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Operation and maintenance manual

C-series cooling station with Siemens PLC

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Contents

1. About this manual

Information on possible safety hazards

The following symbol is used in this manual.

⚠ WARNING
Warns of a situation which may cause personal injury, death, and/or substantial damage to the machine or other property if not avoided

Optional equipment

The cooling station can be equipped with various accessories or optional equipment. Optional equipment or functions are marked with text ”option” in this manual. This manual may describe optional features that are not opted for this cooling station.

Other manuals and instructions

Project documentation includes *Operation and maintenance manual* and *Installation manual*. The documentation package also includes component-specific manuals and layout drawings for the cooling station. If some additional documentation for components is required, please contact Adwatec technical support.

2. Terminology

Term	Definition
Operator	Person/personnel operating the cooling system locally or remotely.
Customer	Company who has ordered the product and end-user of the cooling system.
Coolant	Cooling medium used in cooling circuit. Usually glycol-based liquid.
Technical water	Cooling medium in the secondary circuit.
Refrigerant	Cooling medium in the chiller circuit. Usually R513A or R410A.
to power electronics	Coolant flow from cooling station to power electronics.
from power electronics	Coolant flow from power electronics to cooling station.
Orifice plate	Plate used in pressure difference measurement for flow calculation.
Flow indicator	Rotameter used to measure the flow.
Cooling circuit	Includes the cooling station and power electronics. Main function is to cool down the power electronics.
Secondary circuit	Secondary side of the heat exchanger used to cool down the cooling circuit with technical water or air.
Micro-bubble collector	Piping from top of the pump housing to expansion tank. Collects micro-bubbles from coolant to expansion tank.
Chiller circuit	Includes evaporator, condenser, compressor, filter drier, sight glass, expansion valve and piping between the components.
Buffer tank/evaporator circuit	Circuit between buffer tank and evaporator. Pump circulates coolant between buffer tank and evaporator.

De-ionization circuit	De-ionization circuit is used to keep coolant conductivity low. It includes a de-ionization tank, a filter and a rotameter.
Cooling station	Includes Adwatec pumps, manifolds, a 3-way valve, an electric cabinet, sensors and a heat exchanger.
Cooling system	Includes the cooling station and an external dry cooler.
Automatic de-airing	The de-airing vent removes extra air from the cooling circuit or from the secondary circuit.
3-way valve	A valve with one input line and two output lines that divide the flow to heat exchanger or bypass heat exchanger.
Shut-off valve	A valve designed to stop the flow or isolate the pipeline.
Throttle flange	A flange used to restrict the flow.
Balancing valve	Restricts the flow to desired value.
Plate heat exchanger	Liquid-liquid counter current heat exchanger. Adwatec uses brazed plate heat exchangers and gasketed plate heat exchangers. Brazed plate heat exchangers are more commonly used and gasketed plate heat exchangers are used when secondary circuit uses sea water and for that reason might need cleaning time to time.
Dry cooler	Liquid-air heat exchanger with fans to create cross flow through piping.

3. Safety instructions

To ensure safety and the reliable functioning of the product, all persons operating the cooling station must read this manual carefully and understand how cooling station operates. Read the safety instructions before starting work on the cooling station.

⚠ WARNING
The frequency converter and electric motor used in this machinery may emit non-ionising radiation. This radiation could potentially cause harm to individuals, especially those with active or non-active implantable medical devices, such as pacemakers. Operators and exposed persons must be aware of this potential risk. Ensure appropriate safety measures are in place to prevent exposure to harmful radiation

⚠ WARNING

Airborne noise emitted by CR pumps:

	50 Hz	60 Hz
Motor [kW]	dB(A)*	dB(A)*
Up to 0,75	50	54
1,1	52	57
1,5	54	59
3,0	55	60
4,0	62	66
5,5 to 18,5	60	65

**ISO3743-2/ISO1680*

⚠ WARNING

Always follow the safety instructions.

Cooling station must be installed in accordance with accepted industry standards. Failure to meet the following conditions may cause danger to the operator or damage to the system, this can cause void for the warranty. When working on the cooling station, follow all generally acknowledged safety standards. EU directives and national regulations must also be followed.

- Cooling station must only be used in accordance with the operating instructions provided in this manual. Any other use, or operation outside the specified guidelines, is strictly prohibited. Unauthorized use may result in damage to the cooling station, personal injury, or other hazardous situations. The manufacturer assumes no responsibility for any consequences arising from improper use or misuse of the equipment.
- Only qualified electricians and mechanics are allowed to carry out the installation and maintenance work on the cooling station.
- Shut the power off before any maintenance work. The power must not be reconnected before the installation work is complete.
- Switch off the cooling station and let it cool down before maintenance work. Cooling station might contain hot coolant during normal operation.
- Cooling station and primary cooling circuit can contain high-pressure coolant (6 bar) during operation. Release the pressure from the cooling station before maintenance activities. Use safety goggles and other needed safety equipment and clothing.
- When handling the glycols (coolant) always keep its safety datasheet and handling instructions nearby and make sure that the person responsible for handling the glycol has read the safety and handling instructions.

- Seek medical advice if you get glycol or corrosion inhibitor in your eyes, mouth or on your skin. The coolant consists of plain tap water or mixture of water, ethylene glycol and corrosion inhibitor or mixture of water and propylene glycol depending on the project. Glycol and corrosion inhibitors are dangerous to health.
- It is the customer's responsibility to provide flow and temperature control to the secondary circuit. If the project specified flow and temperature for the secondary circuit is not met, the warranty is not valid.
- Retain these operation and maintenance instructions during the entire life cycle of the cooling station.
- The cooling station should always be transported empty (without coolant) to prevent damage caused by low or high ambient temperatures.
- Any force or vibration in the cooling station through the secondary circuit pipe connections or through the fixing points will shorten the MTBF (mean time between failure) of the cooling station.
- Cooling station must be leak tested before continuous use.
- Cooling station components or internal wiring must not be changed without Adwatec Oy approval.
- Use only Adwatec approved spare parts in the cooling station.
- Maintenance for cooling station or separate components of the cooling station must be done according to this manual or component service manuals.
- Always install a filter before the cooling station if the secondary circuit cooling liquid contains particles larger than 0.1 mm (100µm). If the secondary circuit liquid contains chemical or biological residue, the MTBM (mean time between maintenance) is significantly reduced due to clogging of the plate heat exchanger.
- Adwatec recommends using a VFD or a soft starter at pump supply to soften the pump startup, to prevent current peaks and to reduce risks caused by pressure hammers for the pipelines and power electronics. If a soft starter or VFD is not used, Adwatec recommends that the number or pump starts is minimized to increase the cooling system and power electronics MTBF.
- Pumps with 5,5 kW or larger motors must be started with soft starter or VFD. Failure to meet this requirement causes void for the warranty.
- Operating voltage 660/690 VAC with VFD control requires reinforced windings in the pump motor, otherwise the lifetime of the pump motors may be significantly reduced.

4. General information about operation and maintenance

This manual contains information for operation and maintenance of the cooling station. It shows the fundamentals of the C-series cooling station and is to be used as a guideline and assistance in different situations you might encounter when operating the cooling station.

Operators and maintenance personnel must study this manual carefully and understand properly how the cooling station works, and how it can be operated and maintained.

In case of difficulties in operation or during maintenance, do not hesitate to contact Adwatec Oy.

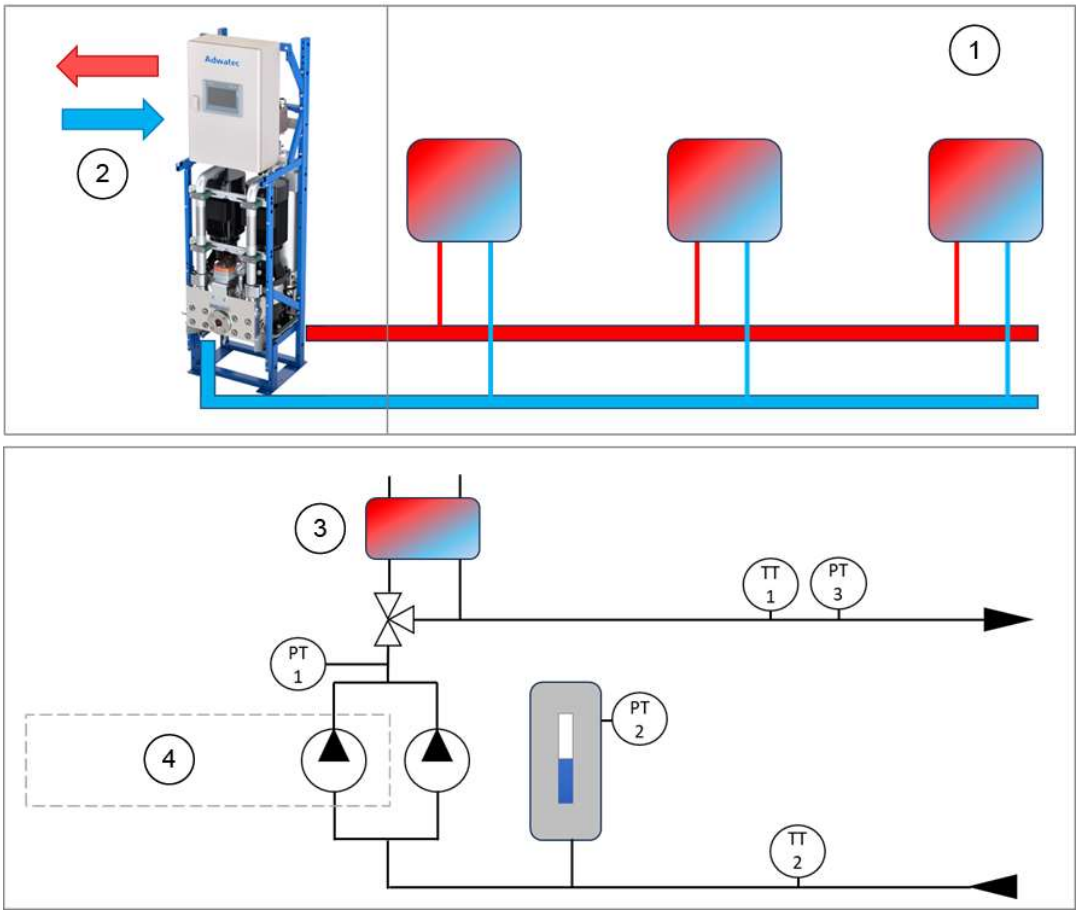
5. General system description

The compact cooling station is a water cooling station for a closed loop water cooling system. It is designed to cool power electronics and to control the cooling temperature.

Cooling station can be mounted into a cubicle. Cooling stations are available with either one pump or two pumps. When the station has two pumps, one pump is active and the other pump is for redundancy.

Cooling stations' principle of operation is based on transfer of heat. The cooling circuit transports the heat load from the power electronics to the heat exchanger. The heat exchanger can be a plate heat exchanger or a dry cooler.

When using a plate heat exchanger, the technical water circuits through the plate heat exchanger collecting the heat load and then transporting it to an external cooler. This external cooler is part of the customers' existing cooling system.



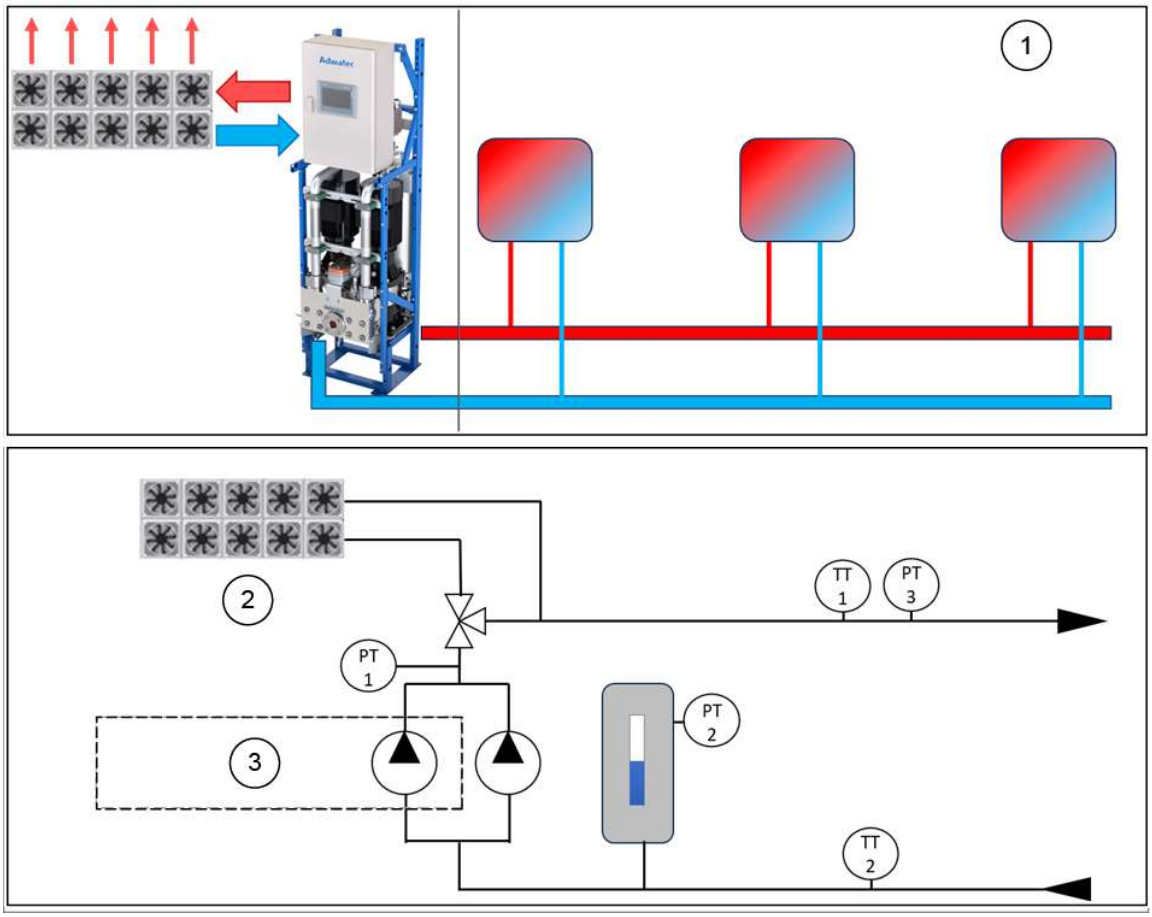
1. Power electronics
2. Technical water
3. Plate heat exchanger
4. Two pumps in redundant cooling stations

PT Pressure transmitter
TT Temperature transmitter

* C-series cooling stations do not have a flow sensor, the flow is measured from PT1 and PT2 pressure difference and flow is calculated according to affinity laws.

Figure 1. Cooling station with plate heat exchanger.

When operating with a dry cooler, the operation is otherwise same, but the plate heat exchanger is replaced with a dry cooler. When operating with a dry cooler, there is no need for an external cooler.



1. Power electronics
2. Dry cooler
3. Two pumps in redundant cooling stations

Figure 2. Cooling station with dry cooler.

6. Main components

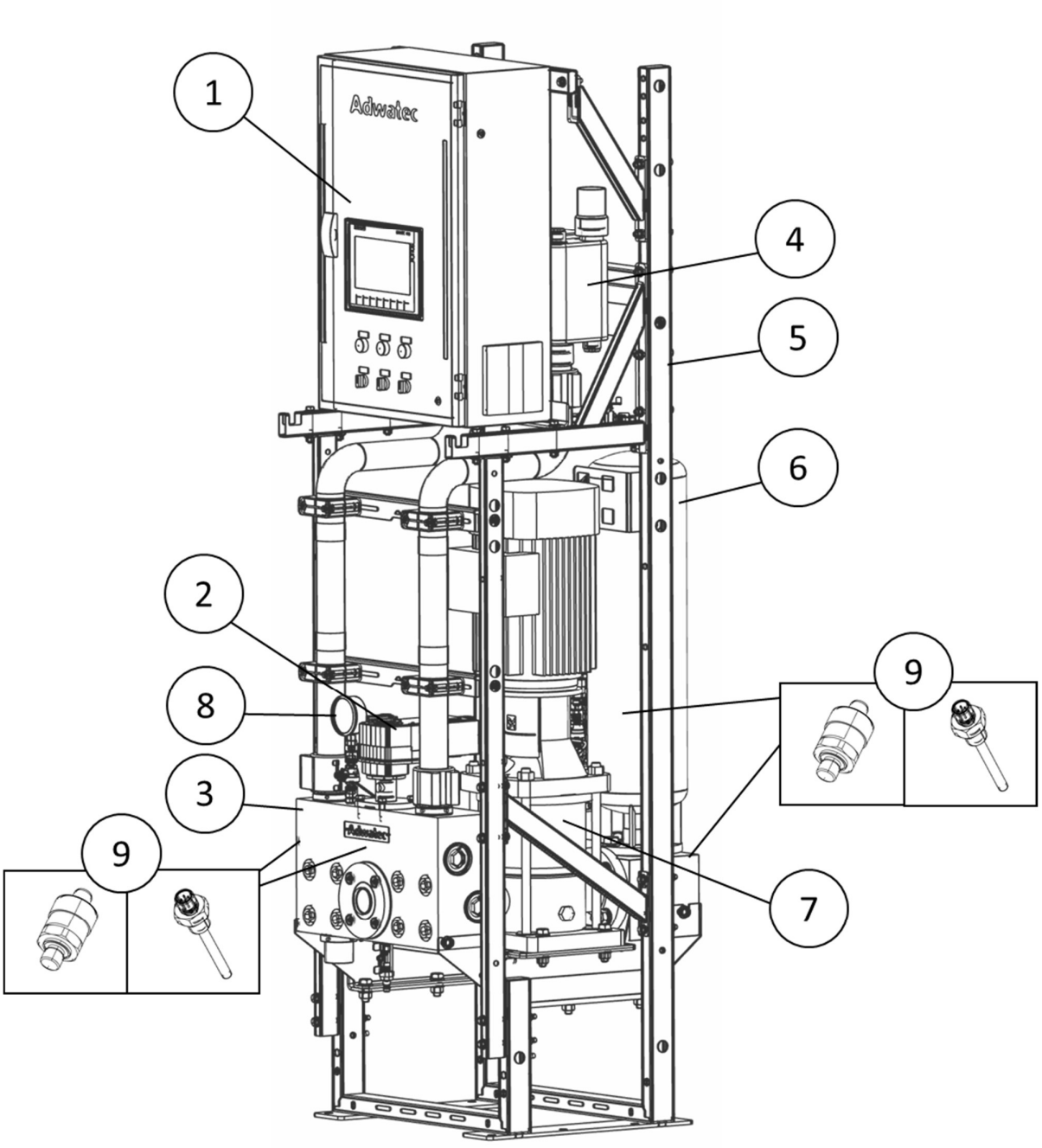


Figure 3. Regular CCE cooling station. Exact type and locations of the components may vary.

