data.

Figure 71. Connect to data



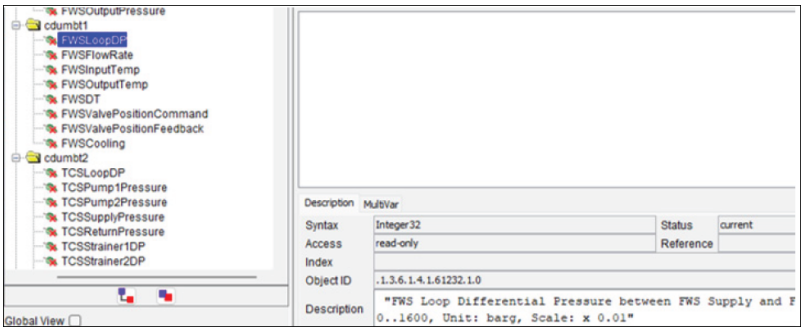
7. Right-click on the main window to select **Clear** in order to clear any text in the main window.

Figure 72. Clear



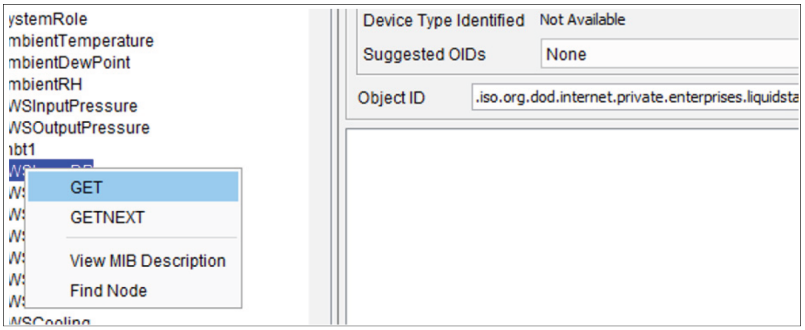
8. If the user selects any parameter on the left side, the description of the selected parameter is shown in the area near the bottom.

Figure 73. Description



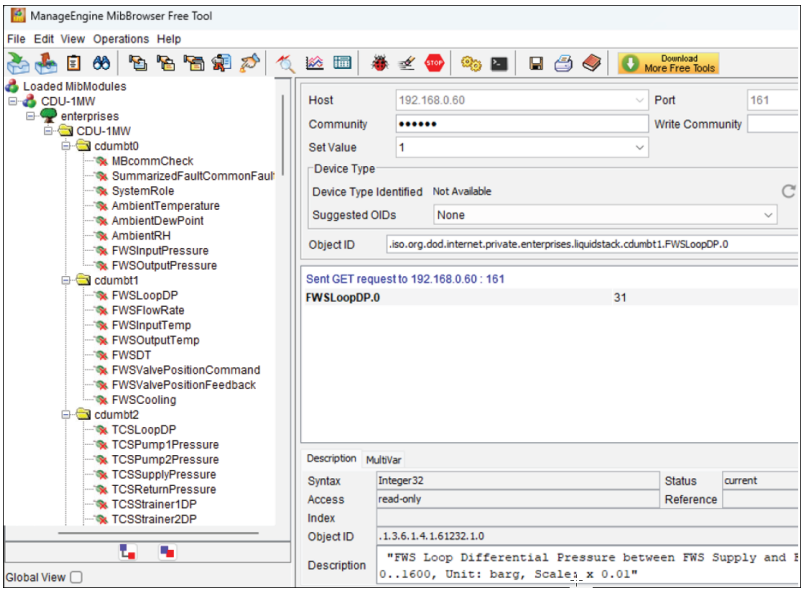
9. A user can right-click on one of the parameters and press **GET** to acquire the current value from the TCDU SNMP agent.

Figure 74. GET current value



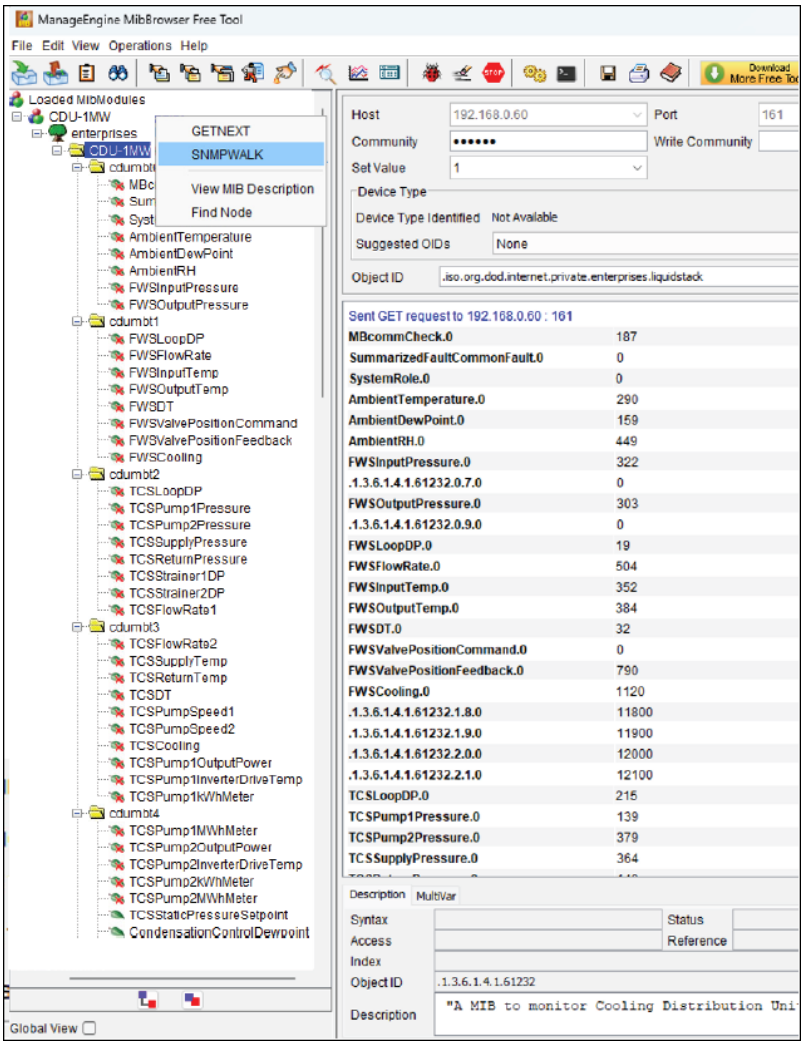
10. Each value in the list can be acquired with this process.

Figure 75. View values



11. To retrieve all the values under the tree table, the user can right-click on **Trane** and select **SNMPWALK**. All the data values will then be listed out at the TCDU SNMP agent.

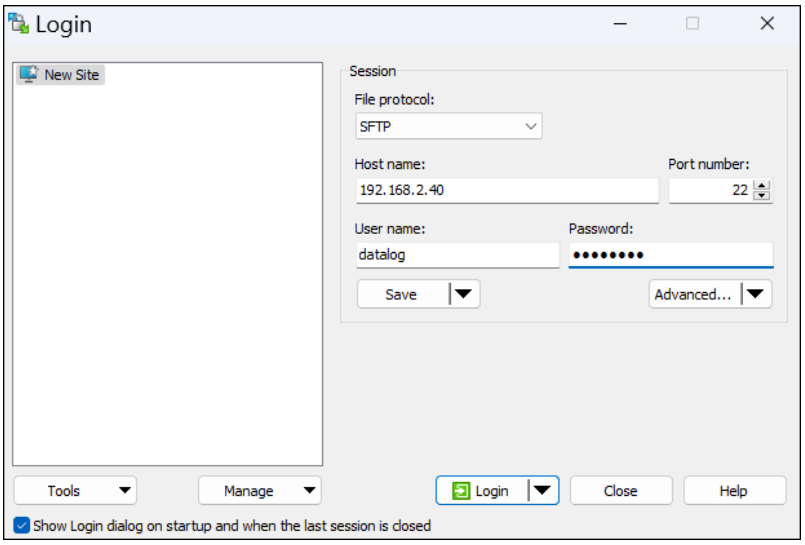
Figure 76. SNMPWALK



Download the DataLog

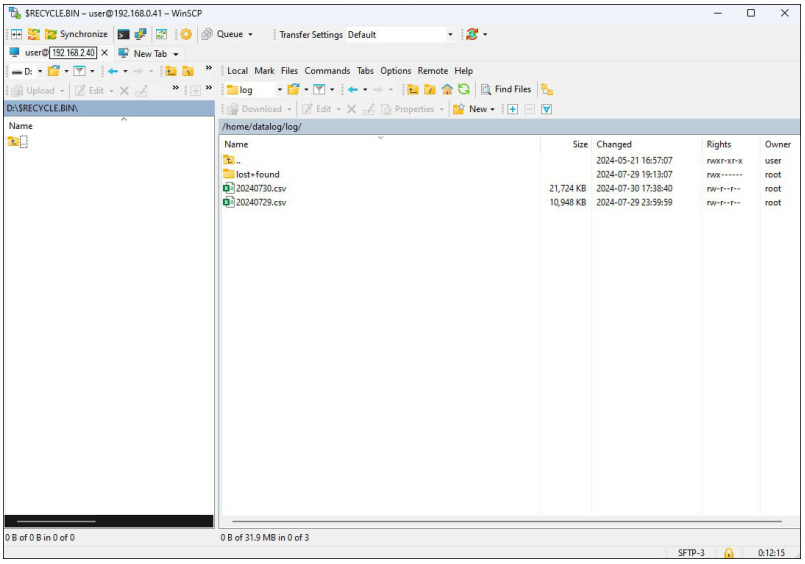
1. Use WinSCP software on a PC through port 22 to connect to the **RJ45 for Telemetry Control** port at the bottom of the electrical panel. The default IP address is 192.168.2.40. WinSCP is an open-source freeware. The username and password for login will be provided separately to customers.

Figure 77. Login



2. After login, the CSV files can be downloaded to the local PC.

Figure 78. Download CSV file



3. CSV file formats are described in “Data Log Format,” p. 102.

Group Control

Group Control Overview

The **Group Mode** control function allows for a maximum of four TCDUs to synchronize their running states. One of the TCDUs must be set as the **Principal** unit while the others are set as **Agents**. Agent TCDUs will always use the same settings as the Principal TCDU. When both Principal and Agent TCDUs are in Auto mode, the following settings are synchronized:

1. TCS Pump Duty Mode
2. Pump Control Mode
3. Auto Control Mode Setpoints
   a. Fixed Flow Rate Control Setpoint
   b. Fixed dP Control Setpoint
   c. Fixed Speed % Setpoint – Single Mode
   d. Fixed Speed % Setpoint – Dual Mode
4. Pump Duty Changeover Duration
5. TCS Static Pressure Setpoint
6. TCS Supply Temperature Setpoint
7. Condensation Control Setpoint

RS-485 Connection

An RS-485 connection between the Principal TCDU and the Agent TCDUs is required as a daisy-chain connection.

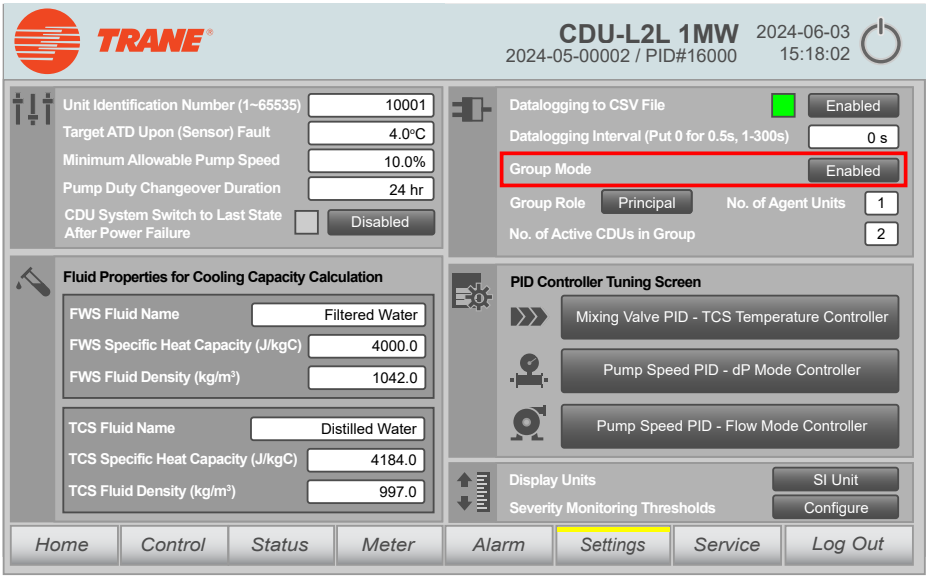
Group Control Operation

To activate Group Mode, follow the procedure below.

