



User Guide

FreeCool : Free Cooling unit V1.1

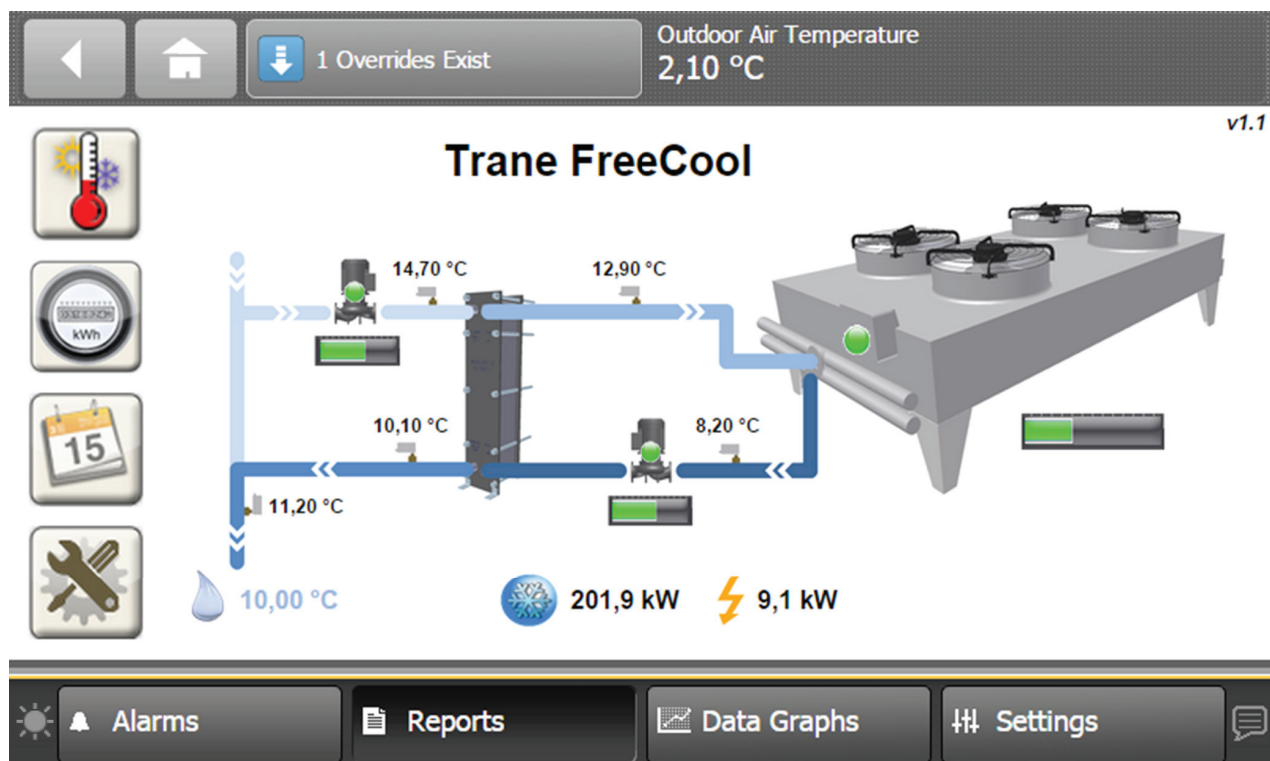


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Introduction

Foreword

These instructions are given as a guide to good practice in the use of the Trane FreeCool free cooling unit. They do not contain the full service procedures necessary for the continued successful operation of this equipment. The services of a qualified service technician should be employed, through the medium of a maintenance contract with a reputable service company.

Warranty

Warranty is based on the general terms and conditions of the manufacturer. The warranty is void if the equipment is modified or repaired without the written approval of the manufacturer, if the operating limits are exceeded, or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance, or failure to comply with the manufacturer's instructions, is not covered by the warranty obligation. If the user does not conform to the instructions given in this document, it may entail cancellation of warranty and liabilities by the manufacturer.

General features

The operation of the Trane FreeCool application is based on:

- A Trane Tracer™ UC600 microprocessor control board, housed inside the electrical panel, integrating all the different preprogrammed functions to operate the free cooling system.
- A Trane Tracer™ XM70 extension module with additional inputs and outputs.
- A Trane Tracer™ TD7 graphic user interface allowing the user to interact with the system.

The preprogrammed functions integrated in the controller are:

- **Operation of the free cooling system**

The system determines whether all conditions are met to operate free cooling efficiently, before enabling or disabling free cooling operation.

- **Speed control of the components**

The system determines the optimum speed for the dry cooler fans and for the pumps.

- **External control and setpoint**

The system can be enabled and its setpoint defined from an outside source, including through communication.

- **Maximum capacity information**

The system determines whether the unit has reached its maximum free cooling capacity. This information can be used by the chiller controllers or a chiller plant control system to enable or disable chillers.

- **Freeze prevention**

Upon detecting a risk of freezing, the system takes measures such as starting or stopping pumps.

- **Schedule**

A schedule can be defined to enable/disable the FreeCool operation.

- **Alarm management**

A system fault is indicated by the pilot light and on the screen display. It can also be reported remotely (if wired).

- **Energy metering**

The energy production and consumption measured are computed and shown to the user on different performance screens and on trending charts.

- **Cooling system total flow and required capacity**

Based on the available sensors, the system calculates in real time the total flow in the chiller plant and its required cooling capacity based on the active setpoint. This information is shown to the user.

Some of these functions require a number of parameters to be set at startup to manage the specific conditions of the chiller plant system that is controlled.

Benefits of applying free cooling include:

- **Lower utility costs:**

The efficiency of a free cooling system that uses “free” low ambient temperatures is several times higher than that of a chiller.

