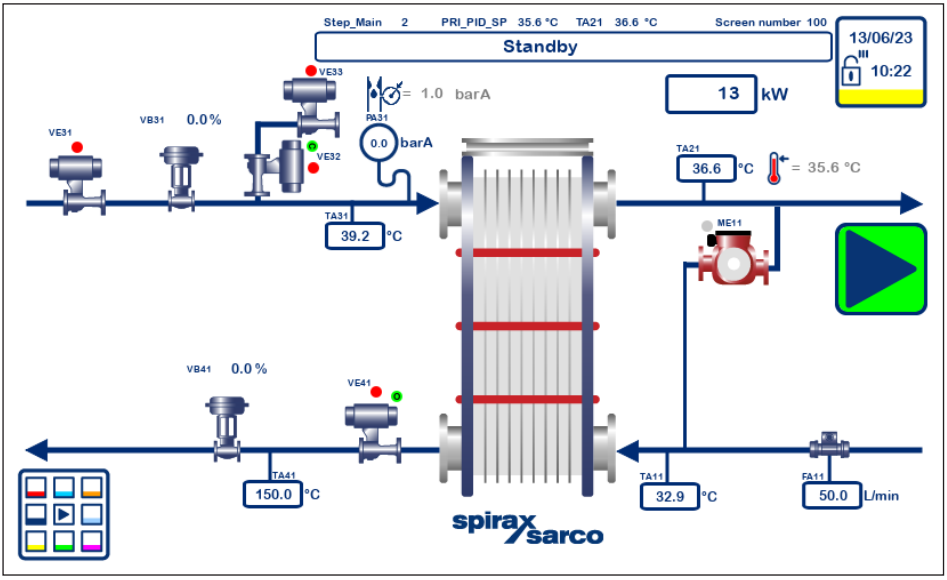
Easiheat

Operating System Instructions



Contents

1. General product information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used, and maintained by qualified personnel in compliance with the operating instructions.

Document definition

The purpose of this document is to provide clear operating instructions of the Easiheat operating system specifically related to v1.01 of the operating system for Easiheat only.

2. System overview

2.1 Product models

The EasiHeat product has two intended applications. These applications dictate the test conditions that the control system has been validated against.

2.1.1 Hot water for heating (HH)

- 5:1 turndown ratio with very slow load changes in typical applications.
- High level of water circulation by the customer's pumping system with very little make-up cold water.
- Very rarely experiences rapid changes in load.

2.1.2 Domestic Hot Water (DHW)

- 10:1 turndown ratio with very high load changes to be expected.
- Expect to have 100% cold water supply with no water circulation.

2.2 Control configuration

In order to meet the intended applications, there are a number of control orientations.

2.2.1 Steam side control

- Applicable to HH and DHW applications.
- Single PID controller using VB31 to control Water Outlet Temperature.
- Auxiliary valve VB32 can be used to spread the water PID control value over 2 valves for split range control.

2.2.2 Condensate side control

- Applicable to HH applications only.
- Single PID controller using VB41 to control Water Outlet Temperature.
- VE31 limits inlet energy flow using Condensate Control Inlet Isolation secondary control.

2.2.3 Dual control

- Applicable to HH and DHW applications.
- Single PID controller using VB31 to control Water Outlet Temperature.
- Secondary PID controller using VB41 to control Condensing Pressure Regulation.

2.3 Abbreviations

Item	Description
AI	Analogue Input
AO	Analogue Output
DI	Digital Input
DO	Digital Output
DHW	Domestic Hot Water
HH	Hot water Heating
HMI	Human Machine Interface
IHL	Independent High Limit
I/O	Inputs / Outputs
LTHW	Low Temperature Hot Water
NC	Normally Close
NO	Normally Open
PID	Proportional, Integral, Derivative
P&ID	Piping and Instrumentation Diagram
PLC	Programmable Logic Controller
PT100	Resistive temperature device operating over the PT100 resistance tables
UPS	Uninterruptable Power Supply
VFC	Volt Free Contact

3. Control system

3.1 Unit I/O

The items list below are used by the control system or monitored directly by the PLC.

Item	Description
E-Stop button	Surface mounted in a prominent location on the control panel. NC contact that breaks the signal to the e-stop relay when pressed. A secondary NO contact is utilised to inform the PLC that the e-stop button has been pressed. Latches when pressed and requires manual manipulation to un-press.
Reset button	Surface mounted in a prominent location on the control panel. Spring return NO contact to the PLC.
UPS	Panel mounted battery system to provide 24 Vdc in the event of power loss to the package. Provides a NC contact that opens in response to an alarm status. Provides a NO contact when discharging from the battery. Accepts a DI to power off the battery supply when the package is in a safe state.
Smart fuse	Provides a NO contact when a fuse has tripped. Provides a NO contact when a fuse has reached 90% of its maximum capacity. Accepts a DI to reset any fuses that have tripped.
Internal temperature sensor	Panel mounted 4-20 mA signal that provides the current temperature inside the control panel.
E-Stop relay	Enables and disables power and control signals to critical control instrumentation to ensure the safe and immediate stoppage of the package. Provides power to the e-stop status lamp.
24 Vac transformer	Provides power for the electric powered steam inlet isolation valve.
Power Status Lamp	Powered by the 24 Vdc power supply.

Item	Description
E-Stop Status Lamp	Powered when the e-stop relay is disabled.
Run status VFC	A NO and NC contact controlled by the PLC. Triggered by the run status of the PLC, when not in standby mode or in e-stop mode
E-Stop status VFC	A NO and NC contact controlled by the PLC. Triggered by the run status of the PLC, when in e-stop mode.
Steam control valve position retransmission	A 4-20 mA source provided by the PLC if VB31 is fitted. Provides a retransmission of the VB31 control signal or VA31 if control valve feedback is selected.
Auxiliary steam control valve position retransmission	A 4-20 mA source provided by the PLC if VB32 is fitted. Provides a retransmission of the VB32 control signal or VA32 if control valve feedback is selected.
Condensate control valve position retransmission	A 4-20 mA source provided by the PLC if VB41 is fitted. Provides a retransmission of the VB41 control signal or VA41 if control valve feedback is selected.
Water PID setpoint transmission	A 4-20 mA source provided by the PLC of the water PID setpoint. Scaling for the 4-20 mA signal is dictated by the scaling for TA21 input temperature sensor.
Water outlet temperature retransmission	A 4-20 mA source provided by the PLC of TA21 Scaling for the 4-20 mA signal is dictated by the scaling for TA21 input temperature sensor.

3.2 Component definitions

As per section 9 of the installation and maintenance guide the below information describes a component identification V1 of the EasiHeat system.

- Area 1 for return water connection to main heat exchanger connection.
- Area 2 for heated water from main heat exchanger to water outlet.
- Area 3 for plant steam from steam inlet to connection to main heat exchanger.
- Area 4 for condensate from connection to main heat exchanger to trap.
- Area 5 for drain condensate from trap connection to condensate return connection.

3.2.1 Area 1 Return water

- TA11 Return water temperature analogue input signal.
- FA11 Bypass water flow rate analogue input signal.
- HU11 Main heat exchanger.
- ME11 Recirculation pump.

3.2.2 Area 2 Heated water

- TA21 Outlet water temperature analogue input.
- TD21 Outlet water temperature high limit switch.

3.2.3 Area 3 Plant steam

- TA31 Plant steam temperature analogue input.
- PA31 Plant steam supply pressure analogue input.
- VE31 Plant steam digital isolation valve (open signal output).
  - VD31 Plant steam isolation valve fully open digital input.
  - VD32 Plant steam isolation valve fully closed digital input.
- VE32 Test, air isolation valve (open signal output).
  - VD33 air isolation valve fully open digital input.
  - VD34 air isolation valve fully closed digital input.
- VE33 Test, air vent valve (pressurise signal output).
- VB31 Plant steam control valve analogue output (low flow).
  - VA31 Plant steam control valve feedback analogue input.
  - VD35 Plant steam control valve fully closed digital input.
- VB32 Auxiliary steam control valve analogue output (high flow).
  - VA32 Auxiliary steam control valve feedback analogue input.
  - VD36 Auxiliary steam control valve fully closed digital input.

3.2.4 Area 4 Condensate

- TA41 Pre-trap condensate temperature analogue input.
- VE41 Test, condensate isolation valve (closed signal output).
  - VD41 condensate isolation valve fully open digital input.
  - VD41 condensate isolation valve fully closed digital input.
- VB41 Condensate control valve analogue output.
  - VA41 Condensate valve feedback analogue input.

3.2.5 Area 5 Condensate exhaust

- TA51 Post-trap condensate temperature analogue input.

3.2.6 Area X External to steam system

- PDX1 Air pressure switch.
- VEX1 Combined air pressure dump valve.
- VEX2 Steam control valve air pressure dump valve.
- VEX3 Auxiliary/condensate control valve air pressure dump valve

P&ID drawing

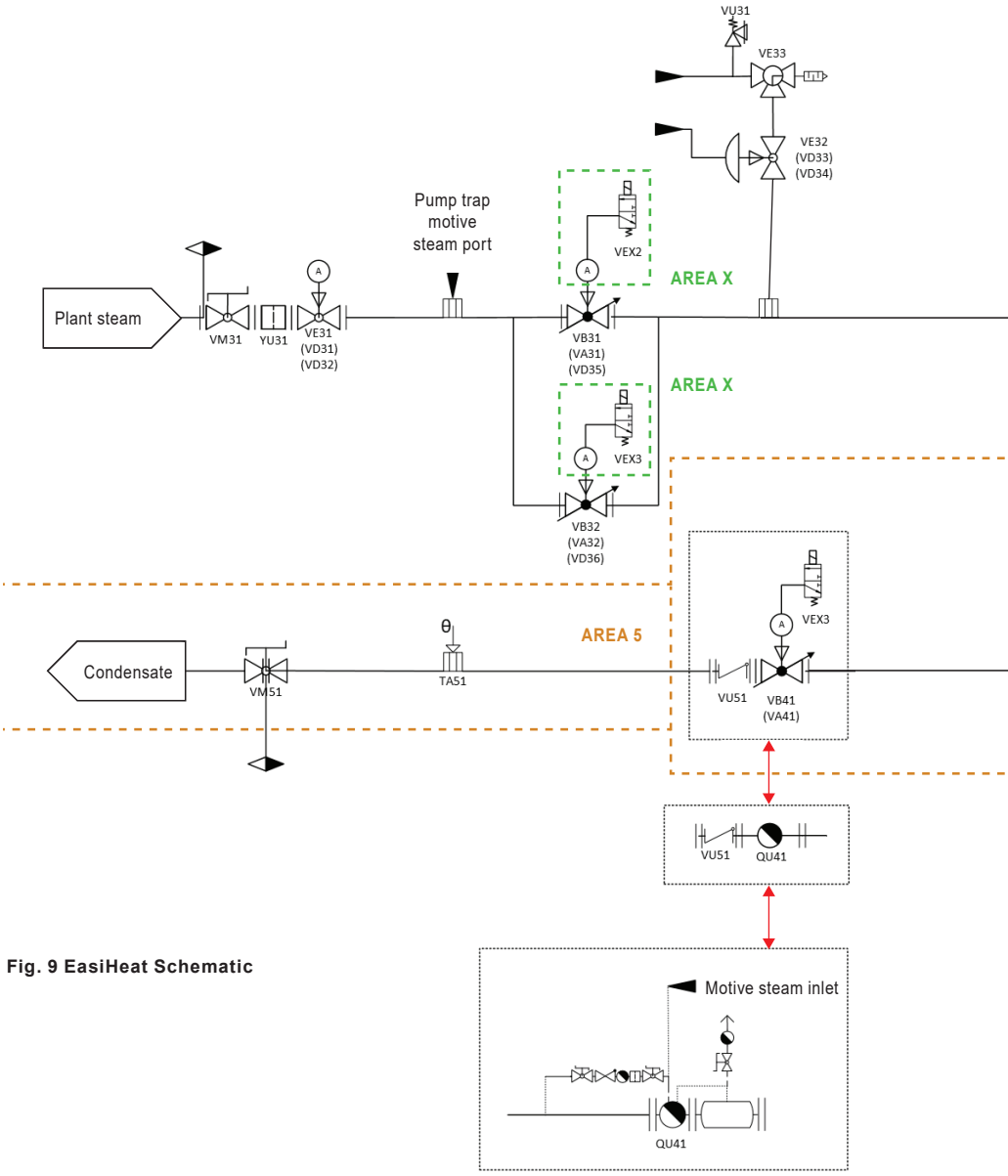
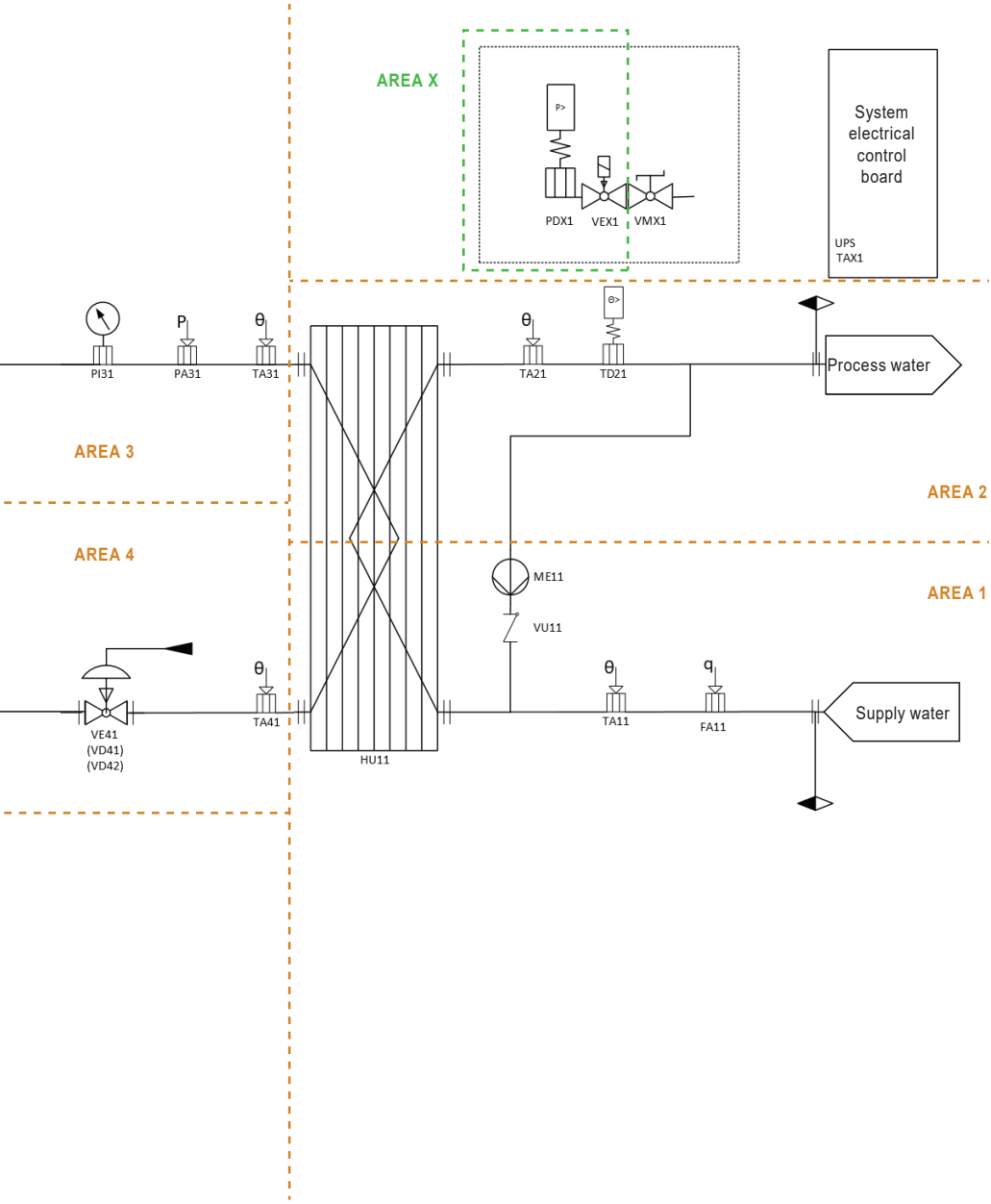


Fig. 9 EasiHeat Schematic


AREA X
P>
PDX1
VEX1
VMX1
System electrical control board
UPS
TAX1
PI31
PA31
TA31
TA21
TD21
Process water
AREA 3
AREA 2
AREA 4
AREA 1
ME11
VU11
VE41
(VD41)
(VD42)
TA41
HU11
TA11
FA11
Supply water

4. Core controls

4.1 Water outlet temperature

- TA21 Outlet temperature controlled by steam system PID control loop.
- Control value from PID control loop is transmitted to the following control valves:
  - Steam Side single control or Dual Control valve VB31.
  - Steam Side split range control valves VB31 and VB32.
  - Condensate side Control valve VB41.
- Outside weather compensation for heating systems.
  - Offset water temperature set-point based on outdoor weather temperature.
    - Input from scaled 4-20 mA signal.
    - Input from industrial communications input.
- To ensure that the PID loop calculation is ready for restart (regardless of the previous state of the calculation when stopped previously), the PID setpoint is set to 10 °C below TA21 when in standby mode or e-stop state.

4.2. Condensate pressure regulation

The condensate pressure PID loop availability is dependent upon the configuration of the package.

- Using a condensate control valve VB41, control the condensing pressure PA31 of the heat exchanger using a PID control loop.
- Condensing pressure setpoint.
  - Calculated setpoint based on customer supply pressure using design calculation from the sizing calculations.
  - Optional manually selected condensing pressure setpoint.
- To ensure that the PID loop calculation is ready for restart (regardless of the previous state of the calculation when stopped previously), the PID setpoint is set to 1 bar below PA31 when in standby mode or e-stop state.

5. Secondary controls

Control systems that are designed to support or supplement the core controls, where adverse or abnormal run conditions are encountered.

5.1 Start-up sequences

The start-up sequences take the package from a standby state to the intended run state conditions as desired by the user in a fast, reliable, and safe manner.

5.1.1 Cold start

- If fitted, the recirculation pump (ME11) is enabled.
- PLC looks for TA21 to be below a minimum setpoint (WARM_TA21_SP, default 40 °C).
- Opens the control valve responsible for water outlet temperature PID to a setpoint (WARM_VB##_SP, default 10%)
- If fitted, the condensate PID is enabled.
- When water outlet temperature reaches the minimum setpoint (default 25 °C), or a timer elapses (default 2 minutes) Water PID control is enabled.
- Water PID setpoint is ramped over time (default 120 seconds) from the current TA21 temperature to the user selected setpoint.

5.1.2 Restart

- If fitted, the recirculation pump (ME11) is enabled.
- PLC looks for TA21 to be above a minimum setpoint (WARM_TA21_SP, default 40 °C).
- All PID controls are enabled.
- PID setpoint is ramped over time (default 120 seconds) from the current TA21 temperature to the user selected setpoint.

5.1.3 Restart from suspension

- When conditions have returned to a safe state, the PLC will start from Cold Start/Restart selection point.
  - Suspension state as a result of Smart Fuse trip or Internal High Limit without manual reset.

5.2 Shutdown

Depending upon the situation and run conditions of the package, the PLC will shut down to run process in the following ways.

5.2.1 Sequenced shutdown

A ramped shutdown sequence to reduce the possibility of sudden load change on additional heat generators in the customer's system.

- If TA11 is fitted and TA11 lower than TA21 (default Δ10 °C).
- Water temperature PID setpoint is ramped down over time (default 30 seconds) to match TA11 and then stopped.
- If fitted, condensate PID control is stopped.
- If fitted, the recirculation pump (ME11) is disabled after a period of time (default 60 seconds)

5.2.2 Shutdown sequence bypass

Sequenced shutdown is bypassed if:

- If TA11 is not fitted or,
- If TA11 is fitted and there is not a differential larger than a setpoint (default Δ10 °C).

When the shutdown sequence is bypassed, all PID loops are stopped and the recirculation pump (ME11) is disabled after a period of time (default 60 seconds)

5.2.3 Internal high limit suspension

Using the internal high limit alarm, the system will stop if the following conditions are met.

- If the internal high limit is configured to not require a manual reset.

If high limit is tripped, package stops and moves to a suspended state.

- Suspended resets when TA21< Water PID Setpoint.

5.2.4 Smart fuse reset

- If smart fuse detects one of the channels has tripped
- Package stops and moves to a suspended state.
- PLC attempts to reset the smart fuse 4 times after a time delay of 30 seconds.
- If smart fuse cannot be reset automatically, the PLC will enter e-stop state.
- Suspended resets when smart fuse resets.

5.3 Forward controls

Forward controls will supplement the water PID controls when load changes are detected that are outside of normal run conditions.

5.3.1 Low load change

- Low demand prediction for abnormal load conditions, reduces water PID setpoint for fixed period. (default 10 °C for 15 seconds)
  - Rapid increase in return water temperature. (default 1.0 °C over 3 seconds)
  - Rapid reduction in return water flow rate. (default 1.0l/min over 3 seconds)

5.3.2 High load change

- High demand prediction for abnormal load conditions, raises water PID setpoint for fixed period. (default 15 °C for 15 seconds)
  - Rapid reduction in return water temperature. (default 1.0 °C over 3 seconds)
  - Rapid increase in return water flow rate. (default 1.0l/min over 3 seconds)

5.4 Integrity test

If fitted with the necessary equipment, the integrity test will conduct a pneumatic pressure decay test before a cold start start-up sequence.

- Steam side decay test isolates from steam inlet isolation valve (VE31) to condensate isolation valve (VE41) and includes, steam control valves (VB31, VB32 if fitted), heat exchanger, steam and condensate temperature sensors (TA31, TA41 if fitted) and steam pressure sensor (PA31 if fitted).
- Detects pressure drop due to leak (default Δ0.5 bar).
- Detects pressure rise due to environmental high temperature providing a false positive test (default Δ0.5 bar).

5.5 Condensate control inlet isolation

- Condensate control inlet isolation when operating at lower limits of control.
  - Return water temperature approaches outlet water temperature (default 10 °C).
  - Outlet water temperature rises above PID control setpoint (default 10 °C).

5.6 Isolation valve anti-binding sequence

- To ensure that isolation valves that have been held in a single position are still functional.
- Whilst in Run mode, at 00:00 of the set PLC time, steam inlet isolation valve will be instructed to close for 1 second, then instructed to open.
- Isolation valve feedback diagnostics is disabled for this time.

5.7 Re-circulation pump

- Pump runs at beginning of start-up sequence.
- Pump continues to run after shutdown to allow for heat exchanger cooling (default 60 seconds).