1	Electrical cabinet, control system	Electrical cabinet is mounted to sheet metal plate. Siemens HMI is integrated to electrical cabinet.
2	Valve actuator	Spring return control actuator with analogue signal control and position feedback.
3	Manifolds, 3-way valve	C-series cooling stations have 2 aluminium manifolds. One in the suction side and the other in the pressure side. 3-way valve is integrated in the pressure side manifold.
4	Heat exchanger	Pictures show Brazed plate heat exchanger. Dry cooler can be used as an alternative.
5	Frame	C-series cooling stations have welded carbon steel structure. Painted colour blue RAL 5017.
6	Expansion tank	Stainless steel tank without membrane. Quick-connect fitting for air filling and pressurizing the system. Visual coolant level indicator outside of the vessel with capacitive level switch.
7	Pump	Vertical multistage centrifugal pump Grundfos CR with wetted parts made of 304 stainless steel.
8	Pressure gauge	0 … 10 bar pressure gauges at the expansion tank and pump output. Gauges equipped with shut off valves.
9	Sensors and transmitters	Pressure transmitters: Coolant inlet and outlet ports are equipped with piezoresistive pressure transmitter with wetted parts of stainless steel. Output signal 4-20mA. Temperature transmitters: Coolant inlet and outlet ports are equipped with PT100 or PT1000 temperature transmitters. Transmitters installed into the stainless-steel pockets.

7. Type designation

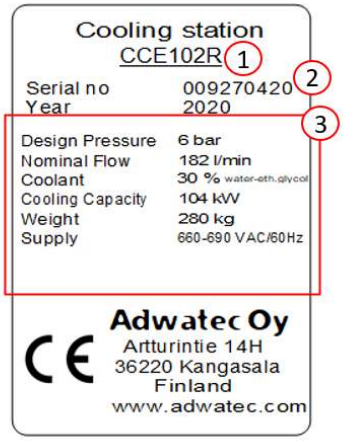


Figure 4. Example of a type designation that can be found on every cooling station.

The type designation tells important data about the system and is located in a visible location on the cooling station.

1	CCE	102	R
	Compact cooling station	Pump: CRI 10-2	Pump Redundancy
2	00927	04	20
	Cooling station number	Month	year
3	General information about the cooling station		

8. Materials

All parts and components in contact with coolant are made of stainless steel, 6000 series aluminum or high-quality plastic.

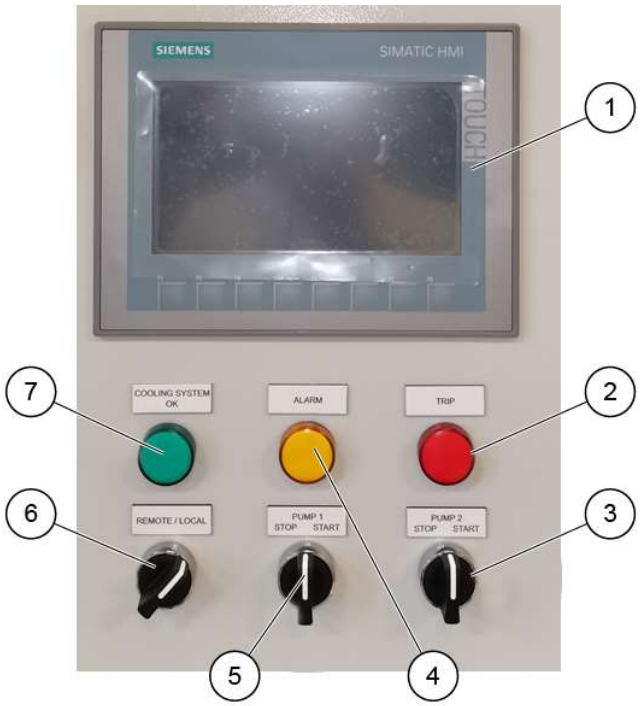
Pump	AISI 304 / AISI316
Piping	AISI 303 / AISI 304 / AISI304L / AISI316 / AISI316L / AISI 316Ti
Manifolds	6000 series Aluminum
Tank visual indicator	FEP
Gaskets	PTFE, EPDM, NBR, FKM, Fiber

9. Control system

The control system monitors process values and statuses. Control system controls the functions of the cooling station and operator interface. It includes Siemens S7-1200-series PLC with Siemens KTP700 Basic 7” touch panel (HMI).

Control system is assembled on sheet metal plate. Cabinet is painted steel with colour RAL 7035, light grey.

9.1 Operation panel and switches



1. HMI panel
2. Trip light
3. PUMP 2 START/STOP switch (option)
4. Alarm light
5. PUMP 1 START/STOP switch
6. Mode selection switch (REMOTE/LOCAL)
7. Cooling system OK light

Figure 5. Operation panel and switches.

In normal operation, the mode selection switch is in REMOTE mode. LOCAL mode is recommended to be used only during commissioning and maintenance.

When the REMOTE mode is selected, the pump control switches are not in use.

If mode selection is in LOCAL mode, then the operator can use switches pump 1 and pump 2 (option) to force pump on/off.

Status lights on the PLC cabinet doors are:

RUN	green light	pump is running
ALARM	yellow light	alarm in cooling system
TRIP	red light	cooling system

9.2 Signals for remote control

There are hardwired remote signals to control cooling station:

- Start
- Stop
- Reset

9.3 Signals for remote status monitoring

There are hardwired status signals for cooling station statuses:

- Cooling system Functional (means that one pump running, REMOTE mode selected and no sensor alarms)
- Alarm (0=no alarms, 1=one or more alarms)
- No trip (0=tripped, 1=not tripped, five seconds delay for trip)
- Pump 1 running
- Pump 2 running (option)

9.4 Alarms and trips

Cooling system has following alarms on HMI:

- FT1 – ALARM – Low coolant flow
- LS2 – ALARM – Tank level low
- PT1 – ALARM – low pump output pressure
- PT2 – ALARM – Low tank pressure
- PT2 – ALARM – High tank pressure
- TT1 – ALARM – High coolant temperature to power electronics
- TT2 – ALARM – High coolant temperature from power electronics
- TT20 – ALARM – High secondary side temperature (optional)
- QT1 – ALARM – High coolant conductivity (optional)
- P1 – ALARM – Pump 1 circuit breaker off
- P2 – ALARM – Pump 2 circuit breaker off (option)
- PT1 – ALARM – Pressure sensor failure
- PT2 – ALARM – Pressure sensor failure
- TT1 – ALARM – Temperature sensor failure
- TT2 – ALARM – temperature sensor failure

Sensor fault alarm from all sensors if signal is:

- < 0V or over 10V

- TT20 – ALARM – temperature sensor failure (optional)
- QT1 – ALARM – conductivity sensor failure (optional)
- PT1/PT2 – ALARM – pressure difference too high when pumps are stopped

Cooling system has following trips on HMI.

- FT1 – TRIP – Low coolant flow
- LS1 – TRIP – Tank level low
- PT1 – TRIP – Low pump output pressure
- PT2 – TRIP – Low tank pressure
- TT2 – TRIP – Coolant temperature high from power electronics
- TT20 – TRIP – secondary side temperature (option)
- QT1 – TRIP – High coolant conductivity (option)
- P1&P2 – TRIP – Both pumps stopped (option, when two pumps)
- P1 – TRIP – Pump stopped (option, when one pump)
- PT3 – TRIP – Pressure high and pump speed minimum (option, only when pressure control)

10. Cooling system function modes

Cooling system has two different main modes:

- Remote
- Local

LOCAL or REMOTE mode can be selected from cubicle front door panel switches.

10.1 Remote mode

Cooling station is controlled by PLC. Cooling station is started with remote START signal and stopped with remote STOP signal. Cooling station stops if the LS1 trip signal (TRIP - Coolant tank level low) is on.

After the STOP signal, the cooling system stops and pressure and flow (FT1, PT1) alarms and trips are not active.

10.2 Local mode

Local mode is used only in commissioning and maintenance.

In LOCAL mode the cooling system can operate even in trip condition except if LS1 trip is active.

In LOCAL mode, if there are no alarms and pump is running, switching to remote mode keeps the pump running. If the cooling station has two pumps (option), the running pump stops, and stand-by pump starts the normal REMOTE operation.

Control valve positions are set from HMI.

If heater (option) is included, there are on/off-buttons for the heater. The heater is on when the pump is running and the cooling station is set to LOCAL mode. If the pump stops or the heater overheats, then the heater must be turned on again manually.

11. Pump change-over (option, only in redundant pump cooling stations)

When pump output pressure or flow drops below trip level pump change-over is forced. Trip signal may not be active, but alarm signal is active. (Trip signal has 5sec delay).

In REMOTE-mode pump changeover is done after every 350 hours of continuous running for pump 1 and 300 hours for pump 2. Running pump changes in every REMOTE-mode start. When pump 1 and pump 2 runtimes differ, both pumps don't wear down in same phase.

12. Cooling station operation

Before continuing further, make sure that the cooling station installation has been completed totally and without any problems. Do not start the pumps without coolant in the system.

If any trip is active during remote mode, a remote start is not possible. The reason for the trip needs to be solved and acknowledged first.

Note that when the START signal is on, the cooling station starts immediately after the trip reason is solved and trip is acknowledged.

12.1 Cooling system start/stop in local mode

1. Before start, check that the start does not cause any risk.
2. Check that the valves in the cooling circuit and in secondary circuit are open.
3. Turn the cooling station to LOCAL mode from control panel switch.
4. Turn main switch ON
5. Wait until PLC's and HMI starts.
6. Start the pump from control panel switches.
7. Reset the alarms from HMI.
8. Check the coolant level.
9. Check in the HMI that the temperature, pressure and flow indications are in right level.
10. Check alarm and trip parameters.

Pumps can be started in local mode at almost any condition. Only tank low level trip (LS1) prevents starting.

12.2 Cooling system start/stop in remote mode

Remote start can be done when the select switch is on REMOTE. Start is done by an external START signal.

After a remote start there is a 5 second delay before alarm limits are valid. Active alarms don't prevent REMOTE start.

All trip signals need to be acknowledged before a REMOTE start.

After the cooling system is stopped from the external control system, flow (FT1) and pressure (PT1) alarm & trips limits are not valid.

12.3 Trips that stop the pumps

In REMOTE mode cooling system can be stopped from external control with HW-signal on via fieldbus.

Interlockings which stop the pump are:

- Low coolant level (LS1) trip on more than 20 seconds
- Low pump output pressure (PT1) trip on more than 20 second
- PT3 pressure high and pump speed minimum more than 5 seconds (NOTE! Only when pressure control enabled)

In LOCAL mode pumps stop only by operation panel switches or when tank coolant level is below LS1.

Cooling system stops if the pump (or both pumps in redundant systems) fails or if AC main power is lost.

12.4 3-way valve operation

Cooling station temperature is controlled with 3-way valve. 3-way valve controls the flow to heat exchanger and to bypass line. In need of cooling the 3-way valve controls the flow to heat exchanger. When cooling is not required anymore the flow is controlled through bypass. 3-way valve can be operated proportionally, and flow can be controlled partially to heat exchanger and bypass line.

3-way valve can be operated with proportional control or with PID-control.

For more information about 3-way valve positions see **Appendix D. 3-way valve position.**

12.5 3-way valve operation on proportional control

In proportional-mode the 3-way valve will be closed (no flow to heat exchanger) below temperature T1 setpoint (sensor TT2). 3-way valve starts to open at T1 and will be fully open to heat exchanger at temperature T2.

T1 and T2 setpoints can be set from the parameter settings window.

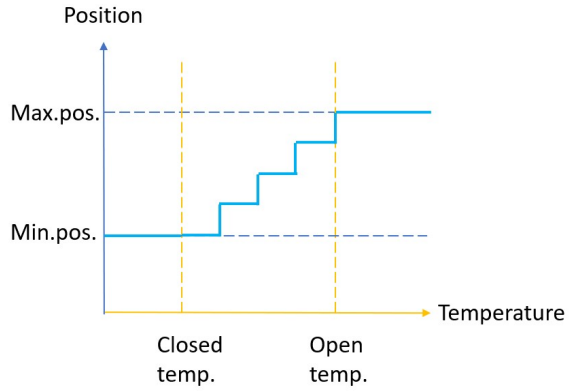


Figure 6. Example from proportional control.

The proportional mode will minimize the fluctuation of the 3-way valve and maximize the lifetime of the moving components.

12.6 3-way valve operation on PID-control

Operator can set the temperature setpoint of the coolant for power electronics. Temperature variation is compensated by PID-control.

PID function has three variables: gain, integral and derivate. These functions are explained below.

GAIN = The proportional term produces an output value that is proportional to the current

error value. The proportional response can be adjusted by multiplying the error by a constant GAIN, called the proportional gain constant. A high proportional gain results in a large change in the output for a given change in the error. **If the proportional gain is too high, the system can become unstable**. In contrast, a small gain results in a small output response to a large input error, and a less responsive or less sensitive controller. **If the proportional gain is too low, the control action may be too small when responding to system disturbances.**

TI (ms) = The contribution from the integral term is proportional to both the magnitude of the error and the duration of the error. The integral in a PID controller is the sum of the instantaneous error over time and gives the accumulated offset that should have been corrected previously. The accumulated error is then multiplied by the integral gain (TI) and added to the controller output. **The integral term accelerates the movement of the process towards set point and eliminates the residual steady-state error that occurs with a pure proportional controller.**

TD(ms)= The derivate of the process error is calculated by determining the slope of the error over time and multiplying this rate of change by the derivative gain TD. The magnitude of the contribution of the derivative term to the overall control action is termed the derivative gain, TD.

The derivative term slows the rate of change of the controller output. Derivative control is used to reduce the magnitude of the overshoot produced by the integral component and improve the combined controller-process stability. However, the derivative term slows the transient response of controller. Also, differentiation of a signal amplifies noise and thus this term in the controller is highly sensitive to noise in the error term, and can cause a process to become unstable if the noise and the derivative gain are sufficiently large.

TD(ms)= TIME LAG OF THE DERIVATIVE ACTION. The algorithm of the D action includes a time lag that can be

assigned at the “time lag of the derivative action” input.

12.7 3-way valve manual control (only in local mode)

In LOCAL- mode the 3-way valve will stay on the position set by the operator. Valve position can be adjusted and read from the HMI.

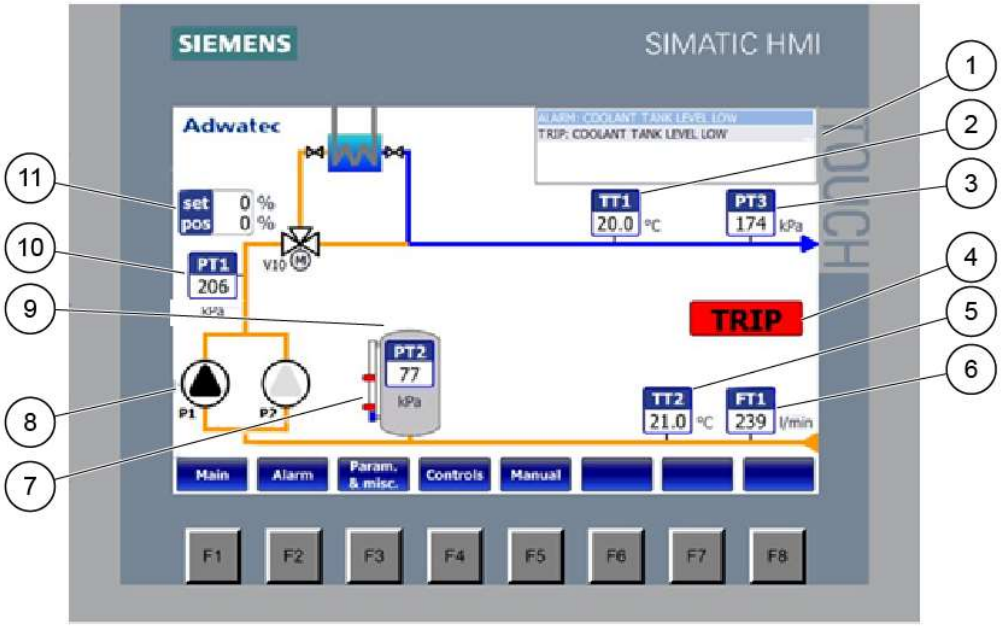
13. HMI screens

13.1 Main screen

Main screen presents simplified process diagram (see screen capture below).

All CCS's sensors and current values can be seen from the main screen.

If some sensors or other components are not used in a project they are disabled from the screen.



1. Alarm window
2. Temperature to power electronics
3. Measurement for pressure control
4. Trip indicator
5. Temperature from power electronics
6. Coolant flow (calculated)
7. Tank level switch alarms
8. Pump running status (Black triangle means pump is running)
9. Static pressure
10. Pump output pressure
11. 3-way valve position and setpoint.

Figure 7. Main screen.

Note! Special options with their main screens are documented in their own specific chapters.

13.2 Alarm screen

Alarms can be reset after failure has been corrected.

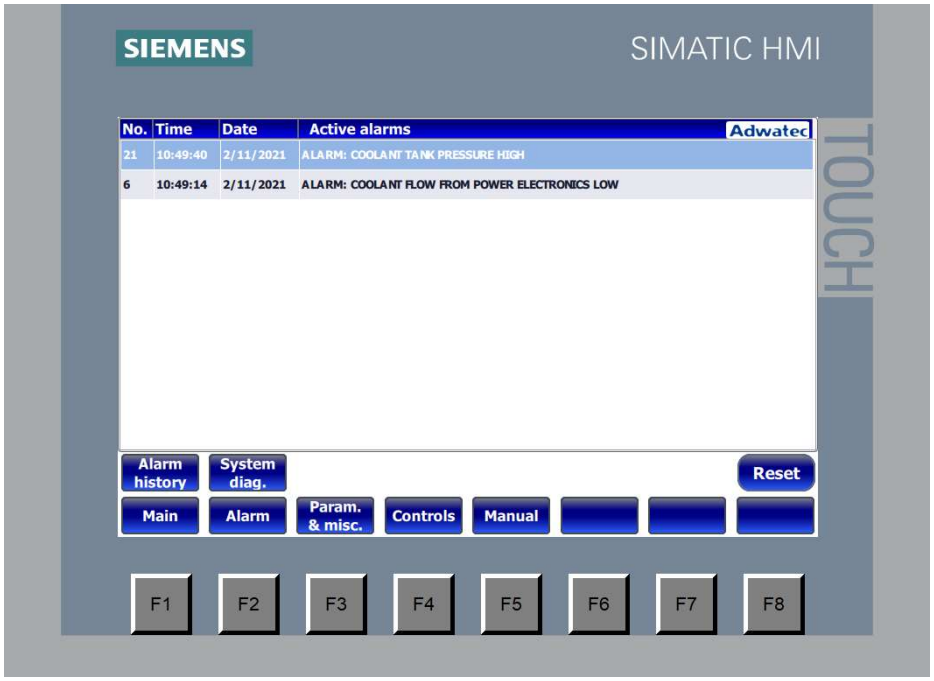


Figure 8. Alarm screen.