1. Confirm the TCDUs are connected via the RS-485 connection.
2. In the Settings menu, set Group Mode to **Enabled**.

Note: *The label on the button is the current state.*

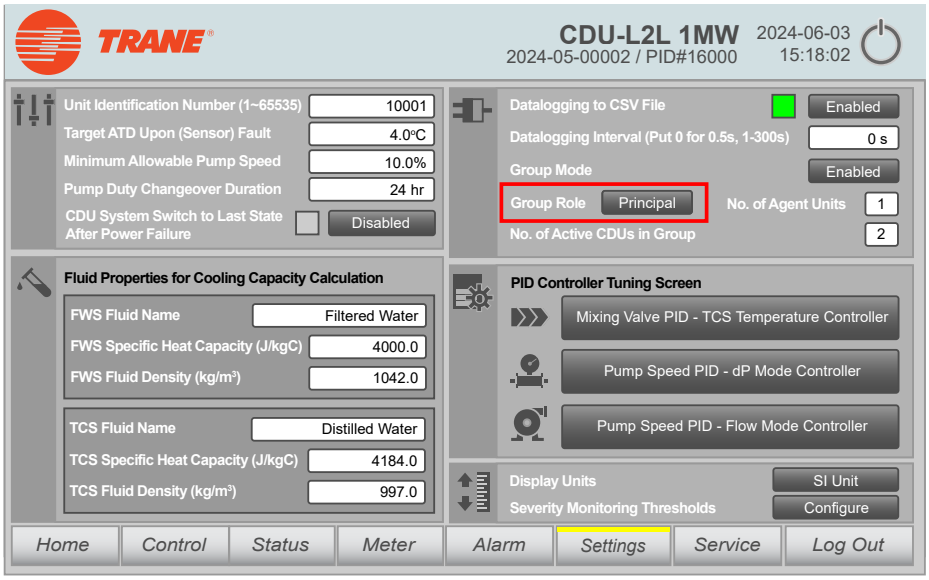
Figure 79. Group Mode Enabled



3. Select whether the unit is the Principal unit or an Agent unit by toggling the button for **Group Role**.

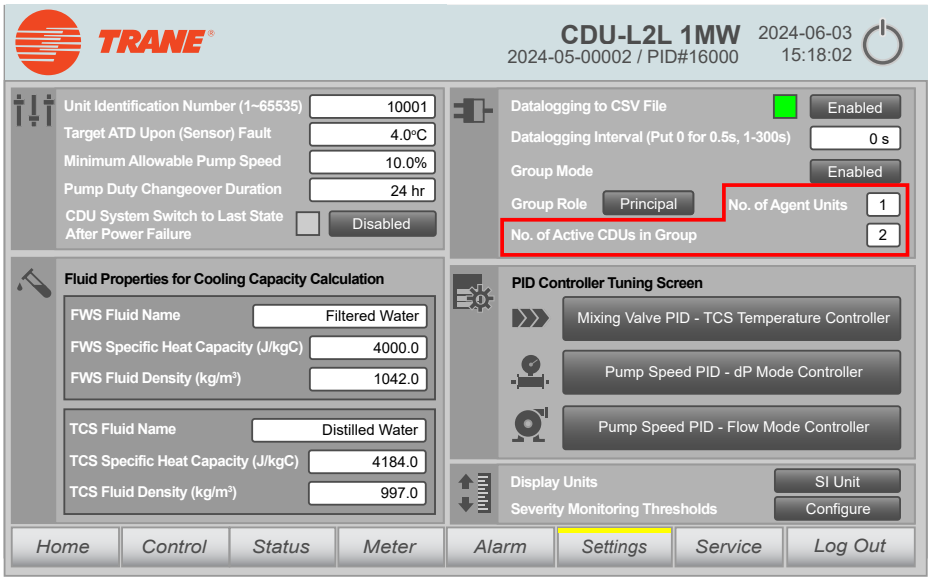
Note: *The label on the button is the current role.*

Figure 80. Group Role Principal



4. If the unit is set at the Principal unit, enter values for **No. of Agent Units** and **No. of Active TCDUs in Group**.

Figure 81. No. of Active TCDUs in Group



The following are Group Mode use case examples:

- If “No. of Active TCDUs in Group” is '1', then the two TCDUs (one Principal and one Agent) will alternate operating with only one TCDU active at any given time.
- If “No. of Active TCDUs in Group” is '2', then the two TCDUs (one Principal and one Agent) will both lwas be active.

After the following conditions are met, the TCDUs will synchronize their operating parameters based on the settings of the Principal unit:

1. Group Mode is activated with only one Principal and at least one Agent.
2. The TCDUs are set to operate in Auto mode.
3. Communication is established via the RS-485 connection.

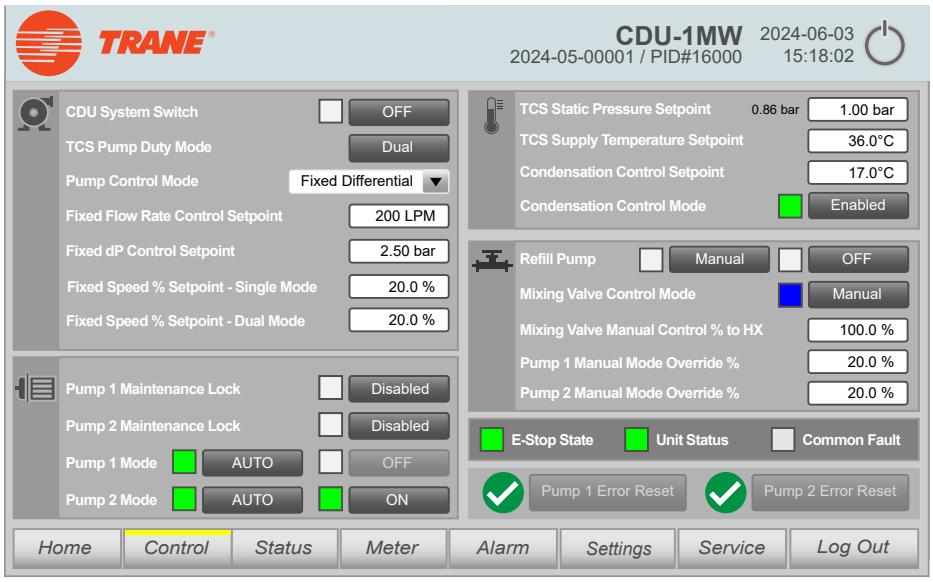
For example, if the Principal TCDU has both Pump 1 and Pump 2 set to **Auto** mode, Pump Control Mode is **Fixed Speed %** set to 20%, and TCS Pump Duty Mode is **Dual**, the Agent TCDUs will have the same configuration if it is also in **Auto** mode.

If the units are equipped with a 3-way valve, the Agent TCDUs will have the same configuration as the Principal TCDU regardless of the setting for Mixing Control Valve Mode (**Auto**) as long as the units maintain an active connection.

If the units are equipped with ePICV, the Agent TCDUs will have the same configuration as the Principal TCDU regardless of the setting for FWS ePICV mode (**Auto**) as long as the units maintain an active connection.

Note that TCDU with Mixing Control Valve Mode (**Manual**) and FWS ePICV mode (**Manual**) will operated independently even they are part of a group.

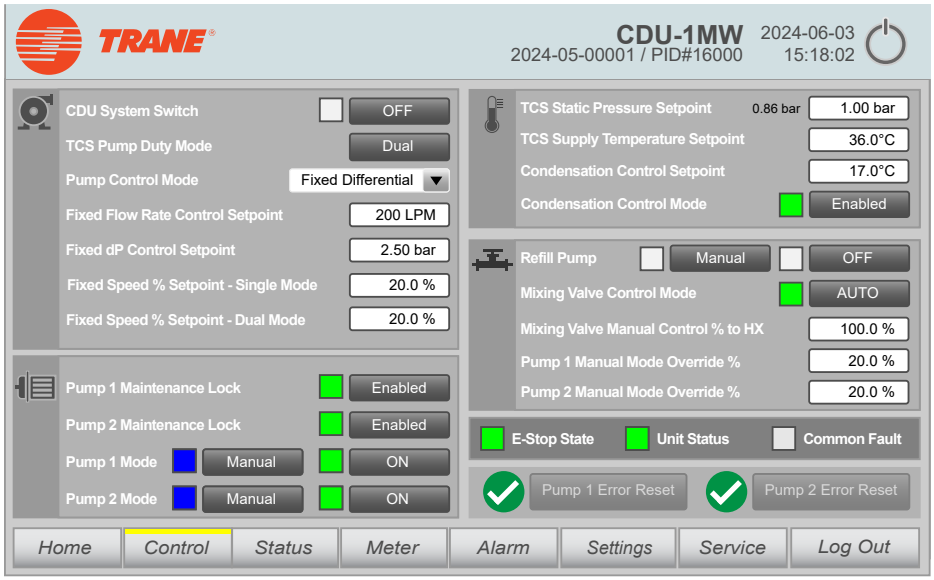
Figure 82. Group control



Manual Override

The Group Mode operation can be temporarily overridden by setting the pumps to **Manual** mode for troubleshooting or maintenance purposes.

Figure 83. Manual override



The corresponding CDU with a pump set to operate in **Manual** mode will be considered to be in a running state regardless of the command is from the Principal CDU.

Failsafe, Alarm, and Recovery

If communication between the CDUs is lost while Group Mode is active, an alarm will be activated. Agent CDUs that were in the group will operate as standalone units using the last settings received from the Principal CDU.

It should be noted that Agent CDUs cannot change Pump Control Mode while still configured to run in Group Mode. However, Principal CDUs can change Pump Control Mode at any time.

If a CDU is configured to operate in Group Mode and stops operating for any reason, like a pump fault, another CDU in the same group may be automatically activated to maintain operation.

Note: *This operation is dependent on the No. of Active CDUs in Group setting.*

- If the No. of Active CDUs in a Group setting is 'n' while the total number of CDUs is also 'n', then all CDUs in the group will be active all of the time.
- If the"No. of Active CDUs in a Group setting is 'n-1', 'n-2', or 'n-3', while the total number of CDUs is 'n', then one of the CDUs will be automatically activated to maintain operation.

Figure 84. Alarm status

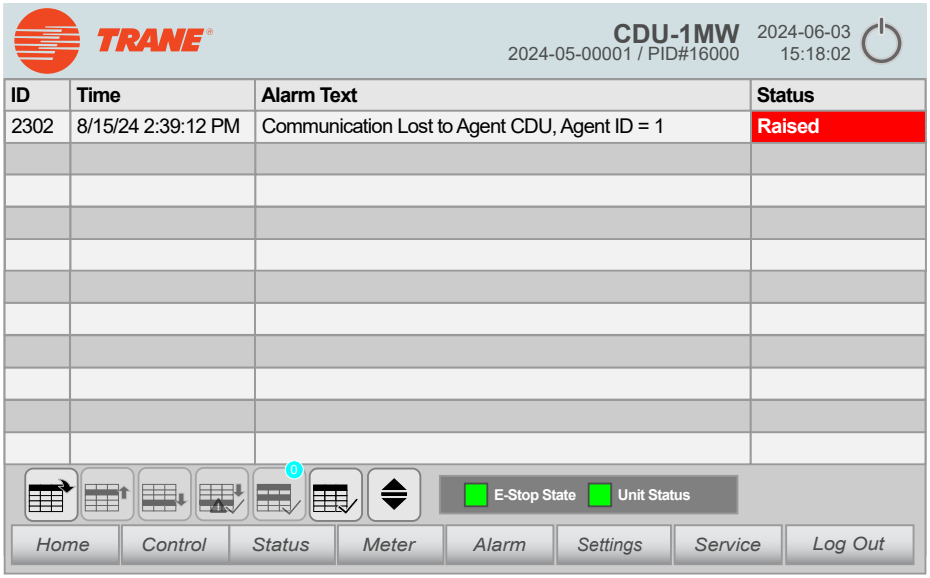


Table 29. Alarm status

2301	Comm_Lost to Master	Communication with the Master Control CDU has been lost.	Alarm
2302	Comm_Lost to Slave 1	Communication with the Slave CDU has been lost (Slave ID = 1).	Alarm
2303	Comm_Lost to Slave 2	Communication with the Slave CDU has been lost (Slave ID = 2).	Alarm
2304	Comm_Lost to Slave 3	Communication with the Slave CDU has been lost (Slave ID = 3).	Alarm

Maintenance

⚠ WARNING

System is Pressurized!

Failure to follow instructions below could result in death, serious injury, or equipment damage. Only qualified personnel should operate valves and open system.

Suggested Maintenance Schedule

Maintenance services should be carried out every 3 months, 6 months, and 12 months in the first year after initial unit startup. After then, the planned maintenance service will be twice annually (semi-annually).

Checklists are provided in the following sections that can be photocopied and used for preventative maintenance schedule records.

