Service manual

Compressor Controller

update 11/2023

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1. General information

Figure 1: Controller visualization

1.1. Controller description

Controller dedicated for compressors with a power of up to 500 kW. The controller can work with compressors operating in a star-delta configuration or equipped with an inverter.

Controller features:

- 4.3” touchscreen display
- Built-in web server
- Charts of the most important compressor operation parameters and creating statistics
- Supervision function: network pressure, oil pressure, oil temperature, motor, air, motor power consumption and dew point
- Control of oil heaters, air dryer and condensate drain
- Freely configurable controller input and output
- Automatic operation restart function
- Inverter control using the Modbus RTU protocol (selection of standard Yaskawa, Danfoss and Delta inverter)
- Star-delta or direct start-up (for compressors without inverter)
- Analog inverter control
- Service parameters and user with access control menu
- Service counters and working time counters
- Network operation mode supporting up to 6 compressors

- Remote operation mode (using digital input)
- Operation scheduling with a division into cyclical and one time events, up to 28 events in total
- Software update via USB port

1.2. Input and output list

1. The controller is equipped with 4 RTD inputs to support resistive temperature sensors and has the possibility of independent configuration of each input to a selected sensor (PT100, PT1000, KTY84, PTC). Thanks to the RTD temperature inputs, the controller can control the following parameters:
    - Oil temperature
    - Motor temperature
    - Compressor outlet air temperature
    - Ambient temperature
2. The controller is equipped with 3 analog inputs to support 4-20 mA sensors. The measuring range can be configured from the controller. Supported parameters:
    - Network pressure
    - Oil pressure
    - Dewpoint sensor
3. The controller is equipped with 1 analog input to operate a 5 A standard current transformer. The primary winding current can be freely configured from the controller level.
4. The controller is equipped with 8 digital inputs to support sensors or binary signals with the possibility of configuring the default logic (normally open/normally closed) for each input independently. Supported sensors or signals:
    - Suction sensor
    - Dryer ready
    - Remote start-stop
    - Remote load-unload signal
    - Ready status
    - Emergency stop
    - Power supply asymmetry
    - Phase sequence error signal
    - Overload relay error signal
    - Air filter error signal
    - Oil filter error signal
    - Separator error signal
    - Fan error signal
    - Inverter error signal
5. The controller is equipped with 9 configurable digital (relay) outputs, including:

- 4 outputs with common potential
- 4 outputs with independent potential
- 1 NO/NC output with independent potential

Functions that can be configured on each of the outputs:

- Main power supply
- Star
- Delta
- Y valve
- Condensate drain
- Inverter start-stop signal
- Fan
- Dryer
- Heater 1
- Heater 2
- Warning
- Error
- Warning/error status
- Ready
- Running
- Compressing
- Service
- High dew point warning
- Low dew point warning

6. The controller is equipped with 2 USB sockets and 1 Ethernet socket

1.3. Language versions

Controller has 4 language versions:

- Polish
- English
- German
- Russian

It is possible to develop other language versions in consultation with the compressor manufacturer or distributor.

2. Safety information

Before controller installation and start, refer to the user's manual and warranty terms and conditions. Incorrect installation and operation not in line with the manual will void the warranty.

All connection and assembly work must be carried out with the power supply disconnected.

Installation work should be carried out by an authorized service provider or authorized personnel.

To comply with safety standards, the PE terminal of the controller should be connected to the PE protective conductor.

Any use or operation of the controller without the housing installed is not allowed, as this poses a risk of electric shock.

Exposing the controller to water or operating in conditions of excessive humidity may cause damage.

Before starting, check that all connections are correct, according to the connection diagram in the user's manual.

Before starting the controller, check that the power supply meets the requirements specified in the user's manual.

Repairs must only be carried out by the manufacturer's service. Repairs carried out by an unauthorized person will make the warranty null and void.

3. Description of connectors

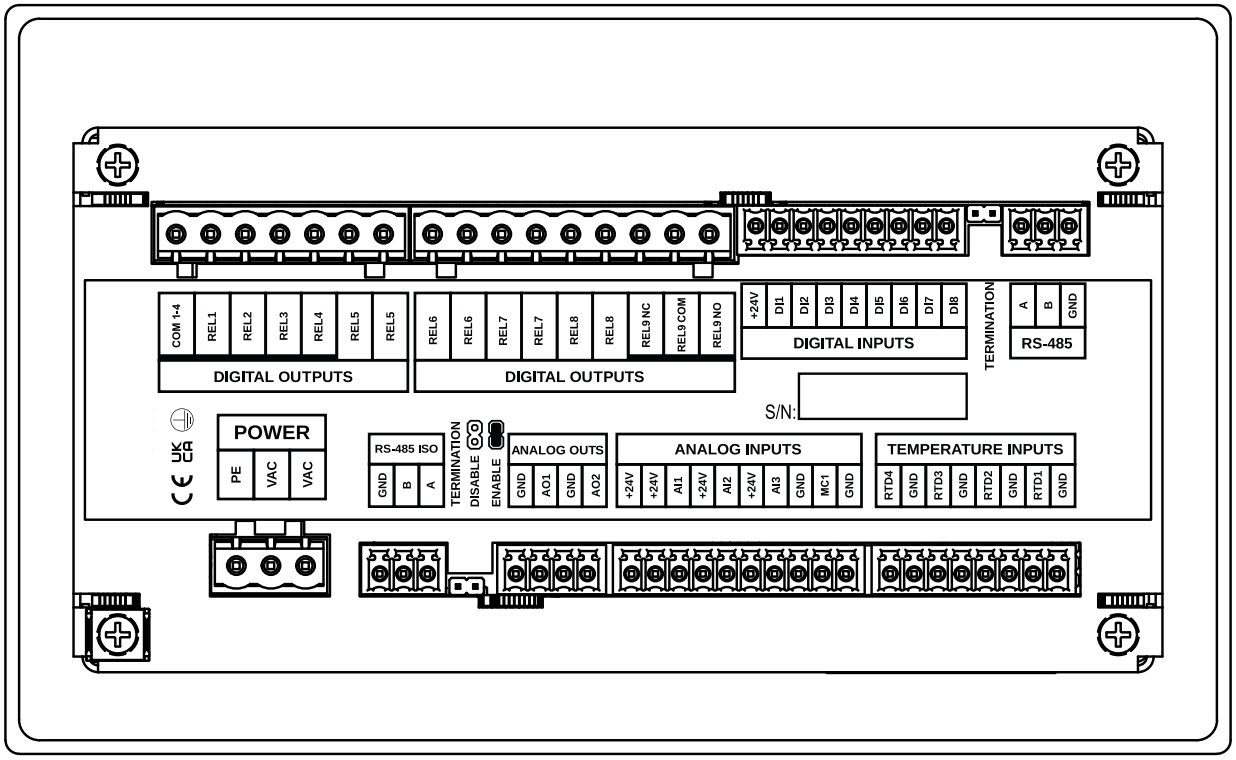

Figure 2: Electrical outlets of the controller (housing rear wall)

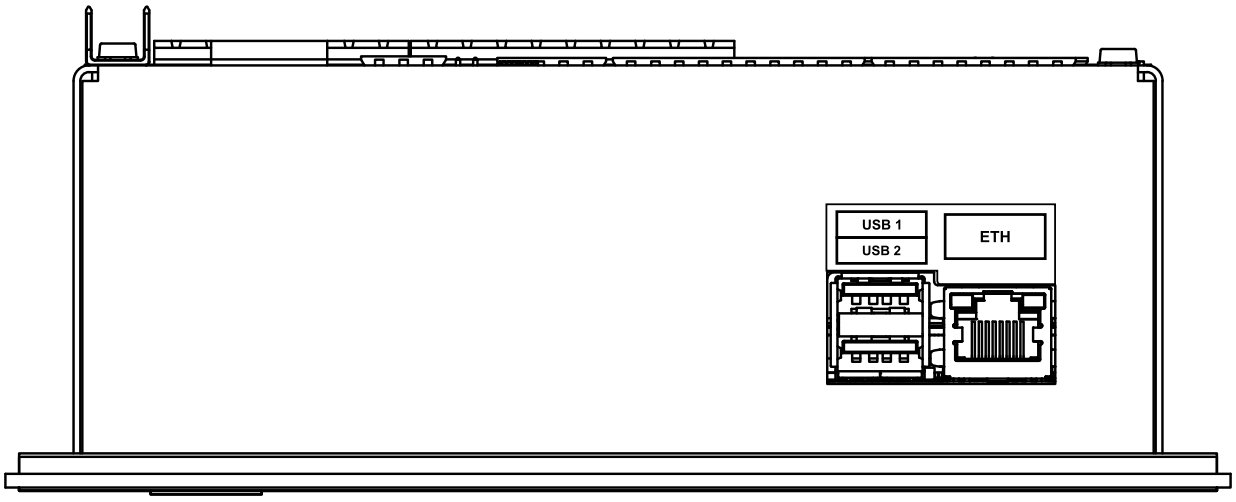

Figure 3: Controller communication connectors (housing side wall)

Table 1: Description of digital outputs (DIGITAL OUTPUTS)

Name	Description
COM 1-4	Common output of relay outputs from 1 to 4

Table 1: Description of digital outputs (DIGITAL OUTPUTS)

Name	Description
REL1	Configurable relay output 1
REL2	Configurable relay output 2
REL3	Configurable relay output 3
REL4	Configurable relay output 4
REL5	Two outputs of the configurable relay 5
REL6	Two outputs of the configurable relay 6
REL7	Two outputs of the configurable relay 7
REL8	Two outputs of the configurable relay 8
REL9 NC	N/C contact (normally closed) of relay 9
REL9 COM	Configurable relay output 9
REL9 NO	N/O contact (normally open) of relay 9

Table 2: Description of digital inputs (DIGITAL INPUTS)

Name	Description
+24V	Internal reference voltage output
DI1	Configurable digital input 1
DI2	Configurable digital input 2
DI3	Configurable digital input 3
DI4	Configurable digital input 4
DI5	Configurable digital input 5
DI6	Configurable digital input 6
DI7	Configurable digital input 7
DI8	Configurable digital input 8

Table 3: Description of RS-485 connector leads

Name	Description
A	RS-485 interface non-reversing line
B	RS-485 interface reversing line
GND	RS-485 interface ground

Table 4: Description of RS-485 ISO connector leads

Name	Description
GND	Isolated RS-485 interface ground
B	Isolated RS-485 interface reversing line
A	Isolated RS-485 interface non-reversing line

Table 5: Description of power outlets (POWER)

Name	Description
PE	PE Connector
VAC	Controller supply voltage (24 VAC)
VAC	Controller supply voltage (24 VAC)

Table 6: Description of analog outputs (ANALOG OUTPUTS)

Name	Description
GND	Analog output 1 ground
AO1	Analog output 1
GND	Analog output 2 ground
AO2	Analog output 2

Table 7: Description of analog inputs (ANALOG INPUTS)

Name	Description
+24V	24 VDC power output
+24V	Analog input 1 power supply
AI1	Analog input 1
+24V	Analog input 2 power supply
AI2	Analog input 2
+24V	Analog input 3 power supply
AI3	Analog input 3
GND	MC1 analog input ground
MC1	Motor current measurement MC1 analog input
GND	Ground terminal

Table 8: Description of RTD analog inputs (TEMPERATURE INPUTS)

Name	Description
GND	Resistive temperature sensor 1 ground
RTD1	Resistive temperature sensor input 1
GND	Resistive temperature sensor 2 ground
RTD2	Resistive temperature sensor input 2
GND	Resistive temperature sensor 3 ground
RTD3	Resistive temperature sensor input 3
GND	Resistive temperature sensor 4 ground
RTD4	Resistive temperature sensor input 4

Table 9: Description of communication outputs

Name	Description
USB 1	USB port
USB 2	USB port
ETH	Ethernet port (RJ45)

The controller is equipped with a housing ground terminal, which is located under one of the housing screws.

4. User interface

4.1. Controller front

The front panel contains:

- 2 buttons (“START”, “STOP”)
- 2 LEDs indicating the compressor status
- A touchscreen displaying the graphical user interface

Figure 4: Controller front panel

Table 10: Description of LED signals

LED	Colour	LED signal
START	Green	**Continuous** - the motor is running (compression, idle) **Pulse** - the motor is starting
STOP	Red	**Continuous** - the motor is stopped **Pulse** - the compressor is stopping or waiting for pressure drop

Table 11: Description of buttons

Button	Function
START	Starts the compressor
STOP	Stops the compressor

5. Graphical user interface

5.1. Main view

Figure 5: Main view divided into sections

Description of each section:

1. Network pressure, pressure settings and bargraph
2. Main menu icon
3. Active errors and warning icons
4. Current compressor status icon
5. Operation scheduling icon (calendar operations)
6. Network operation icon
7. Current date and time
8. Compressor status text message field
9. Basic compressor operation parameters display field

The individual elements of the main view in the controller are also shortcuts to other sections of the graphical user interface. To use them, click on the icon on the screen.

Main view items and sections lead to:

- Network pressure indicator - network pressure chart
- Pressure setting - network pressure setting
- Operation scheduling icon - operation scheduling menu
- Current date and time - date and time settings
- Network operation icon - network operation view (only if a controller is operating as a master controller)

5.2. Compressor status icon

The status icon visible in the sidebar of the user interface displays the current compressor status.

Motor stopped

Compressing

Idle

Motor start-up or stop

Ready for start-up (waiting)

5.3. Error and warning icons

Error and warning icons indicate errors and warnings that are currently occurring in the controller, or have occurred in the past. They may have different visual representations, depending on their location in the graphical user interface.

Active error icon (Sidebar)

Active warning icon (Sidebar)

Active error icon (Screen saver)

Active warning icon (Screen saver)

Error icon (Events)

Warning icon (Events)

5.4. Bargraph

The bargraph available in the main view of the graphical user interface informs about the speed of pressure changes in the network.
Information about the rate of pressure increase or decrease in the network is displayed in the form of coloured rectangles in the area of the bargraph bar. The more rectangles are displayed, the higher the rate of change. In the event of pressure increase, the rectangles are green, and in the event of pressure decrease, they are red.
Bargraph sensitivity can be adjusted (User Preferences → Display → Bargraph sensitivity) in the range of 0.02-0.3 bar/s, this value is represented by a single rectangle, e.g., for a set sensitivity of 0.3 bar/s, 3 full green rectangles will denote 0.9 bar/s, as shown in the figure below.

5.5. Navigating the graphical user interface

The graphical user interface is operated through a touch screen. The basic principles of graphical user interface navigation are described below. More detailed descriptions can be found in chapters dedicated to individual functions.

5.5.1. Navigating the main view

From the main view, you can go to the ”Active warnings and errors” tab by clicking the motor or error/warning icon. To return to the main view, click the “Close” button.

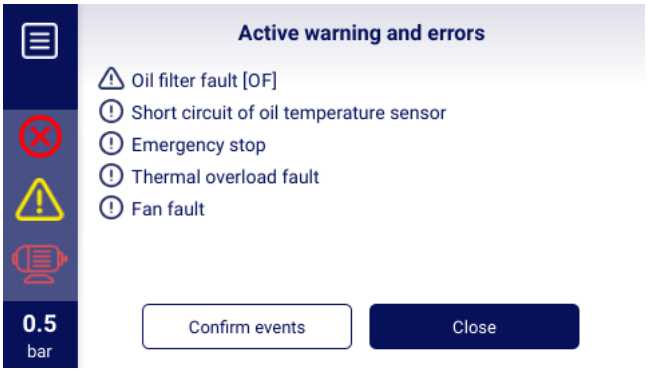

Figure 6: ”Active warnings and errors” tab

The list icon in the upper left corner of the screen opens the main menu of the controller. When the main menu opens, the list icon is replaced with an icon that allows you to return to the previous tab. This mechanism applies to the entire interface.

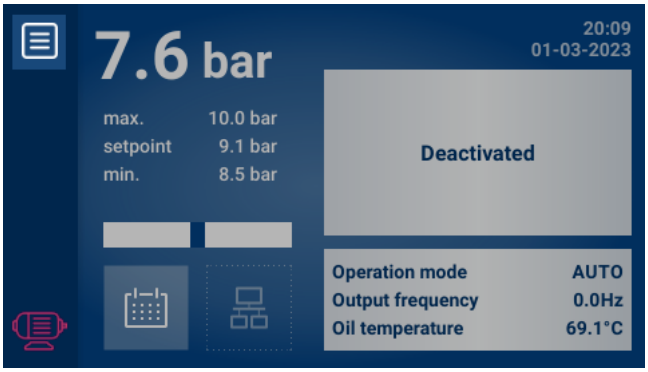

Figure 7: Main menu icon

The main menu of the controller contains icons of all available subtabs, at the same time allowing the user to continuously preview the selected parameters of the main view. Icons that allow you to navigate to individual subtabs also appear in other places of the user interface, also in the form of rectangular tiles with a description.

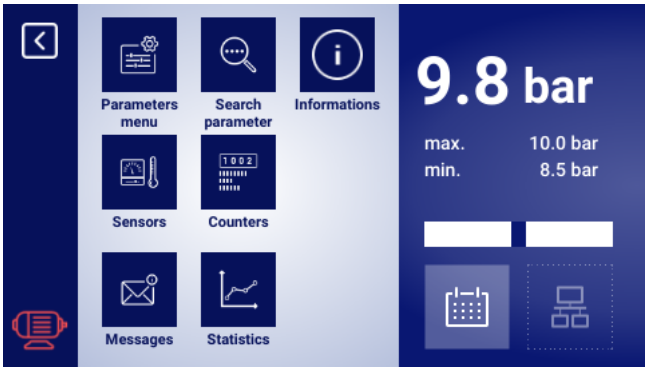

Figure 8: Controller main menu

5.5.2. Basic menu types

he user interface has 2 basic types of menus (tabs). They differ in the way they can be viewed. Navigating the subpages of the first menu can be done using the arrows displayed on the controller screen. Depending on the number of icons displayed, the arrows may be at the bottom or right side of the screen. The number of the currently viewed page and the total number of pages is displayed between the arrows. E.g. 2/3 means that subpage 2 of 3 is being displayed. A scroll list is the second type of menu. On the right side of the screen you will see a white scroll bar with a blue thumb representing the currently viewed list item. The size of the blue thumb corresponds to the size of the list. The smaller the blue thumb, the longer the list. While keeping your finger on the screen, swipe up or down to scroll the list. The faster you move your finger, the more rows will be scrolled. It is also possible to scroll the list using the blue thumb. Click an area on the scroll bar to go to the corresponding place on the list.

Figure 9: Sample navigation arrows menu (left) and scroll list (right)

5.5.3. Sidebar

A rectangular bar on the left side of the screen is always displayed in the graphical user interface. The motor icon visible on the sidebar displays the status of the compressor and allows you to go to the active errors and warnings tab, without having to go back to the main view. The menu icon, interchangeably with the return icon, allows you to navigate the graphical user interface. The sidebar displays the current pressure in the network, also when the user is not in the main view. Current controller errors and warnings are displayed as icons on the sidebar.

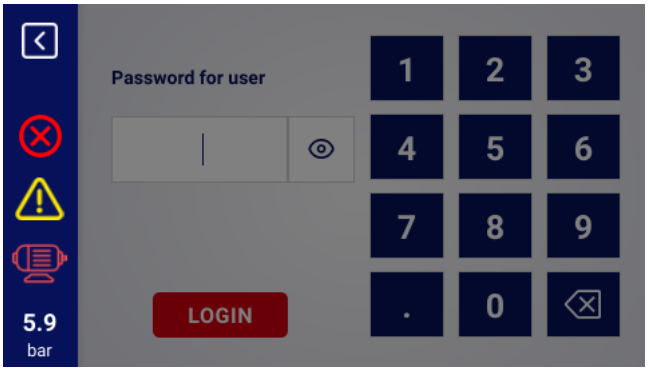

Figure 10: Sidebar with network pressure and error and warning icons

5.5.4. Login screen

Some elements of the interface require user or service authorization. To this end, select the appropriate access level icon, and then enter the password and confirm by clicking the ”LOGIN” button. The entered password is masked and appears as dots. The eye icon on the right allows you to show the entered password. The password will be previewed as long as the icon is pressed.

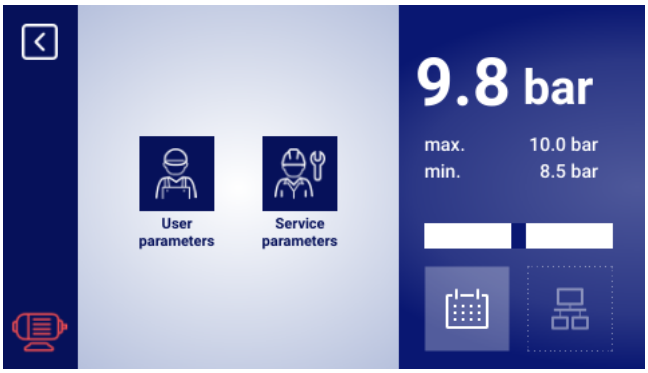

Figure 11: Selecting access level

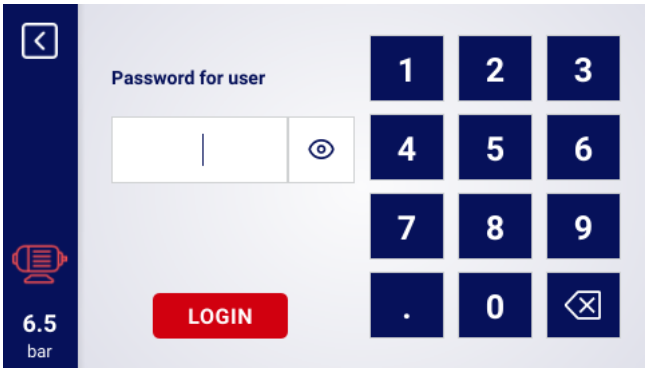

Figure 12: Authorisation screens

5.5.5. Configuring parameters

The graphical user interface stores parameters in subgroups, which are displayed in the form of tiles with descriptions. To move to the selected subgroup, press the corresponding tile.

Figure 13: Tiles with parameter subgroups for operation parameters

After moving to the selected subgroup, the parameters will be displayed in the form of tiles with the name of the parameter and its current value (in the blue field at the right end of the tile). To edit a parameter, click on the field with its value.

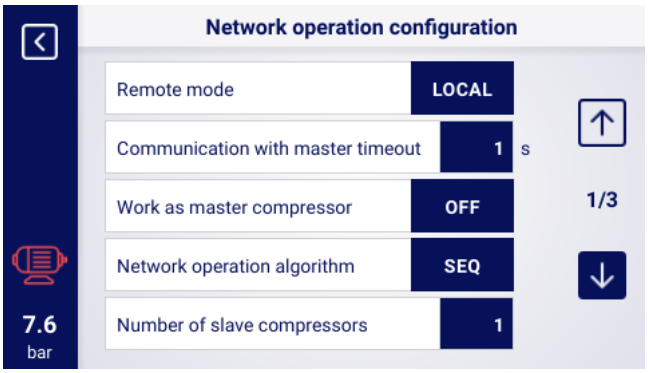

Figure 14: Parameter tiles of a network operation configuration parameters subgroup

The configuration of a selected parameter, depending on its type, is done by entering a value from the on-screen keyboard or by selecting an value from a predefined drop-down list. The on-screen keyboard may vary depending on the parameter being edited, and entering negative values is possible in some instances (use the negative symbol to enter negative values). After entering the new parameter value, confirm your choice by clicking the ”SAVE” button. The allowed parameter range is displayed below the parameter value field. To cancel a change, click the return icon and the new value will be discarded.

