

23.3. CHARGING OF BATTERIES

The power supply can be used to charge lead-acid or maintenance free batteries. (4x 12V batteries in series)

Instructions for charging batteries:

- a) Set jumper on the front of the unit into "Parallel Use"
- b) Set output voltage (measured at no load and at the battery end of the cable) very precisely to the end-of-charge voltage.

End-of-charge voltage	55.6V	55V	54.3V	53.6V
Battery temperature	10°C	20°C	30°C	40°C

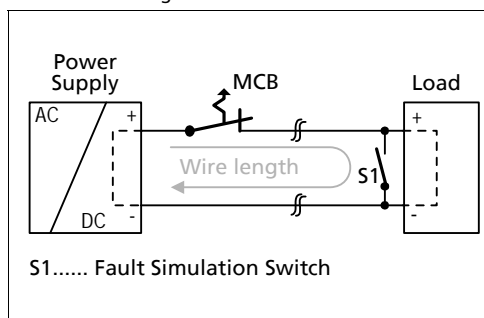
- c) Use a 10A circuit breaker (or blocking diode) between the power supply and the battery.
- d) Ensure that the output current of the power supply is below the allowed charging current of the battery.
- e) Use only matched batteries when putting 12V types in series.
- f) The return current to the power supply (battery discharge current) is typ. 4.4mA when the power supply is switched off (except in case a blocking diode is utilized).

23.4. OUTPUT CIRCUIT BREAKERS

Standard miniature circuit breakers (MCB's or UL1077 circuit breakers) are without doubt, one of the most efficient and economical ways to open circuits on faulty branches. Most of these breakers may also be used on 48V branches. MCB's are designed to protect wires and circuits. If the ampere value and the characteristics of the MCB are adapted to the wire size that is used, the wiring is considered as thermally safe regardless of whether the MCB opens or not.

To avoid voltage dips and under-voltage situations in adjacent 48V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10ms is necessary corresponding roughly to the ride-through time of PLC's. This requires power supplies with high current reserves and large output capacitors. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to actually flow. The best current reserve in the power supply does not help if Ohm's law does not permit current flow. The following table has typical test results showing which B- and C-Characteristic MCBs magnetically trip depending on the wire cross section and wire length.

Fig. 23-3 Test circuit



Maximal wire length for a magnetic (fast) tripping *):

	0.75mm ²	1.0mm ²	1.5mm ²	2.5mm ²
C-2A	52m	70m	94m	148m
C-3A	33m	42m	64m	97m
C-4A	19m	23m	33m	48m
C-6A	8m	9m	13m	22m
C-8A	-	-	-	-
C-10A	-	-	-	-
B-6A	18m	22m	33m	46m
B-10A	4m	5m	10m	13m

*) Don't forget to consider two times the distance to the load (or cable length) when calculating the total wire length (+ and - wire).

23.5. EXTERNAL INPUT PROTECTION

The unit is tested and approved for branch circuits up to 30A (U.S.A.) and 32A (IEC). An external protection is only required, if the supplying branch has an ampacity greater than this. Check also local codes and local requirements. In some countries local regulations might apply.

If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 6A B- or 3A C-Characteristic breaker should be used

23.6. USING ONLY 2 LEGS OF A 3-PHASE SYSTEM

The power supply is allowed to run permanently on two legs of a 3-phase system, when the output power is reduced according to the curves below. A long-term exceeding of these limits will result in a thermal shut-down of the unit. No external protection device is required to protect against a phase-loss failure. EMC performance, hold-up time and losses differ from a three phase operation. Therefore, check suitability of your individual application. The screw of the terminal which remains unused must be securely tightened.

Using only two legs of a 3-phase system is not included in the UL approval. Therefore, additional testing might be necessary.