Quarterly Maintenance Schedule

Date: _____

Performed by: _____

Model number: _____

Serial number: _____

- ☐ Check the TCS strainer dP, change the TCS strainer if necessary.
- ☐ Check CDU valve operation. Adjust parameters if necessary.
- ☐ Check 3-Way Valve / ePICV command and feedback.
- ☐ Check for any current warnings or alarms, correct and clear.
- ☐ Download alarm and data logs.
- ☐ Check all temperature sensors with calibrated temperature sensor.
- ☐ Check that all temperature, pressure, and flow sensors are securely fixed with no leakage.
- ☐ Check that FWS pipework is securely connected with no leakage.
- ☐ Check that FWS pipework thermal insulation (if fitted).
- ☐ Check and record the maximum flow rate of FWS circuit, and adjust if necessary. _____
- ☐ Check and record the FWS supply temperature. _____
- ☐ Check and record the FWS pressure. _____
- ☐ Check fuses (if any).
- ☐ Check contactors for pitting (replace if pitted).
- ☐ Check/re-tighten wire connections.
- ☐ TCS Pump—Compare to nameplate amps L1, L2, L3
- ☐ Check TCS pipework is securely connected with no leakage.
- ☐ Check the normal TCS flow rate.
- ☐ Check the opening of TCDU auto air vent for obstructions.
- ☐ Check the expansion tank for leaks.
- ☐ Check whether the manual override of the refill pump is still operational.
- ☐ Check firmware status and upgrade if necessary.
- ☐ Take a water sample and check if it meets the required specifications.

Semi-Annual Maintenance Checks

Perform the following semi-annual maintenance checks in addition to the quarterly checks.

Date: _____

Performed by: _____

Model number: _____

Serial number: _____

- ☐ Simulate the TCS pump change over.
- ☐ If TCDUs are configured in Group Control Mode, simulate the TCDUs switch off to test if backup TCDUs meet the performance requirement.
- ☐ Check the leakage detection.
- ☐ Check the functionality of the remote control.

Annual Maintenance Checks

Perform the following annual maintenance checks in addition to the quarterly and semi-annual checks.

Date: _____

Performed by: _____

Model number: _____

Serial number: _____

- ☐ Check all drain valves for blockages.
- ☐ Check all the cable connections and terminals. Tighten if necessary.
- ☐ Check the rack heat load and the TCS control mode setting.
- ☐ Override FWS valve from current operating value to 100%.
- ☐ Override TCS pump inverters from current operating value to 100%.
- ☐ Record TCS pump currents in L1, L2, and L3.
  - L1: _____
  - L2: _____
  - L3: _____
- ☐ Record TCS pump run hours. _____
- ☐ Record 3-Way Valve / ePICV run hours. _____

Two-Year Maintenance Check

Perform the following maintenance checks after two years in addition to the quarterly, semi-annual, and annual checks.

Date: _____

Performed by: _____

Model number: _____

Serial number: _____

☐ Drain the fluid and re-commission the TCS circuit if necessary. Only replace with coolant that meets the TCS coolant specification.

TCS Circuit

TCS Strainer Replacement

Replace the TCS strainer in accordance with the maintenance schedule. The TCS strainer should be checked at least annually.

Notes:

- *The TCS circuit consists of two circuits. During maintenance, one circuit can be turned off during operation (for example, strainer change).*
- *The TCS pump in the circuit to be maintained must first be powered down via the system.*
- *Pump 1 / 2 Maintenance Lock can be used to prevent the TCS pump from operating during a maintenance task. Otherwise, there is a risk of a malfunction or system downtime.*
- *It is recommend to perform the strainer change procedure several times while the TCS circuit on the customer side is not in operation.*

1. Check the Home screen to identify the strainer for which maintenance is due (the strainer with the highest differential pressure).
2. On the Control screen, enable the Pump 1 / 2 Maintenance Lock (1 or 2) and confirm that the other pump is active.
3. Open the rear door of the TCDU.
4. Close the 2x TCS supply pump 1 / 2 isolation valves (the pipes are under pressure), one above the TCS pump while the other is located behind the strainer. Only close the isolation valve in which the TCS supply pump has stopped.
5. Prior to changing the TCS strainer, connect a drain hose (field supplied) to the TCS strainer drain valve 1 / 2 to depressurize the TCS strainer housing.
6. Loosen the nut on the tri-clamp with a 16-mm wrench. Collect the escaping coolant (approximately 4 liters). Remove the tri-clamp.
7. Pull the TCS strainer handle to pull the TCS strainer out. Either wash the TCS strainer and replace it or install a new strainer if necessary.
8. Install the new or cleaned TCS strainer in the strainer housing, make sure it is seated properly on the strainer housing.
9. Re-install the nut and tighten it to a torque of 22 Nm.

Note: *Apply anti-seize lubricant to the threads before tightening.*

10. Close the TCS strainer drain valve 1 / 2 and disconnect the drain hose.
11. On the Control screen, use the Refill Pump in Auto Mode to make sure the static pressure and thus coolant inside the piping is sufficient.
12. Slowly reopen the TCS supply pump 1 / 2 isolation valve and open valve at strainer slowly to let air bleed from the air vent. Open the valve above the TCS supply pump 1 / 2 slowly to vent any residual air.
13. Disable the Pump 1 / 2 Maintenance Lock so that the turned off pump is active again. Care should be taken so that the TCS Return Pressure does not drop below the alarm threshold.

TCS Circuit Coolant Removal

Removing the TCS circuit coolant is usually done for the following activities:

- Pack for shipping.
- Removal from row and relocation.

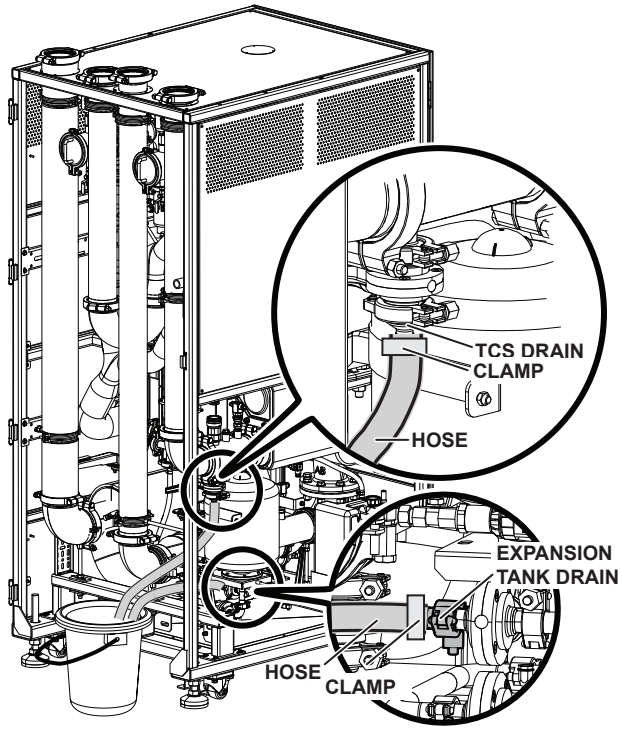
Note: *If decommissioning for long term storage or shipping, it is recommended to flush with clean water if glycol was previously used in order to avoid growth of bacteria or acids.*

Procedure:

1. Power down the TCDU.
2. Shut off the customer circuit connected to the TCS circuit.

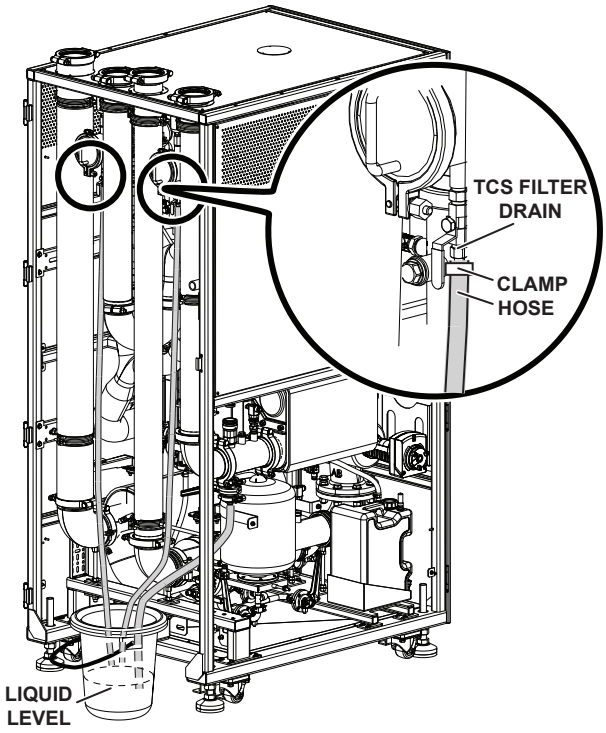
3. Connect one end of a hose to the bottom TCS drain and a hose to the expansion tank drain. Route the other ends of both hoses into a suitable field-supplied container for the coolant. As the amount of coolant in the circuit may vary, make sure multiple containers are available in case the first container is filled completely or use a container large enough to contain all of the coolant while still allowing for gravity drainage of the coolant. Use a clamp to make sure the hose is installed securely.

Figure 85. Connect hose



4. Connect one end of a hose to each of the TCS strainer drains, and route the other end of the hoses into the same container. Keep the other ends of the hoses above the liquid level to allow for air intake. Use a clamp to make sure the hose is installed securely.

Figure 86. Connect hose

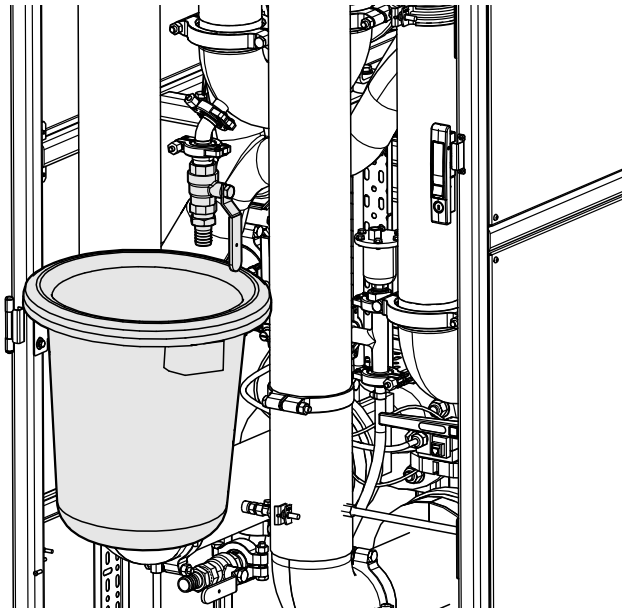


5. Open the valves to the TCS drain and expansion tank drain, and then open the TCS strainer drains.

Note: *Close the valves if the coolant level is going to overfill the container(s).*

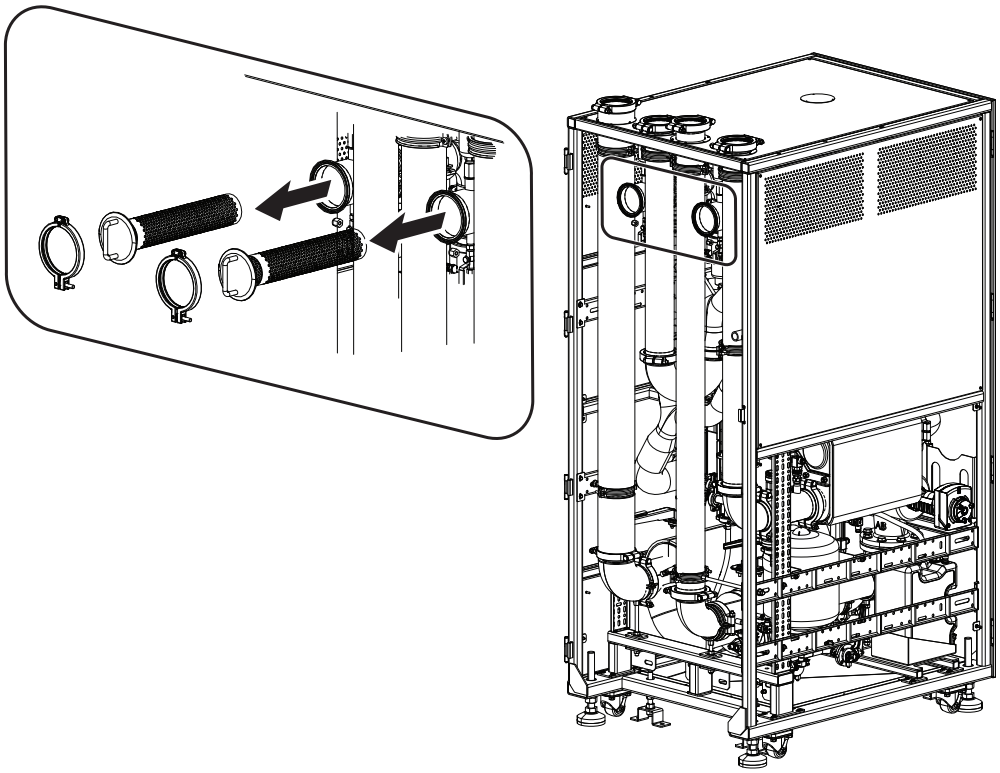
6. If the TCDU is using the top piping configuration, use suitable container(s) to collect the coolant from the bottom of the TCS supply through the drain at the elbow.