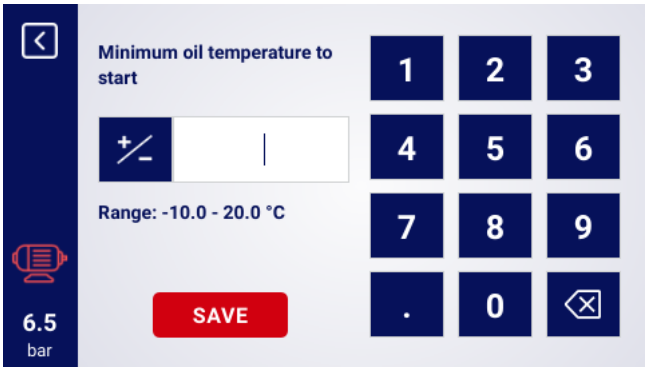

Figure 15: On-screen keyboard for motor start minimum oil temperature

The second method of editing parameters is selecting a value from the drop-down list. The drop-down lists are divided into basic and advanced. The basic ones offer a choice between two values, e.g. ”Enable” and ”Disable”. The currently selected value is marked with a blue frame and a darker background colour. The advanced list offers several values and can have its own subpages. The currently selected value is marked with a blue frame and a square tick icon. To exit the basic or advanced value editing mode, select a value or click anywhere on the dimmed user interface.

Figure 16: Example of a basic list (left) and an advanced list (right)

5.5.6. Screen messages

SThe controller displays messages addressed to the user in the upper right corner of the screen, in the form of a message windows. You can close the message window by clicking anywhere on the screen. The messages help the user and inform, for example, about entering an incorrect password or software update progress. Messages are not archived in the controller’s memory.

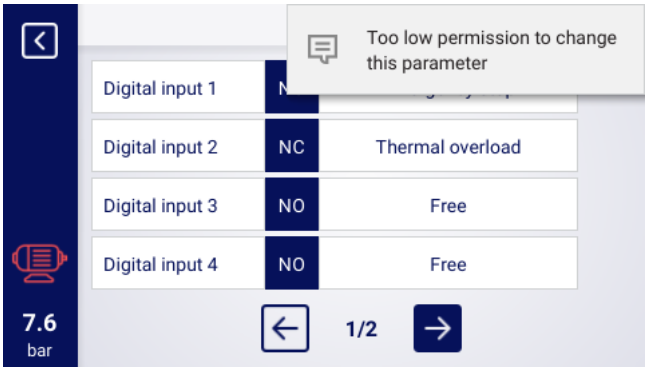

Figure 17: Example of a screen message

5.6. Main menu

To go to the main menu, click on its icon which can be found on the main view. From there is then possible to select the available sub-tabs.

List of sub-tabs:

- Parameter menu
- Search parameter
- Information
- Sensors
- Counters
- Events
- Statistics

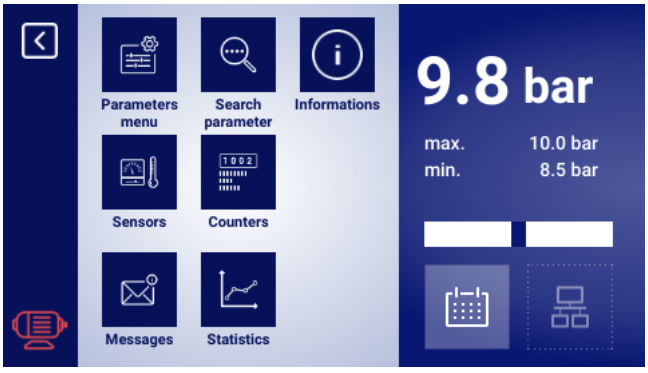

Figure 18: Main menu

5.6.1. Search parameter

The ”Search parameter” tab allows you to go to a specific parameter or group of parameters by entering its number in the search engine.

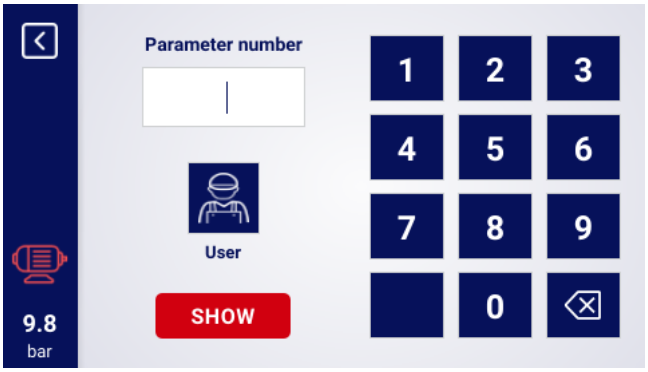

Figure 19: User parameter search menu

Table 14: User parameter numbers

No.	Parameter
1	Operation scheduling
2	Service counters
3	Language
4	Network operation ON/OFF
5	Rotation time of pressure limits during operation
6	Controller information
7 and 18	Event list preview
8 and 25	RS-485 settings
11	Time settings
12	Date settings
15	Run time after exceeding the upper pressure setting, after which the compressor goes into standby
18	Event list preview
25	RS-485 settings
26	Network operation algorithm selection
27	Network operation menu
28	Network operation menu
30	Dryer settings
40	Condensate drain settings
51	Display brightness and screen saver settings
61	Enable automatic idle timing
90	Controller auto restart settings
111	Restore user settings
423	User password setting
500	Safety valve test

5.6.2. Information

The ”Information” tab contains basic data about the compressor and the controller. Here you will also find the button which initiates the controller software update procedure.

List of data stored in the information tab:

- Software version
- Compressor serial number
- Controller serial number
- Compressor manufacturer information
- Compressor start-up method
- Controller IP address
- Controller MAC address

Figure 20: Information tab

5.6.3. Sensors

In the ”Sensors” tab, a preview of the current values of measurements made by the controller and read from the inverter is available. The preview is only available for active sensors, configured in the input and output parameters. Each value is displayed in a given unit, except for motor temperature for the PTC sensor (in this case, the user can read the correct temperature marked with the ”✓”, symbol, or the incorrect temperature marked with ”**X**”).

List of values in the sensors tab:

- Network pressure
- Oil pressure
- Oil temperature

- Motor temperature
- Air temperature
- Ambient temperature
- Motor current
- Motor power
- Dew point
- Output frequency

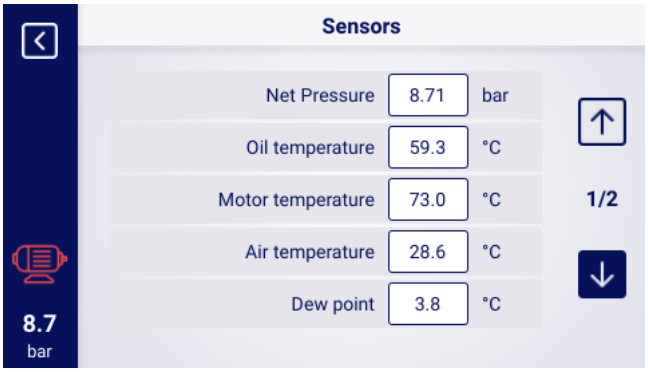

Figure 21: Sensor menu 1 / 2.

5.6.4. Counters

The ”Meters” tab allows you to view the current values of service counters and modify them. Each counter is presented in the form of a tile containing information about the date of the next service and the remaining number of working hours. The service counter can be configured for both of the previously mentioned values or only for one of them. If you do so, only the configured value will be displayed. If the counter is inactive, an ”OFF” icon will be displayed on its tile.

Figure 22: The ”Service counters” tab

5.6.5. Events

The ”Events” tab allows you to check the history of errors and warnings that occurred on the controller. Each event has a date and time, content and symbol. The list archives 200 events, and when this number is exceeded, the oldest events are deleted.

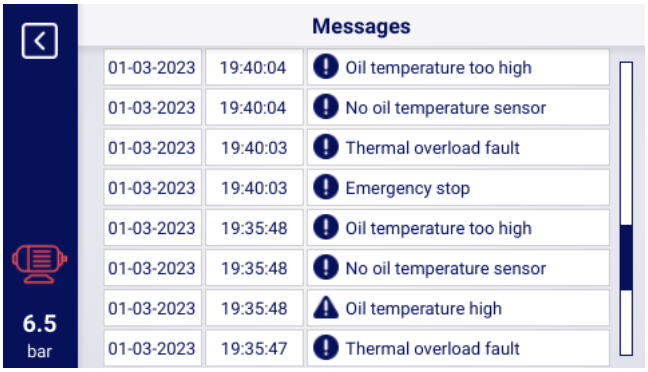

Figure 23: Events tab

5.6.6. Statistics

The controller aggregates measurements from sensors and information about the operation of the compressor and presents them in the form of statistics (which are divided into 2 categories: consumption and charts). Information about the time and cycles of the compressor is stored in the ”Consumption” tab. The types of load data are different for star-delta start-up compressors and inverter compressors.

Table 15: ”Consumption” tab parameters

Parameter name	Parameter description
Total running time	Total motor run time
Run time under load	Total compressor time
Medium load	Total run time to run time under load ratio
Motor start-up counter	Total number of motor start-ups
Average number of motor start-ups	Average number of motor start-ups per hour
Y-valve engagement counter	Total number of Y-valve engagements
load 80% - 100% [F]	Total run time in a given load range
load 60% - 80% [F]	Total run time in a given load range
load 40% - 60% [F]	Total run time in a given load range
load 20% - 40% [F]	Total run time in a given load range

[F]-Parameter available only for compressors equipped with an inverter

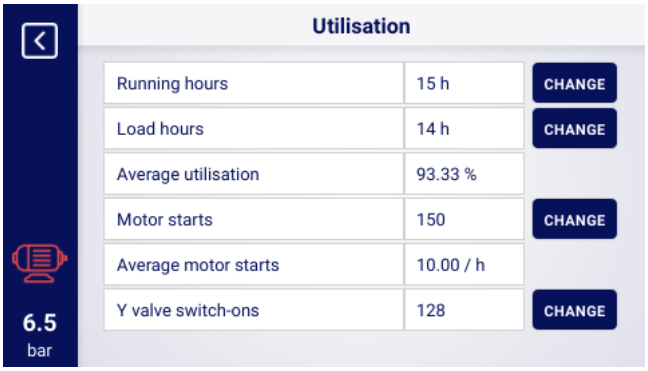

Figure 24: Consumption tab

The controller creates charts from selected data from the following time periods: last hour, last day, last week. The preview range can be set by the user, independently for each of the charts.

List of data from which charts are generated:

- Network pressure
- Oil temperature
- Motor temperature
- Air temperature
- Motor current
- Output frequency

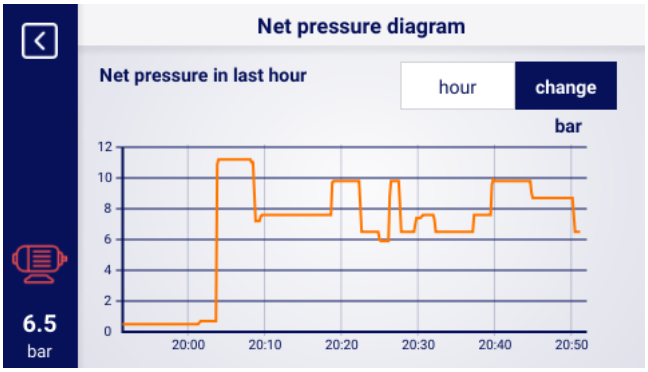

Figure 25: Network pressure chart

6. User preferences

The user can configure his preferences in the ”User preferences” tab **User parameters → User preferences**, under the set of settings that do not have a direct impact on the operation of the compressor, but have an impact on the user’s comfort of use.

List of sub-tabs:

- Display
- Units
- Language
- Date & time
- Compressor name

6.1. Adjust screen brightness

The brightness of the screen in the controller can be adjusted in the ”Display” tab **User parameters → User preferences → Display**. The brightness level is selected by changing the position of the slider, the minimum available brightness level is 0%, the maximum is 100%

6.2. Screen saver setup

The screen saver can be enabled or disabled by going to the **User Parameters tab → User Preferences → Display**, by setting the ”Screen Saver” toggle to ”On” or ”Off”, respectively. The ”Screen Saver Delay” parameter defines the number of seconds after which the screen saver will turn on in the event of inactivity.

6.3. Bargraph sensitivity configuration

The sensitivity of the bargraph displayed in the main view of the controller can be configured by going to the **User parameters tab → User preferences → Display**. decrease in pressure that is represented by one bargraph scale.
The available configuration range is 0.02 bar/s to 0.2 bar/s.

6.4. Pressure measurement accuracy

The accuracy of the pressure measurement can be configured by going to the **User parameters tab → User preferences → Display**. The user can choose a range with one decimal place or two. The selected range is visible in every place of the user interface, except for the ”Sensors” tab, where the pressure is always displayed to 2 decimal places.

6.5. Units

The controller allows you to configure the units in which the values from individual sensors are displayed, the configuration is available in the **User parameters tab → User preferences → Unit**.

List of temperature units:

- °C

- °F

List of pressure units:

- bar
- psi

6.6. Controller language

In order to select a different language version of the user interface, go to the **User parameters tab → User preferences → Language**.

List of language versions:

- Polish
- English
- German
- Russian

6.7. Date & time settings

In order to set the correct date and time on the controller, go to the **User parameters tab → User preferences → Date and time**, or use the shortcut by clicking on the date and time on the main controller view. The controller also allows you to change the display format of the hour to 12 hours.

6.8. Compressor name

The controller allows the user to give a name to each compressor, which allows for quick compressor identification from the Web server. To enter a compressor name, go to the **User Parameters tab → User preferences → Compressor name**, and then enter the name using the on-screen keyboard.

7. User parameters

Primary user password: 0000

User parameters are available in the ”Parameters menu” tab. Access requires a user password, default password is ”0000”. Parameters are grouped into several submenus. Some parameters are only available in preview mode. The value of parameters in the preview mode can only be viewed. When attempting to modify a parameter that is available for preview only, the controller will display a screen message saying “Too low permission level to change this parameter”. The visibility and range of individual parameters may depend on the values of other interdependent parameters.

Table 16: List of user parameters

Name	Modification	Range	Location
Display brightness	Yes	0-100 %	User preferences → Display
Screensaver	Yes	On; Off	User preferences → Display
Screensaver delay	Yes	≥ 0 s	User preferences → Display
Sensitivity of the barograph	Yes	0.02-0.3 bar/s	User preferences → Display
Number of decimal places in displayed pressure measurements	Yes	1; 2	User preferences → Display
Temperature unit	Yes	°C; °F	User preferences → Units
Pressure unit	Yes	bar; psi	User preferences → Units
Language	Yes	Polish; English; German; Russian	User preferences → Language
Time	Yes	hh:mm	User preferences → Date and time
Date	Yes	dd-mm-rrrr	User preferences → Date and time
Time format	Yes	24h; 12h	User preferences → Date and time
Automatic change to daylight saving time	Yes	On; Off	User preferences → Date and time
Compressor name	Yes		User preferences → Compressor name
Operation mode	Yes	AUTO; CONST	Operation parameters → Operation modes
Remote mode	Yes	LOCAL; NET; REM; RVM	Operation parameters → Operation modes
Network pressure high warning	Yes		Operation parameters → Network pressure
Unload pressure	Yes		Operation parameters → Network pressure
Set pressure[F]	Yes		Operation parameters → Network pressure
Load pressure	Yes		Operation parameters → Network pressure
Low network pressure warning	Yes		Operation parameters → Network pressure
Restart delay	No		Operation parameters → Time parameters
Main contactor delay	No		Operation parameters → Time parameters
Motor acceleration time	No		Operation parameters → Time parameters
Y valve on delay	No		Operation parameters → Time parameters
Idle time	Yes	10-32767 s	Operation parameters → Time parameters
Adaptive idle (AutoTlse)	Yes	On; Off	Operation parameters → Time parameters

Table 16: List of user parameters

Name	Modification	Range	Location
Motor deceleration time	Yes	≥ 0 s	Operation parameters → Time parameters
Star-delta changeover time	No		Operation parameters → Time parameters
Condensate drain function	Yes	On; Off	Operation parameters → Condensate drain
Drain open time period	Yes	0-720 min	Operation parameters → Condensate drain
Drain open time	Yes	0-600 s	Operation parameters → Condensate drain
Fan function	No		Operation parameters → Fan
Fan on	No		Operation parameters → Fan
Fan off	No		Operation parameters → Fan
Dryer function	No		Operation parameters → Dryer
Drying time before compressor start	No		Operation parameters → Dryer
Drying time after compressor stop	No		Operation parameters → Dryer
Duration of pulse mode after compressor stop	No		Operation parameters → Dryer
Pulsation period time	No		Operation parameters → Dryer
Enable time in pulse mode	No		Operation parameters → Dryer
Waiting time in pulse mode	No		Operation parameters → Dryer
Heater 1	No		Operation parameters → Heater → Heater 1
Heater 1 hysteresis	No		Operation parameters → Heater → Heater 1
Heater 2	No		Operation parameters → Heater → Heater 2
Heater 2 temperature offset	No		Operation parameters → Heater → Heater 2
Heater 2 hysteresis	No		Operation parameters → Heater → Heater 2
Idle reheating	No		Operation parameters → Heater → Idle reheating
Idle reheating on temperature	No		Operation parameters → Heater → Idle reheating
Idle reheating off temperature	No		Operation parameters → Heater → Idle reheating
High dew point warning	No		Operation parameters → Dew point
High dew point warning level	No		Operation parameters → Dew point
Low dew point warning	No		Operation parameters → Dew point
Dew point too low warning level	No		Operation parameters → Dew point
Dew point too high error	No		Operation parameters → Dew point
Dew point too high error level	No		Operation parameters → Dew point
Dew point too low error	No		Operation parameters → Dew point
Dew point too low error level	No		Operation parameters → Dew point
Dew point temperature event delay	No		Operation parameters → Dew point
Restart after power failure	Yes	On; Off	Operation parameters → Auto restart
Restart after error	Yes	On; Off	Operation parameters → Auto restart

Table 16: List of user parameters

Name	Modification	Range	Location
Reboot delay	Yes	≥ 0 s	Operation parameters → Auto restart
Maximum number of restart attempts	Yes	≥ 1	Operation parameters → Auto restart
Power loss restart	No		Operating parameters → Temperature switch
Temperature source	No		Operating parameters → Temperature switch
Upper temperature switching	No		Operating parameters → Temperature switch
Lower temperature switching	No		Operating parameters → Temperature switch
Restore user settings from local backup	Yes		Factory settings → Restoring and saving settings
Restore user settings from external data carrier	Yes		Factory settings → Restoring and saving settings
Save logs to data carrier	Yes		Factory settings → Service logs
User password	Yes	1-10 digits	Factory settings → Passwords
Function and logic of each digital input	No		Inputs/outputs configuration → Digital outputs
Function and logic of each digital output	No		Inputs/outputs configuration → Digital outputs
Function and range of each analog input	No		Inputs/outputs configuration → Analog outputs
Function of each analog output	No		Inputs/outputs configuration → Analog outputs
Baud rate	Yes	2400; 4800; 9600; 19200; 38400; 57600; 115200; 230400	Inputs/outputs configuration → RS-485/RS-485 ISO
Parity	Yes	None; Even; Odd;	Inputs/outputs configuration → RS-485/RS-485 ISO
Stop bits	Yes	1; 1.5; 2	Inputs/outputs configuration → RS-485/RS-485 ISO
RS-485/RS-485 ISO function	Yes	None; Master; Slave	Inputs/outputs configuration → RS-485/RS-485 ISO
Modbus address	Yes	1-255	Inputs/outputs configuration → RS-485/RS-485 ISO
Assigning an IP address	Yes	Auto(DHCP); Static (without DHCP)	Inputs/outputs configuration → IP settings
IP address	Yes		Inputs/outputs configuration → IP settings
Subnet mask	Yes		Inputs/outputs configuration → IP settings
Gateway	Yes		Inputs/outputs configuration → IP settings
Turn on Y valve	Yes	Enable; Disable	Diagnostics → Manual Y-valve control
Safety valve test	Yes	< 15.5 bar	Diagnostics → Safety valve test
Master compressor communication timeout	Yes	≥ 0 s	Network operation → Configuration
Operate as master compressor	Yes	Enable; Disable	Network operation → Configuration
Network operation algorithm	Yes	SEQ; CAS	Network operation → Configuration
Number of slave compressors	Yes	0-5	Network operation → Configuration

Table 16: List of user parameters

Name	Modification	Range	Location
Switching delay between slave compressors	Yes	0-60 s	Network operation → Configuration
Rotation time	Yes	≥ 1 min	Network operation → Configuration
Unload pressure for master compressor	Yes		Network operation → Configuration
Load pressure for master compressor	Yes		Network operation → Configuration
Automatic pressure limits reconfiguration	Yes	Enable; Disable	Network operation → Configuration
Network operation point	Yes		Network operation → Configuration
Unload pressure (slave compressor)	Yes		Network operation → Compressor 1/2/3/4/5
Load pressure (slave compressor)	Yes		Network operation → Compressor 1/2/3/4/5
Interface (slave compressor)	Yes	RS-485; RS-485 ISO	Network operation → Compressor 1/2/3/4/5
Modbus address (slave compressor)	Yes	1-255	Network operation → Compressor 1/2/3/4/5
Scheduled work	Yes	Enable; Disable	Operation scheduling
Add event	Yes		Operation scheduling → One-time events/Recurring events

[F]-Parameter available only for compressors equipped with an inverter

7.1. Changing user password

To change the default user password, go to the **User parameters → Factory settings → Passwords**, tab and then enter a value in the ”User password” parameter. The password can be 1 to 10 digits long.
In case of forgetting the user password, please contact the service.

8. Service Parameters

Primary user password: 0000
Primary service password: 2326

Service parameters are available in the ”Parameter Menu” tab. Access requires entry of the service password. Parameters are grouped into various submenus. Service parameters also include all user parameters. The visibility and ranges of individual parameters may depend on the volume of other interdependent parameters.
The chart below contains a set of service parameters and user parameters. Selected service parameters are visible from the user parameters but cannot be edited.