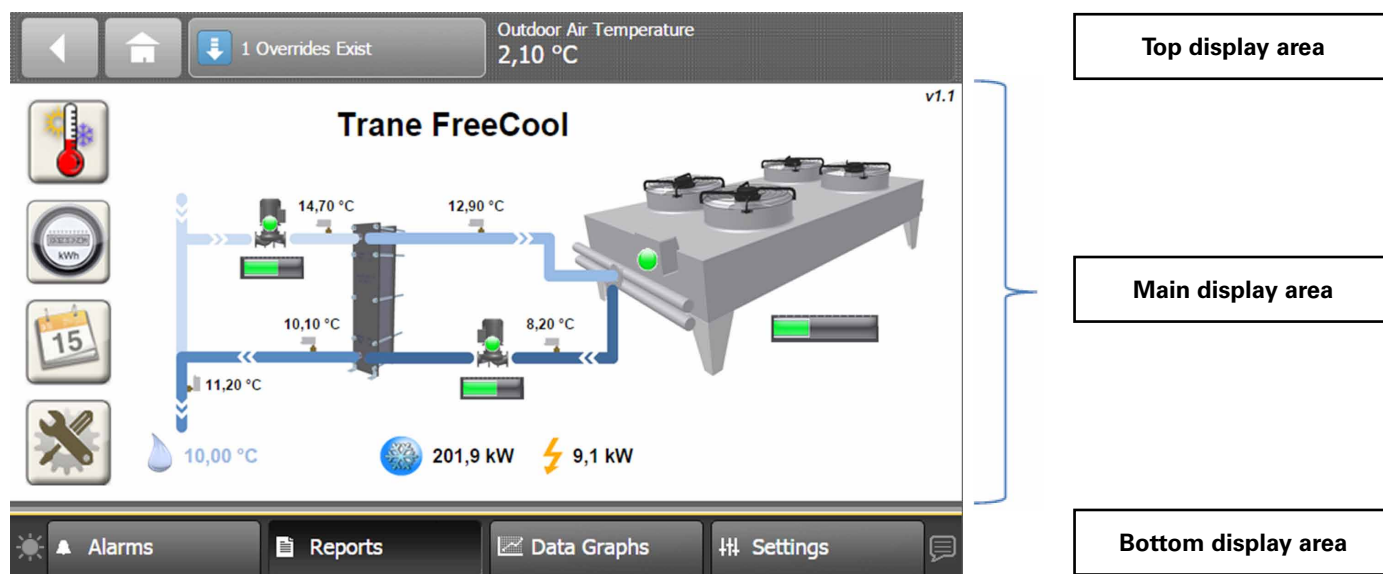
- **Reduced maintenance, less wear and longer lifetime of chillers:**

Through reduced operating hours and chiller compressor stress.

User interface

The user interface is a 7-inch colour touchscreen display mounted on the FreeCool panel.

Figure 1 - User Interface Description





The screen includes three distinct areas:


- Top display area
- Main display area
- Bottom display area

The top and bottom areas are displayed on all of the user screens.


Top display area

-  Left arrow button: returns to the last visited screen.
-  Home button: navigates to the Main screen.
- Overrides button: summarizes the current number of user overrides.

Bottom display area

-  Sun icon: controls the brightness level of the display
- **Alarms** button: navigates to the Alarms screen. When an alarm is present, this button flashes red. Use this function to review alarms.
- **Reports** button: navigates to the Reports screen. This button is not used for common usage of the Trane FreeCool.
- **Data graphs** button: opens the Data Graphs screen to view data logs in graphical format. Use this function to view data trends that are defined in the Trane FreeCool. *Refer to the relevant chapter about the available trends.*

Settings button: navigates to the Settings screen to access settings for UC600 and TD7. This function is not needed for common usage of the Trane FreeCool.

-  Dialog button: navigates to the Language selection screen. This function is not needed for common usage of the Trane FreeCool.

The top and bottom display areas are displayed on all user screens.

Main display area

The center area is the main display area. Data in this area will differ based on the user navigation. *Refer to the next section for more details.*

User screens

The user can navigate to different screens to view or set information. From any screen, press the Home button


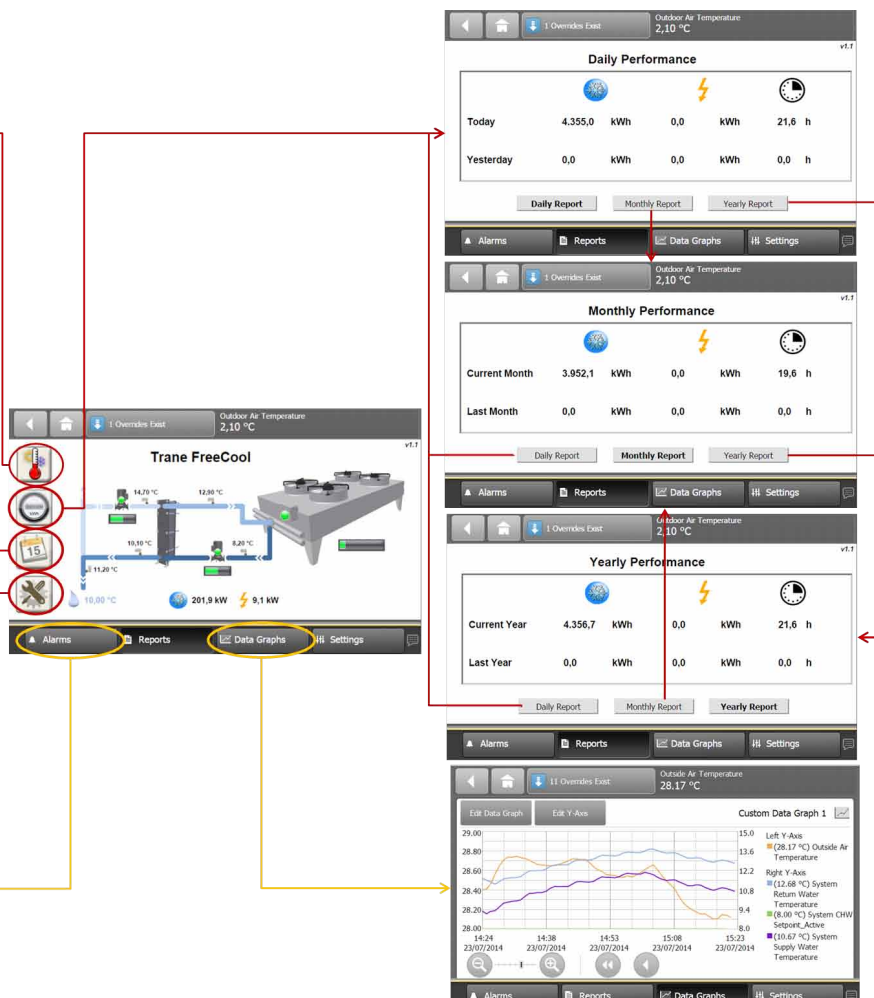
 to navigate back to the main screen.

