

Power Factor Controller

PFW03-M08

User Manual



User Manual

PFW03-M08

Language: English

Document: 10006614888

Revision: 01

Date: 05/2024

SUMMARY OF THE REVISIONS

The information below describes the revisions made to this manual.

Version	Overhaul	Description
-	R00	First edition
-	R01	General review

1 GENERAL INFORMATION.....	1-1
1.1 SYMBOLS	1-1
1.2 GENERAL WARNINGS	1-1
1.3 RECEIPT CONTROL AND CONTENTS OF THE DELIVERY	1-2
1.4 PFW03-M08 REACTIVE POWER CONTROL RELAY	1-2
1.5 PFW03-M08 FRONT PANEL	1-3
2 INSTALLATION.....	2-1
2.1 PREPARATION FOR INSTALLATION	2-1
2.2 PLACING ON THE PANEL.....	2-1
2.3 WIRING DIAGRAMS	2-4
1.1 DIMENSIONS	2-5
3 MENUS.....	3-1
3.1 “FIRST POWER-ON” SETTINGS	3-1
3.2 BASIC SETTINGS	3-2
3.3 ADVANCED SETTINGS	3-3
3.4 ALARMS SETTINGS	3-4
3.5 EXTREME CASES.....	3-5
3.6 COMMUNICATION – RS485 SETTING	3-6
3.7 SECURITY.....	3-7
3.8 CLEAR MENU.....	3-7
3.9 INFO	3-7
3.10 SAVE PROCEDURE.....	3-8
3.11 APPROVAL PROCEDURE.....	3-8
3.12 INSTANTANEOUS VALUES	3-8
4 MODBUS PROTOCOL.....	4-1
4.1 RS485 WIRING DIAGRAM.....	4-1
4.2 COMPUTER CONNECTION.....	4-1
4.3 MESSAGE FORMAT AND DATA TYPES OF MODBUS-RTU PROTOCOL	4-1
4.4 IMPLEMENTED FUNCTIONS FOR MODBUS-RTU PROTOCOL	4-2
4.5 DATA AND SETTING PARAMETERS FOR PFW03-M08	4-2
4.5.1 Readable Data for PFW03-M08	4-2
5 TECHNICAL SPECIFICATIONS	5-1

1 GENERAL INFORMATION

1.1 SYMBOLS

**ATTENTION!**

This symbol indicates that there is cautionary information where it is used.

**DANGER!**

This symbol indicates that there is dangerous voltage or current.

1.2 GENERAL WARNINGS

- Voltage measurement input connections: Overcurrent protection is required for voltage measurement connections V1, V2 and V3: 2 Arms gL fuses (IEC 269) or M type fuses (IEC 127) with rated voltage 300 VAC.
- Compensation relay connections: Overcurrent protection is required for compensation relay outputs. Fuses are recommended to be inserted at COM connections, namely COM1 (for 1..8 compensation relays). Technical details are as follows: 13 Arms gL fuses (IEC 269) or M type fuses (IEC 127) with rated voltage 300 VAC.
- Alarm relay connections: Overcurrent protection is required for alarm relay outputs: 3 Arms gL fuses (IEC 269) or M type fuses (IEC 127) with rated voltage 300 VAC.
- It is required to use a circuit breaker in order to easily disconnect PFW03-M08 from mains. Circuit breaker should have the following specifications:
3 poles (one pole for each phase), 300 VAC or above rated voltage 1 A or above rated current.
- “Do not use this product for any other purpose than it is designed for”.
- Ensure that energy supply is cut off in the panel or in all relevant systems before attempting to connect the device to mains.
- Installation and connections shall be performed by qualified persons with respect to the instructions on the user’s manual.
- Device shall only be activated after all connections are made.
- We advise you to connect a 2 A fuse between the voltage inputs of the device and the mains and supply input and mains.
- We advise you to connect a 1 mm² (AWG17) cable to supply input and measure inputs; and to connect a 2 mm² (AWG14Cu) cable to the current inputs.
- Do not remove PFW03-M08 current transformer connections without short circuiting the K-L ends of the current transformer to somewhere else or connecting a load adequately low impedance to the K-L ends. Otherwise, dangerous high voltages may occur on the secondary ends of the current transformer. The same applies to starting of the device.
- Device should be kept away from humid, wet, vibrant and dusty environments.
- Use a dry cloth to clean the device or remove the dust on it. Do not use alcohol, thinner or an abrasive agent.
- Do not open the inside of the device. There are no parts which the users can intervene inside.

1.3 RECEIPT CONTROL AND CONTENTS OF THE DELIVERY

When the PFW03-M08 is delivered to you, check that:

- The packing of PFW03-M08 is in good condition.
- The product is not damaged during transport.
- Name of the product and order number is correct.

Table 1.1: Product and order number

Material SAP	Short code	Description
14387138	PFW03-M08	PFW03-M08; 1phase; 08 steps

Contents of the PFW03-M08 packing is listed below.

- 1 PFW03-M08.
- 2 panel tightening tools.
- 1 pc of 3-pin female terminal for alarm outputs (Com2;A2; A1).
- 1 pc of 2-pin female terminal for current inputs (k; l).
- 1 pc of 2-pin female terminal for voltage input (La; Lb).
- 1 pcs of 9-pin female terminal for step outputs (Com1, K1...K8).
- 1 pc of RS485 3-pin female terminal (D+, gnd1, D-).
- 1 pc of 2-pin female terminal for generator input (GENA, GENB).

1.4 PFW03-M08 REACTIVE POWER CONTROL RELAY

PFW03-M08 is a multi-function reactive power control relay. It measures active and reactive powers of the system that it is connected. As a result of these measurements, it activates capacitors in the compensation panel. All user actions can be performed easily using the LCD display and 4 keys on the front panel. PFW03-M08 has an isolated RS485 port. It also has 2 alarm relay and many more features.

PFW03-M08 measures/calculates:

- Current, voltage and frequency.
- Active, reactive and apparent power.
- THDV, THDI.
- Power factor, $\cos\varphi$.

PFW03-M08 has features such as:

- Compensation manually or smart mode.
- Compensation in 08 steps.
- THDV and THDI harmonics up to 51st harmonics.

- Also, PFW03-M08 has the following features.
- Setting an alarm for various measurement parameters including temperature.
- Setting an alarm for extreme cases. If the alarms which in this menu are set and when any of alarm is active, steps are deactivated in 10 second intervals after delay time.
- Prevention of unauthorized usage with 4 digit password input.
- Communication with RS485, Modbus RTU.

