

# **Instruction manual for services**

## **Compressor Controller**

update 7/2024

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## 1. General information

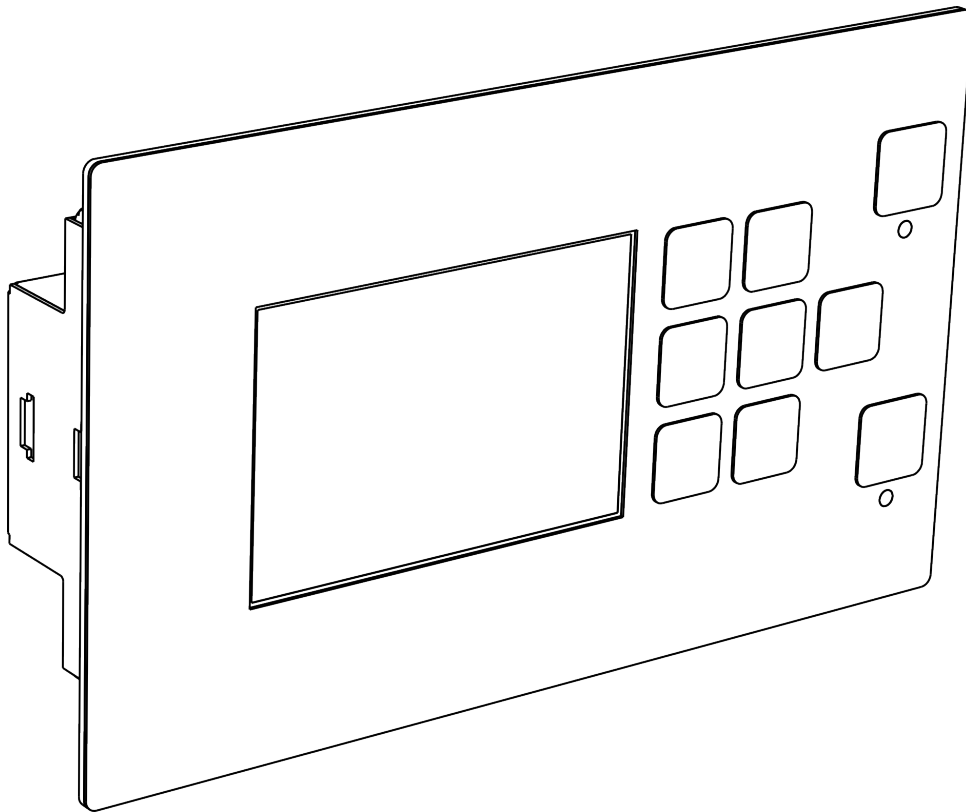


Figure 1: Controller visualisation

### 1.1. Controller description

Controller dedicated for compressors with a power of up to 22 kW. The controller can work with compressors operating in a star-delta configuration or equipped with an inverter.

Controller features:

- 3.5" color display
- Built-in web server
- Creating statistics
- Supervision function: network pressure, oil pressure, oil temperature, motor temperature and motor current
- Control of oil heaters, air dryer and condensate drain
- Freely configurable controller inputs and outputs
- Automatic restart function
- Inverter control using the Modbus RTU protocol (selection of standard Yaskawa, Danfoss, ABB and Delta inverter)
- Star-delta or direct start-up (for compressors without inverter)
- Service parameters and user with access control menu
- Service counters and working time counters
- Network operation mode supporting up to 4 compressors
- Remote operation mode (using digital input)
- Operation scheduling with a division into cyclical and one time events, up to 5 events in total



- Software update via USB port

## 1.2. Input and output list

1. The controller is equipped with 2 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
2. The controller is equipped with 2 analog inputs to support 4-20 mA sensors. The measuring range can be configured from the controller. Supported parameters:
  - Network pressure
  - Oil pressure
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 6 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
  - Emergency stop
  - Power supply asymmetry
  - Phase sequence error signal
  - Overload relay error signal
  - Air filter error signal
  - Oil filter error signal
  - Separator error signal
  - AFOFSEP error signal (common error for air filter, oil filter and separator)
  - Fan error signal
5. The controller is equipped with 7 configurable digital (relay) outputs, including:
  - 3 outputs with common potential
  - 3 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
  - Fan
  - Dryer
  - Heater 1
  - Heater 2
  - Warning
  - Error
  - Warning/error status
  - Ready
  - Running
  - Compressing
  - Service
6. The controller is equipped with 1 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 controller manufacturer.

## 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

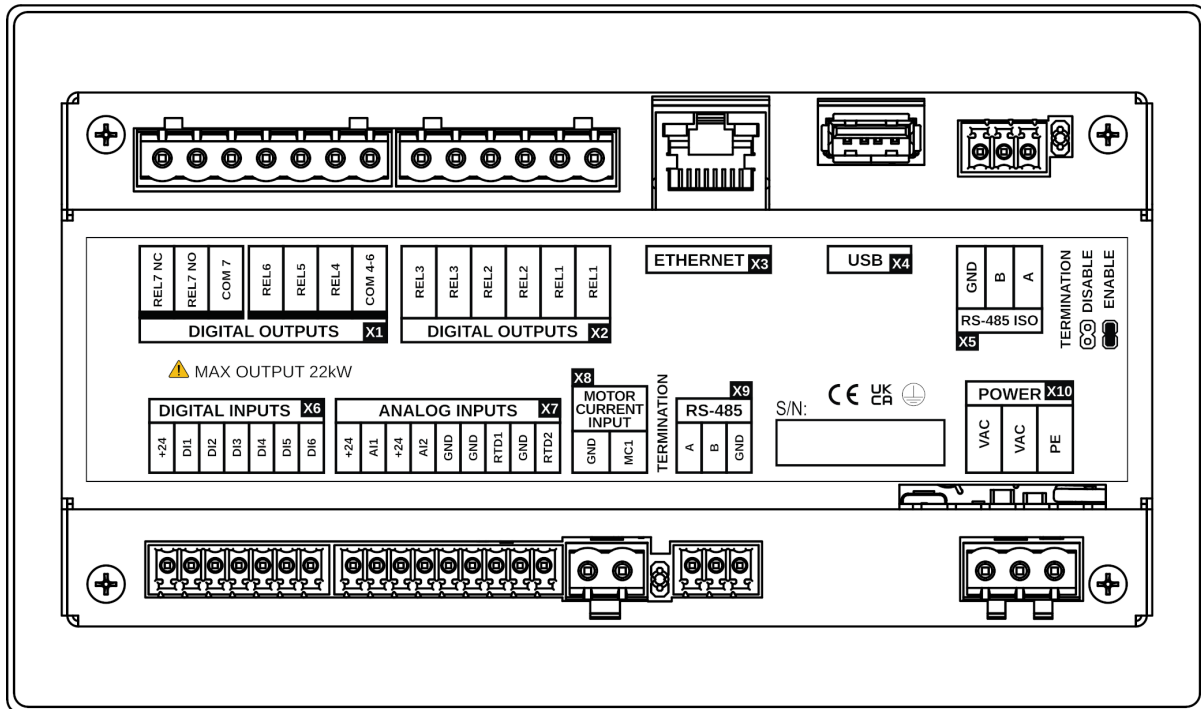


Figure 2: Electrical terminals of the controller

Table 1: Description of digital outputs (X1, X2 DIGITAL OUTPUTS)

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

Table 2: Description of communication outputs (X3,X4)

Name	Description
ETHERNET	Ethernet port (RJ45)
USB	USB port

Table 3: Description of RS-485 ISO connector (X5)

Name	Description
<i>GND</i>	Isolated RS-485 interface ground
<i>B</i>	Isolated RS-485 interface reversing line
<i>A</i>	Isolated RS-485 interface non-reversing line

Table 4: Description of digital inputs (X6 DIGITAL INPUTS)

Name	Description
<i>+24V</i>	Internal reference voltage output
<i>DI1</i>	Configurable digital input 1
<i>DI2</i>	Configurable digital input 2
<i>DI3</i>	Configurable digital input 3
<i>DI4</i>	Configurable digital input 4
<i>DI5</i>	Configurable digital input 5
<i>DI6</i>	Configurable digital input 6

Table 5: Description of analog inputs (X7 ANALOG INPUTS)

Name	Description
<i>+24V</i>	Analog input 1 power supply
<i>AI1</i>	Analog input 1
<i>+24V</i>	Analog input 2 power supply
<i>AI2</i>	Analog input 2
<i>GND</i>	Ground terminal
<i>GND</i>	Resistive temperature sensor 1 ground
<i>RTD1</i>	Resistive temperature sensor input 1
<i>GND</i>	Resistive temperature sensor 2 ground
<i>RTD2</i>	Resistive temperature sensor input 2

Table 6: Description of 5A current transformer input (X8 MOTOR CURRENT INPUT)

Name	Opis
<i>GND</i>	Ground terminal of MC1 input
<i>MC1</i>	Motor current measure input MC1

Table 7: Description of RS-485 connector (X9)

Name	Description
<i>A</i>	RS-485 interface non-reversing line
<i>B</i>	RS-485 interface reversing line
<i>GND</i>	RS-485 interface ground

Table 8: Description of power outlets (X10 POWER)

Name	Description
<i>PE</i>	PE Connector
VAC	Controller supply voltage (24 VAC)
VAC	Controller supply voltage (24 VAC)

The controller is equipped with a housing ground terminal, which is located next to X10 connector.

## 4. Technical specification

### 4.1. Electrical parameters

Table 9: List of electrical parameters

Parameter	Value
Supply voltage	24 VAC 50/60 Hz +/- 10%
Power consumption	Up to 10 W
Relays - maximum switching voltage	250 VAC
Maximum load sum of REL4, 5, 6 relay group (resistive)	4 A
Maximum load of each of the REL1, 2, 3 relays (resistive)	3 A
REL7 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

### 4.2. Mechanical parameters

Table 10: Mechanical parameters

Parameter	Value
Housing dimensions	176 x 106 x 38 mm
Weight (without packaging)	465 g
Assembly	Clips

### 4.3. Operating conditions

Table 11: Permissible operating conditions

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

## 5. User interface

### 5.1. Front panel

On the front panel, you will find:

- 9 buttons
- 2 LEDs indicating compressor status
- A display screen showing the graphical user interface

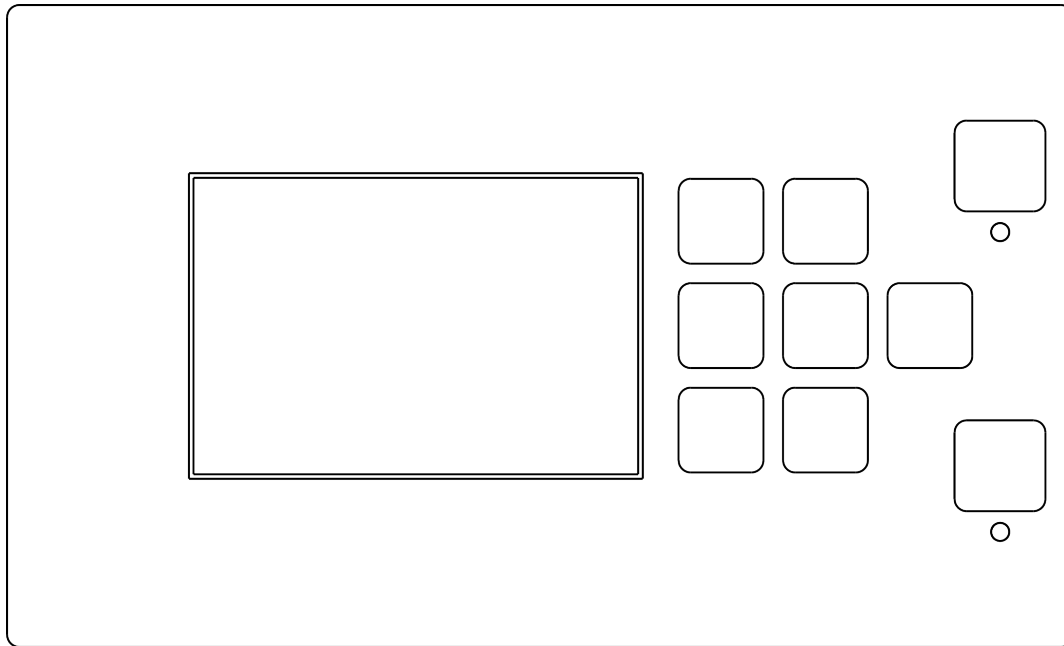


Figure 3: Controller front panel

Table 12: Description of LED operation

LED	Colour	LED behaviour
START	Green	<b>Constant</b> - compressor running (compression, idle mode) <b>Pulse</b> - Motor startup
STOP	Red	<b>Constant</b> - compressor not running <b>Pulse</b> - compressor shutting down or waiting for pressure drop

Table 13: Button operation description

Button	Function
START	Allow compressor to start working
STOP	Stop compressor operation
Up	Navigation arrow in the graphical user interface
Down	Navigation arrow in the graphical user interface
Right	Navigation arrow in the graphical user interface
Left	Navigation arrow in the graphical user interface



Table 13: Button operation description

Button	Function
OK	Confirm action
Back	Go return to previous level of graphical user interface
Menu	Switch to main menu

## 6. Graphical user interface

### 6.1. Main view

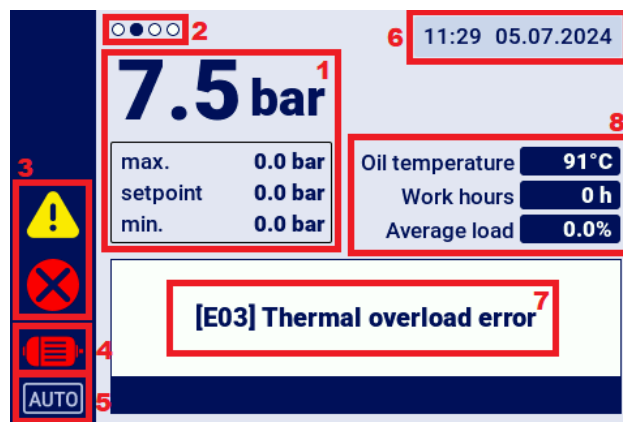


Figure 4: Main view with sections divided

#### Description of individual sections:

1. Pressure gauge in the network, pressure settings
2. Shortcut indicator available from the main view
3. Error icons and warnings
4. Icon indicating current compressor status
5. Operation mode icon
6. Current date and time
7. Text display showing text messages related to compressor status
8. Basic parameters display showing compressor operation

### 6.2. Main view shortcuts

The controller has the ability to quickly switch from the main view to selected user interface tabs. This can be done using the left and right arrow buttons.

