BTB ELECTRIC

Instructions for using

Power Factor Relay Type Bs

POWER FACTOR RELAY
PFR-96Bs /120Bs

This user manual is prepared for quick commisioning and operating of the device. Please read this manual carefully before commisioning or operating PFR-96Bs/120Bs Series

Precautions for Safe Use and Installation

1) Maintenance, installation and operation of PFR-96Bs/120Bs series must be performed only by the qualified technicians.
2) PFR-96Bs/120Bs series is connected to the network with current transformer. Do not disconnect the current transformer terminals. If you disconnect them, be sure to short-circuit or connect them to another parallel load which have low impedance. In case of failure, dangerously high voltage at the secondary side of current transformer may cause an electric shock.
3) Device is suitable only for panel mounting.
4) Verify terminal connections when wiring.
5) Do not use this product for any other purpose than its original task.
6) Do not operate undervoltage.
7) When device is connected to the network, do not remove the front panel.
8) Do not open the PFR-96Bs/120Bs series' housing. There are no user servicable parts inside it.
9) Do not clean the device with solvent or similar items. Only clean with a dry cloth.
10) Electrical equipment should be serviced only by your competent seller.

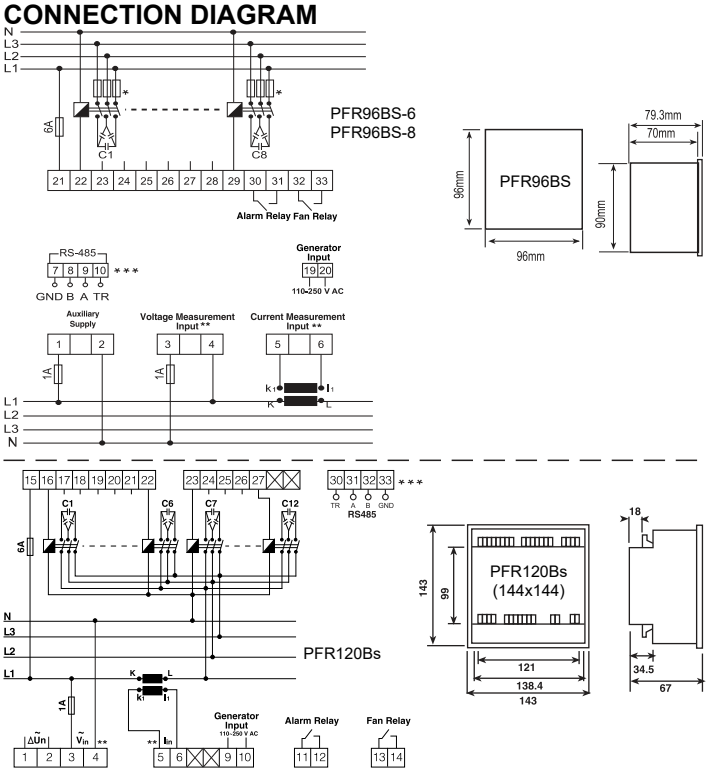
No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences arising out of the use of this material.

DIMENSIONS

1) Panel cut-out dimension must be 91 mm x 91 mm for Type 96Bs and 143 mm x 143 mm for Type 120Bs.
2) Before installation, remove the mounting brackets.
3) Mount the device to front panel.
4) Insert the mounting brackets.
5) Wire thickness for voltage and current terminals must be 2,5 mm^2, but it is suitable for cables which have up to 4 mm^2 section.
6) CAT5 cable is recommended for RS-485 input terminal.

Excessive force can damage the device.
Turn the screw into the terminals and tighten until the PFR-96Bs/120Bs series is secured in place.

