

STEP-PS/1AC/24DC/4.2

Primary-switched power supply for building automation



1 Description

STEP POWER power supply units – for building automation

The new STEP POWER generation of compact power supply units is particularly suitable for installation distributors and flat control panels thanks to its design. The power supply units are available with 24 V DC output voltage in four performance classes and widths and with the special voltages 5, 12, 15 and 48 V DC. Their high degree of efficiency and the low standby losses make for high power efficiency.

Features

- Easy assembly on the DIN rail or panel
- Maximum energy efficiency thanks to low idling losses
- Quick startup with LED function monitoring
- High operating safety due to long mains buffering under full load and high MTBF (> 500,000 h)
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package
- Wide temperature range of -25°C to +70°C
- Parallel connection possible for increased performance and redundancy



DANGER OF EXPLOSION!

Only remove equipment when it is disconnected and not in the potentially explosive area.



DANGER

The device contains dangerous live elements and high levels of stored energy. Never carry out work when the power is turned on.

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3 Ordering data

| Description | Type | Order No. | Pcs. / Pkt. |
|---|----------------------|-----------|-------------|
| DIN rail power supply unit 24 V DC/4.2 A, primary switched-mode, 1-phase. | STEP-PS/1AC/24DC/4.2 | 2868664 | 1 |

4 Technical data

| Input data | |
|--|--|
| Input nominal voltage range | 100 V AC ... 240 V AC |
| AC input voltage range | 85 V AC ... 264 V AC |
| DC input voltage range | 95 V DC ... 250 V DC |
| AC frequency range | 45 Hz ... 65 Hz |
| DC frequency range | 0 Hz |
| Current consumption | Approx. 1.3 A (120 V AC) Approx. 0.8 A (230 V AC) |
| Inrush current limitation | < 15 A (typical) |
| I^2t | < 1 A ² s |
| Power failure bypass | > 20 ms (120 V AC) > 100 ms (230 V AC) |
| Typical response time | < 0.5 s |
| Protective circuitry | Transient surge protection Varistor |
| Input fuse, integrated | 4 A (slow-blow, internal) |
| Recommended backup fuse for mains protection | 6 A 10 A 16 A (characteristic B) |
| Output data | |
| Nominal output voltage | 24 V DC \pm 1% |
| Setting range of the output voltage | 22.5 V DC ... 29.5 V DC (> 24 V constant capacity) |
| Output current | 4.2 A (-25°C ... 70°C) 4.4 A (-25°C ... 40°C permanent) 6.5 A (maximum output current) |
| Derating | Above +55°C: 2.5% per Kelvin |
| Control deviation | < 1 % (change in load, static 10% ... 90%) < 2 % (change in load, dynamic 10% ... 90%) < 0.1 % (change in input voltage \pm 10%) |
| Power loss nominal load max. | 13.2 W |
| Maximum power dissipation idling | 0.7 W |
| Efficiency | > 88 % (for 230 V AC and nominal values) |
| Ascent time | < 0.5 s (U_{OUT} (10% ... 90%)) |
| Residual ripple | < 25 mV _{PP} (with nominal values) |
| Peak switching voltages | < 25 mV _{PP} (with nominal values) |
| Connection in parallel | Yes, for redundancy and increased capacity |
| Connection in series | Yes |
| Surge protection against internal surge voltages | Yes, limited to approx. 35 V DC |
| Resistance to reverse feed | max. 35 V DC |
| LED status indicator | |
| Status display | "DC OK" LED green / U_{OUT} > 21.5 V: LED lights up |

General data

| | |
|--|---|
| Insulation voltage input/output | 4 kV AC (type test) 2 kV AC (routine test) |
| Degree of protection | IP20 |
| Class of protection | II |
| MTBF | > 500 000 h in acc. with IEC 61709 (SN 29500) |
| Dimensions W / H / D (state of delivery) | 90 mm / 90 mm / 61 mm |
| Weight | 0.4 kg |

Ambient conditions

| | |
|--|---|
| Ambient temperature (operation) | -25 °C ... 70 °C (> 55° C derating) |
| Ambient temperature (storage/transport) | -40 °C ... 85 °C |
| Max. permissible relative humidity (operation) | 95 % (at 25 °C, no condensation) |
| Vibration (operation) | < 15 Hz, amplitude ± 2.5 mm in acc. with IEC 60068-2-6 15 Hz ... 150 Hz, 2.3g, 90 min. |
| Shock | 30g in all directions in acc. with IEC 60068-2-27 |
| Pollution degree in acc. with EN 50178 | 2 |
| Climatic class | 3K3 (in acc. with EN 60721) |

