Compact and high efficiency power factor correction unit

The BPF Series devices are power factor correction units that achieve unprecedented high efficiency using the latest semiconductor technology. Because of the high efficiency the heating value of the unit is low, allowing operation even with natural air cooling. There are no restrictions on fan air cooling or heat radiator construction, so it can be used in any applications and conditions.

Furthermore, since the unit contains output from internal auxiliary +12V power source, it does not require special power source in equipment for operation in standby mode. High capacity of 100mA allows to use the unit directly as a drive power source for inverters and other devices.

■ Characteristics
- Output voltage accuracy ±3%
- PowerGood output function
- High efficiency 94%/96% (100V/200V)
- Auxiliary power output (+12V, 100mA)
- High power factor 0.98/0.96(100V/200V)
- Operating temperature -20°C ~ +70°C
- Non-isolated type converter
- Natural air cooling up to +50°C without derating
- Internal overcurrent protection circuit
- Temperature derating required if temperature above +50°C
- Undervoltage protection
- Noise terminal voltage: VCCI CISPR22 ClassB
- ON/OFF control
- RoHS compliant

■ Models and ratings
Table 1

<table>
<thead>
<tr>
<th>Models BPF Series</th>
<th>Power W</th>
<th>Input V Vac</th>
<th>Output V Vdc</th>
<th>Output I A</th>
<th>Efficiency % (typ.)</th>
<th>Power factor (typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPF-360S0R7</td>
<td>250</td>
<td>85~264</td>
<td>360</td>
<td>0.7</td>
<td>94 (100Vin)</td>
<td>0.98 (100Vin)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>96 (200Vin)</td>
<td>0.96 (200Vin)</td>
</tr>
</tbody>
</table>

Note 1: Depending on ambient temperature, temperature derating and forced air cooling may be required.

■ Specifications
Table 2

- Input voltage range *1 AC85~264V
- Rated input voltage AC100/200V
- Rated output voltage DC360V
- Output voltage accuracy ±3%
- Input fluctuation 0.2% typ. (Rated input for input voltage range given in the Table 1)
- Load fluctuation 0.1% typ. (Rated input/output voltage, for load varying from 0 to 100%)
- Ripple noise 11Vp-p typ. (Rated input/output, measurement frequency bandwidth 20MHz)
- Efficiency 94% typ. (input voltage AC100V) 96% typ. (input voltage AC200V), for rated load
- Power factor 0.98 typ. (input current AC100V) 0.95 typ. (input current AC200V)
- Inrush current *2 Up to 11A (input voltage AC100V) up to 26.5A (input voltage AC200V)
- Leakage current Up to 0.25mA (input voltage AC100V) up to 0.5mA (input voltage AC200V)
- Overcurrent protection Yes
- Under voltage lock out Yes
- Output overvoltage protection Yes
- Remote ON/OFF Yes
- P-Good output Yes
- Auxiliary power source output 12V±10%, 100mA
- Noise terminal voltage VCCI CISPR22: ClassB
- Operating temperature range -20°C to +70°C (refer to temperature derating on separate sheet)
- Storage temperature range -40°C ~ +90°C
- Humidity range 20 ~ 95%R.H. (max. wet bulb temperature 69°C without condensation)
- Cooling conditions Natural air cooling
- Weight 200g typ.
- Outer dimensions W=100 L=90 H=38.1 (mm) (Refer to outer dimensions on separate dimension/shape specifications)

*1 The operating range of the power factor correction function is AC85~255V.
*2 Cold start, no external capacitor. Excluding inrush current to input filter.
* The above specifications are provided for rated values, unless otherwise specified.
* The contents of this datasheet may be changed for improvement or other purposes at any time without prior notice.
1. Scope

This specification applies to the BPF series AC output power factor correction module.

2. Models and ratings

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated input voltage</th>
<th>Rated output</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPF-360S0R7</td>
<td>AC 100 / 200V</td>
<td>360V, 0.7A (250W)</td>
</tr>
</tbody>
</table>

Unless otherwise mentioned in the specifications, rated input, rated output and ambient temperature 25°C±5°C are used.