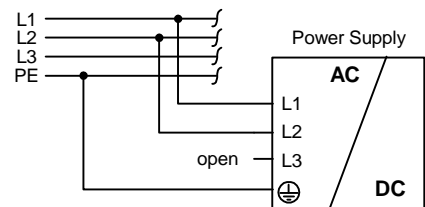


Fig. 23-4

Allowed output current for use on only two legs of a 3-phase system

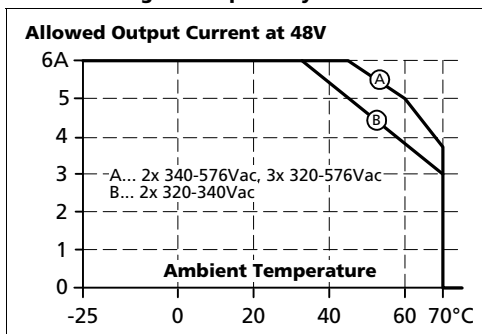


Fig. 23-5

Hold-up time for use on only two legs of a 3-phase system

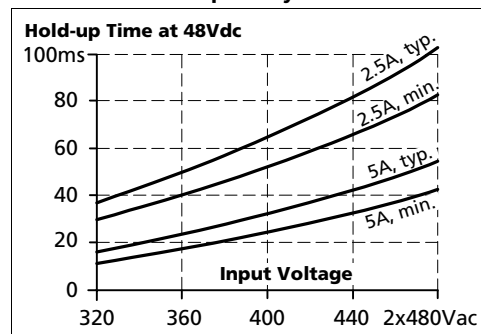


Fig. 23-6

Efficiency vs. output current at 24V for use on only two legs of a 3-phase system

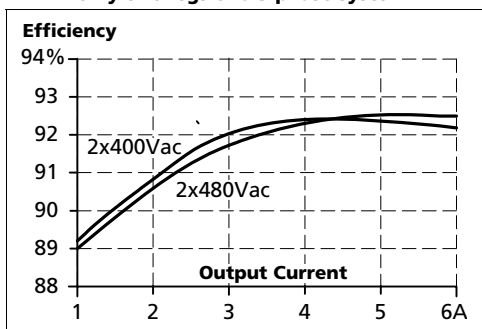
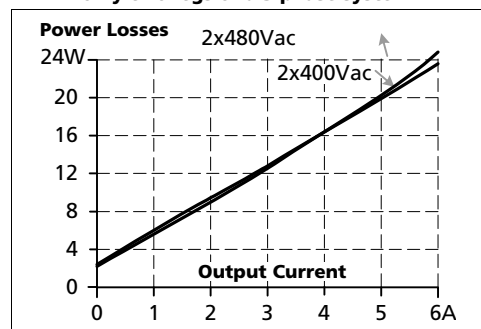


Fig. 23-7

Losses vs. output current at 24V for use on only two legs of a 3-phase system

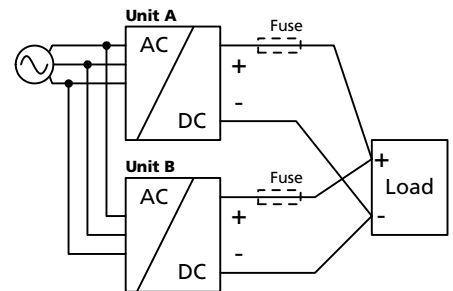


23.7. INDUCTIVE AND CAPACITIVE LOADS

The unit is designed to supply any kind of loads, including unlimited capacitive and inductive loads.

23.8. PARALLEL USE TO INCREASE OUTPUT POWER

CT10.481 power supplies can be paralleled to increase the output power. This power supply can also be paralleled with power supplies of the same type. The output voltage of all power supplies shall be adjusted to the same value ($\pm 100\text{mV}$) in "Single use" mode with the same load conditions on all units, or the units can be left with the factory settings. After the adjustments, the jumper on the front of the unit shall be moved from "Single use" to "Parallel use", in order to achieve load sharing. The "Parallel use" mode regulates the output voltage in such a manner that the voltage at no load is approx. 5% higher than at nominal load. See also chapter 6. If no jumper is plugged in, the unit is in "Single use". Factory setting is "Single use" mode. A fuse (or diode) on the output of each unit is only required if more than three units are connected in parallel. If a fuse (or circuit breaker) is used, choose one with approximately 150% of the rated output current of the power supply. Keep an installation clearance of 15mm (left / right) between two power supplies and avoid installing the power supplies on top of each other. Do not use power supplies in parallel in mounting orientations other than the standard mounting orientation (input terminals on the bottom and output terminals on top of the unit) or in any other condition where a derating of the output current is required (e.g. altitude, above 60°C, ...). Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.