5.8 Remote control

- External remote run request signal via a volt-free relay from the customer.
- External remote stop request signal via a volt-free relay from the customer.
- External remote emergency stop signal via a volt-free relay from the customer.
- External remote set-point controlled via a 4-20 mA signal from the customer.

5.9 Communications control

- Watchdog style connection control between PLC and customer's control system.
- Enable signal in a combined command word sent from the customer's control system.
- Stop signal in a combined command word sent from the customer's control system.
- Remote set-point sent from the customer's control system.

5.10 Manual override of remote controls

- For either communications control or remote control of the start/stop functions and setpoint can be overridden by the local operator.
- For manual override of start/stop controls, once the override control has been implemented, control is returned to external controls.
- For manual override of setpoint, control is only returned to external controls when manual override is released by the local user.

6. E-Stop

Depending upon the configuration of the package, the configuration of the e-stop relay and control will also change.

6.1. E-Stop action

The following items are controlled or limited by the e-stop relay and react differently when the relay is enabled (safe state) or disabled.

6.1.1. VE31 Inlet isolation valve

For the pneumatic variation of VE31, the control signal is the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC can pass through to the valve. When disabled, the e-stop relay blocks the control signal from the PLC.
For the electric variation of VE31, the control signal is the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC will allow 24vAC to pass through the e-stop relay into the valve. When disabled, the e-stop relay blocks both the control signal and 24vAC to the valve.

6.1.2. VB31 Steam control valve

For the pneumatic variation of VB31, the control signal is the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC can pass through to the valve. When disabled, the e-stop relay blocks the control signal from the PLC.
For the electric variation of VB31, the control signal is not the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC will pass through to the valve. When disabled, the e-stop relay will only block the control signal to the valve. The power supply to the valve is maintained to the valve at all times.
If VE31 is not fitted, a UPS is required to ensure that the valve is always supplied with power, even in the event of power loss to the package.

6.1.3. VB32 Auxiliary steam control valve

For the pneumatic variation of VB32, the control signal is the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC can pass through to the valve. When disabled, the e-stop relay blocks the control signal from the PLC.
For the electric variation of VB32, the control signal is not the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC will pass through to the valve. When disabled, the e-stop relay will only block the control signal to the valve. The power supply to the valve is maintained to the valve at all times.
If VE31 is not fitted, a UPS is required to ensure that the valve is always supplied with power, even in the event of power loss to the package.

6.1.4. VB41 Condensate control valve

For the pneumatic variation of VB41, the control signal is the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC can pass through to the valve. When disabled, the e-stop relay blocks the control signal from the PLC.
For the electric variation of VB41, the control signal is not the only source of power for the valve. When the e-stop relay is enabled, the control signal from the PLC will pass through to the valve. When disabled, the e-stop relay will only block the control signal to the valve. The power supply to the valve is maintained to the valve at all times.

If VE31 is not fitted, a UPS is required to ensure that the valve is always supplied with power, even in the event of power loss to the package.

6.1.5. Air pressure dump valves
When the e-stop relay is enabled, the control signal from the PLC can pass through to VEX1, VEX2 and/or VEX3. When disabled, the e-stop relay blocks the control signal from the PLC.

6.1.6. E-Stop status lamp
When the e-stop relay is enabled, power can pass through to lamp. When disabled, the e-stop relay blocks the power to the lamp.

6.2. E-Stop control
Power to enable the e-stop relay is provided by the PLC e-stop relay status DO.
Power to enable the e-stop relay is interrupted by any of the following relays.

- PDX1
- UPS discharge status
- UPS fault status
- Spirax IHL
- E-Stop push button
- External e-stop push button

6.2.1. Mandatory software E-Stop triggers
The DO from the PLC for the e-stop relay status is disabled by the following alarms.

- Analogue input alarm for TA21 Water Outlet Temperature.
- Analogue input alarm for TAX1 Panel Temperature.
- If fitted, isolation valve feedback alarm.
- Internal high limit alarm.
- Independent hight limit alarm.
- If fitted, compressed air pressure failure.
- Smart fuse trip.
- Panel temperature high limit.
- UPS self-diagnostic alarm.
- Mains power supply failure.

6.2.2. Optional software E-Stop triggers "on" by default

The DO from the PLC for the e-stop relay status can be disabled by the following alarms, however they can be disabled as desired by a user from the HMI.

- Analogue input alarm for RAX1 remote setpoint.
- Steam supply failure.
- HMI communications failure.
- If fitted, control valve analogue feedback alarm.
- If fitted, control valve analogue input alarm for analogue feedback inputs.

6.2.3. Optional software E-Stop triggers "off" by default

The DO from the PLC for the e-stop relay status can be disabled by the following alarms, however they must be enabled as desired by a user from the HMI.

- All other alarms.
- Diagnostics cannot be optional e-stops.

7. Diagnostics and alerts

7.1 Step sequence diagnostic

- Timings for each step are monitored and will produce prompts on the HMI based on the requirements to progress to the next step in the sequence

7.2 Diagnostic alerts

7.2.1 Hazardous system notifications

Whilst in standby mode:

- Any fitted temperature sensor detects a hazardous temperature. (default 50 °C)
- Any fitted pressure sensor detects a hazardous pressure. (default 1.5 barA)
- Any fitted flow meter detects flow. (default 1.0l/min)
- Any fitted valve feedback detects a non-standby position.

7.2.2 Water PID band alerts

- Upper allowable outlet temperature after alert time. (default 10 °C for 10 seconds)
- Lower allowable outlet temperature after alert time. (default 10 °C for 30 seconds)
- Leads to Water PID Band alarms.

7.2.3 Water control design load limit alert

- Control valve(s) fully open for prolonged time but no band alarm triggered. (default 5 minutes)
- If water inlet temperature and inlet water flow rate are fitted, a calculation of the energy transferred by the package and this is above the rated energy rating but no band alarm is triggered.

7.2.4 Condensate PID band alerts

- Upper allowable condensing pressure after alert time. (default +1.0 bar for 10 seconds)
- Lower allowable condensing pressure after alert time. (default 1.0 bar for 10 seconds)
- Leads to Condensate PID Band alarms.

7.2.5 Isolation valve anti-binding alert

- Notification that the Isolation valve anti-binding sequence was initialised.

7.2.6 Smart Fuse 90% Alert

- Monitoring function of the smart fuse has detected that the total capacity of any of its channels has reached 90% capacity of the trip setpoint.

7.2.7 Water control low standing load alert

- If PID control function is operating at a low level for a prolonged time and band alarm is NOT triggered. (default 5 minutes)
- If water inlet temperature and inlet water flow rate are fitted, a calculation of the energy transferred by the package and this is below the minimum designed turndown energy rating.
- Leads to low standing load Alarm.

7.2.8 System initialisation

- Package has successfully completed the internal Initialisation sequence after electrical power has been provided to the package.

7.2.9 E-Stop reset hold

- E-Stop reset is being prevented by an alarm state.

7.2.10 Flow forward controls

- Forward Controls has been initiated after the water flow conditions indicated and rapid change demand.

7.2.11 Thermal forward controls

- Forward Controls has been initiated after the water inlet temperature conditions indicated and rapid change demand.

7.2.12 Energy transferred calculation

- If TA11 and FA11 are fitted, a calculation for transferred energy is executed and displayed on the HMI.

8. Alarms

8.1 Analogue input alarms

- Open circuit detection (<3.0 mA).
- Short circuit detection (>21.0 mA).

8.2 Remote control Set-point alarm

- Open circuit detection of the remote set-point input.
- Short circuit detection of the remote set-point input.

8.3 Control valve failure alarm

- Valve feedback does not accurately track control output from PLC. (default 10%, 120 seconds)

8.4 Isolation valve failure alarm

- Timer to allow valve to start opening elapses. (default 15.0 seconds)
- Timer to allow valve to start closing elapses. (default 15.0 seconds)
- Timer to allow valve to transition from open/close elapses. (default 60.0 seconds)

8.5 Internal high temperature limit

- Water outlet temperature sensor used for PID control, reaches a maximum level. (default 95.0 °C)
- Optional manual reset of the alarm via the Reset button.

8.6 Independent high temperature limit

- Independent temperature switch closing steam supply to heat exchanger.
  - Spirax High Limit – Thermostat triggers emergency stop circuit, closing steam valves.
  - EN14597 High Limit – Thermostat to EN14597 closes EN14597 isolation valve at customer set temperature.
  - INAIL High Limit – Thermostat to INAIL closes EN14597 isolation valve at 95 °C.

8.7 Independent high limit setting error

- For 2 seconds after the Independent high limit alarm is triggered, if the water outlet temperature sensor does not equal the intended setpoint for the independent high limit. (default 95.0 °C)

8.8 Air supply pressure alarm

- If the compressed air preparation option is fitted, this alarm is triggered when the PDX1 air pressure switch is unable to detect suitable air pressure.

8.9 Smart fuse trip

- Alarm state from smart fuse relay.

8.10 Control panel internal temperature alarm

- Triggered when the temperature sensor lodged inside the control panel exceeds 50 °C.

8.11 Customer water supply failure

- Minimum flow rate alarm from water inlet flow meter. (default 1.0 l/min)

8.12 Control panel internal temperature limit

- Triggered when the temperature sensor lodged inside the control panel exceeds 50°C for 1 hour.
- Triggered when the temperature sensor lodged inside the control panel exceeds 60°C for 1 second.

8.13 Steam supply failure

- Triggered if Steam control valve(s) are fully open during running mode and steam pressure is below selected limit. (default 1.0 barA)

8.14 Trap failure

- Using temperature/flow sensors around the trap, control valve position(s) and know flow conditions, detect if the trap has failed closed.

8.15 HMI communications failure

- HMI Watchdog control system between the HMI and the PLC detects that the HMI has failed.

8.16 Communications control failure

- Comms Watchdog control system between the PLC and the customer's control system detects that the link has become disconnected.

8.17 Communications Set-Point out of range

- The set-point from the customer's system is outside of the permissible range.

8.18 Water PID process band alarms

- Upper allowable outlet water temperature after alarm time. (default +10 °C for 30.0seconds)
- Lower allowable outlet water temperature after alarm time. (default -10 °C for 30.0seconds)

8.19 Package design load limit alarm

- If PID control function is fully open for prolonged time and band alarm triggered default (5 minutes).
- If water inlet temperature and inlet water flow rate are fitted, a calculation of the energy generated by the package and this is above the rated energy rating and band alarm is triggered.

8.20 Condensate temperature alarm

- Condensate outlet temperature exceeds allowable limit. (default 95 °C)

8.21 Heat exchanger leak

- Integrity test option that sequences a test that detects if is a leak in the heat exchanger or package piping. (default 0.5 bar)

8.22 Integrity test high temperature

- Integrity test option sequence has detected an increase in pressure as a result of thermal expansion. (default 0.5 bar)

8.23 Integrity test high temperature max count

- After an Integrity Test High Temperature alarm event, the Integrity test sequence will retest in anticipation of the thermal expansion settling and allow for a valid test.
- If the number of retests reaches the maximum value of 5 without a valid test, the Maximum Count alarm will trigger.

8.24 Condensate PID process band alarms

- Upper allowable condensate pressure after alarm time. (default +0.5 bar for 30.0seconds)
- Lower allowable condensate pressure after alarm time. (default -0.5 bar for 30.0seconds)

8.25 Package low standing load alarm

- If PID control function is operating at a low level (default 5%) for a prolonged time (default 1440 minutes/ 24 hours) AND band alarm is triggered.
- If water inlet temperature and inlet water flow rate are fitted, a calculation of the energy transferred by the package and this is below the minimum designed turndown energy rating AND band alarm is triggered.

8.26 UPS self diagnostic alarm

- UPS managed diagnostic, preventing the UPS from providing power in the event of power loss.

8.27 Mains power supply failure

- UPS detects that incoming power supply has ceased and requires battery power to supply the package until power down conditions have been met.

9. HMI operation

9.1 Security

- Levels
  0. Default (logged out)
  1. User
  2. Customer Engineer
  3. Spirax Sarco Engineer
- Access
  - Default
    - Blocked from accessing screens 750 (Manual control), 760 (Data storage), 780 (Configuration) and 790 (Factory reset).
    - Permitted the following controls only:
    - Local start/stop controls (when enabled) on screen 100 (home)
    - Local water setpoint (when enabled) on screen 400 (process settings).
    - Language selection on screen 310 (Languages).
  - User
    - All access of the Default level.
    - Access to view all screens.
    - Manual controls on screen 100 (home).
    - Manual override of external control of start/stop function on screens 100 (Home) and 740 (External Configuration)
    - Manual override of external control of setpoint on screens 400 (Process settings), 401 (external offset) and 740 (External configuration).
  - Customer Engineer
    - All access of the User level.
    - Able to modify all alarm settings.
    - Able to modify all process settings.
    - Able to modify external control configuration on screen 740 (External configuration).
    - Able to use storage controls on screen 760 (Data).
    - Able to modify 4-20 mA scaling on screen 770 (4-20 mA).
    - Able to use reset controls on screen 790 (Factory).
- Passwords

Username	Password	Level
Default	-	Default
user	1111	User
eng	7452	Customer Engineer

9.2 Engineering units

- Temperature: Celsius (°C)
  - Optional: Fahrenheit (°F)
- Pressure: bar
  - Optional: Pounds per square inch (PSI)
- Flow: Litres per minute (L/min)
  - Optional: Gallons per minute (GPM)
- Energy: Watts
  - Optional: British Thermal Units (BTU)

9.3 Languages

The following languages are available for the HMI:

- English
- French
- Italian
- German
- Spanish
- Portuguese
- Polish
- Dutch
- Norwegian
- Danish
- Finnish
- Swedish
- Turkish
- Chinese
- Korean
- Japanese
- Taiwanese
- Indonesian
- English (US)

9.4 HMI Screen Guide

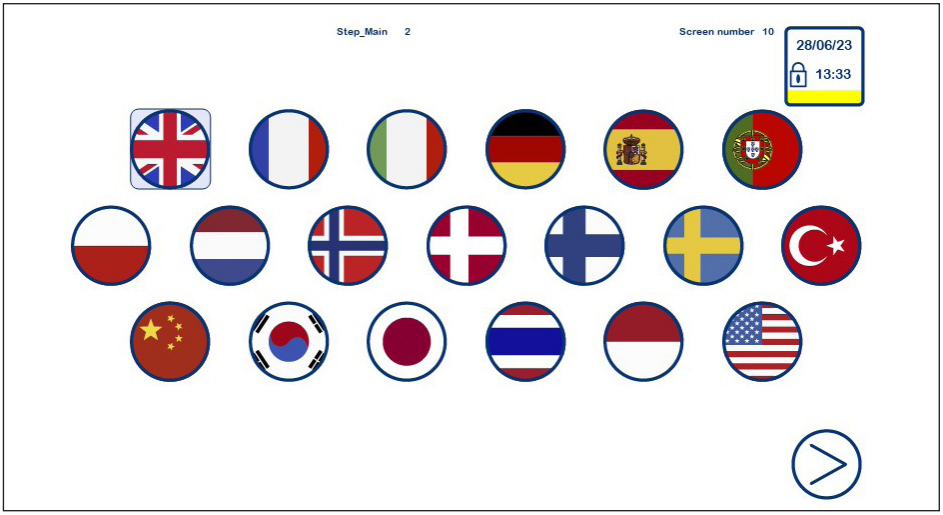
9.4.1 001 - Home Screen

Selecting anywhere on this screen will progress to the next screen.

If the package has not been commissioned, the user will be guided to screen 010 to begin the commissioning sequence to configure the system in accordance with the product nomenclature.

If the package has been commissioned, the user will be guided to screen 100.

9.4.2 010 - Commissioning, language selection

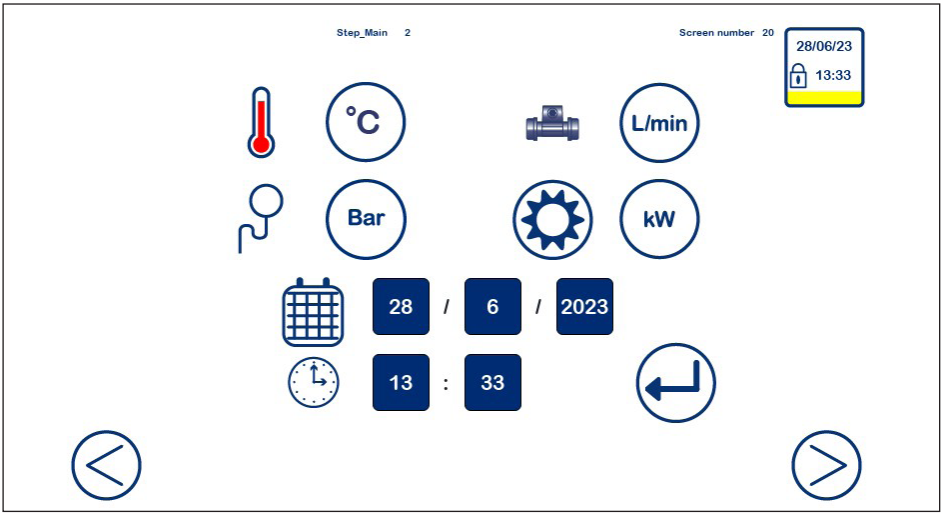


Select the relevant flag representing the desired language.

Security log-in is not required.

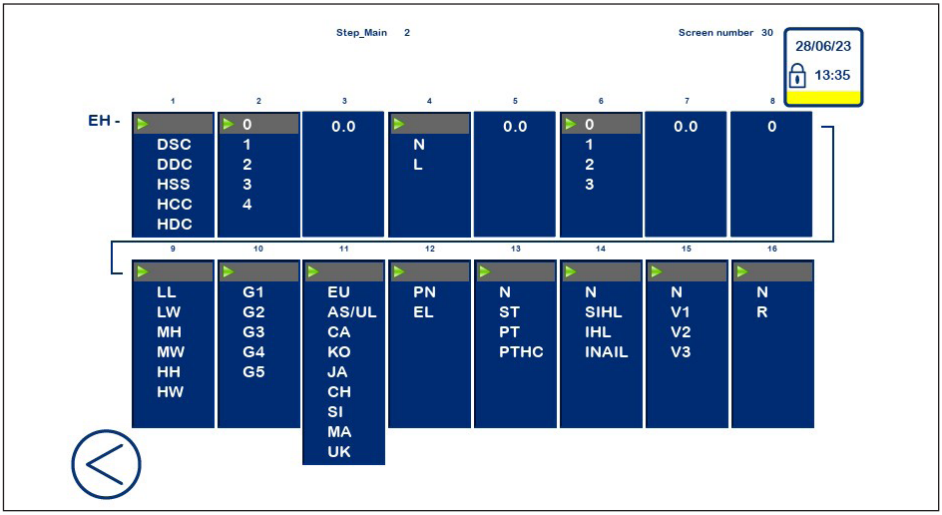
The next arrow will not appear until a language is selected.

9.4.3 020 - Commissioning, engineering units, date and time



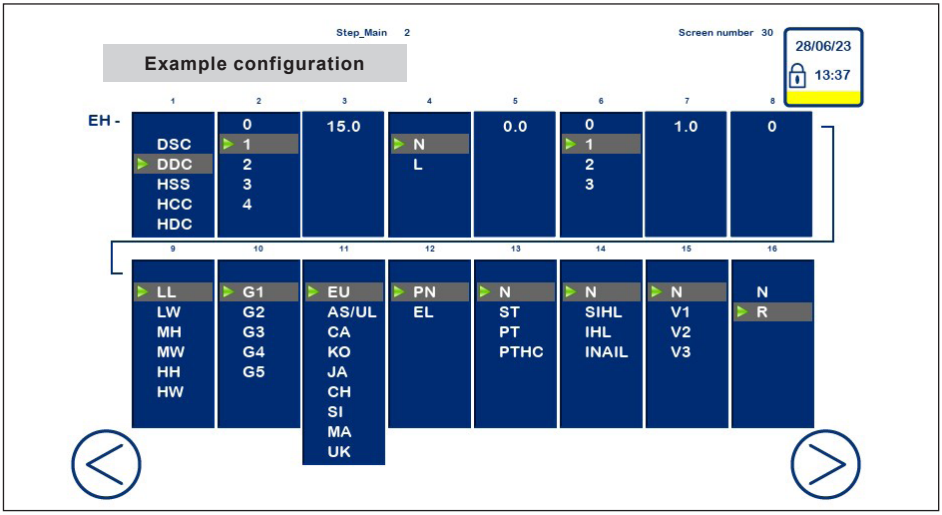
°C °F	Select the relevant unit to switch between metric and standard.
	Set the time and date.

9.4.4 030 - Commissioning, nomenclature part 1

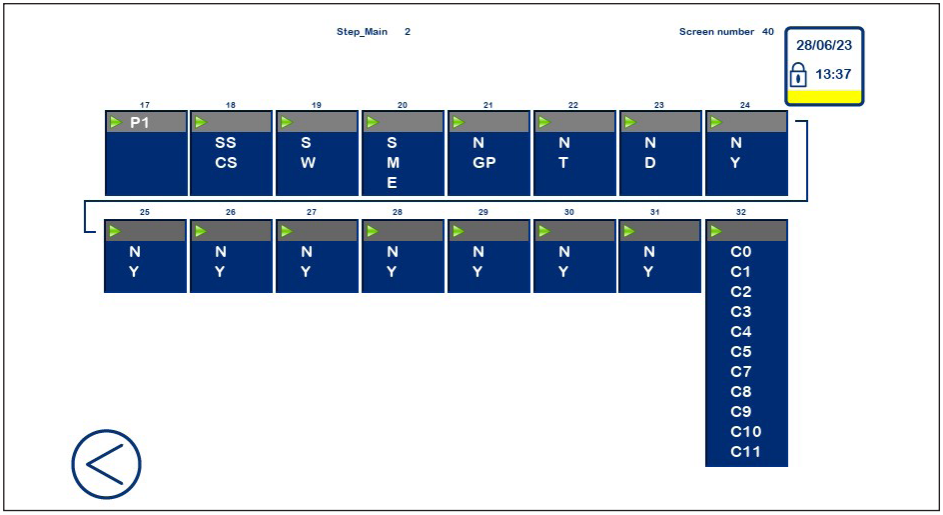


Using the nomenclature issued with the product, insert the first 16 fields of nomenclature code.

The next arrow will not appear until all relevant fields have been selected.

