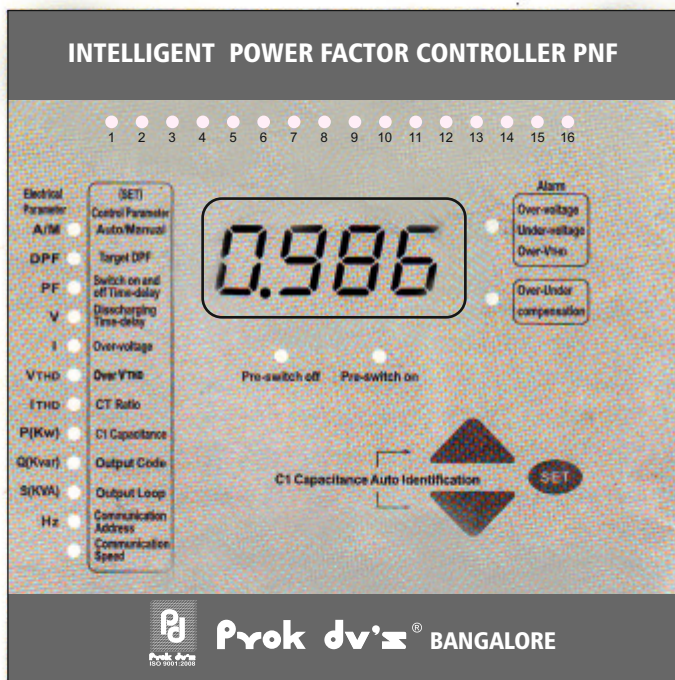




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Total reliability in power system protection & monitoring
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INTELLIGENT POWER FACTOR CONTROLLER PNF



User Manual

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1. Introduction

1.1 About User Manual

This User Manual is designed to help you for quick understand the installation, debugging, working parameter and menu operation of series RPCF reactive power auto compensation controllers. Before installation and operation please read this section very carefully.

1.2 Usage Scope

Series PNF INTELLIGENT POWER FACTOR CONTROLLER (call PNF for short at below) is suitable for automatically adjusting of low voltage distribution system capacitor compensating device to make power factor get user's predetermined state, increase the utilization efficiency of power transformer, reduce line loss, and improve the voltage quality of power supply.

2. Function and Characteristics

(1) Accounting switch on and switch off capacity capacitance by the fundamental wave reactive power may avoid any form switch on and switch off vibration, and be able to demonstrate the electrical network power factor correctly under the harmonic wave situation.

(2) High measuring accuracy of power factor, wide display scope.

(3) Real time display total power factor (PF) and fundamental wave power factor (DPF).

(4) Real time display voltage distortion current distortion rate.

(5) There are five codes output types for user's selection.

(6) 16 loop output at most.

(7) Friendly human-computer interface, easy to operate.

(8) Various controlling parameter whole digit tunable, easy to operate.

(9) Two working modes of auto running and manual running.

(10) Over-voltage and under-voltage protective function.

(11) Voltage harmonic wave overnorm protective function.

(12) Data cannot loss as it has breaking power supply protective function.

(13) Current signal switch on impedance is lower $\leq 0.01 \Omega$

PNF

3. Service Condition

(1) Not over altitude 2500m.

(2) Ambient temperature $-25^{\circ}\text{C} \sim +50^{\circ}\text{C}$

(3) Air humidity is less than 50% at 40°C . And is less than 90% at 20°C

(4) Working in the medium which not any corrosive gas, electric conduction dust inflammable and explosive matters.

(5) The installation site without shrewd vibration.

4. Technical Data

Rated Working Voltage: AC 380V or AC 220V

Rated Working Frequency: 45Hz-65Hz

Measuring Reactive Power: 0-9999K var

Under-voltage Protective Value: AC 300V or AC 180V

Sensitivity: 20mA

Overall Dimension: 144mm×144mm or 122mm×122mm

Hole Dimension: 138mm×138mm or 110mm×110mm

Installation Mode: inserting type installation rear gear accessories fixed of guide rail installation.

Connection Mode: Socket connecting terminal screw fasten protection Class: Enclosure IP 40

