DK-45

COMPRESSOR CONTROLLER

DESCRIPTION

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

The controller incorporates all functions needed in a compressor control panel. Thus no additional modules are necessary resulting in lower panel cost.

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

The controller is directly supplied from the 230/400V utility network. It provides fail contact and sensor supplies internally, removing the need for a supply transformer in the panel.

Utility mains voltages and frequency can be read on the controller. It offers low/high voltage and phase order protections.

The 2.9" wide, 128x64 pixels graphical screen displays values in bigger size and with graphic support.

The logic level Modbus RTU communication port of the controller allows computer connection providing monitoring and program parameter adjusting.

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

The controller provides 5 relay outputs rated at 5 Amps.

The controller configuration may be done through the front panel or using the free PC software. The PC software is available for free download at manufacturer's website.

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

FEATURES

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

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ABOUT THIS DOCUMENT

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

Follow carefully advices 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 below e-mail address:

technical.support@datakom.com.tr

QUERRIES

If additional information to this manual is required, please contact the manufacturer directly at below e-mail address:

technical.support@datakom.com.tr

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

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

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	19.06.2015	MH	First edition, firmware version 1.0

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.

> ## SAFETY NOTICE
> ### Failure to follow below instructions
> ### will result in death or serious injury

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

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

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

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

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

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

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

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

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

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

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

- **Only for front panel mounting.**

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1.1 INSTALLATION INSTRUCTIONS

Before installation:

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

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

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

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

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

- Be sure that adequate cooling is provided.

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

Below conditions may damage the device:

- Incorrect connections.

- Incorrect power supply voltage.

- Voltage at measuring terminals beyond specified range.

- Overload or short circuit at relay outputs

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

- High voltage applied to communication ports.

- Ground potential differences at non-isolated communication ports.

- Excessive vibration, direct installation on vibrating parts.

Below conditions may cause abnormal operation:

- Power supply voltage below minimum acceptable level.

- Power supply frequency out of specified limits

1.1. FRONT AND REAR PANELS
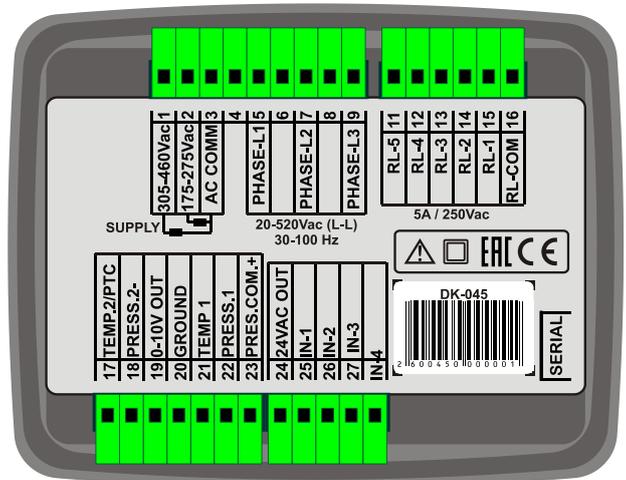
1.2. MECHANICAL INSTALLATION
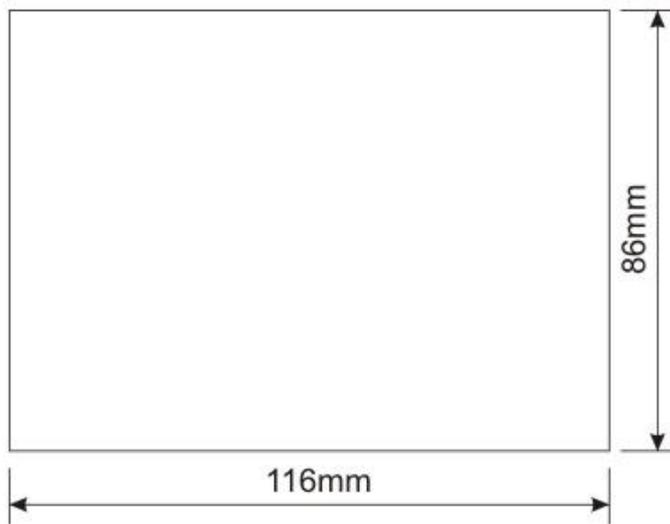
Panel Cutout Dimensions
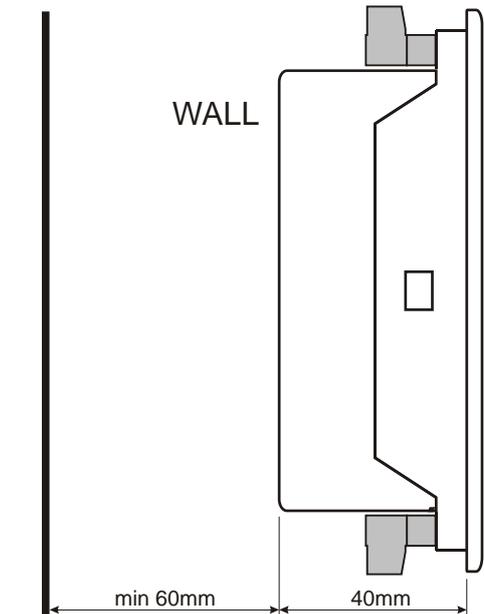
Required Panel Depth

1.3. ELECTRICAL INSTALLATION

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

Although the controller 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 of the controller.**

- **Fuses must be of fast type (FF) 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.**

- **Connect only the provided serial port adapter to the serial communication port.**

1.4. CONNECTION DIAGRAM
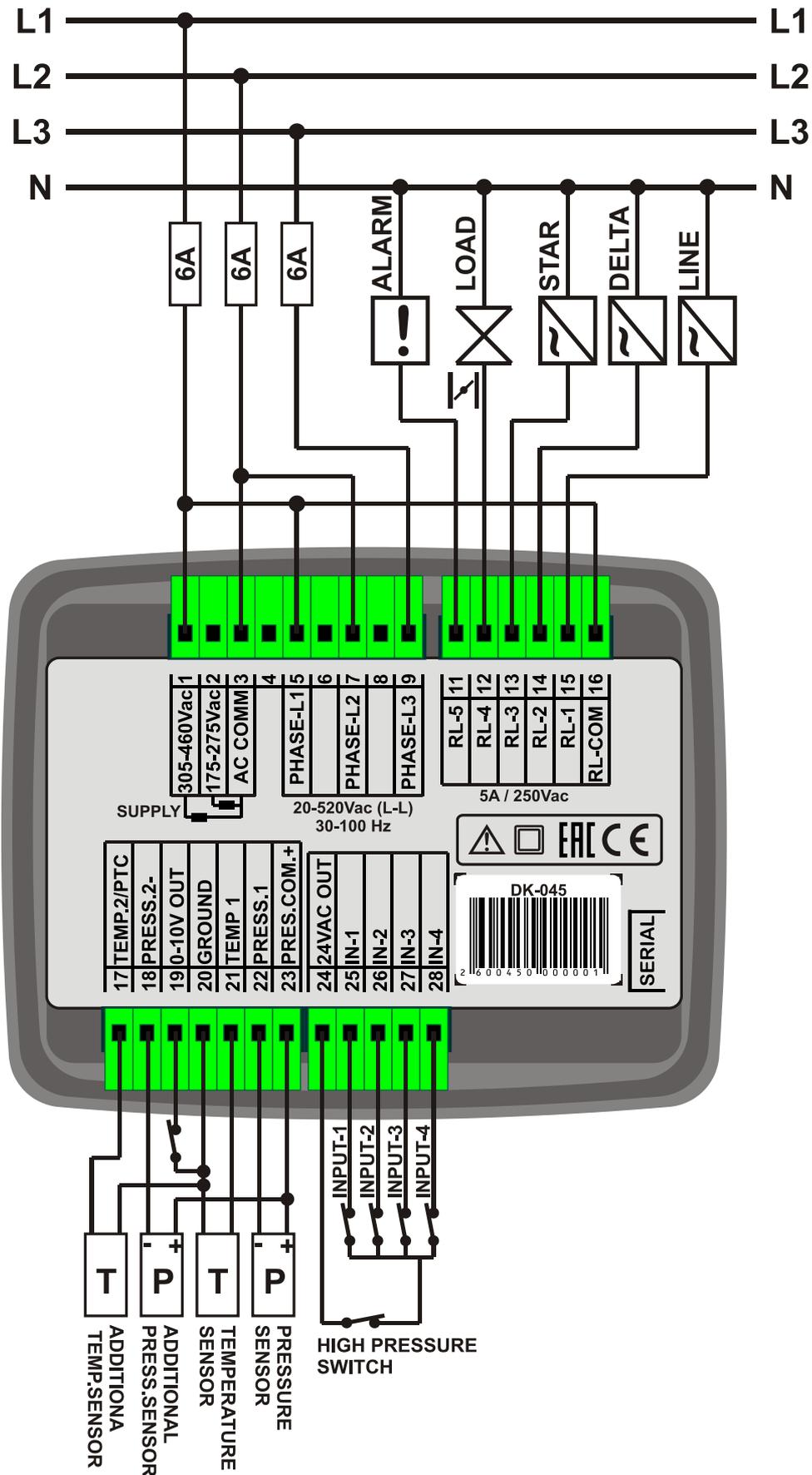
2. PUSHBUTTON FUNCTIONS

Three pushbuttons on the front panel allow access to programming and measuring screens.

BUTTON	DESCRIPTION	FUNCTION
	MENU	**Displays the next parameter.** **Reset alarms.** **PROGRAMMING: Save the adjusted parameter.**
	RUN	**Reset alarms and run the compressor.** **PROGRAMMING: Increase parameter value.**
	STOP	**Reset alarms and stop the compressor.** **PROGRAMMING: Decrease parameter value.**

3. SCREEN SCROLLING

When the controller powers-on, the top part of the display will show (P1) the first pressure sensor (or first pressure switch). The pressure unit may be displayed as **PSI** or **Bar** following program parameter setting.