Standards

| | |
|--|---------------------------------------|
| Electrical Equipment for Machinery | EN 60204 |
| Safety transformers for power supply units | IEC 61558-2-17 |
| Electrical safety (of information technology equipment) | IEC 60950/VDE 0805 (SELV) |
| Electronic equipment for use in electrical power installations | EN 50178/VDE 0160 (PELV) |
| SELV | IEC 60950 (SELV) and EN 60204 (PELV) |
| Safe isolation | DIN VDE 0100-410 DIN VDE 0106-1010 |
| Protection against electric shock | DIN 57100-410 |
| Protection against electric shock, basic requirements for safe isolation in electrical equipment | DIN VDE 0106-101 |
| Limitation of mains harmonic currents | EN 61000-3-2 |
| Certificate | CB Scheme |

Approvals

| | |
|--------------|--|
| UL approvals | UL/C-UL listed UL 508 UL/C-UL Recognized UL 60950 |
| Shipbuilding | Germanischer Lloyd |

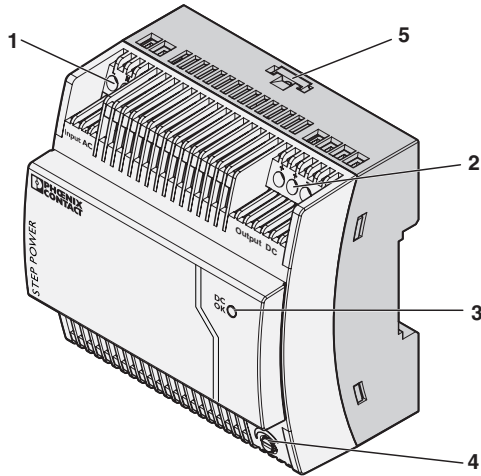
Conformance with EMC guideline 2004/108/EC and for low-voltage guideline 2006/95/EC**Noise immunity according to EN 61000-6-2**

| | | |
|-----------------------------|-------------------|--|
| Electrostatic discharge | EN 61000-4-2 | |
| | Housing | Level 3 |
| | Contact discharge | ± 6 kV (Contact discharge) |
| | Discharge in air | ± 8 kV (Air discharge) |
| | Comments | Criterion B |
| Electromagnetic HF field | EN 61000-4-3 | |
| | Housing | Level 4 |
| | Frequency range | 80 MHz ... 3000 MHz |
| | Field intensity | 10 V/m |
| | Comments | Criterion A |
| Fast transients (burst) | EN 61000-4-4 | |
| | Input | 4 kV (level 4 - asymmetrical) |
| | Output | 2 kV (Level 3 - asymmetrical) |
| | Comments | Criterion B |
| Surge current loads (surge) | EN 61000-4-5 | |
| | Input | 4 kV (asymmetrical: Conductor to ground) 2 kV (symmetrical: Conductor to conductor) |
| | Output | 2 kV (level 3 - asymmetrical: conductor to ground) 1 kV (Level 3 - symmetrical: Conductor to conductor) |
| | Comments | Criterion B |
| Conducted interference | EN 61000-4-6 | |
| | Input/output | Level 3 - asymmetrical |
| | Frequency range | 10 kHz ... 80 MHz |
| | Voltage | 10 V |
| | Comments | Criterion A |
| Voltage dips | EN 61000-4-11 | |
| | Input | (mains buffering > 20 ms) |
| | Comments | Criterion A |

Emitted interference in acc. with EN 61000-6-3

| | |
|--|---|
| Radio interference voltage in acc. with EN 55011 | EN 55011 (EN 55022) class B used in industry and residential area / EMC 1 |
| Emitted radio interference in acc. with EN 55011 | EN 55011 (EN 55022) class B used in industry and residential area / EMC 1 |