Dots in the top left corner of the display indicate which shortcut view is currently selected.

Table 14: List of main view shortcuts

Tab name	Position relative to main view
Main view	-
Active events	<
Sensors	>
Network work view *	> >

\* -Shortcut only visible when the controller's main mode is enabled.

### 6.3. Compressor status icon

The icon on the side panel of the user interface informs about the current status of the compressor.



**Motor stopped**



**Compression**



**Idle**



**Motor startup or motor stop**



**Ready to start (waiting)**

### 6.4. Error and warning icon

Error and warning icons inform about errors and warnings that occur on the controller or occurred in the past, and may vary visually depending on the location on 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)**



**Emergency kill switch icon**

### 6.5. Navigating the graphic user interface

The user graphic interface is operated using a set of buttons located on the front panel of the controller. The arrow buttons allow you to move between the available fields in the menu data, the cursor in the form of a blue frame indicates which field is currently selected.

To select a specific field move the cursor over a field and confirm your selection with the “OK” button. The button with a 180-degree curved arrow symbol is the “Undo” button. It allows you to go back to the previous view of the graphic interface, pressing it repeatedly (the number of presses depends on the level of nesting of the specified menu) will always move you to the main view.

The button with the symbol of three horizontal dashes is the “Menu” button, pressing it takes you directly to the main menu.

More detailed descriptions are included in the sections dedicated to each function.

### 6.5.1. Navigating the main view

The main view of the controller allows you to quickly navigate to tabs such as "Active events", "Sensors" and "Network operation view" by using the left and right arrow buttons.

"Network operation view" is only visible if the controller is configured as a master.



Figure 5: The active events tab is accessible via a quick transition between pages

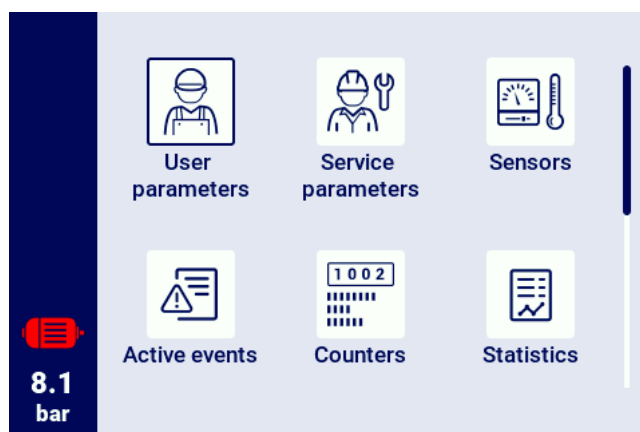


Figure 6: Controller main menu

### 6.5.2. Basic menu types

The user interface is divided into 2 basic menu types (tabs), which differ in the way they are navigated. The first type is a matrix menu, navigation in this case is done using the left, right, top and down buttons.

The second type is a menu in the form of a list, in which navigation is possible using the up and down buttons. If there are more parameters in the list than can fit on the display at the same time, the numbering of the subpages on which the parameters are located is displayed in the upper left corner. The left and right buttons allow you to quickly move to the next page.



Figure 7: Example matrix menu



Figure 8: Example list type menu

### 6.5.3. Sidebar

The rectangular bar on the left side of the screen is visible anywhere on the user's graphic interface, it allows you to continuously view the most important parameters of the compressor.

#### List of information that is displayed on the sidebar:

- Current network pressure
- Motor status
- Active error icon
- Active warning icon
- Safety button icon
- page numbering in the list

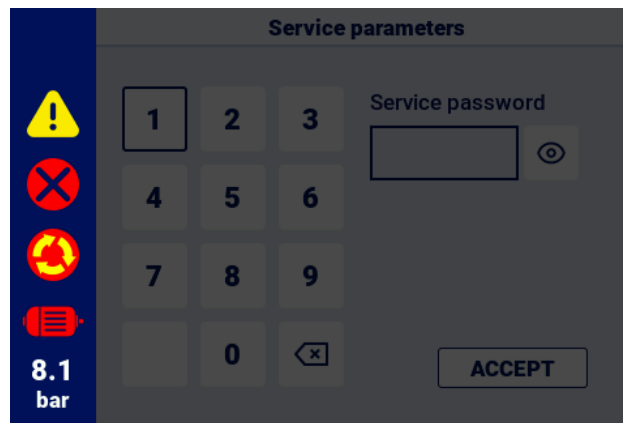


Figure 9: Side bar with visible indication of network pressure and icons for error, warning and emergency button

#### 6.5.4. Log in screen

Some interface functionalities require user or service authorization. To do this, select the appropriate access level icon, enter the password, and confirm with the "LOGIN" button. The entered password is encoded in the form of dots, and the eye icon on the right-hand side allows you to view the entered password. The preview is visible as long as the user presses the "OK" button.

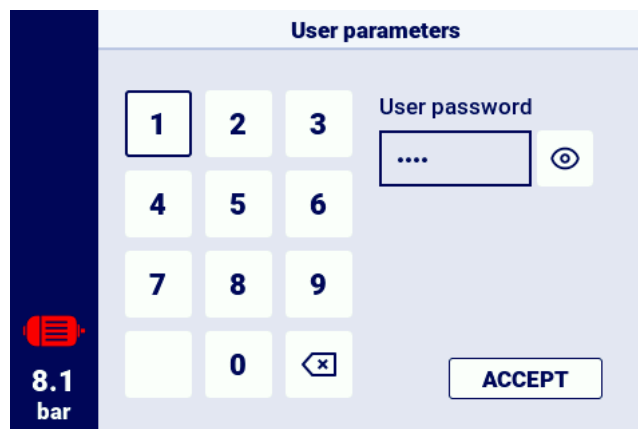


Figure 10: Authorization screen

#### 6.5.5. Configuring parameters

The user's graphic interface stores parameters in subgroups, which are displayed as tiles with descriptions. To go to the desired subgroup, select the tile area with the cursor, and then press the "OK" button.

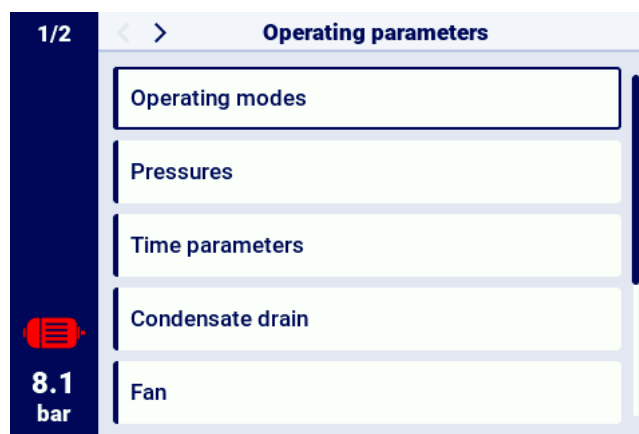


Figure 11: Parameter subgroup tiles showing work parameters

After navigating to the selected subgroup, the parameters will be displayed in the form of tiles displaying the name of the parameter and its current value. To modify the value of a parameter, press the "OK" button when the cursor is on the specified parameter.

The pencil symbol indicates that the specified parameter can be modified. Parameters with a switch symbol are an exception. There is no pencil symbol next to them, but they can be modified.

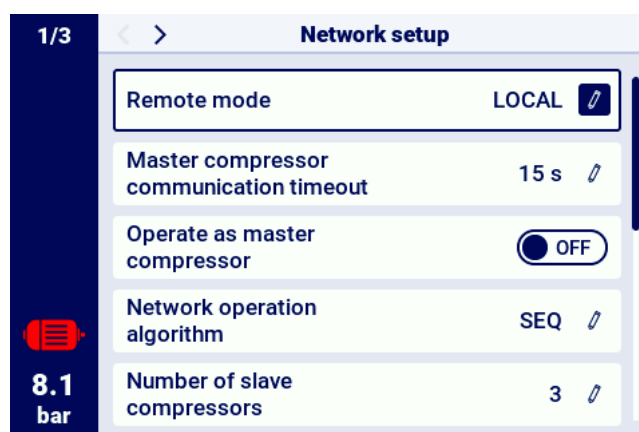


Figure 12: Parameter tiles showing a subgroup of network operation configuration parameters

A selected parameter, depending on its type, can be configured by entering values from the on-screen keyboard or by selecting an item from a predefined list. The on-screen keyboard may vary depending on the parameter being edited, allowing negative values to be entered (by using the symbol for changing the sign to negative). After entering a new parameter value, the operation must be approved with the "SAVE" button. The permissible range of the parameter is displayed. Under the field where the entered value is displayed. To cancel the change, press the "Undo" button instead of saving the new value.

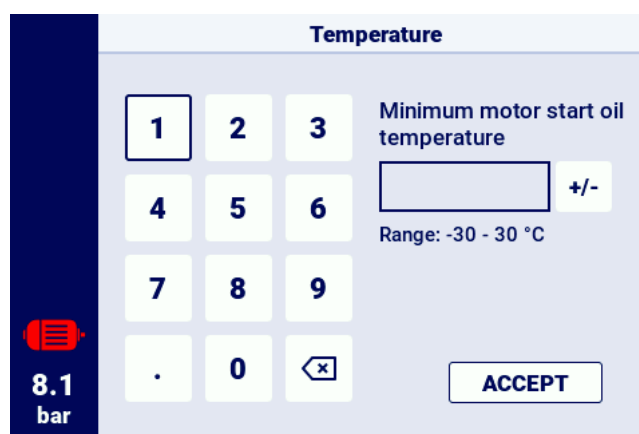


Figure 13: The on-screen keypad showing start minimum oil temperature

Parameters which require selecting a value from a predefined list for configuration are another type of parameters.

The "On", "Off" parameters are a special type of such parameters. They are marked with a slider symbol and allow you to change the value without opening the selection list. Just selecting such a parameter changes its value to the opposite of the current one.

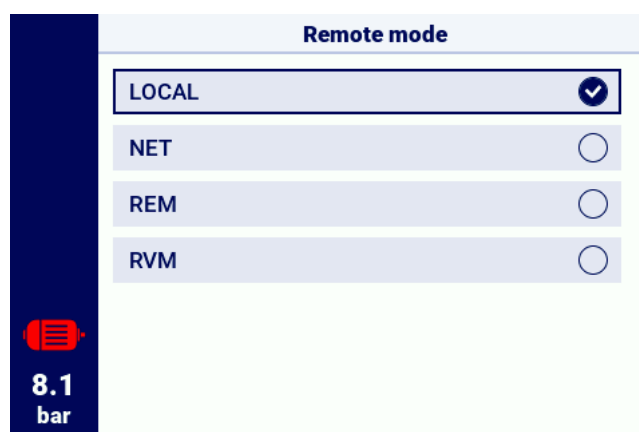


Figure 14: List example

### 6.5.6. Screen messages

The controller displays messages addressed to the user in the upper right corner of the screen, in the form of a message window. To close the message window, press any of the buttons on the controller except the "On" and "Off" buttons. These messages inform, for example, that an invalid password has been entered or that the update is in progress. They are not archived in the controller's memory.



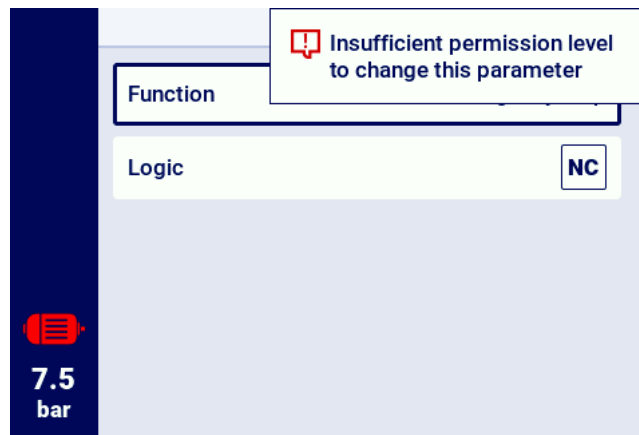


Figure 15: On-screen message example

## 6.6. Main menu

To access the main menu, press the menu button (3 horizontal dashes). From this level, it is possible to select available sub-tabs.

