DK-45 MK2
COMPRESSOR CONTROLLER

DESCRIPTION

DK-45 MK2 is a high-tech product providing control of screw or piston type air compressors driven by electric motors.

The controller incorporates all functions needed in a compressor control panel; thus, it eliminates the need for additional modules, resulting in lower panel cost.

The early start function analyzes the air consumption trend and runs the compressor so that the pressure never falls below the low limit.

Using the Weekly Schedule and Pressure Calendar functions, the compressor can be scheduled to work on given hours and days of the week with given set pressure values.

The unit is directly supplied from the 380/220V utility network. It provides fail contact and sensor supplies internally, removing the need for a supply transformer in the panel.

Utility mains voltage and frequency can be read on the unit. It offers low/high voltage and phase order protection.

The 2.9" wide, 128x64 pixel graphical screen displays values with graphic support.

RS-485 MODBUS RTU and USB communication ports allow monitoring and parameter setting via PC.

Optically isolated digital inputs feature noise filtering, allowing fault-free operation in electrically noisy environments.

The unit has 5 relays with 5A output current.

The unit may be configured from the front panel or using the free software Rainbow Plus, available at the manufacturer's website.

It is possible to monitor and record the unit using the free RAINBOW+ software.

FEATURES

- *Graphical LCD screen: 128x64 pixels, 2.9"*
- *Automatic operation from output pressure*
- *Voltage protection relay function*
- *Phase order protection function*
- *Flexible motor hours calculation algorithm*
- *0-10V Analog speed control output*
- *Multiple compressor support*
- *Early start function against pressure drop*
- *Dryer control function*
- *Event records*
- *5 independent service counters*
- *Supports various topologies*
- *Displays utility mains voltages*
- *No external transformer needed*
- *Star / Delta start-up*
- *Frequency inverter driving capability*
- *Load solenoid control*
- *5 programmable relay outputs*
- *Optically isolated, programmable digital inputs*
- *2 pressure sensor inputs*
- *2 temperature sensor inputs*
- *Adjustable sensor characteristics*
- *USB communication port*
- *RS-485 MODBUS communication*
- *Password protected front panel programming*
- *Low panel depth, easy installation*
- *Wide operating temperature range*
- *Sealed front panel (IP65 with gasket)*

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ABOUT THIS DOCUMENT

This document describes minimum requirements and necessary steps for the successful installation of the DK-45 MK2 controllers.

Follow the advice given in the document carefully. They are often good practices for the installation of compressor controllers to reduce future issues.

For all technical queries please contact Datakom at:

technical.support@datakom.com.tr

QUERIES

If additional information to this manual is required, please contact the manufacturer directly at:
technical.support@datakom.com.tr

Please provide following information in order to get answers to any question:

- Device model name (see the back panel of the controller),
- Complete serial number (see the back panel of the controller),
- Firmware version (read from the display screen),
- Measuring-circuit voltage and power supply voltage,
- Precise description of the query.

RELATED DOCUMENTS

FILE NAME	DESCRIPTION
Rainbow Setup	Rainbow Plus Installation Manual
Rainbow User	Rainbow Plus User Manual
Software Update	Software Update Manual

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	02.10.2019	OK	First Edition

TERMINOLOGY
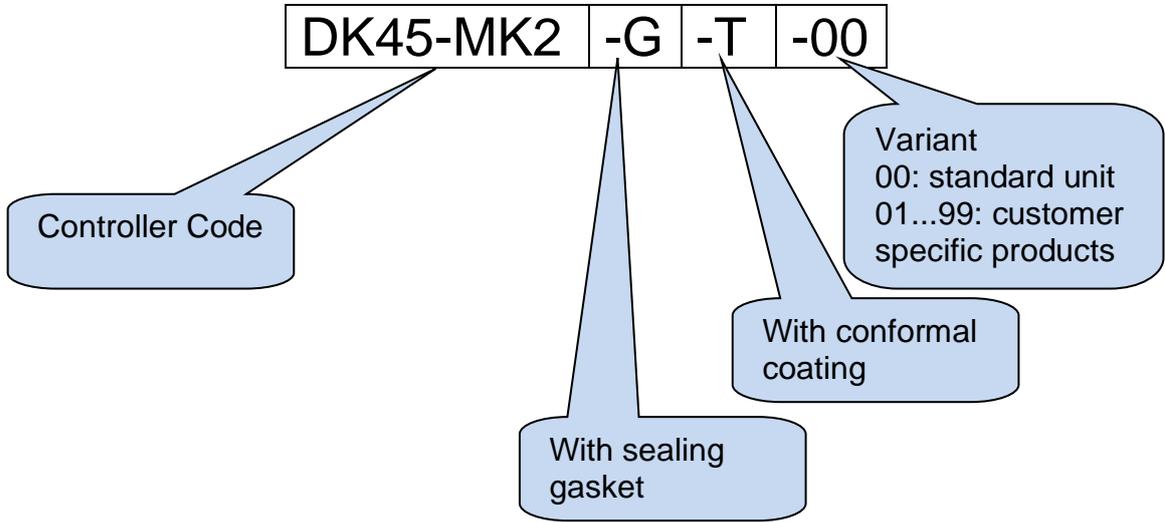
CAUTION: Potential risk of injury or death.

WARNING: Potential risk of malfunction or material damage.

ATTENTION: Useful hints for the understanding of device operation.

ORDER CODES

DK-45 MK2 controllers have a variety of options and features. Please use the following tips to order the correct model.

| DK45-MK2 | -G | -T | -00 |

Controller Code

With sealing gasket

With conformal coating

Variant
00: standard unit
01...99: customer specific products

SPARE PARTS

Screw type bracket
Stock Code=J10P01 (per unit)

Self-Retaining type bracket
Stock Code=K16P01 (per unit)

Sealing Gasket, Stock Code= K96P01

SAFETY NOTICE
Failure to follow the following instructions may result in death or serious injury

- **Electrical equipment should be installed only by qualified specialist. No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences resulting from the non-compliance to these instructions.**

- **Check the controller for cracks and damages due to transportation. Do not install damaged equipment.**

- **Do not open the controller. There are no serviceable parts inside.**

- **Fuses must be connected to the power supply and phase voltage inputs, in close proximity of the controller.**

- **Fuses must be of fast type with a maximum rating of 6A.**

- **Disconnect all power before running on equipment.**

- **When the controller is connected to the network, do not touch terminals.**

- **Any electrical parameter applied to the device must be in the range specified in the user manual. Although the controller is designed with a wide safety margin, over-range parameters may reduce lifetime, alter operational precision or even damage the controller.**

- **Do not try to clean the device with solvent or the like. Only clean with a damp cloth.**

- **Verify correct terminal connections before applying power.**

- **Only for front panel mounting.**

TABLE OF CONTENTS

1. INSTALLATION INSTRUCTIONS

Before installation:

- Read the user manual carefully, determine the correct connection diagram.

- Remove all connectors and mounting brackets from the controller, then pass the controller through the mounting opening.

- Put mounting brackets and tighten. Do not tighten too much, this can break the enclosure.

- Make electrical connections with plugs removed from sockets, then place plugs to their sockets.

- Take into consideration that supply inputs are isolated from measurement inputs.

- Be sure that adequate cooling is provided.

- Be sure that the temperature of the environment will not exceed the maximum operating temperature in any case.

The following conditions may damage the device:

- Incorrect connections.

- Incorrect power supply voltage.

- Voltage at measuring terminals beyond specified range.

- Voltage at digital inputs beyond specified range.

- Overload or short circuit at relay outputs

- Connecting or removing data terminals when the controller is powered-up.

- High voltage applied to communication ports.

- Ground potential differences at non-isolated communication ports.

- Excessive vibration, direct installation on vibrating parts.

The following conditions may cause abnormal operation:

- Power supply voltage below minimum acceptable value.

- Power supply frequency outside specified limits.

- Phase order fault.

2. MOUNTING

2.1. DIMENSIONS

Dimensions: 133x107x46mm (WxHxD)
Panel cutout: 117x87mm minimum
Weight: 350g
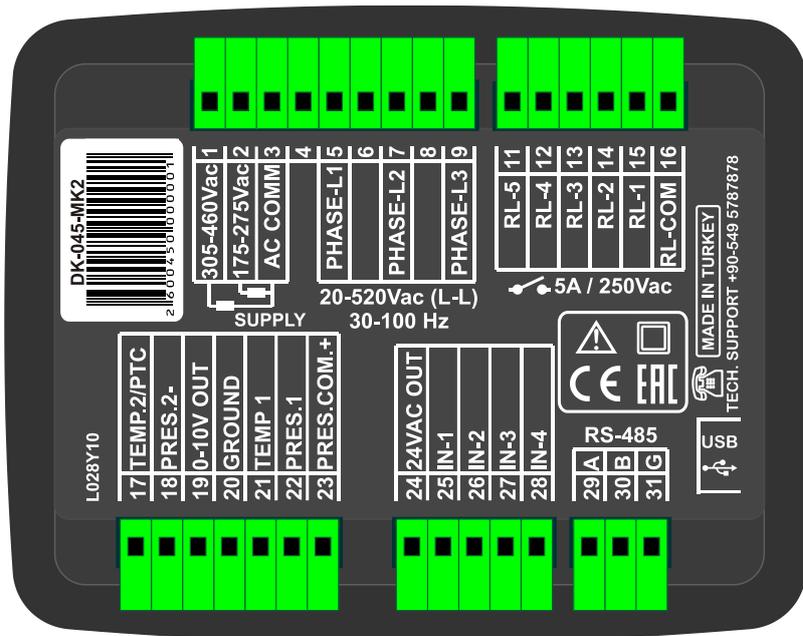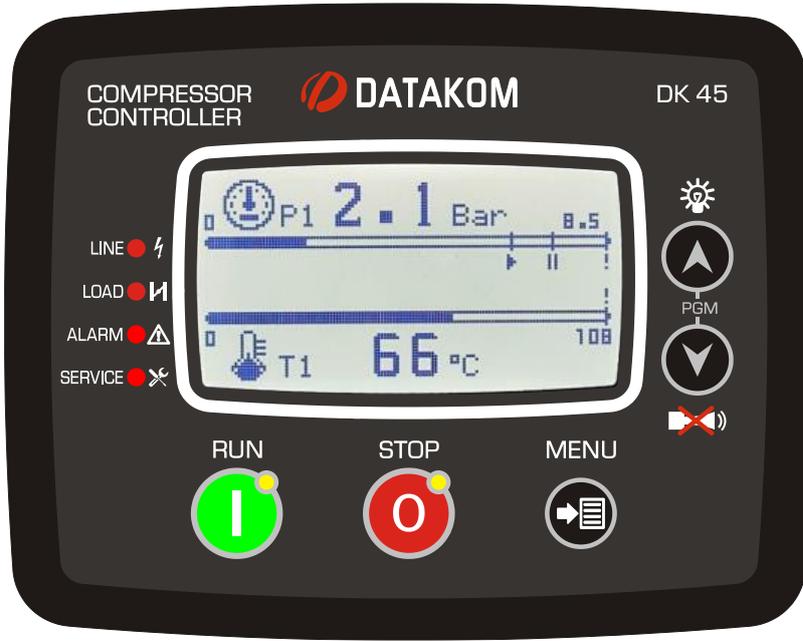
The controller is designed for panel mounting. The user should not be able to access parts of the unit other than the front panel.

Mount the unit on a flat, vertical surface. Before mounting, remove the mounting brackets and connectors from the unit, then pass the unit through the mounting opening.

Place and tighten the mounting brackets.
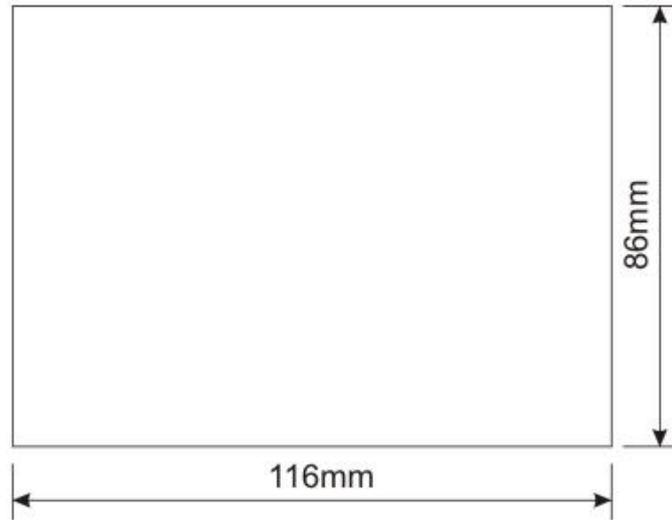
Panel Cutout
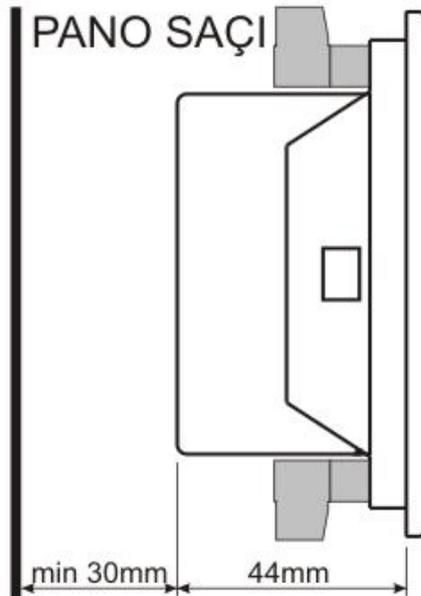
Required Panel Depth

One of the following mounting brackets is supplied with the controller:

Screw type bracket   Self-retaining type bracket

Screw type bracket mounting   Self-retaining type bracket mounting

> ⚠ **Do not tighten excessively as it may break the brackets.**

2.2. SEALING GASKET
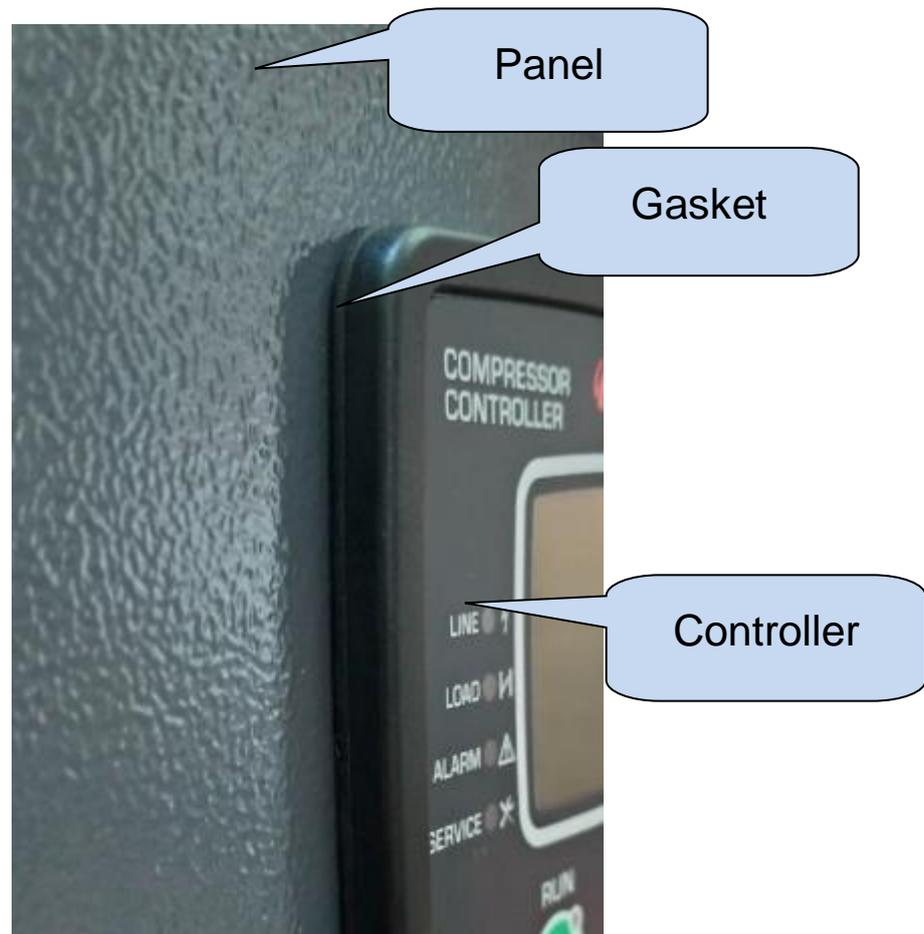
The sealing gasket provides IEC 60529-IP65 protection if used while mounting the controller on the panel. A short definition of IP protection ratings is given below:

1st Digit

0 Not protected
1 Protected against solid foreign objects of 50 mm diameter and greater
2 Protected against solid foreign objects of 12,5 mm diameter and greater
3 Protected against solid foreign objects of 2,5 mm diameter and greater
4 Protected against solid foreign objects of 1,0 mm diameter and greater
5 Protected from the amount of dust that would interfere with normal operation
6 Dust tight

2nd Digit

0 Not protected
1 Protected against vertically falling water drops
2 Protected against vertically falling water drops when enclosure is tilted up to 15 °
3 Protected against water sprayed at an angle up to 60 ° on either side of the vertical
4 Protected against water splashed against the component from any direction
5 Protected against water projected in jets from any direction
6 Protected against water projected in powerful jets from any direction
7 Protected against temporary immersion in water
8 Protected against continuous immersion in water, or as specified by the user

2.3. ELECTRICAL INSTALLATION

> ⚠️ **Do not install the unit close to high electromagnetic noise emitting devices like contactors, high current busbars, switchmode power supplies and the like.**

Although the unit is protected against electromagnetic disturbance, excessive disturbance can affect the operation, measurement precision and data communication quality.