CONNECTION DIAGRAM



*** Current value of 3-Fuses, which are connected to protect the capacitors, is chosen according to the nominal current value of capacitors.**

**** At 3 phase 4 wire applications L1 and Neutral must be connected device's voltage measurement inputs, at 3 phase 3 wire applications L2 and L3 phases must be connected. L1 phase's current transformer must be connected to current measurement input. If load is unbalanced, current cable which is nearest value of total average value must be connected to current transformer. In this condition voltage inputs must be set refer to current. When device programmed to automatic setup, it will program suitable phase angle. So it will measure true values and true compensation.**

***** Communication terminals are only available in BS models.**

Do not use device without checking terminal connections.

1. PFR96Bs/PFR120Bs Series Connection

a) For proper operation, current and voltage connections must be connected as shown in the connection diagram.
b) After current and voltage terminal connections, capacitor steps' connection must be done according to the connection diagram.
c) Lastly, computer communication connection must be done.
d) Do not power-up the device before verifying terminal connections.

2. Commissioning PFR-96Bs/120Bs Series

a) Device can detect wrong connection on the way of active power. For correcting connection fault, automatic setup must be done or suitable phase value must be programmed from "AngL" menu, which is for programming phasor angle, from transformer menu. When user does automatic setup (ASEt), device will open and close 3 phase capacitor in 1st step during correction of connection failure. Sudden changes in loads and nonlinear loads (Thyristor or triac controlled frequency inverter, UPS etc.) existing, automatic setup may not be done. In this condition, user should disconnect the device and restart it and make the same operation. This operation can do with selecting "S-on" under "ASEt" menu. In this case device corrects the errors and then calculates the capacitor values.If user does not want calculating capacitor values, selecting "S-oF" parameter provides this.
b) User must enter capacitor values after entering current and voltage transformer ratios. Capacitor values can be calculated automatically or maually. Capacitor powers are measured automatically by entering "S-on" under device's "ASEt" setting (for details please look Operating Mode Settings). If 10th program (PS-10) is selected in program menu, all capacitor values are measured by switching on/off of the capacitors in sequence. In this program, 3 phase capacitors can be connected as desired according to system requirements. If capacitor steps have been calculated as in the previous step, this step is not necessary. Selecting other program condition device only calculate 1st step and other steps will be calculated according to selected program. Device calculates the capacitor values which will be switched "ON" according to selected program; so device switches on/off the required steps.
c) Connection of circuit breaker or automatic fuse between the network and PFR-96Bs/120Bs series is highly recommended. Circuit breaker must be in close proximity to the device.
d) All used fuses must be FF type and the current values of the fuses must be 2A or 3A and 6A (Refer to Connection Diagram).
e) Generator input must be done only when the network is supplied by the generator. Otherwise device will be switched to the generator position for each generator starts including the maintaining purpose.

Generator Input

When 110-250 V AC connection is connected to device's generator input, **"COS1"** position will be passive and **"COS2"** will be active. So, compensation will be done according to target COS2 as long as a voltage is present at generator input.

CONTROLS and OPERATIONS

ASEt Automatic Capacitor Recognition and Phase Setup Mode

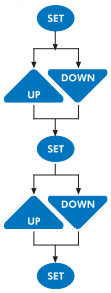
Capacitor values are recognized and saved with "ASEt" operation. For doing this, enter program menu on the device and find "ASEt" menu. "ASEt" menu includes 2 parameters which are ***"S-oF"*** and ***"S-on"***.

When ***"S-on"*** is selected and SET button is pressed; the device will find and correct any connection failures (such as wrong connection at voltage and current inputs) first and then recognize all capacitor steps. If 10th program (PS-10) is selected, all capacitor powers will be measured. In other programs, only first capacitor step power is measured and other capacitor steps are calculated and recorded according to selected program. If ***"S-oF"*** is selected and SET button is pressed during capacitor recognition, automatic recognition will be ended.

Note: If there are loads other than compensation on the system, the device may find the connection after several tries. If the device doesn't complete the automatic connection process, it can't do the step calculation process. In order to have correct power values for capacitor steps, current and voltage transformer ratios must be entered correctly. If current and voltage transformer ratios are not entered, these ratios are assumed to be "1" and capacitor powers are calculated according to these values (Refer to VT and CT ratio settings).