5 Structure



- 1 AC input
- 2 DC output
- 3 "DC OK" LED
- 4 Potentiometer 22.5 V DC ... 29.5 V DC
- 5 Universal snap-on foot for EN DIN rails and for wall mounting

| | [mm ²] | | AWG | [Nm] Torque |
|--------|--------------------|-----------|---------|----------------|
| | solid | stranded | | |
| Input | 0.2 - 2.5 | 0.2 - 2.5 | 24 - 12 | 0.6 - 0.8 |
| Output | 0.2 - 2.5 | 0.2 - 2.5 | 24 - 12 | 0.6 - 0.8 |

Input data

| | |
|--|--|
| Input nominal voltage range | 100 V AC ... 240 V AC |
| AC input voltage range | 85 V AC ... 264 V AC |
| DC input voltage range | 95 V DC ... 250 V DC |
| AC frequency range | 45 Hz ... 65 Hz |
| DC frequency range | 0 Hz |
| Input fuse, integrated | 4 A (slow-blow, internal) |
| Recommended backup fuse for mains protection | 6 A 10 A 16 A (characteristic B) |

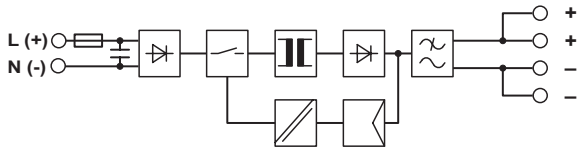
| | |
|--------------------|------------------|
| Type of connection | Screw connection |
| Stripping length | 6.5 mm |

Output data

| | |
|-------------------------------------|--|
| Nominal output voltage | 24 V DC \pm 1% |
| Setting range of the output voltage | 22.5 V DC ... 29.5 V DC (> 24 V constant capacity) |
| Output current | 4.2 A (-25°C ... 70°C) 4.4 A (-25°C ... 40°C permanent) 6.5 A (maximum output current) |

| | |
|--------------------|------------------|
| Type of connection | Screw connection |
| Stripping length | 6.5 mm |

6 Block diagram



7 Safety notes



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Only remove equipment when it is disconnected and not in the potentially explosive area.

DANGER

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Never carry out work when the power is turned on.



WARNING

Before startup please ensure:

The mains connection has been carried out by a competent person and protection against electric shock is guaranteed!

The device can be disconnected outside the power supply unit in accordance with the regulations as in EN 60950 (e.g. through primary side line protection)!

All feed lines are sufficiently protected and dimensioned!

All output lines are dimensioned according to the maximum output current of the device or separately protected!

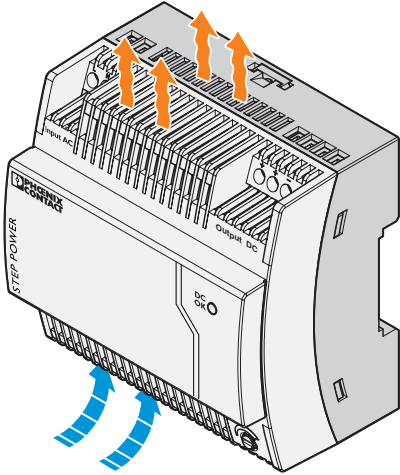
Sufficient convection is guaranteed!



CAUTION

The power supply units are built-in devices. The device may only be installed and put into operation by qualified personnel. The corresponding national regulations must be observed.