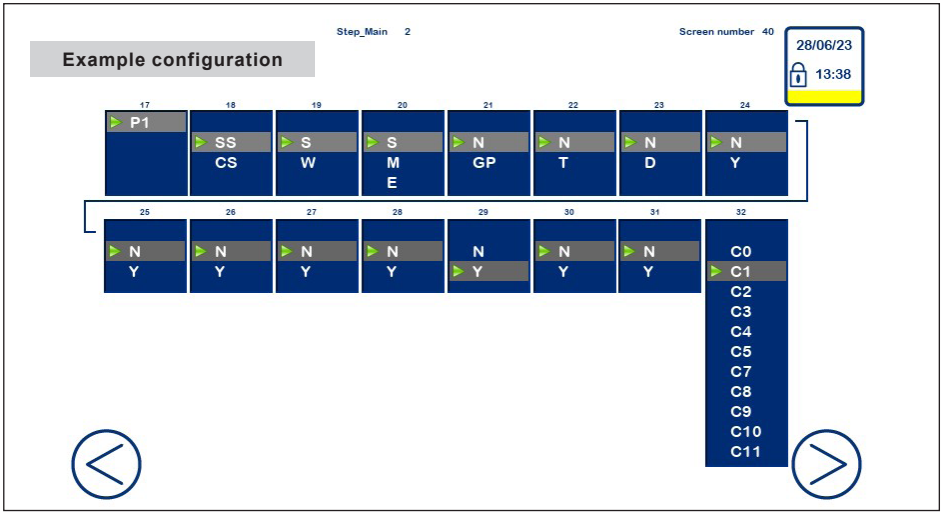


9.4.5 040 - Commissioning, nomenclature part 2

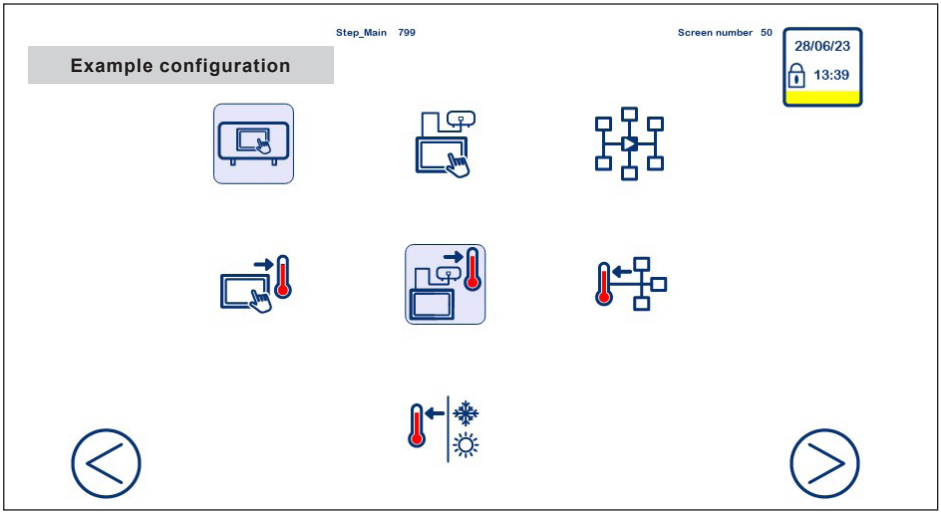


Using the nomenclature issued with the product, insert the final 16 fields of nomenclature code. Some fields cannot be deselected when other options are selected.

The next arrow will not appear until all relevant fields have been selected.



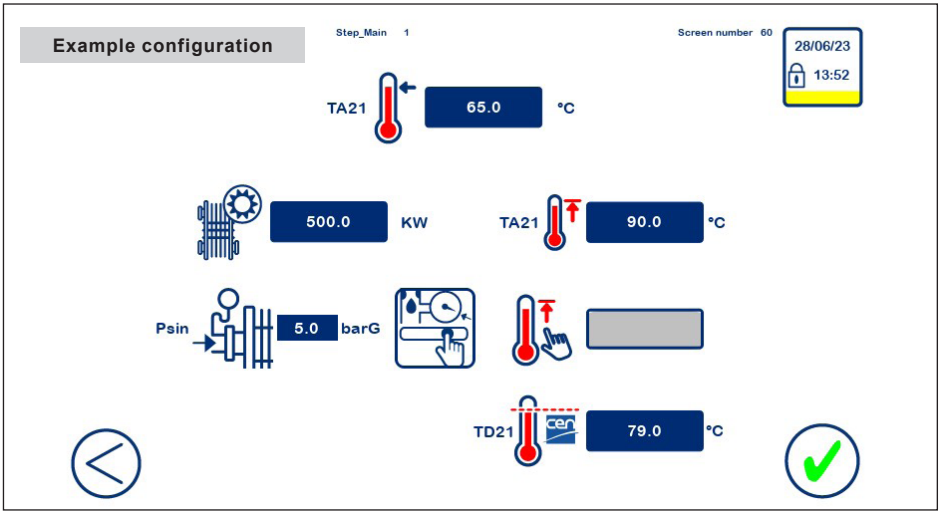
9.4.6 050 - Commissioning, Control selection



Using the nomenclature issued with the product, insert the final 16 fields of nomenclature code. Some fields cannot be deselected when other options are selected.

Local start stop control.	Remote controlled hot water setpoint.
Remote start stop control.	Communications controlled hot water setpoint.
Communications start stop control.	The next arrow will not appear until all relevant fields have been selected.
Externally influenced hot water setpoint.	
Locally selected hot water setpoint.	

9.4.7 060 - Commissioning, setpoint selection

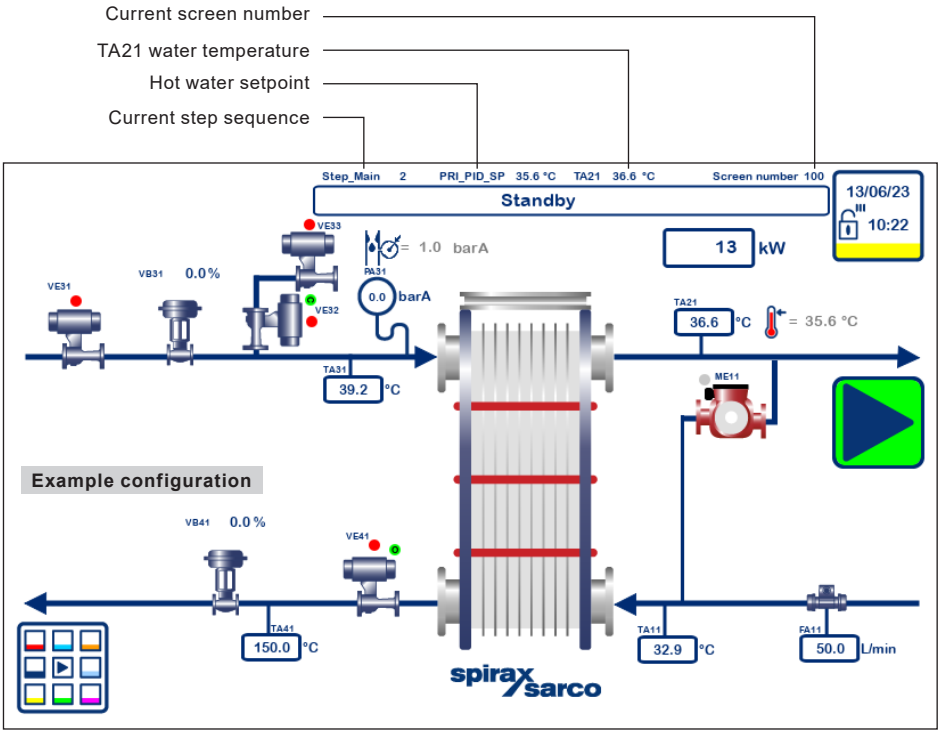


Using the nomenclature issued with the product, insert the final 16 fields of nomenclature code. Some fields cannot be deselected when other options are selected.

	Water outlet temperature setpoint.
	Design load limit.
 	Condensate control pressure setpoint selection.
	Customer supply pressure for condensate control pressure setpoint calculation.

	Manual setpoint for condensate control pressure setpoint.
	Integrated high limit setpoint.
	Manual reset of integrated high limit.
	
	Intended independent high limit setpoint.
	
	Commissioning complete button will not be available until all relevant fields have been completed.

9.4.8 100 - Home screen, icon descriptions



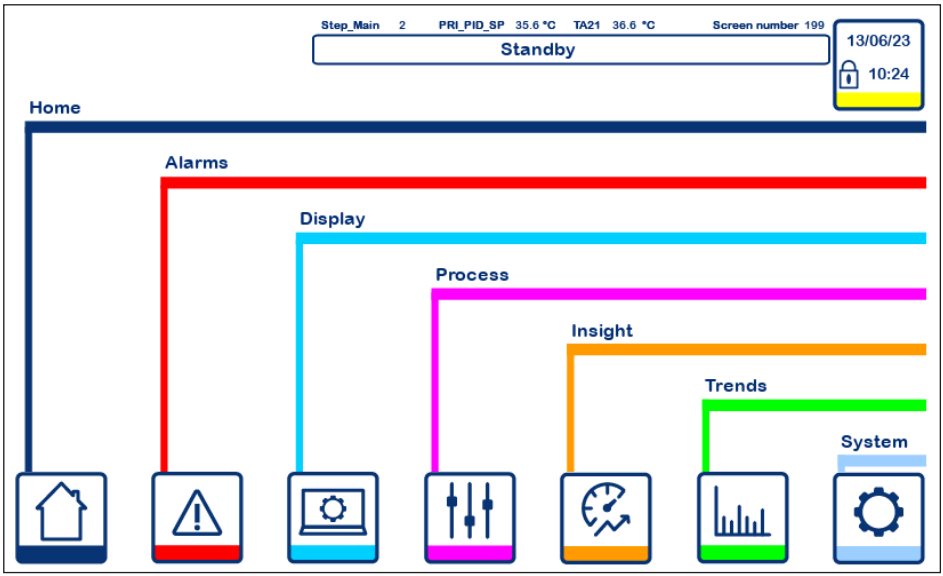
	Main Menu.
	Security access.
	Pressure sensor.
	Temperature sensor.
	Flow sensor.
	Startup available.
	Stop available.

	External control override.
	Valve open signal.
	Valve closed signal.
	Valve open position.
	Valve closed position.
	Pump running.
	Pump idle.
	Manual control position.

Log in and tap on the below icons for manual controls.

	Isolating valve (EL & PN).
	Recirculation pump.
	Modulating control valve (EL & PN).

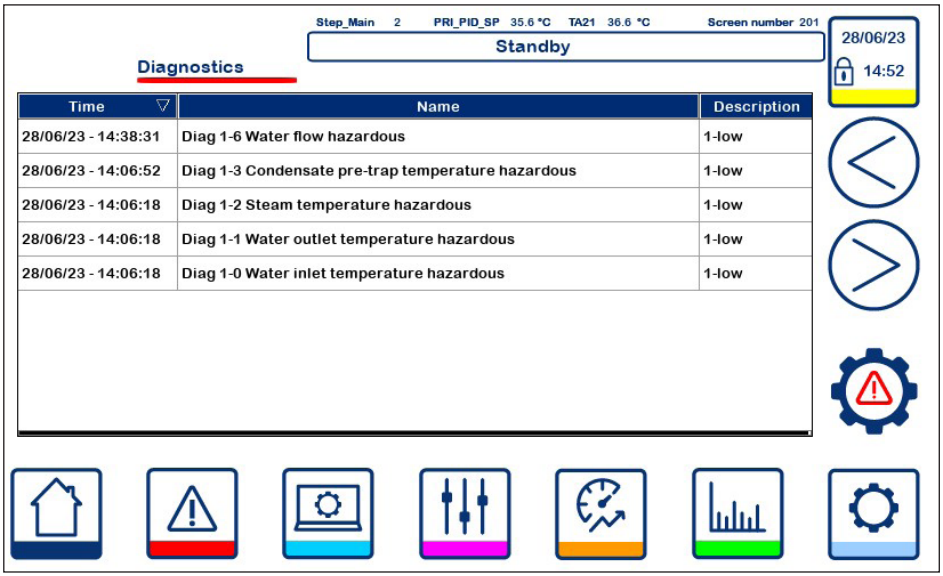
9.4.9 199 - Main menu

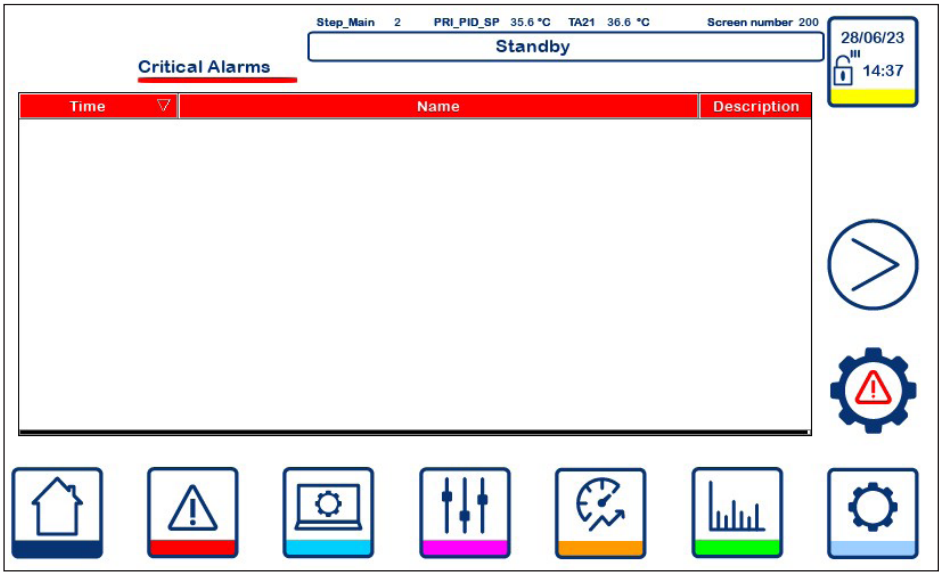


Using the nomenclature issued with the product, insert the final 16 fields of nomenclature code. Some fields cannot be deselected when other options are selected.

	Navigate to the Home screen (100)
	Navigate to the Alarms area (200)
	Navigate to the Display area (300)
	Navigate to the Process Settings area (400)
	Navigate to the Insights page (500)
	Navigate to the Trends page (600)
	Navigate to the System area (700)

9.4.10 200 - Critical Alarms
201 - Diagnostics
210 - Alarm History





The notifications displayed on the Critical Alarms screen (200) are displayed to inform of the package not running within specification.

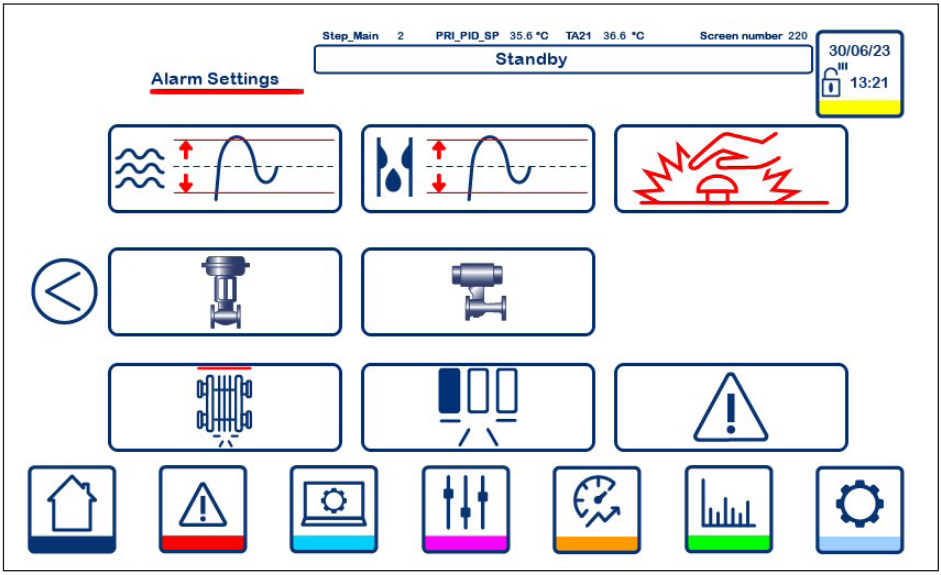
The notifications displayed on the Diagnostics screen (201) are displayed to help identify causes for the Critical Alarms or may indicate that a Critical Alarm may be triggered.

The Alarms History screen (210) records all notifications from the Critical Alarms and Diagnostics screens.

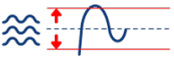
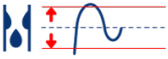
The next and previous buttons cycle between the 3 alarms screens.

Navigate to the Alarm Settings screen (220).

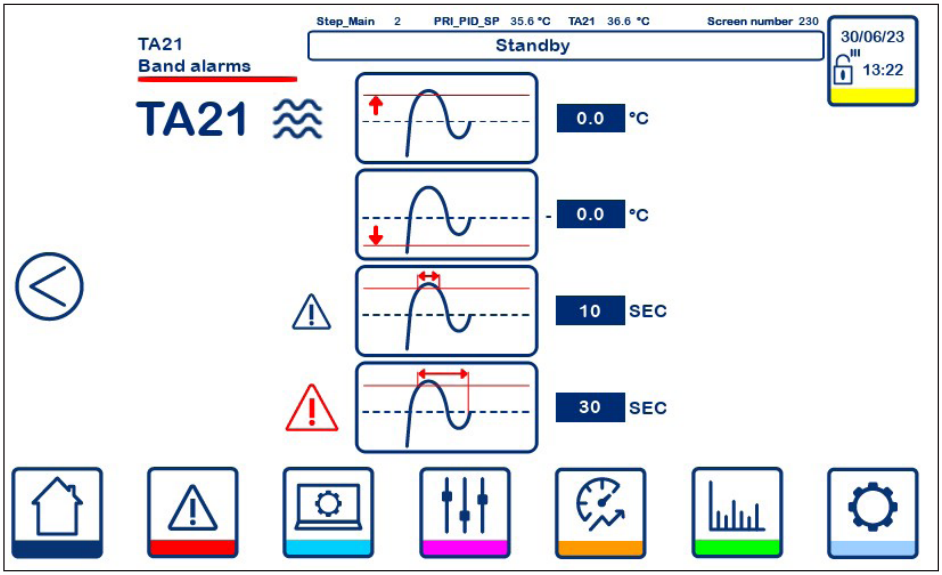
9.4.11 220 - Alarm Settings

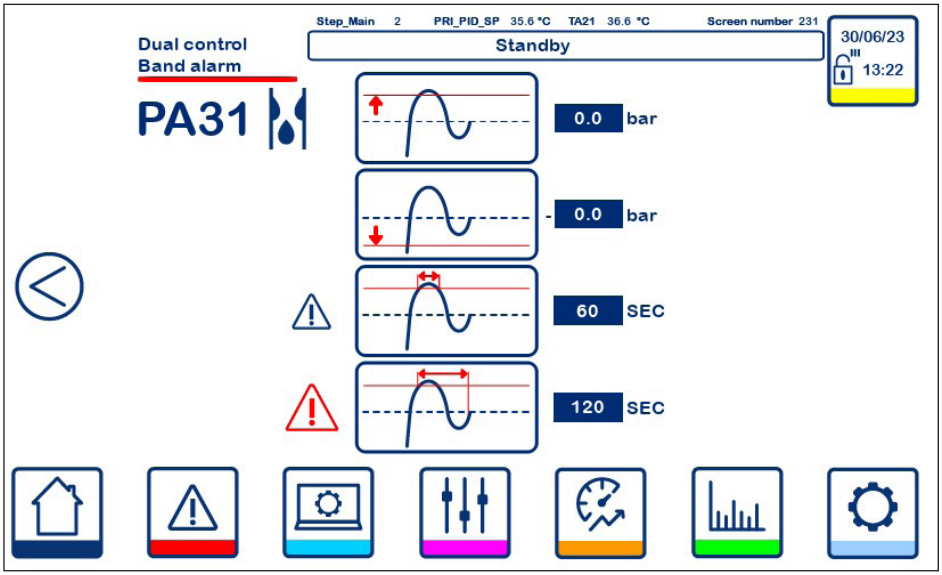


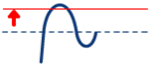
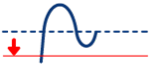
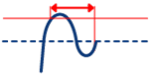
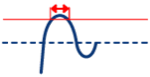
Using the nomenclature issued with the product, insert the final 16 fields of nomenclature code. Some fields cannot be deselected when other options are selected.

	Navigate to TA21 Band Alarm (230)
	Navigate to PA31 Band Alarm (231)
	Navigate to Optional E-stops (270)
	Navigate to Control Valve Positioning (260)
	Navigate to Isolation Valve Positioning (261)
	Navigate to Design Load Limits (240)
	Navigate to Low Standing Load (241)
	Navigate to Hazardous Alert Settings (280)

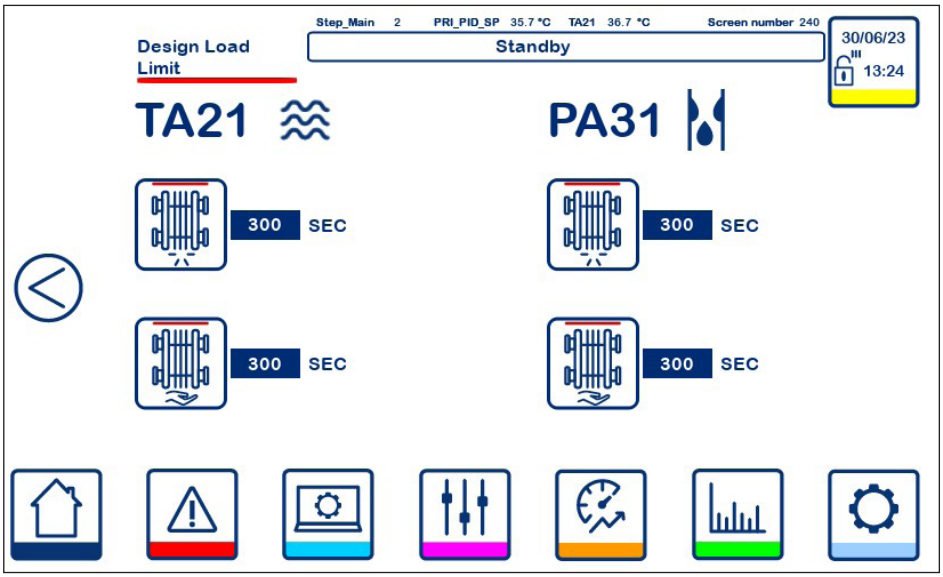
9.4.12 230 - TA21 Band Alarms
231 - Dual Control Band Alarms





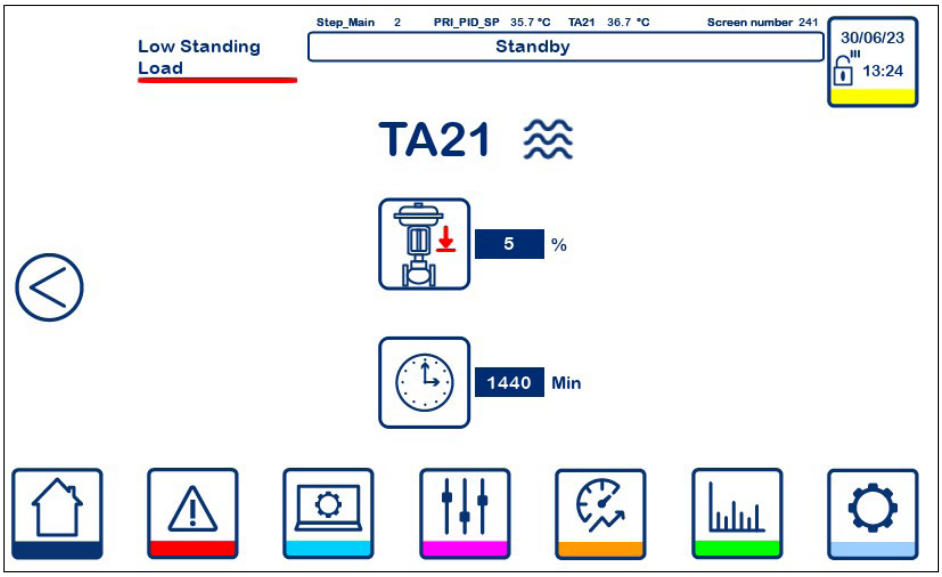
		Band alarm high limit value.
		Band alarm low limit value.
		Deviation time for diagnostic alert.
		Deviation time for critical alarm.