1.5 PFW03-M08 FRONT PANEL

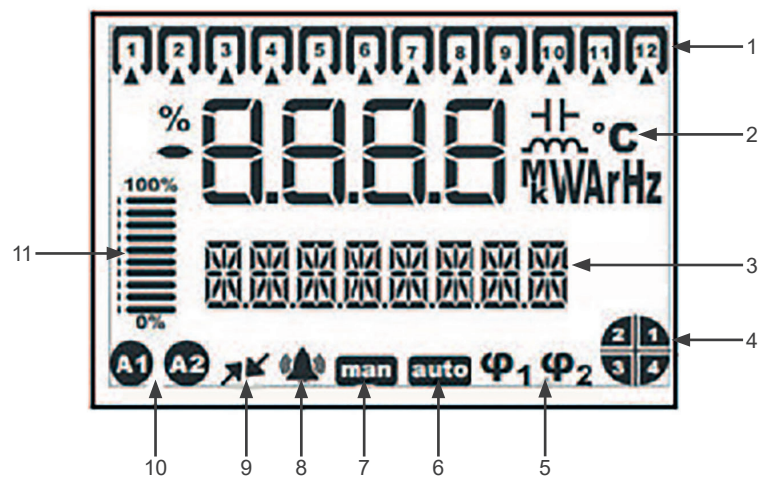


Figure 1.1: PFW03-M08

1. Steps.
2. Indicators and units.
3. Menu bar.
4. 4 quadrant indication.
5. Target Cosφ.
6. Automatic Mode.
7. Manual Mode.
8. Alarm icon.
9. Communication active icon.
10. Alarm relay icons.
11. The ratio of the steps in the operation to the total step power.

2 INSTALLATION

This section contains information on the installation, cable connections and connection methods of PFW03-M08.

2.1 PREPARATION FOR INSTALLATION

PFW03-M08 that you have purchased may not include all hardware options specified in the installation manual. This is not issue for the electrical installation.

**DANGER!**

Installation and connections of PFW03-M08 shall be performed by qualified persons with respect to the instructions on the user's manual.

**DANGER!**

Do not operate the device before making the connections correctly.

2.2 PLACING ON THE PANEL

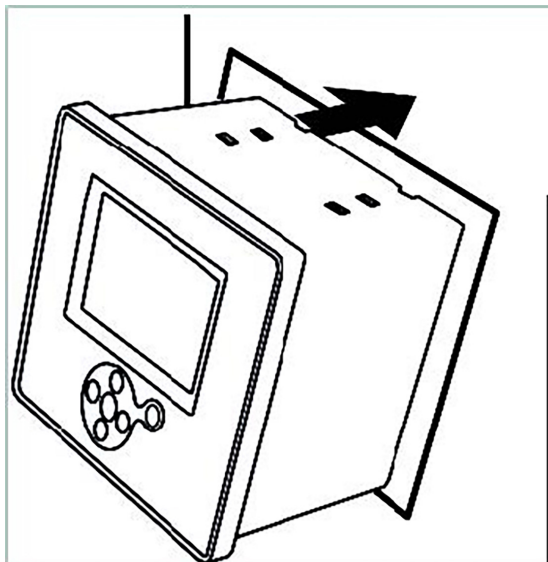


Figure 2.1: Placing PFW03-M08 on the panel

After placing PFW03-M08 on the panel tightening tool is installed and then secured by tightening its screw.

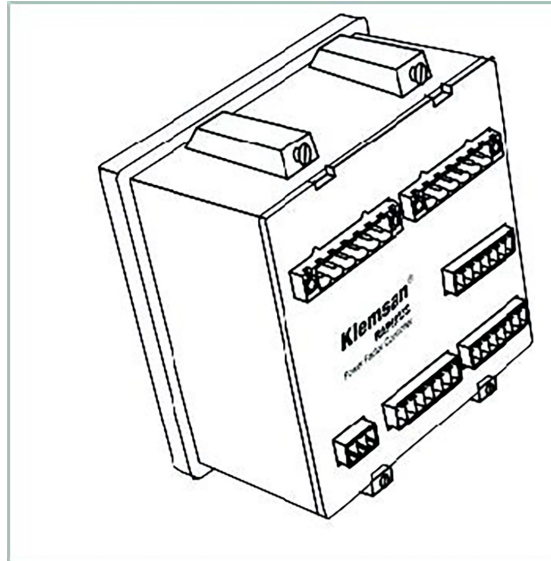


Figure 2.2: Securing PFW03-M08

PFW03-M08 has female terminals with 2.5 mm² and 1.5 mm² screws. Female terminal is removed on its housing on PFW03-M08 (removed from the fixed male terminal). Screws on the female terminal are loosened.

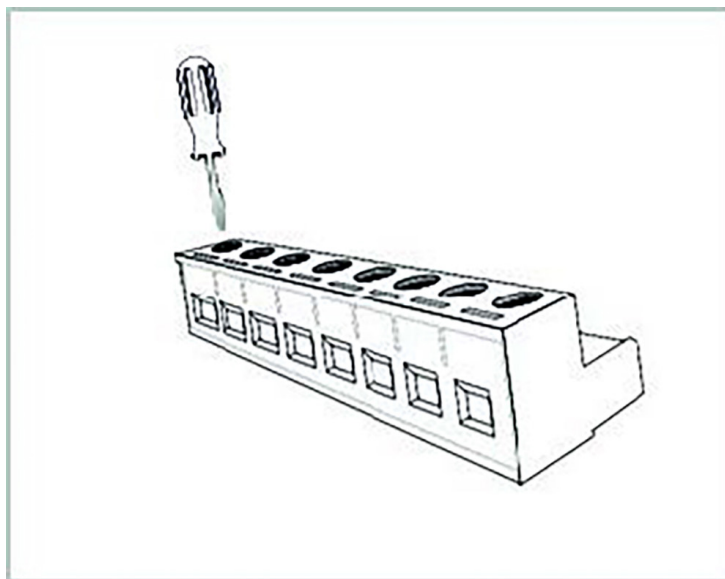


Figure 2.3: Loosening of the terminal screws



DANGER!

Make sure that the power is cut off before connecting voltage and current ends to PFW03-M08.



DANGER!

Do not remove PFW03-M08 current transformer connections without short circuiting the K-L ends of the current transformer to somewhere else. Otherwise, dangerous high voltages may occur on the secondary ends of the current transformer. The same applies to starting of the device.

Cable is placed in the relevant connection hole.

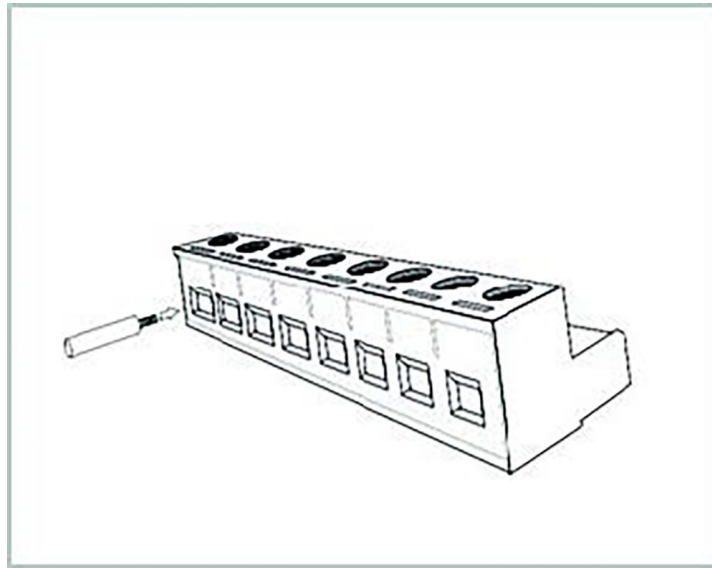


Figure 2.4: Inserting cable into the terminal block

After the cable is placed, the screws are tightened and the cable is fixed.