Figure 2 - Navigation overview



Navigation overview

The synoptic below illustrates how to navigate among the different screens of the FreeCool application.



User screens

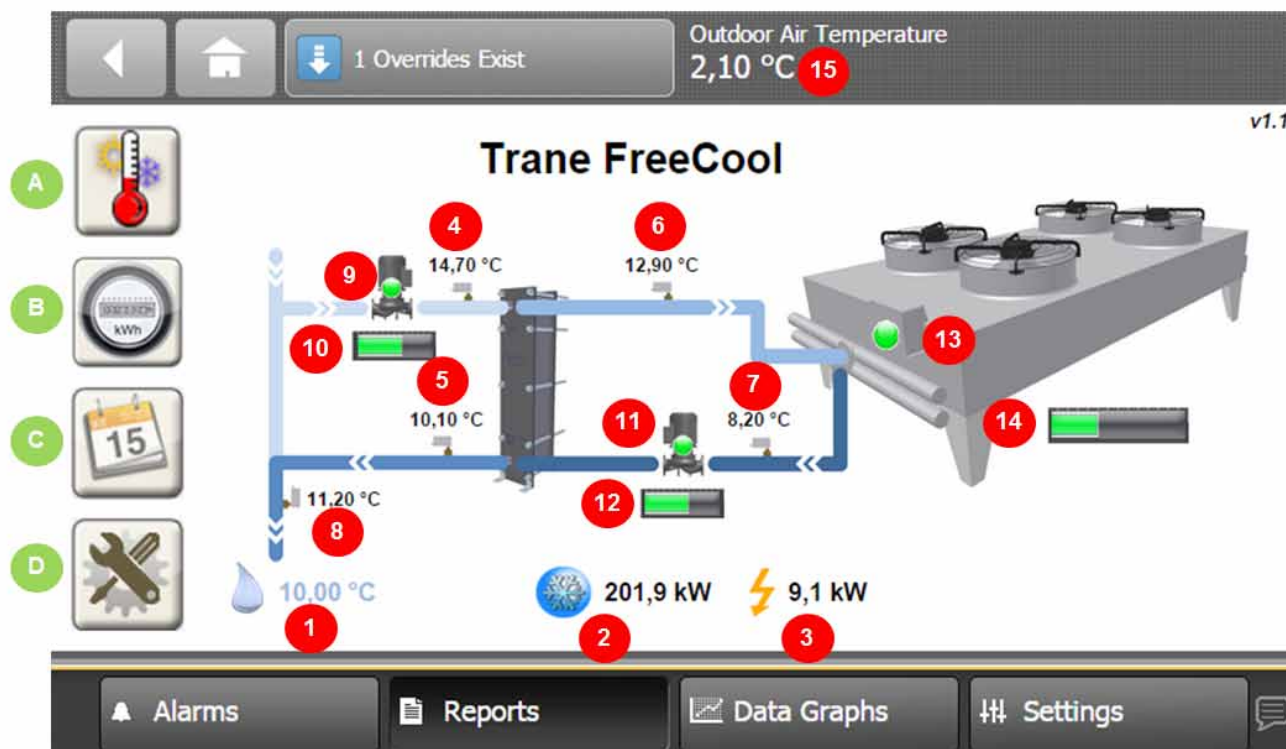
Main screen

This Main screen displays the main operation parameters of the Free Cooling unit.

The main components of the unit are represented:

- Dry Cooler
- Heat Exchanger separating the primary side (dry cooler) from the secondary side (cooling system)
- Primary and Secondary Pumps

Figure 3 - Main screen



The following information is displayed:

1. Setpoint for the chiller plant mixing temperature.
2. Free cooling capacity produced
3. Electrical total power input
4. Heat exchanger secondary inlet temperature
5. Heat exchanger secondary outlet temperature
6. Dry cooler inlet temperature
7. Dry cooler outlet temperature
8. System Mixing Water Temperature
9. Operation or fault of the secondary pump
10. Relative speed of the secondary pump
11. Operation or fault of the primary pump
12. Relative speed of the primary pump
13. Operation or fault of the dry cooler
14. Relative speed of the dry cooler
15. Ambient air temperature

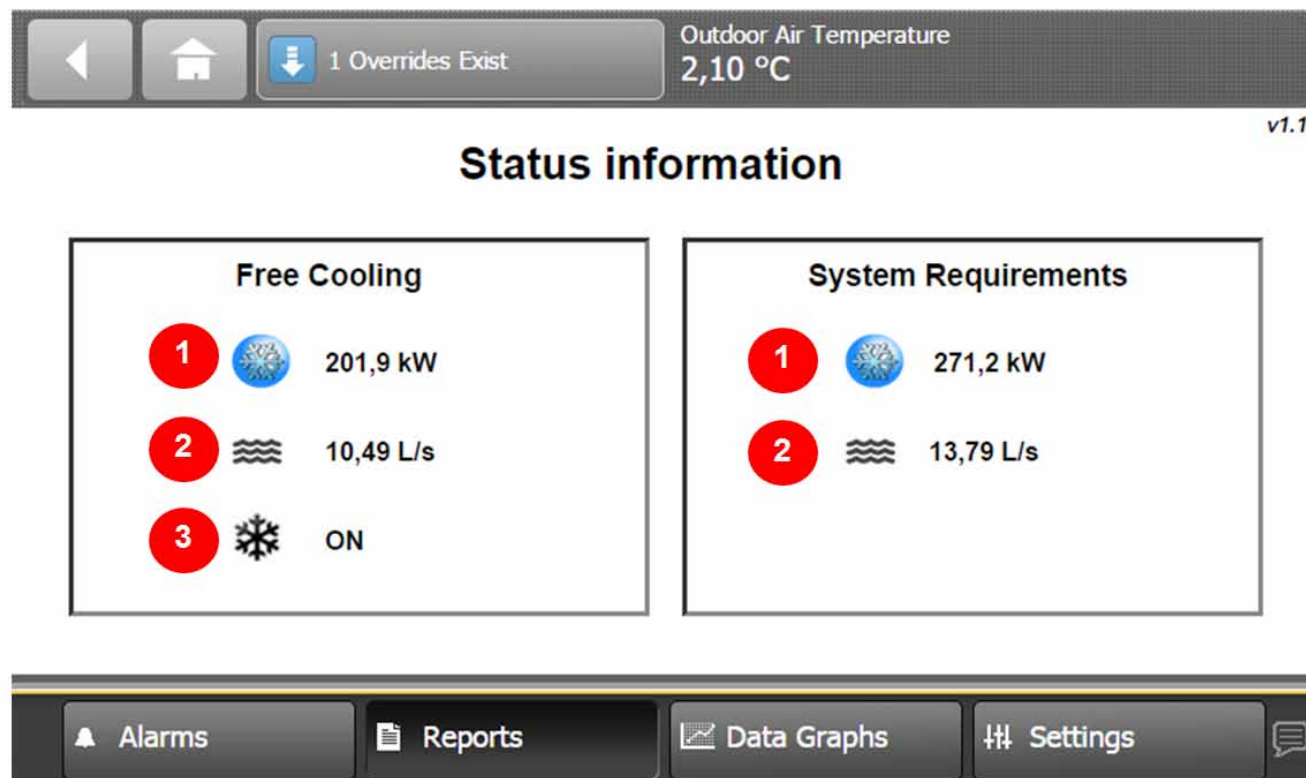
Four icons on the left-hand side of the screen enable to access to the following screens:

- A. Status information
- B. Energy metering screens (Daily, monthly and yearly performance)
- C. Schedule screen
- D. User settings screen

User screens

Status information

Figure 4 - Status information screen



This Status information screen displays additional information about the Free cooling unit and the cooling system:

Free cooling - on the FreeCool unit:

1. Free cooling capacity produced
2. Chilled water flow measured on the secondary side (cooling system side)
3. On / off status of the electrical trace heating (the trace heating is turned on by a thermostat that is independent from the controls system)

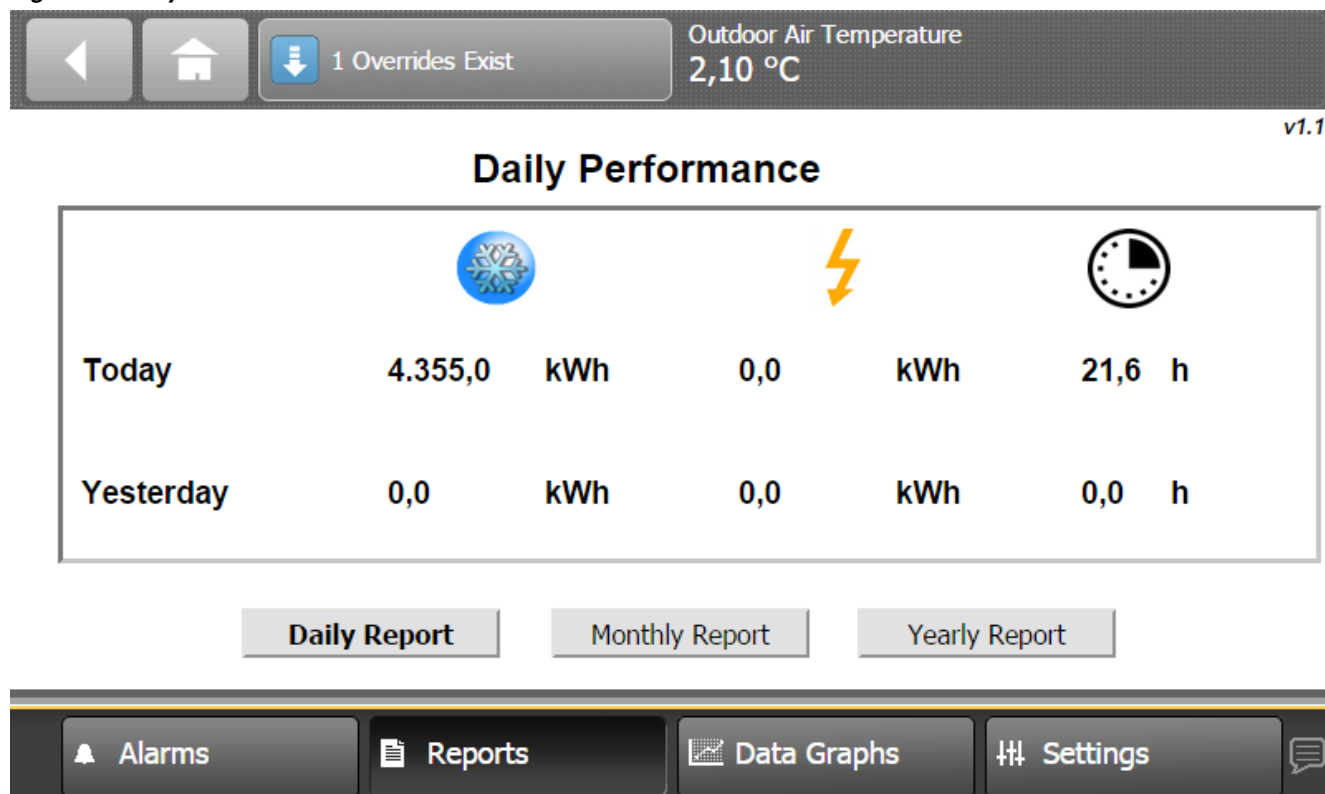
System requirements - on the cooling system:

1. Calculated total required capacity
2. Calculated chilled water flow

These parameters are calculated based on the available temperature and flow measures and on the active chilled water setpoint.