9.4.13 240 - Design Load Limit



	Time for control valve to be at maximum position for diagnostic alert time.
	Time for control valve at maximum position and exceeding band alarm for alarm.

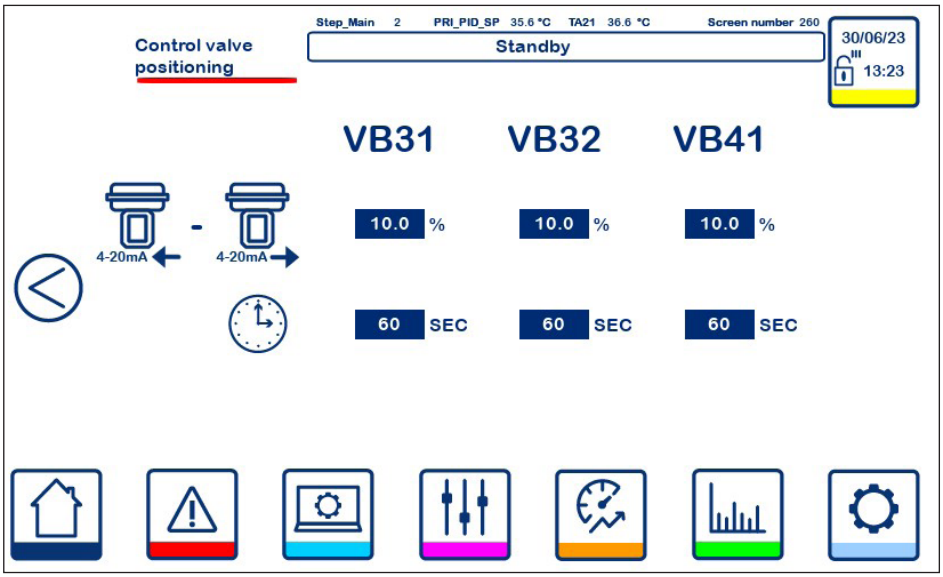
9.4.14 241 - Low Standing Load



Low valve position for low load condition.

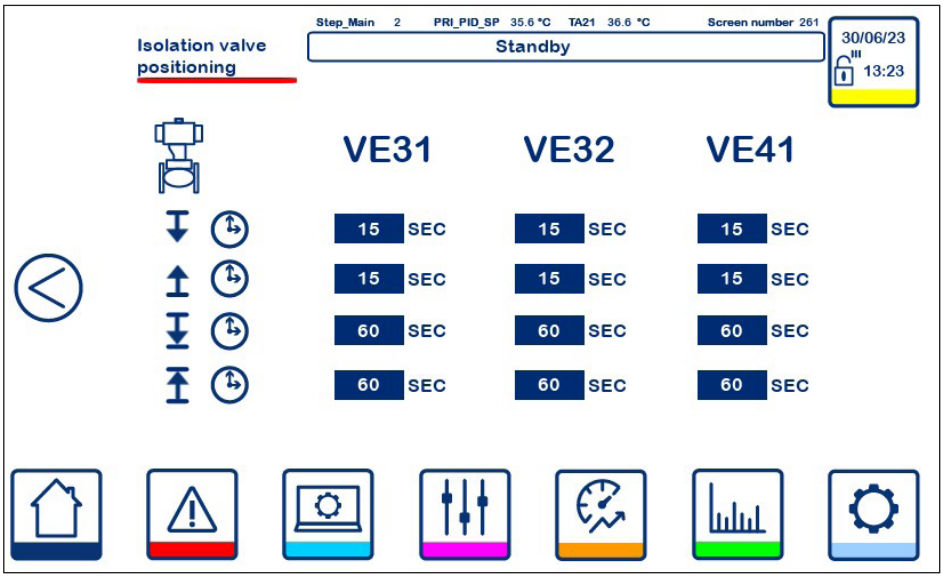
Time at low load condition without exceeding band alarm for diagnostic alert and exceeding band alarm for alarm.

9.4.15 260 - Control Valve Positioning



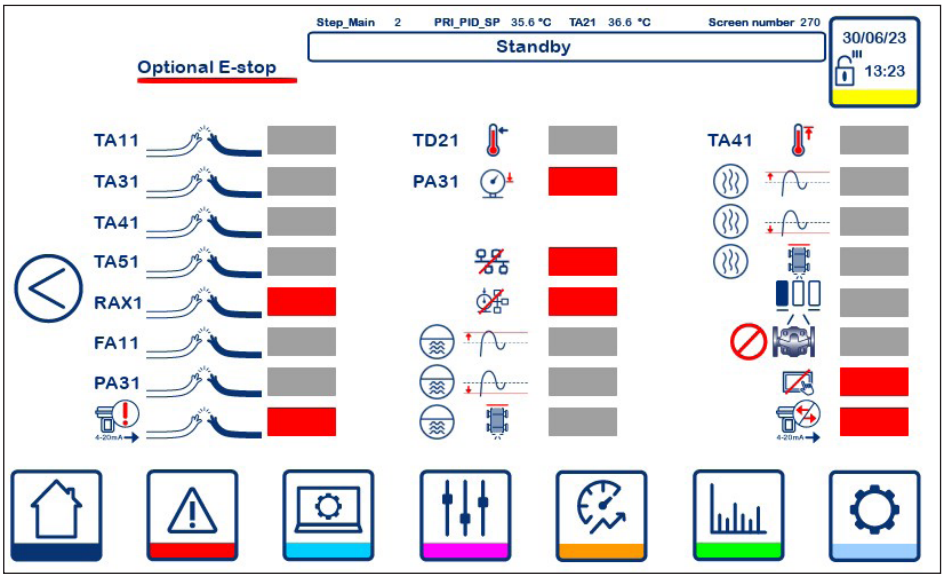
4-20mA - 4-20mA	Position tolerance between control signal and feedback signal.
	Allowable time for valve position to be outside of position tolerance.

9.4.16 261—Isolation Valve Positioning

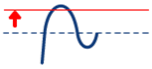
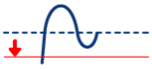


	Time to move away from open position switch.
	Time to move away from closed position switch.
	Transition time to move from open to closed position.
	Transition time to move from closed to open position.

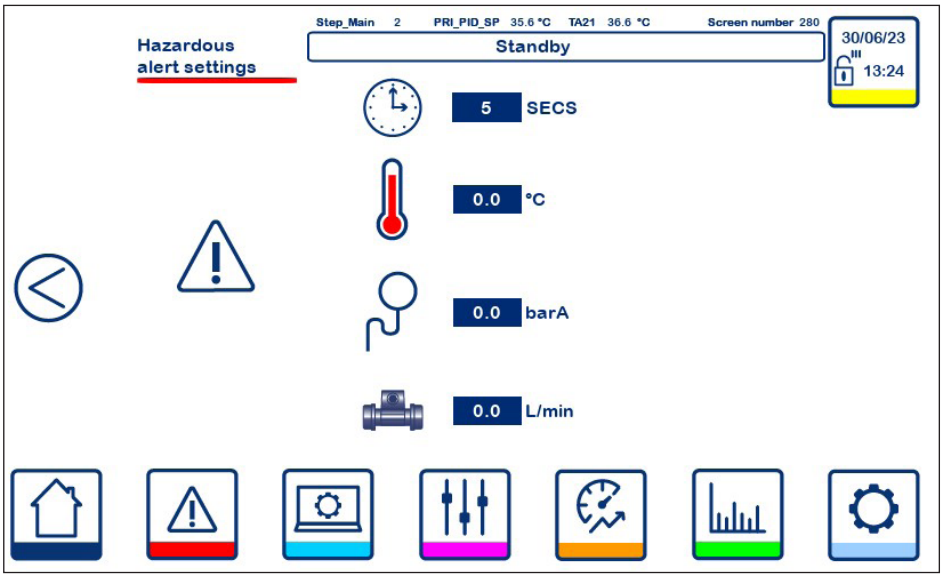
9.4.17 270 - Optional E-stop



	Wiring connection fault for analogue inputs.
	Wiring connection fault for valve feedback, including VA31, VA32 and VA41.
TD21 	Independent High Limit setting error.

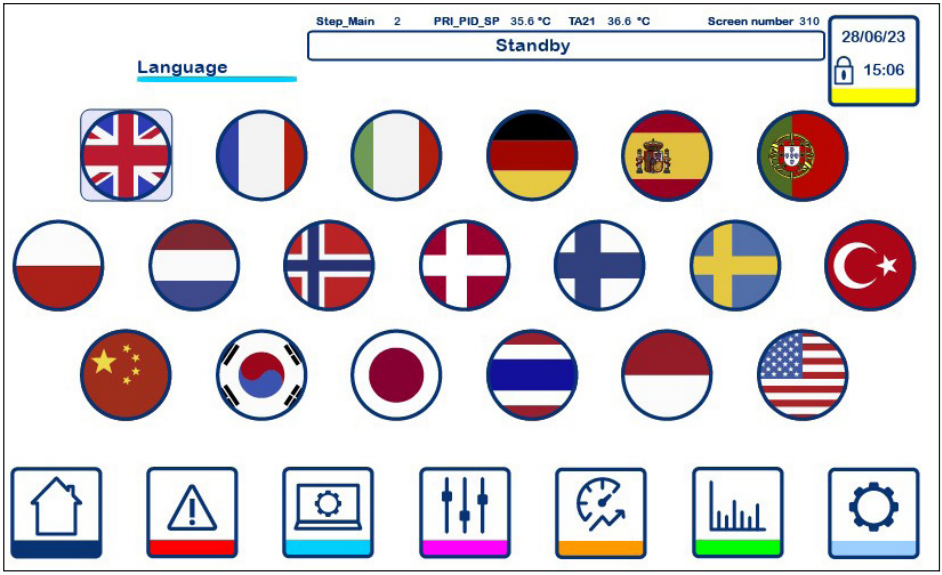
PA31		Low inlet pressure limit.
		Network communications fault.
		Communications external setpoint error.
		Alarms relating to water related systems.
		Alarms relating to dual control related systems.
		High band alarm.
		Low band alarm.
		Design load limit alarm.
TA41		TA41 high limit alarm.
		Low standing load alarm.

9.4.18 280 - Hazardous alert settings



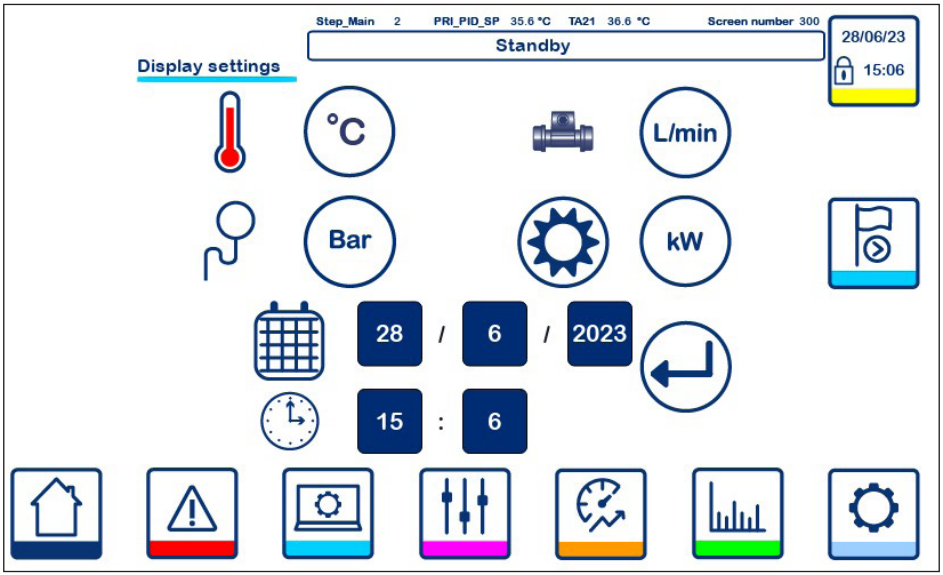
	Time delay before reporting process condition alert.
	Hazardous temperature during idle state.
	Hazardous pressure during idle state.
	Hazardous flow during idle state.

9.4.19 300 - Display Settings
310 - Language



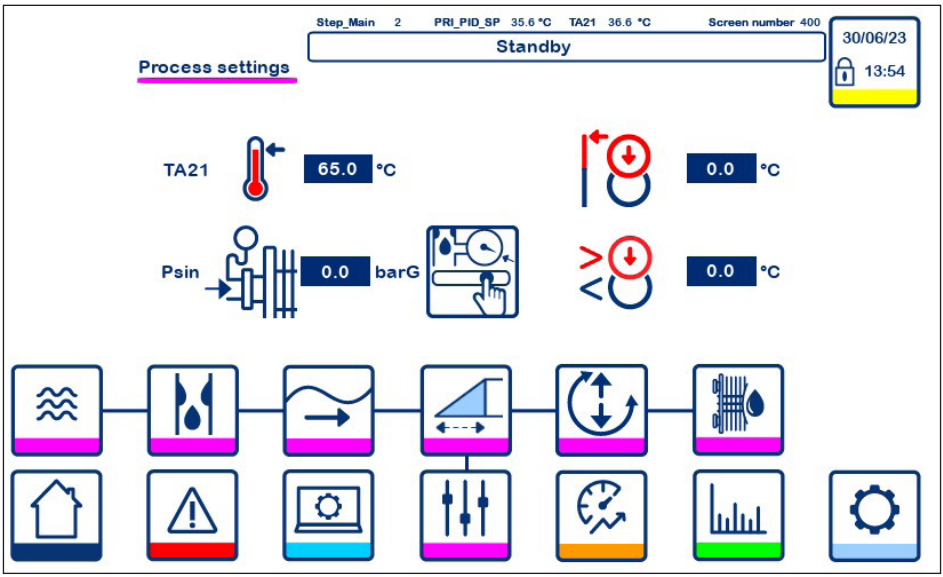
°C °F	Select the relevant unit to switch between metric and standard.
	Set the time and date.
	Select the relevant flag representing the desired language.

Continued on next page



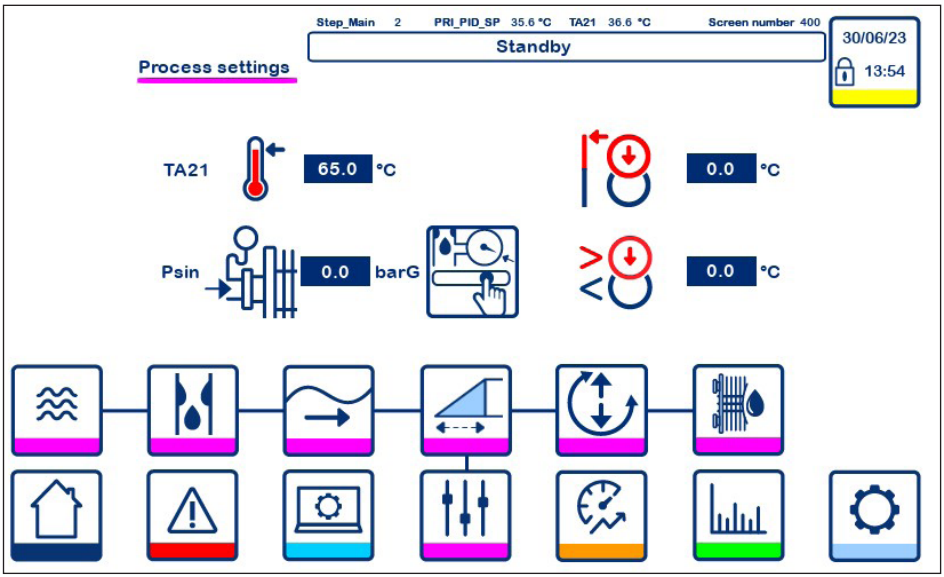
°C °F	Select the relevant unit to switch between metric and standard.
	Set the time and date.
	Select the relevant flag representing the desired language.

9.4.20 400 - Process Settings



TA21		Water outlet temperature setpoint.
		Manual override of external controls.
		Calculated value
		Condensate control pressure setpoint selection.
		Direct set point
		Condensate control return limit isolation valve close.

Continued on next page

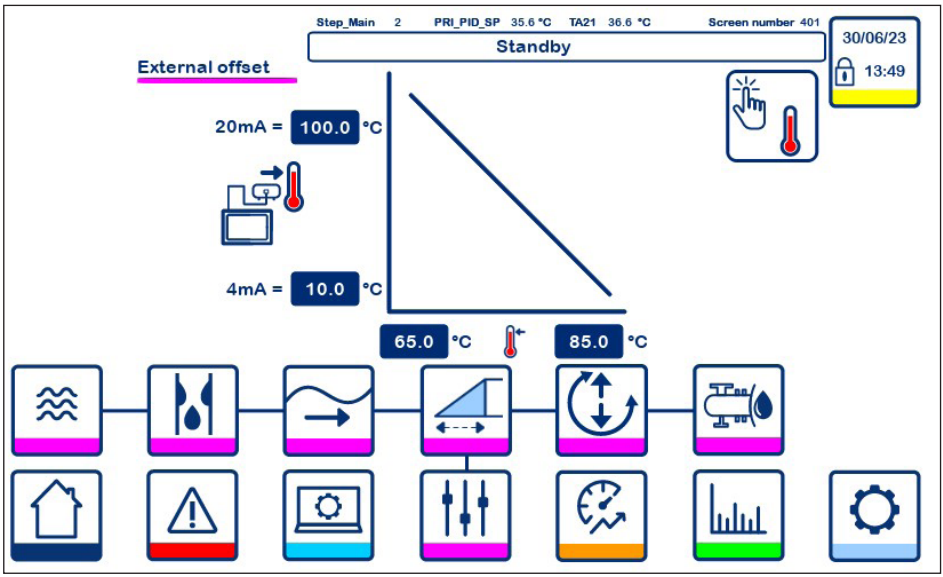


		Condensate control return differential limit isolation valve close.
Psin		Customer supply pressure for condensate control pressure setpoint calculation.
		Manual setpoint for condensate control pressure setpoint.

The below buttons are visible across the Process Settings section (400-450).

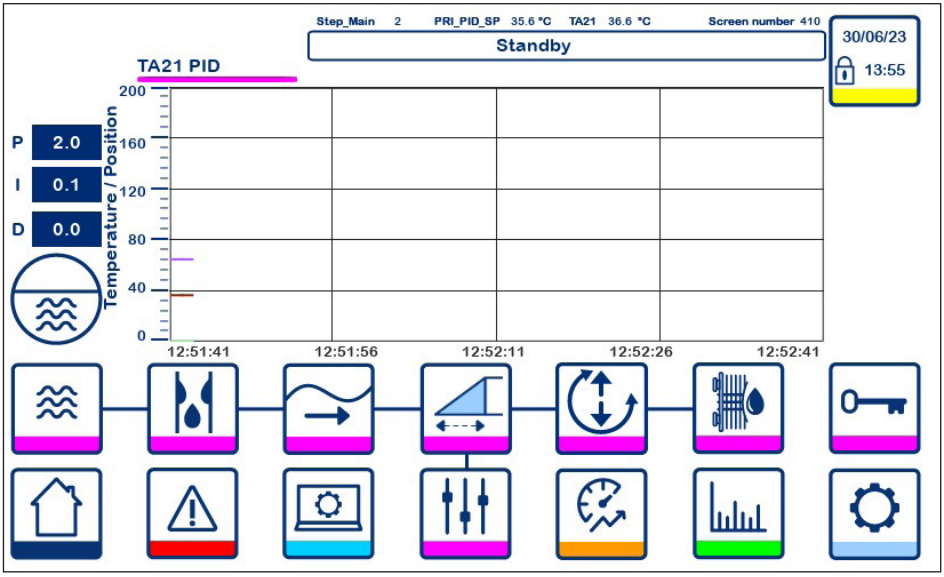
	TA21 Water PID (410)
	PA31 Dual Control PID (410)
	Forward Controls (420)
	Start-up settings (430)
	Process limits (440)
	Integrity test (450)

9.4.21 401 - External offset



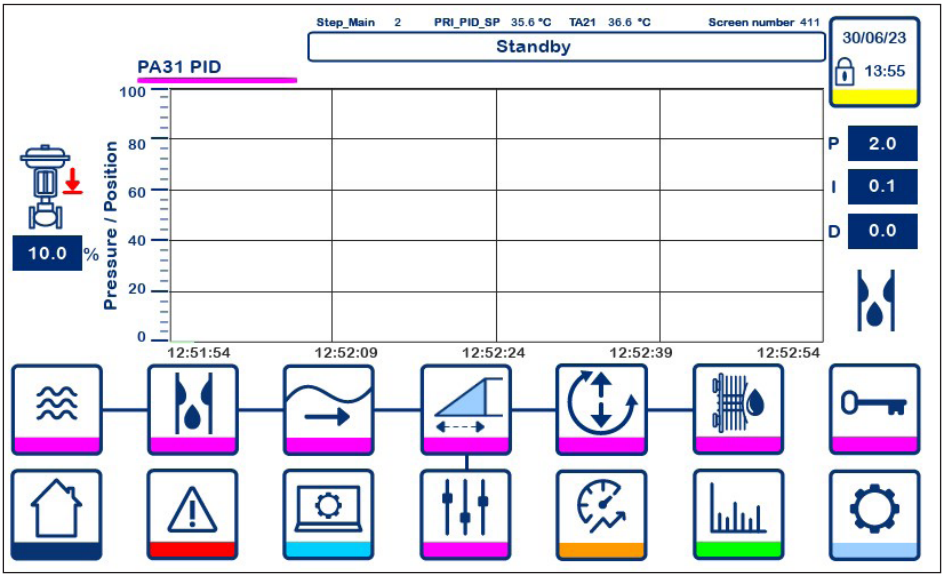
	Input range for external offset provided by communications controls.
	Input range for external offset provided by remote controls (4-20mA).
	Range for the water output PID setpoint controlled by external offset.
	Manual override of external offset.

