DATAKOM

DK-70

INTERNET BASED COMPRESSOR CONTROLLER

DESCRIPTION

DK-70 is a next generation compressor controller providing control of a screw or piston type air compressor driven by electric motor.

DK-70 offers wide internet-based communication capabilities satisfying tomorrow's needs. It allows remote monitoring and control over internet. A mobile phone app is also available for ease of use.

The unit incorporates all functions needed in a compressor control panel, eliminating the need for extra modules in the panel and lowering panel cost.

The early start function analyzes the air consumption trend and starts the compressor before the pressure falls below the low set limit.

Using the Weekly Schedule Program and Pressure Calendar functions, the compressor can be programmed to start on given hours and days of the week with user defined set pressure values.

The unit is supplied from the utility. Fault contacts and senders are internally supplied, eliminating the need for a supply transformer in the panel.

The 2.9", 128x64 pixel LCD screen displays values in bigger size with graphic support.

The controller is designed to conform to highest industrial standards in safety, vibration, EMC and environmental conditions.

Firmware updates can be done easily via the USB port.

The device can be monitored and programmed via USB, RS-485, Ethernet, WIFI and GPRS using the Windows based free PC software.

Rainbow Scada web service enables central remote monitoring and control of an unlimited number of compressors.

FEATURES

Ethernet (optional)
GSM-2G-3G-4G-NB/IOT-SMS (optional)
Wi-Fi connection (optional)
Embedded Web server
Monitoring & programming & control
Canbus multi-compressor operation (opt.)
Modbus RS-485 (optional)
RS-232 (optional)
Modbus TCP/IP - SNMP
*USB Flash Drive socket (*optional*)*
USB GPS support
USB Device Port

FUNCTIONS

Equal aging, multiple compressor control
Weekly schedule and pressure calendar
5 independent service counters
Star / Delta starting
0-10V and 4-20mA frequency inverter control
8 programmable relay outputs
8 programmable digital inputs
3 pressure sender inputs
4 temperature sender inputs
Adjustable sender curves
Current, voltage, power, and phase sequence protections
V & I harmonic analysis and oscilloscope
Fully closed front panel (IP65 with gasket)

CONNECTIONS

3 phase 4 wire, star
3 phase 4 wire, delta
3 phase 3 wire, 2 CTs (L1-L2)
3 phase 3 wire, 2 CTs (L1-L3)
2 phase 3 wire, L1-L2
1 phase 2 wire

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ABOUT THIS DOCUMENT

This document describes the minimum requirements and necessary steps for the successful installation of the DK-70 family compressors.

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

For all technical queries, please contact Datakom at the e-mail address below:

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 the following information in order to receive answers to any question:

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

RELATED DOCUMENTS

FILE NAME	DESCRIPTION
Rainbow Installation	Rainbow Plus Installation Manual
Rainbow Use	Rainbow Plus User Manual
Rainbow Scada Use	Rainbow Scada User Manual

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	26.03.2019	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.
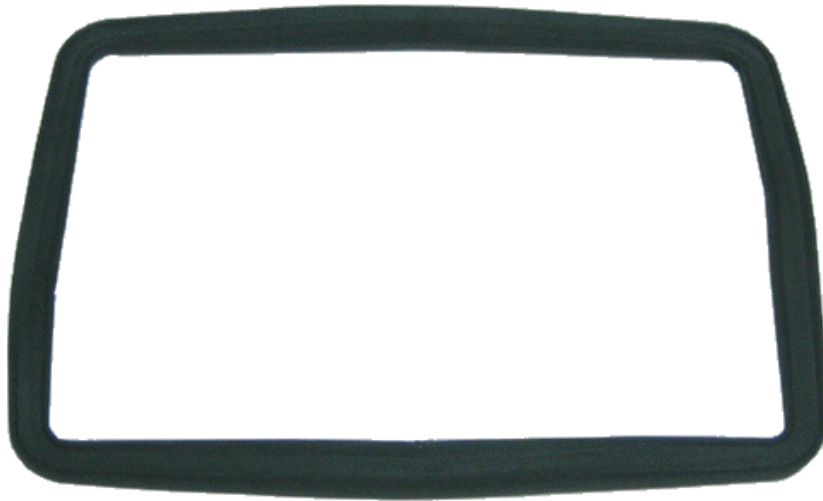
SPARE PARTS

Screw type bracket
Stock Code=J10P01 (per unit)

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

Sealing Gasket, Stock Code= L057P01

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

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

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

- **Disconnect all power before working on the equipment.**

- **Do not touch the terminals when the controller is connected to the network.**

- **Short circuit terminals of unused current transformers.**

- **Any electrical parameter applied to the device must be within 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 panel mounting.**

Current transformers must be used for current measurement. No direct connection allowed.

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.
- Place the 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 into their sockets.
- 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.

Below conditions may damage the device:

- Incorrect connections.
- Incorrect power supply voltage.
- Voltage at measuring terminals beyond the specified range.
- Voltage at digital inputs beyond the specified range.
- Current through measuring terminals beyond the specified range.
- Overload or short circuit at relay outputs.
- Connecting or disconnecting data terminals while the device is powered on.
- High voltage applied to communication ports.
- Ground potential differences at non-isolated communication ports.
- Excessive vibration, direct installation on vibrating parts.

> **Current transformers must be used for current measurement.**
>
> **No direct connection allowed.**

Below conditions may cause abnormal operation:

- Power supply voltage below minimum acceptable level.
- Power supply frequency out of specified limits.
- Incorrect phase order of voltage inputs.
- Current transformers not matching relevant phases.
- Incorrect current transformer polarity.

2. MOUNTING

2.1. DIMENSIONS

Dimensions: 211x162x42mm
Panel cutout: 176x121mm minimum
Weight: 500g (approx.)
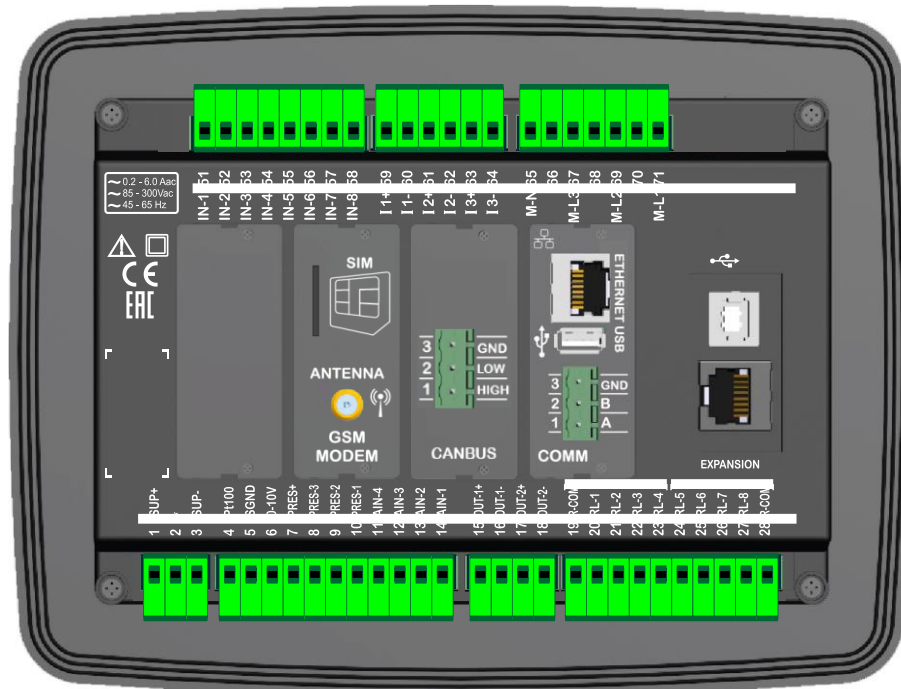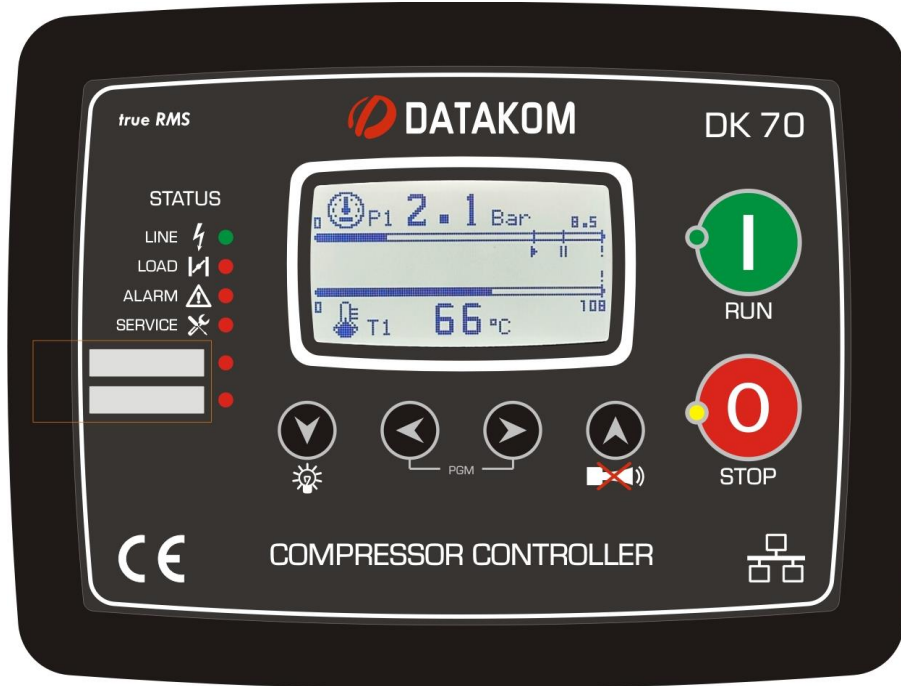
The unit is designed for panel mounting. The user should not be able to access parts of the unit other than the front panel.

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

Place and tighten the mounting brackets.

121mm

176mm

Panel Cutout

WALL

min 60mm   40mm
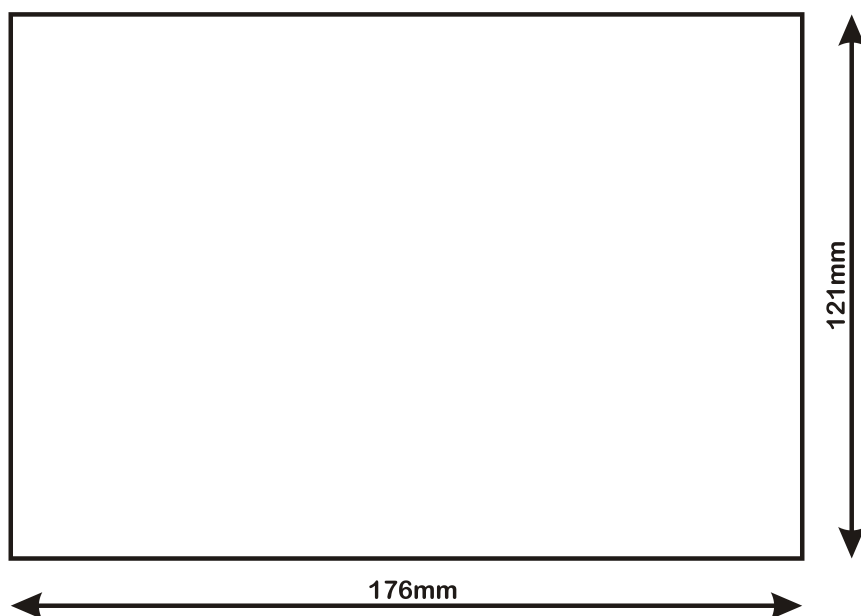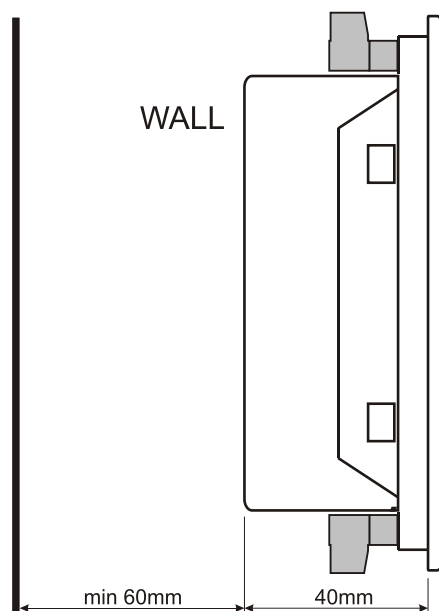
Required Panel Depth

Two different types of brackets are provided:

Screw type bracket

Self-retaining type bracket

Installation of screw type bracket

Installation of self-retaining type bracket

Do not tighten too much, this may break the unit.

2.2. SEALING GASKET

Panel
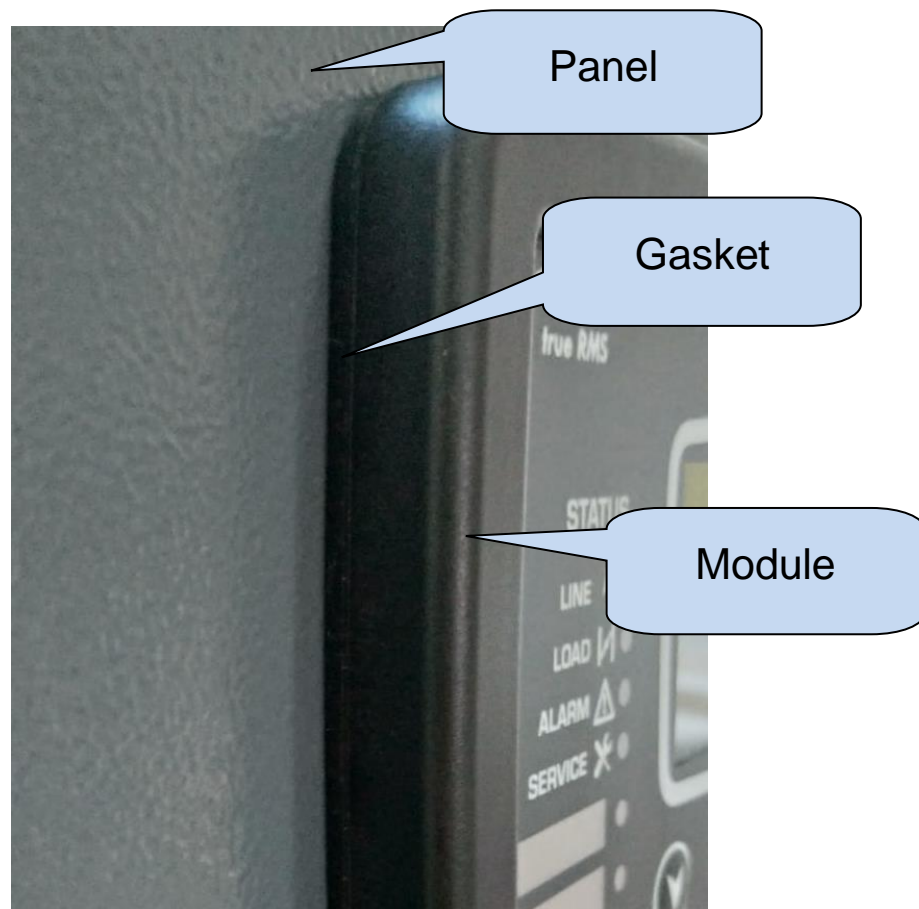
Gasket

Module

The rubber gasket provides a watertight means of mounting the module to the compressor panel. Together with the gasket, IEC 60529-IP65 protection can be reached from the front panel. A short definition of IP protection levels 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 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, switch-mode 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.**

- **Current transformers must have 5A or 1A output.**

- **For current transformer inputs, use at least 1.5mm^2 section (AWG15) cable.**

- **The current transformer cable length should not exceed 1.5 meters. If a longer cable is used, increase the cable section proportionally.**

⚠️ **Current transformers must be used for current measurement.**

No direct connection allowed.

3. TERMINAL DESCRIPTIONS

3.1. POWER SUPPLY INPUT

Supply voltage:	85-300 VAC or 88-400VDC
Polarity:	Indifferent
Maximum power:	7W @ 230VAC. (All features active, relay outputs empty)
Typical operating power:	2W @ 230VAC. (All features passive, relay outputs empty)
Isolation:	2000 VAC (between voltage inputs and supply inputs)

3.2. AC VOLTAGE INPUTS

Measurement method:	True RMS
Sampling rate:	8000 Hz
Harmonic analysis:	Up to 31st harmonic
Input voltage range:	0 - 300 VAC phase-neutral, 0-520V phase-phase.
Minimum voltage for frequency detection:	15 VAC (Ph-N)
Supported topologies:	3 phase 4 wire star 3 phase 3 wire delta 3 phase 4 wire delta 2 phase 3 wire L1-L2 1 phase 2 wire
Measuring range:	0 … 300VAC Ph-N (0 … 520VAC Ph-Ph)
Input impedance:	4.5M-ohm
Display resolution:	1V-DC
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:	DC - 500Hz
Frequency display resolution:	0.1 Hz
Frequency accuracy:	0.2% + 1 digit (±0.1 Hz @ 50Hz)

3.3. AC CURRENT INPUTS

Measurement method:	True RMS
Sampling rate:	8000 Hz
Harmonic analysis:	Up to 31st harmonic
Supported topologies:	3 Phase 3 CT 3 Phase 2 CT L1-L2 2 Phase 2 CT L1-L2 1 Phase 1 CT
CT secondary:	5A or 1A
Measuring range:	5/5 - 5000/5A minimum
Input impedance:	15 milli-ohm
Burden:	0.375W
Maximum continuous current:	6A
Measuring range:	0.1 - 7.5A
Display resolution:	1A
Accuracy:	0.5% + 1 digit @ 5A (± 4.5A @ 5/500A full range)

Selecting the CT Rating and Cable Section:

The load on a CT should be kept to a minimum in order to minimize the phase shift effect of the current transformer. Phase shift in a CT will cause erroneous power and power factor readings, although amp readings are correct.

It is advised CT rating be selected from this table for the best measurement accuracy.
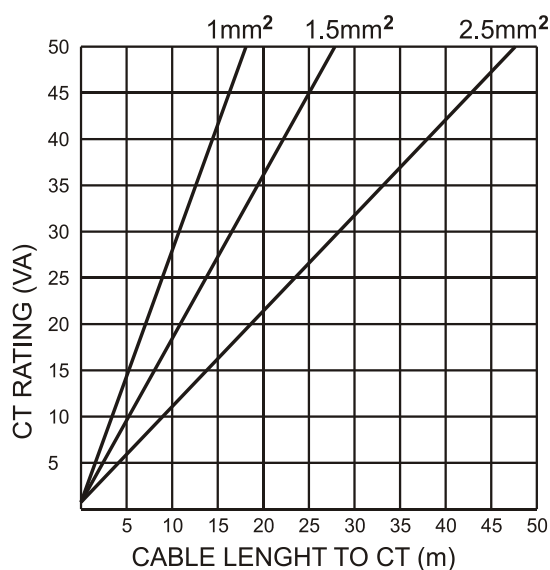
Selecting the CT Accuracy Class:

The CT accuracy class should be selected in accordance with the required measurement precision. The accuracy class of the controller is %0.5. Thus %0.5 class CTs are advised for the best result.

Connecting CTs:

Be sure to connect each CT to the relevant phase input with the correct polarity. Mixing CTs between phases will cause faulty power and pf readings.

Many combinations of incorrect CT connections are possible, so check both the order of the CTs and their polarities. Reactive power measurement is affected by incorrect CT connections in a similar way as active power measurement.

CORRECT CT CONNECTIONS
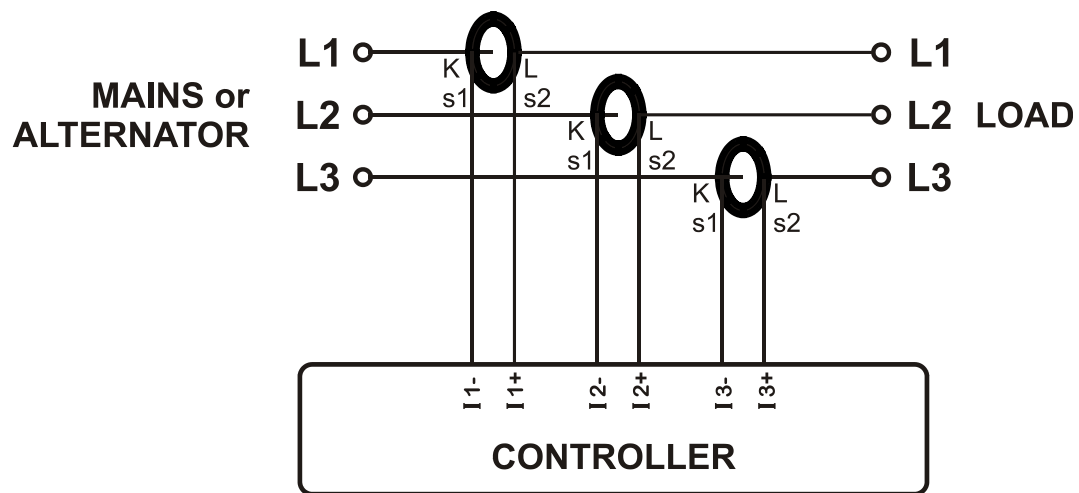
Let's suppose that the compressor is loaded with 100 kW on each phase. The load power factor (PF) is 1. Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	100.0	0.0	100	1.00
Phase L3	100.0	0.0	100	1.00
Total	**300.0**	**0.0**	**300**	**1.00**

EFFECT OF POLARITY REVERSAL
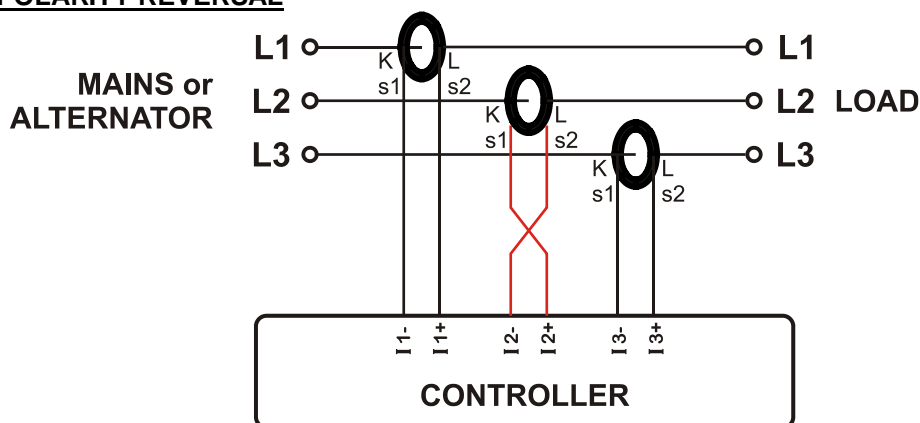
The compressor is still loaded with 100 kW on each phase. The load power factor (PF) is 1. PF in phase L2 will show -1.00 due to reverse polarity. The result is that total compressor power displayed by the controller is 100 kW.
Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	-100.0	0.0	100	-1.00
Phase L3	100.0	0.0	100	1.00
Total	**100.0**	**0.0**	**300**	**0.33**

EFFECT OF PHASE SWAPPING
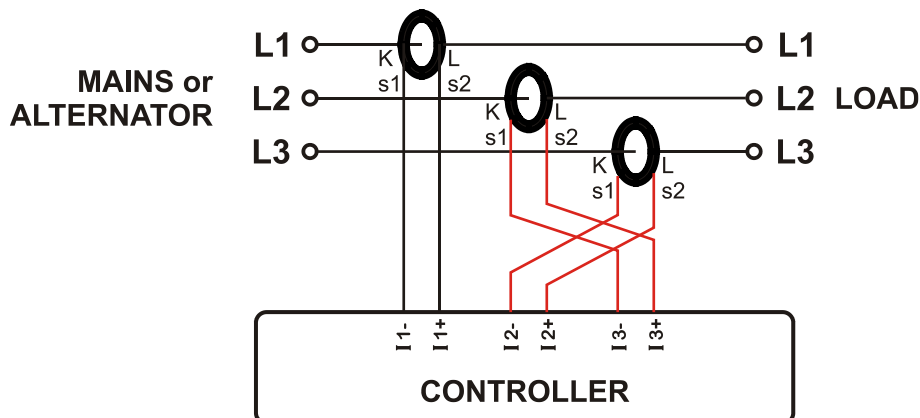
The compressor is still loaded with 100 kW in each phase. The load power factor (PF) is 1. PF in phases L2 and L3 will show -0.50 due to phase shift between voltages and currents which is caused by CT swapping. The result is that total compressor power displayed by the controller will be 0 kW.
Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	-50.0	86.6	100	-0.50
Phase L3	-50.0	-86.6	100	-0.50
Total	**0.0**	**0.0**	**300**	**0.0**

3.4. DIGITAL INPUTS

Number of inputs:	8 inputs, all configurable
Structure:	Serial diode, with 113k-ohm resistor to the GND terminal
Function selection:	From list
Contact type:	Normally open or normally closed (programmable)
Switching:	Active under positive-DC or AC voltage, passive when left open
Low level threshold:	1.0V-DC/AC
High level threshold:	6.0V-DC/AC
Maximum input voltage:	150V-DC/AC
Reverse input voltage:	-500V-DC maximum
Noise filtering:	Yes

3.5. PT100 TEMPERATURE SENDER INPUT

Number of inputs:	1 input, additional sender ground input
Structure:	PT100 measuring Wheatstone bridge and instrumentation op-amp
Measurement:	Analog resistance measurement.
Function:	The measured resistance value is converted to temperature via the preprogrammed PT100 sender curve.
Analog measurement range:	75 – 240-Ohm
Accuracy:	1° Celsius
Noise filtering:	Yes

3.6. ANALOG TEMPERATURE SENDER INPUTS

Number of inputs:	4 inputs
Measurement:	Analog resistance measurement.
Function:	The measured resistance value is converted to temperature via the programmable sender curve.
Open circuit voltage:	3.3VDC
Short circuit current:	330 µA-DC
Measurement range:	1k-ohm to 100k-ohm
Open circuit threshold:	100k-ohm
Resolution:	12-bit
Accuracy:	% 0.3
Noise filtering:	Yes

3.7. PRESSURE SENDER INPUTS

Number of inputs:	3 inputs, additional +12V (PRES+) sender supply
Structure:	50-ohm resistance to ground
Measurement:	Analog DC current measurement
Function:	The measured current value is converted to pressure via the programmed sender curve.
Nominal input current:	4-20mA-DC
Current measurement range:	0-30mA-DC
Breakdown limit:	70mA-DC
Resolution:	12-bit
Accuracy:	%0.5
Noise filtering:	Yes

3.8. 0-10V ANALOG OUTPUT

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

3.9. 4-20 mA ANALOG OUTPUTS

These outputs transfer the analog measurement information to external PLC systems. Any desired measurement can be fed to the PLC system. Output values can be configured for 4mA and 20mA.

The outputs are isolated. This ensures that they operate safely and correctly without being affected by ground voltage differences.

The outputs are supplied over the PLC measuring circuit, which means they are passive. The supply can be 12V or 24V.

Number of 4-20 mA analog outputs	2
Structure:	Passive output with two terminals. External supply required.
Function selection:	From list, upper/lower limits are programmable.
Output current range:	3.6 – 22mA-DC
Input supply voltage:	8 - 24VDC
Resolution:	16-bit
Accuracy:	%0.5
Cutoff frequency:	16Hz

3.10. RELAY OUTPUTS

The controller offers 8 digital outputs which can be programmed by selecting from the program list.

Structure:	Relay output, normally open contact. Two independent groups of 4 relays, COM terminals common within the group.
Maximum switching current:	5A @250VAC
Maximum switching voltage:	250VAC
Maximum switching power:	1250VA
Function selection:	From list

3.11. INPUT/OUTPUT EXPANSION

The controller offers the possibility to add 32 digital inputs and 32 digital outputs in addition to the existing inputs and outputs.

The number of digital inputs can be increased using the **DKG-188 Digital Input Expansion** module, each unit providing 8 additional inputs. Digital inputs can be programmed from the main controller. Any function in the list can be assigned to the desired digital input.

The number of digital outputs can be increased using the **DKG-186 Digital Output (FET) Expansion** module, each unit providing 8 additional outputs. Any function in the list can be assigned to the desired digital output.