Alarm history shows alarm time, details and status.

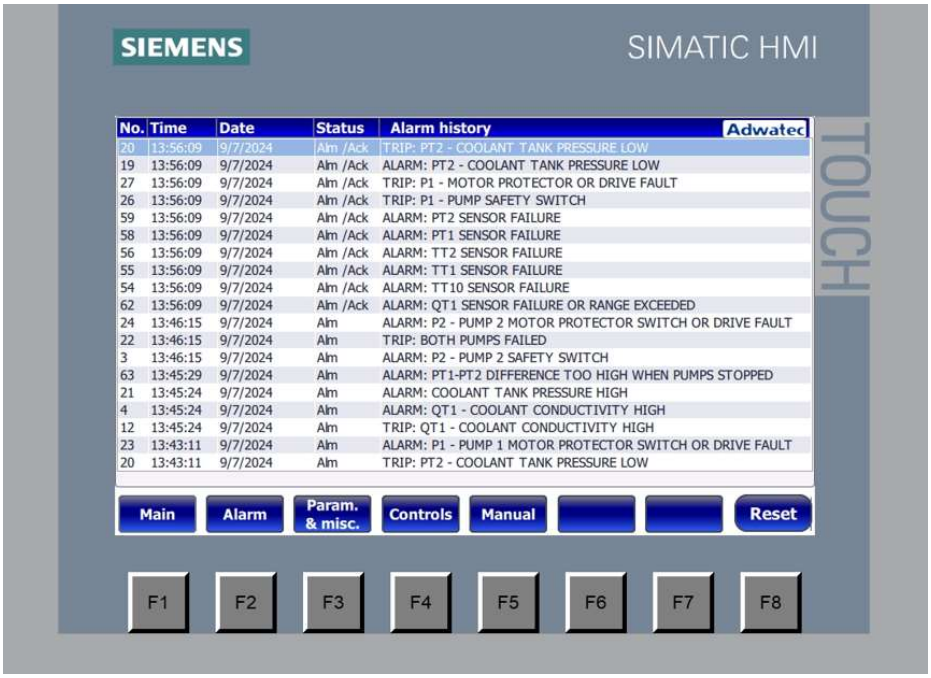


Figure 9. Alarm history screen.

System diagnostics show the history of events occurred.

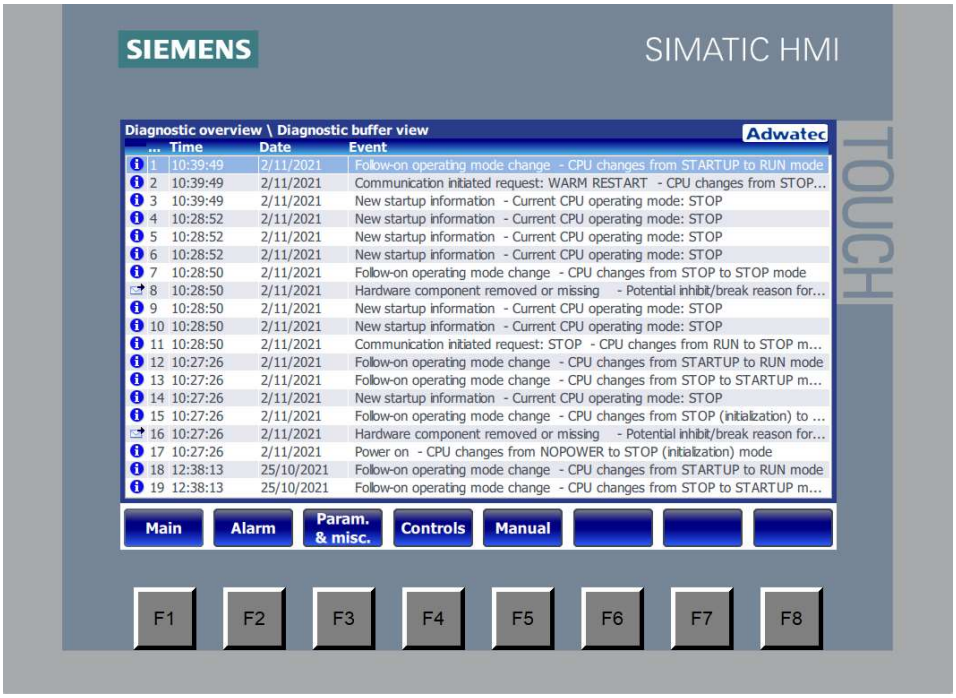


Figure 10. System diagnostics screen.

13.3 Parameter and miscellaneous menus

Parameters can be set via this menu. There are buttons for the following functions:

- Alarm parameters
- Other parameters like heater (option) parameters
- Running hour monitoring for pumps and fans
- ModbusTCP parameters
- Time settings

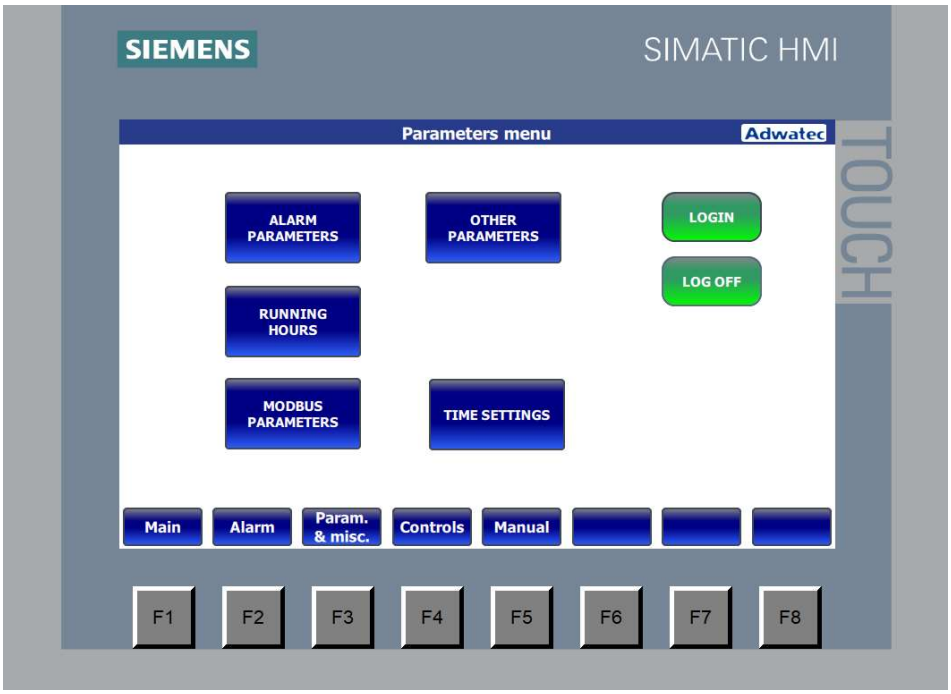


Figure 11. Parameter menu.

Some parameters screens are password protected. A login window opens when a password protected parameter screen is opened. It is also possible to login by clicking LOGIN and login out with LOG OFF. If there has been no activity for 5 minutes, log off will be done automatically.

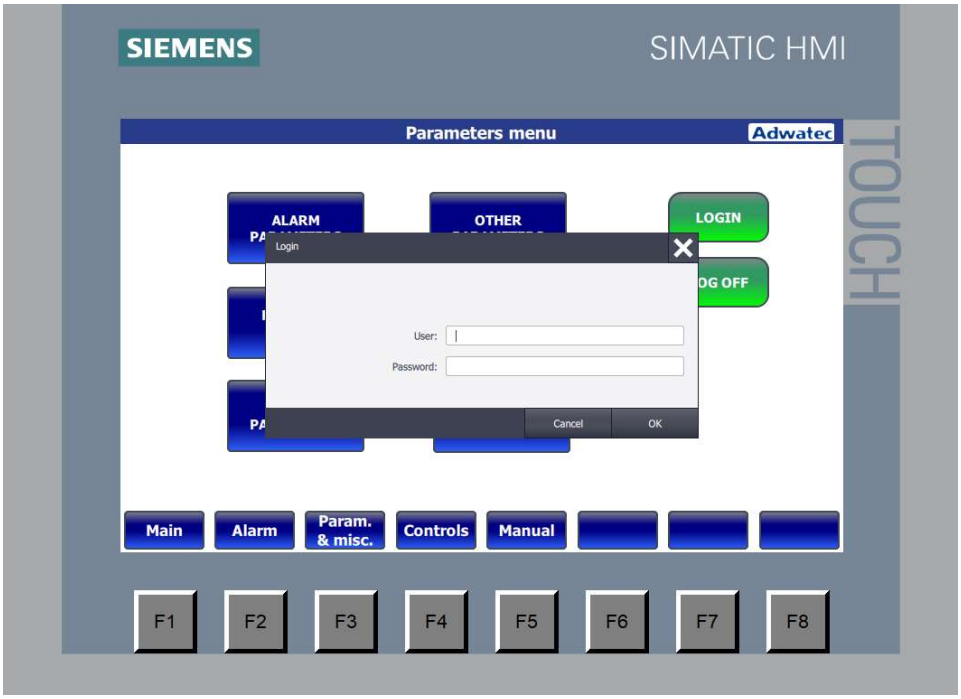


Figure 12. Parameter menu login window.

There are three alarm parameter screens. On the screen can be seen sensor position, description and parameter values. All parameters can be set back to factory setting values by clicking FACTORY SETTINGS button.

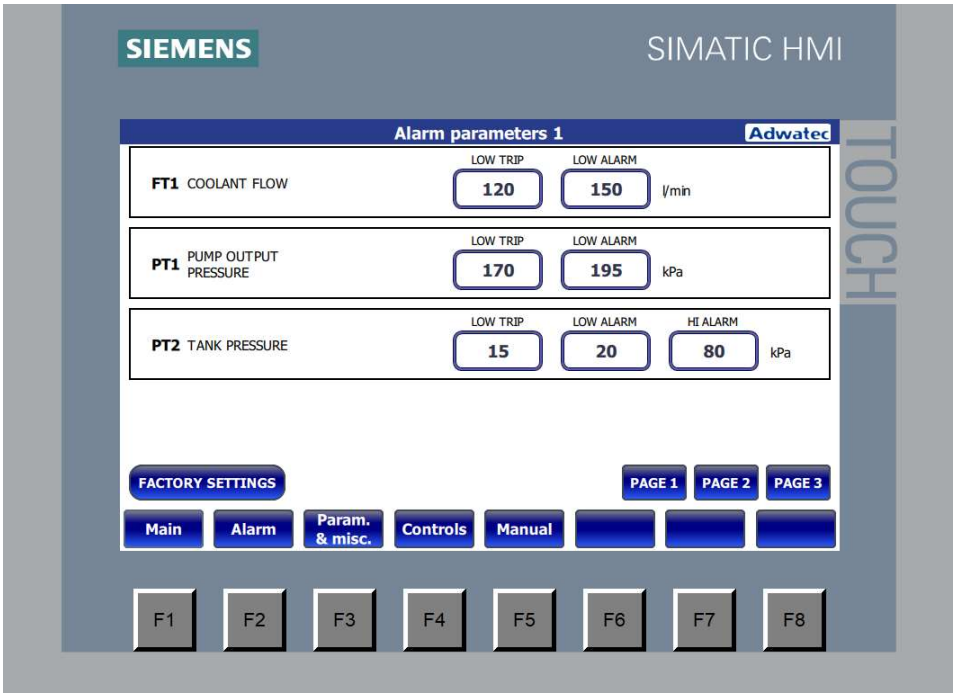


Figure 13. Alarm parameter screen (password protected).

When there is no pressure control but there are frequency converters without speed reference coming from PLC, the selected pump speed must be set on HMI for flow calculation. This applies to cooling stations with product code P.

Optional electrical heater is installed into the expansion tank. Heater ON and OFF setpoints can be adjusted from heater parameter screen.

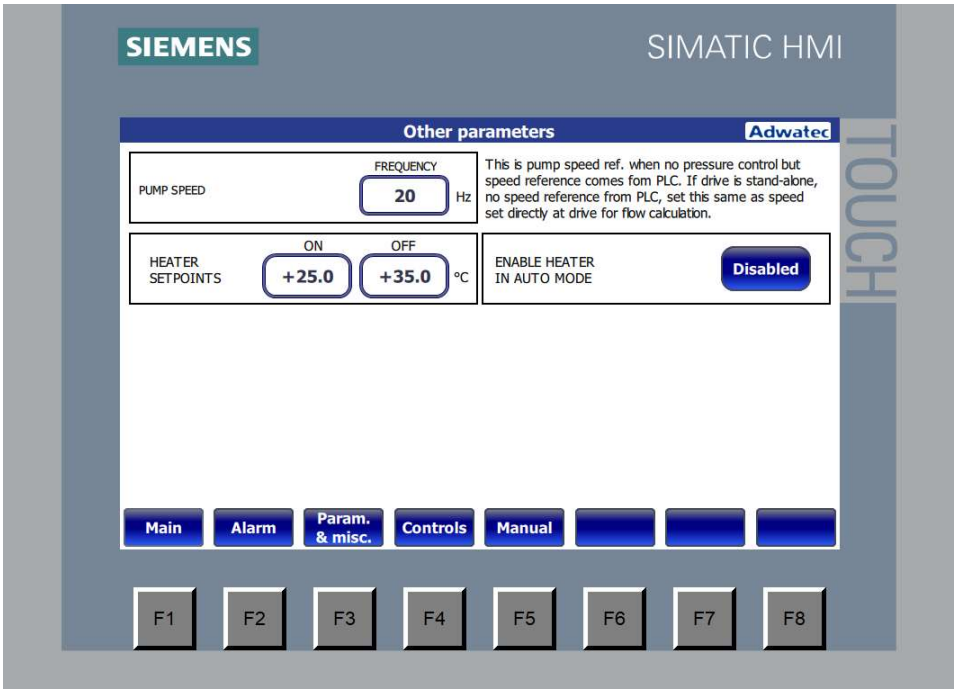


Figure 14. Screen for miscellaneous parameters.

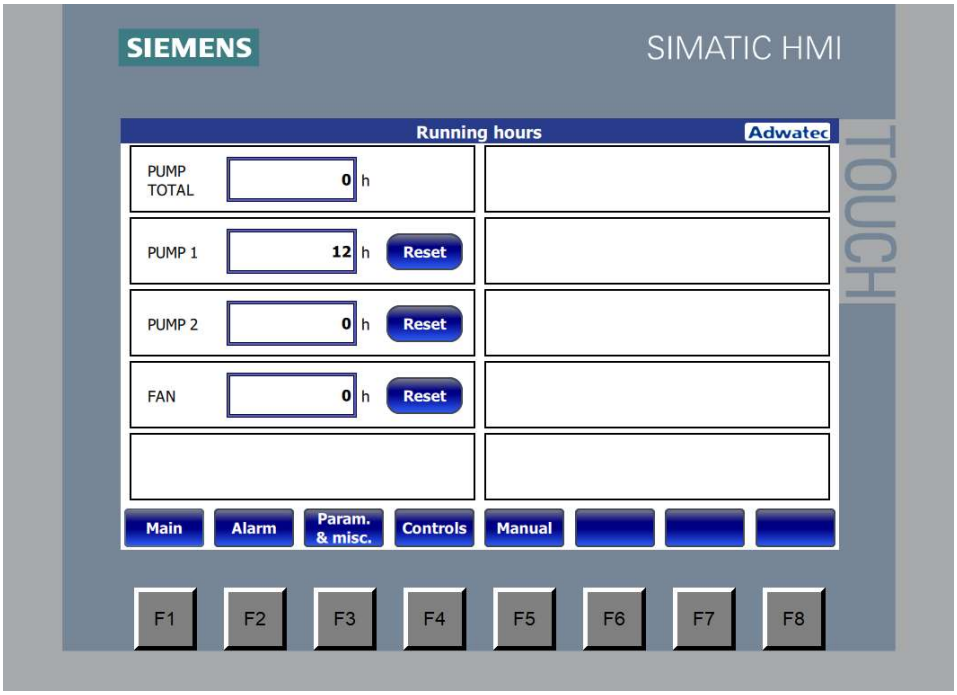


Figure 15. Running hours screen.