The upper visual bar fills up in relation with the current pressure level.

The right end of the bar is always set to the maximum displayable pressure, which is **E.03 High Pressure Alarm** Limit.

The left end of the bar is set to the minimum displayable pressure level.

The � (start) icon on the bar indicates the E05. Starting Pressure, the ‖ (stop) icon indicates the E04. Stop Pressure and the ▪ icon indicates the **E.03 High Pressure Alarm** Limit.

The bottom part of the display shows (T1) the first temperature sensor. The temperature unit may be **°C** (degrees celcius) or **°F** (degrees Fahrenheit) following program parameter setting.

The lower visual bar fills up in relation with the current temperature.

The right end of the bar is always set to the maximum displayable pressure, which is **E.08 High Temperature Alarm** Limit. The left end of the bar is set to the minimum displayable temperature.

The ▪ icon indicates the **E.08 High Temperature Alarm** Limit.

If a relay output is set as the Fan Relay (see chapter 9), when this relay is active a fan icon will appear at the bottom right corner of the display screen.

Through parameter setting in the programming menu, (P2) second pressure value or the differential pressure P2-P1 (DP), (T2) second temperature sensor or the differential temperature T1-T2 (DT) may be displayed in a **second pressure/temperature screen**.

All measurement screens are scrolled by depressing the MENU 🔘 pushbutton.

First Pressure/Temperature Screen

Second Pressure/Temperature Screen

Phase-to-Neutral voltage screen

```
L--1              - -       0 V
L--2                        0 V
L--3                        0 V
FRQ                    0.0 Hz
```

Phase-to-Phase voltage screen

```
L12                         0 V
L31                         0 V
L23                         0 V
FRQ                    0.0 Hz
```

Run Hours Screen

```
RUN H.                      0 h
LOAD H.                     0 h
LD/RUN                  100 %
STRTS/h                  60
```

Service Timers Screen

```
                            🔧🕐
                  2000 ━━━━━━ A
              4000 ━━━━━━━━ B
          6000 ━━━━━━━━━━ C
   10000 ━━━━━━━━━━━━━━ D
   20000 ━━━━━━━━━━━━━━ E
```
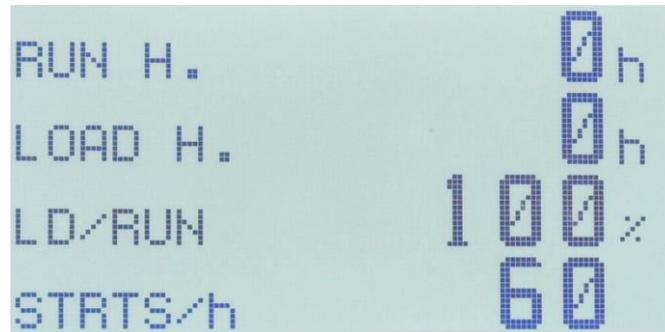
This screen shows remaining time to services A,B, C, D and E in **hours**. Service timers operate on a decremental basis. Service bars are emptied with relation to timer values.

Information Screen

```
STRT PRES    6.5 Bar
STOP PRES    7.4 Bar

MASTR DEV. ADR  1
NUM OF DEVICES  2

SOFTWARE VER. 5.3
```

If the **E.47 Motor Control PWM Signal** is enabled, then instead of start/stop pressures, this screen will show the **E.48 Motor Control PWM Set Pressure (DRVR SET PRS)** parameter.

Alarm history Screen

```
1                    🔔
   ❄🌡  ALARM 8
```

Alarm history will be described in detail in chapter 6.6.

Above screens or values shown in screens may not be displayed depending on program parameter setup.

⚠️ **Display of some values are selected with program parameters. Display screens may differ following compressor manufacturers.**

⚠️ **When an alarm occurs, the display will show the alarm code and alarm symbol.**

Below is the description of some abbreviations displayed on the screen:

ABBREVIATION	DESCRIPTION
P1	First pressure sensor value or first pressure switch position
P2	Second pressure sensor value or second pressure switch position
DP	P2-P1 differential pressure (Delta pressure)
T1	First temperature sensor value
T2	Second temperature sensor value
DT	T1-T2 differential temperature (Delta temperature)
L-1	Voltage between phase L1 and neutral
L-2	Voltage between phase L2 and neutral
L-3	Voltage between phase L3 and neutral
L12	Voltage between phases L1 and L2
L23	Voltage between phases L2 and L3
L31	Voltage between phases L3 and L1
FRQ	Frequency
RUN H.	Total motor run hours (On-load + off-load)
LOAD H.	On-load motor run hours
LD/RUN	(On-load) / (Total) motor hours ratio
STRTS/h	Maximum number of starts per hour
DRVR SET PRS	Motor control PWM signal set pressure
STRT PRES	Compressor's starting pressure
STOP PRES	Compressor's stop pressure
MASTR DEV. ADR	Master device address (multi-compressor operation)
NUM OF DEVICES	Number of devices (multi-compressor operation)
SOFTWARE VER.	Device firmware version
msec	milisecond
sec	second)
min	minute
h (hour)	hour
V	Volt
Hz	Hertz
%	percent

Below is the description of some icons displayed on the screen:

ICON	DESCRIPTION
	OFF, disabled, not-OK
	Remote Start
	Reset, cancel, disable
	Enabled, adjusted, action complete, OK
	Enter / change password
	Motor PTC
P2	Pressure-2 in Separator filter
P+	Waiting the pressure in separator filter to drop
	Remote Start / Stop
	Waiting input signal
MAX SLAVE	Max Slaves
	Auto restart register, PORO
	Dryer function
PX	Insufficient pressure (run the compressor)
P✔	Sufficient pressure (stop the compressor)
	Remaining hours to service
	Run hour counters
	Programming
	Remote Stop

4. MODES OF OPERATION

Selecting the mode of operation:

When powered-up, the device turns-on all lights during 3 seconds for verification. Then it goes into STOP mode and the STOP led turns on.

The compressor may be run with the REMOTE START signal (icon displayed during 5 seconds) or by depressing the RUN   pushbutton.

If the E.27 Safety Timer is not expired, then the RUN led will flash until the expiration of the timer. Then the motor will run is the output pressure is below **E.05 Start Pressure**.

> ⚠️ **If an alarm occurs the compressor will stop immediately and the screen will display the alarm code and related icon.**
> **Please see chapter_5 for the complete list of alarm codes.**

The compressor is usually stopped with REMOTE STOP signal (icon is displayed during 5 seconds) or by depressing the STOP   pushbutton.

Stop procedure:

STOP led starts flashing.

If the compressor is under load, the load relay will release and the motor continues to run during **E.27 Safety Delay Timer** or **E.25 Unload Timer** (whichever is longer). During this period the RUN mode may be resumed by depressing the RUN   pushbutton.

If the STOP   pushbutton is depressed again during off-load running, then the compressor will stop immediately.

The STOP led will continue to flash until the complete stop.

> ⚠️ **If the compressor is running off-load and the STOP pushbutton is depressed, it will continue to run until the expiration of the E.25 Unload Timer.**
> **By depressing again the STOP pushbutton the compressor may be stopped immediately.**

Start-up procedure:

If utility mains voltages and frequency is between set limits and the phase order is correct, the the LINE led will turn on. The compressor can run only when the LINE led is on. Otherwise it cannot be run by any means.

The RUN mode is selected by depressing the RUN pushbutton or by setting the REMOTE START signal (if enabled). At this stage the compressor will run only when the output pressure falls below the **E.05 Start Pressure** (or when the pressure switch closes).

Before the compressor runs, the **STAR** relay will be activated. After the expiration of **E.15 Delay Between Relays** Timer the **MAIN** relay will be active. Thus the motor will start-up in **STAR** configuration.

After the expiration of **E.22 Star Timer** the **STAR** relay will release. After the expiration of **E.23 Star Delta Timer** the **DELTA** relay will be active.

After the expiration of **E.24 Time Before Load**, the **LOAD** relay will become active and the compressor starts producing compressed air.

Unloading and reloading of the compressor:

When the output pressure reaches **E.04 Stop Pressure** limit (or the pressure switch opens) the load relay will release and the motor will run off-load during **E.25 Unload Timer**. If the pressure falls below the **E.05 Start Pressure** before expiration of the timer, then the **LOAD** relay will be activated again.

Stopping and restarting following output pressure:

If the output pressure stays over the **E.05 Start Pressure** during **E.25 Unload Timer**, then the **DELTA** relay relases. After **E.15 Delay Between Relays** the **MAIN** relay releases and the compressor stops.

In this position the RUN led is flashing.

The maximum number of start cycles that the compressor is allowed to perform in 1 hour is defined by the **F.01 Max Starts per Hour** program parameter.

If the maximum number of starts is reached, then following stop cycles will be skipped until the expiration of 1 hour period.

5. ALARMS AND WARNINGS

Abnormal conditions of a compressor are divided into 3 categories, being WARNINGS, ALARMS and SERVICE REQUESTS.
Warnings are the lowest priority fault conditions and result only in visual warnings.
Alarms are highest level fault conditions and cause the compressor to stop immediately, the alarm relay to operate (if enabled) and the controller give visual warning.

When a fault condition occurs, the related fault code and icon will appear on the screen. If the fault condition is an alarm, then the ALARM led will turn on. If the fault is a service request then the SERVICE led turns on.