Figure 87. Collect coolant



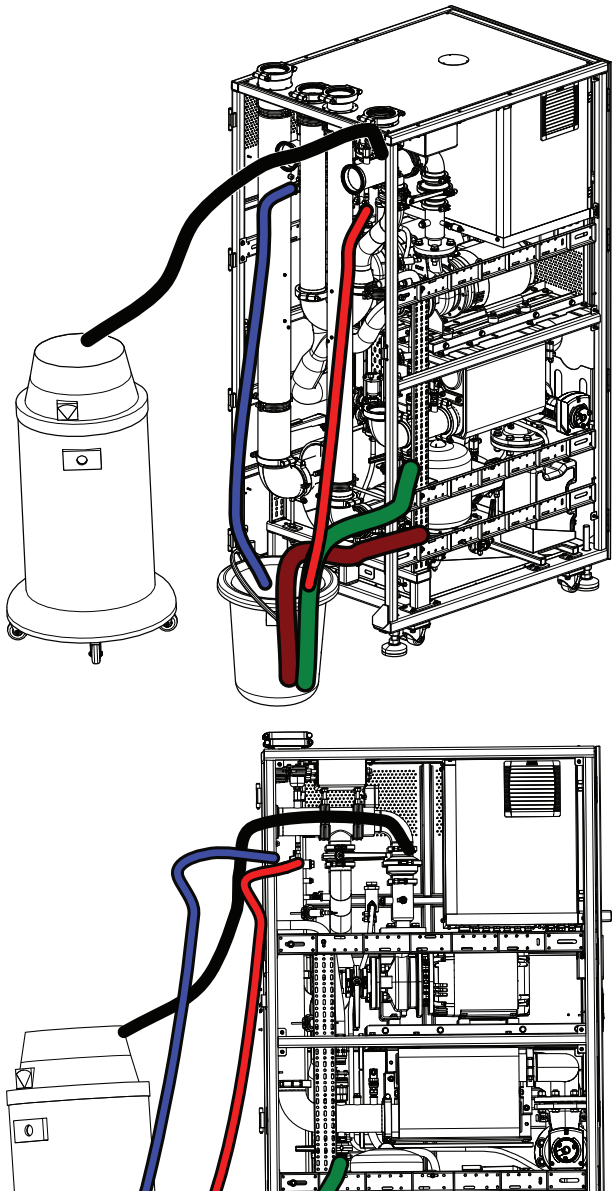
7. Remove the TCS strainers.

Figure 88. Remove TCS strainers



8. Use a vacuum cleaner to go into the region above the check valve to remove any trapped coolant. Make sure to use a vacuum cleaner that is rated for removing liquid.

Figure 89. Remove coolant with vacuum



Anti-Freeze Agent

To confirm sufficient concentration of the anti-freeze agent, check the concentration according to the maintenance schedule.

This test is carried out using a conventional density measuring system or refractometer. See the manufacturer's product information.

Check / top up the anti-freeze agent as follows:

1. Take a sample from the system circuit. Withdraw at least 0.1 gal (0.5 l) of the medium to confirm a conclusive measuring result.
2. Measure the concentration with a suitable measuring instrument.
3. If the concentration is outside of the specified range, top up the anti-freeze agent.

Troubleshooting

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear PPE and follow proper handling guidelines could result in death or serious injury.

Always wear appropriate personal protective equipment in accordance with applicable regulations and/or standards to guard against potential electrical shock and flash hazards.

⚠ WARNING

Pressurized Liquid!

Failure to follow instructions below could result in death, serious injury, or equipment damage.

The TCDU expansion tank is under pressure when the unit is switched off and depressurized. Exercise extreme caution when working on the expansion tank.

⚠ WARNING

Electrical hazard!

Failure to follow instructions below could result in death or serious injury.

The TCDU must be disconnected from the power supply via a power switch. An emergency switch is also available to quickly interrupt the power connection.

⚠ WARNING

Electrical Shock, Fire, or Explosion Hazard!

Failure to follow instructions below could result in serious injury, death, or property damage.

- **Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.**
- **This equipment must be installed and serviced by qualified personnel only.**
- **Turn off all power supplying this equipment before working on or inside the equipment.**
- **Replace all devices, doors, and covers before turning on power to this equipment.**
- **Always use a properly rated voltage sensing device to confirm power is off.**

Notes: *The following must be observed in order to avoid injuries and damage to property:*

- *Only qualified personnel are authorized to perform these tasks.*
- *Comply with the all safety warnings.*

Table 30. Troubleshooting

Fault	Cause	Note
No Flow / Insufficient Flow detected	The flow meter is defective. The isolation valves are closed. The control settings are incorrect. The strainer is clogged.	Check the flow meter. Check the isolation valves. Check if the control settings are correct. Check and clean strainer if necessary.
Coolant too warm / too cold	Temperature sensor removed from thermowell.	Check the temperature sensor.
Loss of coolant in piping	Piping system leaking	Check the system for leaks. Check the valves for leaks. Check the expansion tank for leaks.

Appendix

Alarm List

Discrete Alarm List

Note: *Depending on unit configuration, not all alarms are necessarily active.*

Table 31. Discrete alarm list

ID	Name	Description	Class
1101	Sensor_Ambient Temp	Sensor Failure: Ambient Temperature Sensor	Alarm
1102	Sensor_Ambient RH	Sensor Failure: Ambient Relative Humidity % Sensor	Alarm
1103	Sensor_FWS InPress1	Sensor Failure: FWS Input Pressure Sensor	Alarm
1104	Sensor_FWS InPress2	Sensor Failure: FWS Input Pressure 2 Sensor (After Strainer)	Alarm
1105	Sensor_FWS InFlowRate	Sensor Failure: FWS Input Flow Rate cannot be evaluated	Alarm
1106	Sensor_FWS InTemp	Sensor Failure: FWS Input Temperature Sensor	Alarm
1107	Sensor_FWS OutTemp	Sensor Failure: FWS Output Temperature Sensor	Alarm
1108	Sensor_FWS OutPress	Sensor Failure: FWS Output Pressure Sensor	Alarm
1109	Sensor_TCS Pump1 Press	Sensor Failure: TCS Pump1 Output Pressure Sensor	Alarm
1110	Sensor_TCS Pump2 Press	Sensor Failure: TCS Pump2 Output Pressure Sensor	Alarm
1111	Sensor_TCS SupplyPress1	Sensor Failure: TCS Supply Pressure 1	Alarm
1112	Sensor_TCS SupplyPress2	Sensor Failure: TCS Supply Pressure 2	Alarm
1113	Sensor_TCS SupplyPressV	Sensor Failure: TCS Supply Pressure (No reading available)	Alarm
1114	Sensor_TCS ReturnPress1	Sensor Failure: TCS Return Pressure 1	Alarm
1115	Sensor_TCS ReturnPress2	Sensor Failure: TCS Return Pressure 2	Alarm
1116	Sensor_TCS ReturnPressV	Sensor Failure: TCS Return Pressure (No reading available)	Alarm
1119	Sensor_TCS FlowRate1	Sensor Failure: TCS Flow Rate 1	Alarm
1120	Sensor_TCS FlowRate2	Sensor Failure: TCS Flow Rate 2	Alarm
1121	Sensor_TCS FlowRateV	Sensor Failure: TCS Flow Rate (Redundant failure, no reading are available)	Alarm
1122	Sensor_TCS SupplyTemp1	Sensor Failure: TCS Supply Temperature 1	Alarm
1123	Sensor_TCS SupplyTemp2	Sensor Failure: TCS Supply Temperature 2	Alarm
1124	Sensor_TCS SupplyTempV	Sensor Failure: TCS Supply Temperature (No reading available)	Alarm
1125	Sensor_TCS ReturnTemp1	Sensor Failure: TCS Return Temperature 1	Alarm
1126	Sensor_TCS ReturnTemp2	Sensor Failure: TCS Return Temperature 2	Alarm
1127	Sensor_TCS ReturnTempV	Sensor Failure: TCS Return Temperature (No reading available)	Alarm
1128	Sensor_DewPoint	Sensor Failure: Ambient Dew Point cannot be evaluated	Alarm
1129	Sensor_FWS Strainr dP	Sensor Failure: FWS Strainer dP cannot be evaluated, strainer condition not monitored	Alarm
1130	Sensor_FWS Loop dP	Sensor Failure: FWS Loop dP cannot be evaluated	Alarm
1131	Sensor_TCS Strainer1 dP	Sensor Failure: TCS Strainer 1 dP cannot be evaluated, strainer condition not monitored	Alarm
1132	Sensor_TCS Strainer2 dP	Sensor Failure: TCS Strainer 2 dP cannot be evaluated, strainer condition not monitored	Alarm

Table 31. Discrete alarm list (continued)

ID	Name	Description	Class
1133	Sensor_TCS Loop dP	Sensor Failure: TCS Loop dP cannot be evaluated.	Alarm
1134	Sensor_FWS dT	Sensor Failure: FWS dT cannot be evaluated	Alarm
1135	Sensor_TCS dT	Sensor Failure: TCS dT cannot be evaluated	Alarm
2101	Type1_E-Stop	Emergency Stop Button has been triggered	Alarm
2102	Type1_Safety Relay OFF	The Safety Status is in the OFF state, the interlock is enforced, and pump start not possible. Clear the Interlock via the Safety Reset switch on the Alarm screen.	Warning
2103	Type1_3-Way Valve Error	FWS 3-Way valve regulation error, position discrepancy	Alarm
2104	Type1_Maint OFF Pump1	TCS Pump 1 Lock is turned off for unit maintenance	Notification
2105	Type1_Maint OFF Pump2	TCS Pump 2 Lock is turned off for unit maintenance	Notification
2106	Type1_Inverter1 Error	Inverter 1 for TCS Pump 1 is in an error state	Alarm
2107	Type1_Inverter2 Error	Inverter 2 for TCS Pump 2 is in an error state	Alarm
2108	Type1_Route 1 Error	TCS Pump 1 pump loop is not available to run. Check the output pressure on Pump 2.	Notification
2109	Type1_Route 2 Error	TCS Pump 2 pump loop is not available to run. Check the output pressure on Pump 2.	Notification
2110	Type1_Leak	Leakage has been detected at the drain pan	Alarm
2111	Type1_Main lost	The main power supply has been lost; the pumps will not start.	Alarm
2112	Type1_UPS Error	The controller supercapacitor has an error.	Alarm
2113	Type1_DryRun1 Error	Pump 1 Route Dry Run Protection. The circuit is possibly not filled enough to reach the desired pressure.	Alarm
2114	Type1_DryRun2 Error	Pump 2 Route Dry Run Protection. The circuit is possibly not filled enough to reach the desired pressure.	Alarm
2115	Type1_Unit not Ready	The CDU is not in a state to be operated and pumps will not start.	Alarm
2201	Type2_Sub value Pump1	TCS Pump 1 is using the substitution value (value from the other pump) for control.	Alarm
2202	Type2_Sub value Pump2	TCS Pump 2 is using the substitution value (value from the other pump) for control.	Alarm
2203	Type2_Condense_Active	Condensation control is active; TCS temperature is limited.	Alarm
2204	Type2_dP Low Load turndown	One of the TCS pumps is OFF due to further turndown in dP control mode.	Alarm
2205	Type2_Fill Pump Error	The refill pump has an error; the pump is not responding.	Alarm
2206	Type2_Tank Empty	The coolant reservoir is empty.	Alarm
2207	Type2_Level Sensor Conflict	The coolant reservoir level sensors have conflicting readings: Coolant High cannot be active (overflow) when there is not enough fluid in the reservoir.	Alarm
2208	Type2_3-Way Valve FB Lost	The position feedback signal from the FWS 3-way valve has been lost.	Alarm
2209	Type2_UPS Low	Warning: UPS batteries are low	Warning
2210	Type2_FWB Bubble	FWS pipe air bubble detected or empty	Alarm
2301	Comm_Lost to Principle	Communication with the Principle Control CDU has been lost.	Alarm
2302	Comm_Lost to Agent 1	Communication with the Agent CDU has been lost (Agent ID = 1).	Alarm
2303	Comm_Lost to Agent 2	Communication with the Agent CDU has been lost (Agent ID = 2).	Alarm
2304	Comm_Lost to Agent 3	Communication with the Agent CDU has been lost (Agent ID = 3).	Alarm

Table 31. Discrete alarm list (continued)

ID	Name	Description	Class
2305	Comm_Lost to Inverter 1	Communication with Pump Inverter 1 has been lost; status readings and energy measurements are not available.	Alarm
2306	Comm_Lost to Inverter 2	Communication with Pump Inverter 2 has been lost; status readings and energy measurements are not available.	Alarm
2307	Comm_Lost to 2-Way Valve	Communication with the FWS ePICV has been lost.	Alarm