The input and output expansion modules are connected to the controller in order. A connection cable is provided with each extension module.
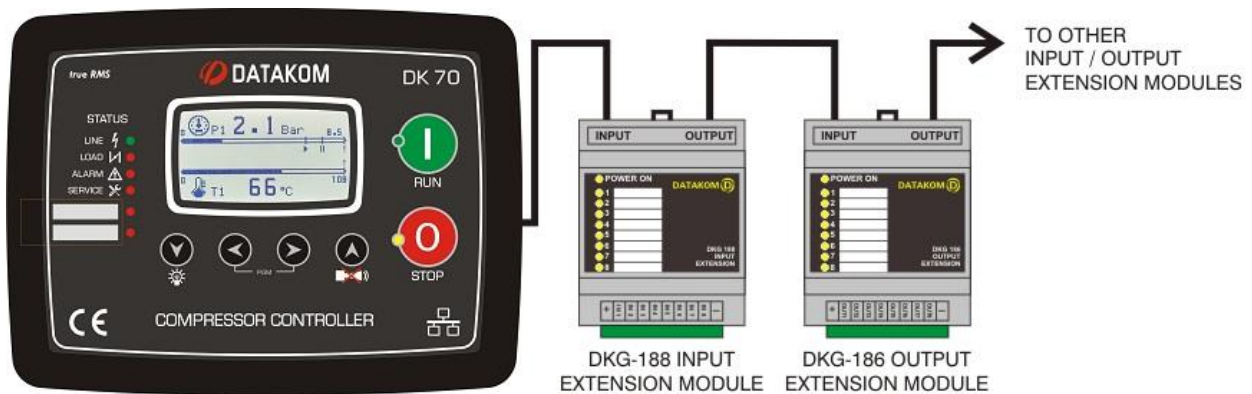
3.12. RS-485 PORT (OPTIONAL)

Structure:	RS-485, isolated.
Connection:	3 wire (A-B-GND). Half duplex
Data transfer rate:	2400-115200 baud, adjustable.
Data type:	8-bit data, no parity, 1 bit stop
Isolation:	250VAC, 1 minute
Termination:	External 120-ohm termination resistance required.
Common mode voltage:	-0.5 VDC ... +7VDC, internally clamped by transient suppressors.
Max distance:	1200m @ 9600 baud (with 120-ohm balanced cable)
	200m @ 115200 baud (with 120-ohm balanced cable)

The RS-485 port features MODBUS-RTU protocol. Multiple modules can be paralleled on the same RS-485 bus for data transfer to automation or building management systems.

> ⚠️ **The Modbus register list is given in chapter 22 of this document.**

The RS-485 port provides also a good solution for distant PC connection where RainbowPlus program will enable programming, control and monitoring.

> ⚠️ **For more details about programming, control and monitoring through RS-485 port, please refer to RainbowPlus user manual.**

3.13. ETHERNET PORT (OPTIONAL)

Description:	IEEE802.3 compliant, 10/100 Base-TX RJ45 ethernet port
Data transfer rate:	10/100 Mbit/s, auto detecting
Connector:	RJ45
Cable type:	CAT5 or CAT6
Isolation:	1500 VAC, 1 minute
Max distance:	30m.
Function:	Embedded TCP/IP, Web Server, Web Client, SMTP, e-mail, SNMP, Modbus TCP_IP

STANDARD ETHERNET CABLE

LED FUNCTIONS:

GREEN: This LED turns on when Ethernet connection is established.

YELLOW: This LED blinks when data transfer occurs inwards or outwards. Periodic blinking will witness data flow.

3.14. USB DEVICE PORT

USB Connector

USB A-B Cable
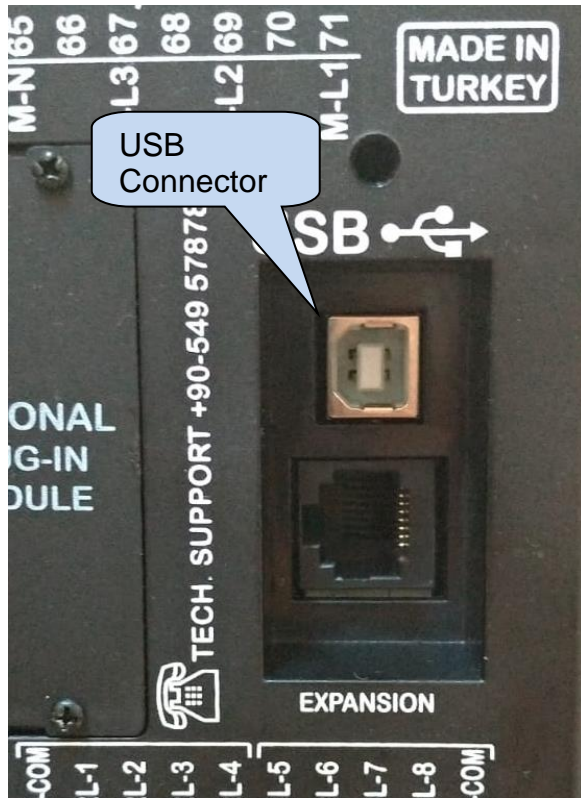
Description:	USB 2.0, non-isolated, HID mode
Data transfer rate:	1.5/12 Mbit/s, auto detecting
Connector:	USB-B (standard printer connector)
Cable length:	Max 6m
Function:	Modbus, FAT32 for firmware upgrade (boot loader mode only)

The USB device port is designed to connect the module to a PC. Using the RainbowPlus software, programming, control of the compressors and monitoring of measured parameters are achieved.

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

The connector on the module is of USB-B type. Thus, A to B type USB cable should be used. This is the same cable used for USB printers.

For more details about programming, control and monitoring, please refer to RainbowPlus user manual.

⚠ **If USB device port is plugged in, USB host port is disabled.**

3.15. USB HOST PORT (OPTIONAL)

USB FLASH DRIVE
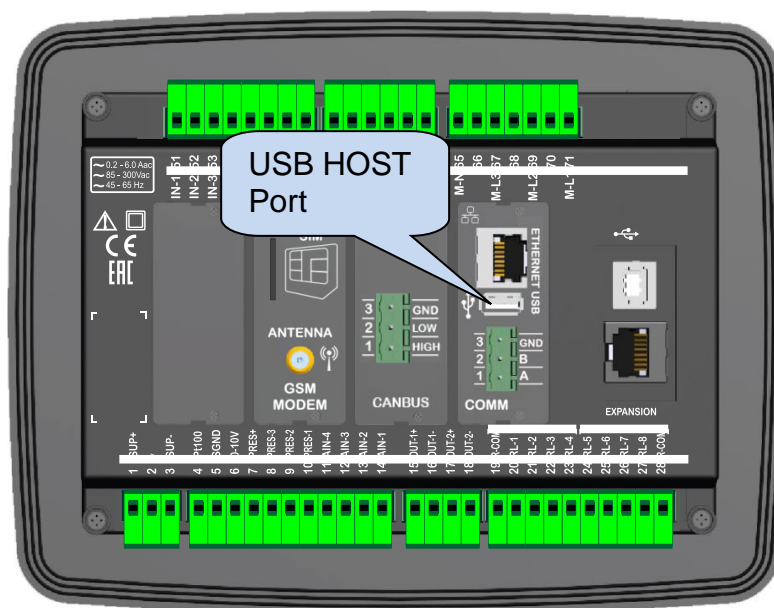
⚠️ **USB host port is available in units with COMM option.**

Description:	USB 2.0, non-isolated
Supply output:	5V, 300mA max.
Data transfer rate:	Full speed 1.5/12 Mbits/s, auto detecting
Connector:	USB-A (PC type connector)
Cable length:	Max. 1.5m
Function:	USB memory, FAT32, data recording
Memory capacity:	All USB flash memories.

The USB host port is designed for detailed data recording. The period of recording is adjustable through program parameter.
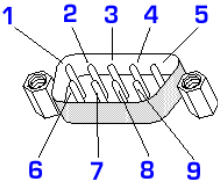
As soon as a USB flash memory is inserted, the unit will start data recording and continue until the memory is removed.

For more details about data recording, please review the "**Data Recording**" chapter.

⚠️ **If USB host port is plugged in, USB device port is disabled.**

3.16. RS-232 PORT (OPTIONAL)

Description:	RS-232, isolated.
Function:	External GSM modem, external PSTN modem
Connector:	DB-9 (9 pin male)
Connection:	5 wire (Rx-Tx-DTR-CxD-GND). Full duplex.
Baud rate:	2400-115200 baud, adjustable.
Data type:	8 bit data, no parity, 1 bit stop
Isolation:	250VAC, 1 minute
Max distance:	15m
Cable type:	Standard modem cable
Connection terminals:	1: CxD input 6: NC 2: Rx input 7:NC 3: Tx output 8: NC 4: DTR output 9: NC 5: GND

3.17. GSM MODEM (OPTIONAL)

The optional GSM modem offers the advantage of being internally powered and is fully compatible with the unit. It does not require any special setup.

The 850/1900 MHz magnetic antenna together with its 2-meter cable is supplied with the internal modem option. The antenna is intended to be placed outside the compressor panel for the best signal reception.

The module requires a GPRS enabled SIM card for full functionality. Voice-only type SIM cards will usually not function properly.

Please refer to **GSM Modem Configuration Guide** for more details.

Description:	4band GSM/GPRS 850/900/1800/1900MHz module. GPRS multi-slot class 12/12 GPRS mobile station class B Compliant to GSM phase 2/2+. – Class 4 (2 W @850/ 900 MHz) – Class 1 (1 W @ 1800/1900MHz)
Function:	Web Client, SMTP, Modbus TCP/IP (client), SMS, e-mail
Operating temp range:	-40°C ... +85 °C
Data rate:	max. 85.6 kbps (download), 42.8 kbps (upload)
SIM card type:	External SIM 3V/1.8V, GPRS active
Antenna:	4 band, magnetic, with 2m cable
Module certificates:	CE, FCC, ROHS, GCF, REACH

LOCATION DETERMINATION VIA GSM

The unit determines automatically the geographical position through the GSM network. It is necessary to set the "GSM Location Information Active" parameter to 1.

This feature is especially useful for remote monitoring where the controller will appear automatically at its geo-position.

Although the controller supports also GPS location determination for more precise positioning, the GSM based location is free of charge, available everywhere even where there is no GPS signal.

> **The location precision will depend on the GSM network. In highly populated areas, the precision is good (a few hundred meters), but rural areas may lead to errors of several kilometers.**

3.18. Wi-Fi COMMUNICATION (OPTIONAL)

Wi-Fi protocols:	802.11 b/g/n
Frequency range:	2.4 GHz ~ 2.5 GHz (2400M ~ 2483.5M)
Network Protocols:	IPv4, TCP/UDP
Security:	WPA/WPA2
Functionality:	Web Client, E-mail, Modbus TCP_IP

4. TOPOLOGIES

Various topologies can be selected from the program parameters.

4.1. 3 PHASE, 4 WIRE, STAR
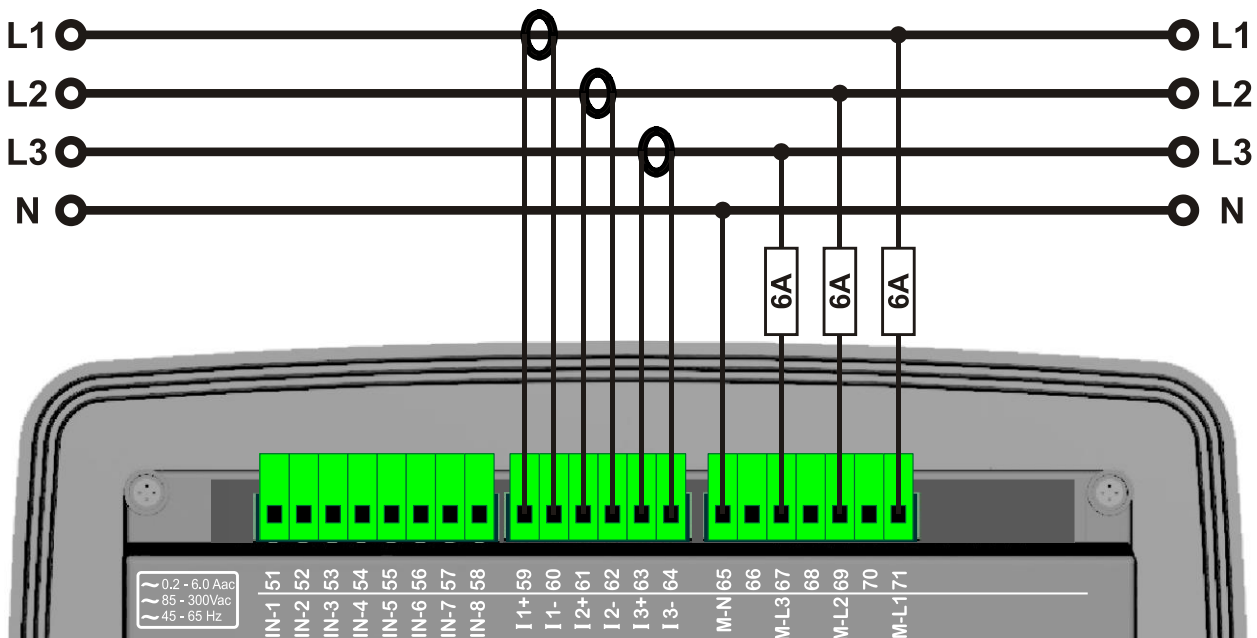
4.2. 3 PHASE, 4 WIRE, DELTA
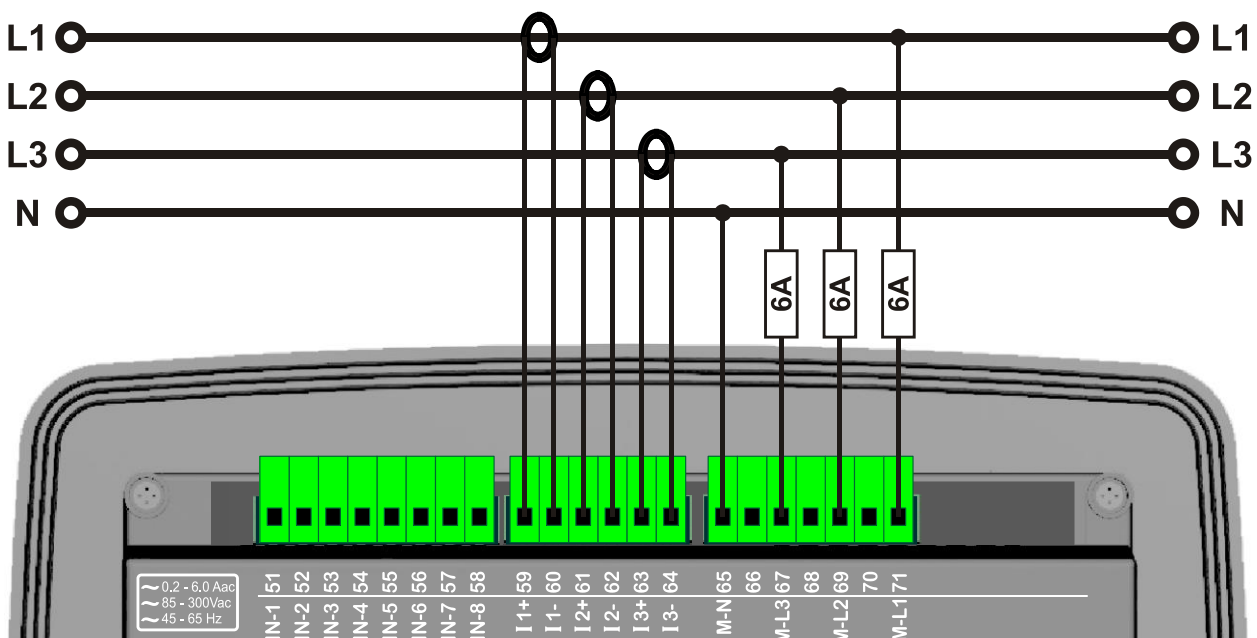
4.3. 3 PHASE, 3 WIRE, DELTA, 2 CT (L1-L2)
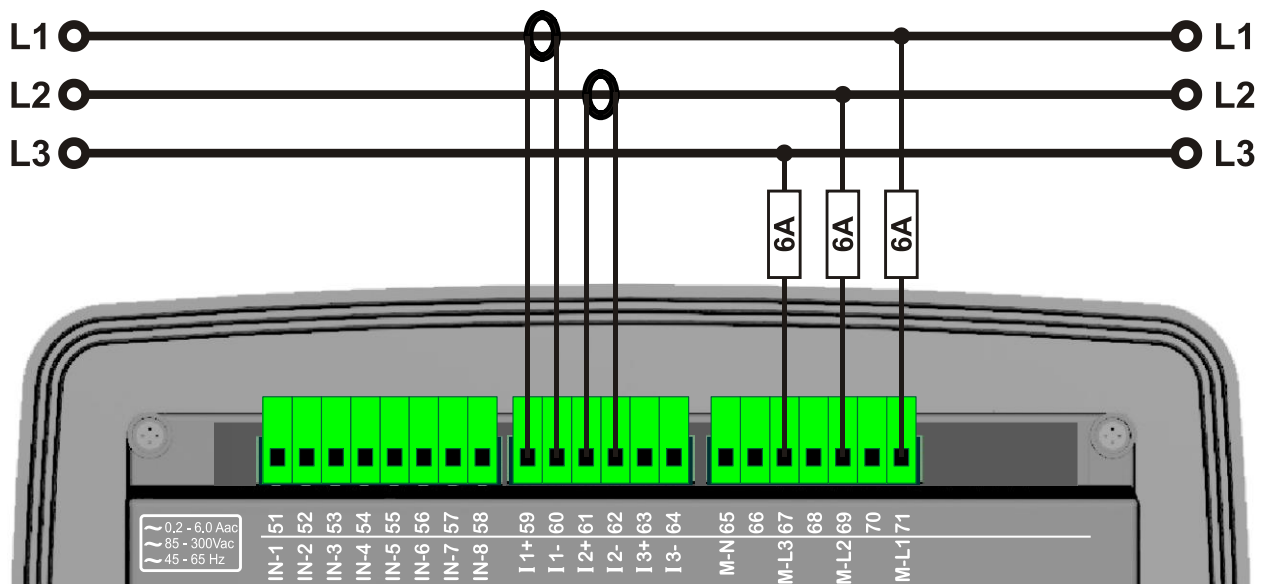
4.4. 3 PHASE, 3 WIRE, DELTA, 2 CT (L1-L3)
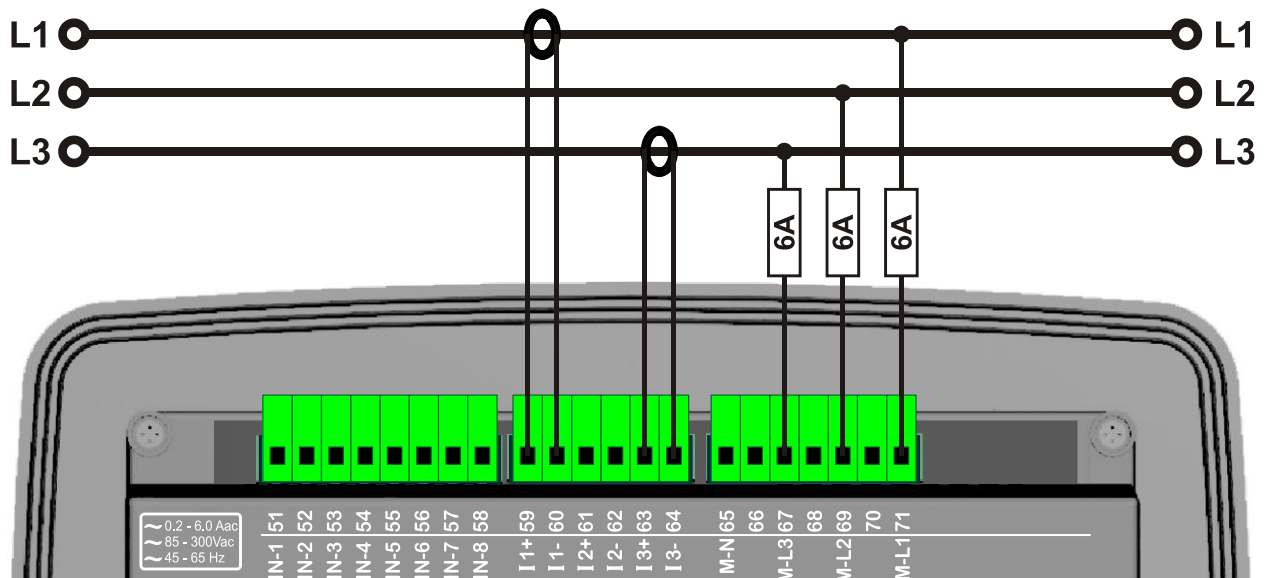
4.5. 2 PHASE, 3 WIRE, DELTA, 2 CTs (L1-L2)
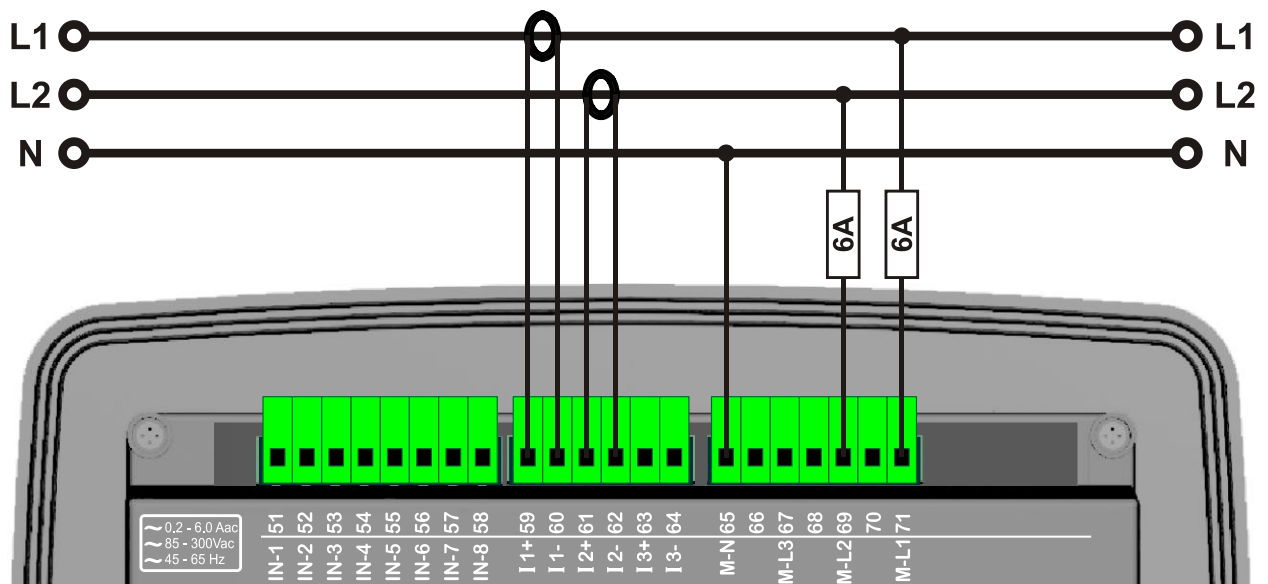
4.6. 1 PHASE, 2 WIRE
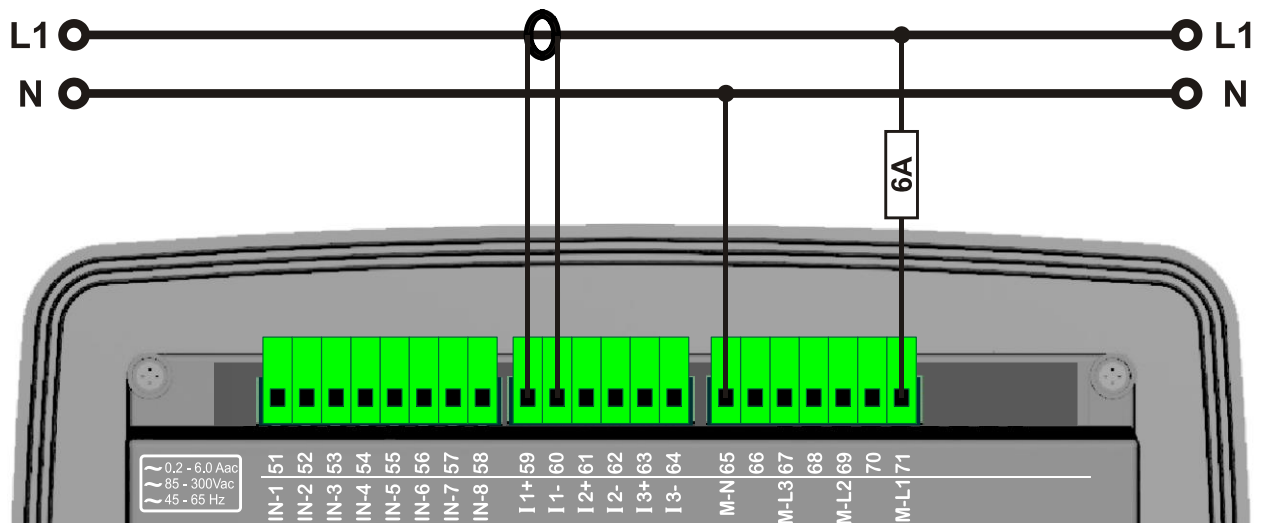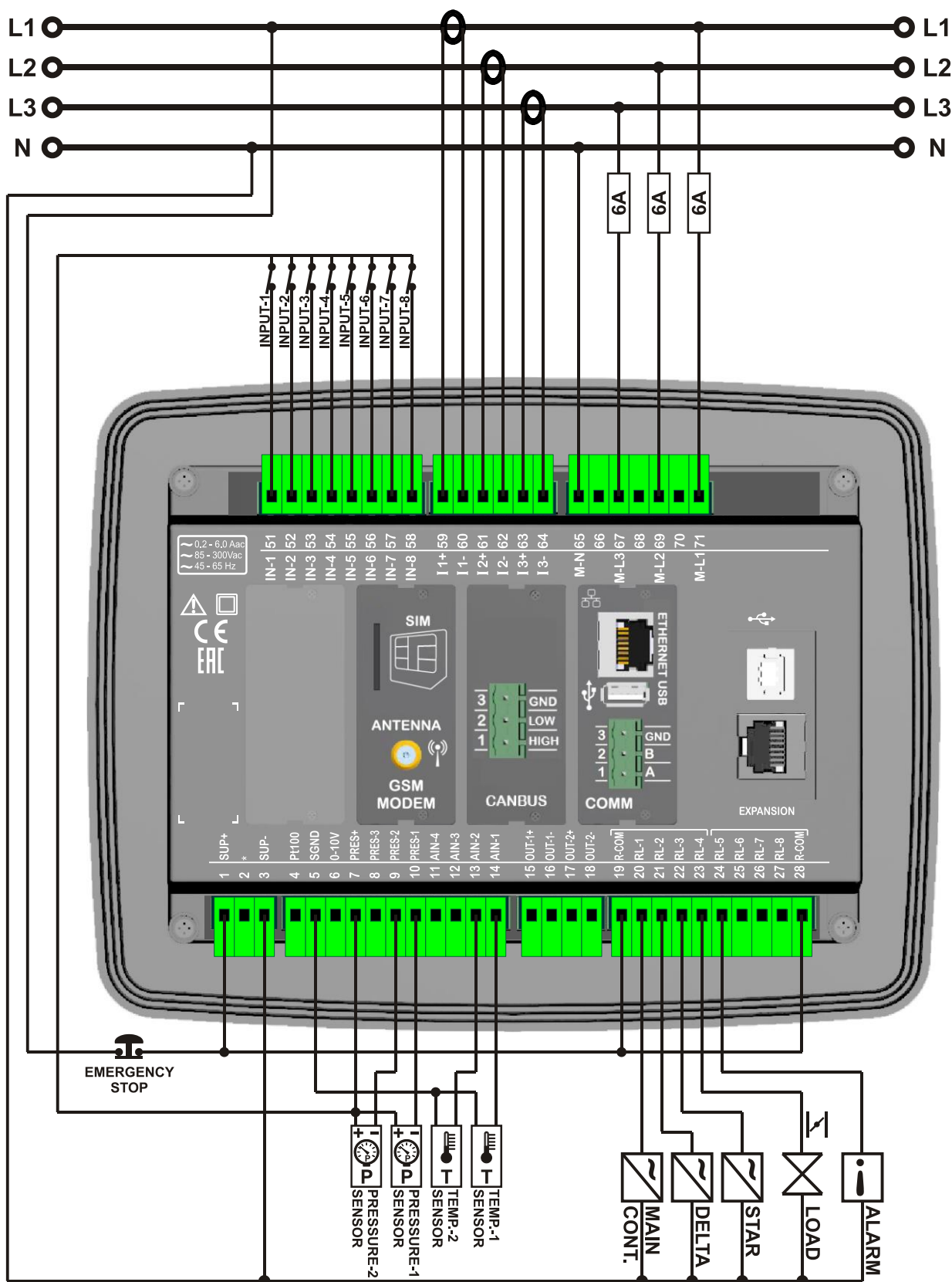
Term	Function	Technical data	Description
1	SUP+	85-300V-AC or 88-400V-DC	Connect the PHASE terminal of the AC supply to this terminal. If DC supply is used, connect the (+) terminal. Reverse connection does not affect device operation.
2	-	-	No connection
3	SUP-	Neutral or 0 VDC	Connect the NEUTRAL terminal of the AC supply to this terminal. If DC supply is used, connect the (-) terminal. Reverse connection does not affect device operation.

