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# TRIO-PS/1AC/24DC/2.5



## Primary switched power supply, 1-phase, output current: 2.5 A

## INTERFACE

Data Sheet
102776_en_03

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## 1 Description

TRIO POWER is the DIN-rail-mountable power supply unit with basic functions. With an output voltage of 12 V DC, 24 V DC and 48 V DC and 1- and 3-phase versions with 60 W or 960 W, it is particularly suited for use in series production in mechanical engineering. The wide-range input and international certification package allows worldwide implementation.
The high MTBF of 500,000 h stands for high supply reliability. The devices can be connected in parallel to increase the capacity and redundancy.
The clear LED signaling and the device connection with double terminal block for plus and minus for fast potential distribution are further advantages of this device series. A third terminal block simplifies the grounding on the secondary side. All power supply units are idle proof and short circuit proof and provide a regulated and adjustable output voltage.

**Features**

- Reliable power supply unit even at high ambient temperatures
- No load and short circuiting resistance
- High dielectric strength
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package

**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.

Make sure you always use the the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.

A conversion table is available on the Internet at
www.download.phoenixcontact.com/general/7000_en_00.pdf.

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# 3 Ordering data

| Description | Type | Order No. | Pcs. Pkt. |
|---|---|---|---|
| Primary switched power supply, 1-phase, output current: 2.5 A | TRIO-PS/1AC/24DC/2.5 | 2866268 | 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 |
| AC frequency range | 45 Hz ... 65 Hz |
| Current consumption | 0.95 A (120 V AC)<br>0.5 A (230 V AC) |
| Inrush current limitation | < 15 A |
| $I^2t$ | 0.5 $A^2s$ |
| Power failure bypass | > 20 ms (120 V AC)<br>> 100 ms (230 V AC) |
| Typical response time | < 1 s |
| Power factor (cos phi) | 0.72 |
| Protective circuitry | Transient surge protection Varistor |
| Input fuse, integrated | 2 A (slow-blow, internal) |
| Recommended backup fuse for mains protection | 6 A<br>10 A<br>16 A (characteristic B) |
| Discharge current to PE | < 3.5 mA |
| **Output data** | |
| Nominal output voltage | 24 V DC ±1% |
| Setting range of the output voltage | 22.5 V DC ... 29.5 V DC |
| Output current | 2.5 A (-25°C ... 70°C) |
| Derating | Above +55°C: 2.5% per Kelvin |
| Current limitation | Approx. 5 A (for short circuit) |
| Max. capacitive load | Unlimited |
| Control deviation | < 1 % (change in load, static 10% ... 90%)<br>< 2 % (change in load, dynamic 10% ... 90%)<br>< 0.1 % (change in input voltage ±10%) |
| Power loss nominal load max. | 11 W |
| Maximum power dissipation idling | 0.9 W |
| Efficiency | > 85 % |
| Ascent time | < 2 ms ($U_{OUT}$ (10% ... 90%)) |
| Residual ripple | < 30 $mV_{PP}$ |
| Peak switching voltages | < 20 $mV_{PP}$ |
| Connection in parallel | Yes, for redundancy and increased capacity |
| Connection in series | No |
| Surge protection against internal surge voltages | Yes, < 35 V DC |
| Resistance to reverse feed | 35 V DC |
| **Signal output DC OK active** | |
| 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)<br>2 kV AC (routine test) |
| Insulation voltage input / PE | 2 kV AC (type test)<br>2 kV AC (routine test) |
| Insulation voltage output / PE | 500 V DC (type test) |
| Degree of protection | IP20 |
| Class of protection | I, with PE connection |
| MTBF | > 500 000 h in acc. with IEC 61709 (SN 29500) |
| Type of housing | Steel sheet, zinc-plated |
| Side element version | Aluminum |
| Dimensions W / H / D (state of delivery) | 32 mm / 130 mm / 115 mm |
| Weight | 0.5 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<br>15 Hz ... 150 Hz, 2.3g, 90 min. |
| Shock | 15g 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) |