Warnings may be cancelled by depressing the MENU pushbutton. Alarms cannot be cancelled with

pushbuttons. The alarm signal must also be removed. However the depression of the MENU pushbutton will cause the large alarm icon to disappear and the alarm goes to the upper right corner of the screen.

⚠️ **When the MENU pushbutton is depressed, the display will rever to the "measurements" screen.**

5.1. SERVICE ALARM OPTIONS

Following the selection of the program parameter **F.02 Stop Service Request**, the expiration of a service timer may simply cause a visual warning and the activation of the alarm relay, or it may also cause below behaviour:

TIME TO SERVICE	ACTION TAKEN
> 100 hours	No warning occurs
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 depressing the **RUN** pushbutton.
-100 hours	The compressor stops. Service request warning is given and the service led turns on. The compressor may be run again by depressing the **RUN** pushbutton.
Between -120 and -200 hours, every 20 hours	The compressor stops. Service request warning is given and the service led turns on. The compressor may be run again by depressing the **RUN** pushbutton.
Between -210 and -300 hours and every 10 hours	The compressor stops. Service request warning is given and the service led turns on. The compressor may be run again by depressing the **RUN** pushbutton.
-300 hours	The compressor stops. Service request warning is given and the service led turns on. The compressor will run only after service is performed.

5.2. LIST OF FAULT CODES

ICON	CODE	DESCRIPTION	FAULT LEVEL
ALARM 01	01	Pressure Safety Switch Open	ALARM
ALARM 02	02	High Pressure	ALARM
ALARM 03	03	Pressure sensor failure	ALARM
ALARM 04	04	High temperature Alarm	ALARM
ALARM 05	05	High Temperature Warning	WARNING
ALARM 06	06	Temperature sensor failure	ALARM
ALARM 07	07	Low temperature Alarm	ALARM
ALARM 08	08	Fan motor high temperature	ALARM
ALARM 09	09	Motor PTC high temperature	ALARM
ALARM 10	10	Voltage unbalance	ALARM
ALARM 11	11	High voltage	ALARM
ALARM 12	12	Low voltage	ALARM
ALARM 13	13	High frequency	ALARM
ALARM 14	14	Low frequency	ALARM
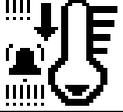
ICON	CODE	DESCRIPTION	FAULT LEVEL
ALARM 15	15	Phase order failure	ALARM
ALARM 16	16	Air filter clogged	WARNING
ALARM 17	17	Max starts per hour exceeded	WARNING
ALARM 18	18	Emergency stop	ALARM
ALARM 19	19	Internal failure	WARNING
ALARM 20	20	High differential pressure	ALARM
ALARM 21	21	Sensor-2 high pressure	ALARM
ALARM 22	22	Pressure sensor-2 failure	ALARM
ALARM 23	23	Sensor-2 high temperature / Delta_T (tS2-tS1) Alarm	ALARM
ALARM 24	24	Temperature sensor-2 failure	ALARM
ALARM 25	25	Sensor-2 low temperature alarm	ALARM
ALARM 26	26	Air in separator filter	WARNING
ALARM 27	27	Delta temperature sensor-2	WARNING
ALARM 28	28	Motor thermic protection switch open (Motor Overload)	ALARM
ALARM 29	29	Sensor-2 low pressure	ALARM
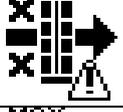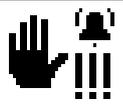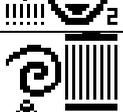
ICON	CODE	DESCRIPTION	FAULT LEVEL
ALARM 30	30	Input expected	WARNING
ALARM 50	50	Data line failure (multiple control)	WARNING
SERVİS A	100	Service period A exceeded	SERVICE
SERVİS B	101	Service period B exceeded	SERVICE
SERVİS C	102	Service period C exceeded	SERVICE
SERVİS D	103	Service period D exceeded	SERVICE
SERVİS E	104	Service period E exceeded	SERVICE
Uzak Durdur	200	Remote stop signal	-

6. OTHER FEATURES

6.1. RESETTING SERVICE COUNTERS

> ⚠️ **Service counters can be reset only when the compressor is in STOP state.**

In order to reset service counters:

- Hold pressed MENU and RUN pushbuttons during 3 seconds. If the HIGH LEVEL password is not entered in the last 90 minutes, then the controller will ask for password.
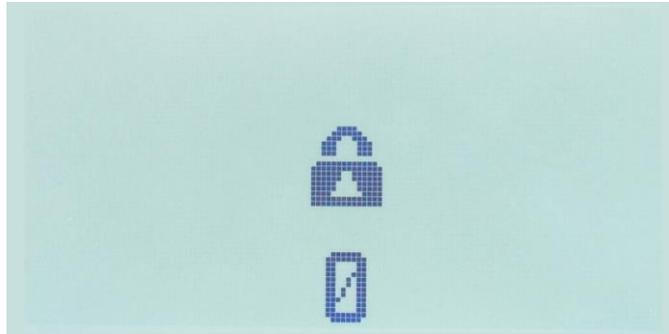
- Enter password.
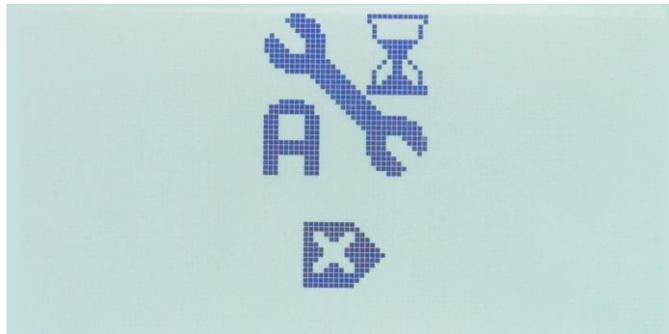
- (hours remaining to service A) icon and (reset) icon will be displayed.

- Press again the MENU ⊕ pushbutton. The remaining hours to service A will be displayed.

- In order to reset service A, hold the MENU ⊕ button pressed during 3 seconds.

⊕ (hours remaining to service B) icon and ⊠ (reset) icon will be displayed.

- Press again the MENU ⊕ pushbutton. The remaining hours to service B will be displayed.

- In order to reset service B, hold the MENU ⊕ button pressed during 3 seconds.

- With successive MENU ⊕ button keypresses other (C,D,E) service counters may be displayed and reset.

> ⚠ **After the last counter, the display will revert to the measurement screen.**

6.2. MODIFYING MOTOR RUN HOURS

Below are run hour counters of the device.

MESSAGE	DESCRIPTION
RUN H.	Total motor run hours (on_LOAD + off_LOAD) This counter increments while the motor is running.
LOAD H.	Total on_LOAD run hours (LOAD output active) This counter increments while the LOAD led is on.

> ⚠ **Hour run counters can be modified only when the compressor is in STOP state.**

In order to set hour run counters to a given value:

- Hold pressed during 3 seconds MENU, RUN and STOP pushbuttons. If the HIGH LEVEL password is not entered in the last 90 minutes, then the controller will ask for password.

- Enter password.

- "**RUN H.**" Message and the zero counter value will be displayed.

- Adjust the counter to the desired value using RUN and STOP pushbuttons.

- If the MENU pushbutton is held pressed for 3 seconds, ✔ (adjusted) icon will be displayed announcing that the counter is set to its new value.

If MENU pushbutton is shortly depressed then the counter value will not change and the next counter's value will be displayed. The counter value may be modified and saved as explained above.

> ⚠ **After modification, the display will revert to the measurement screen.**

6.3. SELECTION OF MOTOR HOURS COUNTING METHOD

The controller offers the possibility of counting motor hours with a variable coefficient depending on output air temperature.

The usage of variable coefficient is selected with **F.03 Motor Hours Calculation Method** parameter. If this parameter is not activated, then all service and motor hour counters are calculated with a coefficient of 1.00, independent of the output air temperature.

When the variable coefficient calculation is activated:

<u>On-LOAD operation,</u>

Below 90 °C coefficient is 1.00

Between 90-95 °C coefficient is 1.50

Between 95-100 °C coefficient is 2.00

Above 100 °C coefficient is 3.00

<u>Off_LOAD operation</u>

Below 90 °C coefficient is 0.50

Between 90-95 °C coefficient is 0.75

Between 95-100 °C coefficient is 1.00

Above 100 °C coefficient is 1.50

> ⚠️ **These coefficients are valid for all service and motor run hour counters.**

6.4. CONNECTION TOPOLOGIES

The controller supports various utility mains connection topologies. The selection is made through **C.04 Connection Topology** parameter.

Connection diagrams for various topologies are below:

C.04 = 3

C.04 = 1

C.04 = 2

C.04 = 3

Supply and measurement inputs of the module are isolated.

Above connection requires a different product variant which should be notified in the order.

6.5. PREVENTING PRESSURE LOSS

If the outputs pressure stays above **E.05 Start Pressure** during **E.25 Unload Timer**, then the controller will stop the motor. When the motor is at rest, if the pressure falls below **E.05 Start Pressure** then the motor will run again.

A delay equal to **E.22+E.23+E.24+E.15x3** will pass until the compressor enters under load again.

During this period, depending on air consumption, the pressure may fall well below **E.05 Start Pressure.** But in most systems the pressure is not desired to fall below **E.05 Start Pressure**.

In order to prevent this unwanted situation, the controller offers 3 different solutions and the related procedure is selected through **E.38 Prevent Pressure Loss** parameter. Using these procedures, the controller redetermines dynamically the startup pressure (**Pi: Restart Pressure**).

E.38 = 0 → No special care is taken for pressure loss. Restart pressure is always **E.05** parameter.