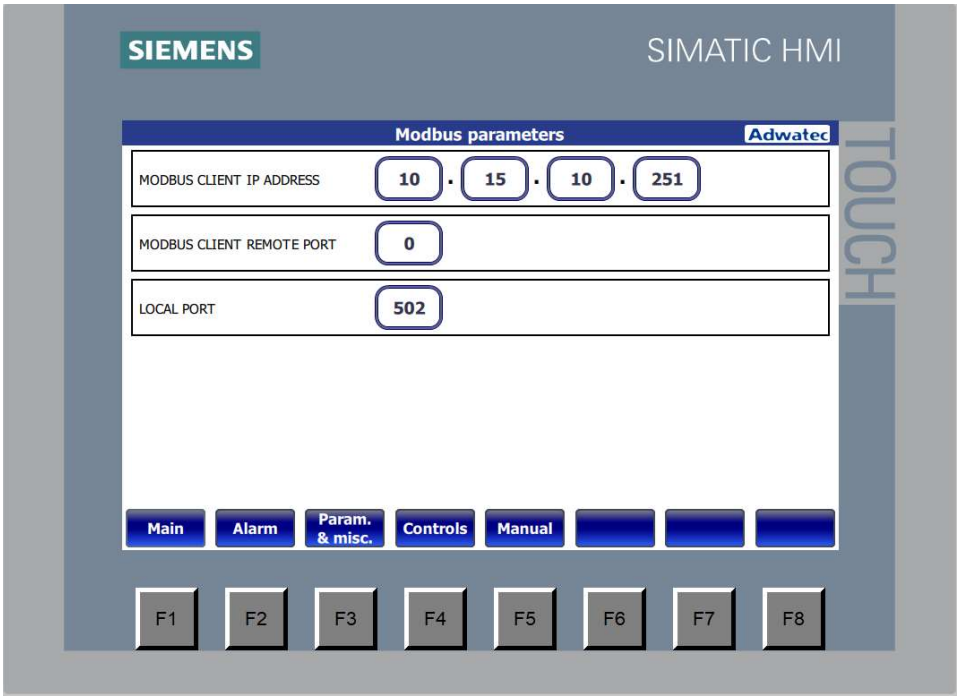


Figure 16. Modbus parameters screen

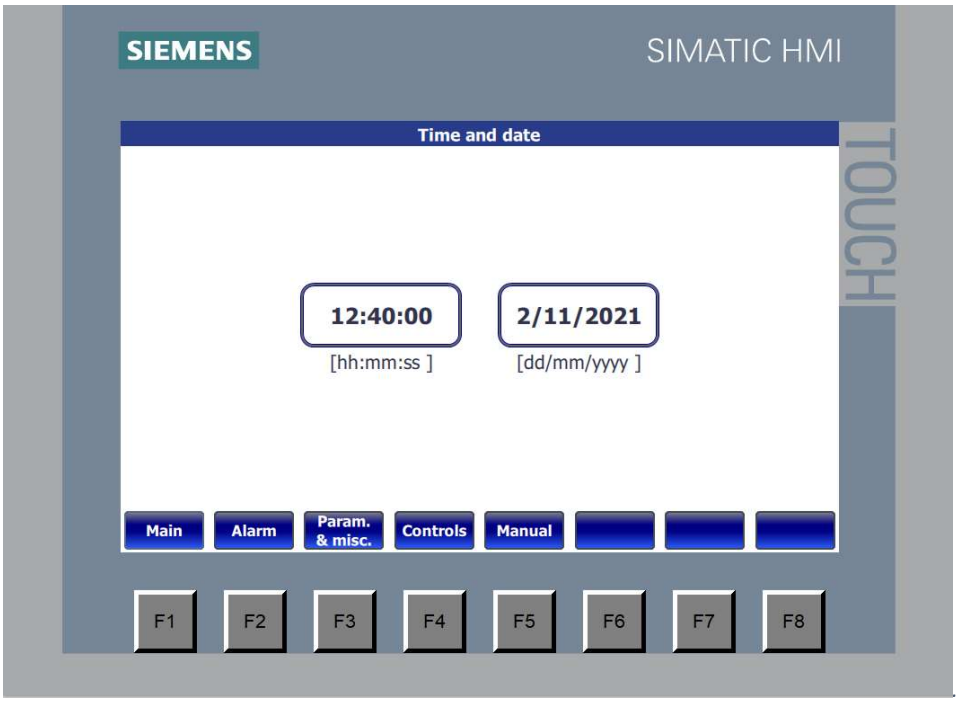


Figure 17. Time setting screen

13.4 Controls menu

Controls button opens screen for temperature control, pressure control (option) and fan temperature control (option). Pressure control and fan temperature control buttons are not visible when they are not enabled.

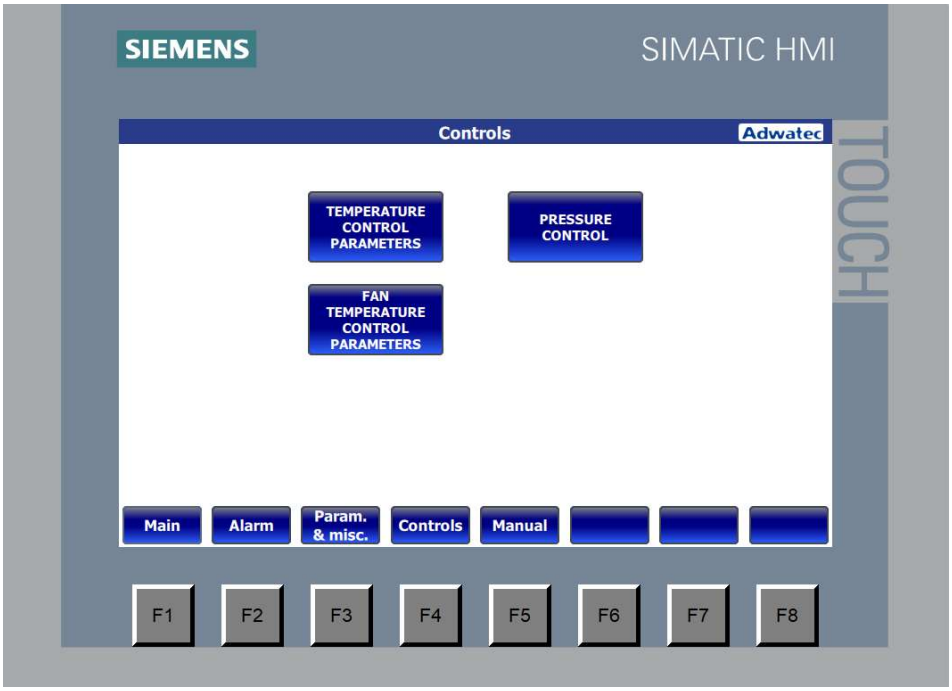


Figure 18. Controls menu screen.

The temperature control regulates coolant temperature with control valve directing coolant flow to heat exchanger or to by-pass line. Pressure control controls coolant pressure to the device to be cooled with pump speed. Fan temperature regulates coolant temperature with speed of the fans in systems with dry cooler.

In temperature control parameters there is selection for STEP (proportional control) or PID. STEP control is the standard solution. Controller output can be corrected with offset when needed. In STEP control there are open temperature and closed temperature setting which represent temperature when valve is open or closed. The temperatures between these two temperatures are calculated as steps.

In temperature settings you can select 3-way valve control type. Control type can be selected as Proportional or PID. In proportional control settings the “Control valve, open temperature” and “Control valve, closed temperature” can be selected (T1 and T2, see Figure 6). PID control has only 1 temperature setpoint. By pressing “PID PARAM” the PID parameter selection screen opens.

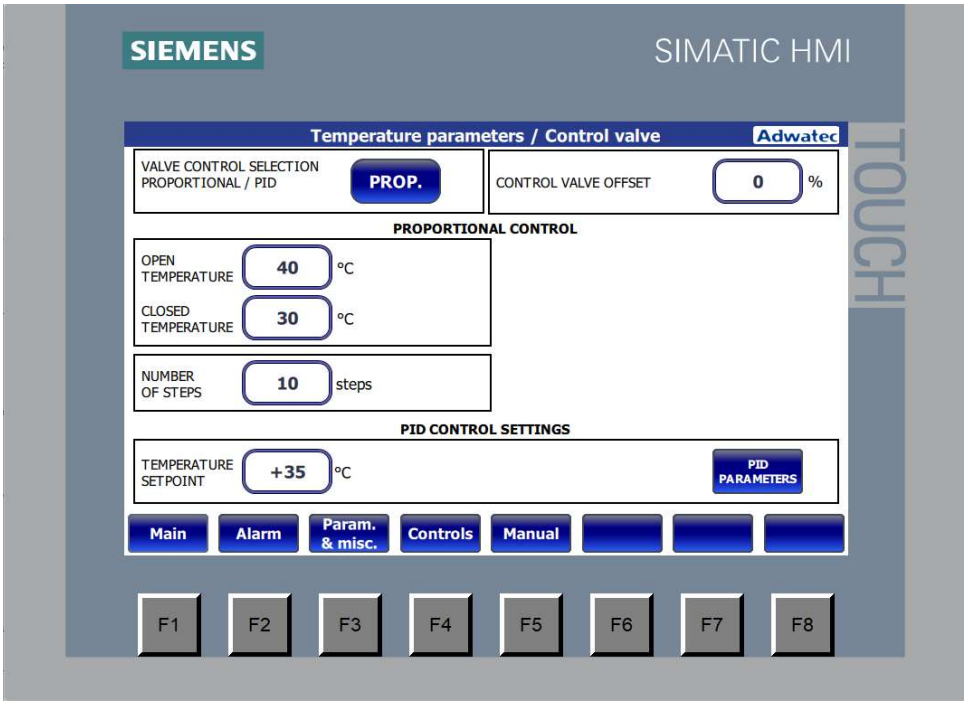


Figure 19. Temperature control parameter screen

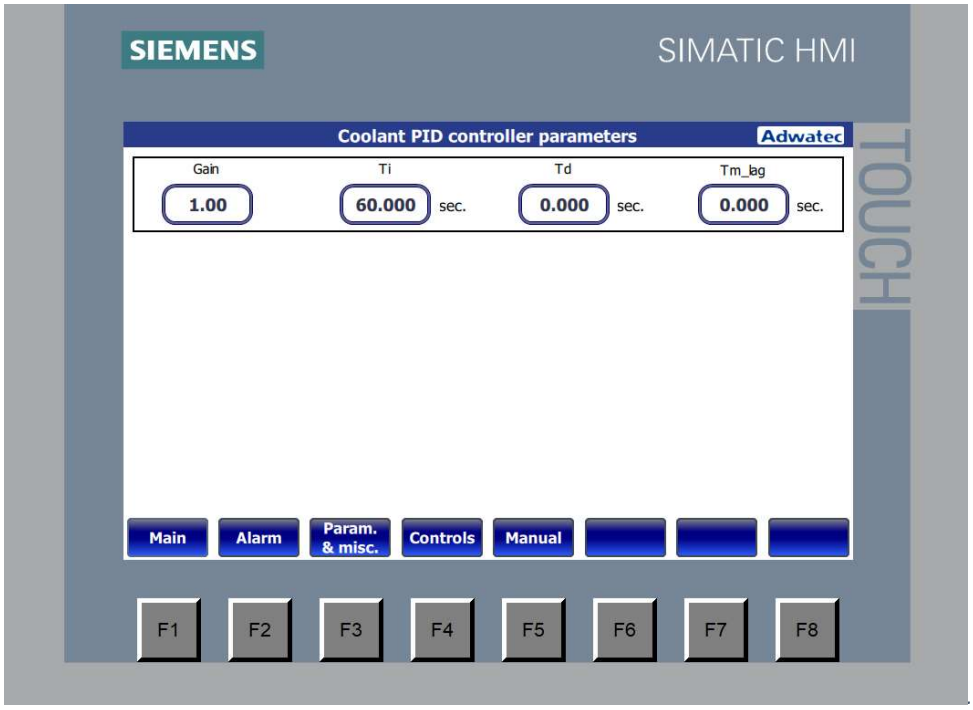


Figure 20. Temperature PID controller parameters screen

13.5 Manual control screen

In local mode it is possible to set control valve position and fan speed reference manually (pump speed when analogue signal for speed reference exists). If the cooling station has heater (option), it can be switched on or off in this page.

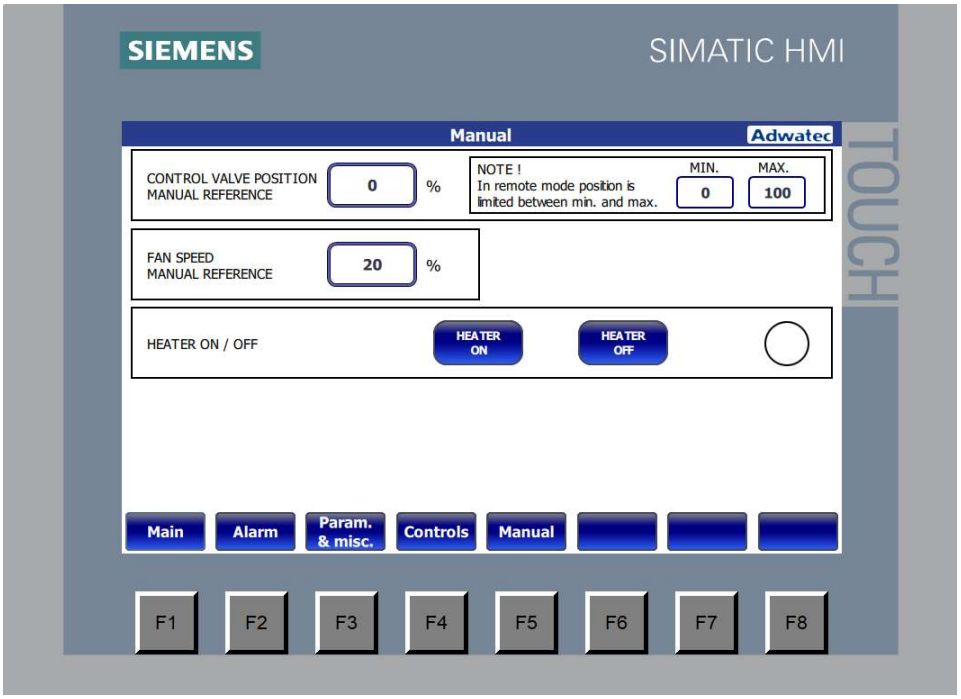


Figure 21. Manual control screen

14. Pressure control (option)

Pressure control is additional control type that is used in cooling systems that needs pressure limitation. Pressure sensor PT3 is located near to power electronics. Operating range for pressure is selectable with high and low limits. Information about commissioning tasks regarding to pressure control can be found in the Appendices.

14.1 Pressure control function

Pressure control is limiting the pipeline pressure near the cooled device, for example batteries, which are not high pressure resistant. There is a pressure sensor PT3 (see Figure 7) located near to cooled device. The control has two higher limits and two lower limits around the pressure setpoint and corresponding speed steps for each pressure limit.

For example, when one cooling line to batteries is closed manually for maintenance, the pressure will rise. When pressure goes above a limit, the pump speed is decreased with corresponding step value. When a correction to speed is calculated, a control delay starts and next correction is calculated when the delay is elapsed, if pressure is still too high/low. Control delay starts and runs only when correction value is calculated and pressure is above or below a limit. Same function when pressure drops below limit. When pressure is between low level and high level, no correction will be calculated.

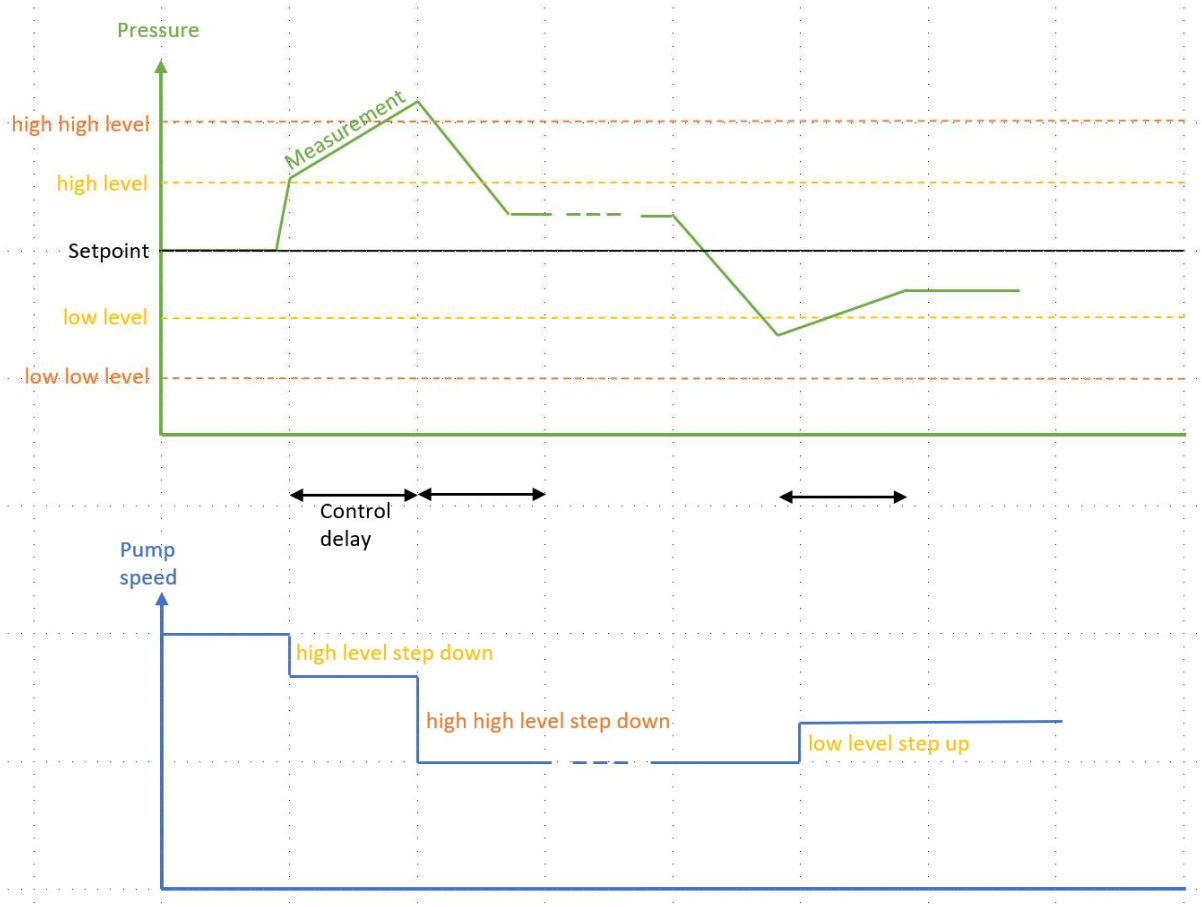


Figure 22. Representational picture of pressure controls control levels.

Normally, the control screen only shows the setpoint and the manual/auto selection.

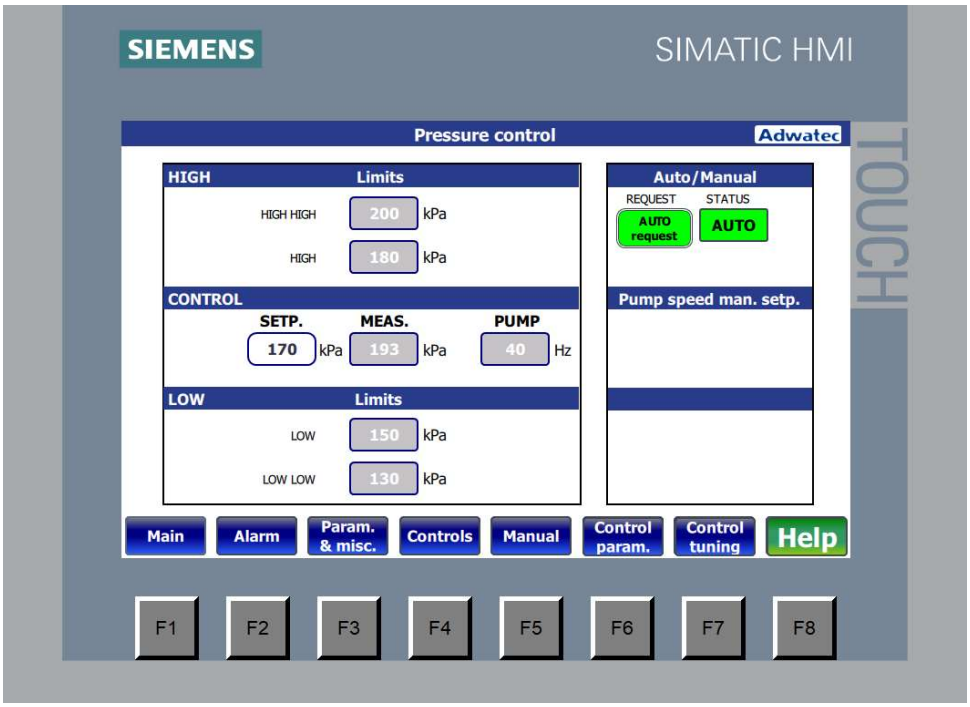


Figure 23. Pressure control screen.