Term	Function	Technical data	Description
4	PT100 Sender Input	75-240 ohm resistance measuring circuit	If PT100 sender is used, it must be connected between this terminal and the adjacent SGND terminal.
5	SGND (sender ground)	0 VDC	One terminal of the PT100 and other temperature senders must be connected here.
6	0-10V Analog Output	DC 0-10 V Output resistance 1 k-ohm	This output supplies 0-10VDC analog voltage in order to control the frequency inverter. The output is controlled by a PID loop.
7	PRES+ (12V Pressure sender Supply)	DC +12V output 70mA max.	The output supplies the positive to the 4-20mA pressure senders.
8	Pressure Sender-3 Input	4-20mA inputs	The (-) terminal of the 4-20mA output pressure senders is connected to this terminal. The (+) terminal of the senders must be connected to the PRES+ terminal.
9	Pressure Sender-2 Input		
10	Pressure Sender-1 Input		
11	Analog Temperature Sender-1	1 k-ohm – 100 k-ohm resistance measuring inputs	One terminal of the NTC/PTC type temperature senders must be connected to this terminal. The other terminal of the senders must be connected to SGND.
12	Analog Temperature Sender-2		
13	Analog Temperature Sender-3		
14	Analog Temperature Sender-4		

Term	Function	Technical data	Description
15	4-20mA Output-1+	Externally supplied, passive and isolated 4-20mA analog outputs.	These outputs are designed to transfer information to external PLC systems. Any analog measurement can be programmed to the desired output.
16	4-20mA Output-1-		
17	4-20mA Output-2+		
18	4-20mA Output-2-		

Term	Function	Technical data	Description
19	**Relay COM1**	Relay COM1 output, 5A/250V-AC	Common terminal for Relay-1-2-3-4.
20	**Relay 1 Output**	Normally open outputs 5A/250V-AC	This relay's function is programmable from function list. Factory setting is **Compressor MAIN Relay** output.
21	**Relay 2 Output**		This relay's function is programmable from function list. Factory setting is **Compressor DELTA Relay** output.
022	**Relay 3 Output**		This relay's function is programmable from function list. Factory setting is **Compressor STAR Relay** output.
23	**Relay 4 Output**		This relay's function is programmable from function list. Factory setting is **Compressor LOAD Relay** output.
24	**Relay 5 Output**		These relays' functions are programmable from function list. Factory settings are **Input 5-6-7-8 Simulation** outputs respectively.
25	**Relay 6 Output**		
26	**Relay 7 Output**		
27	**Relay 8 Output**		
28	**Relay COM2**	Relay COM2 output, 5A/250V-AC	Common terminal for Relay-5-6-7-8.

Term	Function	Technical data	Description
51	**Digital Input 1**	Digital Inputs, 0-150V-DC	This input is programmable. Factory setting: **User Function 1**
52	**Digital Input 2**		This input is programmable. Factory setting: **Alarm Mute**
53	**Digital Input 3**		This input is programmable. Factory setting: **Emergency Stop**
54	**Digital Input 4**		These inputs are programmable. Factory settings: **Not used**
55	**Digital Input 5**		
56	**Digital Input 6**		
57	**Digital Input 7**		
58	**Digital Input 8**		

Term	Function	Technical data	Description
59	**CURRENT_1+**	Current transformer inputs, 5A-AC or 1A-AC	Connect the terminals of current transformers to these terminals. Do not connect the same CT to other devices; this may cause malfunction. Do not use common terminals. Do not ground. Be sure to connect each CT to the correct terminal with the correct polarity. Otherwise, kW and cosΦ measurements will be erroneous. If the measured power is negative, reverse the polarities of all 3 current transformers. The primary value of all 3 current transformers must be the same. Secondary current must be either 1A or 5A. (for example 200/5 A)
60	**CURRENT_1-**		
61	**CURRENT_2+**		
62	**CURRENT_2-**		
63	**CURRENT_3+**		
64	**CURRENT_3-**		

Term	Function	Technical data	Input
65	**MAINS NEUTRAL**	0-300V-AC	Neutral terminal for utility mains.
67	**MAINS L3 Phase**	Utility mains phase inputs, 0-300V-AC	Connect the utility mains phases to these terminals. High and low limits for mains phase voltages can be programmed.
69	**MAINS L2 Phase**		
71	**MAINS L1 Phase**		

6. TECHNICAL SPECIFICATIONS

Supply input:
    Input voltage: 85-300V-AC or 88-400V-DC
    Frequency: DC to 500Hz
    Power consumption: 7W maximum
Voltage inputs:
    Measurement range: 0 - 300 V-AC (Ph-N) , 0 - 520V Ph-Ph
    Frequency range: 0-500 Hz.
    Burden: < 0.1VA per phase
    VT Range: 0.1/1 – 6500.0 / 1
Current inputs:
    Input type: Current transformers. ../5A or …/1A
    Burden: < 0.5VA per phase
    CT Range: 5/5A - 5000/5A
kW Range: 0.1kW - 65000 kW
Accuracy:
    Voltage: %0.5+1digit
    Current: %0.5+1 digit
    Frequency: %0.5+1 digit
    Power (kW, kVAr): %1.0+2 digit
    Power factor: %0.5 +1digit
4-20mA Analog inputs:
    Number of inputs: 3
    Accuracy: 12 bit
NTC/PTC Analog inputs:
    Number of inputs: 3
    Measurement range: 1k-ohm to 100k-ohm
    Heating current: < 0.3mA
    Accuracy: 12 bit
PT100 Input:
    Measurement range: 75-240 ohm
    Accuracy: 12 bit
Digital inputs:
    Number of inputs: 8
    Threshold level: < 6V-DC/AC
4-20mA Analog outputs:
    Number of outputs: 2
    Output range: 3.6 – 22mA
    Accuracy: 16 bit
0-10V Analog output:
    Output range: 0-10.5V
    Accuracy: 16 bit
Relay Outputs:
    Number of outputs: 8
    Switching power: 5Amp@250V-AC
Input-output expansion: up to 32 additional digital outputs and 32 additional digital inputs.
Communication Ports:
    USB Device: USB 2.0 full speed (1.5-12Mbits)
    USB Host (optional): USB 2.0 full speed (1.5-12Mbits)
    Ethernet Port (optional): 10/100 Mbits
    GSM Modem (optional): 2G-3G-4G-NB/IOT
    WIFI (optional): 802.11 b/g/n, 2.4GHz
    RS-485 Port(optional): 2400-115200 baud, isolated
    RS-232 Port(optional): 2400-115200 baud, isolated
Operating temperature: -20°C ... +70°C
Storage temperature: -40°C ... 80°C
Maximum relative humidity: %95 non-condensing.

IP Protection Rating: IP54 front panel, IP30 back panel.
Dimensions: 211x162x42mm (WxHxD)
Panel Cutout Dimensions: 176x121mm minimum
Weight: 500g (approx.)
Enclosure: High temperature, non-flammable, ROHS compliant ABS/PC
Mounting: Front panel mounted with rear retaining plastic brackets.

EU Directives Conformity
        -2014/35/EC (Low voltage)
        -2014/30/EC (electromagnetic compatibility)
Norms of reference:
        EN 61010 (safety requirements)
        EN 61326 (EMC requirements)

7. DESCRIPTION OF CONTROLS

7.1. FRONT PANEL FUNCTIONALITY

LINE
(MAIN relay)
status indicator

LCD screen

RUN mode
button

LOAD
(Load relay)
status

Fault status
indicators

STOP mode
button

Programmable
LED indicators

Next screen in
the same group.
LAMP TEST if
held pressed

Previous
screen in
same group.
ALARM Mute

Previous
group screen

Next group
screen
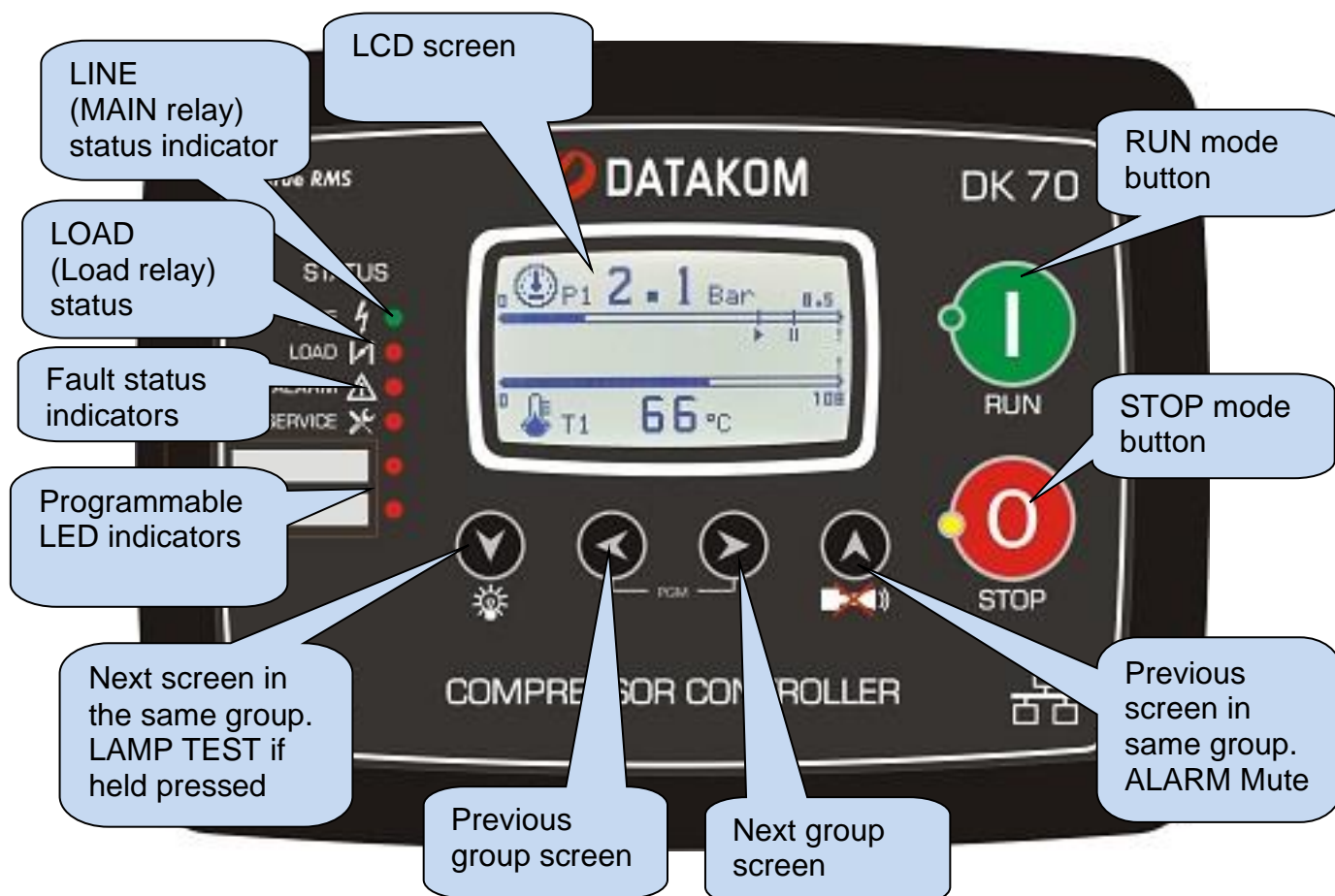
To turn off the SERVICE REQUEST LED and reset the service period, press together ALARM MUTE and LAMP TEST keys for 5 seconds.

7.2. PUSHBUTTON FUNCTIONS

BUTTON	FUNCTION
	Select RUN mode. Compressor starts running.
	Select STOP mode. Compressor stops. The controller resets if held pressed for 30 seconds.
	Navigates to next display screen in the same group. LAMP TEST (long press).
	Navigate to previous display screen group.
	Navigate to next display screen group.
	Navigate to previous display screen in the same group. ALARM MUTE (long press).
	When held pressed for 5 seconds, enters PROGRAMMING mode.
	Reset to factory defaults. Please refer to RESETTING TO FACTORY DEFAULTS chapter for more details.
	When held pressed for 5 seconds, resets service request counters. Please refer to SERVICE REQUEST ALARM for more details.
	When held pressed for 5 seconds, toggles the panel button lock. (Unlocks if locked, locks if unlocked)
	When held pressed for 5 seconds, resets the minimum and maximum values.
	When held pressed for 5 seconds, resets the LCD screen by turning off and on again.

7.3. DISPLAY SCREEN ORGANIZATION

The unit measures a large number of electrical and compressor parameters. The display of the parameters is organized as PARAMETER GROUPS and items in a group.

Navigation between different groups is made with and buttons.

Each depression of the button will cause the display to switch to the next group of parameters. After the last group, the display will switch to the first group.

Each depression of the button will cause the display to switch to the previous group of parameters. After the first group, the display will switch to the last group.

Navigation inside a group is made with and buttons.

Each depression of the button will cause the display to switch to the next parameter in the same group. After the last parameter, the display will switch to the first parameter.

Each depression of the button will cause the display to switch to the previous parameter in the same group. After the first parameter, the display will switch to the last parameter.

Below is a basic list of parameter groups:

Compressor Parameters: Temperature and pressure sender measurements, multi operation screen, unloaded and loaded engine running hours, engine and fan start counts, oil change interval, and service timers

Mains Parameters: Mains voltages, currents, kW, kVA, kVAr, pf, Energy counters, digital output counters, demands, minimum and maximum values etc...

Scopemeter Display: This group displays waveforms of voltages and currents as an oscilloscope. All Ph-N and Ph-Ph voltages and currents are available. This feature is especially useful to investigate waveform distortions and harmonic loads.

Graphical Harmonic Analysis Results: This group displays harmonic composition of voltages and currents. All Ph-N and Ph-Ph voltages and currents are available. This feature is especially useful to investigate harmonics caused by complex loads. Only harmonics above 2% are represented in the graphics because of the display resolution. In order to see all harmonic levels, please use the Alphanumerical Harmonic Analysis Results.

Alphanumerical Harmonic Analysis Results: This group displays harmonic composition of voltages and currents with 0.1% resolution. All Ph-N and Ph-Ph voltages and currents are available. This feature is especially useful to investigate harmonics caused by complex loads.

Alarm Display: This group displays all existing alarms and warnings one screen per alarm. When there is no more alarms to display, it will show "END OF ALARM LIST".

GSM Modem Parameters: Signal strength, counters, communication status, IP addresses, etc...

Ethernet Parameters: Ethernet connection status, counters, IP addresses etc...

Status & Counters Group: This group includes various parameters such as engine status, date-time, firmware version etc...

7.4. MEASURED PARAMETERS

The unit performs a detailed set of AC measurements.

The list of measured Electrical Parameters is below:

Mains voltage phase L1-Neutral	Mains kW phase L2
Mains voltage phase L2-Neutral	Mains kW phase L3
Mains voltage phase L3-Neutral	Mains total kW
Mains phase neutral voltage average value	Mains kVA phase L1
Mains voltage phase L1-L2	Mains kVA phase L2
Mains voltage phase L2-L3	Mains kVA phase L3
Mains voltage phase L3-L1	Mains kVAr phase L1
Mains frequency	Mains kVAr phase L2
Mains current phase L1	Mains kVAr phase L3
Mains current phase L2	Mains pf phase L1
Mains current phase L3	Mains pf phase L2
Mains average current value	Mains pf phase L3
Mains kW phase L1	Mains total pf

The unit also records the demand, minimum and maximum values for electrical parameters.

The unit features 4 temperature sender inputs with configurable temperature-resistance curves, 1 PT100 temperature sender input, and 3 pressure sender inputs (4-20mA) with configurable pressure-current(mA) curves.

Below is a list of measured Pressure and Temperature parameters:

P1: Pressure measured by the 1st pressure sender

P2: Pressure measured by the 2nd pressure sender

P3: Pressure measured by the 3rd pressure sender

P12: Difference of the pressures measured by the 1st and 2nd pressure senders (P1 – P2)

P13: Difference of the pressures measured by the 1st and 3rd pressure senders (P1 – P3)

P23: Difference of the pressures measured by the 2nd and 3rd pressure senders (P2 – P3)

T1: Temperature measured by the 1st temperature sender

T2: Temperature measured by the 2nd temperature sender

T3: Temperature measured by the 3rd temperature sender

T4: Temperature measured by the 4th temperature sender

T5: Temperature measured by the PT100 temperature sender which is the 5th

T12: Difference of temperatures measured by the 1st and 2nd temperature senders (T1 – T2)

T13: Difference of temperatures measured by the 1st and 3rd temperature senders (T1 – T3)

T23: Difference of temperatures measured by the 2nd and 3rd temperature senders (T2 – T3)

T14: Difference of temperatures measured by the 1st and 4th temperature senders (T1 – T4)

T24: Difference of temperatures measured by the 2nd and 4th temperature senders (T2 – T4)

T34: Difference of temperatures measured by the 3rd and 4th temperature senders (T3 – T4)
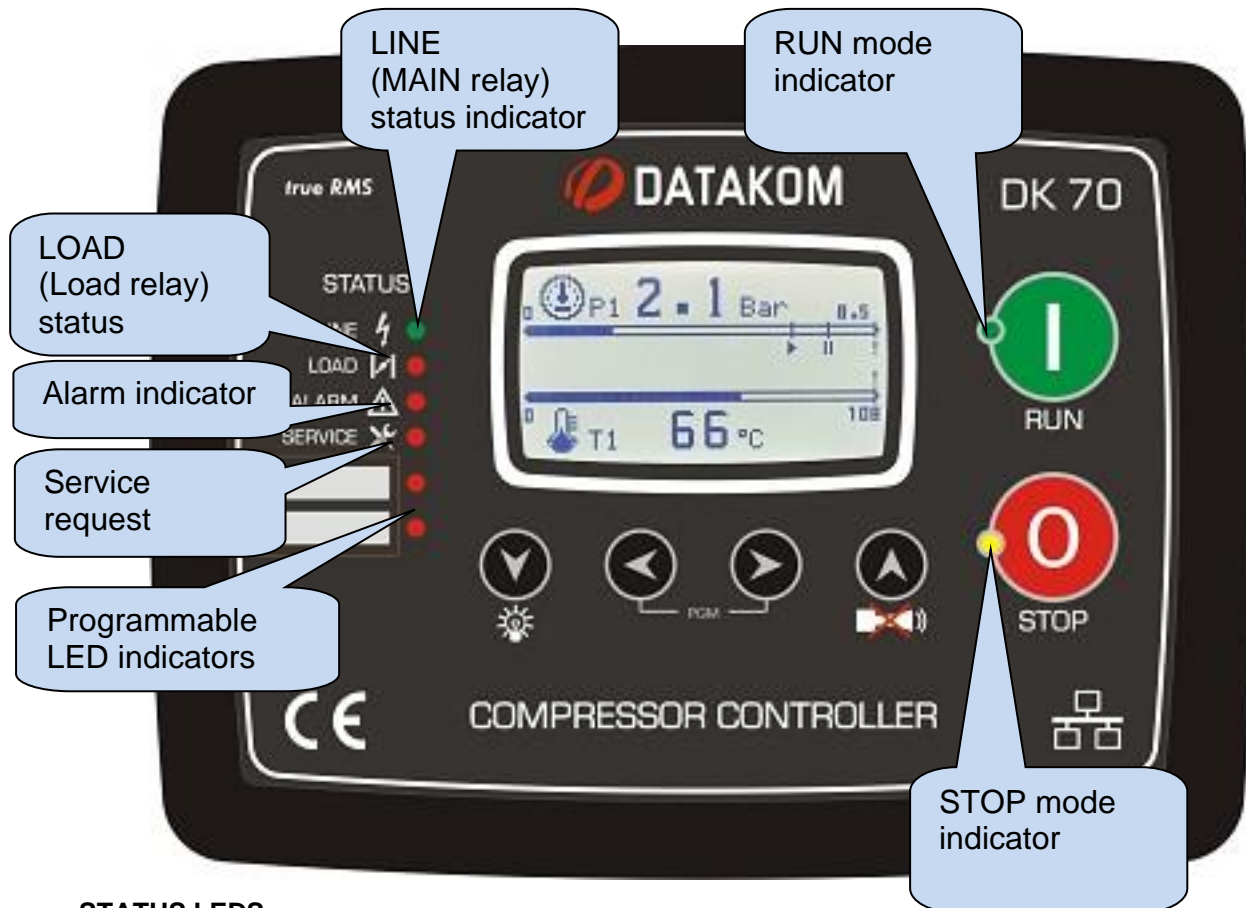
STATUS LEDS:

 LINE (MAIN RELAY): If RUN mode is selected and there are no conditions to prevent the compressor from starting, the main relay engages and this LED turns on.

 LOAD (LOAD RELAY): If the load relay is engaged (the compressor is running under load and generating compressed air) this LED turns on.

 ALARM: If an alarm condition occurs, this LED turns on.

 SERVICE REQUEST: If one of the service counters expires, this LED turns on.

PROGRAMMABLE LEDS: The controller offers 2 LEDs which can be user defined. Any alarm, input or relay function can be assigned to these LEDs.

MODE LEDS: The relevant LED turns on when a mode is selected either from the physical device or remotely.

8. WAVEFORM DISPLAY & HARMONIC ANALYSIS

The unit features a waveform display along with a precision harmonic analyzer for mains voltages and currents. Both phase to neutral and phase to phase voltages are analyzed, thus there are 9 channels in total.

Available channels are:

Mains voltages: V1, V2, V3, U12, U23, U31

Mains currents: I1, I2, I3
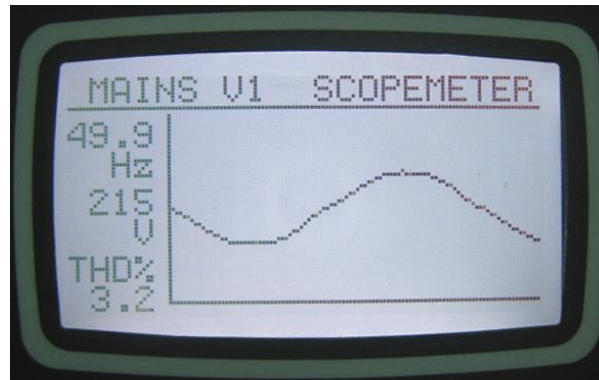
Scopemeter Display

The waveform display can store 100 samples in memory and has 13 bit resolution. Sampling rate is 4096Hz. This one cycle of a 50Hz signal is represented with 82 points.

The waveform is displayed on the device screen and on PC screen at a higher resolution using RainbowPlus program.

The display memory is also available in the Modbus register area for third party applications. For further detail please refer to "**MODBUS Communications**" chapter.

The waveform display is updated twice a second. All channels may be scrolled using ⊽ ⊼ buttons.

The harmonic analyzer uses the Fast Fourier Transform (FFT) algorithm which runs twice a second on the selected channel.

The sample memory is of 1024 samples length and 13 bits resolution with a sampling rate of 4096Hz.

According to theory, a periodic signal may have only odd multiples of the main frequency. Thus, in a 50Hz network, harmonics will be found only at 150, 250, 350, 450Hz etc...

The unit is able to analyze up to 1800Hz and up to the 31st harmonic, whichever is smaller. Thus, in a 50Hz system all 31 harmonics will be displayed, but on a 60Hz system only 29 harmonics will be shown on screen.

Graphical Harmonic Table
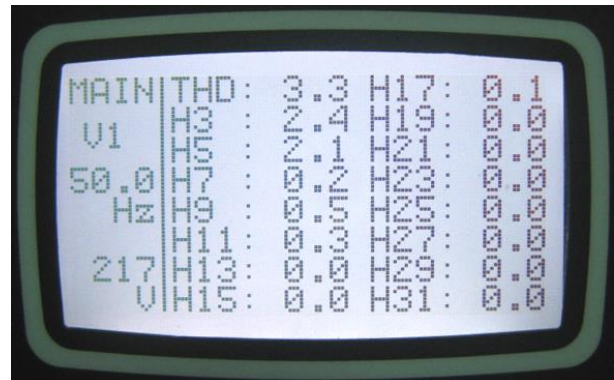
Alphanumeric Harmonics Table

Harmonics are represented by 2 different methods on the device display. The first one is a graphical representation allowing one sight perception of the harmonic structure. Because of the display resolution, only harmonics above 2% are displayed.

The second method is alphanumeric; thus, all harmonics are displayed with 0.1% resolution in order to provide more detailed information.

On RainbowPlus program, harmonics and waveform are displayed on a single screen with more resolution.
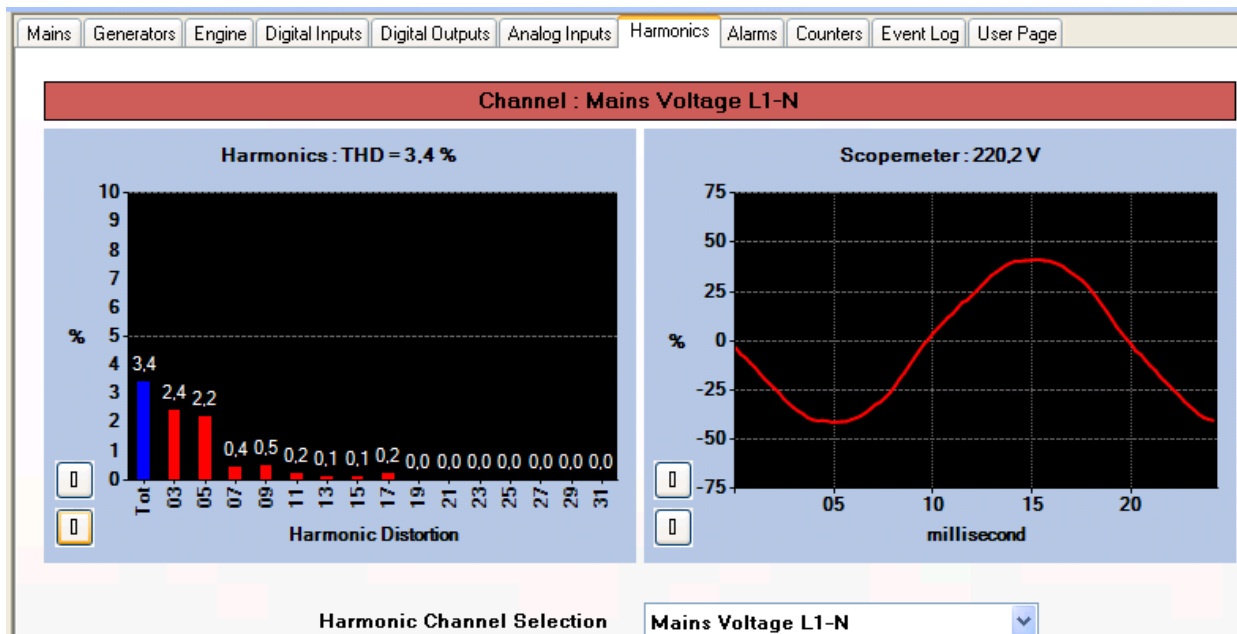
RainbowPlus Scada section: Harmonic Analysis and Waveform Display

9. MINIMUM, MAXIMUM & DEMAND VALUES

Demand values are the calculated average values of measured parameters over a user defined period.