9.4.22 410 - TA21 PID
411 - PA31 PID



	Water control for TA21 water outlet temperature.
	Pressure control for PA31 Steam inlet condensing pressure.
	Minimum valve opening of VB41 under Run state.
	Key for graph colours and interpretation.

Continued on next page



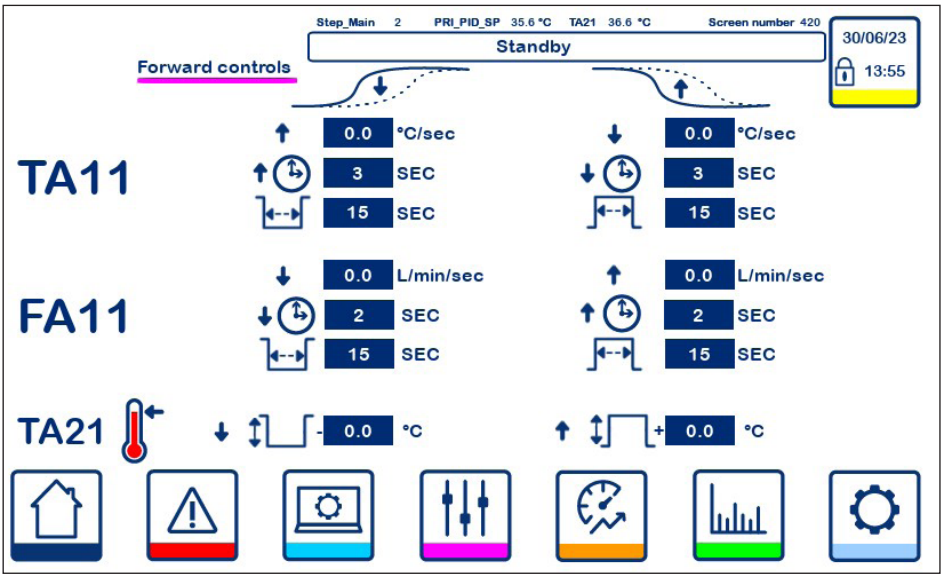
Water control for TA21 water outlet temperature.

Pressure control for PA31 Steam inlet condensing pressure.

Minimum valve opening of VB41 under Run state.

Key for graph colours and interpretation.

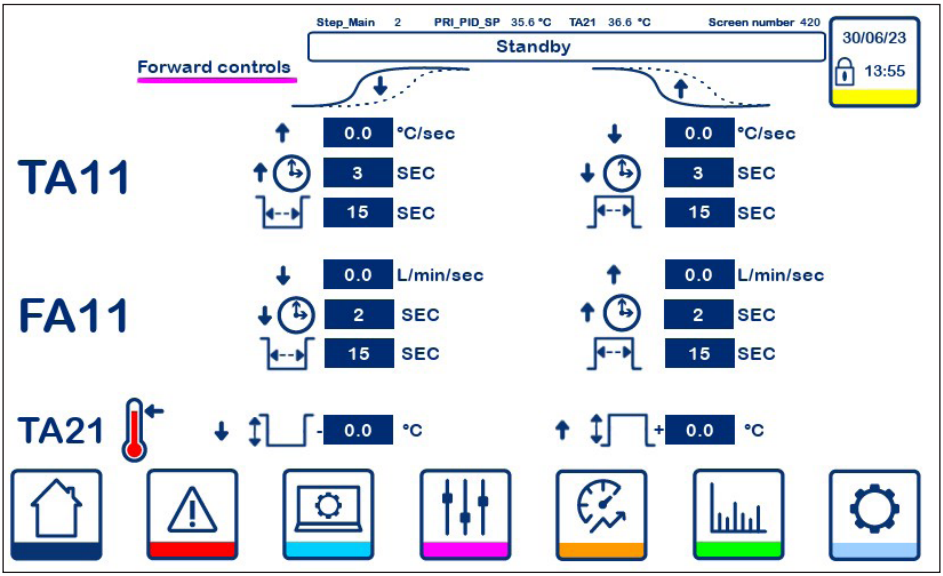
9.4.23 420 - Forward Controls



TA11

	Sudden low demand forward controls.
	Sudden high demand forward controls.
	Temperature rise rate of TA11 for thermal low demand detection.
	Temperature drop rate of TA11 for high demand detection.
	Duration of thermal low demand detection.

Continued on next page



TA11 (continued)

	Duration of high demand detection.
	Duration of thermal low demand controls.
	Duration of thermal high demand controls.

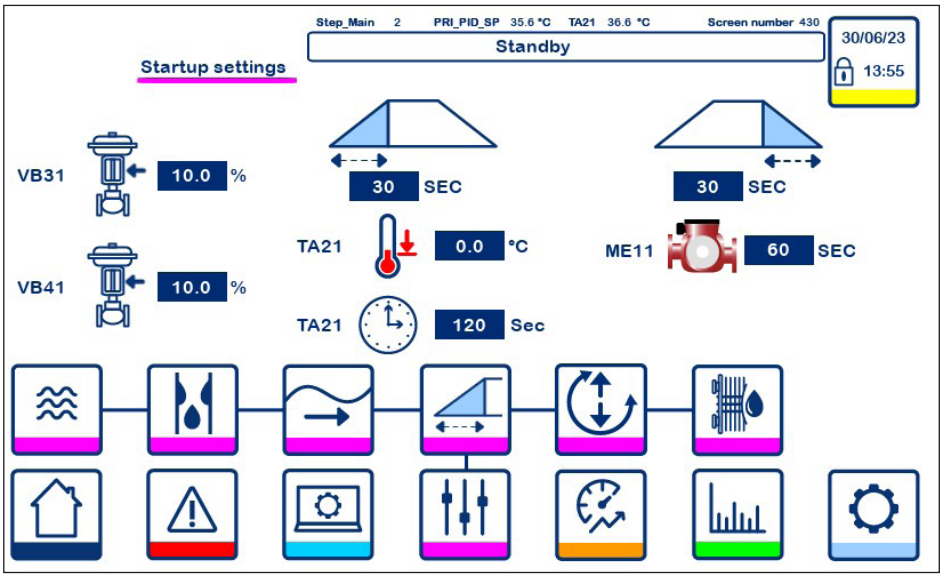
FA11

	Flow drop rate of FA11 for flow low demand detection.
	Flow drop rate of FA11 for flow high demand detection.
	Duration of flow low demand detection.
	Duration of flow high demand detection.
	Duration of flow low demand controls.
	Duration of flow high demand controls.

TA21

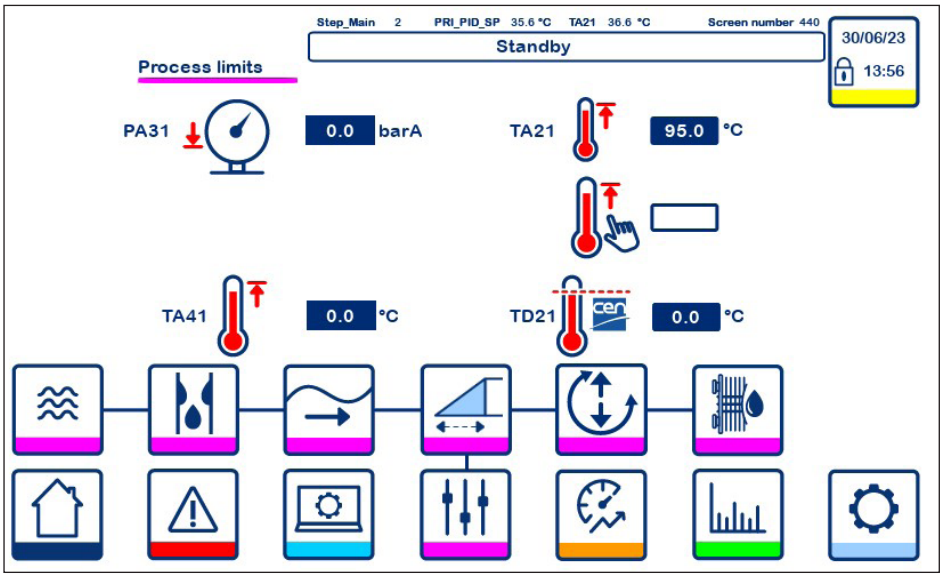
	Drop of TA21 PID setpoint due to thermal or flow low demand controls.
	Rise of TA21 PID setpoint due to thermal or flow high demand controls.

9.4.24 430 - Startup settings



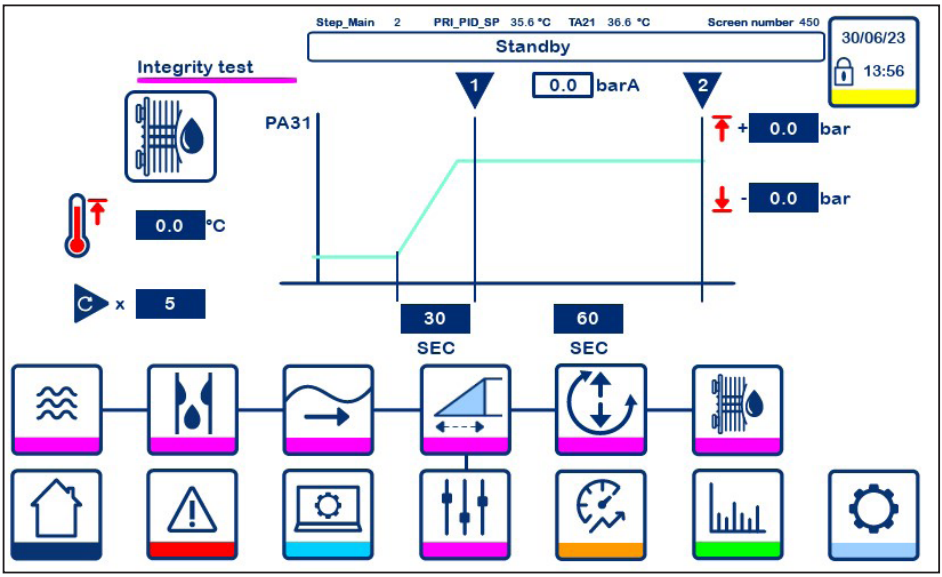
	Valve position for startup sequence.
	Maximum startup sequence warm up time.
	Minimum TA21 temperature for startup sequence.
	TA21 PID setpoint ramp up time for startup sequence.
	TA21 PID setpoint ramp down time for shutdown sequence.
	ME11 pump overrun time for shutdown sequence.

9.4.25 440 - Process limits



		Minimum allowable PA31 pressure when under full load.
TA41		Maximum allowable TA41 temperature.
TA21		Internal high limit for TA21 outlet temperature.
		Toggle to enable manual reset of Internal High limit alarm.
		Intended setpoint for SXS TD21 Independent High limit.
		Intended setpoint for EN14597 TD21 Independent High limit.
		Intended setpoint for INAIL TD21 Independent High limit.

9.4.26 450 - Integrity Test



Disabled

Select integrity test at next available startup sequence.

Enabled

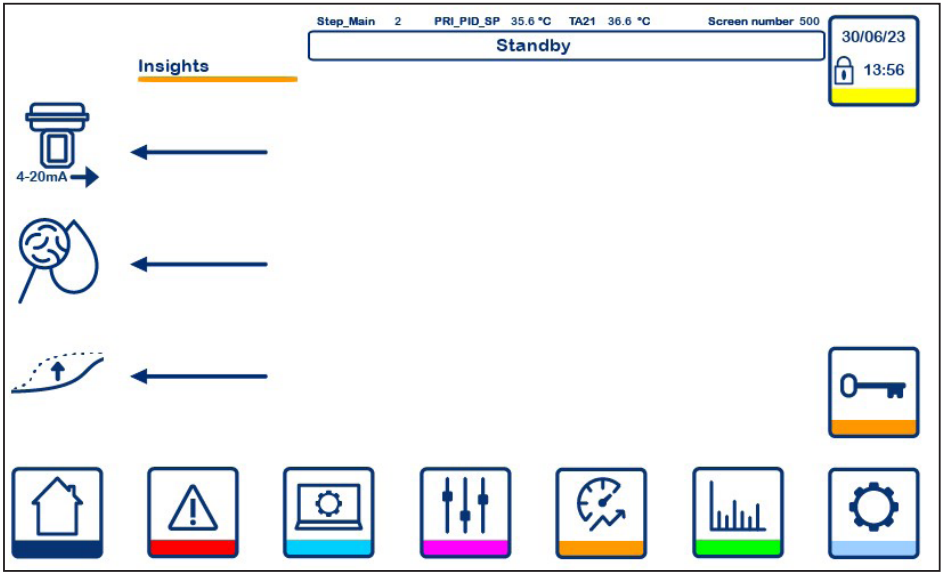
Maximum allowable temperature across the package to allow the integrity test

x Number of repeat cycles due to high pressure result.

Maximum allowable pressure rise during the integrity test.

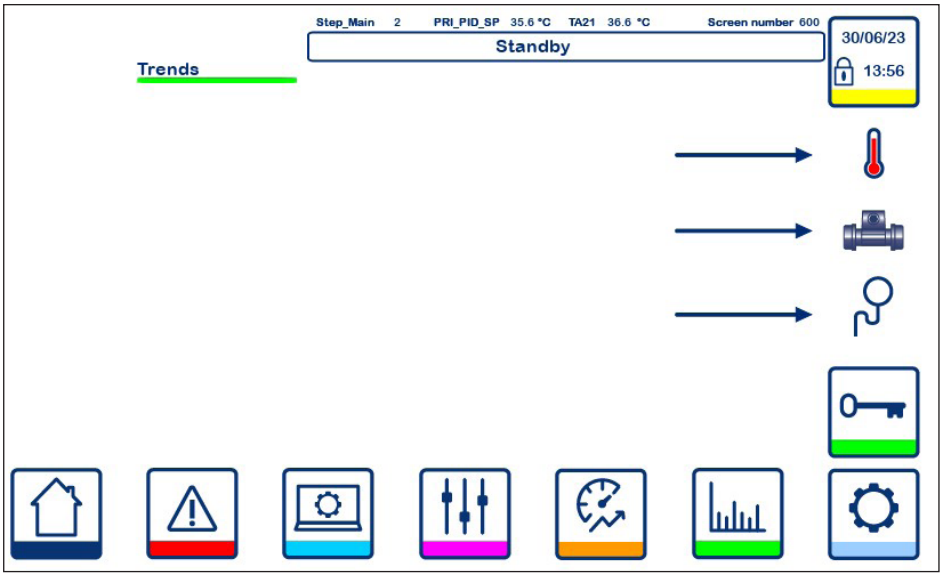
Maximum allowable pressure drop during the integrity test.

9.4.27 500 - Insights



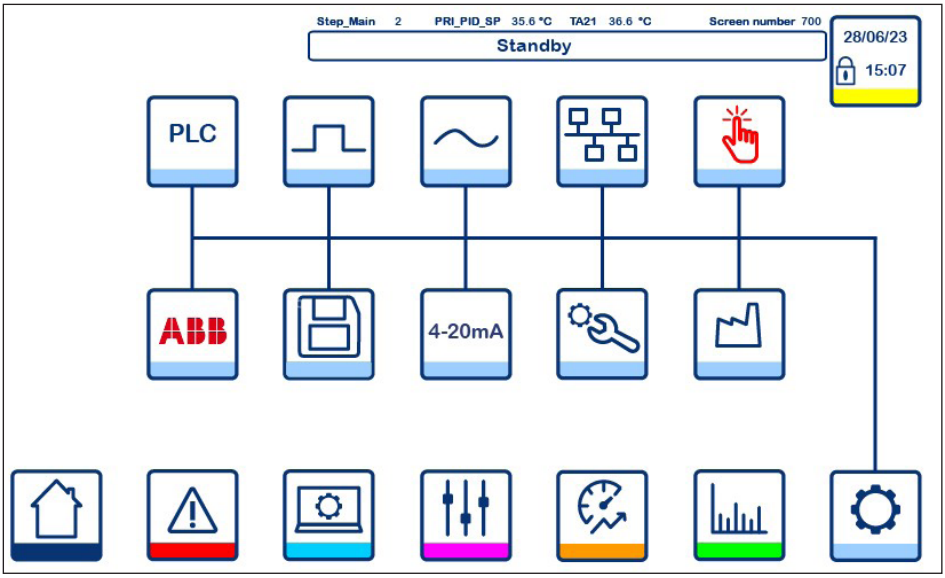
	Display graph for valve feedback diagnostics.		Display graph for forward controls insights.
	Display graph for legionella insights.		Key for displayed contents of the insights graphs.

9.4.28 600 - Trends



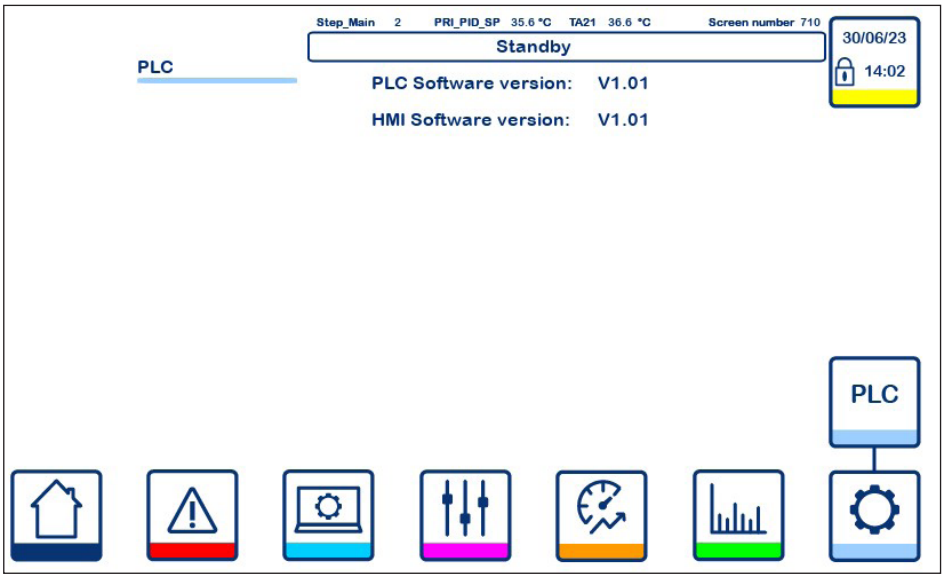
	Display graph for temperatures.
	Display graph for flow.
	Display graph for pressure.
	Key for displayed contents of the trends graphs.

9.4.29 700 - System



PLC	Navigate to PLC (710).
	Navigate to Digital I/O (720).
	Navigate to Analogue I/O (730).
	Navigate to External Configuration and Network (740).
	Navigate to Override I/O (750).
ABB	Displays PLC and HMI supplier.
	Navigate to Data (760).
4-20mA	Navigate to 4-20mA (770).
	Navigate to System Configuration (780).
	Navigate to factory (790).

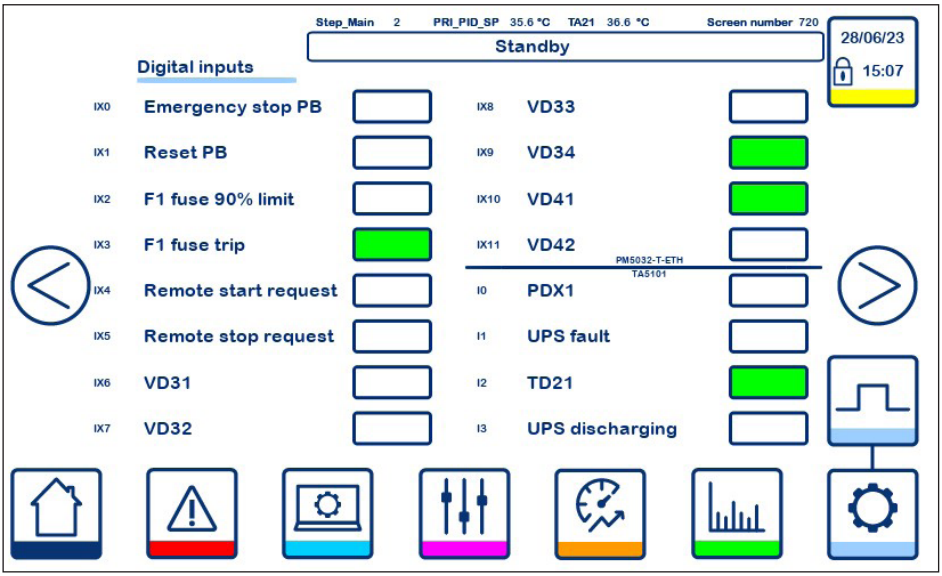
9.4.30 710 - System



Displays PLC and HMI version numbers.

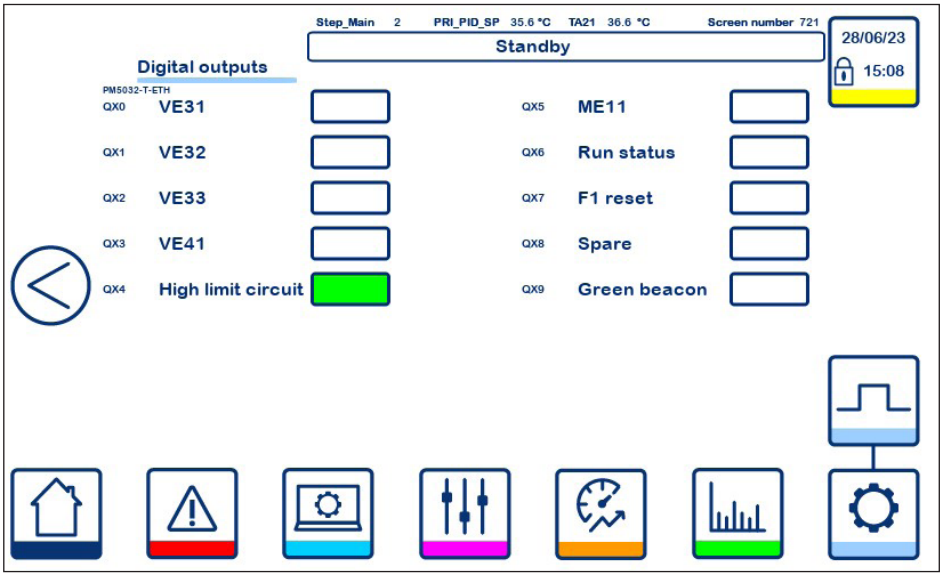
Wherever possible, PLC and HMI versions should always match.