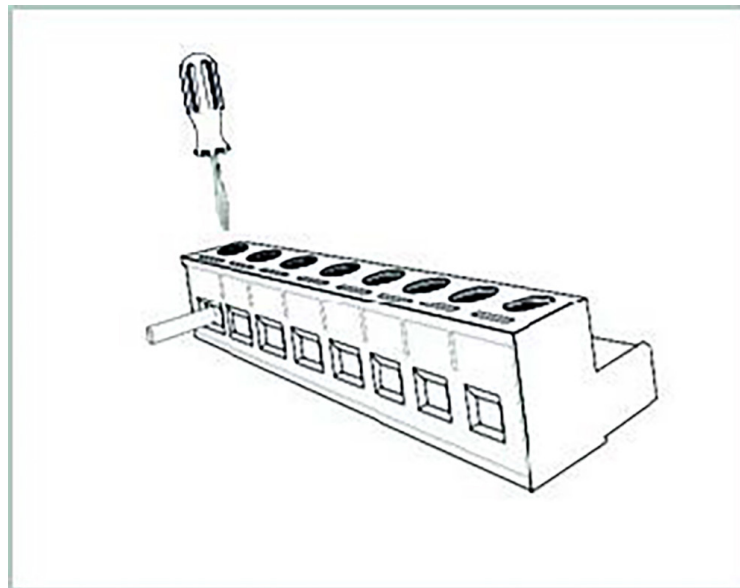


Figure 2.5: Fixing the cable to the terminal block

Terminal is placed on its housing on PFW03-M08.



ATTENTION!

Consider this warning if PFW03-M08 is used with current transformers. Correct operating threshold values of transformers vary as per the type and size of the current transformers used. Please check that the measured current value is higher than the current threshold specified in the user's manual of current transformer.

2.3 WIRING DIAGRAMS

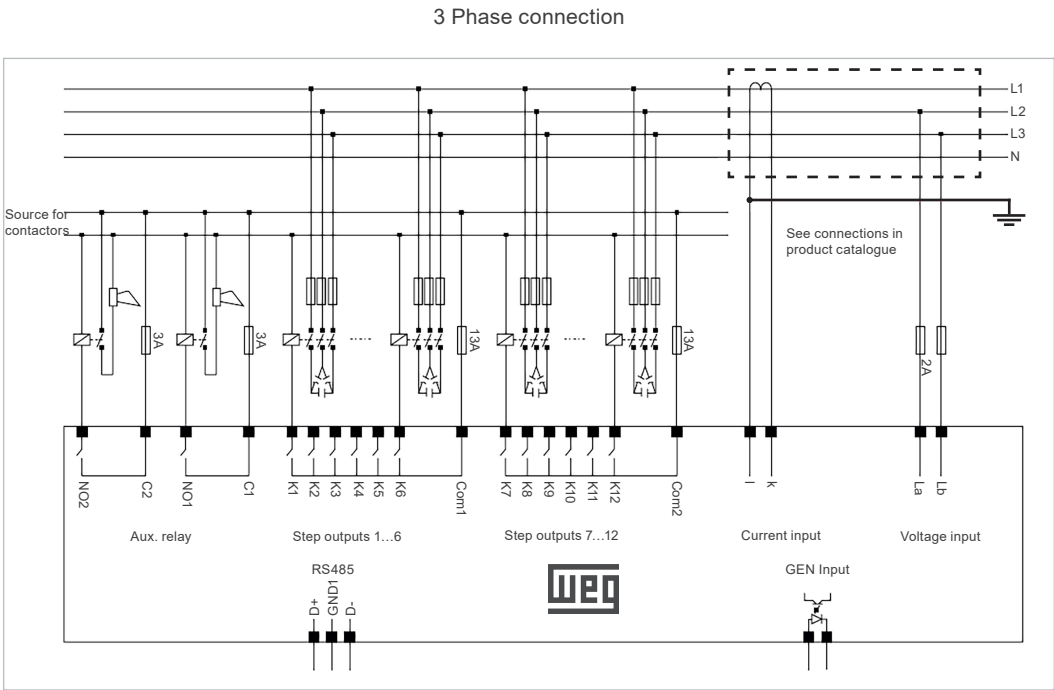


Figure 2.6: PFW03-M08 – 3 phase connection

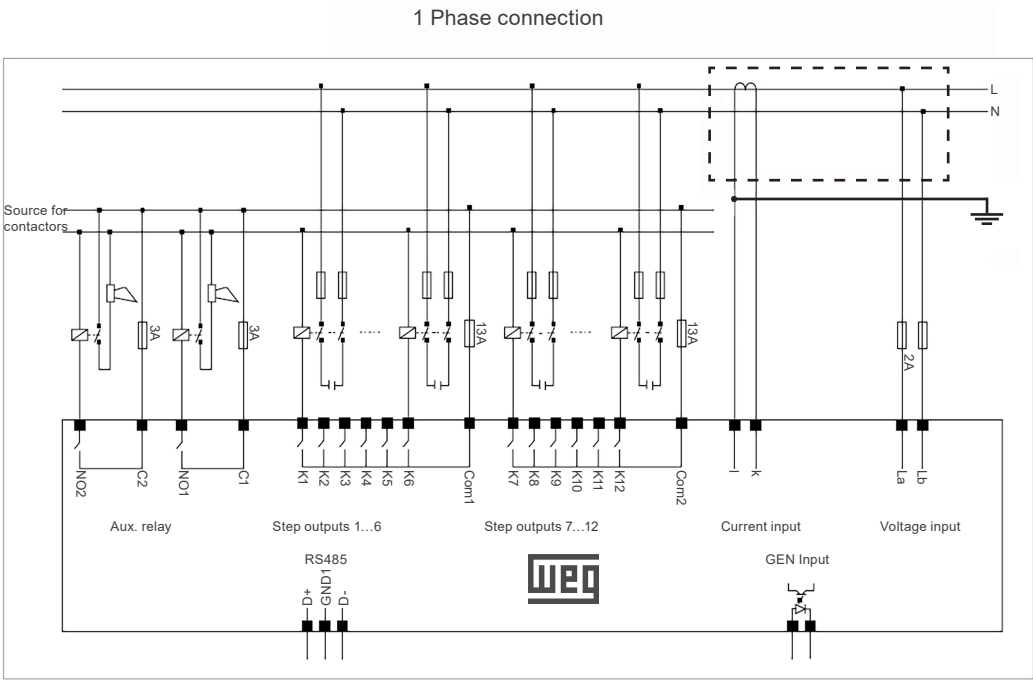


Figure 2.7: PFW03-M08 - 1 phase connection

2.4 DIMENSIONS

Dimensions are in millimeters.