Rated Working Current: AC 0-5A

Display Power Factor: lag 0.001-lead 0.001

Measuring Active Power: 0-9999KW

Output Contact Capacitance: AC 220V 7A

Complete Machines consumed power: 10VA

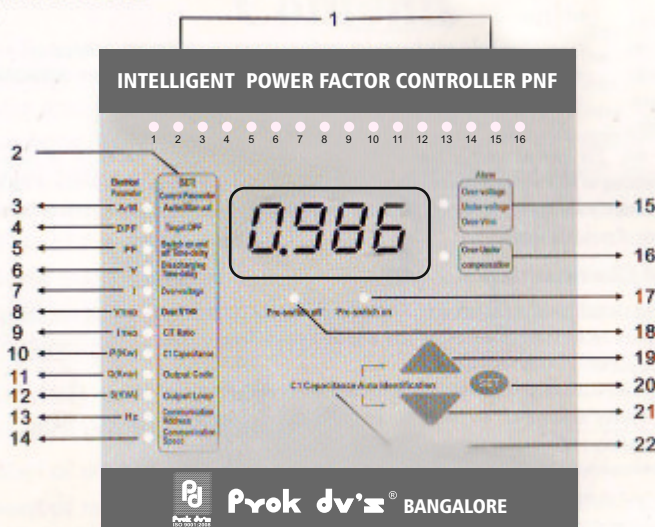
Display: 4-position red nixie tube

5. Model and Implication

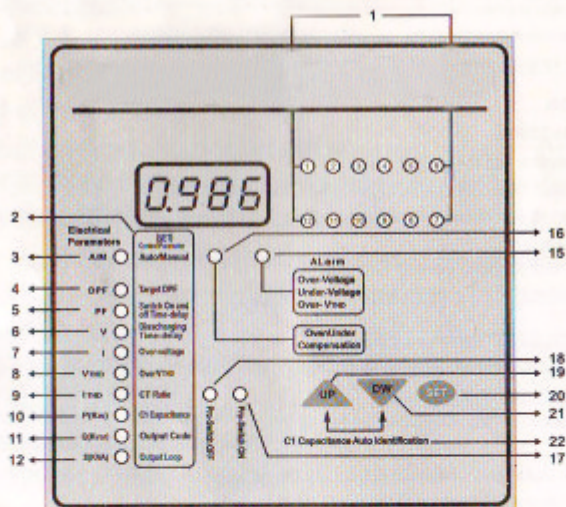
PNFF (C)- XX - XX X

- Hole dimension, s for 113mm×113mm, on mark for 140mm×140mm.
- Output total loop, loop 4, 6, 8, 10, 12, 16 can be selected.
- Voltage signal sampling mode, PP (line voltage), PN (phase voltage) ordered model.
- C for communication function, no mark for no communication function.
- For controlling physical quantity with G (Power factor), W (reactive power), F (G+W).
- For reactive power compensation controller

6. Front Panel Function



Front Panel Function Drawing for Hole Dimension: 138mmX138mm



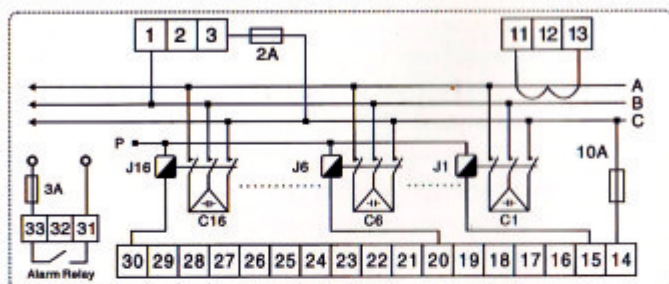
Front Panel Function Drawing for Hole Dimension: 110mmX110mm

6.1 Button and Lights

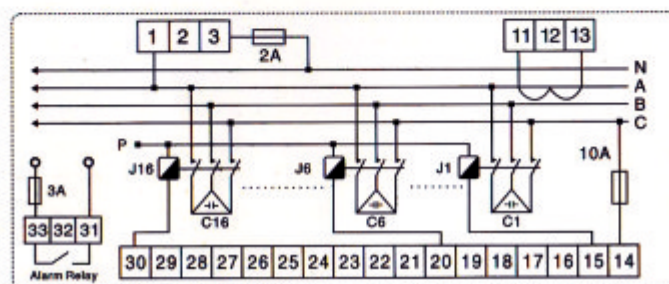
1. See 1-16 or 1-12 for loop capacitor switch on and switch off indication
2. Control parameter setting menu.
3. Auto/Manual Lights: If this light is continuously ON, PNF is in Automatic Mode. If it is blinking PNF is under Manual Mode. By pressing SET button 3 seconds; you enter to Menu and change operating mode.