If automatic setup is selected as "S-on", automatic mode starts immediately without waiting to escape from the menu.

Note: A parameter that is calculated automatically by the device can be changed by the user.



Press SET button 3 sec. and select "Auto" option.

Select "ASEt" parameter by using UP/DOWN buttons.

Press SET button and enter "ASEt" menu ("S-oF" is displayed)

Select "S-on" option by using UP/DOWN buttons.
(This parameter should be selected as "ON" in order to start the Automatic Capacitor Recognition.)

Press SET button in order to activate your selection.

AUto Operating Mode (Automatic/Manual Mode) Settings

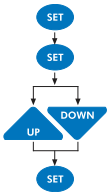
PFR-96Bs/120Bs series has two operating modes which are automatic mode and manual mode. Operating mode can be selected by selecting **"A-on"** (automatic) or **"A-oF"** (manual) option. Manual mode is used for test purpose. In this mode, capacitor steps are switched on&off to test the relay outputs of the device. In the manual mode, capacitor steps are switched on by pressing **"SET"** button and also capacitor steps are switched off by pressing **"ESC"** button. Factory set values for switching on (ond) and switching off (oFd) time is 10 seconds. These time values can be programmed in the Delay (dELy) menu (Refer to delay time setting). In the manual mode, step numbers, which will be switched on&off, can be programmed in "Step" menu (Refer to step number setting). Even if manual mode is selected, after 5 minutes, device starts to work in automatic mode and continues to operate in automatic mode.

When automatic mode is selected, AUTO/MAN LED lights on continuously. When manual mode is selected, AUTO/MAN LED blinks.

Warning: Device warns user by blinking (short ON, long OFF) the capacitor steps which will be switched on. Also device warns user by blinking (long ON, short OFF) the capacitor steps which will be switched off.

For switching capacitors; voltage inputs must be connected and measured voltage must be higher than (min. 0.5 times) programmed nominal network voltage.

POWER FACTOR RELAY
PFR-96Bs /120Bs



Press SET button for 3 sec. and select “Auto” option.

Press SET button and enter “AUto” menu. (“A-on” is displayed)

Select “A-on” or “A-oF” option by using UP/DOWN buttons.

In order to activate the selection, press SET button.

CURRENT and VOLTAGE TRANSFORMER RATIO SETTINGS, PHASE ANGLE and NETWORK VOLTAGE PROGRAMMING

In order to have correct power values for capacitor steps, current and voltage transformer ratios must be entered correctly. Current and voltage transformer ratios are entered in “trF” menu. If no value is entered in the menu, these ratios are assumed to be “1” and capacitor powers are calculated according to these values.

Current Transformer Ratio

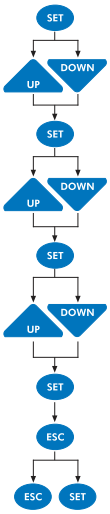
CT ratio can be programmed between 1 and 2000. This value must be the Current Transformer’s ratio.

Exp: For 150 A/5 A current transformer, CT ratio must be entered as “30”.

Voltage Transformer Ratio

VT ratio can be set between 1-2000. This value must be the Voltage Transformer’s ratio.

Exp: For 34,5 KV / 100 V voltage transformer, VT ratio must be entered as “345”.



Press SET button for 3 sec.

Select “trF” menu by using UP/DOWN buttons.

Press SET button and select “Utr” option.

Select “Utr / Ctr” option by using UP/DOWN buttons.

Press SET button to enter Voltage / Current Transformer Ratio.

Enter VT or CT ratio between 1-2000 by using UP/DOWN buttons. (Use “SET” or “ESC” button to set next digit or previous digit)

Press SET button to confirm your selection.

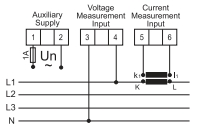
Press ESC button until SAVE is displayed.