When pressing Control param. button, more parameters are shown. This function is password protected.

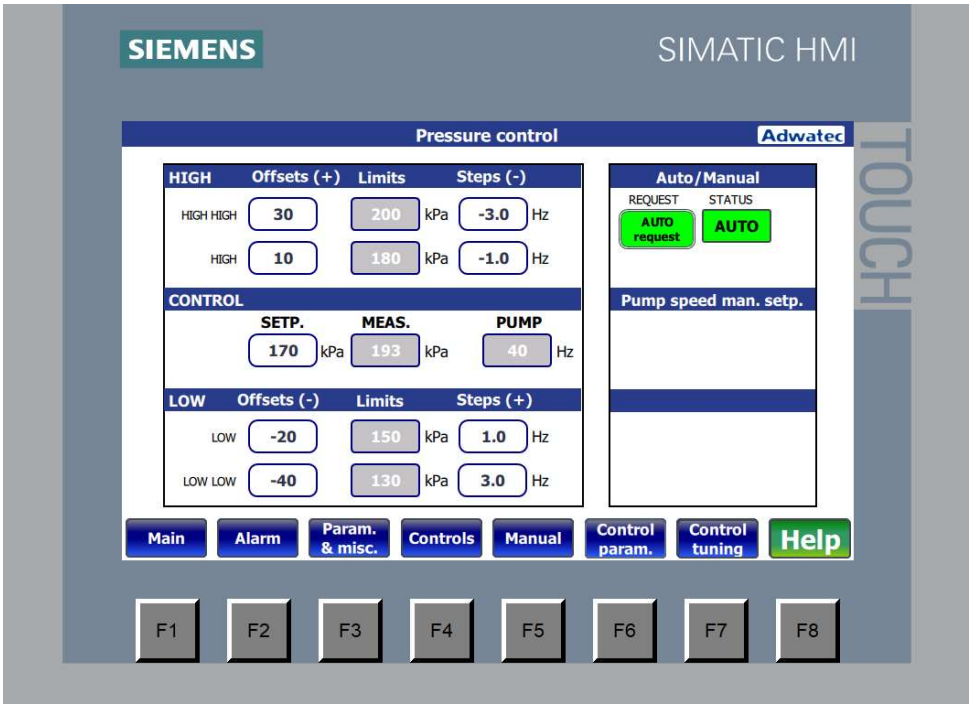


Figure 24. Pressure control screen with control parameters, F7 (password protected)

With Control tuning button minimum and maximum values can be set as well as delays for control.

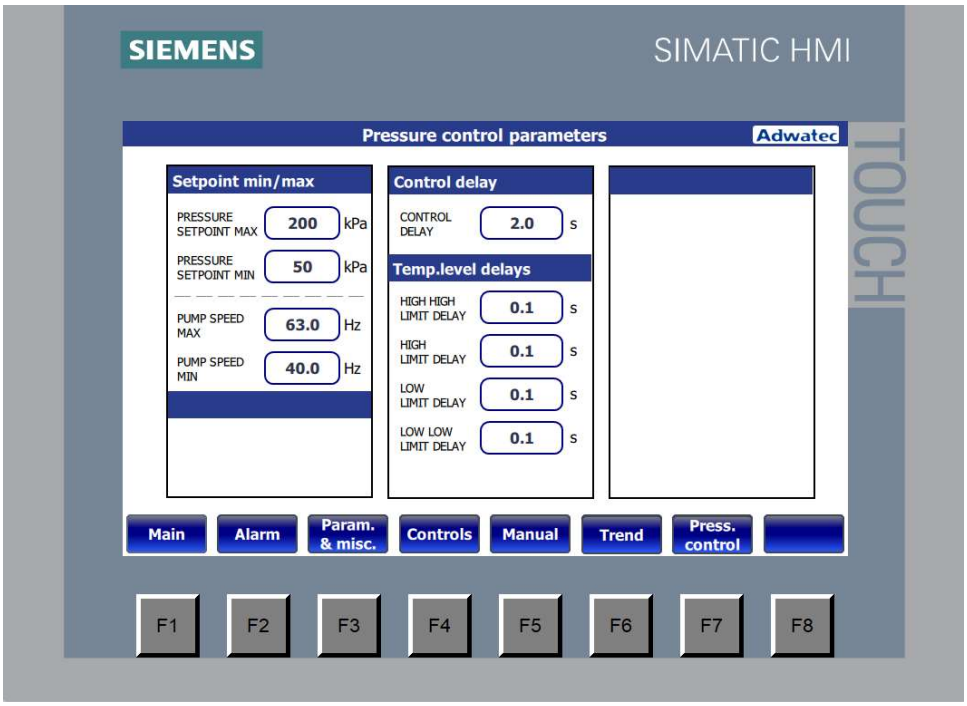


Figure 25. Pressure control screen with control parameters, F7 (password protected)

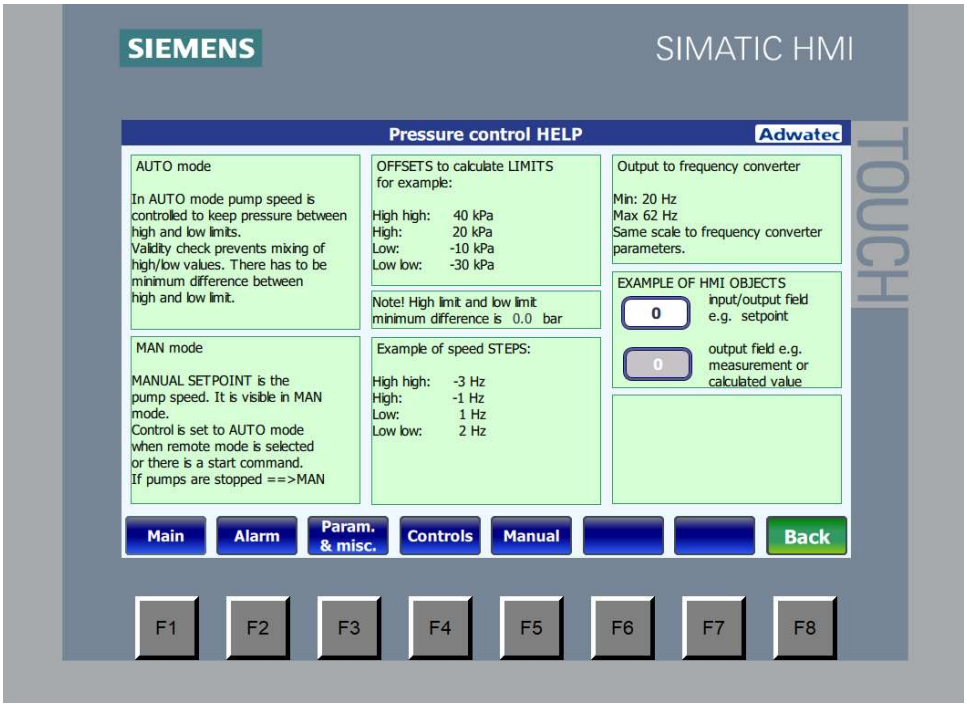


Figure 26. Pressure control help screen

15. Secondary circuit control and shut-off valve

Cooling system secondary circuit can be equipped with control valve and/or shut-off valve. These valves can be used to control the flowrate on secondary circuit.

Secondary circuit temperature TT20 is controlled with control valve V20. It can reduce secondary circuit water flow and restrict water usage when heat load is low or when secondary circuit water temperature is low. Temperature control is active in remote mode. In local mode control valve position can be set manually.

In remote mode shut-off valve V21 is open when coolant pump P1 (or P2 when exists) is running. Valve is closed when pump stops. Shut-off valve is used to totally prevent the water flow in secondary circuit. In local mode shut-off valve can be opened/closed manually.

When secondary side valves are used in cooling station the valves are shown on Main screen.

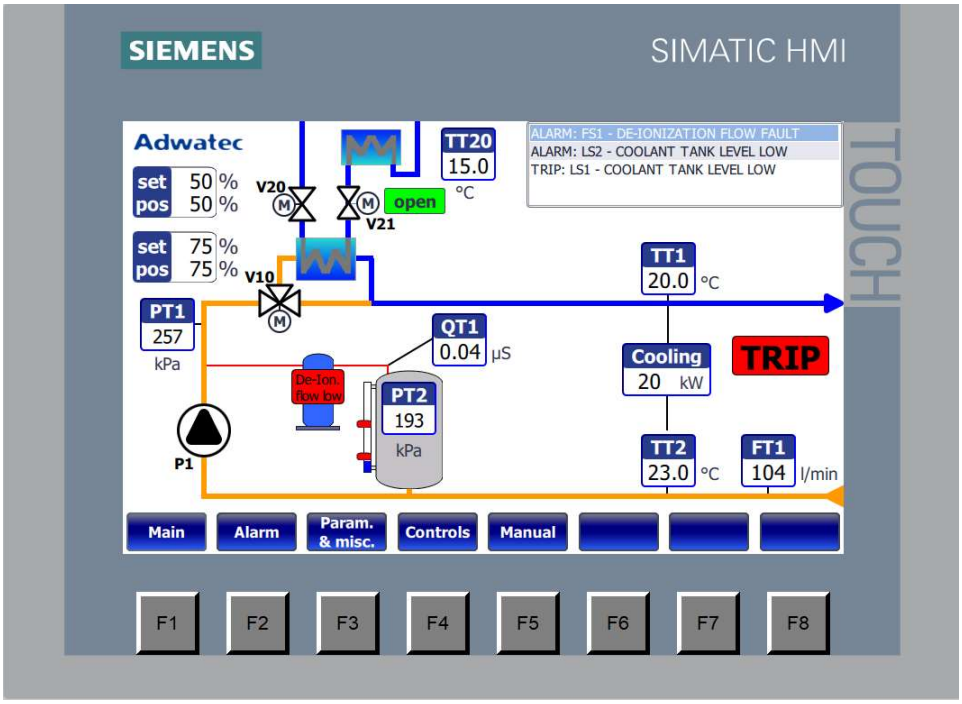


Figure 27. Main screen with secondary side control valve, shut off valve and TT20.

The secondary side control valve position is controlled proportionally. Open and closed temperatures have setpoints. In open setpoint temperature the control valve is fully open and in closed setpoint temperature the control valve is in minimum position restricting the flow to minimum. The number of steps the control is using can be changed. Control is similar to coolant temperature proportional control (see chapter **3-way valve operation on proportional control**).

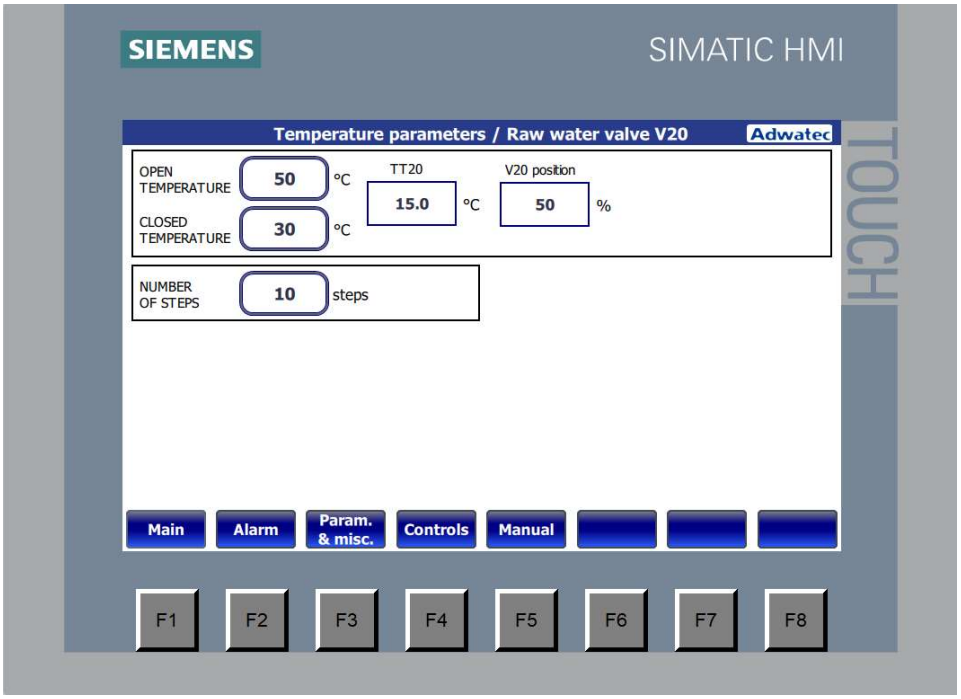


Figure 28. Secondary side control valve parameters.

In local mode secondary side shut off valve can be opened and closed manually, and control valve positions can be changed freely.

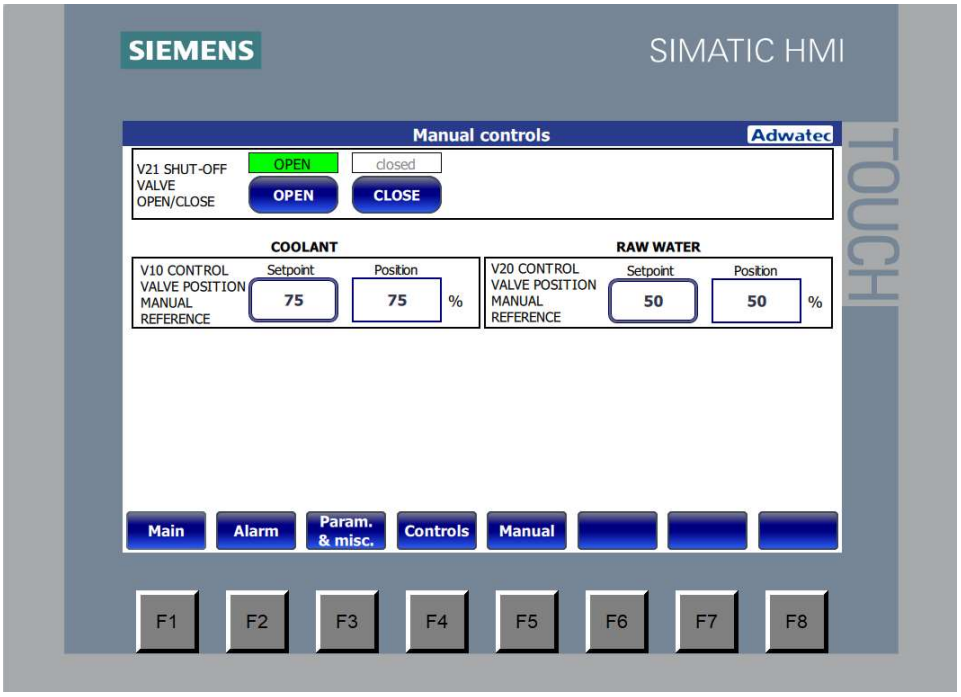


Figure 29. Secondary side control valve in local mode

16. Fan temperature control (option)

When there is a dry cooler instead of water/water heat exchanger, the coolant temperature is controlled with rotation speed of dry cooler fan/fans. Fan speed reference is calculated with PID controller.

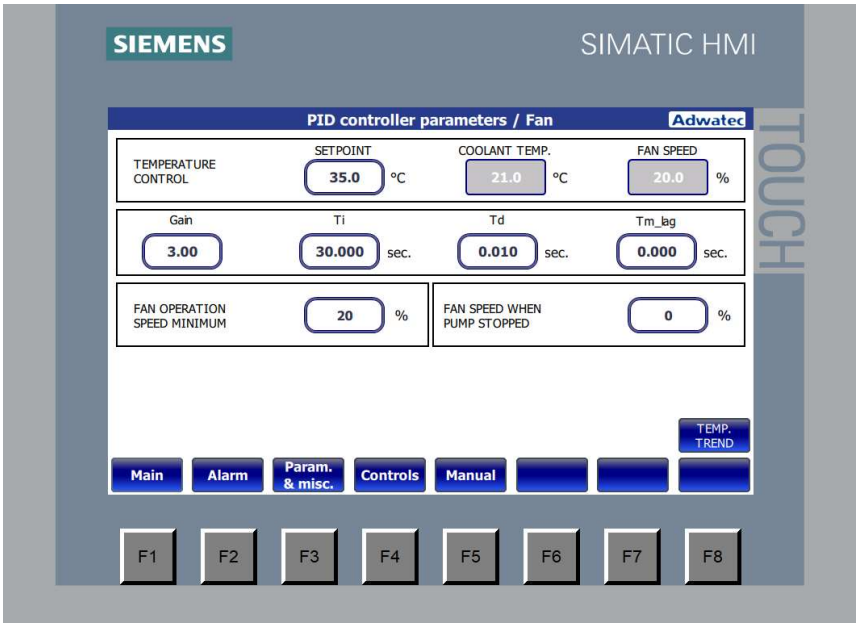


Figure 30. Fan temperature control screen

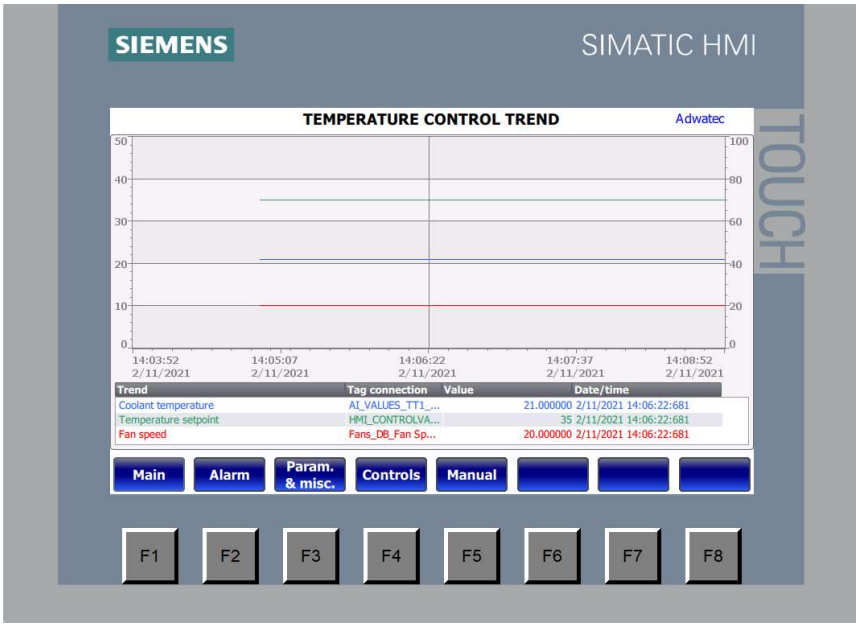


Figure 31. Fan temperature control actual trend screen

17. Maintenance

Cooling station must be maintained on time. For general maintenance, follow these instructions. Generally, all components must be kept clean and in good condition. If any problem occurs in the system or in any component, it must be repaired immediately to prevent any problem or damage.