- **ALWAYS remove plug connectors when inserting wires with a screwdriver.**

- **Fuses must be connected to the power supply and phase voltage inputs, in close proximity to the unit.**

- **Fuses must be of fast type with a maximum rating of 6A.**

- **Use cables of appropriate temperature range.**

- **Use adequate cable section, at least 0.75mm^2 (AWG18).**

- **Follow national rules for electrical installation.**

3. TERMINAL DESCRIPTIONS

3.1. POWER SUPPLY INPUT

Power supply voltage:	175 - 275VAC or 305 – 460VAC
Polarity:	Indifferent
Maximum power:	4VA
Isolation:	3300VAC

3.2. AC VOLTAGE INPUTS

Measurement method:	True RMS
Sampling rate:	8000 Hz
Input voltage limits:	0 - 300 VAC Ph-N (0 … 520VAC Ph-Ph)
Minimum voltage for frequency detection:	15 VAC (Ph-N)
Supported topologies:	3 phase 2 phase 1 phase
Measurement limits:	0 … 300VAC Ph-N (0 … 520VAC Ph-Ph)
Input impedance:	1 M-ohms
Screen resolution:	1V-AC
Accuracy:	0.5% + 1 digit @ 230V-AC ph-N (±2VAC ph-N) 0.5% + 1 digit @ 400V-AC ph-ph (±3VAC ph-ph)

Frequency range:	30-100 Hz
Screen resolution:	0.1 Hz
Frequency accuracy:	0.2% + 1 digit (±0.1 Hz @ 50Hz)

3.3. DIGITAL INPUTS

Number of inputs:	4 fully configurable inputs
Structure:	Opto-isolated inputs
Function selection:	From function list
Contact type:	Normally open or normally closed (programmable)
Switching:	To the 24VAC_OUT terminal
Low threshold:	< 1VAC
High threshold:	>5VAC
Maximum input voltage:	30VAC
Reverse input voltage:	30VAC max
Noise filtering:	Yes, hardware and software level

3.4. ANALOG TEMPERATURE SENDER INPUTS

Number of inputs:	2
Measurement method:	Analog resistance measurement
Function:	The measured resistance value is converted to temperature via the programmed curve.
Open circuit voltage:	3.3VDC
Short circuit current:	330 uA-DC
Measurement range:	1st Temperature sender: between 100ohm – 20k-ohm 2nd Temperature sender: between 100ohm – 100k-ohm
Open circuit threshold:	100k-ohm
Resolution:	12 bit
Accuracy:	% 0.3
Noise filtering:	Yes

3.5. PRESSURE SENDER INPUTS

Number of inputs:	2, additional 12V (PRES+) sender supply
Structure:	50-ohm resistor to ground
Measurement method:	Analog DC current measurement
Function:	The measured current value is converted to pressure via programmed values.
Nominal input current:	4-20mA-DC
Current measurement range:	0-30mA-DC
Breakage limit:	70mA-DC
Resolution:	12 bit
Accuracy:	%0.5
Noise filtering:	Yes

3.6. 0-10V ANALOG OUTPUT

Number of outputs:	Single 0-10V analog output
Structure:	Op-amp output over 1k-ohm series resistor
Function:	Controls the variable rpm driver via PID control loop.
Resolution:	16 bit
Accuracy:	%0.5
Cutoff frequency:	16Hz

3.7. RELAY OUTPUTS

The controller offers 5 digital outputs selectable from the functions list.

Structure:	Relay output, normally open contact. Common terminal.
Max. switching current:	5A @250VAC
Max. switching voltage:	250VAC
Max. switching power:	1250VA
Function selection:	From function list

3.8. RS-485 PORT

Structure:	RS-485, non-isolated.
Connection:	3 wires (A-B-GND). Half duplex
Data transmission speed:	2400-115200 baud, adjustable.
Data type:	8 bit data, no parity, 1 bit stop
Termination:	An external 120-ohm termination resistor is required.
Common mode voltage:	-0.5 VDC ... +7VDC, protected in the controller with a transzorb.
Max. distance:	1200m @ 9600 baud (with 120-ohm balanced cable)
	200m @ 115200 baud (with 120-ohm balanced cable)

The RS-485 port supports MODBUS-RTU protocol. To provide data transfer in automation or building management systems, multiple modules can be connected in parallel on the same RS-485 line.

Modbus register list is provided in Chapter 15 of this document.

RainbowPlus program offers programming, control, and monitoring of the controller via the RS-485 port.

Please refer to the RainbowPlus User Manual for details about programming, control, and monitoring via the RS-485 port.

3.9. USB PORT
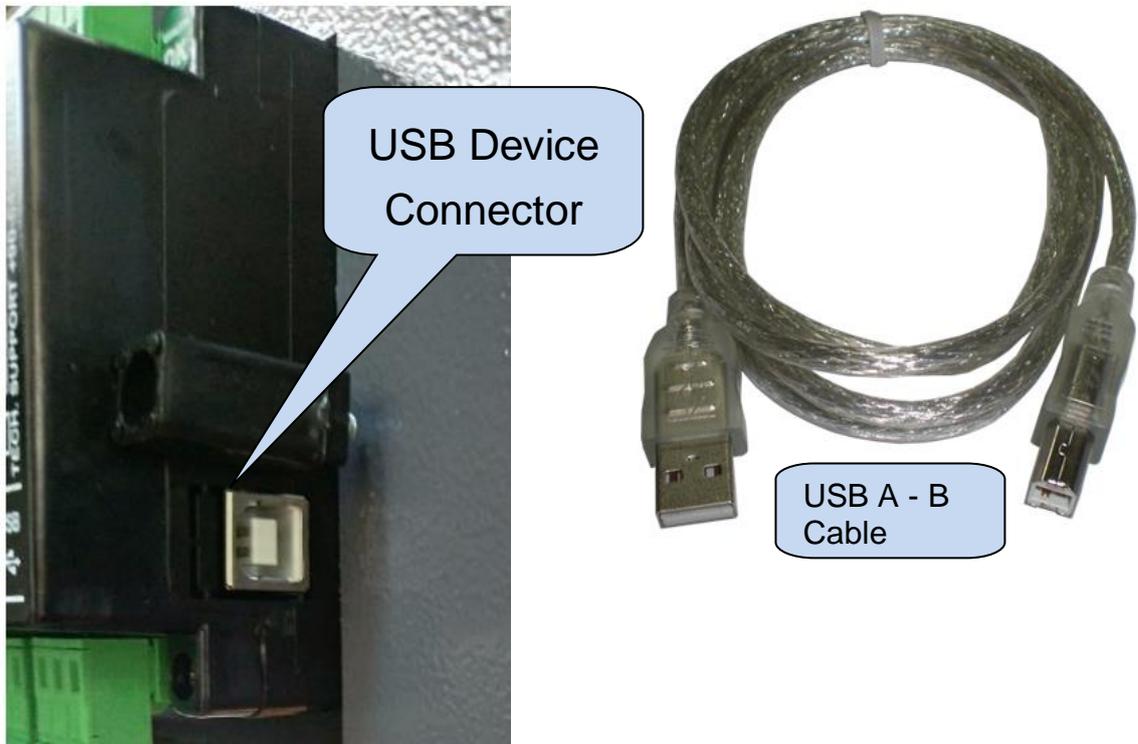
Description:	USB 2.0, non-isolated, HID mode
Data transmission speed:	1.5/12 Mbit/s, automatic detection
Connector:	USB-B (printer connector)
Cable length:	6m max.
Function:	Modbus and FAT32 software update (boot mode only)

The USB port is designed to connect the controller to PC. Programming, control, and monitoring of the compressors can be done using the RainbowPlus program.

RainbowPlus software can be downloaded from **www.datakom.com.tr**.

The connector on the controller is USB type B. Thus, a USB cable type A to B must be used. It is the same type of cable used to connect printers to PC.

Please refer to the Rainbow Plus User Manual for details about programming, control, and monitoring.

4. TOPOLOGIES

If the controller will not be used in a 3-phase power grid, it should be specified in the order. Various topologies may be chosen from the program parameters.

4.1. 3 PHASES
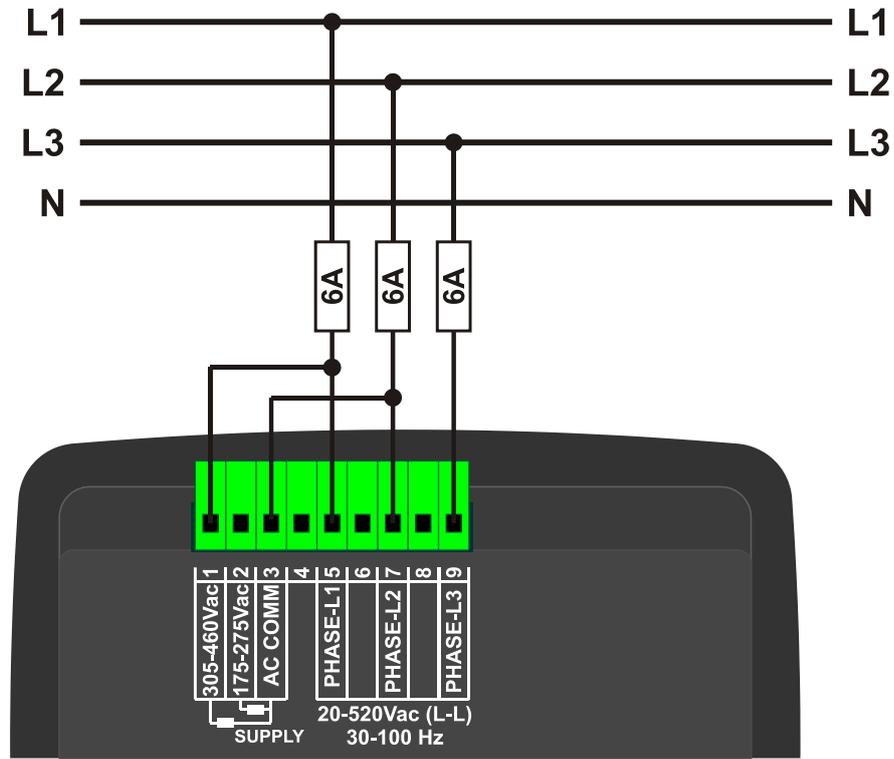
4.2. 2 PHASES
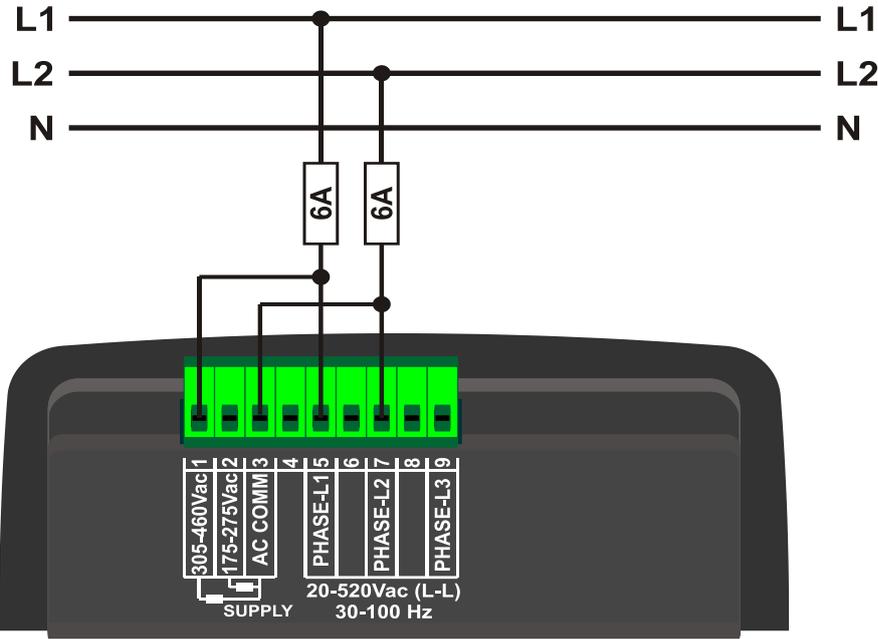
4.3. 1 PHASE
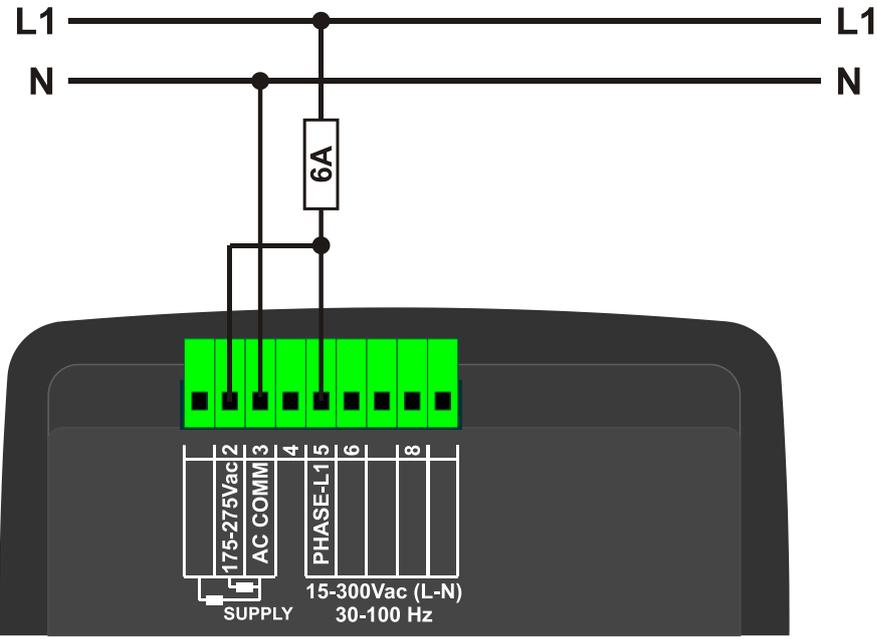
⚠️ **Single phase controllers are custom made upon request. The standard controller can not be used in single phase connection.**