4. DPF/Target DPF Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network fundamental wave power factor. By pressing SET button 3 seconds you enter into SET menu, target power factor can be made by selecting this light.
5. PF/Switch On and off Time-delay Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network total power factor. By pressing SET button 3 seconds you enter in to SET menu, switch on and switch off timedelay time can be made by selecting this light.
6. V/Discharging Time-Delay Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network voltage. By pressing SET button 3 seconds you enter into SET menu, capacitor discharging time can be made by selecting this light.
7. I/Over voltage Indicator: Under Automatic Mode, When this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network primary current. By pressing SET button 3 seconds you enter into SET menu, overvoltage threshold value can be made by selecting this light.
8. VTHD/ Distortion Rate Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network voltage distortion rate. By pressing SET button 3 seconds you enter into SET menu, voltage distortion rate protective value can be made by selecting this light.
9. ITHD/CT Rate Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network current distortion rate. By pressing SET button 3 seconds you enter into SET menu, signal current transformer rate numerator value can be made by selecting this light.
10. P (KW)/C1 Capacitance Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network reactive power. By pressing SET button 3 seconds you enter into SET menu, primary loop capacitor capacitance (Kvar) can be made by pressing SET button 3 seconds.
11. Q (Kvar) /Output sequence Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network apparent power. By pressing SET button 3 seconds you enter into SET menu, control output sequence project can be made by selecting this light.
12. S (KVA)/ Output Loop Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network apparent power. By pressing SET button 3 seconds you enter into SET menu, control output loop can be made by selecting this light.
13. Hz/ Communication Address Indicator: Under Automatic Mode, when this light is selected by pressing UP and DOWN buttons, nixie tube will really time display power network frequency. By pressing SET button 3 seconds you enter into SET menu, communication add can be made by selecting this light.
Note: only Model PNFC controller has this function.
14. Communication Speed Indicator: Under Automatic Mode, Pressing SET button 3 seconds you enter into SET Menu, Communication Add Speed (baud rate).
Note: only Model PNFC controller has this function.
15. Over-voltage, under-voltage, voltage distortion rated overnorm alarm indicator: If this light ON, controller will switch off the switch on capacitor group with 1 s per step time-delay, and alarm relay OFF alarm.
16. Over-compensation, under-compensation indicators: If it is not enough to compensate or be compensated the extra capacitor or electric network display capability when the capacitor switch on fully, the alarm relay will OFF.
17. Pre-switch on Indicator: If this lamp ON that means the controller is waiting for capacitor group's switch on.
18. Pre-switch off Indicator: If this lamp ON that means the controller is waiting for capacitor group's switch off.
19. Up Button: To select Menu or to move up in the Menu.
20. Parameter SET Button: To start parameter Adjustment Program by pressing this Key 3 seconds.
21. DOWN Button: To select Menu or to move down in the Menu.
22. C1 Capacitance and Signal Homonymic Terminal Auto Identification: To start C1 capacitor capacitance and signal homonymic terminal auto identification program by pressing UP and DOWN Button together for 3 seconds.

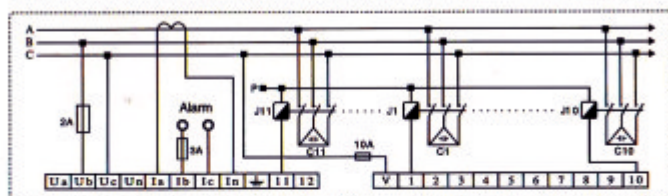
7. Connection Diagram



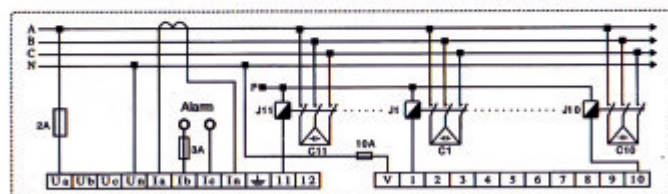
Connection Diagram for Model PNF-PP-XX Hole Dimension 138mmX138mm
Point P connects with B when the AC connector rated working voltage is 380V; connects with N if it is 220V.



Connection Diagram for Model PNF -PN-XX Hole Dimension 138mmX138mm
Point P connects with B when the AC connector rated working voltage is 380V; connects with N if it is 220V.



Connection Diagram for Model PRCFX-PP-XXS Hole Dimension 110mm×110mm
Point P connects with B when the AC connector rated working voltage is 380V; connects with N if it is 220V.



Connection Diagram for Model PRCFX-PN-XXS Hole Dimension 110mm×110mm
Point P connects with B when the AC connector rated working voltage is 380V; connects with N if it is 220V.

8. Preset parameter

All settings are made by Pressing SET button at the PNF front panel for 3 seconds. The set values are kept EEPROM even if the device is switched off. When it is switched on, PNF sets control parameter with the data kept in EEPROM. After entering into pre-set Menu, pressing SET Button at the PNF panel for 3 seconds, or if you do not make any adjustments during 20 seconds, pressing PNF will store the changed parameter and return to Automatic Operating Mode or Manual Operating Mode.

8.1 Preset of Operating Mode (Automatic/ Manual Mode)

Two Operating Modes are valid for switching on/off the capacitor group. Automatic Operating Mode is the capacitor groups are controlled by PNF automatically; Manual Operating Mode is the capacitor groups are switched on/off manually.

Mode selection is done as followed:

By pressing SET button at PNF panel 3 seconds, nixie tube starts to display:



Auto/Manual light is selected by using UP-DOWN button. The light is ON, the nixie tube is displayed: **AUTO**. Pressing SET key if the nixie tube displays: **A On**, Which means the present operating mode is Manual Operating Mode. If the nixie tube displays: **A Off**.

Which means the present operating mode is Auto Operating Mode.

Automatic Mode or Manual Mode can be selected by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **AUTO**, selecting others preset parameter by using UP and DOWN buttons.

PNF will store the changed control parameter and exit Parameter Preset Menu by pressing SET button 3 seconds, A/M light starts blinking under Manual Mode. A/M light is continuously ON under Automatic Mode.

8.1.1 Operation of Manual Operating Mode

It wants to switch on under Manual mode by pressing UP button, the light is ON, PNF connects the capacitor groups after a delay time according to user's preset code. It wants to switch off under Manual Mode after pressing DOWN button, the light is in ON, PNF disconnects the capacitor groups after a delay time according to user's preset code.