Press SET button to save or ESC button to exit without saving.

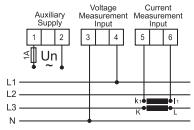
Phase Angle Setting

Phase angle is changed for all possibility of current and voltage connections in this menu. If user knows phases, which are connected to measurement inputs, phase angle can be set manually in this menu. Automatic setup (ASEt) is recommended for this application. At the end of “ASEt” application, present connection is displayed at this menu.

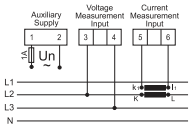
-It can be programmed between 0 and 360 in 30 degree differences (0, 30, ..., 330).



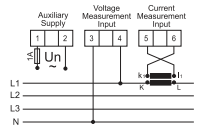
Phase 0°



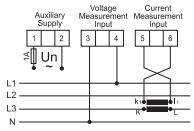
Phase 120°



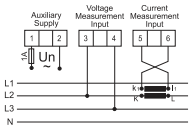
Phase 330°



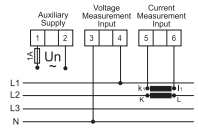
Phase 180°



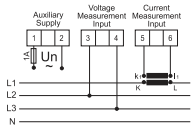
Phase 300°



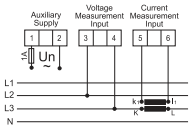
Phase 150°



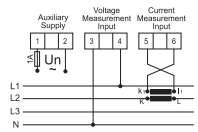
Phase 240°



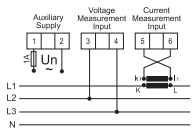
Phase 90°



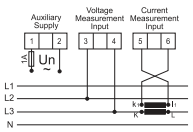
Phase 210°



Phase 60°



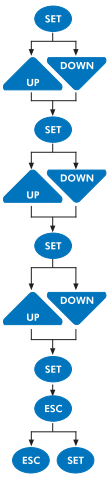
Phase 270°



Phase 30°

Operating Voltage Programming

Nominal voltage of the network where the device is connected in this menu. For insuring a true compensation, measured voltage value must be higher than min. 0.5 times of programmed nominal network voltage.



Press SET button for 3 sec.

Select “trF” menu by using UP/DOWN buttons.

Press SET button and select “Utr” option.

Select “An9L/U-no” option by using UP/DOWN buttons.

Press SET button to enter Phase Angle / Operating Voltage value.

Enter phase angle between -150° to 180° (programmed 30 degress differences) or operating voltage value by using UP/DOWN buttons (Use “SET” or “ESC” button to set next digit or previous digit)

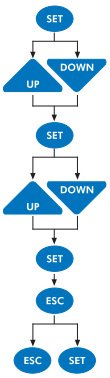
Press SET button to confirm your selection.

Press ESC button until SAVE is displayed.

Press SET button to save or ESC button to exit without saving.

Program Selection

PFR-96Bs/120Bs series has 10 different program modes which determines the power ratio sequences of capacitor steps. These are given on the tables below. If capacitors sequence is set just like 2nd program (P-02) (1.1.1.1.....), many identical connection compenents are required. Selecting between 3th program (P-03) to 8th program (P-08), less connection components are used (exp: 1.2.2.....). 9th program (P-09) provides different group powers. 9th program’s capacitor sequence working principle is one group’s power can be higher than previous groups’ sums by first group power. With this method, less capacitors can be used. For 10th program (P- 10), there is no rule of arranging the steps from low to high. With auto setup, capacitor steps can be calculated automatically or user can enter the capacitor values manually. User can select used or not used capacitor steps from CAP menu at 10th program. PFR-96Bs/120Bs series counts the number of switch on/off of every capacitor step and switches on required steps every time. With this method, it prolongs capacitor’s life time duration. Enter your required program by following the steps below.



Press SET button for 3 sec.

Select “Prog” menu by using UP/DOWN buttons.

Press SET button in order to see preset program number (Exp: 10).