5. CONNECTION DIAGRAM

Terminal	Function	Technical Data	Description
1	**305-460VAC**	305 – 460 VAC supply input	If the supply voltage is within 305 – 460 VAC, connect the phase terminal of the AC power supply to this terminal. If the supply is done Phase-Phase, any phase can be connected. Reverse connection does not affect device operation.
2	**175-275VAC**	175 – 275 VAC supply input	If the supply voltage is within 175 – 275 VAC, connect the PHASE terminal of the AC power supply to this terminal. Reverse connection does not affect device operation.
3	**AC COMM**	Neutral	Connect the NEUTRAL terminal of the AC power supply to this terminal. If the supply is done Phase-Phase, any phase can be connected. Reverse connection does not affect device operation.
5	**PHASE-L1**	Mains phase inputs, 20-520VAC (Ph-Ph) 10-300VAC(Ph-N) Frequency: 30 – 100 Hz	Connect the mains phases to these terminals. Upper and lower voltage limits are programmable.
7	**PHASE-L2**		
9	**PHASE-L3**		

Terminal	Function	Technical Data	Description
11	**RL-5**	Normally open outputs of relays 5A @ 250V-AC	The relay's function can be selected from a list and programmed. Factory setting is **Alarm Relay** output.
12	**RL-4**		The relay's function can be selected from a list and programmed. Factory setting is **Compressor LOAD Relay** output.
13	**RL-3**		The relay's function can be selected from a list and programmed. Factory setting is **Compressor STAR Relay** output.
14	**RL-2**		The relay's function can be selected from a list and programmed. Factory setting is **Compressor DELTA Relay** output.
15	**RL-1**		The relay's function can be selected from a list and programmed. Factory setting is **Compressor MAIN Relay** output.
16	**RL-COM**	Relay COM output, 5A @ 250V-AC	Common terminal for Relays-1-2-3-4-5.

Terminal	Function	Technical Data	Description
17	TEMP.2/PTC	1 k-ohm – 10 k-ohm resistance measurement input. Heating current < 0.3mA	Connect one terminal of KTY/NTC/PTC type temperature sender to this terminal. The other terminal of the sender should be connected to the GROUND terminal.
18	PRESS.2-	4-20mA input	Connect the (-) terminal of a 4-20mA output pressure sender here. The (+) terminal of the sender must be connected to PRES+ terminal.
19	0-10V OUT	DC 0-10 V 1 k-ohm output resistor	This output produces an analog 0-10VDC voltage to drive a variable frequency inverter. The output is controlled by a PID loop.
20	GROUND	0 VDC	The common terminal of temperature senders must be connected here.
21	TEMP 1	1 k-ohm – 10 k-ohm resistance measurement input. Heating current < 0.3mA	Connect one terminal of KTY/PT1000 type temperature sender to this terminal. The other terminal of the sender should be connected to the GROUND terminal.
22	PRESS.1	4-20mA input	Connect the (-) terminal of a 4-20mA output pressure sender here. The (+) terminal of the sender must be connected to PRES+ terminal.
23	PRES.COM. + (12V Pressure sender supply)	DC +12V output 70mA max.	This output supplies the positive terminal to the 4-20mA pressure senders.

Terminal	Function	Technical Data	Description
24	24VAC OUT	24VAC output	24VAC output for digital inputs.
25	IN-1	Digital inputs, **Supply:** Provided from within the controller. **Active level:** external contact resistor < 3 K-ohm **Isolation:** opto-isolated, 1000V AC, 1 minute	This terminal is programmable. Factory setting: **Emergency Stop**
26	IN-2		This terminal is programmable. Factory setting: **Motor Overload Alarm**
27	IN-3		This terminal is programmable. Factory setting: **User Function 1**
28	IN-4		This terminal is programmable. Factory setting: **Air Filter Blockage Warning**

Terminal	Function	Technical Data	Description
29	RS485-A	RS-485 communication port, 2400-115200 baud adjustable	Connect the A-B terminals of the RS-485 data line to these terminals.
30	RS485-B		
31	RS485-G	Output 0VDC	Connect the ground terminal of the RS-485 cable to this terminal.

6. TECHNICAL SPECIFICATIONS

Supply Input:	305 – 460 VAC 175 - 275VAC	
Supply Frequency:	50 - 60Hz nominal (± %10)	
Power Consumption:	< 4 VA	
Measuring inputs:	**Voltage:**	20 - 520 V AC (Ph-Ph) 10 - 300 V AC (Ph-Neutral)
	Frequency:	30 - 100 Hz
Accuracy:	**Voltage:**	% 0.5 + 1 digit
	Frequency:	% 0.5 + 1 digit
Loading:	**Voltage inputs:**	< 0.1VA per phase
Relay outputs:	5A @ 250V AC	
Digital inputs:	**Supply:** Internal, from device. **Active level:** external contact resistance < 3 K-ohm **Isolation:** opto-isolated, 1000V AC, 1 minute	
Pressure inputs:	4-20mA pressure sender	
Temperature inputs:	1st Temperature sender: between 100ohm – 20k-ohm	
	2nd Temperature sender: between 100ohm – 100k-ohm (KTY or NTC or PTC sender) Heating current < 0.3mA	

Communication ports:

USB Device:	USB 2.0 full speed (1.5-12Mbits)
RS-485 Port:	2400-115200 baud adjustable

Operating Temperature: -20°C to +70 °C (-40°C to +70 °C with heating option)

Storage Temperature: -40°C to 80 °C

Max. Relative Humidity: %95 non-condensing.

Protection Rating:	IP 65 (Front panel, with gasket) IP 30 (Back panel)
Device Enclosure:	Flame retardant, ROHS compliant, high heat resistance ABS/PC (UL94-V0)
Mounting:	Panel mounted, retaining brackets on the back side
Dimensions:	133x107x46mm (WxHxD)
Panel cutout:	117x87mm minimum

Weight: 350 gr

EU Directives:	**Reference Standards:**
2014/35/EC (LVD)	TS-EN 61010 (safety)
2014/30/EC (EMC)	TS-EN 61326 (EMC)

7. DESCRIPTION OF CONTROLS

7.1. FRONT PANEL FUNCTIONALITY

LINE
(MAIN relay)
status indicator

Graphical LCD
Screen

Move to
previous
measurement
screen.
LAMP TEST

LOAD
Relay status
indicator

Fault
condition
indicator

Service
Request
Indicator

COMPRESSOR
CONTROLLER

DATAKOM

DK 45

LINE

LOAD

ALARM

SERVICE

P1 2.1 Bar

T1 66 °C

RUN

STOP

MENU

PGM

Move to next
measurement
screen. ALARM
MUTE

RUN button

STOP button

Shows the next
alarm log in
Alarm history
screen, shows
the previous
alarm log if
pressed longer

7.2. PUSHBUTTON FUNCTIONS

PUSHBUTTON	FUNCTION
	Enter RUN mode. Compressor starts.
	Enter STOP mode. Compressor stops. The controller will be reset if held pressed for 15 seconds.
	Moves to next measurement screen. Press and hold to mute alarms.
	Shows the next alarm log in alarm history screen. Shows the previous alarm log if pressed longer in alarm history screen.
	Move to previous measurement screen. LAMP TEST button (press and hold).
	Press and hold together for 5 seconds to enter PROGRAMMING mode.
	Press and hold together for 5 seconds to enter factory reset screen. Please refer to RESET TO FACTORY DEFAUTS section.
	Press and hold together for 5 seconds to reset the LCD screen.

7.3. DISPLAY SCREEN ORGANIZATION

The controller measures multiple electrical and compressor parameters. The parameters are viewable in measurement screens.

Shows the next measurement screen each time button is pressed. Moves to the first measurement screen after the last measurement screen is reached, in a loop.

Shows the previous measurement screen each time button is pressed. Moves to the last measurement screen after the first measurement screen is reached, in a loop.

7.4. MEASURED PARAMETERS

The controller displays below AC measurements:

The measured electrical parameters are listed below:

Mains voltage between phase L1 and Neutral
Mains voltage between phase L2 and Neutral
Mains voltage between phase L3 and Neutral
Mains average voltage between phase and neutral
Mains voltage between phases L1-L2
Mains voltage between phases L2-L3
Mains voltage between phases L3-L1
Mains frequency

The controller has 2 temperature sender inputs with configurable temperature-resistance curve and 2 pressure sender inputs with configurable pressure-current curve (4-20 mA).

The measured Pressure and Temperature parameters are listed below:

P1: Pressure measured by the first pressure sender

P2: Pressure measured by the second pressure sender

P12: The difference between the pressure values measured by the first and second senders (P1 – P2)

T1: Temperature measured by the first temperature sender

T2: Temperature measured by the second temperature sender

T12: The difference between the temperature values measured by the first and second senders (T1 – T2)

7.5. LED LAMPS

LINE
(MAIN relay)
status indicator

LOAD
Relay status
indicator

Alarm
indicator

Service
request
indicator

COMPRESSOR
CONTROLLER

DATAKOM

DK 45

LINE

LOAD

ALARM

SERVICE

RUN

STOP

MENU

RUN mode
indicator

STOP mode
indicator
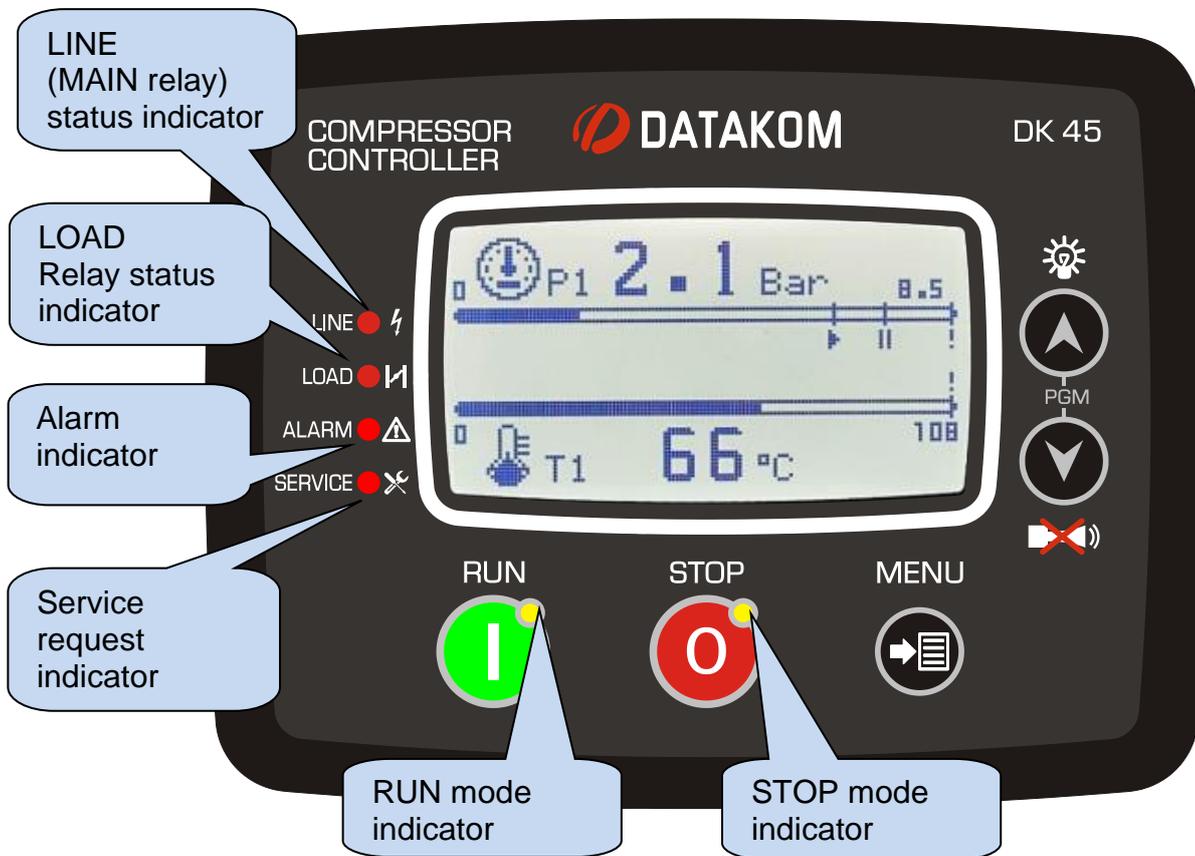
STATUS LEDS:

LINE (MAIN RELAY): If RUN mode is selected and the compressor is free to run, main relay is energized and this LED turns on.

LOAD (LOAD RELAY): If the load relay is energized (compressor is running under load and producing pressurized air), this LED turns on.

ALARM: This LED turns on if an alarm condition occurs.

SERVICE: This LED turns on if one of the service counters expires.

MODE LEDS (RUN, STOP): The related LED turns on if a mode is selected remotely or on the device.

8. EVENT LOGS

The controller records over 400 events with date, time, and measurement values.

Event logs include the following:

-event order
-event type / error definition (refer below for different event sources)
-date and time
-Device Operation (Compressor Status)
-Pressure and Temperature sender measurements: P1, P2, P12, T1, T2, T12
-Mains phase-neutral voltages: L1-L2-L3
-Mains phase-phase voltages: L12-L23-L31
-Mains frequency
-Mains ph-n average voltage
-Running hours
-Loaded running hours
-Loaded running / running hours percentage
-Number of Motor starts
-Number of Motor starts within the last hour

The controller's event recording conditions are user programmable:

Program menu entry event: Each entry to the program menu using a password is logged.
Periodic recording: A log entry is written every 60 minutes.
Alarm/warning events: An event log is written for each alarm and warning.

Event logs are viewed from the programming menu. Thus, they do not interfere with other measurement screens.

To enter **Event logs** menu, press and hold 🔽 and 🔼 buttons for 5 seconds.

The following password prompt will be displayed upon entering programming mode.

Press the 🔘 button 4 times to bypass the password prompt.

Press the 🔘 button again. The most recent event entry will be displayed.

Event order, event type, error type, and date-time information are displayed on the first page.

When viewing event logs:

button displays the next piece of information related to the same event.

button displays the previous piece of information related to the same event.

button displays the same piece of information in the previous event. Pressing it for 2 seconds exits the Event Logs screen.

button displays the same piece of information in the next event.

9. STATISTICAL COUNTERS

The controller offers a series of counters for statistical use.

The counters are listed below:

> -total running hours
> -loaded running hours
> -number of Motor starts
>
> - Service-A remaining hours
> - Service-B remaining hours
> - Service-C remaining hours
> - Service-D remaining hours
> - Service-E remaining hours

The counters are stored in a nonvolatile memory which is protected against power loss.

10. MODES OF OPERATION

10.1. SELECTION OF OPERATION MODE

When energized, the controller starts in STOP mode and the STOP LED turns on.