8.2 Preset of Target Power Factor

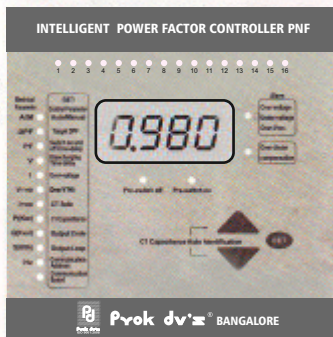
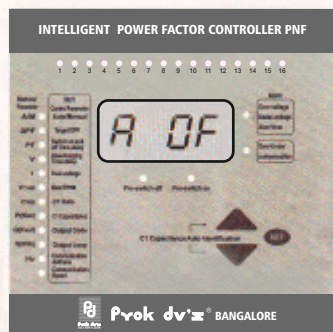
Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



The power factor is selected by using UP and DOWN buttons, the light is ON and the nixie tube displays: **0.980**. power Factor preset Value is shown at the nixie tube by pressing SET Button. A value between 0.7 and 0.70 cap is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays **0.980**, selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit parameter preset Menu.



8.3 Preset of Switch On/Off time delay

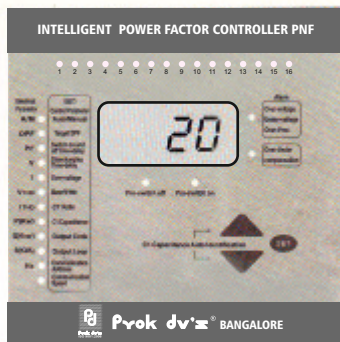
Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



Time delay is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **dEL**. Time delay time preset value of the capacitor is shown at the nixie tube by pressing SET Button. A value between 2-200 seconds is adjusted by using UP-DOWN buttons.

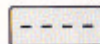
By pressing SET Button, the nixie tube displays: **dEL**, selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit parameter Preset Menu.



8.4 Preset of Capacitor Discharging Time delay

Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



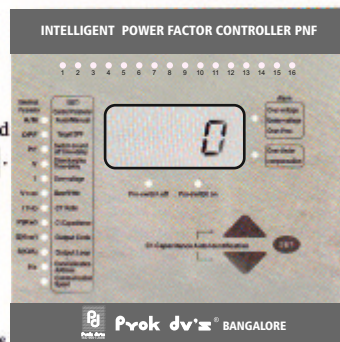
Capacitor Discharging Time-delay is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **ddEL**. Capacitor Discharging Time-delay preset Value is shown at the nixie tube by pressing SET Button. A value between 0-210 seconds is adjusted by using UP-DOWN buttons, please refer to the User Manual of Capacitor for the specific values.

By pressing SET Button, the nixie tube displays: **ddEL**

Selecting others preset parameter by using UP and DOWN buttons.

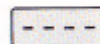
Pressing SET button 3 seconds, PNF will store the changed control parameter and exit Parameter Preset Menu.

The usage of this parameter: PNF will forbid to the capacitor switching on (named as locking function) within the time accounting from a capacitor group switch-off to user preset capacitor discharging time delay.



8.5 Preset of Over Voltage

Pressing SET button at PNF panel 3 seconds, nixie tube starts display:

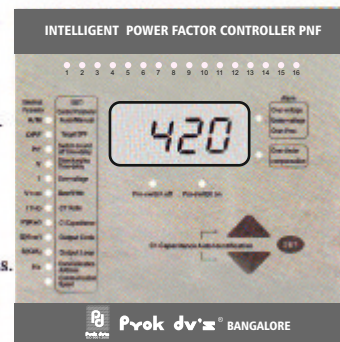


Over voltage is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **OL**. Over voltage Value is shown at the nixie tube by pressing SET Button. A value between 400V or 220V -480V or 260V is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **OL**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing EET button 3 seconds, PNF will store the changed control parameter and exit parameter Preset Menu.



8.6 Preset of Voltage Distortion Rate Protective Threshold Value

Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



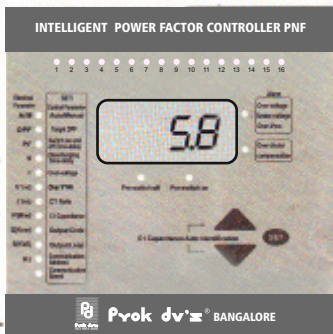
Over VTHD is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **[d, 5t]**. Voltage Distortion Rate Protective Threshold Value is shown at the nixie tube by pressing SET Button. A value between 1.0% and 30% is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **[d, 5t]**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit parameter Preset Menu.

Note: PNF will switch off capacitor group when the voltage signal distortion rated exceeds this preset value.



8.7 Preset Current Transformer Ratio

Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



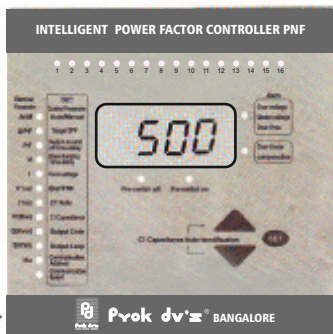
CT Ratio is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **[CT]**. CT Ratio Preset Value is shown at the nixie tube by Pressing SET Button. A value between 50 and 4000 is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **[CT]**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit Parameter Preset Menu.

Note: CT Ratio that means numerator value used in PNF current transformer ratio, For example: If signal current transformer ratio is 500/5, then, user should input 500.