U - User parameter
S - Service parameter
S* - Service parameter visible to the user

Table 17: List of service parameters

Name	Access level	Scope	Location
Display brightness	U	0-100%	User Preferences → Display
Screensaver	U	On; Off	User Preferences → Display
Screensaver delay	U	≥ 0 s	User Preferences → Display
Bar graph sensitivity	U	0.02-0.3 bar/s	User Preferences → Display
Number of decimal places in the displayed pressure readings	U	1; 2	User Preferences → Display
Temperature Unit	U	°C; °F	User Preferences → Units
Pressure Unit	U	bar; psi	User Preferences → Units
Language	U	Polish; English; German; Russian	User Preferences → Language
Time	U	hh:mm	User Preferences → Date and Time
Date	U	dd-mm-yyyy	User Preferences → Date and Time
Time Format	U	24 h; 12 h	User Preferences → Date and Time
Automatic daylight saving time	U	On; Off	User Preferences → Date and Time
Compressor name	U		User Preferences → Compressor name
Operating mode	U	AUTO; CONST	Operating Parameters → Operating modes
Remote mode	U	LOCAL; NET; REM; RVM	Operating Parameters → Operating modes
High Network Pressure Warning	U		Operating Parameters → Network Pressure
Pressure relief	U		Operating parameters → Network pressure
Set pressure^{F}	U		Operating parameters → Network pressure
Load pressure	U		Operating parameters → Network pressure
Low network pressure warning	U		Operating parameters → Network pressure
Restart delay	S*	≥ 0 s	Operating parameters → Time parameters
Main contactor delay	S*	≥ 10 ms	Operating parameters → Time parameters
Motor acceleration time	S*	≥ 0 s	Operating parameters → Time parameters

Table 17: List of service parameters

Name	Access level	Scope	Location
Y valve activation delay	S*	≥ 0 s	Operating parameters → Time parameters
Idle run time	U	10-32767 s	Operating parameters → Time parameters
Adaptive idle run(AutoTlse)	U	On; Off	Operating parameters → Time parameters
Engine stop time	U	≥ 0 s	Operating parameters → Time parameters
Star-Delta switching time	S*	≥ 10	Operating parameters → Time parameters
Condensate drain function	U	On; Off	Operating parameters → Condensate drain
Condensate drain interval	U	0-720 min	Operating parameters → Condensate drain
Condensate drain duration	U	0-600 s	Operating parameters → Condensate drain
Fan function	S*	On; Off	Operating parameters → Fan
Fan activation	S*	60°C - 300°C	Operating parameters → Fan
Fan deactivation	S*	60°C - 300°C	Operating parameters → Fan
dryer function	S*	On; Off	Operating parameters → Dryer
Pre-Compressor start dry time	S*	0-60 min	Operating parameters → Dryer
Post-Compressor stop dry time	S*	0-360 min	Operating parameters → Dryer
Post-Compressor stop pulsation mode duration	S*	0-720 min	Operating parameters → Dryer
Pulsation period time	S*	0-1800 s	Operating parameters → Dryer
Pulsation mode activation Time	S*	0-600 s	Operating parameters → Dryer
Dryer mode waiting time	S*	0-720 min	Operating parameters → Dryer
Heater 1	S*	On; Off	Operating parameters → Heater → Heater 1
Heater 1 Hysteresis	S*	1.0-20.0°C	Operating parameters → Heater → Heater 1
Heater 2	S*	On; Off	Operating parameters → Heater → Heater 2
Heater 2 Temperature offset	S*	0.0-20.0°C	Operating parameters → Heater → Heater 2
Heater 2 Hysteresis	S*	1.0-20.0°C	Operating parameters → Heater → Heater 2
Idle run heating	S*	On; Off	Operating parameters → Heater → Idle run heating
Idle run heating activation temperature	S*	2.10-9.50°C	Operating parameters → Heater → Idle run heating
Idle run heating deactivation temperature	S*	7.50-90.0°C	Operating parameters → Heater → Idle run heating
High dew point warning	S*	On; Off	Operating parameters → Dew point
High dew point warning level	S*		Operating parameters → Dew point
Low dew point warning	S*	On; Off	Operating parameters → Dew point
Low dew point warning level	S*		Operating parameters → Dew point
High dew point error	S*	On; Off	Operating parameters → Dew point
High dew point error Level	S*		Operating parameters → Dew point
Low dew point error	S*	On; Off	Operating parameters → Dew point

Table 17: List of service parameters

Name	Access level	Scope	Location
Low dew point error level	S*		Operating parameters → Dew point
Dew point temperature event delay	S*	≥ 0 s	Operating parameters → Dew point
Power loss restart	U	On; Off	Operating parameters → Auto restart
Restart after error	U	On; Off	Operating parameters → Auto restart
Restart delay	U	≥ 0 s	Operating parameters → Auto restart
Maximum restart attempts	U	≥ 1	Operating parameters → Auto restart
Power loss restart	S*	On; Off	Operating parameters → Temperature switch
Temperature source	S*	Slow; Oil temperature; Air temperature; Engine temperature; Ambient temperature; Additional temperature; Dew point Temperature	Operating parameters → Temperature switch
Upper temperature switching point	S*	0.0-300.0°C	Operating parameters → Temperature switch
Lower temperature switching point	S*	-30.0-0.0°C	Operating parameters → Temperature switch
Maximum oil temperature	S	105.0-300.0°C	Factory settings → Temperature
High oil temperature warning	S	20.0-110.0°C	Factory settings → Temperature
Minimum oil temperature for Start	S	-10.0-20.0°C	Factory settings → Temperature
Engine maximum temperature control	S	On; Off	Factory settings → Temperature
Maximum engine temperature	S	≥0.0°C	Factory settings → Temperature
oil temperature increment control	S	On; Off	Factory settings → Temperature
minimum oil temperature increment	S	0.0-200.0°C	Factory settings → Temperature
Control duration	S	0-1440 min	Factory settings → Temperature
oil temperature increment control activity threshold	S	0.0-500.0°C	Factory settings → Temperature
Maximum permissible network pressure	S	0.00-50.00 bar	Factory settings → Pressure
Maximum oil pressure for startup	S	0.00-3.00 bar	Factory settings → Pressure
maximum engine starts per hour	S	0-30	Factory settings → Time parameters
Number of engine starts in the last hour	S		Factory settings → Time parameters
Reset number of engine starts in the last hour	S	Reset	Factory settings → Time parameters
Maximum idle run time	S	≥10 s	Factory settings → Time parameters
Minimum idle run time	S	≤1800 s	Factory settings → Time parameters
Post-startup motor current control	S	On; Off	Factory settings → Motor protections
Minimum post-startup motor current	S	0-500 A	Factory settings → Motor protections

Table 17: List of service parameters

Name	Access level	Scope	Location
Exceeding maximum motor current error	S	On; Off	Factory settings → Motor protections
Maximum permissible current	S	≥ 0 A	Factory settings → Motor protections
Motor current error delay	S	≥ 1 s	Factory settings → Motor protections
RTD 1 Current value	S		RTD Input Offset
RTD 1 przesunięcie	S		RTD Input Offset
RTD 2 Current value	S		RTD Input Offset
RTD 2 przesunięcie	S		RTD Input Offset
RTD 3 Current value	S		RTD Input Offset
RTD 3 przesunięcie	S		RTD Input Offset
RTD 4 Current value	S		RTD Input Offset
RTD 4 przesunięcie	S		RTD Input Offset
Restore service settings from local copy	S		Factory settings → Restore and save settings
Restore user settings from local copy	U		Factory settings → Restore and save settings
Save a local backup of settings	S		Factory settings → Restore and save settings
Restore service settings from external media	S		Restore and save settings
Restore user settings from external media	S		Restore and save settings
Save a backup of settings to external media	S		Restore and save settings
Reset warning and error history	S	Reset	Reset warning and error history → Restore and save settings
Reset sensor history	S	Reset	Reset warning and error history → Restore and save settings
Save logs to data media	U		Factory settings → Service logs
User password	U	1-10 cyfr	Factory settings → Passwords
Service password	S	1-10 cyfr	Factory settings → Passwords
Function and logic for each digital input	S*		Input/Output configuration → Digital inputs
Function and logic for each digital output	S*		Input/Output configuration → Digital outputs
Function and range for each analog input from 1 to 3	S*		Input/Output configuration → Analog inputs
Function and range for analog input 4	S*		Input/Output configuration → Analog inputs
Function for each analog output	S*	None; Setpoint for an analog drive; Analog sensor tracking; RTD sensor tracking	Input/Output configuration → Analog outputs
Transmission speed	U	2400; 4800; 9600; 19200; 38400; 57600; 115200; 230400	Input/Output configuration → RS-485/RS-485 ISO
Parity	U	None; Even; Odd;	Input/Output configuration → RS-485/RS-485 ISO
Stop bits	U	1; 1.5; 2	Input/Output configuration → RS-485/RS-485 ISO
RS-485/RS-485 ISO Function	U	None; Master; Sub	Input/Output configuration → RS-485/RS-485 ISO
Modbus address	U	1-255	Input/Output configuration → RS-485/RS-485 ISO

Table 17: List of service parameters

Name	Access level	Scope	Location
IP address assignment	U	Auto (DHCP); Static (without DHCP)	Input/Output configuration → IP settings
IP address	U		Input/Output configuration → IP settings
Subnet mask	U		Input/Output configuration → IP settings
Gateway	U		Input/Output configuration → IP settings
Turn on valve Y	U	On; Off	Diagnostics → Manual control of valve Y
Manual control of valve Y	S	On; Off	Diagnostics → Manual control of valve Y
Safety valve test	U	< 15.5 bar	Diagnostics → Safety valve test
Remote mode	U	LOCAL; NET; REM; RVM	Network operation → Configuration
communication time limit with master compressor	U	≥ 0 s	Network operation → Configuration
Operate as master compressor	U	On; Off	Network operation → Configuration
Network operation algorithm	U	SEQ; CAS	Network operation → Configuration
Number of sub compressors	U	0-5	Network operation → Configuration
startup delay between sub compressors	U	0-60 s	Network operation → Configuration
Rotation time	U	≥ 1 min	Network operation → Configuration
Pressure relief for master compressor	U	0.0-11.0 bar	Network operation → Configuration
Pressure loading for master compressor	U	0.0-10.0 bar	Network operation → Configuration
Automatic pressure limit reconfiguration	U	On; Off	Network operation → Configuration
Network operation point	U	≥0.00 bar	Network operation → Configuration
Pressure relief (Sub compressor)	U	0.0-11.0 bar	Network operation → Compressor 1/2/3/4/5
Pressure loading (Sub compressor)	U	0.0-10.0 bar	Network operation → Compressor 1/2/3/4/5
Interface (Sub compressor)	U	RS-485; RS-485 ISO	Network operation → Compressor 1/2/3/4/5
Modbus address (Sub compressor)	U	1-255	Network operation → Compressor 1/2/3/4/5
Scheduled operation	U	Activate; Deactivate	Scheduling
Add event	U		Scheduling → One-time Events/Cyclic events

[F]-Parameter available only for compressors equipped with an inverter

8.1. Change service password

To change the default service password, go to the tab:
Service parameters → Factory settings → Passwords.
Then enter a value in the ”Service password” parameter. The password can be 1 to 10 digits long.
In case of forgetting the service password, contact the manufacturer.

Service access also allows for changing the user password.

9. Production parameters

The production parameters of the controller form a separate group of parameters that define, among other things, the key features of the compressor and the controller.
Access to the production parameters menu is possible by entering a special password during login to the service parameters. The password for the production parameters is provided only to authorized personnel, in agreement with the compressor manufacturer.

Table 18: List of production parameters

Name	Range
Compressor serial number	12 characters
Startup method	Star-Delta; Analog inverter; Modbus inverter; Direct
drive type	Belt;Direct
Manufacturer's password	10 characters
ULTRA SPEED Function	On; Off
Clear memory error	
Reset controller memory to factory settings	

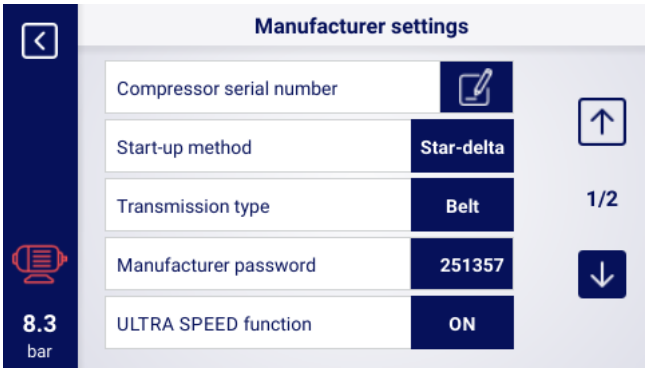

Figure 26: View of Production parameter menu

9.1. Controller default settings

To facilitate the configuration of the controller, after selecting the compressor startup method in the production parameters, a message appears on the screen regarding the controller settings change for the selected drive type. If "Yes" is selected, The controller will change the parameter settings to the defaults intended for the selected motor startup type. If the "No" option is chosen, the controller will change the startup method while retaining the current parameter settings.
To obtain the current list of default parameters, please contact the compressor manufacturer.

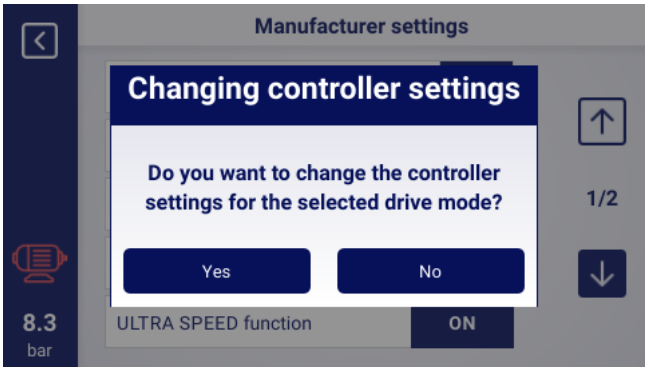

Figure 27: Message about changing controller settings to default

9.2. Reset controller memory to factory settings

The parameter ”Reset controller memory to factory settings” restores all parameters to their initial settings and erases all data saved on the controller.
To reset the memory, press and hold the ”Reset” button until it turns red, and press it again.
After resetting the controller’s memory, an error message will appear stating ”Controller memory has been cleared” to remind you that key controller parameters, such as input/output settings, may have changed.
To clear this error from the controller, press the reset button next to the ”Clear memory error” parameter.

10. Operating algorithm

The controller is equipped with several motor control algorithms depending on the type of compressor. The control algorithm is configured according to the compressor's specifications during the production stage. The controller allows for determining the following starting methods:

- Star-Delta
- Analog inverter
- Modbus inverter
- Direct

The above methods of electric motor control and their operating principles are described in the sub-sections below.

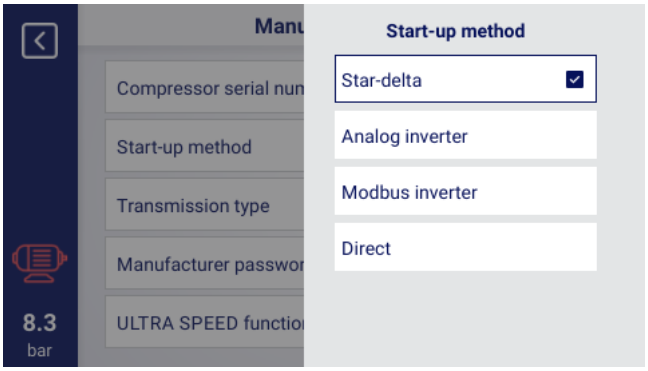

Figure 28: View of the menu with startup mode settings

10.1. Operating algorithm diagram in Star-Delta configuration

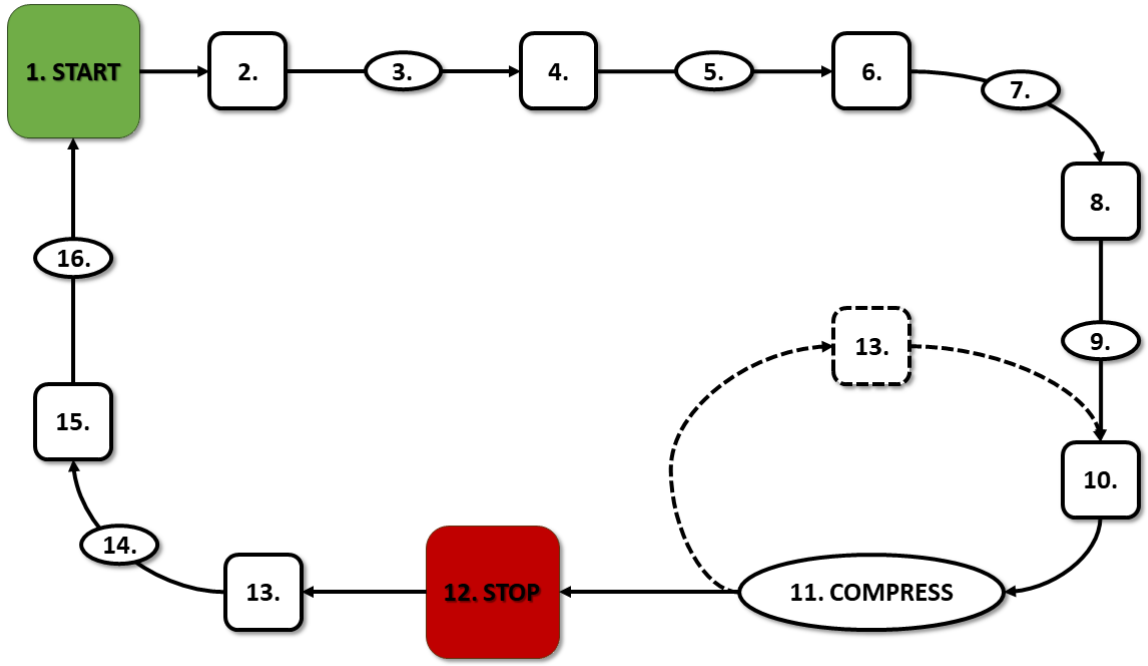

Figure 29: Engine control algorithm

The basic operating algorithm of a compressor in a star-delta configuration:

1. Start (e.g., pressing the **START** button)
2. Activate the star contactor (start the motor in star configuration)
3. Main contactor delay
4. Activate the main contactor
5. Startup - motor acceleration time
6. Deactivate the star contactor
7. Star-delta switching time
8. Activate the delta contactor (start the motor in delta configuration), and start the actual operation
9. Compression delay - delay in opening the Y valve
10. Open the Y valve - and then start the compression
11. Compression - The Y valve is controlled by the operating algorithm according to the required upper and lower pressure settings. Deactivating the Y solenoid valve relieves the compressor, and the motor enters an idle state
12. Stop operation ((e.g., pressing the **STOP** button)
13. Close the Y valve, and go to an idle state
14. Stopping - motor stopping time

15. Deactivate the delta and main contactors
16. Restart delay

10.1.1. Compressor operating time parameters

Settings for all times and delays used in the control algorithm can be found in:
User parameters → Operating parameters → Time parameters.

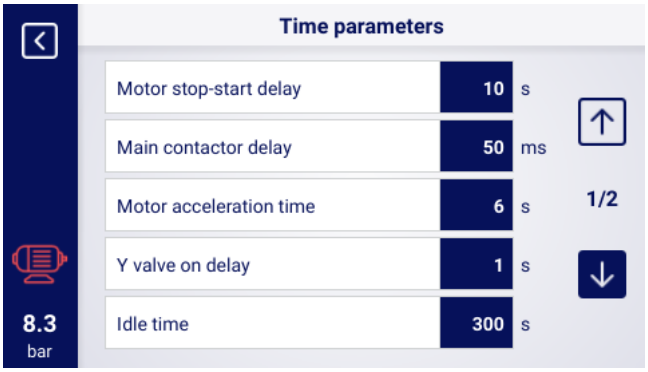

Figure 30: View of the menu with time parameter settings for the Star-Delta configuration

Table 19: List of compressor operating time parameters

Name	Unit	Description
Restart delay	s	The minimum time between compressor shutdown and the next start. If the compressor is restarted before this time elapses, the motor will start with an appropriate delay
Main contactor delay	ms	The time between turning on the main contactor and turning on the star configuration contactor
Motor ramp-up time	s	The time it takes for the electric motor to ramp up. The time it takes to switch from the star configuration to the delta configuration
Y-Valve activation delay	s	The waiting time for pressurization, during which the motor is idling
Idle running time	s	The time the motor is idling after exceeding the upper pressure limit
Motor stop time	s	The time the motor is idling after pressing the **STOP** button
Star-Delta switching Time	ms	The time between turning off the star configuration contactor and turning on the delta configuration contactor.
Adaptive idle run (AutoTlse)		Described in the chapter **12.1.2. Adaptive idle run (AutoTlse)**

10.2. Scheme of the control algorithm in the inverter configuration

The operating principle of the control algorithm for Inverter Modbus and Inverter analog configurations is the same. The difference lies in the method of communication between the inverter and the controller. More information can be found in the chapters **Modbus Inverter configuration** and **Connecting an analog inverter**.

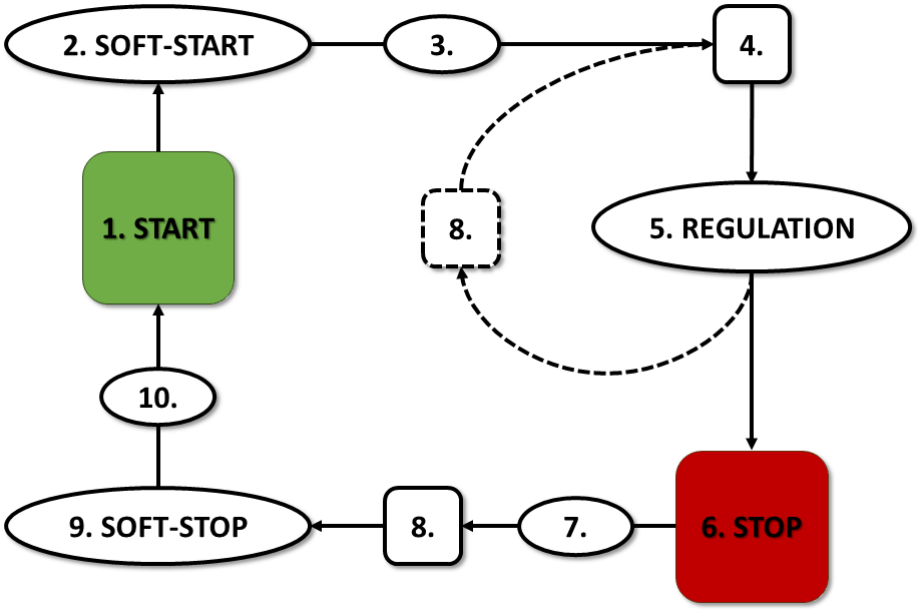

Figure 31: Motor control algorithm

The primary algorithm for compressor operation in the Inverter configuration:

1. Starting the operation (e.g., pressing the **START** button)
2. Startup - motor acceleration time
3. Compression delay - delay in turning on valve Y
4. Valve Y activation - and then start of compression
5. Compression - during compression, pressure is controlled by turning valve Y on and off, and motor speed is controlled by the PID algorithm. Turning off solenoid valve Y releases the compressor and puts the motor in idle mode.
6. Stopping the operation (e.g., pressing the **STOP** button)
7. Delay in deactivating valve Y
8. Deactivation of valve Y, transition to idle mode
9. Stopping - motor stopping time
10. Restart delay

10.2.1. Compressor operating time parameters

Settings for all times and delays used in the control algorithm can be found in:
User parameters → Operating parameters → Time parameters.

Figure 32: Menu view with time parameter settings for the Inverter configuration

Table 20: List of compressor operating time parameters

Name	Unit	Description
Restart delay	s	The minimum time between compressor shutdown and the next start. If the compressor is restarted before this time elapses, the motor will start with an appropriate delay.
Motor acceleration time	s	The time it takes for the electric motor to accelerate. A gradual motor startup procedure (**SOFT-START**) to the minimum speed.
Y-Valve activation delay	s	The waiting time for pressurization, during which the motor is idling.
Y valve deactivation delay	s	The delay in deactivating Valve Y after pressing the button **STOP**
Idle running time	s	The time the motor is idling after exceeding the upper pressure limit.
Motor stop time	s	The time it takes for the electric motor to stop. Gradual engine stop procedure (**SOFT-STOP**)
Adaptive idle run (AutoTlse)		Described in the chapter **12.1.2. Adaptive idle run (AutoTlse)**

10.2.2. PID Controller

The output frequency of the drive motor is controlled by a PID algorithm based on the current and desired pressure values. The controller will aim to maintain the appropriate rotational speed of the compressor shaft to optimize the compression process and reduce electrical energy consumption. The correct operation of the controller under the PID algorithm requires the correct configuration of algorithm parameters in the section:
Service parameters → Drive → Drive parameters.

Table 21: PID Controller tuning parameters

Parameter	value Default	Description
Proportional gain	30.00 bar	Affect the shortening of the regulation time, potentially increasing the speed of the control signal's response to pressure changes. Excessive values of this parameter can lead to overshooting and unstable operation
Integral time	6.00 s	The purpose of this parameter is to reduce the regulation error to zero in the steady state. It influences the prolongation of the regulation time.