The compressor starts after receiving **REMOTE START** signal or by pressing the RUN button.

If **Safety Timer** has not expired yet, the RUN LED blinks until it has expired. When the timer is elapsed and if the main pressure is below **Start Pressure**, then the compressor starts.

> **If an alarm condition occurs, the compressor stops immediately, and the alarm type and definition are displayed on screen.**

The compressor can normally be stopped via the REMOTE STOP signal or by pressing the STOP button.

10.2. STOPPING MODE

STOP LED starts blinking.

If the compressor is under load, the LOAD relay disengages and keeps running until either **Safety Timer** or **Unload Timer** (whichever is longer) is expired. During this period, the RUN button can be pressed to return to RUN mode and resume running. If the STOP button is pressed during unloaded work, the compressor stops immediately.

The STOP LED blinks until the compressor stops completely.

> **When the STOP button is pressed, if the compressor is already running unloaded, then it will keep running until *Safety Timer* expires. The compressor can be stopped immediately by pressing the STOP button again.**

10.3. STARTING THE COMPRESSOR

The controller switches to running mode by pressing the RUN ⊙ button or by sending the Remote START/STOP command if enabled. In this phase, the controller activates the compressor if the output pressure (main pressure) is lower than **Starting Pressure (**or pressure switch closes).

Before the compressor is started, STAR relay output is activated. After the **Delay Between Relays** timer expires, MAIN relay engages; thus, the Motor starts in star connection.

After **Star timer** expires, the STAR relay disengages and after the **Star/Delta Timer** expires, DELTA relay engages.

After **Before Loading Timer** expires, the LOAD relay engages and the compressor starts producing pressurized air.

10.4. LOADING AND UNLOADING THE COMPRESSOR

If output pressure (P1) reaches **Stop Pressure** (or pressure switch opens), LOAD relay disengages and the Motor keeps running until the **Unload Timer** expires. If the output pressure drops below the **Start Pressure** before the timer expires, the LOAD relay re-engages.

10.5. STOPPING AND RESTARTING THE COMPRESSOR ACCORDING TO OUTPUT PRESSURE

If output pressure is higher than **Start Pressure** during **Unload Timer**, (or pressure switch remains open) the DELTA relay disengages first, then the MAIN relay disengages after the **Delay Between Relays** timer expires.

The RUN LED starts blinking in this situation.

The maximum number of Motor starts that the compressor is allowed to perform in an hour is adjusted by the **Hourly Maximum Starts** parameter.

If the maximum number of starts is reached, Motor stopping is prevented until the 1 hour duration expires, and the Motor keeps running unloaded.

11. ALARMS AND WARNINGS

If any of the measured parameters go outside the predefined limits, an ALARM occurs.

If a fault condition occurs, the alarm pop-up screen is displayed and the alarm function is activated. To control various systems, the alarm condition may be assigned to a relay output.

The controller has 2 different levels of protection, being alarms and warnings.

- 1- **ALARMS:** These are the most urgent faults and cause the following operations:

    - **ALARM** LED turns on and remains on,
    - The compressor stops immediately.

- 2- **WARNINGS:** These faults are less urgent and cause only the **ALARM** LED to flash.

The alarm pop-up screen is displayed automatically if a fault condition occurs.

To acknowledge the alarm and close the alarm pop-up screen, press the HORN (ALARM MUTE) button. This action does not remove the alarms.

The alarms have a low/high level setting and a timer. If the fault condition disappears before the timer is expired, the alarm does not occur.

The alarms can be latching or non-latching as defined by programming parameters. For latching alarms, the alarm led stays on even if the alarm condition is removed.

Many errors have programmable limits. Refer to the programming section for more information.

11.1. SERVICE COUNTER WARNINGS

The service LED is used to help remind the periodic services for the compressor.

Periodic services are done upon completion of specified Motor running hours (2000 hours for example).

The device has 5 independent service timers (hours). When any one of them is up, the service LED turns on.

If the **Stop On Service Request** parameter is set to 1, the compressor behaves as follows:

TIME LEFT UNTIL SERVICE	RESPONSE
> 100 hours	No warning is given.
100 hours	Service warning given and service LED turns on. The compressor continues normal operation.
0 hours	The compressor stops. Service warning is given and service LED turns on. The compressor can be restarted using the **RUN** button.
-100 hours	The compressor stops. Service warning is given and service LED turns on. The compressor can be restarted using the **RUN** button.
Between -120 and -200 hours, once every 20 hours	The compressor stops. Service warning is given and service LED turns on. The compressor can be restarted using the **RUN** button.
Between -210 and -300 hours, once every 10 hours	The compressor stops. Service warning is given and service LED turns on. The compressor can be restarted using the **RUN** button.
-300 hours	The compressor stops. Service warning is given and service LED turns on. The compressor cannot be restarted unless service is performed.

The device's service periods can each be programmed separately. If the time (period) parameter of a service is set to 0, the related service counter and warnings are not shown.

> ⚠ **Service timers can each be reset separately from program parameters.**

The controller's service counters are stored in non-volatile memory which will not be affected by power losses. Cutting the power supply will not cause any information loss.

Service times can be displayed in measurement screens.

11.2. ALARMS

ALARM	DESCRIPTION
HIGH / LOW VOLTAGE	Occurs when phase voltages are outside the programmed limits for the related **Alarm Duration**. The alarms are: **High Voltage Alarm, Low Voltage Alarm**
HIGH / LOW FREQUENCY	Occurs when the frequency is outside the programmed limits. The lower and upper limits can be programmed separately. The alarms are: **High Frequency Alarm, Low Frequency Alarm.**
VOLTAGE UNBALANCE	If any of the phase voltages differ from the average value by <u>**Volt. Unbalance Alarm**</u> parameter for <u>**Volt. Unbalance Timer**</u>, **Volt. Unbalance Alarm** occurs.
PHASE ORDER FAULT	If mains grid phase order is reversed, **Phase Order Fault** alarm occurs.
TEMPERATURE SENDER FAULT	If the related sender was not connected or the sender is malfunctioning, the alarm occurs. Both senders have their own separate alarms. The alarms are: **Temperature Sender-1 Error, Temperature Sender-2 Error.**
HIGH / LOW TEMPERATURE	If the temperature values are outside the programmed limits for the related **Alarm Duration,** the alarm occurs. Both temperature senders have their own alarms. The alarms are: **High Temperature Sender-1, High Temperature Sender-2, Low Temperature Sender-1, Low Temperature Sender-2.**
MOTOR PTC HIGH TEMPERATURE	If <u>**Temperature Sender-2 Setting**</u> parameter is set to "Motor PTC" and the resistance measured from the 2nd temperature sender exceeds the <u>**Motor PTC Alarm Value**</u> parameter, **MPTC High Temperature** alarm occurs.
TEMPERATURE DIFFERENCE ALARM	**Sender-2 Temperature Difference Alarm:** If <u>Temperature Sender-2 Setting</u> Parameter is set to "2: Temperature Difference" and T12 (T1-T2) temperature difference exceeds <u>**T1-T2 Temperature Difference Alarm**</u> parameter, **Sender-2 Temperature Difference Alarm** occurs.
PRESSURE SENDER FAULT	Occurs if the related sender is not connected or is malfunctioning. Both pressure senders have their own alarms. These are the alarms: **Pressure Sender-1 Error, Pressure Sender-2 Error.**
HIGH / LOW PRESSURE	If the pressure values are outside the programmed limits for the related **Alarm Duration,** the alarm occurs. Both pressure senders have their own alarms. The alarms are: **High Pressure Sender-1, High Pressure Sender-2, Low Pressure Sender-2.** Low Pressure Sender-2 alarm is checked only if the compressor is active, otherwise it is not checked.

ALARM	DESCRIPTION
PRESSURE DIFFERENCE ALARM	If the compressor is running under load and the main pressure measurement is higher than **<u>Start Pressure</u>** parameter, the pressure alarm is checked. Otherwise, Pressure Difference Alarm is not checked. **Sender-2 Pressure Difference Alarm:** If P12 (P1-P2) pressure difference exceeds **<u>P1-P2 Pressure Difference Alarm</u>** parameter, **Sender-2 Pressure Difference Alarm** occurs.
EMERGENCY STOP	If a programmable digital input function is set as "**Emergency Stop**" and the defined conditions are met, **Emergency Stop** alarm occurs.
MOTOR OVERLOAD	If a programmable digital input function is set as "**Motor Overload Alarm**" and the defined conditions are met, **Motor Overload** alarm occurs.
MAIN CONTACTOR FAIL TO CLOSE	When a programmable digital input function is set as "Main Relay Auxiliary Contactor Input", if there is no "contact closed" confirmation from the auxiliary contact in 5 seconds after the main Motor contactor closes, this alarm occurs.
MAIN CONTACTOR FAIL TO OPEN	When a programmable digital input function is set as "Main Relay Auxiliary Contactor Input", if there is no "contact open" confirmation from the auxiliary contact in 5 seconds after the main Motor contactor opens, this alarm occurs.
FAN CONTACTOR FAIL TO CLOSE	When a programmable digital input function is set as "Fan Relay Auxiliary Contactor Input", if there is no "contact closed" confirmation from the auxiliary contact in 5 seconds after the main Motor contactor closes, this alarm occurs.
FAN CONTACTOR FAIL TO OPEN	When a programmable digital input function is set as "Fan Relay Auxiliary Contactor Input", if there is no "contact open" confirmation from the auxiliary contact in 5 seconds after the main Motor contactor opens, this alarm occurs.

> ⚠️ **Digital outputs' alarm names, sampling, and operation are all programmable.**
> **Only internal alarms are explained in this section.**

> ⚠️ **For pressure and temperature senders, no alarm occurs if the related sender's setting parameter is set to "deactivated".**
> **For other alarms, no alarm occurs if the related limit parameters are set to 0.**

11.3. WARNINGS

WARNING	DESCRIPTION
HIGH TEMPERATURE	A warning is given if temperature values exceed the programmed warning limits. Each temperature sender produces a different warning. These are the warnings: **High Temperature-1, High Temperature-2.**
WAIT 1 HOUR BEFORE STOPPING	If the Motor starts <u>**Hourly Max. Starts**</u> times within one hour, the warning **Wait 1 hour Before Stopping** comes up and the motor is not allowed to stop until the hour is up. The Motor will keep running even if the pressure is sufficient; it will continue to run without load.
WAITING FOR SEPARATOR PRESSURE	If a programmable digital input function is set as "**Waiting for Separator Pressure**" and the defined conditions are met, **Waiting for Separator Pressure** alarm occurs.
WAITING FOR INPUT (DRIVE)	If a programmable digital input function is set as "**Waiting for Input (Drive)**" and the defined conditions are met, **Waiting for Input (Drive)** alarm occurs.
AIR FILTER BLOCKED	If a programmable digital input function is set as "**Air Filter Blocked**" and the defined conditions are met, **Air Filter Blocked** alarm occurs.
MULTI COMMUNICATION FAILURE	When the compressors are in multiple operation, if a communication problem occurs, this warning is given.
SERVICE TIME	Warning is given if one of the service counters expires. These are the warnings: **Service A Time Warning, Service B Time Warning, Service C Time Warning, Service D Time Warning, Service E Time Warning.** Service counters can be reset separately in program parameters.
REMOTE START / REMOTE STOP	If a programmable digital input function is set as "**Remote Start/Stop**" and the defined conditions are met, **Remote Start** warning is displayed and the controller enters RUN mode. If the defined conditions are not met, **Remote Stop** warning is displayed and the controller enters STOP mode.
STOPPED – WEEKLY SCHEDULE **RAN – WEEKLY SCHEDULE** **WEEKLY SCHEDULE CANCELLED**	*Weekly Schedule Active* parameter is set to 1, the compressor starts and stops automatically as given in Weekly Schedule. When the compressor stops automatically, "**STOPPED-Weekly Schedule**" warning is displayed. When the compressor runs automatically "**STARTED-Weekly Schedule**" warning is displayed. If the **STOP** button is pressed while the compressor is running or **START** button is pressed while stopping according to the Weekly Schedule, "**Weekly Schedule Cancelled**" warning is displayed and *Weekly Schedule Active* parameter will be set to 0.
LOW TEMPERATURE FOR LOADING	If the main temperature measurement is below **Minimum Loading Temperature** parameter, this warning is displayed and the compressor is not allowed to take the load until **Minimum Loading Temperature** is reached.

WARNING	DESCRIPTION
DIGITAL INPUT TAKE LOAD COMMAND	If *Take Load Command Source* parameter is set to "1: Digital Input" and one digital input function is set as "Take Load Command", this warning is given when the "take load" command is issued from the digital input and the compressor takes the load.
DIGITAL INPUT UNLOAD COMMAND	If *Take Load Command Source* parameter is set to "1: Digital Input" and one digital input function is set as "Take Load Command", this warning is given when the "unload" command is issued from the digital input and the compressor unloads.
MODBUS TAKE LOAD COMMAND	If *Take Load Command Source* parameter is set to "2: Modbus Command", when "take load" command is given via Modbus (set register 8222 to value 170) and the compressor takes the load, this warning occurs.
MODBUS UNLOAD COMMAND	If *Take Load Command Source* parameter is set to "2: Modbus Command", when "unload" command is given via Modbus (set register 8222 to value 10) and the compressor unloads, this warning occurs.
POWER LOSS / RESTART	Refer to Section 13.3 **Automatic Restart Delay** parameter description.

> ⚠ **Digital outputs' alarm names, sampling, and operation are all programmable.**
> **Only internal alarms are explained in this section.**

12. PROGRAMMING

12.1. RESETTING TO FACTORY DEFAULTS

<u>**In order to return to factory settings:**</u>

- Press and hold [O] [V] [A] buttons for 5 seconds,
- The screen will display "**RETURN TO FACTORY DEFAULTS**",

- Press and hold [→▤] button for 5 seconds,
- The controller will be reset to factory defaults.

Programming mode is used to program the timers and delays, running limits, and program parameters.

Program parameters can be changed from the front panel as well as via the free RainbowPlus software.

The parameter changes are automatically saved to memory and are effective immediately.

Entering programming mode does not affect device operation.

12.2. ENTERING THE PROGRAMMING MODE

To enter programming mode, press and hold [V] and [A] buttons for 5 seconds.

A password prompt will appear upon entering programming mode.

[V] [I] [→▤] [A]   buttons can be used to enter the 4-digit code.

[V] , [A]   buttons increase or decrease the selected digit. [I] , [→▤] buttons move between digits.

The controller has 3 levels of passwords. The level 1 password can be used to change parameters on the field. The level 2 password is for factory level settings. The level 3 password is for device calibration parameters.

Level 1 password is '**1234**' and level 2 password is '**9876**'.

If the wrong password is entered, the programming parameters can be viewed but cannot be changed.

12.3. NAVIGATING BETWEEN MENUS

The programming mode is designed as a two-level menu system. The main menu is made up of program groups. Program parameters are in the groups.

When programming mode is entered, the program groups list will be displayed. Use the and buttons to move between groups. The highlighted group will be shown with a black background in opposite color. Press the button to enter the group. To exit to main menu, press the button.

12.4. MODIFYING PARAMETER VALUE

Use the and buttons to move within the program parameters group. An arrow sign is shown to the right of the chosen parameter. To display / change the value of this parameter, press the button.

The parameter value is increased / decreased by the buttons. Press and hold these buttons to increment / decrement by steps of 10. The new program parameter will be saved as soon as it is changed.

Press the button to move to the next parameter. button goes back to the main group.