3. Environmental conditions

3-1 Temperature range

- Operating temperature: -20°C ~ +70°C (temperature above 50°C requires derating)
- Storage temperature: -30°C ~ +90°C

3-2 Humidity range

- Operating humidity: 20 ~ 95% R.H. (max. wet bulb temperature 35°C without condensation)
- Storage humidity: 20 ~ 95% R.H. (max. wet bulb temperature 35°C without condensation)

3-3 Air cooling conditions

- Natural air cooling

  Temperature derating exists. See chapter 5. Temperature derating.

3-4 Vibration and shock testing

- Vibration: 5 ~ 10Hz total amplitude 10mm, 10 to 55Hz acceleration 2G (1 hour in each of 3 directions)
- Shock: acceleration 20G (3 times in each of 3 directions)
  shock time 11±5ms
4. Specifications and standards

This product is RoHS compliant.

4-1 Input characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specifications and standards</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage *1</td>
<td>AC 85 ~ 264V (rated 100 / 200V)</td>
<td>Power factor correction operating rage AC 85 ~ 255V</td>
</tr>
<tr>
<td>Input frequency</td>
<td>AC 45 ~ 65Hz (rated 50 / 60Hz)</td>
<td></td>
</tr>
<tr>
<td>Input current</td>
<td>2.7A typ., 1.3Atyp</td>
<td>For input voltage 100V For input voltage 200V</td>
</tr>
<tr>
<td>Power factor</td>
<td>0.98 typ., 0.95 typ.</td>
<td>For input voltage 100V and rated load</td>
</tr>
<tr>
<td>Inrush current *2</td>
<td>11A max., 26.5A max.</td>
<td>For input voltage 100V For input voltage 200V</td>
</tr>
<tr>
<td>Leakage current</td>
<td>0.25mA max., 0.5mA max.</td>
<td>For input voltage 100V For input voltage 200V</td>
</tr>
</tbody>
</table>

*1 Outside the voltage range for power factor correction the module functions as rectifier. The output voltage is obtained from the input voltage by full-wave rectification.

*2 Cold start, no external capacitor. Excluding inrush current to input filter.

Output characteristics and functions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specifications and standards</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated output voltage</td>
<td>360V</td>
<td></td>
</tr>
<tr>
<td>Output voltage setting accuracy</td>
<td>±3%</td>
<td></td>
</tr>
<tr>
<td>Adjustable output voltage range</td>
<td>Fixed</td>
<td></td>
</tr>
<tr>
<td>Output current</td>
<td>0 to 0.7A</td>
<td>For input fluctuation in the range 85~255V</td>
</tr>
<tr>
<td>Input fluctuation</td>
<td>±0.2% typ., ±1% max.</td>
<td>For load fluctuation in the range 0~0.7A</td>
</tr>
<tr>
<td>Load fluctuation</td>
<td>±0.1% typ., ±1% max.</td>
<td>For load fluctuation in the range 0~0.7A</td>
</tr>
<tr>
<td>Temperature fluctuation</td>
<td>±0.3% typ., ±2% max.</td>
<td>For temperature fluctuation in the range -20~+50°C</td>
</tr>
<tr>
<td>Ripple noise</td>
<td>11Vp-p max., 20Vp-p max.</td>
<td>BW = 20MHz</td>
</tr>
<tr>
<td>Efficiency</td>
<td>94% typ., 96% typ.</td>
<td>For input voltage 100V and rated output</td>
</tr>
<tr>
<td>Overcurrent protection</td>
<td>Operates at 105% or higher</td>
<td>Constant power control, voltage drooping type</td>
</tr>
<tr>
<td>Under voltage lock out</td>
<td>Yes, Activation voltage: AC75V typ.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deactivation voltage: AC65V typ.</td>
<td></td>
</tr>
</tbody>
</table>
## Parameter Specifications and standards