Average values are compared to the demand values at the end of the period, and if the new value is greater, it is recorded as the demand value. Demand values are automatically reset at the start of each month. Thus, demand values are valid only for the current month.

Demand calculations can be done for the following values:
- demand I1
- demand I2
- demand I3
- demand Io (average current)
- demand active power
- demand reactive power

Min-max values are dependent on internal measurements. They may be sensitive to short term changes and transients since they do not have an averaging period, such as starting currents due to engine starts.

As long as the unit is active, it compares the actual value to the recorded minimum or maximum value. If the actual value provides the condition (greater than max or less than min), it is recorded as the new value.

Pressing the ⏷ and ⏵ buttons together for 5 seconds resets the min-max values.

Min-max values can also be reset from the programming menu. relevant parameter:
ELECTRICAL PARAMETERS > Reset Min/Max

For more robust results, min/max detection starts 10 seconds after the device powers on. Mains demand, minimum and maximum values are located in the **Mains Electrical Parameters** display group.

Navigating between screens is done by using the ⏷ ⏶ buttons.

Min/max is calculated for the following values:

- Mains Min voltage L1-N
- Mains Min voltage L2-N
- Mains Min voltage L3-N
- Mains Min voltage L1-2
- Mains Min voltage L2-3
- Mains Min voltage L3-1
- Mains Min frequency
- Mains Min current I1
- Mains Min current I2
- Mains Min current I3
- Mains Min current Io (average current)
- Mains Min active power
- Mains Min inductive reactive power
- Mains Min capacitive reactive power
- Mains Max voltage L1-N
- Mains Max voltage L2-N
- Mains Max voltage L3-N
- Mains Max voltage L1-2
- Mains Max voltage L2-3
- Mains Max voltage L3-1
- Mains Max frequency
- Mains Max current I1
- Mains Max current I2
- Mains Max current I3
- Mains Max current Io (average current)
- Mains Max active power
- Mains Max inductive reactive power
- Mains Max capacitive reactive power

10. EVENT RECORDS

The unit features more than 400 event logs with date-time stamp and full snapshot of measured values at the moment that the event has occurred.

Stored values in an event record are listed below:

-event number
-event type / fault definition (see below for various event sources)
-date and time
-operation mode & status
-PT-100 Temperature sender measurement: T5
-Pressure and temperature sender measurements: P1, P2, P3, P12, P13, P23, T1, T2, T3, T12, T13, T23
-Mains phase voltages: L1-L2-L3
-Mains phase currents: L1-L2-L3
-Mains frequency
-Total active power (kW)
-Total power factor
-Running hours
-Loaded running hours
-Loaded / total running hours percentage
-Number of motor starts
-Number of fan starts
-Alarm bits
-Digital input and output bits

There are various possible event sources. Each source can be individually enabled or disabled:

Program mode entrance event: recorded with the password level when program mode is entered.

Periodic event: recorded every 60 minutes.

Alarm/warning events: recorded when the relevant fault condition occurs.

Event records are displayed within the program mode menu. This is designed in order to reduce the interference of event logs with other measurement screens.

To enter the **Event log** display, press together ⬅ and ➡ buttons for 5 seconds.

When the program mode is entered, the following password prompt will be displayed.

Skip the password prompt by pressing ➡ 4 times.

Press the ➡ button again. The last recorded event will be displayed.

The first page will show the event number, event type, fault type and date-time information.

When displaying event logs:

⬇ will display the next information in the same event.

⬆ will display the previous information in the same event.

◀ will display the same information of the previous event.

▶ will display the same information of the next event.

11. STATISTICAL COUNTERS

The unit provides a set of incremental counters for statistical purposes.

The counters are listed below:
- total mains kWh
- total mains kVArh inductive
- total mains kVArh capacitive

- total running hours
- loaded running hours
- Number of motor starts
- Number of fan starts
- Minutes left until next oil service request

- 1st digital input pulse counter
- 2nd digital input pulse counter

- Engine hours to Service-A
- Engine hours to Service-B
- Engine hours to Service-C
- Engine hours to Service-D
- Engine hours to Service-E

The counters are stored in non-volatile memory so as not to be affected by power outages.

12. OPERATION OF THE UNIT

12.1. SELECTION OF OPERATION MODE

When power is supplied, the unit enters STOP mode and the STOP LED turns on.

The compressor is started with the **REMOTE START** signal or by pressing the RUN button.

If **Safety Timer** has not expired yet, the RUN LED blinks until the timer expires. When the timer is expired and the (P1) output pressure is below **Start Pressure**, then the compressor starts running.

> ⚠ **In case of an alarm, the compressor stops immediately and the alarm is displayed on the screen.**

The compressor is normally stopped with the **REMOTE STOP** signal or by pressing the STOP button.

12.2. STOPPING METHOD

The STOP LED starts blinking.

If the compressor is under load, the LOAD relay releases and the motor keeps running for the duration of

Safety Timer or **Unload Timer** (whichever is longer). If the RUN button is pressed while this timer is

counting down, the compressor will enter run mode again. If the STOP button is pressed again while running unloaded, the compressor stops immediately.

The STOP LED will blink until the compressor has fully stopped.

> ⚠ **If the compressor is running unloaded already, it will keep running until *Safety Timer* expires when the STOP button is pressed.**
> **The compressor can be stopped immediately by repressing the STOP button.**

12.3. STARTING THE COMPRESSOR

Pressing the RUN 🔵 button or issuing a Remote START/STOP command if enabled will switch the compressor to run mode. In this phase, the controller decides to start the compressor if the output pressure (Main Pressure measurement value) drops below **Start Pressure** (or when the pressure switch closes).

The STAR relay output is activated before the compressor starts running. At the end of **Delay Between Relays** timer, the MAIN relay engages, thus the motor will start-up in STAR configuration.

At the end of **Star Timer**, the STAR relay disengages and the DELTA relay engages at the end of **Star/Delta Timer**.

After the expiration of **Time Before Load**, the LOAD relay will engage and the compressor starts producing compressed air.

12.4. UNLOADING AND RELOADING THE COMPRESSOR

When the output pressure (P1) reaches the **Stop Pressure**, (or the pressure switch closes) the load relay will release and the motor will run off-load for the duration of **Unload Timer**. If the output pressure falls below **Start Pressure** before this timer expires, the LOAD relay will be activated again.

12.5. STOPPING AND RESTARTING FOLLOWING OUTPUT PRESSURE

If the output pressure stays above the **Start Pressure** for the duration of **Unload Timer**, (or the pressure switch remains open) then the DELTA relay releases. After **Delay Between Relays**, the MAIN relay releases.

The RUN LED starts blinking in this case.

The maximum number of start cycles that the compressor is allowed to perform in 1 hour is defined by the **Max Starts per Hour** program parameter.

If the maximum number of starts has been reached, the following stop cycles will be skipped until the end of the 1 hour period and the motor keeps running off-load.

13. ALARMS AND WARNINGS

If any of the measured parameters of the controller goes outside the preset limits, a fault condition occurs.

When a fault occurs, the alarm pop-up screen is displayed and the alarm function is activated. In order to transfer the alarm condition to other systems, the alarm function can be assigned to a relay output.

The unit features 2 different levels of protections; alarms and warnings:

1- **ALARMS:** These are the highest level fault conditions and cause the following operations:

   - **ALARM** LED turns on constantly,
   - Compressor stops immediately.

2- **WARNINGS:** These faults are lower priority warnings.

   - **ALARM** LED flashes,

If a fault condition occurs, the alarm pop-up screen is automatically displayed.

To acknowledge the alarm and delete the alarm pop-up screen, press ALARM MUTE. This button does not remove the alarms.

The alarms feature low/high level settings and timers. If the fault cause is removed before the programmed timer, no alarm is triggered.

Alarms can be of latching or non-latching type according to programming. For latching alarm types, the alarm LED stays on even if the alarm cause is removed.

Many faults have programmable limits. Please refer to the programming section to find these limits.

13.1. SERVICE REQUEST ALARM

The service LED is designed to help the periodic maintenance of the compressor consistently.

The periodic maintenance is basically carried out after a given engine hours (for example 2000 hours).

The unit features 5 independent service counters. When any of the counters expires, the service LED turns on.

If the **Stop Service Request** parameter is set to 1, the compressor behaves according to the table below:

TIME TO SERVICE	ACTION TAKEN
> 100 hours	No warning issued
100 hours	Service request warning is given and the service LED turns on. The compressor continues normal operation.
0 hours	The compressor stops. Service request warning is given and the service LED turns on. The compressor may be run again by pressing the **RUN** button.
-100 hours	The compressor stops. Service request warning is given and the service LED turns on. The compressor may be run again by pressing the **RUN** button.
Between -120 and -200 hours and once every 20 hours	The compressor stops. Service request warning is given and the service LED turns on. The compressor may be run again by pressing the **RUN** button.
Between -210 and -300 hours and once every 10 hours.	The compressor stops. Service request warning is given and the service LED turns on. The compressor may be run again by pressing the **RUN** button.
-300 hours	The compressor stops. Service request warning is given and the service LED turns on. The compressor will only run after service is performed.

The service periods can be programmed independently. If the period parameter of a service is set to 0, the relevant service counter and its warnings are not shown.

> **To turn off the service LED and reset all service counters, press the ALARM MUTE and LAMP TEST buttons together for 5 seconds. Service counters can be independently reset from program parameters.**

The unit stores the service counters in non-volatile memory so as not to be affected by power outages. Removing the supply does not cause any information loss.

Time remaining to service may be viewed from the **Compressor Parameters** display menu.

13.2. ALARMS

ALARM	DESCRIPTION
HIGH / LOW VOLTAGE	If the phase voltages are outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. The alarms are: **High Voltage Alarm, Low Voltage Alarm**
HIGH / LOW FREQUENCY	If the frequency is outside the programmed limits, this alarm occurs. The lower and upper limits for the alarm can be configured independently. The alarms are: **High Frequency Alarm, Low Frequency Alarm.**
HIGH / LOW ACTIVE POWER	If any of the phase powers is outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. The alarms are: **High kW Alarm, Low kW Alarm**
CAPACITIVE / INDUCTIVE POWER	If any of the phase reactive powers is outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. The alarms are: **kVAr Capacitive Alarm, kVAr Inductive Alarm.**
CAPACITIVE / INDUCTIVE POWER FACTOR	If any of the phase power factors is outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. The alarms are: **PF Capacitive Alarm, PF Inductive Alarm.**
OVER CURRENT	If any of the phase currents is above the **High Current Alarm** parameter for the duration of **Current Alarm Timer**, **Over Current Alarm** occurs.
HIGH VOLTAGE THD	If any of the phase voltages' THD (Total Harmonic Distortion) is above the **THD-V High Alarm** parameter for the duration of **THD-V Alarm timer**, **High THD-V Alarm** occurs.
HIGH CURRENT THD	If any of the phase current outputs' THD (Total Harmonic Distortion) is above the **THD-I High Alarm** parameter for the duration of **THD-I Alarm Timer**, **High THD-I Alarm** occurs.
VOLTAGE UNBALANCE	If any of the phase voltages differs from the average value by **Volt. Unbalance Alarm** parameter for the duration of **Volt. Unbalance Timer**, **Volt. Unbalance Alarm** occurs.
CURRENT UNBALANCE	If any of the phase currents differs from the average value by **Current Unbalance Alarm** parameter for the duration of **Current Unbalance Timer**, **Current Unbalance Alarm** occurs.
PHASE ORDER FAILURE	If the order of the mains phases is reversed, **Phase Order Failure** alarm occurs.
TEMPERATURE SENDER FAILURE	If the relevant sender is not connected or the sender malfunctions, this alarm occurs. Each temperature sender has its independent alarm. The alarms are: **Temperature Sender-1 Failure, Temperature Sender-2 Failure, Temperature Sender-3 Failure, Temperature Sender-4 Failure, PT100 Sender Failure.**

ALARM	DESCRIPTION
HIGH / LOW TEMPERATURE	If the temperature values are outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. Each temperature sender has its independent alarm. The alarms are: **High Temperature Sender-1, High Temperature Sender-2, High Temperature Sender-3, High Temperature Sender-4, PT100 High Temperature, Low Temperature Sender-1, Low Temperature Sender-2, Low Temperature Sender-3, Low Temperature Sender-4, PT100 Low Temperature.**
MOTOR PTC HIGH TEMPERATURE	If any of the 2nd, 3rd or 4th temperature senders is set to "Motor PTC" from the Sender Configuration parameter, and the relevant sender exceeds a certain temperature value, **MPTC High Temperature** alarm occurs.
TEMPERATURE DIFFERENCE ALARMS	Temperature difference alarms are the following: **Sender-2 Temperature Difference Alarm:** If the Temperature Sender-2 Configuration Parameter is set to "2: Temperature Difference", and the T12 (T1-T2) temperature difference exceeds **T1-T2 Temperature Difference Alarm** parameter, **Sender-2 Temperature Difference Alarm** occurs. **Sender-3 Temperature Difference Alarm:** If the Temperature Sender-3 Configuration Parameter is set to "2: Temperature Difference", and the T13 (T1-T3) temperature difference exceeds **T1-T3 Temperature Difference Alarm** parameter, or the T23 (T2-T3) temperature difference exceeds **T2-T3 Temperature Difference Alarm** parameter, **Sender-3 Temperature Difference Alarm** occurs. **Sender-4 Temperature Difference Alarm:** If the Temperature Sender-3 Configuration Parameter is set to "2: Temperature Difference", and the T14 (T1-T4) temperature difference exceeds **T1-T4 Temperature Difference Alarm** parameter, or the T24 (T2-T4) temperature difference exceeds **T2-T4 Temperature Difference Alarm** parameter, or the T34 (T3-T4) temperature difference exceeds **T3-T4 Temperature Difference Alarm** parameter, **Sender-4 Temperature Difference Alarm** occurs.
PRESSURE SENDER FAILURE	If the relevant sender is not connected or the sender malfunctions, this alarm occurs. Each pressure sender has its independent alarm. The alarms are: **Pressure Sender-1 Failure, Pressure Sender-2 Failure, Pressure Sender-3 Failure.**
HIGH / LOW PRESSURE	If the pressure values are outside the programmed limits for the duration of the relevant **Alarm Timer**, this alarm occurs. Each pressure sender has its independent alarm. The alarms are: **High Pressure Sender-1, High Pressure Sender-2, High Pressure Sender-3, Low Pressure Sender-2, Low Pressure Sender-3.** Low pressure alarms are checked if the compressor is running. Otherwise, Low Pressure Alarm condition is not checked.

ALARM	DESCRIPTION
PRESSURE DIFFERENCE ALARMS	If the compressor is running loaded, and the Main Pressure measurement is above the Start Pressure parameter, pressure difference alarms are checked. Otherwise the Pressure Difference Alarm conditions are not checked. Pressure difference alarms are listed below: **Sender-2 Pressure Difference Alarm:** If P12 (P1-P2) pressure difference exceeds the **P1-P2 Pressure Difference Alarm** parameter, **Sender-2 Pressure Difference Alarm** occurs. **Sender-3 Pressure Difference Alarm:** If P13 (P1-P3) pressure difference exceeds the **P1-P3 Pressure Difference Alarm** parameter, or P23 (P2-P3) pressure difference exceeds the **P2-P3 Pressure Difference Alarm** parameter, **Sender-3 Pressure Difference Alarm** occurs.
EMERGENCY STOP	If any of the programmable input functions is configured as "**Emergency Stop**" and the configured conditions are met, **Emergency Stop** alarm occurs.
MOTOR OVERLOAD	If any of the programmable input functions is configured as "**Motor Overload Alarm**" and the configured conditions are met, **Motor Overload** alarm occurs.
MAIN CONTACTOR FAIL TO CLOSE	If any of the programmable input functions is configured as "Main Relay Auxiliary Contact Input", and if the "closed" signal from the auxiliary contact is not received within 5 seconds after the main motor contactor closes, this alarm occurs.
MAIN CONTACTOR FAIL TO OPEN	If any of the programmable input functions is configured as "Main Relay Auxiliary Contact Input", and if the "open" signal from the auxiliary contact is not received within 5 seconds after the main motor contactor opens, this alarm occurs.
FAN CONTACTOR FAIL TO CLOSE	If any of the programmable input functions is configured as "Fan Relay Auxiliary Contact Input", and if the "closed" signal from the auxiliary contact is not received within 5 seconds after the fan motor contactor closes, this alarm occurs.
FAN CONTACTOR FAIL TO OPEN	If any of the programmable input functions is configured as "Fan Relay Auxiliary Contact Input", and if the "open" signal from the auxiliary contact is not received within 5 seconds after the fan motor contactor opens, this alarm occurs.

> **The alarm name, sampling, and operation are configurable in digital input alarms.**
> **Only internal alarms are described in this section.**

> **If the Sender Upper Limit parameter of the PT100 sender is set to 0, the relevant sender's temperature alarm is disabled.**
> **If the configuration parameter of a temperature or pressure sender is set to "inactive", the relevant alarm is disabled. For the remaining alarms, if the relevant limit parameters are set to 0, the alarms are disabled.**

WARNING	DESCRIPTION
HIGH TEMPERATURE	If the temperature values exceed the configured warning limits, this warning is issued. Each temperature sender has its independent warning. The warnings are: **High Temperature-1, High Temperature-2, High Temperature-3, High Temperature-4 .**
WAIT 1 HOUR TO STOP	If the motor has started (perform start-stop cycles) <u>**Max. Starts per Hour**</u> times within 1 hour, the warning **Wait 1 Hour to Stop** is issued and the motor is not allowed to stop until the hour is up; even if the output pressure is sufficient, the motor will keep running unloaded.
WAITING FOR SEPARATOR PRESSURE	If any of the programmable input functions is configured as "**Waiting for Separator Pressure**" and the configured conditions are met, **Waiting for Separator Pressure** warning is issued.
WAITING FOR INPUT (DRIVE)	If any of the programmable input functions is configured as "**Waiting for Input (Drive)**" and the configured conditions are met, **Waiting for Input (Drive)** warning is issued.
AIR FILTER CLOGGED	If any of the programmable input functions is configured as "**Air Filter Clogged**" and the configured conditions are met, **Air Filter Clogged** warning is issued.
MULTI OPERATION COMMUNICATION FAILURE	If any communication problems occur when multiple compressors operation is activated, this warning is issued.
SERVICE PERIOD	Issued when one of the service counters expires. The warnings are: **Service A Timer Warning, Service B Timer Warning, Service C Timer Warning, Service D Timer Warning, Service E Timer Warning.** To reset the service counters, hold pressed ⊽ and ⌃ for 5 seconds. 'Completed' will be displayed on screen.
REMOTE START / REMOTE STOP	If any of the programmable inputs functions is configured as "**Remote Start/Stop**", and the configured conditions are met, **Remote Start** warning is issued and the unit enters RUN mode, if the configured conditions are not met, **Remote Stop** warning is issued and the unit will enter STOP mode.
EEPROM WRITE FAILURE	If there is a problem with writing to the built-in memory, this warning is issued.
STOPPED - WEEKLY SCHEDULE RUNNING - WEEKLY SCHEDULE WEEKLY SCHEDULE CANCELLED	If the *Weekly Schedule Active* parameter is set to 1, the compressor starts and stops automatically as configured in the Weekly Schedule. When the compressor stops automatically in this manner, "**STOPPED-Weekly Schedule**" warning is given, when the compressor runs automatically, "**RUNNING-Weekly Schedule**" warning is given. If **STOP** button is pressed while the compressor is running or **START** button is pressed while the compressor is stopped according to the Weekly Schedule, "**Weekly Schedule Cancelled**" warning is issued and *Weekly Schedule Active* parameter is set to 0.
TEMPERATURE TOO LOW FOR LOADING	If the main temperature measurement is below the **Minimum Loading Temperature** parameter when the compressor is started, this warning is issued and the compressor is not allowed to take the load until **Minimum Loading Temperature** is reached.

WARNING	DESCRIPTION

DIGITAL INPUT TAKE LOAD COMMAND	If the *Take Load Command Source* parameter is set to "1 : Digital Input" and one of the digital input functions is configured as "Take Load Command", this warning is issued when the digital input sends the "take load" command and the compressor takes the load.
DIGITAL INPUT UNLOAD COMMAND	If the *Take Load Command Source* parameter is set to "1 : Digital Input" and one of the digital input functions is configured as "Take Load Command", this warning is issued when the digital input sends the "unload" command and the compressor unloads.
MODBUS TAKE LOAD COMMAND	If the *Take Load Command Source* parameter is set to "2 : Modbus Command", this warning is issued when the "take load" command is sent over Modbus (inputting the value 170 to the address 8236) and the compressor takes the load.
MODBUS UNLOAD COMMAND	If the *Take Load Command Source* parameter is set to "2 : Modbus Command", this warning is issued when the "unload" command is sent over Modbus (inputting the value 10 to the address 8236) and the compressor unloads.
ENERGY LOSS / RESTART	Refer to Section 15.3, **Automatic Restart Delay** parameter.

For digital input warnings, the name, sampling and operation can be configured as desired.

This section describes only the built-in warnings.

14. PROGRAMMING

14.1. RESETTING TO FACTORY DEFAULTS

To perform a factory reset:

-Press and hold the **STOP, LAMP TEST** and **ALARM MUTE** buttons for 5 seconds,
-The screen will display "**FACTORY RESET**",
-Press the **RIGHT ARROW** key and hold for 5 seconds,
-Factory parameters will be reprogrammed to memory.

The programming mode is used to configure timers, operation limits and program parameters.

All program parameters can be modified from the front panel as well as from the free Rainbow Plus PC software.

Any changes made to parameters are automatically saved to the nonvolatile memory and are effective immediately.

Entering the programming mode does not affect device operation.

14.2. ENTERING THE PROGRAMMING MODE

To enter the programming mode, press together the ◀ and ▶ buttons for 5 seconds.

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

▼ ◀ ▶ ▲ buttons are used to enter the 4-digit password.

▼, ▲ buttons change the digit values. ◀ ▶ buttons change the cursor location on the digits.

The unit stores 3 levels of passwords. Level_1 password can be used to make parameters changes necessary on the field. Level_2 password is used to change settings which need to be made in the factory. Level_3 password protects the calibration parameters of the unit.

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

If the password is mistyped, the program parameters can be viewed but cannot be changed.

14.3. NAVIGATING BETWEEN MENUS

The programming mode is organized into a 2-level menu system. Main menu consists of program groups. Program parameters are located inside the groups.

Upon entering programming mode, the list of program groups will be displayed. Moving between groups is done by ▼ and ▲ buttons. The selected group's background will be highlighted in inverse color. To enter the group, press the ▶ button. To exit to main menu from the group, press the ◀ button.

Return to previous menu within the group

Enter the group

Next group

Previous group

Use the ▼ ▲ buttons to navigate within the group among program parameters. The selected parameter will be marked with an arrow sign next to it. Press the ▶ button to view/change the parameter value. The parameter value is incremented/decremented with the ▼ ▲ buttons. When these buttons are held pressed, the values will be incremented/decremented in steps of 10. The program parameter will be automatically recorded once it has been changed. ▶ button moves to the next parameter. ◀ button returns to the main group.

Return to main menu

Change parameter value

Move to previous parameter within the

Move to next parameter within the group

14.4. MODIFYING PARAMETER VALUE

Previous parameter **Long press:** Return to top menu

Next parameter

Decrement parameter value

Increment parameter value

```
       PROGRAMMING
CONTROLLER CONFIG.
LCD Contrast
                  39
```

14.5. EXITING PROGRAMMING MODE

Press and hold the ◄ button for 5 seconds to exit programming mode.

If no operation is performed, the controller will exit programming mode automatically after 2 minutes.

Long press: Exit programming mode

```
       PROGRAMMING
▶DISPLAY EVENT LOGG.
 CONTROLLER CONFIG.
 ELECTRICAL PARAMS.
```
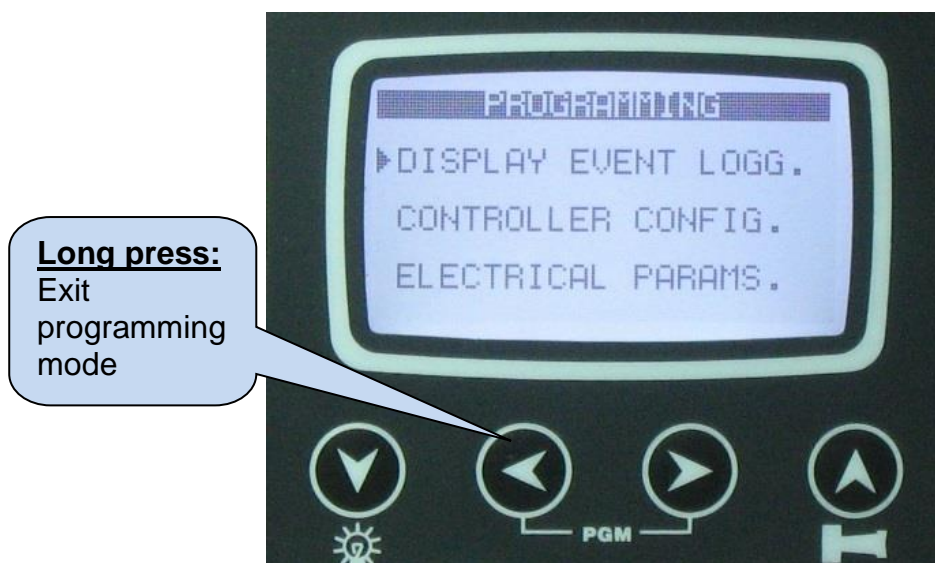
15. PROGRAM PARAMETER LIST

15.1. CONTROLLER CONFIGURATION GROUP

Parameter Definition	Unit	Min	Max	Factory Setting	Description
LCD Contrast	-	30	100	33	This parameter adjusts the LCD contrast. Modify to ensure best viewing.
Language Selection	-	0	1	0	**0:** English **1:** Turkish. This language can differ according to the country of use. Various languages can be uploaded using Rainbow Plus program.
Alarm Relay Timer	Sec	0	65000	30000	Whenever an alarm occurs, the **ALARM** relay is energized for the duration of this timer. At the end of the timer, the ALARM relay opens and active alarms are acknowledged. If this timer is set to 0, the alarm output is activated indefinitely.
Intermittent Alarm Relay	-	0	1	0	**0:** continuous **1:** intermittent (activates/deactivates once per second)
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
Modem / GPS Selection	-	0	5	1	**0:** no modem / no GPS **1:** Internal modem / no GPS **2:** External Datakom modem / no GPS **3:** External generic modem / no GPS **4:** No modem / RS-232 GPS **5:** Internal modem / RS-232 GPS
GSM SIM Card PIN	-	0000	9999	0	If the GSM SIM card has a PIN, enter the PIN here. If mistyped, the SIM card will not activate.
SMS Sending Active	-	0	1	0	**0:** SMS message OFF **1:** SMS message ON
GPRS Connection Active	-	0	1	1	**0:** GPRS connection OFF **1:** GPRS connection ON
Web Programming	-	0	1	0	**0:** Web programming OFF **1:** Web programming ON
Web Control	-	0	1	0	**0:** Web control OFF **1:** Web control ON
Internet Refresh Rate	Sec	0	240	10	The unit updates the web page at this rate.
Ping Period	Sec	30	900	120	The unit checks internet connectivity at this period.
Rainbow Scada Refresh Rate	Sec	10	65535	60	The unit sends data to the remote monitoring system at this rate.
Rainbow Scada Address-1 Port	-	80	65535	90	The port number of the first address which will receive data.
Rainbow Scada Address-2 Port	-	80	65535	90	The port number of the second address which will receive data.