12.5. PROGRAMMING MODE EXIT

Press the button to exit programming mode.

The device exits the programming mode automatically if no action is performed within 2 minutes.

13. PROGRAM PARAMETER LIST

13.1. CONTROLLER CONFIGURATION GROUP

Parameter Definition	Unit	Min	Max	Factory Default	Description
LCD Contrast	-	30	100	33	This parameter adjusts the contrast of the LCD display. Select the value to ensure optimum visibility.
Language Selection	-	0	1	0	**0:** English **1:** Turkish. This language can vary according to the region the controller will be used in. Language packs can be uploaded to the controller using the Rainbow Plus program.
Alarm (Horn) Relay Timer	sec	0	65000	32000	If any alarm occurs, the **Alarm (Horn)** relay is energized for the duration of this timer; after this timer expires, the Alarm (Horn) relay opens the contact and active alarms are confirmed. If this timer is set to 0, the horn output is closed indefinitely.
Weekly Schedule Active	-	0	1	0	**0:** Weekly Schedule disabled **1:** Weekly Schedule enabled
Pressure Calendar Active	-	0	1	0	**0:** Pressure Calendar disabled **1:** Pressure Calendar enabled
Modbus Address	-	0	254	33	This parameter is the Modbus address of the controller. Multiple operation mode is started if any of the devices' Modbus address is set to 1 in the multiple operation network. Since Modbus addresses between 1-32 are used for multiple operation, it is advised to set this parameter to a value between 33-254 if multiple operation will not be used.
RS-485 Communication Rate	bps	2400	115200	9600	RS-485 Modbus port communication rate.
Flashing Relay ACTIVE Timer	sec	0	6500	0	Flashing Relay ACTIVE timer.
Flashing Relay PASSIVE Timer	sec	0	6500	0	Flashing Relay PASSIVE timer.
Remote Control Active	-	0	1	1	Enables the remote control of the device via RS-485 Modbus and USB Modbus protocols. **0:** Remote Control OFF **1:** Remote Control ON
LCD Backlight Timer	min	0	1440	60	If no button is pressed during this period, the LCD backlight turns off.
Periodic Event Log	-	0	1	0	0: No periodic (hourly) event log is recorded. 1: Periodic (hourly) event log is recorded.

13.1. CONTROLLER CONFIGURATION GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
PGM Mode Event Record	-	0	1	1	**0:** No event record is made upon entering Programming mode. **1:** An event record is made upon entering Programming mode.
Show Fahrenheit	-	0	1	0	**0:** Temperature measurement unit is degrees **Celsius** (°C). **1:** Temperature measurement unit is degrees **Fahrenheit** (°F).
Pressure Show PSI	-	0	1	0	**0:** Pressure measurement unit is **Bar**. **1:** Pressure measurement unit is **PSI.**
Local Time Zone	hours	-12	+12	3	This parameter selects the time zone of the controller's current region. Thus, the controller's internal clock is coordinated to UTC.

13.2. ELECTRICAL PARAMETERS GROUP

Parameter Definition	Unit	Min	Max	Factory Reset	Description
Voltage Transformer Ratio	-	0.1	5000.0	1.0	Voltage transformer ratio. This ratio is multiplied by the voltage measurement reading values. If no transformer is used, this parameter should be set to 1.0.
Alarm Over Timer	Sec	0	255	20	After the cause of the alarm is removed for electrical alarms, if the alarm is not latching, alarm condition expires after this timer is up.
Phase Order Check	-	0	1	0	**0:** Phase order not checked. **1:** Alarm raised if phase order is faulty.
Low Voltage Alarm Value	V	0	65000	0	If one of the mains phase voltages is lower than this value for the duration of **Voltage Alarm Timer, Low Voltage Alarm** occurs. If this parameter is set to 0, the condition is not checked.
High Voltage Alarm Value	V	0	65000	0	If one of the mains phase voltages is higher than this value for the duration of **Voltage Alarm Timer, High Voltage Alarm** occurs. If this parameter is set to 0, the condition is not checked.
Voltage Alarm Timer	Sec	0	255	30	If a mains phase voltage is outside the limits for this duration, the related alarm is raised.
Voltage Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Low Frequency Alarm Value	Hz	0	400	0	An alarm is raised if the mains frequency is below this limit. If this parameter is set to 0, the condition is not checked.
High Frequency Alarm Value	Hz	0	400	0	An alarm is raised if the mains frequency is higher than this limit. If this parameter is set to 0, the condition is not checked.
Frequency Alarm Timer	Sec	0	255	30	If mains frequency is outside the limits for this duration, the related alarm is raised.
Frequency Alarm Latching	-	0	1	0	0: non-latching 1: latching
Voltage Unbalance Alarm	%	0	50	0	An alarm is raised if voltage unbalance is higher than this limit. The condition is not checked if the parameter is set to 0. Voltage unbalance is calculated as the maximum deviation from the average value.
Voltage Unbalance Delay Timer	Sec	0	255	30	If voltage unbalance is higher than the limit for this duration, an alarm is raised.
Voltage Unbalance Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Connection Topology	-	0	2	0	**0:** 3 Phase, **1:** 1 Phase, **2:** 2 Phase

13.3. COMPRESSOR PARAMETERS GROUP

Parameter Definition	Unit	Min	Max	Factory Default	Description
Pressure Sender-1 Control Setting	-	0	2	2	**0:** Disabled **1:** Pressure Switch **2:** Pressure Sender
Pressure Sender-1 Upper Limit	bar	1.7	99.9	16.0	The upper measurement limit of the 1st pressure sender must be entered here.
High Pressure-1 Alarm Value	bar	1.2	99.4	8.5	An alarm is raised if the 1st pressure measurement value is above this limit.
Stop Pressure	bar	0.7	99.2	7.4	If the main pressure measurement value is above this parameter, the load relay will open.
Start Pressure	bar	0.5	99.0	6.5	If the main pressure measurement value is above this parameter, the load relay will close.
Pressure Sender-1 Offset Value	bar	-2.0	2.0	0	This offset parameter is added to the 1st pressure measurement value.
Temperature Sender-1 Upper Limit	°C	-400	400	130	The upper measurement limit of the 1st temperature sender must be entered here. If this parameter is set to 0, the first temperature measurement is not displayed and the related alarms are cancelled.
High Temperature-1 Alarm Value	°C	-400	400	108	If the 1st temperature measurement is higher than this, an alarm is raised.
High Temperature-1 Warning Value	°C	-400	400	103	If the 1st temperature measurement is higher than this, a warning is given.
Low Temperature-1 Alarm Value	°C	-400	400	0	If the 1st temperature measurement is lower than this, an alarm is raised.
Temperature Sender-1 Offset Value	°C	-20	20	0	This offset parameter is added to the 1st temperature measurement value.
Temperature Sender for Fan Relay	-	0	1	0	This parameter selects the temperature sender which controls the fan relay. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2)
Automatic Restart Delay	Sec	0	255	0	**0:** The controller turns on in STOP mode. **1-255:** The controller turns on in the mode it was in before power loss. If the compressor was running when power loss occurred, it restarts automatically when this timer expires after power is restored. Before running, "**Power Loss / Restart**" warning is given. If this parameter is set to 0, this functionality is cancelled.
Main Temperature Value for Pressure	°C	0	999	0	Until the main temperature measurement is reached, **Start Pressure + (Stop Pressure – Start Pressure)/4** is used instead of **Stop Pressure.** Thus, the compressor stops before reaching **Stop Pressure**. If this parameter is set to 0, this functionality is cancelled.
Delay Between Relays Timer	msec	20	250	100	This is the minimum delay time between opening a relay and closing another relay.

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
Temperature Sender-2 Setting	°C	0	3	0	**0:** Disabled **1:** Absolute Temperature **2**: Temperature Difference **3:** Motor PTC (If the resistance value measured by the sender input is higher than **Motor PTC Alarm Limit**, **MPTC High Temperature** alarm is raised.)
Temperature Sender-2 Upper Limit	°C	-400	400	130	Enter the upper measurement level of the 2nd temperature sender here.
High Temperature-2 Alarm Limit	°C	-400	400	110	If the 2nd temperature measurement is higher than this, an alarm is raised.
High Temperature-2 Warning Limit	°C	-400	400	85	If the 2nd temperature measurement is higher than this, a warning is given.
Low Temperature-2 Alarm Limit	°C	-400	400	-10	If the 2nd temperature measurement is lower than this, an alarm is raised.
T1-T2 Temperature Difference Alarm Limit	°C	-100	100	0	If T1-T2 temperature difference is higher than **T1-T2 Temperature Difference Alarm Limit** for the duration of **Temperature Difference Alarm Delay,** **Sender-2 Temperature Difference Alarm** is raised.
Temperature Alarm Delay	S	1	600	2	This is the delay timer for high and low temperature alarms.
Temperature Sender-2 Offset Value	°C	-20	20	0	This offset parameter is added to the 2nd temperature measurement value.
Star Timer	Sec	2	20	7	This is the duration that the star relay remains closed while starting the Motor.
Star-Delta Transition Timer	msec	10	50	15	This is the duration between the opening of the star relay and closing of the delta relay while starting the Motor.
Before Loading Timer	Sec	1	120	2	The Motor runs unloaded for the duration of this timer before taking the load.
Unload Timer	Sec	0	600	60	When the Motor raises the main pressure value to **Stop Pressure** under load, it unloads and works unloaded for the duration of this timer, then stops. This timer is not updated immediately if changed in RUN mode. It is updated only when the device is first turned on or in STOP mode.
Variable Unload Timer	-	0	1	0	**0:** Constant **1:** Variable **If this parameter is set to 1:** If stop time is longer than unloaded running time, unloaded running time is decreased by 1 minute at each start (does not become shorter than 2 minutes). Refer to section 14.7 for mor information.
Safety Timer	Sec	1	240	2	Refer to section 10 for this parameter's function.

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Uni	Min	Max	Factory Default	Description
Service A Hours (Timer)	Hours	0	32767	2000	When Service A is reset, it syncs to this value. If this parameter is set to **0**, no Service A warning is issued.
Service B Hours (Timer)	Hours	0	32767	4000	When Service B is reset, it syncs to this value. If this parameter is set to **0**, no Service B warning is issued.
Service C Hours (Timer)	Hours	0	32767	6000	When Service C is reset, it syncs to this value. If this parameter is set to **0**, no Service C warning is issued.
Service D Hours (Timer)	Hours	0	32767	10000	When Service D is reset, it syncs to this value. If this parameter is set to **0**, no Service D warning is issued.
Service E Hours (Timer)	Hours	0	32767	20000	When Service E is reset, it syncs to this value. If this parameter is set to **0**, no Service E warning is issued.
Number of Max. Hourly Starts	-	6	240	120	This parameter defines the maximum number of Motor starts (stopping and restarting) within 1 hour. If the compressor starts **Number of Max. Hourly Starts** times within 1 hour, **Wait 1 Hour Before Stopping** warning is given and the Motor will not be allowed to stop until 1 hour is up; it will continue running unloaded in case the pressure is sufficient.
Fan Running Temperature	°C	30	124	85	If the temperature measurement from the sender selected in **Temperature Sender for Fan Relay** parameter is higher than **Fan Running Temperature,** the fan relay closes; if the value is lower than (**Fan Running Temperature – Fan Stopping Temperature Difference**) the fan relay opens.
Fan Stopping Temperature Difference	°C	1	100	5	
Motor PTC Alarm Value	Ohm	0	12000	2000	If **Temperature Sender-2 Setting** parameter is set to "Motor PTC" and the resistance measurement from 2nd temperature sender input is higher than "Motor PTC Alarm Value", "Motor PTC High Temperature Alarm" is raised.
Pressure Loss Prevention Method	-	0	2	0	**0:** None (Standard Operation) **1:** Iteration method **2:** Curve lope method This parameter's function is described in section 14.6.
Slave Start Timer (Multi Mode)	Sec	1	65000	180	This parameter's function is described in section 14.10.
Master Switch Timer (Multi Mode)	Hours	1	999	100	This parameter's function is described in section 14.10.

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
Pressure Sender-2 Control Setting	-	0	2	0	**0:** Disabled **1:** Pressure Switch **2:** Pressure Sender
Pressure Sender-2 Upper Limit	bar	1.7	99.9	16.0	2nd pressure sender upper measurement limit must be entered here.
High Pressure-2 Alarm Limit	bar	1.2	99.4	8.8	If the measurement from 2nd pressure sender exceeds this value, an alarm is raised.
P1-P2 Pressure Difference Alarm Limit	bar	-10.0	10.0	0	If P1-P2 pressure difference is higher than **P1-P2 Pressure Difference Alarm Limit** for the duration of **Pressure Difference Alarm Delay**, **Sender-2 Pressure Difference Alarm** is raised.
Pressure Alarm Delay	Sec	1	600	2	This is the delay timer for high and low pressure alarms.
Pressure Sender-2 Offset Value	bar	-2.0	2.0	0	This offset parameter is added to the 2nd pressure measurement value.
Low Pressure-2 Alarm Limit	bar	0	98.9	0	If the 2nd pressure measurement value falls below this parameter while the compressor is running, an alarm is raised. The alarm condition is not checked while the compressor is not running.
Stop on Service Request	-	0	1	0	**0:** Only a warning is issued after service counter expires. **1:** The compressor stops as described in section 11.1 when service timer expires.
Variable Service Hours	-	0	1	0	**0:** Constant service counter coefficient **1:** Variable service counter coefficient Refer to section 14.5 for further detail.
Inverter PWM Setting	-	0	1	0	**0:** Inverter PWM signal disabled **1:** Inverter PWM signal enabled Refer to section 14.8 for further detail.
Inverter Set Pressure	bar	0.5	99.4	7.0	This is the target pressure while driving the inverter with 0-10V analog output. Refer to section 14.8 for further detail.
Inverter PID Gain (P) coefficient	%	0	99.9	3.0	Inverter PID control P coefficient.
Inverter PID Integrator (I) coefficient	%	0	99.9	0.4	Inverter PID control I coefficient.
Inverter PID Derivator (D) coefficient	%	0	99.9	5.0	Inverter PID control D coefficient.
Inverter PID Integrator (I2, inverse I) coefficient	%	0	99.9	0.4	Inverter PID control inverse I coefficient.
Inverter PID Start delay	Sec	1	99.9	10	Refer to section 14.8 for further detail.
Inverter PID Start Temperature	°C	0	250	0	Refer to section 14.8 for further detail.