E.38 = 1 → At the moment where the compressor takes the load, if the pressure is below **E.05 Start Pressure**, the controller will increase the **Restart Pressure** by 0.1 bar. If the prssure is above the **E.05 Start Pressure**, the controller will decrease the **Restart Pressure** by 0.1 bar. Thus it will try to put the compressor under under load exactly when the pressure equals to the **E.05 Start Pressure**.

E.38 = 2 → When the compressor unloads after reaching the **E.04 Stop Pressure**, the controller monitors the pressure decrease in the first 8 seconds and recalculates the **Restart Pressure** dynamically for each restart period.

> **At the end of E.25 Unload Timer, if the pressure is above E.05 Start Pressure but below Restart Pressure, then the compressor continues off_load operation.**

6.6. ALARM HISTORY

The controller keeps record of last 9 alarms in its alarm history list.

The alarm history may be visualized on the screen or read through Modbus communication.

Alarm history is kept in a non-volatile memory and is not affected by power failures.

The primary condition for an alarm to be saved to the history, is that the alarm is different from the last one or the motor has run at least 6 minutes from the last alarm.

In order to display the latest alarm on the list press MENU button until (alarm history) icon is displayed. The alarm history may also be accessed from the programming menu. Please see chapter 10 for this.

In order to visualize previous alarms please use RUN and STOP buttons.

In order to reset the alarm history, please long-press the STOP button when the motor is at rest.

In the alarm history screen, the history record number (1 to 9) appears at top left of the screen. The alarm history icon appears at the top right. The alarm icon and alarm number appears at the center of the screen.

> ⚠ **When the alarm list is displayed the STOP button is always enabled and stops the compressor. Run button is not active and does not run the compressor. In order to scan the alarm history when the motor is running, please use the RUN button.**

6.7. DRYER FUNCTION

If **E.56 Dryer Delay Timer** is adjusted to a value other than zero, the "STARTUP PROCEDURE" described in chapter 4 will be performed in a different manner.

If the timer is not zero, then the MAIN relay output will be activated before the STAR relay and will stay active during **E.56 Dryer Delay Timer**.

Thus the air dryer supplied from the main contactor will be run during the desired period before the compressor starts producing compressed air.

When the timer is elapsed, the STAR relay output becomes active and the startup predure is performed as explained in chapter 4.

> ⚠ **If E.56 Dryer Delay Timer is adjusted to zero, then the dryer function is disabled.**

6.8. VARIABLE UNLOAD TIMER

This feature is designed to prevent the motor running unnecessarily off_load, consuming energy.

When the pressure reaches **E.04 Stop Pressure** limit (or the pressure switch opens) the LOAD relay will open. During **E.25 Unload Timer** or **E.27 Safety Delay Timer** (whichever longer) the motor continues to run, then stops.

If **E.26 Variable Unload Timer** parameter is adjusted to **1** and the period where the motor is at rest is longer than **E.25 Unload Timer** then the controller decides that the motor has run unnecessarily longtime off_LOAD and shortens the **Unload Timer** for the next cycle by 1 minute, but never below 2 minutes.

If the compressor is stopped with the STOP 🔴 button or programming mode is selected, then the **Unload Timer** is reset to **E.25 Unload Timer** parameter value.

6.9. PID CONTROL AND ANALOG OUTPUT (PWM)

If **E.47 Motor PWM Signal** (0-10V) parameter is set to **1** then the PID controlled analog output of the module is activated. The analog control signal is output from the terminal number 19, **0-10V OUT**.

The analog output will control the motor speed in order to match **E.48 PWM Set Pressure**. The control is performed by changing the analog output voltage between 0 and 10VDC.

Before starting the control process, the module will wait for the compressor to heat-up. When the temperature T1 is above E.54 PID Start Temperature the module will decide to provide analog output. After E.53 PID Control Delay it will start controlling the motor speed.

PID control coefficients may be adjusted through **E.49 PID P Value**, **E.50 PID I Value**, **E.51 PID D Val**ue and **E.52 PID I Inverse Value** parameters.

6.10. MOTOR PTC INPUT

The secondary temperature sensor or a Motor PTC may be connected to the terminal 17 (TEMP.2/PTC) input of the controller.

If a motor PTC sensor is connected, then **E.16 Temp.2 Sensor** parameter should be **0** and **E.12 Motor PTC** parameter should be **1**.

In this case, when the motor overheats and the motor PTC impedence goes over 2000 ohms, the controller will give **ALARM 09 Motor PTC High Temperature**.

7. MULTI-COMPRESSOR OPERATION

The multi-compressor mode is designed for cases where more than 1 compressor is needed to supply the necessary compressed air.

In case of low air demand, the multi-compressor mode turns on only the necessary number of compressors, providing energy efficiency, cost control and equal aging of compressors.

The controller allows a maximum of 8 compressors to operate in parallel.

In multi-compressor mode, the communication between controllers runs on the serial port. Devices are interconnected using special RS-485 converters provided by the controller manufacturer.

> ⚠️ **Please contact the manufacturer to order RS-485 converters.**

The multi-compressor more is enabled by setting the parameter **B.01 Modbus Address** to 1. Other compressors in the group must have **consecutive addresses**. Unused addresses are not allowed.

> ⚠️ **Controllers with skipped addresses do not take part in the multi-compressor operation. They will run independently.**

System operation in multi-compressor mode:

1. If communication between controllers is lost, compressors resume independent operation.

2. The youngest of controllers will become the master and runs continuously for E.04 and E.05 values. Other compressors enter into service depending their **engine hours**.

3. If any of compressors becomes younger than the master by **B.04 Master Change Timer**, then this controller becomes automatically the new master.

4. If an alarm occurs on the master controller, then another controller will become the new master.

5. When the pressure falls below **E.05**, the master compressor runs immediately. Other compressors will run in the order of their run-hours (youngest first) with delays of **B.03/8**.

6. If the pressure is above **E.05**, but below **(E.04+E.05)/2** at the expiration of **B.03**, then controllers will enter into service with delays of **B.03/4**.

7. When the pressure approaches **E.04**, controllers will quit the system in the order of their age (oldest first).

8. DIGITAL INPUTS

The controller provides 4 user programmable digital inputs.

Input characteristics are programmed with parameters D.02 to D.05.

The input configuration consists on 3 pieces and the programmed value is the sum of these 3 pieces.

> ⚠️ **Configuration = piece_1 + piece_2 + piece_3**

Piece_1 = input alarm code

This value determines the alarm generated when the fault signal comes from the input. The list of alarm codes is given in chapter 5.

Piece_2 = input contact type (NO or NC)

NO (normally open) contact = 256

NC (normally closed) contact = 0

Piece_3 = input detection delay

0.1sec delay : piece_3 = 0

0.5sec delay : piece_3 = 512

2.0sec delay : piece_3 = 1024

5.0sec delay : piece_3 = 1536

Example 1:

In order to program the Input_2 as EMERGENCY STOP, NC contact and 0.1sec delay:

Piece_1 = 18 (see chapter 5)

Piece_2 = 0 (NC contact)

Piece_3 = 0 (0.1 sec)

D.03 (Input_2 configuration) = 18+0+0 = **18**

Example_2:

In order to program the Input_4 as REMOTE START, NO contact and 2.0sec delay:

Piece_1 = 200 (see chapter 5)

Piece_2 = 256 (NO contact)

Piece_3 = 1024 (2.0 sec)

D.05 (Input_4 configuration) = 200+256+1024 = **1480**

9. RELAY OUTPUTS

The unit provides 5 relay outputs with fully programmable functions.

The factory set values of relay functions and related program parameters are shown in below table:

RELAY #	FACTORY SET	PROGRAM #
RL 1	Main relay	D.06
RL 2	Delta relay	D.07
RL 3	Star relay	D.08
RL 4	Load relay	D.09
RL 5	Alarm relay	D.01

RELAY FUNCTION LIST:

PARAMETER VALUE	FUNCTION	DESCRIPTION
0	DEFAULT	Relay adjusted to "FACTORY DEFAULT" function.
1	FAN	Operates when the temperature measured from the first temperature sensor is higher than **E.34**. Releases when lower than (**E.34-E.35**).
2	LOAD	Load relay
3	NO LOAD	Inverse of load relay
4	MOTOR	Operates when the motor is running, releases when the motor is stopped.
5	MOTOR STOP	Operates when the motor is stopped, releases when the motor is running.
6	FLASHING RELAY	Released during **E.36** timer. Operates during **E.37** timer.
7	ALARM	Operates when there is an alarm.
8	PID ACTIVE	Operates when the PID is active.
9	FORCE TO MIN (PID INACTIVE)	Operates when PID is not active.
10	BUTTON 1	Operates when button_1 (MENU) is pressed.
11	BUTTON 2	Operates when button_2 (START) is pressed.
12	BUTTON 3	Operates when button_3 (STOP) is pressed.

10. PROGRAMMING

10.1. ENTERING THE PROGRAMMING MODE

⚠️ **Program menu can be selected only when the compressor is in STOP mode.**

The program menu is protected by a 2 level password system. Parameter set and password levels may differ following compressor manufacturers. This document is based on factory set parameter list.

⚠️ **Factory set passwords:**
Low level password = 1
High level password = 2

Entering the program menu:

- When the compressor is in STOP MODE, hold pressed MENU 🔲 and STOP 🔴 buttons 3 seconds.

- 🔒 (enter password) icon will appear on top of display. Enter the password using RUN 🟢 and STOP 🔴 buttons and press MENU 🔲 button. In order to increase/decrease the value faster you can hold RUN 🟢 or STOP 🔴 buttons pressed.

Exiting the program menu:

- Hold pressed the MENU 🔲 button for 3 seconds.

Modifying program parameters:

- When program mode is entered, the ⚙️ (programming) icon appears on top-right of the screen. Below comes parameter groups. Selected parameter group is displayed with a black background. The icon appearing on the left side when the parameter is not selected, moves to the right when it is selected.