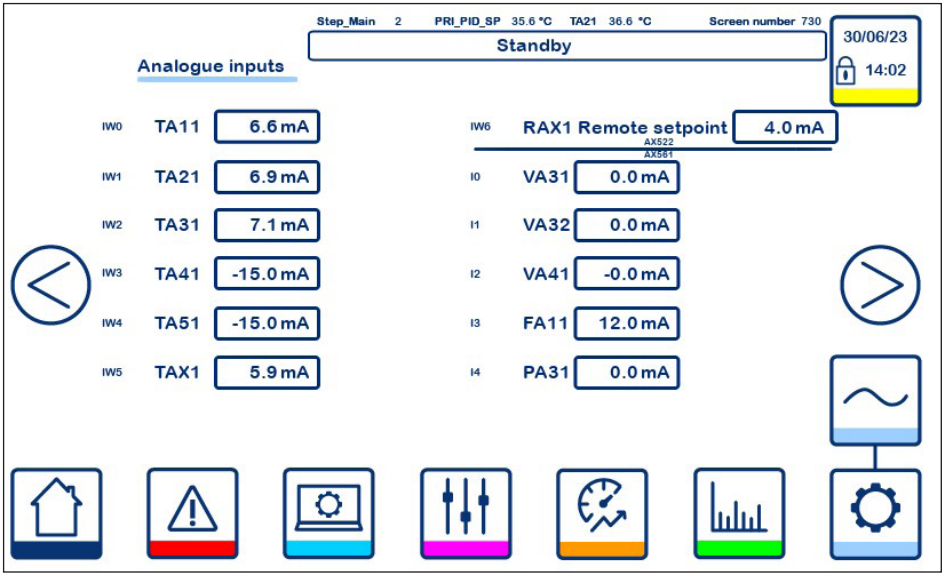
9.4.31 720 - Digital Inputs
721 - Digital Outputs
730 - Analogue Inputs
731 - Analogue Outputs

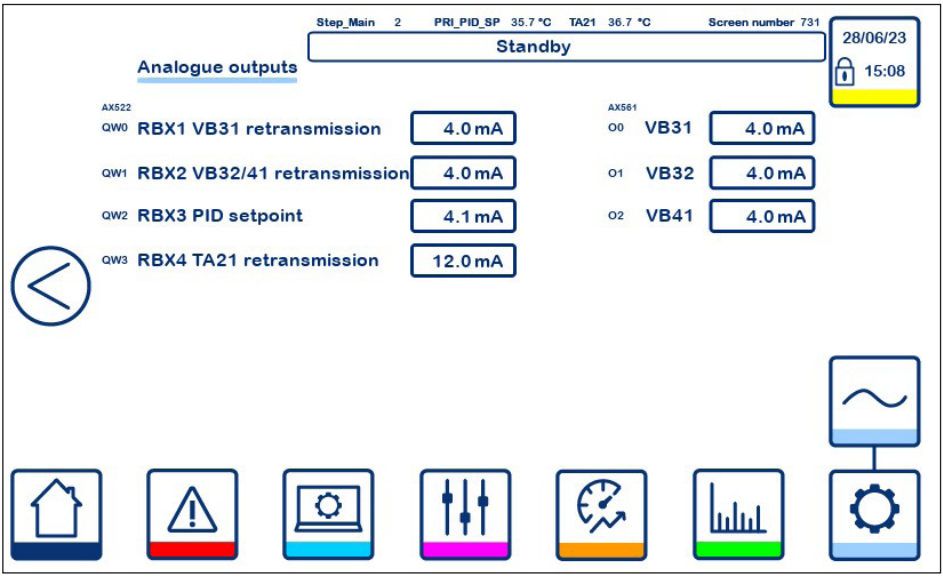


	Display graph for temperatures.
	Display graph for flow.
	Display graph for pressure.
mA	Key for displayed contents of the trends graphs.

Continued on next page

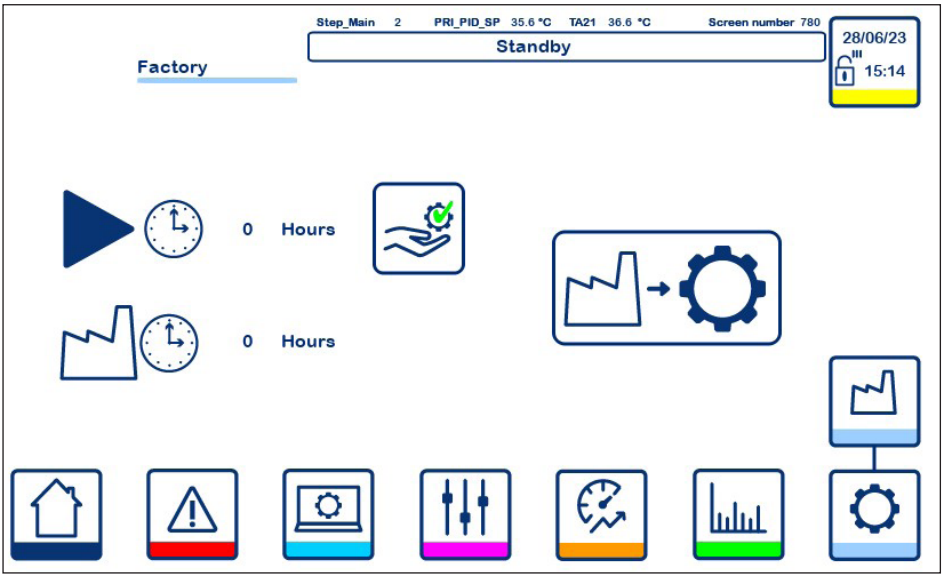

Step_Main 2 PRI_PID_SP 35.6 °C TA21 36.6 °C Screen number 721
Standby
28/06/23
15:08
Digital outputs
PM5032-T-ETH
QX0 VE31
QX1 VE32
QX2 VE33
QX3 VE41
QX4 High limit circuit
QX5 ME11
QX6 Run status
QX7 F1 reset
QX8 Spare
QX9 Green beacon


Step_Main 2 PRI_PID_SP 35.6 °C TA21 36.6 °C Screen number 730
Standby
30/06/23
14:02
Analogue inputs
IW0 TA11 6.6 mA
IW1 TA21 6.9 mA
IW2 TA31 7.1 mA
IW3 TA41 -15.0 mA
IW4 TA51 -15.0 mA
IW5 TAX1 5.9 mA
IW6 RAX1 Remote setpoint 4.0 mA
AX522
AX561
I0 VA31 0.0 mA
I1 VA32 0.0 mA
I2 VA41 -0.0 mA
I3 FA11 12.0 mA
I4 PA31 0.0 mA



	Display graph for temperatures.
	Display graph for flow.
	Display graph for pressure.
mA	Key for displayed contents of the trends graphs.

9.4.32 740 - External Configuration



	Local start stop control.
	Remote start stop control.
	Communications start stop control.
	Externally influenced hot water setpoint.
	Override external controls for start/stop.
	Override external controls for external setpoint.

Locally selected hot water setpoint.

Remote controlled hot water setpoint.

Communications controlled hot water setpoint.

BACnet 01

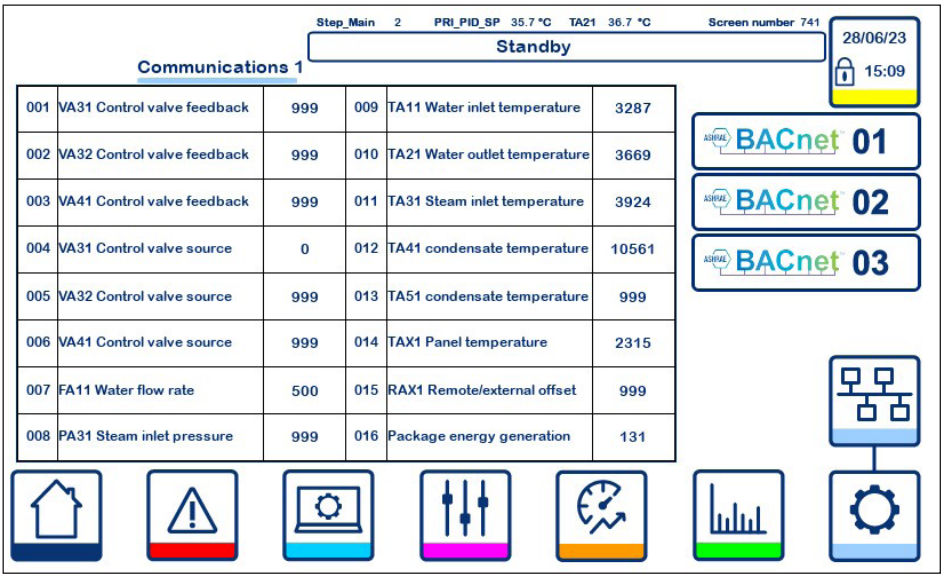
PROFINET 01

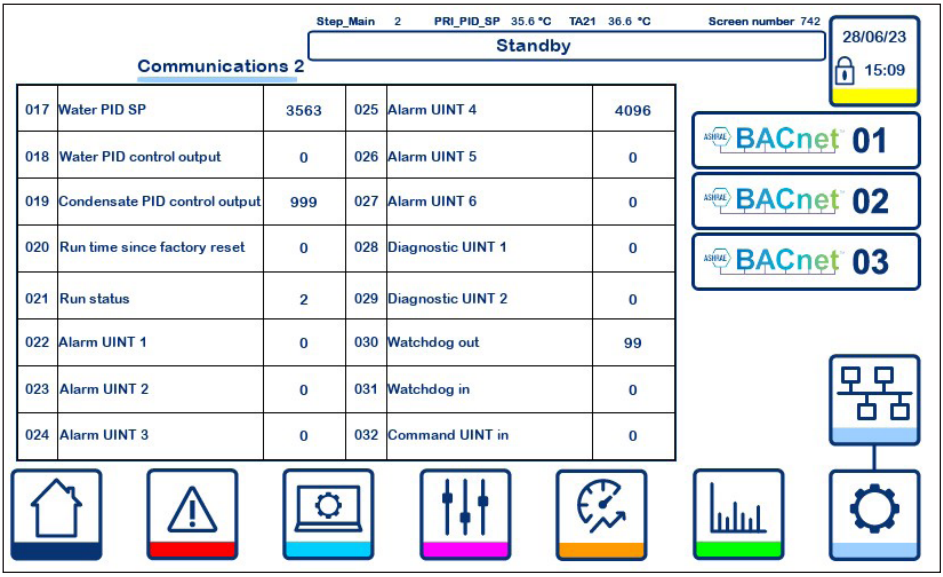
Modbus 01 Navigate to communications table (741-743).

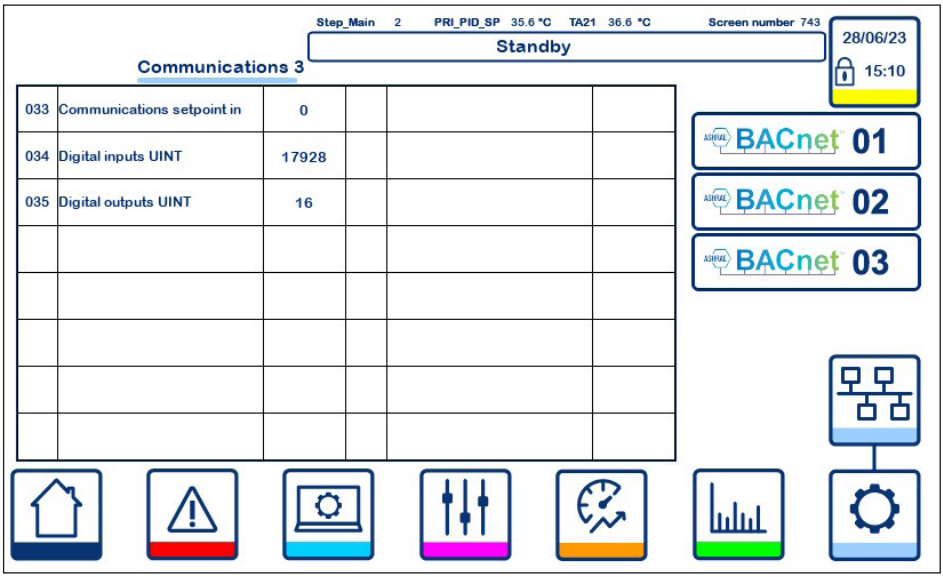
PROFIBUS 01

EtherNet/IP 01

9.4.33 741 - Communications 1
742 - Communications 2
743 - Communications 3



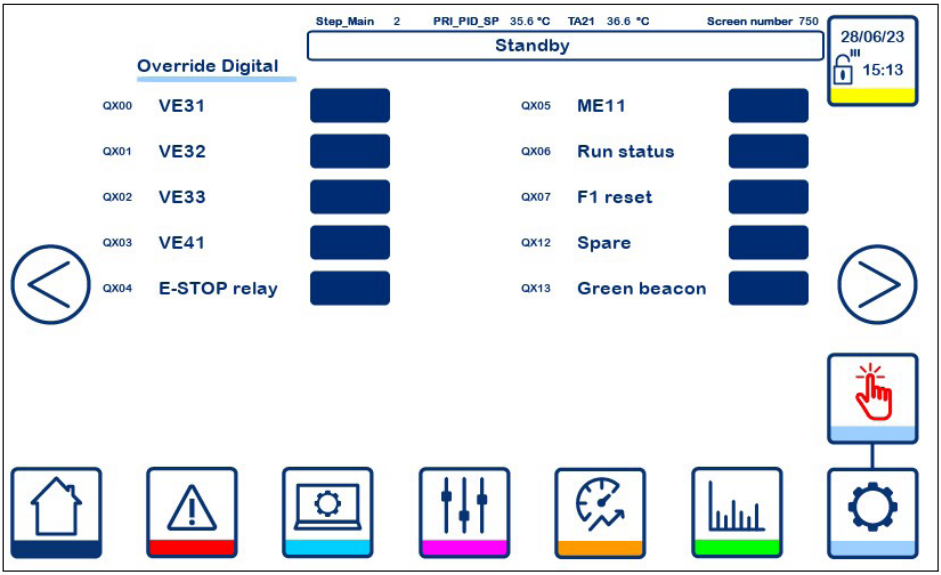


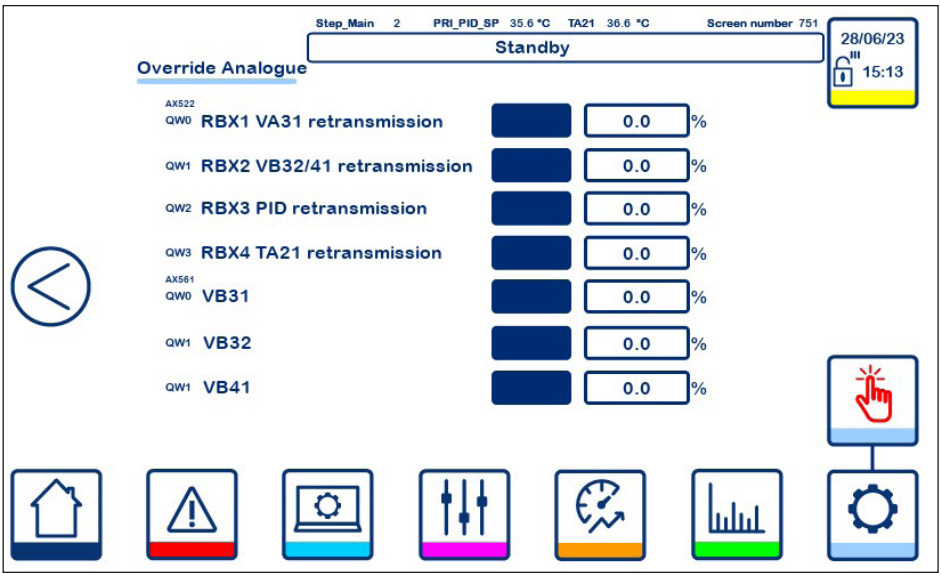


Displays actual values transmitted over the selected communications protocol.

Offset value of transmitted variable	Name of transmitted variable	Transmitted variable

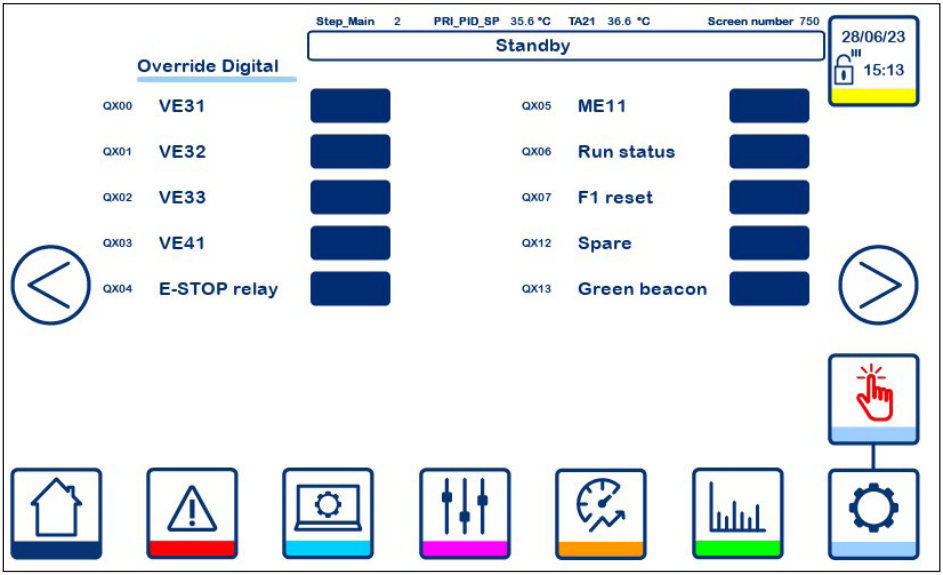
9.4.34 750 - Override Digital
751 - Override Analogue





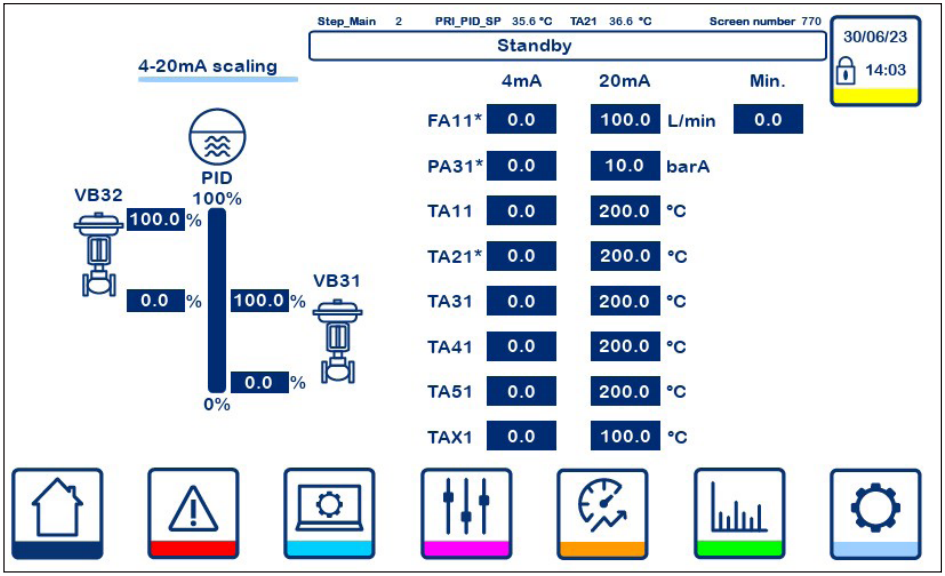
	Output override disabled.
	Output override enabled. Digital outputs will now operate.
 %	Analogue output value. Resets to 0% when override is disabled.

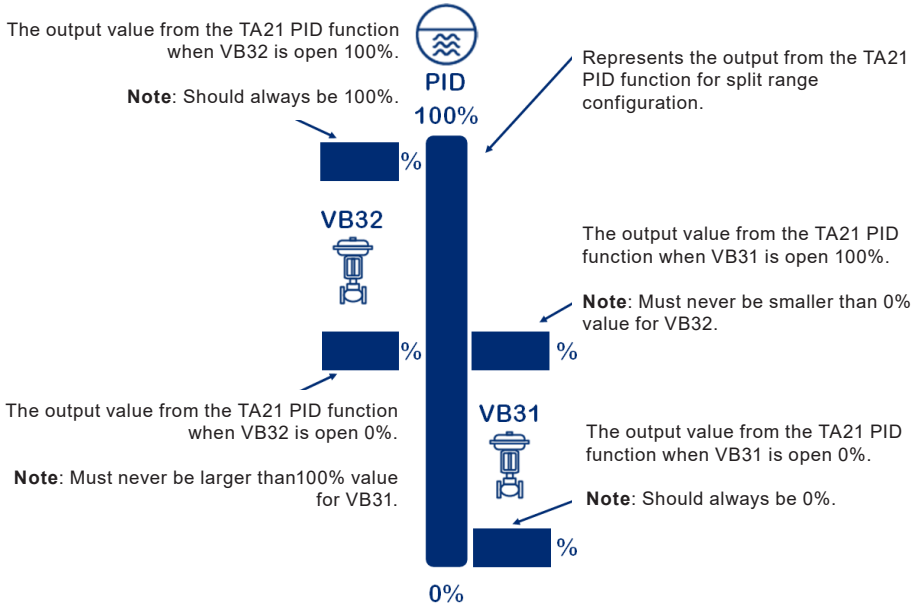
9.4.35 760 - Data



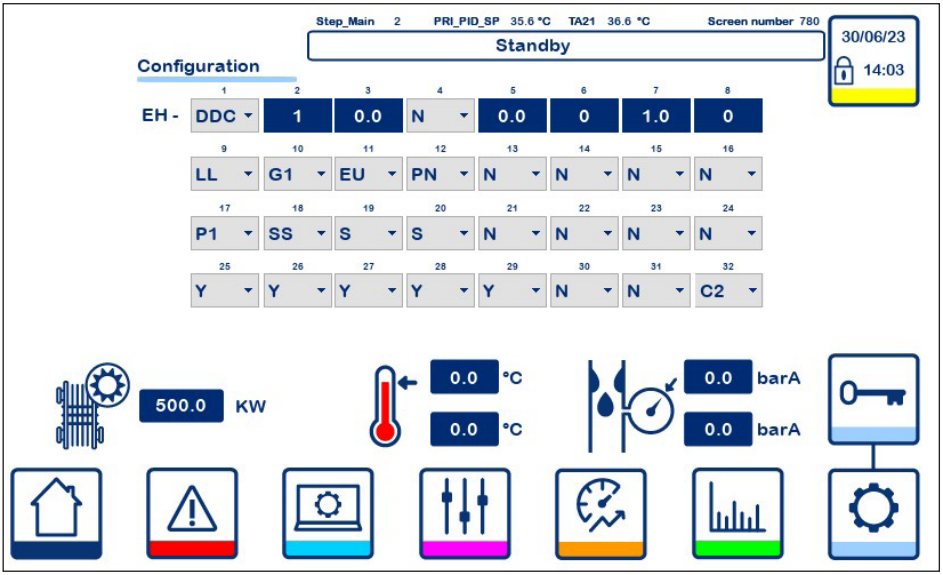
	Save current configuration to memory to recall later.
	Load configuration from memory to overwrite the current configuration.
	Download logged data to USB device. Background will change to **Grey** whilst downloading. Background will change to **Green** when complete. Background will change to **Red** if there is an error in the download process.
	Eject USB drive to avoid corruption of device.