### ON/OFF control
- Yes
- CN3 ON/OFF terminal
- Photo coupler input (20mA max)
- Current flows: OFF
- Open: ON
- With reference to CN3 SGND terminal

### P-Good output
- CN3: between PG–SGND terminals
- Open collector output (30V max, 10mA max)
- Normal output: closed (0.4V max)
- Output low: open
- Closes 200ms after the output voltage reaches 320V or higher.
- Open when output voltage lowers to 260V or lower

### Output overvoltage protection
- Yes
- Switching stop, automatic restoration
- Operating threshold: 410V typ.

### Instantaneous power failure time *3
- 20ms: output voltage 260V min.
- For rated input

### Start-up time
- 400 ms typ, 1s max
- For input voltage 100V

### Auxiliary power source output
- 12V±10%, 100mA
- Ripple noise: 200mVp-p typ, 500mVp-p max

### Maximum load capacitance
- 230 µF
- For input voltage 240V

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*1 Measured using measurement circuit in the chapter 4-2.

*2 Unless otherwise mentioned, measured at rated input, rated output and ambient temperature 25°C±5°C.

*3 Without external capacitor. For 0.7A (CC mode) load.

### 4-2 Measurement circuit

![Measurement Circuit Diagram](image-url)
5. Temperature derating

5-1 Derating curve

Natural air cooling

Output power [W]

<table>
<thead>
<tr>
<th>Output power [W]</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature [°C]</td>
<td>-20</td>
<td>-10</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

- 100Vin
- 200Vin

5-2 Grounding direction

*Please consult about other installation directions.*
6. Outer dimensions and terminals
6-1 Shape and dimensions

Units: mm
Unspecified dimensional tolerances: ±0.5
6-2 Description of terminals

1) Power supply input connector CN1 (B3P5-VH: made by J.S.T. Connector)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC(L)</td>
<td>AC power supply terminal</td>
</tr>
<tr>
<td>3</td>
<td>AC(N)</td>
<td>AC power supply terminal</td>
</tr>
<tr>
<td>5</td>
<td>FG</td>
<td>Frame ground terminal</td>
</tr>
</tbody>
</table>

2) Output connector CN2 (B3P-VH: made by J.S.T. Connector)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VOUT</td>
<td>Output terminal.</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>Not connected. Do not connect it electrically.</td>
</tr>
<tr>
<td>3</td>
<td>PGND</td>
<td>Output reference terminal.</td>
</tr>
</tbody>
</table>

3) Control connector CN3 (B4B-XH-A: made by J.S.T. Connector)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VAUX</td>
<td>+12V auxiliary power supply output terminal</td>
</tr>
<tr>
<td>2</td>
<td>ON/OFF</td>
<td>Remote ON/OFF control input terminal</td>
</tr>
<tr>
<td>3</td>
<td>PG</td>
<td>P-Good output</td>
</tr>
<tr>
<td>4</td>
<td>SGND</td>
<td>GND for VAUX output. Connected to PGND internally.</td>
</tr>
</tbody>
</table>

6-3 Lot No indication

1) 4 digits indication following the example of production lot number (3 digits for the first lot of the month).

Example:

1. Number of lot of this month (1st=no, 2nd=2, 3, 4)
2. Month of manufacture (Jan-Sep, Oct=O, Nov=N, Dec=D)
3. Year of manufacture (2 lower digits)
7. Various functions

7-1 Capacitance of external output capacitor

Output holding time can be extended by connecting external output capacitor. Capacitance of the capacitor can be calculated using the following expression.

\[ t = \frac{1}{2} \left( C_1 + C_2 \right) \times \left( V_1^2 - V_2^2 \right) / P_{out} \]

- \( t \): Holding time at instantaneous failure (sec.)
- \( V_1 \): Output voltage=360V (V)
- \( V_2 \): Minimal held voltage at instantaneous failure (V)
- \( C_1 \): Capacitance of internal capacitor=270uF (F)
- \( C_2 \): Capacitance of external capacitor (F)
- \( P_{out} \): Actual load power (W)

*Select the capacitance of the external capacitor within the range of the maximum load capacitance. Note that connecting the external capacitor increases the inrush current.