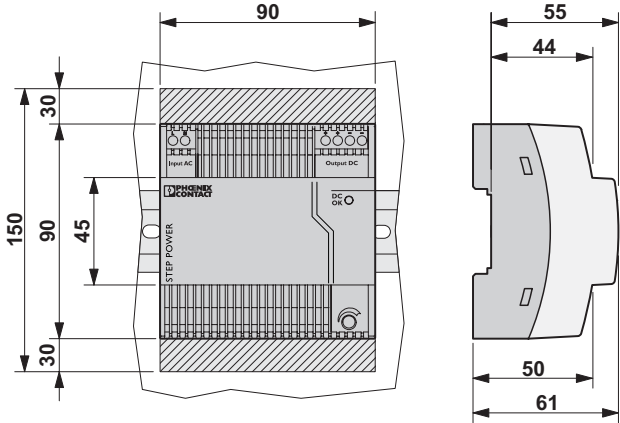
8 Installation



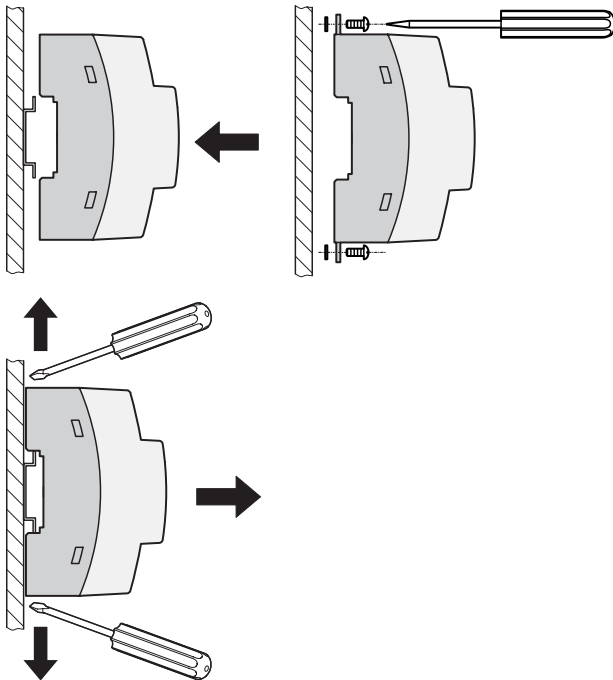
! ATTENTION
In order to ensure sufficient convection, we recommend a minimum vertical distance of 30 mm to the other devices.

i The power supply can be snapped onto all DIN rails in accordance with EN 60715. Wall mounting is also possible. The device must be mounted horizontally (connection terminal blocks on top).

9 Installation position



10 Mounting on DIN rails



Assembly

To mount on an EN DIN rail, snap the device straight onto the DIN rail.

If the power supply unit is to be fastened directly onto an even surface, press the orange base latch upward and down.

Place a washer between the pulled-out base latch and the even surface (max. outer diameter 8.5 mm, max. thickness 1.3 mm, e.g., spring washer for M4 in acc. with DIN 127-B or toothed lock washer in acc. with DIN 6797).

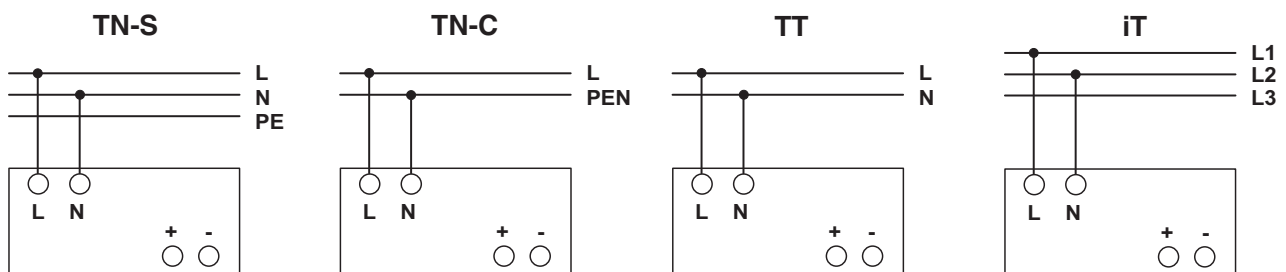
Then fasten the device with two screws (max. thread diameter 4 mm, max. head diameter 8.5 mm).

Removing

To dismantle from the EN DIN rail, press the orange base latch outward and pull the device off of the DIN rail.

In the case of wall mounting, loosen the screws and press the base latch inwards again.

11 Connection to various systems



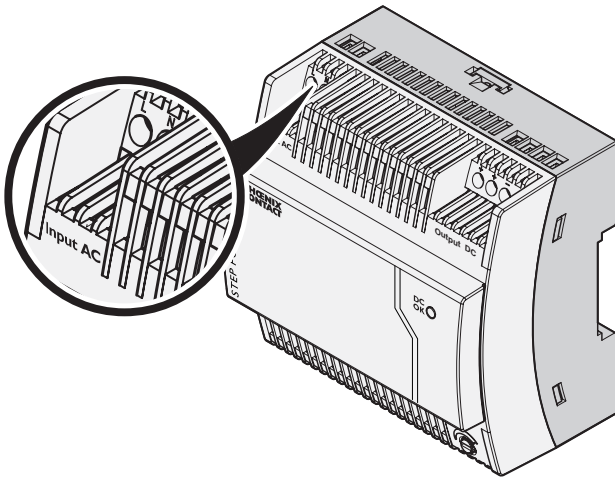
The 100 V AC ... 240 V AC connection is made using the L and N screw connections.