23.9. PARALLEL USE FOR REDUNDANCY

Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption. Redundant systems for a higher power demand are usually built in a N+1 method. E.g. five power supplies, each rated for 5A are paralleled to build a 20A redundant system. For N+1 redundancy the same restrictions apply as for increasing the output power, see also section 23.8.

Please note: This simple way to build a redundant system does not cover failures such as an internal short circuit in the secondary side of the power supply. In such a case, the defect unit becomes a load for the other power supplies and the output voltage can not be maintained any more. This can only be avoided by utilizing decoupling diodes which are included in the decoupling module YRM2.DIODE.

Recommendations for building redundant power systems:

- Use separate input fuses for each power supply.
- Set the power supply into "Parallel Use".
- Monitor the individual power supply units. A DC-ok lamp and a DC-ok contact is included in the redundancy module YRM2.DIODE. This feature reports a faulty unit.
- It is desirable to set the output voltages of all units to the same value ($\pm 100\text{mV}$) or leave it at the factory setting.

23.10. DAISY CHAINING OF OUTPUTS

Daisy chaining (jumping from one power supply output to the next) is allowed as long as the average output current through one terminal pin does not exceed 25A. If the current is higher, use a separate distribution terminal block.

Fig. 23-8 Daisy chaining of outputs

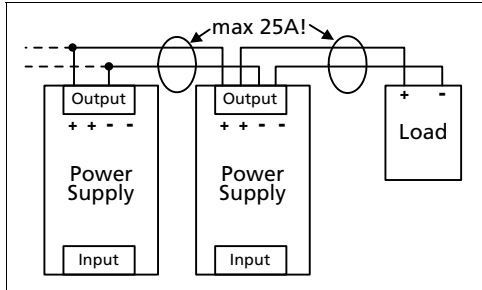
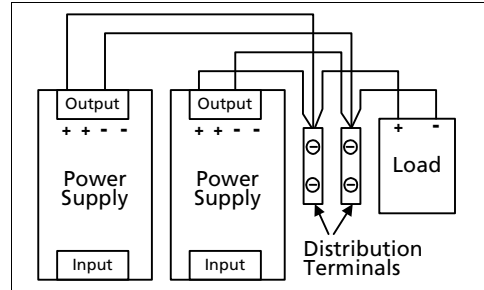
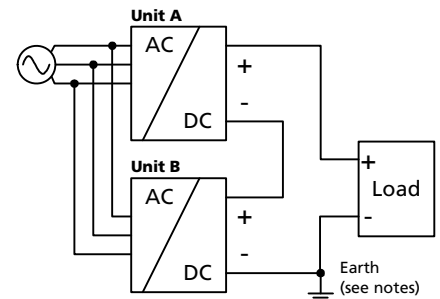


Fig. 23-9 Using distribution terminals



23.11. SERIES OPERATION

Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150Vdc. Voltages with a potential above 60Vdc are not SELV any more and can be dangerous. Such voltages must be installed with a protection against touching. Earthing of the output is required when the sum of the output voltage is above 60Vdc. Avoid return voltage (e.g. from a decelerating motor or battery) which is applied to the output terminals. Keep an installation clearance of 15mm (left / right) between two power supplies and avoid installing the power supplies on top of each other. Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.



23.12. USE IN A TIGHTLY SEALED ENCLOSURE

When the power supply is installed in a tightly sealed enclosure, the temperature inside the enclosure will be higher than outside. In such situations, the inside temperature defines the ambient temperature for the power supply.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure.