### List of sub-tabs:

- User parameters
- Service parameters
- Sensors
- Active events
- Counters
- Statistics
- Operation planning
- Event history
- Information
- Search parameter

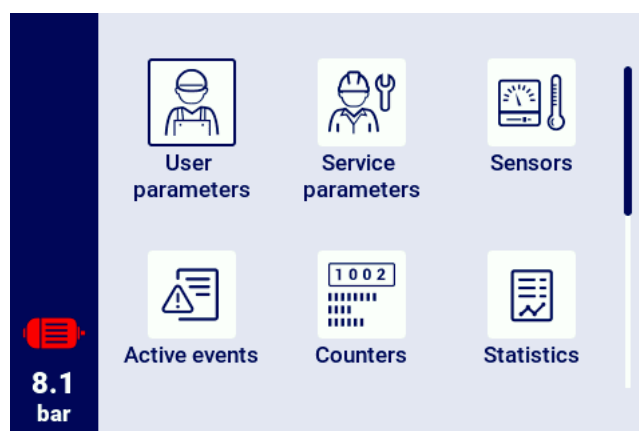


Figure 16: Main menu

### 6.6.1. Search parameter

The "Search parameter" tab allows you to navigate to a specific parameter or group of parameters by entering its number in the search bar.

For a complete list of parameters with their numbers, see the section on parameters.

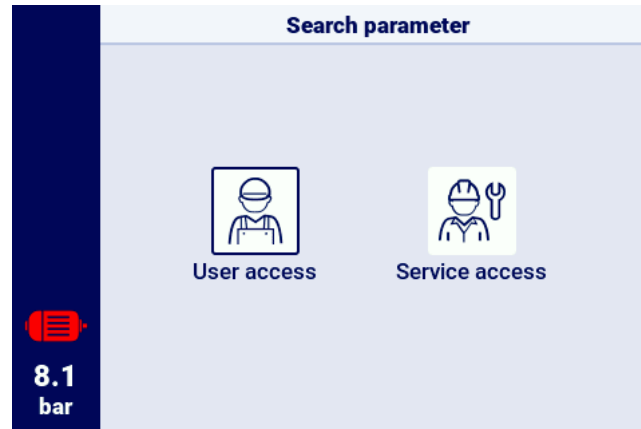


Figure 17: Access level selection

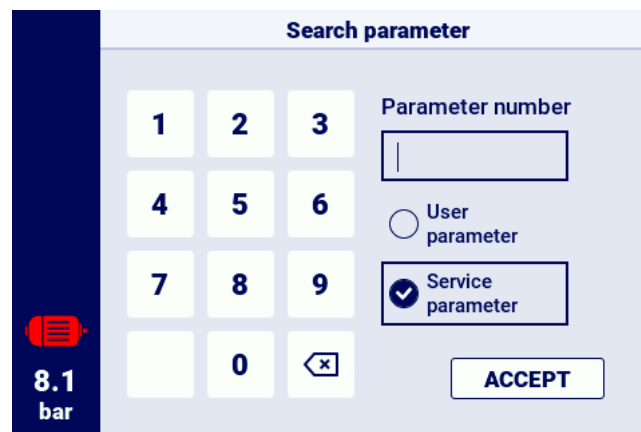


Figure 18: Parameter search menu

### 6.6.2. Information

The "Information" tab contains basic data about the compressor and the controller. You will also see a button used to start the controller software update procedure.

#### List of data stored in the information tab:

- Software version
- Compressor serial number
- Controller serial number
- Manufacturer information

- Compressor startup method
- Controller IP address
- Controller MAC address

### 6.6.3. Sensors

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

#### List of values in the sensors tab:

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

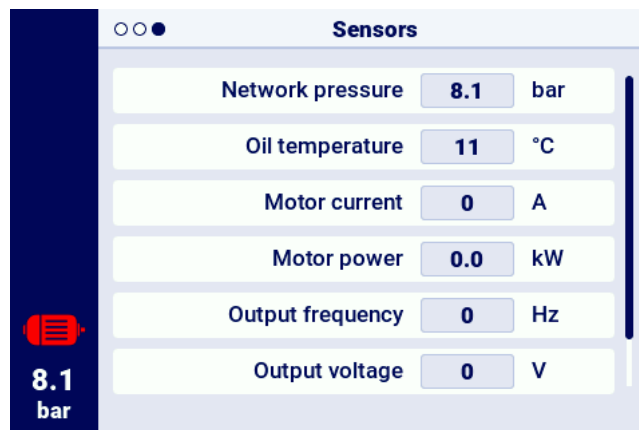


Figure 19: Sensors view

### 6.6.4. Counters

The "Counters" 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 operating hours. The service counter can be configured for both of the previously mentioned values or only for one of them. In this case, only the configured value is displayed. If the counter is inactive, its tile shows an "OFF" icon.

To reset the counter, select its tile, and then select the "RESTART" parameter. The counter will be restarted to the values defined by the compressor manufacturer. The list of counters may vary depending on the compressor configuration.

#### List of supported counters:

- General inspection counter
- Oil change counter
- Oil filter counter
- Air filter counter
- Separator counter
- Belt tensioner counter
- Motor bearing lubrication counter
- General purpose counter 1
- General purpose counter 2

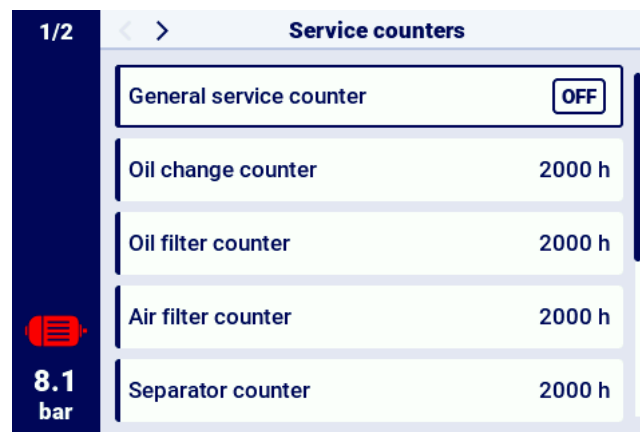


Figure 20: "Service counters" tab

#### 6.6.5. Events

The "Events" tab allows you to check the history of errors and warnings that occurred on the controller. Each event has the following parameters assigned: date and time occurrence, content and symbol. The list archives 50 events, and when this number is exceeded, the oldest events are deleted.



Figure 21: Event history tab

### 6.6.6. Statistics

The controller aggregates sensor measurements and information on compressor operation and presents them in the form of statistics. The "Statistics" tab stores information about the time and cycles of compressor operation. The types of load data are different for star-delta start and inverter compressors.

Table 17: Parameters from the "Consumption" tab

Parameter name	Parameter description
Total operating time	Total motor operating time
Operating time under load	Total compression time
Average load	Ratio of running time under load to total running time
Number of motor starts	Total number of motor starts
Average number of motor starts	Average number of motor starts per hour
Number of Y-valve engagements	Total number of Y-valve engagements
Load 80% - 100% <sup>F</sup>	Total operating time per load range
Load 60% - 80% <sup>F</sup>	Total operating time per load range
Load 40% - 60% <sup>F</sup>	Total operating time per load range
Load 20% - 40% <sup>F</sup>	Total operating time per load range

<sup>F</sup>-Parameter available only for compressors equipped with an inverter

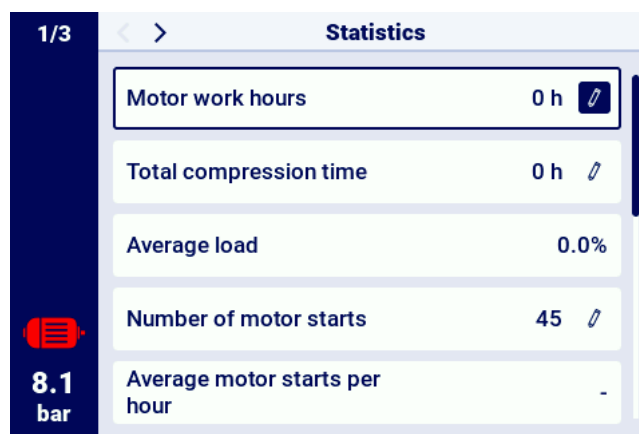


Figure 22: Statistics tab

## 7. User Preferences

The user can configure his preferences in the "User preferences" tab:

**User parameters -> User preferences.** There you will find a set of settings that do not directly affect the operation of the compressor, but have an impact on the user's comfort in operating the controller.

### List of sub-tabs:

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

### 7.1. Adjusting the display brightness

The controller display brightness can be adjusted in the tab:

**User parameters -> User preferences -> Display.**

The minimum brightness level available is 10%, the maximum is 100%

### 7.2. Screen saver configuration

You can enable or disable the screen saver by going to the tab:

**User parameters -> User preferences -> Display.**

Setting the "Screen saver" switch to "On" or "Off". The "Screen saver delay" parameter defines the number of seconds after which the screen saver will turn on in case of inactivity.

### 7.3. Units

The controller allows you to configure the units in which the values read from each sensor are displayed, the configuration is available in the tab:

**User parameters -> User preferences -> Units.**

**List of temperature units:**

- °C
- °F

**List of pressure units:**

- bar
- psi

### 7.4. Controller language

To select a different language version of the user interface, go to the tab:

**User parameters -> User preferences -> Language.**

**List of language versions:**

- Polish
- English
- German
- Russian

### 7.5. Date and time settings

To set the correct date and time on the controller, go to the tab:

**User parameters -> User preferences -> Date and time.**

The controller also allows you to change the time display format to 12 hours.

### 7.6. Compressor name

The controller allows you to give a name to your own compressor. This allows quick identification of the compressor from the Web server. To enter a compressor name, go to the tab:

**User parameters -> User preferences -> Compressor name.**

Then enter the name using the on-screen keyboard.

## 8. User parameters

### Default 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 18: List of user parameters

Name	Modification	Range	Location
Display brightness	Yes	10-100 %	User preferences -> Display
Screensaver	Yes	On; Off	User preferences -> Display
Screensaver delay	Yes	≥ 0 s	User preferences -> Display
Temperature unit	Yes	°C; °F	User preferences -> Units
Pressure unit	Yes	bar; psi	User preferences -> Units
Language	U	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 <sup>F</sup>	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
Motor deceleration time	No	≥ 0 s	Operation parameters -> Time parameters



Table 18: List of user parameters

Name	Modification	Range	Location
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
Dryer waiting time	S*	0-720 min	Operating parameters -> Dryer
Heater 1	No		Operation parameters -> Heater
Heater 1 hysteresis	No		Operation parameters -> Heater
Heater 2	No		Operation parameters -> Heater
Heater 2 temperature offset	No		Operation parameters -> Heater
Heater 2 hysteresis	No		Operation parameters -> Heater
Idle reheating	No		Operation parameters -> Heater
Idle reheating on temperature	No		Operation parameters -> Heater
Idle reheating off temperature	No		Operation parameters -> Heater
Restart after power failure	Yes	On; Off	Operation parameters -> Auto restart
Restart after error	Yes	On; Off	Operation parameters -> Auto restart
Reboot delay	Yes	≥ 0 s	Operation parameters -> Auto restart
Maximum number of restart attempts	Yes	≥ 1	Operation parameters -> Auto restart
Restore user settings from local copy	Yes		Service and Diagnostics -> Restore and save settings
Restore user settings from external media	Yes		Service and Diagnostics -> Restore and save settings
User password	Yes	1-10 digits	Factory settings -> Passwords
Function and logic of each digital input	No		Input/output configuration -> Digital inputs
Function and logic of each digital output	No		Input/output configuration -> Digital outputs
Function and range of each analog input	No		Input/output configuration -> Analog inputs
Baud rate	Yes	2400; 4800; 9600; 19200; 38400; 57600; 115200; 230400	I/O configuration -> RS-485/RS-485 ISO
Parity	Yes	None; Even; Odd;	I/O configuration -> RS-485/RS-485 ISO
Stop bits	Yes	1; 1.5; 2	I/O configuration -> RS-485/RS-485 ISO

Table 18: List of user parameters

Name	Modification	Range	Location
RS-485/RS-485 ISO function	Yes	None; Superior; Subordinate	I/O configuration -> RS-485/RS-485 ISO
Modbus address	Yes	1-255	I/O configuration -> RS-485/RS-485 ISO
IP address assignment	Yes	Auto(DHCP); Static(no DHCP)	I/O configuration -> IP settings
IP address	Yes		I/O configuration -> IP settings
Subnet Mask	Yes		I/O configuration -> IP settings
Gateway	Yes		I/O configuration -> IP settingsP
Safety valve test <sup>o</sup>	Yes	< 15.5 bar	Diagnostics -> Safety valve test
Remote mode	Yes	LOCAL; NET; REM; RVM;	Network operation -> Configuration
Communication time limit with master compressor	Yes	≥ 0 s	Network operation -> Configuration
Operation as master compressor	Yes	Enable; Disable	Network operation -> Configuration
Network operation algorithm	Yes	SEQ; CAS	Network operation -> Configuration
Number of slave compressors	Yes	0-3	Network operation -> Configuration
Switch-on delay between slave compressors	Yes	0-60 s	Network operation -> Configuration
Rotation time	Yes	≥ 1 min	Network operation -> Configuration
Relief pressure for master compressor	Yes		Network operation -> Configuration
Load pressure for master compressor	Yes		Network operation -> Configuration
Automatic reconfiguration of pressure limits	Yes	Enable; Disable	Network operation -> Configuration
Network operation point	Yes		Network operation -> Configuration
Pressure relief (slave compressor)	Yes		Network operation -> Compressor 1/2/3
Load pressure (slave compressor)	Yes		Network operation -> Compressor 1/2/3
Interface (slave compressor)	Yes	RS-485; RS-485 ISO	Network operation -> Compressor 1/2/3
Modbus address (slave compressor)	Yes	1-255	Network operation -> Compressor 1/2/3
Scheduled operation	Yes	Activate; Deactivate	Scheduling operation
Add event	Yes		Job scheduling -> One-time events/cyclic events

<sup>F</sup>-Parameter available only for compressors equipped with an inverter

<sup>o</sup>-Optional parameter

## 8.1. Change user password

To change the default user password, go to **User parameters->Factory settings->Passwords**, and then enter a value in the “User password” parameter. The password can be from 1 to 10 digits in length.