Select desired program number (1-10) by using UP/DOWN buttons

Press SET button to confirm your selection.

Press ESC button until SAVE is displayed.

Press SET button to save your changes or ESC button to exit without saving.

Available Programs

PROGRAM	SEQUENCE
01	linear
02	1.1.1.1.....
03	1.1.2.2.....
04	1.2.2.2.....
05	1.2.3.3.....
06	1.2.4.4.....
07	1.1.2.4.....
08	1.2.3.4.....
09	1.2.4.8.....
*10	Any sequence can be selected by user.

*** Recommended program mode.**

Step Number Setting

The maximum number of steps that the device can control depends on the device model. It can be 6, 8 or 12 . Each of these steps can be programmed “oFF”, “oN” or “Auto” in the 10th program.

AUto : Programming capacitor power (kVAr) menu.

on : Capacitor programmed as a steady.

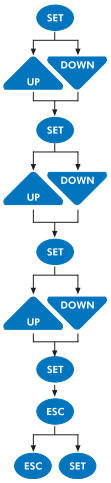
oFF : Meaning of there is no capacitor connection at output.

When other programs are selected, 1st step’s capacitor power can be programmed. Other steps’ power can be programmed according to selected program.

POWER FACTOR RELAY
PFR-96Bs /120Bs

dELY **Delay Time Setting**

Switch “ON” delay (ond), Switch “OFF” delay (oFd) and discharge time (rC) is programmed for the steps in this menu.
Delay time can be set between 2 and 1800 seconds in this menu.



Press SET button for 3 sec.

Select “dELy” menu by using UP/DOWN buttons.

Press SET button and select “ond” parameter. (Exp:10)

Select ond / oFd / rC option by using UP/DOWN buttons.

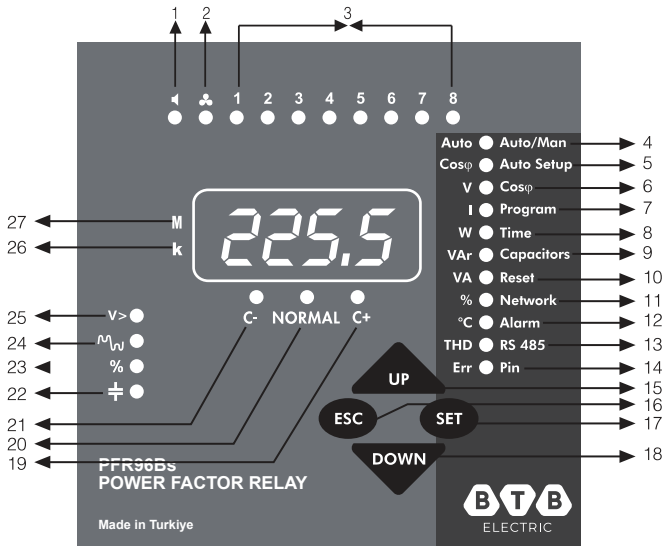
Press SET button.

Enter delay time between 2-1800 sec. by using UP/DOWN buttons. (Use “SET” or “ESC” button to set next digit or previous digit)

Press SET button to confirm your selection.

Press ESC button until SAVE is displayed.

Press SET button to save your changes or press ESC button to exit without saving.



NOTE: Icon explanations are the same for type 96Bs and 120Bs models. The figure above shows the front panel of PFR-96Bs/120Bs. The step numbers of the device shown with number 3 will change according to the model number.

1. : In case of any failure, alarm relay is switched on and alarm led lights.

2. : When measured temperature value increase fan measured value after 10 second fan led light will be on.

3. 1,2,...,8 LEDs : The LEDs of the steps that are to be switched on or off. They indicate the switched on steps for compensation. The LED of the switched on step lights up.