8.8 Preset C1 Capacitor Capacitance

Pressing SET button at PNF panel 3 seconds, nixie tube starts display:



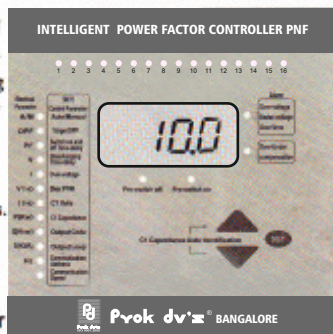
C1 Capacitor Capacitance is selected by pressing UP and DOWN buttons the light is ON and the nixie tube displays: **[CAP]**. C1 Capacitor Capacitance Preset Value is shown at the nixie tube by pressing SET Button. A value between 0.5 Kvar and 150.0 Kvar is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **[CAP]**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit Parameter Preset Menu.

Note: C1 Capacitance, which means capacitor power value (Unit: Kvar) for Capacitor Code C1 of PNF driving, refer to Section 7 Connection Diagram.



8.9 Preset of Output Sequence

Pressing SET button at PNF panel 3 seconds, nixie tube starts display: **----**

Output Sequence is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **Pr09**. Output Code Value is shown at the nixie tube by pressing SET Button. The output Sequence mode from Pr-1 and Pr-12 can be selected by pressing UP-DOWN buttons:

Pr-1=> 1: 1: 1: 1: 1: ... 1	Pr-2=> 1: 2: 2: 2: 2: ... 2:
Pr-3=> 1: 2: 4: 4: 4: ... 4	Pr-4=> 1: 2: 4: 8: 8: ... 8:
Pr-5=> 1: 1: 2: 2: 2: ... 2	Pr-6=> 1: 1: 2: 4: 4: ... 4:
Pr-7=> 1: 1: 2: 4: 8: ... 8	Pr-8=> 1: 2: 3: 3: 3: ... 3:
Pr-9=> 1: 2: 3: 6: 6: ... 6	Pr10=> 1: 1: 2: 3: 3: ... 3:
Pr11=> 1: 1: 2: 3: 6: ... 6	Pr12=> connect and disconnect as per sequence

By pressing SET Button if the nixie tube displays: **Pr09**, Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit Parameter Preset Menu.

8.10 Preset of Output Loop

Pressing SET button at PNF panel 3 seconds, nixie tube starts display: **----**

Output Loop is selected by pressing UP and DOWN buttons, the light is ON and the nixie tube displays: **OUTP**. Output Loop preset Value is shown at the nixie tube by pressing SET Button. A value between 1 and Output Max Loop of PNF is adjusted by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **OUTP**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit Parameter Preset Menu.

8.11 Preset of Communication Address

Pressing SET button at PNF panel 3 seconds, nixie tube starts display: **----**

Communication Address is selected by pressing UP and DOWN buttons the light is ON and the nixie tube displays: **Addr**. Communication Address Preset Value is shown at the nixie tube by pressing SET Button. The Communication Add between 1 and 255 is selected by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **Addr**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit parameter preset Menu.

8.12 Preset of Communication Speed

Pressing SET button at PNF panel 3 seconds, nixie tube starts display: **----**

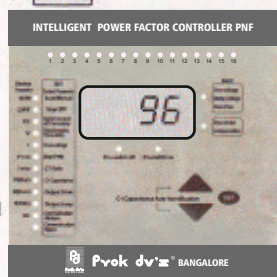
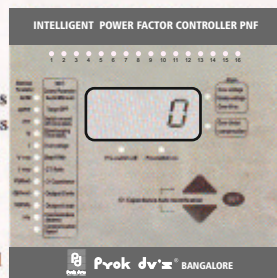
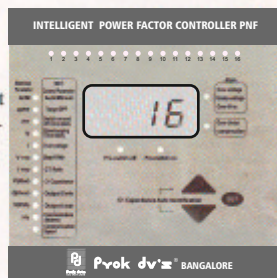
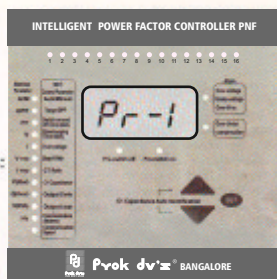
Communication Speed (Baud Rate) is selected by pressing UP and DOWN buttons the light is ON and the nixie tube displays: **CSPE**. Communication Speed Preset Value is shown at the nixie tube by pressing SET Button. The Communication Speed among 4800, 9600, 19200, 38400, 115200 is selected by using UP-DOWN buttons.

By pressing SET Button, the nixie tube displays: **CSPE**

Selecting others preset parameter by using UP and DOWN buttons.

Pressing SET button 3 seconds, PNF will store the changed control parameter and exit parameter Preset Menu.

Note: Real Communication Speed = Display value \times 100, for example: If display value is 96, the real communication speed = $96 \times 100 = 9600$, see testsoft help for details of communication stipulation MODBUS-RTU, RS485.



9. Display of Electric Network Parameter

9.1 Display of fundamental power factor (DPF)

Under Automatic Operating Mode, the DPF Indicator is ON by means of Up and DOWN buttons. And fundamental power factor value is displayed this time. When the power factor value is negative, the system is capacitive and if the power factor value is positive, the system is inductive.