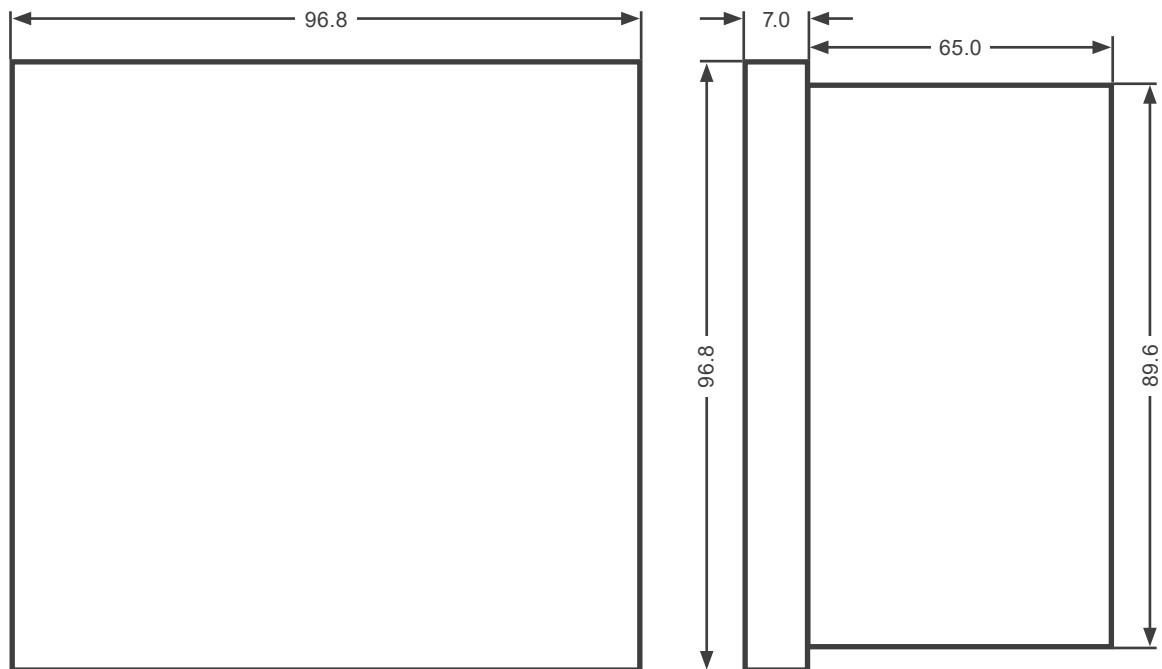


Figure 2.8: Dimensions

3 MENUS

3.1 “FIRST POWER-ON” SETTINGS

The following page is displayed when PFW03-M08 is energized for the “first time” after it is released from the factory.

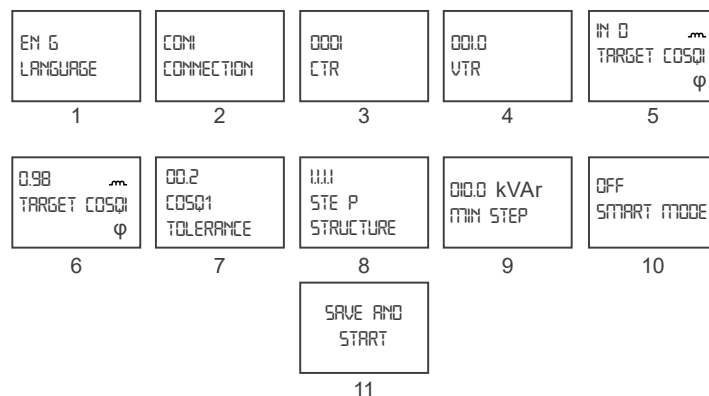


Figure 3.1: First operation settings

1. Language selection.
 2. Connection type is selected.
 3. Current transformer ratio is entered.
 4. Voltage transformer ratio is entered.
 5. The target $\cos\phi_1$ sign selection.
 6. The target $\cos\phi_1$ value is entered.
 7. $\cos\phi_1$ tolerance value is entered.
 8. Step structure selection (1.1.1.1,1.2.2.2,1.2.4.4,Entr).
 9. (*) Minimum step value is entered.
 10. (**) Smart Mode is selected as “ON” or “OFF”.
 11. Settings are saved and the device is started.
- (*) If the step structure is set to “Entr”, the “MIN STEP” screen does not appear on this page. Each step power and voltage level is entered in sequence.
- (**) If the step structure is set to “Entr”, the “Smart Mode” will be activated automatically. For this reason the 10th screen will not appear.

3.2 BASIC SETTINGS

In the first power-on screen, when the device settings are saved and started, the main screen is displayed. When the right key is pressed for >1 sec, the “SETTINGS” menu is reached. Pressing the right key again, the “BASIC” setting menu is accessed. Again with the right key, the submenus are reached. The basic settings have the same submenus as the first power-on settings.



Figure 3.2: Basic settings

1. Main screen.
2. Settings menu.
3. Basic settings menu.
4. Connection: In this menu, connection type is selected. 3 different connection types can be selected as CON1, CON2, CON3.
 - **CON3:** the phase-neutral connection type in which the current measurement phase and the voltage measurement phase are the same.
 - **CON2:** in non-neutral connections, the current is the phase-phase connection type in which the measured phase and the next phase are used.
 - **CON1:** it is the phase-phase connection type in the non-neutral connection which the other two phases are used, except the phase in which the current is measured.



NOTE!

For diagrams see product catalog.

Table 3.1: Wiring diagram

	CON 3	CON 2	CON 1
Current (k-I)	Voltage (La-Lb)	Voltage (La-Lb)	Voltage (La-Lb)
k1-l1	L1-N	L1-L2	L2-L3
k2-l2	L2-N	L2-L3	L3-L1
k3-l3	L3-N	L3-L1	L1-L2

5. CTR: The current transformer ratio can be adjusted between 1-5000.
6. VTR: The current transformer ratio can be adjusted between 0.1 - 999.9.
7. Target Cosφ1 sign: The target cosφ1 sign is chosen to be inductive or capacitive.
8. Target Cosφ1 value: Target cosφ1 value is set here. It can be set between 0.80 and 1.00.
9. Cosφ1 tolerance: It is the upper and lower tolerance value for target 1. It can be set between 0.00 and 0.20.

10. Step structure: With this setting, it will be set which structure will perform in PFW03-M08 while compensating.

PFW03-M08 compensates with 4 different structures.

- **1.1.1.1:** All capacitor stages have the same power. The sequence of operation is first-infirst-out (FIFO). The step which activated first, will be the first deactive step if needed.
- **1.2.4.4:** This structure can be used in panels with a step power ratio of 1.2.4.4. PFW03-M08 will always activate or deactivate 1st step first. The other steps are used in sequence.
- **1.2.2.2:** This structure can be used in panels with a step power ratio of 1.2.4.4. PFW03-M08 will always activate or deactivate 1st step first. Unklie in 1.2.4.4, this structure operates according to the FIFO (first in first out) principle after the 1st step is activated or deactivated.
- **Entr:** In this option, the power of the stages is entered manually. While PFW03-M08 is running in this structure, “Smart Mode” will be activated automatically. The device reaches the target, using the minimum number of steps.

11. Min Step: When any of 1.1.1.1, 1.2.4.4 or 1.2.2.2 is selected, the minimum step power is entered from this menu.

(**) Step Power - Step Voltage: If the step structure is set to “Entr”, the power and voltage values of the existing steps are entered manually and respectively.