- Determine the parameter group with RUN 🟢 and STOP 🔴 buttons.

- Enter into the parameter group with the MENU 🔲 button.

- When inside a parameter group, the group name and icon will be displayed on top of screen. Below will come the code and name of the parameter. If the parameter has a unit, it will be displayed together with the parameter value.

If the parameter has a descriptive icon, it will be displayed at the bottom right of the parameter value.

- Select the parameter to modify with RUN 🟢 and STOP 🔴 buttons.

- Press MENU 🔲 button to make the parameter value underlined. Adjust parameter value with RUN 🟢 and STOP 🔴 buttons and press MENU 🔲 button to remove the underline.

If the parameter before the first one or after the last one is selected, the parameter group menu will be resumed.

In order to return to upper parameter group screen or exit the programming menu please hold pressed the MENU 🔲 button during 3 seconds.

Programlama konumundaki parametre grupları sırasıyla şunlardır:

- A.ALARM HISTRY (Alarm history)
- B.CONFIGURATION (Configurations)
- C.ELECTRICAL (Electrical parameters)
- D.INPUT-OUTPUT (Input-Output parameters)
- E.COMPRESSOR (Compressor parameters)
- F.MOTOR (Motor parameters)
- G.PASSWORD (Change password)
- H.RETURN/SAVE (Return/Save to factory settings or set values)
- K.LCD CONTRAST (LCD contrast)
- L.BACKLIGHT (LCD backlight timer)

> **When no action is taken during 1 minute, the upper menu will be automatically selected. If the main programming menu is selected then programming mode will be exited.**

10.2. LIST OF PARAMETERS ⚙

Below is the list of all possible parameters. The description section gives first the parameter name in uppercase letters as it appears on the screen, then the description of it in lowercase letters.

⚠ **Some of the parameters in this list may not apeear on the controller.**

10.2.1. ALARM HISTORY 🔔

Please see chapter 6.6.

10.2.2. CONFIGURATION

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
B.01	DISP TEMP.IN F : Display temperature in degrees F.	✘ **0**:Celcius ✔ **1**:Fahrenheit	0
B.02	MODBUS ADDRESS :	**1**: Starts multi-compressor operation **2... 254**: Modbus address	9
B.03	TIMETO.SLV.STRT : Slave start timer (Multi-compressor)	1...999 sec	11 sec
B.04	MASTER CH.TIM : Master change timer (Multi-compressor)	0.1 ... 999.9 hour	4.0 hour
B.05	SERI.NO.LOW WRD : Serial number (lower 16 bits)	0 ... 65535	10
B.06	SERI.NOHGH WRD : Serial number (higher 16 bits)	0 ... 65535	10
B.07	SHOW PSI : Show pressure in PSI	✘ **0**: pressure displayed in bars ✔ **1**: pressure displayed in PSI	0

10.2.3. ELECTRICAL PARAMETERS

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
C.01	VOLT.UNBALANCE % : Voltage unbalance ratio	% 0 ... 20	5 %
C.02	LOW VOLT. ALARM : Low voltage alarm enable	**0**: disabled **1**: enabled If this parameter is set to **0** then the parameter **C.03** will not be visible.	1
C.03	LOW VOLT. ALARM : Low voltage alarm limit	100 ... 600	360 V-AC
C.04	WIRING TOPOLOGY :	**1:** Single phase **2:** Two phased **3:** Three phased	3
C.05	PHASE L1 CONSTNT : Phase L1 calibration coefficient	1 ... 32767	1219
C.06	PHASE L2 CONSTNT : Phase L2 calibration coefficient	1 ... 32767	1219
C.07	PHASE L3 CONSTNT : Phase L3 calibration coefficient	1 ... 32767	1219
C.08	LOW FREQ. ALARM : Low frequency alarm enable	**0**: disabled **1**: enabled If this parameter is set to **0** then the parameter **C.09** will not be visible.	1
C.09	LOW FREQ. ALARM : Low frequency alarm limit	10.0 ... 60.0	48.0 Hz
C.10	HIGH FREQ.ALARM: High frequency alarm enable	**0**: disabled **1**: enabled If this parameter is set to **0** then the parameter **C.11** will not be visible.	1

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
C.11	HIGH FREQ.ALARM: High frequency alarm limit	50.0 ... 990.0 Hz	62.0
C.12	DISPLAY FREQ : Display frequency	**0**: no **1**: yes	1
C.13	DISPLAY VOLT. L1 : Display voltage L1	**0**: no **1**: yes	0
C.14	DISPLAY VOLT. L2 : Display voltage L2	**0**: no **1**: yes	0
C.15	DISPLAY VOLT. L3 : Display voltage L3	**0**: no **1**: yes	0
C.16	DISPLY.VOLT. L12 : Display voltage L1-L2	**0**: no **1**: yes	1
C.17	DISPLY.VOLT. L23 : Display voltage L2-L3	**0**: no **1**: yes	1
C.18	DISPLY.VOLT. L31 : Display voltage L3-L1	**0**: no **1**: yes	1
C.19	HIGH VOLT.ALARM : High voltage alarm enable	**0**: disabled **1**: enabled If this parameter is set to **0** then the parameter **C.20** will not be visible.	1
C.20	HIGH VOLT.ALARM : High voltage alarm limit	100 ... 650 V	445
C.21	PHASE SEQUENCE : Phase sequence check enable	**0**: disabled **1**: enabled	1

10.2.4. INPUT-OUTPUT PARAMETERS ⊕
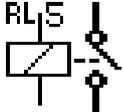
ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
RL5 ... D.01	RELAY5 FUNCTION :	0 ... 12 (see chapter 9)	0
1. ... D.02	INPUT-1 CONTROL : Input_1 configuration	0 ... 2047 Please see chapter 8 for details.	18
2. ... D.03	INPUT-2 CONTROL : Input_2 configuration	0 ...2047 Please see chapter 8 for details.	28+512=540
3. ... D.04	INPUT-3 CONTROL : Input_3 configuration	0 ... 2047 Please see chapter 8 for details.	8+512=520
4. ... D.05	INPUT-4 CONTROL : Input_4 configuration	0 ... 2047 Please see chapter 8 for details.	16+256+=1808
RL1 ... D.06	RELAY1 FUNCTION :	0 ... 12 (see chapter 9)	0
RL2 ... D.07	RELAY2 FUNCTION :	0 ... 12 (see chapter 9)	0
RL3 ... D.08	RELAY3 FUNCTION :	0 ... 12 (see chapter 9)	0
RL4 ... D.09	RELAY4 FUNCTION :	0 ... 12 (see chapter 9)	0
... D.10	SEC. INPUT FUNC. : Güvenlik girişi siviçi fonksiyon seçimi	1 ... 255	1
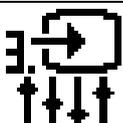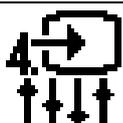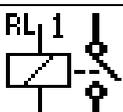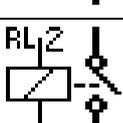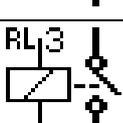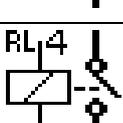
10.2.5. COMPRESSOR PARAMETERS

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
E.01	PRESS. CONTROL : Pressure sensor type	**0**: Analog sensor connected **1**: Pressure switch connected If this parameter is set to 1 then parameters **E.02** ... **E.06** will not be visible.	0
E.02	PRESS.TOP RANGE : Pressure upper display limit	1.7... 99.9	15.0 bar
E.03	HIGH PRES.ALARM : High pressure alarm limit	(**E.02**-0.5) ... (**E.04**+0.2)	8.5 bar
E.04	STOP PRESSURE :	(**E.03**-0.2) ... (**E.05**+0.2)	7.4 bar
E.05	START PRESSURE :	0.5 ... (**E.04**-0.2)	6.5 bar
E.06	PRES.SNSR.OFSET : Pressure sensor offset adjustment	-2.0 ... +2.0	0.0 bar
E.07	TEMP. TOP RANGE : Temperature display upper limit	(**E.08**+2) ... 130	130 °C
E.08	HIGH TEMP.ALARM : High outlet temperature alarm limit	(**E.09**+2) ... (**E.07**-2)	108 °C
E.09	HIGH TEMP.WARNG : High outlet temperature warning limit	(**E.10**+2) ... (**E.08**-2)	103 °C
E.10	LOW TEMP. ALARM : Low outlet temperature alarm limit	-10 ... (**E.09**-2)	0 °C
E.11	TEMP. OFFSET : Temperature sensor offset adjustment	-10 ... +10	0 °C