If you forget the user password, please contact the service.

## 8.2. User parameter search

The "Search parameter" tab allows you to navigate to a specific parameter or group of parameters by entering its number in the search bar.

Table 19: List of user parameters

Parameter number	Parameter description
1	Scheduling operation
2	Service counters
3	Change language
4   5   26	Configuring network operation
6	Information screen
7   18	Event history
8   25	Input/output configuration
11   12	Date and time settings
15   61	Time parameters
27   28	Network operation settings
30	Dryer parameters
40	Condensate drain parameters
51   52	Display settings
90	Auto restart settings
111	Reset menu
423	Changing user password
500	Safety valve test

## 9. Service Parameters

**Default user password: 0000**

**Default 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 20: List of service parameters

Name	Access level	Scope	Location
Display brightness	U	10-100%	User Preferences -> Display
Screensaver	U	On; Off	User Preferences -> Display
Screensaver delay	U	≥ 0 s	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 <sup>F</sup>	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 20: 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(AutoIdle)	U	On; Off	Operating parameters -> Time parameters
Engine stop time	S*	≥ 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 waiting time	S*	0-720 min	Operating parameters -> Dryer
Heater 1	S*	On; Off	Operating parameters -> Heater
Heater 1 Hysteresis	S*	1.0-20.0°C	Operating parameters -> Heater
Heater 2	S*	On; Off	Operating parameters -> Heater
Heater 2 Temperature offset	S*	0.0-20.0°C	Operating parameters -> Heater
Heater 2 Hysteresis	S*	1.0-20.0°C	Operating parameters -> Heater
Idle run heating	S*	On; Off	Operating parameters -> Heater
Idle run heating activation temperature	S*	2.10-9.50°C	Operating parameters -> Heater
Idle run heating deactivation temperature	S*	7.50-90.0°C	Operating parameters -> Heater
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
Maximum oil temperature	S	25.0-290.0°C	Factory settings -> Temperature
High oil temperature warning	S	20.0-290.0°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

Table 20: List of service parameters

Name	Access level	Scope	Location
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 idle run time	S	≥10 s	Factory settings -> Time parameters
Minimum idle run time	S	≤1800 s	Factory settings -> Time parameters
Maximum engine starts per hour	S	0-30	Factory settings -> Motor protection
Number of engine starts in the last hour	S		Factory settings -> Motor protection
Reset number of engine starts in the last hour	S	Reset	Factory settings -> Motor protection
Post-startup motor current control	S	On; Off	Factory settings -> Motor protection
Minimum post-startup motor current	S	0-100 A	Factory settings -> Motor protection
Exceeding maximum motor current error	S	On; Off	Factory settings -> Motor protection
Maximum permissible current	S	≥ 0-100 A	Factory settings -> Motor protection
Motor current error delay	S	≥ 1 s	Factory settings -> Motor protection
RTD 1 actual value	S		Service and Diagnostics -> RTD input calibration
RTD 1 correction	S		Service and Diagnostics -> RTD input calibration
RTD 1 actual value	S		Service and Diagnostics -> RTD input calibration
RTD 2 actual value	S		Service and Diagnostics -> RTD input calibration
RTD 2 correction	S		Service and Diagnostics -> RTD input calibration
RTD 2 actual value	S		Service and Diagnostics -> RTD input calibration
AI 1 actual value	S		Service and Diagnostics -> Analog input calibration
AI 1 gain	S		Service and Diagnostics -> Analog input calibration
AI 1 offset	S		Service and Diagnostics -> Analog input calibration
AI 1 actual value	S		Service and Diagnostics -> Analog input calibration
AI 2 actual value	S		Service and Diagnostics -> Analog input calibration
AI 2 offset	S		Service and Diagnostics -> Analog input calibration
AI 2 actual value	S		Service and Diagnostics -> Analog input calibration
AI 2 actual value	S		Service and Diagnostics -> Analog input calibration
Restore service settings from local copy	S		Service and Diagnostics -> Restore and save settings
Restore user settings from local copy	U		Service and Diagnostics -> Restore and save settings
Save local backup of settings	S		Service and Diagnostics -> Restore and save settings

Table 20: List of service parameters

Name	Access level	Scope	Location
Restore service settings from external media	S		Service and Diagnostics -> Restore and save settings
Restore user settings from external media	S		Service and Diagnostics -> Restore and save settings
Save backup of settings from external media	S		Service and Diagnostics -> Restore and save settings
Reset warning and error history	S	Reset	Service and Diagnostics -> Reset warning and error history
Save logs to storage media	U		Factory settings -> Service logs
User password	U	1-10 digits	Factory settings -> Passwords
Service password	S	1-10 digits	Factory settings -> Passwords
Function and logic of each digital input	S*		Input/output configuration -> Digital inputs
Function and logic of each digital output	S*		Input/output configuration -> Digital outputs
Function and range of each analog input	S*		Input/output configuration -> Analog inputs
Range of current measurement input	S*		Input/output configuration -> Analog inputs
Baud rate	U	2400; 4800; 9600; 19200; 38400; 57600; 115200	I/O configuration -> RS-485/RS-485 ISO
Parity	U	None; Even; Odd;	I/O configuration -> RS-485/RS-485 ISO
Stop bits	U	1; 1.5; 2	I/O configuration -> RS-485/RS-485 ISO
RS-485/RS-485 ISO function	U	None; Superior; Subordinate	I/O configuration -> RS-485/RS-485 ISO
Modbus address	U	1-255	I/O configuration -> RS-485/RS-485 ISO
IP address assignment	U	Auto(DHCP); Static(no DHCP)	I/O configuration -> IP settings
IP address	U		I/O configuration -> IP settings
Subnet Mask	U		I/O Configuration -> IP Settings
Gateway	U		I/O configuration -> IP settings
Inverter interface <sup>F</sup>	S	RS-485; RS-485 ISO	Inverter -> Interface configuration
Modbus protocol <sup>F</sup>	S	Danfoss; Yaskawa; Delta; Inovance; ABB	Inverter -> Interface configuration
Modbus address of inverter <sup>F</sup>	S	1-255	Inverter -> Interface configuration
Timeout for communication error with inverter <sup>F</sup>	S	≥0 ms	Inverter -> Interface Configuration
Gain of the proportional member <sup>F</sup>	S	≥0 %/bar	Inverter -> Inverter parameters
Integration time <sup>F</sup>	S	≥0 s	Inverter -> Inverter parameters
Maximum speed <sup>F</sup>	S	0-300 Hz	Inverter -> Inverter parameters
Minimum speed <sup>F</sup>	S	0-300 Hz	Inverter -> Inverter parameters
Speed reduction from pressure <sup>F</sup>	S	On; Off	Inverter -> Speed reduction from pressure
Point 1/2/3/4/5/6 <sup>F</sup>	S	On; Off	Inverter -> Speed reduction from pressure

Table 20: List of service parameters

Name	Access level	Scope	Location
Pressure for point 1/2/3/4/5/6 <sup>F</sup>	S	0-16 bar	Inverter -> Speed reduction from pressure
Speed for point 1/2/3/4/5/6 <sup>F</sup>	S	0-300 Hz	Inverter -> Speed reduction from pressure
Y	U valve	On; Off	Diagnostics and Service -> Manual control of Y valve
Manual control of valve Y	S	On; Off	Diagnostics -> Manual control of valve Y
Safety valve test <sup>O</sup>	U	< 15.5 bar	Diagnostics and Service -> 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
Operation as master compressor	U	Enable; Disable	Network operation -> Configuration
Network operation algorithm	U	SEQ; CAS	Network operation -> Configuration
Number of slave compressors	U	0-3	Network operation -> Configuration
Switch-on delay between slave compressors	U	0-60 s	Network operation -> Configuration
Rotation time	U	≥ 1 min	Network operation -> Configuration
Relief pressure for master compressor	U	0.0-16.0 bar	Network operation -> Configuration
Load pressure for master compressor	U	0.0-15.0 bar	Network operation -> Configuration
Automatic reconfiguration of pressure limits	U	On; Off	Network operation -> Configuration
Network operating point	U	≥ 0.00 bar	Network operation -> Configuration
Relief pressure (slave compressor)	U	0.0-16.0 bar	Network operation -> Compressor 1/2/3
Load pressure (slave compressor)	U	0.0-15.0 bar	Network operation -> Compressor 1/2/3
Interface (slave compressor)	U	RS-485; RS-485 ISO	Network operation -> Compressor 1/2/3
Modbus address (slave compressor)	U	1-255	Network operation -> Compressor 1/2/3
Scheduled operation	U	Activate; Deactivate	Scheduling operation
Add event	U		Work scheduling -> One-time events/cyclic events

<sup>F</sup>-Parameter only available for compressors equipped with inverter

<sup>O</sup>-Optional parameter.

## 9.1. 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 from 1 to 10 digits long.

If you forget the service password, contact the manufacturer.



Service level access also allows you to change the user password.

## 9.2. Service parameter search

The "Search parameter" tab allows you to navigate to a specific parameter or group of parameters by entering its number in the search bar.

Table 21: List of service parameters

Parameter number	Parameter description
1	Factory time parameters
2	Service counters
4	Analog input configuration
8   28   78	Motor protection
9   14   47   271	Digital input configuration
10   36	Time parameters
16   265	Configuration of network operation
20   21	Calibration of RTD inputs
23	Calibration of current sensors
38   39	Inverter parameter overview
41	Inverter interface view
45	Pressure settings
50	Manual Y-valve control
63	Temperature settings
64	Fan parameters
111   112	Reset menu
177	Changing the password
199   201	Deleting event history
553   586   597	Statistics view

## 10. 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 22: List of production parameters

Name	Range
Compressor serial number	12 characters
Startup method	Star-Delta; Modbus inverter; Direct
drive type	Belt; Direct
ULTRA SPEED Function	On; Off
Safety valve test function	On; Off
User password	10 characters
Service password	10 characters
Manufacturer password	10 characters

Table 22: List of production parameters

Name	Range
Clear memory error	
Reset controller memory to factory settings	

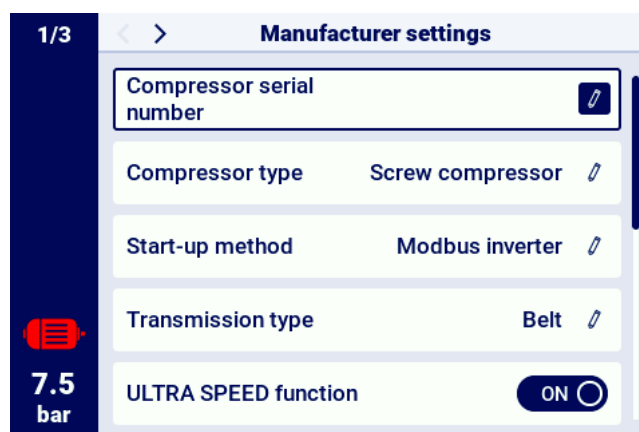


Figure 23: View of Production parameter menu

### 10.1. 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.

### 10.2. 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.

## 11. 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
- Modbus inverter
- Direct

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

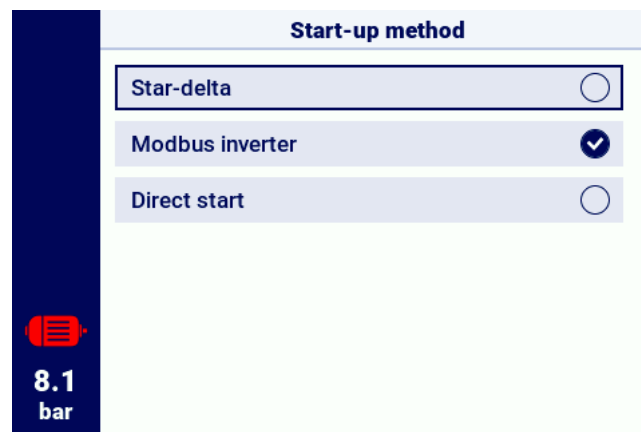


Figure 24: View of the menu with startup mode settings

### 11.1. Operating algorithm diagram in Star-Delta configuration

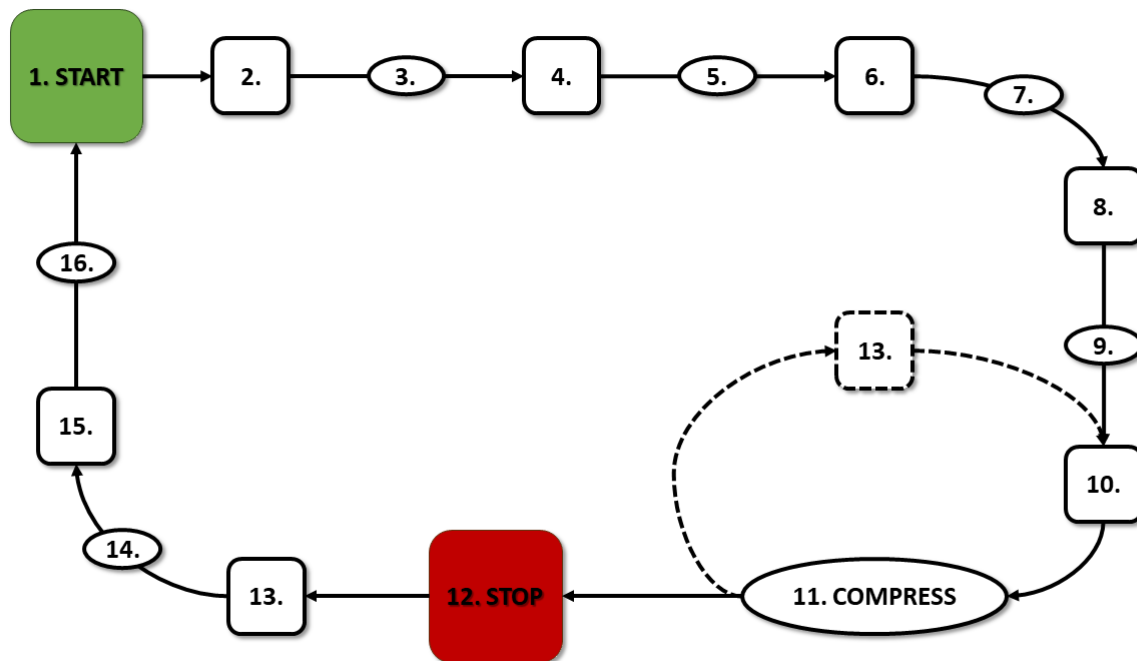


Figure 25: Motor control algorithm

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

### 11.1.1. 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.**

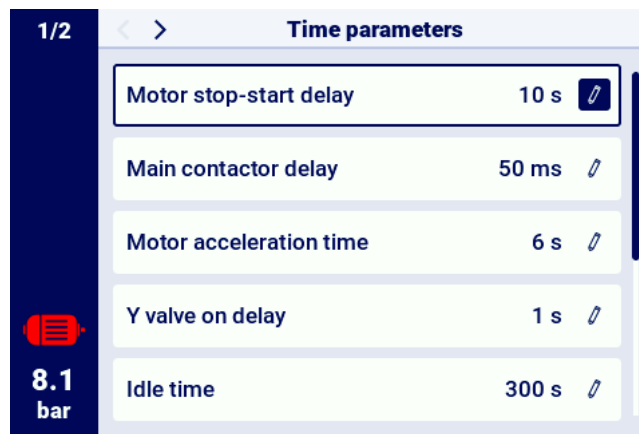


Figure 26: View of the menu with time parameter settings for the Star-Delta configuration