4. OTO/MAN LED : Indicates if the operating mode is automatic or manual. (If it is continuously ON, PFR-96Bs/120Bs series operates in Automatic Mode. If it blinks, PFR-96Bs/120Bs series operates in Manual Mode)

5. Cosφ /Auto Setup LED : Press SET button for 3 seconds, when Cosφ/Auto Setup LED is open, automatic setup is done. In measurement mode Cosφ value is displayed.

6. V / Cosφ LED : Press SET button for 3 seconds, when V / Cosφ LED is open COS1 and COS2 is programmed. In measurement mode voltage value is displayed.

7. I / Program LED : Press SET button for 3 seconds, select PROGRAM/I light to select power sequence program. In the measurement mode, current values of related phases are displayed.

8. W / Time LED : Press SET button for 3 seconds, select TIME/W led to set switching on delay time, switching off delay time and discharge time. In the measurement mode, active power value is displayed.

9. VAr / Capacitor LED : Press SET button for 3 seconds, select CAPACITORS/VAr led to set capacitor values and capacitor connections (AUto, on, oFF). In the measurement mode, reactive power values are displayed.

10. VA / Reset LED : Press SET button for 3 seconds, select RESET/VA LED for erasing alarms. In measurement mode apparent power value is displayed.

11. % / Network LED : Press SET button for 3 seconds, select NETWORK/% LED to set current transformer ratio (Ctr), Voltage transformer ratio (Vtr), phase angle (AngL) and capacitor nominal voltage value (U-no) is set. In measurement mode inductive and capacitive ratio values are displayed as %.

12. °C / Alarm LED : Press SET button for 3 seconds, select ALARM / °C LED to set alarms for over voltage, reactive/active ratio, temperature and harmonics. In measurement mode temperature is displayed.

Technical Features

Operating Voltage (Un)	: **Please look at the rear label of the device**
Operating Voltage Ratio ΔU	: (0.9-1.1)xUn
Operating Current Range ΔI	: 50mA-5.5A
Frequency	: 50 Hz / 60 Hz
Measurement Class	: 1% ±1digit (V,I,Cosφ), 2%±1 digit (W, VAr, VA)
Power Consumption	: <2 VA(Current) 3 VA - 10 VA (Voltage)
Output Contact	: 5 A, 250 V AC, 1250 VA
Generator Input	: 110V AC ~ 250 V AC
No-Volt Feature	: In case of power failure longer than 20 msec., all capacitor steps are disconnected automatically.
Setting Range	
COS1 Setting	: -0.800 ... +0.800
COS2 Setting	: -0.800 ... +0.800
CT Ratio	: 1 - 2000
VT Ratio	: 1 - 2000
Switching on&off and, Discharge Time Setting	: Switching on&off and discharge times can be set seperately between 2-1800 sec.
Step Number	: 6, 8(PFR-96Bs), 12(PFR-120Bs)
Over Voltage Value	: Selectable.
Ambient Temp. Range	: -5° C - 55° C
Measurement Temp. Range	: 00.0 - 100 °C
Display	: Red LED Display with 4 Digits
Equipment Protection Class	: Double Insulation (⧈)
Cable Section (for terminals)	: 2.5 mm2
Terminal Protection Class	: IP 00
Box Protection Class	: IP 54 (front panel)
Connection Type	: Terminal
Dimension	: Type 96Bs, Typr 120Bs
Panel Cut-out	: 91x91 mm, 139x139 mm
Weight	: 0.85 kg, 0,45 kg
RS-485 Communication*	
Address	: 1-247
Baud Rate	: 1.200 Kbps, 2.400 Kbps, 4.800 Kbps, 9.600 Kbps, 19.20 Kbps, 38.40 Kbps
Parity	: no, odd, even
Default Factory Settings	
Target COS1	: 1,000
Target COS2	: 0,900
Program	: P-10
t-on (Switching on delay)	: 10 sec.
t-off (Switching off delay)	: 10 sec.
Discharge time	: 14 sec.
Over Voltage	: 265.0 V AC
Delay	: 3.0 sec.
Step Protection	: oF
Over Harmonic	: 5.0%
Delay	: 3.0 sec.
Step Protection	: oF
Inductive Ratio Range	: 25
Capacitive Ratio Range	: 15
Ratio Time	: 240 hour
Temperature Protection	
Alarm Value	: 55 °C
Step Protection	: oF
Lower Alarm	: 53 °C
Fan Setting	
Operation Temperature	: 45 °C
Lower Temp. Value	: 40 °C
CT Ratio	: 1
VT Ratio	: 1
Connection Angle	: 0°
Nominal Line Voltage	: 230 V
RS-485 Communication	
Address	: 1
Baud Rate	: 9.600 Kbps
Parity	: no
Password	: 1234
Password Activation	: oFF