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
E.12	MOTOR PTC : Motor PTC connection	✖ **0**: Not connected ✔ **1**: Connected If this sensor type is selected, when the sensor impedance is over **2000 ohms**, the **ALARM 09 Motor PTC High Temperature** will occur.	0
E.13	AUTO. RESTART : Automatic restart	✖ **0**: No (controller turns on at STOP mode) ✔ **1**: Yes (controller turns on at the last mode) ✔ **2**: Automatic restart (PORO)	0
E.14	CMPNS.PRES.TEMP. : Pressure compensation temperature	0 ... (**E.09**) Until outlet air temperature reaches this level, instead of **E.04 Stop Pressure**, **E.05**+(**E.04**-**E.05**)/4 will be used. Thus the compressor will stop before reaching the stop pressure.	0 °C
E.15	DELAY BETWN.REL : Delay between relays	20 ... 250 ms This is the minimum period between release of a relay and operation of another relay.	100 ms
E.16	TEMP.-2 SENSOR : Temperature sensor 2 operation type	✖ **0**: Not connected T2 ✔ **1**: Reads absolute temperature T₁-T₂ ✔ **2**: Reads differential temperature If this parameter is set to **0** then parameters **E.17**, **E.18**, **E.19**, **E.20** and **E.21** will not be visible.	0
E.17	TEMP.-2 TOP : Temperature 2 display upper limit	(**E.18**+2) ... 200	130 °C
E.18	TEMP-2 HGH ALRM : High temperature 2 alarm limit (differential temperature alarm limit)	(**E.19**+2) ... (**E.17**-2) (Differential alarm limit)	110 °C
E.19	TEMP-2 LOW ALRM Low temperature 2 alarm limit (differential temperature warning limit)	-40 ... (**E.18**-2) (differential warning limit)	-10 °C
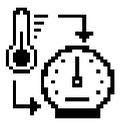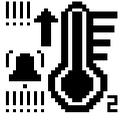
ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
E.20	T2 AL WRN TIME : Temperature 2 alarm/warning automatic reset delay	1 ... 600	10 sec
E.21	TEMP.-2 OFFSET : Temperature sensor 2 offset adjustment	-10 ... +10	0 °C
E.22	STAR TIMER : Star relay timer	2 ... 20	7 sec
E.23	STAR DELTA TIME : Star / delta transition timer	10 ... 50	15 ms
E.24	TIME BEFOR.LOAD : Time before load	1 ... 999 Sec	2 sec
E.25	UNLOAD TIME :	0 ... 10	2 minute
E.26	VAR.UNLOAD TIME : Variable unload timer enable	**0**: Constant unload timer **1**: Variable unload timer Please see chapter 6.8 for details.	0
E.27	SAFETY TIMER : Safety delay timer	1 ... 240 Please see chapter 4 for details.	30 sec
E.28	SERVICE A TIME : Service A period (Change air filter)	0 ...32767 If this parameter is set to **0** then service A warning will not be given.	2000 hours
E.29	SERVICE B TIME : Service B period (Change oil filter)	0 ... 32767 If this parameter is set to **0** then service B warning will not be given.	4000 hours
E.30	SERVICE C TIME : Service C period (Change separator filter)	0 ... 32767 If this parameter is set to **0** then service C warning will not be given.	6000 hours
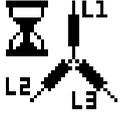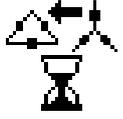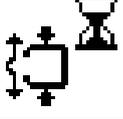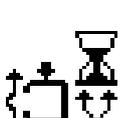
ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
E.31	SERVICE D TIME : Service D period (Change oil)	0 ... 32767 If this parameter is set to **0** then service D warning will not be given.	10000 hours
E.32	SERVICE E TIME : Service E period (Check compresssor)	0 ... 32767 If this parameter is set to **0** then service E warning will not be given.	20000 hours
E.33	DISP 2.TEMP PRS : Display second temperature and pressure values	**0**: No **1**: Yes	1
E.34	FAN ON TEMP. : Fan turn-on temperature	30 ... (**E.09**-2) Please see chapter 9 for details.	85 °C
E.35	FAN OFF TEMP. : Fan turn-off differential temperature	5 ... 15 Please see chapter 9 for details.	5 °C
E.36	FLASH OFF TIME : Flashing relay off timer	0 ... 999 Please see chapter 9 for details.	2 sec
E.37	FLASH ON TIME : Flashing relay on timer	0 ... 11999 Please see chapter 9 for details.	3 sec
E.38	PRVNT PRES.LOSS : Pressure loss prevention method	**0:** Standard operation **1:** Increase/decrease after each cycle. **2:** Calculation through pressure slope Please see chapter 6.5 for details.	0
MODBUS SLAVE **E.39**	SLV.MAX RN TIME : Slave compressor maximum run time (multi compressor)	0 … 65535	0 minute
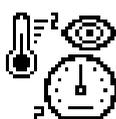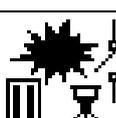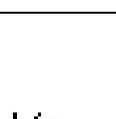
ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set

E.40	PRES-2 SNSR.TYP : Pressure 2 sensor type	**0**: not connected
		  1: Pressure switch connected
		  2: Analog sensor connected
		 If this parameter is set to 1 then parameters **E.41** ... **E.45** will not be visible.
			0

E.41	PRESS.-2 TOP : Pressure 2 upper display limit	1.7 ... 99.9 Bar	16.0 bar
E.42	HGH PRES-2 ALRM : High pressure_2 alarm limit	1.2 ... (**E.41**-0.5)	8.0 bar
E.43	DELTA.PRES.ALRM : Differential pressure alarm limit (Press1 – Press2)	-10.0 ... +10.0 If the pressure difference **P1-P2** stays over this limit during **E.44** period, then **ALARM 20 High Differential Pressure** is given.	0 bar
E.44	P2 ALARM DELAY : Differential pressure alarm delay timer	1 ... 600 If the pressure difference **P1-P2** stays over **E.43** limit during this period, then **ALARM 20 High Differential Pressure** is given.	15 sec
E.45	P2 SENSOR.OFSET : Pressure sensor 2 offset adjustment	-2 ... +2	0 bar
E.46	LOW PRES-2 ALRM : Air pressure sensor 2 low alarm limit. (Alarm disabled when set to 0.0 bar)	0.0: alarm disabled 0.1... (**E.42**-0.5)	1 bar
E.47	MOTOR PWM SIGNL : Analog (0-10V) motor control signal enable	**0**: Disabled **1**: Enabled If this parameter is set to **0** then parameters **E.48, E.49, E.50, E.51, E.52, E.53** and **E.54** will not be visible.	0
E.48	PWM SET PRESS. : Analog (0-10V) motor control signal set pressure	0.5 ... (**E.03**-0.2)	7.0 bar
E.49	PID P VALUE : PID control P gain	%0.0 ... 99.9	% 3.0

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
E.50	PID I VALUE : PID control I gain	%0.0 ... 99.9	% 0
E.51	PID D VALUE : PID control D gain	%0.0 ... 99.9	% 5.0
E.52	PID I INVRS VAL : PID control inverse I gain	%0.0 ... 99.9	% 0
E.53	PID CNTRL DELAY : PID control activation delay	1 ... 999 sec Please see chapter 6.9 for details.	10 sec
E.54	PID START TEMP. : PID control start temperature	0 ... (**E.08**-2) Please see chapter 6.9 for details.	15 °C
E.55	MAX SLAVES : Maximum number of slaves under load	0 ... 8	0
E.56	DRYER DLY.TIMER : Dryer function delay timer	0 ... 999 sec If this parameter is set to **0** then the dryer function is disabled. Please see chapter 6.7 for details.	0 sec

10.2.6. MOTOR PARAMETERS

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
MAX/h **F.01**	MAX STRTS PER H : Maximum number of starts allowed in one hour	6 ... 240	20
F.02	STP.SRVC.RQUEST : Service safety selection	**0:** Warning only on service request **1:** Operates as explained in chapter 5.1	0
F.03	MOTOR HOUR CAL : Motor hours calculation method	**0**: Constant coefficient **1**: Variable coefficient Please see chapter 6.3 for details.	0

10.2.7. PASSWORD CHANGING

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
1. **G.01**	LEVL 1 PASSWORD : Low level password	0 ... 999	1
2. **G.02**	LEVL 2 PASSWORD : High level password	0 ... 999	2

10.2.8. RETURN/SAVE TO FACTORY SETTINGS OR SAVED SETTINGS 🔌↩

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
🖫↻ **H.01**	RETURN SAVE : Return to restore values/ return to factory settings	57Fxr DEFA ULT5 **0**: no action 🔌↩ **1**: Return to restore point values 🖫 **2**: Save current parameter set as restore point 57Fxr DEFA ULT5 **57**: Return to factory settings	0

10.2.9. LCD CONTRAST ⊕

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
👁⊖⊕ **K.01**	LCD CONTRAST : LCD contrast adjustment	25 ... 50	32

10.2.10. LCD BACKLIGHT TIMER ☀

ICON and No:	DESCRIPTION	ADJUSTMENT LIMITS	Factory Set
⏳☀👁 **L.01**	BACKLIGHT TIMER : LCD backlight dimming timer	0 ... 210 minutes If no action happens and no button is pressed during this timer, then LCD backlight will turn off. If this parameter is set to **0** then LCD backlight never turns off. It is always on.	1 minute

11. MODBUS COMMUNICATIONS

11.1. DESCRIPTION

The unit offers the possibility of MODBUS communication through its serial port.

The serial port has 0/+5V logic levels.Using special adapters it is converted to RS-232 or RS-485 standards.

The MODBUS properties of the unit are:

-Data transfer mode: RTU

-Serial data: 9600 bps, 8 bit, no parity, 1 bit stop
-Supported functions:
-Function 3 (Read multiple registers, max 120 registers)
-Function 6 (Write single register)
-Function 16 (Write multiple registers, max 32 registers)

-Answer to a message is sent within 4.3ms after the reception of the querry.

Each register consists of 2 bytes (16 bits). A larger data structure will contain multiple registers.

Detailed description about the MODBUS protocol is found in the document "**Modicon Modbus Protocol Reference Guide"**. This document may be downloaded at: www.modbus.org/docs/PI_MBUS_300.pdf

> **Each device in the same RS-485 serial network must be assigned a different slave address. Otherwise the Modbus communications will not be performed.**

Data reading

The function 03 (read multiple registers) will be used for data reading. The MODBUS master will send a query. The answer will be one of the below:

      -A response containing the requested data

      -An exceptional response indicating a read error.

The maximum number of registers read in one message is 120. If more registers are requested, the unit will send only the first 120 registers.