9.2 Display of Total Power Factor (PF)

Under Automatic Operating Mode, the PF Indicator is ON by means of Up and DOWN buttons. And Total Power Factor value is displayed this time.

Note: in a system without harmonics or harmonic wave is small, DPF and PF are equal to each other.

9.3 Display of Signal Voltage Value (V)

Under Automatic Operating Mode, the V Indicator is ON by means of Up and DOWN buttons. Signal Voltage Value is displayed this time.

9.4 Display of Signal Current Value (I)

Under Automatic Operating Mode, the I Indicator is ON by means of Up and DOWN buttons. Signal Current Value is displayed this time.

9.5 Display of Signal Voltage Distortion Rate (VTHD)

Under Automatic Operating Mode, the VTHD Indicator is ON by means of Up and DOWN buttons. Signal Voltage Distortion Rate is displayed this time.

9.6 Display of Signal Current Distortion Rate (ITHD)

Under Automatic Operating Mode, the ITHD Indicator is ON by means of Up and DOWN buttons. Signal Current Distortion Rate is displayed this time.

9.7 Display of Electric Network Active Power Value [p (Kw)]

Under Automatic Operating Mode, the p Indicator is ON by means of Up and DOWN buttons. Electric Network Active Power Value is displayed this time.

9.8 Display of Electric Network Reactive Power Value [Q (Kvar)]

Under Automatic Operating Mode, the Q Indicator is ON by means of Up and DOWN buttons. Electric Network Reactive Power Value is displayed this time.

9.9 Display of Apparent Power Value [S (KVA)]

Under Automatic Operating Mode, the S Indicator is ON by means of Up and DOWN buttons. Apparent Power Value is displayed this time.

9.10 Display of Signal Frequency Value (HZ)

Under Automatic Operating Mode, the HZ Indicator is ON by means of Up and DOWN buttons. Signal Frequency Value is displayed this time.

10. Capacitor Capacitance and Signal Homonymic Terminal Auto Identification

Under Automatic Mode, C1 Capacitor Capacitance and Signal Homonymic Terminal Auto Identification program will be started by pressing UP and DOWN at the same time for 3 seconds. PNF calculates C1 the capacitance through switch-ON/OFF capacitor groups (code C1) indirectly 10 times. After the Auto Identification Program finished, PNF will display the checking result. If EE is displayed, it means the checking is failed; if OP is displayed, it means the checking is correct and the checking result will be stored in the EEPROM, at that time, user presses PNF button at will to enter into Automatic Operating Mode. The accounted checking result may be wrong when the load of electric network is changed so fast or suddenly changed even through the checking result is displayed correctly during Auto Identification Program. The best method is input the C1 capacitance through Preset Menu by manual. If voltage signal and current signal is on the non homonymic terminal state, the connecting wire of current signal should be exchanged by manual; if it is allowable to break load at site before operating the capacitor capacitance auto identification process to reduce the influence from load changed during auto identification process.

11. How to estimate whether the voltage and current signal in homonymic terminal?

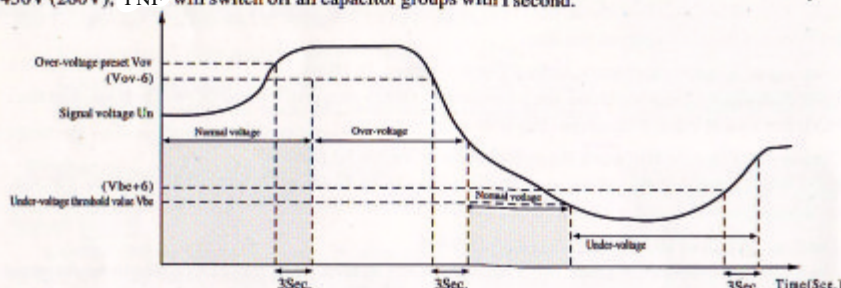
Under the condition of making voltage and current signal sampling correct, connecting on capacitor group by manual function and treat according to the follows:

- 1). The power factor is inductive (positive) before have not switched on capacitor group. If power factor increasing unceasingly or being capacitive (negative) along with the switching-on of capacitor group, the voltage current signal can be judged in homonymic terminal from the above condition.
- 2). The power factor is capacitive (negative) before have not switched on capacitor group. If power factor reducing unceasingly or being capacitive (negative) along with the switching-on of capacitor group, the voltage current signal can be judged in homonymic terminal from the above condition.
- 3). The power factor is inductive (positive) before have not switched on capacitor group. If power factor reducing unceasingly and being inductive (positive) along with the switching-on of capacitor group, the voltage current signal can be judged in non-homonymic terminal from the above condition. User should exchange the cable of connecting current signal.
- 4). The power factor is capacitive (negative) before have not switched on capacitor group. If power factor increasing unceasingly and being inductive (positive) along with the switching-on of capacitor group, the voltage current signal can be judged in non-homonymic terminal from the above condition. User should exchange the cable of connecting current signal.