The device can be connected to 1-phase AC networks or to two of the phase conductors of three-phase systems (TN, TT or IT networks in acc. with VDE 0100-300/IEC 60364-3) with nominal voltages of 100 V AC ...240 V AC.



For operation on two of the phase conductors of a three-phase system, an isolating facility for all poles must be provided.

12 Input



CAUTION

If an internal fuse is triggered, there is most probably a malfunction in the device. In this case, the device must be inspected in the factory!

Protection of the primary side

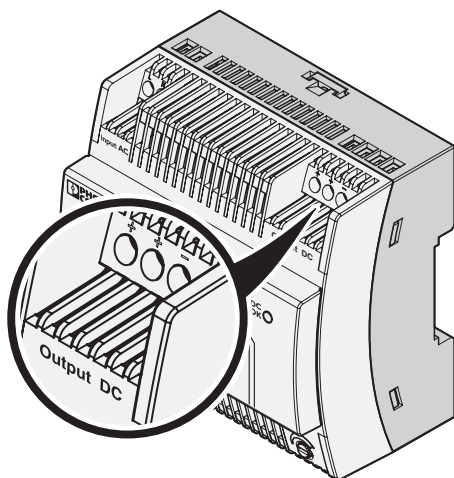
The device must be installed in acc. with the regulations as in EN 60950. It must be possible to disconnect the device using a suitable isolating facility outside the power supply.

The primary side line protection, for example, is suitable. For device protection, there is an internal fuse. Additional device protection is not necessary.

Recommended backup fuse for mains protection

Power circuit-breaker 6 A, 10 A or 16 A, characteristic B (or identical function). Connect a suitable fuse upstream for DC applications!

13 Output



CAUTION

Make sure that all output lines are dimensioned according to the maximum output current or are separately protected. The cables on the secondary side must have sufficiently large cross sections in order to keep the voltage drops on the lines as low as possible.

The connection is made using the "+" and "-" screw connections on the screw connection of the DC output. At the time of delivery, the output voltage is 24 V DC. The output voltage can be set on the potentiometer.

Protection of the secondary side

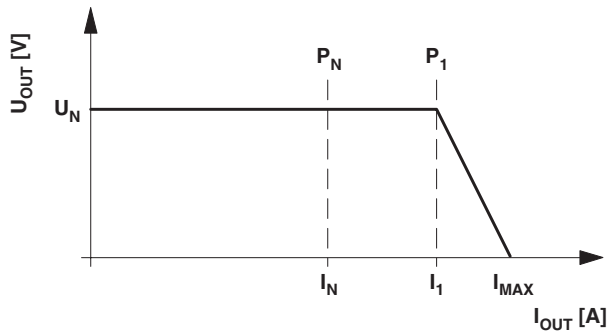
The device is electronically protected against short circuit and idling. In the event of a malfunction, the output voltage is limited to 35 V DC.

14 Signaling

The "DC OK" LED enables evaluation of the function of the power supply directly on site.

| | State 1 | State 2 |
|-------------|--------------------------------------|--|
| "DC OK" LED | ON | OFF |
| Cause | Output voltage > 21.5 V | Output voltage < 21,5 V or no voltage at the output |
| Meaning | Output voltage and output current OK | The device is in operation, but there is a fault in the consumer, the current consumption is greater than I_1 or the output is short circuited. The device is out of operation because there is no mains voltage, the fuse on the primary side has been triggered, or the device is faulty. |

15 Function



Output characteristic curve

The power supply works with a power reserve as shown in the U/I characteristic curve in the figure. At ambient temperatures $T_{AMB} < +40^\circ\text{C}$, I_1 is available continuously. At higher temperatures, it's available for a few minutes. In the event of a secondary-side short circuit or overload, the output current is limited to I_{MAX} . Thereby, the module does not switch off, but rather supplies a continuous output current. The secondary voltage is reduced here until the short circuit is eliminated. The U/I characteristic curve with the power reserve ensures that both high inrush currents of capacitive loads as well as consumers with DC/DC converters in the primary circuit can be supplied.