Energy Metering

Figure 5 - Daily Performance screen



The energy metering screens display the following parameters over a given period of time:

- The cooling energy produced by the Free cooling unit (kWh)
- The total electricity consumption of the Free cooling unit (kWh)
- The number of running hours of the unit (h)

Three performance screens are available:

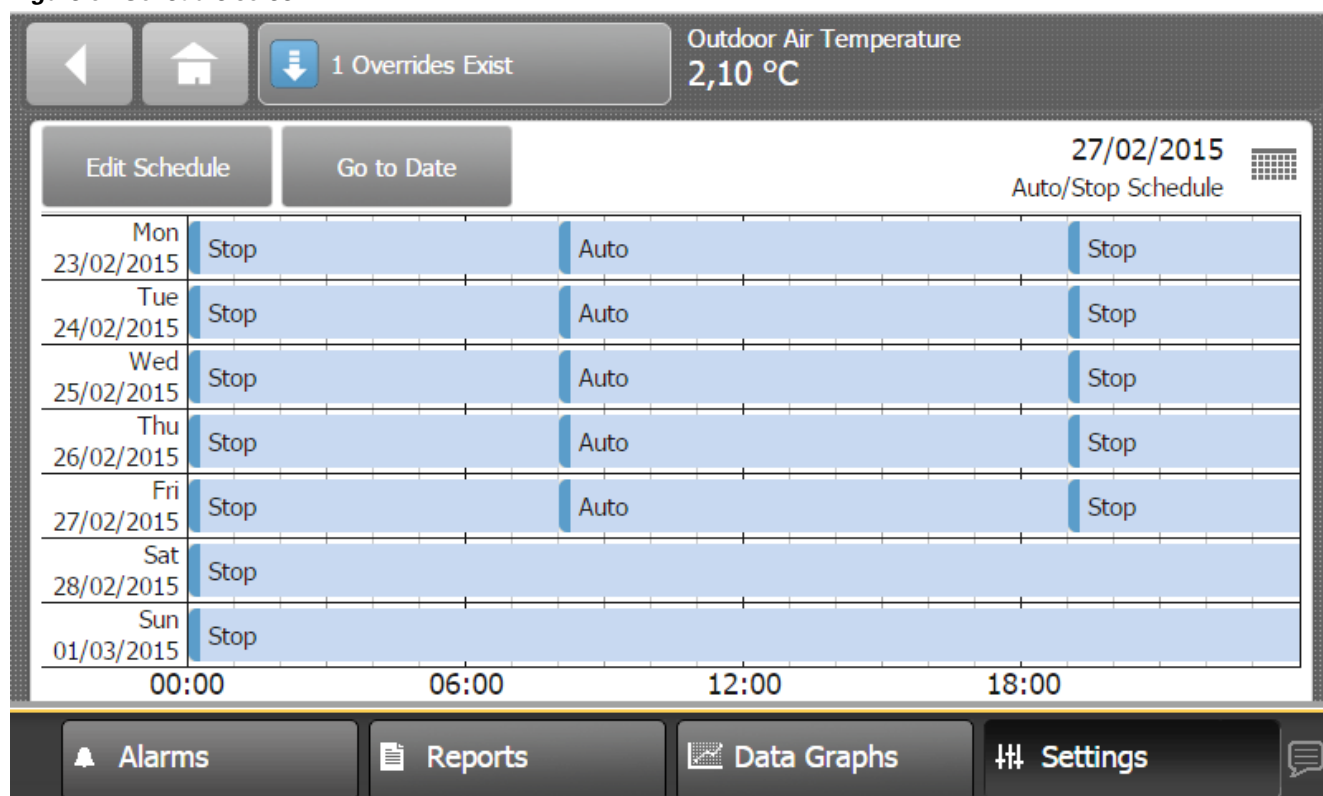
- Daily (current and previous day)
- Monthly (current and previous month)
- Yearly (current and previous year)

User screens

Schedule

The Schedule screen shows the weekly operation of the Free cooling unit. By default, the operation mode is permanently set to Auto mode. This agenda can be modified in order to limit the operation of the unit, for example from 8 AM to 7 PM on workdays only, as is represented in the following figure.

Figure 6 - Schedule screen



The elapsed days of the current week appear without schedule.

To review a (full) week, with each day of the week displaying a schedule, use the **Go to Date** action button and move the date one month forward.

In order to modify the agenda, select **Edit Schedule** then **Events**.

The « Stop » and « Auto » events can be modified or removed. New events can be added by using **Add Event**. When an event is saved, it can be edited by pressing the relevant date line.

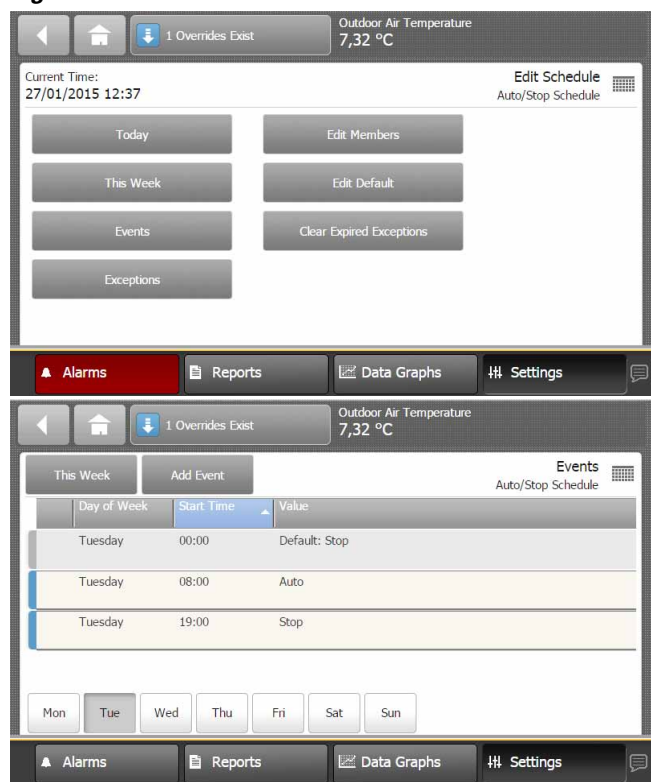
Note: The last described event for the day ends at the end of the day / midnight.

To add exception dates, use the **Edit Schedule** action button and the **Exceptions** button.

Exception events can be single events or recurring events (Monthly or Yearly).