15.1. CONTROLLER CONFIGURATION GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Web Server Port	-	80	65535	80	Port number of the internal Web server. The unit responds to incoming queries to this port only.
Modbus over TCP/IP Port	-	0	65535	502	Port number of the Internal Modbus TCP/IP server. The unit responds to incoming Modbus queries to this port only.
E-mail Server Port	-	0	65535	587	Server port for e-mail sending.
Modbus Address	-	0	254	1	This parameter is the Modbus address of the unit.
RS-485 Baud Rate	bps	2400	115200	9600	RS-485 Modbus port communication speed.
Ethernet Active	-	0	1	1	**0:** Ethernet port OFF **1:** Ethernet port ON
Flashing Relay ACTIVE Timer	Sec	0	6500	0	Flashing relay ACTIVE duration.
Flashing Relay INACTIVE Timer	Sec	0	6500	0	Flashing relay INACTIVE duration
Real Time Clock Adjustment	-	0	255	117	This parameter trims precisely the real time clock circuit. Values from 0 to 63 speed up the clock by 0.25sec/day steps. Values between 127 and 64 slow down the clock by 0.25sec/day steps.
CANBus Address	-	1	64	64	This parameter is the CANbus address for multiple operation. If the address of any device is set to 32 or lower, this compressor is included in the multiple operation network. Refer to section 25.11 for further information on multiple operation. It is recommended to set the address to a value between 33-64 if multiple operation is not performed.
CANBus Communication Rate	kbps	50	500	250	CANbus communication rate for multiple operation.
E-mail on IP change	-	0	1	0	If the IP changes when GPRS connection is established, an e-mail is sent. No warnings will be shown on the controller if the IP changes. **0:** No e-mail on IP change. **1:** E-mail sent on IP change.
Remote Control Enabled	-	0	1	1	This parameter enables the remote control of the controller via Rainbow, Modbus, and Modbus TCP/IP. **0:** Remote control disabled **1:** Remote control enabled
Log Records Period	Sec	5	3600	5	This parameter adjusts the data logging frequency to micro-SD or USB Flash memories. Frequent recording will require higher memory capacity. With a period of 2 seconds, 4GB per year of memory is necessary. With a period of 1 minute, 133MB is consumed per year.
LCD Backlight Timer	Min	0	1440	60	If no button is pressed during this period, the unit will reduce the LCD screen backlight intensity for economy.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
SMS Commands Enabled	-	0	1	1	**0:** SMS commands not accepted **1:** SMS commands accepted only from listed telephone numbers.
Periodic Event Recording Enabled	-	0	1	0	**0:** No periodic (hourly) event records. **1:** Periodic (hourly) event records enabled.
PGM Entered Event	-	0	1	1	**0:** No event recorded upon entering programming mode. **1:** Event recorded upon entering program mode.
Temperature Display Fahrenheit	-	0	1	0	**0:** Temperature measurements are displayed in degrees **Celsius** (°C). **1:** Temperature measurements are displayed in degrees **Fahrenheit** (°F).
Pressure Display PSI	-	0	1	0	**0:** Pressure measurements are displayed in **Bar**. **1:** Pressure measurements are displayed in **PSI**.
Current Transformer Secondary	-	0	1	0	**0:** xxx/5A **1:** xxx/1A
Compressor Fan Stop Together	-	0	1	1	**0:** When the compressor turns off, "Fan OFF Temperature" is checked to turn off the fan. **1:** The fan turns off with the compressor.
Local Time Zone	Hours	-12	+12	3	This parameter selects the time zone for the location of the unit. This allows the real time clock to be synchronized to UTC.
GSM Location Info	-	0	1	1	0: Location over GSM disabled. 1: Location over GSM enabled.
T1 Upload Sender Curve T2 Upload Sender Curve T3 Upload Sender Curve T4 Upload Sender Curve	-	0	6	0	These parameters enable the upload of the below 16-point ohm-temperature sender curves for the senders 1,2,3, 4. **0:** No Upload: If the sender curve will not be changed, this value must be selected. **1:** KTY 13.5 R25=2K sender curve uploaded. **2:** KTY R25=1K sender curve uploaded. **3:** PT1000 sender curve uploaded. **4:** NTC R25=10K B=3435K sender curve uploaded. **5:** NTC R25=10K B=3760K sender curve uploaded. **6:** NTC R25=10K B=3950K sender curve uploaded.

15.2. ELECTRICAL PARAMETERS GROUP

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Current Transformer Primary	A	5	10000	500	Current transformer primary current value
Voltage Transformer Ratio	-	0.1	5000.0	1.0	Voltage Transformer Ratio. The voltage and power measurements are multiplied by this ratio. If a transformer is not used, this value must be set to 1.0.
Alarm Dismiss Timer	Sec	0	255	20	When the alarm reason is removed for electrical alarms, if the alarm is not latching type, the alarm status is over at the end of this timer.
Phase Order Check	-	0	1	0	**0:** Phase order is not checked. **1:** Alarm occurs if phases are out of order.
Low Voltage Alarm Value	V	0	65000	0	If any of the mains phase voltages drops below this value for the duration of **Voltage Alarm Timer, Low Voltage Alarm** occurs. If this value is set to 0, the alarm is disabled.
High Voltage Alarm Value	V	0	65000	0	If any of the mains phase voltages exceeds this value for the duration of **Voltage Alarm Timer, High Voltage Alarm** occurs. If this value is set to 0, the alarm is disabled.
Voltage Alarm Timer	Sec	0	255	30	If any of the mains phase voltages are outside the limits for the duration of this timer, the relevant alarm occurs.
Voltage Alarm Latching	-	0	1	0	**0:** non-latching **1**: latching
Low Frequency Alarm Value	Hz	0	400	0	When mains frequency drops below this value, an alarm occurs. If this value is set to 0, the alarm is disabled.
High Frequency Alarm Value	Hz	0	400	0	When mains frequency exceeds this value, an alarm occurs. If this value is set to 0, the alarm is disabled.
Frequency Alarm Timer	Sec	0	255	30	If the mains frequency is outside the limits for the duration of this timer, the relevant alarm occurs.
Frequency Alarm Latching	-	0	1	0	0: non-latching 1: latching
Low Active Power Alarm Value	kW	0	9999	0	If any of the active channels' power drops below this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.
High Active Power Alarm Value	kW	0	9999	0	If any of the active channels' power exceeds this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.
Active Power Alarm Timer	Sec	0	255	30	If the active power of any channel is outside the limits for the duration of this timer, an alarm occurs.
Active Power Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Reactive Capacitive Alarm Value	kVAr	0	9999	0	If the reactive power of any channel is capacitive and above this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Reactive Inductive Alarm Value	kVAr	0	9999	0	If the reactive power of any channel is inductive and above this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.
Reactive Alarm Timer	Sec	0	255	30	If the reactive power of any channel is outside the limits for the duration of this timer, an alarm occurs.
Reactive Power Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Power Factor (PF) Capacitive Alarm Value	-	0	0.999	0	If the power factor of any channel is capacitive and below this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.
Power Factor (PF) Inductive Alarm Value	-	0	0.999	0	If the power factor of any channel is capacitive and below this limit, an alarm occurs. If this value is set to 0, the alarm is disabled.
Power Factor (PF) Alarm Timer	Sec	0	255	30	If the power factor of any channel is outside the limits for the duration of this timer, an alarm occurs.
Power Factor (PF) Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Over Current Alarm Value	A	0	5000	0	If any of the phase currents exceeds this value for the duration of **Current Alarm Timer**, **Over Current Alarm** occurs. If this value is set to 0, the alarm is disabled.
Current Alarm Timer	Sec	0	255	30	If any of the phase currents is outside the limits for the duration of this timer, an alarm occurs.
Current Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
High THD-V Alarm Value	%	0	50	0	If the total harmonic distortion of any phase input exceeds this value, an alarm occurs. If this value is set to 0, the alarm is disabled.
THD-V Alarm Timer	Sec	0	255	30	If the THD-V exceeds the limit for the duration of this timer, an alarm occurs.
THD-V Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
High THD-I Alarm Value	%	0	50	0	If the total harmonic distortion of any phase input current exceeds this value, an alarm occurs. If this value is set to 0, the alarm is disabled.
THD-I Alarm Timer	Sec	0	255	30	If the THD-I exceeds the limit for the duration of this timer, an alarm occurs.
THD-I Alarm Latching	-	0	1	0	0: non-latching 1: latching
Voltage Unbalance Alarm	%	0	50	0	If the voltage unbalance exceeds this limit, an alarm occurs. If this value is set to 0, the alarm is disabled. Voltage unbalance is calculated as the maximum deviation from average.
Voltage Unbalance Alarm Timer	Sec	0	255	30	If the voltage unbalance exceeds the limit for the duration of this timer, an alarm occurs.

15.2. ELECTRICAL PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Voltage Unbalance Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
Current Unbalance Alarm	%	0	50	0	If the current unbalance exceeds this limit, an alarm occurs. If this value is set to 0, the alarm is disabled. Current unbalance is calculated as the maximum deviation from average.
Current Unbalance Alarm Timer	Sec	0	255	30	If the current unbalance exceeds the limit for the duration of this timer, an alarm occurs.
Current Unbalance Alarm Latching	-	0	1	0	**0:** non-latching 1: latching
kW-kVAr Pulse Timer	msec	1	1000	100	This is the pulse timer for the kW and kVAr pulse relay (output) function.
Minimum Displayed Voltage	V	0	100	25	This parameter defines the minimum voltage value to be displayed. Phase-neutral voltage values less than the multiplication of this parameter and the voltage transformer ratio are displayed as 0V. For phase-phase voltages, 1.5x multiple of this parameter is used.
Connection Topology (Type)	-	0	5	0	**0:** 3 Phase, 4 Wire, Star **1:** 1 Phase, 2 Wire **2:** 2 Phase, 3 Wire, L1-L2 CT **3:** 3 Phase, 4 Wire, Delta **4:** 3 Phase, 3 Wire, L1-L2 CT **5:** 3 Phase, 3 Wire, L1-L3 CT
Minimum Displayed Current	%	0	100	4	This parameter defines the minimum current value to be displayed. Values below 0.01 times the multiplication of Current Transformer Primary value and this parameter are displayed as 0A.
Reset Min/Max	-	0	1	-	**0:** No effect **1:** Resets the Min/Max values. This parameter is not saved to memory, it is always read as 0.
Reset kWh Counter	-	0	1	-	**0:** No effect **1:** Resets the kWh counter. This parameter is not saved to memory, it is always read as 0.
Reset kVArh-Ind. Counter	-	0	1	-	**0:** No effect **1:** Resets the inductive kVArh counter. This parameter is not saved to memory, it is always read as 0.
Reset kVArh-Cap. Counter	-	0	1	-	**0:** No effect **1:** Resets the capacitive kVArh counter. This parameter is not saved to memory, it is always read as 0.
Reset Digital Input Counter-1	-	0	1	-	**0:** No effect **1:** Resets Digital Input Counter-1. This parameter is not saved to memory, it is always read as 0.
Reset Digital Input Counter-2	-	0	1	-	**0:** No effect **1:** Resets Digital Input Counter-2. This parameter is not saved to memory, it is always read as 0.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Temperature Sender for Heating Relay	-	0	4	0	This parameter selects the sender to be used to control the heating relay. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2) 2: Temperature Sender-3 (T3) 3: Temperature Sender-4 (T4) 4: PT100 Temperature Sender (T5)
Heater ON Temperature	°C	-100	100	0	If the measurement sent by the **Temperature Sender for Heating Relay** parameter is less than **Heater ON Temperature**, the heating relay activates. If the measurement is greater than (**Heater ON Temperature + Heater OFF Temperature Difference**), the heating relay disengages.
Heater OFF Temperature Difference	°C	1	30	5	
0-10V Analog Output Configuration	-	0	25	0	This parameter defines the mode of operation for the 0-10V Analog output. 0: Motor Drive 1: Fan Drive 2: Total Active Power 3: Total Reactive Power 4: Total Power 5: Average Voltage 6: Average Current 7: Average Power Factor (PF) 8: L1 Active Power 9: L2 Active Power 10: L3 Active Power 11: L1 Reactive Power 12: L2 Reactive Power 13: L3 Reactive Power 14: L1 Total 15: L2 Total 16: L3 Total 17: L1-N Voltage 18: L2-N Voltage 19: L3-N Voltage 20: L1-2 Voltage 21: L2-3 Voltage 22: L3-1 Voltage 23: L1 Current 24: L2 Current 25: L3 Current 26: Temperature-1 (T1) 27: Temperature-2 (T2) 28: Temperature-3 (T3) 29: Temperature-4 (T4) 30: Pressure-1 (P1) 31: Pressure-2 (P2) 32: Pressure-3 (P3) 33: PT100 Temperature (T5)

15.2. ELECTRICAL PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
0-10V Analog Output MIN Value	-	0	3200.0	0	If the 0-10V Analog output is used for sending a voltage value proportional to a measurement value (NOT motor or fan drive), MIN value must be set to the measurement value corresponding to 0V, and MAX value must be set to the measurement value corresponding to 10V.
0-10V Analog Output MAX Value	-	0	3200.0	0	
Inverter Minimum Load Speed	rpm	0	9900	1800	The minimum rpm for the motor driven by the inverter while the compressor is loaded.
Inverter Minimum Speed Duration	Sec	0	15	3	The duration for the inverter to ramp up to the minimum motor drive speed
Inverter Idle Speed	rpm	0	9900	1900	The idle speed for the inverter to drive the motor after the compressor unloads.

15.3. COMPRESSOR PARAMETERS GROUP

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Pressure Sender-1 Control Setting	-	0	2	2	**0:** Disabled **1:** Pressure Switch **2:** Pressure Sender
Pressure Sender-1 High Limit	bar	1.7	99.9	16.0	The upper measurement limit for the 1st pressure sender must be entered here.
High Pressure-1 Alarm Value	bar	1.2	99.4	8.5	If the 1st pressure measurement value exceeds this parameter, an alarm occurs.
Stop Pressure	bar	0.7	99.2	7.4	If the main pressure measurement value exceeds this parameter, the load relay opens.
Start Pressure	bar	0.5	99.0	6.5	If the main pressure measurement value exceeds this parameter, the load relay closes.
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 High Limit	°C	-400	400	130	The upper measurement for the 1st temperature sender must be entered here. If this parameter is set to 0, the 1st temperature measurement is not displayed and the relevant alarms are disabled.
High Temperature-1 Alarm Value	°C	-400	400	108	If the 1st temperature measurement value exceeds this parameter, an alarm occurs.
High Temperature-1 Warning Value	°C	-400	400	103	If the 1st temperature measurement value exceeds this parameter, a warning is displayed.
Low Temperature-1 Alarm Value	°C	-400	400	0	If the 1st temperature measurement value drops below this parameter, an alarm occurs.
Temperature Sender-1 Offset Value	°C	-20	20	0	This offset parameter is added to the 1st temperature measurement value.
Temperature Sender for Fan	-	0	4	0	This parameter selects the temperature sender for fan control. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2) 2: Temperature Sender-3 (T3) 3: Temperature Sender-4 (T4) 4: PT100 Temperature Sender (T5)
Automatic Restart Delay	Sec	0	255	0	**0:** The controller always turns on in STOP mode **1-255:** The controller turns on in the mode it was when energy was lost. If the power was lost while the compressor was running, the compressor automatically restarts after this timer expires, and displays the "**Energy Loss / Restart**" warning before restarting. This function is disabled if the parameter is set to 0.
Main Temperature Value for Pressure	°C	0	999	0	Until the main temperature value reaches this parameter, instead of **Stop Pressure**, **Start Pressure+(Stop Pressure – Start Pressure)/4** is used. That means the compressor stops before reaching **Stop Pressure**. If this parameter is set to 0, this function is disabled.
Delay Between Relays	msec	20	250	100	This is the minimum delay duration between opening one relay and closing another.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Temperature Sender-2 Configuration	°C	0	3	0	**0:** Disabled **1:** Absolute Temperature **2**: Temperature Difference **3:** Motor PTC (If sender reading exceeds 2000 Ohms, **MPTC High Temperature** alarm occurs.)
Temperature Sender-2 High Limit	°C	-400	400	130	The upper measurement limit of the 2nd temperature sender must be entered here.
High Temperature-2 Alarm Value	°C	-400	400	110	If the 2nd temperature measurement value exceeds this parameter, an alarm occurs.
High Temperature-2 Warning Value	°C	-400	400	85	If the 2nd temperature measurement value exceeds this parameter, a warning is displayed.
Low Temperature-2 Alarm Value	°C	-400	400	-10	If the 2nd temperature measurement value drops below this parameter, an alarm occurs.
T1-T2 Temperature Difference Alarm Value	°C	-100	100	0	If T1-T2 temperature difference is greater than **T1-T2 Temperature Difference Alarm Value** for the duration of **Temperature Difference Alarm Delay**, **Sender-2 Temperature Difference Alarm** occurs.
Temperature Alarm Delay	Sec	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 Duration	Sec	2	20	7	This is the duration that the star relay remains closed while starting up the motor.
Star-Delta Transition Duration	msec	10	50	15	This is the time between opening the star relay and closing the delta relay while starting up the motor.
Time Before Load	Sec	1	120	2	The motor runs off-load for the duration of this timer before taking the load.
Unload Timer	Sec	0	600	60	The motor unloads after bringing the Main pressure measurement value up to **Stop Pressure**, and continues to run off-load for the duration of this timer, then stops. This parameter is not updated immediately upon reconfiguration, it is only updated when the device is first powered up and in STOP mode.
Variable Unload Timer	-	0	1	0	**0:** Constant **1:** Variable **If this parameter is set to 1:** If the motor has been at rest for longer than Unload Timer, the unload timer is shortened by 1 minute at each operation cycle, but never below 2 minutes. Refer to section 25.7 for more details.
Safety Timer	Sec	1	240	2	Refer to section 12 for the function of this parameter.

15.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Service A Hours (Timer)	Hours	0	32767	2000	Service A is synchronized to this value when reset. If this parameter is set to **0**, service A warning is disabled.
Service B Hours (Timer)	Hours	0	32767	4000	Service A is synchronized to this value when reset. If this parameter is set to **0**, service B warning is disabled.
Service C Hours (Timer)	Hours	0	32767	6000	Service A is synchronized to this value when reset. If this parameter is set to **0**, service C warning is disabled.
Service D Hours (Timer)	Hours	0	32767	10000	Service A is synchronized to this value when reset. If this parameter is set to **0**, service D warning is disabled.
Service E Hours (Timer)	Hours	0	32767	20000	Service A is synchronized to this value when reset. If this parameter is set to **0**, service E warning is disabled.
Maximum Number of Starts per Hour	-	6	240	120	This parameter defines the maximum number of start/stop cycles the motor can perform within 1 hour. If the compressor cycles **Max. Number of Starts per Hour** times within 1 hour, **Wait 1 Hour Before Stopping** warning is displayed and the motor is not allowed to stop until the hour is up. The motor will not stop even if the pressure is sufficient, it continues to run off-load.
Fan Start Temperature	°C	30	124	85	If the temperature measurement coming from the temperature sender for fan exceeds the **Fan Start Temperature**, the fan relay engages. If the temperature measurement is less than **Fan Stop Temperature**, the fan relay disengages.
Fan Stop Temperature	°C	1	120	80	
Motor PTC Alarm Value	Ohm	0	12000	2000	If any of the 2nd, 3rd or 4th temperature senders has been configured as "Motor PTC", and if the resistance measurement from the relevant sender input exceeds the "Motor PTC Alarm Value", "Motor PTC High Temperature Alarm" occurs. Only a single temperature sender, and not multiple senders, must be configured as "Motor PTC".
Pressure Loss Prevention Method	-	0	2	0	**0:** None (Standard Operation) **1:** Iteration method **2:** Curve slope method. This parameter's function is explained in section 25.6.
Slave Start Time (Multiple Operation)	Sec	1	6500	180	This parameter's function is explained in section 25.11.
Master Switch Time (Multiple Operation)	hours	1	999	100	This parameter's function is explained in section 25.11.

Parameter Definition	Unit	Min	Max	Factory Settings	Description
Pressure Sender-2 Control Setting	-	0	2	0	**0:** Disabled **1:** Pressure Switch **2:** Pressure Sender
Pressure Sender-2 High Limit	bar	1.7	99.9	16.0	The upper measurement limit of the 2nd pressure sender must be entered here.
High Pressure-2 Alarm Value	bar	1.2	99.4	8.8	If the 2nd pressure measurement exceeds this value, an alarm occurs.
P1-P2 Pressure Difference Alarm Value	bar	-10.0	10.0	0	If P1-P2 Pressure difference is greater than **P1-P2 Pressure Difference Alarm Value** for the duration of **Pressure Difference Alarm Delay**, **Sender-2 Pressure Difference Alarm** occurs.
Pressure Alarm Delay	Sec	1	600	2	This is the delay timer for the 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 Value	bar	0	98.9	0	If the 2nd pressure measurement value drops below this parameter, an alarm occurs.
Stop on Service Request	-	0	1	0	**0:** Only displays a warning when a service timer expires. **1:** The compressor stops as explained in section 13.1 when a service timer expires.
Variable Service Hours	-	0	1	0	**0:** Constant service hours coefficient **1:** Variable service hours coefficient Explained in detail in section 25.5.
PWM Motor Drive Setting	-	0	1	0	**0:** PWM motor drive signal disabled **1:** PWM motor drive signal active Refer to section 25.8 for detailed information.
PWM Set Pressure	bar	0.5	99.4	7.0	When using 0-10V or 4-20mA analog outputs to drive the motor, this is the target pressure level. Refer to section 25.8 for further detail.
Motor PID Gain (P) coefficient	%	0	99.9	3.0	Motor PID control P coefficient.
Motor PID Integrator (I) coefficient	%	0	99.9	0.4	Motor PID control I coefficient.
Motor PID Derivative (D) coefficient	%	0	99.9	5.0	Motor PID control D coefficient.
Motor PID Integrator (I2, inverse I) coefficient	%	0	99.9	0.4	Motor PID control inverse I coefficient.
Motor PID Start delay	Sec	1	99.9	10	Refer to section 25.8 for detailed information.
Motor PID Start Temperature	°C	0	250	0	Refer to section 25.8 for detailed information.
Temperature Sender-3 Configuration	°C	0	3	0	0: Disabled 1: Absolute Temperature 2: Temperature Difference 3: Motor PTC (MPTC High Temperature alarm occurs when sender measurement value exceeds 2000 Ohms.)

15.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Settings	Description
Temperature Sender-3 High Limit	°C	-400	400	130	The upper measurement limit of the 3rd temperature sender must be entered here.
High Temperature-3 Alarm Value	°C	-400	400	110	If the 3rd temperature measurement value exceeds this parameter, an alarm occurs.
High Temperature-3 Warning Value	°C	-400	400	85	If the 3rd temperature measurement value exceeds this parameter, a warning is displayed.
Low Temperature-3 Alarm Value	°C	-400	400	0	If the 3rd temperature measurement value drops below this parameter, an alarm occurs.
T1-T3 Temperature Difference Alarm Value	°C	-100	100	0	If the T1-T3 temperature difference is greater than **T1-T3 Temperature Difference Alarm Value**, or T2-T3 temperature difference is greater than **T2-T3 Temperature Difference Alarm Value** for the duration of **Temperature Difference Alarm delay, Sender-3 Temperature Difference Alarm** occurs.
T2-T3 Temperature Difference Alarm Value	°C	-100	100	0	
Temperature Difference Alarm Delay	Sec	1	600	10	This is the delay timer for temperature difference alarms.
Temperature Sender-3 Offset Value	°C	-20	20	0	This offset parameter is added to the 3rd temperature measurement value.
Temperature Sender-4 Configuration	°C	0	3	0	**0:** Disabled **1:** Absolute Temperature **2**: Temperature Difference **3**: Motor PTC (**MPTC High Temperature** alarm occurs when sender measurement value exceeds 2000 Ohms.)
Temperature Sender-4 High Limit	°C	-400	400	130	The upper measurement limit of the 4th temperature sender must be entered here.
High Temperature-4 Alarm Value	°C	-400	400	110	If the 4th temperature measurement value exceeds this parameter, an alarm occurs.
High Temperature-4 Warning Value	°C	-400	400	85	If the 4th temperature measurement value exceeds this parameter, a warning is displayed.
Low Temperature-4 Alarm Value	°C	-400	400	0	If the 4th temperature measurement value drops below this parameter, an alarm occurs.
T1-T4 Temperature Difference Alarm Value	°C	-100	100	0	If the T1-T4 temperature difference is greater than **T1-T4 Temperature Difference Alarm Value**, or T2-T4 temperature difference is greater than **T2-T4 Temperature Difference Alarm Value**, or the T3-T4 temperature difference is greater than **T3-T4 Temperature Difference Alarm Value** for the duration of **Temperature Difference Alarm delay, Sender-4 Temperature Difference Alarm** occurs.
T2-T4 Temperature Difference Alarm Value	°C	-100	100	0	
T3-T4 Temperature Difference Alarm Value	°C	-100	100	0	
Temperature Sender-4 Offset Value	°C	-20	20	0	This offset parameter is added to the 4th temperature measurement value.

Parameter Definition	Unit	Min	Max	Factory Settings	Description
Pressure Sender-3 Control Setting	-	0	2	0	**0:** Disabled **1:** Pressure Switch **2:** Pressure Sender
Pressure Sender-3 High Limit	bar	1.7	99.9	16.0	The upper measurement limit of the 3rd pressure sender must be entered here.
High Pressure-3 Alarm Value	bar	1.2	99.4	8.8	If the 3rd pressure measurement value exceeds this parameter, an alarm occurs.
Low Pressure-3 Alarm Value	bar	0	98.9	0	If the 3rd pressure measurement value drops below this parameter, an alarm occurs.
P1-P3 Pressure Difference Alarm Value	bar	-10.0	10.0	0	If P1-P3 Pressure difference is greater than **P1-P3 Pressure Difference Alarm Value** or P2-P3 Pressure difference is greater than **P2-P3 Pressure Difference Alarm Value** for the duration of **Pressure Difference Alarm Delay**, **Sender-3 Pressure Difference Alarm** occurs.
P2-P3 Pressure Difference Alarm Value	bar	-10.0	10.0	0	
Pressure Difference Alarm Delay	Sec	1	600	10	
Pressure Sender-3 Offset Value	bar	-2.0	2.0	0	This offset parameter is added to the 3rd pressure measurement.
PT100 Sender Temperature High Limit	°C	-400	400	0	The upper measurement limit of the PT100 temperature sender must be entered here. If this parameter is set to 0, the PT100 temperature measurement will not be displayed and the relevant alarms will be disabled.
PT100 High Temperature Alarm Value	°C	-400	400	110	If the PT100 temperature measurement value (T5) exceeds this parameter, an alarm occurs.
PT100 Low Temperature Alarm Value	°C	-400	400	0	If the PT100 temperature measurement value (T5) drops below this parameter, an alarm occurs.
PT100 Temperature Sender Offset Value	°C	-20	20	0	This offset parameter is added to the PT100 temperature measurement value (T5).
Active Oiling Duration	Sec	0	500	2	The OILING relay function is activated for the duration of this timer.
Oiling Period	Min	0	30000	11000	The OILING relay function is disabled for the duration of this timer. When the OILING relay function switches off, Time remaining for oiling (min) counter is set equal to **Oiling Period** and the counter starts the countdown. When the countdown ends, OILING relay function is activated.
PWM Fan Drive Setting	-	0	1	0	**0:** PWM fan drive signal disabled. **1:** PWM fan drive signal active. Refer to section 25.9 for detailed information.
Fan Drive Target Temperature	°C	0.5	99.4	85	When using the 0-10V or 4-20mA analog outputs to drive the fan, this is the target temperature. Refer to section 25.9 for detailed information.
Fan PID Gain (P) coefficient	%	0	99.9	3.0	Fan PID control P coefficient.
Fan PID Integrator (I) coefficient	%	0	99.9	0.4	Fan PID control I coefficient.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Fan PID Derivative (D) coefficient	%	0	99.9	5.0	Fan PID control D coefficient.
Fan PID Correction (%) coefficient	%	0	99.9	1.0	Fan PID control inverse I coefficient.
Fan PID Delay Timer	Sec	1	99.9	0	Refer to section 25.9 for detailed information.
Max Number of Slaves Under Load	-	0	32	0	The function of this parameter is explained in section 25.11.
Reset All Service Counters	-	0	1	-	**0:** No effect **1:** Resets all service counters. The service counters are set equal to the relevant Service Hours parameters. This parameter is not saved to memory, it is always read as 0.
Reset Service A Counter	-	0	1	-	**0:** No effect **1:** Service A Counter is set equal to the **Service A Timer** parameter. This parameter is not saved to memory, it is always read as 0.
Reset Service B Counter	-	0	1	-	**0:** No effect **1:** Service B Counter is set equal to the **Service B Timer** parameter. This parameter is not saved to memory, it is always read as 0.
Reset Service C Counter	-	0	1	-	**0:** No effect **1:** Service C Counter is set equal to the **Service C Timer** parameter. This parameter is not saved to memory, it is always read as 0.
Reset Service D Counter	-	0	1	-	**0:** No effect **1:** Service D Counter is set equal to the **Service D Timer** parameter. This parameter is not saved to memory, it is always read as 0.
Reset Service E Counter	-	0	1	-	**0:** No effect **1:** Service E Counter is set equal to the **Service E Timer** parameter. This parameter is not saved to memory, it is always read as 0.
Reset Running hours Counter	-	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 Running Hours Counter	-	0	1	-	**0:** No effect **1:** Resets the Loaded Running hours counter. This parameter is not saved to memory, it is always read as 0.
Reset Number of Motor Starts Counter	-	0	1	-	**0:** No effect **1:** Resets the number of motor starts counter. This parameter is not saved to memory, it is always read as 0.
Reset Number of Fan Starts Counter	-	0	1	-	**0:** No effect **1:** Resets the number of fan starts counter. This parameter is not saved to memory, it is always read as 0.