$$U_N = 24 \text{ V}$$

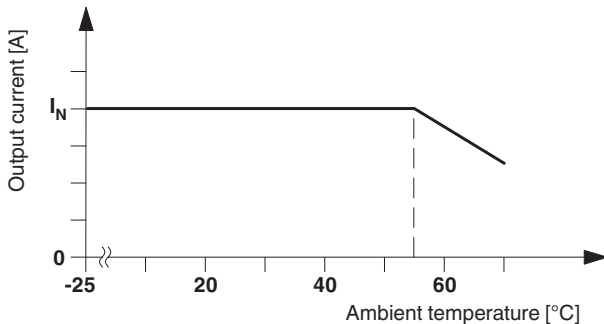
$$I_N = 4.2 \text{ A}$$

$$P_N = 100 \text{ W}$$

$$I_1 = 4.4 \text{ A}$$

$$P_1 = 105.6 \text{ W}$$

$$I_{MAX} = 6.5 \text{ A (} U_{OUT} = 0 \text{ V)}$$

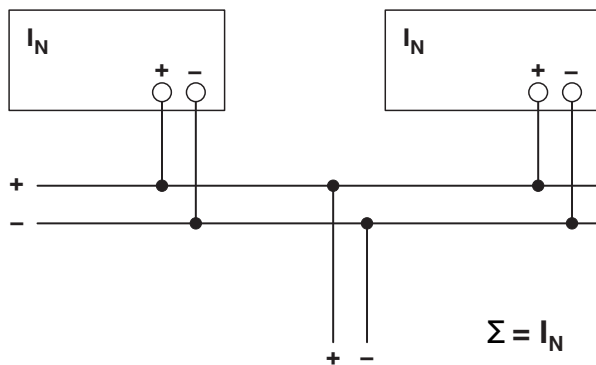


Thermal behavior

With an ambient temperature of up to +55°C, the device supplies the continuous output current of I_N . In the case of ambient temperatures above +55°C, the output current must be reduced by 2.5% per Kelvin increase in temperature. The device does not switch off at ambient temperatures of +70°C or thermal overload. The output capacity is reduced as far as necessary to provide device protection. After it has cooled down, the output capacity is increased again.

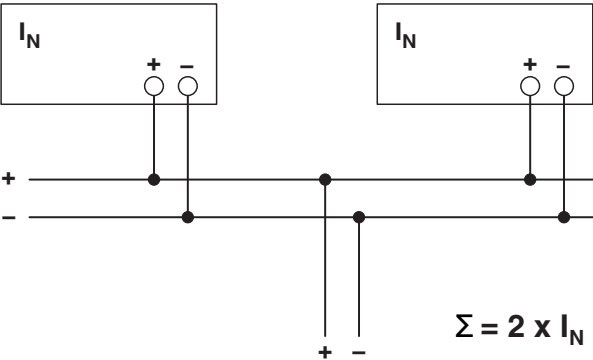
Parallel operation

Devices of the same type can be connected in parallel to enable both redundancy and an increase in efficiency. On default upon delivery, a further adjustment is not needed. If the output voltage is adjusted, a uniform distribution of power is guaranteed by setting all parallel operated power supply units to exactly the same output voltage. To ensure symmetrical current distribution we recommend that all cable connections from the power supply unit to the busbar are the same length and have the same cross-section! Depending on the system, for parallel connection of more than two power supply units a protective circuit should be installed at each individual device output (e.g. decoupling diode, DC fuse or power circuit breaker). This prevents high return currents in the event of a secondary device fault.



Redundant operation

Redundant circuits are suitable for the supply of systems which make especially high requirements on the operational safety. If a fault occurs in the primary circuit of the first power supply unit, the second device automatically takes over the entire power supply, without interruption, and vice versa. For this reason, the power supply units to be connected in parallel are dimensioned in such a way that the total current requirement of all consumers can be completely covered by one power supply unit. 100% redundancy makes external decoupling diodes necessary (QUINT-DIODE/40, Order No. 2938963)!



Increased performance

For n parallel connected devices, the output current can be increased to $n \times I_N$. Parallel connection to increase efficiency is used for the expansion of existing systems. It is advisable to use parallel connection if the power supply unit does not cover the current requirement of the most powerful consumer. Otherwise the consumers should be spread among individual devices independent of one another. A maximum of five devices can be connected in parallel!