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
Temperature Difference Alarm Delay	Sec	1	600	10	Delay timer for Temperature Difference Alarms.
Pressure Difference Alarm Delay	Sec	1	600	10	Delay timer for Pressure Difference Alarms.
Pressure and Temperature Alarms Latching	-	0	1	0	**0:** non-latching **1:** latching
Number of Max. Loaded Slaves	-	0	32	0	The function of this parameter is explained in section 14.10.
Dryer Timer	Min	0	120	30	Dryer relay function is activated simultaneously with MAIN relay function. However, the dryer relay remains active for this duration (**Dryer Timer**) after the MAIN relay is deactivated.
Minimum Loading Temperature	°C	-100	100	0	If the main temperature measurement is below the **Minimum Loading Temperature** parameter when the compressor starts, "**Low Temperature for Loading"** warning is issued and the compressor is not allowed to take the load until **Minimum Loading Temperature** is reached.
Preheating Active	-	0	1	0	**0**: pre-Heating function disabled **1:** pre-Heating function enabled
Preheating Unloaded Timer	Sec	1	6000	60	Preheating is activated if the main temperature measurement is below the **Minimum Loading Temperature** during first start and **Pre-Heating Active** parameter is set to **1**. The compressor will cycle between loaded/unloaded operation until **Minimum Loading Temperature** is reached. **Preheating Unloaded Timer** parameter adjusts the unloaded running duration in the cycle.
Preheating Stop Pressure	Bar	0	99.9	3.5	While the compressor is running under load in the heating cycle, if the 1st pressure measurement exceeds this value, the compressor switches to unloaded operation.
Preheating Loaded Timer	Sec	1	6000	180	This parameter adjusts the loaded running duration in the heating cycle.
Take Load Command Source	-	0	2	0	This parameter selects which source gives the command to start running under load. 0: Pressure Sender 1: Digital Input 2: Modbus Command

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
Loaded Water Drainage Timer	Sec	0	6500	5	The **Water Drainage relay** is active for this duration while the compressor is loaded.
Loaded Water Drainage Delay	Sec	0	6500	60	The **Water Drainage relay** is inactive for this duration while the compressor is loaded.
Unloaded Water Drainage Timer	Sec	0	6500	0	The **Water Drainage relay** is active for this duration while the compressor is unloaded.
Unloaded Water Drainage Delay	Sec	0	6500	600	The **Water Drainage relay** is inactive for this duration while the compressor is unloaded.
Temperature Sender for Heating Relay	-	0	1	0	This parameter selects the temperature sender for monitoring the heating relay. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2)
Heater Running Temperature	°C	-100	100	0	If the reading from the sender selected in **Temperature Sender for Heating Relay** is lower than **Heater Running Temperature**, the heater relay closes; if it is higher than (**Heater Running Temperature** + **Heater Stopping Temperature Difference**), the heater relay opens.
Heater Stopping Temperature Difference	°C	1	30	5	
Main Temperature Sender	-	0	1	0	This parameter selects the main temperature sender for compressor control. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2)
Main Pressure Sender	-	0	1	0	This parameter selects the main pressure sender for compressor control. 0: P1: Pressure Sender-1 1: P2: Pressure Sender-2
Upload T1 Sender Configuration	-	0	3	0	Use this parameter to select the 16-point resistance(ohm)-temperature(°C) curve to be uploaded as the configuration of the 1st sender. **0:** No Upload: Set to 0 if the curve of the 1st temperature sender will not be changed. **1:** KTY 13.5 R25=2K sender curve is uploaded. **2:** KTY R25=1K sender curve is uploaded. **3:** PT1000 sender curve is uploaded.
Upload T2 Sender Configuration	-	0	6	0	Use this parameter to select the 16-point resistance(ohm)-temperature(°C) curve to be uploaded as the configuration of the 2nd sender. **0:** No Upload: Set to 0 if the curve of the 2nd temperature sender will not be changed. **1:** KTY 13.5 R25=2K sender curve is uploaded. **2:** KTY R25=1K sender curve is uploaded. **3:** PT1000 sender curve is uploaded. **4:** NTC R25=10K B=3435K sender curve is uploaded. **5:** NTC R25=10K B=3760K sender curve is uploaded. **6:** NTC R25=10K B=3950K sender curve is uploaded.

13.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Default	Description
Reset All Service Counters	-	0	1	-	**0:** No effect **1:** Resets all service counters. The service counters are set to the related Service Hours (Timer) parameter. This parameter is not saved to memory; it is always read as 0.
Reset Service A Counter	-	0	1	-	**0:** No effect **1:** Resets Service A counter to **Service A Hours (Timer)**. This parameter is not saved to memory; it is always read as 0.
Reset Service B Counter	-	0	1	-	**0:** No effect **1:** Resets Service B counter to **Service B Hours (Timer)**. This parameter is not saved to memory; it is always read as 0.
Reset Service C Counter	-	0	1	-	**0:** No effect **1:** Resets Service C counter to **Service C Hours (Timer)**. This parameter is not saved to memory; it is always read as 0.
Reset Service D Counter	-	0	1	-	**0:** No effect **1:** Resets Service D counter to **Service D Hours (Timer)**. This parameter is not saved to memory; it is always read as 0.
Reset Service E Counter	-	0	1	-	**0:** No effect **1:** Resets Service E counter to **Service E Hours (Timer)**. This parameter is not saved to memory; it is always read as 0.
Reset Running Hours	-	0	1	-	**0:** No effect **1:** Resets the Running Hours counter. This parameter is not saved to memory; it is always read as 0.
Reset Loaded Hours	-	0	1	-	**0:** No effect **1:** Resets the Loaded Hours counter. This parameter is not saved to memory; it is always read as 0.
Reset Motor Start Counter	-	0	1	-	**0:** No effect **1:** Resets the Motor Start counter. This parameter is not saved to memory; it is always read as 0.

13.4. ADJUST DATE AND TIME
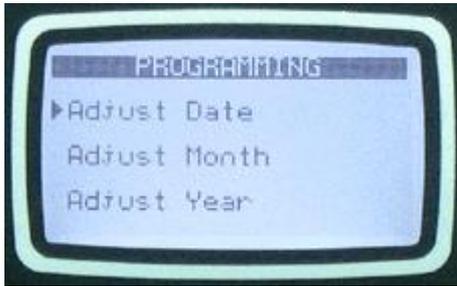
Date-time info is received from the battery supported real time clock in the controller.

Parameter Definition	Unit	Min	Max	Description
Day	-	01	31	Day of the month
Month	-	01	12	Month info
Year	-	00	99	Last 2 digits of the year
Hour	-	00	23	Hour of the day
Minute	-	00	59	Minute of the hour
Second	-	00	59	Second of the minute

13.5. WEEKLY OPERATION SCHEDULE

In some applications, it is desired that the compressor activates automatically only during office hours. The weekly schedule allows for these types of applications.

Using the weekly schedule, the controller can be set to automatically start and stop by hourly segments.

The weekly schedule has 7 days x 24 hours = 144 parameters. Each hour of the week can be selected as RUN or STOP mode on the controller.

In order for the compressor to start and stop automatically according to the weekly schedule, the **Weekly Schedule Active** parameter in the Controller Configuration Group must be set to 1.

If the *Weekly Schedule Active* parameter is set to 1, the compressor starts and stops automatically as set in the Weekly Schedule. When the compressor stops in this operation, "**STOPPED-Weekly Schedule**" warning is given; when the compressor starts in this operation, "**STARTED-Weekly Schedule**" warning is given.

If the **STOP** button is pressed while the compressor is running, or **START** button is pressed while the compressor is stopping according to the Weekly Schedule, "**Weekly Schedule Cancelled**" warning is shown, and *Weekly Schedule Active* parameter is automatically set to 0. The *Weekly Schedule Active* parameter must be set to 1 again if the compressor is desired to run according to the weekly schedule.

13.6. PRESSURE CALENDAR

16 different pressure calendar records can be set in the device. Starting day, hour, minute, duration, Start Pressure, and Stop Pressure can be set independently for each pressure calendar record. Start Pressure and Stop Pressure cannot be set higher than (**High Pressure-1 Alarm Limit** - 0.2) bar.

Thus, the compressor can run for the desired duration starting from the desired day and time using the desired Start Pressure and Stop Pressure.

To disable a pressure record, set the duration of the related Pressure Calendar Record to 0

Set the **Pressure Calendar Active** parameter in the Controller Configuration Group to 1 to operate the compressor according to the Pressure Calendar.

If the Start Pressure and Stop Pressure were changed according to a Pressure Calendar Record, "**SCHLD**" is written between the start pressure and stop pressure in the main pressure and temperature measurement screen.

If the Start Pressure and Stop Pressure are changed according to the Pressure Calendar Record, instead of the **Inverter Set Pressure** parameter, the average of the Start Pressure and Stop Pressure set in the Pressure Calendar is used as Set Pressure.

13.7. SENDER CONFIGURATION

The controller has 2 4-20mA pressure sender inputs and 2 analog temperature sender inputs. Each sender has a 16-point programmable curve.

One of the analog temperature senders' curve parameters are described below. The other analog temperature sender has identical parameters. Each temperature sender has the following parameters:

Parameter Definition	Unit	Min	Max	Factory Default	Description
Sender Curve-1 ohm	ohm	0	65535	1036	Point-1 ohm value
Sender Curve-1 temperature	°C	-32768	32767	-50	Point-1 temperature value
Sender Curve-2 ohm	ohm	0	65535	1369	Point-2 ohm value
Sender Curve-2 temperature	°C	-32768	32767	-20	Point-2 temperature value
Sender Curve-3 ohm	ohm	0	65535	1495	Point-3 ohm value
Sender Curve-3 temperature	°C	-32768	32767	-10	Point-3 temperature value
Sender Curve-4 ohm	ohm	0	65535	1630	Point-4 ohm value
Sender Curve-4 temperature	°C	-32768	32767	0	Point-4 temperature value
Sender Curve-5 ohm	ohm	0	65535	1772	Point-5 ohm value
Sender Curve-5 temperature	°C	-32768	32767	10	Point-5 temperature value
Sender Curve-6 ohm	ohm	0	65535	1922	Point-6 ohm value
Sender Curve-6 temperature	°C	-32768	32767	20	Point-6 temperature value
Sender Curve-7 ohm	ohm	0	65535	2080	Point-7 ohm value
Sender Curve-7 temperature	°C	-32768	32767	30	Point-7 temperature value
Sender Curve-8 ohm	ohm	0	65535	2245	Point-8 ohm value
Sender Curve-8 temperature	°C	-32768	32767	40	Point-8 temperature value
Sender Curve-9 ohm	ohm	0	65535	2418	Point-9 ohm value
Sender Curve-9 temperature	°C	-32768	32767	50	Point-9 temperature value
Sender Curve-10 ohm	ohm	0	65535	2599	Point-10 ohm value
Sender Curve-10 temperature	°C	-32768	32767	60	Point-10 temperature value
Sender Curve-11 ohm	ohm	0	65535	2788	Point-11 ohm value
Sender Curve-11 temperature	°C	-32768	32767	70	Point-11 temperature value
Sender Curve-12 ohm	ohm	0	65535	2984	Point-12 ohm value
Sender Curve-12 temperature	°C	-32768	32767	80	Point-12 temperature value
Sender Curve-13 ohm	ohm	0	65535	3188	Point-13 ohm value
Sender Curve-13 temperature	°C	-32768	32767	90	Point-13 temperature value
Sender Curve-14 ohm	ohm	0	65535	3400	Point-14 ohm value
Sender Curve-14 temperature	°C	-32768	32767	100	Point-14 temperature value
Sender Curve-15 ohm	ohm	0	65535	3847	Point-15 ohm value
Sender Curve-15 temperature	°C	-32768	32767	120	Point-15 temperature value
Sender Curve-16 ohm	ohm	0	65535	4576	Point-16 ohm value
Sender Curve-16 temperature	°C	-32768	32767	150	Point-16 temperature value

One of the 4-20mA pressure senders' curve parameters are described below. The other pressure sender has identical parameters. Each pressure sender has the following parameters:

Parameter Definition	Unit	Min	Max	Factory Default	Description
Sender Curve-1 mA	mA	0	512.0	4.0	Point-1 mA value
Sender Curve-1 pressure	bar	0	3000.0	0	Point-1 pressure value
Sender Curve-2 mA	mA	0	512.0	5.0	Point-2 mA value
Sender Curve-2 pressure	bar	0	3000.0	1.0	Point-2 pressure value
Sender Curve-3 mA	mA	0	512.0	6.0	Point-3 mA value
Sender Curve-3 pressure	bar	0	3000.0	2.0	Point-3 pressure value
Sender Curve-4 mA	mA	0	512.0	7.0	Point-4 mA value
Sender Curve-4 pressure	bar	0	3000.0	3.0	Point-4 pressure value
Sender Curve-5 mA	mA	0	512.0	8.0	Point-5 mA value
Sender Curve-5 pressure	bar	0	3000.0	4.0	Point-5 pressure value
Sender Curve-6 mA	mA	0	512.0	9.0	Point-6 mA value
Sender Curve-6 pressure	bar	0	3000.0	5.0	Point-6 pressure value
Sender Curve-7 mA	mA	0	512.0	10.0	Point-7 mA value
Sender Curve-7 pressure	bar	0	3000.0	6.0	Point-7 pressure value
Sender Curve-8 mA	mA	0	512.0	11.0	Point-8 mA value
Sender Curve-8 pressure	bar	0	3000.0	7.0	Point-8 pressure value
Sender Curve-9 mA	mA	0	512.0	12.0	Point-9 mA value
Sender Curve-9 pressure	bar	0	3000.0	8.0	Point-9 pressure value
Sender Curve-10 mA	mA	0	512.0	13.0	Point-10 mA value
Sender Curve-10 pressure	bar	0	3000.0	9.0	Point-10 pressure value
Sender Curve-11 mA	mA	0	512.0	14.0	Point-11 mA value
Sender Curve-11 pressure	bar	0	3000.0	10.0	Point-11 pressure value
Sender Curve-12 mA	mA	0	512.0	15.0	Point-12 mA value
Sender Curve-12 pressure	bar	0	3000.0	11.0	Point-12 pressure value
Sender Curve-13 mA	mA	0	512.0	16.0	Point-13 mA value
Sender Curve-13 pressure	bar	0	3000.0	12.0	Point-13 pressure value
Sender Curve-14 mA	mA	0	512.0	17.0	Point-14 mA value
Sender Curve-14 pressure	bar	0	3000.0	13.0	Point-14 pressure value
Sender Curve-15 mA	mA	0	512.0	18.0	Point-15 mA value
Sender Curve-15 pressure	bar	0	3000.0	14.0	Point-15 pressure value
Sender Curve-16 mA	mA	0	512.0	20.0	Point-16 mA value
Sender Curve-16 pressure	bar	0	3000.0	16.0	Point-16 pressure value

13.8. INPUT CONFIGURATION

The controller has 4 digital inputs.

One of the digital inputs' parameters are described below. The other digital inputs have identical parameters.

The name of the input function can be entered using the RainbowPlus software from the **USER INPUT TAGS** parameter group. If the input function for digital input-X is chosen as "User Function-X", the configured User Input Tag will be shown when warnings or alarms regarding this input occur. Thus, the digital inputs can be used for any function.

Each digital input has the following programmable parameters:

Parameter Definition	Unit	Min	Max	Factory Default	Description
Input Function	-	0	99		Predefined input functions are selected. If this parameter is set to 1, 2, 3, or 4, input function name can be entered as desired. The input function list is given in the next table.
Action (ACT)	-	0	3		0: alarm 1: alarm **2:** warning **3:** no action
Sampling (SMP)	-	0	3		**0:** always **1:** If motor running (loaded or unloaded) **2:** If motor running under load **3:** If the load relay is not closed
Latching (LAT)	-	0	1		**0:** no latching. The error message is deleted once the alarm cause is removed. **1:** latching. The error message remains until reset from the controller even if the alarm cause is removed.
Contact Type	-	0	1		**0:** Normally open **1:** Normally closed
Delay Timer Factor (DLU)	-	0	1		**0:** Delay timer is taken as is **1:** Delay timer is multiplied by 2
Delay Timer (DLY)	-	0	3		**0:** No delay **1:** Delay (1sec) **2:** Delay (5sec) **3:** Delay (50sec)

INPUT FUNCTION LIST

#	Description	#	Description	#	Description
1	User Function-1	8	User Function-8	15	Waiting for Input (Drive)
2	User Function-2	9	Alarm Mute	16	Waiting for Separator Pressure
3	User Function-3	10	Panel Lock	17	Take Load Command
4	User Function-4	11	Emergency Stop	18	Main Relay Auxiliary Contact Input
5	User Function-5	12	Remote Start/Stop	19	Fan Relay Auxiliary Contact Input
6	User Function-6	13	Air Filter Blocked	20	Not used
7	User Function-7	14	Motor Overload Alarm		

13.9. DIGITAL OUTPUT (RELAY) CONFIGURATION

The following parameters define the functions of the controller's programmable digital outputs (relays). The controller offers 5 programmable digital outputs (relays).