13. THD / RS-485 LED : Press SET button 3 seconds, select RS-485/THD LED for setting address, baudrate and parity values for RS-485 communication protocol. In measurement mode THD values (19th harmonics) is displayed by pressing SET button.

14. Err / Pin LED : Press SET button 3 seconds, select PIN/ERR LED for setting and changing password in measurement mode if any error happens this LED will be on (If there are more than one error, errors' code is displayed by pressing SET button).

15. Up Button : Go to next menu or increase related value.

16. Esc Button : Exit from a menu. In the measurement mode, it is used to exit from harmonic menu.

17. Set Button : Enter to a menu or confirm the data entry. In the measurement mode, it is used to observe the harmonic values of current, voltage and power values.

18. Down Button : Go to the previous menu or decrease related value.

19. C+ LED : This LED represents that PFR-96Bs/120Bs is waiting to switch capacitor steps on.

20. Normal LED : This LED represents that PFR-96Bs/120Bs wil not switch any capacitor steps on&off.

21. C- LED : This LED represents that PFR-96Bs/120Bs is waiting to switch capacitor steps off.

22. ⏚ : If capacitor is not connected to the related step, “⏚” lights is ON.

23. % : If reactive energy ratios exceed adjusted set values, “%” led lights.

24. ∿ : If voltage harmonic ratios exceed adjusted set values, “∿” led lights.

25. V> : When the value of voltage exceeds adjusted set value or devices measured the value of voltage less than 30V or when devices can not measure current during auto setup, “V>” light is ON.

26. k LED : Represents measurement values with kilo unit ($x10^3$).

27. M LED : Represents measurement values with mega unit ($x10^6$).

POWER FACTOR RELAY
PFR-96Bs /120Bs

FAn Fan Relay Settings

This function is used for “switching-on” and “switching-off” the fan output contact according to measured temperature. There are two submenus as “F-on” and “F-oF”.

F-on : This is the assignment menu for programming the switch-on temperature value. After the temperature measured by the device increases the set value and stays over that value for 10 seconds, contact will be switched-on and fan LED will be on. Value can be defined between 00.0- 99.8 °C. If this value is set as 0.00, fan function will be disabled and “F- oF” value will be set as 00.0 automatically.

F-oF : This is the assignment menu for programming the switch-off temperature value. A value higher than “F-on” can not be used.

Monitoring the measured temperature

In order to make a correct measurement, device must be in operation at least 30 min.

In order to observe the measured environmental temperature, press UP/DOWN buttons untill flashing C°/Alarm LED.

ALr Programmable Alarm Protection

These programs are set for protecting capacitors by user.

VoLt Over Voltage Protection Setup

This protects capacitors from over voltage. It has 3 parameters.

“SP-U” : It can be programmed between 0-500 V. Setting to “0” means alarm is turned off.

“dELy” : Delay time. It can be programmed between 0-999.9 sec.

“CAP” : It shows step state in alarm condition. Selecting “on” will cause the steps to remain the same. Selecting “oF” will cause to switch off the capacitor steps.

tHd Over THDV Protection Setup

Device gives an alarm if THDV value exceeds entered set value. It has 3 parameters.