User screens

Figure 7 - Schedule Edit and Events screens

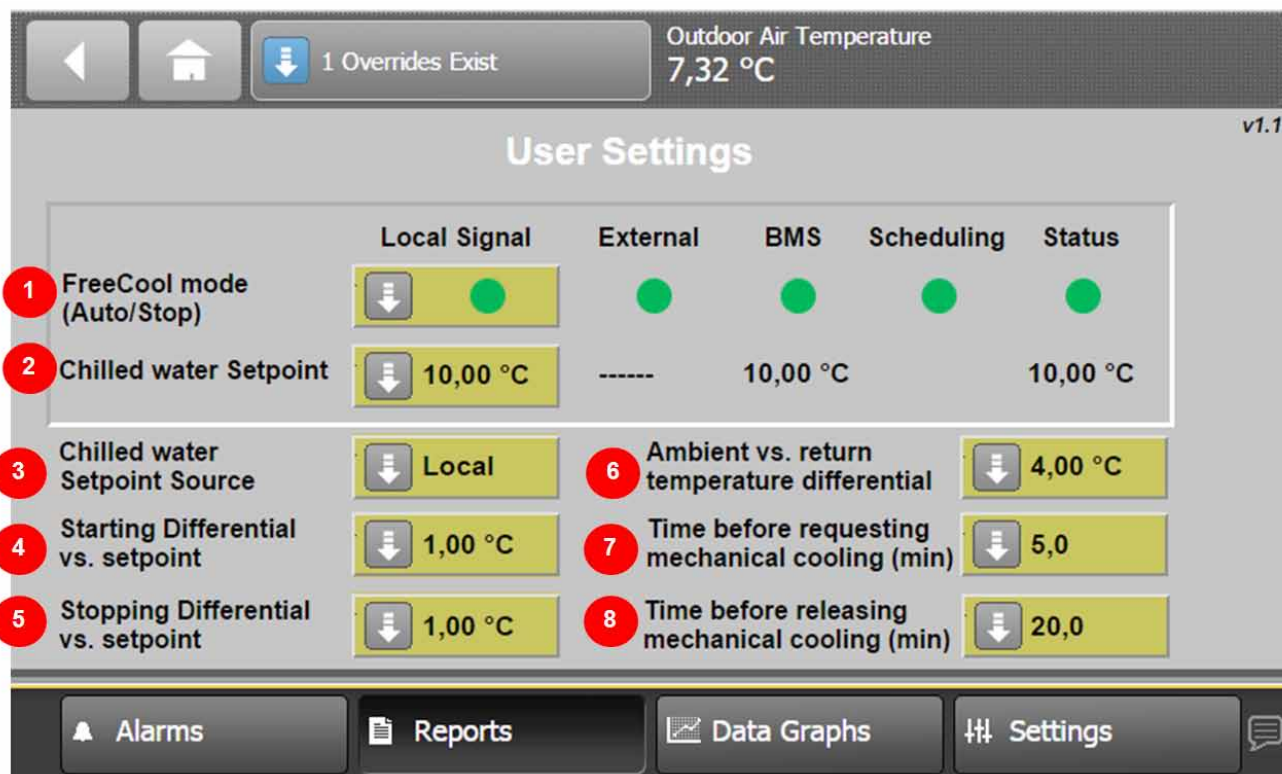


User screens



User settings

The User settings screen shows the status of the main operational parameters and enables the user to override them.


Figure 8 - User Settings Screen



	Local Signal	External	BMS	Scheduling	Status
1 FreeCool mode (Auto/Stop)	↓ ●	●	●	●	●
2 Chilled water Setpoint	↓ 10,00 °C	-----	10,00 °C		10,00 °C
3 Chilled water Setpoint Source	↓ Local				
4 Starting Differential vs. setpoint	↓ 1,00 °C				
5 Stopping Differential vs. setpoint	↓ 1,00 °C				
6 Ambient vs. return temperature differential				↓ 4,00 °C	
7 Time before requesting mechanical cooling (min)				↓ 5,0	
8 Time before releasing mechanical cooling (min)				↓ 20,0	

The operating modes are indicated by the On/Auto  and Off  icons.

The last column Status shows the active status or value, which is a synthesis of the previous ones.

The down arrow icons  can be used by the user to override default settings.

The eight parameters that can be overridden by the user are explained below. The numbers correspond to the numbers on Figure 8.

1. FreeCool operating mode: Auto or Stop.

The resulting mode is the conjunction of:

a) Local signal (User input). The user can override the value through the TD7 screen here.

See User Override section below.

And

b) External (Hardware) command, if such a command has been wired.

If no external command has been wired, a jumper is needed on the terminal board to default to Auto.

And

c) BMS (Communication) signal, if such option has been setup.

If no communication has been defined, this input defaults to Auto.

And

d) Schedule, if such option has been setup, with periods of Auto or OFF modes.

If no schedule has been defined, this input defaults to Auto.

Note: the four commands must be in Auto mode to result in a synthesis as Auto.

2. System Mixing Water Temperature Setpoint

The setpoint used for the System Mixing Water Temperature is one of the following:

a) Local signal (User input). The user can override the value through the TD7 screen here.

b) External (Hardware) command, if such a command has been wired. Else, the value "-----" is shown.

c) BMS (Communication) signal, if such option has been setup.

The parameter that is actually used can be defined by the user with parameter 3.

User screens

3. **Chilled Water Setpoint Source:** Determines which source is used for the System mixing water temperature setpoint (2).

Default: Local

4. **Starting Differential vs. Setpoint:** One of the conditions to enable Free Cooling is that the measured System mixing water temperature is higher than the setpoint (parameter 2) plus this differential.

Example: if this value is 1°C and the setpoint is 12°C, Free Cooling will be enabled when the measured System mixing water temperature rises above 13°C.

Default: 1°C

5. **Stopping Differential vs. Setpoint:** One of the conditions to disable Free Cooling is that the measured Heat exchanger secondary inlet temperature is lower than the System mixing water temperature setpoint (parameter 2) minus this differential.

Example: if this value is 1°C and the setpoint is 12°C, Free Cooling will be disabled when the measured Heat exchanger secondary inlet temperature drops below 11°C.

Default: 1°C

6. **Ambient vs Return Temperature Differential:** One of the conditions to enable Free Cooling is that the measured System mixing water temperature is higher than the measured Ambient temperature plus this differential.

Example: if this value is 4°C and the System mixing water temperature is 16°C, Free Cooling will be enabled when the measured Ambient temperature drops below 12°C.

Default: 4°C

7. **Time before requesting Mechanical Cooling:** When the maximum free cooling capacity under current conditions is reached, the information can be sent to a chiller plant control system that at least one chiller should be enabled. This happens once thisTime (in minutes) has passed.

Default: 5 minutes

8. **Time before releasing Mechanical Cooling:** When the maximum free cooling capacity under current conditions is not reached, the information can be sent to a chiller plant control system that the chillers could be disabled. This happens once thisTime (in minutes) has passed.