The query message specifies the starting register and quantity of registers to be read. The message structure is below:

Byte	Description	Value
0	Controller address	254
1	Function code	3
2	Starting address high	See chapter 11.2 for the description of available
3	Starting address low	registers
4	Number of registers high	always 0
5	Number of registers low	max 78h (120 decimal)
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

Here is the sequence to read 16 registers starting from address 20h (32 decimal):

      01 03 00 20 00 10 45 CC (each byte is expressed as 2 hexadecimal characters)

The checksum value in the above message may be used for the verification of checksum calculation algorithm.

The normal response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	3
2	Data lenght in **bytes** (L)	number of registers * 2
3	High byte of 1st register	
4	Low byte of 1st register	
5	High byte of 2nd register	
6	Low byte of 2nd register	
....		
L+1	High byte of the last register	
L+2	Low byte of the last register	
L+3	CRC low byte	See below for the checksum calculation
L+4	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	131 (function code + 128)
2	Exception code	2 (illegal address)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

Data Writing (single register)
The function 06 (write single register) and the function 16 (write multiple registers) are used for data writing.
The MODBUS master will send a query containing data to be written. The answer will be one of the below:

-A normal response confirming successful write,
-An exceptional response indicating a write error.

Only some of the available registers are authorized to be written. An attempt to write a write protected register will result to the exceptional response.

The query message specifies the register address and data. The message structure is below:

Byte	Description	Value
0	Controller address	1 to 254
1	Function code	6
2	Register address high	See below the description of available registers
3	Register address low	
4	Data high byte	
5	Data low byte	
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

Here is the sequence to write the value 0010h to the register 40h (64 decimal):
　　　　01 06 00 40 00 10 89 D2 (each byte is expressed as 2 hexadecimal characters)

The checksum value in the above message may be used for the verification of checksum calculation algorithm

The normal response will be the same as the query:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	6
2	Register address high	See below the description of available registers
3	Register address low	
4	Data high byte	
5	Data low byte	
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	134 (function code + 128)
2	Exception code	2 (illegal address) or 10 (write protection)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

Data Writing (multiple register)

The function 06 (write single register) and the function 16 (write multiple registers) are used for data writing.

The MODBUS master will send a query containing data to be written. The answer will be one of the below:

-A normal response confirming successful write,
-An exceptional response indicating a write error.

Only some of the available registers are authorized to be written. An attempt to write a write protected register will result to the exceptional response.

The query message specifies the register address and data. The message structure is below:

Byte	Description	Value
0	Controller address	1 to 254
1	Function code	16
2	Starting address high	See below the description of available registers
3	Starting address low	
4	Number of registers high	always 0
5	Number of registers low	max 32
6	Data lenght in **bytes** (L)	number of registers * 2
7	High byte of 1st register	
8	Low byte of 1st register	
9	High byte of 2nd register	
10	Low byte of 2nd register	
....		
L+5	High byte of the last register	
L+6	Low byte of the last register	
L+7	CRC low byte	See below for the checksum calculation
L+8	CRC high byte	

The normal response is below:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	16
2	Starting address high	See below the description of available registers
3	Starting address low	
4	Number of registers high	always 0
5	Number of registers low	max ??
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	144 (function code + 128)
2	Exception code	2 (illegal address) or 10 (write protection)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

CRC calculation

Here is a procedure for generating a CRC:

1) Load a 16–bit register with FFFF hex (all 1's). Call this the CRC register.

2) Exclusive OR the first 8–bit byte of the message (the function code byte) with the low–order byte of the 16–bit CRC register, putting the result in the CRC register.

3) Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB. The LSB is the least significant bit of the CRC **before** the shift operation.

4) If the LSB is 1: Exclusive OR the CRC register with the polynomial value A001 hex.

5) Repeat Steps 3 and 4 until 8 shifts have been performed. Thus, a complete 8–bit byte will be processed.

6) Repeat Steps 2 through 5 for the next 8–bit byte of the message. Continue doing this until all bytes have been processed.

7) The final contents of the CRC register is the CRC value.

8) Place the CRC into the message such that the low byte is transmitted first. The algorithm should give the correct CRC for below messages:
>   01 03 00 20 00 10 45 CC
>   01 06 00 40 00 10 89 D2

Error codes
>   Only 3 error codes are used:
>   01: illegal function code
>   02: illegal address
>   10: write protection (attempt to write a read_only register)

Data types
- Each register consists of 16 bits (2 bytes)
- If the data type is a byte, only the low byte will contain valid data. High byte is don't care.
- For data type longer than 16 bits, consecutive registers are used. The least significant register comes first.

Data formats

16bit variables: These variables are stored in a single register. Bit_0 denotes the LSB and bit 15 denotes the MSB.

32 bit variables: These variables are stored in 2 consecutive registers. The high order 16 bits are in the first register and the low order 16 bits are 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.

11.2. MODBUS REGISTER LIST

CONTROLLER REGISTERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/WRITE	DATA TYPE	COEFF
40001	Frequency		16 BIT	R-O	unsigned word	0.1
40002	Voltage phase L1		16 BIT	R-O	unsigned word	1
40003	Voltage phase L2		16 BIT	R-O	unsigned word	1
40004	Voltage phase L3		16 BIT	R-O	unsigned word	1
40005	Voltage phase L1-L2		16 BIT	R-O	unsigned word	1
40006	Voltage phase L2-L3		16 BIT	R-O	unsigned word	1
40007	Voltage phase L3-L1		16 BIT	R-O	unsigned word	1
40008	Pressure		16 BIT	R-O	unsigned word	0.1
40009	Temperature		16 BIT	R-O	signed word	1
40010	Motor PTC ohms	Reads in ohms	16 BIT	R-O	signed word	1
40011	Temperature-2	Read from temp sensor-2	16 BIT	R-O	signed word	1
40012	Pressure-2	Read from press. Sensor-2	16 BIT	R-O	unsigned word	0.1
40013 / 40014	Service A counter	Time to service-A	32 BIT	R-O	signed long	0.1
40015 / 40016	Service B counter	Time to service-B	32 BIT	R-O	signed long	0.1
40017 / 40018	Service C counter	Time to service-C	32 BIT	R-O	signed long	0.1
40019 / 40020	Service D counter	Time to service-D	32 BIT	R-O	signed long	0.1
40021 / 40022	Service E counter	Time to service-E	32 BIT	R-O	signed long	0.1
40023 / 40024	Total run hours	On_load+off_LOAD+STOP the total time the compressor has run or has waited ready to run	32 BIT	R-O	unsigned long	0.1
40025 / 40026	Total motor hours	On_load+off_LOAD the total time the compressor has run	32 BIT	R-O	unsigned long	0.1
40027 / 40028	Total load hours	the total time the compressor has run on_LOAD	32 BIT	R-O	unsigned long	0.1
40029 / 40030	Alarms	Alarm bits List is given in chapter 11.3	32 BIT	R-O	unsigned long	1
40031	Warnings	Warning bits List is given in chapter 11.3	16 BIT	R-O	unsigned word	1
40032	Service request	Service request bits List is given in chapter 11.3	16 BIT	R-O	unsigned word	1

CONTROLLER REGISTERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/WRITE	DATA TYPE	COEFF
40033	Motor status	Current status of the motor **0**: Compressor STOP mode **1**: Motor in star run **2**: Motor in delta (off_load) **3**: Motor in delta (on_load) **4**: Unload timer **5**: Motor stopped, compressor in RUN mode	16 BIT	R-O	unsigned word	1
40034	Last fault code	Currently active alarm, warning or service request code. Fault code list is given in chapter 5.	16 BIT	R-O	unsigned word	1
40035	Relay outputs	Current status of relays: bit 1-3:- bit 4: RL1 bit 5: RL5 bit 6: RL4 bit 7: RL2 bit 8: RL3 bit 9-16: -	16 BIT	R-O	unsigned word	1
40036	-	-	16 BIT	R-O	unsigned word	1
40037	Alarm 1	Alarm #1 in alarm history	16 BIT	R-O	unsigned word	1
40038	Alarm 2	Alarm #2 in alarm history	16 BIT	R-O	unsigned word	1
40039	Alarm 3	Alarm #3 in alarm history	16 BIT	R-O	unsigned word	1
40040	Alarm 4	Alarm #4 in alarm history	16 BIT	R-O	unsigned word	1
40041	Alarm 5	Alarm #5 in alarm history	16 BIT	R-O	unsigned word	1
40042	Alarm 6	Alarm #6 in alarm history	16 BIT	R-O	unsigned word	1
40043	Alarm 7	Alarm #7 in alarm history	16 BIT	R-O	unsigned word	1
40044	Alarm 8	Alarm #8 in alarm history	16 BIT	R-O	unsigned word	1
40045	Alarm 9	Alarm #9 in alarm history	16 BIT	R-O	unsigned word	1
40046	Utility mains topology	1:one phase 2:two phases 3: three phase	16 BIT	R-O	unsigned word	1
40047	0-10 V output	Output analog value (0-1023)	16 BIT	R-O	unsigned word	1
40048	-		16 BIT	R-O	unsigned word	1
40049	-		16 BIT	R-O	unsigned word	1
40050	-		16 BIT	R-O	unsigned word	1
40051	-		16 BIT	R-O	unsigned word	1
40052	-		16 BIT	R-O	unsigned word	1
40053	-		16 BIT	R-O	unsigned word	1
40054	LEDs	LED statuses	16 BIT	R-O	unsigned word	1
40055	% Load	Load percentage	16 BIT	R-O	unsigned word	1
40056	Master address	Modbus address of master	16 BIT	R-O	unsigned word	1
40057	Number of controllers	Number of controllers in multi compressor	16 BIT	R-O	unsigned word	1
40058	Requests	Start Stop request	16 BIT	R-O	unsigned word	1