Analog Alarm List

Note: *Depending on unit configuration, not all alarms are necessarily active.*

Table 32. Analog alarm list

ID	Name	Description	Class
3001	Ambient RH_Severity AH	The ambient relative humidity percentage is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3002	Ambient RH_Severity WH	The ambient relative humidity percentage is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3003	Ambient RH_Severity WL	The ambient relative humidity percentage is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3004	Ambient RH_Severity AL	The ambient relative humidity percentage is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3005	Ambient Temp_Severity AH	The ambient temperature is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3006	Ambient Temp_Severity WH	The ambient temperature is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3007	Ambient Temp_Severity WL	The ambient temperature is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3008	Ambient Temp_Severity AL	The ambient temperature is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3009	DewPoint_Severity AH	The calculated dew point is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3010	DewPoint_Severity WH	The calculated dew point is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3011	DewPoint_Severity WL	The calculated dew point is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3012	DewPoint_Severity AL	The calculated dew point is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3015	FWS InFlowRate_Severity AH	The FWS input flow rate is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3013	FWS dT_Severity AH	The FWS change in temperature between the input and output temperatures is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3014	FWS dT_Severity WH	The FWS change in temperature between the input and output temperatures is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3016	FWS InFlowRate_Severity WH	The FWS input flow rate is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3017	FWS InFlowRate_Severity WL	The FWS input flow rate is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3018	FWS InFlowRate_Severity AL	The FWS input flow rate is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm

Table 32. Analog alarm list (continued)

ID	Name	Description	Class
3019	FWS InPress_Severity AH	The reading from the FWS input pressure sensor 1 (before strainer) is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3020	FWS InPress_Severity WH	The reading from the FWS input pressure sensor 1 (before strainer) is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3021	FWS InPress_Severity WL	The reading from the FWS input pressure sensor 1 (before strainer) is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3022	FWS InPress_Severity AL	The reading from the FWS input pressure sensor 1 (before strainer) is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3027	FWS InTemp_Severity AH	The reading from the FWS input temperature sensor is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3028	FWS InTemp_Severity WH	The reading from the FWS input temperature sensor is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3029	FWS InTemp_Severity WL	The reading from the FWS input temperature sensor is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3030	FWS InTemp_Severity AL	The reading from the FWS input temperature sensor is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3031	FWS Loop dP_Severity AH	The FWS differential pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3032	FWS Loop dP_Severity WH	The FWS differential pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3033	FWS OutPress_Severity AH	The FWS output pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3034	FWS OutPress_Severity WH	The FWS output pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3035	FWS OutPress_Severity WL	The FWS output pressure is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3036	FWS OutPress_Severity AL	The FWS output pressure is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3037	FWS OutTemp_Severity AH	The FWS output temperature is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
3038	FWS OutTemp_Severity WH	The FWS output temperature is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3039	FWS OutTemp_Severity WL	The FWS output temperature is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
3040	FWS OutTemp_Severity AL	The FWS output temperature is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4001	TCS dT_Severity AH	The TCS delta temperature between supply and return is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4002	TCS dT_Severity WH	The TCS delta temperature between supply and return is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4003	TCS Loop dP_Severity AH	The TCS differential pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm

Table 32. Analog alarm list (continued)

ID	Name	Description	Class
4004	TCS Loop dP_Severity WH	The TCS differential pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4005	TCS Pump1 Press_Severity AH	The TCS pump 1 output pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4006	TCS Pump1 Press_Severity WH	The TCS pump 1 output pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4007	TCS Pump1 Press_Severity WL	The TCS pump 1 output pressure is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4008	TCS Pump1 Press_Severity AL	The TCS pump 1 output pressure is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4009	TCS Pump2 Press_Severity AH	The TCS pump 2 output pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4010	TCS Pump2 Press_Severity WH	The TCS pump 2 output pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4011	TCS Pump2 Press_Severity WL	The TCS pump 2 output pressure is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4012	TCS Pump2 Press_Severity AL	The TCS pump 2 output pressure is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4013	TCS ReturnPressV_Severity AH	The TCS return pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. The system is possibly overcharged.	Alarm
4014	TCS ReturnPressV_Severity WH	The TCS return pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. The system is possibly overcharged.	Warning
4015	TCS ReturnPressV_Severity WL	The TCS return pressure is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings. Check refill/makeup pump system.	Warning
4016	TCS ReturnPressV_Severity AL	The TCS return pressure is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings. Check refill/makeup pump system.	Alarm
4017	TCS ReturnTempV_Severity AH	The TCS return temperature is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. Cooling is insufficient.	Alarm
4018	TCS ReturnTempV_Severity WH	The TCS return temperature is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. Cooling is insufficient.	Warning
4019	TCS ReturnTempV_Severity WL	The TCS return temperature is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings. Low load or FWS cooling is unable to regulate.	Warning
4020	TCS ReturnTempV_Severity AL	The TCS return temperature is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings. Low load or FWS cooling is unable to regulate.	Alarm
4021	TCS SupplyTempV_Severity AH	The TCS supply temperature is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. Cooling is insufficient.	Alarm
4022	TCS SupplyTempV_Severity WH	The TCS supply temperature is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. Cooling is insufficient.	Warning
4023	TCS SupplyTempV_Severity WL	The TCS supply temperature is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings. Low load or FWS cooling is unable to regulate.	Warning
4024	TCS SupplyTempV_Severity AL	The TCS supply temperature is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings. Low load or FWS cooling is unable to regulate.	Alarm

Table 32. Analog alarm list (continued)

ID	Name	Description	Class
4029	TCS Strainer1 dP_Severity AH	Differential pressure at TCS strainer 1 dP is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. Replace or clean the strainer.	Alarm
4030	TCS Strainer1 dP_Severity WH	Differential pressure at TCS strainer 1 dP is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. Replace or clean the strainer.	Warning
4031	TCS Strainer2 dP_Severity AH	Differential pressure at TCS strainer 2 dP is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. Replace or clean the strainer.	Alarm
4032	TCS Strainer2 dP_Severity WH	Differential pressure at TCS strainer 1 dP is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. Replace or clean the strainer.	Warning
4033	TCS FlowRateV_Severity AH	The TCS flow rate is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Alarm
4034	TCS FlowRateV_Severity WH	The TCS flow rate is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4035	TCS FlowRateV_Severity WL	The TCS flow rate is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings.	Warning
4036	TCS FlowRateV_Severity AL	The TCS flow rate is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings	Alarm
4025	TCS SupplyPressV_Severity AH	TCS supply pressure is above the alarm high (AH) threshold set in the Parameters > Severity Monitoring Threshold settings. The system is possibly overcharged.	Alarm
4026	TCS SupplyPressV_Severity WH	TCS supply pressure is above the warning high (WH) threshold set in the Parameters > Severity Monitoring Threshold settings. The system is possibly overcharged.	Warning
4027	TCS SupplyPressV_Severity WL	TCS supply pressure is below the warning low (WL) threshold set in the Parameters > Severity Monitoring Threshold settings. Check the refill/ makeup pump system.	Warning
4028	TCS SupplyPressV_Severity AL	TCS supply pressure is below the alarm low (AL) threshold set in the Parameters > Severity Monitoring Threshold settings. Check the refill/ makeup pump system.	Alarm
1001	Common Fault Warning	Common Fault Warning: At least one warning has been triggered.	Notification
1002	Common Fault Alarm	Common Fault Warning: At least one critical alarm has been triggered.	Notification

Data Log Format

Table 33. Data log format

Name	Description
DayTime	Time in YYYY/MM/DD, hh:mm:ss format
Comm. Check PLC	Communication Check in PLC
Summarized Fault Common Fault	Number of Common Fault(s) that appeared.
System Role	System Role
Ambient Temperature	Ambient Temperature, format in 0.1C, 277 = 27.7C
Ambient Dew Point	Ambient Dew Point, format in 0.1C, 164 = 16.4C
Ambient RH	Ambient Relative Humidity, format in 0.1%, 502 = 50.2%
FWS Input Pressure 1	FWS Input Pressure 1, format in 0.1barg, 120 = 12barg

Table 33. Data log format (continued)

Name	Description
Reserved	Reserved
FWS Output Pressure	FWS Output Pressure , format in 0.1barg, 98 = 9.8barg
Reserved	Reserved
FWS Loop DP	FWS Loop Differential Pressure, format in 0.1barg, 23 = 2.3barg
FWS Flow Rate	FWS Flow Rate, format in LPM, 810 = 810LPM
FWS Input Temp	FWS Input Temperature, format in 0.1C, 263 = 26.3C
FWS Output Temp	FWS Output Temperature, format in 0.1C, 263 = 26.3C
FWS DT	FWS Differential Temperature, format in 0.1C, 20 = 2C
FWS Valve Position Command	FWS Valve Position Command,
FWS Valve Position Feedback	FWS Valve Position Feedback
FWS Cooling	FWS Cooling
Spare	Not used
Spare	Not used
Spare	Not used
Spare	Not used
Spare	Not used
TCS Pump 1 Pressure	TCS Pump 1 Pressure, format in 0.1barg, 293 = 29.3barg
TCS Pump 2 Pressure	TCS Pump 2 Pressure, format in 0.1barg, 294 = 29.4barg
TCS Supply Pressure	TCS Supply Pressure, format in 0.1barg, 281 = 28.1barg
TCS Return Pressure	TCS Return Pressure, format in 0.1barg, 117 = 11.7barg
TCS Strainer 1 DP	TCS Strainer 1 Differential Pressure, format in 0.1barg, 12 = 1.2barg
TCS Strainer 2 DP	TCS Strainer 2 Differential Pressure, format in 0.1barg, 12 = 1.2barg
TCS Flow Rate 1	TCS Pump 1 Flow Rate, format in LPM, 185 = 185LPM
TCS Flow Rate 2	TCS Pump 2 Flow Rate, format in LPM, 185 = 185LPM
TCS Supply Temp	TCS Supply Temperature, format in 0.1C, 267 = 26.7C
TCS Return Temp	TCS Return Temperature, format in 0.1C, 268 = 26.8C
TCS DT	TCS Differential Temperature, format in 0.1C, 1 = 0.1C
TCS Pump Speed 1	TCS Pump 1 Speed, format in 0.1%, 466 = 46.6%
TCS Pump Speed 2	TCS Pump 2 Speed, format in 0.1%, 466 = 46.6%
TCS Cooling	TCS Cooling
TCS Pump1 Output Power	TCS Pump 1 Output Power
TCS Pump 1 Inverter Drive Temp	TCS Pump 1 Inverter Driver Temperature, format in 0.1C, 350 = 35.0C
TCS Pump 1 kWh Meter	TCS Pump 1 kWh Meter, format in kWh, 890 = 890kWh
TCS Pump 1 MWh Meter	TCS Pump 1 MWh Meter, format in MWh, 1 = 1MWh
TCS Pump 2 Output Power	TCS Pump 1 Output Power
TCS Pump 2 Inverter Drive Temp	TCS Pump 1 Inverter Driver Temperature, format in 0.1C, 350 = 35.0C

Table 33. Data log format (continued)

Name	Description
TCS Pump 2 kWh Meter	TCS Pump 1 kWh Meter, format in kWh, 890 = 890kWh
TCS Pump 2 MWh Meter	TCS Pump 1 MWh Meter, format in MWh, 1 = 1MWh
TCS Static Pressure Setpoint	TCS Static Pressure Setpoint, format in 0.1barg, 100 = 10.0barg
Condensation Control Dew point	Condensation Control Dew Point, format in 0.1C, 170 = 17C
System ATD Target	System ATD Target, format in 0.1C, 40 = 4.0C
TCS Supply Temperature Setpoint	TCS Supply Temperature Setpoint, format in 0.1C, 280 = 28.0C
TCS Total Flow Rate Setpoint For Group	TCS Total Flow Rate Setpoint for Group, format in LPM, 1000 = 1000LPM
TCS Flow Rate Setpoint	TCS Flow Rate Setpoint, format in LPM, 180 = 180LPM
TCS DP Setpoint	TCS Differential Pressure Setpoint, format in 0.1barg, 165 = 16.5barg
TCS Fixed Speed Percent Single Pump Mode	TCS Fixed Speed Single Pump Mode Percentage, format in 0.1%, 150 = 15%
TCS Fixed Speed Percent Dual Pump Mode	TCS Fixed Speed Dual Pump Mode Percentage, format in 0.1%, 200 = 20%
Pump 1 Manual Speed Setpoint	TCS Pump 1 Manual Speed Setpoint, format in 0.1%, 125 = 12.5%
Pump 2 Manual Speed Setpoint	TCS Pump 2 Manual Speed Setpoint, format in 0.1%, 125 = 12.5%
TCS Pump Control Mode	TCS Pump 1/2 Control Mode: 1 = Fixed Differential Pressure, 2 = Fixed Flow Rate, 3 = Fixed Percentage
TCS Pump Cycle Duty Duration	TCS Pump Cycle Duty Duration, format in hour, 1 = 1 hour
Spare	Not used
FWS Valve Manual Percent	FWS Valve Manual Percentage, format in 0.1%, 500 = 50.0%
Data Log Interval	Data Log Interval, format in second, default 0 = 0.5s
FWS Fixed Flow Rate Setpoint	FWS Fixed Flow Rate Setpoint
Spare	Not used
Spare	Not used
Ambient Temperature State	Ambient Temperature State
Ambient Dew Point State	Ambient Dew Point State
Ambient RH State	Ambient Relative Humidity State
FWS Input Pressure 1 State	FWS Input Pressure 1 State
Reserved	Not used
FWS Output Pressure State	FWS Output Pressure State
Reserved	Not used
FWS Loop DP State	FWS Loop Differential Pressure State
FWS Flow Rate State	FWS Flow Rate State
FWS Input Temp State	FWS Input Temperature State
FWS Output Temp State	FWS Output Temperature State
FWS DT State	FWS Differential Temperature State
TCS Pump 1 Pressure State	TCS Pump 1 Pressure State
TCS Pump 2 Pressure State	TCS Pump 2 Pressure State