Table 23: 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 <b>STOP</b> 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 <b>11.4.2. Adaptive idle run (AutoTlse)</b>

## 11.2. Scheme of the control algorithm in the inverter configuration

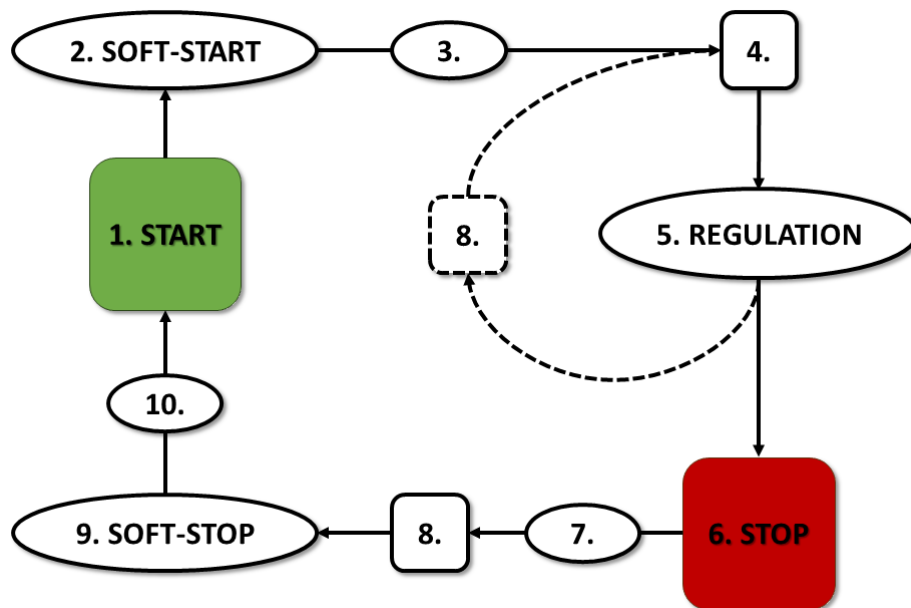


Figure 27: Motor control algorithm

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

### 11.2.1. 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.**

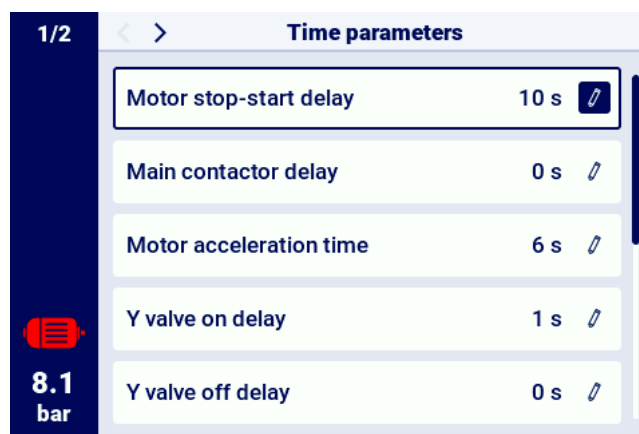


Figure 28: Menu view with time parameter settings for the Inverter configuration

Table 24: 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 ( <b>SOFT-START</b> ) 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 <b>STOP</b>
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 ( <b>SOFT-STOP</b> )
Adaptive idle run (AutoTlse)		Described in the chapter <b>11.4.2. Adaptive idle run (AutoTlse)</b>

### 11.2.2. 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 25: 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.

### 11.2.3. 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.

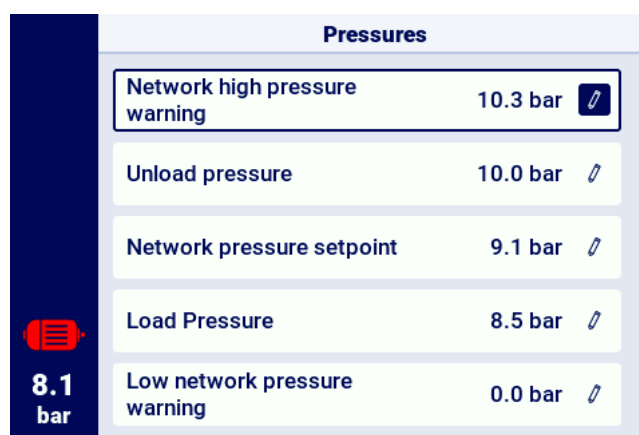


Figure 29: Network pressure settings



### 11.3. Primary operation algorithm in Direct Start configuration

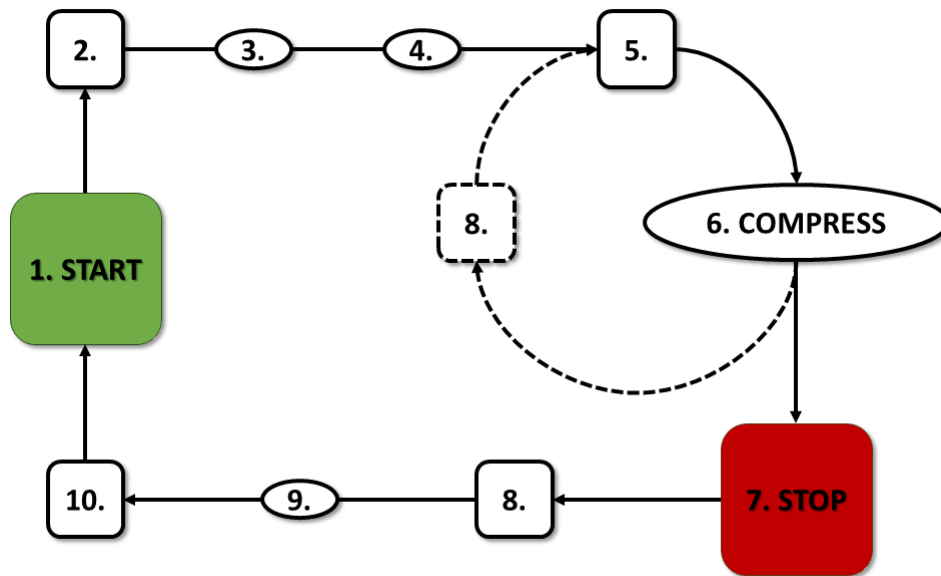


Figure 30: Motor control algorithm

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

#### 11.3.1. 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.**

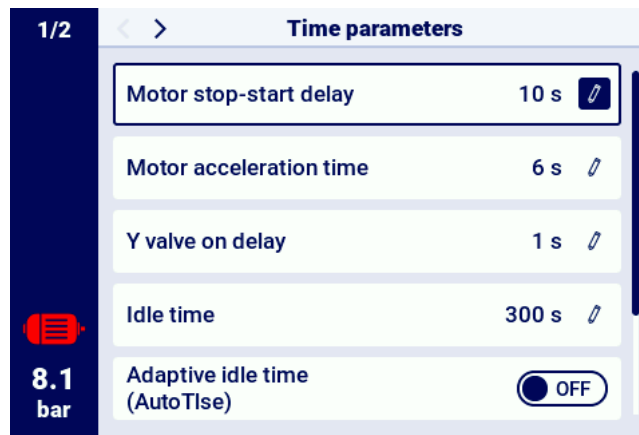


Figure 31: View of the menu with time parameter settings for Direct Start configuration

Table 26: 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 <b>STOP</b> button
Adaptive idle run (AutoTlse)		Described in the chapter <b>11.4.2. Adaptive idle run (AutoTlse)</b>

## 11.4. 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.

### 11.4.1. 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.**

#### **11.4.2. Adaptive idle run (AutoTlse)**

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 **AutoTlse** controls 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 **AutoTlse** go to the **User parameters screen -> Work parameters -> Time parameters** and set the "Adaptive idle run" parameter to "Enable."

#### **11.5. 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.

## 12. 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.

### 12.1. 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** 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 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.

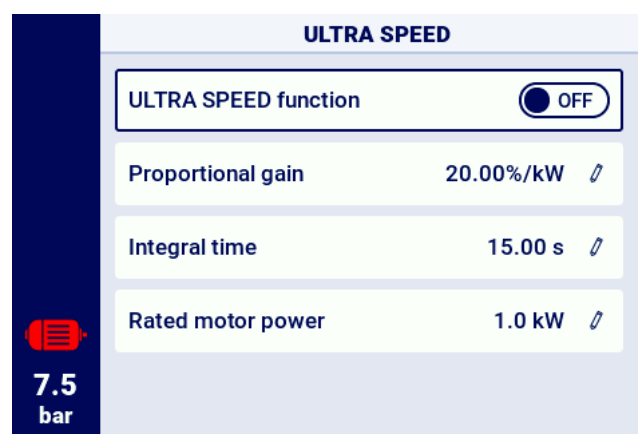


Figure 32: Window view with ULTRA SPEED settings

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.

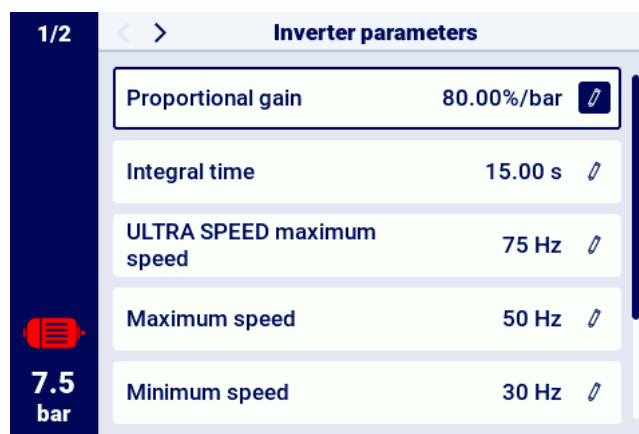


Figure 33: View of the window with inverter parameter settings

### 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.

## 13. 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.

### 13.1. Operation modes

Available operation modes:

- AUTO
- CONST

#### 13.1.1. 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.

#### 13.1.2. 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.

### 13.2. Remote modes

Available remote modes:

- LOCAL
- NET
- REM
- RVM

### 13.2.1. 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.

### 13.2.2. 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.

### 13.2.3. 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.

### 13.2.4. 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**).

### 13.2.5. 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.

### **13.2.6. 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**).

### **13.2.7. 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.

### **13.2.8. 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**).

### **13.2.9. 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.

## 14. Connecting the Inverter

The controller can control the inverter using the Modbus RTU protocol via any of the controller's RS-485 ports. The inverter's setting parameters will be visible in the controller's service parameters only if the "Startup mode" parameter in the manufacturer's menu is configured as "Modbus inverter". 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.**

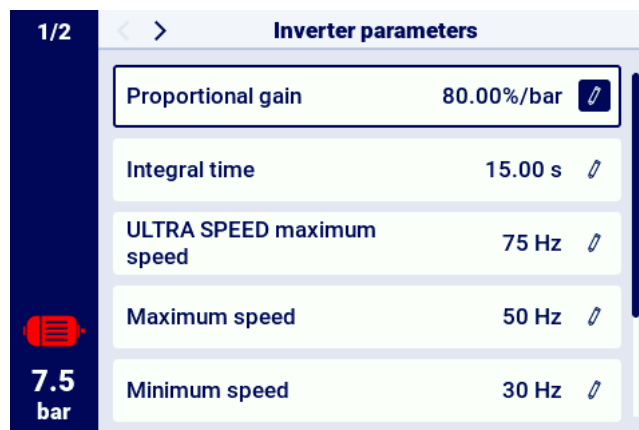


Figure 34: View of the screen with the inverter settings

### 14.1. Modbus inverter connection

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

#### 14.1.1. 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

## Supported ABB inverter models:

1. ACS series

### 14.1.2. 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 35: 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.**

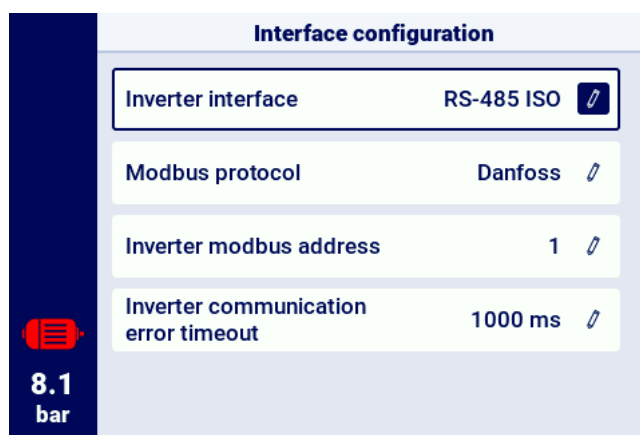


Figure 36: View of the screen with inverter interface settings

Table 27: 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
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.