12. Smart Mode: Any one of 1.1.1.1, 1.2.4.4 or 1.2.2.2 is selected and if “Smart Mode” is activated, PFW03-M08 reaches the target, using the minimum number of steps and it works according to FIFO (first in first out) principle.



ATTENTION!

When the step structure is selected as “Entr”, this mode will be activated automatically.

3.3 ADVANCED SETTINGS

When you enter the “ADVANCED” menu with the right key, the following submenus are accessed.

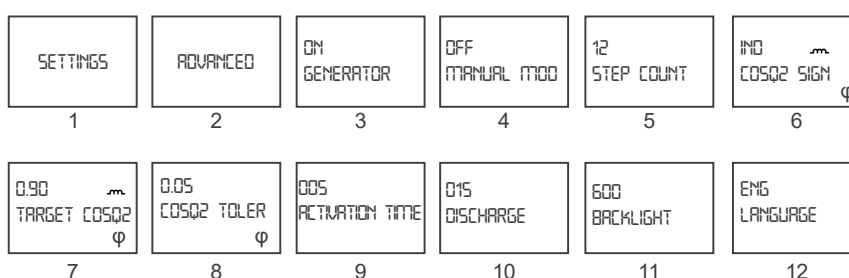


Figure 3.3: Advanced settings

1. Settings menu.
2. Advanced settings.
3. Generator Mode: If “Generator Mode” selected as “ON”, compensation is performed as per the set “Cosφ2 Inductive” and “Cosφ2 Capacitive” values when GEN input is active. It is also necessary to apply a voltage of 95-240 VAC from the GEN input.

4. Manual Mode: When the manual program is active, the “man” icon appears under the main menu page. This icon indicates that PFW03-M08 is in the manual compensation program. In the main menu screen, manual mode is activated by pressing the down and up keys at the same time. With the up and down keys, move to the desired step and press the right button. Thus, the stage is activated. If it is desired to be deactivated, the step will be deactivated if it is pressed on the right button. Pressing the up and down keys at the same time also exits the manual mode.



NOTE!

For PFW03-M08 to operate in automatic mode again, “Manual Mode” must be set to “OFF”.

5. Step Count: The number of steps to be used is entered.
6. Target Cos ϕ 2 sign: The target cos ϕ 2 sign is chosen to be inductive or capacitive.
7. Target Cos ϕ 2 value: Target Cos ϕ 2 value is set here. It can be set between 0.80 and 1.00.
8. Cos ϕ 2 tolerance: It is the upper and lower tolerance value for target 2. It can be set between 0.00 - 0.20.
9. Activation Time/sec: PFW03-M08 waits for the “Activation time” before activating a step. Activation time may be selected between 1 and 600 seconds.
10. Discharge Time/sec: Discharge time is entered here. PFW03-M08 waits for the discharge time before reactivating a step that it has deactivated. It can be set between 3 - 600 seconds.
11. Backlight Time/sec: PFW03-M08 backlight setting is made. Adjustable from 10 to 600 seconds. On (continuous), off (continuously disabled), 10, 30, 60, 120, 600 can be selected.
12. Language: In this menu the device language is set.

3.4 ALARMS SETTINGS

When the “ALARMS” menu is accessed with the right key, the following submenus are accessed.



Figure 3.4: Alarms settings

1. Settings menu.
2. Alarms setting menu.
3. Cos ϕ Alarm: In this menu Cos ϕ alarm settings are made. When entering the menu, the following setting screens are displayed:

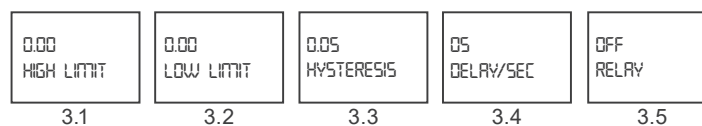


Figure 3.5: Cos ϕ Alarm

- **3.1 - High Limit:** this tab is used for entering alarm high limit. In order to set an alarm for Cos ϕ values, user shall enter a higher high limit than low limit. If low limit and high limit values entered are the same, Cos ϕ parameter is closed for alarms.
 - **3.2 - Low Limit:** this tab is used for entering alarm low limit. In order to set an alarm for Cos ϕ values, user shall enter a lower limit than high limit. If low limit and high limit values entered are the same, Cos ϕ parameter is closed for alarms
 - **3.3 - Hysteresis:** it is the tolerance value that can be entered between 0.00 - 1.00.
 - **3.4 - Delay/sec:** PFW03-M08 waits for the delay time before giving an alarm when the related alarm parameter exceeds "Low limit" or "High limit" value. Also, PFW03-M08 waits for the delay time again before cancelling an alarm condition when the related alarm parameter returns back in the limits. It can be selected between 0 and 60 seconds.
 - **3.5 - Relay:** this setting is used for switching on/off of the relays when an alarm occurred. In order to ensure that PFW03-M08 gives a Cos ϕ alarm, lower and upper limit values shall be set as described below. Alarm relay options:
 - **Off:** no alarm relay is pulled in case of an alarm.
 - **AL1:** only relay 1 is switch on in case of an alarm.
 - **AL2:** only relay 2 is switch on in case of an alarm.
4. Voltage Alarm: This sub-menu is used for voltage alarm settings. Settings are the same for the settings for Alarm->Cos ϕ menu. (Voltage high and low limit values: 0-600.0, Hysteresis: 0-600.0).
 5. Current Alarm: This sub-menu is used for current alarm settings. Settings are the same for the settings for Alarm->Cos ϕ menu. (Current high and low limit values: 0-6.0, Hysteresis: 0-6.0).
 6. Frequency Alarm: This sub-menu is used for frequency alarm settings. Settings are the same for the settings for Alarm->Cos ϕ menu. (Frequency high and low limit values: 45-65, Hysteresis: 0-20).
 7. Temperature Alarm: This sub-menu is used for temperature alarm settings. Settings are the same for the settings for Alarm->Cos ϕ menu. (Temperature high and low limit values: 0-99.9, Hysteresis: 0-99.9).

**NOTE!**

When any of the above alarms are active, the value or values of that alarm will start flashing with the alarm icon under the main menu page. If the alarm is assigned to any relay, the relay of that alarm becomes active and the corresponding relay icon appears in the lower left corner of the main menu page.

3.5 EXTREME CASES

When the "EXTREME CASES" menu is accessed with the right arrow key, the following menus are shown. If the alarms which in this menu are set and when any of alarm is active, steps are deactivated in 10 second intervals after delay time. There is a constant hysteresis value of 3 %.