17.1 Spare parts

Use only original or Adwatec approved spare parts to ensure proper and safe operation. Wrong type or unreliable component may cause safety risk and unreliable operation. If any other than original spares are used, the warranty period of the cooling system is not valid anymore. It is strongly recommended to keep critical spare parts on site.

Spare part list can be found in the document package. For more information on spare part availability or technical details, contact Adwatec service.

17.2 Maintenance safety

⚠ WARNING

Supply voltage of the cooling station is equipped with main switch. When servicing electrically operated equipment, like pumps or 3-way valve, remember to disconnect and isolate hardwired circuits from power supply.

⚠ WARNING

Use safety goggles and other personal protective equipment when maintaining the cooling station. If the maintenance work is focused on piping or other pressurized part of the cooling station, make sure that cooling station is free of pressure before starting maintenance work by releasing the pressure and checking that the pressure indicators are showing 0 bar(g).

17.3 Notes for maintenance

If any of the measured values are near to alarm limits, the reason for it must be found and the source of the problem must be repaired.

When doing maintenance work, visually check the cooling station that all parts are in good condition. (For example, electrical cables, hoses, etc.)

17.4 Preventive maintenance

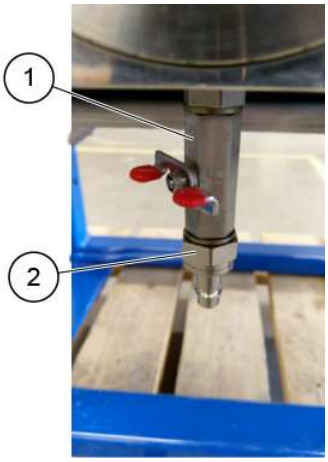
ISSUE OR ITEM	TOTAL QUANTITY in cooling station	CHECK INTERVAL	NORMAL CHANGE INTERVAL	Cooling station needs to be stopped during the service (yes/no)
Water leakages / Pressure drop		1 month		no
Noise/vibration		1 month		no
Coolant level		1 month		no
Motor valve actuator test drive (in local-mode use motor valve 0-100%)	1 piece	1 year		no
Air heat exchanger visual inspection: Amount of dirt or other objects on the coils (option)	1 piece	1 year		
Pump sealing change	1-2 pieces		5 years	yes
Pump motor bearing sets change	1-2 pieces		5 years (single pump models) 10 years (redundant, two-pump models)	yes
3-way valve seal change	1 piece		8 years	yes
Coolant change	x liters		10 years	yes
Ion exchanger tank (option)	1 piece	1 year	3 years or when conductivity level rises to alarm level	no
DI-module coolant filter (option)	1 piece	1 month	Same time with Ion exchanger vessel, or when dirty	no

Note that small pressure drop from tank pressure can be considered normal. Tank pressure and coolant leakages needs to be monitored and coolant or air needs to be added time to time if the pressure or coolant level decreases.

17.5 Draining the cooling station

⚠ WARNING
Wear safety glasses or a face shield, as well as protective clothing, to reduce the possibility of personal injury when draining, filling or pressurizing the cooling system.

1. Before draining the cooling station, stop the pumps and isolate it from power supply.
2. Connect hose to the fill/drain connector (2) and lead it to a bucket or container. Open the shut-off valve (1).



1. Shut-off valve 2. Fill/drain connector

Figure 32. C-series cooling station filling / draining point. Located to a cooling station low point. Filling / draining point location varies depending on model.

3. Check that valves from the pipeline and parts of the system that needs to be drained are open.
4. Open the shut-off valve (1) and add replacing air to the tank through the air filling valve (2) with a hand pump or an oil-free compressor.

1. Shut-off valve 2. Air filling valve

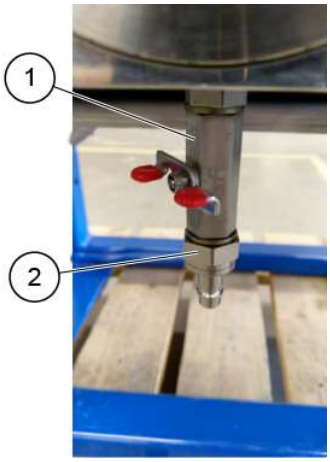
Figure 33. C-series cooling station air filling point. Located to cooling station expansion tank. Air filling point location varies depending on model.

5. Wait for the liquid to flow out of the system periodically adding air to the system. Keep the pressure under 1,5 bar(g) during the draining.
6. Wait for the liquid to settle and keep draining the system until it is fully empty.

17.6 Filling the cooling station without de-ionizing circuit

⚠ WARNING
Wear safety glasses or a face shield, as well as protective clothing, to reduce the possibility of personal injury when draining, filling or pressurizing the cooling system.

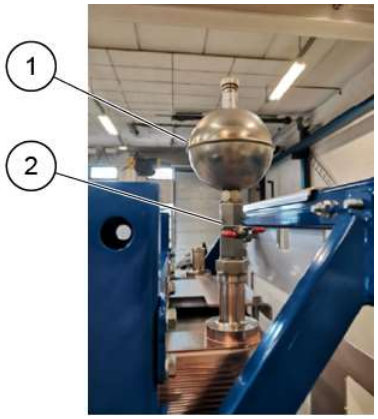
1. Before filling, check that all valves are open to cooling circuit.
2. Connect a coolant filling pump to the fill connector (1). If you use a stand-alone filling pump, it may need to be filled up with coolant and deaired.



1. Shut-off valve 2. Fill connector

Figure 34. Automatic de-airing vent

3. Open the shut off valve (2) under automatic de-airing vent (1). Slim cooling stations do not have automatic de-airing vents.

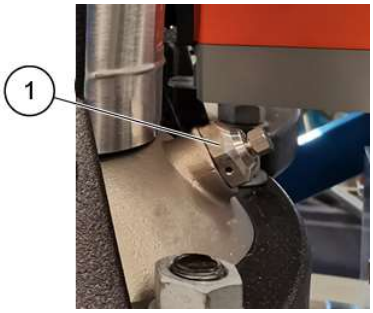


1. De-air vent 2. Shut-off valve

Figure 35. Automatic de-airing vent.

4. Open the V13 shut-off valve.
5. Start filling.

6. De-air the pumps from pump de-airing points and from other de-airing points that might be found from cooling station and pipeline. De-air from one de-airing point at a time.



1. Pump de-airing point

Figure 36. Pump de-airing point.

7. Fill the cooling station until the coolant level in the tank is at nominal level. Nominal level can be seen on expansion tank level indicator.
8. Connect a hand air pump to the air filling point on top of the expansion tank and open the shut-off valve connected to the air filling point. Increase the pressure level to 120 kPa using the hand air pump. The pressure must not exceed 250kPa at any point.

- **NOTE!**
    - **A project specific static pressure may have been defined for the cooling system if the system includes low pressure class components. Always follow the project specific static pressure requirements**.
    - **If project specific static pressure is not known, please contact Adwatec technical support.**
    - **Only use oil free compressed air.**

9. Bleed out air once again from all de-airing points and keep the pressure (PT2) approximately at 120 kPa (or at project specific value) before the first start of the cooling station.
10. Automatic de-airing can be left open for further de-airing while pumps are running. When all extra air is bled out from the system close, the valve under the automatic de-airing and close the V13 shut-off valve.
11. Check that there are no leakages in the system.

17.7 Filling the cooling station with de-ionizing circuit

⚠ WARNING
Wear safety glasses or a face shield, as well as protective clothing, to reduce the possibility of personal injury when draining, filling or pressurizing the cooling system.

Cooling systems with de-ionization circuits must be filled from the de-ionization circuit filling point and the draining is done from a separate draining point on front manifold or connection pipes.

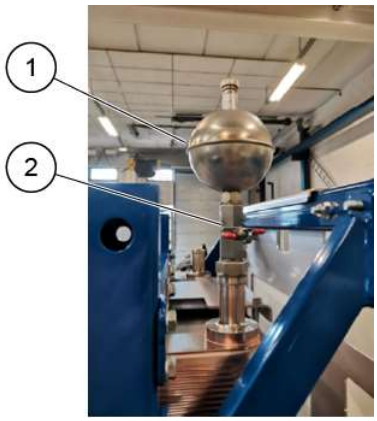
1. Before filling, check that all valves are open to cooling circuit.

2. Change the 3-way valve position so that the handle is pointing upwards (clockwise).

1. Filling point

Figure 37. 3-way valve position and filling point

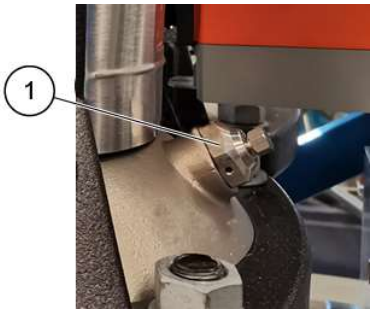
3. Connect a coolant pump to the fill connector V19 (1). If you use a stand-alone filling pump, it may need to be filled up with coolant and deaired.
4. Open the shut-off valves under automatic de-airing vent.



1. De-air vent 2. Shut-off valve

Figure 38. Automatic de-airing vent

5. Open the V13 shut-off valve.
6. Start filling.
7. De-air the pumps from pump de-airing points and from other de-airing points that might be found from cooling station and pipeline. De-air from one de-airing point at a time.



1. Pump de-airing point

Figure 39. Pump de-airing point.

8. Fill the cooling station until the coolant level in the tank is at nominal level. Nominal level can be seen on expansion tank level indicator.
9. Before stopping the filling pump, turn the 3-way valve handle so that it is pointing left. Make sure that all other valves in the de-ionization circuit are open.
10. Connect a hand air pump to the air filling valve on top of the expansion tank (2) and open the shut-off valve (1). Increase the pressure level by air pump to 120 kPa. The pressure must not exceed 250kPa.

    NOTE!

    - **A project specific static pressure may have been defined for the cooling system if the system includes low pressure class components. Always follow the project specific static pressure requirements**.
    - **If project specific static pressure is not known, please contact Adwatec technical support.**
    - **Only use oil free compressed air.**

1. Shut-off valve 2. Air filling valve

Figure 40. Air filling point

11. Bleed out air once again from all de-airing points and keep the pressure (PT2) approximately at 120 kPa (or project specific static pressure value) before the first start of the cooling station.
12. Check that there are no leakages in the system.
13. Automatic de-airing can be left open for further de-airing while pumps are running. When all extra air is bled out from the system close the valve under the automatic de-airing and close the V13 shut-off valve.

17.8 Pump maintenance

Pump runs normally steady (without vibration) and the sound level is stable. If there is abnormal vibration or sound, the reason must be solved.

Pump cannot be maintained during operation. Make sure that you have spare parts ready for maintenance.

Instructions for pump maintenance:

⚠ WARNING
• Switch off and lock power supplies before any maintenance work. • Close valves to and from power electronics before releasing pressure. • Release pressure from cooling station before any maintenance work.

1. Drain cooling station from filling/drain valve.
2. Make maintenance according to the pump service manual or see links below.
    - www.youtube.com/watch?v=XZOVnwi3Jj8&t=1460s

3. After service open all valves and de-air the cooling station.
4. Make sure that coolant is at nominal level.
5. Make sure that pressure is at nominal level (120kPa or at project specific value).
6. Turn power supplies back on.
7. Test cooling station operation.
8. For detailed pump and motor instructions, see section “Component Datasheets” in the documentation package.

17.9 Pump sealing change

Pumps have mechanical seals which normally have a very small leakage. Normally the leakage is not visible because liquid evaporates to air (in water glycol system some glycol may be visible). Pump seal must be replaced if the leakage increases so that it is visible.

Follow the pump maintenance instructions when changing the pump mechanical sealings. Detailed information about mechanical sealing change is in pump service manual and in video link shown in **Pump maintenance**.

17.10 Motor bearings

Pump motors without grease nipple are maintenance free. If the motor has a grease nipple, it needs to be lubricated regularly. Use lithium-based grease that is intended to be used in high temperatures. See the instructions on motor fan cover. Depending on the ambient temperature, the bearing must be replaced or lubricated according to the table below:

Motor size [kW]	Bearing replacement interval [operating hours]				
	40 °C	45 °C	50 °C	55 °C	60 °C
0.37-0.75	18000	-	-	-	-
1.1-7.5	20000	15500	12500	10000	7500
Motor size [kW]	**Lubrication interval [operating hours]**				
	40 °C	45 °C	50 °C	55 °C	60 °C
11-18.5	4500	3400	2500	1700	1100
22	4000	3100	2300	1500	1000
30-75	4000	3000	2000	1500	-

17.11 Replacing process sensors

Sensors can be replaced without draining the cooling station. When a sensor is disconnected it creates a sensor failure, fault and/or some other fault(s). This fault causes the pumps to shut down. For this reason is recommended to turn off the pumps while the sensors are changed.

After changing the sensors, reset the alarms and faults and check that the replaced sensors are working properly. After this the pumps can be restarted.

Replacing temperature sensors

Temperature sensors are connected to pockets. Temperature sensors can be changed without draining the cooling station. Replace them as described below:

1. Uninstall M12 sensor coupling.
2. Dismount sensor from the pocket but **do not uninstall the pocket**. Replace the sensor with a new one. Tighten the sensor to pocket by hand, no tools are required.
3. Install sensor coupling to sensor.
4. Reset alarms and faults.

1. Temperature sensor pocket
2. Temperature sensor
3. Sensor coupling

Figure 41. Temperature sensor mounted into temperature sensor pocket. Sensor location may vary depending on cooling station model.

Replacing pressure sensors

Pressure sensors are connected to shut-off valves. Replace the pressure sensor as described below:

1. Close the shut-off valve and uninstall the M12 coupling.
2. Dismount the pressure sensor and replace it with a new one.
3. Open the shut-off valve and check that the connection does not leak.
4. Install sensor coupling.
5. Reset alarms and faults.

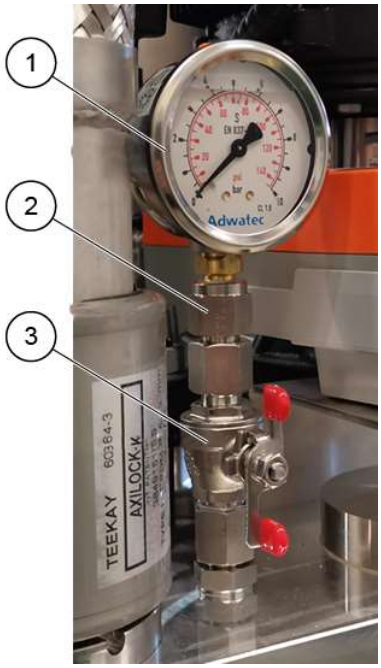
1. Sensor coupling
2. Pressure sensor
3. Shut-off valve

Figure 42. Pressure sensor connected to the shut-off valve. Pressure sensor location may vary depending on cooling station model.

17.12 Replacing pressure indicator

Pressure indicator can be replaced while cooling station is in operation. Replace the pressure indicator as described below:

1. Close the shut off valve.
2. Remove the adjustable connector from the shut-off valve.
3. Detach the pressure indicator from the adjustable connector and replace it with a new one.
4. Connect the adjustable connector with the pressure indicator back to the shut-off valve. Adjust the pressure indicator position before tightening.
5. Open the shut-off valve and check that the connection does not leak.



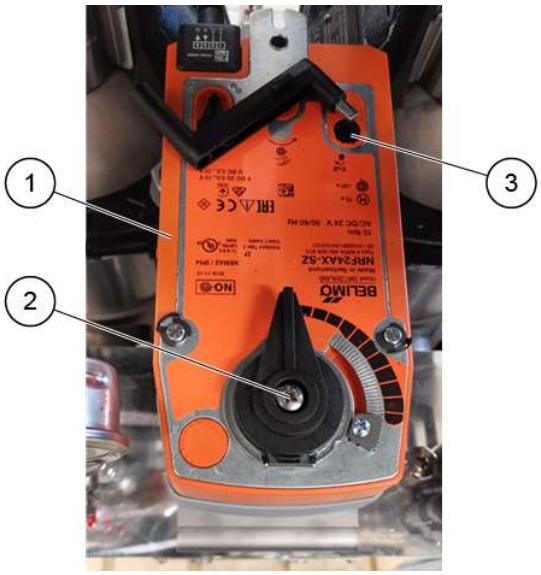
1. Pressure indicator
2. Adjustable connector
3. Shut-off valve

Figure 43. Pressure indicator installed to shut-off valve. Pressure indicator location may vary depending on cooling station model.

17.13 Replacing 3-way valve actuator

3-way valve actuator can be replaced without draining the cooling station. Cooling station should not be in operation while changing the actuator. Replace 3-way valve actuator as described below:

1. Make sure that the actuator is at “OPEN” position. OPEN/CLOSED positions are shown on the 3-way valve actuator.
2. Remove the installation screw.
3. Lift and remove the old actuator.
4. Do the electrical work according to electrical drawings of the cooling station.
5. Make sure that the new actuator is at “OPEN” position (same position as the old one).
6. Install the new actuator and tighten the installation screw.
7. Make sure that the actuator operates/rotates in right direction. Direction of the rotation can be changed from rotation direction switch.



1. 3-way valve actuator
2. Installation screw
3. Rotation direction switch

Figure 44. 3-way valve actuator. Actuator location may vary depending on the cooling station model.

More detailed information about actuator and replacing it in actuator data sheet or by contacting the Adwatec service.

17.14 Heat exchanger cleaning

Heat exchanger can be cleaned if cooling power or flow degreases. If cleaning doesn't help the problem, the heat exchanger should be changed. Regular C-series cooling station plate heat exchanger is located on the rear section of the cooling station. Heat exchanger can be accessed by removing the bolts holding electrical cabinet. Electrical cabinet can then be set hanging on the hooks located under the electrical cabinet as shown in figure below:

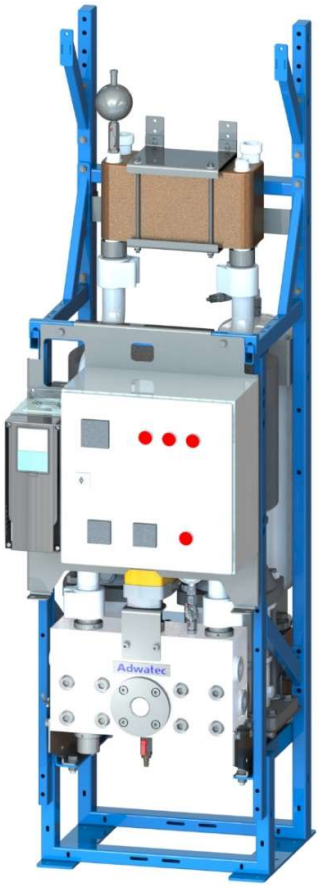


Figure 45. Electric cabinet hanging on the maintenance position at the front side of the CCE cooling station.