9.4.36 770 - 4-20mA scaling





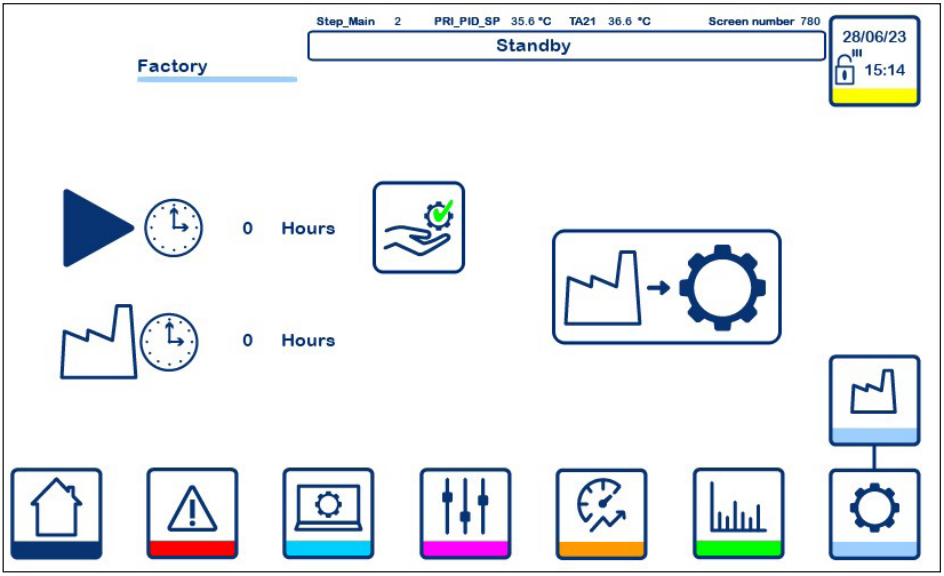
9.4.37 780 - Configuration



Using the nomenclature issued with the product, the 32 fields of the nomenclature code can be edited here if it was entered incorrectly or needs to be updated with changes in hardware.

	Design load limit.
	Upper and lower range for TA21 PID setpoint.
	Upper and lower range for PA31 Dual control PID setpoint.

9.4.38 790 - Factory



	Run time since last reset.
	Reset run timer.
	Total run time since first commissioning.
	Loads factory commissioned settings when held between 0.5 and 2 seconds. When held for over 6 seconds, ALL SETTINGS WILL BE DELETED including commissioned configuration. A full PLC and HMI reset will be required.

10. External monitoring and control

10.1 USB data

The following 14 data points are available to download from the HMI's data logging functionality. Each data point is instantaneously recorded once every 5 seconds for a total of 120,960 records (total of 1,693,440 records). When a data point reaches the maximum count, the oldest record is removed, and a new record is added.

- TA11 Return water temperature analogue input signal
- TA21 Outlet water temperature analogue input
- TA31 Temperature sensor - steam into HEX
- TA41 Pre-trap condensate temperature analogue input
- TA51 Post-trap condensate temperature analogue input
- PA31 Steam CV analogue position feedback
- FA11 Bypass water flow rate analogue input signal.
- Water PID setpoint
- Water PID control value
- VA31 Plant steam control valve analogue output (low flow).
- VA32 Split range CV analogue position feedback
- Condensate PID setpoint
- Condensate PID control value
- VA41 Condensate CV analogue position feedback

Note: When the trend data is full, the limited processing power of the HMI means that the download to the USB drive can take up to 10 minutes. Whilst downloading to USB the button will transition from grey (downloading) to green (download complete). If the button changes to red, the transfer encountered a problem and is incomplete or faulty.

10.2 Remote monitoring

The below values are able to be monitored directly from the outputs from the package and are accessible via terminals inside the control panel.

- VB31 Steam control valve source retransmission.
- VB32 Auxiliary steam control valve source retransmission or VB41 Condensate control valve source retransmission.
- Water PID setpoint retransmission.
- TA21 Water outlet temperature retransmission.
- Running status relay contact.
- Emergency stop status relay contact.

10.3 Communications monitoring

The following data points are available if a communications option is installed inside the package. The reference table for these data points are provided in annex B.

- All valve position feedbacks.
- All valve control values.
- All process values.
- Remote setpoint/external temperature offset.
- Generated Energy.
- Water PID setpoint.
- Water PID control value.
- Condensate PID control value.
- Run time (hours).
- Run status.
- All alarm statuses.
- All diagnostic statuses.
- All digital outputs.
- All digital inputs.
- Network control watchdog system.

Note: unless stated otherwise, all engineering units are metric and all timers in seconds.

10.4 Remote control

10.4.1 Remote run request

The Remote Run Request relay requires a 24V dc signal to be provided to the terminals (see EasiHeat IM-P565-10, Section 3.4.2). The request will only be accepted by the package when the following conditions have been met:

Condition	Required status
External control configuration	Remote Control
Run status	Standby mode (STEP_MAIN = 2)
Local override	Disabled
Stop Request Relay	De-energised

If the above conditions are not met, but the Run Request relay is energised, the command will not be accepted by the package. The relay must be de-energised until the above conditions are met before the command will be accepted.

10.4.2 Remote stop request

The Remote Stop Request relay requires a 24V dc signal to be provided to the terminals (see EasiHeat IM-P565-10, Section 3.4.2). The request will only be accepted by the EasiHeat-OS when the following conditions have been met:

Condition	Required status
External control configuration	Remote Control
Run status	Not in standby mode (STEP_MAIN ≠ 2)
Local override	Disabled

If the above conditions are not met, but the Stop Request relay is energised, the command will not be accepted by the package. The relay must be de-energised until the above conditions are met before the command will be accepted.

10.4.3 Communications run request

The communications run request is a bit included in the Command WORD (see Appendix B). The request will only be accepted by the package when the following conditions have been met:

Condition	Required status
External control configuration	Comms Control
Run status	Standby mode (STEP_MAIN = 2)
Local override	Disabled
Communications watchdog	Healthy

If the above conditions are not met, but the Run Request bit remains energised, the command will not be accepted by the package. The bit must be de-energised until the above conditions are met before the command will be accepted.

10.4.4 Communications stop request

The communications stop request is a bit included in the command WORD (see Appendix B). The request will only be accepted by the package when the following conditions have been met:

Condition	Required status
External control configuration	Comms Control
Run status	Not in standby mode (STEP_MAIN ≠ 2)
Local override	Disabled
Communications watchdog	Healthy

If the above conditions are not met, but the Stop Request bit remains energised, the command will not be accepted by the package. The bit must be de-energised until the above conditions are met before the command will be accepted.

10.4.5 Water set point

The water set point request is a UInt with the value multiplied by value stated in Appendix B. The request will only be accepted by the pacakge when the following conditions have been met:

Condition	Required status
External control configuration	Comms Control
Local override	Disabled
Communications watchdog	Healthy

If the above conditions are not met, the set point will not be accepted by the package.
Additionally, if the set point is outside the allowable limits for the package, the Remote Set point Limit Alarm will be triggered. This is an optional emergency stop and can be disabled in the Alarms Settings screen (270).

10.5 Communications watchdog

To ensure that correct control is being maintained by the external communications control, a watchdog system is employed.

Whilst the watchdog system is able to verify a valid connection, external communications controls are accepted by the package. If the watchdog system is not able to establish a valid connection, the Control Communication Failure Alarm will be triggered. This is an optional emergency stop and can be disabled in the Alarms Settings screen (270).

The watchdog system transmits a UInt value from the Watchdog Out parameter (See Appendix B). When this value is returned via the Watchdog Return parameter (See Appendix B), the watchdog system will validate the connection between the package and the external communications control.

If the Watchdog Return value does not match the Watchdog Out value, the Control Communication Failure Alarm will be triggered.

The Watchdog Out parameter will periodically change to continually monitor the connection. The external communications control has 5 seconds to return the new value. If the new Out value is not returned, the watchdog system will trigger the Control communication Failure Alarm.

11. Network

11.1 Network infrastructure

Network Components

Configuration	Component			
	PLC	HMI	Comms module	Router
Base Package	•	•		
Base Package + Digital	•	•		•
C1 BACnet IP	•	•	•	•
C2 Profinet	•	•	•	•
C3 Modbus TCP/IP	•	•		•
C4 BACnet MSTP	•	•	•	•
C5 Profibus	•	•	•	•
C6 Modbus RTU	•	•	•	•
C7 BACnet BTL IP	•	•	•	•
C8 BACnet BTL MSTP	•	•	•	•
C9 Ethernet/IP	•	•	•	•

11.2 Internal IP address

The following addresses are used within the closed network of the package. These are not editable and are not intended for external connections.

PLC	10.11.12.33
HMI	10.11.12.34
Comms module (PLC facing)	10.11.12.35
Router	10.11.12.36
Digital gateway	10.11.12.37
Comms module (Router facing, where applicable)	10.11.12.38

11.3 Default External Interface

- Ethernet Connections

DCHP client

- Serial Connections

Wired directly to the comms module and configured internally.

12. Communications modules

For each communications option selected, there is a corresponding communications module to integrate the package into the customer's network.

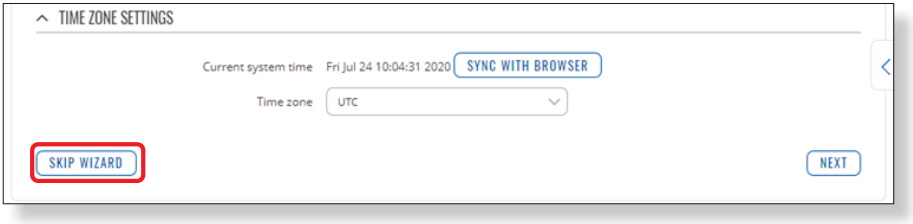
However, due to the inclusion of a routing network switch with dedicated WAN port, communications options C1, C2, C3, C6 and C8 do not require modification of their settings once they have been installed at the manufacturing centre.

12.1 C3 Modbus TCP/IP – Teltonika RUT300

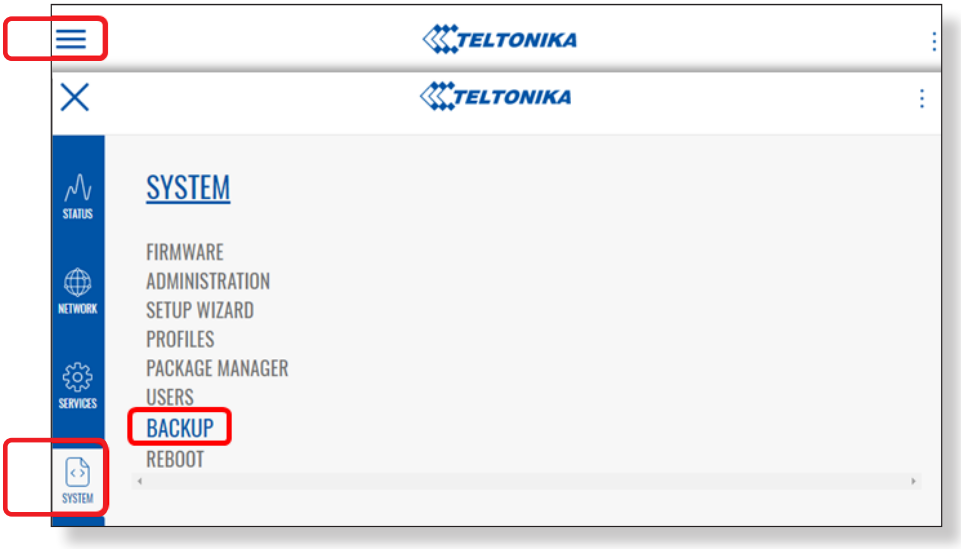
The backup file for the RUTX08 router is available from Spirax Sarco.

The Instruction manual for the router can be found here:
https://wiki.teltonika-networks.com/view/RUTX08_First_Start

Complete the First start procedure remembering to record the password.



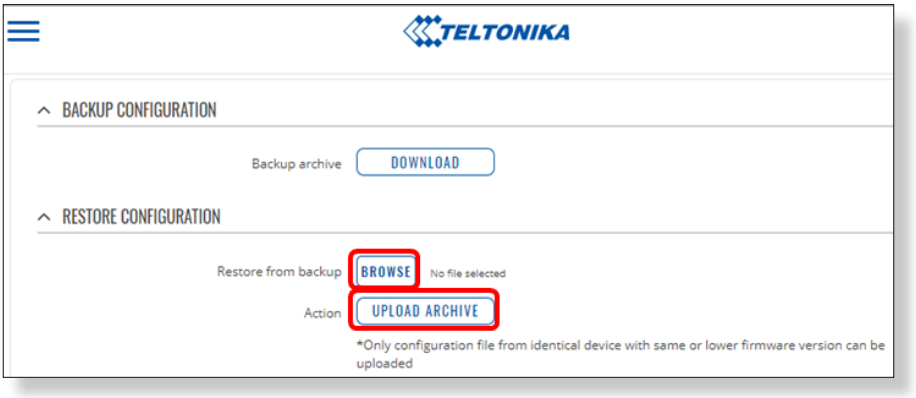
Skip the setup wizard when it appears



Open the menu at the top of the screen and select:System > Backup

Select browse and select the correct configuration file

Select Upload Archive



The router is now configured to receive it's network identification for a DCHP server.

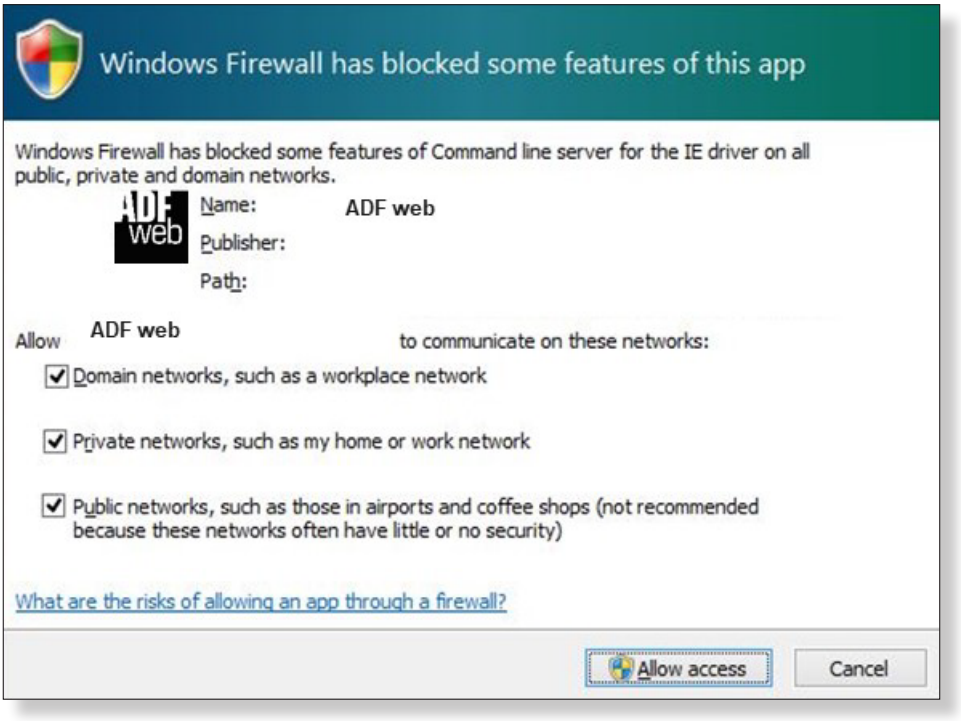
12.2 C4 BACnet MSTP - ADF™ HW67673-MSTP-A1

Software for the C4 option can be obtained from the ADF™ website.

Manual : http://www.adfweb.com/download/filefold/mn67673_eng.pdf
Software : http://www.adfweb.com/download/filefold/sw67673.zip

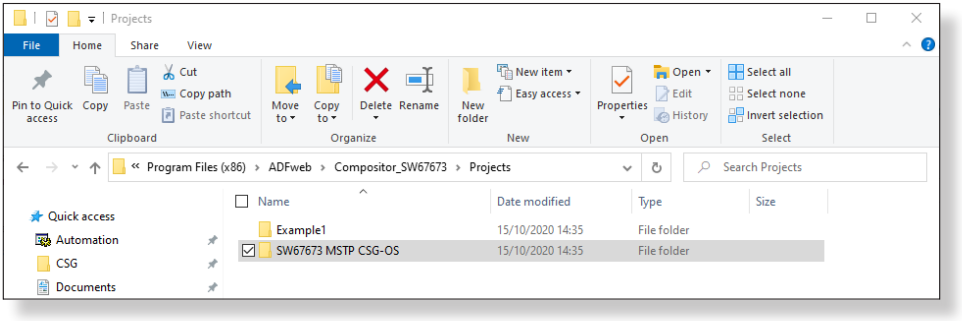
Follow the instructions for the installation of the software.

IMPORTANT : When opening the software for the first time, enable connection to public, private and domain networks.



Once the software is installed, the configuration for the CSG will need to be stored in the correct location. The configuration is available from Spirax Sarco.

The folder and its contents will need to be copied into the following folder:
C:\Program Files (x86)\ADFweb\Compositor_SW67673\Projects



Open the software and load the SW67673 MSTP CSG-OS configuration. The ‘Set communications’ button will allow users to edit the settings for the external connection.

Follow the software instructions and load the software into the module.

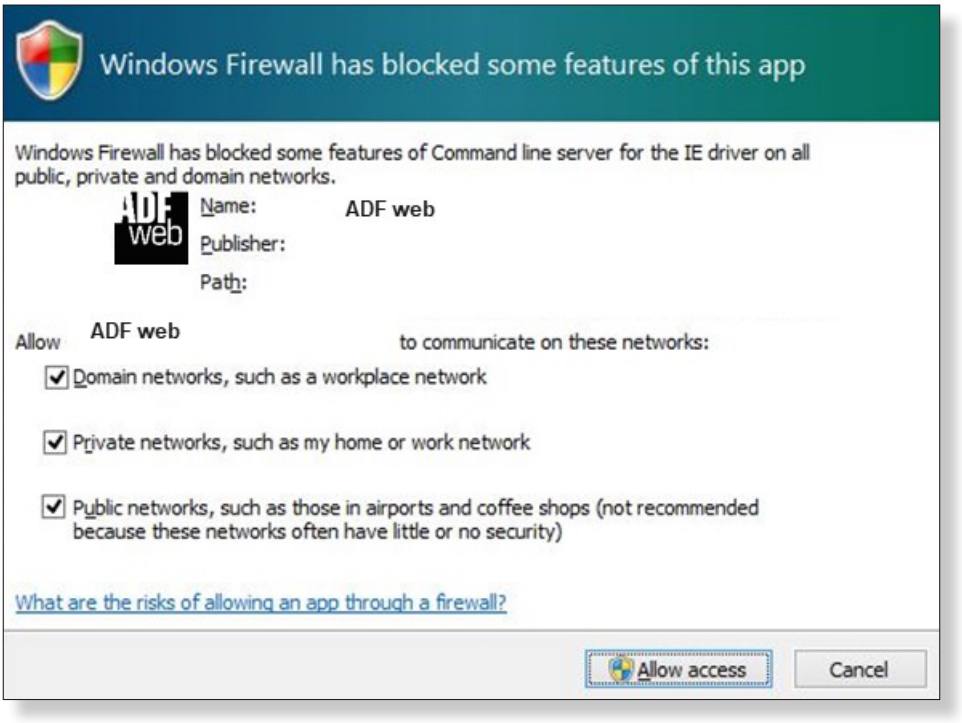
12.3 C5 Profibus - ADF™ HW67564-A1

Software for the C5 option can be obtained from the ADF™ website.

Manual : http://www.adfweb.com/download/filefold/mn67564_eng.pdf
Software : http://www.adfweb.com/download/filefold/sw67564.zip

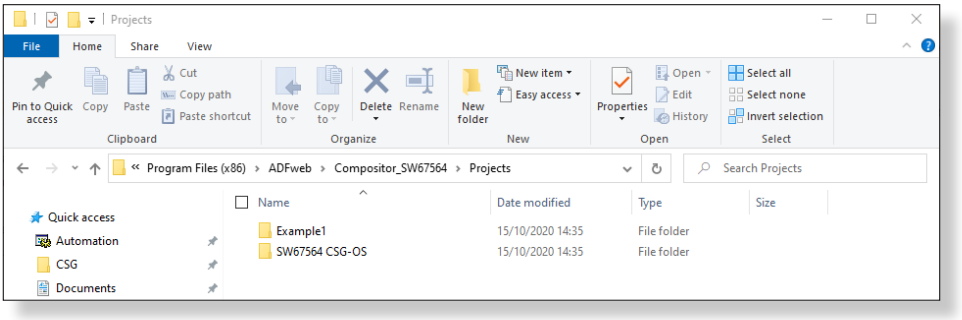
Follow the instructions for the installation of the software.

IMPORTANT : When opening the software for the first time, enable connection to public, private and domain networks.



Once the software is installed, the configuration for the CSG will need to be stored in the correct location. The configuration is available from Spirax Sarco.

The folder and its contents will need to be copied into the following folder:
C:\Program Files (x86)\ADFweb\Compositor_SW67564\Projects



Open the software and load the SW67564 CSG-OS configuration. The ‘Set communications’ button will allow users to edit the settings for the external connection.

Follow the software instructions and load the software into the module.