Parameter Definition	Factory Default	Terminal number	Description
Relay-01	55	15	Factory default Compressor Main Relay output
Relay-02	56	14	Factory default Compressor Delta Relay output
Relay-03	57	13	Factory default Compressor Star Relay output
Relay-04	58	12	Factory default Compressor Load Relay output
Relay-05	1	11	Factory default Horn

OUTPUT FUNCTION LIST

No	Description
1	Horn
2	Phase order fault alarm
3	Alarm
4	Warning
5	Low voltage alarm
6	High voltage alarm
7	Voltage alarm
8	Low frequency alarm
9	High frequency alarm
10	Frequency alarm
11	Voltage unbalance alarm
12	MPTC High Temperature
13	High Temperature Snd-1
14	Low Temperature Snd-1
15	High Temperature Snd-2
16	Low Temperature Snd-2
17	Temp. Difference Alarm Snd-2
18	High Pressure Snd-1
19	High Pressure Snd-2
20	Pressure Diff. Alarm Snd-2
21	Low Pressure Snd-2
22	Temperature Alarm Snd-1
23	Temperature Alarm Snd-2
24	Pressure Alarm Snd-1
25	Pressure Alarm Snd-2
26	Temperature Sender Fault
27	Pressure Sender Fault
28	High Temperature Alarm
29	Low Temperature Alarm
30	High Pressure Alarm
31	Temperature Alarm
32	Pressure Alarm
33	User input alarm-1
34	User input alarm-2
35	User input alarm-3
36	User input alarm-4
37	User input alarm-5

No	Description
38	User input alarm-6
39	User input alarm-7
40	User input alarm-8
41	Up Arrow button simulation
42	Down Arrow button simulation
43	Menu button simulation
44	RUN button simulation
45	STOP button simulation
46	Input 1 simulation
47	Input 2 simulation
48	Input 3 simulation
49	Input 4 simulation
50	User output 1
51	User output 2
52	User output 3
53	User output 4
54	User output 5
55	Compressor MAIN Relay
56	Compressor DELTA Relay
57	Compressor STAR Relay
58	Compressor LOAD Relay
59	FAN
60	Flasher relay
61	Main Pressure Normal : Relay Function active if Main pressure measurement value is between Start pressure and Stop Pressure.
62	DRYER
63	High Temperature Warning
64	Service Warning
65	Wait 1 Hour Before Stop. Error
66	Multiple Operation Communication Failure
67	Water Drainage
68	HEATER
69	NOT USED

13.10. SITE ID STRING

Site ID String can be used to distinguish the compressor on which the controller is installed.

A line of up to 20 characters can be entered here.

13.11. ENGINE SERIAL NUMBER

Motor serial number can be used to distinguish the compressor on which the device is installed.

13.12. USER INPUT TAGS

A tag line can be entered for each of the 4 digital input user function using the RainbowPlus software. When a digital input related alarm or warning occurs, the tag line entered here is displayed as the description for the alarm or warning.

14. SOFTWARE FEATURES

14.1. REMOTE START

The device can be programmed to switch to RUN mode when an external Remote Start signal is given, and switch to STOP mode when the signal is turned off.

Any digital input can be defined as the **Remote Start/Stop** signal. This can be done in the **Input Configuration** program menu.

14.2. SINGLE PHASE OPERATION

If the device is intended for single phase mains grid, it should be specified in the order and the topology must be **1 Phase**.

When topology is set to **1 Phase**, the controller measures the AC electrical parameters only from the **L1** phase.

In the same way, voltage protection is only done on the L1 phase.

L2 and **L3** phas measurements are not shown on screen.

14.3. EXTERNALLY CONTROLLED DIGITAL OUTPUTS

The controller has remote controllable digital output functions. In order to use this feature, one of the "User Function X" functions must be selected for digital outputs.

These functions have no effect on device operation.

Remote control of these outputs can be done via RS-485 or USB Modbus.

14.4. RESETTING THE CONTROLLER

If necessary, the device can be manually reset by holding the STOP button for 15 seconds.

Manual reset causes the device to be reprogrammed.

14.5. VARIABLE SERVICE HOURS SELECTION

The controller offers the option to calculate the service hours using a variable coefficient determined by the main temperature measurement.

Variable coefficient use can be selected from **Variable Service Hours** parameter. If this parameter is not active, the service counters are calculated with constant coefficient 1.00 and independently of main temperature measurement.

When variable coefficient calculation method is activated (**Variable Service Hours** parameter is set to 1):

During loaded operation,

Up to 90 °C, coefficient is 1

Between 90-95 °C, coefficient is 1.5

Between 95-100 °C, coefficient is 2

Above 100 °C, coefficient is 3

During unloaded operation,

Up to 90 °C, coefficient is 0.5

Between 90-95 °C, coefficient is 0.75

Between 95-100 °C, coefficient is 1

Above 100 °C, coefficient is 1.5

> **These coefficients are valid for all service counters.**

14.6. PREVENTING PRESSURE LOSS

If the main pressure measurement is higher than **Start Pressure** for the duration of **Unload Timer**, the controller stops the motor. If the main pressure measurement decreases below **Start Pressure** while the motor is not running, the motor is restarted.

The compressor will take the load after a total delay of **Star Timer** + **Star -> Delta Transition Timer** + **Before Loading Timer** + **Delay Between Relays x3**.

During this period, the pressure value might have decreased well below the **Start Pressure.**

However, in many systems, it is desired that the pressure value never drops below **Start Pressure.**

The controller offers 3 different methods to prevent this and the method is selected via the **Pressure Loss Prevention Method** parameter. The controller calculates the pressure value at which the motor will restart (**Pi, Restart Pressure**) dynamically.

Pressure Loss Prevention Method = 0 (None) → No extra precaution for pressure loss is taken.

Pi = Start Pressure always.

Pressure Loss Prevention Method = 1 (iteration method) → For each time the system takes load, if the pressure measurement is below **Start Pressure**, **Pi Restart Pressure** is increased by 0.1 bar. If the pressure measurement is higher than **Start Pressure**, **Pi Restart Pressure** is decreased by 0.1 bar. Thus, the pressure value when the system goes under load again is kept equal to the **Start Pressure**.

Pressure Loss Prevention Method = 2 (curve slope method) → The system calculates the **Pi Restart Pressure** from the first 8 seconds of the pressure loss curve after reaching **Stop Pressure** for each cycle.

> ⚠️ **After the Unload Timer expires, if the main pressure is higher than Start Pressure but lower than Pi Restart Pressure, the controller maintains unloaded operation.**

14.7. VARIABLE UNLOAD TIMER

This feature is designed to prevent energy consumption by excessive unloaded operation in low air demand situations.

When the main pressure value reaches the set pressure, the LOAD relay disengages first, then the motor keeps running for **Safety Timer** or **Unload Timer** (whichever is longer), and finally stops.

If the **Variable Unload Timer** parameter is set to **1**, and the motor has been stopping for more than **Unload Timer**, the controller decides that the motor has been running unloaded for too long and decreases the Unload Timer by 1 minute at the end of the next running cycle. This timer cannot drop below 2 minutes with this parameter.

If the compressor is restarted by pressing the STOP button and then the START button, the **Unload Timer** takes the newly adjusted value.

14.8. PID CONTROL AND ANALOG OUTPUT (PWM)

If the device is not in STOP mode and **Inverter PWM Setting** parameter is set to 1, the PID controlled 0-10V analog output is activated for inverter control.

0-10V analog output will control the speed of the main motor in order to reach and maintain the set pressure adjusted by the **Inverter Set Pressure** parameter. This control is provided by varying the analog output voltage between 0-10V. Before starting the PID control of the motor, the controller will wait for the compressor to heat up. When the temperature measurement from the main temperature sender exceeds the temperature value set by the **Motor PID Start Temperature** parameter, the controller decides to generate the analog signal. After **Motor PID Start Delay** timer is up, the controller starts generating the analog signal to drive the main motor.

Motor PID control coefficients can be adjusted from **Motor PID P coefficient, Motor PID Integrator (I) coefficient, Motor PID Derivator (D) coefficient** and **Motor PID Integrator (I2, inverse I) coefficient** parameters.

If the Pressure Calendar is enabled and the Start and Stop Pressures are changed according to a Pressure Calendar record, instead of the **Inverter Set Pressure**, the average of the Start Pressure and Stop Pressure in the Pressure Calendar record is used.

14.9. MOTOR PTC INPUT

A Motor PTC (thermal motor) sender can be connected to the controller instead of a second temperature sender. If a motor PTC sender has been connected to the 2nd temperature sender input, **Temperature Sender-2 Setting** parameter must be set as "Motor PTC".

In this case, if the motor overheats and causes the Motor PTC sender's resistance measurement to exceed the **Motor PTC Alarm Limit** parameter, **Motor PTC High Temperature** alarm is raised.

14.10. MULTIPLE COMPRESSOR OPERATION

Multiple operation mode is designed for situations which require parallel operation of many compressors.

Multiple operation mode prevents excessive energy consumption by operating only the required number of compressors in low air demand and enables equal aging among compressors.

At most 32 compressors may operate in this mode.

The controller enables multiple operation via its RS-485 port. The controllers are connected to each other on the common **RS-485** communication line.

Multiple operation mode is started by setting one of the devices' **Modbus Address** parameter to **1.**

The devices included in multiple operation must be given **adjacent addresses**. No number should be skipped.

> ⚠ **Devices which have been skipped or given non-adjacent addresses will not be included in the multiple operation group and will work independently.**

Operation of the System:

1. If communication between the devices is disrupted, all of the devices continue running independently.

2. The youngest of the devices becomes the master and operates non-stop for **Stop Pressure and Start Pressure**. Other devices activate and deactivate according to their **Motor hours** (aging value).

3. If any of the devices become younger than the master controller by **Master Change Delay**, it becomes the new master.

4. If an alarm occurs in the master controller, another device becomes the master.

5. When the output pressure drops below **Start Pressure**, the master activates immediately; while the pressure is below **Start Pressure**, the other devices activate one by one after each waiting for **Slave Start Timer/16** in order of increasing age.

6. When the output pressure is higher than **Start Pressure**, but lower than **(Stop Pressure + Start Pressure)/2**, every device except the master will activate one by one after each waiting for **Slave Start Timer /4**.

7. As the output pressure approaches **Stop Pressure**, every device except the master will deactivate one by one in order of decreasing age.

8. The number of slave devices operating under load simultaneously cannot be greater than **Max. Number of Loaded Slaves**. If the number of slave controllers under load is greater than the **Max. Number of Loaded Slaves** parameter, the devices with the lower priority unload immediately until the number of slave controllers under load equalizes to **Max. Number of Loaded Slaves**. If **Max. Number of Loaded Slaves** parameter is set to 0, this condition is not checked.

15. MODBUS COMMUNICATION

The controller offers MODBUS in the following ways:
        -RS485 serial port, adjustable data transmission rate between 2400 and 115200 baud

The controller's MODBUS features:
    -Data transfer mode: RTU
    -Serial data: adjustable baud rate, 8 bit data, no parity, 1 bit stop
    -Supported functionalities:
        -Function 3 (multiple record reading)
        -Function 6 (single record writing)
        -Function 16 (multiple record writing)

Each register is made up of 2bytes (16 bits). Larger data structures are provided using multiple registers.

Each device in the Modbus communication network must have a distinct Modbus address. The controller supports addresses from 1 to 254.

> ⚠ **Each device in the RS-485 serial network must have a different address. Otherwise, modbus communication will not be possible.**

15.1. REQUIRED PARAMETERS FOR RS-485 MODBUS OPERATION

Modbus Address: Select a value between 1 and 254.
RS-485 Communication Rate: Adjustable between 2400 and 115200 bauds. Each device in the network must have the same communication rate.

Increasing the data transmission rate provides faster communication; however, communication range decreases. Decreasing the data transmission rate provides higher communication range at the cost of communication speed.

At 9600 baud rate, using a 120-ohm balanced cable provides 1200m communication range.

15.2. DATA FORMATS

16 bit variables: These variables are stored in a single log. Bit_0 is the least significant bit (LSB) and Bit_15 is the most significant bit (MSB).

32 bit variables: These variables are stored in 2 ordered logs. The most significant 16 bits are in the first log and least significant 16 bits are in the second log.

Bit fields: Fields larger than 16 bits are stored in multiple logs. The least significant bit of the first log is Bit_0. The most significant bit of the first log is Bit_15. The least significant bit of the second log is Bit_16. The most significant bit of the second log is Bit_31. This pattern continues as is.

The records which can be read through Modbus are listed below.

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
10240	R	32bit	x10	Phase L1 voltage
10242	R	32bit	x10	Phase L2 voltage
10244	R	32bit	x10	Phase L3 voltage
10246	R	32bit	x10	Phase L1-L2 voltage
10248	R	32bit	x10	Phase L2-L3 voltage
10250	R	32bit	x10	Phase L3-L1 voltage
10252	R	16bit	x100	Frequency
10253	R	16bit	-	Reserved
10254	R	16bit	x10	Voltage unbalance (%)
10255	R	32bit	x10	Average voltage
10257	R	16bit		Digital input status bits. Bit definitions are given at the end of the table.
10258	R	16bit		Digital output (relay) status bits. Bit definitions are given at the end of the table.
10259	R	16bit	-	Reserved
10260	R	16bit	x10	0-10V analog output percentage of maximum (%)
10261-10264	R	64bit	-	Alarm status bits. Bit definitions are given at the end of the table.
10265	R	16bit	-	Digital input alarm bits. Bit definitions are given at the end of the table.
10266-10269	R	64bit	-	Warning status bits. Bit definitions are given at the end of the table.
10270-10277	R	128bit	-	Relay (digital output) function status bits. Bit definitions are given at the end of the table.
10278	R	16bit	-	Reserved
10279	R	16bit	-	Motor Status **0:** Motor in stop mode **1:** Star relay engaged **2:** Motor running unloaded before loading **3:** Motor running loaded **4:** Motor running unloaded after loading **5:** Motor stopping
10280	R	16bit	x1	Analog sender-1 temperature value (T1)
10281	R	16bit	x1	Analog sender-2 temperature value (T2)
10282	R	16bit	x10	Pressure sender-1 pressure value (P1)
10283	R	16bit	x10	Pressure sender-2 pressure value (P2)
10284	R	16bit	x1	T1-T2 Temperature difference value
10285	R	16bit	x10	P1-P2 Pressure difference value
10286-10288	R	16bit x3	-	Reserved
10289	R	32bit	x10	Running hours
10291	R	32bit	x10	Loaded running hours
10293	R	32bit	x10	Hours remaining to Service A
10295	R	32bit	x10	Hours remaining to Service B
10297	R	32bit	x10	Hours remaining to Service C
10299	R	32bit	x10	Hours remaining to Service D
10301	R	32bit	x10	Hours remaining to Service E
10303	R	32bit	x1	Motor Start counter
10305	R	16bit	-	Reserved
10306	R	16bit	x1	Modbus address
10307-10370	R	32bit x32	x10	Running hours counters of devices in multiple operation group