Please contact Adwatec technical support for Slim C-series cooling station heat exchanger cleaning.

Mechanical cleaning

Only gasketed plate heat exchangers can be cleaned mechanically.

See the instructions of cleaning the gasketed plate heat exchanger in "component datasheet" section from documentation package.

Chemical cleaning

Chemical cleaning is done by flushing the plate heat exchanger with cleaning liquid.

Clean the heat exchanger according to manufacturer's instructions.

See the instructions of cleaning heat exchanger in "component datasheet" section from documentation package.

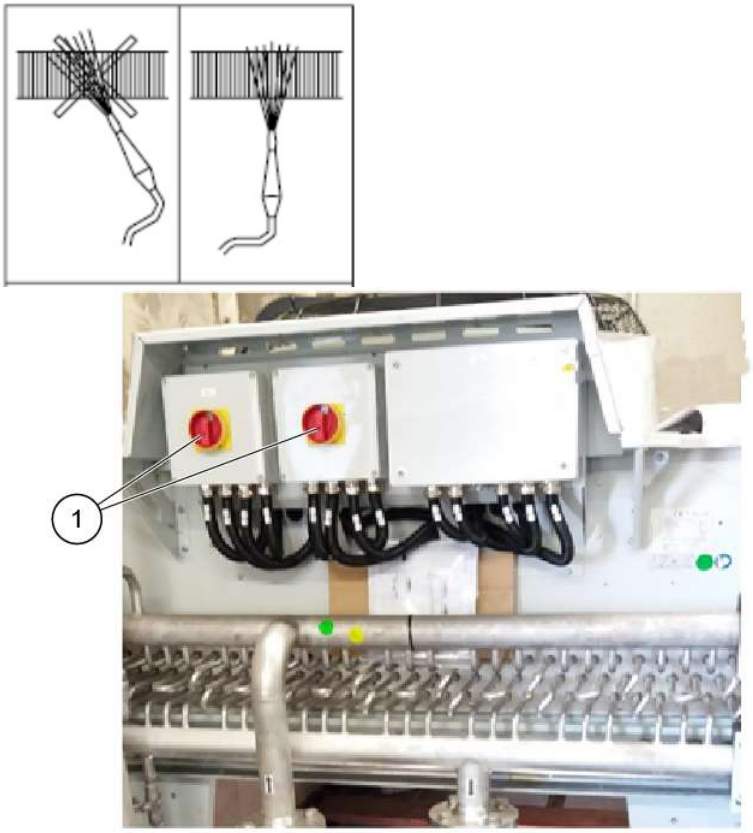
Dry cooler cleaning (option)

If the cooling station has dry coolers, they must be cleaned time to time to guarantee the efficiency of the cooler. Cleaning is done by washing the suction sides of the coils.

Before attempting to make any maintenance, the power supply should be turned off from the cooling station. For further security operator should turn the safety switches OFF position and lock switches (see figure below). Water pressure must be maximum 2 bar.

Clean the dry cooler according to manufacturer's instructions.

See the instructions of cleaning the dry cooler in "component datasheet" section from documentation package.



1. Safety switches to fan motors

Figure 46. Dry cooler cleaning

17.15 Troubleshooting

Problem	Possible cause	Solution
Low coolant tank level	Leakage in the system	Locate the leakage with visual inspection and fix the leakage
	Pump seal is worn out	Change the pump axel seal
Pressure drops in the system	Liquid leakage in the system	In case of liquid leakage coolant level drops. See also **Low coolant tank level**.
	Air leakage in the system	Locate the leakage by going through all the connection points that might have air inside. This kind of point are high points in the system like tank and pressure gauges. If the leak doesn't show up change the pump axel seals and monitor the situation.
Abnormal low coolant flow	Lines to power electronics or to heat exchanger are not fully open	Ensure that lines to power electronics and heat exchanger are free and all valves in the lines are fully open
	Pump does not produce enough flow	Ensure that the pump rotates in the right direction. De-air the pump. Compare the flow of both pumps. Check the condition of the pump.
Abnormal high coolant temperature (coolant to power electronics)	Coolant does not flow to the heat exchanger	Check function of all valves and motor valve. Make sure that cooling circulation is ok
	Dust on air heat exchanger	Check if there is dust on the suction side of the coils.
	Coolant flow is too low	See **Abnormal low coolant flow**
High coolant conductivity	Cooling station has been stopped for a while	Start cooling station in local mode and run pumps until the conductivity is in right level.
	De-ionizing circuit is closed	Make sure that de-ionizing circuit valves are open. Adjust de-ionizing flow from rotameter.
	Capacity of ion exchanger has worn out	Replace the ion exchanger bottle
	De-ionizer flow is too low	Adjust the rotameter and check that the de-ionizing circuit filter is clean.

18. Tables

18.1 Inputs and outputs

Symbol	Description	DO	DI	AO	AI	Comments
PT1	Pressure, 0-16 bar				X	4-20 mA
PT2	Pressure, 0-16 bar				X	4-20 mA
TT1	Temperature				X	PT100 or PT1000
TT2	Temperature				X	PT100 or PT1000
TT20	Temperature (optional)				x	PT100 or PT1000
LS2	Tank level, middle		X			
LS1	Tank level, low		X			
QT1	Coolant conductivity (optional)				X	4-20 mA
P1	Cooling system pump 1 start	X				
P2	Cooling system pump 2 start	X				
	Coolant heater	X				
	Overheat switch		X			
M10	3-way valve position setpoint			X		0-10 / 2-10 V
M10	3-way valve actual position				X	0-10 / 2-10 V
M20	Secondary side control valve position setpoint (optional)			X		0-10 / 2-10 V
M20	Secondary side control valve actual position (optional)				X	0-10 / 2-10 V
M21	Secondary side shut off valve (control) (optional)	X				
	Pump speed reference			X		4-20 mA
	Fan speed refence			X		4-20 mA
P1	Pump 1 running status		X			
P1	Pump 1 ok		X			
P2	Pump 2 running status		X			
P2	Pump 2 ok		X			
	Local mode		X			
	Cooling system start		X			
	Remote trip reset		X			
	Common alarm signal	X				
	Common no-trip signal	X				
	Cooling system functional	X				
P1	Pump 1 running control	X				
P2	Pump 2 running control	X				

18.2 Operation parameters, factory settings

ITEM	VARIABLE	Range	Unit	Signal	Low trip	Low alarm	Temperature setpoint	High alarm	High trip
FT1	**Coolant flow**	0-750	l/min	Calculated	**40**	**60**		n/a	n/a
PT1	**Pump output pressure**	0-1600	kPa	4-20mA	**140**	**180**		n/a	n/a
PT2	**Tank pressure**	0-1600	kPa	4-20mA	**40**	**60**		**250**	n/a
TT1	**Coolant temperature to power electronics**	-30…130	℃	Pt100	n/a	n/a		**48**	**50**
TT2	**Coolant temperature from power electronics**	-30…130	℃	Pt100	n/a	n/a		**43**	**44**
LS2	**Tank level, low middle**			switch, NC	n/a	Open		n/a	n/a
LS1	**Tank level, low**			switch, NC	Open	n/a		n/a	n/a
LI1	**Tank level**		mm	visual	n/a	n/a		n/a	n/a
	3-way valve actuator	closed	℃	0-10VDC			**25**		
	3-way valve actuator	open	℃	0-10VDC			**30**		
	Control valve offset		%				**0**		
	PID Temperature setpoint		℃				**0**		
	PID Control parameters, GAIN						**20**		
	TI		ms				**30000**		
	TD		ms				**1500**		

Alarms, trips and setpoints vary depending on the project and cooling station in use.

18.3 Technical data

Expansion tank	Stainless steel
Maximum ambient temperature	40°C
Minimum ambient temperature	10°C
Maximum humidity	95% r.h. on pipe surface. More about ambient conditions in installation manual.
Materials	Stainless steel and aluminium All materials are copper free No surface coatings
Coolant	Water-glycol mixture

Pumps used in C-series cooling stations are Grundfos CR series pumps in size categories 3-64.

Pump size	**50/60 Hz**	
	El. power	**Voltage**
3-6	1,1 kW	400/690V
5-6	1,1 kW	400/690V
10-4	3,0 kW	400/690V
15-3	4,0 kW	400/690V
15-4	5,5 kW	400/690V
20-4	7,5 kW	400/690V
32-2	7,5 kW	400/690V
64-2-1	18,5 kW	400/690V

18.4 System diagram

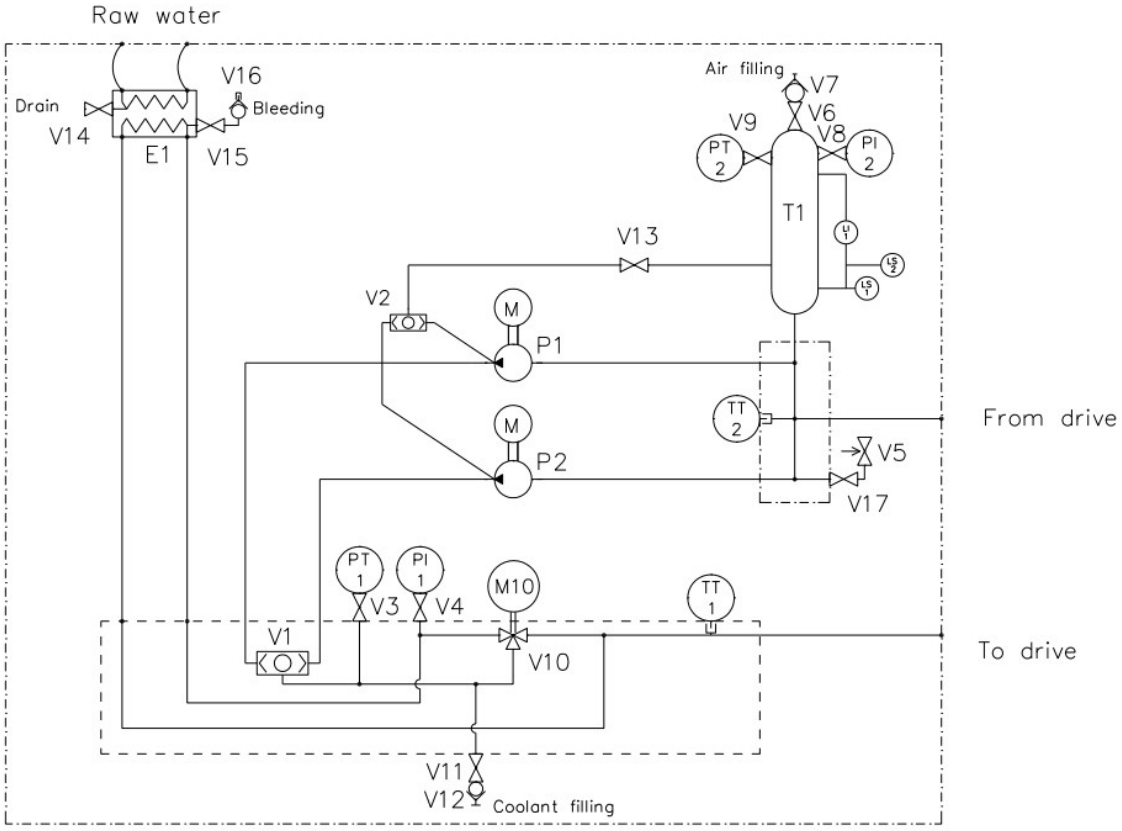


Figure 47. Generic system diagram example

Appendix A: Pressure control commissioning information (option)

Pressure control parameters have been pre-set in the factory tests and they are tested with testing circuit. Pre-set parameters are set by using initial information about the cooling system pressure drops and flow rates. The pre-set values might need adjusting when pressure drop of the cooling system pipeline or power electronics varies from the initial information or the initial information is incomplete.

Commissioning task must be performed as instructed below:

1. Set the expansion tank pressure (PT2) to project specific value. If the project specific pressure is not known, contact Adwatec technical support. Add more air to tank if pressure drops during the de-airing.
2. Perform a complete de-airing before pressure control commissioning.
3. Set pressure control to manual mode before de-airing.

When the status changes to manual the pressure control is in manual mode and frequency can be changed.

4. Set frequency to minimum 30 Hz at first start up.
5. Start the pump in local mode
6. Increase the pump speed by increasing frequency in 1-2 Hz steps. Monitor PT3 pressure not to exceed the setpoint. PT3 is measurement for pressure control.

7. When the cooling system is fully de-aired the pressure control can be tested. Manually set the frequency higher or lower to get the PT3 pressure to same level with setpoint pressure.
   Increasing the frequency increases the pressure and decreasing the frequency decreases the pressure.
8. When pressure setpoint and measured pressure from PT3 are at the same level check the flowrate.
   a. If the flowrate is too high the frequency can be lowered until the flowrate is acceptable. When the flow rate is acceptable the pressure setpoint can be changed to the same value as the measured pressure PT3 value. In most cases flowrate can be higher than the nominal flowrate. Find out the maximum allowable flowrate and adjust the flowrate accordingly.
   b. If the flowrate is too low the frequency must be risen to increase the flowrate and pressure setpoint must be set higher. **This must not be done without contacting the Adwatec technical support first.**
9. When the pressure setpoint is tested and the flowrate is on desired level the pressure control can be changed back to the AUTO mode.
10. If pressure setpoint is changed during commissioning, it might have effect on alarm and trip limits. Report changes to the Adwatec technical support for alarm and trip limit validation.

PT3 is installed to the cooling station outlet by standard. It is recommended by Adwatec to install the PT3 as near as possible to the power electronics inlet (the point where pressure is restricted) for more accurate pressure control.

Appendix B: Heat exchanger secondary circuit flow switch (option)

When there is a flow switch to monitor the heat exchanger secondary circuit flow, the alarm status can be seen on the main screen and on the alarm screen.

Main screen

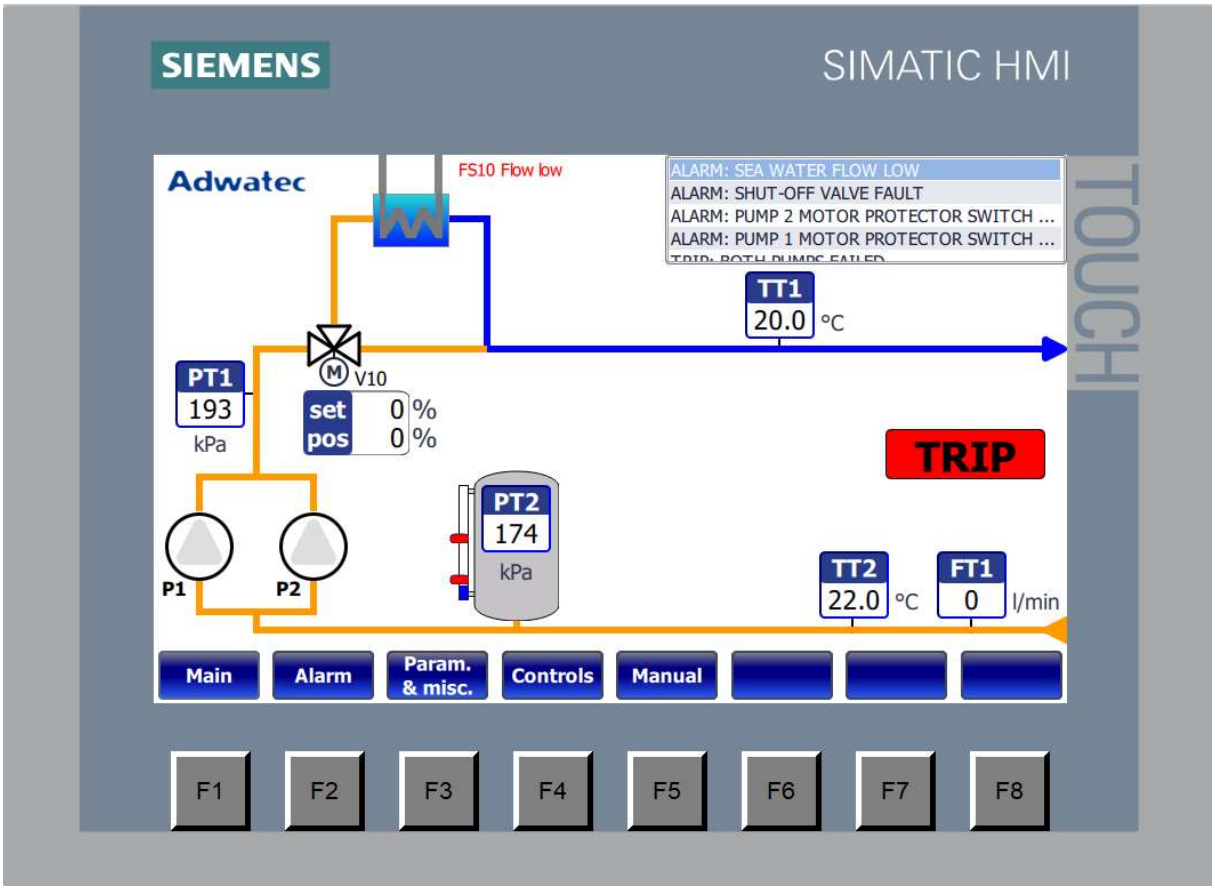


Figure 48. Heat exchanger secondary circuit flow switch in the main screen

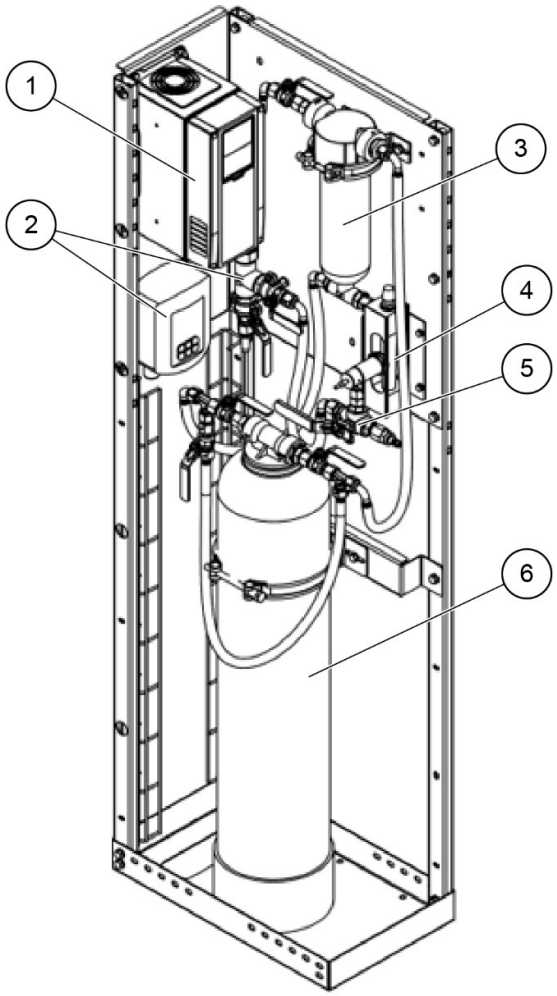
When flow is too low, an alarm is activated and red text **FS10 Flow low** appears on HMI main screen near heat exchanger symbol. There is also an alarm with date and time on alarm screen.