15.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Reset Oiling Counter	-	0	1	-	**0:** No effect **1:** The oiling counter is set equal to **Oiling Period** parameter. This parameter is not saved to memory, it is always read as 0.
Pressure and Temperature Alarms Latching	-	0	1	0	**0:** Non-latching **1:** Latching
Dryer Delay Timer	min	0	120	30	Dryer relay function activates simultaneously with the MAIN relay function, but waits for the duration of **Dryer Delay Timer** following the deactivation of MAIN relay function.
Minimum Loading Temperature	°C	-100	100	0	If the main temperature measurement is below the **Minimum Loading Temperature** parameter when the compressor is started, the warning "**Temperature Too Low for Loading"** is issued, and the compressor is not allowed to take the load until **Minimum Loading Temperature** is reached.
Pre-Heating Enabled	-	0	1	0	**0**: Pre-heating function disabled **1**: Pre-heating function enabled
Pre-Heating Offload Timer	Sec	1	6000	60	If the main temperature measurement is below the **Minimum Loading Temperature** parameter when the compressor is started, and the **Pre-Heating Enabled** parameter is set to 1, pre-heating operation is performed for the compressor. The compressor performs load/unload cycles until it reaches the **Minimum Loading Temperature. Pre-Heating Offload Timer** adjusts the unloaded working duration in the cycle.
Pre-Heating Stop Pressure	Bar	0	99.9	3.5	While the compressor is working under load in the pre-heating cycle, the compressor unloads if the main pressure measurement value exceeds this value.
Pre-Heating Loaded Timer	Sec	1	6000	180	This parameter adjusts the loaded working duration in the pre-heating cycle.
Take Load Command Source	-	0	3	0	This parameter selects the source for the take load command. 0: Pressure Sender 1: Digital Input 2: Modbus Command
On-Load Water Discharge Timer	Sec	0	6500	5	The **Water Discharge Relay** is activated for the duration of this timer while the compressor is running on-load.
On-Load Water Discharge Delay	Sec	0	6500	60	The **Water Discharge Relay** is disengaged for the duration of this timer while the compressor is running on-load.
Off-Load Water Discharge Timer	Sec	0	6500	0	The **Water Discharge Relay** is activated for the duration of this timer while the compressor is running off-load.
Off-Load Water Discharge Delay	Sec	0	6500	600	The **Water Discharge Relay** is disengaged for the duration of this timer while the compressor is running off-load.

15.3. COMPRESSOR PARAMETERS GROUP (cont.)

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Main Temperature Sender	-	0	4	0	This parameter selects the main temperature sender to control the compressor. 0: Temperature Sender-1 (T1) 1: Temperature Sender-2 (T2) 2: Temperature Sender-3 (T3) 3: Temperature Sender-4 (T4) 4: PT100 Temperature Sender (T5)
Main Pressure Sender	-	0	2	0	This parameter selects the main pressure sender to control the compressor. 0: Pressure Sender-1 (P1) 1: Pressure Sender-2 (P2) 2: Pressure Sender-3 (P3)

15.4. ADJUST DATE AND TIME
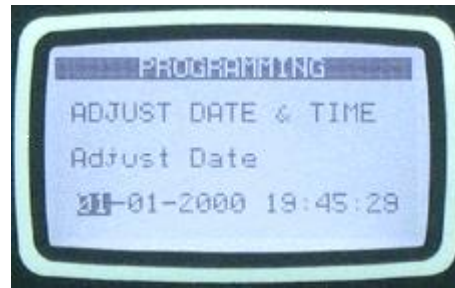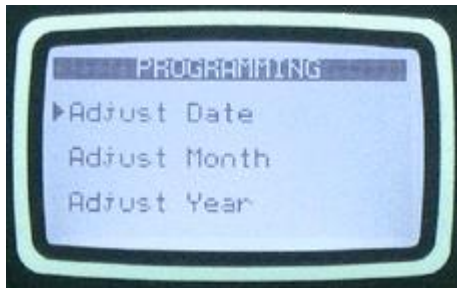
Date-time information is received from the built-in, battery-powered real time clock.

Parameter Definition	Unit	Min	Max	Description
Day	-	01	31	Day of the month
Month	-	01	12	Month information
Year	-	00	99	Last two 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

15.5. WEEKLY OPERATION SCHEDULE

In some applications, it is required that the compressor activates only during working hours. The weekly operation schedule allows for this kind of application.

Using the weekly schedule, the unit can be configured to turn on or off automatically in hourly sections.

The weekly operation schedule has 7 days x 24 hours = 144 parameters. The device can be configured to switch to RUN mode or STOP mode for each hour of the week.

In order for the compressor to follow the weekly operation schedule and start/stop automatically, the **Weekly Operation Schedule Enabled** parameter in the Controller Configuration Group must be set to 1.

If the *Weekly Operation Schedule Enabled* parameter is set to 1, the compressor will start and stop as configured in the weekly operation schedule. When the compressor stops while this feature is active, "**STOP-Weekly Schedule**" warning occurs; when the compressor starts automatically, "**RUN-Weekly Schedule**" warning is displayed.

If the **STOP** button is pressed while the compressor is running according to weekly schedule, or if the **START** button is pressed while the compressor is stopped according to weekly schedule, "**Weekly Schedule Cancelled**" warning is displayed and the *Weekly Operation Schedule Enabled* parameter is automatically set to 0. If the compressor is required to operate according to the weekly schedule, the *Weekly Operation Schedule Enabled* parameter must be set to 1 again.

15.6. PRESSURE CALENDAR

The controller offers 32 independent pressure calendars. For each pressure calendar; the starting day, hour and minute, the duration, Start Pressure, and Stop Pressure can be independently configured. Start Pressure and Stop Pressure cannot be set higher than 0.2 Bar above **Main Pressure High Alarm Limit**.

This allows for the compressor to run in the desired day and hour of the week for the desired amount of time with the desired Start Pressure and Stop Pressure.

If a Pressure Calendar's duration is set to 0, it is disabled.

In order for the compressor to operate according to the Pressure Calendar, the **Pressure Calendar Enabled** parameter in the Controller Configuration Group must be set to 1.

If the compressor's Start Pressure or Stop Pressure has been changed according to a Pressure Calendar entry, the string "**SCHLD**" is displayed between the Start Pressure and Stop Pressure on the main pressure and temperature screen.

If the compressor's Start Pressure and Stop Pressure have been changed according to a Pressure Calendar entry, instead of **PWM Set Pressure,** the average of Start Pressure and Stop Pressure set in the Pressure Calendar is used.

15.7. SENSOR CHARACTERISTICS

The controller offers 3x 4-20mA pressure sender inputs, 4x analog temperature sender inputs and 1x PT100 temperature sender inputs. Each sender has a 16-step programmable curve.

The curve parameters of only one of the analog temperature senders is explained below. All of the other analog temperature senders have the same parameters. Each analog temperature sender has the following programmable parameters:

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

The curve parameters of only one of the 4-20mA pressure senders is explained below. All of the other pressure senders have the same parameters. Each pressure sender has the following programmable parameters:

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

The PT100 temperature sender's curve parameters are explained below. PT100 sender has the following programmable parameters:

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Sender Curve-1 ohm	ohm	0	6553.5	60.2	Step-1 ohm value
Sender Curve-1 temp	°C	-32768	32767	-100	Step-1 temperature value
Sender Curve-2 ohm	ohm	0	6553.5	80.3	Step-2 ohm value
Sender Curve-2 temp	°C	-32768	32767	-50	Step-2 temperature value
Sender Curve-3 ohm	ohm	0	6553.5	96.1	Step-3 ohm value
Sender Curve-3 temp	°C	-32768	32767	-10	Step-3 temperature value
Sender Curve-4 ohm	ohm	0	6553.5	100.0	Step-4 ohm value
Sender Curve-4 temp	°C	-32768	32767	0	Step-4 temperature value
Sender Curve-5 ohm	ohm	0	6553.5	103.9	Step-5 ohm value
Sender Curve-5 temp	°C	-32768	32767	10	Step-5 temperature value
Sender Curve-6 ohm	ohm	0	6553.5	107.8	Step-6 ohm value
Sender Curve-6 temp	°C	-32768	32767	20	Step-6 temperature value
Sender Curve-7 ohm	ohm	0	6553.5	111.7	Step-7 ohm value
Sender Curve-7 temp	°C	-32768	32767	30	Step-7 temperature value
Sender Curve-8 ohm	ohm	0	6553.5	115.5	Step-8 ohm value
Sender Curve-8 temp	°C	-32768	32767	40	Step-8 temperature value
Sender Curve-9 ohm	ohm	0	6553.5	119.4	Step-9 ohm value
Sender Curve-9 temp	°C	-32768	32767	50	Step-9 temperature value
Sender Curve-10 ohm	ohm	0	6553.5	123.2	Step-10 ohm value
Sender Curve-10 temp	°C	-32768	32767	60	Step-10 temperature value
Sender Curve-11 ohm	ohm	0	6553.5	127.1	Step-11 ohm value
Sender Curve-11 temp	°C	-32768	32767	70	Step-11 temperature value
Sender Curve-12 ohm	ohm	0	6553.5	130.9	Step-12 ohm value
Sender Curve-12 temp	°C	-32768	32767	80	Step-12 temperature value
Sender Curve-13 ohm	ohm	0	6553.5	138.5	Step-13 ohm value
Sender Curve-13 temp	°C	-32768	32767	100	Step-13 temperature value
Sender Curve-14 ohm	ohm	0	6553.5	149.8	Step-14 ohm value
Sender Curve-14 temp	°C	-32768	32767	130	Step-14 temperature value
Sender Curve-15 ohm	ohm	0	6553.5	175.8	Step-15 ohm value
Sender Curve-15 temp	°C	-32768	32767	200	Step-15 temperature value
Sender Curve-16 ohm	ohm	0	6553.5	247.1	Step-16 ohm value
Sender Curve-16 temp	°C	-32768	32767	400	Step-16 temperature value

15.8. INPUT CONFIGURATION

The controller offers 8 digital inputs. The number of these inputs can be increased to 40 using external extension input modules.

The parameters of only one of the digital inputs are explained below. All of the other digital inputs have the same programmable parameters.

The name of the input function can be entered as desired with the **USER INPUT TAGS** parameter group. If the input function for digital input-X is set as "User Function-X", when warnings or alarms relevant to that digital input occur, the configured user input tag is displayed, allowing a wide range of functions for digital inputs.

Each digital input has the following programmable parameters:

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Input Function	-	0	99		Selects pre-defined input functions. If this parameter is set to 1,2,3,4,5,6,7 or 8, input function name can be entered as desired. Input functions are listed in the next table.
Action (ACT)	-	0	3		**0:** alarm **1:** alarm **2:** warning **3:** no action
Sampling (SMP)	-	0	3		**0:** always **1:** When motor is running (on or off load) **2:** When motor running on load **3:** If load relay is not closed
Latching (LAT)	-	0	1		**0:** non-latching. The fault is dismissed when the alarm cause is removed. **1:** latching. The fault display remains until manually dismissed even if the alarm cause is removed.
Contact Type	-	0	1		**0:** Normally Open **1:** Normally Closed
Delay Timer Coefficient (DLU)	-	0	1		**0:** Delay timer taken as is **1:** Delay timer 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	11	Input Counter 2 Reset	21	Waiting for Input (Drive)
2	User Function-2	12	Input Counter 2 Incr.	22	Waiting for Separator Pressure
3	User Function-3	13	-	23	Take Load Command
4	User Function-4	14	Alarm Mute	24	Main Relay Auxiliary Contact Input
5	User Function-5	15	High Temperature Input	25	Fan Relay Auxiliary Contact Input
6	User Function-6	16	Panel Lock	26	Fan Thermal Fault
7	User Function-7	17	Emergency Stop	27	Inverter Fault
8	User Function-8	18	Remote Start/Stop	75	Not Used
9	Input Counter 1 Reset	19	Air Filter Clogged		
10	Input Counter 1 Incr.	20	Motor Overload Alarm		

15.9. DIGITAL OUTPUT (RELAY) CONFIGURATION

The following parameters determine the functions of the programmable digital outputs (relays) and LEDs. The controller offers 8 programmable digital outputs (relays) and 2 programmable LEDs.

The number of relay outputs on the device can be increased up to 40 using the **External Relay Module**.

Parameter Definition	Factory Setting	Terminal Number	Description
Relay-01	81	23	Factory setting Compressor Main Relay output
Relay-02	82	22	Factory setting Compressor Delta Relay output
Relay-03	83	21	Factory setting Compressor Star Relay output
Relay-04	84	20	Factory setting Compressor Load Relay output
Relay-05	101	24	Factory setting Fan
Relay-06	1	25	Alarm
Relay-07	133	26	Not used
Relay-08	133	27	Not used

Parameter Definition	Factory Setting	Terminal Number	Description
Relay-09	133	-	External output module – 1 (Factory set "Not used")
Relay-10	133	-	External output module – 1 (Factory set "Not used")
Relay-11	133	-	External output module – 1 (Factory set "Not used")
Relay-12	133	-	External output module – 1 (Factory set "Not used")
Relay-13	133	-	External output module – 1 (Factory set "Not used")
Relay-14	133	-	External output module – 1 (Factory set "Not used")
Relay-15	133	-	External output module – 1 (Factory set "Not used")
Relay-16	133	-	External output module – 1 (Factory set "Not used")
Relay-17	133	-	External output module – 2 (Factory set "Not used")
Relay-18	133	-	External output module – 2 (Factory set "Not used")
Relay-19	133	-	External output module – 2 (Factory set "Not used")
Relay-20	133	-	External output module – 2 (Factory set "Not used")
Relay-21	133	-	External output module – 2 (Factory set "Not used")
Relay-22	133	-	External output module – 2 (Factory set "Not used")
Relay-23	133	-	External output module – 2 (Factory set "Not used")
Relay-24	133	-	External output module – 2 (Factory set "Not used")
Relay-25	133	-	External output module – 3 (Factory set "Not used")
Relay-26	133	-	External output module – 3 (Factory set "Not used")
Relay-27	133	-	External output module – 3 (Factory set "Not used")
Relay-28	133	-	External output module – 3 (Factory set "Not used")
Relay-29	133	-	External output module – 3 (Factory set "Not used")
Relay-30	133	-	External output module – 3 (Factory set "Not used")
Relay-31	133	-	External output module – 3 (Factory set "Not used")
Relay-32	133	-	External output module – 3 (Factory set "Not used")
Relay-33	133	-	External output module – 4 (Factory set "Not used")
Relay-34	133	-	External output module – 4 (Factory set "Not used")
Relay-35	133	-	External output module – 4 (Factory set "Not used")
Relay-36	133	-	External output module – 4 (Factory set "Not used")
Relay-37	133	-	External output module – 4 (Factory set "Not used")
Relay-38	133	-	External output module – 4 (Factory set "Not used")
Relay-39	133	-	External output module – 4 (Factory set "Not used")
Relay-40	133	-	External output module – 4 (Factory set "Not used")

Parameter Definition	Factory Setting	Terminal Number	Description
Led-01	133	-	Not used
Led-02	133	-	Not used

OUTPUT FUNCTION LIST

#	Description
1	Horn
2	Flashing relay
3	Phase order fault alarm
4	Voltage fault
5	Voltage OK
6	Alarm
7	-
8	Warning
9	Alarm
10	kWh Pulse (Tick)
11	kVArh Pulse (Tick)
12	Low Voltage Alarm
13	High Voltage Alarm
14	Low Frequency Alarm
15	High Frequency Alarm
16	Frequency Alarm
17	Low active power alarm
18	High active power alarm
19	Active power alarm
20	Capacitive reactive alarm
21	Inductive reactive alarm
22	Reactive power alarm
23	Capacitive PF alarm
24	Inductive PF alarm
25	PF alarm
26	High current alarm
27	THD-V alarm
28	THD-I alarm
29	THD alarm
30	Voltage Unbalance Alarm
31	Current Unbalance Alarm
32	Unbalance 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
38	User input alarm-6
39	User input alarm-7
40	User input alarm-8
41	Button 1 (Up MENU button) simulation
42	Button 2 (Down MENU button) simulation
43	Button 3 (Left MENU button) simulation

#	Description
44	Button 4 (Right MENU button) simulation
45	Button 5 (RUN button) simulation
46	Button 6 (STOP button) simulation
47	Button 7 simulation (not available)
48	Button 8 simulation (not available)
49	Input 1 simulation
50	Input 2 simulation
51	Input 3 simulation
52	Input 4 simulation
53	Input 5 simulation
54	Input 6 simulation
55	Input 7 simulation
56	Input 8 simulation
57	Input 9 simulation
58	Input 10 simulation
59	Input 11 simulation
60	Input 12 simulation
61	Input 13 simulation
62	Input 14 simulation
63	Input 15 simulation
64	Input 16 simulation
65	User output 1
66	User output 2
67	User output 3
68	User output 4
69	User output 5
70	User output 6
71	User output 7
72	User output 8
73	User output 9
74	User output 10
75	User output 11
76	User output 12
77	User output 13
78	User output 14
79	User output 15
80	User output 16
81	Compressor MAIN Relay
82	Compressor DELTA Relay
83	Compressor STAR Relay
84	Compressor LOAD Relay
85	MPTC High Temperature

#	Description
86	High Temp. Snd-1
87	Low Temp. Snd-1
88	High Temp. Snd-2
89	Low Temp. Snd-2
90	Temp. Diff. Alarm Snd-2
91	High Temp. Snd-3
92	Low Temp. Snd-3
93	Temp. Diff. Alarm Snd-3
94	High Temp. Snd-4
95	Low Temp. Snd-4
96	Temp. Diff. Alarm Snd-4
97	High Pressure A. Snd-1
98	High Pressure A. Snd-2
99	Press. Diff. Alarm Snd-2
100	Low Pressure A. Snd-2
101	FAN
102	OILING
103	High Pressure A. Snd-3
104	Press. Diff. Alarm Snd-3
105	Low Pressure A. Snd-3
106	PT100 High Temp.
107	Temp. Alarm Sender-1
108	Temp. Alarm Sender-2
109	Temp. Alarm Sender-3
110	Temp. Alarm Sender-4
111	Press. Alarm Sender-1
112	Press. Alarm Sender-2
113	Press. Alarm Sender-3
114	PT100 Temp. Alarm
115	Temp. Sender Fault
116	Press. Sender Fault
117	Temp. Diff. Alarm
118	Pressure Diff. Alarm
119	High Temp. Alarm
120	Low Temp. Alarm
121	High Press. Alarm
122	Low Press. Alarm
123	Temperature Alarm
124	Pressure Alarm
125	High Temp. Warning
126	Service Warning
127	Wait 1 Hour to Stop Fault
128	Multi Communication Fault
129	HEATER
130	DRYER
131	Main Pressure Normal: Relay function active if Main pressure measurement value is between Start Pressure and Stop Pressure.
132	Water Discharge
133	NOT USED

15.10. ENGINE SITE ID

Engine site ID is used to identify the compressor on which the controller is mounted.

In order to be able to distinguish compressor in the SMS and e-mail messages sent by the controller and also on the webpage, the engine site ID is written in the title. One line of up to 20 characters can be set as the engine site ID.

15.11. ENGINE SERIAL NUMBER

Engine serial number is used to identify the compressor on which the controller is mounted.

In the SMS and e-mail messages sent by the controller and also on the webpage, the engine serial number is written in the title.

15.12. SMS1-2-3-4 TELEPHONE NUMBERS

Phone numbers of up to 16-digit length can be entered into the phone number memory.

Every phone number is used for SMS sending.

Enter the phone numbers starting with the first digit and without spaces.

15.13. GSM MODEM PARAMETERS

Parameter Definition	Description
APN Username	APN username may be required depending on the GSM operator. For accurate APN username information, refer to your GSM operator.
APN Password	If APN username is required, an APN password might also be required depending on the GSM network provider. For accurate information about APN password, refer to your GSM operator.
APN Name	APN name information is always used by GSM network providers. Please refer to your GSM operator for the correct APN name.
SMS Service Center No	SMS service number may be required by GSM operators. However, some operators allow SMS sending without entering a service number. Refer to your GMS network provider for SMS service number information.

The modem parameters listed below are located under Controller Configuration group.

Parameter Definition	Unit	Min	Max	Factory Setting	Description
GSM Sim Card PIN	-	0000	9999	0	If the GSM SIM Card has a PIN, enter the PIN here. The card will not be activated if the PIN is mistyped.
SMS Sending ON	-	0	1	0	**0:** No SMS sending **1:** SMS sending active
GPRS Connection ON	-	0	1	0	**0:** No GPRS connection **1:** GPRS connection active

15.14. ETHERNET PARAMETERS

Parameter Definition	Factory Setting	Description
Network IP Address	0.0.0.0	This is the IPv4 address given to the controller by the DHCP server. If this parameter is left as 0.0.0.0, the controller automatically takes an empty IP address. If you wish to give the controller a static IP address, enter the address in this parameter.
Gateway IP Address	0.0.0.0	This is the router IP address. If left unchanged as 0.0.0.0, the controller will take an empty IP address.
Subnet Mask	255.255.255.0	Reserved for IP professionals. If you are not an IP please leave this address as 255.255.255.0.
User IP Mask 1 (2) (3)	255.255.255.255 0.0.0.0 0.0.0.0	These parameters control the IPv4 access to the unit.
Domain Name	d500.dyndns-ip.com	This string is used in Dynamic DNS feature. The unit will register itself to the dynamic DNS server under this name. For detailed information, please refer to "**Dynamic DNS Feature**" and "**Dynamic DNS Account Setting**" documents.
Membership Address	members.dyndns.org	This string is used in Dynamic DNS feature. The unit will register itself to the dynamic DNS server under this name. For detailed information, please refer to "**Dynamic DNS Feature**" and "**Dynamic DNS Account Setting**" documents.
Username/Password		These strings are used in Dynamic DNS feature. The unit will register itself to the dynamic DNS server under this name. For detailed information, please refer to "**Dynamic DNS Feature**" and "**Dynamic DNS Account Setting**" documents.
Ping Address	www.google.com	This Internet address is accessed regularly in order to check the availability of Internet connectivity and access.
IP Confirmation Address	checkip.dyndns.org	This Internet address is accessed regularly in order to read the IPv4 address of the unit.
Rainbow Address-1 Rainbow Address-2	wss1.datakom.com.tr	The server addresses which will receive the data periodically sent by the controller must be entered here. The unit sends a data packet to the defined address at each refresh period. The DATAKOM server address is set as the first server address.

15.14. ETHERNET PARAMETERS (cont.)

Parameter Definition	Factory Setting	Description
E-mail Account Name	d500_a	This is the account name appearing in the **"from"** tab of the e-mail recipient.
E-mail Account Password	d500_1234	This is the password of the above e-mail account.
E-mail Server Name	smtp.mail.yahoo.com	This is the outgoing mail server address of the above e-mail account (ex: smtp.gmail.com)
E-mail Address-1 E-mail Address-2 E-mail Address-3	- - -	The unit sends e-mails to 3 users. The e-mail addresses of the users must be entered here.

⚠️ **The following Ethernet parameters are located under Controller Configuration group.**

Parameter Definition	Unit	Min	Max	Factory Setting	Description
Web Programming Enable	-	0	1	0	**0:** Web programming disabled **1:** Web programming enabled
Web Control Enable	-	0	1	0	**0:** Web control disabled **1:** Web control enabled
Web Refresh Rate	Sec	0	240	10	The unit refreshes the Webpage periodically at this interval.
Ping Period	Min	0	240	0	The unit checks the availability of Internet connection at this interval.
Rainbow Refresh Rate	Sec	0	65535	60	The unit will update the remote monitoring terminal at this rate.
Rainbow Scada Address-1 Port	-	80	65535	90	This is the port number of the first monitoring terminal address.
Rainbow Scada Address-2 Port	-	80	65535	90	This is the port number of the second remote monitoring terminal address.
Web Server Port	-	80	65535	80	This is the port number of the internal Web server. The unit will respond to queries to this port only.
Modbus TCP/IP Port	-	0	65535	502	This is the port number of the internal Modbus TCP/IP terminal. The unit will respond to Modbus requests to this port only.
SMTP Port	-	0	65535	587	This is the port number used for e-mail sending.
E-mail on IP Change	-	0	1	0	This parameter controls e-mail sending when the IP address of the GPRS or Ethernet connection changes. No warnings are generated upon GPRS IP change. **0:** no e-mail on IP change. **1:** e-mail sent on IP Change.

15.15. SNTP PARAMETERS

SNTP (simple network time protocol) communication allows the controller to query high precision, atomic clock-based date/time servers through the Internet and to synchronize its internal real time clock to these servers.

This feature allows the internal RTC to reach atomic clock precision.

Parameter Definition	Factory Setting	Description
SNTP Refresh Rate	30 seconds	This is the waiting period between two outbound SNTP requests in order to synchronize its internal RTC with the servers.
SNTP Address 1 Port	123	This is the port number of the 1st SNTP server
SNTP Address 2 Port	123	This is the port number of the 2nd SNTP server

15.16. USER INPUT STRINGS

For each of the 8 digital inputs, one-line strings can be entered. When an alarm or warning is generated by one of the digital inputs, the input strings are displayed as the alarm or warning description.

16. ETHERNET CONFIGURATION

Related parameters are:

Parameter Definition	Factory Set	Description
Network IP Address	0.0.0.0	This is the IPv4 (internet protocol version 4) address that the unit will require from the DHCP (dynamic host control protocol) server. If this parameter is set to 0.0.0.0 then the unit will require any IPv4 address from the DHCP server. If you are not an IP professional please leave this address as "0.0.0.0".
Gateway IP Address	0.0.0.0	This is the router IPv4 address, If the Network IP address and Gateway IP Address are set to "0.0.0.0" then the unit will get the gateway address automatically. If you are not an IP professional please leave this address as "0.0.0.0".
Subnet Mask	255.255.255.0	Reserved for IP professionals. If you are not an IP professional please leave this address as "255.255.255.0".
Modbus TCP/IP Port	502	Internal Modbus TCP/IP server's port number. The unit answers Modbus requests to this port only.
Modbus Address	1	This is the modbus controller identity used in Modbus communication.

The ethernet connection status is monitored at ethernet screen page.

IP address of the unit, assigned by the network

Connection status indicator

TCP/IP SCREEN

IP:192.168. 2. 39

Rx   969 bytes
Tx   1755 bytes

Data Receive and Transmit Indicators

Related parameters are:

Parameter Definition	Factory Set	Description
SMS Enable	0	**0:** SMS messages disabled **1:** SMS messages enabled
GPRS Connection Enable	0	**0:** GPRS disabled **1:** GPRS enabled
SMS on Mains Change	0	This parameter controls SMS sending when mains voltages status is changed. No warnings generated. **0**: no SMS on mains failed or restored **1**: SMS sent on mains failed or restored
SMS on Engine Run/Stop	0	This parameter controls SMS sending when the engine runs or stops. No warnings generated. 0: no SMS on engine run/stop 1: SMS sent on engine run/stop
SMS Commands Enabled	0	0: SMS commands not accepted 1: SMS commands are accepted but from listed telephone numbers only.
GSM Location Active	0	0: no location information from GSM 1: location information read from GSM system.
APN User Name		The APN (access point name) username may be required by the GSM operator. However some GSM operators may allow access without username. The exact information should be obtained from the GSM operator. Please search the GSM operator's website with "APN" string.
APN Password		If the APN (access point name) username is required by the GSM operator, most probably the APN password will also be required. However some GSM operators may allow access without password. The exact information should be obtained from the GSM operator. Please search the GSM operator's website with "APN" string.
APN Name		The APN (access point name) is always required by the GSM operator. The exact information should be obtained from the GSM operator. Please search the GSM operator's website with "APN" string.