10.2.3. Set pressure

For configurations with a drive motor in the control algorithm, in addition to the lower and upper-pressure limits, the set pressure value is also taken into account. This is the so-called PID algorithm control point, which is the desired pressure value in the network, and the algorithm strives to continuously maintain this pressure value through smooth compressor output adjustment.

Its value can be set, along with the other pressure settings, in the section:
User parameters → Operating parameters → Network pressure.
The value of this parameter is also displayed on the main screen of the controller. For other control algorithms, such as Star-Delta, this parameter is not visible.

Figure 33: Network pressure settings

10.3. Primary operation algorithm in Direct Start configuration

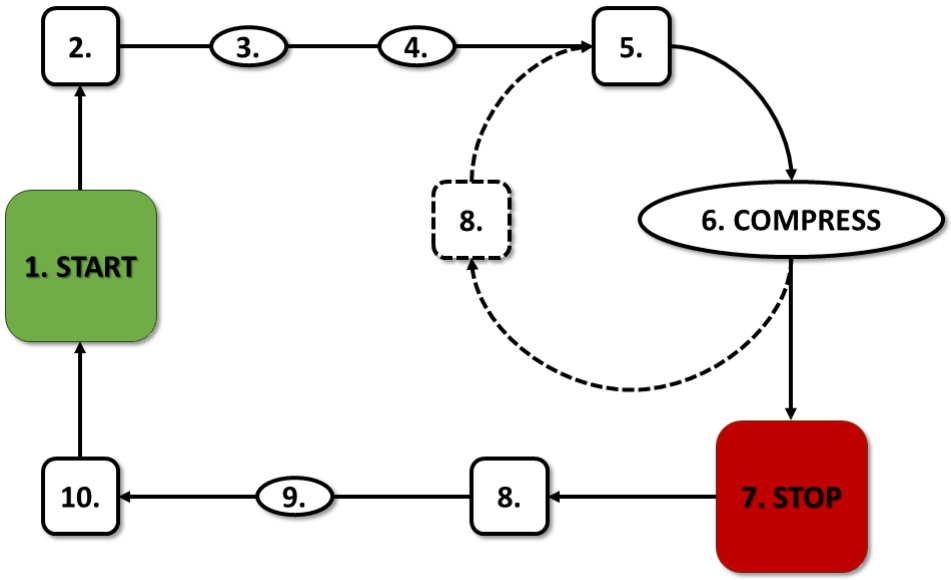

Figure 34: Motor control algorithm

Primary operation algorithm in Direct Start configuration:

1. Starting work (e.g., pressing the **START** button)
2. Main contactor activation
3. Motor startup - motor ramp-up time
4. Compression delay - delay in turning on valve Y
5. Valve Y activation - and the start of compression
6. Compression. Valve Y is switched on/off by the operation algorithm according to the required upper and lower pressure limits
7. Stopping work (e.g., pressing the **STOP** button)
8. Turning off valve Y, transition to idle mode
9. Stopping - motor stopping time
10. Main contactor deactivation

10.3.1. Compressor operating time parameters

The settings for all times and delays used in the control algorithm can be found in:
User parameters → Operation parameters → Time parameters.

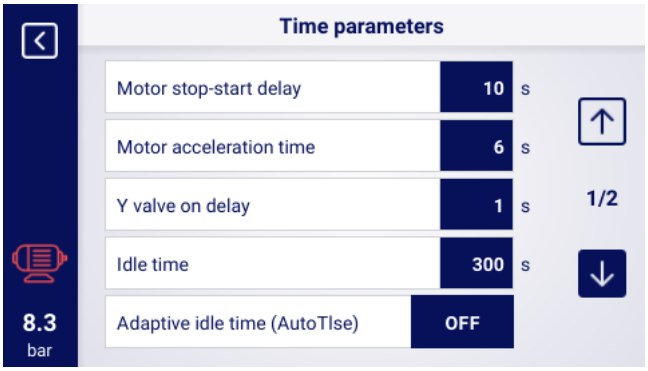

Figure 35: View of the menu with time parameter settings for Direct Start configuration

Table 22: List of time parameters for compressor operation

Name	Unit	Description
Restart delay	s	The minimum time between compressor shutdown and the next start. If compressor operation resumes before this time elapses, the motor will start with the appropriate delay
Motor ramp-up time	s	Time it takes for the electric motor to reach full speed
Y-valve activation delay	s	Waiting time for pressurization, during which the motor is idling
Idle run time	s	Time of free operation after exceeding the upper pressure limit
Motor stopping time	s	Time of free operation after pressing the **STOP**button
Adaptive idle run (AutoTlse)		Described in the chapter **12.1.2. Adaptive idle run (AutoTlse)**

10.4. Idle run

The idle run of the compressor is a part of every operating mode provided in the controller. It is accomplished by closing the Y-valve and keeping the motor running. This allows the machine to quickly return to the air compression state in case of pressure drop, without the need for a full motor restart.
The idle run time can be defined by going to the tab:
User parameters → Operating parameters → Time parameters → Idle run time.
The available range for idle run time setting depends on the specific compressor model. When the idle run time ends the motor is stopped.

10.4.1. Configuring the idle run time range

User parameters allow setting the idle run time within a specific range, which is defined in the service parameters, under the section:
Service parameters → Factory settings → Time parameters → Maximum/Minimum Idle run time.

10.5. Decompression control method

The controller can control decompression using several methods, including a suction sensor, time delay, or oil pressure sensor.

Suction sensor - Decompression control is performed using a sensor connected to the digital input (DI) of the controller.. To activate control, you need to assign the ”Suction sensor” function to one of the digital inputs. If the compressor is not decompressed during the motor startup attempt, a ”Waiting for decompression” message will be displayed. The startup will only occur when the sensor signal indicates decompression.

Oil Pressure Sensor - Decompression control is performed using an oil pressure sensor connected to one of the analog inputs (AI) of the controller. To activate control, you need to assign the ”Oil pressure sensor” function to one of the analog inputs and set the maximum oil pressure at which the compressor can start the motor

(**Service parameters → Factory settings → Pressure → Maximum oil pressure for startup**). If during the startup attempt, the pressure is higher than the defined value, the message ”Waiting for decompression” will be displayed. The start will only occur when the pressure drops below the maximum oil pressure value for startup.

Time Delay - The time delay allowing the compressor to decompress can be defined in the parameter:

Service parameters → Operation parameters → Time delay → Restart delay. If the time from stopping the compressor to attempting a restart is shorter than the delay time defined by the parameter, the compressor startup will be held until the delay time elapses, and the controller will display the message ”Engine restart delay.”

Each of the decompression control methods is independent. This means that when using more than one method, for the engine to start, each of the control conditions must be met.

11. ULTRA SPEED function

A standard compressor equipped with an inverter regulates the rotation of the drive motor as a function of pressure. The controller transmits the reference frequency to the inverter, which matches the output frequency to it. The power on the motor shaft then increases as the pressure increases, while the compressor capacity remains constant.
In this case, the rotational speed is included within the limits between the minimum frequency setpoint (for discharge pressure above the set pressure) and the maximum setpoint on the compressor controller (for pressures below the set pressure).

The ULTRA SPEED function is an additional PID controller, which is designed to increase the output frequency of the inverter in the range from the maximum frequency set on the controller to the maximum frequency of the ULTRA SPEED function related to the construction of the compression stage and the drive motor (additionally limited by the internal parameters of the inverter). The controller is designed to keep the currently consumed power as close as possible to the rated value of the motor. This translates into an increase in speed and thus efficiency when operating the compressor at pressures lower than nominal and has a positive impact on electricity savings. The ULTRA SPEED function is particularly useful in moments of excessive demand for compressed air.

11.1. ULTRA SPEED Setup

The ULTRA SPEED function can be configured if it has been previously activated in the menu from the Manufacturer Settings. To activate the functionality, select ”Enable” in the ULTRA SPEED Function parameter. Without it, the function is hidden in the entire controller and invisible to the user and the service technician.
To properly configure the controller in question, go to the **Service Parameters tab → Inverter → ULTRA SPEED** oraz aktywować funkcję poprzez parametr Funkcja ULTA SPEED na „Włącz”, and activate the function via the ULTRA SPEED Function parameter to ”Enable”, and then enter the value of the Nominal motor power parameter. The controller will to maintain the declared power (the value should be consistent with the rated power of the motor). Reinforcement of the proportional member and Integration time are the parameters of the controller, which provide the rate of power increase and the response time of the system.

Figure 36: Window view with ULTRA SPEED settings

To finish setting up UltraSpeed, go to the tab at the end:
Service parameters -> Inverter -> Inverter parameters and set the Maximum Speed parameter for the ULTRA SPEED function to the appropriate value.

Figure 37: View of the window with inverter parameter settings

Note!
Please note that this frequency is directly related to the construction of the screw stage and the electric motor, and its value should only be modified in consultation with the compressor manufacturer!
The difference between the Maximum Speed and the Maximum Speed for the ULTRA SPEED function is the adjustment window of the PID controller performing the described algorithm. Said regulator is deactivated when the compressor set pressure is reached. This case means that the network pressure is adequate and a high compressed air capacity is not required. The compressor will start, then operate at a speed lower than the Maximum Speed, and on the other hand limited by the Minimum Speed.

12. Compressor and controller operation settings

Compressor operation mode settings can be found in the **User Parameters → Operation Parameters → Operating Modes** tab. The operation mode settings are divided into 2 independent groups: Operation mode and Remote mode. The first one defines the compressor's operation algorithm, the second one defines the way the compressor is controlled.

12.1. Operation modes

Available operation modes:

- AUTO
- CONST

12.1.1. Automatic mode (AUTO)

The automatic operating mode involves the compressor starting and stopping automatically when predefined load and unload pressure values are reached. To initiate automatic operation, press the green START button.
When the network pressure reaches the maximum set value, the compressor will enter an idle state. If the network pressure falls below the minimum set value before the idle time elapses, the compressor will resume loading. If the idle time ends, and the network pressure falls within the set pressure range, the engine will be stopped. The compressor will automatically restart when the pressure drops below the minimum pressure value. To disable automatic operation, press the red STOP button.
During automatic operation, it is possible to force the transition from the idle state to the loading state before the load pressure is reached by pressing the START button, provided the current network pressure is lower than the unload pressure.

12.1.2. Adaptive idle run (AutoTIse)

Optimally setting the idle run time is crucial for economic reasons. A time set too long results in unnecessary idle running of the engine, leading to increased electrical energy consumption. Conversely, setting a short idle run time can lead to frequent compressor start and stop cycles, causing an increase in electrical energy consumption and reducing the mechanical components' lifespan.
Utilizing the algorithm allows for automatic control of the engine's idle run time in the automatic compressor operation mode. The system continuously analyzes the historical and current tank pressure value, taking into account the following parameters:

- pressure monotonicity,
- pressure rise/fall rate,
- reference pressure values to upper and lower limits,
- pressure rise/fall times in previous compressor start/stop cycles,
- set idle run time,
- estimated number of compressors starts per hour.

Based on the gathered information, the function **AutoTIse** scontrols the idle run time mainly by reducing it, ensuring that it is never shorter than the minimum idle run time set in the time parameters in the controller's factory settings. If there is little demand for pressure in the network during idle operation and the pressure decreases slowly or not at all, the algorithm accelerates the compressor's shutdown. If there is an anticipated need to restart the compressor shortly after the motor is turned off, the compressor remains in idle run mode.
The Adaptive idle run function can be used both on standalone compressors and compressors in a network.
To enable this function **AutoTIse** go to the **User parameters screen → Work parameters → Time parameters** and set the "Adaptive idle run" parameter to "Enable."

12.1.3. Continuous mode (CONST)

The continuous operation mode keeps the compressor motor in a continuous state of operation. This is done through infinite idling time. To start the continuous mode, press the green START button.
When the network pressure reaches the setpoint (max.), the compressor will idle until the network pressure falls below the setpoint (min.), after which it will start compressing again. When the compressor is started with the START button and the network pressure is within the set pressure, the motor will not start. The motor will be started for the first time when the pressure drops below the minimum value. Press the red stop button to deactivate the continuous operation mode. During continuous operation, it is possible to force the transition from idle run to the compression state before the load pressure is reached by pressing the START button, provided that the current network pressure is lower than the offload pressure.

12.2. Remote modes

Available remote modes:

- LOCAL
- NET
- REM
- RVM

12.2.1. Local control mode (LOCAL)

In local control mode, the compressor operates according to pressures set on the controller (minimum and maximum). The compressor is controlled by the START and STOP buttons, and its operation is governed by internal algorithms of the controller, depending on the selected operation mode.

12.2.2. Network mode NET

In network operation mode, the compressor operates according to the pressure settings provided by the master controller via Modbus RTU. The NET mode is dedicated to the operation of the compressor as a slave. The master controller is responsible for starting the operation of the compressor, you do not have to press the START button.

12.2.3. Remote control mode REM

In REM remote control mode, the compressor does not control the network pressure setting. It is done through a digital input configured as ”Remote load - unload signal”. Pressure control is carried out externally, e.g. via the master controller.
When the load signal appears on the controller’s digital input, the compressor will behave in the same way as if the pressure dropped below the setpoint (min.). When the signal on the digital input is changed to unload, the compressor will behave as if the upper limit of the set pressure (max.) was exceeded.
Apart from the above mentioned differences, the operation of the compressor control algorithm is carried out according to the selected operating mode. When the REM remote control mode is selected in the main interface view, pressure ranges will be replaced by an ”External pressure control” message. Despite the lack of supervision over the set pressure in the network, the controller continuously controls the pressure limits set by the compressor manufacturer. If the measured pressure in the network exceeds the maximum pressure value, the compressor will be stopped.
Note!
To start the compressor in the REM remote control mode, press the START button on the controller.

12.2.4. REM remote control mode configuration

To configure remote control in REM mode, set the ”Remote mode” parameter to ”REM” (**User parameters→ Operation parameters→ Operation modes → Remote mode**). In order to enable remote control in REM mode, one of the digital inputs of the controller should be assigned the function ”Load-relief remote signal”. In order to check and possibly configure one of the digital inputs as ”Remote load - relief signal”, go to the digital input configuration parameters **Service parameters→ Configure inputs/outputs→ Digital inputs**).

12.2.5. RVM remote control mode

In REM remote control mode, the compressor does not control the network pressure setting. It is done through a digital input configured as ”Remote load - unload signal”. Pressure control is carried out externally, e.g. via the master controller.
When the load signal appears on the controller’s digital input, the compressor will behave in the same way as if the pressure dropped below the setpoint (min.). When the signal on the digital input is changed to unload, the compressor will behave as if the upper limit of the set pressure (max.) was exceeded.
Apart from the above mentioned differences, the operation of the compressor control algorithm is carried out according to the selected operating mode. When the REM remote control mode is selected in the main interface view, pressure ranges will be replaced by an ”External pressure control” message. Despite the lack of supervision over the set pressure in the network, the controller continuously controls the pressure limits set by the compressor manufacturer. If the measured pressure in the network exceeds the maximum pressure value, the compressor will be stopped.
Note!
To start the compressor in the REM remote control mode, press the START button on the controller.

12.2.6. RVM remote control mode configuration

To configure remote control in RVM mode, set the ”Remote mode” parameter to ”RVM” (**User parameters→ Operation parameters→ Operation modes → Remote mode**).

12.2.7. Remote start function

The remote compressor start function allows the user to control the compressor using digital input. Remote control operates to pressing the START or STOP button was pressed on the controller.
Note!
The START and STOP buttons override the remote start function, which means that pressing the START button is necessary to grant permission to remote start. If all remote start conditions are met the compressor will start. Whereas, if there are any issues with input signal, the message ”Waiting for remote start signal” will be displayed in the text message. Pressing the stop button cancels the start permission until the START button is pressed again.

12.2.8. Remote start configuration

The configuration of remote start is done by assigning the ”Remote start-stop” function to one of the digital inputs of the controller. In order to verify and configure one of the digital inputs as ”Remote load - relief signal”, go to the digital input configuration parameters **Service parameters→ Configure inputs/outputs→ Digital inputs**).

12.2.9. Differences between REM and RVM remote modes and the remote start function

Remote REM/RVM is a special controller mode which controls network pressure externally. In REM/RVM mode, the controller operates based on an external load and relief signal that replaces pressure settings. This mode is dedicated to master control, in which the master controller is responsible for controlling network pressure.
The remote start function as opposed to the remote REM/RVM mode is only a signal that can be assigned to one of the digital controller inputs. It does not affect the control algorithm. The compressor will operate according to the selected operating modes. The remote start function is an additional condition that must be met for the compressor to start. This function allows, for example, to assign an a compressor start-stop switch to an external operator panel. It can also be used to run simple algorithms in master operation.

13. Connecting the Inverter

The controller can control an inverter using the Modbus protocol or analog and digital inputs and outputs of the controller. The choice of communication method between the inverter and the controller can be made in the production settings of the controller in the ”Startup method” parameter.

When controlling an electric motor using an inverter, its speed is adjusted using a PID controller. Basic inverter parameter configuration can be done in the following tab:
Service parameters → Inverter → Inverter parameters.

Figure 38: View of the screen with the inverter settings

13.1. Modbus inverter connection

The controller can control and communicate with the inverter using the RS-485 interface and the Modbus RTU protocol.

13.1.1. Supported inverter models

The list of supported inverter models is provided below. It includes lists of device models from each manufacturer, whose support is included in the presets set in the service parameters and whose compatibility has been confirmed.

Supported Yaskawa inverter models:

1. A1000
2. J1000
3. V1000
4. GA700

Supported Danfoss inverter models:

1. VLT series

Supported Delta inverter models:

1. C2000 series

13.1.2. Connection configuration

Communication between the controller and the inverter is carried out using the RS-485 interface, which is integrated into the controller. For proper operation, one of the controller's inputs - RS-485 or RS-485 ISO - needs to be configured to work with the inverter. It is recommended to use the isolated RS-485 ISO input. The interface configuration can be done in the following menu:
Service parameters → Input/Output configuration → RS-485 ISO.

Figure 39: View of the screen with the RS-485 ISO interface settings

The parameter values for "Transmission speed," "Parity," and "Stop bits" must match the settings in the inverter. Set the "RS-485 ISO Function" parameter to "Master." Detailed information on configuring the inverter can be found in the inverter's manual.

Establishing communication with the inverter also requires configuring the service parameters that control communication. To do this, go to the following tab:
Service Parameters → Inverter → Interface configuration.

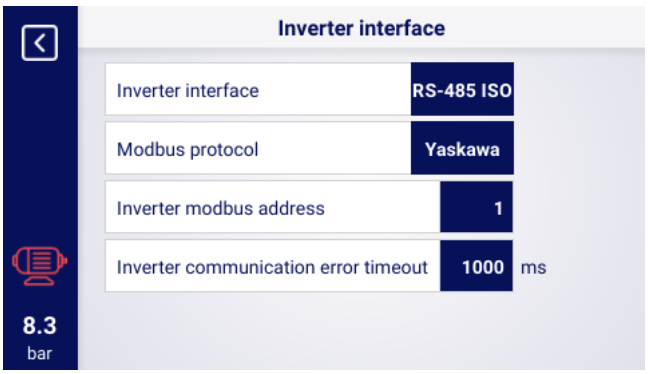

Figure 40: View of the screen with inverter interface settings

Table 23: Inverter interface configuration parameters

Parameter	Description
Inverter interface	Selection of the interface (connector) to which the inverter is connected
Modbus protocol	Selection of the communication preset for the appropriate inverter model
Inverter Modbus address	Modbus address set in the inverter parameters

Table 23: Inverter interface configuration parameters

Parameter	Description
Communication error timeout limit with the inverter	The time the controller waits for a response from the inverter. If the inverter does not respond to the controller's query within this time, a communication error with the inverter will be displayed.

After successfully configuring the controller and inverter parameters and connecting them to the bus, communication is established automatically. In case of a failed connection, a critical error **E26 Inverter communication error** will occur, leading to the compressor's shutdown. The connection status is periodically checked, so a communication error can occur at any time during operation.

13.1.3. Internal Inverter Errors

In case of an internal inverter error, its number will be visible. For each of the presets, there is a defined list of warnings and errors, and their codes are interpreted and their full names are displayed. The list of errors is provided in the chapter **23. Warnings and errors**. Confirming an error while displaying the inverter error message will acknowledge the error and clear it if its cause has been resolved.

13.2. Connecting an analog inverter

If the inverter equipped with the compressor does not support Modbus RTU communication or is not compatible with the controller (**13.1.1. Supported inverter models**), there is still the possibility to control the inverter using the analog output and digital inputs and outputs of the controller
The inverter must be configured to control the set speed using the analog and digital inputs to which the controller has connected the corresponding functions it manages. Detailed information about the inverter's configuration can be found in the inverter's manual.

13.2.1. Configuring the analog output

To control the speed of an electric motor, one of the analog outputs, AO1 or AO2, is utilized. The configuration of one of the outputs should be performed in the **Service parameters → Input/output configuration → Analog outputs** tab setting the parameter to "Set value for analog inverter."
The inverter must have an analog input that supports a 4-20 mA signal. An example of connecting the controller with the inverter is presented below in **13.2.4. Wiring diagram for the analog inverter**.
The 4-20 mA signal is proportionally regulated according to the desired frequency of the electric motor set by the controller. The value set in the "Maximum speed" parameter in the
Service parameters → Inverter → Inverter parameters
. tab corresponds to 20 mA on the configured analog output, while a value of 4 mA will always correspond to a frequency of 0 Hz.

13.2.2. Configuring the digital output

To control the inverter, a start/stop signal is also required. To achieve this, you should set the "Start-Stop signal for the inverter" on one of the digital outputs of the controller and connect this output to the inverter's remote start digital input.
this output to the inverter's remote start digital input. An example of connecting the controller with the inverter is shown below **13.2.4. Wiring diagram for the analog inverter**.

13.2.3. Configuration of the digital input

If the inverter has digital outputs and the option to configure it as an error output, you should connect this signal to one of the available digital inputs on the controller. In the **Service parameters → Input/output configuration → Analog outputs** tab configure this input as ”Inverter error.”
In case of an error on the inverter, the controller will display a critical error E25, ”Inverter error,” and the compressor’s operation will stop. To identify the error, it is necessary to consult the inverter’s documentation and review the description of the error displayed on it.

13.2.4. Wiring diagram for the analog inverter

The diagram below presents an example of connecting the controller to the inverter. Note that the availability and descriptions of inputs and outputs on the inverter may vary depending on the manufacturer and model.

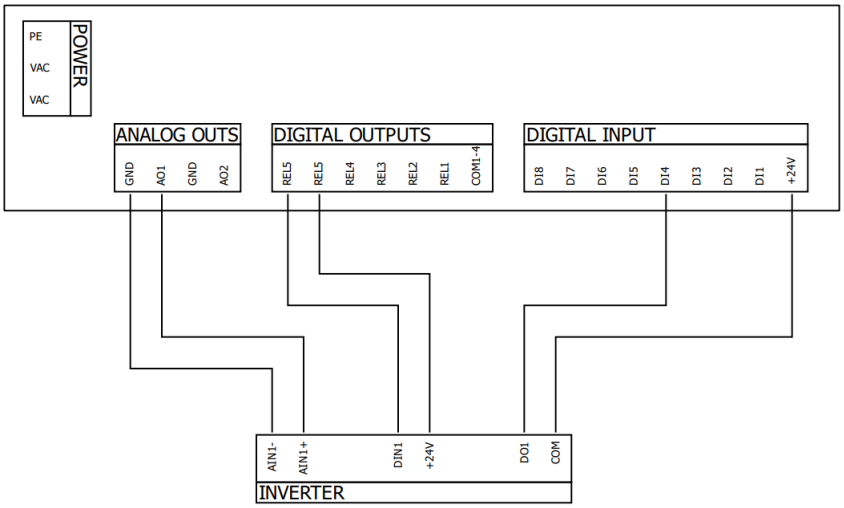

Figure 41: Wiring diagram for the analog inverter

Table 24: Description of inputs and outputs

Input/Output	Description
GND	Ground for controller’s analog output 1
AO1	Controller’s analog output 1
REL5	Pair of configurable transmitter outputs 5 on the controller
DI4	Configurable digital input 4 on the controller
+24V	Internal reference voltage output
AIN1-	Analog input (4-20 mA) on the inverter
AIN1+	Analog input (4-20 mA) on the inverter
DIN1	Configurable binary input on the inverter
+24V	Internal reference voltage output
DO1	Configurable binary output on the inverter
COM	Output common for transmitter output DO1

14. Input/output configuration

The controller is equipped with inputs and outputs whose functions and types of sensors can be configured from the controller's graphic interface.