7-2 ON/OFF control

This function allows turning the power factor correction ON and OFF. ON/OFF control of the standby power is not supported. Setting the ON/OFF terminal (CN3 Pin 2) High or Low (relatively to SGND terminal (CN3 3Pin)) it is possible to turn the power factor correction function ON or OFF. By combining with the auxiliary power supply, it is possible to perform ON/OFF control by opening and closing the circuit.

Although the switching operation is stopped when the output is OFF, voltage of approximately 1.41 x input voltage is generated on output terminal through diode rectification.

Avoid chattering on ON/OFF terminal. The chattering may cause malfunction of internal circuits.

The terminal is connected internally to the light-emitting side (diode) of a photo coupler. (20mA max)

When the ON/OFF control is not used, leave the ON/OFF terminal open or connect it to SGND.

---

**Internal connection**  **External connection**

- VAUX
- 2.2kΩ
- ON/OFF
- SGND
- SW1

Fig.a Example of connection circuit when the ON/OFF control is used.

SW1 closed: ON, open: OFF
Compact and high efficiency power factor correction unit

Bellnix® BPF Series

7-3 Under voltage lock out
The unit is equipped with under voltage lock out (UVLO) function preventing malfunction when input voltage is low. When input voltage reaches the operation start voltage (75V typ), the unit starts switching operation. If the input voltage falls to operation stop voltage (65V typ), the switching operation is stopped.

7-4 Output overvoltage protection
When the output voltage exceeds the threshold of the output overvoltage protection function, the unit stops switching operation. However, the function does not activate if overvoltage is caused by damaged unit.

7-5 Overcurrent protection
When output current exceeds the threshold of the overcurrent protection and the overcurrent condition occurs, the output power is limited by lowering the output voltage. When the overcurrent condition is canceled, the output voltage will be restored automatically.

7-6 P-Good output
When the output voltage reaches 320V (typ.), terminals P-Good and SGND close after 200 ms (typ.) (low impedance), and open (high impedance) when the output voltage reaches 260V typ.
Even if the ON/OFF control is turned OFF, the P-Good output functions when the output voltage exceeds the threshold value.
The output is open collector output of internal photo coupler. (Applicable voltage: 30V max.)
When the P-Good output is not used, leave the PG terminal open or connect it to SGND.

8. Expected life
The expected life is given in the following table.

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Average load factor</th>
<th>Expected life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 40°C</td>
<td>80%</td>
<td>7 years</td>
</tr>
</tbody>
</table>

(For input voltage 100V)
9. Precautions for use

To ensure user's safety, check specifications before using the product and always observe the following precautions when using it:

- The product is intended for use in general electronics equipment (office equipment, communication equipment, measurement equipment). Do not use the product in medical equipment, nuclear equipment, trains, and other areas, where human life or property may be directly affected by damaged product, or in the environment with constant vibration. For any use other than in general electronics equipment please consult the manufacturer.
- High voltage is generated on the output of this product. Do not touch the output terminal in energized state or within 60 seconds after disconnecting the input.
- Mount the product by fixing it with screws.
- While the product has a built-in overcurrent protection circuit, a prolonged short circuit condition should be avoided as it can damage the product.
- A power thermistor is used in this product to limit the inrush current. Do not connect and disconnect input repeatedly.
- The product may be damaged if used under nonstandard electrical or environmental conditions including temperature, etc. The product must be always used within specifications.
- Avoid storing or using the product in places where corrosive gas or dust are generated.
- The product may be damaged by static electricity. Take measures against static electricity in the working environment, such as using grounding straps to discharge the static charge on workers, etc.
- The product does not come with a test report.

10. Warranty

The warranty period of this product is one year. Should the product become defective within the warranty period due defects in design or manufacture, it will be repaired or replaced free of charge. However, this warranty does not cover products which have been subjected to internal modifications, etc.

The scope of the warranty is limited to this product only.