Signal Strenght Indicator

Modem is Ready

GPRS Status Indicator

MODEM SCREEN

†.••••••... TELSIM GSM
Modem Ready
10. 69. 31. 97
1 **G** **Rx** **Tx**

IP address

RainbowScada packet counter

Data Receive and Transmit Indicators
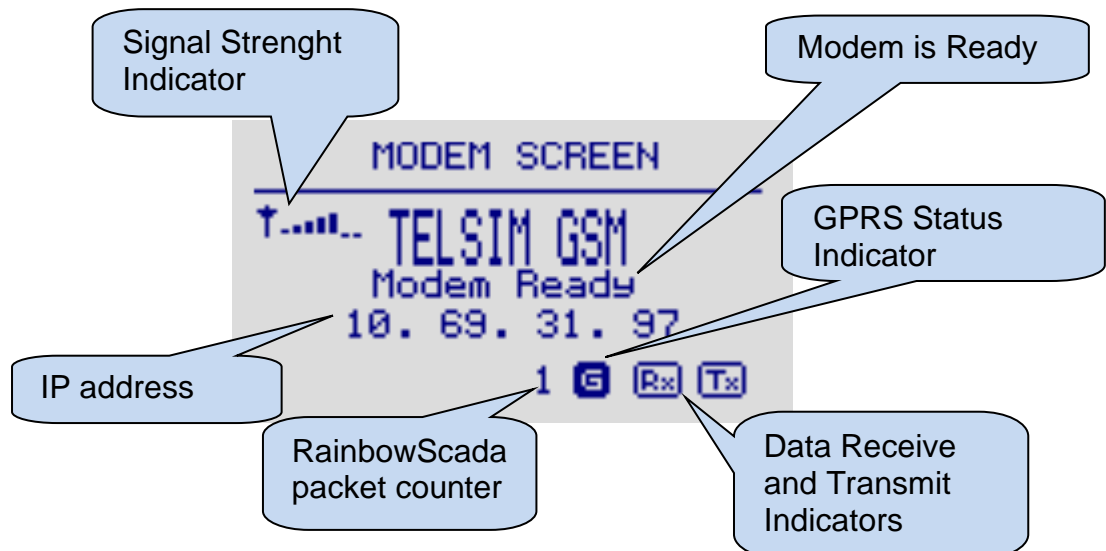
18. Wi-Fi CONFIGURATION

Related parameters are:

Parameter Definition	Factory Set	Description
SSID	……….…..……	This is the name of wireless network that you want to connect.
Wi-Fi Password	……….…..……	This is the password of wireless network that you want to connect.
Network IP Address	0.0.0.0	This is the IPv4 (internet protocol version 4) address that the unit will require from the DHCP (dynamic host control protocol) server. If this parameter is set to 0.0.0.0 then the unit will require any IPv4 address from the DHCP server. If you are not an IP professional please leave this address as "0.0.0.0".
Gateway IP Address	0.0.0.0	This is the router IPv4 address, If the Network IP address and Gateway IP Address are set to "0.0.0.0" then the unit will get the gateway address automatically. If you are not an IP professional please leave this address as "0.0.0.0".
Subnet Mask	255.255.255.0	Reserved for IP professionals. If you are not an IP professional please leave this address as "255.255.255.0".

The ethernet connection status is monitored at ethernet screen page.
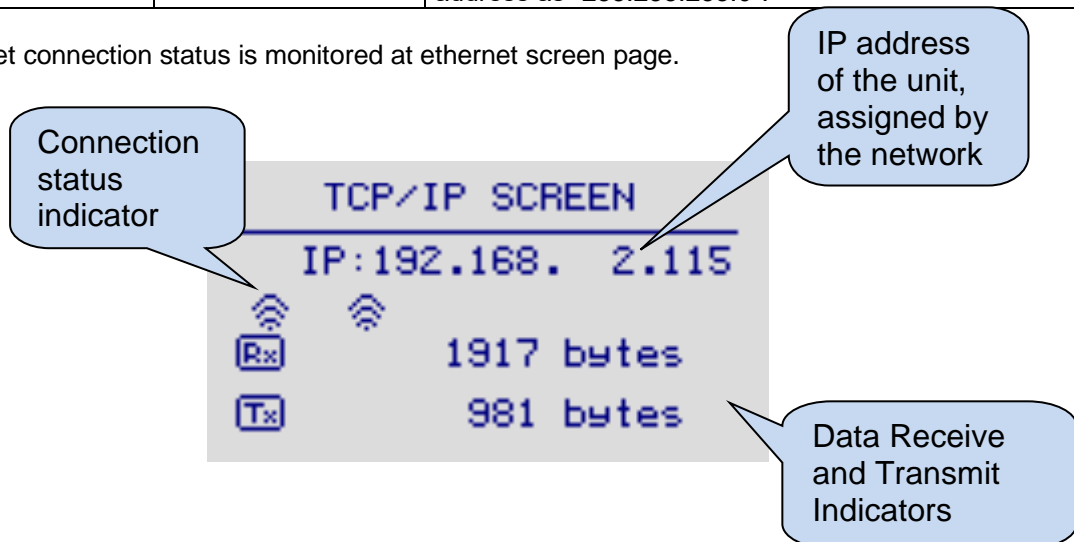
Connection Status Indicators:

If there is no any wireless indicator on connection screen, it shows that device can't find available networks.

Connected to network.

There are available networks but SSID can't be found.

Wi-Fi password error.

19. SMS COMMANDS

⚠ SMS messages are only accepted from phone numbers set in *SMS1-2-3-4 PHONE NUMBERS* parameters.

Responses to SMS messages are sent to all recorded numbers.

⚠ SMS messages must be sent exactly as below, without spaces.

Only **CAPITAL LETTERS** must be used.

COMMAND	DESCRIPTION	RESPONSE
GET IP	If GPRS connection is active, the IP address of the connection is sent.	*IP: 188.41.10.244*
GPRS 1	GPRS connection enabled.	**GPRS enabled!**
GPRS 0	GPRS connection disabled.	**GPRS disabled!**
RESET ALARMS	Dismisses the alarms on the device. Operation mode is not changed.	**Alarms cleared!**
REBOOT	The unit switches off and on again	No response
RESET MODEM	The modem of the unit switches off and on again	No response
FORCE STOP	The unit enters STOP mode.	**Unit forced to STOP!**
FORCE RUN	The unit enters RUN mode.	**Unit forced to RUN!**
OUT1 ON	Set remote controlled output #1 to active state.	*User Output 1 = ON*
OUT1 OFF	Set remote controlled output #1 to passive state.	*User Output 1 = OFF*
OUTxx ON	Set remote controlled output #xx to active state. (xx denotes any number between 1 and 16)	*User Output xx = ON*
OUTxx OFF	Set remote controlled output #xx to passive state. (xx denotes any number between 1 and 16)	*User Output xx = OFF*

20. DATA RECORDING

20.1. DATA RECORDING MEDIA

Data can be recorded in USB flash memory or MICRO-SD memory card. Both options are available.

As soon as a USB flash memory or a MICRO-SD card is inserted, the unit will start data recording and continue until the memory is removed.

USB FLASH DRIVE
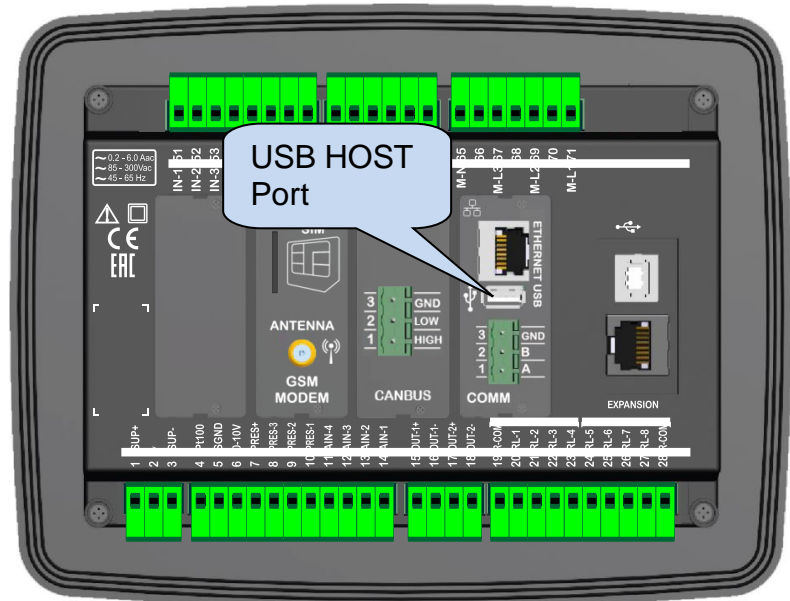
> ⚠ **The USB-Host port and MICRO-SD card slot are available with COMM option.**

> ⚠ **If USB-Device is plugged in, USB-Host port will not function.**

20.2. DIRECTORY STRUCTURE

The unit records data to a USB-Flash memory or micro-SD flash memory card.

GENSET-01 ──► 2012 ──► 20121231.csv
                        20121230.csv
                        ⋮
                        20120101.csv

            ──► 2011 ──► 20111231.csv
                        ⋮
                        20120101.csv

SITE-ID

Year 2012

Year 2011

Previous years

Last day of the year

First day of the year
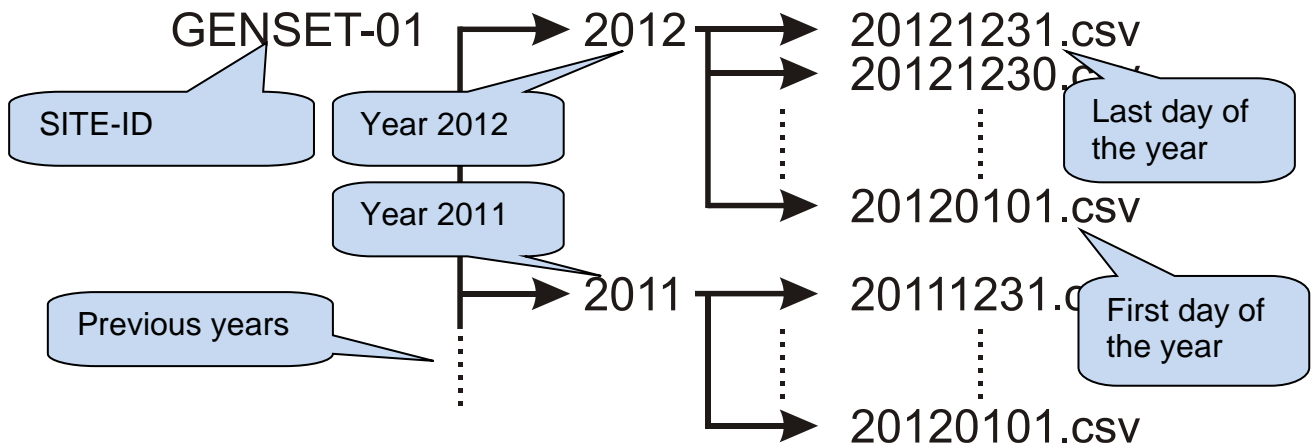
The unit will record data in a directory with the first 11 characters of its site-id parameter. In order to avoid confusion between records, it is highly recommended to configure the site-id parameter according to the compressor installation site. Thus, the same memory module may be used for recording data from different controllers. Inside the directory, the unit will make a separate directory for each year of recording. The directory will simply be named by year (2018, 2019, etc.) Inside the directory, the controller will records data in a different file for each day of recording. The record will be named YYYMMDD (ex. "20190331", meaning March 31, 2019). Thus, alphabetical listing will produce a sorted list by date of recording. The recorded file type is CSV (comma separated values). This is a text file which can be opened using Microsoft Excel without any loss of information. It can also be opened with any text editor such as Notepad. Inside the file, each record consists of a line listing a large set of measured parameters. The recorded parameters list is not adjustable. The controller records all practically necessary parameters.

20.3. CSV FORMAT

The ".csv" file is basically a text file format. This allows for it to be opened by any text editor in any operating system.

When opened with Microsoft Excel, the values will appear in tabulated form, enabling application of formulas, graphs and other features of Excel.

20.4. RECORDED DATA LIST, RECORD PERIOD

The recording period is adjustable between 5 seconds and 3600 seconds (1 hour) from the **Data Logging Period** parameter.

Short recording periods will provide better resolution while using more data in the memory.

One data record is typically 250 bytes long. If recorded with a 5 second interval, it will consume 4.32 MB per day (250x12x60x24). A 4GB memory card can record 925 days, amounting to over 2.5 years.

With a recording period of 1 minute, a 4GB memory card can record for 30 years.

Recorded parameters

Date and Time of Record
Sender-1 temperature measurement (T1)
Sender-2 temperature measurement (T2)
Sender-3 temperature measurement (T3)
Sender-4 temperature measurement (T4)
Sender-1 pressure measurement (P1)
Sender-2 pressure measurement (P2)
Sender-3 pressure measurement (P3)
PT100 Sender temperature measurement (PT100)
Phase voltage L1 – L2 (L12)
Phase voltage L2 – L3 (L23)
Phase voltage L3 – L1 (L31)
Phase current L1 (I1)
Phase current L2 (I2)

Phase current L3 (I3)
Frequency (Freq.)
Average Ph-N Voltage (V-avr)
Average Ph-Ph Voltage (U-avr)
Average Current (I-avr)
Active Power (P)
Reactive Power (Q)
Total (S)
Power Factor (PF)
Phase Current L1 demand value (dI1)
Phase Current L2 demand value (dI2)
Phase Current L3 demand value (dI3)
Average current demand value (dIo)
Active power demand value (dkW)
Reactive power demand value (dkVAr)

21. SOFTWARE FEATURES

21.1. REMOTE START

The unit can be programmed to enter RUN mode when a Remote Start signal is received, and to enter STOP mode when the signal is not received.

Any digital input can be programmed as **Remote Start/Stop** signal. This operation can be performed from the **Input Configuration** program menu.

21.2. SINGLE PHASE OPERATION

If the unit is used in a single-phase electrical network, it is advised to select the topology as **1 Phase 2 Wire**.

When the topology is set to **1 Phase 2 Wire,** the unit will measure electrical parameters only on **L1** phase only.

In a similar manner, over current and voltage checks and protections will be performed only on phase **L1.**

L2 and **L3** phase measurements will not be displayed on screen.

21.3. EXTERNALLY CONTROLLED DIGITAL OUTPUTS

The controller offers externally controllable digital output functions. To enable this feature, the digital outputs must be set to one of the "User output X" functions.

These functions have no effect on device operation.

These outputs can be remote controlled via Modbus, Modbus TCP/IP, and Rainbow Scada.

21.4. RESETTING THE CONTROLLER

If necessary, the controller may be manually reset by holding the STOP button pressed for 30 seconds.

The manual reset will cause the hardware to be configured according to new settings.

It is advised to manually reset or power off/on cycle the device after every hardware configuration modification.

21.5. VARIABLE SERVICE TIMER SELECTION

The controller offers the option of calculating service hours with a coefficient which is a function of the main temperature measurement value.

Variable coefficient use can be selected via the **Variable Service Hours** parameter. If this parameter is disabled, all service counters are calculated with a 1.00 multiplier independent of the main temperature measurement.

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

On load,

Up to 90 °C the multiplier is 1

Between 90-95 °C the multiplier is 1.5

Between 95-100 °C the multiplier is 2

Above 100 °C the multiplier is 3

Off load,

Up to 90 °C the multiplier is 0.5

Between 90-95 °C the multiplier is 0.75

Between 95-100 °C the multiplier is 1

Above 100 °C the multiplier is 1.5

These coefficients are valid for all service counters.

21.6. PREVENTING PRESSURE LOSS

If the main pressure measurement remains higher than **Start Pressure** for a longer duration than **Off-load Working Timer,** the controller stops the motor. If the main pressure measurement drops below **Start Pressure** while the motor is stopped, the motor is restarted.

Until the compressor takes the load again, the amount of time elapsed will be **Star Timer + Star -> Delta Timer + Before Loading Timer + Delay Between Relays x3**.

During this period, the pressure value might be well below **Start Pressure** depending on air consumption.

However, in many systems, pressure value is required to never drop below **Start Pressure.**

The unit offers 3 methods which can be configured in the **Pressure Loss Prevention Method** parameter to eliminate this unwanted situation. The unit dynamically calculates the pressure value (**Pi, Restart Pressure**) at which the motor will restart.

Pressure Loss Prevention Method = 0 (None) → No extra measures taken to prevent pressure loss.

Pi = Start Pressure in all circumstances.

Pressure Loss Prevention Method = 1 (iteration method) → Each time the system takes the load, if the pressure measurement is lower than **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. This aims to keep the reloading pressure value equal to the original **Start Pressure**.

Pressure Loss Prevention Method = 2 (curve slope method) → The system recalculates the **Pi Restart Pressure** at each cycle according to the slope of the pressure loss curve after the system has reached **Stop Pressure**.

> ⚠ **If the main pressure measurement at the end of Unload Timer is higher than Start Pressure, but lower than Pi Restart Pressure, the unit continues operating off-load.**

21.7. VARIABLE UNLOAD TIMER

This feature is designed to conserve energy by preventing the motor from running off-load for extended periods of time in low air consumption scenarios.

When the Main Pressure measurement reaches the set value, the LOAD relay opens first, the motor keeps running off-load for the duration of **Safety Timer** or **Unload Timer** (whichever is longer), then stops.

If the **Variable Unload Timer** parameter is set to **1**, and the motor stays at rest for longer than **Unload Timer**, the controller decides that the motor has been running for an unnecessarily long period and shortens the off-load running period by 1 minute for the next cycle, but never below 2 minutes.

If the compressor has been stopped by pressing the STOP button and restarted using the START button, **Unload Timer** takes the value of the most recently updated **Unload Timer** parameter.

21.8. PID CONTROL AND ANALOG OUTPUT

If the unit is not in STOP mode, **Motor Drive PWM Setting** parameter is set to 1, and any of the analog outputs' configuration parameter is set to "**Motor Drive**", the PID controlled analog output of the unit is enabled for motor drive.

The selected analog output will control the motor speed in order to match the pressure measurement value to **PWM Set Pressure** parameter. This is done by varying the analog output voltage between 0-10V for the 0-10V analog output, or varying the analog output current between 4-20mA for the 4-20mA analog output.

The unit will wait for the compressor to heat up before starting PID control. The controller prepares to generate the analog signal when the temperature measurement from the main temperature sender exceeds **Motor PID Start Temperature** parameter, and starts generating the signal after the **Motor PID Start delay** expires.

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

If Pressure Calendar is enabled and the Start Pressure and Stop Pressure have been changed according to a Pressure Calendar entry, instead of **PWM Set Pressure**, the average of the Start Pressure and Stop Pressure set in the Pressure Calendar is used.

21.9. PID CONTROLLED FAN DRIVE

If the device is not in STOP mode, the temperature measurement from **Temperature Sender for Fan** is higher than **Fan Start Temperature**, **PWM Fan Drive Setting** parameter is set to 1, and any of the analog outputs' configuration parameter is set to "**Fan Drive**", the PID controlled analog output of the unit is enabled for fan drive.

If the measurement value from the temperature for fan is lower than (**Fan Start Temperature - Fan Stop Temperature Difference**), the PID controlled analog output will stop the fan.

The selected analog output will control the fan speed in order to match the temperature value set in the **Fan Drive Set Temperature** parameter. This is done by varying the analog output voltage between 0-10V for the 0-10V analog output, and varying the analog output current between 4-20mA for the 4-20mA analog output.

The unit waits for the duration of **Fan PID Delay** to start the fan after it decides to generate the analog signal.

Fan PID control coefficients can be adjusted from **Fan PID Gain (P) coefficient**, **Fan PID Integrator (I) coefficient**, **Fan PID Derivative (D) coefficient** and **Fan PID Correction (%) coefficient**.

21.10. MOTOR PTC INPUT

The unit allows for a motor PTC (thermal sensor) connection to the 2nd,3rd, or 4th temperature sender input.
If the motor PTC sensor is connected to one of these inputs, the relevant sender input's Temperature Sender Configuration must be set to "Motor PTC".
In this case, if the motor overheats and the motor PTC sensor measurement exceeds 2000 ohm, **Motor PTC High Temperature** alarm occurs.

21.11. MULTIPLE OPERATION

Multiple operation mode is designed for scenarios where multiple compressors are used in parallel.
Multiple operation mode conserves energy by running the minimum necessary number of compressors in the group in low air consumption cases. This mode also ensures equal aging among compressors.
The unit allows up to 32 compressors to run in parallel.
Multiple operation is conducted via the CANBus port on the device, enabling communication between compressors.

The devices are connected to the common **CANBUS** communication line. The CANBUS line must be terminated by 120 Ohm resistor on both ends.

If the **CANBUS Address** parameter is set to a number up to and including 32, multiple operation mode is activated. The same address can be assigned to devices in the same multiple operation group. In this case, the devices automatically receive an address.

> ⚠️ **Devices with CANBUS Address parameter set to a number greater than 32 are not included in the multiple operation group and work independently.**

Operation of the System:
1. If communication between devices is broken, the devices continue running independently.
2. The youngest device becomes the master device and continuously runs according to **Stop Pressure** and **Start Pressure**. The other devices in the group run and stop according to their **engine hours** (age).
3. If any of the devices become younger than the master by **Master Change Timer**, the younger device becomes the new master.
4. If any alarm occurs in the master device, another device becomes the master.
5. The master starts running immediately if the output pressure drops below **Start Pressure**. The other devices in the group start running sequentially if the main pressure remains lower than **Start Pressure** in ascending age order, each with a delay of **Slave Start Timer/16**.
6. If the output pressure is higher than **Start Pressure** but lower than **(Stop Pressure + Start Pressure)/2,** the slave devices start running sequentially, each with a delay of **Slave Start Timer/4**.
7. As the output pressure approaches **Stop Pressure**, the slave devices stop running sequentially in descending age order.

8. The number of slaves running on-load cannot be higher than **Max Number of Slaves Under Load** parameter. If the number of slave devices under load is greater than **Max Number of Slaves Under Load** parameter, the lowest priority devices immediately stop running until the number of slave devices running under load is equal to **Max Number of Slaves Under Load** parameter. If this parameter is set to 0, **Max Number of Slaves Under Load** check is disabled.

22. MODBUS COMMUNICATION

The unit offers MODBUS in the following forms:

-RS485 serial port, adjustable data transfer rate between 2400 and 115200 baud
-MODBUS-TCP/IP over the Ethernet port (10/100Mb)
-MODBUS-TCP/IP over GPRS Network (85/42kb), valid only with Rainbow Scada.

MODBUS features of the unit:

-Data transfer mode: RTU
-Serial data: adjustable baud rate, 8 bit data, no parity, 1 bit stop
-Modbus-TCP/IP: Ethernet 10/100Mb or GPRS Class 10.
-Supported functions:
-Function 3 (read multiple registers)
-Function 6 (write single register)
-Function 16 (write multiple registers)

Each register consists of 2bytes (16 bits). Larger data structures are provided with multiple registers.

Each device on the Modbus communication network must have a distinct Modbus address. The unit supports addresses in the range 1-240.

> ⚠ **Every device on the RS-485 serial network must have a distinct address. Otherwise, Modbus communication will not function.**

> ⚠ **MODBUS TCP/IP devices registered to <u>different IP or port numbers</u> may use the same addresses.**

22.1. PARAMETERS FOR RS-485 MODBUS OPERATION

Modbus Address: May be set as any value between 1 and 254.
RS-485 Baud Rate: May be any value between 2400 and 115200 bauds. All devices in communication with one another must have the same baud rate.

Increasing the baud rate in devices provide faster communication at the expense of communication range. Decreasing the baud rate increases communication range while decreasing communication speed.

At a rate of 9600 bauds, communication range is 1200m using a 120ohm balanced cable.

22.2. PARAMETERS FOR MODBUS-TCP/IP OPERATION

Modbus Slave Address: May be set as any value between 1 and 240. If there is only one device at the same IP address, it is advised to set this parameter to 1.
Ethernet Enabled: This parameter must be set to 1 in order to enable the Ethernet port.
Modbus TCP/IP Port: This parameter is typically set to 502. However, the device is capable of running on any different address port.
User IP Mask: These parameters are used to control the IPv4 input to the device.
Ethernet Network IP: Must be left as 0.0.0.0 if the device is required to receive a dynamic IP. The desired static IP address must be entered here in order to give the device a static IP.
Ethernet Gateway IP: Must be set up according to router.
Ethernet Subnet Mask: Must be set up according to router.

Please refer to **Ethernet Configuration Guide** for detailed information.

22.3. DATA FORMATS

16-bit variables: These variables are stored in a single register. 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 consecutive registers. The 16 least significant bits are located in the first register and the 16 most significant bits are located in the second register.
Bit arrays: Arrays larger than 16 bits are stored in multiple registers. The LSB of the first register is bit_0. The MSB of the first register is bit_15. The LSB of the second register is bit_16. The MSB of the second register is bit_31, and so on.

Below is the list of available Modbus registers.