14.1. Configuration of digital inputs

To configure individual digital inputs, go to: **PService parameters → Input/output configuration → Digital inputs**.
Each of the digital inputs is described with a number corresponding to the number of the physical input on the controller (e.g. Digital input 5 corresponds to the DI5 input described on the controller case).
To the right of the input name, there is a blue tile indicating the currently selected input logic.
"NO" (Activated high) means normally open, which means that the input is inactive until a +24 VDC signal is applied to it.
"NC" (Activated Low) means normally closed, n this case, the input is activated in the absence of a +24 VDC signal.
To change the input logic, click on the blue tile showing the currently selected logic, and then select between "NO" and "NC" from the list, which will be displayed.
Each digital input has a description of the function assigned to it, inputs that do not have any function assigned are marked as "Free". Each function can be assigned to any of the inputs, as long as it is not already in use.
List of assignable functions with description:

Suction sensor - Signal from the suction sensor.
Dehumidifier ready - Signal that the dehumidifier is ready for operation.
Operation planning on-off - A signal enabling the activation of planned operation using a digital input.
Remote start-stop - Remote start signal.
Remote load-unload signal - Remote compressor load-unload signal.
state of readiness - Signal of the analog inverter being ready for operation.
Emergency stop - The emergency stop signal of the machine, allows you to connect a safety switch to the controller, when activated, it triggers an "Emergency stop" error on the controller, causing the machine to stop immediately.
Attention!
The compressor emergency stop switch must be connected to the electrical installation in such a way as to immediately turn off the machine, regardless of the emergency stop function in the controller, which is for informational purposes only.
Power supply unbalance - Compressor power supply unbalance signal, allows connection of an external power supply unbalance sensor, when activated, it causes an error on the controller "Power unbalance error".
Phase sequence error - Incorrect phase sequence signal, allows you to connect an external phase sequence sensor, when activated, it causes an error on the controller "Wrong phase sequence".
Thermal error - Thermal error signal, if activated, causes an error on the controller "Thermal error".
Air filter error - Air filter contamination signal, allows connection of the air filter sensor, when activated, it triggers a warning on the controller "AF air filter error".
Oil filter error - Oil filter contamination signal, enables connection of the oil filter sensor, when activated, it triggers a warning on the controller "Oil filter error OF".
Separator error - Signal of separator contamination, allows connection of the separator sensor, when activated, it triggers a warning on the driver "SEP separator error".
Fan error - Fan error signal, allows you to connect a fan operation sensor, if activated it causes an

error on the controller ”Fan error”.
Inverter error - The analog inverter error signal is used when operating the analog inverter.

14.2. Configuration of digital outputs (transmitter)

The digital outputs in the controller are potential-free outputs. Outputs 1 to 4 have a common potential terminal ”COM 1-4”. Outputs 5 to 8 are independent transmitters. Output 9, on the other hand, is an independent transmitter with separate ”NO” normally open and ”NC” terminals normally closed. To configure individual digital outputs, go to **Service parameters → Input/output configuration → Digital outputs**. Each of the digital outputs is described with a number corresponding to the number of the physical output on the controller (e.g. Digital output 5 corresponds to the REL5 input described on the controller case). To the right of the input name is a blue indicator indicating the currently selected default output state.
”NO” means normally open, with this setting, the transmitter output terminals will be open by default, only when activated will the terminals be shorted.
”NC” means normally closed, with this setting, the transmitter output contacts will be closed by default, and when activated, the terminals will be opened.
To change the default output state, click on the blue tile showing the currently selected state, and then select between ”NO” and ”NC” from the list, which will be displayed. The exception is output no. 9, because it has physical terminals for ”NO” and ”NC”, it is not possible to switch between the default status.
Each digital output has a description of the function assigned to it, outputs that do not have any function assigned are marked as ”Free”. Each function can be assigned to any of the outputs, as long as it is not already in use. List of assignable functions with description:

Main power supply - Function controlling the main power contactor during engine start-up in the star-delta system.
Star - Function controlling the star contactor during engine start-up in the star-delta system.
Delta - Function controlling the delta contactor during engine start-up in the star-delta system.
Valve Y - Function controlling the compressor load valve.
Condensate drain - Function controlling the condensate drain valve.
Start-stop signal for the inverter - Function controlling the start signal of the analog inverter
Fan - Function controlling the compressor fan.
Dehumidifier - Function controlling the operation of the dehumidifier.
Heater 1 - Function controlling the operation of heater 1.
Heater 2 - Function controlling the operation of heater 2.
Warning - A function that activates the selected transmitter if there is an active warning on the controller.
Error - A function that activates the selected transmitter if there is an active error on the controller.
Warning/Error Status - A function that activates the selected transmitter if there is an active error or warning on the controller.
Ready - A function that activates the selected transmitter when the controller is in the ready state.
Running - A function that activates the selected transmitter when the compressor is compressing, idling, or starting or stopping the engine.
Compression - A function that activates the selected transmitter when the compressor is compressing.
Overview - A function that activates the selected transmitter if any service timer is exceeded.
Warn. from the height of the point dew - A function that activates the selected transmitter if there is an active warning on the controller about a too-high dew point.
Warn. from low pts. dew - A function that activates the selected transmitter if there is an active warning on the controller about a too-low dew point.

Temperature switch - A function that activates the selected transmitter depending on the temperature switch function settings.

14.3. Configuration of analog inputs

The analog inputs in the controller are divided into 3 categories: current loop measurement inputs 4-20 mA, resistance measurement inputs and transformer current measurement input.
The functions of individual inputs are configured similarly to digital inputs/outputs, by selecting a function from the list, while the measurement range configuration is available after clicking the gear icon.

14.3.1. AI analog input configuration (4-20 mA)

The controller is equipped with three 4-20 mA current loop measurement inputs. These inputs are described on the controller case as ”AI1”, ”AI2” and ”AI3”.
To connect a 4-20 mA standard transmitter to the controller, use the terminal of the selected analog input, e.g. ”AI2” and the adjacent +24V terminal. The AI contact in each input is compact to mass (GND).
Each input in the 4-20 mA standard is configured by assigning the transducer function to the input and entering measurement limits for 4 mA and 20 mA respectively.
List of assignable sensors with description:
Network pressure - Basic network pressure sensor, this sensor must be assigned to one of the inputs, otherwise, the compressor operation will be blocked, resulting in an error stating ”Pressure sensor not selected”.
Oil pressure - Oil pressure sensor, used by the compressor operation algorithm to control the decompression of the screw stage.
Dew point sensor - A device used to measure the humidity of compressed air in the form of a pressure dew point.

14.3.2. Configuration of RTD analog inputs (Temperature measurement)

The controller is equipped with 4 RTD resistance measurement inputs. These inputs are labeled on the controller case as ”RTD1”, ”RTD2”, ”RTD3” and ”RTD4”.
To connect a resistance temperature sensor to the controller, use the terminal of the selected RTD input, e.g. ”RTD1” and one of the mass terminals (GND).
Each resistance measurement input is configured by assigning the sensor function to the selected input and selecting the measurement range by selecting the sensor type. Possible temperature measurement sensors to choose from are PT100, PT1000, KTY-84, and PTC. Each sensor can be assigned to any of the inputs regardless of the selected sensor function, except for the PTC sensor, which is dedicated to engine temperature and can be selected only for this function.
List of assignable sensor functions with description:
Oil temperature - The oil temperature sensor protects against oil overheating, based on the oil temperature measurement, the compressor fan is turned on and off.
Engine temperature - The engine temperature sensor protects against engine overheating.
Air temperature - Air temperature sensor at the compressor output.
Ambient temperature - Ambient temperature sensor

14.3.3. RTD input offset

The RTD input offset function allows you to take into account the connection resistance between the controller input, and the sensor during measurement. Entering the offset value subtracts or adds the defined resistance value to the measurement.
To configure the offset, go to **Service parameters → Factory settings → RTD input offset**, and then enter the value by which we want to correct the measurement on the selected input.

14.3.4. Configuration of the transformer current measurement input

The controller is equipped with 1 current transformer current measurement input in the 5A standard. This input is described on the controller case as ”MC1”
To connect a current transformer to the controller, connect the transformer to the ”MC1” terminals and one mass terminal (GND).
Input ”MC1” is described in the user interface as ”Analog Input 4” and the function cannot be changed. The measurement range is changed by applying the current of the primary winding of the transformer coil to 5A of the secondary winding.

14.4. Configuration of analog outputs

The controller is equipped with 2 analog outputs in the 4-20 mA standard. These outputs are described on the controller case as ”AO1” and ”AO2”.
To connect the 4-20 mA output signal to an external device, connect to the selected analog output terminal, e.g. ”AO2” and to the selected mass terminal (GND).
Each analog output is configured by assigning a function to the output and, in the case of the tracking function, selecting the reference signal source and setting the signal limits. Tracking functions allow you to drive a 4-20 mA signal, depending on the signal given at the selected input. Their configuration involves selecting a reference signal and providing limit values for the reference signal, e.g. in the case of the tracking function of the selected RTD input signal,

must provide the temperature at which the signal value at the analog output is to be equal to 4 mA, and the temperature at which the signal value is to be 20 mA. Intermediate values will be calculated linearly.
List of assignable functions with description:
Analog inverter setpoint - Signal to control the speed setpoint of the analog inverter.
Analog Sensor tracking - A function that allows you to associate an analog output signal with a selected analog input.
RTD Sensor tracking - A function that allows you to associate the analog output signal with the selected RTD input.

15. Compressor protection functions

The controller is equipped with a number of functions designed to monitor key compressor parameters, such as:

- Oil temperature
- Motor temperature
- Network pressure
- Motor current
- Number of motor startups in the last hour

Based on these parameters, the real-time controller ensures safe operation of the compressor. If the limits of the above parameters are exceeded, the real-time controller prevents damage to the compressor.

15.1. Too high or too low network pressure protection

The parameter ”Maximum network pressure” is the value that determines the pressure level beyond which a critical error message is displayed and the compressor will stop immediately. The value of this parameter can be configured in the tab:
Service parameters → Factory settings → Pressure. The range is from 0 to 50 bar.

In addition, the controller has two more parameters that trigger a warning in the event that the measured pressure value deviates from the standard values, but this is not a critical value for compressor safety. These are warnings of high and low network pressure. The values of these parameters can be configured in the tab:
Service parameters → Operating parameters → Network pressure.
These are pressure limits at which a warning will be displayed, but this will not cause the compressor to stop running.
The warning about too low network pressure will be activated only when the network pressure drops below the set value, when the machine is in the compression state. The warning will not be displayed when the compressor is stopped or fills an empty compressed air system.

15.2. Oil overheating protection

The oil temperature control function protects the compressor in case of insufficient cooling. This function can be configured in the tab:
Service parameters → Factory settings → Temperature.

In the parameter ”High oil temperature warning”, you can specify the value of the temperature at which the high oil temperature warning W07 will be displayed on the controller, and this will not stop the compressor.
In the parameter ”Maximum oil temperature”, you can specify the value of the temperature at which the E08 error with too high oil temperature will be displayed and the compressor will stop working.

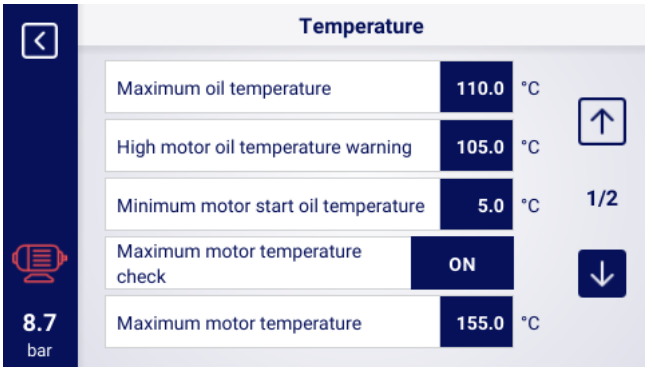

Figure 42: Tab with oil and electric motor temperature control settings

15.2.1. Electric motor temperature protections

The motor temperature control can be carried out using the motor temperature sensor, using the counter of the maximum number of motor startups per hour or both.

The motor temperature control function can be configured in the tab:
Service parameters Factory → settings → Temperature.
The parameter ”Maximum motor temperature control” allows you to activate or deactivate the function. In addition, in the parameter ”Maximum motor temperature”, it is possible to define the value of the motor temperature at which the compressor will come to an emergency stop.

The function of controlling the number of motor startups per hour can be configured in the tab:
Service parameters Factory → settings Time → parameters.
In the parameter ”Maximum number of motor startups per hour”, you can specify the maximum number of motor startups per hour in the range from 0 to 30. In addition, in the tab there is an option to reset the counter by pressing the ”Zero” button.

15.2.2. Oil temperature rise control function

The oil temperature rise control function allows you to detect problems related to the temperature sensor. If the sensor malfunctions, the compressor will stop and an error will occur. This function can be enabled in the tab:
Service parameters Factory → settings → Temperature (page 2/2).

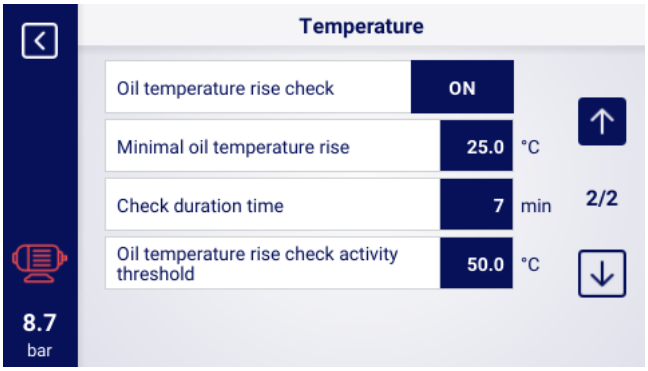

Figure 43: Oil temperature sensor supervision settings tab

The control of the oil temperature sensor operation consists in checking whether the temperature has risen by the set value within the set time (parameter ”Inspection duration”) (parameter ”Minimum oil temperature rise”). In addition, it is possible to disable this protection above the set oil temperature value (parameter ”Oil temperature rise control activity threshold”).

15.2.3. Electric motor current protections

In the **Service Parameters** → **Factory settings** → **Motor protections** tab, two electric motor current monitoring functions can be configured.

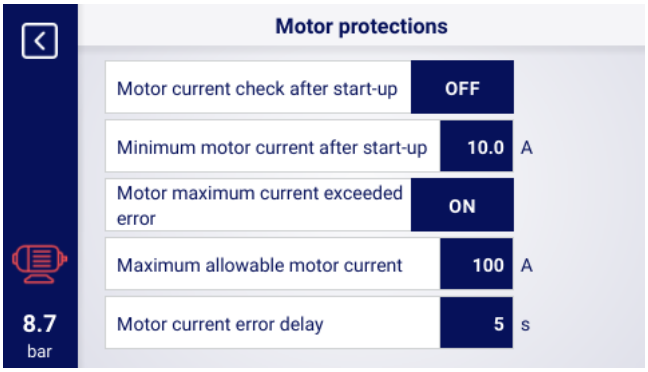

Figure 44: Motor protection settings tab

The first function is ”Motor current check after startup”. It monitors the current value of the motor after start. If its value is lower than the value specified in the parameter ”Minimum motor current after starting”, the compressor will be switched off, indicated by an error about the malfunction of the machine.

The second function is ”Motor Maximum Current Exceeded Error”. Enabling this function provides a control of the maximum value of the motor current specified in the parameter ”Maximum allowable motor current”. If this value is exceeded, the compressor stops immediately and an error occurs. In the parameter ”Motor current error delay”, it is possible to specify the delay of the occurrence of an error with too high motor current. This function allows you to skip momentary spikes in current values that occur, for example, when starting the motor.

16. Diagnostic Functions

The controller is equipped with additional diagnostic tools that can facilitate compressor service and diagnostics. In order to use the diagnostic functions of the controller, go to the **Service parameters → Diagnostics** tab.

16.1. Valve Y Test

The “Y-valve manual control” function allows the service to manually control the boost valve.

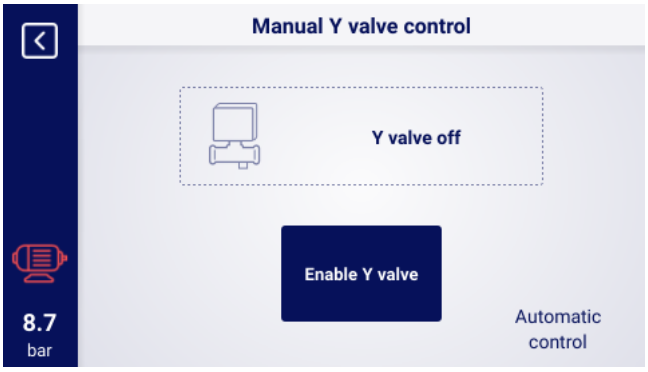

Figure 45: View of the controller screen in the manual control tab of the Y valve

The control is carried out by pressing the ”On/Off Y-valve” button. Each time the button is pressed, the Y valve output state changes to the opposite. To complete the manual control of the Y-valve, press the red ”Cancel” button in the lower right corner of the screen. After cancelling the manual control of the valve, the state of the valve Y is automatically restored, according to the default state of the output to which it is assigned.

Safety valve test

Safety valve testing may only be performed by authorized persons

Carrying out the safety valve test involves setting the target pressure and pressing the ”Start test” button. This will start the compressor, which will compress the air until the set limit is reached.

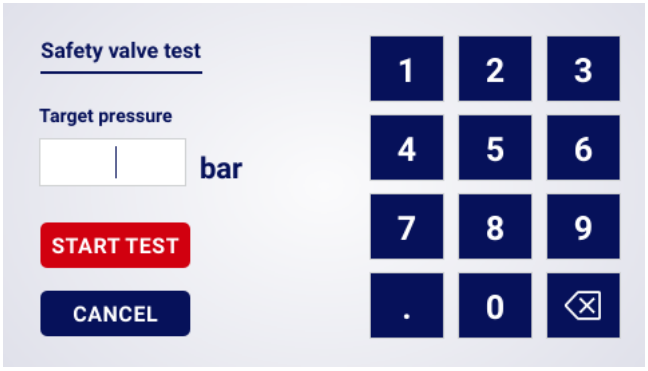

Figure 46: View of the controller screen in the manual control tab of the Y valve

Note that the controller at this point ignores all pressure limits and compresses to the pressure set in the ”Target pressure” field. In order for the safety valve to open, the set pressure limit should be higher than the valve operating level.

Before starting the test, read the information displayed on the controller screen.

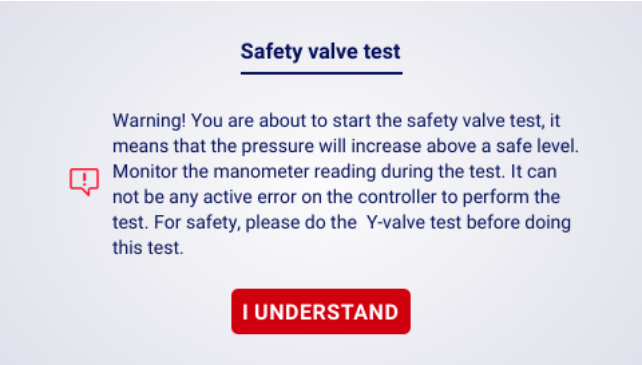

Figure 47: Safety valve test start warning

17. Other functions

17.1. Fan function (compressor cooling)

The fan function is dependant on the oil temperature measurement and allows the oil temperature to be kept in the optimum range. The fan turns on and off at specified oil temperature levels. This function is only active when the START button is pressed.
The parameters of the fan function can be found in the **User parameters tab → Operation parameters → Fan**. Modification of these parameters requires service level authorization.
The fan will stop when the motor is stopped using the stop button or an error occurs when the fan is on. However, if the motor stops during a standard work cycle, the fan will not be turned off, until the oil temperature drops below the fan shutdown temperature. **Note!**
In order for the fan function to work correctly, one of the digital outputs must be assigned the ”Fan” function

17.1.1. Fan function configuration

In order to configure the fan function, go to the **Service Parameters tab → Operation parameters → Fan**, and enter the appropriate values into the parameter fields.
The first ”Fan function” parameter allows you to enable or disable the operation of the fan function.
The second and third parameters ”Fan ON” and ”Fan off”, are used to enter the oil temperatures at which the fan is to be switched on and off.
It is also necessary to assign the fan function to the digital output to which the fan is connected(**Service parameters → Input/output configuration → Digital outputs**).

17.2. Dryer function

The dryer function allows you to control the dryer using one of the digital (relay) controller outputs. There are 2 independent dryer modes: Standard and pulsating.
In standard mode, the dryer is switched on during motor operation, and it is also possible to configure the drying time before starting and after finishing operation.
The pulse mode consists in switching the dryer on and off cyclically in order to maintain the relevant parameters. The pulse mode starts only when the machine motor is stopped when idling time elapses after the set pressure is reached. The dryer will go into pulsed mode (if configured) when the standard operation mode is complete.
When the dryer function is enabled, the user is informed about the remaining time of the dryer operation in the main view of the controller.

In order to configure dryer parameters, go to the **Service parameters rab → Operation parameters → Dryer**. **Note!**
In order for the dryer function to work correctly, one of the digital outputs must be assigned the ”Dryer” function

17.2.1. Dryer standard mode configuration

To configure the standard mode, enter the following parameters:
The ”Dryer function” parameter allows the user to enable or disable the function.
The ”Drying time before compressor star-up” parameter determines the dryer operation time before the motor starts (regardless of whether the start-up is caused by a pressure drop or after pressing the start button). The maximum value that can be set is 60 minutes.

The ”Drying time after compressor stop” parameter determines the dryer operation time after the motor stops (regardless of whether the stop has occurred as a result of reaching the set pressure or after pressing the stop button). The maximum value that can be set is 360 minutes. The ”Dryer idle time” parameter is the period after the drying is completed and the compressor is stopped and during which if the compressor operation is resumed, there will be no need for drying the drying process to initiate before start-up. This parameter is shared with the pulse mode of the dryer if it is active. The maximum value that can be set is 720 minutes.

17.2.2. Dryer pulse mode configuration

To configure the pulse mode, enter the following parameters:
The ”Pulse mode duration” parameter defines the time during which the dryer will operate in pulse mode.
The ”Pulsation period time” parameter determines the time of a single cycle in which the dryer is switched on and off for a specified time . The number of cycle repetitions depends on the ”Pulse mode duration” parameter.
The ”Pulse mode operation time” parameter determines for how long the dryer will be on during one pulse mode cycle.

Note!
In order for the dryer function to work correctly, one of the digital outputs must be assigned the ”Dryer” function

17.3. Condensate drain function

The controller has a built-in condensate drain valve operation function. The valve is opened using one of the digital (relay) outputs of the controller, the time interval and the operating time are defined by the user.