Table 33. Data log format (continued)

Name	Description
TCS Supply Pressure State	TCS Supply Pressure State
TCS Return Pressure State	TCS Return Pressure State
TCS Strainer 1 DP State	TCS Strainer 1 Differential Pressure State
TCS Strainer 2 DP State	TCS Strainer 2 Differential Pressure State
TCS Flow Rate 1 State	TCS Flow Rate 1 State
TCS Flow Rate 2 State	TCS Flow Rate 2 State
TCS Supply Temp State	TCS Supply Temperature State
TCS Return Temp State	TCS Return Temperature State
TCS DT State	TCS Differential Temperature State
Threshold Index Number	Threshold Index Number
Threshold Setpoint Write Value	Threshold Setpoint Write Value
Threshold Setpoint Reading Value	Threshold Setpoint Reading Value
System Status Bits	System Status Bits
System Control Bits	System Control Bits
System Error Bits 1	System Error Bits 1
System Error Bit 2	System Error Bit 2
System Comm Bits	System Comm Bits
System Comm Lost Bits	System Comm Lost Bits
Spare	Not used
Spare	Not used
Spare	Not used
Spare	Not used

Modbus TCP Register List

Table 34. Modbus TCP register list

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
40001	R	INT 16	MBCommCheck			Number increase and loop between 1 to 255
40002	R	INT 16	Summarized Fault / Common Fault		enum	0 = Normal, 1 = At least one warning, 2 = At least one alarm or instrument failure
40003	R	INT 16	System role		enum	0 = Master/Standard alone, 1 = Slave ID1, 2 = Slave ID2, 3 = Slave ID3
40004	R	INT 16	Ambient Temperature	x10	Celsius	Current measured ambient temperature
40005	R	INT 16	Ambient Dew Point	x10	Celsius	Current calculated dew point temperature
40006	R	INT 16	Ambient RH	x10	%	Current measured ambient relative humidity
40007	R	INT 16	FWS Input Pressure 1	x100	barg	Facility liquid supply pressure
40008	R	INT 16	FWS Input Pressure 2	x100	barg	Facility liquid supply pressure after strainer
40009	R	INT 16	FWS Output Pressure	x100	barg	Facility liquid return pressure
40010	R	INT 16	FWS Strainer dP	x100	barg	Differential pressure across FWS strainer

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
40011	R	INT 16	FWS Loop dP	x100	barg	Differential pressure between FWS supply and FWS return pressure
40012	R	INT 16	FWS Flow Rate	x1	LPM	Measured flow rate
40013	R	INT 16	FWS Input Temp	x10	Celsius	Facility liquid at supply side temperature
40014	R	INT 16	FWS Output Temp	x10	Celsius	Facility liquid at return side temperature
40015	R	INT 16	FWS dT	x10	Celsius	Difference of FWS input temperature and FWS output temperature
40016	R	INT 16	FWS Valve Position Command	x10	%	Commanded Cooling Valve position %
40017	R	INT 16	FWS Valve Position Feedback	x10	%	Feedback % of Cooling Valve position instanteneous
40018	R	INT 16	FWS Cooling	x10	kW	Calculated Cooling instanteneously available
40019	R	INT 16	#Spare			
40020	R	INT 16	#Spare			
40021	R	INT 16	#Spare			
40022	R	INT 16	#Spare			
40023	R	INT 16	TCS Loop dP	x100	barg	Difference of TCS Supply Pressure and TCS Return Pressure
40024	R	INT 16	TCS Pump 1 Pressure	x100	barg	Pump 1 current output pressure
40025	R	INT 16	TCS Pump 2 Pressure	x100	barg	Pump 1 current output pressure
40026	R	INT 16	TCS Supply Pressure	x100	barg	Technology Cooling supply side Pressure after Strainer
40027	R	INT 16	TCS Return Pressure	x100	barg	Technology Cooling return side Pressure
40028	R	INT 16	TCS Strainer 1 dP	x100	barg	Differential Pressure across TCS Strainer 1
40029	R	INT 16	TCS Strainer 2 dP	x100	barg	Differential Pressure across TCS Strainer 2
40030	R	INT 16	TCS Flow Rate 1	x1	LPM	Measured flow rate at TCS
40031	R	INT 16	TCS Flow Rate 2	x1	LPM	Measured flow rate at TCS (redundant reading if fitted)
40032	R	INT 16	TCS Supply Temp	x10	Celsius	TCS liquid at supply side Temperature
40033	R	INT 16	TCS Return Temp	x10	Celsius	TCS liquid at return side Temperature
40034	R	INT 16	TCS dT	x10	Celsius	Difference of TCS Supply Temperature and TCS Return Temperature
40035	R	INT 16	TCS Pump Speed 1	x10	%	Current commanded Speed % of Pump 1
40036	R	INT 16	TCS Pump Speed 2	x10	%	Current commanded Speed % of Pump 2
40037	R	INT 16	TCS Cooling	x10	kW	Calculated Cooling instanteneously available
40038	R	INT 16	TCS Pump 1 Output Power	x10	kW	Current drive output Power for Pump1
40039	R	INT 16	TCS Pump 1 Inverter Drive Temp	x10	Celsius	Drive Power Stage Temperature of Pump1 Inverter
40040	R	INT 16	TCS Pump 1 kWh Meter	x10	kWh	kWh Meter for Pump1 Inverter
40041	R	INT 16	TCS Pump 1 MWh Meter	x1	MWh	MWh Meter for Pump1 Inverter
40042	R	INT 16	TCS Pump 2 Output Power	x10	kW	Current drive output Power for Pump2
40043	R	INT 16	TCS Pump 2 Inverter Drive Temp	x10	Celsius	Drive Power Stage Temperature of Pump2 Inverter

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
40044	R	INT 16	TCS Pump 2 kWh Meter	x10	kWh	kWh Meter for Pump2 Inverter
40045	R	INT 16	TCS Pump 2 MWh Meter	x1	MWh	MWh Meter for Pump2 Inverter
40046	R/W	INT 16	TCS Static Pressure Setpoint	x100	barg	Setpoint to trigger ON of Fill pump
40047	R/W	INT 16	System Condensation Control Dew Point	x10	Celsius	The Dew Point temperature that Condensation Control start (Limiting TCS Supply Temperature)
40048	R/W	INT 16	System ATD Target	x10	Celsius	The target ATD (TCS Supply Temp - FWS Supply Temp) used in fault tolerant situation
40049	R/W	INT 16	TCS Supply Temperature Setpoint	x10	Celsius	Setpoint for TCS Supply Temperature regulation
40050	R/W	INT 16	#Reserved	x1	LPM	
40051	R/W	INT 16	TCS Fixed Flow Rate Setpoint	x1	LPM	Setpoint for Pump Control Fixed Flow Rate Mode
40052	R/W	INT 16	TCS Fixed dP Setpoint	x100	barg	Setpoint for Pump Control Fixed dP Mode
40053	R/W	INT 16	TCS Fixed Speed % Single Pump mode	x10	%	Setpoint for Pump Control Fixed Speed % Mode Operating at Single Pump
40054	R/W	INT 16	TCS Fixed Speed % Dual Pump mode	x10	%	Setpoint for Pump Control Fixed Speed % Mode Operating at Dual Pump
40055	R/W	INT 16	TCS Pump 1 Speed % at Manual Mode	x10	%	Setpoint Fixed Speed for Pump 1, when Pump 1 put into Manual Mode with Pump ON locally at HMI
40056	R/W	INT 16	TCS Pump 2 Speed % at Manual Mode	x10	%	Setpoint Fixed Speed for Pump 2, when Pump 2 put into Manual Mode with Pump ON locally at HMI
40057	R/W	INT 16	TCS Pump Control Mode	x1	enum	1 = Fixed Flow, 2 = Fixed dP, 3 = Fixed Speed
40058	R/W	INT 16	TCS Pump Cycle Duty Duration	x1	hour	The duration of a pump run before changeover to partner pump in Single pump mode
40059	R/W	INT 16	FWS Flow Rate Control Mode	x1	enum	FWS ePICV Control Mode. 0 = TCS Temp Control, 1 = Flow Control, 2 = Energy Control
40060	R/W	INT 16	FWS Valve Manual %	x10	%	Manual Mode FWS Valve Fixed % Setpoint
40061	R/W	INT 16	Data Log Interval	x1	Second	0 = Log interval 0.5s, 1 to 300 = Log interval in 1 to 300 seconds
40062	R/W	INT 16	FWS Fixed Flow Rate Setpoint	x1	LPM	FWS ePICV Fixed Flow Rate Mode Regulation Setpoint
40063	R/W	INT 16	FWS dT Limiting Setpoint			
40064	R/W	INT 16	#Reserved			
40065	R	INT 16	Ambient Temperature State		enum	per enumeration range state below
40066	R	INT 16	Ambient Dew Point State		enum	per enumeration range state below
40067	R	INT 16	Ambient RH State		enum	per enumeration range state below
40068	R	INT 16	FWS Input Pressure 1 State		enum	per enumeration range state below
40069	R	INT 16	FWS Input Pressure 2 State		enum	per enumeration range state below
40070	R	INT 16	FWS Output Pressure State		enum	per enumeration range state below
40071	R	INT 16	FWS Strainer dP State		enum	per enumeration range state below
40072	R	INT 16	TCS Loop dP State		enum	per enumeration range state below

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
40073	R	INT 16	FWS Flow Rate State		enum	per enumeration range state below
40074	R	INT 16	FWS Input Temp State		enum	per enumeration range state below
40075	R	INT 16	FWS Output Temp State		enum	per enumeration range state below
40076	R	INT 16	FWS dT State		enum	per enumeration range state below
40077	R	INT 16	TCS Pump 1 Pressure State		enum	per enumeration range state below
40078	R	INT 16	TCS Pump 2 Pressure State		enum	per enumeration range state below
40079	R	INT 16	TCS Supply Pressure State		enum	per enumeration range state below
40080	R	INT 16	TCS Return Pressure State		enum	per enumeration range state below
40081	R	INT 16	TCS Strainer 1 dP State		enum	per enumeration range state below
40082	R	INT 16	TCS Strainer 2 dP State		enum	per enumeration range state below
40083	R	INT 16	TCS Flow Rate 1 State		enum	per enumeration range state below
40084	R	INT 16	TCS Flow Rate 2 State		enum	per enumeration range state below
40085	R	INT 16	TCS Supply Temp State		enum	per enumeration range state below
40086	R	INT 16	TCS Return Temp State		enum	per enumeration range state below
40087	R	INT 16	TCS dT State		enum	per enumeration range state below
40088	R/W	INT 16	Threshold Setpoint Pointer		Word	Table to list all the threshold setpoint with respective index number
40089	R/W	INT 16	Pointer indicated Threshold value for Write	Varies	Word	Threshold value to be updated corresponding to index number selected at Register 40088
40090	R/W	INT 16	Pointer indicated Threshold value for read	Varies	Word	Threshold value read from TCDU control system (ECHO), -999 indicate a write error
40091	R	INT 16 Bit 0	Unit Status		Bit	1 = The Unit is at operating state with either pump possible to switch ON
	R	INT 16 Bit 1	E-Stop Status		Bit	1 = Normal, 0 = Pressed Emergency Button
	R	INT 16 Bit 2	Safety Relay Status		Bit	1 = ON, pump start possible, 0 = OFF, Emergency triggered and not acknowledged
	R	INT 16 Bit 3	Leak Detection		Bit	1 = Leak not detected, 0 = Leak detected or Sensor failure
	R	INT 16 Bit 4	Reservoir Level High		Bit	1 = Sensor at High level detected liquid, 0 = Liquid Level below High level
	R	INT 16 Bit 5	Reservoir Level Low		Bit	1 = Sensor at Low level detected liquid, 0 = Reservoir empty
	R	INT 16 Bit 6	Inverter 1 Error state		Bit	1 = Inverter Normal, 0 = Inverter OFF or not operative with Error / Alarm
	R	INT 16 Bit 7	Inverter 2 Error state		Bit	1 = Inverter Normal, 0 = Inverter OFF or not operative with Error / Alarm
	R	INT 16 Bit 8	Condensation Control in Action		Bit	1 = Condensation Control acting, 0 = Condensation Control is OFF
	R	INT 16 Bit 9	TCS Fill Pump Status		Bit	1 = Fill Pump ON, 0 = Fill Pump OFF
	R	INT 16 Bit 10				