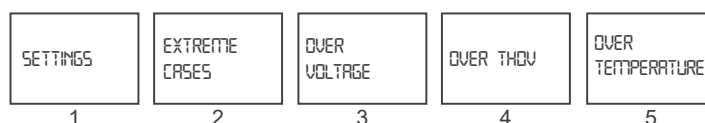


Figure 3.6: Extreme cases settings

1. Settings menu.
2. Extreme Cases menu.
3. Over Voltage alarm: This tab is used for over voltage alarm. When entering the menu, the following setting screens are seen:

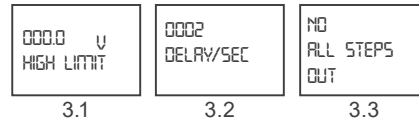


Figure 3.7: Over voltage alarm

- **3.1 - High Limit:** in this tab high limit can be set. Adjustable from 0 to 600.
 - **3.2 - Delay/sec:** PFW03-M08 waits for the delay time before giving an alarm when the related alarm parameter exceeds “High limit” value. Also, PFW03-M08 waits for the delay time again before cancelling an alarm condition when the related alarm parameter returns back in the limits. It can be selected between 0 and 9999 seconds.
 - **3.3 - All Steps Out:** when this option is activated, when the upper limit of the alarm value is exceeded, the steps are deactivated according to the existing structure with intervals of 10 seconds at the end of the delay time.
4. Over THDV: This sub-menu is used for over THDV alarm settings. Settings are the same for the settings for Extreme Cases->Over Voltage menu. (THDV high limit values: 0 - 100 %).
 5. Over Temperature: This sub-menu is used for over temperature alarm settings. Settings are the same for the settings for Extreme Cases->Over Voltage menu. (Temperature high limit values: 0-100 °C).

3.6 COMMUNICATION – RS485 SETTING

When the “RS485” menu is accessed with the right key, the following submenus are accessed. Under this menu, Modbus protocol settings are made.

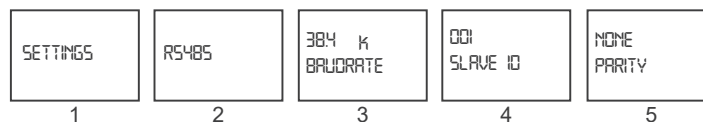


Figure 3.8: RS485 Setting

1. Settings menu.
2. RS485 menu.
3. Baudrate: Communication Signal speed is expressed with “baud” in terms of units. PFW03-M08 communicates with speeds of 1200, 2400, 4800, 9600, 19200 and 38400 bits/second.
4. Slave ID: This is the settings tab for entering the slave id number. Maximum 247 devices may communicate over the same RS485 line. Therefore, slave id may be selected between 1 - 247.
5. Parity: It is a control mechanism for data accuracy. It counts odds “1” in Binary data. There are “odd” and “even” parity control method.

3.7 SECURITY

Use this menu item to turn the password protection on/off, set a password activation time and change password settings editing options.

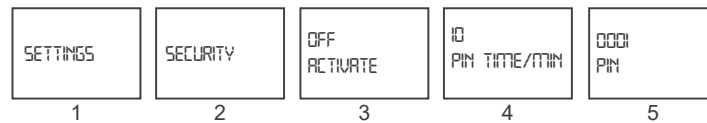


Figure 3.9: Security

1. Settings menu.
2. Security menu.
3. Activate: Security protection can be set to passive or active.
4. Pin Time / min: After a successful login, the device will not ask for a password until the “pin time/min” has elapsed. You can set this value in the respective menu item.
5. Pin: Password can be set in this menu. The factory setting password is “1”.

3.8 CLEAR MENU

Use “CLEAR” menu to delete the stored values in the memory and restore the factory settings.



Figure 3.10: Menú clear

1. Main screen.
2. Clear menu.
3. NONE : Disables the clear process.
4. ALL : Clears all values stored in the memory and restores them to the default factory settings.
5. SET : Restores all settings to the factory settings except alarms.
6. ALR : Restores the alarm settings to the factory settings.

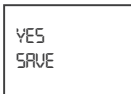
3.9 INFO

When the “Info” menu is accessed with the right key, the following device information is accessed.

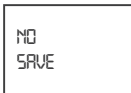
- Version.
- Order No.
- Ambient Temperature.

3.10 SAVE PROCEDURE

After making any changes to the device's "SETTINGS" menu, press the left button until you reach the "save" screen to confirm or discard changes.



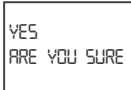
To confirm the changes: Press the right key to blink the "NO" sign. Use the up/down keys to change the "NO" to "YES". Then, press the left key to store the changes.



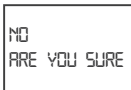
To discard the changes: Press the right key to blink the "NO" sign. Then exit the menu using the left key without saving your changes.

3.11 APPROVAL PROCEDURE

After making any changes to the device's "CLEAR" menu, press the left button until you reach the "ARE YOU SURE" screen to confirm or discard changes.



To confirm the changes: Press the right key to blink the "NO" sign. Use the up/down keys to change the "NO" to "YES". Then, press the left key to store the changes.



To discard the changes: Press the right key to blink the "NO" sign. Then exit the menu using the left key without saving your changes.

3.12 INSTANTANEOUS VALUES

When in the main page, the following instantaneous values are displayed with the up or down keys.

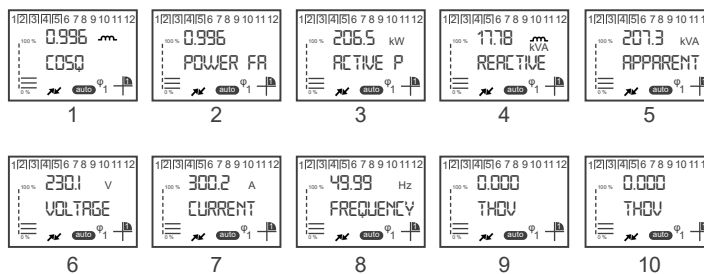


Figure 3.11: Instantaneous values

1. Cosp.
2. Power Factor.
3. Active Power.
4. Reactive Power.
5. Apparent Power.
6. Voltage.
7. Current.
8. Frequency.
9. THDV.
10. THDI.

4 MODBUS PROTOCOL

4.1 RS485 WIRING DIAGRAM

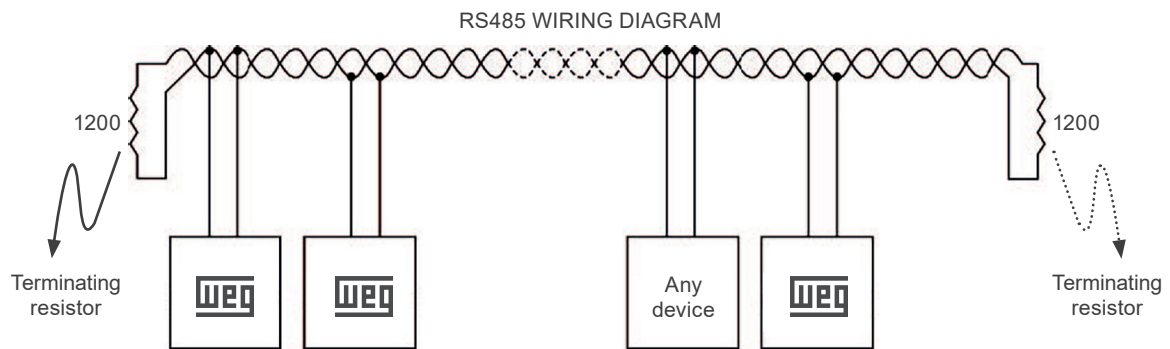


Figure 4.1: RS485 Wiring diagram

4.2 COMPUTER CONNECTION

PFW03-M08 can communicate with PCs via USB-RS85 converter.