The power supply is placed in the middle of the box, no other heat producing items are inside the box

Enclosure:	Rittal Typ IP66 Box PK 9519 100, plastic, 180x180x165mm
Load:	48V, 4A; (=80%) load is placed outside the box
Input:	3x 400Vac
Temperature inside enclosure:	48.9°C (in the middle of the right side of the power supply with a distance of 2cm)
Temperature outside enclosure:	24.7°C
Temperature rise:	24.2K

23.13. MOUNTING ORIENTATIONS

Mounting orientations other than input terminals on the bottom and output on the top require a reduction in continuous output power or a limitation in the max. allowed ambient temperature. The amount of reduction influences the lifetime expectancy of the power supply. Therefore, two different derating curves for continuous operation can be found below:

Curve A1 Recommended output current.

Curve A2 Max allowed output current (results in approximately half the lifetime expectancy of A1).

Fig. 23-10
Mounting Orientation A
(Standard orientation)

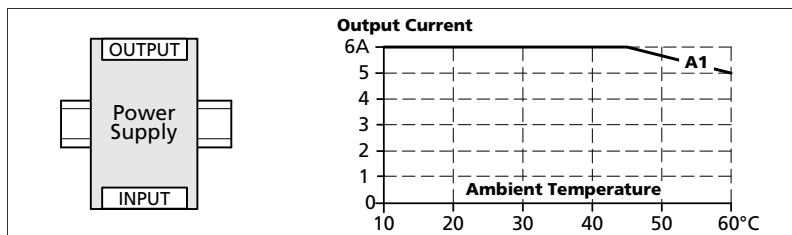


Fig. 23-11
Mounting Orientation B
(Upside down)

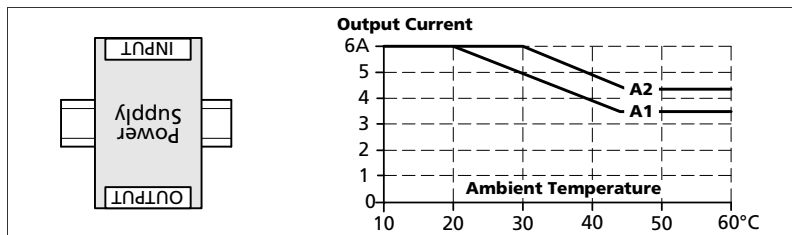


Fig. 23-12
Mounting Orientation C
(Table-top mounting)

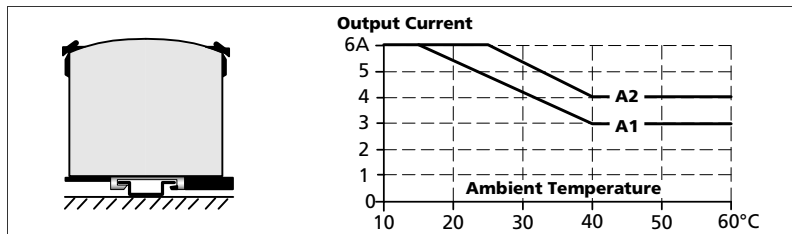


Fig. 23-13
Mounting Orientation D
(Horizontal cw)

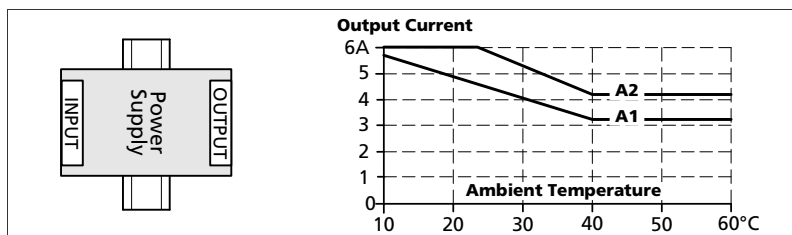


Fig. 23-14
Mounting Orientation E
(Horizontal ccw)