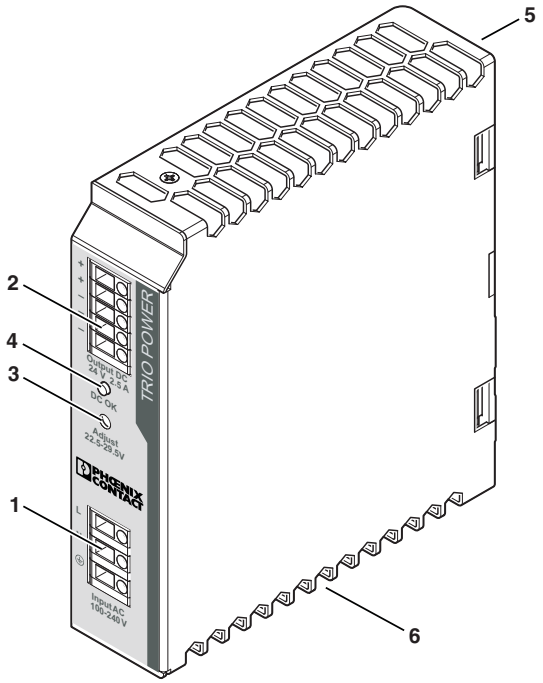
| Standards | |
|---|---|
| Electrical Equipment for Machinery | EN 60204 / Surge voltage category III |
| Safety transformers for power supply units | EN 61558-2-17 |
| Electrical safety (of information technology equipment) | EN 60950/VDE 0805 (SELV)<br>EN 61558-2-17 |
| Shipbuilding | Germanischer Lloyd |
| Electronic equipment for use in electrical power installations | EN 50178/VDE 0160 (PELV) |
| SELV | EN 60950 (SELV)<br>EN 60204 (PELV) |
| Safe isolation | DIN VDE 0100-410<br>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 |

| Approvals | |
|---|---|
| UL approvals | UL/C-UL listed UL 508<br>UL/C-UL Recognized UL 60950 |

| Conformance with EMC directive 89/336/EEC | | |
|---|---|---|
| **Noise immunity according to EN 61000-6-2** | | |
| Electrostatic discharge | EN 61000-4-2 | |
| | Housing | Level 3 |
| | Contact discharge | 8 kV |
| | Discharge in air | 8 kV |
| | Comments | Criterion B |
| Electromagnetic HF field | EN 61000-4-3 | |
| | Housing | Level 3 |
| | Frequency range | 80 MHz ... 3 GHz |
| | Field intensity | 10 V/m |
| | Comments | Criterion A |
| Fast transients (burst) | EN 61000-4-4 | |
| | Input | 4 kV (level 4 - asymmetrical: conductor to ground) |
| | Output | 2 kV (level 3 - asymmetrical: conductor to ground) |
| | Comments | Criterion B |
| Surge current loads (surge) | EN 61000-4-5 | |
| | Input | 4 kV (level 4 - asymmetrical: conductor to ground)<br>2 kV (level 4 - symmetrical: conductor to conductor) |
| | Output | 1 kV (Level 3 - symmetrical: Conductor to conductor)<br>2 kV (level 3 - asymmetrical: conductor to ground) |
| | 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 > 10 ms) |
| | Comments | Criterion B |

| Emitted interference in acc. with EN 61000-6-3 | |
|---|---|
| Radio interference voltage in acc. with EN 55011 | EN 55011 (EN 55022) Class B, area of application: Industry and residential |
| Emitted radio interference in acc. with EN 55011 | EN 55011 (EN 55022) Class B, area of application: Industry and residential |

## 5 Structure



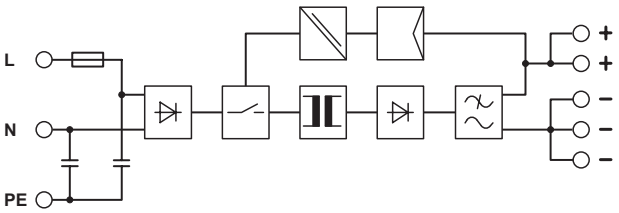

**1** AC input
**2** DC output
**3** Potentiometer 22.5 V DC ... 29.5 V DC
**4** "DC OK" LED
**5** DIN rail adapter
**6** Take-up for cable binders

| | [mm²] | | AWG | [Nm] |
|---|---|---|---|---|
| | solid | stranded | | Torque |
| Input | 0.2 - 2.5 | 0.2 - 2.5 | 24 - 14 | 0.4 - 0.5 |
| Output | 0.2 - 2.5 | 0.2 - 2.5 | 24 - 14 | 0.4 - 0.5 |