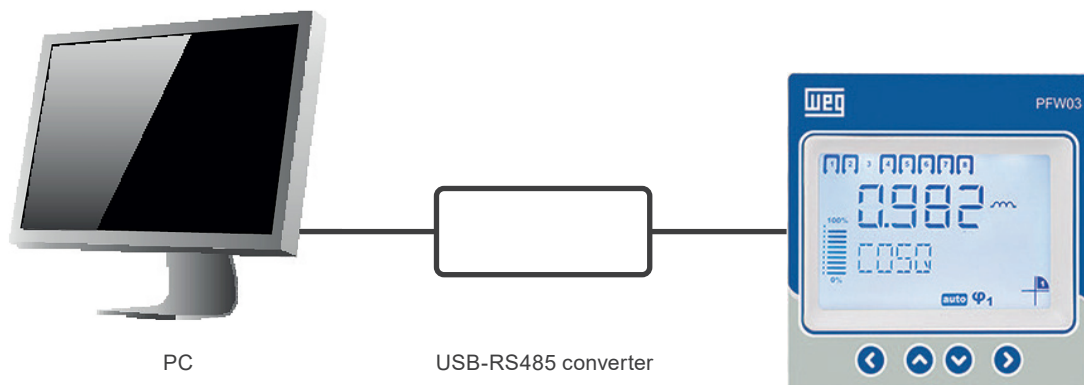


Figure 4.2: RS485 PC Connection

4.3 MESSAGE FORMAT AND DATA TYPES OF MODBUS-RTU PROTOCOL

PFW03-M08, implements modbus RTU protocol. Modbus RTU message format is as follows.

Table 4.1: Message format

Start	Address	Function	Data	CRC	End
≥ 3,5 byte	1 byte	1 byte	0-252 byte	2 byte	≥ 3,5 byte

There should be a time gap, which is at least 3.5 characters wide, between RTU messages.

For instance, when client device requests any information, server device should reply after at least a 3.5 character wide time gap. Following the response of the server, client device should wait 3.5 characters long period, before requesting information again. Los tipos de datos usados en el PFW03-M08 son los siguientes:

Data types used in PFW03-M08 are as follows.

Table 4.2: Int (32 bit) data type

b31 (Bit 31)	-----	b0 (Bit 0)
MSB (Most Significant Bit)	-----	LSB (Least Significant Bit)

int: 32-bit integer value. Byte order starts from the lowest byte address as b0, b1, b2 and so on.

float: it is a 32-bit floating-point number in IEEE 754 standard.

string: character array in ASCII standard. It is only used for PFW03-M08 device name and PFW03-M08 configuration name variables.

4.4 IMPLEMENTED FUNCTIONS FOR MODBUS-RTU PROTOCOL

Table 4.3: Implemented functions for MODBUS RTU Protocol

Function Name	Function Code
Read holding registers	03 H (decimal value 3)
Write single register	06 H (decimal value 6)
Write multiple registers	10 H (decimal value 16)
Read file record	14 H (decimal value 20)

4.5 DATA AND SETTING PARAMETERS FOR PFW03-M08

4.5.1 Readable Data for PFW03-M08

Table 4.4: Selection table

	SEL 1	SEL 2	SEL 3	SEL 4	SEL 5	SEL 6	SEL 7	SEL 8	SEL 9	SEL 10
0	off	CON 1	ind.	1.1.1.1	auto	off	Eng.	1200	none	none
1	on	CON 2	cap.	1.2.4.4	manual	10 sec	Tur.	2400	even	relay 1
2		CON 3		1.2.2.2		30 sec		4800	odd	relay 2
3				Entr		60 sec		9600		
4						120 sec		19200		
5						300 sec		38400		
6						on				

Table 4.5: Alarm-Relay flags

	bit 31	bit 30	bit 29	bit 28	bit 27	bit 26	bit 25	bit 24	bit 23	bit 22	bit 21	bit 20	bit 19	bit 18	bit 17	bit 16
Compensation Relay Flags	-	-	-	-	RL12 ON	RL11 ON	RL10 ON	RL9 ON	RL8 ON	RL7 ON	RL6 ON	RL5 ON	RL4 ON	RL3 ON	RL2 ON	RL1 ON
Alarm and Status Flags	-	-	-	-	-	-	-	-	-	-	-	GEN	RL A2	RL A1	I	V

	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Compensation Relay Flags	-	-	-	-	RL12 ACT	RL11 ACT	RL10 ACT	RL9 ACT	RL8 ACT	RL7 ACT	RL6 ACT	RL5 ACT	RL4 ACT	RL3 ACT	RL2 ACT	RL1 ACT
Alarm and Status Flags	-	-	-	EXTR TEMP	EXTR THDV	EXTR V	TEMP LO	TEMP HI	FREQ LO	FREQ H	CRNT LO	CRNT H	VLTG LO	VLTG HI	COSQ LO	COSQ H

Table 4.6: Readable Data

Addr	Variable	Type	R/W	Unit	Min	Max	Selection
Run Time Values							
40001	COSQ	32 bit float	RO	-			
40003	Power factor	32 bit float	RO	-			
40005	Active power	32 bit float	RO	W			
40007	Reactive power	32 bit float	RO	Var			
40009	Apparent power	32 bit float	RO	VA			
40011	Voltage	32 bit float	RO	V			
4003	Current	32 bit float	RO	A			
40015	Frequency	32 bit float	RO	Hz			
40017	THDV	32 bit float	RO	%			
40019	THDI	32 bit float	RO	%			
40021	Temperature	32 bit float	RO	°C			
40023	Alarm flags	32 bit integer	RO	-			
40025	Relay flags	32 bit integer	RO	-			
Basic Settings							
40027	Connection type	32 bit integer	R/W	-	0	2	SEL 2
40029	CTR value	32 bit integer	R/W	-	1	5000	
40031	VTR value	32 bit float	R/W	-	0.1	999.9	
40033	COSQ1 sign	32 bit integer	R/W	-	0	1	SEL 3
40035	COSQ1 target	32 bit float	R/W	-	0.8	1	
40037	COSQ1 tolerance	32 bit float	R/W	-	0	0.2	
40039	Step structure	32 bit integer	R/W	-	0	3	SEL 4
40041	Smart mode	32 bit integer	R/W	-	0	1	SEL 1
40043	Min step power	32 bit float	R/W	kVAr	0	1000	