“SP-t” : THD% can be set between 0-99.9. Setting to “0” means alarm is turned off.

“dELy” : Delay time. It can be programmed between 0-9999 sec.

“CAP” : It shows step state in alarm condition. Selecting “on” will cause the steps to remain the same. Selecting “oF” will cause to switch off the capacitor steps.

rAtE Ratio Protection Setup

Device gives an alarm if the capacitive and inductive ratio exceeds the value entered by the user in programmed time. It has 3 parameters.

“ind” : Inductive ratio can be set between 0-99.9 %. Setting to “0” means alarm is turned off.

“CAP” : Capacitive ratio can be programmed between 0-99.9 %. Setting to “0” means alarm is turned off.

“HoUr” : Programmed between 1-240 hours.

NOTE : Device shows “ind” and “CAP” ratios according to programmed “xxx” hour, so user can see parameters only for last “xxx” hours.

HEAt Over Heat Protection Setup

After the temperature measured by the device increases the set value and stays over that value for 10 seconds, device gives an alarm. It has 3 parameters.

“SP-H” : Temperature alarm turned off down.

“SP-L” : Back to temperature alarm value can be set between 0-99.9 °C. A value higher than “SP-H” can not be used.

“CAP” : It shows step state in alarm condition. Selecting “on” will cause the steps to remain the same. Selecting “oF” will cause to switch off the capacitor steps.

E-07 Displaying the Alarm Codes which are given by the device

Related Alarm LED is on if any failure is occured for any reason. When user wants to monitor the errors, “UP/DOWN” buttons are used until the “E-xx” number is displayed. All the error codes are displayed respectively by pressing the SET button. This parameter is not displayed if there is no error.

For example, “E-07” means over voltage condition error.

ALARM CODES

NO	DESCRIPTION	LED ☼	REASON
00	Angle between phase voltages doesn’t equal to 120°	⅄	Neutral and Voltage terminal connections may be wrong
01	Reverse phase sequence	⅄	Voltage terminal connections may be in counter clockwise direction
02	One or more phase voltages don’t exist	⅄	Voltage terminal connections may be wrong
03	Phase 1 Current	⅄	Current transformer connections for phase 1 may be wrong or fist capacitor step may be defected
04	Phase 2 Current	⅄	Current transformer connections for phase 2 may be wrong or fist capacitor step may be defected
05	Phase 3 Current	⅄	Current transformer connections for phase 3 may be wrong or fist capacitor step may be defected
06	THD for voltage exceeds the preset value	∿	Excessive harmonic may be exist in the system
07	Voltage value of any phase exceeds the preset value	V>	Voltage value of the system may be increased
08	Reactive capacitive ratio exceeds the preset value	%	Compensation Error
09	Reactive inductive ratio exceeds the preset value	%	Compensation Error
10	Temperature of the capacitors exceeds the preset value	*♣	Over Temperature
11	Automatic connection could not be found	⅄	Defected capacitor step or variable loads
12	Over compensation	≠	Target Cosj is capacitive even if all capacitor steps are switched off
13	Insufficient compensation	≠	Capacitor powers are not sufficient for target Cosφ
14	Phase sequence is not correct	≠	3-phase capacitor powers were not selected properly
15	Capacitor power for phase 1 is not appropriate	≠	Capacitor powers for phase 1 were not selected properly
16	Capacitor power for phase 2 is not appropriate	≠	Capacitor powers for phase 2 were not selected properly
17	Capacitor power for phase 3 is not appropriate	≠	Capacitor powers for phase 3 were not selected properly
18	Capacitor step 1 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
19	Capacitor step 2 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
20	Capacitor step 3 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
21	Capacitor step 4 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
22	Capacitor step 5 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
23	Capacitor step 6 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
24	Capacitor step 7 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
25	Capacitor step 8 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
26	Capacitor step 9 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
27	Capacitor step 10 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
28	Capacitor step 11 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
29	Capacitor step 12 is defected	≠	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown

***Optional**

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