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	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	32bit	x10	Phase L1 current
10254	R	32bit	x10	Phase L2 current
10256	R	32bit	x10	Phase L3 current
10258	R	32bit	-	Reserved
10260	R	32bit	x10	Phase L1 active power
10262	R	32bit	x10	Phase L2 active power
10264	R	32bit	x10	Phase L3 active power
10266	R	32bit	x10	Total active power
10268	R	32bit	x10	Phase L1 reactive power
10270	R	32bit	x10	Phase L2 reactive power
10272	R	32bit	x10	Phase L3 reactive power
10274	R	32bit	x10	Total reactive power
10276	R	32bit	x10	Phase L1 apparent power
10278	R	32bit	x10	Phase L2 apparent power
10280	R	32bit	x10	Phase L3 apparent power
10282	R	32bit	x10	Total apparent power
10284	R	16bit	x1000	Phase L1 power factor
10285	R	16bit	x1000	Phase L2 power factor
10286	R	16bit	x1000	Phase L3 power factor
10287	R	16bit	x1000	Total power factor
10288	R	16bit	x100	Frequency
10289-10291	R	16bit x3	-	Reserved
10292-10297	R	32bit x3	-	Reserved
10298-10301	R	16bit x4	-	Reserved
10302	R	16bit	x10	Voltage Unbalance (%)
10303	R	16bit	x10	Current Unbalance (%)
10304	R	16bit	-	Reserved
10305	R	32bit	x10	Average voltage
10307	R	32bit	x10	Average current
10309	R	16bit	x100	THD of selected channel (Total Harmonic Distortion) (%)
10310-10325	R	16bit x16	x100	Harmonic values for selected channel. 3., 5., 7., 9., 11., 13., 15., 17., 19., 21., 23., 25., 27., 29. and 31. Harmonics (%).
10326	R	16bit	x1	Harmonic channel
10327-10426	R	16bit x100	x10	Scopemeter data
10427	R	32bit	-	Digital input status bits. Bit definitions are given at the end of the table.
10429	R	32bit	-	Digital output (relay) status bits. Bit definitions are given at the end of the table.
10431	R	16bit	-	Reserved

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
10432	R	16bit	-	Motor Status **0:** Motor in Stop mode **1:** Star relay closed **2:** Motor running off-load before loading **3:** Motor running on-load **4:** Motor running off-load after loading **5:** Motor stopping
10433-10436	R	64bit	-	Alarm status bits. Bit definitions are given at the end of the table.
10437-10440	R	64bit	-	Warning status bits. Bit definitions are given at the end of the table.
10441-10450	R	160bit	-	Relay (digital output) function status bits. Bit definitions are given at the end of the table.
10451	R	16bit	-	Digital input alarm bits. Bit definitions are given at the end of the table.
10452	R	16bit	x1	Analog sender-1 temperature value (T1)
10453	R	16bit	x1	Analog sender-2 temperature value (T2)
10454	R	16bit	x1	Analog sender-3 temperature value (T3)
10455	R	16bit	x1	Analog sender-4 temperature value (T4)
10456	R	16bit	x10	Pressure sender-1 pressure value (P1)
10457	R	16bit	x10	Pressure sender-2 pressure value (P2)
10458	R	16bit	x10	Pressure sender-3 pressure value (P3)
10459	R	16bit	x1	PT100 temperature sender temperature value (T5)
10460	R	16bit	x1	T1-T2 Temperature difference value
10461	R	16bit	x1	T1-T3 Temperature difference value
10462	R	16bit	x1	T2-T3 Temperature difference value
10463	R	16bit	x1	T1-T4 Temperature difference value
10464	R	16bit	x1	T2-T4 Temperature difference value
10465	R	16bit	x1	T3-T4 Temperature difference value
10466	R	16bit	x10	P1-P2 Pressure difference value
10467	R	16bit	x10	P1-P3 Pressure difference value
10468	R	16bit	x10	P2-P3 Pressure difference value
10469-10474	R	16bit x6	-	Reserved
10472	R	16bit	x10	0-10V analog output activation percentage (%)
10474	R	16bit	x10	4-20mA analog output-1 activation percentage (%)
10476	R	16bit	x10	4-20mA analog output-2 activation percentage (%)
10478	R	16bit	-	Reserved
10479	R	16bit	x1	Modbus address
10480-10543	R	32bit x32		Running time counters for devices in multiple operation group
10544	R	32bit	-	Reserved
10546	R	16bit	x1	Devices running on-load in multiple operation group
10547	R	16bit	x1	Total number of devices in multiple operation group
10548	R	16bit	x1	Address of the master device in the multiple operation group

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
10549	R	32bit	x1	GPS Location Latitude
10551	R	32bit	x1	GPS Location Longitude
10553	R	32bit	x1	GPS Location Altitude
10555	R	32bit	x1	GPRS-GSM IP address
10557-10559	R	16bit x3	-	Status bits for extension outputs
10560	R	32bit	-	Status bits for extension inputs
10562	R	16bit	-	Reserved
10563	R	32bit	x10	Total active energy counter (kWh)
10565	R	32bit	x10	Total inductive reactive energy counter (kVArh)
10567	R	32bit	x10	Total capacitive reactive energy counter (kVArh)
10569-10580	R	16bit x12	-	Reserved
10581-10588	R	16bit x8	x1	Modem IMEI number
10589	R	32bit	x10	Running Hours
10591	R	32bit	x10	Loaded Running Hours
10593	R	32bit	x10	Hours to Service A
10595	R	32bit	x10	Hours to Service B
10597	R	32bit	x10	Hours to Service C
10599	R	32bit	x10	Hours to Service D
10601	R	32bit	x10	Hours to Service E
10603	R	32bit	x1	Number of motor starts counter
10605	R	32bit	x1	Number of fan starts counter
10607	R	32bit	x1	Time left for oiling (minutes) counter
10609	R	16bit	x1	Controller ID number
10610	R	16bit	x1	Controller hardware version
10611	R	16bit	x1	Controller firmware version
10612-10615	R	16bit x4	-	Reserved
10616-10618	R	16bit x3	x1	Controller MAC address
10619-10624	R	16bit x6	x1	Controller Unique ID
10625	R	32bit	x1	Digital input pulse counter -1
10627	R	32bit	x1	Digital input pulse counter-2
10629	R	32bit	x10	Phase L1 current demand
10631	R	32bit	x10	Phase L2 current demand
10633	R	32bit	x10	Phase L3 current demand
10635	R	32bit	x10	Average current demand
10637	R	32bit	x10	Active power (kW) demand
10639	R	32bit	x10	Reactive power (kVAr) demand
10641	R	32bit	x10	Phase L1 minimum voltage
10643	R	32bit	x10	Phase L2 minimum voltage
10645	R	32bit	x10	Phase L3 minimum voltage
10647	R	32bit	x10	Phase L1-L2 minimum voltage
10649	R	32bit	x10	Phase L2-L3 minimum voltage
10651	R	32bit	x10	Phase L3-L1 minimum voltage

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
10653	R	32bit	x10	Phase L1 minimum current
10655	R	32bit	x10	Phase L2 minimum current
10657	R	32bit	x10	Phase L3 minimum current
10659	R	32bit	x10	Minimum average current
10661	R	32bit	x100	Minimum Frequency
10663	R	32bit	x10	Minimum active power
10665	R	32bit	-	Reserved
10667	R	32bit	x10	Minimum inductive reactive power (kVAr)
10669	R	32bit	x10	Minimum capacitive reactive power (kVAr)
10671	R	32bit	x10	Phase L1 Maximum voltage
10673	R	32bit	x10	Phase L2 Maximum voltage
10675	R	32bit	x10	Phase L3 Maximum voltage
10677	R	32bit	x10	Phase L1-L2 Maximum voltage
10679	R	32bit	x10	Phase L2-L3 Maximum voltage
10681	R	32bit	x10	Phase L3-L1 Maximum voltage
10683	R	32bit	x10	Phase L1 Maximum current
10685	R	32bit	x10	Phase L2 Maximum current
10687	R	32bit	x10	Phase L3 Maximum current
10689	R	32bit	x10	Maximum average current
10691	R	32bit	x100	Maximum Frequency
10693	R	32bit	x10	Maximum active power
10695	R	32bit	-	Reserved
10697	R	32bit	x10	Maximum inductive reactive power (kVAr)
10699	R	32bit	x10	Maximum capacitive reactive power (kVAr)
10701	R	16bit	-	Reserved
10702	R	16bit	-	Connection topology (type) **0:** 3 Phase 4 wire star **1:** 1 Phase 2 wire **2:** 2 Phase 3 wire L1-L2 **3:** 3 Phase 4 wire delta **4:** 3 Phase 3 wire L1-L2 CT **5:** 3 Phase 3 wire L1-L3 CT
10703	R	16bit	x1	Canbus Connection Address (for Multiple Operation)
10704-11215	R	16bit x512	-	Graphical LCD screen memory

BIT	DIGITAL INPUT STATUS BITS DESCRIPTION	BIT	DESCRIPTION
0	Digital input-1 status	16	Digital input-17 status (Extension input-9)
1	Digital input-2 status	17	Digital input-18 status (Extension input-10)
2	Digital input-3 status	18	Digital input-19 status (Extension input-11)
3	Digital input-4 status	19	Digital input-20 status (Extension input-12)
4	Digital input-5 status	20	Digital input-21 status (Extension input-13)
5	Digital input-6 status	21	Digital input-22 status (Extension input-14)
6	Digital input-7 status	22	Digital input-23 status (Extension input-15)
7	Digital input-8 status	23	Digital input-24 status (Extension input-16)
8	Digital input-9 status (Extension input-1)	24	Digital input-25 status (Extension input-17)
9	Digital input-10 status (Extension input-2)	25	Digital input-26 status (Extension input-18)
10	Digital input-11 status (Extension input-3)	26	Digital input-27 status (Extension input-19)
11	Digital input-12 status (Extension input-4)	27	Digital input-28 status (Extension input-20)
12	Digital input-13 status (Extension input-5)	28	Digital input-29 status (Extension input-21)
13	Digital input-14 status (Extension input-6)	29	Digital input-30 status (Extension input-22)
14	Digital input-15 status (Extension input-7)	30	Digital input-31 status (Extension input-23)
15	Digital input-16 status (Extension input-8)	31	Digital input-32 status (Extension input-24)

BIT	DİJİTAL OUTPUT (RÖLE) DURUM BİTLERİ AÇIKLAMA	BIT	AÇIKLAMA
0	Digital output-4 status	16	Digital output-17 status (Extension output-9)
1	Digital output-3 status	17	Digital output-18 status (Extension output-10)
2	Digital output-2 status	18	Digital output-19 status (Extension output-11)
3	Digital output-1 status	19	Digital output-20 status (Extension output-12)
4	Digital output-5 status	20	Digital output-21 status (Extension output-13)
5	Digital output-6 status	21	Digital output-22 status (Extension output-14)
6	Digital output-7 status	22	Digital output-23 status (Extension output-15)
7	Digital output-8 status	23	Digital output-24 status (Extension output-16)
8	Digital output-9 status (Extension output-1)	24	Digital output-25 status (Extension output-17)
9	Digital output-10 status (Extension output-2)	25	Digital output-26 status (Extension output-18)
10	Digital output-11 status (Extension output-3)	26	Digital output-27 status (Extension output-19)
11	Digital output-12 status (Extension output-4)	27	Digital output-28 status (Extension output-20)
12	Digital output-13 status (Extension output-5)	28	Digital output-29 status (Extension output-21)
13	Digital output-14 status (Extension output-6)	29	Digital output-30 status (Extension output-22)
14	Digital output-15 status (Extension output-7)	30	Digital output-31 status (Extension output-23)
15	Digital output-16 status (Extension output-8)	31	Digital output-32 status (Extension output-24)

ALARM STATUS BITS

BIT	DESCRIPTION	BIT	DESCRIPTION
0	High Voltage Alarm	27	Sender-3 Temperature Difference Alarm
1	Low Voltage Alarm	28	Temperature Sender-4 Fault Alarm
2	High Frequency Alarm	29	High Temperature Sender-4 Alarm
3	Low Frequency Alarm	30	Low Temperature Sender-4 Alarm
4	High Active Power (kW) Alarm	31	Sender-4 Temperature Difference Alarm
5	Low Active Power (kW) Alarm	32	Pressure Sender-1 Fault
6	Capacitive Power (kVAr) Alarm	33	High Pressure Sender-1 Alarm
7	Inductive Power (kVAr) Alarm	34	Pressure Sender-2 Fault
8	Power factor (PF) Capacitive Alarm	35	High Pressure Sender-2 Alarm
9	Power factor (PF) Inductive Alarm	36	Sender-2 Pressure Difference Alarm
10	High Current Alarm	37	Low Pressure Sender-2 Alarm
11	High Voltage THD Alarm	38	Pressure Sender-3 Fault
12	High Current THD Alarm	39	High Pressure Sender-3 Alarm
13	Voltage Unbalance Alarm	40	Sender-3 Pressure Difference Alarm
14	Current Unbalance Alarm	41	Low Pressure Sender-3 Alarm
15	Phase Order Fault Alarm	42	PT100 Sender Fault
16	Motor PTC High Temperature Alarm	43	PT100 High Temperature
17	Temperature Sender-1 Fault Alarm	44	PT100 Low Temperature
18	High Temperature Sender-1 Alarm	45	-
19	Low Temperature Sender-1 Alarm	46	-
20	Temperature Sender-2 Fault Alarm	47	Emergency Stop Alarm
21	High Temperature Sender-2 Alarm	48	Motor Overload Alarm
22	Low Temperature Sender-2 Alarm	49	Main Contactor Fail to Close Alarm
23	Sender-2 Temperature Difference Alarm	50	Main Contactor Fail to Open Alarm
24	Temperature Sender-3 Fault Alarm	51	Fan Contactor Fail to Close Alarm
25	High Temperature Sender-3 Alarm	52	Fan Contactor Fail to Open Alarm
26	Low Temperature Sender-3 Alarm	53	-

WARNING STATUS BITS

BIT	DESCRIPTION	BIT	DESCRIPTION
0	Digital input-1 warning	18	Service B Timer Warning
1	Digital input-2 warning	19	Service C Timer Warning
2	Digital input-3 warning	20	Service D Timer Warning
3	Digital input-4 warning	21	Service E Timer Warning
4	Digital input-5 warning	22	Remote Start Warning
5	Digital input-6 warning	23	Remote Stop Warning
6	Digital input-7 warning	24	EEPROM Write Failure
7	Digital input-8 warning	25-28	Reserved
8	High Temperature-1 Warning	29	STOPPED – Weekly Operation Warning
9	High Temperature-2 Warning	30	RUNNING – Weekly Operation Warning
10	High Temperature-3 Warning	31	Weekly Operation Cancelled Warning
11	High Temperature-4 Warning	32	Temperature Too Low for Loading Warning
12	Wait 1 Hour to Stop Warning	33	Digital input Take Load Command Warning
13	Air Filter Clogged Warning	34	Digital input Unload Command Warning
14	Waiting for Separator Pressure Warning	35	Modbus Take Load Command Warning
15	Waiting for Input (Drive) Warning	36	Modbus Unload Command Warning
16	Multi Operation Communication Failure Warning	37	Energy Loss / Restart Warning
17	Service A Timer Warning	38-63	Reserved

RELAY (DIGITAL OUTPUT) FUNCTION STATUS BITS					
BIT	DESCRIPTION	BIT	DESCRIPTION	BIT	DESCRIPTION
0	Horn	45	STOP Button Press	90	High Temperature Sender-3
1	Flashing relay	46	-	91	Low Temperature Sender-3
2	Phase order fault alarm	47	-	92	Temperature Difference Alarm Sender-3
3	Voltage fault	48	Input 1 simulation	93	High Temperature Sender-4
4	Voltage OK	49	Input 2 simulation	94	Low Temperature Sender-4
5	Alarm	50	Input 3 simulation	95	Temp. Diff. Alarm Sender-4
6	-	51	Input 4 simulation	96	High Pressure Al. Sender-1
7	Warning	52	Input 5 simulation	97	High Pressure Al. Sender-2
8	Alarm	53	Input 6 simulation	98	Pressure Diff. Al. Sender-2
9	kWh pulse (tick)	54	Input 7 simulation	99	Low Pressure Al. Sender-2
10	kVArh pulse (tick)	55	Input 8 simulation	100	FAN
11	Low voltage alarm	56	Input 9 simulation	101	OILING
12	High Voltage Alarm	57	Input 10 simulation	102	High Pressure Al. Sender-3
13	Low Frequency alarm	57	Input 11 simulation	103	Pressure Diff. Al. Sender-3
14	High Frequency alarm	59	Input 12 simulation	104	Low Pressure Al. Sender-3
15	Frequency alarm	60	Input 13 simulation	105	PT100 High Temp. Alarm
16	Low active power alarm	61	Input 14 simulation	106	Temp. Alarm Sender-1
17	High active power alarm	62	Input 15 simulation	107	Temp. Alarm Sender-2
18	Active power alarm	63	Input 16 simulation	108	Temp. Alarm Sender-3
19	Capacitive reactive alarm	64	User output 1	109	Temp. Alarm Sender-4
20	Inductive reactive alarm	65	User output 2	110	Press. Alarm Sender-1
21	Reactive power alarm	66	User output 3	111	Press. Alarm Sender-2
22	Capacitive PF alarm	67	User output 4	112	Press. Alarm Sender-3
23	Inductive PF alarm	68	User output 5	113	PT100 Temperature Alarm
24	PF alarm	69	User output 6	114	Temperature Sender Fault
25	High current alarm	70	User output 7	115	Pressure Sender Fault
26	THD-V alarm	71	User output 8	116	Temperature Diff. Alarm
27	THD-I alarm	72	User output 9	117	Pressure Difference Alarm
28	THD alarm	73	User output 10	118	High Temperature Alarm
29	Voltage Unbalance Alarm	74	User output 11	119	Low Temperature Alarm
30	Current Unbalance Alarm	75	User output 12	120	High Pressure Alarm
31	Unbalance Alarm	76	User output 13	121	Low Pressure Alarm
32	User input alarm-1	77	User output 14	122	Temperature Alarm
33	User input alarm-2	78	User output 15	123	Pressure Alarm
34	User input alarm-3	79	User output 16	124	High Temperature Warning
35	User input alarm-4	80	Compressor MAIN Relay	125	Service Warning
36	User input alarm-5	81	Compressor DELTA Relay	126	Wait 1 Hour to Stop Fault (Max Start)
37	User input alarm-6	82	Compressor STAR Relay	127	Multi Operation Comm. Fail.
38	User input alarm-7	83	Compressor LOAD Relay	128	HEATER
39	User input alarm-8	84	MPTC High Temp. Alarm	129	DRYER
40	Up Arrow Button Press	85	High Temp. Sender-1	130	Main Pressure Normal
41	Down Arrow Button Press	86	Low Temp. Sender-1	131	Water Discharge
42	Left Arrow Button Press	87	High Temp. Sender-2	132	NOT USED
43	Right Arrow Button Press	88	Low Temp. Sender-2		
44	RUN Button Press	89	Temperature Difference Alarm Sender-2		

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

22.4. COMMANDS

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
8192	W	16bit	x1	Password (In order to change calibration coefficients over Modbus, the calibration password must be entered here.)
8193	W	16bit	x1	Button simulation. If the following hexadecimal values are entered to this address, the unit responds as if the corresponding buttons were pressed. 0x8001: Stop very long press 0x8010: Run very long press 0x8080: Right very long press 0x8100: Left very long press 0x8200: Up very long press 0x8400: Down very long press 0x4001: Stop long press 0x4010: Run long press 0x4080: Right long press 0x4100: Left long press 0x4200: Up long press 0x4400: Down long press 0x1001: Stop short press 0x1010: Run short press 0x1080: Right short press 0x1100: Left short press 0x1200: Up short press 0x1400: Down short press
8194	W	16bit	x1	Harmonic channel selection. If the following decimals are entered into this address, the corresponding harmonic channel is selected. 0: Phase L1 voltage 1: Phase L2 voltage 2: Phase L3 voltage 6: Phase L1-L2 voltage 7: Phase L2-L3 voltage 8: Phase L3-L1 voltage 12: Phase L1 current 13: Phase L2 current 14: Phase L3 current
8195	W	16bit	x1	Factory Reset. If the decimal 43690 is entered into this addres, the unit resets to factory defaults. Service counters are reset; other counters are not reset.
8196	W	16bit	x1	Reset counters. If the following decimals are entered into this address, the corresponding counter is reset. 1: Reset Active power (kWh) counter. 4: Reset Inductive reactive power (kVArh) counter. 8: Reset Capacitive reactive power (kVArh) counter. 16: Reset Digital input pulse counter-1. 32: Reset Digital input pulse counter-2. 64: Reset Running Hours counter. 128: Reset Loaded Running Hours counter. 256: Reset Number of motor starts counter. 512: Reset Number of fan starts counter. 1024: Oiling Counter set equal to Oiling Period parameter.

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
8197	W	16bit	x1	Reset service counters. If the following decimal values are entered into this address, the corresponding service counter is reset. 1: Reset all service counters. 2: Reset Service A counter. 4: Reset Service B counter. 8: Reset Service C counter. 16: Reset Service D counter. 32: Reset Service E counter.
8198	W	16bit	x1	The value entered into this address is added to Active power (kWh) counter.
8199	W	16bit	x1	The value entered into this address is subtracted from Active power (kWh) counter.
8200	W	16bit	x1	The value entered into this address is added to Inductive reactive power (kVArh) counter.
8201	W	16bit	x1	The value entered into this address is subtracted from Inductive reactive power (kVArh) counter.
8202	W	16bit	x1	The value entered into this address is added to Capacitive reactive power (kVArh) counter.
8203	W	16bit	x1	The value entered into this address is subtracted from Capacitive reactive power (kVArh) counter.
8204	W	16bit	x1	The value entered into this address is added to Digital input pulse counter-1.
8205	W	16bit	x1	The value entered into this address is subtracted from Digital input pulse counter-1.
8206	W	16bit	x1	The value entered into this address is added to Digital input pulse counter-2.
8207	W	16bit	x1	The value entered into this address is subtracted from Digital input pulse counter-2.
8208	W	16bit	x1	The value entered into this address is added to Running hours counter.
8209	W	16bit	x1	The value entered into this address is subtracted from Running hours counter.
8210	W	16bit	x1	The value entered into this address is added to Loaded running hours counter.
8211	W	16bit	x1	The value entered into this address is subtracted from Loaded running hours counter.
8212	W	16bit	x1	The value entered into this address is added to Number of motor starts counter.
8213	W	16bit	x1	The value entered into this address is subtracted from Number of motor starts counter.
8214	W	16bit	x1	The value entered into this address is added to Number of fan starts counter.
8215	W	16bit	x1	The value entered into this address is subtracted from Number of fan starts counter.
8216	W	16bit	x1	The value entered into this address is added to oiling counter.
8217	W	16bit	x1	The value entered into this address is subtracted from oiling counter.
8218	W	16bit	x1	The value entered into this address is added to Service A hours.
8219	W	16bit	x1	The value entered into this address is subtracted from Service A hours.
8220	W	16bit	x1	The value entered into this address is added to Service B hours.
8221	W	16bit	x1	The value entered into this address is subtracted from Service B hours.
8222	W	16bit	x1	The value entered into this address is added to Service C hours.

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
8223	W	16bit	x1	The value entered into this address is subtracted from Service C hours.
8224	W	16bit	x1	The value entered into this address is added to Service D hours.
8225	W	16bit	x1	The value entered into this address is subtracted from Service D hours.
8226	W	16bit	x1	The value entered into this address is added to Service E hours.
8227	W	16bit	x1	The value entered into this address is subtracted from Service E hours.
8228	W	16bit	x1	If the decimal 43690 is entered into this address, the unit resets the maximum and minimum values.
8229	W	16bit	x1	Write to Flash.
8230	W	16bit	x1	Read event record. The unit's event record memory has 400 logs of 64Byte length each. Event records memory structure is given in detail in section 26.5. In order to read the records memory, the block number must be entered into this address. The relevant records can be read from address 3072 to address 5119. If the following values are entered into address 8230, the corresponding logs can be read. 0: Block 0: Event records 1-64 1: Block 1: Event records 65-128 2: Block 2: Event records 129-192 3: Block 3: Event records 193-256 4: Block 4: Event records 257-320 5: Block 5: Event records 321-384 6: Block 6: Event records 385-400 If the value 256 is entered into address 8230, LCD memory space can be read from the address range 3072-3583.
8231	W	16bit	x1	Unit enters boot mode.
8232	W	16bit	x1	The value entered into this address controls the user outputs. To enable user output-1 relay function, enter 0x0001 (1); to disable the user output-1 relay function, enter 0x8001 (32769). T enable user output-2 relay function, enter 0x0002 (2); to disable it, enter 0x8002 (32770). … To enable user output-16 relay function, enter 0x0010 (16); to disable it, enter 0x8010 (32784).
8233	W	16bit	x1	Restart the unit. If the decimal 14536 is entered into this address, the unit restarts.
8234	W	16bit	x1	Read local language.
8235	W	16bit	x1	Read read-only space.
8236	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, enter the decimal 10 to this address, to issue the "Unload" command to the compressor, enter the value 170 to this address.

22.5. EVENT RECORDS MEMORY STRUCTURE

ADDRESS (decimal)	R / W	DATA	COEFF.	DESCRIPTION
+0 +1	R	32bit	x1	32-bit date time information Bits 0-4: second/2 (0-29) Bits 5-10: minute (0-59) Bits 11-15: hour (0-23) Bits 16-20: day (1-31) Bits 21-24: month (1-12) Bits 25-31: year-2000 (0-127=2000-2127)
+2	R	16bit	x1	Recording type
+3 +4_BOT	R	8bit	x1	Digital input status bits
+4_TOP +5	R	8bit	x1	Digital output (relay) status bits
+6 +7	R	32bit	x1	Alarm status bits (Bits 0-31)
+8_BOT	R	8bit	x10	Sender-1 pressure value
+8_TOP	R	8bit	x10	Sender-2 pressure value
+9_BOT	R	8bit	x10	Sender-3 pressure value
+9_TOP	R	8bit	x1	Analog sender-1 temperature value
+10_BOT	R	8bit	x1	Analog sender-2 temperature value
+10_TOP	R	8bit	x1	Analog sender-3 temperature value
+11	R	8bit	x1	PT100 sender temperature value
+12	R	8bit	x1	Reserved
+13 +14	R	32bit	x10	Running hours counter
+15 +16	R	32bit	x10	Loaded running hours counter
+17	R	16bit	x10	Phase L1 voltage
+18	R	16bit	x10	Phase L2 voltage
+19	R	16bit	x10	Phase L3 voltage
+20	R	16bit	x10	Phase L1 current
+21	R	16bit	x10	Phase L2 current
+22	R	16bit	x10	Phase L3 current
+23	R	16bit	x10	Frequency
+24	R	16bit	x10	Total active power (kW)
+25_BOT	R	8bit	x1000	Total power factor (PF)
+25_TOP	R	8bit	x1	Reserved
+26 +27	R	32bit	x1	Number of Motor Starts counter
+28 +29	R	32bit	x1	Number of Fan Starts counter
+30_BOT	R	8bit	x1	Reserved
+30_TOP	R	8bit	x1	Motor status **0:** Motor in Stop mode **1:** Star relay closed **2:** Motor running off-load before loading **3:** Motor running on-load **4:** Motor running off-load after loading **5:** Motor stopping
+31	R	16bit	x1	Reserved

22.6. REAL TIME CLOCK

ADDRESS (decimal)	R / W	DATA	COEFF.	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)

23. SNMP COMMUNICATION

The unit offers SNMP communication over the Ethernet port (10/100Mb).

⚠️ **SNMP version V1.0 is supported.**

Control Parameters:

Control Buttons
Remote controllable digital outputs

Measured Parameters:

Mains Voltages (L1, L2, L3, L12, L23, L31)
Mains Currents (I1, I2, I3)
Mains Active power (L1, L2, L3, Total)
Mains Reactive power (L1, L2, L3, Total)
Mains Apparent power (L1, L2, L3, Total)
Mains Power factor (L1, L2, L3, Total)
Frequency
Total kW-h
Total kVAR-h (inductive)
Total kVAR-h (capacitive)
Digital input Pulse Counters (In1, In2)
Connection Topology (Type)
Current Demand (L1, L2, L3, Average)
Active power and Reactive power Demand
Min. Mains Voltages (L1, L2, L3, L12, L23, L31)
Minimum Mains Currents (I1, I2, I3, Average)
Minimum Frequency
Minimum Active power
Minimum Inductive Power
Minimum Capacitive Power

Max. Mains Voltages (L1, L2, L3, L12, L23, L31)
Maximum Mains Currents (I1, I2, I3, Average)
Maximum Frequency
Maximum Active power
Maximum Inductive Power
Maximum Capacitive Power
Motor Status

Analog Sender Temperature Measurements (T1, T2, T3, T4)
Pressure Measurements (P1, P2, P3)
PT100 Temperature measurement
Temperature Differences (T12, T13, T23, T14, T24, T34)
Pressure Differences (P12, P13, P23)
Service Hours (A, B, C, D, E)
Running Hours
Loaded Running Hours
Number of Motor Starts counter
Number of Fan Starts counter
Loaded/Total Running Ratio (%)
Oiling Period Counter (min)
Remote Controllable Digital outputs
Alarms
Input Alarms
Warnings

⚠️ **Please contact Datakom technical support for SNMP MIB file requests.**

23.1. PARAMETERS FOR ETHERNET SNMP

Modbus Slave Address: Can be set between 1 and 240. If only one device is present in an IP address, it is advised to leave this parameter at 1, its default value.
Ethernet Enabled: This parameter must be set to 1 to enable the Ethernet port.
Modbus TCP/IP Port: This parameter is typically set to 502. However, the device can function on any available port address.
User IP Mask: These parameters are used to control the incoming IPv4 input.
Ethernet Network IP: Must be left as 0.0.0.0 if the unit is required to take a dynamic IP. Enter the desired static IP address to give a static IP.
Ethernet Gateway IP: Must be set according to your router.
Ethernet Subnet Mask: Must be set according to your router.

Please refer to **Ethernet Configuration Guide** for more details on Ethernet configuration.

23.2. SNMP TRAP MESSAGES

If any warnings or alarms occur in the unit, an automatic SNMP Trap message is sent to the user.

In order to enable SNMP Trap functionality, the user must send an SNMP query to the device. This allows the device to save the transmitter of the query and send SNMP Trap messages to its address. The unit sends SNMP Trap messages to the last address which sent a query.

SNMP Trap message includes motor status, running hours and an alarm list.

24. DECLARATION OF CONFORMITY

The unit conforms to the EU directives:
  -2014/35/EC (Low Voltage)
  -2014/30/EC (electro-magnetic 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.

25. MAINTENANCE

DO NOT OPEN THE UNIT!
There are NO serviceable parts inside the unit.

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

26. DISPOSAL OF THE UNIT

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

27. 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)