Default: 20 minutes

User Override

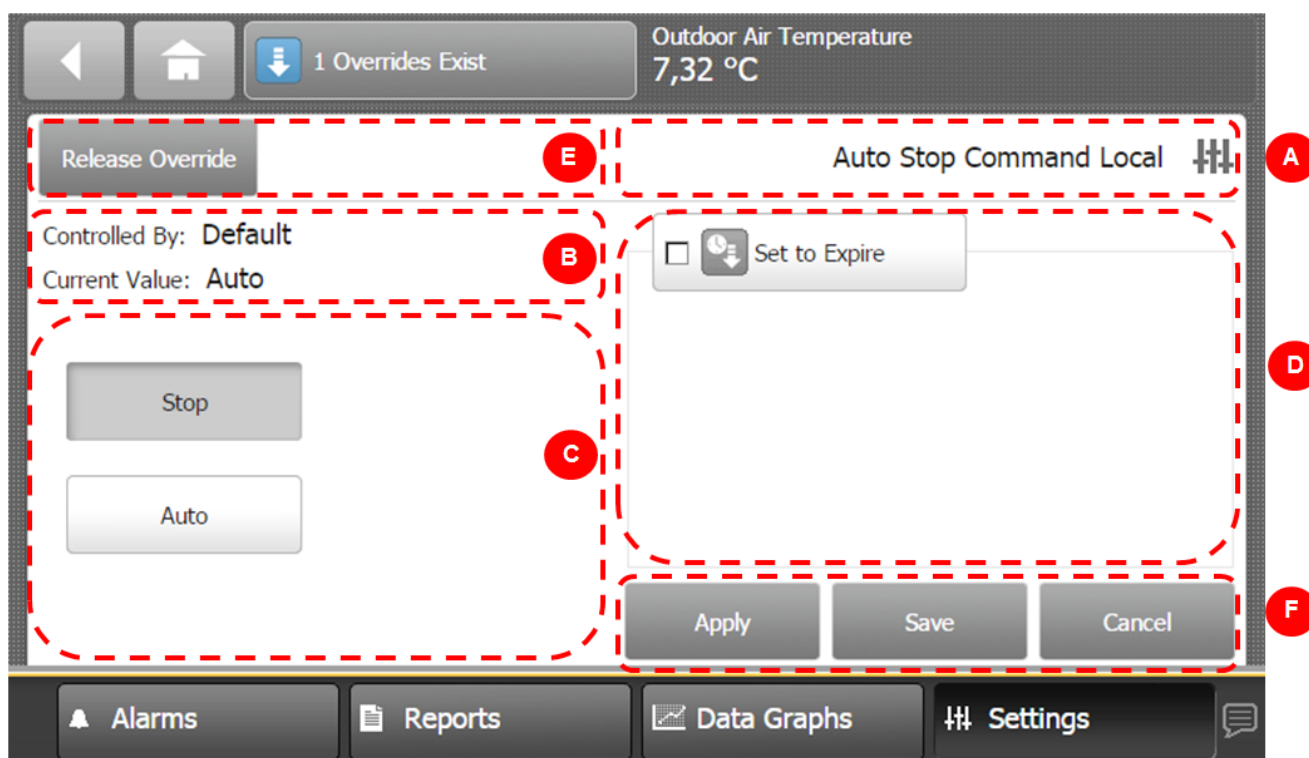
From the User Settings screen, the user can setup or override:

- Mode: Auto / Stop mode, Chilled Water Setpoint Source
- Values: System Mixing Water Temperature Setpoint, Starting and Stopping Differentials vs. Setpoint

To access the Override Screen, push the down arrow button.

Override screen

Figure 9 - Override screen



The override screen is made of six different areas:

- A. Point under control
- B. Point Status area showing who is controlling the point
- C. Override area for user changes
- D. Temporary Override area (when box is checked)
- E. Release button to release override
- F. Action buttons to save or cancel the changes

Overriding value

The Override area (C) provides two ways to change values:

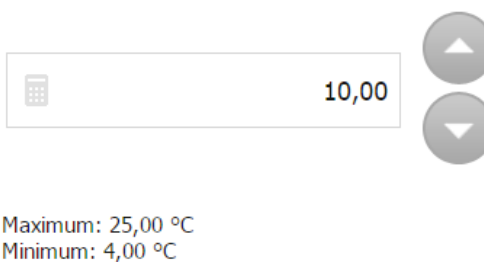
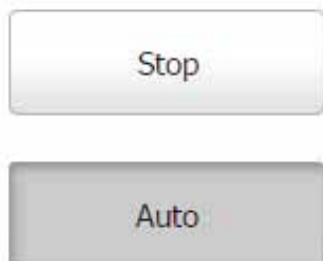
- Use the up or down arrows or
- Touch the keypad icon (onto the left) to open the keypad screen and enter the desired value.

Figure 11 - Overriding value

Overriding mode

Press the relevant button in the Override area (C). Press an action button (F) to save or cancel the change.

Figure 10 - Overriding mode



Trends

To access trends, press the **Data Graphs** button in the bottom display area.