| **Input data** | |
|---|---|
| Input nominal voltage range | 100 V AC ... 240 V AC |
| AC input voltage range | 85 V AC ... 264 V AC (derating < 90 V AC: 2.5% per Kelvin) |
| AC frequency range | 45 Hz ... 65 Hz |
| Input fuse, integrated | 2 A (slow-blow, internal) |
| Recommended backup fuse for mains protection | 6 A<br>10 A<br>16 A (characteristic B) |
| Type of connection | Screw connection |
| Stripping length | 9 mm |

| **Output data** | |
|---|---|
| Nominal output voltage | 24 V DC ±1% |
| Setting range of the output voltage | 22.5 V DC ... 29.5 V DC |
| Output current | 2.5 A (-25°C ... 70°C) |
| Type of connection | Screw connection |
| Stripping length | 9 mm |

## 6 Block diagram




## 7 Safety and warning notes

**DANGER OF EXPLOSION!**

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

**DANGER**

Components with dangerously high voltage and high stored energy are located in the device!
Never carry out work on live parts!
Depending on the ambient temperature and the load, the housing can become very hot!

**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)!

The ground conductor is connected!

All feed lines are sufficiently protected and dimensioned!

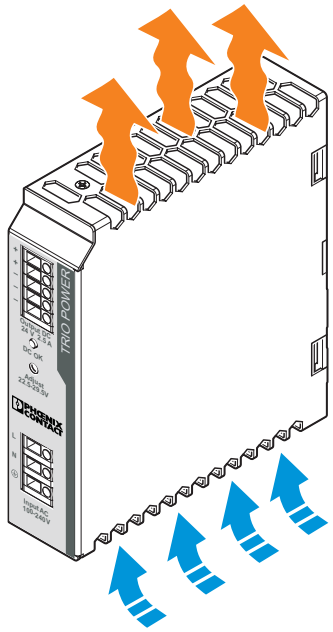
All output lines are dimensioned according to the maximum output current of the device or separately protected!

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

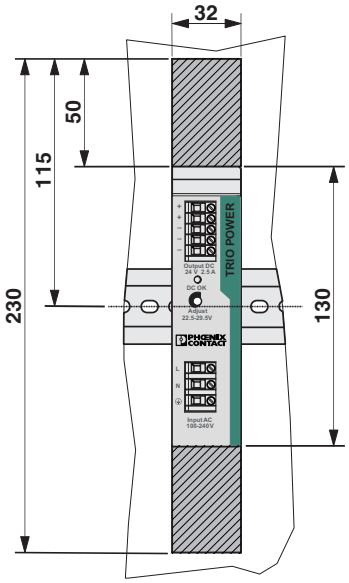


**ATTENTION**

In order to guarantee sufficient convection, we recommend observing the following minimum distance to other modules: 5 cm in a vertical direction and 0 cm in a horizontal direction.

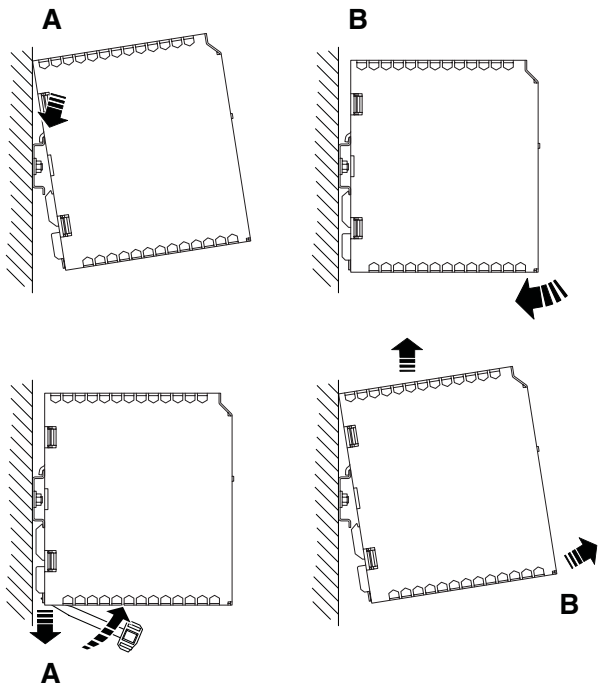
The power supply unit can be snapped onto all DIN rails in acc. with EN 60715. They must be mounted horizontally (connecting terminal blocks top and bottom).