Addr	Variable	Type	R/W	Unit	Mín	Máx	Selection
Steps							
40045	Step 1 power	32 bit float	R/W	kVAr	0	1000	
40047	Step 1 voltage	32 bit float	R/W	V	0	500	
40049	Step 2 power	32 bit float	R/W	kVAr	0	1000	
40051	Step 2 voltage	32 bit float	R/W	V	0	500	
40053	Step 3 power	32 bit float	R/W	kVAr	0	1000	
40055	Step 3 voltage	32 bit float	R/W	V	0	500	
40057	Step 4 power	32 bit float	R/W	kVAr	0	1000	
40059	Step 4 voltage	32 bit float	R/W	V	0	500	
40061	Step 5 power	32 bit float	R/W	kVAr	0	1000	
40063	Step 5 voltage	32 bit float	R/W	V	0	500	
40065	Step 6 power	32 bit float	R/W	kVAr	0	1000	
40067	Step 6 voltage	32 bit float	R/W	V	0	500	
40069	Step 7 power	32 bit float	R/W	kVAr	0	1000	
40071	Step 7 voltage	32 bit float	R/W	V	0	500	
40073	Step 8 power	32 bit float	R/W	kVAr	0	1000	
40075	Step 8 voltage	32 bit float	R/W	V	0	500	
40077	Step 9 power	32 bit float	R/W	kVAr	0	1000	
40079	Step 9 voltage	32 bit float	R/W	V	0	500	
40081	Step 10 power	32 bit float	R/W	kVAr	0	1000	
40083	Step 10 voltage	32 bit float	R/W	V	0	500	
40085	Step 11 power	32 bit float	R/W	kVAr	0	1000	
40087	Step 11 voltage	32 bit float	R/W	V	0	500	
40089	Step 12 power	32 bit float	R/W	kVAr	0	1000	
40091	Step 12 voltage	32 bit float	R/W	V	0	500	
Advanced Settings							
40093	Generator mode	32 bit integer	R/W	-	0	1	SEL 1
40095	Operation mode	32 bit integer	R/W	-	0	1	SEL 5
40097	Used number of steps	32 bit integer	R/W	-	0	12	
40099	COSQ2 sign	32 bit integer	R/W	-	0	1	SEL 3
40101	COSQ2 target	32 bit float	R/W	-	0.8	1	
40103	COSQ2 tolerance	32 bit float	R/W	-	0	0.2	
40105	Step activation time	32 bit integer	R/W	sec	1	600	
40107	Step discharge time	32 bit integer	R/W	sec	3	600	
40109	Backlight time	32 bit integer	R/W	-	0	6	SEL 6
40111	Language	32 bit integer	R/W	-	0	1	SEL 7
40113	Baud rate	32 bit integer	R/W	-	0	5	SEL 8
40115	Slave id	32 bit integer	R/W	-	1	247	
40117	Parity control	32 bit integer	R/W	-	0	2	SEL 9
40119	Password enable	32 bit integer	R/W	-	0	1	SEL 1
40121	Password activation time	32 bit integer	R/W	min	1	60	
40123	Password value	32 bit integer	R/W	-	0	9999	

Addr	Variable	Type	R/W	Unit	Min	Max	Selection
Alarm Settings							
40125	COSQ alarm high limit	32 bit float	R/W	-	0	1	
40127	COSQ alarm low limit	32 bit float	R/W	-	0	1	
40129	COSQ alarm hysteresis	32 bit float	R/W	-	0	1	
40131	COSQ alarm time delay	32 bit integer	R/W	sec	0	60	
40133	COSQ alarm relay	32 bit integer	R/W	-	0	2	SEL 10
40135	Voltage alarm high limit	32 bit float	R/W	V	0	600	
40137	Voltage alarm low limit	32 bit float	R/W	V	0	600	
40139	Voltage alarm hysteresis	32 bit float	R/W	V	0	600	
40141	Voltage alarm time delay	32 bit integer	R/W	s	0	60	
40143	Voltage alarm relay	32 bit integer	R/W	-	0	2	SEL 10
40145	Current alarm high limit	32 bit float	R/W	A	0	6	
40147	Current alarm low limit	32 bit float	R/W	A	0	6	
40149	Current alarm hysteresis	32 bit float	R/W	A	0	6	
40151	Current alarm time delay	32 bit integer	R/W	sec	0	60	
40153	Current alarm relay	32 bit integer	R/W	-	0	2	SEL 10
40155	Frequency alarm high limit	32 bit float	R/W	Hz	45	65	
40157	Frequency alarm low limit	32 bit float	R/W	Hz	45	65	
40159	Frequency alarm hysteresis	32 bit float	R/W	Hz	45	65	
40161	Frequency alarm time delay	32 bit integer	R/W	s	0	60	
40163	Frequency alarm relay	32 bit integer	R/W	-	0	2	SEL 10
40165	Temperature alarm high limit	32 bit float	R/W	°C	0	100	
40167	Temperature alarm low limit	32 bit float	R/W	°C	0	100	
40169	Temperature alarm hysteresis	32 bit float	R/W	°C	0	100	
40171	Temperature alarm time delay	32 bit integer	R/W	sec	0	60	
40173	Temperature alarm relay	32 bit integer	R/W	-	0	2	SEL 10
Extreme Cases							
40175	Voltage high limit	32 bit float	R/W	V	0	300	
40177	Voltage time delay	32 bit integer	R/W	s	0	9999	
40179	Stop compansation voltage	32 bit integer	R/W	-	0	1	SEL 1
40181	THDV high limit	32 bit float	R/W	%	0	100	
40183	THDV time delay	32 bit integer	R/W	sec	0	9999	
40185	Stop compansation-THDV	32 bit integer	R/W	-	0	1	SEL 1
40187	Temperature high limit	32 bit float	R/W	°C	0	100	
40189	Temperature time delay	32 bit integer	R/W	sec	0	9999	
40191	Stop compansation-temp	32 bit integer	R/W	-	0	1	SEL 1
Info							
40193	Firmware version	32 bit float	RO	-			
40195	Device model	32 bit integer	RO	-			
40197	Setting protection	32 bit integer	R/W	-			
Clear							
41001	Reset settings	32 bit integer	WO	-			
41003	Reset alarm limits	32 bit integer	WO	-			
41005	Factory settings	32 bit integer	WO	-			
Save							
42001	Save changes	32 bit integer	WO	-			

5 TECHNICAL SPECIFICATIONS

Supply

Voltage.....120...510 Vac $\pm 10\%$

Frequency.....45...65 Hz

Power Consumption

<10 VA

Measurement Inputs

Voltage.....120...510 Vac $\pm 10\%$ (L-N)

120...510 Vac $\pm 10\%$ -(L)

Current.....10 mA...6 A ac

GEN input.....95...240 Vac

Relay Outputs For Compensation

4 / 6 / 8 / 10 / 12 pcs.

Max. switchig current.....: 2 A

Max. switchig voltage.....: 250 Vac

Max. switchig current.....: 1.5 A (all relays active)
5 A (only one relay is activated)

Alarm Relay Outputs

2 pcs.

Max. switchig current.....: 4 A

Max. switchig voltage.....: 250 Vac

Max. switching power.....: 1250 VA

Number of Steps

Can be selected between 1-8

Target COS ϕ Interval

-0.800-0.800 can be selected with 0.001 steps.

CTR

Can be set 1..5000.

VTR

Can be set 1..5000.

TECHNICAL SPECIFICATIONS

User Interface

Keypad.....: 4 keys with ESD protection.

LCD.....: self-illuminated 160 x 240 graphic.

Communication

Isolated RS485 Port.....: 1 Channel, ESD and over current/voltage protected,
programmable, 1200 bps to 38400 bps baud rate.
2000 V RMS isolation.

Dimensions

W144 x H144 x D78

Operating Temperature/ Storage Temperature / Relative Humidity

-20 to +55 °C (-4 to +131 °F) / -30 to +80 °C (-22 to +176 °F) / maximum 95 % No Condensation

Protection Class

Front panel..... : IP40

Rear cover..... : IP20