17.3.1. Condensate drain function configuration

In order to configure the condensate drain function, go to the **User parameters tab → Operation parameters → Condensate drain**. The ”Condensate drain function” parameter allows the user to enable or disable the function.
The ”Valve open period” parameter specifies the time interval in minutes between successive valve openings. The maximum value that can be set is 720 minutes.
The ”Valve open time” parameter determines the time in seconds during which the drain valve will be opened. The maximum value that can be set is 600 seconds.

Note!
In order for the Condensate drain function to work correctly, one of the digital outputs must be assigned the ”Condensate drain” function

In order to assign the condensate drain function to the output to which the drain valve is connected, go to the (**Service parameters tab → Input/output configuration→ Digital outputs**).

17.4. Auto restart function

The auto restart function allows the compressor to resume automatically when a power failure or error occurs. Not all errors allow auto restart. The full list of errors divided into those allowing and preventing auto restart, can be found in the ”Warnings and errors” section.
The automatic compressor restart function in the event of an error that allows for an auto restart requires the user to confirm the error and to start the compressor. In the event of failure (if it is not possible to confirm the error), the controller will make further attempts at auto restart (the number of attempts and the time interval between attempts are defined by the user).
The procedure for automatic compressor restart in the event of a power failure works in the same way as described above, with the difference that it initiates only after a power failure.
The user is informed about the ongoing auto restart procedure by through a message displayed in the main controller view in the message field.
If the auto restart fails, the function will be reset after the compressor is started manually.

17.4.1. Auto restart function configuration

To configure the auto restart function, go to the **User parameters tab → Operation parameters → Auto restart**. The ”Restart after power failure” and ”Restart after error” parameters allow the user to select the function range. One or both can be enabled at the same time.
The ”Restart delay” parameter allows the user to determine the time in seconds the controller will wait before proceeding to the automatic restart procedure. At the same time, it is also the time interval that the controller will wait between subsequent auto restart attempts.
The ”Maximum number of restart attempts” parameter determines the number of auto restart attempts that the controller will make.

17.5. Heater function

The heater function allows the user to start the oil heater using one of the digital (relay) controller outputs. It is also possible to prevent excessive oil cooling by using idle. The controller provides the possibility of oil heating in 3 independent modes.
The user can view the settings of the heater parameters in the **User parameter tabs → Operation parameters → Heater**. Their modification requires service authorizations.

17.5.1. Heater 1

The function of heater 1 starts when the motor starts and the oil temperature is lower than the minimum starting oil temperature foreseen by the compressor manufacturer. A message informing about the operation of the heater will be visible in the main view of the controller. The start-up will take place when the oil temperature reaches the minimum value for start-up + heater 1 hysteresis value.
Note!
In order for the heater 1 function to work correctly, the ”Heater 1” function must be assigned to one of the digital outputs

17.5.2. Heater 2

The function of heater 2 allows the oil temperature to be maintained in a range that allows the motor to start immediately, regardless of the compressor operation algorithm. This means that the heater will start when the compressor is stopped in order to maintain the oil temperature within the specified

temperature range.
Note!
In order for the heater 2 function to work correctly, the ”Heater 2” function must be assigned to one of the digital outputs

17.5.3. Idle heating

The idle heating function consists in using the idle speed of the compressor in order to prevent the oil temperature from falling below the minimum temperature for start-up. Idle heating starts only when the compressor is able to reach the set pressure. This means that this function will not work if the compressor is stopped.
The user is informed about the activation of the idle heating function through a message in the main view of the controller.

17.6. Temperature switch function

The function of the temperature switch is to link the current value of one of the temperature measurements to one of the transmitters. This allows one of the transmitters to be turned on and off depending on the temperature measured by a specific temperature sensor.
Attention! For the temperature switch function to work properly, the ”Temperature switch” function must be assigned to one of the digital outputs

To configure the temperature switch functions, go to the tab: **User parameters → Operating parameters → Temperature switch**.
The first parameter ”Temperature switch function” allows you to turn the function on and off.
The ”Temperature source” parameter allows you to select the temperature based on which the transmitter will be switched..
”Upper/lower switching temperature” parameters define the upper-temperature limit at which the transmitter will be switched to the opposite state (depending on the selected NO/NC logic). And the lower limit at which the transmitter will return to its previous state.
This allows you to create hysteresis for transmitter switching.
For the function to function properly, one of the digital outputs must be configured as a ”Temperature transmitter”.

17.7. Restoring and saving settings

The controller can save and restore settings from a local copy or an external data carrier. From the user access level, it is only possible to restore user settings in the controller. Service authorizations are required to save or restore the settings of service parameters.

The option of restoring and saving settings on external data carriers allows you to copy settings between controllers.

Figure 48: View of the screen with restoring settings at the user level

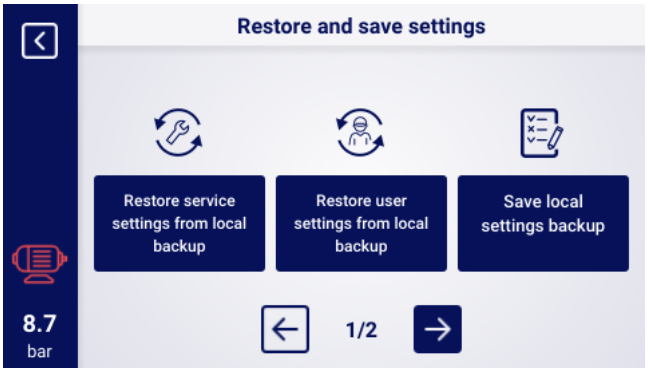

Figure 49: View of the screen with restoring settings from the service technician level

To restore or save the settings, go to the tab:
Service parameters → Factory settings → Restoring and saving settings.
The user can restore the settings from a local copy saved in the controller's memory or from an external data carrier connected to one of the controller's USB ports. The scope of restored settings includes only user parameters. To restore the service settings, logging in from the service technician level is required. Restoring compressor settings overwrites the data and will not be able to be restored. After selecting the recovery source, you must confirm the warning.

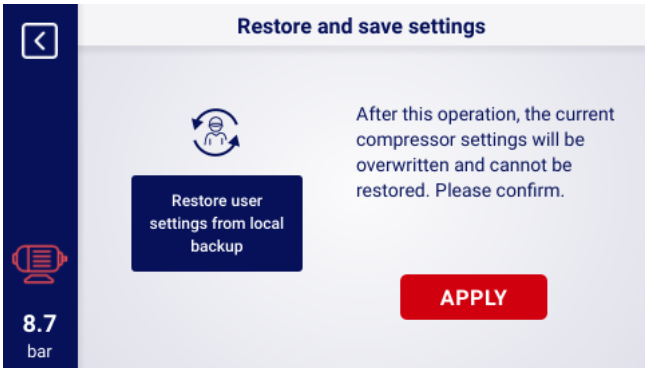

Figure 50: Warning about overwriting user settings

The service technician also has the option of saving settings in the controller's internal memory or on an external data carrier. Please note that if you save a local copy on the controller, the current copy in the controller memory will be overwritten.

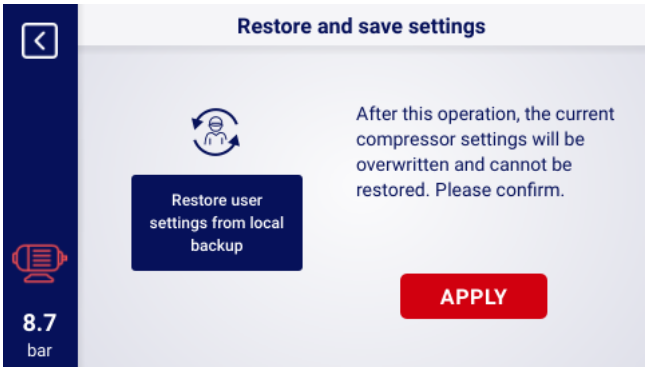

Figure 51: Warning about saving a local copy of settings

18. Service counters

Service counters are designed to remind you of the need to carry out specific service activities. Each meter has 2 operating modes, counting down the remaining operating hours of the compressor or counting down the time to a specific date. Both modes are independent, only one or two of them can be active simultaneously. The remaining operating hours are counted only during motor operation, the hours are not counted when the compressor is switched off or is in an idle mode. The countdown to a specific date takes place independently of the compressor operation.
The controller has 9 independent service counters:

- General service counter
- Oil change counter
- Oil filter counter
- Air filter counter
- Separator counter
- Drive belt counter
- Motor bearing lubrication counter
- General purpose counter 1
- General purpose counter 2

In the case of direct drive compressors, the drive belt counter is not available. It is replaced by general purpose counter 3.

Figure 52: The ”Service counters” tab”

Each counter is displayed in the form of a tile with the name of the counter. The counter status is visible to the right of its name. If the counter is active, depending on the operating mode of the counter, the date of the next inspection or the number of operating hours remaining to the inspection or both are displayed at the same time. If the counter is inactive, the information ”off” is displayed next to it.
If any of the active counters counts down the hours to 0, or reaches the service due date, a warning will appear on the controller with information referring to the meter that needs attention, e.g., ”Change oil”

18.1. Restarting service counters

The service counters can be restarted by selecting the tile of one of the counters and then pressing the ”RESTART” button. Before the restart, a confirmation message will be displayed containing the values to which the counter will be restarted. Service intervals are assigned by the service provider or compressor manufacturer.

18.2. Service counters configuration

Configuration of individual service counters can be done by selecting the tile of one of the counters and then pressing the ”Select other values” button. The settings of each counter are divided into 2 pages, depending on the mode of operation of the counter. The first page contains settings for the countdown mode to a specific date, and the second page contains settings for the hours countdown mode. Each of the modes can be independently switched on or off using the ”On/Off ” slider.
The countdown mode to a specific date is configured using 3 parameters.
The first one is ”Date of the next service”, where the user has to enter the date of the next service according to the name of the parameter.
The second parameter is the ”Periodic service interval”, it is used to determine the interval by which the counter should be increased in the event of a restart (from the day of restart), e.g. The interval of the oil counter is set to 12 months, if the counter is restarted on 10.12.2023, the next inspection date will be set 12 months ahead, in this case it will be 10.12.2024.
The third parameter ”Additional warning (before the service date)” is an additional warning for the user, which will be displayed once there is a certain number of days left until the service date. Once the warning is confirmed, it will not reappear.
The operating hours countdown mode using the ”Counter Interval” parameter, which determines the number of operating hours, is at the same time the number of hours to which the counter will be restored in the event of a restart.
The ”Additional warning (before counting to 0)” parameter works in the same way as the ”Additional warning (before service date)” parameter described above.

19. Statistics

The controller aggregates measurements from sensors and information about the operation of the compressor and presents them in the form of statistics (which are divided into 2 categories: consumption and charts). Information about the time and cycles of the compressor is stored in the ”Consumption” tab. The types of load data are different for star-delta start-up compressors and inverter compressors.

19.1. Consumption statistics

In the ”Consumption” tab, the compressor operating parameters are visible in the form of rows with individual parameters and their values. The ”CHANGE” button allows the user to manually enter the values of the selected parameters. Service level authorization is required.

Table 25: Parameters of the ”Consumption” tab

Parameter name	Parameter description
Total run time	Total motor run time
Run time under load	Total compression time

Table 25: Parameters of the ”Consumption” tab

Parameter name	Parameter description
Medium load	Total run time to run time under load ratio
Motor start-up counter	Total number of motor start-ups
Average number of motor start-ups	Average number of motor start-ups per hour
Y-valve engagement counter	Total number of Y-valve engagements
Load 80% - 100% [F]	Total run time in a given load range
Load 60% - 80% [F]	Total run time in a given load range
Load 40% - 60% [F]	Total run time in a given load range
Load 20% - 40% [F]	Total run time in a given load range

[F]-Parameter available only for compressors equipped with an inverter

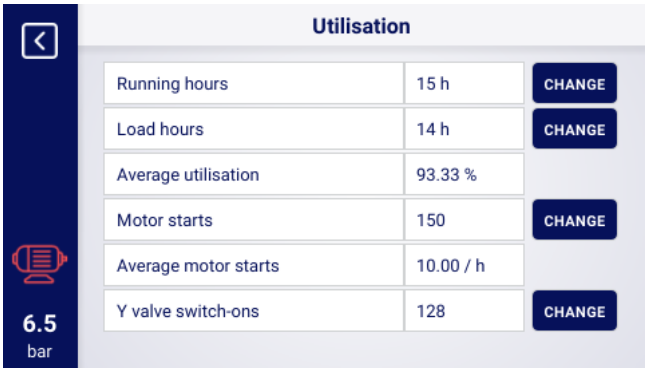

Figure 53: Consumption tab

19.1.1. Deleting and modifying consumption parameters

In order to reset the consumption parameters, manually enter the value 0 in each parameter. It is also possible to manually modify the selected values, the parameters calculated from these values will be automatically recalculated (e.g., Medium load)

19.2. Charts

The controller creates charts from selected data from the following time periods: last hour, last day, last week. The preview range can be set by the user, independently for each of the charts.

List of data from which charts are generated:

- Network pressure
- Oil temperature
- Motor temperature
- Air temperature

- Motor current
- Output frequency

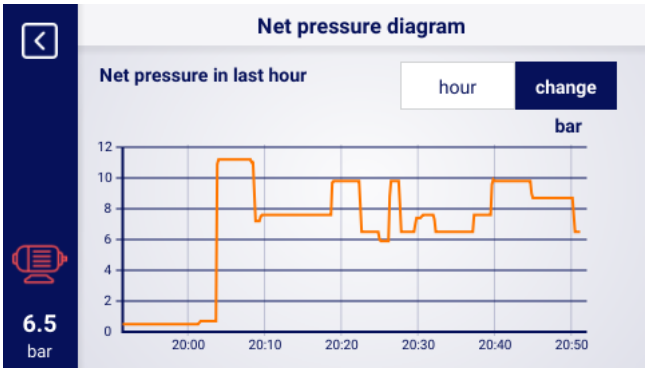

Figure 54: Network pressure diagram

19.2.1. Deleting chart data

To remove the data from the charts, go to the parameter: Factory settings → Reset historical data → Reset sensor history, then hold the ”Reset” button until its field turns red, then release and press it again. After this operation, the chart data will be irretrievably deleted. Correct reloading of charts may take up to several minutes after deleting data.

20. Operation scheduling

The controller is equipped with a compressor operation scheduling function. This allows the compressor to be automatically switched on and off according to a pre-determined schedule. It is schedule to plan up to 28 events, including 8 recurring events and 20 one-off events.
One-time events are set by entering a specific date and time, while cyclical events are configured according to the plan for each day of the week, which repeats in a 7-day cycle.
To go to the ”Work Scheduling” tab, use the shortcut with the calendar icon from the main view or select the ”Work Scheduling” tile in the user parameters.
The tab shows the status of scheduled operations (according to the scheduled events) of the controller, and the number of activated events, broken down by their type. Individual events are visible on the lists, and are available after selecting one of the 2 event setting buttons. Lists allow the user to view the parameters of configured events. To remove an event from the list, hold down the tile with a given event, wait until it becomes red and the message ”DELETE EVENT” is displayed, and then press it again.

Figure 55: The ”operation scheduling” tab and sample list of events

20.0.1. Configuring a one-time event

A one-time event can be configured using the following parameters:

- Operation mode
- Event start date and time
- Event end date and time
- Event activation/deactivation

Figure 56: Example of one-time event configuration

To configure the operating mode press the ”Operation mode” button and select one of the items from the list. In addition to the standard operation modes (AUTO and CONST), the user can also select the ”STOP - compressor stopped” operation mode, which allows the creation of an exception to the cyclic event. The time range of the event can be configured from the on-screen keyboard, after selecting the appropriate date and time fields. The event can be activated or deactivated using the ”ACTIVATE”/”DEACTIVATE” button.

20.0.2. Recurring event configuration

A one-time event can be configured using the following parameters:

- Operation mode
- Days of the week on which the event is to take place
- Event start time for selected days
- Event end time for selected days
- Event activation/deactivation

Figure 57: Example of a recurring event configuration

To configure the operating mode press the ”Operation mode” button and select one of the items from the list. Standard operating modes (AUTO and CONST) are available for cyclic events.
The fields with the names of the days of the week are used to select the days on which the event is to take place. When the user presses on any field, it will highlight in blue, indicating that a given day

has been selected. Pressing the same field again cancels the previous selection.
The time range of the event can be configured from the on-screen keyboard, after selecting the appropriate time fields.
The event can be activated or deactivated using the ”ACTIVATE”/”DEACTIVATE” button.

20.0.3. Operation scheduling algorithm

In order for the compressor to operate in line with the configured events, the scheduled operation must be activated in the ”Operation scheduling” tab by pressing the ”ACTIVATE” button. When scheduled operation is active, the ”ACTIVATE” button will change to ”DEACTIVATE” and the message ”Scheduled operation is active” will be displayed on the screen.
Moreover, in order for the operation scheduling algorithm to control the operation of the compressor, the user must grant prior permission by pressing the ”START” button on the controller. If, in line with the scheduled events, the compressor should be idle at a given moment, then after granting permission to start, the main view of the graphical interface will display the message ”Stopped by scheduled operation”
The scheduled operation algorithm takes into account only events that are active.

NOTE!
One-time events have a higher priority than cyclical events. This makes it possible to make ”exceptions” from cyclical events, e.g. on public holidays. At the same time, events that are higher on the list have a higher priority than those lower on the list. This means that in the situation when two or more scheduled events overlap, the compressor will operate in accordance with the higher priority event.

21. Network operation

The controller can manage a group of up to 6 compressors (including itself) as the master controller, using one of two available algorithms: Sequential (**SEQ**) or cascading (**CAS**).
All controllers in the network must be connected to each other via RS-485 or RS-485 ISO ports. The communication protocol used for network operation is Modbus RTU.

21.1. Network operation view

From the master controller, the user gains access to a preview of the status of all controllers in the network. When the controller is configured as master, the main view of the controller shows the network operation icon together with the letter ”M”, pressing it will take you to the network operation view. The network operation view shows all connected slave controllers (marked with numbers from 1 to 5) and the master controller (marked with the letter ”M”).
The number of visible slave compressors depends on the number of compressors configured in the master controller. Each of the tiles in the network operation view allows the user to read the current pressure settings on each of the compressors and the status of each of the compressors in the form of a short message. In the event of an error or warning on any of the compressors in the network, an error or warning icon will be displayed in its tile field.

If the controller is configured as a slave, a network operation icon with the letter ”S” will be displayed in its main view. It is not possible to display the network operation view from the level of the slave controller.

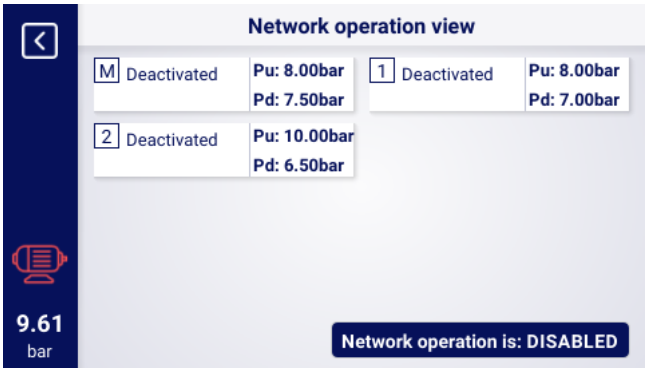

Figure 58: Network operation view

21.2. Starting network operation and changing the settings of the slave controllers

To start the network operation algorithm, go to the network operation view on the master controller, and then press the ”Network operation is: DISABLED” button. When the algorithm is enabled, the button will change its name to ”Network operation is: ENABLED”. In order for the master controller to properly manage the compressor assembly, before starting network operation on the master compressor, press the START button on each of the slave compressors.
Disabling the network operation algorithm will stop all slave compressors. If the stop button has not been pressed on the slave compressors in the meantime, restarting them only requires pressing the ”Network operation is: DISABLED” button in the network operation view on the master controller.

In order to configure the pressure on any of the controllers in the network, press its tile and then enter the appropriate pressure values.

21.3. Errors and events in network operation

If an error occurs in the compressor or in one of the slave compressors, it will be automatically disabled from operation in the master control algorithm. Restoring such a compressor to operation in the algorithm will be only possible when the fault is removed and the error is confirmed on its controller.
If an error occurs in the master controller, it will be excluded from the master operation algorithm, however, it will still control the operation of slave compressors.
If the connection to one or more of the slave controllers is interrupted, the status window of the slave compressor will display the message ”Communication error”. Such a compressor will be excluded from the master operation algorithm, however, if there are no additional errors in the slave compressor, this compressor will operate according to the last pressure settings received from the master controller. This also means that in the event of a loss of communication with the master controller network, the remaining compressors will not shut down, but will operate in accordance with the last pressure settings received.

21.4. Sequential operation algorithm (SEQ)

The sequential algorithm is designed for network operation of a group of compressors of similar power. The assumption of the algorithm is to evenly distribute the run time between all compressors in the network. This is done by rotating the load pressure (Pd) and relief pressure (Pu) settings by a specified rotation time, which can be configured by going to the **User Parameters tab → Network operation → Configuration**.
During the rotation phase, individual compressors do not stop. The compressor may be stopped/started only as a result of the reference of the current pressure in relation to its newly set Pu - Pd limits. Only active compressors are involved in the pressure rotation procedure.
Exclusionary, step intervals are an example, recommended setting of Pu - Pd pressure limits in the sequential algorithm. With such a distribution, the compressor with the highest limit range will be switched off at the last (when the required network pressure is reached) and switched on as the first, because it has the highest lower Pd pressure limit.
The second example of Pu - Pd limit settings in the sequential algorithm is to give the compressors identical upper Pu limits and lower step limits. In this situation, all compressors will be switched off at the same time, and switched on at pressure drops below the subsequent lower Pd limits.

Before rotation			**After first rotation**			**After second rotation**			**cd.**
ID	*Pd*	*Pu*	ID	*Pd*	*Pu*	ID	*Pd*	*Pu*	
1	6.0	7.0	1	3.0	7.0	1	4.0	7.0	
2	5.0	7.0	2	6.0	7.0	2	3.0	7.0	...
3	4.0	7.0	3	5.0	7.0	3	6.0	7.0	
4	3.0	7.0	4	4.0	7.0	4	5.0	7.0	

Compressors stopped manually or as a result of a critical error are automatically given the lowest pressure limits (with the automatic reconfiguration function turned on), and their limits are transferred to active compressors with the lowest Pu - Pd limits. For example, if in the first instance the compressor with ID 2 is stopped manually, then after reconfiguration, the distribution of boundaries will look like in the second instance. If the compressor with ID 2 is still inactive during the rotation procedure, the pressure distribution will look like in the third instance.

21.5. Cascading algorithm (CAS)

The cascade operation algorithm is designed for network operation of a group of compressors of different power capacities. This algorithm assumes that the compressor with the lowest power will be switched on and off most often. The compressor with the highest power will be started only in cases of high demand for air in the network.
An example, recommended setting of Pu - Pd limits in the cascade algorithm is to give the compressors identical upper Pu limits and lower step limits (instance 1). In this situation, all machines will compress air until the required network pressure is reached, and then they will be switched off at the same time. With a low pressure demand, the compressor with the lowest power (ID=4) will be switched on. If, despite its operation, the pressure falls below the lower limit of the compressor with ID=3, this compressor will also be switched on.