#### 14.1.3. 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 **24. 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.

## 15. 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.

### 15.1. Configuration of digital inputs

To configure individual digital inputs, go to: **PService parameters -> Input/output configuration -> Digital inputs**.

Each digital input is described according to the marking on the controller housing (e.g. DI5 corresponds to digital input 5).

All digital inputs have the ability to configure their function and logic.

The "Logic" parameter allows you to enter according to which logic a specific input is to operate, "NO" (Activated by high state) means normally open, which means that the input is inactive until a +24 VDC signal is applied to it.

"NC" (Activated by a low state) means normally closed, in this case, the input is activated in the absence of a +24 VDC signal.

To change the logic of the input, go to edit the "Logic" parameter, and then select between "NO" and "NC" from the displayed list.

The "Function" parameter allows you to assign a function to an input. Inputs with no assigned function are marked as "Free". Any function can be assigned to any of the inputs, as long as it is not already used.

List of assignable functions with description:

**Suction sensor** - Signal from the suction sensor.

**Dehumidifier ready** - Signal that the dehumidifier is ready for operation.

**Remote start-stop** - Remote start signal.

**Remote load-unload signal** - Remote compressor load-unload signal.

**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".

**AFOFSEP error** - Common error signal for separator, oil filter or air filter.

## 15.2. Configuration of digital outputs (transmitter)

The digital outputs on the controller are potential-free outputs. Outputs 1 to 3 are independent relays. Outputs 4 to 6 have a common potential terminal "COM 4-6". While output 7 is an independent relay with a separate terminal "NO" normally open and "NC" normally closed. To configure individual digital outputs, go to **Service parameters -> Input/output configuration -> Digital outputs**. Each digital output is described according to the marking on the controller housing (e.g. REL5 corresponds to digital output 5). All digital outputs have the possibility to configure their function and logic.

The "Logic" parameter allows you to determine according to which logic a specific output is to operate, "NO" means normally open, with this setting, the terminals of the relay output will be open by default. Only when it is activated the terminals will be shorted.

"NC" means normally closed. With this setting, the relay output contacts will be shorted by default, if it is activated, the terminals will be opened.

To change the logic of the output, go to edit the "Logic" parameter, and then select between "NO" and "NC" from the displayed list. Output No. 7 is an exception. This is due to the fact that it has physical terminals from "NO" and "NC". It is not possible to switch between the default state.

The "Function" parameter allows you to assign the function to be performed by the output. Outputs with no assigned function are marked as "Free". Any function can be assigned to any of the outputs, as long as it is not already used.

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.

**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.

## 15.3. 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.

Configuration of the functions of individual inputs is carried out, as in the case of digital inputs/outputs, by selecting a function from the list, while the configuration of the measurement range is done through additional parameters.

### 15.3.1. AI analog input configuration (4-20 mA)

The controller is equipped with two 4-20 mA current loop measurement inputs. These inputs are described on the controller case as "AI1" and "AI2".

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).

The parameter "Value for 4 mA" defines the value that the controller will indicate if the value of the current measured at the input is equal to 4 mA. Any function can be assigned to any of the outputs, as long as it is not already used.

The parameter "Value for 20 mA" defines the value that the controller will indicate if the value of the current measured at the input is equal to 20 mA. The parameter "Value for 4 mA" defines the value that the controller will indicate if the value of the current measured at the input is equal to 4 mA. All measured values between 4 mA and 20 mA are calculated using a linear function. 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 de-compression of the screw stage.

### 15.3.2. AI analog input calibration

The AI input calibration function allows you to calibrate a specific analog input according to the following formula:

$$\text{current} = \text{real} \cdot \text{gain} + \text{offset}$$

where:

current - Current value after calibration

real - Current value before calibration

gain - Gain parameter

offset - Offset parameter

The calibration function is available under **Service parameters -> Diagnostics and service -> AI input calibration**.

#### **Note!**

Each controller has factory calibrated inputs, the factory calibration can only be changed by the manufacturer.

The calibration function available in this controller has been added as an optional tool, to adjust the parameters of the analog inputs to suit specific environmental conditions or application requirements. Nevertheless, if there are no specific calibration needs, it is recommended to leave the factory settings in order to keep the controller functioning optimally.

### 15.3.3. Configuration of RTD analog inputs (Temperature measurement)

The controller is equipped with 2 RTD resistance measurement inputs. These inputs are labeled on the controller case as "RTD1" and "RTD2".

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).

Configuration of each resistance measurement input is done by assigning a sensor function to the selected input, via the "Function" parameter, and selecting the measurement range, through the "Sensor Type" parameter. Selectable temperature measurement sensors 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 motor temperature and is only selectable 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.

#### 15.3.4. Calibration (offset) of RTD inputs

The calibration (offset) function of RTD inputs allows you to take into account the resistance of the connections between the controller input and the sensor during measurement. Entering an adjustment value subtracts or adds a defined resistance value to the measurement.

To configure the offset, go to **Service Parameters -> Diagnostics and Service -> RTD Input Calibration**, and then enter the value by which you want to correct the measurement on the selected input.

**Note!**

Each controller has factory calibrated inputs, the factory calibration can only be changed by the manufacturer.

The calibration function available in this controller has been added as an optional tool, to adjust the parameters of the analog inputs to suit specific environmental conditions or application requirements. Nevertheless, if there are no specific calibration needs, it is recommended to leave the factory settings to maintain optimal functioning of the controller

#### 15.3.5. 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.

#### 15.3.6. 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 "MC 1" 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.

in the range of 0 A - 100 A.



## 16. 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.

### 16.1. 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.

### 16.2. 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.

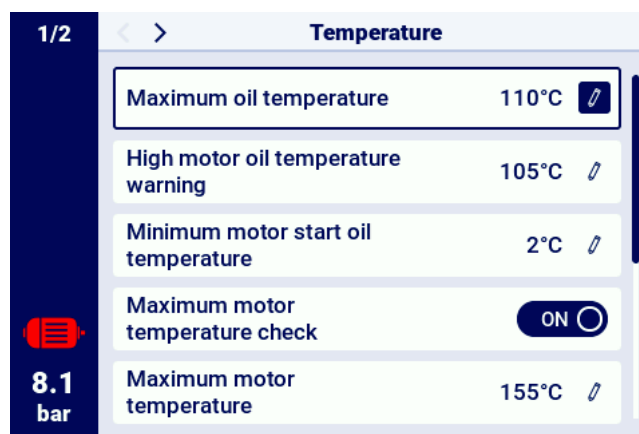


Figure 37: Tab with oil and electric motor temperature control settings

### 16.2.1. 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 -> Motor protection.**

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.

### 16.2.2. 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).**

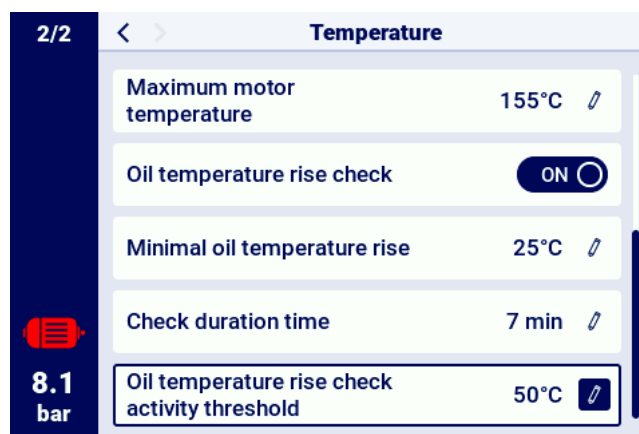


Figure 38: Oil temperature sensor supervision settings tab

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").

### 16.2.3. Electric motor current protections

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

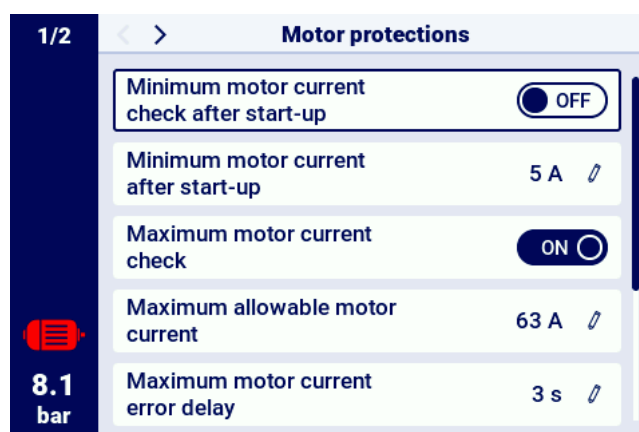


Figure 39: Motor protection settings tab 1/2

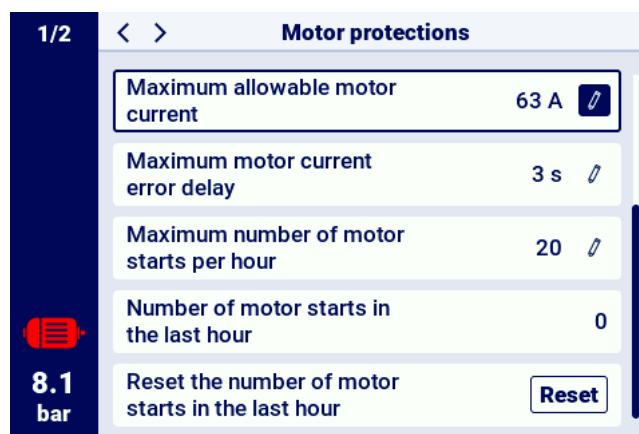


Figure 40: Motor protection settings tab 2/2

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.

## 17. Diagnostic Functions

To use the diagnostic functions of the controller, go to the **Service parameters -> Diagnostics and service** tab.

### 17.1. Input/output diagnostics

The "Input/output diagnostics" tab shows the status of each input and digital and analog outputs, as well as several additional parameters.

At the top of the tab you will find a list of inputs and digital outputs.

**List of diagnostic parameters:**

- Logical state of digital inputs (high/low)
- Digital output status (closed/open)
- Measured value of RTD inputs
- Measured value of AI inputs
- Measured value of MC1 input (transformer secondary winding current)
- Controller battery voltage
- Controller power supply voltage
- Controller 24VDC internal voltage

### 17.2. Valve Y Test

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

### 17.3. 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.

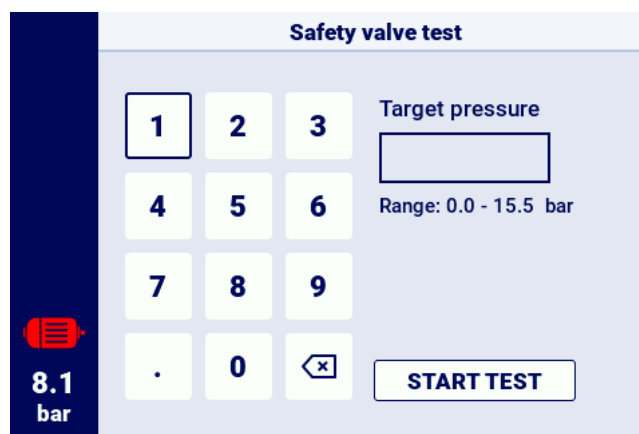


Figure 41: View of the controller screen in the manual control tab of the Y valve

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.

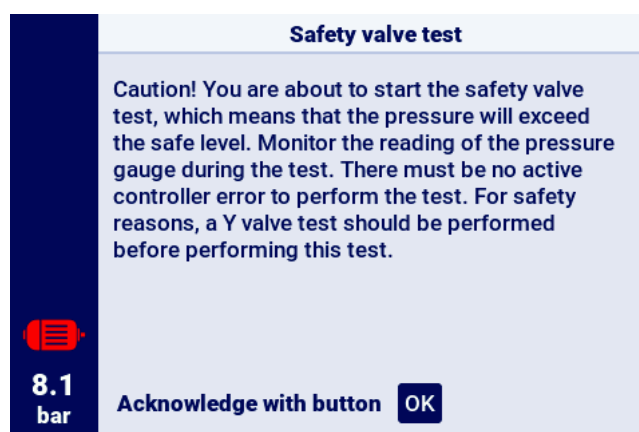


Figure 42: Safety valve test start warning

## 18. Other functions

### 18.1. 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

#### 18.1.1. 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**).

### 18.2. 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.

It is also possible to configure the dryer's operation so that the dryer runs all the time when the compressor is in standby or running condition. This configuration allows the dryer to run continuously even when the set pressure is reached.

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 tab -> Operation parameters -> Dryer**. **Note!**

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

### 18.2.1. 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 start-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. The "Standby drying" parameter also enables the dryer to run in the standby state (when the START button is pressed) when the motor is not running.