12. Reason of Alarm

12.1 Alarm of Over-voltage Under-voltage

If the signal voltage exceeds the protective voltage value (V_{ov}) preset by user for 3 seconds, Overvoltage alarm light is ON, alarm relay closes. During over-voltage state, the over-voltage state will disappear if the signal voltage is lower of equal to $V_{ov}-6$ for 3 seconds. If the signal voltage is lower than undervoltage threshold value, the under-voltage alarm light is ON, the alarm relay closes. Under undervoltage state, if the signal voltage is higher than $V_{be}+6$ for 3 seconds, the undervoltage state will disappear. Under overvoltage or under-voltage state, PNF will switch off the switch-on capacitor group with 1 second per step. When signal voltage exceeds 450V (260V), PNF will switch off all capacitor groups with 1 second.



12.2 Alarm of Over Distortion Rate

When the signal voltage distortion rate exceeds 3 seconds of the protective value preset by user, the over distortion alarm light is ON, alarm relay closes. PNF will switch off the connected capacitor group as per 1 second time delay per step.

12.3 Alarm of Over Compensation

If the AC connector locked or contact burned and lead to PNF control signal losing control action, or taking lighting as electric network system of and electric network capacitive, in addition, it is possible that the electric network to be in capacitive in the electric network system which taking lighting as main load, so that can make the system power factor is higher than target power. By now, the over compensation alarm light is ON, the alarm relay closes.

12.4 Alarm of Under Compensation

The capacitance of capacitor is reducing with the growing of time or the dropping of high breaking fuse, which leads to the system power factor failed to reach target power factor value after the capacitor group sending switch-in signal. By now, under compensation alarm light is ON, the alarm relay closes.

13. Examples for Out Sequence Application

PNF has 12 different output sequence modes:

Correspond to relations: C1: C2: C3: C4: C5:....: C16						C1: C2: C3: C4: C5:....: C16
Pr-1 =>	1:	1:	1:	1:	1:	1: 2: 2: 2: 2: ...: 2:
Pr-3 =>	1:	2:	4:	4:	4:	1: 2: 4: 8: 8: ...: 8:
Pr-5 =>	1:	1:	2:	2:	2:	1: 1: 2: 4: 4: ...: 4:
Pr-7 =>	1:	1:	2:	4:	8:	1: 2: 3: 3: 3: ...: 3:
Pr-9 =>	1:	2:	3:	6:	6:	1: 2: 3: 3: 3: ...: 3:
Pr11 =>	1:	1:	2:	3:	6:	connect and disconnect as per sequence

1) Significance of sequence output

The biggest benefits of sequence output is that can get various kinds of capacitance output through different combination of capacitance capacitor, and avoid the problem of under compensation, over compensation and witch-on off vibration of non-sequence output mode.

2) When the total capacitance of compensation is about 75 Kvar, output loop is 4-loop, the combination category of different capacitance capacitor of different sequence mode.:

Pr-1 === > 20: 20: 20: 20:
Pr-2 === > 10: 20: 20: 20:
Pr-3 === > 6: 12: 24: 24:
Pr-4 === > 5: 10: 20: 40:

Different combination capacitances of Pr-1 code mode: 20, 40, 60, 80, total 4 kinds.

Different combination capacitances of Pr-2 code mode: 10, 20, 30, 40, 50, 60, 70 total 7 kinds.

Different combination capacitances of Pr-3 code mode: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66 total 11 kinds.

Different combination capacitances of Pr-4 code mode: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, and 75, total 15 kinds.

From the above, we can get the result that the number of Pr-4 is the most, Pr-1 is the less. Standing at the technology, Pr-4 is the best compensation project, but, this program will bring certain inconvenience for the elements purchasing and after sales service because it needs much more capacitor specifications. Therefore, user should select the proper sequence modes to install, purchase, do after sales service according to need at side.

3) Explanation: Output Sequence

There are two meanings in this User Manual for the out Sequence:

a. Defining Proportional relations between capacitor groups

PNF takes C1 capacitor capacitance as reference capacitance (C1 is define by user). User calculates

others capacitor capacitance value by capacitance proportional relations defined by selected output code mode. If user selects the output code mode as Pr-3, the output loop is 4, C1 capacitor capacitance is 5.0Kvar, then, the capacitance of C1-C4 capacitor group is 5.0Kvar, 10.0Kvar, 20.0Kvar, 20.0Kvar respectively according to proportional relations stipulated by Pr-3. The rest code mode can be got as per the above.

b. Defining Controlling Program of Control Output In order to explain the problem, the switch-on state of capacitor group is shown by "1", the switch-off state of capacitor group is shown by "0", the code output controlling process is explained by Section a assumed Parameter shown as Table 1.