CONTROLLER REGISTERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/WRITE	DATA TYPE	COEFF
40059 – 40060	Flashing counter	Flashing relay counter value	32 BIT	R-O	unsigned dword	2
40061	Active flashing relays	Number of active flashing relays	16 BIT	R-O	unsigned word	1
40062	Flashing number	Total number of flashing relays	16 BIT	R-O	unsigned word	1
40063	Firmware version	Controller software version	16 BIT	R-O	unsigned word	1
40064 - 40128	reserved	-	16 BIT	R-O	unsigned word	1

PROGRAM PARAMETERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/WRITE	DATA TYPE	COEFF.
40129	E.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40130	E.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40131	E.03	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40132	E.04	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40133	E.05	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40134	E.06	Explained in chapter 10.2	16 BIT	R/W	signed word	0.1
40135	E.07	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40136	E.08	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40137	E.09	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40138	E.10	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40139	E.11	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40140	E.12	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40141	E.13	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40142	E.14	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40143	E.15	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40144	C.01	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40145	E.16	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40146	E.17	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40147	E.18	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40148	E.19	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40149	E.20	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40150	E.21	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40151	E.22	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40152	E.23	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40153	E.24	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40154	E.25	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1

PROGRAM PARAMETERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/ WRITE	DATA TYPE	COEFF.
40155	E.26	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40156	E.27	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40157	E.28	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40158	E.29	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40159	E.30	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40160	E.31	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40161	E.32	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40162	E.33	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40163	G.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40164	G.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40165	F.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40166	C.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40167	C.03	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40168	D.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40169	E.34	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40170	E.35	Explained in chapter 10.2	16 BIT	R/W	signed word	1
40171	E.36	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40172	E.37	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40173	E.38	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40174	B.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40175	E.39	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40176	C.04	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40177	C.05	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40178	C.06	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40179	C.07	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40180	C.08	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40181	C.09	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40182	C.10	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40183	C.11	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40184	C.12	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40185	C.13	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40186	C.14	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40187	C.15	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40188	C.16	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40189	C.17	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40190	C.18	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40191	Rezerve	-	16 BIT	R/W	unsigned word	1
40192	Rezerve	-	16 BIT	R/W	unsigned word	1
40193	B.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40194	B.03	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40195	B.04	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1

PROGRAM PARAMETERS

ADDR.	NAME	DESCRIPTION	LENGTH	READ/WRITE	DATA TYPE	COEFF.
40196	B.05	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40197	B.06	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40198	C.19	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40199	C.20	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40200	C.21	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40201	D.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40202	D.03	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40203	D.04	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40204	D.05	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40205	E.40	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40206	E.41	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40207	E.42	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40208	E.43	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40209	E.44	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40210	E.45	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40211	E.46	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40212	D.06	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40213	D.07	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40214	D.08	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40215	D.09	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40216	F.02	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0.1
40217	F.03	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40218	B.07	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40219	H.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40220	E.47	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40221	E.48	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0,1
40222	E.49	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0,1
40223	E.50	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0,1
40224	E.51	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0,1
40225	E.52	Explained in chapter 10.2	16 BIT	R/W	unsigned word	0,1
40226	E.53	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40227	E.54	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40228	E.55	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40229	D.10	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40230	E.56	Explained in chapter 10.2	16 BIT	R/W	unsigned word	1
40231	Rezerve	-	16 BIT	R/W	unsigned word	
40232	K.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	
40233	L.01	Explained in chapter 10.2	16 BIT	R/W	unsigned word	
40234 - 40256	Reserved	-	16 BIT	R/W	unsigned word	1

SENSOR GRAPHICS

40385 - 40416	Pressure Sensor Graphic [32]	Pressure sensor table (mA - Bar)	32*16 BIT	R-O	unsigned word	1
40417 - 40448	Temperature Sensor Graphic [32]	Temperature sensor table (Ohm - °C)	32*16 BIT	R-O	signed word	1
40449 - 40480	Motor PTC Sensor Graphic [32]	Motor PTC sensor table (Ohm - °C)	32*16 BIT	R-O	signed word	1
40481 - 40512	Temperature Sensor-2 Graphic [32]	Temperature sensor-2 table (Ohm - °C)	32*16 BIT	R-O	signed word	1
40513 - 40544	Pressure Sensor-2 Graphic [32]	Pressure sensor-2 table (mA - Bar)	32*16 BIT	R-O	unsigned word	1

COMMANDS

40769	C01	Reserved	16 BIT	W-O	unsigned word	1
40770	C02	Return to factory settings (value = 0xAA55h)	16 BIT	W-O	unsigned word	1
40771	C03	Reset counter { value = Counter (1-8) }	16 BIT	W-O	unsigned word	1
40772	C04	Lock key (Value = keycode to be locked)	16 BIT	W-O	unsigned word	1
40773	C05	MENU button keypress (Value = 0xAA55)	16 BIT	W-O	unsigned word	1
40774	C06	RUN button keypress (Value = 0xAA55)	16 BIT	W-O	unsigned word	1
40775	C07	STOP button keypress (Value = 0xAA55)	16 BIT	W-O	unsigned word	1
40776 - 40800	Reserved	-	16 BIT	W-O	unsigned word	1
40801	Set service 1	Time to service-A (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40802	Set service 2	Time to service-A (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40803	Set service 3	Time to service-B (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40804	Set service 4	Time to service-B (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40805	Set service 5	Time to service-C (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40806	Set service 6	Time to service-C (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40807	Set service 7	Time to service-D (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40808	Set service 8	Time to service-D (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40809	Set service 9	Time to service-E (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40810	Set service 10	Time to service-E (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40811	Set service 11	LOAD+UNLOAD+STOP counter (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40812	Set service 12	LOAD+UNLOAD+STOP counter (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40813	Set Service 13	LOAD+UNLOAD counter (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40814	Set Service 14	LOAD+UNLOAD counter (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40815	Set Service 15	LOAD counter (lower 2 bytes)	16 BIT	W-O	unsigned word	1
40816	Set Service 16	LOAD counter (higher 2 bytes)	16 BIT	W-O	unsigned word	1
40817	C08	Reset history records (Value = 0xAA55)	16 BIT	W-O	unsigned word	1

11.3. ALARMS, WARNINGS, SERVICE REQUESTS

The alarm record is 32 bytes long. Every bit shows the existency of a given alarm.

BIT NO	DESCRIPTION
1	Low voltage
2	High voltage
3	Low frequency
4	High frequency
5	-
6	Fan motor high temperature
7	High temperature alarm
8	Temperature sensor failure
9	Low temperature alarm
10	Pressure safetyy switch open
11	High pressure
12	Pressure sensor failure
13	Emergency stop
14	-
15	Voltage unbalance
16	Motor PTC High temperature alarm
17	-
18	Phase sequence failure
19	Temperature sensor-2 failure
20	High temperature-2 alarm / Delta (tS2-tS1) alarm
21	Low temperature-2 alarm
22	Pressure sensor-2 failure
23	High pressure-2
24	High delta pressure
25	Motor overload
26	Low pressure-2
27-32	-

Warning record is 16 bits long. Every bit shows the existency of a given warning.

BIT NO	DESCRIPTION
1	Remote stop signal
2	Remote start signal
3	Adjusted parameter out of range
4	High temperature warning
5	Motor not stopped in last 1 hour
6	Motor waiting separator pressure to fall
7	Excessive differential pressure
8	Air filter clogged
9	Data line error (multiple compressor)
10	Waiting input signal
11 ...16	-

SERVICE record is 16 bits long. Every bit shows the existency of a given service request

BIT NO	DESCRIPTION
1	Service period A exceeded
2	Service period B exceeded
3	Service period C exceeded
4	Service period D exceeded
5	Service period E exceeded
6-16	-

12. DECLARATION OF CONFORMITY

The unit conforms to the EU directives
   -2006/95/EC (low voltage)
   -2004/108/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.

13. TECHNICAL SPECIFICATIONS

Supply Voltage: 305 – 460 VAC (COMM-400V)
                    175 - 275VAC (COMM-230V)
Supply Frequency: 50 - 60Hz nominal (± %10)
Power Consumption: < 4 VA
Measurement Inputs:
   Voltage: 20 - 520 V AC (Phase-Phase)
         10 - 300 V AC (Phase-Neutral)
   Frequency: 30 - 100 Hz
   Burden: < 0.1VA per phase
Accuracy: **Voltage:**   % 0.5 + 1 digit
                Frequency: % 0.5 + 1 digit
Relay Outputs: 5A @ 250V AC
Digital Inputs:
   Supply: Provided internally.
   Active Level: external contact < 3 K-ohms
   Isolation: opto-isolated, 1000V AC, 1 min.
Pressure inputs: 4-20mA pressure sensor
Temperature Inputs: 1000 to 5000 ohms
   (KTY/NTC/PTC sensors)
Heating Current: < 0.3mA
Motor PTC Input: gives fault over 2000 ohms
Serial Port:
   Signal Type: logic levels
   Communication: Modbus RTU
   Data Speed: 9600 bauds
Operating Temperature: -20°C to +70 °C
   (-40°C to +70 °C with display heater option)
Storage Temperature: -40°C to +80 °C
Max. Relative Humidity: %95 non condensing
Protection Degree: IP 65 (front, with gasket)
                    IP 30 (back)
Enclosure: Flame retardant, ROHS compliant,
   high temperature ABS/PC (UL94-V0)
Installation: Panel mounted, rear retaining
   plastic brackets.
Dimensions: 133x107x46mm (WxHxD)
Panel Cutout: 117x87mm   minimum
Weight: 350 gr

EU Directives: **Reference standards:**
2006/95/EC (LVD)   EN 61010 (safety)
2004/108/EC (EMC)   EN 61326 (EMC)