### 18.2.2. 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

## 18.3. 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.

### 18.3.1. 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**).

## **18.4. 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.

### **18.4.1. 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.

## **18.5. 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.

### **18.5.1. 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

### 18.5.2. 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

### 18.5.3. 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.

## 18.6. 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.

To restore or save the settings, go to the tab:

**Service parameters -> Diagnostics and service -> Restore and save 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.

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.

## 19. 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 43: 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"

### 19.1. Restarting service counters

O restart service counters select the tile of one of the counters and then select "Reset" in the "Reset Service" parameter. Before the restart occurs, a confirmation will be displayed showing the with values

to which the counter will be restarted. Service intervals are assigned by the service or compressor manufacturer.

Resetting the service counter requires the user or service password.

## 19.2. Service counter configuraion

To configure individual service counters select the tile of one of the counters. The settings of each counter are divided into 2 independent parameters, due to the operation mode of the counter. In the "Other hours" parameter, there are settings for the work hours countdown mode, and in the "Next review date" parameter, there are settings for the countdown to a specific date. Each mode can be independently enabled or disabled using the "On", "Off" parameters for each mode.

The countdown to a specific date mode is configured with the help of 3 parameters.

The first one is "Date of next inspection", here you need to enter the date of the next inspection according to the name of the parameter.

The second parameter is "Interval of periodic inspection", it is used to determine the interval, by which the counter should be increased in case of a restart (from the day of restart), e.g. Oil counter interval is set to 12 months, If the counter is restarted on 10.12.2023, the next inspection date will move 12 months forward, in this case it will be 10.12.2024.

The third parameter "Additional warning (before the review date)" is an additional warning for the user, which will be displayed once, when a certain number of days remain until the review date. Once the warning is confirmed, it will not appear again.

The operating hours countdown mode is configured with the "Counter interval" parameter, which determines the number of operating hours to be counted down. At the same time it is the number of hours to which the counter will be restored in case of restart.

The parameter "Additional warning (before countdown end)" works in the same way as the parameter "Additional warning (before review date)" described above.

## 20. Statistics

The controller records sensor measurements and information on compressor operation and presents them in the form of statistics related to the time and compressor cycles. The types of load data are different for star-delta start and inverter compressors.

In the "Statistics" tab, which is located in the main menu, data is presented in the form of rows with parameter descriptions and values. . The pencil symbol next to the selected line means that it is possible to manually enter the values of the selected parameters, authorization from the service level is required in this case.

Table 28: Parameters from the "Statistics" tab

Parameter name	Parameter description
Total operating time	Total motor operating time.
Operating time under load	Total compression time.
Average load	Ratio of running time under load to total running time
Number of motor starts	Total number of motor starts
Average number of motor starts	Average number of motor starts per hour
Number of Y-valve engagements	Total number of Y-valve engagements
Load 80% - 100% <sup>F</sup>	Total operating time per load interval

Table 28: Parameters from the "Statistics" tab

Parameter name	Parameter description
Load 60% - 80% <sup>F</sup>	Total operating time per load interval
Load 40% - 60% <sup>F</sup>	Total operating time per load interval
Load 20% - 40% <sup>F</sup>	Total operating time per load interval

<sup>F</sup>-Parameter available only for compressors equipped with an inverter

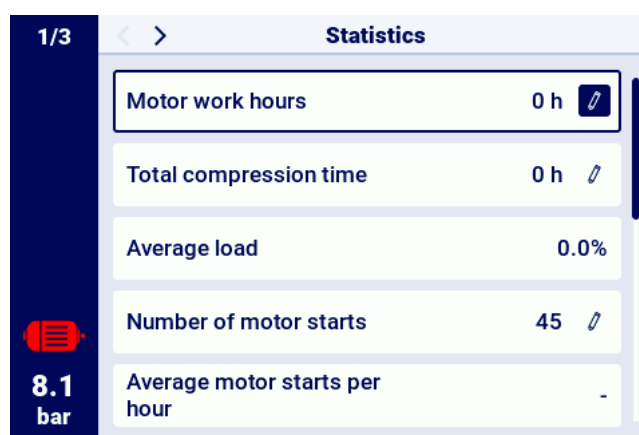


Figure 44: Statistics tab

### 20.0.1. 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)

## 21. Operation scheduling

The controller is equipped with a compressor scheduling function. This allows the machine to automatically turn on and off according to a pre-planned schedule. It is possible to save a total of up to 5 independent one-time or cyclic events.

One-time events are defined by specific dates and times, while recurring events are set up by hours for each day of the week.

The operation scheduling menu is located in the main menu and in the user parameters, under the name "Operation scheduling". The user or service password is required when entering the menu through the main menu.

When you enter the work scheduling menu, the first position is the parameter "ON", "OFF" allowing you to enable or disable the operation of the controller according to the active events, which are shown below in the menu.

Each of the configured events is presented in the form of a field from which you can read basic information about the event, such as the time interval of the event, operation mode, and the status of the event (activated or deactivated). If the field displays the message "Create event", this means that no event has yet been assigned to the field.



Figure 45: The main view of the "Operation scheduling" menu.

### 21.1. Event Configuration

Each event is configured with the following parameters:

- Event status
- Event type
- Operation mode
- Activity date of the event

Figure 46: Example of configuration of scheduled operation event

The "Event status" parameter allows you to activate or deactivate the event. If an event is deactivated, It will not affect scheduled work, but will remain in the event list.

The "Event type" parameter defines whether the event is cyclic or one-time.

The "Operation mode" parameter defines the operation mode in which the compressor will operate during the event. In addition to the standard operating modes (AUTO and CONST), you can also select the "STOP - compressor stopped" operating mode.

The last parameter of the event configuration is the "Event activity term" parameter, which defines the period, during which the event is to be active.

Depending on the selected type of event, its activity period is defined through a different set of parameters.

Cyclic events are parameterized by the "Days of the week", "Start time" and "End time" parameters, while for one-time events these are "Start date", "Start time", "End date", "End time".

Figure 47: Example of event activity date configuration

After entering all the parameters of the event, switch to the "Save Event" field and save the parameters with the OK button.

The "Delete event" field allows you to remove the event from the list.

## 21.2. Work scheduling algorithm

In order for the compressor to operate according to the configured events, the scheduled operation must be activated in the "Operation scheduling" menu. When the scheduled operation is active, the screen will display the message "Scheduled operation is active".

In addition, in order for the operation scheduling algorithm to control the compressor, it is necessary to allow the compressor to start in advance by pressing the "START" button on the controller. If, according to the scheduled events, the compressor is not work at the moment, after allowing the start, the main view of the graphic interface will display the message "Stopped by scheduled operation".

The scheduled operation algorithm only takes into account events that are activated.

### **NOTE!**

One-time events have a higher priority than cyclic events. This allows you to make "exceptions" for cyclic events, such as for public holidays.. At the same time, events that are at a higher position on the list have a higher priority than those at lower positions on the list. This means that when two or more scheduled events overlap in time, the compressor will run according to the event with higher priority.



## 22. Network operation

The controller can manage a group of up to 4 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.

### 22.1. Network operation view

The network operation view is only available in a master controller. To enable the network operation view, go to the tab **Network operation** in the main menu or the main view shortcuts. From the master controller, the user gains access to a preview of the status of all controllers in the network.

The network operation view shows all connected slave controllers (marked with numbers from 1 to 3) 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.

It is not possible to display the network operation view from the level of the slave controller.

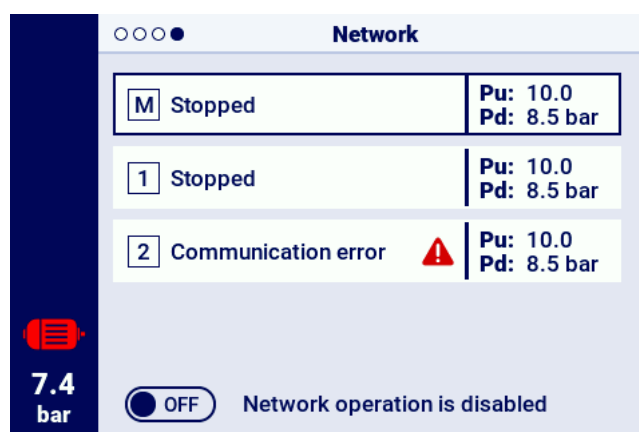


Figure 48: Network operation view

### 22.2. Starting network operation and changing the settings of the slave controllers

To enable the network operation algorithm, go to the network operation view on the master controller, and then enable it with the button ON/OFF next to the text "Network operation is: OFF". When the algorithm is turned on, the inscription will change to "Network operation is: ON". In order for the master controller to properly manage the compressor unit the START button on each of the slave compressors must be pressed before starting network operation on the master compressor (This does not apply to previous generations of MS series controllers. These will turn on automatically)..

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 slave compressors only requires

re-activating the start button of the network operation algorithm in the network operation view on the master controller.

To configure the pressure on any of the controllers in the network, select its tile and then enter the appropriate pressure values.

### 22.3. 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.

### 22.4. 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	<i>Pd</i>	<i>Pu</i>	ID	<i>Pd</i>	<i>Pu</i>	ID	<i>Pd</i>	<i>Pu</i>	...
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.

## 22.5. 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  $P_u$  -  $P_d$  limits in the cascade algorithm is to give the compressors identical upper  $P_u$  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	$P_d$	$P_u$	Power	ID	$P_d$	$P_u$	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  $P_u$  -  $P_d$  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  $P_u$  -  $P_d$  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  $P_u$  -  $P_d$  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.

## 22.6. 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 49: 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.

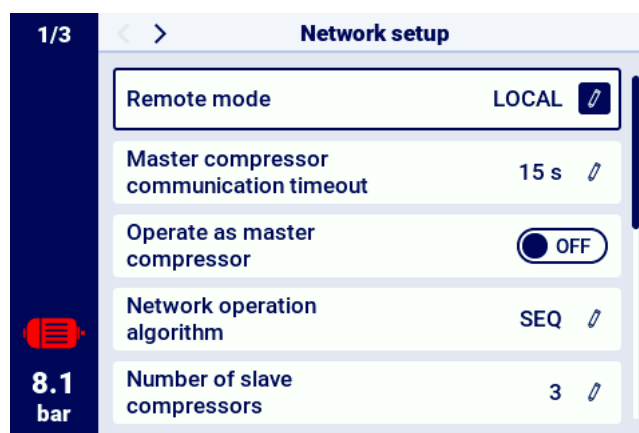


Figure 50: Network operation configuration menu 1/3

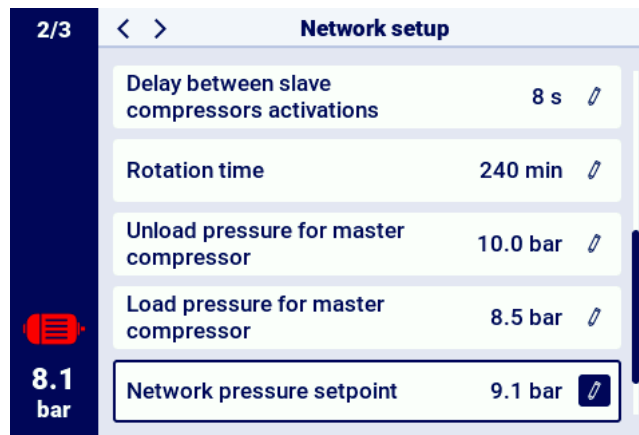


Figure 51: Network operation configuration menu 2/3

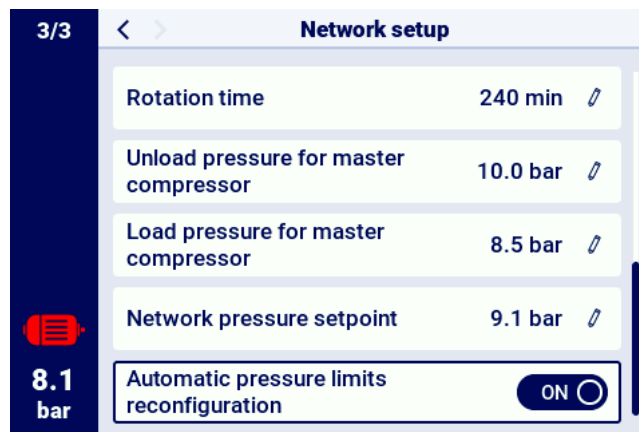


Figure 52: Network operation configuration menu 3/3

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.

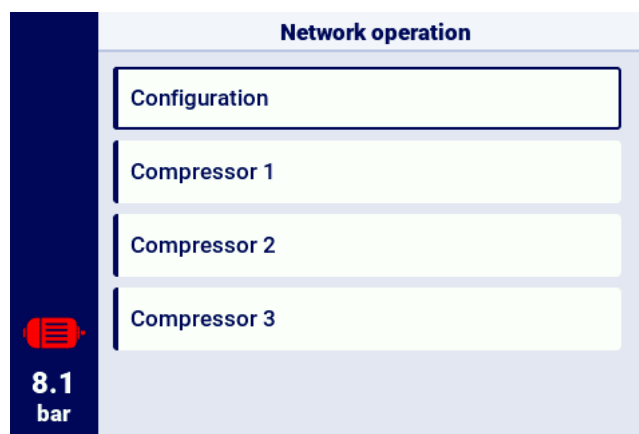


Figure 53: Network operation menu

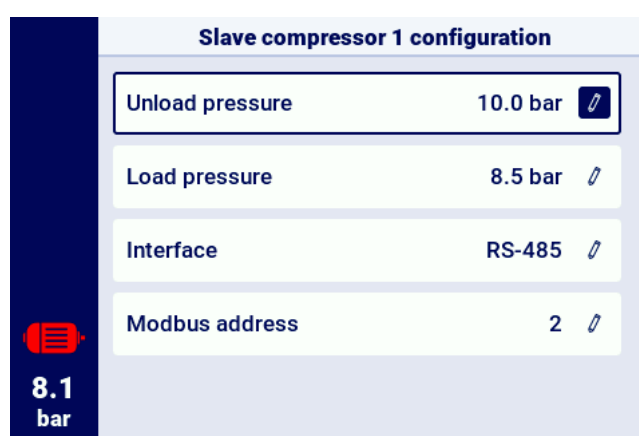


Figure 54: Slave compressor 1 configuration menu

## 22.7. 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 55: 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**.