C1	C2	C3	C4	output total capacity
5.0kvar	10.0kvar	20.0kvar	20.0kvar	
1	0	0	0	5.0kvar
0	1	0	0	10.0kvar
1	1	0	0	15.0kvar
0	0	1	0	20.0kvar
1	0	1	0	25.0kvar
0	1	1	0	30.0kvar
1	1	1	0	35.0kvar
0	0	1	1	40.0kvar
1	0	1	1	45.0kvar
0	1	1	1	50.0kvar
1	1	1	1	55.0kvar

14. PNF Switch-On/Off Principle

1) When the capacitor group can not connect automatically, user should take the following condition into account to see whether it is true or not. Note: the following conditions all are necessary conditions, must meet:

a. System power factor value is lower than target power factor value;

b. Alarm indicator does not light.

c. Taking p as the active power of the present electric network, Q as the reactive power of the present electric network, $\cos\phi$ as target power factor, the formula 1 condition must be true:

$$C1 \text{ capacitance} < Q \times P \times \sqrt{\frac{1}{\cos^2 \phi} - 1} \quad (\text{formula 1})$$

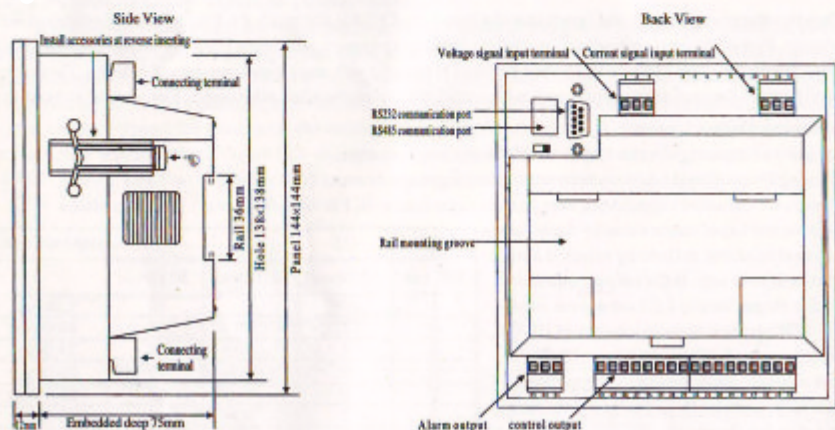
2) When electric network power factor is higher than target power factor; capacitor group cannot auto disconnect, user should take the following condition into account to see whether it is true or not: Taking P as the active power of the present electric network, Q as the reactive power of the present electric network, $\cos\phi$ as target power factor 1, the formula 2 condition must be true:

$$C1 \text{ capacitance} < P \times \sqrt{\frac{1}{\cos^2 \phi} - 1} - Q \quad (\text{formula 2})$$

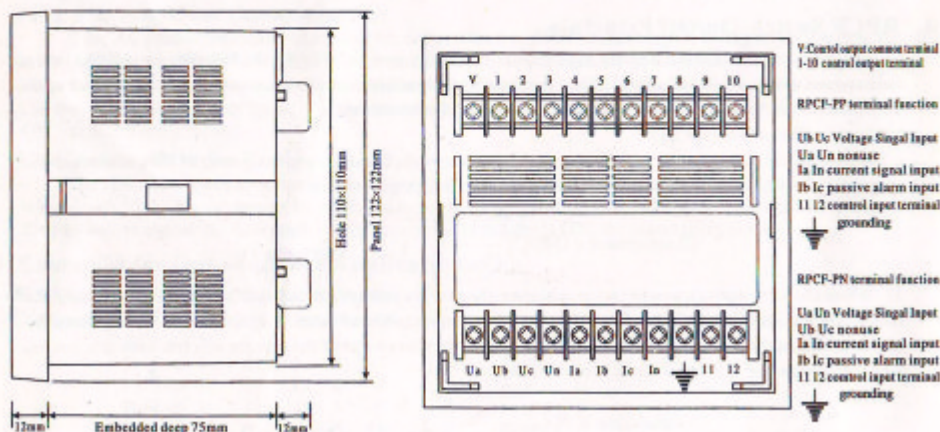
15. Control Parameter Factory Default

- | | |
|---|--|
| 1). Auto/Manual Operating Auto | 2). Power Factor 0.950 ind |
| 3). Switch-on/Off time delay time 10 Sec. | 4). Capacitance discharging time 0Sec. |
| 5). Over-voltage line 420V/(Phase 240V) | 6). Distortion rate 5.0% |
| 7). CT ratio 500/5A | 8). C1 capacitance 10.0 Kvar |
| 9). Output Code Pr-12 | 10). Output Loop Max Loop hardware can support |
| 11). Communication Address 1 | 12). Communication Speed 9600 |

16. PNFX-XX-XX Overall Dimensions and Installation Mode



17. PNFX-XX-XX S Overall Dimensions and Installation Mode



18.Communication Function Test software interface

PNF intelligent power factor controller com test program

Conn Port: COM1 Conn Bds: 9600 Conn Address: 000

Parameter Option:
address: 00
length: 23

Language:
☒ English
☐ Chinese

Display all RPFPC parameter
Display Option:
☐ Hexadecimal ☒ Decimal ☐ binary ☒ By coefficient

Read Write Help

Write RPFPC control parameter list

Auto/Manual		
Target power factor		Ind/cap
Capacitor switch delay		Sec
Capacitor discharge delay		Sec
Over voltage value		V
Over voltage THD		%
Current Transformer		/5A
CI capacitor volume		KVar
Capacitor switch code		
Control output ways		
Communication address		
Communication speed		Bd
Capacitor switch state		NET

Send or receive buffer

conn state:

19.Packaging List

- 19.1 PNF(C) controller one set
- 19.2 Installation accessory 2 purchase
- 19.3 User's Manual 1 copy
- 19.4 CD for Model PNFC controller.