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
10371	R	32bit	-	Reserved
10373	R	16bit	x1	Number of devices running under load in the multiple operation group
10374	R	16bit	x1	Total number of devices in the multiple operation group
10375	R	16bit	x1	Address of the master device in the multiple operation group
10376	R	16bit	-	Reserved
10477	R	16bit	-	Connection Topology **0:** 3 phase **1:** 1 phase **2:** 2 phase
10378	R	16bit	-	Reserved
10379	R	16bit	x1	Device ID number
10380	R	16bit	x1	Device hardware version
10381	R	16bit	x1	Device firmware version
10382-10385	R	16bit x4	-	Reserved
10386-10391	R	16bit x6	x1	Device Unique ID
10392	R	16bit	-	Reserved
10393-10904	R	16bit x512	-	Graphical LCD screen memory

DIGITAL INPUT STATUS BITS			
BIT	**DESCRIPTION**	**BIT**	**DESCRIPTION**
0	Digital input-1 status	8	-
1	Digital input-2 status	9	-
2	Digital input-3 status	10	-
3	Digital input-4 status	11	-
4	-	12	-
5	-	13	-
6	-	14	-
7	-	15	-

DIGITAL OUTPUT (RELAY) STATUS BITS			
BIT	**DESCRIPTION**	**BIT**	**DESCRIPTION**
0	Digital output-1 status	8	-
1	Digital output-2 status	9	-
2	Digital output-3 status	10	-
3	Digital output-4 status	11	-
4	Digital output-5 status	12	-
5	-	13	-
6	-	14	-
7	-	15	-

ALARM STATUS BITS			
BIT	**DESCRIPTION**	**BIT**	**DESCRIPTION**
0	High Voltage Alarm	14	Pressure Sender-1 Fault
1	Low Voltage Alarm	15	High Pressure Sender-1 Alarm
2	High Frequency Alarm	16	Pressure Sender-2 Fault
3	Low Frequency Alarm	17	High Pressure Sender-2 Alarm
4	Voltage Unbalance Alarm	18	Sender-2 Pressure Difference Alarm
5	Phase Order Fault Alarm	19	Low Pressure Sender-2 Alarm
6	Motor PTC High Temperature Alarm	20	Emergency Stop Alarm
7	Temperature Sender-1 Fault Alarm	21	Motor Overload Alarm
8	High Temperature Sender-1 Alarm	22	Main Contactor Fail to Close Alarm
9	Low Temperature Sender-1 Alarm	23	Main Contactor Fail to Open Alarm
10	Temperature Sender-2 Fault Alarm	24	Fan Contactor Fail to Close Alarm
11	High Temperature Sender-2 Alarm	25	Fan Contactor Fail to Open Alarm
12	Low Temperature Sender-2 Alarm	26-63	Reserved
13	Sender-2 Temperature Difference Alarm		

WARNING STATUS BITS			
BIT	**DESCRIPTION**	**BIT**	**DESCRIPTION**
0	Digital input-1 warning	16	Service B Timer Warning
1	Digital input-2 warning	17	Service C Timer Warning
2	Digital input-3 warning	18	Service D Timer Warning
3	Digital input-4 warning	19	Service E Timer Warning
4	Digital input-5 warning	20	Remote Start Warning
5	Digital input-6 warning	21	Remote Stop Warning
6	Digital input-7 warning	22	Power Loss / Restart Warning
7	Digital input-8 warning	23	STOPPED – Weekly Schedule Warning
8	High Temperature-1 Warning	24	STARTED – Weekly Schedule Warning
9	High Temperature-2 Warning	25	Weekly Schedule Cancelled Warning
10	Wait 1 Hour Before Stopping Warning	26	Low Temperature for Loading Warning
11	Air Filter Blocked Warning	27	Digital Input Take Load Command Warning
12	Waiting for Separator Pressure Warning	28	Digital Input Unload Command Warning
13	Waiting for Input (Drive) Warning	29	Modbus Take Load Command Warning
14	Multi. Op. Communication Error Warning	30	Modbus Unload Command Warning
15	Service A Timer Warning	31-63	Reserved

RELAY (DIGITAL OUTPUT) FUNCTION STATUS BITS					
BIT	DESCRIPTION	BIT	DESCRIPTION	BIT	DESCRIPTION
0	Horn	23	Pressure Alarm Sender-1	46	Input 2 Simulation
1	Phase Order Fault Alarm	24	Pressure Alarm Sender-2	47	Input 3 Simulation
2	Alarm	25	Temperature Sender Error	48	Input 4 Simulation
3	Warning	26	Pressure Sender Error	49	User Output 1
4	Low Voltage Alarm	27	High Temperature Alarm	50	User Output 2
5	High Voltage Alarm	28	Low Temperature Alarm	51	User Output 3
6	Voltage Alarm	29	High Pressure Alarm	52	User Output 4
7	Low Frequency Alarm	30	Temperature Alarm	53	User Output 5
8	High Frequency Alarm	31	Pressure Alarm	54	Compressor MAIN Relay
9	Frequency Alarm	32	User Input Alarm-1	55	Compressor DELTA Relay
10	Voltage Unbalance Alarm	33	User Input Alarm-2	56	Compressor STAR Relay
11	MPTC High Temperature	34	User Input Alarm-3	57	Compressor LOAD Relay
12	High Temperature Snd-1	35	User Input Alarm-4	57	FAN
13	Low Temperature Snd-1	36	User Input Alarm-5	59	Flasher Relay
14	High Temperature Snd-2	37	User input alarm-6	60	Main Pressure Normal: Relay function active while main pressure measurement is between Start Pressure and Stop Pressure.
15	Low Temperature Snd-2	38	User input alarm-7	61	DRYER
16	Temperature Difference Alarm Snd-2	39	User input alarm-8	62	High Temperature Warning
17	High Pressure Alarm Snd-1	40	Arrow Up button simulation	63	Service Warning
18	High Pressure Alarm Snd-2	41	Arrow Down button simulation	64	Wait 1 Hour Before Stopping Error
19	Pressure Difference Alarm Snd-2	42	Menu button simulation	65	Multi. Op. Communication Error
20	Low Pressure Alarm Snd-2	43	RUN button simulation	66	Water Drainage
21	Temperature Alarm Snd-1	44	STOP button simulation	67	HEATER
22	Temperature Alarm Snd-2	45	Input 1 simulation	68-127	Reserved

DIGITAL INPUT ALARM BITS			
BIT	DESCRIPTION	BIT	DESCRIPTION
0	Digital input-1 alarm	4	Digital input-5 alarm
1	Digital input-2 alarm	5	Digital input-6 alarm
2	Digital input-3 alarm	6	Digital input-7 alarm
3	Digital input-4 alarm	7	Digital input-8 alarm

15.3. COMMANDS

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
8192	W	16bit	x1	Password (In order to change the calibration coefficients through Modbus, the calibration password must be entered to this address.)
8193	W	16bit	x1	Button simulation. If the following Hexadecimal numbers are entered here, the device will respond as if the corresponding buttons have been pressed. 0x8001: Stop very long press 0x8010: Run very long press 0x8080: Menu very long press 0x8200: Up very long press 0x8400: Down very long press 0x4001: Stop long press 0x4010: Run long press 0x4080: Menu long press 0x4200: Up long press 0x4400: Down long press 0x1001: Stop short press 0x1010: Run short press 0x1080: Menu short press 0x1200: Up short press 0x1400: Down short press
8194	W	16bit	x1	Reserved
8195	W	16bit	x1	Reset to Factory Defaults. If the decimal 43690 is typed into this address, the controller will be reset to factory defaults. Service counters reset, but other counters do not reset.
8196	W	16bit	x1	Reset the counters. If the following decimals are entered into this address, the corresponding counters are reset. 1: Running hours counters is reset. 2: Loaded running hours counters is reset. 4: Motor start counter is reset.
8197	W	16bit	x1	Reset service timers. If the following decimals are entered into this address, the corresponding service timers are reset. 1: Reset all service timers. 2: Reset service A timer. 4: Reset service B timer. 8: Reset service C timer. 16: Reset service D timer. 32: Reset service E timer.
8198	W	16bit	x1	The value typed into this address is added to the running hours counter.
8199	W	16bit	x1	The value typed into this address is subtracted from the running hours counter.
8200	W	16bit	x1	The value typed into this address is added to the loaded running hours counter.
8201	W	16bit	x1	The value typed into this address is subtracted from the loaded running hours counter.
8202	W	16bit	x1	The value typed into this address is added to the number of Motor starts counter.
8203	W	16bit	x1	The value typed into this address is subtracted from the number of Motor starts counter.

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
8204	W	16bit	x1	The value typed into this address is added to Service A hours.
8205	W	16bit	x1	The value typed into this address is subtracted from Service A hours.
8206	W	16bit	x1	The value typed into this address is added to Service B hours.
8207	W	16bit	x1	The value typed into this address is subtracted from Service B hours.
8208	W	16bit	x1	The value typed into this address is added to Service C hours.
8209	W	16bit	x1	The value typed into this address is subtracted from Service C hours.
8210	W	16bit	x1	The value typed into this address is added to Service D hours.
8211	W	16bit	x1	The value typed into this address is subtracted from Service D hours.
8212	W	16bit	x1	The value typed into this address is added to Service E hours.
8213	W	16bit	x1	The value typed into this address is subtracted from Service E hours.
8214	W	16bit	x1	Write to Flash.
8215	W	16bit	x1	Read event log. The controller's event log memory is made up of 400 events, 64 bytes each. Event records memory structure is given in section 15.4. The block number to read from memory must be typed into the address number 8215. Then, the relevant records can be read from address numbers 2048 to 2559. When the following values are typed into address 8215, the corresponding event records can be read. 0: 0. Block: 1.-16. Event records 1: 1. Block: 17.-32. Event records 2: 2. Block: 33.-48. Event records 3: 3. Block: 49.-64. Event records 4: 4. Block: 65.-80. Event records 5: 5. Block: 81.-96. Event records 6: 6. Block: 97.-112. Event records 7: 7. Block: 113.-128. Event records 8: 8. Block: 129.-144. Event records 9: 9. Block: 145.-160. Event records 10: 10. Block: 161.-176. Event records 11: 11. Block: 177.-192. Event records 12: 12. Block: 193.-208. Event records 13: 13. Block: 209.-224. Event records 14: 14. Block: 225.-240. Event records 15: 15. Block: 241.-256. Event records 16: 16. Block: 257.-272. Event records 17: 17. Block: 273.-288. Event records 18: 18. Block: 289.-304. Event records 19: 19. Block: 305.-320. Event records 20: 20. Block: 321.-336. Event records 21: 21. Block: 337.-352. Event records 22: 22. Block: 353.-368. Event records 23: 23. Block: 369.-384. Event records 24: 24. Block: 385.-400. Event records

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
8216	W	16bit	x1	The controller enters boot mode
8217	W	16bit	x1	The value typed into this address controls the user outputs. To activate user output 1 relay function, type 0x0001 (1); to deactivate, type 0x8001 (32769). To activate user output 2 relay function, type 0x0002 (2); to deactivate, type 0x8002 (32770). To activate user output 3 relay function, type 0x0003 (3); to deactivate, type 0x8003 (32771). To activate user output 4 relay function, type 0x0004 (4); to deactivate, type 0x8004 (32772). To activate user output 5 relay function, type 0x0005 (5); to deactivate, type 0x8005 (32773).
8218	W	16bit	x1	If the decimal 16 is typed into this address, all warnings and alarms are reset.
8219	W	16bit	x1	Restart the controller. If the decimal 14536 is typed into this address, the controller restarts.
8220	W	16bit	x1	Reserved
8221	W	16bit	x1	Reserved
8222	W	16bit	x1	If the **Take Load Command Source** parameter is set to **"2 (Modbus Command)"**, to issue the "*Take Load*" command to the compressor, type the decimal 170 to this address. To issue the "*Unload*" command, type the decimal 10.

15.4. EVENT LOGS MEMORY STRUCTURE

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
+0 +1	R	32bit	x1	32 bit date time information Bit_0..4: seconds/2 (0-29) Bit_5..10: minute (0-59) Bit_11..15: hour (0-23) Bit_16..20: day (1-31) Bit_21..24: month (1-12) Bit_25..31: year-2000 (0..127=2000..2127)
+2	R	16bit	x1	Record type
+3_BOT	R	8bit	x1	Digital input status bits
+3_TOP	R	8bit	x1	Digital output (relay) status bits
+4	R	16bit	x1	Reserved
+5 +6	R	32bit	x1	Alarm status bits
+7 +8	R	32bit	x1	Warning status bits
+9	R	16bit	x1	Digital Input Alarms status bits
+10	R	16bit	x10	Phase L1 voltage
+11	R	16bit	x10	Phase L2 voltage
+12	R	16bit	x10	Phase L3 voltage
+13	R	16bit	x10	L1-L2 voltage
+14	R	16bit	x10	L2-L3 voltage
+15	R	16bit	x10	L3-L1 voltage
+16	R	16bit	x100	Frequency
+17	R	16bit	x10	Average voltage
+18	R	16bit	x10	Sender-1 pressure value
+19	R	16bit	x10	Sender-2 pressure value
+20	R	16bit	x1	Analog sender-1 temperature value
+21	R	16bit	x1	Analog sender-2 temperature value
+22 +23	R	32bit	x10	Running hours counter
+24 +25	R	32bit	x10	Loaded running hours counter
+26	R	16bit	x10	Loaded running hours / total running hours percentage (%)
+27 +28	R	32bit	x1	Number of Motor Starts counter
+29	R	16bit	x1	Number of Motor Starts within the last hour counter
+30	R	16bit	x1	Reserved
+31_ALT	R	8bit	x1	Motor status **0:** Motor in Stop mode **1:** Star relay engaged **2:** Motor running off-load before loading **3:** Motor running on-load **4:** Motor running off-loaded after loading **5:** Motor stopping
+31_UST	R	8bit	x1	Reserved

15.5. REAL TIME CLOCK

ADDRESS (decimal)	Read Write	Size	Coefficient	Description
5120	R	16bit	x1	Year (0-4096)
5121	R	16bit	x1	Month (1-12)
5122	R	16bit	x1	Day (1-31)
5124	R	16bit	x1	Hour (0-23)
5125	R	16bit	x1	Minute (0-59)
5126	R	16bit	x1	Second (0-59)

16. DECLARATION OF CONFORMITY

The unit conforms to the following EU directives:
-   -2014/35/EC (Low Voltage Directive)
-   -2014/30/EC (Electromagnetic Compatibility)

Norms of Reference:
-   EN 61010 (safety requirements)
-   EN 61326 (EMC requirements)

The CE mark indicates that this product complies with the European requirements for safety, health, environmental, and customer protection.

17. MAINTENANCE

⚠️ **DO NOT OPEN THE UNIT !**

There are no serviceable parts inside the unit.

Wipe the unit with a soft, damp cloth if necessary; do not use chemical agents.

18. DISPOSAL OF THE UNIT

Following directive 2002/96/EC of the European Parliament and Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), this unit should be stored and disposed separately from usual waste.

19. ROHS COMPLIANCE

The unit is compliant to **"DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment".**

Any of below substances is not used in this device:

Lead (Pb)

Mercury (Hg)

Cadmium (Cd)

Hexavalent chromium (Cr6+)

Polybrominated biphenyls (PBB)

Polybrominated diphenyl ether (PBDE)

Bis(2-ethylhexyl) phthalate (DEHP)

Butyl benzyl phthalate (BBP)