1. All active				**2. Compressor ID=2 not active**			
ID	*Pd*	*Pu*	Power	ID	*Pd*	*Pu*	Moc
1	3.0	7.0	120kW	1	4.0	7.0	120kW
2	4.0	7.0	100kW	2	3.0	7.0	100kW
3	5.0	7.0	50kW	3	5.0	7.0	50kW
4	6.0	7.0	20kW	4	6.0	7.0	20kW

In the cascade algorithm, the Pu - Pd pressure limits are permanently assigned to a given compressor identifier. There is no rotation procedure (the rotation time parameter is not taken into account). Thus, when setting pressure limits, their order relative to ID is important. With the automatic reconfiguration function enabled, compressors stopped manually or as a result of an error are automatically assigned the lowest Pu - Pd pressure limits in the network. This shifts the lower limits up one position. For example, if in instance 1 a critical error occurs in the compressor with ID=2, then after automatic reconfiguration, the distribution of Pu - Pd pressure limits will look like in instance 2. When the compressor with ID=2 is restored to operation, the boundary distribution will return to instance 1.

21.6. Master controller configuration

In order to configure the master controller for network operation, the communication parameters of the RS-485 port must first be configured. There are 2 independent RS-485 ports available in the controller, one of them is isolated (RS-485 ISO). Any of the ports can be used for controller network operation.
To configure the parameters of the selected RS-485 port, go to the **User parameters tab → Configuration of inputs/outputs → RS-485/RS-485 ISO**.
Communication parameters: The band rate, parity, and stop bits should be configured the same for all devices in the network.
For long distances between controllers, it is recommended to set lower band rates.
The ”RS-485 function” parameter must be set to ”Master”.

Figure 59: The RS-485 port configuration menu

In the next step, configure the network operation parameters. To do this, go to the User parameters tab → Network operation → Configuration. The ”Operate as master compressor” parameter should be set to ”Enable”, this will automatically set the ”Remote mode” parameter to ”NET”.
In the remaining parameters, select the number of slave compressors (excluding the master compressor), the operation algorithm of the master control (sequential or cascading).
The parameter ”Switching delay between slave compressors” determines the delay of starting subsequent compressors in the network and aims to protect the power network from overloading as a result of starting too many compressors at once.
The parameter ”Rotation time” applies only to the sequential mode and determines the interval in which the pressure settings will be changed between successive compressors.
The ”Master compressor load/relief pressure” parameters determine the pressure settings for the master compressor.
The ”Automatic reconfiguration of pressure limits” parameter, if enabled, is responsible for transferring the pressure settings from the compressor in which the failure occurred to the compressor that is operating correctly.
In the case of network operation involving compressors equipped with an inverter, the operating point is common to all compressors in the network, it is configured in the ”Network operation point” parameter. This setting is sent to all slave compressors equipped with an inverter.

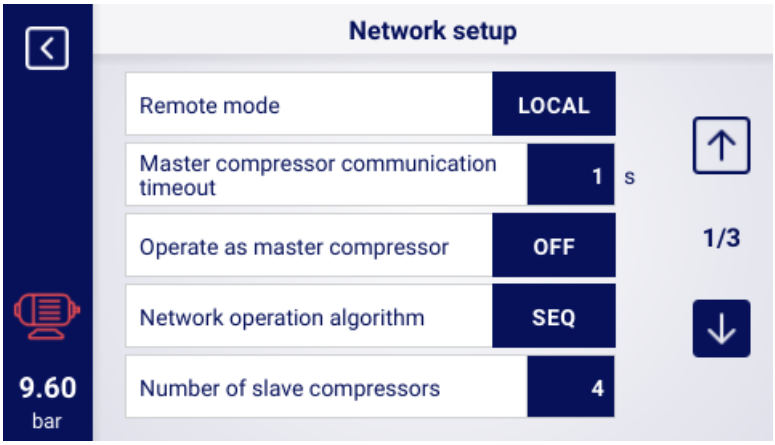

Figure 60: Network operation configuration menu 1/3

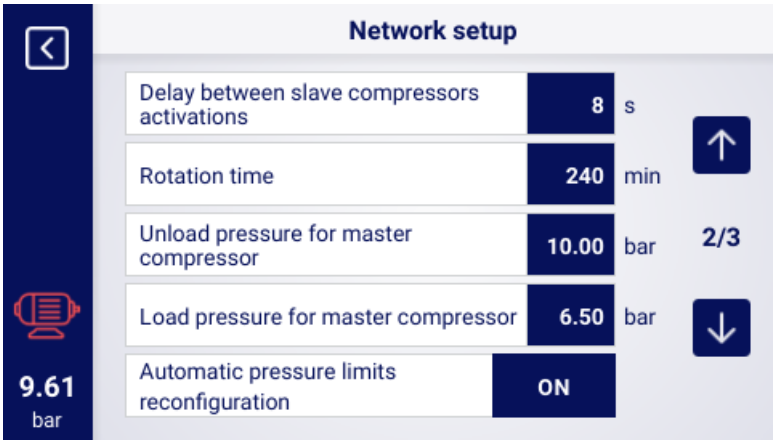

Figure 61: Network operation configuration menu 2/3

Figure 62: Network operation configuration menu 3/3

The last step in the parameterization of the master controller is the configuration of each of the slave compressors. The sub-compressor configuration tabs are available in **User parameters → Network operation → Compressor**. The number of compressors that can be configured depends on the number of slave compressors entered. Each of the slave compressors is configured in the same way by entering the pressure settings of the selected compressor in the ”Relief pressure” and ”Load pressure” parameters.
In the ”Interface” parameter, select which RS-485 port of the master controller the slave compressor is connected to (”RS-485” or ”RS-485 ISO”)..
The ”Modbus address” parameter specifies the modbus address that was assigned to a given slave compressor, it should be rewritten from the slave compressor controller after its configuration.
Note!
Controller addresses within a single network may not be duplicated. Each of the slave compressors should have a different address.

Figure 63: Network operation menu

Figure 64: Slave compressor 1 configuration menu

21.7. Slave controller configuration

In order to configure each of the slave controllers, first configure the RS-485 port to which the network is connected. Go to the **User parameters tab → Configuration of inputs/outputs → RS-485/RS-485 ISO.**
The communication parameters of the selected RS-485 port, i.e. ”Bitrate”, ”Parity” and ”Stop bits”, must be configured in the same way as on the master controller.
Select ”Slave” in the ”RS-485/RS-485 ISO function” parameter
Enter any address that will coincide with the selected slave compressor configured in the master controller in the ”Modbus address” parameter.
Note!
Controller addresses within a single network may not be duplicated. Each of the slave compressors should have a different address.
The whole process must be repeated on each of the slave compressors.

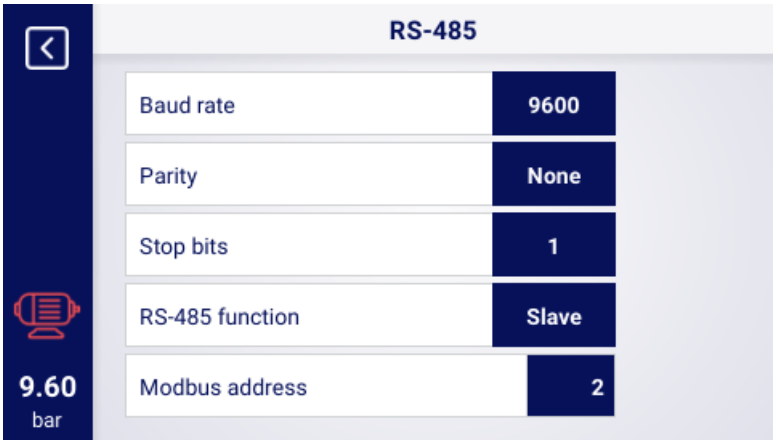

Figure 65: The RS-485 port configuration menu

The last step in the configuration of the slave compressor is to change the remote mode to ”NET”. To make a change, go to the **User parameters tab → Operation parameters → Operation modes**.

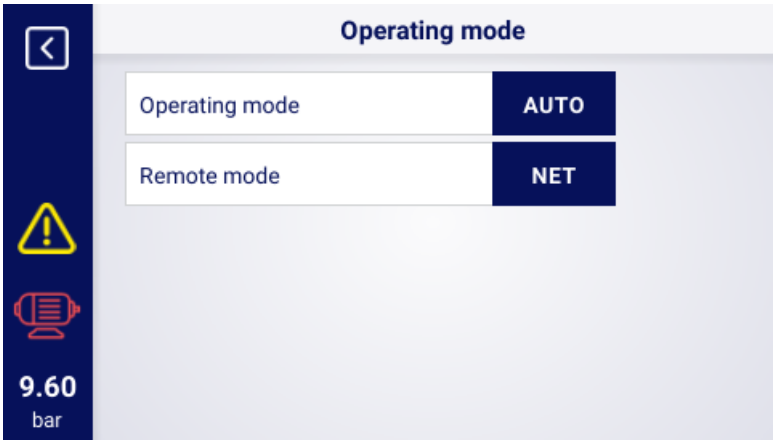

Figure 66: Remote mode setup menu

22. Web server (Visualization system)

The controller is equipped as standard with a visualization system (web server), enabling real-time monitoring of the compressor via the local LAN.
The web server is presented in the form of a website. The website is hosted directly from the controller on the local network, which does not require the installation of any software. For correct operation a web browser on a computer with access to the LAN to which the controller is connected will suffice
It is possible to browse the web server page by several users at the same time, on several computers.

The web server does not have the ability to remotely change the controller parameters.

22.1. Web server - description of the graphical user interface

The web server is divided into many subpages corresponding to individual tabs in the controller. Many of them are extended on the web server.
Regardless of the content of the subpage that the user is currently browsing, the navigation bar on the web server and the top bar are always visible.
The side navigation bar allows the user to go to any subpage of the visualization system, and indicates which subpage the user is currently viewing.
List of subpages of the web server:

- Desktop
- Sensors
- Charts
- Consumption
- Messages
- Service counters
- Scheduled operation
- Information

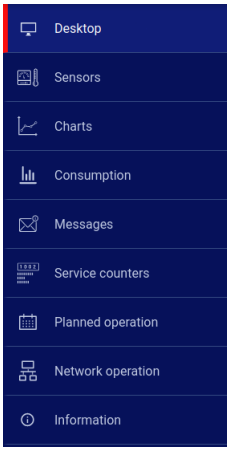

Figure 67: Web server navigation sidebar

The top bar allows the user to view the basic parameters of the compressor regardless of the subpage the user is viewing.
List of parameters visible in the top bar:

- Compressor name
- Current pressure
- Abbreviated compressor status
- Fan operation icon
- Motor icon that changes colours in the same way as on the controller
- Date and time from controller

Figure 68: Top web server info bar

22.2. Web server - Desktop

The ”Desktop” subpage ” is the default view of the web server. It shows all the most important compressor parameters.

List of parameters visible on the Dashboard subpage

- Pressure
- Current pressure settings
- Bargraph and bargraph reading
- Motor frequency
- Pressure chart for the last 8 hours
- Oil temperature
- Compressor status
- Motor status
- Operation mode
- List of active messages
- Network operation icon
- Scheduled operation icon
- Fan operation icon
- Dryer operation icon
- Heater operation icon
- Condensate drain icon

- Compressor and controller basic information

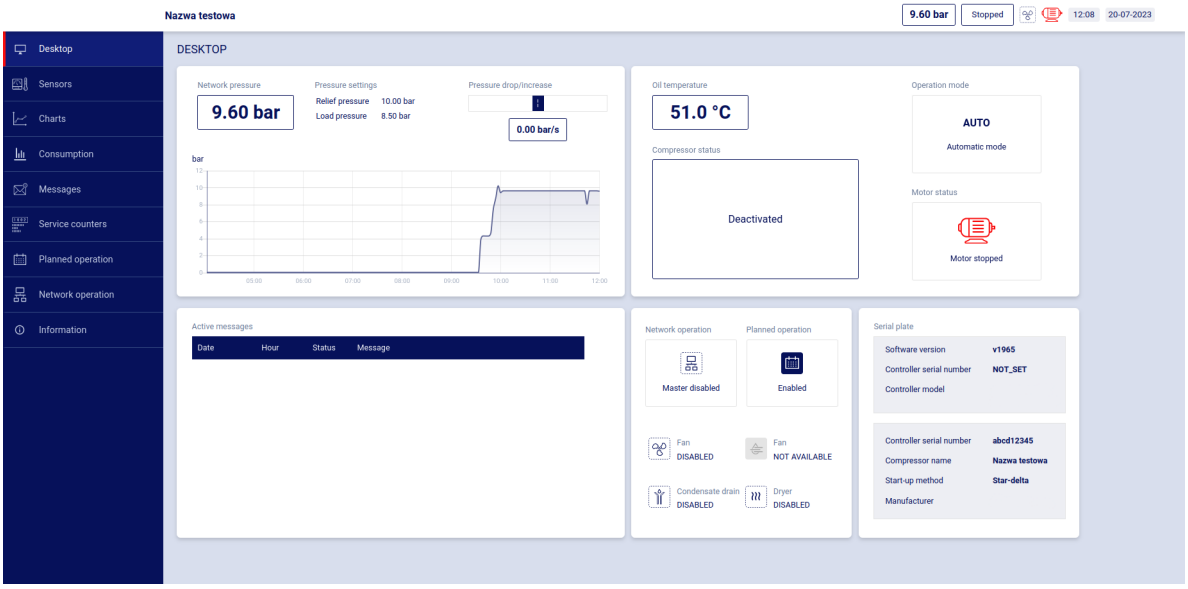

Figure 69: Web server dashboard view

22.3. Web server - Sensors

The ”Sensors” subpage corresponds to the ”Sensors” tab in the controller. Only values of the sensors configured in the controller are displayed in it.

List of sensors available for viewing on the ”Sensors” subpage:

- Network pressure
- Oil pressure
- Oil temperature
- Motor temperature
- Air temperature
- Ambient temperature
- Motor current
- Motor power
- Dew point
- Output frequency

22.4. Web server - Charts

The ”Charts” subpage presents charts available on the controller. The ranges of time intervals are the same as on the controller (hour, day, week). In addition, the web server allows he user to overlay charts of the same types of parameters, e.g. temperatures. After hovering the cursor over a given place on the chart, a window will appear with information about the exact value on the chart along with the date and time.

List of data from which charts are generated:

- Network pressure
- Oil temperature
- Motor temperature
- Air temperature
- Motor current
- Output frequency

22.5. Web server - Consumption

The ”Consumption” subpage presents time statistics from the controller, extending them with a circular diagram of the load and relief work distribution, or in the case of compressors equipped with an inverter, a bar graph showing the work distribution over individual load ranges.

22.6. Web server - Messages

The ”Messages” subpage allows the user to view the history of messages (Errors and Warnings) that have occurred in the controller in the past or are active at a given moment. Active messages are highlighted with a blue flag symbol. The web server allows the user to filter events in the list by type (error, warning, active, inactive) or by date. It is also possible to search for events by name.

22.7. Web server - Service counters

The ”Service counters” subpage shows the service counters active in the controller and their values. Additionally, the progress bar of each meter is also displayed. The progress bar shows 100% in the case of a reset counter, this value decreases with run time / when the date of the next inspection approaches.

22.8. Web server - Scheduled operation

The ”Scheduled operation” subpage presents all events configured in the controller with their parameters and status, divided into one-off and cyclic events.

22.9. Web server - Information

The ”Information” subpage duplicates the information from the ”Information” tab in the controller.

22.10. Initiating and configuring connection with the web server

In order to configure the web server, go to the **User parameters tab → Configure inputs/outputs → IP settings**. Next, select from the list how the IP address will be assigned to the controller in the local network. The avilable modes are auto (DHCP) and static.
In the automatic mode, the IP address will be assigned automatically via the DHCP server running on the network (this depends on the individual configuration of the local network).
In the static mode, the user can configure the standard parameters of the network device.
List of parameters that can be configured in static mode:

- IP address
- Subnet mask
- Gateway

Note!
After each change press the ”SAVE” button, otherwise the parameters will not be saved.

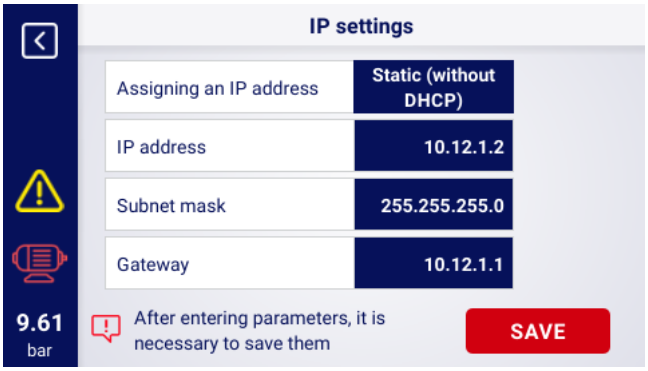

Figure 70: IP address configuration menu

To check the assigned IP address, go to the ”Information” tab available from the main menu of the controller. The MAC address of the device is also available there.

Figure 71: The ”Information” tab with the IP and MAC address.

23. Warnings and errors

The controller displays current errors and warnings in the form of icons on the sidebar of the user interface. The icons will remain visible on the screen until the user confirms the event in the ”Active warnings and errors” tab, only if the error or warning has been resolved. After confirmation, the message will disappear from the list. If the message is still visible, the root cause of the error or warning has not been resolved. Error information is also displayed in the form of a text message on the main interface view. This also applies to errors and warnings of internal inverters. The controller reads the inverter messages and displays them along with a description. The messages can be sorted by their impact on the compressor operation:

Warning - does not affect compressor operation
Critical error - emergency (immediate) motor stop
Non-critical error - standard motor stop

In the event of any error, it will not be possible to restart the motor as long as the error remains active.

23.1. Warnings

23.2. Warnings of the controller

Table 26: Warnings

Error code	Warning Name	Type	Description
W01	Inspection Necessary	Warning	The date set by the service technician on which the overhaul should be performed has arrived.
W02	Service due soon	Warning	The service date set by the service technician is due soon.
W03	Network pressure too high	Warning	The network pressure is close to the maximum value set by the service technician.
W04	Low network pressure	Warning	The network pressure is close to the minimum value set by the service technician.
W05	Received pressure values are invalid	Warning	Driver returns information that the pressure values are invalid.
W06	Oil replacement due soon	Warning	The oil replacement date set by the service technician is due soon.
W07	High motor oil temperature warning	Warning	The oil temperature is close to the maximum value set by the service technician.
W08	Necessary oil change	Warning	The date set by the service technician on which the oil should be changed has arrived.
W09	Oil filter replacement time due soon	Warning	The oil filter replacement date set by the service technician is due soon.
W10	Necessary oil filter inspection	Warning	The date set by the service technician for the oil filter inspection has arrived.

Table 26: Warnings

Error code	Warning Name	Type	Description
W11	Oil filter error [OF]	Warning	The oil filter sensor reports that an error has occurred.
W12	Oil separator replacement due soon	Warning	The oil separator replacement date set by the service technician is due soon.
W13	Necessary oil separator replacement	Warning	The date set by the service technician on which the oil separator filter inspection must be performed has arrived.
w14	Separator error [SEP]	Warning	The separator sensor reports that an error has occurred.
W15	Air filter replacement due soon	Warning	The air filter replacement date set by the service technician is due soon.
W16	Necessary air filter replacement	Warning	The date set by the service technician for the air filter inspection has occurred.
W17	Air filter error [AF]	Warning	The air filter sensor reports that an error has occurred.
W18	Air temperature sensor short circuit	Warning	The sensor has been connected incorrectly or it is faulty.
W19	No air temperature sensor	Warning	The controller informs that an air temperature sensor is not connected to the compressor.
W20	Belt tension check time is due soon	Warning	Service technician set date to check belt tension is due soon.
W21	Belt Tension Check Necessary	Warning	The date set by the service technician to check the belt tension has arrived.
W22	Ambient temperature sensor short circuit	Warning	The sensor has been connected incorrectly or it is faulty.
W23	No ambient temperature sensor	Warning	The controller informs that an ambient temperature sensor is not connected to the compressor.
W24	Dryer not ready	Warning renewable	The dryer is not ready for operation.
W25	Battery warning	Warning	Due to a battery issue, the controller does not save the date.
W26	Controller battery low	Warning	The controller battery is low.
W27	Controller battery critically low	Warning	The controller battery is critically low.
W28	CT short circuit	Warning	Sensor has been misconnected or some part has been damaged.
W29	No CT	Warning	Driver returns information that the compressor has no CT connected.
W30	Dew point too low	Warning	The dew temperature is close the minimum value set by the service technician.

Table 26: Warnings

Error code	Warning Name	Type	Description
W31	Dew point too high	Warning	The dew temperature is close to the maximum value set by the service technician.
W32	Dew point sensor short circuit	Warning	The sensor has been connected incorrectly or it is faulty.
W33	No dew point sensor	Warning	The controller informs that a dew point sensor is not connected to the compressor.
W34	Network operation communication error	Warning	The controller informs that there was a network operation problem.
W35	Slave compressor 1 communication error	Warning	Slave compressor 1 is not connected to the network, or there is a communication error.
W36 Slave compressor 2 communication error	Warning	Slave compressor 2 is not connected to the network, or there is a communication error.	
W37 Slave compressor 3 communication error	Warning	Slave compressor 3 is not connected to the network, or there is a communication error.	
W38 Slave compressor 4 communication error	Warning	Slave compressor 4 is not connected to the network, or there is a communication error.	
W39 Slave compressor 5 communication error	Warning	Slave compressor 5 is not connected to the network, or there is a communication error.	
W40	Network operation has been disabled on master controller	Warning	Network operation has been disabled or lost connection on master controller.
W41	User Counter 1 necessary inspection	Warning	The date set by the service technician on which to perform the inspection of the user counter 1.