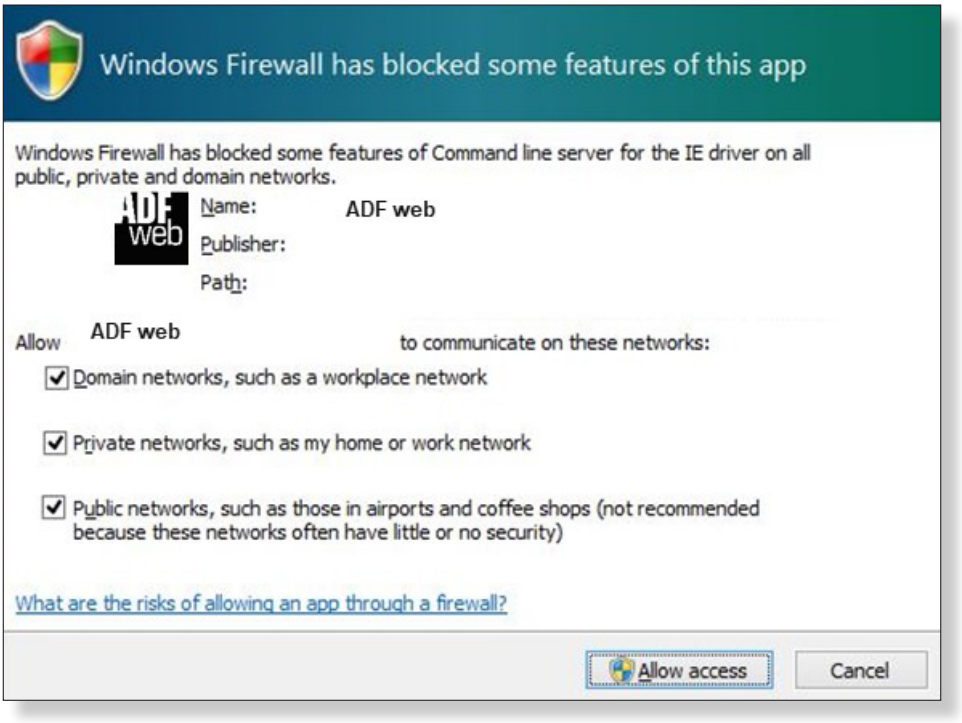
12.4 C6 Modbus RTU - ADF™ HW67510-A1

Software for the C6 option can be obtained from the ADF™ website.

Manual : **http://www.adfweb.com/download/filefold/mn67510_eng.pdf**
Software : **http://www.adfweb.com/download/filefold/sw67510.zip**

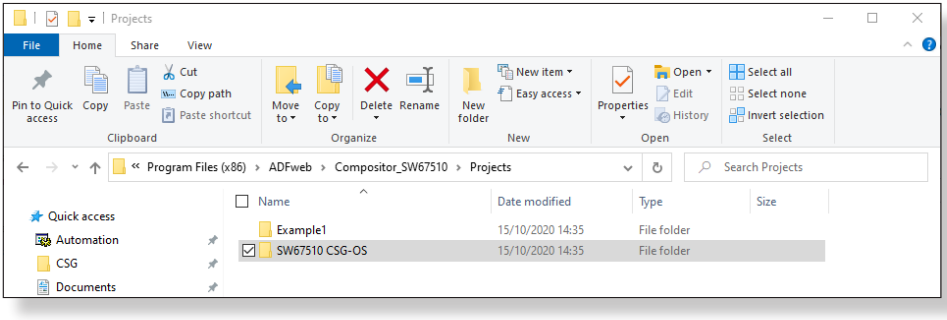
Follow the instructions for the installation of the software.

IMPORTANT : When opening the software for the first time, enable connection to public, private and domain networks.



Once the software is installed, the configuration for the CSG will need to be stored in the correct location. The configuration is available from Spirax Sarco.

The folder and its contents will need to be copied into the following folder:
C:\Program Files (x86)\ADFweb\Compositor_SW67510\Projects



Open the software and load the SW67510 CSG-OS configuration. The ‘Set communications’ button will allow users to edit the settings for the external connection.

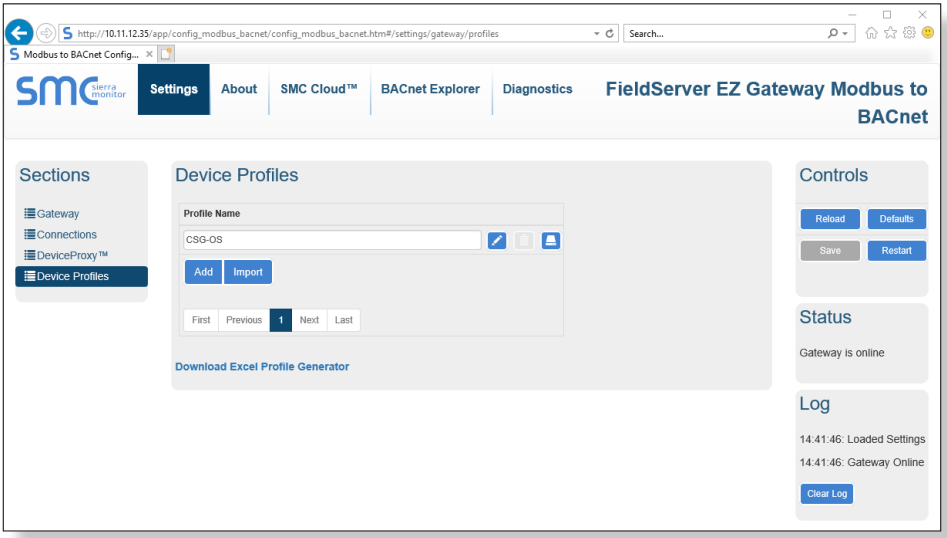
Follow the software instructions and load the software into the module.

12.5 C8 BACnet MSTP (BTL)

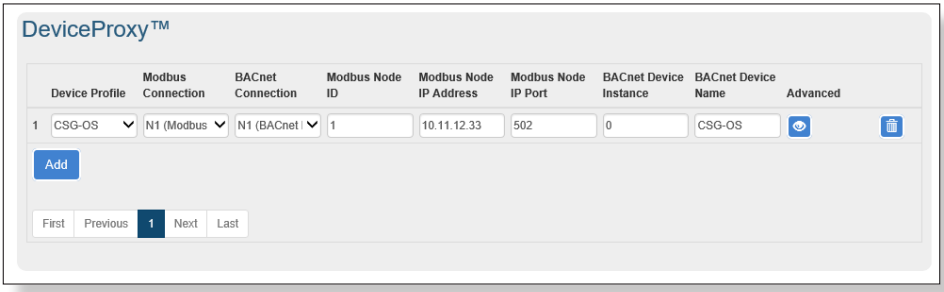
The manual for the C7 module can be found on the SMC website
https://www.sierramonitor.com/downloads/Start-Up_Guide-EZ_Gateway_Modbus_to_BACnet

Follow the instructions for connecting to the gateway via Ethernet (Section 5.1) and reaching the Web Configurator GUI (Section 5.2).

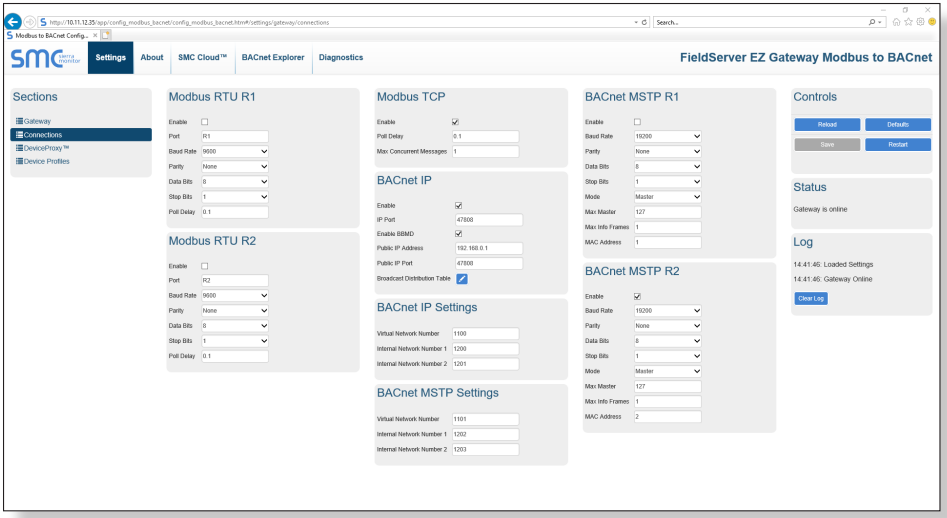
Navigate to the Device Profiles (section 6.2) and select the Import button to load the CSG-OS profile. The profile for the C7 module is available from Spirax Sarco.



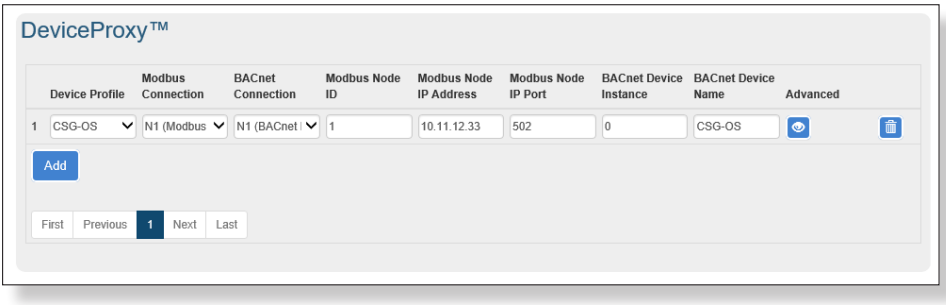
Navigate to the DeviceProxy and input the below settings into the C7 module.



Navigate to the Connections settings (section 6.1) and modify BACnet MSTP R1 section to suit the external connection requirements.



Navigate to the DeviceProxy and input the below settings into the C7 module.



Once the device profile has been loaded, use the Save button to restart the module with the new settings loaded.

13. Appendix

Appendix A

Diagnostic and I/O spreadsheet

Diagnostic	Inputs						
	Temperature				Pressure	Flow	Valve feedback
	TA11	TA31	TA41	TA51	PA31	FA11	
Dual control			•		•		
Sequenced shutdown	•						
Flow forward controls						•	
Thermal forward controls	•						
Integrity test		•			•		Suggested [1]
Control valve position alarm							Suggested [1]
Condensate control	•		•				
Low standing load alarm	Optional [2]					Optional [2]	Suggested [1]
Design load limit alarm	Optional [2]					Optional [2]	Suggested [1]
Water supply failure						•	
Steam supply failure					•		
Trap failure			•	•	•	•	
Condensate temperature alarm			•				

[1] **Suggested:** Improves the accuracy of the diagnostic function if fitted.

[2] **Optional:** Activates the design load limit alarm to use energy load calculation.

Appendix B

Communications data registers

Output				
Register	**Designation**	**type**	**Comment**	**Scale**
1		Uint	VA31 Steam control valve feedback	x100
2		Uint	VA32 Auxiliary steam control valve feedback	x100
3		Uint	VA41 Condensate control valve feedback	x100
4		Uint	VB31 Steam control valve source	x100
5		Uint	VB32 Auxiliary steam control valve source	x100
6		Uint	VB41 Condensate control valve source	x100
7		Uint	FA11 Water inlet flow rate	x10
8		Uint	PA31 Steam inlet pressure	x100
9		Uint	TA11 Water inlet temperature	x100
10		Uint	TA21 Water outlet temperature	x100
11		Uint	TA31 Steam inlet temperature	x100
12		Uint	TA41 Pre-trap condensate temperature	x100
13		Uint	TA51 Post-trap condensate temperature	x100
14		Uint	TAX1 Panel temperature	x100
15		Uint	RAX1 Remote setpoint/External temperature offset	x100
16		Uint	Package energy generation	x10
17		Uint	Water PID setpoint	x100
18		Uint	Water PID control output value	x100
19		Uint	Condensate PID control output value	x100
20		Uint	Run time since Factory Reset (hrs)	x1
21		Uint	Run status	x1

Register	Designation	type	Comment
22		Uint	Alarms 1
	.0	Bool	Alarm 1-0 Water in temperature Analog input alarm circuit open
	.1	Bool	Alarm 1-1 Water in temperature Analog input alarm short circuit
	.2	Bool	Alarm 1-2 Clean steam temperature Analog input alarm circuit open
	.3	Bool	Alarm 1-3 Clean steam temperature Analog input alarm short circuit
	.4	Bool	Alarm 1-4 Supply steam temperature Analog input alarm circuit open
	.5	Bool	Alarm 1-5 Supply steam temperature Analog input alarm short circuit
	.6	Bool	Alarm 1-6 Supply waste temperature Analog input alarm circuit open
	.7	Bool	Alarm 1-7 Supply waste temperature Analog input alarm short circuit
	.8	Bool	Alarm 1-8 Condensate out temperature Analog input alarm circuit open
	.9	Bool	Alarm 1-9 Condensate out temperature Analog input alarm short circuit
	.10	Bool	Alarm 1-10 Panel temperature analogue input alarm circuit open
	.11	Bool	Alarm 1-11 Panel temperature analogue input alarm short circuit
	.12	Bool	Alarm 1-12 Remote setpoint analogue input alarm circuit open
	.13	Bool	Alarm 1-13 Remote setpoint analogue input alarm short circuit
	.14	Bool	Alarm 1-14 Spare AI07 analogue input alarm circuit open
	.15	Bool	Alarm 1-15 Spare AI07 analogue input alarm short circuit

Output - continued on next page

Register	Designation	type	Comment
23		Uint	Alarms 2
	.0	Bool	Alarm 2-0 Supply steam in control valve feedback Analog input alarm circuit open
	.1	Bool	Alarm 2-1 Supply steam in control valve feedback Analog input alarm short circuit
	.2	Bool	Alarm 2-2 Supply steam in control valve feedback Analog input alarm circuit open
	.3	Bool	Alarm 2-3 Supply steam in control valve feedback Analog input alarm short circuit
	.4	Bool	Alarm 2-4 Supply steam in control valve feedback Analog input alarm circuit open
	.5	Bool	Alarm 2-5 Supply steam in control valve feedback Analog input alarm short circuit
	.6	Bool	Alarm 2-6 Feedwater flow rate Analog input alarm circuit open
	.7	Bool	Alarm 2-7 Feedwater flow rate temperature Analog input alarm short circuit
	.8	Bool	Alarm 2-8 Supply steam in pressure Analog input alarm circuit open
	.9	Bool	Alarm 2-9 Supply steam in pressure Analog input alarm short circuit
	.10	Bool	Alarm 2-10 E-stop PB
	.11	Bool	Alarm 2-11 Steam in control feedback error
	.12	Bool	Alarm 2-12 Feedwater control feedback error
	.13	Bool	Alarm 2-13 Feedwater control feedback error
	.14	Bool	Alarm 2-14 Plant isolation valve fail open
	.15	Bool	Alarm 2-15 Plant isolation valve fail close

Output - continued on next page

Register	Designation	type	Comment
		Uint	Alarms 3
	.0	Bool	Alarm 3-0 Plant isolation valve fail stuck
	.1	Bool	Alarm 3-1 Plant isolation valve fail opening speed
	.2	Bool	Alarm 3-2 Test air isolation valve fail open
	.3	Bool	Alarm 3-3 Test air isolation valve fail close
	.4	Bool	Alarm 3-4 Test air isolation valve fail stuck
	.5	Bool	Alarm 3-5 Test air isolation valve fail opening speed
	.6	Bool	Alarm 3-6 Condensate isolation valve fail open
24	.7	Bool	Alarm 3-7 Condensate isolation valve fail close
	.8	Bool	Alarm 3-8 Condensate isolation valve fail stuck
	.9	Bool	Alarm 3-9 Condensate isolation valve fail opening speed
	.10	Bool	Alarm 3-10 Integrated high limit alarm
	.11	Bool	Alarm 3-11 Independent high limit alarm
	.12	Bool	Alarm 3-12 IHL setting error
	.13	Bool	Alarm 3-13 Air supply pressure fail
	.14	Bool	Alarm 3-14 Smart fuse trip
	.15	Bool	Alarm 3-15 Panel temperature limit alarm
		Uint	Alarms 4
	.0	Bool	Alarm 4-0 Customer water supply failure
	.1	Bool	Alarm 4-1 Primary pressure low alarm
	.2	Bool	Alarm 4-2 Trap failure close
	.3	Bool	Alarm 4-3 Trap failure open
	.4	Bool	Alarm 4-4 HMI communications fault
	.5	Bool	Alarm 4-5 Communication Watchdog
	.6	Bool	Alarm 4-6 Communications setpoint high limit
25	.7	Bool	Alarm 4-7 Communications setpoint low limit
	.8	Bool	Alarm 4-8 Water PID band HIGH alarm
	.9	Bool	Alarm 4-9 Water PID band LOW alarm
	.10	Bool	Alarm 4-10 Water PID Undersize alarm
	.11	Bool	Alarm 4-11 Condensate temperature limit alarm
	.12	Bool	Alarm 4-12 Cold negative leak test alarm
	.13	Bool	Alarm 4-13 Cold positive leak test alarm
	.14	Bool	Alarm 4-14 Cold positive test max count
	.15	Bool	Alarm 4-15 Condensate PID band HIGH alarm

Output - continued on next page

Register	Designation	type	Comment
		Uint	Alarms 5
	.0	Bool	Alarm 5-0 Condensate PID band LOW alarm
	.1	Bool	-
	.2	Bool	Alarm 5-2 Water PID oversize alarm
	.3	Bool	Alarm 5-3 UPS Fault alarm
	.4	Bool	Alarm 5-4 Power supply failure
	.5	Bool	-
	.6	Bool	-
26	.7	Bool	-
	.8	Bool	-
	.9	Bool	-
	.10	Bool	-
	.11	Bool	-
	.12	Bool	-
	.13	Bool	-
	.14	Bool	-
	.15	Bool	-
		Uint	Alarms 6
	.0	Bool	-
	.1	Bool	-
	.2	Bool	-
	.3	Bool	-
	.4	Bool	-
	.5	Bool	-
	.6	Bool	-
27	.7	Bool	-
	.8	Bool	-
	.9	Bool	-
	.10	Bool	-
	.11	Bool	-
	.12	Bool	-
	.13	Bool	-
	.14	Bool	-
	.15	Bool	-

Output - continued on next page

Register	Designation	type	Comment
		Uint	Diagnostics 1
	.0	Bool	Diag 1-0 Water inlet temperature hazardous
	.1	Bool	Diag 1-1 Water outlet temperature hazardous
	.2	Bool	Diag 1-2 Steam temperature hazardous
	.3	Bool	Diag 1-3 Condensate pre-trap temperature hazardous
	.4	Bool	Diag 1-4 Condensate post-trap temperature hazardous
	.5	Bool	Diag 1-5 Steam pressure hazardous
	.6	Bool	Diag 1-6 Water flow hazardous
28	.7	Bool	Diag 1-7 VB31 Steam valve position hazardous
	.8	Bool	Diag 1-8 VB32 Auxiliary steam valve position hazardous
	.9	Bool	Diag 1-9 VB41 Condensate valve position hazardous
	.10	Bool	Diag 1-10 VE31 Steam isolation valve position hazardous
	.11	Bool	Diag 1-11 VE32 Test air isolation valve position hazardous
	.12	Bool	Diag 1-12 VE41 Condensate isolation valve position hazardous
	.13	Bool	Diag 1-13 Water PID band low alert
	.14	Bool	Diag 1-14 Water PID band high alert
	.15	Bool	Diag 1-15 Water PID undersize alert
		Uint	Diagnostics 2
	.0	Bool	Diag 2-0 Condensate PID band low alert
	.1	Bool	Diag 2-1 Condensate PID band high alert
	.2	Bool	Diag 2-2 Condensate PID undersize alert
	.3	Bool	Diag 2-3 Isolation valve anti-binding sequence
	.4	Bool	Diag 2-4 Smart fuse warning at 90% capacity
	.5	Bool	Diag 2-5 Package oversize alert
	.6	Bool	Diag 2-6 Initialisation
29	.7	Bool	Diag 2-7 E-stop reset hold
	.8	Bool	Diag 2-8 Flow forward high demand control enabled
	.9	Bool	Diag 2-9 Flow forward low demand control enabled
	.10	Bool	Diag 2-10 Thermal forward high demand control enabled
	.11	Bool	Diag 2-11 Thermal forward low demand control enabled
	.12	Bool	-
	.13	Bool	-
	.14	Bool	-
	.15	Bool	-

Output - continued on next page

Register	Designation	type	Comment	Scale
30		Uint	Command watchdog out	x1
		Uint	Digital Inputs	
	.0	Bool	E-stop (NC)	
	.1	Bool	Reset button (NO)	
	.2	Bool	Digital fuse capacity alert (NO)	
	.3	Bool	Digital fuse alarm (NO)	
	.4	Bool	External start request (NO)	
	.5	Bool	External stop request (NO)	
	.6	Bool	VD31 Supply Isolation valve open (NO)	
34	.7	Bool	VD32 Supply Isolation valve closed (NO)	
	.8	Bool	VD33 Test, air isolation valve open (NO)	
	.9	Bool	VD34 Test, air isolation valve closed (NO)	
	.10	Bool	VD41 Test, condensate isolation valve open (NO)	
	.11	Bool	VD42 Test, condensate isolation valve closed (NO)	
	.12	Bool	PDX1 Air supply switch (NO)	
	.13	Bool	Elec actuator/UPS error (NO)	
	.14	Bool	Independent high limit (NO)	
	.15	Bool	UPS Discharging (NO)	
		Uint	Digital Outputs	
	.0	Bool	VE31 Steam isolation valve	
	.1	Bool	VE32 Test, air isolation valve	
	.2	Bool	VE33 Test, air vent valve	
	.3	Bool	VE41 Test, condensate isolation valve	
	.4	Bool	High Limit alarm	
	.5	Bool	ME11 Pump run	
	.6	Bool	KEX1 External Run status	
35	.7	Bool	Fuse reset	
	.8	Bool	KEX2 Blue beacon	
	.9	Bool	KEX3 Green beacon	
	.10	Bool		
	.11	Bool		
	.12	Bool		
	.13	Bool		
	.14	Bool		
	.15	Bool		

Input				
Register	**Designation**	**type**	**Comment**	**Scale**
31		Uint	Command watchdog return	x1
		Uint	Command word	
	.0	Bool	Communications control Start	
	.1	Bool	Communications control Stop	
	.2	Bool	spare	
	.3	Bool	spare	
	.4	Bool	spare	
	.5	Bool	spare	
	.6	Bool	spare	
32	.7	Bool	spare	
	.8	Bool	spare	
	.9	Bool	spare	
	.10	Bool	spare	
	.11	Bool	spare	
	.12	Bool	spare	
	.13	Bool	spare	
	.14	Bool	spare	
	.15	Bool	spare	
33		INT	Remote clean steam pressure set-point	x100