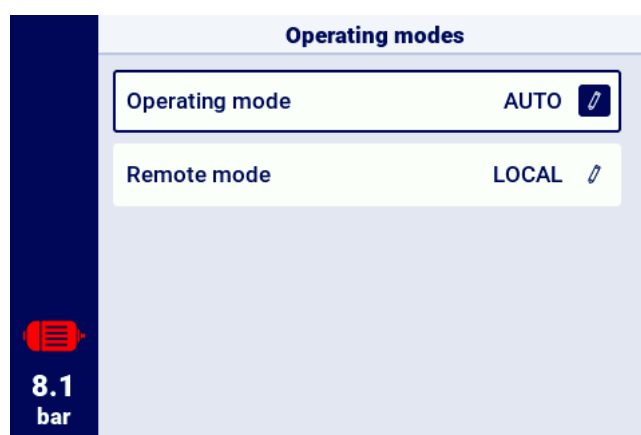


Figure 56: Remote mode setup menu

## 23. 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.**

### 23.1. 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
- Consumption
- Messages
- Service counters
- Scheduled operation
- Information



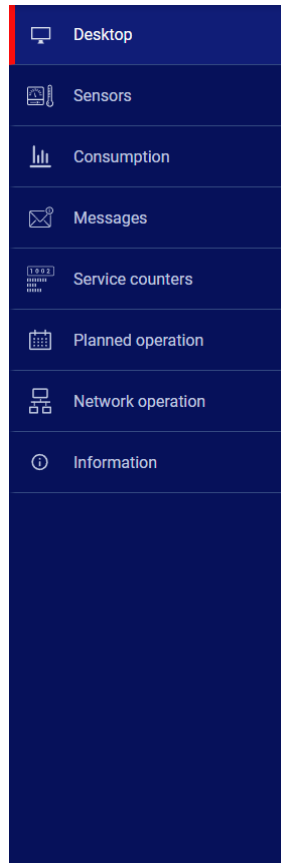


Figure 57: Web server navigation sidebar

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 58: Top web server info bar

## 23.2. 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
- Motor frequency
- 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

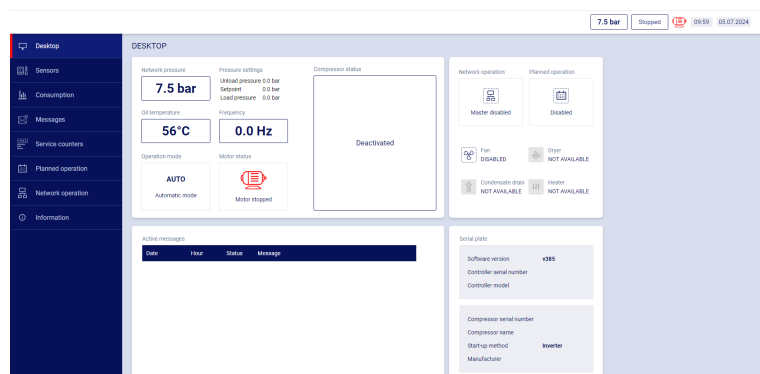


Figure 59: Web server dashboard view

### 23.3. 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
- Motor current
- Motor power
- Output frequency

## 23.4. 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.

## 23.5. 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.

## 23.6. 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.

## 23.7. 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.

## 23.8. Web server - Information

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

## 23.9. 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 available 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.

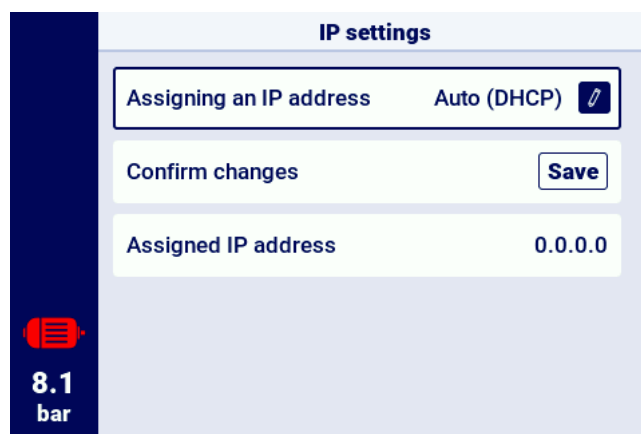


Figure 60: IP address configuration menu

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.

## 24. 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.

### 24.1. Warnings

### 24.2. Warnings of the controller

Table 29: 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 29: 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.
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.
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.
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.

Table 29: Warnings

Error code	Warning Name	Type	Description
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.
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.
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.

### 24.3. DANFOSS inverter warning information

Table 30: 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
W27	IGBT brake
W28	Brake check
W34	Fieldbus error

Table 30: Inverter warnings

Error code	Error description
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

#### 24.4. YASKAWA inverter warning information

Table 31: 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

#### 24.5. Delta inverter warning information

Table 32: 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
oH1	AC motor detects IGBT overheating and above protection level warning oH1
oH2	The controller has detected capacitor overheating
uC	Low current
oSPD	Overspeed warning
dAvE	Overspeed deviation warning
PHL	Input Phase Loss Warning
ot1	Excess torque warning 1
ot2	Over torque warning 2



Table 32: Inverter warnings

Error Code	Error Description
oH3	Engine overheating warning. The AC motor drive detects that the temperature inside the motor is too high
OPHL	Output phase loss

## 24.6. ABB inverter warning information

Table 33: ABB inverter warning information

Kod błędu	Opis błędu
0xA2B1	Overcurrent
0xA2B3	Earth leakage
0xA2B4	Short circuit
0xA2BA	IGBT overload
0xA3A1	DC link overvoltage
0xA3A2	DC link undervoltage
0xA3A3	DC not charged
0xA490	Incorrect temperature sensor setup
0xA491	External temperature 1 warning
0xA4A0	Control board temperature
0xA4A1	IGBT overtemperature
0xA4A9	Cooling
0xA4B0	Excess temperature
0xA4B1	Excess temperature difference
0xA4B2	IGBT temperature
0xA581	Fan error
0xA582	Auxiliary fan missing
0xA5A0	Safe torque off
0xA5F0	Charging feedback error
0xA6A4	Wrong motor nominal values
0xA6A5	No motor nominal values
0xA780	Motor stall
0xA792	Brake resistor wiring error
0xA793	Brake resistor excess temperature
0xA79C	Brake chopper IGBT excess temperature
0xA7A2	Mechanical brake opening failed
0xA7CE	Communication loss

## 24.7. Errors

Table 34: Errors

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

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.
E31	24 V circuit voltage too low	Critical error	24 V circuit voltage below minimum level.
E32	Oil injection pressure drop error	Critical error	Oil injection pressure drop too high.
E33	Oil injection pressure too low	Critical error	Oil injection pressure too low.
E34	Short-circuit of the oil injection pressure sensor	Critical error	Short-circuit at the input of the oil injection pressure sensor.
E35	Oil injection pressure sensor not connected	Critical error	No oil injection pressure sensor connected.
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.

## 24.8. DANFOSS inverter errors

Table 35: 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 35: 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

## 24.9. YASKAWA inverter errors

Table 36: 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

## 24.10. Delta inverter errors

Table 37: 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 37: 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.
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
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
EF	External error. When the drive decelerates based on the Pr setting. 07-20, EF error is displayed on the keypad
EF1	When the Mlx=EF1 contact is turned on, the output stops immediately and displays EF1 on the keypad. The engine is idling
CE1	The communication command is invalid

Table 37: Inverter errors

Error code	Error description
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)
S1	Emergency stop for external safety
Brk	External mechanical brake error The MO terminal is active when MOx=12, 42, 47 or 63, but Mlx=55 does not receive a signal for mechanical brake operation during the time set in Pr. 02-56.
OPLH	Output phase loss
oL3	Low frequency and high current protection

## 25. 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. Software update does not affect the controller settings. Once the software update is performed, the parameter settings remain intact. To perform the update, a flash drive and an update file, provided by the manufacturer, are required. The update can be performed in two ways, which are described in the following subsections.

### 25.1. Updating from the menu level

Updating from the menu level requires a configured flash drive with an update file. This file should be uploaded to the flash drive. The controller will search for the file itself. To start the update, a correctly prepared flash drive should be inserted into the USB connector of the controller. należy umieścić w złączu USB sterownika. Then, in the "Information" tab, select "Update" and confirm with the OK button on the controller. The controller will start searching for files on the flash drive, and then display a list of the names of all update files on the storage media. After selecting one of the files available on the list, the controller will proceed with the update process, informing the user of the progress. The update process may take up to 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 display messages in the upper right corner of the screen. When the update is finished, the display will show the message "UPDATE COMPLETED SUCCESSFULLY. REBOOT...", followed by a restart of the controller to complete the update. After the restart, the controller is ready for use with the updated software version.

### 25.2. Emergency update

The emergency update allows you to update the controller when the graphic interface cannot be started correctly.

First, rename the update file on the flash drive to: "force\_update.update". This file, must be in the "update" folder. Create a folder with this name on the memory stick. When a flash drive with this folder is plugged into the USB port, before the controller starts, it will initiate the update process when the controller starts. When the process is complete, the controller will inform you that the update was successful and ask you to restart. This should be done by unplugging the power supply from the controller for a few seconds and plugging it in again. Before restarting, remember to unplug the device from the USB port, otherwise the update will start again after restart.

### 25.3. 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.

26. Controller dimensions

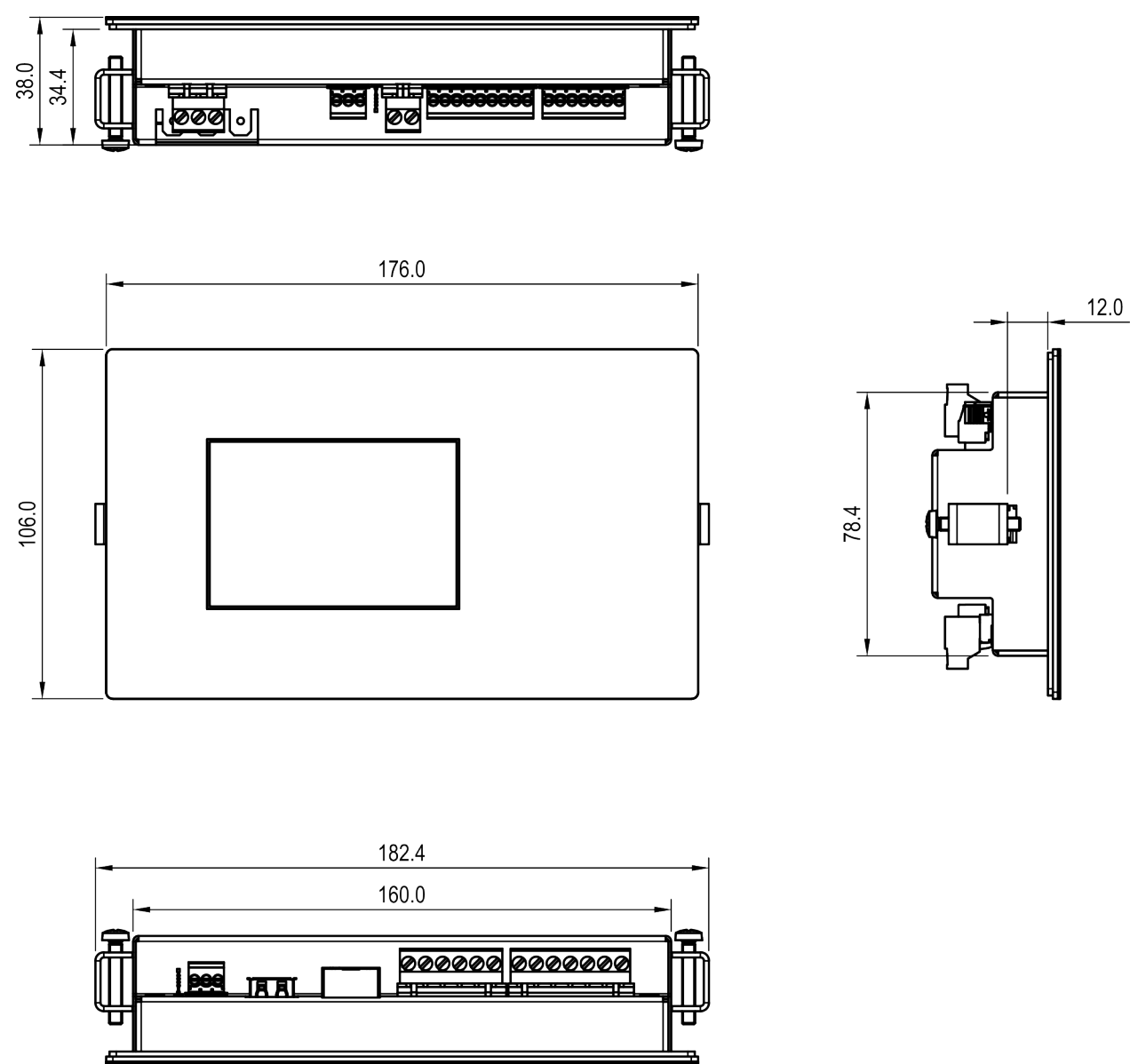


Figure 61: Controller housing drawing