Operating temperatures

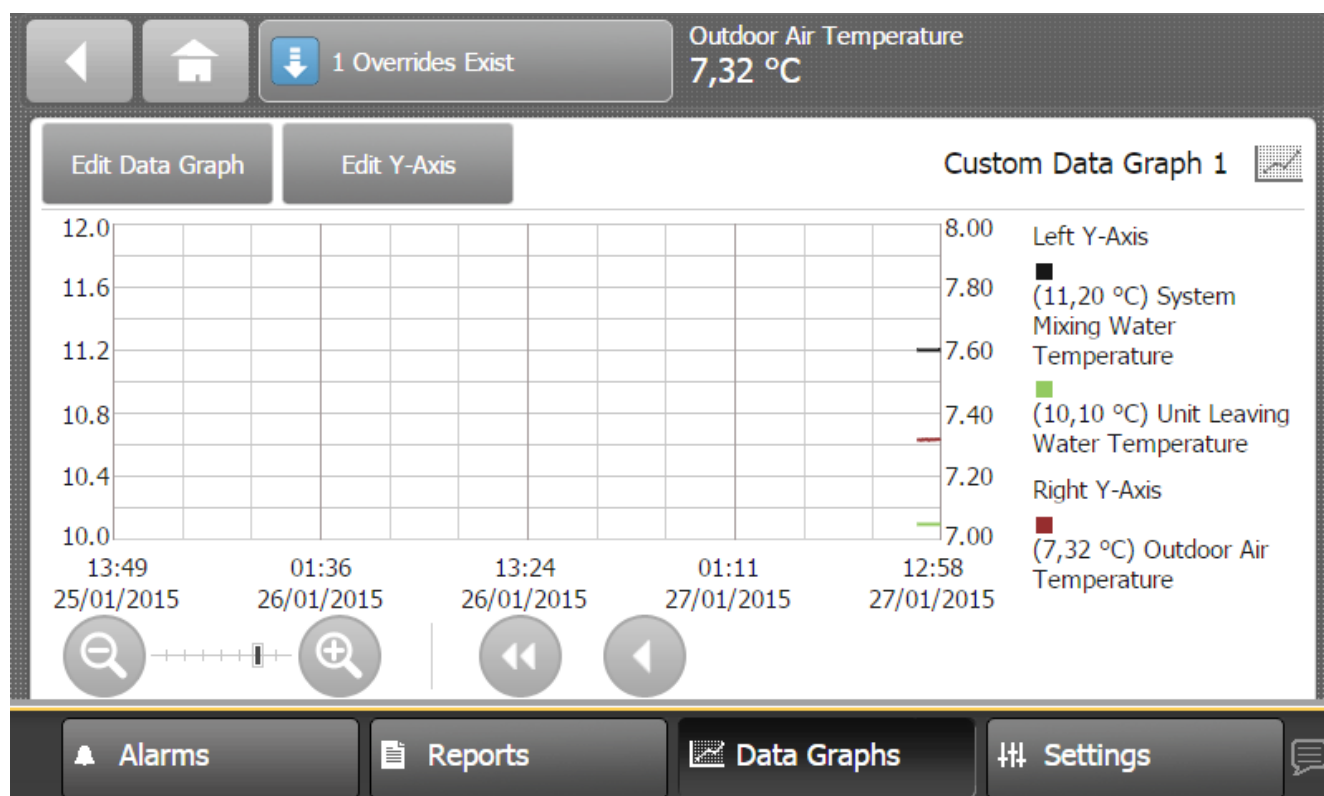
Press **Custom Data Graph 1** to access the Operating Temperatures graph.

- a) Left-side scale:
- System Mixing Water Temperature (°C)
 - Unit Leaving Water Temperature (°C)

- b) Right-side scale:
- Outside Air Temperature (°C)

One-week measurements, 3-minute scan period.

Figure 12 - Operating temperatures graph



Trends

Performance

Press **Custom Data Graph 2** to access the Performance graph.

a) Left-side scale:

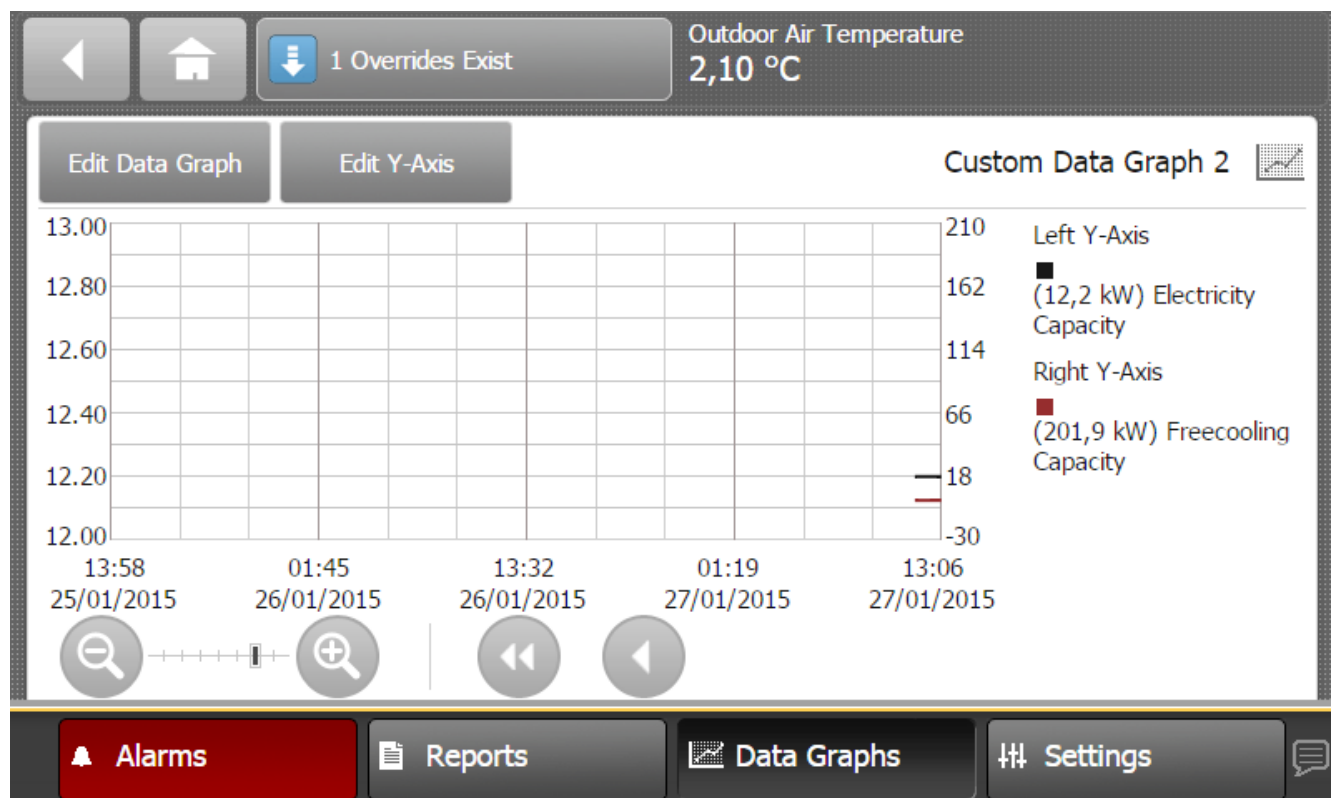
– Electricity input (kW)

b) Right-side scale:

– Free cooling capacity (kW)

One-week measurements, 3-minute scan period.

Figure 13 - Performance Graph





Notes



Notes



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