## 9 Installation position




Mounting position: Installation depth 115 mm (+ DIN rail)

## 10 Mounting on DIN rails



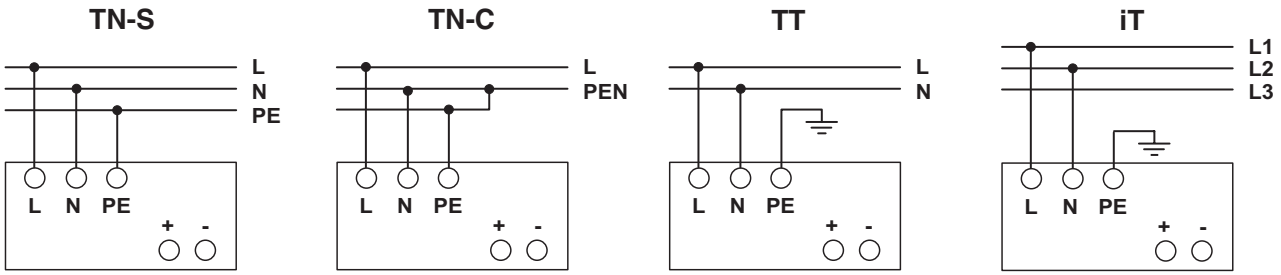

**Assembly**

Position the module with the DIN rail guide on the upper edge of the DIN rail, and snap it in with a downward motion.

**Removing**

Pull the snap lever open with the aid of a screwdriver and slide the module out at the lower edge of the DIN rail.

## 11 Connection to various systems

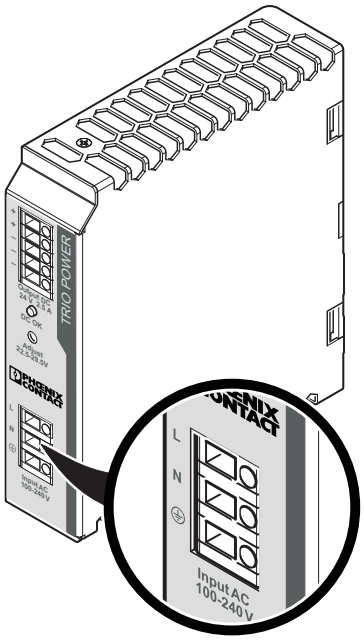



The connection for 100 V AC ... 240 V AC is made using the L, N and PE screw connections.
The device can be connected to 1-phase AC networks or to two of the phase conductors of 3-phase networks (TN, TT or IT networks in acc. with VDE 0100-300/IEC 60364-3) with nominal voltages of 100 V AC ... 240 V AC.
In the case of input voltages > 300 V AC, the device switches off for its own safety. After the overvoltage has ceased, the device starts automatically within a few seconds.

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

In order to comply with the UL certification, use copper cables that are designed for operating temperatures of > 75°C.
In order to comply with EN 60950/UL 60950, flexible cables require ferrules. To safely connect a device, the ferrules should have a length of at least 10 mm. To achieve a reliable and shockproof connection, strip the connecting ends according to section "Structure".

## 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!

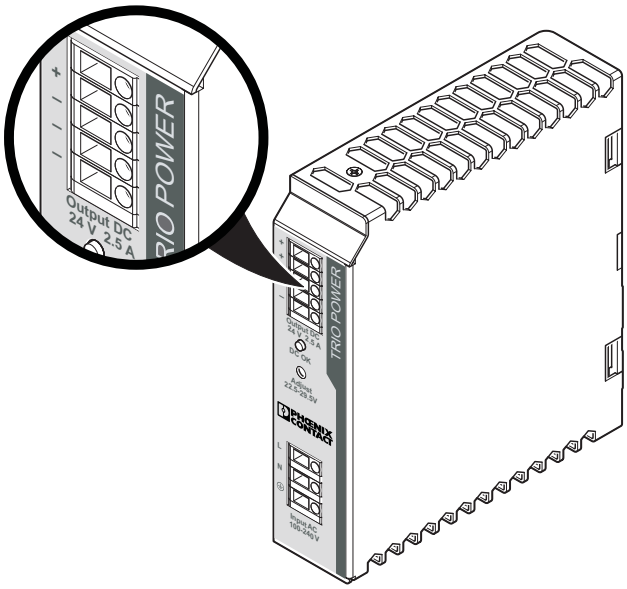
**Protection of the primary side**

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).