Table 26: Warnings

Error code	Warning Name	Type	Description
W42	User Counter 2 necessary inspection	Warning	The date set by the service technician on which to perform the inspection of the user counter 2.
W43	User Counter 1 review date is due soon	Warning	Service technician set date approaching for general Inspection.
W44	User Counter 2 Inspection is due soon	Warning	Service Technician set date approaching for general Inspection.
W45	Inverter Warning	Warning	A warning occurred on the inverter.
W46	Flow sensor short circuit	Warning	Flow sensor short circuit.
W47	No flow sensor	Warning	No flow sensor connected to input.
W48	Motor bearing lubrication required	Warning	Motor bearing lubrication service counter exceeded set value.
W49	Motor Bearing Lubrication Time Approaching	Warning	Warning of Bearing Lubrication Service Counter Approaching Expiration.
W54	Additional Temperature Too Low	Warning	Additional Temperature too Low.
W55	Additional temperature too high	Warning	Additional temperature too high.
W56	No dew point temperature sensor	Warning	No dew point sensor connected.
W57	Dew Point Temperature Sensor Short-circuit	Warning	Dew Point Sensor Short-circuit

23.3. DANFOSS inverter warning information

Table 27: Inverter warnings

Error code	Error description
W1	Low 10V voltage
W2	Live zero error (W2)
W3	No motor
W4	Power loss
W5	High DC circuit voltage
W6	Low DC circuit voltage
W7	DC circuit overvoltage
W8	DC circuit voltage below minimum
W9	Inverter overload
W10	ETR motor overheating
W11	Motor overheating
W12	Torque limitation
W13	Overcurrent
W14	Ground error
W17	TO controller control
W25	Brake resistor
W26	Brake overload

Table 27: Inverter warnings

Error code	Error description
W27	IGBT brake
W28	Brake check
W34	Fieldbus error
W36	Power failure
W47	Low 24V power supply
W49	Maximum speed limit
W59	Current limit
W62	Output frequency limit
W64	Voltage limit
W65	Control card temperature
W66	Low temp.
W68	Safe stop
W69	Power card overheating
W90	Encoder signal loss

23.4. YASKAWA inverter warning information

Table 28: Inverter warnings

Error code	Error description
dEv	Speed deviation
CALL	Communication error
oH2	Inverter overheat warning
oH3	Motor overheat warning
DC Uv	Supply voltage too low

23.5. Delta inverter warning information

Table 29: Inverter warnings

Error Code	Error Description
CE1	Invalid Modbus RS-485 function code
CE2	Invalid Modbus RS-485 data address
CE3	Invalid Modbus RS-485 data value
CE4	Modbus RS-485 data writing is set to read-only
CE10	Modbus RS-485 timeout
SE1	Keypad 1 copy error: Timeout expired
SE2	Keypad 2 copy error: Error writing parameters
oH1	AC motor detects IGBT overheating and above protection level warning oH1
oH2	The controller has detected capacitor overheating
PID	PID Feedback information loss (Analog feedback warning; only works when PID is enabled)
ANL	Analog input current loss (includes all 4-20mA analog signals)

Table 29: Inverter warnings

Error Code	Error Description
uC	Low current
PGFB	PG Information return error warning
oSPD	Overspeed warning
dAvE	Overspeed deviation warning
PHL	Input Phase Loss Warning
ot1	Excess torque warning 1
ot2	Over torque warning 2
oH3	Engine overheating warning. The AC motor drive detects that the temperature inside the motor is too high
oSL	Over slip warning.
tUn	and auto-tuning of parameters are in progress. The keypad displays ”tUn” during auto-tuning
OPHL	Output phase loss
SE3	Keypad 3 copy error: copy model error
CGdn	CANopen protection timeout 1
CHbn	CANopen heart rate error
CbFn	CANopen bus disable error
Cldn	CANopen index error
CAdn	CANopen station address error (only supports 1–127)
CFrn	CANopen memory error
CSdn	SDO transmission timeout (visible only on the master station)
CSbn	CANopen SDO receives a register overflow
CPtn	CANopen protocol format error
PLrA	PLC (RTC) is not adjusted
PLiC	InnerCOM Error
Plrt	PLC Error (RTC)
PLod	PLC download error warning
PLSv	Data error while saving PLC work
PLdA	Data error during PLC operation
PLFn	PLC download function code error
PLor	PLC register overflow
PLFF	Function code error during PLC operation
PLSn	PLC checksum error
PLEd	No PLC termination command
PLCr	PLC MCR command error
PLdF	PLC download failed
PLSF	The PLC scan time exceeds the maximum allowable time
PCGd	CANopen master protection error
PCbF	CANopen master BUS disabled
PCnL	CANopen master node error
PCCt	CANopen master cycle timeout
PCSF	CANopen master SDO overflow
PCSd	CANopen master SDO timeout
PCAd	CANopen master station address error
PcTo	When the disk receives an invalid packet, it means that there is interference or the command from the master unit does not match the CANopen format command

Table 29: Inverter warnings

Error Code	Error Description
ECid	Duplicate MAC ID error. Node address setting error
ECLv	Communication card low voltage
ECtt	The communication card is in test mode
ECbF	The communication board detected too many errors in the BUS file, then went into BUS-OFF mode and stopped communication
ECnP	DeviceNet is missing power
ECFF	Factory Default
ECiF	Serious Internal Error
ECio	Connection of inputs and outputs broken
ECPP	Profibus parameter data error
ECPi	Profibus configuration data error
ECEF	Ethernet cable not connected
ECto	Communication time limit reached for communication card and master unit
ECCS	Communication card and drive checksum error
ECrF	Communication card returns to default settings
ECo0	MODBUS TCP exceeds the maximum communication value
ECo1	Ethernet/IP exceeds the maximum communication value
ECiP	IP setting error
EC3F	Mail Alert: An alarm message will be sent when the communication card establishes
Ecby	Communication card busy: Too many packets received
ECCb	Communication Card error warning
CPLP	Copy PLC password error. When KPC-CC01 processes the PLC copy and the PLC password is invalid, and the CPLP warning appears
CPL0	Copy PLC read mode error
CPL1	Copy PLC write mode error
CPLv	Copy PLC version error. When a non-C2000 embedded PLC is copied to a C2000 drive, a CPLv warning appears
CPLS	Copy PLC capacity size error
CPLF	Use the KPC-CC01 PLC copy function when the PLC is turned off
CPLt	Copy PLC timeout
ictn	Internal communication timeout
SpdR	Estimated speed are in the opposite direction of the actual direction of operation
dEb	Braking energy reserve

23.6. Errors

Table 30: Błędy

Error code	Warning name	Type	Description
E01	Power asymmetry error	Critical error (auto restart possible)	Power supply phase shift

Table 30: Błędy

Error code	Warning name	Type	Description
E02	Phase sequence error	Critical error	Incorrect phase sequence detected.
E03	Thermal fault	Critical error	Motor temperature exceeded.
E04	Network pressure too high	Critical error	The controller informs that the network pressure is too high.
E05	No network pressure sensor	Critical error	The controller informs that there is a problem with the pressure sensor.
E06	Network pressure sensor short-circuit	Critical error	The sensor has been connected incorrectly or it is faulty.
E07	No pressure sensor selected	Critical error	Select a pressure sensor.
E08	Oil temperature too high	Critical error	The controller informs that the oil temperature is too high.
E09	Oil temperature too low	Recurring error	The compressor cannot operate correctly because the oil temperature is too low.
E10	Oil temperature rise too slow	Critical error	Oil temperature is increasing too slowly for the compressor to work correctly.
E11	Oil temperature sensor short-circuit	Critical error	The sensor has been connected incorrectly or it is faulty.
E12	No oil temperature sensor	Critical error	The controller informs that there is a problem with the oil temperature sensor.
E13	Motor undercurrent after start-up	Critical error	The current to the motor is too low after start-up to maintain correct compressor operation.
E14	Motor overcurrent	Critical error	The current to the motor is too high.
E15	Power failure	Recurring error	Power supply received inadequate voltage level.
E16	Motor temperature too high	Critical error	The controller informs that the motor temperature is too high.
E17	No motor temperature sensor	Critical error	The controller informs that there is a problem with the fan.
E18	Motor temperature sensor short circuit	Critical error	The sensor has been connected incorrectly or it is faulty.
E19	Dew point temperature too high	Critical error	The controller informs that the dew point temperature is too high.
E20	Dew point temperature too low	Non-critical error	The controller informs that the dew point temperature is too low.
E21	Fan error	Non-critical error (auto restart possible)	The controller informs that there is a problem with the fan.
E22	Dryer not ready	Recurring error	The dryer is not ready for operation.
E23	Emergency stop	Critical error	C The controller informs that some factor caused an emergency stop of the compressor.
E24	Controller memory has been cleared	Critical error	The controller has been restored to factory settings.

Table 30: Błędy

Error code	Warning name	Type	Description
E25	Inverter error	Critical error	An error occurs on the inverter.
E26	Communication error with inverter	Critical error	Incorrect communication with inverter.
E27	Short-circuit of auxiliary temperature sensor	Non-critical error	Short-circuit at auxiliary temperature sensor input.
E28	No auxiliary temperature sensor	Non-critical error	No auxiliary temperature sensor connected.
E29	Auxiliary temperature too low	Non-critical error	Measured auxiliary temperature value below minimum level.
E30	Auxiliary temperature too high	Non-critical error	Measured auxiliary temperature value above maximum level.
E31	24 V circuit voltage too low	Critical error	24 V circuit voltage below minimum level.
E36	Short-circuit of oil pressure sensor	Critical error	Short-circuit at oil pressure sensor input.
E37	Oil pressure sensor not connected	Critical error	No oil pressure sensor connected.

23.7. DANFOSS inverter errors

Table 31: Inverter errors

Error code	Error type	Error description
A2	Critical error	Live zero error
A4	Critical error	Phase loss
A7	Critical error	DC circuit overvoltage
A8	Critical error	DC circuit voltage below minimum
A9	Critical error	Inverter overload
A10	Critical error	ETR motor overheating
A11	Critical error	Motor overheating
A12	Critical error	Torque limitation
A13	Critical error	Overcurrent
A14	Critical error	Ground error
A16	Critical error	Short circuit
A17	Critical error	TO controller control
A25	Critical error	Brake resistor
A26	Critical error	Brake overload
A27	Critical error	GBT brake
A28	Critical error	Brake check
A30	Critical error	U phase loss
A31	Critical error	V phase loss
A32	Critical error	W phase loss
A33	Critical error	Pre-charging system error in start-up phase
A34	Critical error	Communication bus error
A36	Critical error	Power failure

Table 31: Inverter errors

Error code	Error type	Error description
A38	Critical error	Internal error
A47	Critical error	Low 24V power supply
A48	Critical error	Low 1.8V power supply
A63	Critical error	Brake error
A65	Critical error	Control card temperature
A67	Critical error	Option change
A68	Critical error	Safe stop
A69	Critical error	Power card temperature
A80	Critical error	Inverter running

23.8. YASKAWA inverter errors

Table 32: Inverter errors

Error code	Error type	Error description
Uv1	Critical error	DC supply voltage too low
SC	Critical error	Output short circuit or IGBT error
GF	Critical error	Ground error
oC	Critical error	Overcurrent
ov	Critical error	DC supply overvoltage
oH	Critical error	Heat sink overheat
oH1	Critical error	Heat sink overheat
oL1	Critical error	Motor overloaded
oL2	Critical error	Inverter overload
PF	Critical error	Input phase loss
LF	Critical error	Output phase loss
oH4	Critical error	Motor overheating
CE	Critical error	Modbus communication error
EF1	Critical error	External error - S1 terminal
SCF	Critical error	Safety system fault
oH3	Critical error	Motor overheating

23.9. Delta inverter errors

Table 33: Inverter errors

Error code	Error description
ocA	The output current exceeds 2.4 times the rated current during acceleration. When ocA occurs, the drive closes the output gate immediately. The engine is idling and the display shows the ocA error
ocd	The output current exceeds 2.4 times the rated current during deceleration. When ocd occurs, the drive closes the output gate immediately. The engine is idling and the display shows ocd error

Table 33: Inverter errors

Error code	Error description
ocn	The output current exceeds 2.4 times the rated current during deceleration. When ocn occurs, the drive closes the output gate immediately. The engine is idling and the display shows an ocn error
GFF	When one of the output terminals is grounded, the short circuit current is greater than the Pr setting value
occ	A short circuit has been detected between the upper bridge and the lower bridge of the IGBT module
ocS	Excessive current or hardware error in stopping current detection. After ocS occurs, turn on the power. If a hardware failure occurs, cd1, cd2, or cd3 will appear on the display.
ovA	DC bus overvoltage during acceleration, when ovA occurs, the drive closes the output gate, the motor idling and the display shows ovA error.
ovd	Excess DC bus voltage during deceleration. When overvoltage occurs, the drive immediately closes the output gate, the motor is idling, and the display shows ovd error
ovn	Excessive DC bus voltage during deceleration. When an overvoltage occurs, the drive immediately closes the output gate, the motor is idling, and the display shows the ovn error
ovS	Power surge when stopping
LvA	The DC bus voltage is lower than the Pr setting value. 06-00 during acceleration
Lvd	The DC bus voltage is lower than the Pr setting value. 06-00 during acceleration
Lvn	The DC bus voltage is lower than the Pr setting value. 06-00 at constant speed
LvS	The DC bus voltage is lower than the Pr value. 06-00 value at stop. Voltage detection hardware failure
Orp	Input power phase loss
oH1	The IGBT temperature exceeds the protection level
oH2	The capacity temperature exceeds the protection level
tH1o	IGBT hardware error in temperature detection
tH2o	Hardware error in capacitor temperature detection
oL	The AC motor drive detects excessive current. The overload capacity persists for 1 minute when the drive is outputting 120% of the drive's rated output current.
EoL1	Electronics Thermal transmitter protection 1. Drive stops to stop when activated
EoL2	Electronics thermal transmitter protection 2. Drive stops to stop when activated
oH3	Engine overheating
ot1	When the output current exceeds the over-torque detection level
ot2	When the output current exceeds the over-torque detection level
uC	Low current detection
LMIT	When MIx=45 (forward run limit) or MIx=44 (reverse run limit) during operation, LMIT error will appear
cF1	The internal EEPROM cannot be programmed
cF2	The internal EEPROM cannot be read
cd1	U phase current detection error when power on
cd2	Phase V current detection error when power on
cd3	W phase current detection error when power on
Hd0	cc (current terminal) hardware protection error when power is on
Hd1	Oc hardware protection error with power on
Hd2	Hardware protection error after power-up
Hd3	occ IGBT short circuit detection protection error when power on

Table 33: Inverter errors

Error code	Error description
AUE	Auto engine tuning error
AFE	PID Feedback Loss (analog feedback signal is only valid when PID function is enabled)
PGF1	The motor runs in the opposite direction to the control direction frequency of the control direction
PGF2	Pr. 10-00 and Pr. 10-02 are not set in PG control mode in PG control mode. When you press the ”RUN” button, a PGF2 error will occur
PGF3	In PG mode, when the motor frequency exceeds the stall level of the encoder observer (Pr. 10-10) and the error time starts longer than the encoder observer overload detection time (Pr. 10-11). encoder observer (Pr. 10-11), PGF3 error occurs. PGF3 error occurs.
PGF4	In PG mode, when the motor frequency exceeds the encoder observer slip range (Pr. 10-13) and the error time is longer than the encoder observer slip detection time (Pr. 10-14), PGF4 error will occur. encoder observer slip (Pr. 10-14), PGF4 error will occur
ACE	Signal Loss on Analog Input (including all 4-20mA analog signals)
EF	External error. When the drive decelerates based on the Pr setting. 07-20, EF error is displayed on the keypad
EF1	When the MIx=EF1 contact is turned on, the output stops immediately and displays EF1 on the keypad. The engine is idling
bb	When the MIx=bb contact is on, the output stops immediately and displays bb on the keypad. The engine is idling
Pcode	Entering the wrong password three times in a row
CE1	The communication command is invalid
CE2	Data address is invalid
CE3	The data value is invalid
CE4	Data is written to a read-only address
CE10	MODBUS transmission timeout occurred
bF	Motor drive brake transistor is abnormal (for models with built-in brake transistor)
ydc	The error occurs when Y-Δ switches
dEb	When Pr. 07-13 is not 0, the power will be turned off suddenly, causing the DCBUS voltage to be lower than the dEb operating level, the dEb function will operate and the motor will stop. The Keypad then displays dEb
oSL	Based on the maximum traction limit set with Pr. 10-29, speed deviation is abnormal. When the motor drives at a constant speed, F>H or F<H exceeds the level set with Pr. level set with Pr. 07-29 and exceeds the time set with Pr. 07-30, oSL will appear. oSl occurs only in induction motors. Only.
ryF	Electric valve switch error when performing soft start function
PGF5	PG card hardware error
SdRv	The direction of rotation is different from the direction detected without a sensor
SdOr	Overspeed detected sensorless
SdDe	Large deviation between rotation speed and command detected by sensorless
WDTT	Watchdog error
SSTL1	STO1 - SCM1 internal loop detection error
S1	Emergency stop for external safety
Brk	External mechanical brake error The MO terminal is active when MOx=12, 42, 47 or 63, but MIx=55 does not receive a signal for mechanical brake operation during the time set in Pr. 02-56.

Table 33: Inverter errors

Error code	Error description
STO	Active safe torque off function
STL2	STO2-SCM2 inner loop detection error
STL3	Inner loop detection STO1-SCM1 and STO2-SCM2 error
OPHL	Output phase loss
OPHL	V phase output phase loss
OPHL	Phase loss at W phase output
AboF	ABZ line disabled for protection when using PG02U
UvoF	UVW line disabled for protection when using PG02U
oL3	Low frequency and high current protection
RoPd	Rotor position detection error protection
Fstp	Keypad forced PLC to stop
TRAP	Processor failure
CGdE	CANopen protection error
ChbE	CANopen heartbeat error
CbFE	CANopen bus disable error
CIdE	CANopen index error
CAdE	CANopen station address error (only supports 1-127)
CFrE	CANopen memory error
ictE	Internal communication timeout
SfLK	The inverter has a RUN command with the output frequency, but the permanent magnet motor does not rotate
AUE1	No feedback current error when motor parameter automatically detects
AUE2	Motor phase loss error when motor parameter automatically detects
AUE3	No-load current measurement error I0 when motor parameter automatically detects
AUE4	Lsigma leakage inductance measurement error when motor parameter automatically detects
CBM	Error matching control card

24. Software Update

The controller is equipped with a system using a USB port. The current version of the driver software can be found in the ”Information” tab. The software update does not affect the controller settings. Parameter values are saved from before the update. To perform the update, a pendrive with the update package is required. The update can be performed in two ways, which are described in the following subsections.

24.1. Update from menu level

Updating from the menu level requires preparing a pen drive with the appropriate update package. The update file should have the extension ”.update” and be located on the data carrier in the ”update” folder. To start the update, a properly prepared pendrive must be inserted into the controller’s USB connector. Then, in the ”Information” tab, after pressing the ”Update” button, the device update process will begin.

Figure 72: Starting the update

The update process may take several minutes. During this time, the user can continue to use the controller. The user is informed about the entire process in the form of messages displayed in the upper right corner of the screen. When the update is finished, the message ”UPDATE COMPLETED SUCCESSFULLY. RESTARTING...” will appear on the display, then the driver restarts to complete the update. After restarting, the controller is ready for use with the updated software version.

Figure 73: Update completed successfully

24.2. Emergency Update

The second update method must be performed before the driver starts. At the very beginning, change the name of the update file on the pen drive to: ”force_udpate.update”. This file, as in the previous method, must be located in the ”update” folder. If a pen drive with this folder is plugged into the USB port before starting the controller, it will initiate the update process when the controller starts.

When the process is completed, the driver will inform you that the update was successful and ask you to restart.

Before restarting, remember to unplug the device from the USB port, otherwise, the update will start again after the restart.

24.3. Function for saving service logs on external memory

The service logs function was created to facilitate the verification of possible problems with the controller, service logs are in the form of an encrypted file, and only the manufacturer can read it.
To record service logs on a pen drive, place it in one of the controller’s USB ports, and then go to the **Service parameters → Factory settings → Service logs** tab and select the ”Save” button.
The process of copying logs to external memory may take up to several minutes.

25. Touch display calibration

If the touch display becomes uncalibrated, the controller has a function to calibrate the part of the display responsible for touch recognition. To calibrate the display, you must prepare an external data carrier (pen drive) with the appropriate file. You can create the calibration file yourself. You need to create a new empty file called **”force_calibration”**. The file prepared in this way should be placed on the media in the folder named **”update”**. The next step is to place the pen drive in the controller’s USB connector and restart it. Upon restart, the driver will initiate the screen calibration procedure. A black screen will appear with indicators that are calibration points. At this point, press the screen at the indicator locations. Once all points have been indicated, the calibration process will end and the controller will run completely.

26. Technical specification

26.1. Electrical parameters

Table 34: List of electrical parameters

Parameter	Value
Supply voltage	24 VAC 50/60 Hz
Power consumption	Up to 10 W
Relays - maximum switching voltage	250 VAC
Maximum load sum of REL1, 2, 3, 4 relay group (resistive)	4 A
Maximum load of each of the REL5, 6, 7, 8 relays (resistive)	3 A
REL9 relay maximum load (resistive)	3 A
Maximum relays load (inductive)	0,5 A
Maximum current in the current loop	28 mA
Maximum power consumption from internal reference voltage	250 mA
Digital inputs - minimum voltage	-0,5 VDC
Digital inputs - maximum voltage	24,7 VDC
Analog inputs - minimum voltage	-0,5 VDC
Analog inputs - maximum voltage	24,7 VDC

26.2. Mechanical parameters

Table 35: Mechanical parameters

Parameter	Value
Housing dimensions	180 x 110 x 74 mm
Weight (without packaging)	951 g
Assembly	Clips

26.3. Operating conditions

Table 36: Permissible operating conditions

Parameter	Value
Operating temperature	-15 ÷ 50°C
Storage temperature	-20 ÷ 70°C
Relative humidity	10 ÷ 90%, no condensation

27. Controller dimensions

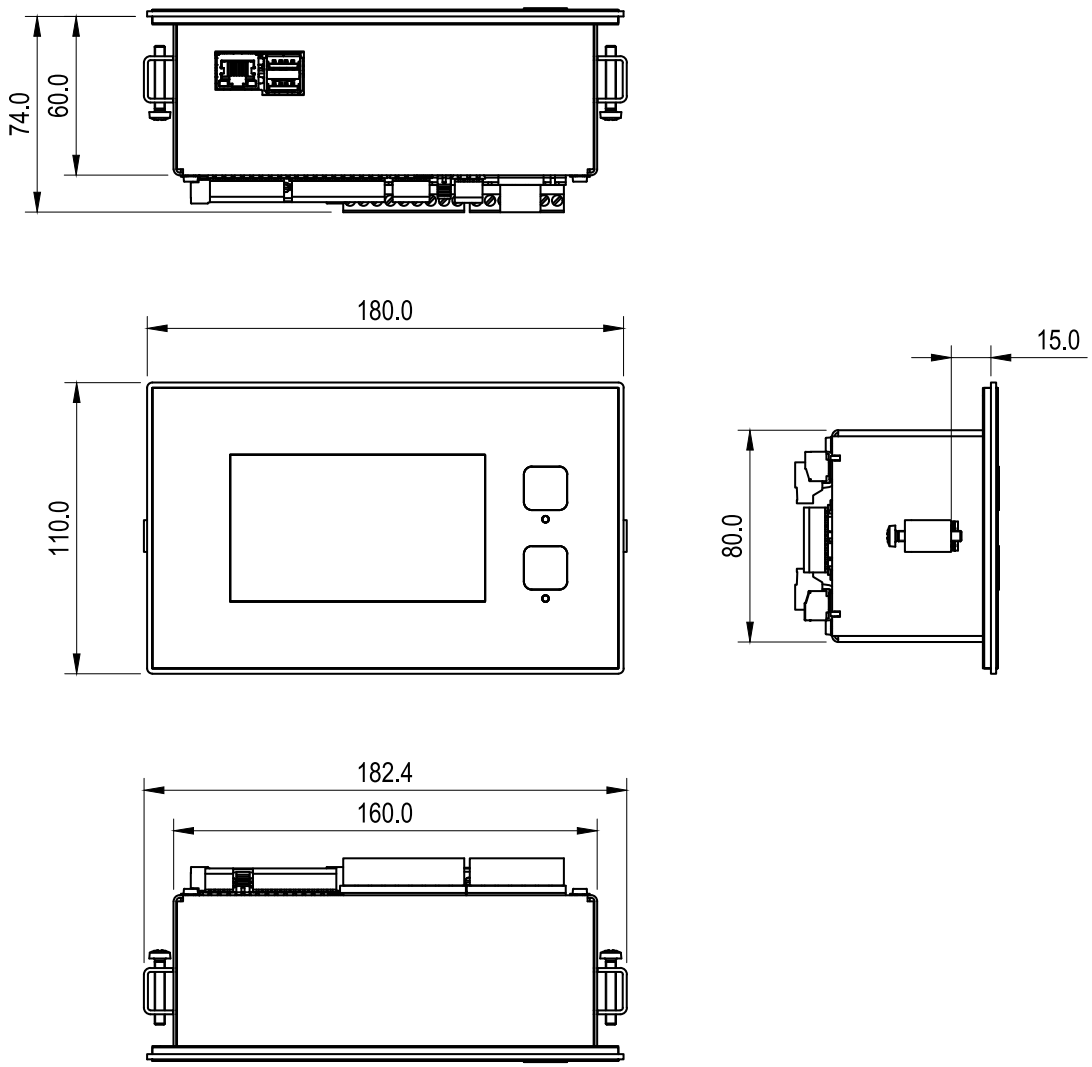

Figure 74: Controller case drawing