When flow is high enough in secondary circuit, the alarm can be reset.

Appendix C: De-ionization circuit (option)

De-ionization circuit components

De-ionization circuit is designed to keep coolant conductivity at a low level. Circuit consists of conductivity sensor, rotameter, filter, and ion exchanger vessel. De-ionizing circuit can be isolated, and filter or ion exchanger vessel can be changed while cooling station is in operation.



2. Frequency converter for cooling station pump can be located to DI-module.
3. Conductivity sensor and transmitter
4. Cartridge filter
5. Rotameter with flow switch and flow restrictor screw
6. 3-way valve and cooling station filling point
7. Ion exchanger vessel

Figure 49. De-ionization circuit. The component location might vary depending on the product.

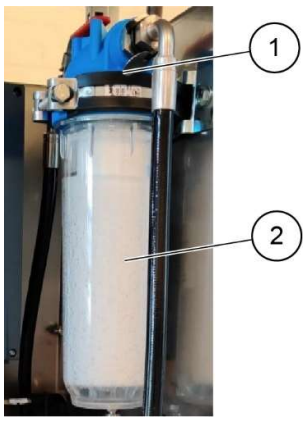
Filter and ion exchanger maintenance

De-ionization filter cleans the impurities of the coolant and ensures that resin from the ion exchanger doesn't go to the system. Filter element must be replaced at the same time with ion exchanger vessel or earlier if coolant flow in the deionizing circuit is too low. If ion exchanger vessel is changed, some small particles from the new vessel may block the filter.

Replacing the filter

If the de-ionizing circuit flow is too low fully open the rotameter throttle, or if the flow does not increase up to 5 l/min filter element should be replaced:

1. Isolate de-ionizing circuit by closing ball valves from conductivity sensor and tank
2. Release pressure inside the bowl from de-airing point
3. Open the filter bowl by turning it (lower part)
4. Replace the filter element with new original filter element
5. Close the filter bowl
6. Slowly open closed ball valves
7. De-air from filter bowl and de-ionization circuit
8. Check that there are no leakages
9. Check the coolant and pressure levels



1. Filter bowl cap, de-airing screw on top
2. Filter element inside the bowl

Figure 50. Replacing the filter

Replacing the ion exchanger vessel

The lifetime of the ion exchanger should be over 2 years depending on the system volume, coolant quality, coolant line materials and cleanliness. If the cooling system is filled with high conductivity coolant or if impurities enter to the circuit during maintenance, lifetime of the ion exchanger will decrease. If coolant conductivity starts to increase, ion exchanger vessel must be replaced.

1. Isolate the ion exchanger vessel, close the ion-exchanger vessel ball valves and open the by-pass valve.
2. Dismount the hoses from the connection part of the ion exchanger vessel. Open the connection using two wrenches.

1. Connections
2. Bypass valve
3. Valves before and after the vessel

Figure 51. Replacing the ion exchanger vessel

3. Replace ion exchanger vessel with a new one
4. Open the ball valves (to and from ion exchanger vessel) slowly and close the by-pass valve
5. De-air the filter and the de-ionization circuit
6. Adjust the de-ionization circuit flow to normal level, 5 l/min
7. Check the coolant level and tank pressure
8. A couple of hours after the ion exchanger has been replaced, check the condition of the filter.

Replacing the conductivity sensor

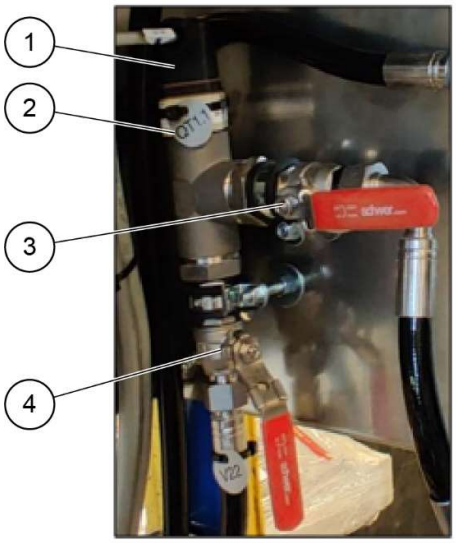
⚠ WARNING
Remember safety goggles and other safety equipment when maintaining cooling station. Make sure that cooling station is free of pressure before maintenance work by releasing the pressure.

Conductivity sensors are located in the de-ionization circuit and can be changed without cooling station shutdown.

Isolate and replace conductivity sensor as described below:

1. Close the ball valve on the pressure side and then close the ball valve on de-ionization tank side.
2. Disconnect the sensor cable coupling from the sensor.
3. Dismount the sensor from T-part and replace it with a new sensor. Remember to change the sealing ring.
4. Install the sensor cable coupling and open the ball valves.
5. Reset alarms from the HMI.

NOTE! Some coolant might drain out after you remove the sensor.

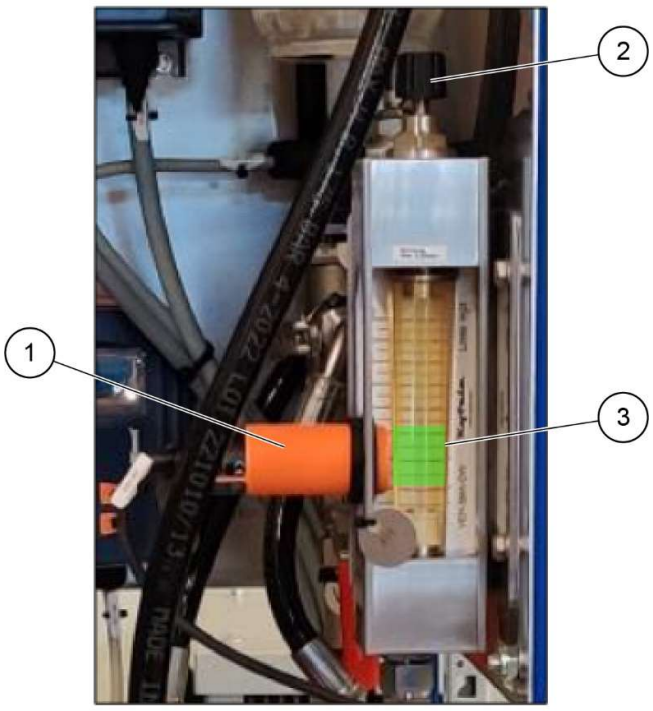


4. Sensor cable coupling
5. Conductivity sensor
6. Ball valve (de-ionizer side)
7. Ball valve (pressure side)

Figure 52. Replacing the conductivity sensor

De-ionizing circuit in operation

De-ionizing circuit has a rotameter that is equipped with a flow switch and a flow adjusting screw.



1. Flow switch
2. Flow adjusting screw
3. Flow switch active in this area (green highlight)

Figure 53. De-ionizing circuit flow switch

If the flow rate in de-ionizing circuit is not on flow switch activation area (shown on picture) the alarm is activated. In commissioning make sure to adjust the flow through the de-ionizing circuit in middle of this activation area. Flow adjustment can be done by rotating the flow adjustment screw.

Appendix D: 3-way valve position

3-way valve position is marked on 3-way valve actuator with stickers. The pointer on 3-way valve will show the position between open and closed positions. If the pointer is facing the open sticker, then the flow is going through the heat exchanger. When the pointer is facing the closed sticker, the flow is directed to the bypass channel.

3-way valve position can be certified from 3-way valve shaft. 3-way valve shaft head has line that shows the 3-way valve piston position. 3-way valve shaft also has dot facing outward from the cooling station when the 3-way valve is open to the heat exchanger. Open and closed positions are shown below for CCE36S and CCE56S:

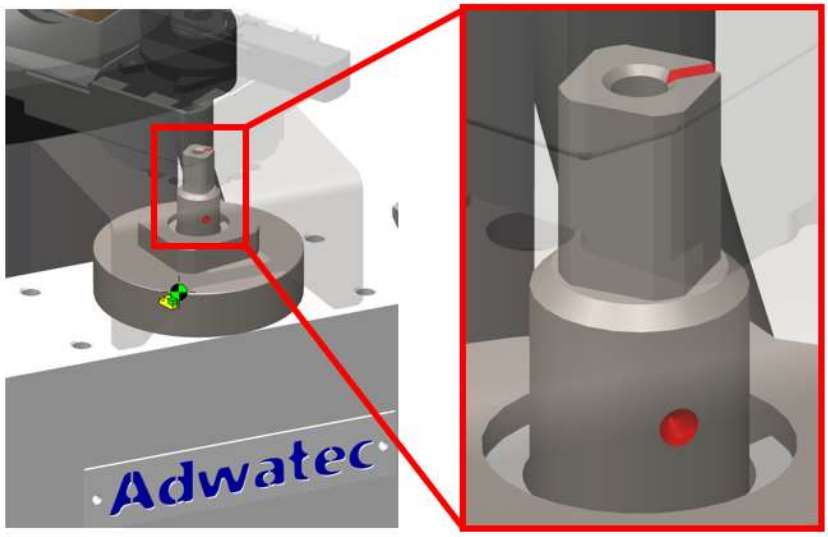


Figure 54. 3-way valve open to heat exchanger (CCE36S and CCE56S)

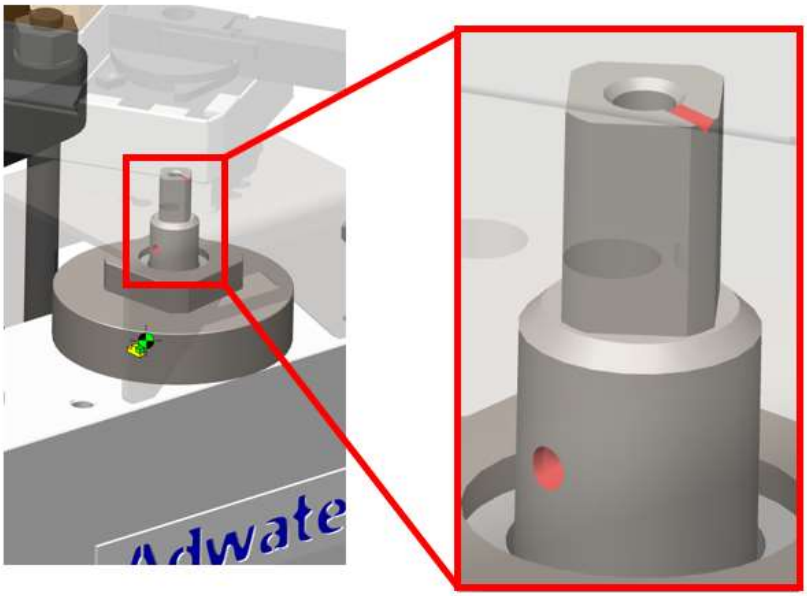


Figure 55. 3-way valve closed, directed to bypass line (CCE36S and CCE56S)

Open and closed positions are shown below for all other CCE cooling stations except CCE36S and CCE56S:

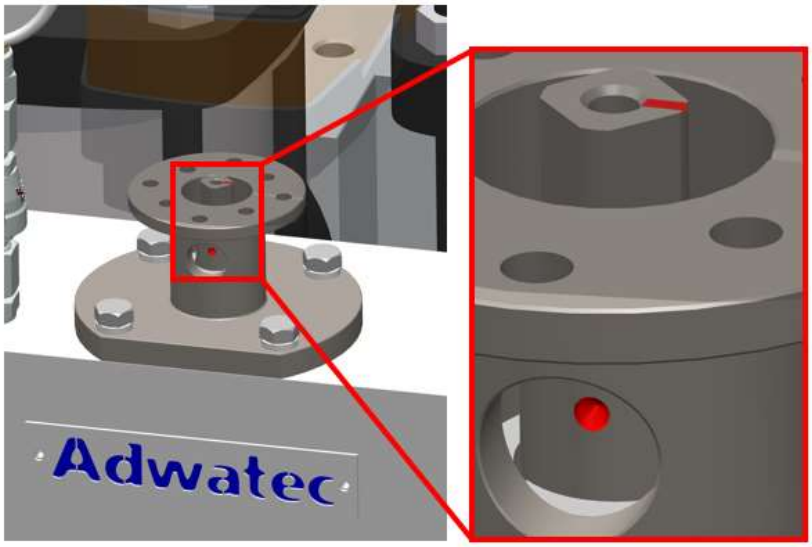


Figure 56. 3-way valve open to heat exchanger (all other CCE cooling stations)

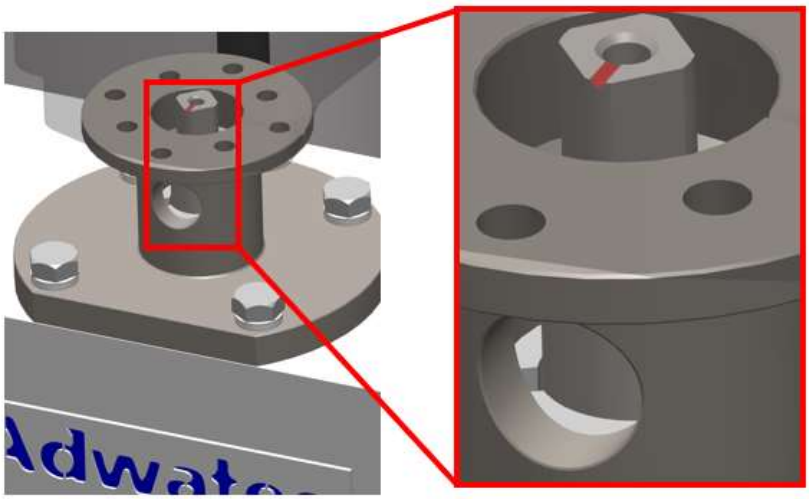


Figure 57. 3-way valve closed, directed to bypass line (all other CCE cooling stations)

If the 3-way valve indicators are showing positions between these open and closed positions, then the flow is going through both channels. This is normal since the 3-way valve is proportional.

Appendix E: Pump speed eco /normal modes (option)

If cooling station is equipped with eco/normal modes for pump speed, those can be adjusted from other parameters window. Eco mode for pump speed can be selected with fieldbus connection for example via Modbus.

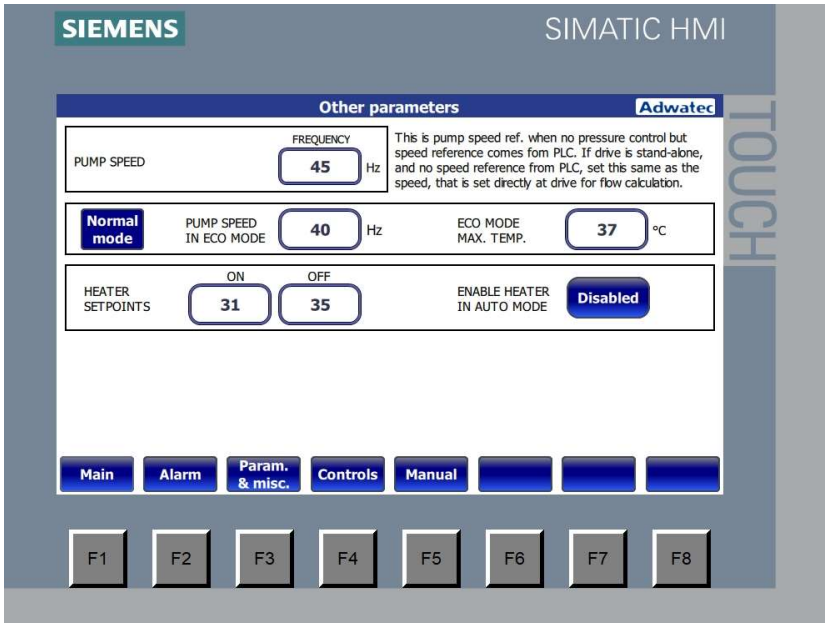


Figure 58. Pump speed eco mode

Eco mode has max temperature for TT1. If temperature rises above that limit the eco mode is disabled and cooling station will continue running in normal mode.

Note that alarm parameters have own alarm values when eco or normal mode is selected. Alarm values can be modified in alarm parameters window.

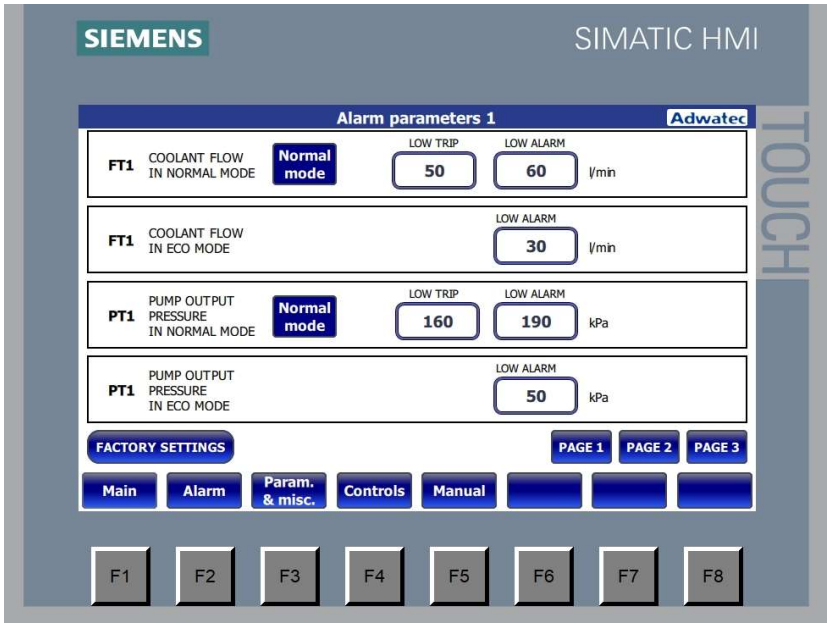


Figure 59. Alarm parameters