## 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.

You can fasten the connection cables to the housing using cable binders.
Ensure that the cable binders and the connection cables are designed for the surface temperatures that occur in operation.
Make sure that the insulation of the connection cables is not damaged when tightening the cable binders.

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**

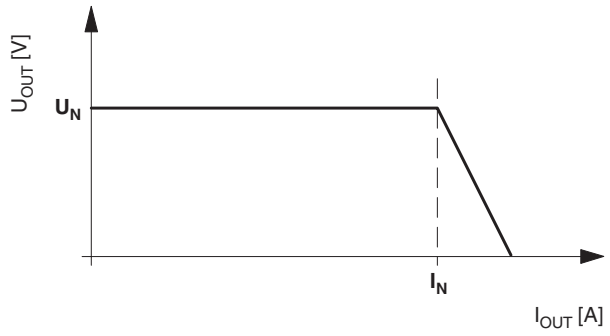
The device is electronically protected against short circuit and idling. In the event of a malfunction, the output voltage is limited to 35 V DC.

## 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 $I_N$ or the output is short circuited.<br>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



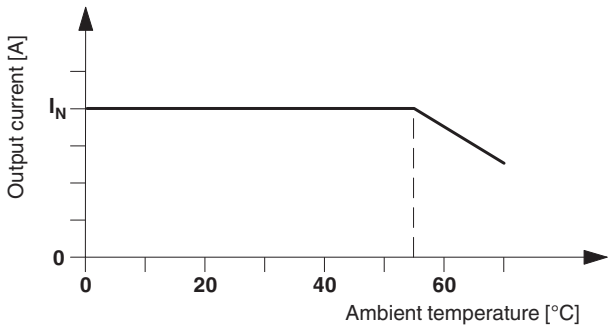

**Output characteristic curve**

The device functions following the U/I characteristic curve. Under load, the working point follows this curve. The output current is limited in the event of a short circuit or overload. Thereby, the device does not switch off, but rather supplies a continuous output current.
The secondary voltage is reduced until the short circuit or overload on the secondary side has been remedied. The U/I characteristic curve ensures that both heavily capacitive loads and loads with DC/DC converters in the primary circuit can be supplied. Downstream fuses are triggered. Selectivity in the design of your system is guaranteed at all times.

$U_N$ = 24 V

$I_N$ = 2.5 A

$P_N$ = 60 W

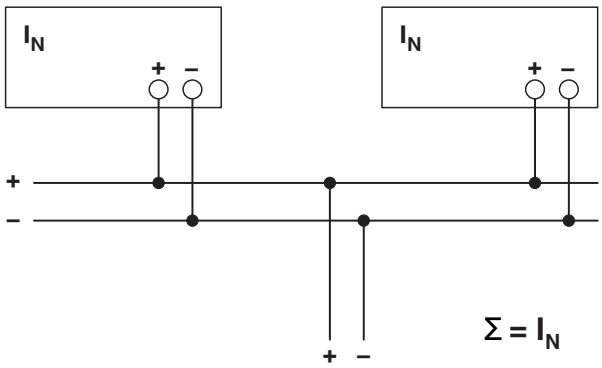



**Thermal behavior**

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.

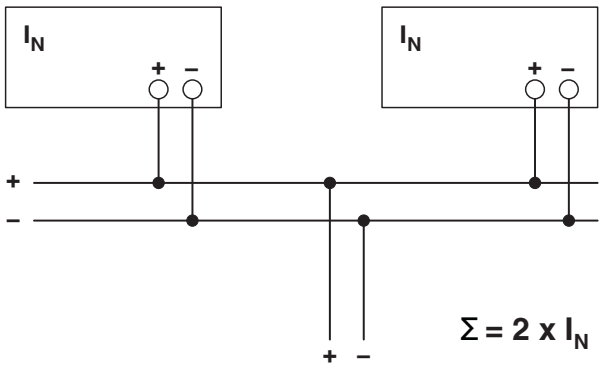
**Parallel operation**

Devices of the same type can be connected in parallel to enable both redundancy and an increase in efficiency. No other alignment is necessary when in the state of delivery. 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 distribution of power, we recommend designing all cable connections from the power supply unit to a busbar of the same length and with the same conductor cross section. The system makes it advisable to install a protective circuit at the output of each device when more than two power supply units are connected in parallel (e.g. decoupling diode or DC fuse). This prevents high reverse feed 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 x $I_N$. 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!

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