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
	R	INT 16 Bit 11				
	R	INT 16 Bit 12				
	R	INT 16 Bit 13				
	R	INT 16 Bit 14				
	R	INT 16 Bit 15				
40092	R/W	INT 16 Bit 0	TCS Pump 1 Lock OFF for maintenance		Bit	0 = Normal, 1= Lock to OFF. Locking the Pump 1 as OFF for hot swap maintenance
	R/W	INT 16 Bit 1	TCS Pump 2 Lock OFF for maintenance		Bit	0 = Normal, 1= Lock to OFF. Locking the Pump 2 as OFF for hot swap maintenance
	R/W	INT 16 Bit 2	Condensation Control		Bit	0 = Disabled, 1 = Enabled
	R/W	INT 16 Bit 3	Reset Safety Relay Pulse		Bit	A short pulse will be output to Safety Relay to clear fault/ OFF state
	R/W	INT 16 Bit 4	TCS Pump Duty Mode		Bit	0 = Single, 1 = Dual
	R/W	INT 16 Bit 5				
	R/W	INT 16 Bit 6				
	R/W	INT 16 Bit 7				
	R/W	INT 16 Bit 8				
	R/W	INT 16 Bit 9				
	R/W	INT 16 Bit 10				
	R/W	INT 16 Bit 11				
	R/W	INT 16 Bit 12				
	R/W	INT 16 Bit 13				
	R/W	INT 16 Bit 14				
	R/W	INT 16 Bit 15	DataLogEnable		Bit	0 = OFF, 1 = Data Logging is ON
40093	R	INT 16 Bit 0	Ambient Temperature Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 1	Ambient Dew Point Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 2	Ambient RH Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 3	FWS Input Pressure 1 Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 4	FWS Input Pressure 2 Error		Bit	0 = Normal, 1 = Error / Sensor failure

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
	R	INT 16 Bit 5	FWS Output Pressure Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 6	FWS Strainer dP Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 7	FWS loop dP Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 8	FWS Flow Rate Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 9	FWS Input Temp Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 10	FWS Output Temp Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 11	FWS dT Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 12	FWS Cooling Status Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 13	FWS ePICV Error Status		Bit	0 = Normal, 1 = Abnormal / high discrepancy to control % value
	R	INT 16 Bit 14	FWS ePICV Bubble Detection		Bit	0 = Normal, 1 = Bubble detected / Empty Pipe
	R	INT 16 Bit 15				
40094	R	INT 16 Bit 0	TCS Pump 1 Pressure Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 1	TCS Pump 2 Pressure Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 2	TCS Supply Pressure Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 3	TCS Return Pressure Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 4	TCS Strainer 1 dP Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 5	TCS Strainer 2 dP Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 6	TCS Flow Rate 1 Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 7	TCS Flow Rate 2 Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 8	TCS Supply Temp Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 9	TCS Return Temp Error		Bit	0 = Normal, 1 = Error / Sensor failure
	R	INT 16 Bit 10	TCS dT Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 11	TCS Cooling Status Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
	R	INT 16 Bit 12	TCS Fill Pump Error		Bit	0 = Normal, 1 = Fill pump failure detected / Fill pump operation time-out
	R	INT 16 Bit 13	TCS Pump 1 Failure		Bit	0 = Normal, 1 = TCS Pump 1 Route not available to run, check Pump 1 Output Pressure
	R	INT 16 Bit 14	TCS Pump 2 Failure		Bit	0 = Normal, 1 = TCS Pump 2 Route not available to run, check Pump 2 Output Pressure

Table 34. Modbus TCP register list (continued)

Register	R/W	Data Type	Register Name	Multiplier	Type	Description
	R	INT 16 Bit 15	TCS Loop dP Error		Bit	0 = Normal, 1 = Cannot evaluated / Calculated due to other sensor error
40095	R	INT 16 Bit 0	Comm Lost Inverter 1		Bit	0 = Normal, 1 = Communication is lost to Inverter 1
	R	INT 16 Bit 1	Comm Lost Inverter 2		Bit	0 = Normal, 1 = Communication is lost to Inverter 2
	R	INT 16 Bit 2	Comm Lost Master		Bit	0 = Normal, 1 = Communication is lost to Master (when unit set as Slave)
	R	INT 16 Bit 3	Comm Lost FWS ePICV		Bit	0 = Normal, 1 = Communication is lost to FWS ePICV
	R	INT 16 Bit 4				
	R	INT 16 Bit 5				
	R	INT 16 Bit 6				
	R	INT 16 Bit 7				
	R	INT 16 Bit 8				
	R	INT 16 Bit 9				
	R	INT 16 Bit 10				
	R	INT 16 Bit 11				
	R	INT 16 Bit 12				
	R	INT 16 Bit 13	Supply Power to System is Lost		Bit	0 = Normal, 1 = Main is lost and run on batteries
	R	INT 16 Bit 14	Batry Bad - Not usable		Bit	0 = Normal, 1 = Batteries is not usable and have to be replaced
	R	INT 16 Bit 15	Battery Low - State of Change		Bit	0 = Normal, 1 = The batteries is at low state 30%
40096	R	INT 16	Comm Lost Slaves bit Field		16-Bit Field	0 = Normal, 1 = Communication is lost to (bit 1 = 1 = Slave 1 Lost, bit 2 = 1 = Slave 2 Lost…..)
40097	R	INT 16	#Spare			
40098	R	INT 16	#Spare			
40099	R	INT 16	#Spare			
40100	R	INT 16	#Spare			
40101	R	INT 16	#Spare			

RESTful API Table (ePICV)

Table 35. RESTful API (ePICV)

URL	Output Example	Access Right

/redfish/v1/CDU/	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDU",
	"Name": "Cooling Distribution Unit", "Members@odata.count": 5, "Members": [
	{
	"@odata.id": "/redfish/v1/CDU/General"
	},
	{
	"@odata.id": "/redfish/v1/CDU/FWS"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS"
	},
	{
	"@odata.id": "/redfish/v1/CDU/ThresholdSetpoint"
	},
	{
	"@odata.id": "/redfish/v1/CDU/DataLog"
	}
	],
	"@odata.id": "/redfish/v1/CDU"
	}
		No login required

/redfish/v1/CDU/ DataLog	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "DataLog",
	"Name": "Cooling Distribution Unit Data Log", "Status": {
	"DataLogOnOff": "On", "DataLogInterval": 0
	},
	"Members@odata.count": 2, "Members": [
	{
	"@odata.id": "/redfish/v1/CDU/DataLog/Control/Interval"
	},
	{
	"@odata.id": "/redfish/v1/CDU/DataLog/Control/OnOff"
	}
	],
	"@odata.id": "/redfish/v1/CDU/DataLog"
	}
		No login required

/redfish/v1/CDU/ DataLog/ Control/ Interval	{
	"@odata.type": "#Control.Control", "Id": "CDUDataLogControlInterval",
	"Name": "CDU Data Log Control Data Interval",
	"Description": "Unit: Second, Write Value Scale, x1 for (Time), 0 = 0.5 or 1-300 second", "Status": {
	"DataLogInterval": 0,
	"Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=300": 300
	},
	"@odata.id": "/redfish/v1/CDU/DataLog/Control/Interval"
	}
		Admin required

/redfish/v1/CDU/ DataLog/ Control/OnOff	{
	"@odata.type": "#Control.Control", "Id": "CDUDataLogControlOnOff",
	"Name": "CDU Data Log Control Turn On or Off", "Status": {
	"DataLogOnOff": "On", "AllowableToSet URL?State=Off": 0,
	"AllowableToSet URL?State=On": 1
	},
	"@odata.id": "/redfish/v1/CDU/DataLog/Control/OnOff"
	}
		Admin required

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right

/redfish/v1/CDU/FWS	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUFWS",
	"Name": "Cooling Distribution Unit FWS",
	"Description": "Unit: kW, Read Value Scale, x1 for (Time,FlowRate,MWh,State,Role), x0.1 for (Temperture,Percent,DewPoint,RH,kW,kWh), x0.01 for (Pressure)",
	"Status": { "FWSCooling": 50,
	"ePICVCommLost": "Normal", "FWSCoolingStatusError": "Normal", "FWSLoopDP": 3,
	"FWSLoopDPState": 3, "FWSLoopDPError": "Normal", "FWSDT": 2,
	"FWSDTState": 3,
	"FWSDTError": "Normal", "FWSFlowRate": 354,
	"FWSFlowRateState": 3, "FWSFlowRateError": "Normal"
	},
	"Members@odata.count": 3, "Members": [
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Pressure"
	},
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Temperature"
	},
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Valve"
	}
	],
	"@odata.id": "/redfish/v1/CDU/FWS"
	}	

/redfish/v1/CDU/FWS/Pressure	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUFWSPressure",
	"Name": "Cooling Distribution Unit FWS Pressure", "Description": "Read Value Scale, x0.01 for (Pressure)", "Status": {
	"FWSInputPressure": 60,
	"FWSInputPressureState": 3, "FWSInputPressureError": "Normal", "FWSOutputPressure": 57,
	"FWSOutputPressureState": 3, "FWSOutputPressureError": "Normal"
	},
	"@odata.id": "/redfish/v1/CDU/FWS/Pressure"
	}	

/redfish/v1/CDU/FWS/Temperature	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUFWSTemperature",
	"Name": "Cooling Distribution Unit FWS Temperature", "Description": "Read Value Scale, x0.1 for (Temperture)", "Status": {
	"FWSInputTemp": 299,
	"FWSInputTempState": 3, "FWSInputTempError": "Normal", "FWSOutputTemp": 296,
	"FWSOutputTempState": 3, "FWSOutputTempError": "Normal"
	},
	"@odata.id": "/redfish/v1/CDU/FWS/Temperature"
	}	

/redfish/v1/CDU/FWS/Valve	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUFWSValve",
	"Name": "Cooling Distribution Unit FWS Valve Open Percentage", "Description": "Unit Percent, Read Value Scale, x0.1 for (Percent)", "Status": {
	"FWSValvePositionCommand": 1000,
	"FWSValvePositionFeedback": 1000, "FWSValveErrorStatus": "Normal", "ePICVCommLost": "Normal"
	},
	"Members@odata.count": 3, "Members": [
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/FlowRateControlMode"
	},
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/ManualValvePercent"
	},
	{
	"@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/FixFlowRateSetpoint"
	}
	],
	"	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right
/redfish/v1/CDU/FWS/ Valve/ Control/ FixFlowRateSetpoint	{ "@odata.type": "#Control.Control", "Id": "FWSFixFlowRateSetpoint", "Name": "CDU FWS Fix Flow Rate Setpoint", "Description": "Unit Flow Rate, Write Value Scale, x1 for (FlowRate)", "Status": { "FWSFixFlowRateSetpoint": 600, "Minimum AllowableToSet URL?Setpoint=0": 0, "Maximum AllowableToSet URL?Setpoint=1200": 1200 }, "@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/FixFlowRateSetpoint" }	
/redfish/v1/CDU/FWS/ Valve/ Control/ FlowRateControlMode	{ "@odata.type": "#Control.Control", "Id": "FWSFlowRateControlMode", "Name": "CDU FWS Flow Rate Control Mode", "Description": "0 = TCS Temp Control, 1 = Flow Control, 2 = Reserved", "Status": { "FWSFlowRateControlMode": 1, "Minimum AllowableToSet URL?Setpoint=0": 0, "Maximum AllowableToSet URL?Setpoint=2": 2 }, "@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/FlowRateControlMode" }	
/redfish/v1/CDU/FWS/ Valve/ Control/ ManualValvePercent	{ "@odata.type": "#Control.Control", "Id": "FWSControlManualValvePercent", "Name": "CDU FWS Control Manual Valve Open Percentage", "Description": "Unit Percent, Write Value Scale, x10 for (Percent)", "Status": { "FWSValveManualPercent": 500, "Minimum AllowableToSet URL?Setpoint=0": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/FWS/Valve/Control/ManualValvePercent" }	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right

/redfish/v1/CDU/TCS	{
	"@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCS",
	"Name": "Cooling Distribution Unit TCS",
	"Description": "Unit: kW, Read Value Scale, x1 for (Time,FlowRate,MWh,State,Role), x0.1 for (Temperture,Percent,DewPoint,RH,kW,kWh), x0.01 for (Pressure)",
	"Status": { "TCSCooling": 0,
	"TCSCoolingStatusError": "Normal", "TCSDT": 0,
	"TCSDTState": 1,
	"TCSDTError": "Normal"
	},
	"Members@odata.count": 16, "Members": [
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/PumpDutyMode"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/PumpControlMode"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/PumpCycleDutyDuration"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/DPSetpoint"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/FlowRateSetpoint"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/FixSpeedPercentageSPMode"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/FixSpeedPercentageDPMode"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/StaticPressure"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Control/ATDTarget"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Pressure"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/FlowRate"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Temperature"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Pump1"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Pump2"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Strainer"
	},
	{
	"@odata.id": "/redfish/v1/CDU/TCS/Reservoir"
	}
	],
	"@odata.id": "/redfish/v1/CDU/TCS"
	}	

/redfish/v1/CDU/TCS/ Control/ ATDTarget	{
	"@odata.type": "#Control.Control", "Id": "TCSControlATDTarget",
	"Name": "CDU TCS Control ATD Target",
	"Description": "Unit: Celsius, Write Value Scale, x10 for (Temperture)", "Status": {
	"SystemATDTarget": 40,
	"Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000
	},
	"@odata.id": "/redfish/v1/CDU/TCS/Control/ATDTarget"
	}	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right
/redfish/v1/CDU/TCS/Control/ DPSetpoint	{ "@odata.type": "#Control.Control", "Id": "TCSControlDPSetpoint", "Name": "CDU TCS Control Differential Pressure Setpoint", "Description": "Unit: Barg, Write Value Scale, x100 for (Pressure)", "Status": { "TCSDPSetpoint": 150, "Minimum AllowableToSet URL?Setpoint=140 ": 140, "Maximum AllowableToSet URL?Setpoint=900": 900 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/DPSetpoint" }	
/redfish/v1/CDU/TCS/Control/ FixSpeedPercentageDPMode	{ "@odata.type": "#Control.Control", "Id": "TCSControlFixSpeedPercentageDPMode", "Name": "CDU TCS Control Fix Speed Percentage Dual Pump Mode", "Description": "Unit: Percentage, Write Value Scale, x10 for (Percent)", "Status": { "TCSFixedSpeedPercentDualPumpMode": 200, "Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/FixSpeedPercentageDPMode" }	
/redfish/v1/CDU/TCS/Control/ FixSpeedPercentageSPMode	{ "@odata.type": "#Control.Control", "Id": "TCSControlFixSpeedPercentageSPMode", "Name": "CDU TCS Control Fix Speed Percentage Single Pump Mode", "Description": "Unit: Percentage, Write Value Scale, x10 for (Percent)", "Status": { "TCSFixedSpeedPercentSinglePumpMode": 600, "Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/FixSpeedPercentageSPMode" }	
/redfish/v1/CDU/TCS/Control/ FlowRateSetpoint	{ "@odata.type": "#Control.Control", "Id": "TCSControlFlowRateSetpoint", "Name": "CDU TCS Control Flow Rate Setpoint", "Description": "Unit LPM, Write Value Scale, x1 for (FlowRate)", "Status": { "TCSFlowRateSetpoint": 200, "Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/FlowRateSetpoint" }	
/redfish/v1/CDU/TCS/Control/ PumpControlMode	{ "@odata.type": "#Control.Control", "Id": "TCSControlPumpControlMode", "Name": "CDU TCS Control Pump Control Mode", "Status": { "TCSPumpControlMode": 3, "AllowableToSet URL?Setpoint=1 ": "FixFlow", "AllowableToSet URL?Setpoint=2": "FixedDP", "AllowableToSet URL?Setpoint=3": "FixedSpeed" }, "@odata.id": "/redfish/v1/CDU/TCS/Control/PumpControlMode" }	
/redfish/v1/CDU/TCS/Control/ PumpCycleDutyDuration	{ "@odata.type": "#Control.Control", "Id": "TCSControlPumpCycleDutyDuration", "Name": "CDU TCS Control Pump Cycle Duty Duration", "Description": "Unit: Hour, Write Value Scale, x1 for (Time)", "Status": { "TCSPumpCycleDutyDuration": 2, "Minimum AllowableToSet URL?Setpoint=1 ": 1, "Maximum AllowableToSet URL?Setpoint=7200": 7200 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/PumpCycleDutyDuration" }	
/redfish/v1/CDU/TCS/Control/ PumpDutyMode	{ "@odata.type": "#Control.Control", "Id": "TCSControlPumpDutyMode", "Name": "CDU TCS Control Pump Duty Mode", "Status": { "TCSPumpDutyMode": "Single", "AllowableToSet URL?State=Off": "Single", "AllowableToSet URL?State=On": "Dual" }, "@odata.id": "/redfish/v1/CDU/TCS/Control/PumpDutyMode" }	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right
/redfish/v1/CDU/TCS/ Control/ StaticPressure	{ "@odata.type": "#Control.Control", "Id": "TCSControlStaticPressure", "Name": "CDU TCS Control Static Pressure", "Description": "Unit:Barg, Write Value Scale, x100 for (Pressure)", "Status": { "TCSStaticPressureSetpoint": 120, "Minimum AllowableToSet URL?Setpoint=120 ": 120, "Maximum AllowableToSet URL?Setpoint=900": 900 }, "@odata.id": "/redfish/v1/CDU/TCS/Control/StaticPressure" } "	
/redfish/v1/CDU/TCS/ FlowRate	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSFlowRate", "Name": "Cooling Distribution Unit TCS Flow Rate", "Description": "Unit: LPM, Read Value Scale, x1 for (FlowRate)", "Status": { "TCSFlowRate1": 140, "TCSFlowRate1State": 1, "TCSFlowRate1Error": "Normal", "TCSFlowRate2": 140, "TCSFlowRate2State": 1, "TCSFlowRate2Error": "Normal" }, "@odata.id": "/redfish/v1/CDU/TCS/FlowRate" }	
/redfish/v1/CDU/TCS/ Pump1	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSPump1", "Name": "Cooling Distribution Unit TCS Pump1", "Description": "Read Value Scale, x1 for (Time,FlowRate,MWh,State,Role), x0.1 for (Temperture,Percent, DewPoint,RH,kW,kWh), x0.01 for (Pressure)", "Status": { "TCSPumpSpeed1": 0, "TCSPump1Failure": "Normal", "TCSPump1Pressure": 130, "TCSPump1PressureState": 3, "TCSPump1PressureError": "Normal", "TCSPump1OutputPower": 0, "TCSPump1InverterDriveTemp": 440, "TCSPump1kWhMeter": 1830, "TCSPump1MWhMeter": 0, "CommLostInverter1": "Normal" }, "Members@odata.count": 2, "Members": [{ "@odata.id": "/redfish/v1/CDU/TCS/Pump1/Control/ManualSpeed" }, { "@odata.id": "/redfish/v1/CDU/TCS/Pump1/Control/LockOff" }], "@odata.id": "/redfish/v1/CDU/TCS/Pump1" }	
/redfish/v1/CDU/TCS/ Pump2	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSPump2", "Name": "Cooling Distribution Unit TCS Pump2", "Description": "Read Value Scale, x1 for (Time,FlowRate,MWh,State,Role), x0.1 for (Temperture,Percent, DewPoint,RH,kW,kWh), x0.01 for (Pressure)", "Status": { "TCSPumpSpeed2": 500, "TCSPump2Failure": "Normal", "TCSPump2Pressure": 273, "TCSPump2PressureState": 3, "TCSPump2PressureError": "Normal", "TCSPump2OutputPower": 7, "TCSPump2InverterDriveTemp": 370, "TCSPump2kWhMeter": 1880, "TCSPump2MWhMeter": 0, "CommLostInverter2": "Normal" }, "Members@odata.count": 2, "Members": [{ "@odata.id": "/redfish/v1/CDU/TCS/Pump2/Control/ManualSpeed" }, { "@odata.id": "/redfish/v1/CDU/TCS/Pump2/Control/LockOff" }], "@odata.id": "/redfish/v1/CDU/TCS/Pump2" }	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right
/redfish/v1/CDU/TCS/ Pump2/ Control/LockOff	{ "@odata.type": "#Control.Control", "Id": "TCSPump2ControlLockOff", "Name": "CDU TCS Pump2 Control Lock Off for Maintenance", "Status": { "TCSPump2LockOFFForMaintenance": "Normal", "AllowableToSet URL?State=Off": "Normal", "AllowableToSet URL?State=On": "LockedOff" }, "@odata.id": "/redfish/v1/CDU/TCS/Pump2/Control/LockOff" }	
/redfish/v1/CDU/TCS/ Pump2/ Control/ ManualSpeed	{ "@odata.type": "#Control.Control", "Id": "TCSPump2SpeedPercentageAtManualMode", "Name": "CDU TCS Pump2 Speed Percentage At Manual Mode", "Description": "Unit: Percent, Write Value Scale, x10 for (Percent)", "Status": { "TCSPump2SpeedPercentageAtManualMode": 250, "Minimum AllowableToSet URL?Setpoint=0": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/TCS/Pump2/Control/ManualSpeed" }	
/redfish/v1/CDU/TCS/ Pump2/ Control/ ManualSpeed	{ "@odata.type": "#Control.Control", "Id": "TCSPump2SpeedPercentageAtManualMode", "Name": "CDU TCS Pump2 Speed Percentage At Manual Mode", "Description": "Unit: Percent, Write Value Scale, x10 for (Percent)", "Status": { "TCSPump2SpeedPercentageAtManualMode": 250, "Minimum AllowableToSet URL?Setpoint=0": 0, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/TCS/Pump2/Control/ManualSpeed" }	
/redfish/v1/CDU/TCS/ Reservoir	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSReservoir", "Name": "Cooling Distribution Unit TCS Reservoir", "Status": { "ReservoirLevelHigh": "On", "ReservoirLevelLow": "On", "TCSFillPumpStatus": "Off", "TCSFillPumpError": "Normal" }, "@odata.id": "/redfish/v1/CDU/TCS/Reservoir" }	
/redfish/v1/CDU/TCS/ Strainer	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSStrainer", "Name": "Cooling Distribution Unit TCS Strainer Differential Pressure", "Description": "Unit: Barg, Read Value Scale, x0.01 for (Pressure)", "Status": { "TCSStrainer1DP": 0, "TCSStrainer1DPState": 3, "TCSStrainer1DPError": "Normal", "TCSStrainer2DP": 14, "TCSStrainer2DPState": 3, "TCSStrainer2DPError": "Normal" }, "@odata.id": "/redfish/v1/CDU/TCS/Strainer" }	
/redfish/v1/CDU/TCS/ Temperature	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "CDUTCSTemperature", "Name": "Cooling Distribution Unit TCS Temperature", "Description": "Unit: Celsius, Read Value Scale, x0.1 for (Temperture)", "Status": { "TCSSupplyTemp": 291, "TCSSupplyTempState": 3, "TCSSupplyTempError": "Normal", "TCSReturnTemp": 291, "TCSReturnTempState": 3, "TCSReturnTempError": "Normal" }, "Members@odata.count": 1, "Members": [{ "@odata.id": "/redfish/v1/CDU/TCS/Temperature/Control/SupplyTemperature" }], "@odata.id": "/redfish/v1/CDU/TCS/Temperature" }	

Table 35. RESTful API (ePICV) (continued)

URL	Output Example	Access Right
/redfish/v1/CDU/TCS/ Temperature/Control/ SupplyTemperature	{ "@odata.type": "#Control.Control", "Id": "TCSSupplyTemperatureSetpoint", "Name": "CDU TCS Supply Temperature Setpoint", "Description": "Unit: Celsius, Write Value Scale, x10 for (Temperture)", "Status": { "TCSSupplyTemperatureSetpoint": 250, "Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=500": 500 }, "@odata.id": "/redfish/v1/CDU/TCS/Temperature/Control/SupplyTemperature" }	
/redfish/v1/CDU/ ThresholdSetpoint	{ "@odata.type": "#ThermalEquipment.ThermalEquipment", "Id": "ThresholdSetpoint", "Name": "Cooling Distribution Unit ThresholdSetpoint", "Status": { "ThresholdIndexNumber": 1 }, "Members@odata.count": 2, "Members": [{ "@odata.id": "/redfish/v1/CDU/ThresholdSetpoint/Control/Index" }, { "@odata.id": "/redfish/v1/CDU/ThresholdSetpoint/Control/Value" }], "@odata.id": "/redfish/v1/CDU/ThresholdSetpoint" }	
/redfish/v1/CDU/ ThresholdSetpoint/ Control/ Index	{ "@odata.type": "#Control.Control", "Id": "CDUThresholdSetpointIndex", "Name": "CDU Threshold Setpoint Index", "Status": { "ThresholdIndexNumber": 1, "ThresholdSetpointReadingValue": 100, "Minimum AllowableToSet URL?Setpoint=1 ": 1, "Maximum AllowableToSet URL?Setpoint=1000": 1000 }, "@odata.id": "/redfish/v1/CDU/ThresholdSetpoint/Control/Index" }	
/redfish/v1/CDU/ ThresholdSetpoint/ Control/ Value	{ "@odata.type": "#Control.Control", "Id": "CDUThresholdSetpointSetValue", "Name": "CDU Threshold Setpoint Set Value", "Description": "Write Value Scale, x1 for (Time,FlowRate,MWh,State,Role), x10 for (Temperture,Percent, DewPoint,RH,kW,kWh), x100 for (Pressure)", "Status": { "ThresholdSetpointReadingValue": 100, "Minimum AllowableToSet URL?Setpoint=0 ": 0, "Maximum AllowableToSet URL?Setpoint=9999": 9999 }, "@odata.id": "/redfish/v1/CDU/ThresholdSetpoint/Control/Value" } "	

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